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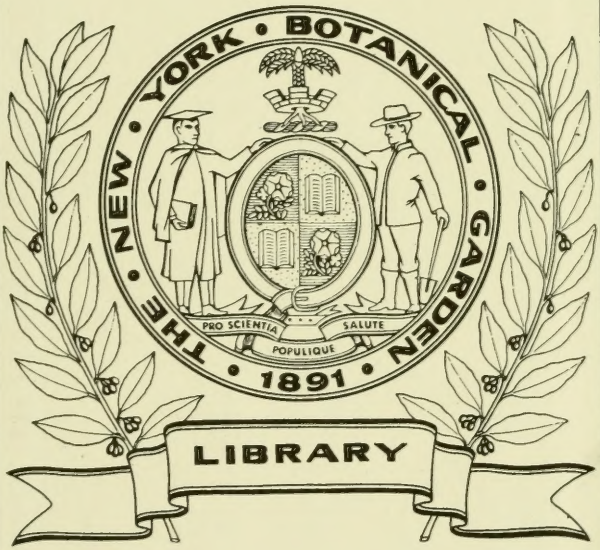

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A NEW SPECIES OF FRITILLARIA FROM NORTHEASTERN TURKEY

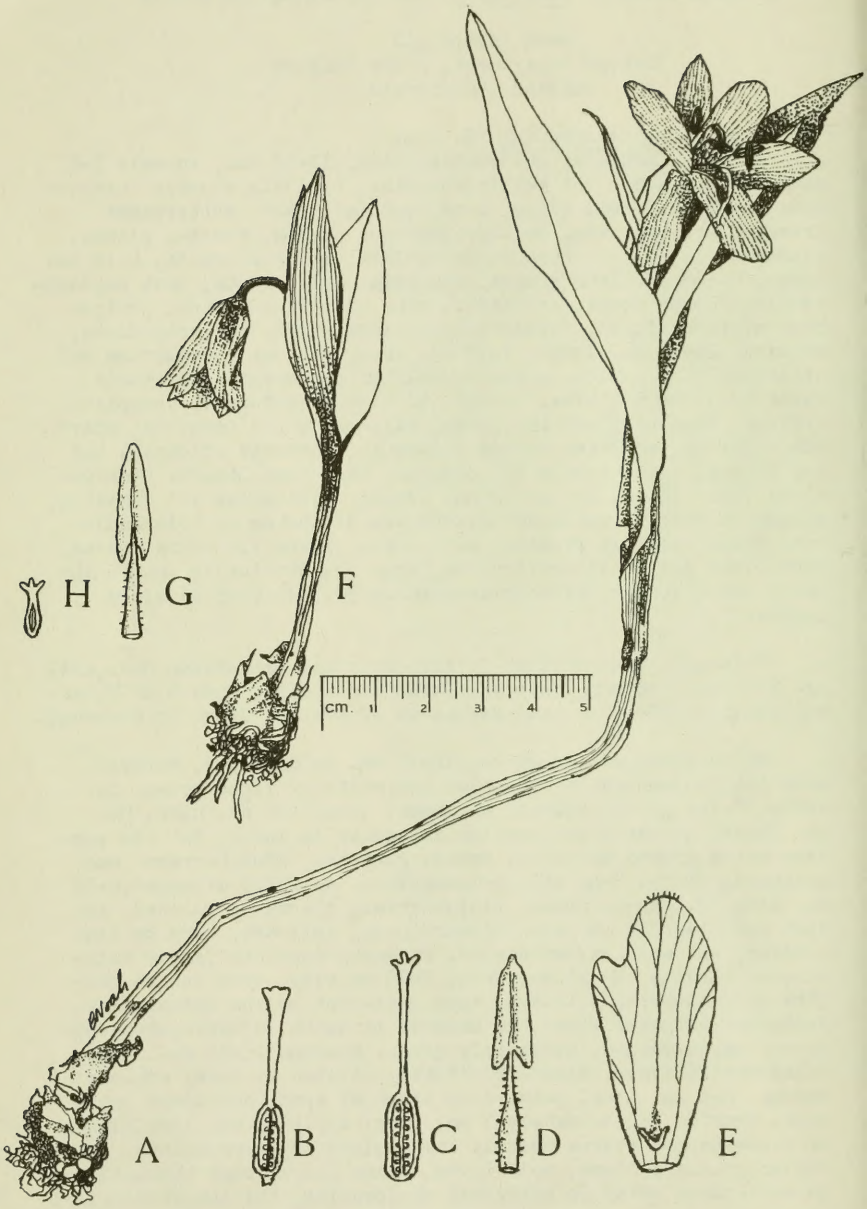
Baki Kasapligil
Biology Department, Mills College
Oakland, California

Fritillaria erzurumica sp. nov.

Bulbus globularis vel ovatus, diam. 10-18 mm., squamis 3-4 membranaceis albis vel helvis obtectus, bulbilis abundis instructus. Caulis 8-22 cm. altus, diam. 3-4 mm., pars subterranea irregulariter curvata, ea supraterranea erecta, veneta, glauca, glabrata. Folia 3-4, oblongo-lanceolata, omnia spiralia, 4-12 cm. longa, 0.5-2 cm. lata glauca, glabrata, apice acuta, basi amplexicaulia. Flores rosei, solitarii, plus minusve nutantes, perigonium acetabuliforme. Perianthii segmenta subtiliter reticulata, obovata, 22-24 mm. longa, 9-12 mm. lata, margine integerrima vel unilateraliter lobata, apice dorsaliter pubescentia. Nectaria supra basin tepali sita, lunata vel hippocrepiformis, conspicue viridia. Stamina 15-18 mm. longa, filamentis filiformibus, sparsim ciliatis, ad basem versus dilatatis, antheris oblongis, 4-8 mm. longis, apice acutis vel obtusis, basi hastilabiis. Ovarium circa 7 mm. altum, stylus 12 mm. longus, filiformis vel clavatus, stigma ut videtur aut trilobulatum aut dilatatum ac tricrenulatum. Grana pollinis prolata, unisulcata, exina 1.6 micra crassa, subtiliter polygonali-reticulata, axis longitudinalis 60.2(54.4-64.6) micra longus, axis transversalis 39.1(34.0-45.9) micra longus.

Holotype: Northeastern Turkey, Erzurum, Palandöken Mts., alt. 2900 m., eastern exposure, mountain steppe, June 4, 1970, Sabri Özyurt No.975 (U.C. and Herbarium of Atatürk Üniv. in Erzurum).

Bulbs spherical or ovate, 10-18 mm. in diameter, covered with 3-4 membranous scales which are white or light brown in color, "rice grain" bulbils abundant. Stem 8-22 cm. high, 3-4 mm. thick, subterranean portion irregular in shape, but the portion above ground straight, erect, glabrate, bluish-green and glaucous. Leaves 3-4, oblong-lanceolate, spirally arranged, 4-12 cm. long, 0.5-2 cm. broad, bluish-green, glabrate, pointed at apex and clasping at base. Flowers pink, solitary, more or less nodding, perianth saucer-shaped. Perianth segments finely reticulate, obovate, 22-24 mm. long, 9-12 mm. wide, with entire margins or unilaterally lobate, apex pubescent on the dorsal side. Nectaries situated above the base of perianth segments, crescent- or horseshoe-shaped, strikingly green. Stamens 15-18 mm. long; filaments filiform, sparsely ciliate, dilated at base; anthers oblong, 4-8 mm. long, pointed or blunt at apex, hastulate at base. Ovaries approximately 7 mm. long; style 12 mm. long, linear or club-shaped; stigma visibly trilobulate or tricrenulate. Pollen grains prolate, unisulcate, exine 1.6 microns thick, finely reticulate owing to polygonal sculpturing, the longitudinal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A
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axis 60.2 (54.4-64.6) microns long, transverse axis 39.1(34.0-45.9) microns long.

Fritillaria erzurumica Kasapligil var. abortivus var. nov. Flores penduli, infundibuliformes, ovarium abortivum, circa 5 mm. longum, ovulis deficientibus; stylus brevissimus; stigma conspicue trilobatum. Grana pollinis 1/3 steriles, deformata,axis longitudinalis 48.2 (45.9-51.0) micra longus, axis transversalis 21.8 (20.4-25.5) micra longus.

Holotype: Northeastern Turkey, Erzurum, Palandöken Mts.,alt.ca. 2700 m., northern exposure, mountain steppe, June 4, 1970, Sabri ÖzyurtNo. 946 (U.C. and Atatürk Üniversity in Erzurum).

Flowers pendent, funnel-shaped, ovary abortive, about 5 mm. long, without ovules; style extremely short;stigma conspicuously trilobed. One third of the pollen grains sterile and deformed,the longitudinal axis 48.2 (45.9-51.0) microns long and the transverse axis 21.8 (20.4-25.5) microns long.

Fritillaria erzurumica belongs to the section Eufritillaria Baker (1874) and subsection Olostyleae Boissier (1884) according to the classification followed by Krause (1930). This new species is closely related to F. caucasica Adams (Syn. F. tulipifolia M. Bieb.) and F. armena Boiss.both of which are native to Caucasia, Transcaucasia and to northeastern Turkey (cf. Komarov 1935 for their distribution). All three species show a remarkable resemblance with regard to their vegetative organs, and they are characterized by the lack of checkering on their tepala. However, they can be distinguished sharply from each other by several features as summarized in the following table:

F. erzurumica	F. caucasica	F. armena
Flowers: Saucer-shaped,semipendulous.	Campanulate-conical, Completely pendent.	Campanulate-funnel-shaped,compl.pendent.
Perianth:bright pink with dark pink reticulum.	Brownish purple inside,glaucous-blue outside.	Dark red with gray bloom and greenish gold streaks.
Tepala: Obovate with entire margins or unilaterally lobate.	Elliptic lanceolate, with entire margins, apiculate.	Elliptic lanceolate with serrulate margins.
Nectaries:Crescent-shaped, prominently green.	Linear oblong,green.	Obscure, greenish depression.
Filament: Sparsely ciliate.	Glabrous.	Shaggy trichomes.
Style: Linear or club-shaped.	Club-shaped.	Linear.

F. erzurumica	F. caucasica	F. armena
Stigma: Tricrenate to trilobulate.	Obscurely trilobed.	Entire or obscurely trilobed.
Habitat: Mountain steppe.	Alpine scrub vegetation.	Alpine meadows.
Flowering: June	April	April

The range of variation in stem height is quite similar in F. erzurumica and F. armena although F. caucasica tends to be a tall plant reaching a height up to 40 cm. Beck (1953, p.59) describes "lower opposite leaves" for F. armena but the specimens and the classical illustrations (cf. Baker 1878, Stoyanoff 1931) I examined show alternate leaf arrangements only. Turrill (1948) distinguishes the genus Fritillaria from the related genus Lilium on the basis of attachment of filaments to the anthers. Although basifixed anthers seem to be a general occurrence among the specimens I examined, this property also shows a considerable variation in F. erzurumica. Some of the stamens I studied had more or less dorsifixed anthers resulting in a versatile condition, as in Lilium.

F. erzurumica var. abortivus seems to be a member of a population which is very well established in its habitat. The abortion of its pistil as well as of one third of the pollen grains may be the result of hybridization, polyploidy, fragmentation or structural heterozygocity of the chromosomes. Beetle (1944) and Cave (1970) reported morphological and cytological diversities among populations of F. lanceolata Pursh and several other California species. Both F. erzurumica var. erzurumica and F. erzurumica var. abortivus need to be studied cytologically to determine the nature and extent of their variability. The perpetuation of sterility has been accomplished by successful asexual reproduction by means of bulbils.

Grateful acknowledgements are due to Miss Barbara Noah (Mills College 1971) for having prepared the figures A and F from the type specimens; to Dr. Rimo Bacigalupi of the Jepson Herbarium (University of California, Berkeley) for having read the manuscript and to Mr. Sabri Özyurt (Assist. Botanist of the Faculty of Sciences, Atatürk University, Erzurum, Turkey) for having supplied the desiccata.

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LEGENDS FOR THE PLATE:

Fritillaria erzurumica Kasapligil: A. Habit drawing with semi-pendent flower above and several "rice grain" bulbils at base; B. a pistil with club-shaped style and tricrenulate stigma; C. a pistil with linear style and trilobulate stigma; D. a stamen with ciliate filament dilated at base; E. adaxial view of a unilaterally lobate tepal showing the dichotomous branching of three vascular bundles and the nectary situated above the base. Fritillaria erzurumica var. abortivus Kasapligil: F. Habit of the plant with a distinctly pendent flower; G. abaxial view of a stamen with dorsifixed anther; H. abortive pistil. Figures A and F: 1X, all others: 2X.

NOTES ON NEW AND NOTEWORTHY PLANTS. LIII

Harold N. Moldenke

AEGIPHILA CUATRECASASI var. NITIDA Moldenke, var. nov.

Haec varietas a forma typica speciei foliis supra glaberrimis nitidisque subtus minutissime et perobscure puberulis recedit.

This variety differs from the typical form of the species in having its leaf-blades smaller, to 16.5 cm. long and 9 cm. wide, completely glabrous and very shiny above, and extremely obscurely fine-puberulent beneath.

The type of the variety was collected by Sigifredo Espinal T. and J. E. Ramos (no. 2897) at 1750 meters altitude at Matarredonda, Cauca, Colombia, on October 2, 1968, and is deposited in my personal herbarium at Plainfield, New Jersey.

CARYOPTERIS ODORATA f. ALBIFLORA (Voigt) Moldenke, comb. nov.

Clerodendron odoratum β albiflorum Voigt, Hort. Suburb. Calc. 466. 1845.

CITHAREXYLUM SULCATUM var. HIRTELLUM Moldenke, var. nov.

Haec varietas a forma typica speciei foliis majoribus subtus ad reticulum venorum vemulorumque patente hirtellis recedit.

This variety differs from the typical form of the species in having the leaves larger, to 12 cm. long and 6 cm. wide, and the extremely prominent venation on the lower surface spreading-hirtellous.

The type of the variety was collected by Sigifredo Espinal T. and J. E. Ramos (no. 3284) at an altitide of 2900 meters between Coconuco and Paletará, Cauca, Colombia, on November 13, 1968, and is deposited in my personal herbarium at Plainfield, New Jersey.

CLERODENDRUM INERME var. MACROCARPUM (Wall.) Moldenke, comb. nov.

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

CLERODENDRUM PHLOMIDIS f. RUBRUM (Roxb.) Moldenke, comb. nov.

Clerodendron phlomoïdes β rubrum Roxv. ex Voigt, Hort. Suburb. Calc. 465. 1845.

SYNGONANTHUS GRACILIS f. PROLIFER Moldenke, f. nov.

Haec forma a forma typica speciei capitulis distincte proliferis recedit.

This form differs from the typical form of the species in having its flower-heads distinctly proliferous, producing each from 3 to many erect linear leaf-like growths to 5 mm. in length.

The type of the form was collected by George Gardner (no. 5281) somewhere in Brazil and is deposited in the Britton Herbarium at the New York Botanical Garden.

BOOK REVIEWS

Alma L. Moldenke

"POLLEN AND SPORES OF CHILE — Modern Types of the Pteridophyta, Gymnospermae, and Angiospermae" by Calvin J. Heusser, xiv & 167 pp., illus., University of Arizona Press, Tucson, Arizona 85700. 1971. $15.00.

In today's book market this oversized, well-printed and well-bound work with 60 fine fullpage photographic plates is bargain-priced -- and readers will acquire a scientific bargain, too. The text covers a general vegetational survey, detained descriptions of pollen grains and spores, citations, locations, ranges, keys, glossary, and bibliography. In its preparation material has been examined for members of 178 plant families from herbarium specimens preserved in the Museo Nacional de Historia Natural in Santiago and from fresh field collections.

"THE BIOLOGY OF PARASITIC FLOWERING PLANTS" by Job Kuijt, v & 246 pp., illus., University of California Press, Los Angeles, California, & Berkeley, California 94720. 1969. $15.00.

This excellent book garners a wealth of material over a great range of time and place resulting in up-to-date monographs of the parasitic groups within the mistletoes, sandalwoods, dodders, rafflesias, broomrapes and figworts. There is a detailed treatment of haustoria that are root-origined, their physiology, evolution, and history. "It is my thesis that parasitism has arisen at least eight different times in unrelated groups of dicotyledons: (1) Santalales; (2) Scrophulariaceae and Orobanchaceae; (3) Rafflesiaceae and Hydnoraceae; (4) Balanophoraceae; (5) Cuscuta; (6) Cassytha; (7) Lemnoaceae; (8) Krameria."

The book is enriched by many excellent drawings and fine photographs. It is likewise rich in its full bibliography, including the author's many papers on mistletoes.

"GENETICS OF THE EVOLUTIONARY PROCESS" by Theodosius Dobzhansky, x & 505 pp., illus., Columbia university Press, London & New York, N. Y. 10025. 1970 copyright, 1971 actual publication. $10.95.

Surely this work by one of the most outstanding geneticists and biological thinkers will prove to be a classic. The chapters cover (1) the unity and diversity of life, (2) genetic continuity and change, (3) mutation and genetic variability, (4) normalizing natural selection, (5) balancing selection and chromosomal polymorphism, (6) balancing selection and genetic load, (7) directional selection, (8) random drift and founder principle, (9)

populations, races and subspecies, (10) reproductive isolation, (11) patterns of species formation, and (12) patterns of evolution. There is an excellent bibliography with well over a thousand entries, an author index with almost a thousand entries from works cited in the text and page references, and a subject index with most of the scientific names not italicized.

This book is a reappraisal, and more, of the author's other classic work entitled "Genetics and the Origin of Species", originally published in 1937, with its second and third editions of 1941 and 1951. This new work emphasizes the "balance model" of genetic population structure as "a greater or lesser proportion of the gene loci being in the heterozygous state, frequently though not invariably for pairs of interacting alleles that give heterosis" rather than the older concept of a largely homozygous population as the normal. "Evolution is a creative process..... The evolution of every phyletic line yields a novelty that never existed before and is a unique, unrepeatable, and irreversible proceeding.....An evolutionary history is a unique chain of events. Natural selection has tried out an immense number of possibilities and has discovered many wonderful ones. Among which, to date, the most wonderful is man."

"CELL BIOLOGY" — Fifth Edition by E. D. P. De Robertis, W. W. Nowinski & F. A. Saez, xvii & 555 pp., illus., W. B. Saunders Company, London WC 1A-1DB, Toronto 7, and Philadelphia, Pa. 19105. 1970. $11.00.

This famous text, already in its 2nd Russian, 1st Hungarian, 1st Polish, 7th Spanish and 1st Italian editions, needs no introduction to biologists, but this new English edition deserves a hearty welcome. Its text and bibliographies at the close of each chapter are brought up-to-date. Basic principles are still stressed; the explanations are clear, the photographic illustrations and many new diagrams are excellent. As in the past editions, the botanical part of cell biology is limited lamentably to a few pages on cellulose and chloroplasts, but the rest of the text refers to the plant cell contents and processes that are shared with other living cells. There are a few careless slips in printing, such as the misspellings of alkaline on p. 116 and leucoplast on p. 237 and the omission of O_2 on the photosynthesis formula on p. 244.

"THE BIOLOGY OF FLOWERING" by Frank B. Salisbury, xi & 174 pp., illus., Natural History Press, c/o Doubleday & Company, New York, N. Y. 10017. 1971. $5.95.

Aiming this interesting, simple book towards amateur botanists, students and teachers, the author states "There is so much left to learn about flowering that it is not difficult for a student (even junior high level) to devise experiments that have never been performed before. If this book should achieve the goal of starting a student on his way to experiments in flowering, I

would certainly like to learn about the results." And so the author describes what flowering involves anatomically and physiologically by various methods of study including temperature responses, phytochrome, time measurement, biochemistry including especially the flowering hormone and a survey of flowering in natural environments.

Many of the illustrative diagrams are very helpful. There is provided a useful bibliography and index.

"FLORA OF THE GALÁPAGOS ISLANDS" by Ira L. Wiggins and Duncan L. Porter, xx & 998 pp., illus., Stanford University Press, Stanford, California 94305. 1971. $37.50.

A marvelous work like this has been made possible by (1) the inspirational leadership of the senior author who is outstanding for his lifelong scholarship and field work, (2) the cooperation of several specialists, (3) the coordinated diligence of many diverse assistants, and (4) the considerable and worthwhile funding by N. S. F. for the research that went into the book and by UNESCO for the establishment of the Charles Darwin Foundation Research Station on Isla Santa Cruz.

For all biologists — student, teacher, researcher, interested amateur — there is a glow connected with these mostly Pleistocene volcanic islands 500 miles off the coast of Ecuador because of their association with Darwin's "Voyage of the Beagle". This present book perpetuates and validates this feeling with its valuable store of information. The introduction discusses settlement and history, physiography and geology, climate, soil and vegetation zones, fauna, and botanical collecting. The major higher plant groups are keyed and then are treated in careful manual style with descriptions, keys, drawings and geographic distribution maps. There are known to date 642 species with 60 subspecies and varieties in 348 genera in 107 families of which 228 species are endemic and 42 consist of new records for the Galápagos.

In the book there are a glossary of botanical terms, a bibliography, and index to botanical names, and almost a hundred beautiful color photographs of plants in their natural ecological settings or in portrait.

"PHLOEM TRANSPORT IN PLANTS" by Alden S. Crafts & Carl E. Crisp, xxii & 481 pp., illus., W. H. Freeman & Co., San Francisco, California 94104. 1971. $12.50.

"The aim of this book is to collect and interpret the experimental information available....not only to support the mechanism of assimilate movement, but to provide detailed analyses of the anatomy of the transport path itself, the phenomenon of phloem plugging, the movement of endogenous as well as xenobiotic compounds, the effects of environmental factors, and the complex quantitative aspects of assimilate distribution."

Thanks to much recent careful work in this field checked in a bibliography 34 pages long and thanks to the development of the electron microscope, the authors are able to conclude their text "with the recognition of the existence of open pores in sieve plates, of the composition and nature of phloem exudate, and of common distribution patterns of tracers in plants, pressure flow or mass flow seems to be the inescapable answer to the translocation enigma."

On p. 69 Castanea is misspelled; also internodes on p. 70.

This book provides the only collection of this type of botanical knowledge at present in print.

"MANUAL OF THE GRASSES OF THE UNITED STATES" by A. S. Hitchcock, facsimile of 2nd edition revised by Agnes Chase, Volumes I & II, 1051 pp., illus., Dover Publications, Inc., New York, N. Y. 10014. 1971. $8.00 paper bound.

This unabridged replication of a needed botanical classic is welcome indeed for its excellent descriptions, keys and illustrations of 1,398 species in 169 genera of grasses that are native or well established in the United States as well as 120 species of "waifs" in 16 genera. Complete synonymy, uses, a glossary, brief biographical sketches of persons for whom grasses have been named, and an index are included.

The publisher prints on the back cover an assurance that the binding is stitched, completely openable and "permanent" — all necessary attributes if this edition is to get the use the former ones did.

"MARINE FOOD CHAINS" edited by J. H. Steele, viii & 552 pp., illus., University of California Press, Los Angeles, California, and Berkeley, California 94720. 1970. $13.50.

This volume is composed of the proceedings of a 4-day symposium at the University of Aarhus in Denmark during July 1968 under the aegis of the International Council for the Exploration of the Sea. There are 35 worthwhile papers grouped under the following 7 headings: (1) recycling of organic matter and energy, (2) pelagic food chains forming the most intricate webs, (3) feeding mechanisms such as both "skimming" and "swallowing" patterns in baleen whales and the macro-plant detritus feeding of such broad spectrum herbivores as Mugil cephalus telescoping food chains in shallow estuaries, (4) food requirements for fish production showing how management is increasingly dependent on knowledge of the quantitative interaction among several species, (5) food abundance and availibility in relation to production, (6) theoretical problems in estimating marine biomass production and analysis of trophic processes, and (7) a summary by L. B. Slobodkin stressing that the simplified constant of 10 percent ecological efficiency should not be used without checking for any fisheries' regulation decisions. Many valuable charts and

detailed bibliographies are included in each paper. For the whole work there is provided a subject index as well as a systematics index.

"THE LYNN INDEX: A Bibliography of Phyto-Chemistry, Monograph VII edited by Norman R. Farnsworth et al., 236 pp., College of Pharmacy, University of Illinois Medical Center, Chicago, Illinois 60680. 1971. $5.00 paper-back.

This new volume covers assuredly the bulk of the phytochemical sources published in the period from 1560 to 1954 for the following plant orders: Pandales, Helobiae, Principes, Spathiflorae, Farinosae, Liliiflorae, Piperales, Salicales, Garryales, Myricales, Juglandales, Fagales and Urticales. The cumulative index is especially valuable because it includes the orders, families and genera treated in all of the seven monographs published to date.

This same group of editors has more current material on the subject included it their mimeographed periodical, PHARMACOGNOSY TITLES.

"CHARLES SPRAGUE SARGENT AND THE ARNOLD ARBORETUM" by S. B. Sutton, xvii & 382 pp., illus., Harvard University Press, Cambridge, Mass. 1970. $10.00.

Apropos of the impending centennial of the famed Arnold Arboretum next year, its present director commissioned this careful interesting account of its founder who served for 55 years as its director and of its growth as the first in history and prominence in the United States.

The author describes Sargent's early life in a family of intelligence, industry, prominence and affluence, and his interest in horticulture. When assigned the creation of the Arnold Arboretum, "he devoted himself with passionate intensity to institution-building and to his study of trees". "He was happier with trees than with people; he loved trees and shrubs and the beauty of fine plants as most men love children and grandchildren or as they love a fair lady." Yet he knew personally many prominent people, had a wonderfully warm and understanding wife and five children, and cherished his home. At the time of the golden jubilee in 1922, the then 81 year old director reported that the Arnold Arboretum had doubled its acreage supporting between 5,000 and 6,000 woody species, labeled and mapped, in 324 genera and 87 plant families, introduced nearly 2,000 species and varieties into cultivation in the United States, enlarged the herbarium 200-fold, built up a library of 35,500 bound volumes, 8,000 pamphlets and 10,000 photographs, and planned more and better prospects for the years ahead.

A few of Sargent's confrères are also well delineated in this book — Wilson, Rehder, Gray. Sargent's monumental work on the forest census, his Silva of North America, as well as his famous (or infamous) treatment of Crataegus with 700 species, 22 varie-

ties and 5 forms, are well known botanically.

Unfortunately, the page numbers and running titles are centered at the bottom of the pages inefficiently wasting readers' time. On p. xii eastern is misspelled.

This book is a deserving and informative tribute to a great man and to a great institution.

"PRINCIPLES OF DISPERSAL IN HIGHER PLANTS" by L. van der Pijl, vii & 154 pp., illus., Springer-Verlag, Berlin, Heidelberg & New York, N. Y. 10010. 1969. 36 DM. or $9.00.

This is a companion volume to the author's and K. Faegri's "Principles of Pollination Ecology" of 1966. Both works are so fascinating and excellent in scope and treatment that they should appeal to a broad spectrum of amateur, teaching and professional botanists and biologists of all kinds everywhere.

The illustrations are especially valuable since they cover so many more examples than the limited few that get repeated from one botany text to another. Even more would have enhanced the value of the book.

The bibliography is comprehensive, including Ridley's classic "Dispersal of Plants throughout the World" of 1930, yet omitting some partial references given in the body of the text itself. The three useful indexes for subject, plant scientific names and animal scientific names are valuable features.

The contents include (a) the role of dispersal in the chain of life, (b) elaborate terminology, (c) relationships among flowers, seeds and fruits, (d) ecological dispersal classes based on agents — icthyochory, saurochory, ornithochory, autochory, myrmechory, anemochory, hydrochory, epizoochory, barochory, etc., along with their combinations and limitations, (e) establishment, germination and vivipary, (f) interesting and debatable evolutionary concepts of dispersal organ development, (g) ecological development in legume fruits, and finally (h) man and his plants — the crops and weeds. This succinct modern treatment stresses the tropics.

More careful proof-reading should have checked and caught the "ist" on p. 14, the repeated "Violaceae" on p. 112, the bibliographic omissions and other slips. Actually, the book is really a gem, with just a few minor flaws.

"THE AUSTRALIAN GREAT BARRIER REEF IN COLOUR" by K. Gillett, 112 pp., illus., Charles E. Tuttle, Tokyo, Japan, & Rutland, Vermont 05701. 1971. $6.65.

"No other region in the world has been so lavishly endowed as this 1,250-mile strip of coral-built rampart and its adjacent waters", as this attractive little book with its carefully written text, 16 black/white plates and 50 gorgeous full color ones of corals, sea anemones, starfish, turtles, fish, etc., attests. The role of plants, especially algae, is not considered except on p. 91.

ADDITIONAL MATERIAL TOWARD A MONOGRAPH OF THE GENUS CALLICARPA. XIX

Harold N. Moldenke

CALLICARPA SIMONDII Dop

Additional bibliography: Moldenke, Phytologia 21: 500. 1971.

Continuation of the original description of this species by Dop (1932): "Folia.....supra pilis simplicibus sparsis horrida, subtus molliter pilis stellatis dispersis tomentosa et punctato-glandulosa, 8--10 cm. longa x 4--5 cm. lata; nervus vix prominens, valde tomentosus; costae 12--14 tenues, tomentosae, vix recurvatae; venae subparalleles, vix conspicuae; reticulones inconspicuae; petiolum crassum, tomentosum, 8--10 mm. longum. Inflorescentiae: cymae tomentosae, divaricato-dichotomae, multiflorae, 3,5 cm. latae et longae; bracteae lineares, subulatae, 3--4 mm. longae; pedunculi 15 mm. longi; pedicelli 1 mm. longi; flores 3 mm. longi. -- Calyx stellato-tomentosus, 1,2 mm. longus, dentibus 4 minimis, triangularibus. Corolla glabra 2,5 mm. longa, lobis 4 rotundatis, 0,5 mm. longis. Stamina 4 longe exserta; filamenta ad basim corollae inserta; antherae glandulosae. Ovarium glabrum; stylus stamina superans; stigma capitatum. -- Fructus....? Tonkin: Long Tschéou (Simond 152). Cette espèce est très voisine du C. rubella Lindl. Elle s'en distingue par ses feuilles pétiolées, elliptiques ou en peu obovales, membraneuses, et son calice muni simplement de poils étoilés."

Nothing is known to me of this taxon except what is stated in the literature listed above.

CALLICARPA SIONG-SAIENSIS Metc., Lingnan Sci. Journ. 11: 407--408. 1932.

Synonymy: Callicarpa siongsaiensis Metc. ex Moldenke, Phytologia 14: 225. 1967.

Bibliography: Metc., Lingnan Sci. Journ. 11: 407--408. 1932; A. W. Hill, Ind. Kew. Suppl. 9: 46. 1938; Moldenke, Known Geogr. Distrib. Verbenac., ed. 1, 58 & 87 (1942) and ed. 2, 135 & 178. 1949; H.-T. Chang, Act. Phytotax. Sin. 1: 270, 308, & 310. 1951; Moldenke, Résumé 174 & 445. 1959; Moldenke, Phytologia 14: 225 & 246. 1967.

The original description of this species reads as follows: "Shrub to 2 m. Cymes trichotomous, loose, many-flowered, peduncles stellate, as long or longer than petioles. Calyx cup-shaped, entire, glabrous. Fr. dark brown when dry, glabrous (about 3 mm. diam.). Leaves obovate to oblanceolate (10--14 cm. long and to 5.5 cm. wide, short acuminate to acute, base cuneate to obtuse, margin subentire to irregularly shallow, serrate, glabrous above, and subglabrous and yellowish glandular beneath. Branchlets, petioles and inflorescence sparsely and minutely stellate pubescent. Siong-Sai, an Island 20 miles seaward from mouth of river Min,

[which is 34 miles from Foochow]. Liu, Y. T., FCU 11793; 5 ft., rocky hillside, ex herb. Fukien Christian University (Arnold Arboretum, Type).

"A rather characteristic species closely related to C. Giraldiana Hesse and C. pedunculata R. Brown (C. formosana Rolfe), but distinguished easily by the glabrous leaves and glabrous calyx. From C. dichotoma (Loureiro) Ramschel and C. japonica Thunberg it is separated by the subentire to shallowly-serrate margins. It will be interesting to see if this species will ever be found on the mainland. P'ei cites this number under his C. formosana Rolfe. This however is synonymous with C. pedunculata R. Brown (see Lam & Bakh. l.c.). The citation was incorrectly given as Tai 11793, but the collector's name was Liu, Yu Tai."

It should be commented here that the island on which the type specimen of this species was collected is one of the White Dog [or Crocodile] Islands.

The Lau 3924 & 4469, distributed as C. siong-saiensis, are actually C. formosana Rolfe, while Lau 4054 is C. integerrima Champ.

Nothing is known to me of this species except what is stated in the literature cited above.

CALLICARPA SORDIDA Urb., Symb. Ant. 7: 355—356. 1911.

Bibliography: Urb., Symb. Ant. 7: 355—356. 1911; Prain, Ind. Kew. Suppl. 5, pr. 1, 44. 1921; Urb., Arkiv Bot. 22A (17): 108. 1929; Moldenke in Fedde, Repert. Spec. Nov. 39: 299 (1936) and 40: 50, 52—53, 56, 73, 78, 120, & 123. 1936; Moldenke, Geogr. Distrib. Avicenn. 7. 1939; Moldenke, Known Geogr. Distrib. Verbenac., ed. 1, 36 & 87. 1942; Moldenke, Alph. List Cit. 1: 216 & 314 (1946) and 4: 1035. 1949; Moldenke, Known Geogr. Distrib. Verbenac., ed. 2, 47 & 178. 1949; Moldenke, Résumé 56 & 445. 1959; Prain, Ind. Kew. Suppl. 5, pr. 2, 44. 1960; Moldenke, Phytologia 14: 150. 1966; J. A. Clark, Card. Ind. Gen. Sp. Pl. n.d.

Liogier describes this plant as a much-branched shrub, 1 m. tall, growing in thickets in dry areas on dogtooth limestone, at an altitude of 30 meters, flowering in February.

Urban (1929), in his discussion of C. selleana Urb. & Ekm., notes that the latter is "Affinis.....C. sordidae Urb., quae pube aliena, foliis oblongis v. elliptico-oblongis basi obtusis v. rotundatis, pedunculis 0,5—0,7 cm longis diversa est". In his 1911 work he says "Altera species domingensis, Callicarpa aculeolata Schauer, ramis manifeste aculeolatis, foliis lineari-lanceolatis 2—4 cm. longis, 0,6—0,8 cm. latis, margine subintegris facile distingui potest. Longius distant Callicarpa cubensis Urb. et Callicarpa fulva A. Rich. (e Cuba)".

In all, 14 herbarium specimens, including the type, and 14 mounted photographs of C. sordida have been examined by me.

Additional & emended citations: HISPANIOLA: Dominican Republic: Fuertes 848 (E—photo of type, F—385395—isotype, Lu—

isotype, Mi--photo of isotype, S--photo of type, W--698001--isotype, W--photo of type); Liogier 13649 (N, Z).

CALLICARPA STENOPHYLLA Merr. in Merr. & Merritt, Philip. Journ. Sci. Bot. 5: 380--381. 1910.

Bibliography: E. D. Merr. in Merr. & Merritt, Philip. Journ. Sci. Bot. 5: 380--381 & 554. 1910; Prain, Ind. Kew. Suppl. 4, pr. 1, 34. 1913; E. D. Merr., Philip. Journ. Sci. Bot. 10: 71. 1915; H. J. Lam, Verbenac. Malay. Arch. 47, 61, & 362. 1919; Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 24. 1921; E. D. Merr., Enum. Philip. Fl. 3: 388. 1923; E. D. Merr., Philip. Journ. Sci. 30: 87. 1926; Moldenke, Bull. Torrey Bot. Club 60: 55. 1932; Moldenke, Alph. List Common Vern. Names 17 & 18. 1939; Moldenke, Known Geogr. Distrib. Verbenac., ed. 1, 62 & 87. 1942; Moldenke, Phytologia 2: 95. 1945; Moldenke, Known Geogr. Distrib. Verbenac., ed. 2, 141 & 178. 1949; Prain, Ind. Kew. Suppl. 4, pr. 2, 34. 1958; Moldenke, Résumé 183 & 445. 1959; Moldenke, Phytologia 14: 143 (1966), 14: 228 (1967), 15: 24 (1967), and 21: 234, 332, 452, & 454. 1971.

A shrub, 2--4 m. tall; trunk about 4 cm. in diameter; branches slender, terete, grayish- or reddish-brown, glabrous; young branchlets densely stellate-pubescent or -tomentose; petioles 2--4 mm. long, densely stellate-pubescent or -tomentose; leaf-blades membranous or chartaceous, lanceolate or narrow-lanceolate, 7--15 cm. long, 1--2 cm. wide, straight or somewhat falcate, gradually and slenderly long-acuminate at the apex, denticulate along the margins, acute at the base, subglabrous above or with scattered and very short simple hairs, more or less densely stellate-pubescent beneath with simple (not plumose) rather pale or brownish hairs and with numerous, very minute, dark-colored or yellow to reddish glands; secondaries about 9 on each side, curvate-ascending, anastomosing; cymes axillary, solitary, about 2 cm. long, 2--2.5 cm. wide, rather dense, densely stellate-tomentose; pedicels very short; bracts subtending the primary branches of the inflorescence linear-lanceolate, 3 mm. long; bractlets similar, subulate, 1 mm. long; calyx cup-shaped, obscurely quadrangular, about 1 mm. long, subglabrous, its rim shortly 4-toothed; corolla 2 mm. long, the limb subequally 4-lobed, the lobes 0.4 mm. long, rounded; filaments 3 mm. long, exserted; anthers ellipsoid, 0.3 mm. long; drupes globose, 1.5 mm. in diameter when dry, pink or violet to purple when fresh.

This species is based on M. Ramos s.n. [Herb. Philip. Bur. Sci. 5739] from the Sablan River near Baguio, Benguet, Philippine Islands, and was deposited in the herbarium of the Bureau of Science at Manila, now destroyed. Merrill (1910) cites also Curran, Merritt, & Zschokke 18162, Darling s.n. [Herb. Philip. Forest Bur. 16574], and M. Ramos s.n. [Herb. Philip. Bur. Sci. 5790], and comments that the species is "Probably most closely allied to Callicarpa caudata Maxim., differing in its less dense and simply stellate, not plumose-stellate tomentum. It is well distinguished by its narrow leaves which are very long and slenderly acumin-

ate."

Lam (1919) comments that "This species seems to have — according to the description, since we could not examine any specimens of it — a close affinity with our γ-variety of C. caudata, or even to be identical with it. According to Merrill it has, however, less hairy and narrower and longer leaves." The C. caudata var. glabriuscula H. J. Lam, to which he refers here, is regarded by me as belonging in the synonymy of typical C. dolichophylla Merr. Bakhuizen van den Brink (1921) reduces C. stenophylla to synonymy under what he calls C. pedunculata R. Br.

Recent collectors have found C. stenophylla growing on forested slopes and in pine regions, at altitudes of 665 to 1800 meters, flowering in February and March, and fruiting in April, August, September, and November to January. Vernacular names reported for it are "karangit" and "layop".

Material has been misidentified and distributed in herbaria under the name C. cuspidata Roxb. On the other hand, the Ramos & Edaño s.n. [Herb. Philip. Bur. Sci. 40505], distributed as C. stenophylla, is actually C. caudata Maxim., while R. S. Williams 1158 is C. formosana f. angustata Moldenke.

In all, 18 herbarium specimens of C. stenophylla have been examined by me.

Citations: PHILIPPINE ISLANDS: Luzon: Curran, Merritt, & Zschokke s.n. [Herb. Philip. Forest. Bur. 18162] (W--711724); F. W. Darling s.n. [Herb. Philip. Forest. Bur. 16574] (W--711370); Haenke 74 (Ca--280928); M. Ramos s.n. [Herb. Philip. Bur. Sci. 5790] (W--629083), s.n. [Herb. Philip. Bur. Sci. 27388] (W--1376378), s.n. [Herb. Philip. Bur. Sci. 33012] (N), s.n. [Herb. Philip. Bur. Sci. 40778] (Bz--17516, Ca--239385); Ramos & Edaño s.n. [Herb. Philip. Bur. Sci. 26312] (W--1294731), s.n. [Herb. Philip. Bur. Sci. 37635] (Bz--17519, W--1260352), s.n. [Herb. Philip. Bur. Sci. 37679] (Bz--17513, W--1260384), s.n. [Herb. Philip. Bur. Sci. 48504] (B, Bz--17514, Ca--322116, N, W--1551528).

CALLICARPA SUBALBIDA Elm., Leafl. Philip. Bot. 1: 337--338. 1908.

Synonymy: Callicarpa erioclona var. subalbida (Elm.) Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 19. 1921.

Bibliography: Elm., Leafl. Philip. Bot. 1: 337--338 (1908) and 3: 862. 1910; Prain, Ind. Kew. Suppl. 4, pr. 1, 34. 1913; H. J. Lam, Verbenac. Malay. Arch. 49, 63--64, & 362. 1919; Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 19. 1921; E. D. Merr., Enum. Philip. Flow. Pl. 3: 388. 1923; Elm., Leafl. Philip. Bot. 10: 3860. 1939; Moldenke, Prelim. Alph. List Invalid Names 10. 1940; Moldenke, Known Geogr. Distrib. Verbenac., ed. 1, 62 & 87. 1942; Moldenke, Alph. List Invalid Names 9. 1942; Moldenke, Alph. List Cit. 4: 1259. 1949; Moldenke, Known Geogr. Distrib. Verbenac., ed. 2, 141 & 178. 1949; Prain, Ind. Kew.

Suppl. 4, pr. 2, 34. 1958; Moldenke, Résumé 183, 242, & 445. 1959; Moldenke, Phytologia 14: 179 (1966) and 21: 230. 1971.

Suberect shrub, 3--4 m. tall; trunk to 10 cm. in diameter; wood soft, white; bark light- or ashy-gray; ultimate branchlets slender, more or less tetragonal, minutely gray-tomentose; leaves decussate-opposite, descending, about 5 cm. apart; petioles stout, ashy-gray, 1--1.7 cm. long or on larger leaves 3--4 cm. long, subglabrous to slightly scurfy or minutely gray-tomentose, wrinkled when dry; leaf-blades submembranous or chartaceous, flat, deep- but dull-green above, silvery-white beneath, oblong or elliptic-oblong to broadly ovate-lanceolate or ovate, 11--25 cm. long, 4.3--12 cm. wide below the middle, gradually tapering on the upper half, slenderly long-acuminate or acute at the apex, entire along the margins or somewhat denticulate toward the apex, cuneate or subcuneate to somewhat rounded at the base, glabrous above, with a silvery-white covering of minute stellate hairs beneath; secondaries 7--13 on each side of the prominent midrib, ascending-curvate, quite prominent beneath, the connecting tertiaries rather numerous; inflorescences ascending; cymes in the axils of the upper leaves, about 4 cm. long and 6 cm. wide, dichotomously branched, gray and finely scurfy or minutely gray-tomentose, the branches subtended by linear bracts 5 mm. long; peduncles about 1 cm. long, yellowish-lanate; flowers in little woolly clusters, 3--5 together, sessile, "caducous, on a woolly receptacle surrounded by a subwhorl of unequal lanose persistent involucral bracts", not odorous; calyx strongly turbinate, glandular-dotted, 1--2 mm. long, 1.5 mm. wide at the apex, somewhat pubescent, its rim subentire or obscurely 4-apiculate-toothed; corolla yellowish-white or white, cupuliform, 2 to nearly 3 mm. long, glabrous, the tube only a little longer than the calyx, the 4 lobes each 1 mm. long, obtuse at the apex, with little glands on the outer surface; stamens 4, about 3.5 mm. long, only slightly exserted; filaments slender, 2 mm. long, glabrous, inserted on the corolla, with a strong bend below the middle; anthers oblong, 1.25 mm. long, 0.75 mm. wide, basifixed, the apex emarginate, the base subcordately lobed, glutinous and covered with pale-yellow granules along the connective between the cells on both sides; style 4 mm. long if straightened out, glabrous, with a conspicuous double loop below the middle; stigma peltate or subdisciform, terminal; ovary subglobose, 0.75 mm. wide, densely yellow-glandulose on the upper half with sulphur-yellow granules, the lower half glabrous; drupes globose, 2 mm. in diameter, glabrous, blackish when dry, half enclosed by the fruiting calyx.

The type of this species was collected by Adolph Daniel Edward Elmer (no. 9184) in humid woods on the road between Lucban and Sampaloc, at an altitude of 500 meters, Lucban, Tayabas, Luzon, Philippine Islands, in May, 1907. Elmer (1908) erroneously refers to the fruit as "berries". Bakhuizen van den Brink (1921) distinguishes his variety subalbida from typical C. erioclona Schau. by ascribing to the variety the following characters:

"Folia oblonga vel elliptica, basi cuneata vel subrotundata, apice sensim longe acuminata, integerrima, 10--20 c.M. longa, 3.5--7 c.M. lata; petiolus 1--2 c.M.; calyx sparse lanata margine subglabrescens; corolla subglabra." Lam (1919) says "This species seems to have a close affinity with the γ-repanda-variety of C. erioclona" and cites McGregor 10269 from Polillo. I regard C. erioclona var. repanda (Warb.) H. J. Lam as a synonym of typical C. erioclona Schau.

Callicarpa subalbida has been found growing in woods and by creeks in forests, at altitudes of 10 to 500 meters, flowering in May and June, and fruiting in May, June, and August. In all, 15 herbarium specimens, including the type collection, and 1 mounted photograph have been examined by me.

Citations: PHILIPPINE ISLANDS: Catanduanes: Ramos & Edaño s.n. [Herb. Philip. Bur. Sci. 75602] (Ca--449391, N). Luzon: Elmer 9184 (Bz--17580--isotype, N--isotype, Vt--isotype); Ramos & Edaño s.n. [Herb. Philip. Bur. Sci. 28969] (W--1294196). Mindanao: M. S. Clemens 1962 [Herb. Philip. Bur. Sci. 15639] (Ca--238908, Ca--268522, N). Mindoro: M. Ramos s.n. [Herb. Philip. Bur. Sci. 41009] (Bz--17582, W--1261764), s.n. [Herb. Philip. Bur. Sci. 41059] (Bz--17581, V, Z--photo). Polillo: C. B. Robinson s.n. [Herb. Philip. Bur. Sci. 6861] (W--629534); Salvoza 235 [Herb. Philip. Forest. Bur. 29707] (Ca--256859).

CALLICARPA SUBCANDIDA Elm., Leafl. Philip. Bot. 10: 3797--3798. 1939.

Bibliography: Elm., Leafl. Philip. Bot. 10: 3797--3798 & 3860. 1939; Hill & Salisb., Ind. Kew. Suppl. 10: 38. 1947; Moldenke, Phytologia 2: 483. 1948; Moldenke, Known Geogr. Distrib. Verbenac., ed. 2, 141 & 178. 1949; Moldenke, Résumé 183 & 445. 1959.

A lax undershrub; stems single or a few from the same root, ascending, branched from below the middle, terete, about 3 m. tall and 2.5 cm. in diameter; wood dingy-white, soft, with a large white pith; bark brown, lenticellate, the hypodermis green; main branches ascending, laxly rebranched; twigs terete, 5 mm. in diameter, covered with a grayish-white indumentum; leaves comparatively few, widely scattered and opposite, horizontal or descending; petioles stout, suberect, 2--4 cm. long, yellowish to gray, very short-tomentose, longitudinally canaliculate and ridged on the upper surface; leaf-blades submembranous or subchartaceous, green above but turning brown in drying, broadly lanceolate or suboblong, 15--25 cm. long, 6--9 cm. wide, gradually tapering into the acute to acuminate apex, unequally short-dentate along the margins except for the entire subcuneate basal portion, entirely glabrous above, whitish and minutely papillate beneath; midrib prominent and covered with a grayish-white indumentum beneath, slightly impressed toward the base above; secondaries 7--10 per side, ascending-curvate, less prominent than the midrib beneath; veinlet reticulation abundant, not visible above,

the interstices minutely stellate-punctate beneath; inflorescence in the axils of the leaves or of fallen leaves, densely corymbosely paniculate from near the base, abundantly rebranched and forming a dense mass 5 cm. wide, scurfy brown-pubescent when young, the numerous short and divaricate branchlets, as well as the short pedicels and even the calyx, turning gray when old; corolla creamy-white; drupes globose, 1.5—2 mm. in diameter, azure-blue, glabrate.

The type of this species was collected by Adolph Daniel Edward Elmer (no. 15124) in moist stony ground among thickets on a steep incline, at 750 meters altitude, Irosin (Mt. Bulusan), Sorsogon Province, Luzon, Philippine Islands, in November, 1915.

Elmer (1939) notes that "Evidently our specimen is best matched by Callicarpa nana Linn. [by which he doubtless meant C. cana L.] or Callicarpa bicolor Schauer, but our leaves are larger, longer petioled, more attenuate toward the base and with a different indumentum on the flowers."

Nothing is known to me of this species except what is stated in the bibliography listed above.

CALLICARPA SUBINTEGRA Merr., Philip. Journ. Sci. Bot. 12: 299—300. 1917.

Bibliography: E. D. Merr., Philip. Journ. Sci. Bot. 12: 299—300 & 382. 1917; E. D. Merr., Enum. Philip. Flow. Pl. 3: 388. 1923; A. W. Hill, Ind. Kew. Suppl. 6: 34. 1926; Moldenke, Known Geogr. Distrib. Verbenac., ed. 1, 62 & 87 (1942) and ed. 2, 141 & 178. 1949; Moldenke, Résumé 183 & 445. 1959; Moldenke, Phytologia 13: 499 (1966) and 21: 329 & 336. 1971.

A small tree, 2—5 m. tall; trunk to 6 cm. in diameter; branches terete, pale-brown, ultimately glabrous; younger branchlets very densely and uniformly stellate-puberulent, the hairs white or brownish-white; leaves decussate-opposite; petioles 1—1.5 cm. long, densely stellate-puberulent; leaf-blades chartaceous, lanceolate, 8—11 cm. long, 1.5—2 cm. wide, slenderly caudate-acuminate at the apex, entire or distantly and obscurely denticulate along the margins, acute at the base, olivaceous and shiny above, glabrous above or with the midrib sometimes stellate-pubescent, the lower surface completely covered with a very dense and pale stellate-puberulent indumentum, no glands evident; secondaries about 8 per side, arcuate-ascending, anastomosing, the primary reticulations distinct; cymes axillary, solitary, dichotomously branched, to 2.5 cm. long and 4 cm. wide, all the parts very densely stellate-puberulent; peduncles to 1 cm. long; bractlets in the primary cyme-branches linear, to 5 mm. long; prophylla on the secondary cyme-branches similar but shorter; flowers densely crowded on the ultimate cyme-branches, sessile or subsessile; calyx 1.5 mm. wide, externally densely pale-puberulent, its rim truncate or minutely and obscurely 4-toothed; corolla about 2.5 mm. long, glabrous, its limb 4-lobed, the lobes broadly ovate, about 1 mm. long, obtuse at the apex; anthers about 1 mm. long, exserted; style glabrous, about 4 mm. long; young drupes ellipsoid or obov-

oid, 2.5--3 mm. wide, glabrous, black when dry.

The type of this species was collected by Maximo Ramos and Gregorio E. Edaño (Herb. Philip. Bur. Sci. 26619) on dry slopes, at about 200 meters altitude, on Mount Dingalan, in Tayabas Province, Luzon, Philippine Islands, on August 25, 1916, and was deposited in the herbarium of the Philippine Bureau of Science at Manila, but is now destroyed. A vernacular name for the species is "marataringao".

Merrill (1917) comments that "In some respects this species resembles Callicarpa angusta Schauer, from which it is readily distinguished by its denser indumentum, its entire or but slightly toothed leaves, fewer nerves, and longer petioles. Its true alliance is with Callicarpa longipetiolata Merr., from which it is at once distinguished by its differently shaped, narrow, caudate-acuminate leaves."

This plant resembles C. longipetiolata var. glabrescens Moldenke in its leaf characters, but in that variety the inflorescences are much longer-pedunculate and more massive.

Callicarpa subintegra has been found growing on damp forested slopes, flowering in April, July, and October, and fruiting in July and November. Material has been misidentified and distributed in herbaria under the names C. angusta Schau. and C. pentandra var. paloensis f. celebica (Koord.) Bakh.

In all, 12 herbarium specimens, including type material, and 2 mounted photographs of C. subintegra have been examined by me.

Citations: PHILIPPINE ISLANDS: Luzon: Loher 12312 (Ca--243062); M. Ramos s.n. [Herb. Philip. Bur. Sci. 40767] (Bz--18605, W--1261642); Ramos & Edaño s.n. [Herb. Philip. Bur. Sci. 26619] (Bz--18604--isotype, N--isotype, N--photo of isotype, Z--photo of isotype), s.n. [Herb. Philip. Bur. Sci. 29707] (Bz--18603, N, W--1376380), s.n. [Herb. Philip. Bur. Sci. 48530] (B, Bz--18602, Ca--321340, N).

CALLICARPA SUBINTEGRA var. PARVA Merr., Philip. Journ. Sci. Bot. 12: 300. 1917.

Bibliography: E. D. Merr., Philip. Journ. Sci. Bot. 12: 300 & 382. 1917; E. D. Merr., Enum. Philip. Flower. Pl. 3: 388. 1923; Moldenke, Known Geogr. Distrib. Verbenac., ed. 1, 62 & 87. 1942; Moldenke, Phytologia 2: 95. 1945; Moldenke, Known Geogr. Distrib. Verbenac., ed. 2, 141 & 178. 1949; Moldenke, Résumé 183 & 445. 1959.

Merrill (1917) distinguishes this variety as follows: "A typo differt foliis minoribus, leviter acuminatis, haud caudato-acuminatis. Foliis 5 ad 7 cm longis, 1 ad 1.5 cm latis".

The variety is based on Ramos & Edaño s.n. [Herb. Philip. Bur. Sci. 26465] from forested slopes at about 350 meters altitude on Mount Umingan, in Nueva Ecija Province, Luzon, Philippine Islands, collected on August 13, 1916, and originally deposited in the herbarium of the Philippine Bureau of Science at Manila, now unfor-

tunately destroyed. A vernacular name recorded for the plant is "maratariñgau".

In all, only a single herbarium specimen (but that fortunately being of the type collection) has been examined by me.

Citations: PHILIPPINE ISLANDS: Luzon: Ramos & Edaño s.n. [Herb. Philip. Bur. Sci. 26465] (N--isotype).

CALLICARPA SUBPUBESCENS Hook. & Arn., Bot. Beech. Voy. 305. 1838 [not C. subpubescens Maxim., 1918].

Synonymy: Callicarpa boninensis Hayata, Journ. Coll. Sci. Imp. Univ. Tokyo 30 (1): [Mater. Fl. Formos.] 218. 1911.

Bibliography: Hook. & Arn., Bot. Beech. Voy. 305. 1838; Walp., Repert. Bot. Syst. 4: 129. 1845; Schau. in A. DC., Prodr. 11: 646. 1847; Maxim., Mél. Biol. 12: 504 & 507. 1886; Maxim., Bull. Acad. Sci. St. Pétersb. 32: 77. 1887; J. Matsum., Bot. Mag. Tokyo 3: 318. 1889; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 386. 1893; Briq. in Engl. & Prantl, Nat. Pflanzenfam., ed. 1, 4 (3a): 166. 1895; Hayata, Journ. Coll. Sci. Imp. Univ. Tokyo 30 (1): [Mater. Fl. Form.] 218. 1911; Prain, Ind. Kew. Suppl. 5, pr. 1, 43. 1912; J. Matsum., Ind. Pl. Jap. 2 (2): 529—530. 1912; Koidz., Bot. Mag. Tokyo 32: 56. 1918; P. C. Standl., Contrib. U. S. Nat. Herb. 23: 1253. 1924; Hosokawa, Journ. Soc. Trop. Agr. Taiwan 6: 205. 1934; Moldenke in Fedde, Repert. Spec. Nov. 40: 40 & 118. 1936; Bullock & Marquand, Kew Bull. Misc. Inf. 1938: 399. 1938; Tuyama, Journ. Jap. Bot. 16: 376. 1940; Moldenke, Known Geogr. Distrib. Verbenac., ed. 1, 61, 86, & 87. 1942; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 386. 1946; Hara, Enum. Sperm. Jap. 1: 185. 1948; Moldenke, Known Geogr. Distrib. Verbenac., ed. 2, 140, 177, & 178. 1949; Moldenke, Phytologia 3: 296. 1950; Anon., U. S. Dept. Agr. Bot. Subj. Index 15: 14354. 1958; Moldenke, Résumé 182, 241, 415, & 445. 1959; Anon., Kew Bull. Gen. Index 1929-1956, 59. 1959; Prain, Ind. Kew. Suppl. 5, pr. 2, 43. 1960; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 1: 386. 1960; Moldenke, Résumé Suppl. 4: 8. 1962; Moldenke, Phytologia 13: 434 (1966), 14: 167 (1966), and 14: 235 & 236. 1967; Tuyama, Pl. Bonin Isls. 98. 1968; Hara, Outline Phytogeogr. Jap. 87. 1969; Moldenke, Phytologia 21: 332, 385, & 386. 1971.

Illustrations: Tuyama, Journ. Jap. Bot. 16: 376. 1940.

The original description of this species by Hooker & Arnott (1838) is "foliis oblongo-lanceolatis utrinque attenuatis petiolatis serratis glabris adultis sparse stellato-pubescentibus, pedunculis axillaribus petiolum aequantibus, floribus copiosis cymosis. Leaves, including the petiole, nearly a span long, two inches broad at the widest part, closely serrated."

The species is said to be a native of Mexico by Hooker & Arnott (1838), Walpers (1845), Schauer (1847), Jackson (1893), and Standley (1924), but is credited to the Bonin Islands by Maximowicz (1886, 1887), Matsumura (1889, 1912), Moldenke (1936, 1942, 1949, 1959), Bullock & Marquand (1938), and Hara (1948). In this regard Bullock & Marquand (1938) have the following very pertinent comments: "As stated by Hooker & Arnott in Bot. Beechey Voy. 275

(1839-40), the localities of the Mexican plants listed were sometimes doubtful, as the same species was sometimes also found in packets of plants from Bonin and Loo Choo, in the North Pacific. That a wrong locality was given seems to be established beyond doubt in the case of Callicarpa subpubescens (op. cit. 305), which was said to come from Tepic. The Beechey specimens in Herb. Hook. and Herb. Benth. have the locality Bonin written by Bentham himself, and were transferred, apparently by the late Dr. Stapf, to their proper places in the Kew Herbarium, and identified with other Bonin specimens. The species was listed as somewhat doubtfully Mexican by Standley on page 1253 of his 'Trees and Shrubs of Mexico.'"

Maximowicz (1886) says "Species a Hookero et Arnott quidem inter mexicanas describitur, sed a Hemsley in Biol. centr. amer. II. haud enumeratur, ex qua re patet, tantum confusione schedularum patriam Mexico indicatam, revera autem plantam e Bonin-sima allatam fuisse". He cites a Small s.n. and Yatabe s.n. from "ad collium latera" and describes the plant as "frutex dumosus floribus purpureis".

The plant has been found growing at altitudes of 75 to 200 feet, flowering in June and July. The common names "shima murasaki", "shima-murasaki", and "softwood" have been recorded for it. The original Hooker & Arnott reference is cited as "1841" by Hara (1948) and as "1839-40" by Bullock & Marquand (1938), but pages 289--384 of that work were published in 1838.

Matsumura reduces this species to synonymy under C. glabra Koidz., but it is C. subpubescens Maxim. apud Koidz., Bot. Mag. Tokyo 32: 56, in syn. (1918) that belongs in that synonymy.

Material of C. subpubescens has been misidentified and distributed in herbaria under the names C. cana L. and C. dichotoma Juss. On the other hand, the Mexia 1108, distributed as C. subpubescens, is actually C. acuminata H.B.K.

In all, 7 herbarium specimens of C. subpubescens have been examined by me.

Citations: BONIN ISLANDS: Chichijima: Kondo 18 (Bi), 44 (Bi); A. R. Mead s.n. [Kondo 117] (Bi), s.n. [Kondo 117a] (Bi), s.n. [Kondo 117b] (Bi). Island undetermined: C. Wright s.n. [Bonin Islands] (T, W--9962, W--9971).

CALLICARPA SUPERPOSITA Merr., Philip. Journ. Sci. 30: 86--87. 1926.

Bibliography: E. D. Merr., Philip. Journ. Sci. 30: 86--87. 1926; A. W. Hill, Ind. Kew. Suppl. 8: 37. 1933; Moldenke, Known Geogr. Distrib. Verbenac., ed. 1, 64 & 87 (1942) and ed. 2, 145 & 178. 1949; Moldenke, Résumé 192 & 445. 1959; Van Steenis, Blumea 15: 149. 1967; Moldenke, Phytologia 20: 495 (1971) and 21: 39, 40, 109, & 494. 1971.

Merrill's original (1926) description of this species is "Frutex circiter 3 m altus plus minusve ferrugineo-villosus, indumento haud stellato; ramis ramulisque teretibus, ramulis circiter 2 mm diametro; foliis chartaceis vel membranaceis, lanceolatis, in

siccitate olivaceis, opacis, 15 ad 20 cm longis, 4 ad 5 cm latis, longissime tenuiter caudato-acuminatis, deorsum angustatis, basi rotundato-truncatis, circiter 1 cm latis, margine perspicue crenato-dentatis, dentibus plerumque apiculatis, utrinque plus minusve villosis, subtus glandulosis; nervis primariis utrinque 10 ad 12, tenuibus, perspicuis, curvato-adscendentibus; petiolo dense villoso, 5 ad 8 mm longo; cymis solitariis, pedunculatis, dichotomis, perspicue ferrugineo-villosis, 3 ad 5 mm supra axillis insertis, circiter 3 cm longis latisque, pedunculo 1 ad 1.5 cm longo; floribus numerosis, calycis 1 ad 1.2 mm longis, obscure 4-dentatis, extus leviter pubescentibus; corolla 2.5 mm longa, extus obscure puberula, subaequaliter 4-lobata; staminibus 4, filamentis 3 mm longis, antheris ellipsoideis, circiter 0.6 mm longis; ovarium glabrum, styli 5 mm longi; fructibus globosis, glabris, circiter 2 mm diametro. BRITISH NORTH BORNEO, Simporna, No. 1227, 1236 (type) D. D. Wood, col. B. Evangelista, July 14, 1924, growing at sea level. A species readily distinguishable among the numerous species of this genus through its simple, not at all stellate indumentum, the weak, elongated, jointed hairs being either pale or ferruginous, as well as by its lanceolate, long caudate-acuminate leaves and its solitary cymes being inserted some distance above the axils. In aspect it resembles the Philippine Callicarpa lancifolia Merr. and C. stenophylla Merr., but is remote from both." The type was deposited in the herbarium of the Philippine Bureau of Science at Manila, but is now unfortunately destroyed.

Van Steenis (1967) says that the species is related to C. barbata Ridl., C. fulvohirsuta Merr., C. havilandii (King & Gamble) H. J. Lam, and C. saccata Steen., but to me it appears most closely related to C. caudata Maxim.

Material of C. superposita has been misidentified and distributed in herbaria as C. longifolia Lam.

Thus far only a single herbarium specimen of C. superposita, albeit one cited by Merrill himself, has been examined by me.

Citations: GREATER SUNDA ISLANDS: Sabah: Evangelista s.n. [D. D. Wood 1227] (Ca—239820).

CALLICARPA SURIGAENSIS Merr., Philip. Journ. Sci. Bot. 3: 362. 1908.

Synonymy: Callicarpa longivillosa Merr., Philip. Journ. Sci. 17: 313. 1920. Callicarpa pentandra var. cumingiana f. surigaensis (Merr.) Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 16—17. 1921. Callicarpa surigaënsis Merr. ex Moldenke, Alph. List Common Vern. Names 2 & 7. 1939.

Bibliography: E. D. Merr., Philip. Journ. Sci. Bot. 3: 262. 1908; Prain, Ind. Kew. Suppl. 4, pr. 1, 34. 1913; H. J. Lam, Verbenac. Malay. Arch. 50, 79, & 362. 1919; E. D. Merr., Philip. Journ. Sci. 17: 313. 1920; Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 16—17. 1921; E. D. Merr., Enum. Philip.

Flow. Pl. 3: 386 & 388. 1923; A. W. Hill, Ind. Kew. Suppl. 7: 36. 1929; Moldenke, Alph. List Common Vern. Names 2 & 7. 1939; Moldenke, Known Geogr. Distrib. Verbenac., ed. 1, 62 & 87. 1942; Moldenke, Alph. List Invalid Names 10. 1942; Moldenke, Phytologia 2: 95. 1945; Moldenke, Known Geogr. Distrib. Verbenac., ed. 2, 141, 177, & 178. 1949; Moldenke, Phytologia 4: 268 (1953) and 5: 28. 1954; Prain, Ind. Kew. Suppl. 4, pr. 2, 34. 1958; Moldenke, Résumé 183, 245, 246, & 445. 1959.

A small tree, about 8 m. tall; branches and branchlets densely stellate-tomentose with ferruginous hairs and with numerous long hirsute hairs interspersed; leaves decussate-opposite; petioles about 1 cm. long, densely hirsute and stellate-tomentose with ferruginous hairs; leaf-blades subcoriaceous, oblong-ovate to lanceolate-ovate, 10--15 cm. long, 4--7 cm. wide, gradually narrowed above into a long and slender caudate acumen at the apex, minutely denticulate along the margins, acute at the base, rather densely hirsute on the midrib and secondaries above, with scattered hairs on the lamina, paler and densely ferruginous-stellate-villous beneath and with scattered long hairs on the midrib and secondaries; secondaries about 7 per side, prominent beneath; vein and veinlet reticulation distinct; cymes axillary, pedunculate, to 4 cm. long, densely ferruginous-hirsute; calyx about 3 mm. long, externally densely villous, its rim 4-toothed; corolla red, about 5 mm. long, glabrous, its limb 4-lobed, the lobes about 2 mm. long, obtuse at the apex; stamens 4; filaments subequal, about 4 mm. long; anthers about 2 mm. long; style 7 mm. long; stigma capitate; ovary glandulose.

This species is based on W. B. Allen 168 and Ahern 318, as cotype collections, both from Surigao Province, Mindanao, Philippine Islands, the former collected in July, 1907, and the latter in May, 1901, both originally deposited in the herbarium of the Philippine Bureau of Science at Manila, but unfortunately both now destroyed. Merrill (1908) comments that this is "A species well characterized by its dense stellate-tomentose and hirsute, ferruginous indumentum." Callicarpa longivillosa is based on Ramos & Pascasio s.n. [Herb. Philip. Bur. Sci. 34538], also from Mindanao, Philippine Islands, and also originally deposited in the herbarium of the Philippine Bureau of Science at Manila, now destroyed through the misfortunes of war.

Recent collectors have found this plant growing in forests along streams at low altitudes, flowering in April and May. Vernacular names recorded for it are "alingtutiñgau" and "buyakan".

Bakhuizen van den Brink (1921), in reducing this species to mere form rank, gives the following distinguishing characters for it: "Ramuli subteretes, tenuisculi; foliorum oppositorum paria singula cum foliis 1--2 alternantia, saepe folia omnia, oblonga vel lanceolata-oblonga, basi acuta, raro cuneata apice sensim in acumen caudato-attenuata, minutissime serrato-denticulata, adulta supra dense ferrugineo-hirsuta, subtus subdense, molliter pilis stellatis uniformiter tomentosa, siccando ferruginea 10--15 c.M. longa, 3.5--1 c.M. lata; nervis lateralibus utrinque 7--10; petiolus 1--2 c.M.

longus; cymae minusculae, 3—4 c.M. longae; pedunculus 1.2—5 c.M. longus, calyx breviter 4—5-dentatus extus dense ferrugineo-hirsutus. ± 0.3 c.M. altus fructifer paulo auctus cupuliformis, drupam inferius dimidium amplectens; corolla 4—5-laciniata, extus glabra ± o.5 c.M. alta; stamina 4—5, longe exserta ± 0.4 c.M. longa; antherae lanceolato-oblongae ± 0.2 c.M. longae drupa subdepresse globosa, mediocris, matura (rubra) (4)—5-locularis, loculis bipartitis locellis monospermis; semina (4)—5—(8)—10."

If the characters enumerated by Bakhuizen van den Brink are accurately stated, it would appear that this species should be placed in the genus Geunsia. Material actually has been identified and distributed in herbaria under the names Callicarpa pentandra var. pubescens f. cumingiana (Schau.) Bakh. and Geunsia farinosa Blume.

In all, 11 herbarium specimens, including type material of all the names involved, and 8 mounted photographs of Callicarpa surigaensis have been examined by me.

Citations: PHILIPPINE ISLANDS: Dinagat: Ramos & Convocar s.n. [Herb. Philip. Bur. Sci. 83993] (Bz—18607), s.n. [Herb. Philip. Bur. Sci. 84082] (Bz—18606). Mindanao: Ahern 318 (W—445256—cotype, W—445257—cotype, W—445663—cotype, Z—cotype, Z—photo of cotype), 318Q [N. Y. Bot. Gard. Photos Neg. E.4200] (Bz—18211—cotype, N—photo of cotype, N—photo of cotype, Z—photo of cotype); Ramos & Pascasio s.n. [Herb. Philip. Bur. Sci. 34379] (W—1263620), s.n. [Herb. Philip. Bur. Sci. 34538] (Bz—18210, N—photo, N—photo, Z—photo, Z—photo), s.n. [Herb. Philip. Bur. Sci. 34545] (Ca—212149, W—1263678).

CALLICARPA TAKAKUMENSIS Hatusima, Journ. Jap. Bot. 24: 81. 1949.

Bibliography: Hatusima, Journ. Jap. Bot. 24: 81. 1949; Moldenke, Phytologia 3: 306. 1950; E. J. Salisb., Ind. Kew. Suppl. 11: 40. 1953; Moldenke, Résumé 172 & 445. 1959; Kitamura & Okamoto, Col. Illustr. Trees & Shrubs Jap. 220. 1960; Ohwi, Fl. Jap. 764 & 998. 1965; Okuyama, Journ. Jap. Bot. 42: 218. 1967; Moldenke, Phytologia 21: 35 & 42. 1971.

Hatusima's original (1949) description of this plant is "Frutex ramuli subtetragoni glabrati circ. 2 mm crassi. Folia oblongo-lanceolata utrinque acuminata in sicco membranacea, circ. 10—18 cm longa 2.5—3.7 cm lata, margine obscure minuteque denticulata, supra costa nervisque cinereo-puberula cetera glabra, subtus glabrata dense minuteque glandulosa, nervis lateralibus 12—14 arcuato-ascendentibus. Petioli circ 1 cm longi pubescentes. Cymae axillares pedunculatae circ. 3 cm latae, pedunculis circ. 1.3 cm longis 0.5 cm crassis breviter pubescens. Calyx circ. 0.6 mm latus glaber, corolla circ. 1 mm longa eytus puberula sed eglandulosa, antheris corollam circ. duplo superantibus."

The type of the species was collected by T. Kameda on Mount Takakuma, in Ohsumi Province, Kyusku, Japan, in August, 1942. Hatusima (1949) comments that "This is closely related to C. lon-

gifolia var. longissima Hemsl. from Formosa, but differs from it by its glabrous branchlets and leaves, and its smaller flowers. This is also near to C. shikokiana Mak., but easily distinguishable from it by its longer leaves with obscure serration, its glabrous branchlets, and its much smaller flowers without glands." A common name recorded for it is "Takakuma-murasaki".

Ohwi (1965) refers to the species as "rare" and separates it from two similar taxa as follows (with his nomenclature brought up-to-date):

1. Leaves caudate, glandular dotted on both sides..... C. japonica var. luxurians.

1a. Leaves acuminate to acute, glandular-dotten on the underside only.

2. Cymes supra-axillary; anthers broadly ellipsoidal..... C. dichotoma.

2a. Cymes axillary.

3. Corolla 1 mm. long, not glandular-dotted; branches slightly 4-angled; leaves with 12—14 pairs of veins..... C. takakumensis.

3a. Corolla 3—5 mm. long, glandular-dotted; branches terete; leaves with 5—9 pairs of veins.....C. japonica.

Callicarpa takakumensis is known to me only from the literature cited above.

CALLICARPA TIKUSIKENSIS Masam., Trans. Nat. Hist. Soc. Formos. 30: 64—65. 1940.

Bibliography: Masam., Trans. Nat. Hist. Soc. Formos. 30: 64—65. 1940; H.-T. Chang, Act. Phytotax. Sin. 1: 308. 1951; E. J. Salisb., Ind. Kew. Suppl. 11: 40. 1953; Li, Wood. Fl. Taiwan 824 & 944. 1963; Moldenke, Résumé Suppl. 8: 3. 1964.

Masamune's original (1940) description of this taxon is "Frutex ca. 1 m altus. Rami validiusculi cinerascentes, juveniles stellato-tomentosi. Folia opposita petiolata, (petiolis ca. 5 mm longis cinerascenteo-stellato-tomentosis) ovato-elliptica, ovato-lanceolata vel rhomboideo-elliptica, chartacea 3 x 1, 6 x 2, 7 x 2, 8 x 2.5 vel 9 x 2.5 cm magna apice acuminata vel cuspidato-acuminata vel acuta, basi cuneata, obtusa vel vix rotundata margine minute apiculato-serrata, costis subtus prominente supra leviter elevatis, venis primariis utrimque latere 6—9 suboppositis, ad costam venasque stellato-tomentosa et sparse hirsuta, supra pubescentia subtus pallidiora et subglabra. Cymae axillares subdense racemosae, ramis divaricatis, stellato-tomentosis, pedicellis ca. 1.5 mm longis; bracteis minutis subulatis. Drupa globosa purpurea ca. 4 mm crasa, pyrenis saepe 3 ellipticis dorso convexis ventrali concavis albo-flavis ca 2 mm longis 1.5 mm latis."

A common name recorded for the plant by Masamune is "Tikusi-murasakisikibu", and the type is T. Nakamura 3968 from Tikusiki, Sitisei-gun, Taihoku-syū, Formosa, collected on October 7, 1939, and deposited in the herbarium of the University of Tokyo. Also cited by Masamune (1940) is T. Nakamura 3956 from Formosa. The

species has been collected in fruit in October. Li (1963) refers to the species as "insufficiently known". I know nothing of it beyond what is stated in the bibliography cited above.

CALLICARPA TINGWUENSIS Chang, Act. Phytotax. Sin. 1: 273 & 302—303, fig. 3—5. 1951.

Bibliography: H.-T. Chang, Act. Phytotax. Sin. 1: 273 & 302—303, fig. 3—5. 1951; Moldenke, Résumé Suppl. 14: 3. 1966; G. Taylor, Ind. Kew. Suppl. 13: 21. 1966; Moldenke, Phytologia 20: 499. 1971.

Illustrations: H.-T. Chang, Act. Phytotax. Sin. 1: 273, fig. 3—5. 1951.

Chang's original (1951) description of this species is "Frutex 1.5 m altus. Ramuli juveniles fulvello-stellato-tomentosi. Folia chartacea elliptica vel oblongo-elliptica, 14—20 cm longa, 5—8.5 cm lata, apice acuminata vel breviter acuminata, basi late cuneata vel obtusa, margine in parte 1/2 superiore denticulata, dentibus breviter calloso-apiculatis, supra costis exceptis viridia glabra, subtus pallidiora stellato-pubescentia, nervis utrinsecus 10—12 supra planis subtus elevatis; petioli 1—1.5 cm longi, stellato-pubescentes. Cymae axillares dense multiflorae, 2—2.5 cm latae, pedunculatae, pedunculis circ. 5 mm longis, pilis eis ramulorum similiter obtectis, pedicellis 1—1.5 mm longis sparsissime puberulis; bracteae et bracteolae subulatae; calyx 1 mm longus parcissime stellato-puberulus, subtruncatus; corolla alba, tubo 3—4 mm longo, lobis late ovatis circ. 1 mm longis; stamina prope basin corollae inserta, filamentis corolla subaequilongis, antheris 1.5 mm longis exsertis; ovarium dense stellato-pubescens, stylo 5—6 mm longo. Fructus globosus 3 mm diametro, parce stellato-puberulus."

The species is based on H.-T. Chang 4321 from Canton, Kwangtung, China, deposited in the herbarium of the Botanical Institute, Sunyatsen University, Canton. Cited also by Chang (1951) are Gilchrist 30 and Tsiang 10999 from the same province. The species is said to be related to C. brevipes (Benth.) Hance and to C. collina Diels. It is known to me only from the literature cited above.

CALLICARPA TOMENTOSA (L.) Murr. in L., Syst. Veg., ed. 12 ["13"], 130. 1774 [not C. tomentosa Auct., 1962, nor Bakh., 1932, nor Hook. & Arn., 1918, nor L. ex Moldenke, 1959, nor L. ex Spreng., 1825, nor Lam & Bakh., 1951, nor Lam., 1783, nor sensu auct. japon., 1965, nor sensu Matsum., 1964, nor sensu Matsum. & Hayata, 1963, nor Thunb., 1959, nor Vahl, 1919, nor Willd., 1809].

Synonymy: Tondi teregam Rheede in Rheede & Munnicks, Hort. Ind. Malab. 4: 123—124. 1683. Tóndi-teregam Rheede in Rheede & Munnicks, Hort. Ind. Malab. 4: pl. 60. 1683. Tondi-teregam Rheede ex Ray, Hist. Pl. 2: 1787. 1693. Illa P. Herm., Mus. Zeyl., ed. 1, 11. 1717. Arbor malabarica Illa dicta Burm., Thes. Zeyl. 26. 1737.

Tomex tomentosa L. ex Dassaw, Nov. Gen. Pl. Zeyl. 5. 1747. Tomex tomentos. L., Syst. Nat., ed. 10, 2: 897. 1759. Callicarpa lanata L., Mant. Pl. Alt. 331. 1767 [not C. lanata Gamble, 1889, nor Hosséus, 1912, nor H. J. Lam, 1940, nor Lam., 1821, nor Ridl., 1966, nor Schau., 1870, nor Vahl, 1847, nor Walp., 1921, nor Zipp., 1841]. Callicarpa fol. integerrimis lanatis L. ex J. A. Murr. in L., Syst. Veg., ed. 12 ["13"], 130, in syn. 1774. Cornutia corymbosa Lam., Dict. Encycl. Bot. 1: 54--55. 1783 [not Cornutia corymbosa Burm. f., 1768]. Callicarpa integrifolia L. ex [Retz.], Nom. Bot. 35, nom. nud. 1772; Retz., Obx. Bot. 5: 2, in syn. 1789 [not C. integrifolia Champ., 1890, nor Forbes & Hemsl., 1932, nor Jacq., 1780]. Callicarpa foliis integerrimis lanatis L. ex Gaertn., Fruct. & Sem. Pl. 2: 81, in syn. 1791. Callicarpa foliis ovatis basi rotundatis integerrimis subdenticulatis, supra rugosis subtus ramisque lanato-tomentosis Vahl ex Willd., Linn. Sp. Pl. 1: 620, in syn. 1797. Tondi-caravatti Rheede ex Poir. in Lam., Encycl. Méth. Bot. 7: 697, in syn. 1806. Callicarpa tomex Poir. in Lam., Encycl. Méth. Suppl. 2: 32. 1811. Callicarpa tomentosa Murr. ex Steud., Nom. Bot., ed. 1, 137, in syn. 1821. Callicarpa lanata Willd. ex Ainslie, Mat. Ind. 2: 180--182. 1826. Callicarpa farinosa Roxb. ex Wall., Numer. List 87, hyponym. 1831 [not C. farinosa Sieb., 1865, nor Sieb. & Zucc., 1971]. Callicarpa lanata Roxb. ex J. Grah., Cat. Pl. Bombay 156. 1839. Callicarpa wallichiana Walp., Repert. Bot. Syst. 4: 125. 1845. Callicarpa lanata Wall. ex Miq., Fl. Ned. Ind. [Fl. Ind. Bat.] 2: 890, in syn. 1856. Tondi-teregam Poir. ex Hassk., Hort. Malab. Rheed. Clav. 38, in syn. 1867. Callicarpa arborea Miq. ex C. B. Clarke in Hook. f., Fl. Brit. India 4: 567, in syn. 1885 [not C. arborea Merr., 1940, nor Roxb., 1814, nor Wall., 1829]. Callicarpa tomentosa L. ex E. Balf., Cyclop. Ind., ed. 3, 1: 550, in syn. 1885. Callicarpa lobata C. B. Clarke in Hook. f., Fl. Brit. India 4: 566. 1885. Callicarpa sp. n. 27 Hook. f. & Thoms. ex C. B. Clarke in Hook. f., Fl. Brit. India 4: 567, in syn. 1885. Callicarpa cana Dalz. & Gibs. ex Watt, Dict. Econ. Prod. India 2: 26, in syn. 1889 [not C. cana Gamble, 1889, nor L., 1771, nor Spreng., 1866, nor Vahl, 1866, nor Wall., 1863]. Callicarpa lanata var. typica H. J. Lam, Verbenac. Malay. Arch. 81. 1919. Callicarpa wallichiana Miq. ex Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 21, in syn. 1921. Callicarpa tomentosa var. lanata (L.) Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 21--22. 1921. Callicarpa tomentosa var. typica Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 21. 1921. Tondi teregam Ray apud Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 21, in syn. 1921. Callicarpa tomentosa (L.) Santapau ex Sen & Naskar, Bull. Bot. Surv. India 7: 38. 1965.

[to be continued]

PARMELIA SQUARROSA, A NEW SPECIES IN SECTION PARMELIA

Mason E. Hale, Jr.
Smithsonian Institution, Washington, D.C. 20560

Parmelia squarrosa Hale, sp. nov.

Thallus ut in P. saxatili (L.) Ach. sed differt rhizinis squarrose ramosis atque acidum lobaricum nunquam continente.

Holotype: On Quercus alba L., about 300 m south of the Upper Hawksbill parking area, Shenandoah National Park, Madison Co., Virginia, collected by M. E. Hale, no. 36949 (US; isotypes to be distributed in Fasc. V, Lichenes Americani Exsiccati).

The chief morphological feature of P. squarrosa is the richly squarrosely branched rhizines in contrast to the uniformly simple unbranched rhizines of P. saxatilis. This type of rhizine is species-specific in section Parmelia, known so far in P. sulcata Tayl. and the common Asian P. fertilis Müll. Arg., as well as in twelve other rarer species.

Other morphological differences between P. squarrosa and P. saxatilis are less distinctive and may reflect the different ecological conditions under which they grow. Parmelia squarrosa is a temperate species with a light mineral gray, sometimes even white pruinose color and elongate lobes; P. saxatilis, a boreal and arctic species, tends to turn brownish and to have shorter crowded lobes and a shiny cortex. Isidial formation is essentially the same except for a tendency toward greater marginal growth in P. squarrosa. Both species produce atranorin in the cortex and salazinic acid in the medulla, but while P. saxatilis often produces lobaric acid in the medulla, especially in Europe and eastern North America, this acid has not been demonstrated in any specimens of P. squarrosa on thin-layer chromatographic plates.

Parmelia squarrosa is one of the commonest lichens in the Great Lakes-Appalachian region where it had previously been identified as P. saxatilis. It occurs from southern Maine to northern Alabama and Georgia with two records so far from Arkansas and southern Missouri. In the Great Lakes it occurs as far north as the Canadian border and in the southern part of western Ontario. It is extremely rare in northern California, Oregon, and southern Alaska. Outside of North America it is very common in Japan and Korea and is known from Nepal.

FIVE NEW PARMELIAE FROM TROPICAL AMERICA

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In continuation of my monographic studies of Parmelia I am describing the following four species and one name as new. Chemical constituents were determined with thin-layer chromatography (Brinkmann pre-coated plates in two solvent systems: benzene-dioxane-acetic acid (90:25:4) and hexane-ether-formic acid (9:4:1), sprayed with 10% H_2SO_4 and heated 10 minutes as 110°C).

Parmelia chicitae Hale, sp. nov.

Thallus laxe adnatus, saxicola vel terricola, fragilis, 4-8 cm latus, albidus vel obscurascens, lobis linearibus, 1.5-2.0 mm latis, superne planus, nitidus, sorediis isidiisque destitutis, cortex superior 12-15µ crassus, stratum gonidiale 20-30µ crassum, medulla alba, 75-85µ crassa, cortex inferior 20µ crassus, subtus niger, dense rhizinosus, rhizinis sparse vel dense dichotome furcatis, ab margine projectis. Apothecia rara, adnata, 3-6 mm diametro, sporis octonis, 5X6-7µ; pycnidia numerosa, usque ad 200µ diametro.

Chemistry: Cortex K+ yellow (atranorin); medulla K-, C+, KC+ rose, P- (evernic acid, lecanoric acid, obtusatic acid, and norobtusatic acid). Chemistry of all specimens determined by Dr. Chicita Culberson, for whom the species is named.

Holotype: On rock, along the Carretera Inter-Americana at Asunción (3,335 m), Cerro de la Muerte, Costa Rica, W. L. Culberson, no. 13210, 28 March 1967 (US; isotypes in DUKE, TNS) (Fig. 1).

Nonsorediate KC+ red Hypotrachynas so common in tropical America usually contain alectoronic acid (e.g., P. lineariloba Kurok., P. gigas Kurok.). I had long puzzled over the chemistry of this species because in spite of the KC+ rose color test it did not contain alectoronic acid. In the meantime Dr. Culberson had an opportunity to analyse some Costan Rican collections and was able to unravel the very complex chemistry. The significance of this species, according to Dr. Culberson, is that it falls midway in biogenetic chemical evolution between the species with evernic acid (P. pulvinata Fée, P. rockii Zahlbr.) and those with barbatic and obtusatic acids (P. boliviana Nyl. group). Parmelia chicitae is not common and appears to be restricted to higher elevations in the American tropics.

Additional specimens examined. Costa Rica: Cerro de la Muerte, Crosby 3932 (DUKE, US). Venezuela: Sierra de Sto. Domingo, Merida, Dennis 1940 (BM, US). Peru: Mito, Bryan 364 (F, US).

Parmelia commensurata Hale, sp. nov.

Thallus ut in P. reticulata Tayl. sed differt norlobaridonum continente.

Chemistry: Thallus K+ yellow (atranorin); medulla K-, P-, C-, KC+ rose (norlobaridone, neoloxodic acid).

Holotype: On Acacia, 9 km E Jalapa on highway 140, elev. 1240 m, M. E. Hale, no. 19405, 13 March 1960 (US; isotypes in TNS, UPS) (Fig. 2).

Parmelia commensurata is superficially very close to P. reticulata and is classified with it in section Irregulares. The soralia are coarse and rather broad along the margins, and there is a tendency for the lobes to become revolute as in P. perlata (Huds.) Ach. Rhizines are quite dense, short, and sparsely squarrosely branched. The medulla is negative except for the rather weak KC test but the constituents are easily identified on thin-layer plates. In contrast P. reticulata is strongly K+ red and contains salazinic acid.

The nonsorediate counterpart is P. homotoma Nyl. (Type: Brazil, Weddel, in H), which also contains norlobaridone as one would predict from Vainio's report of a KC+ red color test. Both species are quite rare in tropical America.

Additional specimens examined. Haiti: Below Furcy, Dept. de l'Ouest, Wetmore 2683 (MSC, US). Honduras: Siguatepeque, Comayagua, Standley & Chacón 6778 (F, US). Colombia: 4 km W Cali, Queremal, Valle, Flenniken 2055 (US); 6 km S Medellin, Antioquia, Flenniken 1959 (US).

Parmelia imshaugii Hale, sp. nov.

Thallus adnatus, corticola, 4-6 cm latus, cinereo-alba, lobis subirregularibus, 3-5 mm latis, superne planus vel rugulosus, aetate rimosus, lamine sorediatus, soraliis orbicularibus vel diffusis, margine bulbato-ciliatus, ciliis brevibus, cortex superior 18-22μ crassus, stratum gonidiale 25-30μ crassum, medulla alba, 120-140μ crassa, cortex inferior 18-22μ crassus, subtus niger, modice vel dense rhizinosus, rhizinis simplicibus. Apothecia ignota.

Chemistry: Cortex K+ yellow (atranorin); medulla K+ yellow turning red, P+ orange (salazinic acid).

Holotype: Near Granizo, Montana Compana, Prov. Valparaiso, Chile, H. A. Imshaug, no. 36670, 21 Nov. 1965 (MSC; isotype in US) (Fig. 3).

This species is characterized by bulbate cilia and diffuse soralia. It is the only sorediate species in section Bicornuta. In general appearance it is close to P. brevirhiza Kurok., a Hypotrachyna species with dichotomously branched rhizines and no marginal cilia. Both species produce salazinic acid. Parmelia imshaugii is still known only from the type locality.

Parmelia inornata Hale, sp. nov.

Thallus adnatus, corticola, 5-10 cm latus, viridi-albidus, lobis subirregularibus, rotundatis, 3-7 mm latis, superne continuus, aetate rimosus, pro parte albo-reticulatus, sorediis isidiisque destitutis, cortex superior 8-10μ crassus, stratum gonidiale 20μ crassum, medulla alba, 110-130μ crassa, cortex inferior 6-9μ crassus, subtus centrum versus niger rhizinosusque, rhizinis sparsis, simplicibus, ambitu subnudus, castaneus. Apothecia numerosa, substipitata, disco pallido, imperforata, sporis octonis, 7-8X16-18μ; pycnidia numerosa, 60-80μ diametro, microconidiis 1X6μ.

Chemistry: Cortex K+ yellow (atranorin); medulla K-, P+ red (protocetraric acid).

Holotype: North of East End Village, Grand Cayman, H. A. Imshaug, no. 24454 (MSC; isotype in US) (Fig. 4).

Parmelia inornata represents another West Indian endemic in section Cyclocheila with protocetraric acid, a list that now includes P. caribaea Hale, P. martinicana Nyl., and P. raunkiaeri Vainio. It has rather broad lobes and a distinct bare zone below, similar in many respects to usnic acid-containing P. caperata (L.) Ach., but in overall appearance it is unlike any other members of the section.

Additional specimens examined. Bahamas: Andros, Brace 5067 (NY), Acklin's Island, Brace 4297 (NY). Haiti: West of Cap Haitien, Dept. de Nord, Imshaug 22659 (MSC, US). Grand Cayman: Near old coral castle, Imshaug 24543 (MSC, US).

Parmelia simulans Hale, nom. et stat. nov.

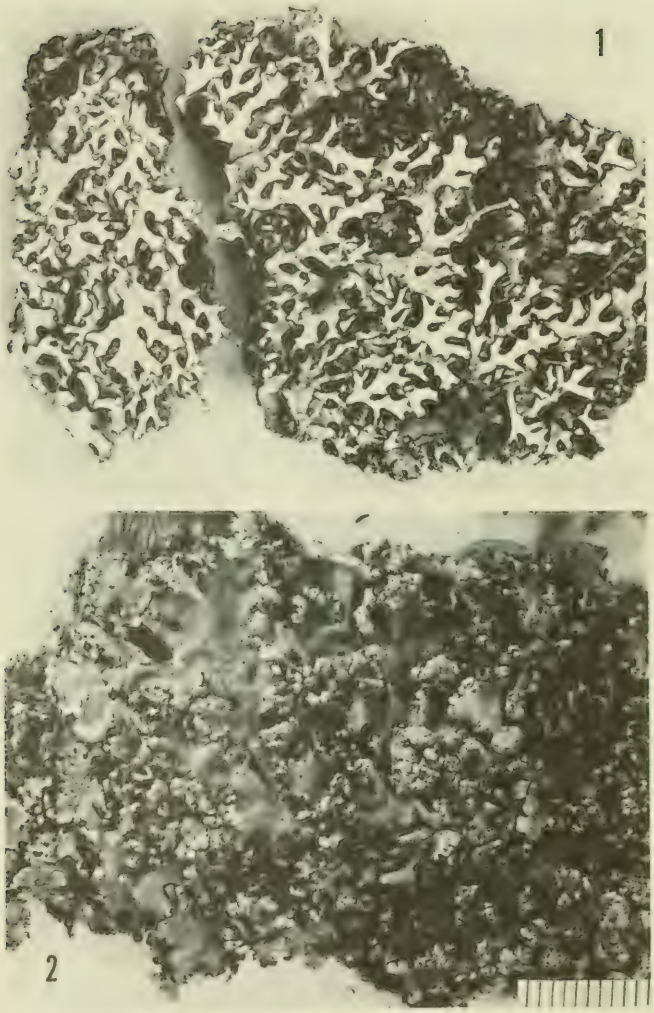
Based on P. macrocarpoides var. subcomparata Vainio, Acta Faun. Fl. Fenn. 7(7):43. 1890.

Lectotype: Sitio, Minarum, Brazil, Lich. Bras. Exs. 918 (TUR).

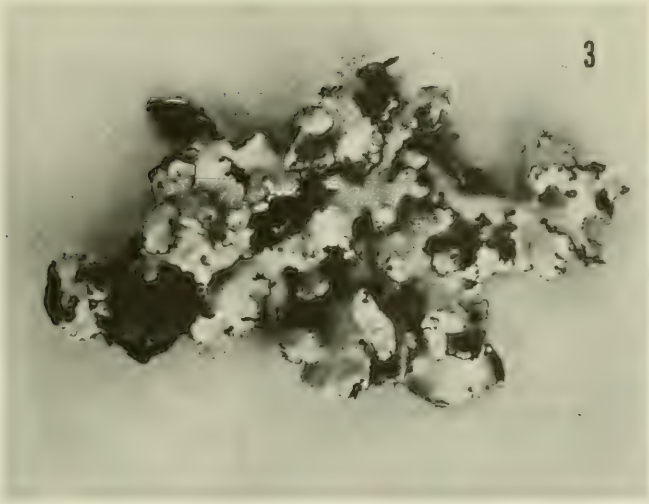
Chemistry: Cortex K+ yellow (atranorin); medulla K-, P-, C-, KC- (caperatic acid).

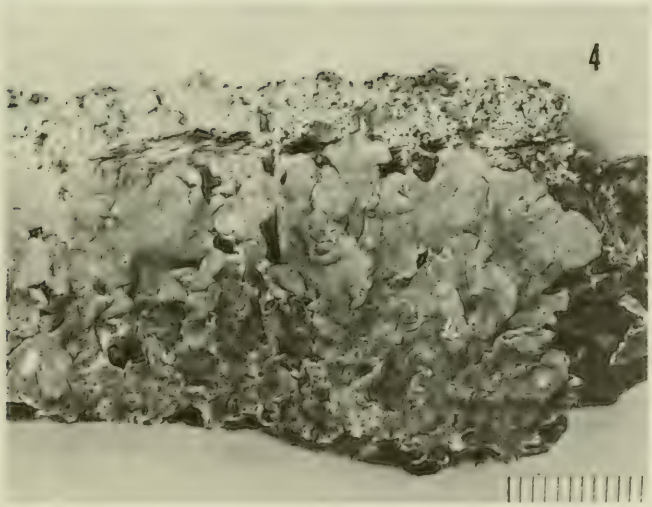
Parmelia simulans would at first be identified as P. reticulata Tayl. without a color test. The primary distinction would be the K- test. Caperatic acid replaces K+ red salazinic acid, the diagnostic component of P. reticulata. Morphologically the two species have similar reticulate cracking to the lobe margins, but P. simulans tends to be strongly laciniate, especially toward the center of the thallus, the coarse soralia being produced most often on these laciniae rather than on the main lobe margins as in P. reticulata. Both species have dense, simple to squarrosely branched rhizines below. Parmelia simulans has a much more restricted distribution than the cosmopolitan P. reticulata. It appears to be the sorediate counterpart of P. macrocarpoides Vainio, a rare endemic in Brazil. There is no isidiate counterpart.

Additional specimens examined. Tennessee: Backbone Rock Recreation Area, Johnson Co., Hale 18034a (US), Trail to Alum Cave, Mt. Le Conte, Sevier Co., Hale 36941 (US). North Carolina: Fodderstack Mt., Macon Co., Moore 1940 (DUKE). Mexico: 5 km E Las Vigas, Veracruz, Hale 20910 (US), Lago de Monte Bello, Chiapas, Hale 20369, 20416, 20467 (US). Haiti: Below Furcy, Dept. de l'Ouest, Wetmore 2679 (MSC, US), Fabius (US). Dominican Republic: Vicinity of Constanza, La Vega, Allard 16541, 17691a, 17442, 17748, 17750, 17679 (US). Brazil: Sitio, Minas Gerais, Vainio, Lich. Bras. Exs. 582B (TUR, FH, UPS, syntype of var. subcomparata). Uganda: 1 km NW Rushasha, Kigeza, Lye L31 (US). Union of South Africa: Between Donnybrook and Creighton, Natal, Doidge 1607 (PRE).



Figures 1, 2. 1. Parmelia chicitae (holotype). 2. Parmelia commensurata (holotype). Scale in mm.





Figures 3, 4. 3. Parmelia imshaugii (holotype). 4. Parinornata (Holotype).

NOTES ON PARMELIA SUBGENUS EVERNIIFORMES WITH DESCRIPTIONS OF SIX NEW SPECIES

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Parmelia subgenus Everniiformes (Hue) Hale & M. Wirth

Parmelia section Everniiformes Hue, Journ. de Bot. 12: 180. 1898. Lectotype species: Parmelia cirrhata Fries.

Species in this subgenus are characterized by a narrow linear-lobed subfruticose thallus with sparse to well developed marginal cilia and a more or less channelled, brown to black lower surface that is rhizinate or bare. There are 16 species in the American tropics and four of these (P. cirrhata Fries, P. nepalensis Tayl., P. sorocheila Vainio, and P. vexans Zahlbr.) also occur throughout montane regions in tropical Asia. Several species in Africa are still under study.

Parmelia catawbiensis (Degel.) Hale & M. Wirth, n. comb.

Parmelia sorocheila var. catawbiensis Degel. Ark. för Botanik, 30A(3):65. 1941. Type: Mt. Le Conte, Tennessee, G. Degelius (Degelius herbarium, not seen).

Degelius recognized this entity as a variety because of the negative K test. Parmelia sorocheila produces K+ red salazinic acid. The two specimens from the United States that I have seen both contain gyrophoric acid and atranorin, and it is almost certain that the Degelius material has the same components. It is somewhat smaller than P. sorocheila, bare below but with fairly conspicuous marginal cilia; both have well developed laminal soralia. Parmelia catawbiensis occurs far north of the range of P. sorocheila and is probably endemic to the southern Appalachians where it grows on twigs of Abies and Rhododendron.

Specimens examined. United States: Virginia: Mountain Lake Biological Station, Giles Co., Hale 18365 (US). North Carolina: Roan Mountain, elev. 6200 ft., Hale 18087 (US).

Parmelia lipidifera Hale & M. Wirth, sp. nov.

Thallus ut in P. cirrhata Fries sed differt acidum protolichesterinicum continente.

Holotype: On deciduous trees, El Sumidero, near Tuxtla Gutierrez, Chiapas, Mexico, elev. 1200 m, collected by M. E. Hale, no. 20064 (US).

The thallus is externally indistinguishable from typical P. cirrhata. The lobes are narrow and strongly convoluted, marginal cilia rather dense, up to 1.5 mm long, and thallus rather fragile. The diagnostic character is the chemistry, P-, K-, with atranorin and protolichesterinic acid proved on TLC Brinkmann pre-coated plates. Parmelia cirrhata contains salazinic acid and reacts P+, K+ red but also contains protolichesterinic acid as an accessory substance. Parmelia lipidifera is rare in Mexico but apparently becomes more common in the range of P. cirrhata from Central America to Peru.

Specimens examined. Mexico: Jalisco: east of Autlán, Crum 943 p.p. (MICH); Chiapas: 2 km N highway 190 on road to Puebla Nueva, Hale 20172 (US), Mt. Ovando, Matuda, April 1936 (MICH). Guatemala: Quezaltenango: Volcán Sta Maria, Steyermark 33948 (MO); Baja Verapaz: Santa Rosa, Standley 69796 (MO). Honduras: Siguatepeque, Yuncker et al. 6627 (US). Peru: Machupichu, Cuzco, Herrera 3286a (US).

Parmelia neocirrhata Hale & M. Wirth, sp. nov.

Thallus subfruticosus, laxe adnatus, albido-cinereus, rigidus, lobis lineari-elongatis, divaricatis, sorediis isidiisque destitutis, margine sparse ciliatis vel nudis, superne nitidus, valde albo-maculatus, cortex superior 20μ crassus, stratum gonidiale 30-35μ crassum, medulla alba, 100-110μ crassa, cortex inferior 12μ crassus, subtus nudus, pallide castaneus vel centrum versus nigricans. Apothecia numerosa, subterminalia, imperforata, sporis octonis, 8-9X16-18μ. Materia chimica: atranorin, acidum norsticticum, acidum salazinicum, et acidum protolichesterinicum.

Holotype: Cerro Azul, Morelia, Michoacán, Mexico, elev. 2300 m, collected by G. Arsène, no. 3726, 10/3/1910 (US; isotypes in TNS, UPS).

This species was first recognized in routine crystal testing of specimens identified as P. cirrhata, using the G. A.o-T. test. Norstictic acid was easily demonstrated, but it was shown with later thin-layer chromatographic tests that these specimens also contain salazinic acid and protolichesterinic acid. It was also possible to find consistent morphological differences from P.

cirrhata, which always lacks norstictic acid, for they are only sparsely ciliate, often pale to almost white below, especially toward the tips, rather rigid and coriaceous, and usually fertile with large subterminal apothecia (Fig. 1).

Parmelia neocirrhata is by far the commonest species of subgenus Everniiformes in Mexico, occurring in a broad zone from Sinaloa to Chiapas (Fig. 2). In this same range P. cirrhata is very rare but becomes the dominant species in Central America.

Specimens examined. Mexico: Sinaloa: 0.5 mi N Los Ornos, Breedlove 16759a (US), La Ferreria, Crum 900a, 943 (MICH); Jalisco: Estancia to San Sebastian, Mexia 1899-a (US), San Sebastian, Mexia 1560-a (US); Nayarit: 18 km from Ahuacatlán, Wirth 227 (US), near Compostela, Wirth 256 (US); Michoacán: Patzcuaro, Pringle 126 (US), Carrindapaz, Morelia, Arsène 8017, 8104 (US), Cerro Azul, Morelia, Arsène 3736, 3967, 8049 (US), 12 km W Uruapan, Wirth 341, 350 (US), 65 km E Morelia, Hale 21025 (US); Colima: s.l., Kerber in 1879 (US), near San Antonia, Wirth 139 (US); Guerrero: Las Lumbreras, Mexia 9072L (F, MO, US); Hidalgo: Honey Station, Pringle 15555 (US); San Luis Potosí: Alvarez, Palmer 456 (US), 279 (MICH); México: 20 mi SW Jacala, Cain 27574 (TRT, US), Desierto de los Leones, Skorepa 5621 (US); Morelos: Kilo 87, Pringle 10713 (MICH, US); Oaxaca: Cerro San Felipe, Hale 20774, 21040 (US), 32 mi NW Oaxaca, Cain 27567 (TRT, US); Chiapas: Km. 1145 on highway 190, west of San Cristobal, Hale 20225 (US), 14 km W San Cristobal, Hale 20579 (US), S of Teopisca, Hale 20524 (US). Guatemala: Sololá: Volcan Atitlan, Kellerman 6029 (US).

Parmelia imitata Hale & M. Wirth, sp. nov.

Thallus ut in P. neocirrhata sed differt acidum gyrophoricum continente.

Holotype: Carrindapaz, Morelia, Michoacán, Mexico, elev. 2100 m, collected by G. Arsène, no. 8042, 8/11/1911 (US; isotype in UPS).

This species is morphologically identical to P. neocirrhata but differs significantly in chemical constituents, reacting P-, C+ red. Gyrophoric acid is accompanied by protolichesterinic acid. The species is known only from Mexico.

Specimens examined: Mexico: Hidalgo: Jacala, Chase 7398 (US).

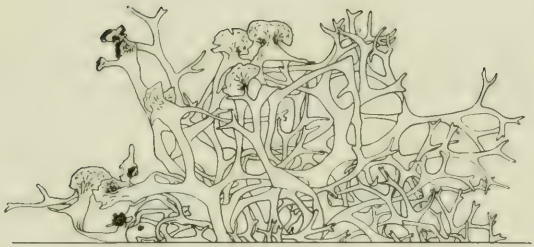

Figure 1. Parmelia neocirrhata (Hale 21025, US), X1.
Drawing by L. Anderson

Figure 2. Distribution of Parmelia neocirrhata.

Parmelia pseudonepalensis Hale & M. Wirth, sp. nov.

Thallus ut in P. nepalensi sed differt acidum norsticticum continente.

Holotype: Wood Station, km 87, Morelos, Mexico, collected by C. G. Pringle, no. 10713, 4 June 1904 (US; duplicates of this number may contain mixtures of P. neocirrhata).

Morphologically the species is close to P. nepalensis Tayl., a widespread species characterized by dense rhizines below. The thallus in both species is rather more rigid than in P. cirrhata and the lobes sometimes only weakly convoluted or even flattened. Thin-layer chromatographic plates show atranorin, norstictic acid, salazinic acid, and protolichesterninc acid. Parmelia nepalensis lacks norstictic acid. Parmelia pseudonepalensis has a fairly restricted distribution in Mexico from Jalisco to Oaxaca.

Specimens examined. Mexico: Jalisco: La Ferreria, E of Autlán, Crum 943 p.p. (MICH), San Sebastian, Mexia 1542-a (US); Michoacán: Carrindapaz, Morelia, Arsène 8016 (US), Cerro Azul, Morelia, Arsène 3724 (US), 65 km E of Morelia, Hale 21026, 21032 (US); Mexico: 10 km SW Cahuacán, X. Madrigal 1423 (US), Popocateptl, Cain 27571, 27588 (US), N of Acambay, Cain 27557 (US); Oaxaca: 32 mi NW of Oaxaca, Cain 27567, 27566b (TRT, US), N of Tlacolula, Ernst 2339 (US), Cerro San Felipe, Hale 20716 (US).

Parmelia arsenei Hale & M. Wirth, sp. nov.

Thallus ut in P. nepalensi sed differt acidum protocetraricum continente.

Holotype: Carrindapaz, Morelia, Michoacán, Mexico, collected by G. Arsène, no. 8016b, Feb. 1909 (US; isotype in UPS).

This species, as with P. pseudonepalensis, is morphologically similar to P. nepalensis but contains atranorin and protocetraric acid only, apparently without protolichesterinic acid. The color test is P+ red but K-. This is a rare species in Mexico and occurs at one locality in Peru.

Specimens examined. Mexico: without locality, Bourgeau (BM); Michoacán: 12 mi W Uruapan, Wirth 342 (US). Peru: Cajatambo, Landeman 5307 (BM).

STUDIES IN THE EUPATORIEAE (ASTERACEAE). XLVI.

A NEW GENUS, STANDLEYANTHUS.

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To those familiar with the tribe Eupatorieae the genus Standleyanthus based on Eupatorium triptychum of B. L. Robinson was inevitable. Of this plant, Robinson (1926) said, " This species is remarkable for its trifoliolate leaves with clearly petiolulate leaflets. It exhibits no close relationship to any other species." Dr. Robinson went on to describe the unusual corolla throat which has a very slender tubular portion about 3 mm. long which expands above into a turbinate portion about 1.6 mm. high. There can be no question that the plant is very distinct and easily recognized and it is hoped that additional material will be found by future collectors in Costa Rica.

The relationships of Standleyanthus can be appreciated since additional characters have been recognized. The mamillose inner surfaces of the corolla lobes, the elongate anther collars with numerous inornate quadrate cells and the slightly enlarged base of the style all indicate that the genus is Ageratinoid. The lax habit of the plant and infusion of some Critonioid characters suggests a place near the genus Neomirandea which is also common in Costa Rica.

Although the trifoliolate leaves are very distinctive, the structure of the achene is equally useful for identification. The mature achene has broad whitish ribs which are prominent against the black sides, the setae occur prominently on both ribs and lateral surfaces and the outer layer of cells often peels away at maturity. In these characters the achenes are most like those of Critonia. Toward the base of the achene, the ribs become greatly enlarged covering the entire surface and obscuring any carpopodial development. On a few achenes a very small carpopodium can be seen which has larger quadrate cells with beaded thickenings in the walls as in Ageratina.

Standleyanthus R.M.King & H.Robinson, genus novum Asteracearum (Eupatorieae). Plantae suffrutescentes laxe pauce ramosae. Caules teretes glabri. Folia opposita longe petiolata ternate decomposita, laminis oblonge-ovatis margine remote crenato-undulatis. Inflorescentiae corymboso-paniculatae. Involucri squamae ca 12 inaequilongae oblongae vel late lanceolatae 2-3-seriatae; receptacula leniter convexa glabra. Flores

ca 12 in capitulo; corollae infundibulares extus inferne glabrae, lobis aequilateraliter triangularibus vel longioribus extus superne aliquantum papillosis, cellulis interioribus brevibus distincte protuberantibus; filamenta antherarum elongata, cellulis inferne plerumque quadratis, parietibus tenuibus inornatis, cellulis exothecialibus subquadratis, appendicibus antherarum ovatis obtusis; styli inferne parum incrassati glabri, appendicibus tenuibus superne leniter mamillosis; achaenia prismatica 4-5-costata, setifera costis inferne valde incrassatis confluentibus; carpopodia indistincta; pappus setiformis uniseriatus, setis ca 20, scabris potius persistentibus tenuibus basi discretis, cellulis apicalibus acutis.

Shrub with terete glabrous stem. Leaves opposite, long-petioled with leaflets petiolulate, blades of leaflets oblong ovate, margins remotely crenate-undulate. Inflorescence a corymbose panicle. Phyllaries ca 12, in 2-3 series, unequal, oblong to broadly lanceolate. Receptacle slightly convex, glabrous. Heads ca 12 flowered, corollas funnelform, outer surface of corolla glabrous below, lobes about as long as wide, papillose on the outer surface, inner surface of corollas with prominent bulging cells. Anther appendages large, anther collars slightly enlarged, composed mostly of quadrate or rectangular cells, walls only slightly thickened, not ornamented. Stylar base scarcely or not enlarged, glabrous, stylar appendage linear, slightly mamillose. Achenes prismatic, 4-5 ribbed, ribs very enlarged at base, pale, setiferous, carpopodia indistinct sometimes a row or two of quadrate cells. Pappus of ca 20 scabrous setae, apical cells acute.

Type species: Eupatorium triptychum B.L.Robinson

Standleyanthus triptychus (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium triptychum B.L.Robinson, Contr. Gray Herb. 77: 43. 1926. Costa Rica.

Acknowledgement

This study was supported in part by the National Science Foundation Grant - 20502 to the senior author.

Reference

Robinson, B.L. 1926. Records preliminary to a general treatment of the Eupatorieae, -vi. Contr. Gray Herb. 77: 3-62.

STUDIES IN THE EUPATORIEAE (ASTERACEAE). XLVII.

A NEW GENUS, STEYERMARKINA.

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The genus is based on a group of species resembling closely the scandent species of Critonia but differing by the area of dense pubescense on the inside surface of the corollas near the bases of the lobes. The genus differs from Critonia also by the lack of distinct lactifers along the sides of the veins of the leaves. Individual species also show corolla lobes cut to below the bases of the anther sacs, hairs on the outer surface of the throat of the corolla, glands on the outer surfaces of the lobes, or dense pubescence on the leaves, characters unlike Critonia.

The previously described species of this genus have all been native to eastern and southern Brazil. The phytogeography of the genus proves more complicated, however, by the discovery of a previously undescribed species in western Venezeula in the mountains east of Lake Maracaibo. The new species, which is described below, represents a nearly two thousand mile extension of the range of this group following no geographic pattern presently recognized in higher plants. It is possible, of course, that future collections will close some of this gap in the range of the genus as presently understood. It seems much more probable, however, that when other groups are understood to the degree that is possible here that other similar patterns will be discovered.

We take great pleasure in naming this new genus in honor of our friend and colleague, Dr. Julian A. Steyermark, the collector of the new Venezeulan species in this genus. Dr. Steyermark has contributed greatly to Neotropical botany both in his publications and collections.

Steyermarkina R.M.King and H.Robinson, genus novum Asteracearum (Eupatorieae). Plantae scandentes pauce ramosae. Caules teretes striati. Folia opposita distincte petiolata, laminis ovatis firme membranaceis, inferne glabris vel pubescentibus. Inflorescentiae laxe paniculatae. Involucri squamae imbricatae valde inaequilongae oblongae glabrae 4-5-seriatae; receptacula convexa vel conica plerumque glabra. Flores 3-5 in capitulo; corollae anguste infundibulares, cellulis anguste oblongis, parietibus leviter vel non sinuosis, lobis anguste lanceolatis extus glabris vel glanduliferis estomatiferis intus laevibus,

faucibus intus hirsutis; filamenta antherarum in parte superiore angusta, cellulis infernis plerumque quadratis, parietibus leniter plerumque transverse ornatis, cellulis exothecialibus subquadratis vel brevioribus, appendicibus antherarum longe triangularibus; styli inferne non nodulosi glabri, appendicibus linearibus mamillosis; achaenia prismatica 4-5-costata, costis et lateribus dense breviter setiferis; carpopodia distincta, cellulis multifariis parvis quadratis; pappus setiformis uniseriatus, setis ca. 30, scabris persistentibus in apicem leniter dilatatis, cellulis apicalibus acutis.

Few branched woody vines. Stems terete, striate. Leaves opposite, petioled, blades ovate, firmly membranous; glabrous to pubescent below. Inflorescence a lax panicle, some nodes with extra axillary branches. Phyllaries imbricated, very unequal, oblong, glabrous, in 4-5 series. Receptacle convex to conical, usually glabrous. Heads 3-5 flowered, corollas narrowly funnelform, cells narrowly oblong, walls slightly or not sinuose, lobes 2-4 times as long as wide, outer surface of lobes glabrous, corolla often setose outside, inner surface of corolla glabrous except for a thick mass of uniseriate, septate eglandular hairs in area below bases of lobes. Anther appendages large, anther collars rather slender, composed of mainly rectangular cells, walls ornate with annular thickenings. Stylar appendages linear mamillose. Achenes prismatic, 4-5 ribbed; carpopodia distinct, of many tiers of small quadrate cells. Pappus of ca 30 scabrous setae which are slightly enlarged at tips.

Type species : Eupatorium pyrifolium A.P.Decandolle

Our studies of the genus indicate that it contains the following four species. A key to the Brazilian species has been provided by Cabrera (1963).

Steyermarkina dispalata (Gardner) R.M.King & H.Robinson, comb. nov. Eupatorium dispalatum Gardner, London Journ. Bot. 4: 117. 1845. Brazil.

Steyermarkina dusenii (Malme) R.M.King & H.Robinson, comb. nov. Eupatorium dusenii Malme, Kungl. Svensk. Vet. Akad. Handl. 12(2): 38. 1933. Brazil.

Steyermarkina pyrifolia (A.P.Decandolle) R.M.King & H.Robinson, comb. nov. Eupatorium pyrifolium A.P.Decandolle, Prodr. 5: 153. 1836. Brazil.

Steyermarkina triflora R.M.King & H.Robinson, sp. nov.
Folia opposita, petiolis pubescentibus 2 cm longis laminis

ovatis ad 9 cm longis ad 5 cm latis integris fere glabris. Involucri squamae ca. 15; receptacula convexa glabra. Flores plerumque 3 in capitulo ca. 5 mm longi; corollae albae extus glabrae, lobis ca. 0.6 mm latis ca. 2.0 mm longis.

Type: VENEZEULA: Trujillo: Steep forested slopes along Quebrada Los Riitos. Selva virgen, arriba de Escuque, entre Escuque y La Mesa de San Pedro. Altura: 1300-1650 metros. Vining; leaves firmly membranous, dull green both sides; flowers whitish; involucre pale green. 20-23 Febrero 1971. Julian A. Steyermark 104684. [Holotype US! Isotype Venezeula].

The new species is closest to S. pyrifolia of Brazil but the latter has 5 flowers per head, corolla lobes less deeply divided and anthers hastate at the base.

Acknowledgement

This study was supported in part by the National Science Foundation Grant - 20502 to the senior author.

Reference

Cabrera, A.L. & N.Vittet. 1963. Compositae Catharinenses. II. Eupatorieae. Sellowia, 15: 149-258.

STUDIES IN THE EUPATORIEAE (ASTERACEAE). XLVIII.

THE GENUS, CRITONIA.

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The genus name Critonia is one of the oldest in the tribe Eupatorieae being established by Patrick Browne in 1756 only three years after Linnaeus' Species Plantarum. Although the name has most often been placed in the synonymy of Eupatorium, it continues to call to mind for many synantherologists plants of distinctive habit with large open panicles, eglandular leaves and flowers, clustered heads and deciduous inner phyllaries. No accurate delimitation of the genus has ever been provided previously, but the various species that have been placed in the genus with few exceptions prove to be Critonias.

The limits of the genus prove to follow closely the general concept that has existed. The lack of glands on the leaves, achenes, and corollas distinguishes Critonia easily from the large related genus, Koanophyllon. Koanophyllon can also be distinguished by the less imbricate phyllaries, the often abrupt tips on the style branches and the shorter anther appendages usually wider than long. Another related genus, Fleischmanniopis has a distinctive carpopodium of very thick-walled cells, slender pappus setae, very short anther appendages, and abruptly enlarged tips on the style branches. Two West Indian species that we have placed in another genus, Urbananthus, differ from Critonia by glabrous achenes, stamens inserted near the base of the corolla, shorter anther appendages and more abrupt tips on the style branches. The Central American genus, Critoniadelphus has slender tipped pappus setae, glands on the backs of the corolla lobes and shorter anther appendages. Two exclusively South American genera also show some similarity to Critonia. Steyermarkina is clearly distinct by the dense pubescence inside the throat of the corolla. Symphyopappus has an inflorescence of irregularly erect-spreading branches and style branches that are more papillose. The many rows of imbricate phyllaries in Critonia resemble the condition in Chromolaena, but in addition to microscopic differences, the older plants of the latter group are distinct in loosing all the phyllaries. Some outer phyllaries always persist in Critonia. There are a number of South American Eupatorieae with heads clustered as in Critonia but all differ by their slender tipped pappus setae.

The limits and relationships of the genus are further clarified by studing the distribution of lactifers in the leaves.

These are present in the areoles of all species of Critonia and occur in their more reduced form in the related genus Urbanianthus. The lactifers are often difficult to observe in the species where they are small and next to the vein and for this reason make a poor key character, but in those species with slender bases on the achenes, the lactifers are usually large and easily seen in leaves moistened with water or aerosol solution. In Critonia stigmatica, the lactifers are extremely large and look like lenses in the center of each areole. These lactifers have been occasionally noted in the literature. Urban (1900) refers to the "punctis lineo-lisque pellucidis" in the leaves of Eupatorium dalea, and B.L.Robinson (1928) mentioned the "more finely pellucid-punctate leaves in Eupatorium heterneuron".

In this treatment, we have made no subgeneric divisions in Critonia. Some rather well defined groups occur in the genus, however. Most evident is the typical element with very slender bases on the achenes, smaller carpopodia, and large lactifers in the leaves. Another large group includes the lianas such as C. billbergiana and coarse herbs and shrubs such as C. quadrangularis and C. morifolia with larger carpopodia and smaller lactifers. Two species have distinctive hastate leaves but each has so many distinctive features of its own that a simple subgeneric classification seems improper. Critonia peninsularis of Baja California has a distinctive oblong anther appendage with many thickenings in the cell walls. Critonia spiniciaefolia has unusually long pedicellate heads and the nodes of the inflorescence usually have numerous extra branches arising from the axils of the leaves sometimes forming a fan of up to seven branches a a node.

Critonia P.Browne, Civ. Nat. Hist. Jam. 490. 1756.

Wikstroemia C. Sprengel, Svensk. Vet. Akad. Handl. Stockh. 167. 1821. after May.

Coarse herbs to small trees or woody vines, sparingly branched. Leaves opposite, distinctly petioled, petioles sometimes winged, blades elliptical to broadly ovate (bases hastate in two species), without capitate glands, with distinct lactifers internally beside the veins or in the centers of the areoles. Inflorescence paniculate, branches opposite usually spreading at 90 degree angles. Heads usually sessile or short pedicellate in clusters of 3-12. Involucre of ca 20-25 imbricate, stramineous, usually glabrous, 2-3 striate phyllaries in 4-6 series; inner series elliptical to narrowly oblong, very easily deciduous, outer series very short orbicular, persistent. Receptacle plain to slightly convex, glabrous or with a few hairs. Flowers 4-12 per head; corollas tubular below and sometimes slightly

spreading above, glabrous; lobes 5, usually longer than wide with smooth elongate cells, cell walls usually slightly sinuous; anther filaments short, inserted above lower third of corolla; collars slender usually with distinct quadrate cells below, walls inornate or with slight but distinct annular thickenings; anther appendages large usually distinctly longer than wide. Style base without enlarged node, glabrous; appendage filiform to spathulate smooth to slightly mamillose. Achenes prismatic with 5 often very prominent ribs, ribs and surfaces sparcely to densely setose. Carpopodium a narrow rim or short cylindrical, cells small, quadrate to rounded with walls of confluent thickenings. Pappus of 30-35 scabrous, coarse, persistent setae with crowded bases, tips slightly enlarged and more closely serrulate, apical cells usually acute. Chromosome number X = 10 (Turner, Powell, and King, 1962).

Type species: Eupatorium dalea Linnaeus.

Our studies of the genus indicate that it contains the following thirty-two species.

Critonia aromatisans (A.P.Decandolle) R.M.King & H.Robinson, comb. nov. Eupatorium aromatisans A.P.Decandolle, Prodr. 5: 160. 1836. Cuba, Dominican Republic.

Critonia bartlettii (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium bartlettii B.L.Robinson, Contr. Gray Herb. 100: 11. 1932. British Honduras.

Critonia billbergiana (Beurl.) R.M.King & H.Robinson, comb. nov. Eupatorium billbergianum Beurl., Vet. Akad. Handl. Stockl. 1854: 134. 1856. British Honduras, Costa Rica, Guatemala.

Critonia campechensis (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium campechense B.L.Robinson, Proc. Amer. Acad. 43: 30. 1907. British Honduras, Mexico.

Critonia chrysocephala (Klatt) R.M.King & H.Robinson, comb. nov. Eupatorium chrysocephalum Klatt, Bot. Beibl. sur Leopoldina 1895: 2. 1895. Costa Rica.

Critonia conzattii (Greenm.) R.M.King & H.Robinson, comb. nov. Eupatorium conzattii Greenm., Proc. Amer. Acad. 34: 574. 1899. Mexico.

Critonia dalea (L.) A.P.Decandolle, Prodr. 5: 140. 1836. Eupatorium dalea L. Systema naturae Edition 10, 1204. 1758. Jamaica.

Critonia daleoides A.P.Decandolle, Prodr. 5: 141. 1836. British Honduras, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama.

Critonia eggersii (Hieron.) R.M.King & H.Robinson, comb. nov. Eupatorium eggersii Hieron., Engl. Bot. Jahrb. 28: 566. 1901. Ecuador.

Critonia eriocarpa (B.L.Robinson & Greenm.) R.M.King & H.Robinson, comb. nov. Eupatorium eriocarpum B.L.Robinson & Greenm. Proc. Amer. Acad. 32: 42. 1896. Mexico.

Critonia hebebotrya A.P.Decandolle, Prodr. 5: 141. 1836. Costa Rica, El Salvador, Guatemala, Mexico.

Critonia hemipteropodia (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium hemipteropodium B.L.Robinson, Proc. Amer. Acad. 42: 39. 1906. Mexico.

Critonia heteroneura Ernst, Flora 57: 210. 1874. Colombia, Venezeula.

Critonia hospitalis (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium hospitale B.L.Robinson, Proc. Amer. Acad. 43: 32. 1907. British Honduras, Guatemala, Mexico.

Critonia imbricata Griseb., Mem. Amer. Acad. n.s. 8: 512. 1863. Cuba.

Critonia inaequidens (Urban) R.M.King & H.Robinson, comb. nov. Eupatorium inaequidens Urban, Symb. Antill. 1: 460. 1899. Dominican Republic, Haiti.

Critonia lanicaulis (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium lanicaule B.L.Robinson, Proc. Amer. Acad. 35: 336. 1900. Guatemala.

Critonia laurifolia (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium laurifolium B.L.Robinson, Proc. Bost. Soc. Nat. Hist. 31: 251. 1904. Costa Rica.

Critonia lozanoana (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium lozanoanum B.L.Robinson, Proc. Amer. Acad. 41: 275. 1905. Mexico.

Critonia macropoda A.P.Decandolle, Prodr. 5: 140. 1836. Trinidad.

Critonia morifolia (Miller) R.M.King & H.Robinson, comb. nov. Eupatorium morifolium Miller, Gard. Dict. Ed. 8. n 10. 1768. Argentina, Bolivia, British Honduras, Colombia, Costa Rica,

El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Paraguay, Brazil, Venezeula.

Critonia nicaraguensis (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium nicaraguense B.L.Robinson, Contr. Gray Herb. 61: 29. 1920. Nicaragua.

Critonia parviflora (Sw.) A.P.Decandolle, Prodr. 5: 140. 1836. Eupatorium parviflorum Sw., Prodr. Veg. Ind. Occ. 111. 1788. Jamaica.

Critonia peninsularis (Brandegee) R.M.King & H.Robinson, comb. nov. Eupatorium peninsulare Brandegee, Erythea 7: 4. 1899. Mexico.

Critonia portoricensis (Urban) Britton & P.Wilson, Sc. Surv. Porto Rico and Virgin Islands 6: 291. 1925. Eupatorium portoricense Urban, Symb. Antill. 1: 459. 1899. Puerto Rico.

Critonia pseudo-dalea A.P.Decandolle, Prodr. 5: 140. 1836. Cuba.

Critonia quadrangularis (A.P.Decandolle) R.M.King & H.Robinson, comb. nov. Eupatorium quadrangulare A.P.Decandolle, Prodr. 5: 153. 1836. El Salvador, Guatemala, Mexico, Nicaragua.

Critonia sexangularis (Klatt) R.M.King & H.Robinson, comb. nov. Piptocarpha sexangularis Klatt, Beibl. zum Leopoldina 1895: extr. 1. 1895. Costa Rica, Guatemala, Honduras, Nicaragua.

Critonia spinaciaefolia (A.P.Decandolle) R.M.King & H.Robinson, comb. nov. Bulbostylis spiniaefolia A.P.Decandolle, Prodr. 5: 139. 1836. Mexico.

Critonia stigmatica (Urban & Ekman) R.M.King & H.Robinson, comb. nov. Eupatorium stigmaticum Urban & Ekman, Arkiv. Bot. 23A, no. 11: 67. 1931. Haiti.

Critonia thyrsigera (Hieron.) R.M.King & H.Robinson, comb. nov. Eupatorium thyrsigerum Hieron. Bot. Jahrb. 28: 570. 1901. Colombia.

Critonia thyrsoidea (Moc. ex A.P.Decandolle) R.M.King & H. Robinson, Eupatorium thyrsoideum Moc. ex A.P.Decandolle, Prodr. 5: 150. 1836. Mexico, Nicaragua.

Acknowledgement

This study was supported in part by the National Science Foundation Grant - 20502 to the senior author.

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Urban, I. 1900. Species novae, praesertim portoricenses. Symb. Antill. 1: 291-481.

STUDIES IN THE EUPATORIEAE (ASTERACEAE). XLIX

A NEW GENUS, CRITONIADELPHUS.

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The two species from Central America and Mexico that we place here in Critoniadelphus have a habit very similar to Critonia and the two genera seem closely related. Certain features of Critoniadelphus are also reminiscent of Koanophyllon. The new genus is considered here as somewhat intermediate between Critonia and Koanophyllon and most closely related to Urbananthus of the West Indies.

Critoniadelphus differs from Critonia primarily by the slender tips of the pappus setae, the glands on the corolla lobes and achenes and the short anther appendages. Two Central American species of Critonia, C. daleoides and especially C. hospitalis with its enlarged style branches, closely resemble Critoniadelphus. The two species of Critonia, however, are in a specialized group of species with large lactifers in the leaves and slender based achenes, and they are not particularly closely related to the new genus.

Critoniadelphus differs from Koanophyllon primarily by the highly imbricate stramineous phyllaries and by the small lactifers beside the leaf veins. Most species of Koanophyllon are also distinguished by having capitate glands on the leaves. The West Indian genus Urbananthus is most like Critoniadelphus in corolla shape, slender sinuous walled corolla cells, short anther appendages, and small lactifers in the leaves, but the genus differs by the glabrous corollas and achenes, the anthers inserted near the bases of the corollas and the style branches less enlarged below the tips.

Critoniadelphus R.M.King & H.Robinson, genus novum Asteracearum (Eupatorieae). Plantae frutescentes laxe ramosae. Folia opposita periolata glabra, laminis ellipticis, cellulis lactiferis obscuris. Inflorescentiae laxe panicultae. Involucri squamae 25-30 inaequilongae 5-6-seriatae orbiculares vel oblongae stramineae glabrae 2-3-striatae, squamae interiores caducae; receptacula plana minuta. Flores 3-8 in capitulo; corollae tubulares, cellulis angustis, parietibus valde sinuosis, lobis 5 aequilateraliter triangularibus extus glanduliferis; filamenta antherarum prope partes tertias inferiores corollarum inserta; filamenta in parte superiore angusta, cellulis plerumque quadratis vel brevioribus, parietibus inornatis; appendicibus

antherarum brevibus; styli inferne non nodulosi glabri, appendicibus superne late ellipticis sublaevibus; achaenia prismatica 5-costata pauce setifera et glandulifera; carpopodia distincta symmetrica breviter cylindrica, cellulis minute quadratis vel rotundatis, parietibus incrassatis; pappus setiformi uniseriatus, setis 30-35 contiguis scabris persistentibus, superne attenuatis, cellulis apicalibus acutis.

Type species: Eupatorium nubigenum Benth.

The two species of the genus Critoniadelphus can be distinguished as follows:

1. Leaf margins closely serrulate; heads with 4-8 flowers C. nubigenus

1. Leaf margins remotely serrulate or entire; heads usually with 3 flowers C. microdon

Critoniadelphus microdon (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium microdon B.L.Robinson, Proc. Amer. Acad. 54: 252. 1918. Guatemala.

Critoniadelphus nubigenus (Benth.) R.M.King & H.Robinson, comb. nov. Eupatorium nubigenum Benth., Pl. Hartw. 85. 1841. El Salvador, Guatemala, Honduras, Mexico.

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STUDIES IN THE EUPATORIEAE (ASTERACEAE). L

A NEW GENUS, URBANANTHUS

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In 1900 Urban described Eupatorium critoniforme, a new species from the island of Jamaica having the habit of Critonia dalea but lacking the pellucid spots in the leaves. In the original description of the plant were such comments as "achaeniis . . . glabris.", "stamina tubo supra basin affixa . . ." and "Stylus . . . apice manifeste clavatis". Further characters of significance not mentioned by Urban are the lack of dilation on the tips of the pappus setae, the short anther appendages and the very slender corolla cells with very sinuous walls. It is of particular importance that all of these characters are repeated again in a second very distinct species from Cuba, Eupatorium pluriseriatum B.L.Robinson. The two species are the basis for the genus Urbananthus described here.

Of the various characters that distinguish Urbananthus from Critonia, the insertion of the stamens is the most important. The placement of the insertion low on the corolla tube is a striking departure from the situation in Critonia and all other close relatives. Perhaps the most useful character for identification of the genus is the complete lack of pubescence on both the corollas and achenes. The characters most indicative of relationship are the presence of only small lactifers beside the leaf veins, a condition found in some Critonias and in Critoniadelphus, and the clavate tips of the style branches which are different in exact form from those of Critoniadelphus but which indicate that Urbananthus is closely related to the latter genus and similarly intermediate between Critonia and Koanophyllon.

Our knowledge of interrelationships among the Critonioid genera is still very incomplete, but the following seems clear. Critonia and Koanophyllon represent two large and diverse complexes that originated on the mainland and which have numerous derived forms in the West Indies. The derived forms of Critonia are represented by C. dalea and its relatives having large lactifers in the leaves and having slender based achenes. Again, on the mainland in Central America is the genus, Critoniadelphus, which has the habit of Critonia and many charcters of Koanophyllon. Related to Critoniadelphus but differing in derived features such as the glabrous corollas and achenes and the lower insertion of the anthers, is the West Indian genus,

Urbanathus. It is clear that the Jamaican species Urbananthus critoniforme is really very remote in relationship from the Jamaican Critonia dalea which it superficially resembles.

Urbanathus R.M.King & H.Robinson, genus novum Asteracearum (Eupatorieae). Plantae frutescentes laxe ramosae. Folia opposita petiolata glabra, laminis ellipticis breviter vel longe acuminatis basi cuneatis, cellulis lactiferis obscuris. Inflorescentiae laxe paniculatae. Involucri squamae 20-30 inaequilongae 5-6-seriatae orbiculares vel oblongae stramineae glabrae 2-3-striatae, squamae interiores caducae; receptacula aliquantum convexa. Flores 4-10 in capitulo; corollae tubulares laeves glabrae, cellulis angustis, parietibus valde sinuosis, lobis 5 oblongo-triangularibus; filamenta antherarum fere ad bases corollarum inserta; filamenta in parte superiore angusta, cellulis plerumque quadratis vel brevioribus, parietibus inornatis; appendicibus antherarum subquadratis vel brevioribus; styli inferne non-nodulosi glabri, appendicibus spathulatus sublaevibus; achaenia prismatica 5-costata glabra; carpopodia distincta symmetrica breviter obturaculiformia, cellulis inferne minute quadratis superne longioribus, parietibus incrassatis; pappus setiformi uniseriatus, setis ca. 30 contiguis scabris persistentibus superne non dilatatis, cellulis apicalibus acutis.

Species typica: Eupatorium critoniforme Urban

Our studies indicate that the genus contains the following two species.

Urbananthus critoniformis (Urban) R.M.King & H.Robinson, comb. nov. Eupatorium critoniforme Urban, Symb. Antill. 1: 458. 1900. Jamaica.

Urbananthus pluriseriatus (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium pluriseriatum B.L.Robinson, Proc. Amer. Acad. 47: 195. 1911. Cuba.

Acknowledgement

This study was supported in part by the National Science Foundation Grant - 20502 to the senior author.

Reference

Urban, I. 1900. Species novae, praesertim portoricenses. Symb. Antill. 1: 291-481.

NEW COMBINATIONS IN MACHAERIUM (LEGUMINOSAE)

Velva E. Rudd, Smithsonian Institution

MACHAERIUM SALVADORENSE (Donn. Sm.) Rudd, comb. nov.

Drepanocarpus salvadorensis Donn. Sm. Bot. Gaz. 44: 109. 1907. Type: L. V. Velasco 9008, El Salvador, San Salvador, Soyapango (holotype US; isotype US).

Machaerium riparium T. S. Brandeg. Univ. Calif. Publ. Bot. 6: 500. 1919. Type: C. A. Purpus 8166, Mexico, Veracruz, near Zacuapan (holotype UC; isotypes GH, NY, US).

Machaerium acanthothyrsus Pittier, Contr. U. S. Nat. Herb. 20: 473. 1922. Type: E. W. Nelson 2331, Mexico, between Hacienda del Capricho, Guerrero, and Llano Grande, Oaxaca (holotype US; isotype GH).

Machaerium habroneurum Standl. Carnegie Inst. Publ. 461: 63. 1935. Type: W. A. Schipp S-676, British Honduras-Guatemala boundary, Camp 32 (holotype F; isotypes BM, F, GH, K, NY).

MACHAERIUM LEIOPHYLLUM (DC.) Benth. var. CRISTA-CASTRENSE (Mart. ex Benth.) Rudd, comb. nov.

Drepanocarpus crista-castrensis Mart. ex Benth. Comm. Leg. Gen. 32. 1837 (preprint); Ann. Wiener Mus. 2: 96. 1838. Type: C. F. P. Martius s. n., Brazil, Amazonas, near Manaus "in sylvis ad Barra do Rio Negro" (lectotype M; isolectotypes K, M).

Machaerium crista-castrense (Mart. ex Benth.) Ducke, Arch. Jard. Bot. Rio de Janeiro 4: 311. 1925.

MACHAERIUM LEIOPHYLLUM (DC.) Benth. var. LATIFOLIUM (Benth.) Rudd comb. nov.

Drepanocarpus crista-castrensis Mart. ex Benth. var. latifolium Benth. in Mart. Fl. Bras. 15(1): 258. 1862. Type: R. Spruce 2552, Brazil, Amazonas, igapó near Rio Uaupés, "in Gapó, i. e. silva inundata ad Rio Uaupés Venezuelae" (holotype K; isotypes BM, C, F, GH, NY, P).

Drepanocarpus frondosus Mart. ex Benth. Comm. Leg. Gen. 32. 1837 (preprint); Ann. Wiener Mus. 2: 96. 1838. Type: C. F. P. Martius s. n., Brazil, Amazonas, "in sylvis ad flumen Japurá" [as "flumen Itapurie"] (lectotype M, the specimen from which plate 84, Fl. Bras. 15(1) was drawn; isolectotypes M).

Machaerium frondosum (Mart. ex Benth.) Ducke, Arch. Jard. Rio de Janeiro 3: 151. 1922.

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THE TAXONOMY OF PINUS FLEXILIS AND P. STROBIFORMIS[1]

by
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James (1823), who participated in the expeditionary search of the Rocky Mountains in the company of Lieutenant S. H. Long, observed at least two undescribed Western species of pine that were new to science. One consequence of his exploration of the eastern slopes of Pike's Peak was his description of Pinus flexilis from living material alone. The ensuing nomenclatural disorder involving the Pinus flexilis complex has created an interesting, but confusing array of nomenclatural problems. Perhaps the primary cause for the dilemma is the resemblance of vegetative features and the growth habit of the "Flexiles" group of pines to others within the North American five-leaved Strobus subgenus. Under less than optimal conditions of growth and in their juvenile stages they appear very similar indeed.

In the present paper, we will attempt to present a historical and contemporary review of P. flexilis James and P. strobiformis Engelm., two North American members of the subsection Strobi (sensu Little & Critchfield 1969), as well as to designate the neotype of P. flexilis.

HISTORICAL

Pinus flexilis

Although James gave a description of P. flexilis in his field notes, no herbarium samples were collected nor did he present a Latin diagnosis with his published description of 1823. Engelmann (1863), however, did publish a Latin diagnosis of P. flexilis and also emended the morphological inconsistencies that appeared in James' description. Earlier familiarization with P. aristata Engelm. led Engelmann (Parry and Engelmann 1862) to judge that James had observed both P. flexilis and P. aristata either side by side or perhaps with brances intertwined, for

[1]This study was supported in part by funds from the National Science Foundation Grant No. G-15879.

the prominent, armed, cone umbos noted by James (1823) is indicative of P. aristata and not P. flexilis.

Fortunately, Engelmann's (1863) accurate analysis clarified some additional confusion generated by Nuttall(1853, III p.107) by his inaccurate text and dismaying illustration. Engelmann, however, did not comment on Nuttall's work nor did he discuss Hooker's (1838, II p.161) contribution of P. lambertina var. β. Hooker, which in turn was based upon Drummond's (1830) field notes of five-leaved pines he observed in Canada while portaging from the Red Deer River to the Columbia at "Height of Land." Drummond's notes describe a taxon that either could be P. flexilis or P. albicaulis Engelm., for the cones he observed were damaged beyond recognition rodents or birds. The geographic locale, orogeny and elevation, however, suggest the trees were P. albicaulis. Endlicher (1847, p.150), not withstanding some reservation about Hooker's interpretation, established P. lambertiana variety β ("brevifolia, foliis brevioribus, rigidioribus, Hook. l.c."), but Endlicher's new combination gained little acceptance.

Further nomenclatural confusion arose when Carriere (1855, pp.309-310) attributed authorship of both P. flexilis and P. strobiformis to Wislizenus. This error probably arose because Engelmann's 1848 article appeared as one of the contributions within a book identified with Wislizenus as author-editor.

Pinus strobiformis

During Dr. Wislizenus travels from Chihuahua westward to the vicinity of Cosíhuiriachi and the Porphory Mountains, he discovered a large number of undescribed plants. On the highest peaks, at elevations of about 8,000 feet, Wislizenus observed large pines 100 to 130 feet tall which bore resemblance to both P. flexilis and P. strobus L. This unknown pine was later named by Engelmann as P. strobiformis (1848). This perfectly valid species name, however, was apparently abandoned by Engelmann since it is conspiciously absent from his later publications (1878, 1880,1882). Shaw (1909, p.11) reasoned that Engelmann, after learning of Ehrenberg's earlier (1838) description of Pinus ayachuite Ehren., assumed that the P. strobiformis of Chihuahua was the same taxon as Ehrenberg's P. ayachuite of Omitlan, Guerro. Since Engelmann had no cones to compare, he probably thought his species was synonymous with Ehrenbert's. Parlatore (1968, pp.406-407) cites P. strobiformis (sic) as a synonym of P. ayacahuite and lists further collection sites in the northern states of Mexico for this species.

After abandoning P. strobiformis as the epithet for the trees found in northern Mexico, ENgelmann (1878), in describing specimens collected by Wheeler's Expedition in Arizona reduced various forms which displayed some of the characteristics he attributed to P. strobiformis to varieties of P. flexilis. These characteristics included serrulation of leaves, reduction in number or lack of stomatal rows on the dorsal leaf survace, elongation of the cones, and elongation and reflexion of cone scales.

His varieties, based on materials from Arizona were collected from orographic sites where environmental conditions permit phenotypic development leading to intermediate morphological characters between P. flexilis and P. strobiformis. The present authors have collected material from all the higher peaks in Arizona and have gathered specimens similar to those described by Engelmann (1878), but more important, have also observed alticlinal change from typical P. strobiformis to P. flexilis as elevation increases. At higher elevations there usually is a preponderance of P. flexilis-like individuals but occasionally with an admixture of P. strobiformis. In short, all of Engelmann's varieties can be found on either a single mountain or on any combination of peaks in southeastern Arizona. Similar variation patterns exist in New Mexico.

Engelmann, as a prelude to his "Revision of the genus Pinus" was experimenting with "varietal taxonomy" which he soon abandoned, but his 1978 paper proposed (sans-Latin) the following three varieties:

1. Pinus flexilis var. α serrulata Engelm. "Leaves slender, slightly and distantly serrulate, and as in the following varieties with few or scarcely any stomata on the back; cone of the ordinary form."

The voucher specimen (Rothrock 654) for the above description consists of foliage, twig and fruiting materials, all of which bear strong resemblances to the P. flexilis-like materials found at higher elevations in Arizona and New Mexico. Materials collected by the senior author at 9700 feet on the west side of Mr. Graham, Arizona are almost identical to Rothrock's 1874 collection from the same area but at 9600 feet.

2. Pinus flexilis var. β macrocarpa Engelm. "Leaves slender, entire; cones cylinderic, 6-8 inches long 2½ inches in diameter, the apophysis of the scales short, rounded."

This material collected by Ferdinand Bischoff of Wheeler's 1871 expedition to the San Francisco Mountains of Arizona consists of foliage, twigs, and cone scales. No intact cone exists at present. Similar specimens were observed and collected by the senior author (Andresen 2121) at 9,000 feet on the west side of Humphrey's Peak in the San Franciscos. The cone scales of var. β are intermediate between vars. α and γ and are also intermediate within the clinal array of the P. flexilis-strobiformis complex of Arizona and New Mexico.

3. Pinus flexilis var. γ reflexa Engelm. "leaves as in last β; cones ovate-cylindrical, about four inches long; apophysis elongated, reflexed."

Voucher materials for the above consist of three related herbarium sheets. The first (MO 1635443) includes a typical P. strobiformis cone

but in an immature stage collected (collector unknown) on 13 August, 1874. Although only four inches long, the elongated ovuliferous scales are strongly reflexed. An old tag attached to the cone reads "P. ayacahuite" (the ayacahuite had been crossed out and was replaced by flexilis var. squarosa 654 8/13 1874). The second sheet is similar to the first sans cone but includes "654=1001". And the third sheet numbered as "1001" bears materials labeled as originating from the Sanoita Valley which passes to the southeast and south of the Santa Rita Mountains. We suggest that the first two sheets were collected in the Madera Canyon drainage on the northwest side of the Santa Ritas and the third sheet was gathered either on the southeastern side of the Santa Ritas or on the northwest side of the Patagonia Mountains, with the former choice as the most likely.

Engelmann (1878) remarked that the cone of the third sheet, 1001, resembled P. koraiensis Sieb. et Zucc., or a small example of P. ayacahuite. Interestingly, on sheet 1001, is the penciled remark in Engelmann-like script "P. ayacahuite var. borealis" which was not published.

For some obscure reason, Engelmann (1880) chose not to include any of his varieties of P. flexilis or P. strobiformis in his "Revision of the Genus Pinus". He did, however, include the very questionable P. bonapartea Carriere within his section Strobi. Shortly afterward, though. he (Engelmann 1882) reduced P. reflexa Engelm. to an altitudinal variant of P. flexilis hence P. flexilis var. reflexa Engelm. Perhaps he observed additional specimens or notes about the flowering habit of his P. reflexa for he wrote "Pinus reflexa n. sp. (P. flexilis. Eng. in Rothrock's Rep. Bot. Exp. Wheeler) proves to be quite distinct from "flexilis" not only by the reflexed scales of the cone, but also and principally by the long peduncled cylindric female aments, erect in the first, recurved in the second year, which associate it with the true Strobi, while the large wingless seeds distinguish it from the other species of that section."

His line of reasoning is difficult to follow for in the true Strobi (sensu Eustrobi Engelm. 1880) he includes P. albiculis and P. pygmaea both of which bear sessile and upright cones with wingless seed as well as P. flexilis whose cones may be sessile or sub-sessile but are always pendant.

The nomenclature was accepted by Coulter and Rose (1886) with a confirmation of species separation based on leaf anatomy. After examining specimens collected by Pringle in 1887 in the same area where Wislizenus collected the specimen described by Engelmann as P. strobiformis, Sargent (1889) concluded that P. strobiformis was probably only a northern form of P. ayacahuite with short leaves and small cones. Three years later, Lemon (1892 p.4), through an interpretive error, credited P. ayacahuite var. strobiformis to Sargent. The assignment was created by a liberal interpretation of Sargent's (1889) opinion of P. reflexa Engelm. vis. "Mr. Pringle rediscovered two years ago Engelmann's Pinus strobiformis on the mountains of Chihuahua, in the very region where Wislizenus first found it, and his specimens who that Pinus reflexa cannot be separated from the Mexican tree which was known previously from a single cone only. It will be found perhaps that Pinus strobiformis is merely a northern

form with short leaves, and small cones, of the widely distributed Pinus ayacahuite [sic.] Erh. The two are certainly very closely related and are not readily separated." Shaw (1909) attempted to correct the error by placing P. ayacahuite var. strobiformis Lemmon in synonomy with P. flexilis var. reflexa Engelm. In the interim, Sargent (1897 pp.33-34) recognized Pinus strobiformis Engelm. as a valid taxon, thus altering his 1889 opinion that P. strobiformis was only a form of P. ayacahuite.

Sudworth (1897 pp. 14-16) concurred with Sargent and placed P. flexilis var. reflexa Engelm., P. reflexa Engelm., and P. ayacahuite var. strobiformis Lemmon in synonomy with P. strobiformis Engelm. In addition, Sudworth listed P. flexilis var. α serrulata Engelm. as synonomous with P. flexilis and unfortunately presented Pinus flexilis var. megalocarpa Sudworth as a nomenclatural alternative to P. flexilis var. ß macrocarpa Engelm. The following year, however, Sudworth (1898 p.14) ignored his P. flexilis var. magalocarpa and calling it by its common name reduced it to synonomy under P. flexilis. Apparently he also believed that P. ayacahuite was synonymous with P. strobiformis Engelm., for he indicated the range of the latter is southwestern United States, Mexico, and Guatamela.

By 1907, Voss decided P. ayacahuite var. reflexa Voss would be preferable to P. reflexa Engelm. Voss (1907) also subordinated P. strobiformis Engelm. to P. ayacahuite Ehrenb.

Shaw (1909) synthesized the existing literature and judged that P. strobiformis Engelm. was synonymous with the northern element of P. ayacahuite, and hence the name P. ayacahuite var. brachyptera Shaw. In his revision, P. flexilis and its var. reflexa were retained as valid taxa, with P. ayacahuite var. strobiformis Lemmon and P. strobiformis sensu Sudworth relegated to synonomy. Shaw evidently perceived that the P. strobiformis of Engelmann, Sudworth, and Sargent were not the same taxon. Later, Shaw (1914) modified his verdict and considered P. strobiformis Engelm. as synonomymous with P. ayacahuite, and all other types previously mentioned as being only forms of P. flexilis. Only P. reflexa Engelm. and P. strobiformis Sargent are mentioned in his synonomy of P. flexilis.

Astutely, Sudworth (1917 pp. 12-13) suggested that P. strobiformis Engelm. bore chronological priority and submitted that this be the valid binomial. Although his logic was sound, few authors followed Sudworth's recommendation for the multitude of tree books and journal articles between 1917 and 1955 refer to this plant as either P. reflexa or P. flexilis. For example, Standley (1920 pp. 54-55) recognized P. flexilis and P. reflexa, but placed P. strobiformis in synonomy with P. ayacahuite.

In his second edition of the "Manual of the Trees of North America", Sargent (1922) omitted P. strobiformis Engelm., though he had included it earlier (Sargent 1905). Thus Sargent again reversed his thoughts -

and entered P. strobiformis Sarg. (non Engelm.) as a synonym for P. flexilis. The authoring of P. strobiformis by Sargent is difficult to comprehend.

CONTEMPORARY

Pinus flexilis and Pinus strobiformis

Martinez (1948 pp. 104-105) accepted Shaw's 1909 treatment of P. ayacahuite and recognized P. reflexa and P. flexilis as valid species. P. strobiformis Sudworth (non Engelm.) and P. ayacahuite var. strobiformis Lemmon (non Sargent) were placed in synonomy under P. reflexa. To round out his liberal interpretation of the white pines of Northern Mexico, Martinez, in an attempt to portray the relationships of the Eustrobi (sensu Shaw), also recognized numerous geographic locations for P. ayacahuite var. brachyptera. Martinez also proposed the hierarchical "Groupo Ayacahuite" with P. ayacahuite as the central element. Radiating from P. ayacahuite are P. lambertiana, P. strobus var. chiapenses (=P. chiapenses (Martinez) Andresen 1964), P. ayacahuite var. veitchii, and P. ayacahuite var. brachyptera. He also depicts the latter as an intermediate (inferior status) between P. ayacahuite and P. reflexa which in turn is linked to P. reflexa. Mirov (1953), using terpeno-chemical relationships as a criterion, believed that P. reflexa and P. ayacahuite are bridged by a series of intermediate forms (not yet chemically analyzed) and that there is a link with flexilis and monticola but only a remote connection with P. strobiformis and an undetermined link with P. lambertiana.

In an attempt to resurrect P. flexilis var. macrocarpa, Douglass (1958) decided that this variety was a morphological link between P. flexilis var. flexilis and P. flexilis var. reflexa and that the three were closely related. She also suggested a "very slight" difference between the vars. of P. ayacahuite and P. flexilis, but her conclusions are unsupported by genetical evidence or any other types of biological data.

Recently, Gaussen (1960 pp. 202-205) recognized as discrete species P. flexilis, P. reflexa and P. strobiformis, with the latter as equivalent to P. ayacahuite var. brachyptera. Little (In Soto, Barrett and Little 1962 p. 88), writing on the classificaiton of P. flexilis and P. strobiformis, indicated that these are the "correct" combinations and that earlier opinions (Little 1950 pp. 13-14; 1953 pp. 265-266) recognizing P. flexilis var. reflexa were now altered. And finally, Critchfield and Little (1966 pp. 6, 7) reiterated Little's 1962 opinion.

TAXONOMY

Pinus flexilis James

Pinus flexilis James, Account of an expedition from Pittsburg to the Rocky Mountains. Vol. 2 pp. 34-35 (1823); Sargent (1897).

Pinus lambertiana var. β Hooker, Flora Boreali-Americana. Vol. 2 p. 161 (1890).

Pinus lambertiana var. β brevifolia Endl., Synopsis coniferarum. p. 150 (1847).

Apinus flexilis (James) Rydb., Torrey Bot. Club. Bul. Vol. 32 p. 598 (1905).

Morphologic description is essentially correct in Sargent (1897).

Distribution: Rocky Mountains south from head waters of Saskatchewan River through Idaho, Montana, Wyoming, Colorado. Mountain ranges of Nevada, Sierra Nevada, and Peaks of southwestern California. Rare and local in Wallawa Mountains, Oregon, southwestern Nebraska, western South Dakota, and southwestern North Dakota. On high peaks of Arizona and New Mexico to the Guadelupes of Texas. Not in Mexico!! (See range map in Critchfield and Little 1966).

Specimens examined:

CANADA: ALBERTA: 50° 23' N. Lat.; 114° 40' W. Long., 1550 m alt., 30 July 1961, Andresen, Andresen and March A1174 (MSC)

UNITED STATES: ARIZONA: Navajo Mountains, 10,500 ft. alt., July 1933, Darsie s.n. (MO); CALIFORNIA: White Mountain Ranger Dist., Inyo Nat. For., 37° 23' N. Lat., 118° 11' Long., 2980 m alt., 31 July 1962, Andresen A1702 (MSC); San Gorgonio Ranger Dist., San Bernardino Nat. For., 34° 07' N. Lat., 116° 51' W. Long., 3070 m alt. 4 Aug. 1962, Andresen and Lord A1721 (MSC); COLORADO: Pike's Peak, (probably early October) 1862, Parry s.n. (MO); Summit, Deer Mountain, Larimer Co., 13 Aug. 1927 Woodson Jr. 1882 (MO) Teller County, western flank of Pike's Peak, on Fourmile Creek just north of junction with Oil Creek, Lat. 38° 51' N. Long. 105° 10' W. 8800 Ft. alt. 19 October 1965, Hawksworth and Stewart 831 (SIU); IDAHO: Pine Spring Pahsimersi River Valley, Custer Co., 2 Aug. 1917, Eggleston 14002 (MO); MONTANA: Gros Bentres Fork, 12 June 1860, Hayden s.n. (MO)Old Marias Pass, 6000 ft. alt., Aug. 1883, Sargent s.n. (MO); NEBRASKA: Bad Lands, Sept. 1955, Hayden s.n. (MO); Polecreek of the Platte River, July 1856, Engelmann s.n. (MO); NEVADA: Austin Ranger District, Toiyabe Nat. For., 39° 23' N. Lat., 117° 04' W. Long., 2540 m alt., 20 July 1962, Andresen and Andresen Jr. A1659 (MSC); NORTH DAKOTA: north of Marmarth, Slope Co., 46° 28' N. Lat., 103° 55' W. Long., 763 m alt., 21 July 1961. Andresen, Andresen, Andresen Jr. A1049 (MSC); OREGON: Joseph Ranger District, Wallowa-Whitman Nat. For., 45° 17' N. Lat., 117° 19' W. Long., 1800 m alt., 3 Aug. 1961, Andresen and Miller A1196 (MSC); SOUTH DAKOTA: "Needles", Custer State Park, Pennington Co., 20 June 1929, Palmer 37408 (MO); UTAH: Salina Ranger District, Fish Lake Nat. For., 38° 57' N. Lat., 111° 39' W. Long.,

2560 m alt., 14 July 1962, Andresen, Andresen Jr., and Hill A1616 (MSC); WYOMING: Loomis Creek, Natrona Co., 3 July 1901, Goodding 185 (MO).

As indicated earlier, James did not prepare any plant specimens of P. flexilis when he observed his new pine on 14 July 1820. In his description, James (1823) probably referred to immature but nearly full sized cones whose ovules were fertilized in the spring of 1820. His notation of "the stobiles erect, composed of large unarmed scales, being somewhat smaller than those of P. rigida, but similar in shape and exuding a great quantity of resin." is an accurate description of sessile, "green" cones (at times aborted or distorted by insect attack) that the senior author has also observed about mid-July. In spite of Engelmann's (1863) opinion that James confounded P. aristata and P. flexilis in his description, we contend that James observed and described P. flexilis by itself without confusion with P. aristata.

Since no type specimens were collected we hereby propose a neotype (Lanjouw et. al., 1961: Art. 7) based on the following material: COLORADO: El Paso County, eastern flank of Pike's Peak, ¼ mile north of Ruxton Park Lat. 38° 51' N. Long. 104° 58' W. 9676 ft. alt. 14 July 1966, Andresen, Andresen, Barger A2125.

The neotype and mature cone which includes a conelet is housed at Southern Illinois University. Other specimens with folieage sprays and mature cones are on file at A, MO, MSC, and NA.

The neotype material is probably from the same locality or station visited by James (1823). From his description and map it seems that he and his party were in the Pike's Peak area from 11 through 15 July 1820 primarily to determine the elevation of Pike's Peak. The ascent of Pike's Peak and the resultant discovery of P. flexilis were ancillary to the triangulation exercise.

The following summary of James' trip is provided to help establish the route of James' ascent and possible points of observation of P. flexilis: After leaving the base camp near the confluence of Cheyenne and Fountain Creeks, James, his party of four men and Lt. Swift with his guide rode until 11 a.m. on the 13th. Lt. Swift set up his triangulation station, the horses were tethered and James, the guide and four men walked until noon when they encountered Manitou Springs. After lunch they ascended the Ruxton Creek drainage and probably camped near the present Ruxton Park. The next morning James described the view of the peak at a spot (possible the present hamlet of Mountain View) east southeast of the peak. By noon of the 14th they had reached and passed timber line and at 4 p.m. had attained the summit. After half an hour at the summit the party descended and camped at timber line. By noon of the 15th they were again at Manitou Springs without most of their baggage which had burned when a wild fire spread from their unattended campfire. No plant collections were made (primarily because of time shortage) but numerous new species were described and many left undescribed because of a shortage of time. The major point, however, is

that the ascent was up the eastern flank and slope of Pike's Peak; no collections or observations other than physiognomic or geologic were made of the other three slopes.

Pinus strobiformis Engelm.

Pinus strobiformis Engelm., Sketch of the botany of Dr. A. Wislizenus's expedition. Sen. Misc. Doc. No. 26 (1848).

Pinus flexilis var. α serrulata Engel. Coniferae of Wheeler's expedition. In Report upon U.S. geographical surveys west of the one hundreth meridian. Vol. VI p.258 (1878).

Pinus flexilis var. β macrocarpa Engelm. Coniferae of Wheeler's expedition in Report upon U.S. geographical surveys west of the one hundreth meridian. Vol. VI p. 258 (1878).

Pinus flexilis var. γ reflexa Engelm. Coniferae of Wheeler's expedition in Report upon U.S. geographical surveys west of the one hundreth meridian. Vol. VI p. 258 (1878).

Pinus flexilis var. magalocarpa Sudworth. Nomenclature of the arborescent flora of the United States, USDA, Division of For. Bull. No. 14:17 (1897).

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Pinus ayacahuite var. strobiformis Sargent ex Lemmon. Handbook of west-American cone-bearers. 4 (1892).

Pinus ayacahuite var. reflexa Voss. Deut. Dendrol. Gessell. Mitt. Vol. 16 p. 92 1907).

Pinus ayacahuite var. brachyptera Shaw. Pines of Mexico Pub. Arnold Arb. No. 1:11 1909.

Morphologic description of Sargent (1897) essentially correct but from our field observations it should be noted that second-year immature cone may be green or purple to lavender in color.

Distribution: Southern Colorado, Arizona, New Mexico, western Texas, the Sierra Madre Occidental of Chihuahua, Durango, Nayarit, Sinola, and Sonora; and the Sierra Madre Oriental of Coahuila, Nuevo Leon, San Luis Potosi, and Tamaulipa.

Specimens examined:

MEXICO: CHIHUAHUA: "Cosiquinachi" 17 September, 1846, Wislizenus 155 (MO) (Holotype); San Pedro Springs, Dec. 1906, Goodding 2114 (MO); DURANGO: Mesa de Sandia, "1903-07" Shaw "Set 8" (MO) (as P. ayacahuite

var. brachyptera); Cerro de Viejo, 15 mi. W. Dulces Nombres, Zaragosa, 2800 m. alt., 18 Aug., 1948, Meyer and Rogers 3002 (MO) (as P. ayacahuite var. brachptera [brachyptera] UNITED STATES: ARIZONA: Chiricahua Mts. , Barfoot Park. 8200 ft. alt., 20 Oct., 1906, Blumer 1311 (MO); Santa Catalina Mts., 7000 ft. alt., 3 Oct., 1937, Darrow s.n. (MO); Santa Rita Mts., 13 Aug., 1871, Rothrock 654 (MO) (Holotype); Santa Rita Mts. 6500-7500 ft. alt., 27 September, 1880, Sargent s.n. (MO); Santa Rita Mts., 6000-8000 ft. alt., 28 May, 1881, Pringle s.n., (MO) (as P. reflexa Engelm.); Indefinite, 13 Aug., 1874, collector unknown, 1635443 (MO): Indefinite 13 Aug. 1874, collector unknown, 654 (MO); Sanoita Valley, 13 Aug. 1874, collector unknown 1001 (MO). COLORADO: La Plata River 1 to 4 mi. N. of May Day 37° 22' N. Lat. 108° 04' W. Long 9000 ft. alt., 12 Sept. 1964, Critchfield and Steinhoff 22 t 24 (CU); S. Fork of Rio Grande River, 215 mi S.W. of Baxterville, 37° 39' N. Lat. 106° 39.7' W. Long. 8300 ft. alt. 15 Sept. 1964 Critchfield and Steinhoff 2021 (CU). NEW MEXICO: Cloudcroft, 6000 ft. alt., 9 July 1909, von Schrenk s.n. (MO) (as P. flexilis); Mogollon Mts., Catron Co., 7000 ft. alt., 26 June 1947, Meyer and Meyer 2212 (MO); TEXAS: Davis Mts., Jeff Davis Co., 2300 m alt., 1 June, 1928, Palmer 34281 (MBG) (as P. flexilis var. reflexa Engelm.); McKittrick Canyon, Guadalupe Mts., Culberson Co., 2400 m alt., 17 July 1931; Moore and Steyermark 3469 (MO) (as P. flexilis).

DISCUSSION

Pinus strobiformis Engelm. as considered here, is a distinct mountain inhabitant of the northern states of Mexico, western Texas, and southern Arizona and New Mexico, but as it is found farther north the higher elevational forms assume the morphology of P. flexilis. Hybrid swarms of P. flexilis and P. strobiformis are also found at higher elevations and with some representatives at 8000 ft., in southern Colorado. Although progeny tests (Steinhoff 1964; Steinhoff and Andresen 1971) revealed apomictic taxa, further investigations of putative hybrids and introgressed populations are called for. Successful artificial hybrids of P. flexilis and P. strobiformis have been produced, but their development under various environmental conditions has not yet been attempted. Also, the manner in which natural selection acts upon segregating hybrid progeny is not well understood.

Recently, an excellent series of maps (Critchfield and Little, 1966) has been released which depicts the geographic distribution of P. flexilis, P. strobiformis, and P. ayacahuite. In addition, their revision (Little and Critchfield 1969) of the genus Pinus assembles within subsection Strobi Loud. the above three taxa, and by including P. armandii Franch. with Strobi, effectively disposed of group Flexiles Shaw. More important, however, are the opinions of Critchfield and Little that P. strobiformis and P. ayacahuite are closely allied, which ties the three taxa into a taxonomic complex worthy of more intensive study.

Earlier chemotaxonomic work by Mirov (1953) linked P. strobiformis [P. reflexa] to P. ayacahuite through a series of intermediate forms whose biochemistry awaits expanded investigation. He placed P. flexilis in a separate chemical group, but suggested that P. parviflora Sieb. and

Zucc. formed a link between the former and P. strobiformis.

Considering recent advances in biochemical and numerical systematics, it is now appropriate to determine the taximetric and genetic affinities of the north to south complex of P. flexilis, P. strobiformis, and P. ayacahuite.

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SUPPLEMENTARY NOTES ON GRAMMITIS IN ECUADOR

C. V. Morton

In 1967 I published a brief revision of the genus Grammitis in Ecuador (Contr. U. S. Nat. Herb. 38: 85--123. 1967), based mostly on the material in the U. S. National Herbarium. Through the kindness of Sir George Taylor, Director, Royal Botanic Gardens, Kew, and of Dr. Frances Jarrett, I have had on loan some of the material from Kew for study, and this has enabled me to amplify or modify some of my remarks, and has also provided the type material for two rather remarkable new species.

Grammitis aphelolepis Morton, Contr. U. S. Nat. Herb. 38: 97. 1967.
Additional Ecuadorean specimen examined: "In regione frigida andium Pastoensium ad arborum truncis," Jameson 370 (K).

Grammitis attenuatissima (Copel.) Morton, Contr. U. S. Nat. Herb. 38: 112. 1967.
Additional Ecuadorean collections examined: Niebli, Sodiro 177 (K). Andes Quitenses, Spruce 5634 (K).
These two collections are larger than the type and have more numerous veins but seem otherwise typical.

Grammitis asplenifolia (L.) Proctor, Brit. Fern Gaz. 9: 76. 1962.
Polypodium asplenifolium L. Sp. Pl. 1084. 1753. Type: Petiver, Pterid. t. 7, f. 16. Petiver's plate, the sole basis for the species (excluding Linnaeus' var β) is a redrawing of Plumier, Tract. Fil. t. 102A, representing a plant from Martinique. This is not by any means a good representation of the species commonly called P. asplenifolium although it may have been intended to be that.

In my treatment of Grammitis in Ecuador I should probably have included G. asplenifolia, for this species had been reported from Ecuador by Sodiro (Crypt. Vasc. Quit. 318. 1893, under the name P. suspensum L.), but I did not because so many of Sodiro's records are suspect. That his report is indeed accurate is shown by a specimen at Kew from near Niebly, Ecuador, collected by Sodiro, July, 1873. This specimen represents the large, long-stipitate form that is the commonest in the Andes and which perhaps deserves a varietal name. In my key G. asplenifolia will run directly to G. lehmanniana (Hieron.) Morton, which is indeed very closely allied. The latter is not well enough known, but apparently differs somewhat in having more and somewhat larger segments, more numerous veinlets, and perhaps a denser pubescence. It is not certain if the stipe is bent at the apex in G. lehmanniana as it characteristically is in G. asplenifolia.

Copeland, in his "Ctenopteris in America," adopted for this species the name C. suspensa (L.) Copel. I have elsewhere (Contr. U. S. Nat. Herb. 38: 58. 1967) commented on the identity of Polypodium suspensum L., and came to the conclusion that this species is by no means the same as P. asplenifolium L. but is probably the same as P. jubiforme Kaulf., for which it would be the earliest name if adopted. However, this can hardly be proved definitely at the present time and so I prefer to consider P. suspensum L. as dubious, for to adopt the name in preference to P. jubiforme would be confusing and not justifiable unless the change could be shown to be absolutely unavoidable.

Grammitis blepharolepis (C. Chr.) Morton, Contr. U. S. Nat. Herb. 38: 98. 1967.

Additional Ecuadorean specimens examined: Eastern Andes of Quito, Jameson (K). "Crescit in devexis Andium regione sylvatica super arborum alt. 7000 ped.," Jameson 350 (K). "In sil. subandin. occident.," Sodiro 48/184 (K). Quito, Jameson (K). Andes of Ecuador, Spruce 5273 (K).

This species has been known in Ecuador from only one collection, but it is evidently quite common. Most of the above collections, none of which have any specific localities strangely, have been referred to G. trichomanoides (Swartz) Ching, which they do indeed resemble. However, they agree with G. blepharolepis in having ciliate rhizome scales.

Grammitis cuencana (Hieron.) Morton

This species, previously known only from the type from Cuenca, Ecuador (Lehmann 5728) may now be reported from five other collections: Chimborazo, August, 1860, Spruce (K), Steere (K); Playa de Antombos, Río Pastaza, Spruce 5274 (K); Quito, Jameson (K); and Surucucho, Jameson (K). It is recognizable by its small size, few veins, and numerous black setae on the lower surfaces.

Grammitis cultrata (Willd.) Proctor, Rhodora 63: 35. 1961.

Additional Ecuadorean specimen examined: Pendent epiphyte in deep, in montane forest, steep-sided valley 5 miles northeast of Borja, Cerro Antisana, Prov. Pichincha, 5,300 feet alt., July 30, 1960, Grubb et al, 1110 (US).

Grammitis daguensis (Hieron.) Morton, Contr. U. S. Nat. Herb. 38: 98. 1967.

When publishing the combination G. daguensis, I predicted that this Colombian species would be found in Ecuador, and a specimen has now come to my attention: In the forests of Esmeraldas, Ecuador, on trunks of trees at 5,000 feet elevation, Jameson (K).

Grammitis erecta Morton, sp. nov.

Rhizoma erectum, terrestre, crassum, 14--24 cm. longum (ad 50 cm. fide Spruce), 2--3 mm. diam., dense et ubique paleaceum, paleis

persistentibus, late lanceolatis, appressis, magnis, 7--9 mm. longis et ultra, 2--3 mm. latis et ultra, integris, non ciliatis, iridescentibus, imbricatis, gradatim attenuatis, apice obtusis, non filiformibus, paullo involutis, eleganter clathratis cellulis numerosissimis, basi in 50-seriebus et ultra, non valde elongatis, saepe subrectangularibus, parietibus non incrassatis, tenuibus, marginalibus transversis parvis et non valde prominentibus; frondes erectae, dissitae, non numerosae; stipites plus minusve crassi, 1--2.5 cm. longi, ca. 1.0 mm. diam., teretes sed utrinque latere minutissime alati, glabri, non setiferi; laminae rigidae, 14--18 cm. longae, 1.0--1.4 cm. latae, apice attenuatae et forsan indeterminatae, basi attenuatae, rhachi ubique anguste alata, atra, utrinque glabra et non squamosa; segmenta numerosissima, 60-juga et ultra, horizontalia, valid coriacea et rigida, medialia oblonga, ca. 4-plo longiora quam latiora, 6--7 mm. long, ca. 1.5 mm. medio lata, margine paullo incurva, alterna, omnia basi late adnata, basalia minora, triangularia, infima valde reducta et anguste semilunata, 3 mm. basi lata et vix 1 mm. longa, omnia glabra, non setosa, opaca; costa et venae immersae, obscurae, costa flexuosa, venis in segmentis maximis 4-jugis, brevibus; sori superficiales, pauci, saepe 1 vel 2 paria, magnae, dorsales in venulis non terminales; sporangia numerosa, glabra, non setosa, tenuiter pedicellata.

Type in the Royal Botanic Gardens, Kew, collected on Mount Tunguragua, Ecuador, November 1857, by R. Spruce, no. 5279A. A paratype is also from Tunguragua, at 9000 feet alt., Spruce 5413 (K).

Neither of the above-mentioned specimens has previously been identified. They are obviously of the group of Grammitis moniliformis (Lag.) Proctor, but differ from the common moniliformis itself and from its allies in being much more robust, the thick rhizome being apparently erect, up to two feet high according to the collector, and with erect leaves. The general habit is somewhat like Grammitis assurgens (Maxon) Morton. The rhizome scales are exceedingly large and rather closely inrolled. They are fragile and difficult to get off without being fragmented. They have more rows of cells than in any previously known species, more than 50 rows. The great difference in aspect from G. moniliformis or G. assurgens is due to the shape of the segments, which are about four times as long as broad in G. erecta and only as long as broad or at least not more than about twice as long as broad in the other two species. In spite of the segments being much longer they have hardly any more pairs of veinlets than G. moniliformis, about four pairs in the largest segments. However, due to the narrowness of the segments the veinlets are short, which obscures to a certain degree the fact that the sori are borne dorsally on the veinlets and not terminally. There are few sori to a segment in the material at hand, mostly only one pair, but this may be an individual peculiarity.

Grammitis intricata Morton, Contr. U. S. Nat. Herb. 38: 101. 1967.
Additional Ecuadorean collections examined: Andes of Quito, Jameson 77 (FI). Volcán Cotopaxi, 13,000 feet, Jameson 439 (FI).
This species has previously been known only from the type. The first collection cited above has the segments quite glabrous above, and so my description should be modified to this effect; the type has the segments very sparsely setose above near the margins.

Grammitis lehmanniana (Hieron.) Morton, Contr. U. S. Nat. Herb. 38: 104. 1967.
A second Ecuadorean collection, quite typical of the species, may now be reported: Foot of Mount Chimborazo, Prov. Chimborazo, Ecuador, August, 1860, Spruce 5711 (K). The only previously known specimen from Ecuador was from the Province of Napo-Pastaza.
An allied Colombian species is Grammitis longisetulosa (Copel.) Morton, comb. nov. (basionym: Ctenopteris longisetulosa Copel. Phil. Journ. Sci. 84: 461. 1955). The type of this is stated by Copeland as "Colombia, Dept. Antioquia, Rionegro; 1. Bro. Daniel 68a," which is inaccurate. The holotype is in the U. S. National Herbarium, although not so stated by Copeland. I do not understand what Copeland's "1." stands for, since there is nothing on the label like this. The correct number is Daniel 680, not 68a. This species differs from G. lehmanniana and its allies in having fewer segments and a blade that is more or less triangular in outline, being truncate at base. The species is placed by Copeland in the group of meridensis, probably on the basis of the blade shape, but that is by no means the alliance of this or of G. lehmanniana, which are much closer to the group of sericeo-lanata, i.e. Grammitis lanigera, which consists of delicate epiphytes with flaccid, pendent, densely pilose blades and pilose sporangia.

Grammitis leucosticta (J. Smith) Morton, Contr. U. S. Nat. Herb. 38: 112. 1967.
Additional Ecuadorean collection examined: Pichincha, August, 1858, Spruce 5636 (K).

Grammitis mathewsii (Kunze ex Mett.) Morton, Amer. Fern Journ. 60: 66. 1970.
Polypodium mathewsii Kunze ex Mett. Abhandl. Senckenb. Naturf. Gesell. 2: 74. 1856. Syntypes: Chachapoyas, Peru, Mathews 1811, 3281 (B, not seen).
In my key to Grammitis in Ecuador, this peculiar species ought to be inserted at the top of page 91, which should then read:
Segments with a costa, this with pinnate veinlets (sect. Cryptosorus).
Veinlets forked or else variously anastomosing. Epiphytes.
Fronds not setose beneath; rhizome scales not ciliate; blades lobed to pinnatifid but not pinnatisect, except in G. mathewsii.

Fronds white-ceraceous beneath, but not at all setose. Segments elongate, not fully confluent, auriculate at the upper base. G. farinosa

Fronds not white-ceraceous beneath.

Sori sunken, round or slightly elongate; blades not pinnatifid, merely slightly lobed, with an elongate, entire basal portion, sparsely setiferous on the costa beneath and copiously ciliate; veins more or less regularly anastomosing to form a series of costal areoles. Texture spongiose. (Probably not in Ecuador). . . . . .G. crispata

Sori superficial; blades pinnatifid or lobed; veins free or anastomosing.

Veins free or only a few casually anastomosing.

Blades at base deeply pinnatifid almost to the rhachis, elongate and narrow, truncate at base, the segments united by only a narrow wing. Texture firm. G. melanopus

Blades shallowly lobed to pinnatifid, short-decurrent at base, the rhachis wing broader, at least 1 mm. broad, the segments or lobes short and broad. Texture spongiose.

Blades linear, just slightly lobed. . . . . G. trichosora

Blades broader than linear.

Blades with an accessory veinlet arising from the costa; basal superior veinlet running toward and nearly reaching the sinus; blades deeply pinnatifid, the larger ones with a costal wing only ca. 1 mm. wide on either side. . . . . G. eminens

Blades with no veinlets arising from the costa apart from the main lateral veins; basal superior veinlet not nearly reaching the sinus; blades shallowly lobed to pinnatifid, the costal wing always broad. G. trifurcata

Veins regularly anastomosing.

Blades deeply pinnatisect, densely setose throughout; venation goniophlebioid, with regular costal areoles, these with a single included fertile veinlet; texture firm. . . . . G. mathewsii

Blades entire or just slightly lobed, not pinnatifid, setose only on stipes, margins, and in sori; costal areoles irregular, without included veinlets, the sori in several rows outside of costal areole; texture spongiose. . . . . .G. trichosora

Grammitis melanopus (Grev. & Hook.) Morton, comb. nov.

Polypodium melanopus Grev. & Hook., in Hook. Bot. Misc. 3: 384, t. 111. 1833.

Ctenopteris melanopus (Grev. & Hook.) Copel. Phil. Jour. Sci. 84: 404. 1955.

Type: Surucucho, Ecuador, Jameson, Sept. 21, 1830 (holotype K, Morton photograph 15419).

In my paper on Grammitis in Ecuador, I left this species among the dubious ones, not being able to match the original description and illustration with any material. An examination of the type shows that the species is a good one, that has probably never been found again since Jameson found it in 1830. Copeland placed it in the group of capillaris, but it does not at all belong there, but rather in the group of meridensis, as shown by the truncate base of the blade, the coriaceous texture, and the glabrate condition of the stipe and lamina. The lamina is just slightly setose on the margins by elongate, sparse setae; there are no setae on the stipe, midribs, or surfaces. The blade is nearly pinnatisect at the base, although even here there is a very narrow rachis wing. The sori do not have any setae intermixed and the sporangia are not setose; the veins of the larger segments have about 20 pairs of veinlets, all of these forked, and some bearing sori terminal on the anterior branch. This species will be found inserted in the new key provided above under G. mathewsii.

Grammitis moniliformis (Lag.) Proctor, Brit. Fern Gaz. 9: 219. 1965.

In 1967, I listed Polypodium subcrenatum Hook. (Icon. Pl. 8: t. 719. 1848) as a synonym on the basis of the treatment in the "Index Filicum." I have now seen an isotype, Andes of Quito, Jameson 215 (FI, Morton photograph 16012), which shows that this species is quite typical moniliformis. A synonym of G. moniliformis that I did not mention in my paper is Jamesonia adnata Kunze, Farnkr. 2: 80, t. 133, f. 1. 1851, based on a collection from the Páramo de Tolima, Colombia, Linden 1006 (isotype FI, Morton photograph 16010). The description of this common species as a new species of the unrelated genus Jamesonia must be ascribed to a temporary aberration of the usually reliable Kunze.

Polypodium patentissimum Mett. ex Kuhn, Linnaea 36: 134. 1869.

Ctenopteris patentissimum (Mett. ex Kuhn) Copel. Phil. Jour. Sci. 84: 459. 1955.

Type: Mount Chimborazo, Ecuador, 3000 feet alt., Spruce 5713 (holotype B, a single frond).

This is another instance of the close similarity at least superficially between Polypodium and Grammitis, for Copeland transferred this species to Ctenopteris without a question and yet it is actually a Polypodium of the P. plumula alliance. It is evident that the cited altitude "3,000 feet" is an error, for even the base of Chimborazo is at a greater elevation than that.

Grammitis phlegmaria (J. Smith) Proctor, Rhodora 68: 467. 1966.

Polypodium phlegmaria J. Smith, London Journ. Bot. 1: 194. 1842. Type: Mount Roraima, Venezuela, Schomburgk 161 (K, photograph US).

Polypodium subdimidiatum Baker, in Hook. & Bak. Syn. Fil. 324. 1867. Syntypes: Venezuela, Fendler 207; Ecuador, Jameson 2122; British Guiana, Appun 1130.

In my treatment of Grammitis in Ecuador I overlooked the fact that Polypodium subdimidiatum Baker was based partly on Ecuadorean material, and so I did not mention the name. This species was reduced by Copeland to Ctenopteris phlegmaria without question, but there is no evidence that Copeland ever saw any of the syntypes. It is likely that at least the British Guiana specimen is truly G. phlegmaria and the Fendler collection also. The Ecuadorean may possibly be different, although I have not seen it. I have in hand a collection, Jameson 756 (K), from Archidona, Province of Napo-Pastaza, Ecuador, that is close to G. phlegmaria and yet which is somewhat different in its smaller segments which have four low rounded lobes on the upper side, whereas typical G. phlegmaria has mostly just a superior basal lobe. Incidentally, I should point out that the new combination G. phlegmaria (J. Smith) Morton in my Grammitis paper (l.c. p. 103, written earlier but not published until 1967) was previously proposed by Proctor in 1966.

Grammitis pichinchae (Sodiro) Morton, Contr. U. S. Nat. Herb. 38: 111. 1967.

Additional Ecuadorean collection examined: Tunguragua, in 1860, Spruce 6580 (K).

Grammitis pilipes (Hook.) Morton, comb. nov.

Polypodium pilipes Hook. Icon. Pl. 3: t. 221. 1840. Type: Chachapoyas, Peru, Mathews in 1838 (holotype K).

Ctenopteris capillaris sensu Copel. Phil. Journ. Sci. 84: 402. 1955 as to concept not basionym.

Copeland did not see the type of Polypodium capillare Desv. (Mag. Naturf. Freund. Berlin 5: 316. 1811) and evidently assumed that it was a South American species, for he restricted the application of the name to a species occurring from Costa Rica south to Peru. This species with entire rhizome scales and a tendency for the segments of the blades to become elongate or even pinnatifid proves to be quite different from the holotype of P. capillare Desv. (P, photograph US) which is from Jamaica. This holotype is actually the same as the Jamaican species described as P. graveolens Baker, as noted by Proctor (Brit. Fern Gaz. 9: 218. 1965) without comment while making the new combination Grammitis capillaris (Desv.) Proctor. Proctor did not consider the identity of the species wrongly called capillaris by Copeland. Copeland mentions other synonyms of his "capillaris," but they are all of later date than pilipes--namely P. blandum Fée, P. decipiens Hook., P. pozuzoense Baker, P. fucoides Christ, and P. crassulum Maxon. Of these, P. fucoides (syn. P. crassulum), of Costa Rica, seems to me clearly different in its large size, coarse habit, thick texture, and especially in the very large, round sori. It may be known as

Grammitis fucoides (Christ) Morton, comb. nov. (basionym Polypodium fucoides Christ, Bull. Herb. Boiss. II, 5: 2. 1905).

Grammitis pseudonutans (Christ & Rosenst.) Morton, Contr. U. S. Nat. Herb. 38: 114. 1967.

Additional Ecuadorean specimens examined: Mount Tunguragua, Spruce 5279 (K), 5279B (K). These specimens are topotypes that agree closely with the type material.

Grammitis recondita Morton, sp. nov.

Rhizoma ut videtur epiphyticum, breve, erectum, tenue, paleis apicalibus numerosis, persistentibus, anguste lineari-lanceolatis, ca. 2.5 mm. longis, 1.5 mm. basi latis, gradatim attenuatis apice unicellularibus, iridescentibus, cellulis basi ca. 6-serialibus, anguste oblongis, parietibus atrorubris, parietibus externis hyalinis pallide flavis, marginalibus valde tenuibus ergo paleis ut videtur dentatis propter parietibus atrorubris marginalibus transversis procurrentibus; stipites 1--2 cm. longi, delicati et gracillimi, ca. 0.2--0.25 mm. diam., teretes, glabri, non setosi, non paleati; laminae 16--28 cm. longae, 3--4 cm. latae, delicatissimae, evidenter pendulae, pallide virides, fere pinnatae basi, alternatim valde decurrentes, rhachi gracillima et fere filiformi, ca. 0.2 mm. diam., nigrescente, subtus glabra, nitente; segmenta alterna, linearia, numerosa, ca. 30-juga, valde adscendentia, subapicalia maxima usque ad 3.5 cm. longa et 1.5 mm. lata, basalia valde reducta, omnia membranacea, pallide viridia, glabra, non squamosa, basi longe in rhachi decurrentia, non dentata vel pinnatifida sed paullo undulata; costa flexuosa, venulis remotis, ca. 14-jugis in segmentis maximis, simplicibus, non marginem attingentibus, alternis, venula prima in latere superiore, eis in latere superiore longioribus quam in latere inferiore, eis inferioribus propiis ad venulam superiorem basalem quam venulam distalem; sori pauci, in venulis terminales, paullo elongati, paullo depressi; sporangia pauca, non setosa vel pilifera, fere sessilia, annulo atro, parietibus lateralibus pallidis.

Type in the Royal Botanic Gardens, Kew, collected in the forests of Archidona, Province of Napo-Pastaza, Ecuador, by W. Jameson.

The type specimen was referred by Hooker to his Polypodium decipiens, and so it is one of the five syntypes of this species, but it can not be the lectotype because it does not agree with the description or illustration of Hooker (Sp. Fil. 4: 231, t. CCLXXIX, B. 1864), which call for a plant with some of the pinnae pinnatifid. Hooker's figure of P. decipiens was drawn from Moritz 337 from Venezuela, and this specimen (K) is here designated lectotype. Polypodium decipiens thus typified is close to or probably synonymous with Grammitis pilipes (Hook.) Morton. The present species, Grammitis recondita, is doubtless close also to G. pilipes, from which it differs primarily in having glabrous rather than strongly setose stipes. The plant is altogether

more delicate and evidently limply pendulous; the pinnae are rather spaced out and show no tendency to become toothed, lobed, or pinnatifid, or elongate and variously modified as they commonly are in G. pilipes. The sori also are somewhat sunken in small depressions.

In my key to Grammitis in Ecuador this species will run down near G. subsessilis (Baker) Morton and G. pseudocapillaris (Rosenst.) Morton. From the rather common G. subsessilis, G. recondita differs in its thin texture, narrower pinnae, not completely alate rhachis, and especially in the lower segments not being reduced to minute, rounded, semilunate lobes. Probably more closely allied is G. pseudocapillaris, which differs in having ciliate rhizome scales, and in the rhachis and costae beneath being at least slightly setose rather than glabrous. There is also a rather subtle difference in aspect. It is possible that Steyermark 53475, from Azuay, which I referred to G. pseudocapillaris in my revision, is really G. recondita, but rhizome scales are lacking.

Grammitis semihirsuta (Klotzsch) Morton, Contr. U. S. Nat. Herb. 38: 113. 1967.

Additional Ecuadorean specimens examined: Quisaya, Feb., 1874, Sodiro (K). Tunguragua, Spruce s. n. (K), (with notation cf. 5283; the true 5283 represents apparently a form of G. taxifolia).

An allied Colombian species with smaller and closer segments, less prominent veins, and rhizome scales more densely grayish ciliate is Grammitis oreophila (Maxon) Morton, comb. nov. (basionym: Polypodium oreophilum Maxon, Contr. Gray Herb. 165: 72. 1947). The species is still known only from the holotype: Cerro Armas, Santander, 1200-1500 m., July 26, 1936, Haught 1959 (US). In his account of Ctenopteris semihirsuta Copeland remarks: "There is wide variation in the pubescence of the lamina. Because it has been treated as distinct I let Polypodium oreophilum so stand," which seems to indicate that he has some doubt of oreophilum being different from semihirsuta, and yet in the same paper he transfers oreophilum to Ctenopteris and places the species in an entirely different group from semihirsuta, the group of sericeo-lanata, to which it is not at all allied.

Grammitis sodiroi (Christ & Rosenst.) Morton var. brevipes Morton, var. nov.

A var typica stipitibus brevioribus, 2--4 (raro 7) cm. longis, et crassioribus, ca. 1 mm. diam., differt.

Type in the Royal Botanic Gardens, Kew, collected on Mount Tunguragua, Province of Tunguragua, Ecuador, November, 1857, by R. Spruce, no. 5279.

Paratypes: Near Tipococha, Province of Chimborazo-Cañar border, Ecuador, 9,800-10,400 feet alt., July 6--9, 1945, Camp E-4076 (US). Small wooded quebrada 5 km. north of Hacienda Piñón, Province of Imbabura, Ecuador, 10,850 feet alt., June 25, 1944, Wiggins 10,359 (US).

In my Grammitis in Ecuador paper, I listed the Camp and Wiggins collections as probably aberrant specimens of G. sodiroi. The finding of still a third collection persuades me that this plant deserves a name; it may well be that it is specifically distinct but I prefer to regard it as only a variety at present. The typical G. sodiroi, which is known only from Mount Tunguragua, has longer (5--12 cm.) stipes, and these are generally more slender, often only 0.5 mm in diameter, although the stouter ones may reach 0.9 mm. The type of the variety, Spruce 5279, was probably considered by Spruce as the same as Spruce 5279A, and the "A" number may have been assigned by Hooker rather than by Spruce himself. However, 5279A is the type of the new species G. erecta, described elsewhere in this paper; it does indeed bear a strong similarity to 5279, but the two must be different. In 5279A the rhizome scales are narrower and taper to a long, one-celled tip; the rhachis bears long black setae, rather than being glabrous, and some setae are borne also among the sporangia in the sori, whereas G. erecta is completely non-setose. The segments in G. sodiroi var. brevipes are also typically more elongate, with more numerous veinlets and sori. It appears that G. erecta is terrestrial, with an erect rhizome and erect fronds, whereas according to the label data by Camp and Wiggins G. sodiroi var. brevipes is epiphytic and with pendent fronds.

Grammitis subflabelliformis (Rosenst.) Morton, Contr. U. S. Nat. Herb. 38: 104. 1967.

Additional Ecuadorean collections examined: Cerro de Abitagua, Spruce 5271 (K, isotype). Mount Pichincha, 4000 feet alt., July, 1876, André 3128 (K).

Grammitis subscabra (Klotzsch) Morton, comb. nov.

Polypodium subscabrum Klotzsch, Linnaea 20: 377. 1847.

Polypodium pichinchense Hieron. Bot. Jahrb. Engler 34: 506. 1904. Lectotype: Ecuador, 3,000-3,400 m., May, 1862, Jameson (B).

Polypodium ecuadorense C. Chr. Ind. Fil. 524. 1906. Based on P. pichinchense Hieron., not P. pichinchae Sodiro. Illegitimate renaming.

Ctenopteris ecuadorensis (C. Chr.) Copel. Phil. Journ. Sci. 84: 434. 1955. Illegitimate, since earliest available epithet pichinchensis was not adopted.

Grammitis pichinchensis (Hieron.) Morton, Contr. U. S. Nat. Herb. 38: 111. 1967.

Type: Mérida, Venezuela, Moritz 332 (isotype K, photo 15441).

Copeland in his revision of American Ctenopteris considered Polypodium subscabrum Klotzsch as a dubious member of the genus, and since I had not seen any authentic material I followed him in my treatment of Grammitis in Ecuador by recognizing P. subscabrum sensu Hook. non Klotzsch = P. pichinchense Hieron. as a distinct species. However, a recent examination of an isotype of P. subscabrum and a comparison with Jameson 51, from the Valley of

Lloa, Ecuador, the basis of Hooker's concept of P. subscabrum and of his plate 274A in his "Species Filicum, vol. 4), shows no obvious differences between the Ecuadorean plants and the isotype from Venezuela. The small, black, ciliate rhizome scales, red-setose stipe, dark setose blades, and obvious lime-dots above, and the elongate, lax blades are fairly characteristic.

Grammitis taxifolia (L.) Proctor, Rhodora 63: 35. 1961.
Additional Ecuadorean collections: Cerro de Abitagua, in 1857, Spruce 5283 (K). Pichincha, Jameson (K). Sin. loc., Jameson (K).

Grammitis trichosora (Hook.) Morton, comb. nov.
Polypodium trichosorum Hook. Second Century t. 12. 1860.
Type: Forests of Archidona, Andes of Quito, Ecuador, Jameson 349 (holotype K, Morton photograph 15890).
There may be some doubt about the type number and type locality, for Jameson 349 in Florence is from Nanegal, Ecuador, and represents a different species, Polypodium patentissimum Mett. There is in Florence a specimen of Jameson 348, also from Nanegal, which is near G. trichosora and could conceivably represent the same species; still, it has the sori in one row only and the veins all free, and so is not by any means identical.
In my paper on Grammitis in Ecuador, I listed Polypodium trichosorum Hook. as a doubtful synonym of G. crispata (J. Smith) Morton, going on the description and plate alone. An examination of the type shows that the two are amply distinct, especially in the sori, which are in pits in G. crispata and superficial in G. trichosora. The venation is also very different, for G. crispata has regular areoles along the costa of the blade, these elongate and without an included veinlet. The venation in G. trichosora, not shown by Hooker, is highly irregular, without regular, narrow costal areoles but with the veinlets often irregularly anastomosing at the middle or beyond. It is likely that Polypodium ecostatum Sodiro, which I also listed as a possible synonym of G. crispata, is really a synonym of G. trichosora, but I have seen no authentic material. Therefore, G. crispata, which was reported in Ecuador only on the basis of these two reputed synonyms, should be excluded from the flora of Ecuador. For its place in my key to Grammitis in Ecuador, see the key presented above under G. mathewsii.

Grammitis truncicola (Klotzsch) Morton, Contr. U. S. Nat. Herb. 38: 98. 1967.
Additional Ecuadorean specimen examined: In forest at San Pablo, on Río Pamplona, Selva Alegra, southwest of Volcán Cotacachi, Prov. Imbabura, 6000 feet, Nov. 30, 1943, Ownbey 2616b (US). This is the third known collection from Ecuador, the other two, the syntypes of Polypodium andinum Hook., having been collected more than 125 years ago.

Extra-limital Species

Grammitis kaieteura (Jenm.) Morton, comb. nov.
Polypodium kaietureum Jenm. Ferns Fern-allies Brit. W. Ind. Guian. 262. 1908.
Ctenopteris kaieteura (Jenm.) Copel. Phil. Journ. Sci. 84: 439. 1955.
Type: Kaieteur Plateau, British Guiana, Jenman 1423 (not seen).
A new record for this species is Mount Roraima, Venezuela, Schomburgk 1146 (K).

Grammitis pennellii (Copel.) Morton, comb. nov.
Ctenopteris pennellii Copel. Phil. Journ. Sci. 84: 397. 1955.
Type: "San José," San Antonio, Department of El Cauca, Colombia, 2400-2700 m. alt., June 28, 1922, Pennell & Killip 7379 (holotype US). Copeland cited the type as "1. Pennell & Killip 7379," but I do not know what the "1." stands for, since there is nothing of the sort on the label. He also omitted to mention the locality and the herbarium in which the type is deposited.
This species is still known only from the type. It belongs to the group of G. moniliformis, but differs in the conspicuously dark setose rhachis beneath, and the setose midribs and sori. It is a much larger plant with more elongate segments than moniliformis or its near allies.

Grammitis sodiroi (Christ & Rosenst.) Morton, Contr. U. S. Nat. Herb. 38: 114. 1967.
The following is the first record of this species outside Ecuador: Volcán Azufral, Department of Nariño, Colombia, 3800 m. alt., March 18, 1876, on roots of shrubs in cloud-forest, André 3286 (K). Azufral is not so far north of the Ecuadorean border.

National Museum of Natural History
Washington, D. C. 20560

DAVID DOUGLAS

Otto & Isa Degener

David Douglas is so famous for his plant introductions that published copies of his biography and of his diary are to be found in about every larger botanical library in the World. To repeat any of these accounts would be redundant. We in Hawaii noted a few obscure observations that we wish to add to the internationally known story of his tragic death.

The late *Mrs. Albert Pierce Taylor, an akamai alii or brilliant Hawaiian lady related to King Kamehameha I and the widow of the local historian Albert P. Taylor, told the kane writer in the early '30s the natives' version of Douglas' death as she knew it. The Caucasian Botany Bay convict, who hunted feral cattle for a living on the slopes of Mauna Kea, according to Mrs. Taylor, had a Hawaiian as wife. Douglas made such a favorable impression on the latter that the disreputable husband became jealous. This was an element in causing Douglas' murder, a crime none of the Hawaiians at the time had the courage to report. Obviously the major motive for the murder was robbery as the following note, in an obscure column in the Hawaiian Herald for May 14, 1906, indicates:

"A.B. Loebenstein takes issue with Dr. Lyman who in 'Hawaiian Yesterdays' speaks of the death of the famous explorer Douglas, after whom the Douglas pine was named. Of course it is well known that he was killed here in Hawaii and is buried in the Kawaiahao cemetery in Honolulu. Dr. Lyman repeats the story that he was found dead in a cattle trap where he had been gored by an animal which had previously fallen in.

Loebenstein, who knows every inch of the country, says that this story is absolutely wrong as he has heard from natives. Douglas he insists, was murdered in cold blood by a white man, a bullock hunter who was an escaped Botany Bay convict. Douglas stayed at this man's house and was incautious enough to show some money. In the morning he started out and was never seen alive again. The bullock hunter was seen following him but the natives were so afraid of the man that they never dared tell of it.

When Douglas' body was found there was no money on it and the wounds which caused death were not made by goring.

Such is the story anyway but after all at this late date it does not really make much difference. Both murdered and murderer have been judged in a very high court long ago."

We know that his mangled corpse was preserved in salt on Hawaii for shipment to Honolulu. In fact, Gorman D. Gilman, in his journal deposited in the Hawaiian Historical Society, reports that "Dr. Da-

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*Emma Ahuena Taylor, friend of King Kalakaua and of his successor, Queen Liliuokalani.

vid Douglas was found dead in a pit dug as a trap for wild cattle, on July 12, 1834, and his body was taken to Honolulu and buried in the Kawaiahao churchyard." Few know that by the time a fitting grave stone had been fashioned and shipped by sail from Europe around Cape Horn, no one remembered the location of his grave!

After recently attending the funeral of a friend in historic Kawaiahao Church in Honolulu, we noted as part of the inner wall near the entrance a slab of white marble showing in low relief a likeness of David Douglas with appropriate inscription. We assume that this is the sculpture donated about 1856 by Julius L. Brenchley in Douglas' memory. Visitors to Honolulu should spend a few Sunday hours, no matter their faith, viewing the monument, thinking about Douglas, and listening to the unexcelled Polynesian voices of the Congregation in song.

NOTES ON BROMELIACEAE, XXXIII

Lyman B. Smith

GUZMANIA MACROPODA L. B. Smith, sp. nov. A G. dudleyi L. B. Smith, cui affinis, bracteis florigeris pedicellisque magnis differt.

PLANT flowering 78 cm high. LEAVES rosulate, to 55 cm long, obscurely brown-lepidote beneath; sheaths elliptic, very dark castaneous at base; blades ligulate, rounded and apiculate, 45 mm wide. SCAPE erect, 5 mm thick at apex; scape-bracts erect, imbricate, elliptic, apiculate. INFLORESCENCE 27 cm long, glabrous, typically subsimple with a single lateral branch 8 cm long; primary bract like the upper scape-bracts, much exceeding the naked sterile base of the branch; branches laxly flowered. FLORAL BRACTS elliptic, apiculate, to 5 cm long, about equaling the sepals or slightly shorter; flowers spreading; pedicels slender, to 20 mm long. SEPALS narrowly elliptic, rounded and apiculate, ecarinate, membranaceous, 28 mm long, connate for 19 mm; petals and stamens unknown. CAPSULE slenderly cylindric, about equaling the sepals; seeds with a red-brown coma. Pl. I, fig. 1: Floral bract and fruit; fig. 2: Reconstructed sepals.

PANAMA: PANAMA: top of Cerro Jefe, 900 m, 9 July 1966, Tyson, Dwyer & Blum 4446 (Summit Herbarium, Canal Zone, type; photo US).

GUZMANIA VIRESCENS (Hook.) Mez var. LAXIOR L. B. Smith, var. nov. A var. virescenti scapi bracteis supremis quam internodiis brevioribus, inflorescentia omnino laxa differt.

PLANT flowering to 75 cm high. LEAVES rosulate, to 34 cm long, obscurely pale-lepidote beneath; sheaths finely purple-striped; blades 25 mm wide. SCAPE straight, slender; upper scape-bracts shorter than the internodes. INFLORESCENCE laxly few-branched. Pl. I, fig. 3: Inflorescence; fig. 4: Sepals.

PANAMA: PANAMA: in tree top, cloud forest, east slope of Cerro Jefe, 810 m, 8 Feb 1966, Tyson 3444 (Summit Herbarium, Canal Zone, type; photo US).

TILLANDSIA BLASSII L. B. Smith, sp. nov. A T. pallidoflaventi Mez, T. michelii Mez et T. pardina L. B. Smith, cuibus affinis, foliis bulbose rosulatis, vaginis valde inflatis differt.

PLANT known only from fragments, estimated flowering 3 dm high LEAVES bulbous-rosulate, covered with pale appressed scales; sheaths inflated, 10 cm long, spotted with black-purple toward apex, very dark below especially on the inside; blades subligulate-triangular, acuminate, about as long as the sheaths, ca 2 cm wide. SCAPE erect, slender, 15 cm long, white-lepidote, becoming glabrous; scape-bracts erect, imbricate or the upper slightly shorter than the internodes, ovate, apiculate or short-caudate. INFLORESCENCE amply tripinnate, white-lepidote; primary bracts ovate, apiculate, exceeding the sterile bases of the branches; branches ascending; spikes lax; rhachis geniculate, very slender. FLORAL BRACTS broadly ovate, acute, about half as long as the

Plate I (Notes Brom.)

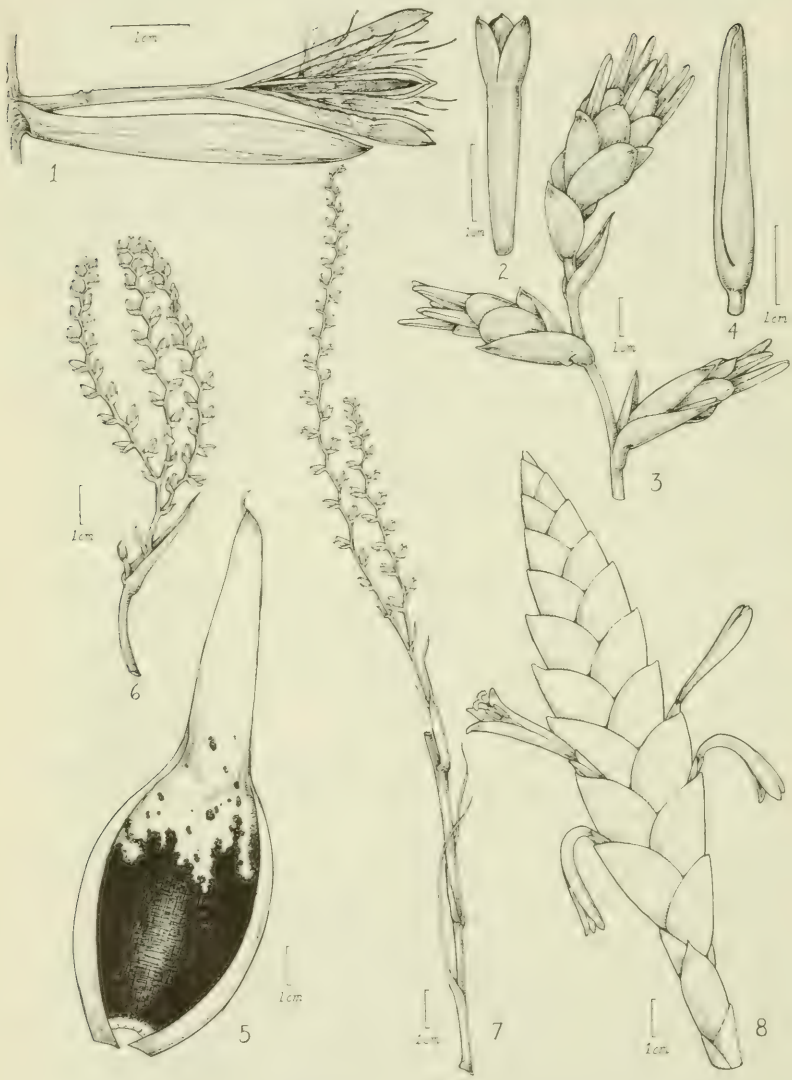

Fig. 1-2: Guzmania macropoda; 3-4: G. virescens var. laxior; 5-6: Tillandsia blassii; 7: T. parviflora var. expansa; 8: Vriesea malzinei var. disticha.

sepals. SEPALS free, asymmetric, obtuse, 5 mm long. Pl. I, fig. 5: Leaf; fig. 6: Basal branch of inflorescence.

ECUADOR: without exact locality, cultivated August 1970, Hort. Alfred Blass 4 (US, type).

TILLANDSIA PARVIFLORA R. & P. var. EXPANSA L. B. Smith, var. nov. A var. parviflora scapi bracteis longe caudatis, inflorescentia ample tripinnatim paniculata differt.

PLANT flowering 4 dm high. LEAVES to 2 dm long. SCAPE straight, very slender; scape-bracts with sheaths shorter than the internodes but with fine linear blades exceeding them. INFLORESCENCE lax, amply tripinnate; branches mostly ascending. Pl. I, fig. 7: Scape and basal branch.

ECUADOR: without exact locality, cultivated, August 1970, Hort. Alfred Blass 6 (US, type).

VRIESEA MALZINEI E. Morr. var. DISTICHA L. B. Smith, var. nov. A var. malzinei floribus distichis differt.

PLANT an exact match for the typical variety except that the flowers and floral bracts are distichous instead of polystichous. Pl. I, fig. 8: Inflorescence.

MEXICO: CHIAPAS: Mal Paso highway about 23 km north of Ocozocoautla, April 14, 1969, E. W. Greenwood (US, type), cultivated and flowered 19 May 1969, T. MacDougall 814.

In my key to Vriesea (Phytologia 13, no. 2: 84. 1966), this variety would fall in subkey V next to the Brazilian V. gradata. However, this variety is distinguishable by its always erect floral bracts with straight apices, as well as by generally smaller parts.

HERBARIUM NOTES, III

Lyman B. Smith

In the Gramineae I am indebted to Dra. Cleofe Calderón for constructive criticism in preparing descriptions of new species and to Dr. Thomas R. Soderstrom for access to unpublished keys and help with the literature.

I have received three excellent regional treatments of Gramineae that are proving of great value because of their proximity to southern Brazil. They are:

Arturo Burkart: Flora Ilustrada de Entre Rios (Argentina), Parte II, Gramíneas, pp. I-XV, 1-551, pl. 1-4, map 1, fig. 1-215. 1969.

Angel L. Cabrera: Flora de la Provincia de Buenos Aires, Parte II, Gramíneas, pp. 1-624, fig. 1-160. 1970.

B. Rosengurtt, B. R. Arrillaga de Maffei & P. Izaguirre de Artucio: Gramíneas Uruguayas, pp. 1-491, fig. 1-192. 1970.

My work on the "Flora Ilustrada Catarinense" has been greatly facilitated by the staff of the Staatsinstitut für allgemeine Botanik und Botanischer Garten of Hamburg. Through their hospitality and loans it has been possible to study the rich collec-

tions of Ule from Santa Catarina in all of the families that I am preparing for publication.

GRAMINEAE

AGROSTIS LONGIBERBIS Hack. ex L. B. Smith, nom. nov. Calamagrostis capillaris Nees ex Steud. Nom. Bot. ed. 2. 1: 249. 1840, nom. nud.; Syn. Pl. Gram. 188. 1854; Doell in Mart. Fl. Bras. 2, pt. 3: 55. 1878, non L. 1753. Agrostis longiberbis Hack. ex Usteri, Fl. Umgebung Stadt São Paulo 152. 1911, nom. nud.

PLANT densely cespitose, annual. CULMS 0.5 mm thick, glabrous LEAVES glabrous; ligules membranaceous, short; blades filiform-attenuate, flat or more often complicate, 2 mm wide. INFLORESCENCE lax but with the ends of the branches subdense, 8-30 cm long. GLUMES lanceolate, subequal, 2-3 mm long, the lower scabrous on the keel. LEMMA lanceolate, bidentate, 1.6 mm long, glabrous except for the long-bearded callus, with or without a very short awn. PALEA lacking. Pl. I, fig. 1: Panicle; fig. 2: Floret; fig. 3: Lemma.

BRAZIL: without locality, Sellow s n (LE(?), type; B, US, isotypes). MINAS GERAIS: Serra do Itatiaia, Mar 1894, Ule 84 (US); open summit, Serra da Gramma, 1700 m, April 1925, Chase 9557 (US) RIO DE JANEIRO: Rezende: grassy summit, base of Agulhas Negras, Serra do Itatiaia, 1950, Segadas-Vianna & Brade 5022 (R, US). SÃO PAULO: Pinheiros, 16 Dec 1906, Usteri in Herv. da Esc. Polyt. de S. Paulo 49 (SP, US, det. Hackel); Alto da Serra, Nov 1910, Luederwaldt in Mus. Paulista 678 (SP, US); swale, Campos do Jordão, Serra Mantiqueira, 1570 m, May 1925, Chase 9853 (US); same, moist campo, 1600 m, 9878 (US); same, Feb 1946, Eugenio Leite 3968 (US). PARANÁ: swamp, Ponta Grossa, 30 Jan 1946, Swallen 8364 (US); low wet open ground, Estação Experimental, Curitiba, 13 Feb 1946, Swallen 8550 (US); Mun. Piraquara: swamp, Rio Bracajuvava, 18 Feb 1961, Hatschbach 7816 (HH, US). SANTA CATARINA: Mun. Campo Alegre: campo, Morro do Iquererim, 1300 m, 5 Feb 1958, Reitz & Klein 6483 (HBR, US); Mun. Curitibanos: swamp, 14 km west of Curitibanos on the road to Campos Novos, 850-950 m, 5 Dec 1956, Smith & Klein 8299 (HBR, R, US). RIO GRANDE DO SUL: without locality, 1935, Orth 1932 (US); dry campo, Cambará, 23 Jan 1948, Rambo s n (PACA 36481, US); swampy thicket, Serra da Rocinha, near Bom Jesus, 3 Feb 1953, Rambo s n (PACA 53900, 53907, US).

The first mention of Calamagrostis capillaris Nees ex Steud. was without description but indicated that Nees took the name from a Trinius manuscript. Hence it seems probable that the type is in Leningrad.

ARISTIDA (Arthratherum) KLEINII L. B. Smith, sp. nov. HERBA perennis, caespitosa, florifera 7-8 dm alta. CULMI stricte erecti, simplices, basi 2 mm diametro, teretes, glaberrimi. FOLIA fere omnia basalia, subtus inter vaginas et laminas paulo incrassata; vaginis auriculatis, longe barbatis; ligulis curtissimis; laminis filiformibus, longe attenuatis, basi 0.7 mm diametro. PANICULA leviter curvata, angusta, subdensa, 15 cm longa; ramis

suberectis, brevibus. GLUMAE lanceolatae, in aristam attenuatae, inaequilongae, inferiore ca 12 mm longa, superiore 8 mm longa. LEMMATA linearia, tubulosa, 7 mm longa; callo late obtuso, dense barbato; columna articulata, 11 mm longa, spiraliter torta; aristis subaequalibus, 20 mm longis. PALEAE parvae, haud carinatae, glabrae. LODICULAE 2, oblongae, ca 1 mm longae. Pl. I, fig. 4: Panicle; fig. 5: Spikelet; fig. 6: Fruit; fig. 7: Callus; fig. 8: Apex of lemma.

BRAZIL: SANTA CATARINA: Mun. São José do Cerrito: campo, 950 m alt, 31 Oct 1963, R. M. Klein 4328 (US, type; HBR, isotype; Mun. Campos Novos: campo, 1000 m alt, 29 Oct 1963, R. M. Klein 4198 (HBR, US).

In Henrard's monograph of Aristida (Meded. Rijks Herb. Leiden 58A. 1932), A. kleinii would key to the vicinity of A. royleana Trin. & Rupr., from which it differs in its smaller panicle, smaller more unequal glumes and broadly rounded callus.

DANTHONIA CONFUSA L. B. Smith, nom. nov. Cortaderia pungens Swallen, Contr. U. S. Nat. Herb. 29: 251. 1949, non Danthonia pungens Cheeseman, 1906.

Pl. I, fig. 9: Panicle; fig. 10: Spikelet; fig. 11: Floret.

The species appears to be distinct, at least from any Andean or Central American ones. Curiously the original description accurately gives the characters of the genus Danthonia while naming it a Cortaderia.

MELICA SPARTINOIDES L. B. Smith, sp. nov. HERBA perennis, submetralis, rhizomatibus brevibus horizontalibus robustis pilosis procreans. CULMI recti. FOLIA scaberula; vaginis carinatis; ligulis brevissimis; laminis attenuatis, 12 cm longis, 5 mm latis PANICULA angusta, pauciramosa, 22 cm longa; ramis suberectis, ad 9 cm longis, basi longe sterilibus, dense secundifloris. SPICULAE oblongae, lateraliter compressae, 10 mm longae, 4-florae; floribus fertilibus 2. GLUMAE late convexae, inaequales, scaberulae; gluma inferiore late obovata, 4 mm longa, 5-nervata, omnino scariosa; gluma superiore spathulata, 5.5 mm longa, 7-nervata, herbacea sed late scarioso-marginata. LEMMATA fertilia lanceolata, acuta, ad 6 cm longa, 9-nervata, pilis longis submarginalibus vestita; lemmate terminale late obconica, indurata. PALEAE lanceolatae, 4 mm longae, breviter bidentatae. CARYOPSIS ellipsoidea, 2.5 mm longa. Pl. I, fig. 12: Branch of inflorescence; fig. 13: Spikelet.

BRAZIL: SANTA CATARINA: Mun. Capinzal: campo, 7 km southeast of Capinzal, 500-600 m, 28 Feb 1957, Smith & Klein 11954 (US, type; HBR, isotype).

Melica spartinoides is distinguished by the combination of a short lower glume and fertile lemmas with long submarginal hairs.

PIPTOCHAETIUM ALPINUM L. B. Smith, sp. nov. HERBA perennis, caespitosa, rhizomatibus brevissimis procreans, ad 3 dm alta. CULMI erecti, simplices, gracillimi, 2-nodes. FOLIA valde paucinervata; vaginis glabris; ligulis membranaceis, haud 1 mm longis; laminis linearibus, acutis, planis vel subconvolutis, 8 cm longis, 1 mm latis, minute ciliatis, alibi glabris. PANICULA laxa, pauciflora, 6 cm longa (sine aristis), basi in foliae

supremae vagina inclusa. GLUMAE lanceolatae, acutae, superiore majore, 4 mm longa. LEMMA anguste obovatum, 5 mm longum, quam glumas longius, pilis erectis pallide brunneis omnino vestitum; corona curtissima; arista 2 cm longa, breviter pubescente. PALEA breviter cuspidata, lemmatis corpus subaequans. Pl. I, fig. 14: Panicle; fig. 15: Spikelet.

BRAZIL: SANTA CATARINA: Mun. Bom Jardim da Serra: campo, Fazenda da Laranja, 1400 m alt, 10 Dec 1958, Reitz & Klein 7710 (US, type; HBR, isotype).

This dwarf alpine species is most nearly related to P. lasianthum Griseb., but differs in its lemma exceeding the glumes.

EUPHORBIACEAE

ACALYPHA ULEANA L. B. Smith & R. J. Downs, sp. nov. HERBA perennis. RADIX centralis, lignosa. CAULES fasciculati, ramosi, ad 20 cm alti, dense albido-hispidi. FOLIORUM stipulis linearibus, 5 mm longis; petiolis brevissimis vel nullis; laminis ovato-ellipticis, acutis, basi subcordatis et 3-nervatis, ad 65 mm longis, 23 mm latis, crenato-serratis, supra viridibus, subtus pallidis, utrinque dense albido-hispidis. INFLORESCENTIAE terminales, ad 2 cm pedunculatae, bisexuales, dense cylindricae; parte masculina terminali, ad 14 mm longa, 2 mm diametro; parte feminea ad 25 mm longa, 5 mm diametro, multiflora; bracteis femineis unifloris, suborbicularibus, 3 mm longis, profunde 4-fidis, pilis rectis et glandulis sessilibus dense vestitis. FLORES femineae sessiles. OVARIUM 3-loculare, hispidum; stylis multifidis. Pl. I, fig. 16: Leaf; fig. 17: Inflorescence; fig. 18: Pistillate bract.

BRAZIL: Santa Catarina: Mun. Bom Jardim da Serra: slopes by source of Rio Capivare, Serra Geral, Feb 1891, Ule s n (HBG, type; photo US).

Acalypha uleana is related to A. phleoides Cav. but differs in its narrower subsessile densely white-hispid leaves and fewer-toothed pistillate bracts.

Plate I (Herb. Notes)

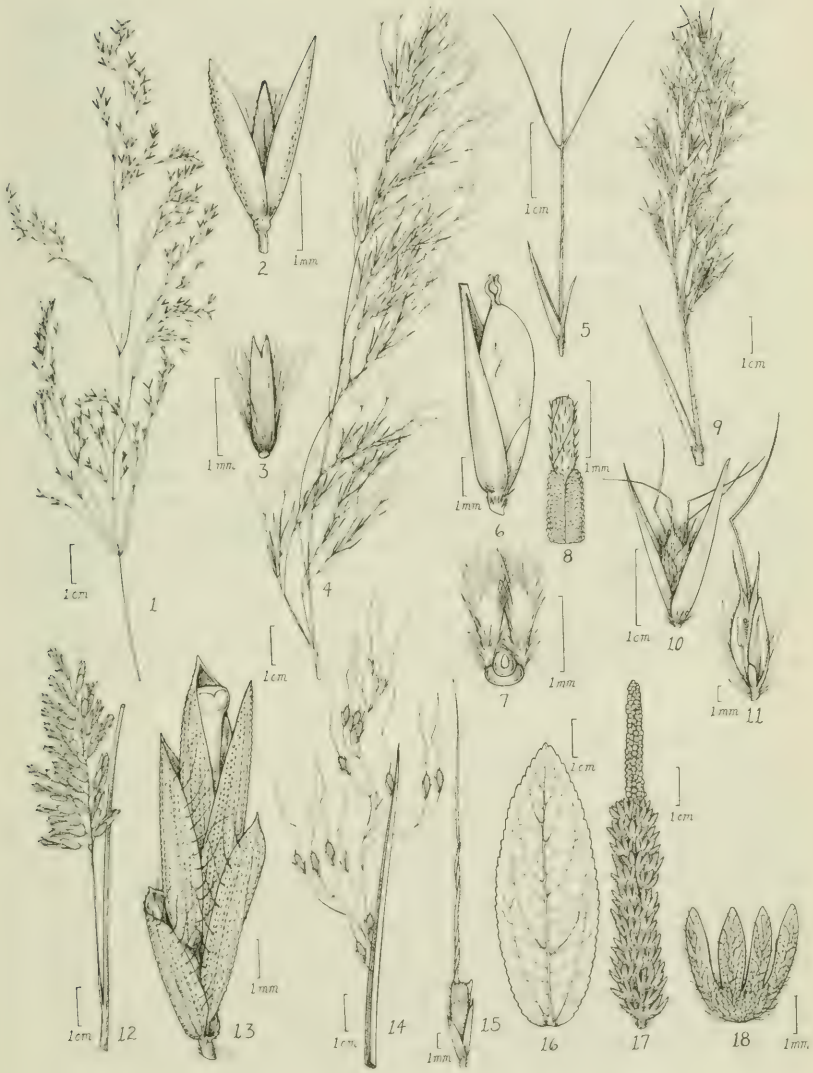

Fig. 1-3: Agrostis longiberbis; 4-8: Aristida kleinii; 9-11; Danthonia confusa; 12-13: Melica spartinoides; 14-15: Piptochaetium alpinum; 16-18: Acalypha uleana.

TWO NEW SPECIES OF PARMELIA (LICHENS) FROM NORTH AMERICA

Mason E. Hale, Jr.
Smithsonian Institution, Washington, D.C. 20560

Parmelia louisianae Hale, sp. nov.

Thallus ut in P. hypotropa Nyl. sed differt acidum alectoronicum continente.

Holotype: On oak in oak-pine forest, 3 miles N Sabine Co. line on highway 175, DeSoto Co., Louisiana, collected by M. E. Hale, no. 34013 (US; isotypes in DUKE, UPS).

Parmelia louisianae, a species in subgenus Amphigymnia, has the broad white margin below and strong white maculation in the upper cortex so characteristic of P. hypotropa, a very widespread lichen in southern United States containing norstictic acid (see Hale, 1965, p. 205). In spite of the morphological similarity, however, P. louisianae is probably more closely related to P. rigida Lynge, its presumptive nonsorediate counterpart, which occurs in the lower coastal plain and in South America. Both specimens examined are sterile.

Additional specimen examined: Louisiana: 4.5 miles NE Vivian, Caddo Parish, Thieret 24473 (LAF, US).

Parmelia weberi Hale, sp. nov.

Thallus adnatus, saxicola, 4-6 cm latus, firmus, pallide albido-viridis, lobis sublinearibus vel subirregularibus ut in P. subramigera Gyel., 2-3 mm latis, superne nitidus, planus vel aetate rugosus, plus minusve transversim rimosus, isidiatus, isidiis simplicibus vel subcoralloideo-ramosis, cylindricis, usque ad 0.3 mm diametro, frequenter apice ruptis truncatisque, cortex superior 12-15μ, stratum gonidiale 25-30μ, medulla alba, 160-190μ crassa, cortex inferior 14-18μ crassus, subtus pallide stramineus, modice rhizinosus, rhizinis pallidis, simplicibus. Apothecia rara, adnata, 2-4 mm diametro, sporis octonis, 4 X 8μ. Cortex K+ flavescens, medulla K-, P-, C+, KC+ roseus, acidum usnicum, acidum hypoprotocetraricum, et materia alia ignota continente.

Holotype: Desert Mtns., 3 miles SW Superior, elev. 2750 ft., just south of Picketpost Mountain, near Southwestern Arboretum, Pinal Co., Arizona, collected by W. A. Weber and J. B. McCleary,

no. S1897, 2 Jan. 1953 (COLO; isotype in US).

Parmelia weberi was first recognized as a P negative Xanthoparmelia from western United States which gave a dense acetone residue and a distinct H_2SO_4+ blue spot on TLC plates. Dr. C. F. Culberson kindly identified the main constituent as hypoprotocetraric acid (with unidentified accessory acids). Having finally established the identity of this unusual population, I found a number of other records in the United States and Mexico and in Africa. Species with hypoprotocetraric acid are rather common in Africa, but P. weberi is the first Xanthoparmelia from the New World with this acid.

Morphologically P. weberi is very close to widespread P. subramigera Gyel., which contains P+ red fumarprotocetraric acid and generally has less dense, thinner isidia but a similar very pale lower surface.

Additional specimens examined. Arizona: 10 miles NE Tucson, Pima Co., Richards et al. 538 (F). New Mexico: 3.5 miles SE of Correo on road to Las Lunas, Valencia Co., Shushan and Weber S6872 (COLO). Mexico: 71 miles S of La Zarea on highway 45 to Durango, Durango, Weber and Charette 33596 (COLO); west of Baviácora, Sonora, Drouet and Lockhart 657 (F), 15 miles S of Naiozari, Sonora, Richards et al. 694 (F). Kenya: near Ngulia Hills, Machakos distr., Vericourt 3698 (BM, US). Uganda: 1 km NE of Kansambia Hill, distr. Masaka, Lye L231 (US); Entebbe Botanical Garden, distr. W. Mengo, Swinscow U10/12 (US). Union of South Africa: Krantzkop near Nystrom, Kofler 37153 (LD); Indumeni Forest, Cathedral Peak Area, distr. Bergville, Almborn 8931, 8932 (LD, US); Upper Umkomaas, Impendhle, Höeg (TRH).

Literature Cited

Hale, M. E. 1965. A monograph of Parmelia subgenus Amphigymnia. Contr. U. S. Nat. Herb. 36:193-358.

NEW PARMELIAE (LICHENES) FROM AFRICA

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Parmelia neodissecta Hale, sp. nov.

Thallus laxe adnatus, corticola, 3-7 cm latus, fragilis, albido- vel olivaceo-cinereus, lobis sublinearibus vel subirregularibus, 1-3 mm latis, aetate late revolutis, superne nitidus, dense isidiatus, isidiis cylindricis, simplicibus, raro apice ciliatis, cortex superior 12-14μ crassus, stratum gonidiale 10-15μ crassum, medulla alba, 60-80μ crassa, cortex inferior 12-14μ crassus, subtus niger, modice aut dense rhizinosus, rhizinis dichotome ramosis. Apothecia adnata, cupuliformia, 4-6 mm diametro, sporis octonis, 6-8 X 12-14μ. Cortex K+ flavescens, medulla K-, P-, C+ rosea, atranorinum et acidum gyrophoricum continente.

Holotype: About 6 km southeast of Zouépo, Mts. Nimba, cercle of N'Zérékoré, Guinea, collected by R. Santesson, no. 10597d, 10 August 1954, elev. 1550 m (UPS; isotype in US) (Fig. 1).

This lichen belongs in section Hypotrachyna, but it seems at first to be P. dissecta Nyl., a pantropical species in section Imbricaria which contains gyrophoric acid and has cilia. On closer examination, however, the rhizines are clearly dichotomously branched and marginal cilia are lacking (although branched rhizines may project somewhat from the margin). Parmelia dissecta has simple rhizines and distinct marginal cilia. We may have here a case of convergent evolution where two unrelated species classified in different sections on the basis of rhizine branching and cilia have extremely similar appearance and identical chemistry. I do not believe that we are simply dealing with an aberrant form of P. dissecta, for the five collections of P. neodissecta are easily distinguishable.

Specimens examined. Africa. Kenya: Kisumu-Londiani, Nyanza Prov., Tinderet Forest Reserve, Maas Geesteranus G11163 (L, US); Union of South Africa: Deepwalls Forest Reserve, Knysna div., Degelius SA-221 (Degelius herbarium), Maas Geesteranus G12166 (L, US). India: Tiger Hill, Darjeeling, Awasthi 3886 (Awasthi herbarium).

Parmelia neutralis Hale, sp. nov.

Thallus adnatus, corticola, 8-14 cm latus, coriaceus, viridi-

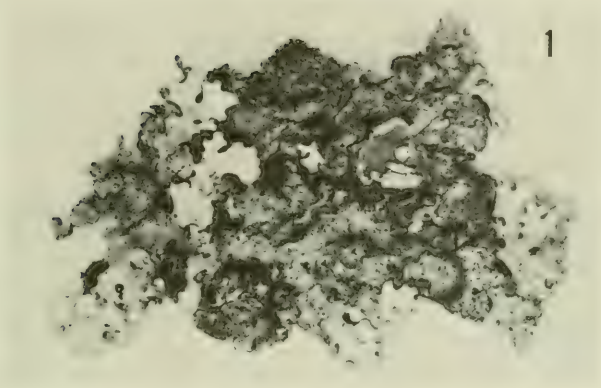

Figure 1. Parmelia neodissecta Hale (holotype, X2).

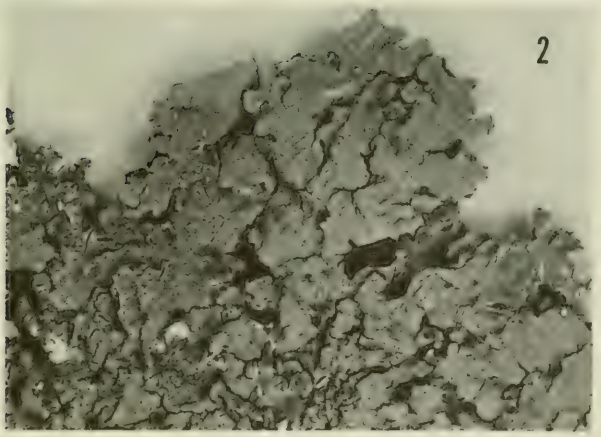

Figure 2. Parmelia neutralis Hale (holotype, X2).

albus, lobis latis, subrotundatis, 4-6 mm latis, pseudocyphellatis, pseudocyphellis elongatis, 0.1-0.5 mm longis, superne planus vel rugosus, soredians, soraliis orbicularibus, lamine atque margine positis, 0.3-0.5 mm diametro, sorediis granulosis, aetate rimosus, cortex superior 10-12µ crassus, stratum gonidiale 25-30µ crassum, medulla alba, 100-120µ crassa, cortex inferior 10-15µ crassus, subtus pallide castaneus, sparse vel modice rhizinosus, rhizinis pallidis, simplicibus. Apothecia ignota. Cortex K+ flavescens, medulla K-, P-, C-, KC-, atranorinum et acidum aliphaticum ignotum continente.

Holotype: Deepwalls Forest Reserve, Knysna distr., Cape Prov., Union of South Africa, collected by R. A. Maas Geesteranus, no. 12177, 5 Dec. 1949 (L; isotypes in LD, US) (Fig. 2).

Parmelia neutralis, a species in section Simplices, superficially resembles P. borreri (Sm.) Turn. because of the laminal punctiform soralia and small pseudocyphellae but the lower surface is pale brown and the thallus as a whole more coriaceous and adnate. There are large transverse cracks where the cortex tends to turn up slightly, forming a broad fissure. The chemistry is still unclear but the fatty acid is probably near caperatic acid, placing the species close to P. bolliana Müll. Arg. which is also rather coriaceous. Parmelia neutralis is known so far only in Africa.

Specimens examined. Uganda: 10 km NW of Kilembe, slopes of Ruwenzori, Swinscow 2U 12/35 (US). Congo: Lake Kivu, Mulungu, S. Kivu, Degelius (Degelius herbarium). Union of South Africa: Zoutpansberg, Transvaal, Watson 778 (PRE), Impendhle, Upper Umkomaas, Höeg (TRH, US), slopes of Muizenberg, Cape, Pillans 3865 (BM).

STUDIES IN ICHNANTHUS (GRAMINEAE). I. NEW TAXA AND NEW COMBINATIONS IN SECTION FOVEOLATA

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ICHNANTHUS BOLIVIANUS K. E. Rogers, sp. nov.

Perennis, 8 m. plus minusue longus; culmi elongati, decumbentes vel verrentes, ad imos nodos radicantes, libere ramosi, glabrosi vel pubescentes; vaginae glabrosae praeter margines pappillosociliatos; ligula membraneo-ciliata, 9.7 - 1.0 mm. longae; laminae anguste lanceolatae, 5 - 15 cm. longae, 0.6 - 1.8 cm. latae; superficies laminarum scabridulosa in nervos, leviter pilosa in internervos, subtus ferme glabrosa vel leviter puberulens vel pilosa; paniculae terminales, 5 - 18 cm. longae, 1.5 - 7.5 cm. latae, multifloridae, virides, plerumque colore purpureo tinctae, rami primarii breves, usque ad basin spiculas gerentes, rigide patentes vel appressi, 0.5 - 6.0 cm. longi; spiculae elliptico-acutae, glabrosae vel leviter brevi-pilosae in glumis et in lemmate inferiore, 2.9 - 3.0 mm. longae; gluma prima basi ovata, acuta, 1.8 - 3.3 mm. longa, inferiore flosculo brevior vel etiam longior; apex camplanatus et nonnihil abortus, interdum brevi-pilosus per marginem, interdum 3-vel 7-nervis; gluma secunda elliptico-acuta, 2.6 - 3.4 mm. longa, aequans inferius lemma vel etiam hoc superans, brevi-pilosa in interiore parte supra mediam, interdum pilosa prope exteriores margines, 5-vel 7-nervis; flosculus inferior staminatus, stamina 1.0 - 2.0 mm. longa; lemma inferius elliptico-acutum, 2.5 - 3.1 mm. longum, intus brevi-pubescens, glabrosum vel pilosum per externum marginem, 5-nervis; palea inferior elliptico-acuta; 2.4 - 2.8 mm. longa, subaequans lemma, nervi longo-ciliati; flosculus superior elliptico-acutus, 2.0 - 2.3 mm. longus; rachilla-appendiculae 0.6 - 0.7 mm. longae.

Holotype in the Herbarium of the U.S. National Museum, No. 1163667, collected at the Hacienda Simaco sobre el camino a Tipuani, region subtropical, La Paz, Bolivia, March 1920, by Buchtien 5236. Isotypes at NY, MO, F, LIL, G.

Additional specimens examined: Bolivia: La Paz: sobre el camino a Tipuani, Buchtien 5336 (GH,K); ibid, Buchtien 5337 (M); ibid, Buchtien 7124 (US).

This species is distinguished by the pilose inner surface of the second glume and lower lemma, the long ciliate nerves of the lower palea, the flattened somewhat twisted apex of the

first glume, and the elongate slender freely branched culms. It appears to be most closely allied to I. ruprechtii Doell. The specific epithet given to the species refers to the locality of the type collection, the only area from which it is presently known.

ICHNANTHUS BRASILIENSIS K. E. Rogers, sp. nov.

Perennis (?); culmi glabrosi vel pubescentes sub nodos; nodi glabrosi; vaginae laxae, superiores saltem superantes internodia, parce pilosae per superiores margines, auriculatae; ligula membraneo-ciliata, 2.3 - 2.6 mm. longa; laminae lanceolato-acutae, 14 - 18 cm. longae, 2.8 - 4.5 cm. latae, amplectentes plus minusue asymmetrico basi, scabridae et parce pilosae supra, subtus molliter pubescentes; panicula terminalis, multiflorida, elongata, 23 cm. longa, 14 cm. lata, rami 2 - 8 cm. longi, inferiores patentes, mediani et superiores ascendentes, panicula maxima ex parte satius angusto-ovata; pulvini pubescentes; spiculae elliptico-acutae, 3.2 - 3.8 mm. longae, glabrosae; gluma prima ovato-acuta, 2.5 - 3.1 mm. longa, aequans 2 ex 3 aut 3 ex 4 partibus longitudinis inferioris flosculi, 3-nervis; gluma seconda elliptico-acuta, 3.0 - 3.2 mm. longa, 5-nervi; flosculo inferior staminatus, stamina 1.2 mm. longa; lemma inferius elliptico-acutum, 2.8 - 3.00 mm. longum, 7-nervis; palea inferior elliptico-acuta, 2.8 - 2.9 mm. longa, lemma inferius subaequans; flosculus superior 2.4 - 2.6 mm. longus, 0.8 - 1.0 mm. latus, margines superioris lemmatis complanati; rachilla-appendiculae 0.5 - 0.6 mm. longae; stamina superiora 1.2 mm. longa.

Holotype in the Herbarium of the U.S. National Museum, No. 2237514, collected in a wood at Leme, Sao Paulo, Brazil, March 11, 1953, by D. Pickel 5938.

This species is distinguished by the presence of appendages at the apex of the sheaths, the rather long, large terminal panicle, and the comparatively small spikelets.

ICHNANTHUS COLONARIUS K. E. Rogers, sp. nov.

Fortasse annuus; culmi graciles, repentes, caespitem vel colonias aedificantes, libere ramosi, ad nodos radicantes, surculi ascendentes 4 - 15 cm. alti; internodia culmi brevia, 1 - 3.5 cm. longa, molliter pilosa sub nodos et per paucos vel nonnullos nervos; vaginae multo breviores quam internodia, 0.5 - 1.0 cm. longae, dense pilosae; ligula membranaceo-ciliata, 0.5 - 0.8 mm. longa; laminae ovato-ellipticae, acutae denum acute brevi-acuminatae, basi asymmetrica amplectentes, 1.2 - 3.5 cm. longae, 0.8 - 1.5 cm. latae, densus pilosae utraque superficie, subtus lanuginosae; paniculae terminales et

axillariae, brevissimis pedunculis, parcissime florescentes; panicula terminalis 1.0 - 2.5 cm. longa, 0.5 cm. lata, e brevissimis rigide appressis ramis composita et cuique ramo 2 - 4 flosculi, rami 0.5 - 1.0 cm. longi; pedicelli 1 - 3 cm. longi; paniculae axillares inclusae vel brevi-exsertae; spiculae 2.8 - 3.3 mm. longae, glabrosae vel parcissime pubescentes prope primae glumae marginem; prima gluma ovata, scuta, 2.5 - 3.1 mm. longa, paulo brevior inferiore flosculo, interdum hinc paene superans, 3-nervis; gluma secunda elliptico-acuta, 2.6 - 3.2 mm. longa, 5-nervis; inferior flosculus staminatus, stamina 1.1 mm. longa, vel interdum cum caryopside; inferius lemma ellipticum, cucullatum apice, 2.3 - 2.5 mm. longum, 5-nervis; palea inferior elliptica, 1.8 - 2.1 mm. longa, lemma subaequans; flosculus superior elliptico-acutus, 1.9 - 2.0 mm. longus, 1.0 - 1.1 mm. latus; rachilla-appendiculae 0.6 mm. longae; stamina superiora 1.0 mm. longa.

Holotype in the Herbarium of the U.S. National Museum, No. 1935003, collected in the upper reaches of Rio Sitio Nuevo, altitude 1500 - 1800 m., Dept. Zacapa, Guatemala, January 25, 1942, by J. A. Steyermark 43216. Isotype at F.

This species is distinguished by the short ovate leaf-blades that are velvety pubescent on the lower surface, the first glume slightly shorter to exceeding the lower floret, and the short, sparsely flowered panicles on short peduncles. The specific epithet refers to the colonial or mat-forming habit of growth.

ICHNANTHUS LATIFOLIUS K. E. Rogers, sp. nov.

Perennis (?); culmis decumbentibus et patentibus, ad imos nodos radicantibus, ramosis, 1.5 - 3.0 m. aut plus longis, pilosis subter nodos atque per unum vel plures nervos, rami feraces ad altitudinem 70 - 100 cm. ascendent; vaginae internodiis multo breviores, maxima ex parte 2 - 6 cm. longae, papilloso-pilosae prope margines; ligula membranaceo-ciliata, 0.3 - 0.5 mm. longa; laminae elliptico-lanceolatae, subito acuminatae, 6 - 15 cm. longae, 2.0 - 5.0 cm. latae, supra pubescentes vel pilosae, subtus pubescentes et plus minusue reticulatae, vel etiam utraque superficie glabrescentes; paniculae terminales et axilliares in longos pedunculos, cum confertioribus floris; paniculae terminales 12 - 25 cm. longae, 4 - 8 cm. latae in pedunculos 9 - 23 cm. longos, rami primarii adscententes demum patentes, ramus imus 6 - 12 cm. longus; spiculae 3.8 - 4.5 mm. longae, glabrosae vel raro pilosae per primae glumae marginem; gluma prima late ovata, attenuata vel caudata, 2.6 - 4.5 mm. longa, ferme imum flosculum aequans vel hunc superans, 3-5 nervis; gluma secunda ovato-elliptica, acuminata, 3.2 - 4.0 mm. longa, 5-7 nervis; flosculus inferior staminatus, stamina 1.3 - 1.5 mm. longa; lemma inferius ellipticum, cucullatum et

hyalinum apice, 2.7 - 3.1 mm. longum, 5-nervis; inferior palea elliptico-acuta, ferme lemma aequans, 2.4 - 2.8 mm. longa; flosculus superior elliptico-acutus, 1.9 - 2.1 mm. longus, 1.1 mm. latus; rachilla-appendiculae 0.5 - 0.6 mm. longa; stamina superiora 1.2 - 1.4 mm. longa.

Holotype in the Herbarium of the New York Botonical Garden, collected at and near the summit of El Cerro de Cuhuatepetl, Tehuacan, 15 - 16 km. southwest of Campo Experimental de Hule, El Palmar, Zongolica, Veracruz, Mexico, November 23, 1944, by Jose Vera Santos 3668. Isotypes at US. MEXU.

Additional specimens examined: Mexico: San Luis Potosi: barranca of Las Canoas, Pringle 3827 (US, MEXU, M, P, K, MO, GH, F, NY).

This species is closely related to I. nemorosus. However, I. latifolius is distinguished from it in the larger spikelets, the larger, more compound panicles, and the larger average size of the leaves.

ICHNANTHUS NEMOROSUS (Swartz) Doell var. SWARTZII K. E. Rogers var. nov.

Culmi prostrato-patentes, libere ramosi, in nodos radicantes, papilloso-pilosi per unum vel plures nervos vel glabrosi, surculi plantae adscentes usque ad 70 cm. etiam plus alti; vaginae saepissime glabrosae superficie et prope margines papilloso-pilosae; ligula 0.7 - 1.8 mm. longa; laminae 3 - 13 cm. longae, 0.5 - 3.0 cm. latae; paniculae terminales et axillares, paucifloridae; paniculae terminales 3 - 13 cm. longae, 0.5 - 8.0 cm. latae; spiculae 4.0 - 5.5 mm. longae, glabrosae vel etiam gluma prima raro pilosa prope margines; gluma prima ovata, caudata, 3.5 - 5.1 mm. longa, flosculum inferiorem superans vel etiam paulo brevior, 3-5 nervis; gluma seconda 3.5 - 4.8 mm. longa, 5-7 nervis; flosculus inferior staminatus (perraro cum caryopside), stamina 1.3 - 1.8 mm. longa; lemma inferius 3.0 - 4.2 mm. longus, 5-nervis; palea inferior 2.8 - 3.6 mm. longa; flosculus superior 2.1 - 2.6 mm. longus, 0.9 - 1.2 mm. latus; rachilla-appendiculae 0.6 - 0.9 mm. longae; stamina superiora 1.3 - 1.8 mm. longa; caryopsis 1.5 - 1.7 mm. longa.

Holotype in the Herbarium of the U.S. National Museum, No. 1077399, collected in thickets vicinity of Petionville, Haiti, altitude ca. 350 m., June 15 - 18, 1920, by E. C. Leonard 4858. Isotypes at IJ, NY, GH.

Additional specimens examined: Cuba: Cobre Range of Sierra Maestra, Leon et al 10078 (US, GH); La Perla, Oriente, Leon 3908

(US, NY); near Santiago, Taylor 385 (NY). Jamaica: Mt. Airy, Patrick 165 (IJ); Clyde River, Harris 11447 (MO, UCWI, F, P, NY, US). Haiti: vicinity of Mission, Fonds Varettes, Leonard 3975 (US, GH, NY); Ma Blanche prope Donyette, Ekman 473 (K). Dominican Republic: Samana Penninsula, Abbott 1366 (IJ, US). Puerto Rico: Near Adjuntas, alto de la Bandera, Britton and Shafer 2018 (NY). St. Kitts: Phillip's Level, Box 141 (US); near The Crater, Box 145 (US). Nevis: The Source, Box 168 (US, K). Montserrat: Olveston Mt., Centre Hills, Proctor 18963 (GH, IJ). Martinique: Duss 773 (NY). St. Vincent: Smith and Smith 127 (K, NY). Grenada: Annandale, Broadway 177 (US). Trinidad: Mount Aripo, North Range, Cowan 1380 (IJ).

I. nemorosus var. swartzii is distinguished from I. nemorosus var. nemorosus as indicated below:

	var. nemorosus	var. swartzii
ligule	0.5 - 1.2 mm.	0.7 - 1.8 mm.
sheaths	surface pilose or glabescent	surface usually glabrous
spikelet	2.3 - 4.0 mm.	4.0 - 5.5 mm.
lower stamens	0.8 - 1.5 mm.	1.3 - 1.8 mm.
upper floret	1.5 - 2.0 (-2.2) mm.	2.1 - 2.6 mm.
upper stamens	1.0 - 1.4 mm.	1.3 - 1.8 mm.
rachilla-appendages	0.3 - 0.6 mm.	0.5 - 0.9 mm.
caryopsis	1.0 - 1.5 mm.	1.5 - 1.7 mm.

The variety is named for Olof Peter Swartz.

ICHNANTHUS PARODII K. E. Rogers, sp. nov.

Perennis; usque ad 2.0 m. longus; culmis decumbento-patentibus, ad imos nodos radicantibus, ramosis, papilloso-pilosis vel glabrosis; vaginae glabrosae vel pilosae, maxima ex parte 1.0 - 4.5 cm. longae (superiores etiam usque ad 7.0 cm. longae); ligula membraneo-ciliata, 1.0 - 1.8 mm. longa; laminae lanceolato-acuminatae, 3 - 12 cm. longae, 0.8 - 3.0 cm. latae, superficies scaberula, pubescens vel glabrosa, inferior glabrosa vel pubescens, plerumque reticulato-venosa; paniculae terminales axillaresque; paniculae terminales breves demum longo-exsertae,

6 - 20 cm. longae, 1 - 9 cm. latae; spiculae elliptico- acuminatae, saepe colore pupureo vel interdum atro-pupureo tinctae, maxima ex parte pilosae per unius vel utriusque glumae margines, 4.2 - 5.5 mm. longae; gluma prima anguste ovata, acuminata, 2.5 - 3.5 mm. longa, aequans inferiorem flosculum vel tertia parte brevior, saepissime pilosa per margines cum tricom sat longis, 3-5 nervis; gluma secunda elliptico-acuta, 3.3 - 4.3 mm. longa, saepe pilosa per margines, 5-7 nervis; flosculus inferior staminatus, stamina 1.2 - 1.6 mm. longa; lemma inferius 2.6 - 3.4 mm. longus, 5-nervis; palea inferior 2.6 - 3.4 mm. longum, 5-nervis; palea inferior elliptica, 1.5 - 2.2 mm. longa; flosculus superior 2.1 - 2.4 mm. longus, 0.8 - 1.0 mm. latus; rachilla-appendiculae 0.7 - 0.8 mm. longae; stamina superiora 1.5 mm. longa; caryopsis 1.4 - 1.6 mm. longa.

Holotype in the Herbarium of the U.S. National Museum, No. 2183209, collected at Esperanca, pr. Montenegro, Rio Grande do Sul, Brazil, July 2, 1949, by B. Rambo 42300.

Additional specimens examined: Brazil: Rio Grande do Sul: Prope Novo Hamburgo, Rambo 42158 (US); Taimbesinho, Rambo 54089 (US), Santa Catarina: Mata da Companhia, Bom Retiro, Blumenau, Reitz & Klein 9502 (US). Parana: Londrina, Swallen 8736 (US). Argentina: Misiones: San Javier, Acaragua, Bertoni 3291 (IAN, MO); Iguazu, Eldorado, Bertoni 4630 (US); Santa Ines, Parodi 4190 (US, IAN); Posadas, Bonpland, Ekman 655 (CORD); San Ignacio, Arroyo Apepu, Schwarz 2790 (IAN, MO); Santa Ana, Lillo 12377 (W, IAN); Cainguas, Puerto Leone, Schwarz 7706 (US). Salta: Oran, Las Juntas, Castellanos 30 (IAN). Paraguay: Montes 10953 (US); Cerro de Acahay, Rojas 3365 (US).

This species is named for L. Parodi, agrostologist of Argentina.

ICHNANTHUS TARIJIANUS K. E. Rogers, sp. nov.

Culmi erecti, 60 cm. vel plus alti, molles, mollibus gracilibus villis; nodi villi; vaginae molliter membranacea, superiacentes, 2 - 4 cm. longae, apice subauriculatae, ut culmi pubescentes, collum pilosum; ligula membraneo-ciliata, 1.5 - 2.0 mm. longa; laminae elliptica demum obovatae, subito acuminatae, basi contracta amplectentes, tenuissimae, supra glabrosae vel brevi-pubescentes, subtus plus minusue brevi-pubescentes, conspicue reticulato-venosae; panicula terminalis, parce florifera, 12 - 14 cm. longa, basi 4 cm. lata, e ramis gracilibus adscendentibus composita 1 - 5 cm. longis; pulvini pubescentes; spiculae elliptico-acutae, 3.0 - 3.4 mm. longae, raro pilosae per glumae primae marginem; glumae et inferius lemma molliter membraneum; gluma prima ovato-acuta, 2.2 - 2.8 mm. longa, aequans

inferioris flosculi duas tertias vel etiam tres quartas partes longitudinis, 3-nervis; gluma secunda elliptico-acuta, 2.8 - 3.2 mm. longa, 5-nervis; stamina 1.4 - 1.6 mm. longa; inferius lemma elliptico-cucullatum, 2.6 - 2.8 mm. longum, subaequans glumam secundam, 5-nervis; palea inferior elliptico-acuta, 2.3 - 2.5 mm. longa, paene aequans lemma inferius; flosculus superior elliptico-acutus, 2.4 - 2.6 mm. longus, 0.8 - 1.0 mm. latus; rachilla-appendiculae 0.5 mm. longae; stamina superiora 1.8 - 1.9 mm. longa.

Holotype in the Herbarium of the U.S. National Museum, No. 2044282, collected at Yacuiba, Department Tarijia, Bolivia, by Steinbach 1768.

This species is distinguished by the erect habit of growth, the auricled or subauricled sheaths, the elliptic to obovate leaf-blades, and panicles terminal only.

The specific epithet of this species refers to the Department Tarijia, Bolivia.

ICHNANTHUS VENTURII K. E. Rogers, sp. nov.

Culmi decumbento-patentes, ad nodos radicantes, usque ad 100 cm. aut plus longi, ramosi, pubescentes cum longis, gracilibus trichmis in tubercula appositis per unum vel paucos nervos vel paene glabrosi; nodi (aliqui saltem) ut internodia pubescentes; vaginae laxae, 2 - 3 cm. longae (superiores etiam usque ad 6 cm. longae), pubescentes; collum pilosum; ligula membraneo-ciliata, 0.5 - 1.0 mm. longa; laminae lanceolatae, longo-acuminatae, amplectentes basi asymmetrica, 7 - 14 cm. longae, 1.5 - 3.0 cm. latae, supra plus minusue longis pilosis et scabridae in nervos, subtus pubescentes vel pilosae; paniculae terminales axillares que, exsertae, 5 - 11 cm. longae, 1.2 - 8.0 cm. latae, rami primarii patentes vel adscendentes, 2 - 7 cm. longi; spiculae 3.7 - 4.8 mm. longae, elliptico-acuminatae, glabrosae vel etiam gluma prope marginem pilosa; gluma prima ovata-acuminata, paulo brevior demum flosculum inferiorem superans, 3.0 - 4.5 mm. longa, 3-5 nervis; gluma secunda elliptico-acuminata, 3.2 - 4.4 mm. longa, 5-7 nervis; flosculus inferior staminatus, stamina 1.3 - 1.6 mm. longa; lemma inferius elliptico-acutum, 2.8 - 3.2 mm. longum, 5-nervis; palea inferior elliptica-acuta; 2.4 - 2.6 mm. longa, subaequans lemma inferius; flosculus superior 1.8 - 2.3 mm. longus, ca. 1.1 mm. latus; rachilla-appendiculae 0.5 - 0.7 mm. longae; stamina superiora 1.5 - 1.7 mm. longa.

Holotype in the Herbarium of the U.S. National Museum, No. 1547074, collected at Yerba Buena, Central Tucuman, Argentina, August 26, 1923, by S. Venturi 2521.

Additional specimens examined: Argentina: Tucuman: Arroyo Los Piedros, without collector, Jan. 8, 1899 (LIL); Yerba Buena, Schreiter 1579 (LIL); Cerro el Nogalito, Venturi 8823 (GH); Cerro del Campo, Venturi 7989 (US, LIL). Salta: Quachipas, Venturi 9856 (NY, K, GH); San Pedrito, Meyer 952 (LIL).

I view this species as belonging to the I. nemorosus complex, which also includes I. latifolius and I. gracilis. In these taxa it is not unusual to find occasionally a well-developed and apparently viable caryopsis in the lower floret. I. venturii is distinguished by the first glume slightly shorter to exceeding the lower floret, and the presence of at least some slender, tubercle-based hairs 3 - 4 mm. long on the culms, sheaths and blades.

The species is named for the collector of the type, S. Venturi.

ICHNANTHUS POLYTHYRSUS (Nees ex Steudel) K. E. Rogers, comb. nov.

Panicum polythyrsum Nees ex Steudel, in Steudel, Syn. Pl. Glum. 1:93. 1854. Lectotype: Brazil: Bahia. Salzman 687 (G).

Culms spreading-ascending, rooting at the lower nodes, papillose-pilose with usually spreading hairs; nodes papillose-pilose; sheaths 1 - 5 cm. long, spreading pappilose-pilose or the uppermost glabrate; leaves to 6 cm. long, 0.6 - 1.3 cm. wide, papillose-pilose on both surfaces; ligule membranous-ciliate, 1.0 - 1.3 mm. long; panicles terminal and axillary, densely flowered; terminal panicles to 9 cm. long and 4 cm. wide; axillary panicles from several of the upper nodes, partly included to short exserted; primary panicle branches erect, to 6 cm. long; secondary panicle branches appresed, to 2 cm. long; peduncle, rachis and panicle branches pubescent and scabridulous on the angles; spikelets 4.2 - 5.0 mm. long, spreading papillose-pilose on both glumes, tinged with purple; first glume 3.0 - 3.7 mm. long, 3/4 the length of the lower lemma or barely exceeding it, ovate-acuminate and pointed, 3-nerved; second glume 4.3 - 5.0 mm. long, quite exceeding the lower lemma, 5-nerved; lower floret staminate; lower lemma 3.3 - 4.0 mm. long, 5-nerved; lower palea ciliolate on the nerves, 2.2 - 2.4 mm. long, slightly shorter to equalling the upper floret; upper floret 2.0 - 2.5 mm. long, about 0.6 mm. wide; rachilla-appendages 0.5 - 0.7 mm. long.

A number of specimens referrable to this species were examined all of which were collected by Salzman in Bahia, Brazil,

and without collector's number. These are in MO, MPU, S, US.

ICHNANTHUS SUBPELLUCIDUS (Steudel) K. E. Rogers, comb. nov.

Panicum subpellucidum Steudel in Steudel, Syn. Pl. Glum. 1:77. 1854. Lectotype: Brazil: Bahia in umbrosis, 1830, Salzman 703 (W).

Ichnanthus candicans var. pilosus Doell in Mart. in Martius Fl. Bras. 2(2): 293. 1877, in part.

Culms elongate, branching, rooting at the lower nodes, with ascending branches; internodes 2 - 8 cm. long, papillose-pilose with spreading hairs; nodes papillose-pilose; sheaths to 3 cm. long, the lower about 1/2 the length of the internode, becoming much shorter than the internodes above, spreading papillose-pilose; collar pilose; ligule membranous-ciliate, about 0.5 mm. long, the cilia minute; blades lanceolate-acuminate, 3 - 6 cm. long, 0.5 - 1.0 cm. wide, papillose-pilose on both surfaces; panicles terminal and axillary; terminal panicles 4 - 8 cm. long, 2 - 4.0 cm. wide, on peduncles 5 - 25 cm. long, the primary branches more or less erect, 2 - 4.5 cm. long, simple; axillary panicles 3 or more from the upper sheaths, included or short exserted; pedicels, rachises, and pulvini short pilose; spikelets 4.4 - 5.0 mm. long, pilose with spreading hairs on glumes I and II; first glume long acuminate, the tip 3/4 to nearly equalling the lower lemma, 3.5 - 4.0 mm. long, 3-nerved; second glume long acuminate, exceeding the lower lemma, 5-7 nerved; lower palea about equalling the upper floret; upper floret about 2.2 mm. long, oblong, the rachilla-appendages about 0.5 mm. long.

Additional specimens examined: Brazil: Bahia, Salzman s.n. (G, MPU).

NOTES ON BLUE-GREEN ALGAL TYPE SPECIMENS

Francis Drouet

Several Type specimens, hitherto misinterpreted in the literature, came to my attention when I visited European herbaria during the summer of 1970. The trip through Europe was supported in major part by grants from the American Philosophical Society and the National Science Foundation. Mr. Richard W. Hildebrand made this typescript.

Chlorogloeopsidaceae Mitra, Ann. No. Nat. Acad. Sci. India 1965: 124. 1967. --Type genus: Chlorogloeopsis Mitra, loc. cit. 1967. --Type species: Chlorogloea Fritschii Mitra, Ann. of Bot., N. S. 14(56): 460. 1950. Nostoc Fritschii Schwabe & El Ayouty, N. Hedwigia 10(3--4): 533. 1966. Chlorogloeopsis Fritschii Mitra, Ann. No. Nat. Acad. Sci. India 1965: 124. 1967. --I studied microscopically a slide of the original culture (the Type) from Allahabad soils at the British Museum (Natural History). The plants therein preserved are distinctly of a species of Nostoc, with heterocysts present; the presence or absence of accompanying Fungi was not determined = Nostoc muscorum Ag. A. B. Gupta in Revue Algologique, N. S. 10(2): 115--117 (1971), in judging the literature cited above, has expressed an opinion that the plants referred to here are of N. commune Vauch.

Fischera tenuis Martens (as "Fischeria") [in Kurz, Proc. Asiatic Soc. Bengal 1870: 259. 1870] ex Bornet & Flahault, Ann. Sci. Nat. VII. Bot. 5: 67. 1887. Stigonema tenue Bornet & Flahault [Mém. Soc. Nat. Sci. Nat. & Math. Cherbourg 25: 210. 1885] ex Bornet & Flahault, Ann. Sci. Nat. VII. Bot. 5: 67. 1887. Fischerella tenuis Forti, Syll. Myxophyc., p. 576. 1907. --No specimen of this was seen by Bornet & Flahault in the preparation of their "Révision des Nostocacées hétérocystées" (1887); they transcribed Martens' description verbatim. The Type specimen (a duplicate of which is in the British Museum), from damp walls of the northern faces of buildings, Botanic Gardens, Calcutta, Jan. 1870, S. Kurz no. 2687 in the Rijksherbarium, Leiden = Trentepohlia lagenifera (Hildebr.) Wille, in excellent condition and virtually free of parasitization by fungi.

Hapalosiphon tenuissimus Grunow [in Rabenhorst, Fl. Eur. Algar. 2: 284. 1865] ex Collins, Holden & Setchell, Phyc. Bor.-Amer. 5: 212. 1896. H. fontinalis var. tenuissimus Collins in Collins, Holden & Setchell, loc. cit. 1896. H. fontinalis fa. tenuissimus Collins & Setchell ex Elenkin, Monogr. Alg. Cyanoph., Pars Spec. 1: 508. 1938. --H. tenuissimus Grun. was not referred to in Bornet & Flahault's "Révision" (1887). Its Type specimen, "Auf Lemna minor in Pfützen . . . bei Kuffstein",

Tyrol, Heufler, 24 Sept. 1860, in the Natural History Museum, Vienna = hyphae of Fungi.

Hyphomorpha Borzi, Studi sulle Mixoficee, p. 68, 82. 1916. --Type species: H. antillarum Borzi, ibid. p. 82. 1916. H. antillana Borzi pro synon., loc. cit. 1916. --Madame Dr. S. Jovet-Ast made available to me several specimens of Trichocolea tomentosa Gottsche from Martinique and Guadeloupe in Husnot's Plantes des Antilles no. 219 (1868), in the Muséum National d'Histoire Naturelle in Paris. In one of these specimens, designated here as the Type, along with some Scytonema Hofmannii Ag., filaments of Hyphomorpha antillarum as described by Borzi are represented sparsely = young Stigonema panniforme (Ag.) Harv.

Rosaria Carter in Compton, Journ. Linn. Soc. Bot. 46: 54. 1922. Nelliecarteria J. de Toni, Noter. di Nomencl. Algol. 8: [5]. 1936. --Type species: Rosaria ramosa Carter, loc. cit. 1922. Nelliecarteria ramosa J. de Toni, loc. cit. 1936. --At the British Museum (Natural History) in 1950 I examined the Type slide, R. H. Compton no. 1181 from New Caledonia, noting that this plant is not a member of the coccoid Myxophyceae; I ascribed it to the Fungi because of its general resemblance to hyphae of Monilia spp. The material had been mounted in liquid containing glycerine, which had subsequently dried, so that a precise assessment of the nature of the plant could not be made. During my 1970 visit I made holes in the sealing compound and ran water under the cover slip on this slide. I discovered that the plant described by Carter as Rosaria ramosa is a member of the Trentepohliaceae = Physolinum Monilia (De Wildem.) Printz.

Mastigocoleopsis Geitler, Beih. z. Bot. Centralbl. 41(2): 258. 1925. --Type species: Mastigocoleus obtusus Carter, Journ. Linn. Soc. Bot. 46: 54. 1922. Mastigocoleopsis obtusa Geitler, loc. cit. 1925. --Another slide in the British Museum (Natural History), the Type specimen of this species, also of R. H. Compton no. 1181 from New Caledonia, was likewise mounted in liquid containing glycerine. I studied it also in water drawn under the cover slip. The plant present, answering to Carter's description = Physolinum Monilia (De Wildem.) Printz, overgrown with Fungi, but otherwise as in the Type of Rosaria ramosa Cart.

Pseudodiplonemataceae Elenkin, Monogr. Alg. Cyanoph., Pars Spec. 2: 1838. 1949. --Type genus: Pseudospelaeopogon Elenkin, ibid. 2: 1839. 1949. --Type species: Spelaeopogon lucifugus Borzi in Sommier, Boll. R. Orto Bot. Palermo 6: Appendice p. 171. 1907. Pseudospelaeopogon lucifugus Elenkin, ibid. 2: 1840. 1949. --A specimen, designated here as the Type, labeled "Leptopogon lucifugus" from Palermo, A. Borzi, Oct. 1904, in the herbarium of Bornet--Thuret at the Muséum National d'Histoire Naturelle in Paris, is excellent and unmistakable material of the widely distributed and often collected stigonematacean species:

Fischerella ambigua (Näg.) Gom. Bourrelly in Les Algues d'Eau Douce 3: 378, footnote (1970) notes that he has observed heterocysts in this or similar material.

SCHIZOTHRIX ANABAENOIDES (Drouet), comb. nov. Phormidium thermale Drouet, Field Mus. Bot. Ser. 20(6): 138. 1942 (not Vouk, Jugoslav. Akad. Prirod. Istraž. Hrvatski i Slavonije, Mat.-Prirod. Razr. 8: 7. 1916). P. anabaenoides Drouet, Madroño 16(3): 108. 1961. --The new combination here is made to supplant the name Schizothrix monticulosa (Bory) Dr. for the species treated on pages 140--142 of my "Revision of the classification of the Oscillatoriaceae" (Monogr. Acad. Nat. Sci. Philadelphia, no. 15. 1968). When I studied the Type (in the Muséum National d'Histoire Naturelle, Paris) of the basionym of the latter (Anabaena monticulosa Bory) in 1960, I was not prepared to recognize the precise distinctions among the small species of Schizothrix which revealed themselves as the revising proceeded until 1966. I re-studied the Type specimen in 1970 and discovered that the material is of S. calcicola (Ag.) Gom. with thin discrete sheaths, which give the terminal cells acutely conical configurations through optical illusion.

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STUDIES IN THE EUPATORIEAE (ASTERACEAE). LI.

THE DISYNAPHIOID COMPLEX.

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The study of the Eupatorieae has reached a point where a large complex of South American genera related to Disynaphia can be recognized. These genera which we refer to as Disynaphioid belong to a still larger complex of primarily eastern North American and eastern South American genera including those we have called Eupatorioid and Gyptoid. The Disynaphia complex is distinct from the Eupatorioids by the lack of hairs on the base of the style and differs from the Gyptoids by the rather consistent five flowers per head. Other characters of the group include the papillose linear style branches, smooth corolla lobes, strongly annulate thickenings in the anther collars and transversely alined punctations on the walls of the achene. The bases of the anthers in a number of the genera are hastate. The Disynaphia complex as presently recognized contains six genera which are treated in the next papers of this series. The distinctions of these genera are summarized in the following key.

1. Inflorescence pyramidally paniculate.
  2. Leaves pinnately to bipinnately dissected with long narrow lobes, style branches in distal part fragile and bearing long spines; apical cells of pappus setae sharply acute — Acanthostyles
  2. Leaves narrowly ovate to linear, serrulate; style branches short-papillose; apical cells of pappus setae blunt and enlarged — Raulinoreitzia
1. Inflorescence corymbose, flattened on top.
  3. Pedicels essentially glabrous, striated with prominent ridges; plants often having viscous appearance — Symphyopappus
  3. Pedicels distinctly pubescent, not or scarcely ridged.
    4. Leaves opposite, sometimes dissected; involucre with long narrow often reddish phyllaries in outer series; pappus not usually separating from achene as a unit — Dimorpholepis
    4. Leaves alternate or opposite, never dissected; involucre without distinctive narrower phyllaries in outer series; pappus often separating from achene as a unit.
      5. Outer surface of phyllaries glabrous; leaves sometimes opposite; achene with small but distinct swollen carpopodium; anthers not hastate at base — Campovassouria

5. Outer surface of phyllaries pubescent; leaves alternate; achene with carpopodium obsolete; anthers hastate at base Disynaphia

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STUDIES IN THE EUPATORIEAE (ASTERACEAE). LII.

A NEW GENUS, ACANTHOSTYLES.

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The plants named here as a new genus show another extreme of variation in the tribe Eupatorieae. The most distinctive feature of the genus is the style branch with widely spaced, greatly elongated papillae. The narrowly lobed, bipinnate to tripinnate leaves allow instant identification macroscopically. The pyramidal paniculate inflorescence with a reddish aspect is similar to the genus Raulinoreitzia. The latter genus differs by characters given above and by having enlarged blunt apical cells on the pappus setae.

Acanthostyles R.M.King and H.Robinson, genus novum Asteracearum. Plantae suffrutescentes erectae laxe multo ramosae. Caules teretes. Folia opposita distincte petiolata, laminis anguste lobatis vel pinnatim dissectis glanduliferis. Inflorescentiae longe paniculatae; pedicelli breviter pubescentes. Involucri squamae imbricatae ca. 25 inaequilongae ca. 4-seriatae glabrae ex parte rufescentes interiores anguste ellipticae vel oblongae; receptacula parva convexa glabra. Flores 5 in capitulo; corollae anguste infundibulares 5-lobatae extus inferne glabrae intus glabrae, cellulis angustis parietibus sinuosis, lobis aequilateraliter triangularibus vel longioribus extus glanduliferis ad apicem vix mamillosis intus laevibus; filamenta antherarum in parte superiore angusta, cellulis infernis plerumque quadratis, parietibus annulate vel intricate ornatis interdum inferne non scleroideis, thecis basi non hastatis, cellulis exothecialibus subquadratis, appendicibus antherarum oblongis vel triangularibus; styli inferne non incrassati glabri, appendicibus longe linearibus remote acicularitер papillosis; achaenia prismatica 4-5-costata, costis breviter setiferis, inferne angustata, punctis saepe in seriebus transversis; carpopodia indistincta; pappus setiformis uniseriatus, setis 30-40 usque ad apicem rigidis non dilatatis scabris vel barbellatis, cellulis apicalibus acutis.

Species typica: Eupatorium buniifolium Hook. & Arn.

Our studies indicate that the genus contains the following two species.

Acanthostyles buniifolius (Hook. & Arn.) R.M.King & H.Robinson, comb. nov. Eupatorium buniifolium Hook. & Arn., Hook. Comp.

Bot. Mag. 1: 240. 1836 (1835). Argentina, Bolivia, Paraguay, Uruguay.

Acanthostyles saucechicoensis (Hieronymus) R.M.King & H.Robinson, comb. nov. Eupatorium saucechicoense Hieronymus, Engl. Bot. Jahrb. 22: 775. 1897. Argentina.

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STUDIES IN THE EUPATORIEAE (ASTERACEAE). LIII.

A NEW GENUS, RAULINOREITZIA.

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Two of the genera, Acanthostyles and Raulinoreitzia, that we refer to the Disynaphia Complex have pyramidally paniculate inflorescences. The slightly reddish colored and sometimes inclined or pendant series of heads are reminiscent of the habit of some grasses. Of these two genera, Raulinoreitzia is totally distinctive by its unlobed leaves, short-papillose stylar appendages and enlarged blunt apical cells on the pappus setae. The genus is distinguished from all others with such enlarged blunt apical cells on the pappus setae by the five flowered heads and by the lack of hairs on the base of the style.

Raulinoreitzia R.M.King & H.Robinson, genus novum Asteracearum (Eupatorieae). Plantae suffrutescentes erectae laxe ramosae. Caules teretes. Folia opposita distincte petiolata, laminis ellipticis vel basi cuneatis margine serrulatis. Inflorescentiae paniculatae; pedicelli glabri. Involucri squamae imbricatae ca. 15-20 valde inaequilongae ca. 4-seriatae glabrae ex parte rufescentes interiores anguste oblongae; receptacula parum convexa glabra. Flores 5 in capitulo; corollae anguste infundibulares 5-lobatae extus glanduliferae intus glabrae, cellulis angustis parietibus sinuosis, lobis aequilateraliter triangularibus vel longioribus extus ad apicem pauce papillosis; filamenta antherarum in parte superiore angusta, cellulis quadratis vel elongatis, parietibus annulate ornatis, thecis basi vix hastatis, cellulis exothecialibus subquadratis, appendicibus antherarum oblongis; styli inferne non incrassati glabri, appendicibus linearibus breviter papillosis; achaenia prismatica 4-5 costata fere glabra, punctis saepe in seriebus transversis; carpopodia parva cylindrica superne dense breviter fimbriata, parietibus tenuibus; pappus setiformis uniseriatus, setis ca. 30 scabris ad apicem dilatatis, cellulis apicalibus inflatis obtusis.
Species typica: Baccharis crenulata Sprengel

The genus is named after P. Raulino Reitz recently appointed Director of the Jardim Botânico in Rio de Janeiro. Dr. Reitz is well known for his previous work at the Herbario "Barbosa Rodrigues" in Itajaí, Santa Catarina, Brasil. In addition to his other contributions, Dr. Reitz has served as

editor of Sellowia and of the important series of Flora Ilustrada Catarinense.

Our studies of the genus indicate that it contains the following two species.

Raulinoreitzia crenulata (Sprengel) R.M.King & H.Robinson, comb. nov. Baccharis crenulata Sprengel, Syst. Veg. 3: 466. 1826. Argentina, Bolivia, Brazil, Peru, Paraguay.

Raulinoreitzia tremula (Hook. & Arn.) R.M.King & H.Robinson, comb. nov. Eupatorium tremulum Hook. & Arn., Hook. Comp. Bot. Mag. 1: 241. 1836. Argentina, Brazil, Uruguay.

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STUDIES IN THE EUPATORIEAE (ASTERACEAE). LIV.

THE GENUS, SYMPHYOPAPPUS.

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Described over a hundred and twenty years ago, the genus Symphyopappus was recognized at least in part for over a hundred years. B.L.Robinson maintained the genus and assigned new species to it. The genus is in B.L.Robinson's key to genera (1913), distinguished by the pappus setae coalesced into a thickened annulus at the base and the leaves being coriaceous. The genus was formally reduced into the synonymy of Eupatorium by Steyermark in 1953, and has been treated in this manner by Cabrera (1963). In retrospect it is obvious that B.L. Robinson was correct in maintaining the genus. Still, the characters given were not particularly distinctive and there was no way to adequately separate the genus from Eupatorium as then conceived. In spite of sometimes great differences in the habits of the plants, the closest relationships of Symphyopappus are clearly to Dimorpholepis and Disynaphia. Many of the species of Symphyopappus have long narrow outer phyllaries such as are characteristic of Dimorpholepis, and the anatomy of the flower is like that of Disynaphia in all respects except the larger carpopodium. The pappus formerly used as key character, is like that of Disynaphia. Symphyopappus is most readily distinguished from its relatives by the glabrous ascending strongly and decurrently ridged pedicels of the inflorescence.

Symphyopappus Turczaninow, Bull. Soc. Nat. Mosc. 21: 583. 1848.

Erect few branched herbs or shrubs. Leaves opposite becoming alternate above in some species, sessile, subsessile to petioled, ovate-lanceolate, serrate. Inflorescence a corymbose panicle, pedicels glabrous, with prominent decurrent ridges. Involucre of ca. 15 substramineus, unequal phyllaries in 3-4 (5) series, often one or more long narrow thickened phyllaries in outer series, receptacle flat or slightly convex, glabrous or with numerous stiff hairs, 4-5 flowers per head. Corollas tubular, 5 lobed, lobes with a few glands near the tips, usually twice as long as wide, outer surface of corolla glabrous below, lobes papillose at tips, stomates absent. Inner surface of corolla glabrous, anther collar short, composed of mostly rectangular or quadrate cells, cell walls with annulate thickenings, base of anthers hastate. Anther appendage large,

composed of large cells, style base not enlarged, glabrous. Stylar appendage not or scarcely enlarged, with crowded short erect papillae. Achenes prismatic, 4-5 ribbed, glabrous or with a few short stalked glands, minute punctations often in transverse rows; carpopodium stout with enlarged thin-walled cells continuing on lower ribs; pappus of ca. 40 scabrous setae united to form a cone or cylinder at base; apical cells acute to obtuse. Chromosome number determined as X = 10 from two species (S. compressus as S. polystachus, and S. cuneatus; Coleman, 1968). Type species: Symphyopappus decussatus Turcz.

Our studies of the genus indicate that it contains the following 13 species.

Symphyopappus angustifolium Cabr., Nat. Mus. La Plata Bot. 19: 191. 1959. Brazil.

Symphyopappus casarettoi B.L.Robinson, Candollea 5: 170. 1934. Brazil.

Symphyopappus compressus (Gardn.) B.L.Robinson, Contr. Gray Herb. n.s. 80: 12. 1928. Brazil.

Symphyopappus cuneatus Sch.-Bip. ex Baker, Mart. Fl. Bras. 6(2): 367. 1876. Brazil.

Symphyopappus decussatus Turcz., Bull. Soc. Nat. Mosc. 21: 584. 1848. Brazil.

Symphyopappus itatiayensis (Hieron.) R.M.King & H.Robinson, comb. nov. Eupatorium itatiayense Hieron., Engl. Jahrb. 22: 764. 1897. Brazil.

Symphyopappus leptophlebius B.L.Robinson, Contr. Gray Herb. n.s. 96: 18. 1931. Brazil.

Symphyopappus lymansmithii B.L.Robinson, Contr. Gray Herb. n.s. 96: 19. 1931. Brazil.

Symphyopappus myricifolius B.L.Robinson, Contr. Gray Herb. n.s. 68: 6. 1923. Brazil.

Symphyopappus pennivenius B.L.Robinson, Contr. Gray Herb. n.s. 68: 7. 1923. Brazil.

Symphyopappus reitzii (Cabr.) R.M.King & H.Robinson, comb. nov. Eupatorium reitzii Cabr., Sellowia 15: 191. 1963. Brazil.

Symphyopappus reticulatus Baker, Mart. Fl. Bras. 6(2): 367.

1876. Brazil.

Symphyopappus tetrastichus B.L.Robinson, Contr. Gray Herb. n.s. 104: 8. 1934. Brazil.

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Steyermark, J.A. 1953. Botanical exploration in Venezeula III. Compositae. Fieldiana Bot. 28(3): 620-678.

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STUDIES IN THE EUPATORIEAE (ASTERACEAE). LV.

THE GENUS, DIMORPHOLEPIS.

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The concept recognized here at the generic level is only slightly altered from the section as established by Barroso in 1950. All species have the characteristic narrow elongate phyllaries in the outer series. The genus is easily distinguished from its closest relatives, Symphyopappus differs by having glabrous and ridged pedicels and Disynaphia differs by having alternate usually narrow leaves. Some species of Dimorpholepis also differ from these related genera by having dissected leaves.

The genus Dimorpholepis itself consists of three closely related but rather distinctive subgroups. The species D. multida has a pappus only about half as long as the corolla and lacking a distinct fused band at the base. This same species has an obsolete carpopodium as in Disynaphia and longer hairs interspersed among the shorter hairs on the pedicels. The typical element including D. grazielae and D. mollissima is also rather distinctive in its ovate leaf blades, longer petioles and sometimes trailing habit. The dissected leaves are found in various members of the genus, D. multifida, D. anethifolia and in some varieties of D. guadichaudiana.

Dimorpholepis (G.M.Barroso) R.M.King & H.Robinson, new status, Eupatorium section Dimorpholepis G.M. Barroso, Arquivos do Jardim Botanico 10: 97. 1950.

Coarse herbs to subshrubs or shrubs, erect to trailing, few branched. Leaves opposite, short petioled, ovate to lanceolate pinnately to bipinnately dissected into narrow segments often serrate. Inflorescence a corymbose panicle. Involucre of ca. 15 unequal phyllaries, in 3-4 series, receptacle flat or slightly convex, glabrous, 5 flowers per head, corollas tubular, 5 lobed, outer surface with a few short stalked glands, lobes longer than wide, short papillose on the backs of the lobes, short hairs on backs of lobes, stomates absent. Inner surface of corollas glabrous, anther collar short, composed of mostly quadrate or rectangular cells with annular thickenings. Anther appendage large, composed of large cells, base of anther hastate. Style base not enlarged, glabrous. Stylar appendage slightly enlarged, papillose. Achenes prismatic, 4-5 ribbed,

often with a few short stalked glands and short setae, carpopodium obsolete or composed of numerous enlarged thin walled cells continuous on the lower ribs; pappus of ca. 20-30 persistent scabrous setae, apical cells acute. Chromosome number determined from one species (D. intermedia as X = 10, Coleman, 1968).

Type species: Eupatorium dimorpholepis Baker = Dimorpholepis grazielae R.M.King & H.Robinson.

Our studies of the genus indicate that it contains the following 9 species.

Dimorpholepis anethifolia (A.P.Decandolle) R.M.King & H.Robinson, comb. nov. Eupatorium anethifolium A.P.Decandolle, Prod. 5: 182. 1836. Brazil.

Dimorpholepis coriacea (Scheele) R.M.King & H.Robinson, comb. nov. Eupatorium coriaceum Scheele, Linnaea 18: 457. 1844. Brazil.

Dimorpholepis gaudichaudeana (A.P.Decandolle)R.M.King & H. Robinson, comb. nov. Eupatorium gaudichaudeanum A.P.Decandolle, Prodr. 5: 148. 1836. Brazil.

Dimorpholepis grazielae R.M.King & H.Robinson, nom. nov. Eupatorium dimorpholepis Baker, Mart. Fl. Bras. 6(2): 331. 1876. Brazil.

Dimorpholepis intermedia (A.P.Decandolle) R.M.King & H.Robinson, comb. nov. Eupatorium intermedium A.P.Decandolle, Prodr. 5: 148. 1836. Brazil.

Dimorpholepis mollissima (Sch.-Bip. ex Baker) R.M.King & H. Robinson, comb. nov. Eupatorium mollissimum Sch.-Bip. ex Baker, Mart. Fl. Bras. 6(2): 331. 1876. Brazil.

Dimorpholepis multifida (A.P.Decandolle) R.M.King & H.Robinson, comb. nov. Eupatorium multifidum A.P.Decandolle, Prodr. 5: 182. 1836. Brazil.

Dimorpholepis numnularia (Hook. & Arn.) R.M.King & H.Robinson, comb. nov. Eupatorium numnularia Hook. & Arn., Hook. Comp. Bot. Mag. 1: 241. 1835. Brazil.

Dimorpholepis serrata (Spreng.) R.M.King & H.Robinson, comb. nov. Eupatorium serratum Spreng., Syst. 3: 415. 1826. Argentina, Brazil, Uruguay.

References

Barroso, G.M. 1950. Considerações sôdre o gênero Eupatorium. Arquivos do Jardim Botanico 10: 13-116.

Coleman, J.R. 1968. Chromosome numbers in some Brazilian Compositae. Rhodora 70: 228-240.

Acknowledgement

This study was supported in part by the National Science Foundation Grant GB- 20502 to the senior author.

STUDIES IN THE EUPATORIEAE (ASTERACEAE). LVI.

A NEW GENUS, CAMPOVASSOURIA.

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A single highly variable species previously known as Eupatorium bupleurifolium is the basis for the new genus Campovassouria recognized here. The species is closely related to the genus Disynaphia and has a similar habit with corymbose-paniculate inflorescence and slender alternate leaves. The exclusively opposite leaves found in some plants do not greatly detract from the overall similarity. However, three more subtle characters indicate a considerable distinction between the two genera. The most obvious character is the lack of pubescence on the outer surface of the phyllaries in C. bupleurifolia where such pubescence is prominent in all species of Disynaphia. Campovassouria has rounded bases on the anthers while those of Disynaphia and the related genera Dimorpholepis and Symphyopappus are prominently pointed. The achene of Campovassouria has a distinct short swollen carpopodium where Disynaphia has only a most rudimentary structure.

The generic name is taken from the common name of the plant as given in Cabrera and Vittet (1963) "vassoura do campo" (broom of the campo).

Campovassouria R.M.King & H.Robinson, genus novum Asteracearum (Eupatorieae). Plantae herbaceae vel suffrutescentes erectae usque ad 3 m altae pauce ramosae. Caules striati subglabri superne breviter pubescentes. Folia opposita vel alterna anguste lanceolata vel linearia integra vel serrulata subsessilia subglabra glanduloso-punctata. Inflorescentiae corymboso-paniculatae; pedicelli breviter pubescentes. Involucri squamae imbricatae ca 12 inaequilongae ca 3-seriatae, oblongae non dimorphae extus glabrae; receptacula plana glabra. Flores 5 in capitulo; corollae anguste infundibulares 5-lobatae extus inferne glabrae intus glabrae, cellulis interioribus oblongis, parietibus aliquantum sinuosis, lobis aequilateraliter triangularibus vel longioribus extus glanduliferis ad apicem pauce papillosis intus sublaevibus; filamenta antherarum in parte superiore angusta, cellulis infernis plerumque quadratis, parietibus annulis plerumque transversis ornatis, thecis basi non hastatis, cellulis exothecialibus subquadratis, appendicibus antherarum oblongis; styli inferne non incrassati glabri, appendicibus linearibus dense breviter et acute papillosis; achaenia prismatica 5-costata pauce glandulifera, punctis in

seriebus transversis; carpopodia distincta parva subcylindrica, cellulis aliquantum inflatis quadratis vel oblongis; pappus setiformis uniseriatus, setis 30-35 scabris persistentibus ad apicem tenuibus laevioribus, cellulis apicalibus acutis.

Species typica: Eupatorium bupleurifolium A.P.Decandolle

Chromosome number determined as X = 10 (Coleman, 1970).

The genus is monotypic.

Campovassouria bupleurifolia (A.P.Decandolle) R.M.King & H. Robinson, comb. nov. Eupatorium bupleurifolium A.P.Decandolle, Prodr. 5: 149. 1836.

Reference

Cabrera, A.L. & N. Vittet. 1963. Compositae Catharinenses II. Eupatorieae. Sellowia 15: 149-258.

Coleman, J.R. 1970. Additional chromosome numbers in Brazilian Compositae. Rhodora 72: 94-99.

Acknowledgement

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STUDIES IN THE EUPATORIEAE (ASTERACEAE). LVII.

THE GENUS, DISYNAPHIA.

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The members of the genus Disynaphia have almost always been recognized as a related group with their slender to obovate spirally arranged leaves, corymbose-paniculate inflorescences and five flowered heads. This distinctive group has sometimes been given the series name Dysnaphia (once spelled Dasynaphia) based on the original generic name. Additional critical characters of the group recognized here are the hastate bases of the anthers, the sparsely glandiferous achenes, the very rudimentary carpopodium, the pubescent outer surfaces of the phyllaries, the lack of long slender phyllaries in the outer series and the linear style branches with crowded erect papillae. On the basis of these characters the generic status is restored.

A few Brazilian species do resemble Disynaphia in habit. Campovassouria bupleurifolia is apparently closely related but differing by the glabrous outer surfaces of the phyllaries and the small but distinct carpopodia among other things. The two species known as Eupatorium blanchetii Sch.-Bip. ex Baker and E. praefictum B.L.Robinson are apparently not closely related to Disynaphia and they can be distinguished very easily by their setiferous achenes with more distinct carpopodia.

Disynaphia W.S.Hooker & Arnott ex A.P.Decandolle, Prodr. 7:267. 1838.

Plants erect, much branched shrubs or subshrubs. Leaves alternate, rarely opposite or subopposite, sessile to subsessile, blades linear to oblong or oblanceolate, entire to serrulate. Inflorescence a corymbose panicle. Pedicles covered with prominent short hairs. Involucre of 11-15 phyllaries, in 2-3(4) series; outer series short and more rounded. Receptacle slightly convex or flat, glabrous to slightly pubescent, 4-5 flowers per head; corollas tubular, 5-lobed, outer surface of corolla glabrous below or with a few short stalked glands, lobes usually about as long as wide, with short stalked glands, stomates absent. Inner surface of corolla glabrous, anther collar short, composed of mostly rectangular or quadrate cells, cell walls with annulate thickenings. Anther bases hastate, in a few species as long as collar. Anther appendage large, composed of large cells; style base not enlarged, glabrous. Stylar appendage slender, densely covered with short erect papillae. Achenes prismatic, 4-5 ribbed, glabrous to slightly glandular, minute

punctations often in transverse rows, a few species setiferous, pappus of ca 35 usually irregularly scabrous setae, pappus often dehiscing as unit. Chromosome number determined from one species Eupatorium ligulifolium H. & A. as X = 10 (Turner & Irwin, 1960).

Type species: Disynaphia montevidensis A.P.Decandolle = D. calyculatum.

Our studies of the genus indicate that it contains the following 12 species.

Disynaphia achillaea (Chod.) R.M.King & H.Robinson, comb. nov. Eupatorium achillaea Chod., Bull. Herb. Boiss. Ser. II. 1: 411. 1901. Paraguay.

Disynaphia albissima (Hassler) R.M.King & H.Robinson, comb. nov. Eupatorium albissimum Hassler, Fedde Rep. Spec. Nov. 11: 172. 1912. Paraguay.

Disynaphia calyculata (Hook. & Arn.) R.M.King & H.Robinson, comb. nov. Eupatorium calyculatum Hook. & Arn., Hook. Comp. Bot. Mag. 1: 242. 1836. Argentina, Brazil, Uruguay.

Disynaphia ericoides(A.P.Decandolle) R.M.King & H.Robinson, comb. nov. Eupatorium ericoides A.P.Decandolle, Prodr. 5: 150. 1836. Brazil.

Disynaphia filifolia (Hassler) R.M.King & H.Robinson, comb. nov. Eupatorium filifolium Hassler, Fedde Rep. Spec. Nov. 11: 171. 1912. Paraguay.

Disynaphia ligulaefolia (Hook. & Arn.) R.M.King & H.Robinson, comb. nov. Eupatorium ligulaefolium Hook. & Arn., Hook. Comp. Bot. Mag. 1: 242. 1835. Brazil.

Disynaphia littoralis (Cabrera) R.M.King & H.Robinson, comb. nov. Eupatorium littorale Cabrera, Bol. Soc. Argent. Bot. 7: 189. 1959. Brazil.

Disynaphia multicrenulata (Sch.-Bip. ex Baker) R.M.King & H. Robinson, comb. nov. Eupatorium multicrenulatum Sch.-Bip. ex Baker, Mart. Fl. Bras. 6(2): 335. 1876. Brazil.

Disynaphia radula (Chod.) R.M.King & H.Robinson, comb. nov. Eupatorium radula Chod., Bull. Herb. Boiss. Ser. II. 2: 311. 1902. Brazil, Paraguay.

Disynaphia senecionidea (Baker) R.M.King & H.Robinson, comb. nov. Eupatorium senecionideum Baker, Mart. Fl. Bras. 6(2): 318. 1876. Brazil.

Disynaphia spathulata (Hook. & Arn.) R.M.King & H.Robinson, comb. nov. Eupatorium spathulatum Hook. & Arn., Hook. Comp. Bot. Mag. 1: 242. 1835. Brazil.

Disynaphia variolata (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium variolatum B.L.Robinson, Contr. Gray Herb. n.s. 73: 20. 1924. Brazil.

Reference

Turner, B.L. & H.S.Irwin 1960. Chromosome numbers in the Compositae II. Meiotic counts for fourteen species of Brazilian Compositae. Rhodora 62:122-126.

Acknowledgement

This study was supported in part by the National Science Foundation Grant GB 20502 to the senior author.

NOTES ON NEW AND NOTEWORTHY PLANTS. LIV

Harold N. Moldenke

ERIOCAULON DICTYOPHYLLUM f. VIVIPARUM Moldenke, f. nov.

Haec forma a forma typica speciei capitulis plusminusve viviparis recedit.

This form differs from the typical form of the species in having its flower-heads more or less viviparous.

The type of the form was collected by R. M. Harley and R. Souza (no. 10097) in the shallower parts of a rapidly flowing stream in the shade of a small gallery forest about 4 km. east of the Royal Society/Royal Geographic Society Expedition's base camp, 12°49' S., 51°46' W., Mato Grosso, Brazil, on September 18, 1968, and is deposited in the Britton Herbarium at the New York Botanical Garden.

SYNGONANTHUS PHELPSAE var. VIRIDIS Moldenke, var. nov.

Haec varietas a forma typica speciei bracteis involucrantibus nigris et foliis glabris vel subglabratis laete viridibus recedit.

This variety differs from the typical form of the species in having black involucral bractlets and bright-green glabrous or subglabrous leaves.

The type of the variety was collected by Julian A. Steyermark (no. 103840) on a swampy savanna, altitude 2300 m., at Planicie de Zuloaga, Río Titirico, in the Cerro de la Neblina, Amazônas, Brazil, between October 10 and 15, 1970, and is deposited in the Britton Herbarium at the New York Botanical Garden. The collector notes that the plant was growing in dense clumps, with subcoriaceous pale-green leaves and white flower-heads.

VITEX ALTISSIMA f. ALATA (Willd.) Moldenke, stat. nov.

Vitex alata Willd., Gesell. Naturforsch. Freund. Berlin, Neue Schr., 4: 203. 1803.

VITEX RAPINI f. DENTATA Moldenke, f. nov.

Haec forma juvenilis a forma adulta speciei foliolis ad marginem grosse dentatis recedit.

This juvenile form of the species differs from the normal adult form in having the leaflet-margins very coarsely dentate.

The type of the form was collected by M. G. Baumann-Bodenheim (no. 15809) in serpentine "maquis" on the crest of Mt. Bouo (Koghis), at 700 to 1000 m. altitude, New Caledonia, on November 6, 1951, and is deposited in the Britton Herbarium at the New York Botanical Garden. The collector describes it as a shrub 2 m. tall.

VITEX RAPINI var. NANA Moldenke, var. nov.

Haec varietas a forma typica speciei statura prostrata et foliolis parvioribus recedit.

This variety differs from the typical form of the species in its

prostrate stature and smaller leaflets, the latter only 1.5—6 cm. long and 1.2--3.5 cm. wide.

The type of the variety was collected by H. Hürlimann (no. 1645) in crevices in peridotic rocks on the summit of Mt. Mono (Koghis), at 1079 m. altitude, New Caledonia, on July 18, 1951, and is deposited in the Britton Herbarium at the New York Botanical Garden. The collector describes the plant as a shrub 50 cm. tall, with rose-colored flowers and green fruit.

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BOOK REVIEWS

Alma L. Moldenke

"THE DOMESTICATION AND EXPLOITATION OF PLANTS AND ANIMALS" edited by Peter J. Ucko & G. W. Dimbleby, vii & 581 pp., illus., Aldine Publishing Co., Chicago, Illinois 60605. 1969. $17.50.

The book consists of the 50 papers, revised in light of subsequent discussions, presented at the Research Seminar in Archaeology and Related Subjects held at the Institute of Archaeology, London University, England, in May 1968. They deal with origins of domestication, patterns of exploitation, methods of investigation, regional and local evidence for domestication, studies in particular taxonomic groups (Arachis hypogaea, Chili peppers, Phaseolus, and algae, higher fungi, yeasts and bacteria used in Southeast Asian food technology), and human nutrition.

There are a few, very interesting photographic plates.

There are three indexes -- general, sites and localities, and authors.

Bibliographies accompany each paper, consequently much valuable material is provided directly and indirectly in this book.

"MARIN FLORA -- Manual of the Flowering Plants and Ferns of Marin County, California" by John Thomas Howell, 2nd edition with supplement, ix & 366 pp., illus., University of California Press, Los Angeles and Berkeley, Cal. 94720. 1970. $10.00.

It is good indeed to have this fine useful book available again and updated. Actually it is an exact reprint of the first (1949) edition to which has been added another preface, a 36-page supplement listing and describing 4 genera, 26 species with their subdivisions and 7 hybrids among new indigenous plants, 1 family, 37 genera and 99 species with their subdivisions among new adventive or naturalized plants, and 5 genera and 7 species with their subdivisions among deleted taxa. This very rich flora now is at a recorded total of 118 families, 564 genera, 1023 indigenous species and 408 introduced species, 173 subspecific entities and 7

hybrids. Fortunately the additions are not all competitive weeds that accompany man as more and more of his kind "develop" the area.

This book has been noted for a score of years for its excellent ecological survey, keys and annotated plant lists. It is of value to the amateur, the student and the professional botanist.

Oh, how this highly competent botanist-author deeply loves this area! "Her scenes are fair to see, her sounds are sweet to hear, her airs are fresh to breathe. Her hills and mountains look down on cathedral groves and over boundless waters."

"ATLAS OF UNITED STATES TREES -- Volume I Conifers and Important Hardwoods" by Elbert L. Little, Jr., v & ca. 340 pp. (unnumbered), illus., U. S. Government Printing Office, Washington, D. C. 20402. 1971. $16.75.

This is an oversized, mapped treasurehouse of forestry information compiled by the highly skilled chief dendrologist of our Forest Service, catalogued as Miscellaneous Publication No. 1146 of the U. S. Department of Agriculture, and listed at less than one third of the price of private printing.

This book shows very clearly and effectively the natural range within continental United States including Alaska of 94 native conifers or softwoods and 106 native deciduous or hardwoods on 12 x 11 inch maps. In addition there are a countied United States map and a subdivisioned North America map. In a backcover pocket there are matching overlay maps on waterways, land-surface forms, contoured topographical relief, plant hardiness zones, length of growing season, precipitation, climates, Wisconsin glaciation extension, and major forest types. There are common and scientific name indexes. A carefully compiled introduction gives the history of this dendrological mapping, its uses and bibliographic citations.

This is a valuable addition for libraries, schools, universities, foresters, wild life enthusiasts, water resource investigators, lumbering people, and lovers of the woods.

"FLORA OF LESOTHO" (Basutoland) by Amy Jacot Guillarmod, 474 pp., Verlag von J. Cramer, 3301 Lehre, Germany. 1971. DM.150 or $41.25.

This is the first extensive work — a doctoral study — done on this small mountainous country surrounded by the low-lying Orange Free State, Natal, East Griqualand and the Eastern Cape Province of the Republic of South Africa. It discusses the history, topography, some ecology, climate, land tenure and use. It provides brief biographical notes on collectors and an analysis of the flora with its 485 (512) species in 159 (147) genera in 17 (15) families of monocots and 1052 (1041) species in 367 (319) genera of 78 (76) families of dicots. The genera with the largest number of species are Helichrysum (64), Senecio (56), Crassula (28), Sutera (23) and Aster (Felicia) (21). It also includes a list of the

lower plants.

This work is Volume III of the "Flora et Vegetatio Mundi" series edited by R. Tüxen and certainly constitutes a valuable addition to floral literature.

"HANDBOOK OF PALYNOLOGY -- An Introduction to the Study of Pollen Grains and Spores" by G. Erdtman, 486 pp., illus., Hafner Publishing Co., New York, N. Y. 10003. 1969. $24.75.

It is good indeed that this definitive work is now available in English. The 1963 Swedish edition has been translated, revised and enlarged especially by the addition of 100 more plates that are excellent. The text covers morphology, taxonomy and ecology. The appendices consider microfossils, palynological preparations and laboratories, literature and references, glossary, and a pollen diagram fold-out chart on the back cover.

"Pollen grains have perhaps a wider distribution in both time and space than any other parts of plants" -- far out over the oceans, at the Poles, in glacier ice, in bottom deposits, in bees' honey, in herbivores' feces, etc.

"TROPICAL GARDENING -- Handbook for the Home Gardener" by Peggy Hickok Hodge, viii & 129 pp., illus., Charles E. Tuttle Co., Tokyo, Japan & Rutland, Vermont 05701. 1971. $7.50.

This is such a pleasant book with many unusually beautiful black/white plant photographs by William Churchill Hodge. It is divided into the following sections: (1) popular island ornamentals, (2) outdoor plantings that show, (3) flower beds, (4) indoor plants and flowers (a distressing expression), (5) outdoor arrangements, (6) trees for Hawaii, (7) fruit in the garden, (8) more good things to eat -- macadamia nuts, vegetables, garden herbs, and (9) battle of the bugs which advocates "on with the sprays and off with the bugs" but warns against DDT. For each section there is a listing of "Where to see the plantings". Much practical experience, plant lore and scientifically derived information are included throughout. There is a detailed botanical index with common and scientific names.

Such a reasonable price in today's inflationary market!

"CHEMICAL ECOLOGY" edited by Ernest Sondheimer and John B. Simeone, xv & 336 pp., illus., Academic Press, London, and New York, N. Y. 10003. 1970. $16.50.

In 1968 some lucky college kids at the State College of Forestry of Syracuse University had a chance to attend eleven lectures by as many different leaders in this emerging phase of ecology. And now the material is shared with the fortunate readers of this book which belongs in all college, university and relevant research laboratory libraries as well as in the hands of ecologists (student, teaching, practicing, research) and educated aficionados of ecology. It deals with chemical ecology in reference to cells

in the soil, lower and higher plants, hormonal and other chemical interactions between plants and insects, chemical communication within animal species, chemical defense against predation in arthropods, chemical ecology of fish, terpenoid compounds in ecology, and chemical aspects of hormonal interactions. All is presented excellently; but the writers, except for R. H. Whittaker, do not direct attention to the whole ecosystem.

Each paper has its own extensive bibliography, resulting in the first gathering of all these references between the two covers of this one easily available book. The print is easily legible and relatively neat except for such spelling slips as in Evenari on p. 45, arboreal on p. 221, and Phytophthora in the index. There is an author index and a somewhat incomplete subject index.

"TREES AND SHRUBS" by Richard E. Harrison and Charles R. Harrison, 199 pp., illus., Know Your Garden Series, Charles E. Tuttle Co., Tokyo, Japan & Rutland, Vermont 05701. 1965. $12.50.

Because of its 582 color photographs, this is a beautiful book. Compiled by a father-son team who have long maintained a horticultural establishment in New Zealand and who must be truly enamored of their subject, it is directed to a worldwide audience of folks interested professionally or amateurly in gardening or in scanning lovely books. Most of the many pictures were taken by the junior author right in the family nursery. They are accompanied by scientific and common names, family alliance and some pertinent text. Among the Verbenaceae, Lantana camara is described as Indian instead of West Indian in origin and Clerodendrum fargesii is used as the name for C. trichotomum var. fargesii; but, by and large, the nomenclature is more carefully checked than that in much horticultural literature.

"A TROPICAL RAINFOREST: A Study of Irradiation and Ecology at El Verde, Puerto Rico" edited and directed by Howard T. Odun and associate edited by Robert F. Pigeon, 1684 pp., U. S. Atomic Energy Commission. 1970. $10.00 paperback & $.95 microfêche.

This work, consisting of 111 chapters with almost half devoted to general ecology, deals with γ-radiation effects on fauna, flora and soil in the El Verde tropical rainforest.

It can be ordered as TID-24270 from the National Technical Information Service, United States Department of Commerce, Springfield, Virginia 22151.

"NATURE DIARY THROUGH THE YEAR" by Mildred Little Rulison, 92 pp., illus., Vantage Press, Washington, Hollywood, & New York, N. Y. 10001. 1971. $3.50.

Here are charming, accurate, never maudlin nature writings of the first order and attractive pen-line illustrations by a recog-

nized naturalist-educator. Much of the material appeared years ago in "Our Parks", published by the Union County Park Commission that operates the oft-mentioned Trailside Museum in the Watchung Reservation in New Jersey.

For those who know this or similar areas well, the book rings nostalgically true. For those who would like to visit, it is enticing. For others of all ages, it is interesting.

A few slips were not caught in proofing, as capitalization in Cypripedium on pp. 13 and 43, misuse of insectivorous on p. 15, misspelling of viridescens on p. 17, and uppercasing of flycatcher on p. 74.

The closing plea is wisely made: "We believe that it is the business of schools, parks, civic organizations, and public institutions to prepare our young citizens for conservation....The child must know and learn to appreciate nature before he becomes interested in conserving it....by giving him facts and correct attitudes, and by instilling standards of behavior, so that he will understand his own relationship to nature and the responsibilities that it brings."

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ADDITIONAL MATERIALS TOWARD A MONOGRAPH OF THE GENUS CALLICARPA. XX

Harold N. Moldenke

CALLICARPA TOMENTOSA (L.) Murr.

Additional synonymy: Callicarpa coja Hamilt. ex Wall., Numer. List 87, in syn. 1831. Callicarpa gongalo Hamilt. ex Wall., Numer. List 87, in syn. 1831. Callicarpa arborea L. ex Burkill, Dict. Econ. Prod. Malay Penins. 1: 408, in syn. 1966. Callicarpa tomentosa "L. ex Willd." apud Moldenke, Résumé Suppl. 14: 7, in syn. 1966. Callicarpa tomentosa Merr. ex Arora, Journ. Indian Bot. Soc. 45: 134. 1966. Tometax tomentosa L. apud Raizada. Indian Forest. 92: 304, in syn. 1966. Calicarpa lanata Pandeya, Puri, & Singh, Res. Meth. Pl. Ecol. 70, sphalm. 1968. -- Callicarpa lanata L. sensu Gamble, in herb.

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Illustrations: Gaertn., Fruct. & Sem. Pl. 2: pl. 94. 1791; R. Wight, Icon. Pl. Ind. Orient. 4: pl. 1480. 1849; R. Wight, Illustr. Ind. Bot. 2: pl. 173 bis, fig. 5 (in color). 1850; W. Griff., Notul. Pl. Asiat. Icon. pl. 447. 1854; Twining, Illustr. Nat. Ord. Pl. 2: 104, fig. 6. 1855; Sieb. & De Vriese, Ann. Hort. Bot. Pays-Bas [Fl. Jard.] 4: 97 (in color). 1861; Beddome, Fl. Sylv. Anal. Gen. pl. 21. 1872; W. A. Talbot, Forest Fl. Bombay 2: 345. 1911; Basu, Ind. Med. Pl. 3: pl. 733. 1918; T. Itô, Taiwan Shokubutu Dzusetu [Illustr. Formos. Pl.] 606. 1928; V. S. Rao, Journ. Indian Bot. Soc. 31: 304, fig. 33--35. 1952; Nair & Rehman, Bull. Nat. Bot. Gard. Lucknow 76, 13, fig. 19. 1962; Corner & Watanabe, Illustr. Guide Trop. Pl. 752. 1969.

Recent collectors describe this plant as a densely tomentose shrub or small to middle-sized slender tree, 2--18 m. tall, with reddish-brown indumentum, the trunk 10--31 cm. in diameter, the leaf-blades grayish beneath and pale softly pubescent, the flowers fragrant or slightly fragrant, the corolla pink, lavender-pink, or purple-pink to purple-lilac, purple, deep-lilac, mauve or white, the pollen-grains spheroidal, 42 mu in diameter (range 39--42 mu), the exine surface areolate, and the drupes about 5 mm. in diameter, purplish-black, purple-black, or purple to black or scarlet. The corollas are described as purple on J. Fernandes 114 and Lörzing 13067, lavender-pink on M. S. Clemens 11195, pink on Brass 27693 & 28719, deep-lilac on C. E. Carr 14870, and white on Prachantasen 25.

Santapau (1952) describes the species as an "Arbusto de hojas y flores elegantes", while Corner & Watanabe (1969) describe it as a "Wild tree. Twigs, inflorescences, and underside of leaves thickly brownish white tomentose. Leaf 12--30 x 5--15 cm. Flowers purple lilac. Berry 2--3 mm, purple.....Medicinal." The fruit, of course, is a drupe, not a berry. Chopra, Badhwar, & Ghosh (1965) report that the bark possesses a peculiar aromatic odor and slightly bitter taste. Löve (1968) has counted the chromosomes in Mehra & Gill 1080 from Nainital in the western Himalayas of India. Crevost & Pételot (1934) say of this species: "Plante qui, aux indes, est employé comme masticatoire en remplacement du bétel".

Collectors have found the plant in forests, rainforests, tropical forests, teak forests, secondary forests, the outskirts of forests, rainforest secondgrowth, and riverbeds, on steep slopes, forested riverbanks, and limestone coasts, and along roadsides and creekbanks in rainforests, at altitudes from sealevel to 1800 meters, flowering from August to June, and fruiting in February, April, August, and December. Razi (1946) refers to it as a mesophanerophyte according to Raunkiaer's classification of life-forms.

Bakhuizen van den Brink (1921) gives the overall distribution of C. tomentosa as "Brit-India! Siam! Malacca! Sumatra! Hongkong! New-Guinea!" -- his var. typica is recorded by him from "Ceylon! Himalaya! Nepal! Sikkim! Assam! Bengal! Burmah! Siam! Malacca!

Sumatra!" and his var. lanata from "Ceylon! Deccan! Himalaya! Nepal! Bhotan! Burmah! Bhamo! Hongkong! China!" He distinguishes the two varieties as follows: var. typica: "Folia adulta subtus tomentosa, incana; 15--40 c.M. longa, 7--15 c.M. lata; cymi magni, pedunculo petiolum aequante vel longiore; calyx dense tomentosus superne glabratus, raro subglabrescens; corolla extus glabra, vel dorso laciniarum subfarinosa; ovarium setaceum vel sparse pilis stellatis tomentosum, sparse glandulis punctatum". Var. lanata: "Folia adulta subtus dense et molle lanato-tomentosa canescentia; 10--30 c.M. longa, 3.5--15 c.M. lata; cymae magnae pedunculo quam petiolus duplo breviore; calyx sparse tomentosus superne glabratus; corolla extus glabra vel dorso laciniarum subtomentosa; ovarium dense setaceum vel sparse pilis stellatis tomentosum, sparse glandulis punctatum."

Lam (1924) gives the species' distribution as "Britisch India, Malakka, Malayischer Archipel, Philippinen"; Beer & Lam (1936) say merely "India to New Guinea". Panigrahi & Joseph (1966) describe it as "abundant" in Nefa, where the bark is "eaten with betel-leaf". Free (1917) adds that the leaves are used by the natives of Ceylon as a substitute for betel leaves. Twining (1855) notes also that there are aromatic properties in the bark, which is used as a substitute for betel by the Cingalese, and that the Malays think it is medicinal. Uphof (1968) notes that the species is a shrub of India "esp. Ghat of Bombay, Madras States, N. Kanara etc. Decoction of the bark and roots is used in Hindu medicine in fever, hepatic obstruction and skin diseases." Sebastine & Ramamurthy (1966) tell us that it is "common" in Kerala, forming the top layer among deciduous trees; Vajravelu and his associates (1968) also describe it as common in Kerala. In Bhutan, according to Deb, Sengupta, & Malick (1968), C. tomentosa is "widespread". Arora (1964) reports it in the understory of bamboo-Xylia-Terminalia ecologic associations, while Kammathy, Rao, & Rao (1967) call it "common on margins of shola".

On Woodlark Island this plant is said to be "occasional in rainforest secondgrowth" by Brass, while in Thailand it is "common in deciduous forests by streams" according to Prachantasen. Gamble (1881) refers to it as "a tree of the hills of Western and South India". Bojer (1837) records it from Mauritius gardens, saying "Pat. Inde orientale. Cult. au jardin du Roi, Pampl., et dans d'autres jardins". Watt (1889) describes it as "A shrub of Western and Southern India and the Circars".

Burkill (1966) avers that C. tomentosa is "A tree, found in India and to Sumatra; in the [Malay] Peninsula it is plentiful southwards to Negri Sembilan. The wood is white....brownish white.....or reddish white.....It is scarcely used for anything but burning, and in India is made into charcoal. The plant is pounded and used for poulticing sores. The juice is given internally for stomach-ache...." Watt (1889) reports that "Ainslie says that this plant is reckoned by the Javanese amongst their emollients. The bark, according to that author, possesses a peculiar aromatic and slightly bitterish taste..." [to be continued]

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TYPIFICATION OF PARMELIA DOLOSA DES ABBAYES (LICHENES)

Mason E. Hale, Jr.
Smithsonian Institution, Washington, D.C. 20560

In my monograph of Parmelia subgenus Amphigymnia (Hale, 1965), I considered P. dolosa to be a synonym of P. paulensis Zahlbr. Examination of several more collections from Madagascar and a review of the chemistry with thin-layer chromatography (which came into use after the publication of the monograph) have shown this treatment to be erroneous. As so generously pointed out by Dr. S. Kurokawa (1969), who took the time to re-examine specimens preserved in US, P. paulensis contains norlobaridone, "neoloxodic acid," and atranorin, accounting for the weak KC+ rose color test. While I have not confirmed this chemistry, I was able to demonstrate gyrophoric acid, as reported by des Abbayes, in both syntypes of P. dolosa, tests for which had previously been unsatisfactory. A fatty acid, probably protolichesterinic acid, is also present along with atranorin. The syntypes differ, however, in morphology; one (near Ankazobe, Madagascar) has laminal lobulate isidia, as mentioned specifically by des Abbayes in the original description, while the other (Manjakatompo, Madagascar) has coarse sorediate isidia along the margins. This latter specimen appears to be identical with P. diacidula Hale, a South African species.

Parmelia dolosa, then, is a valid species, and I am selecting the Ankazobe specimen as the lectotype. All three species involved, P. diacidula, P. dolosa, and P. paulensis, are quite closely related and still rather poorly circumscribed because so few collections are available. A summary of the species follows.

PARMELIA DIACIDULA Hale, 1965, p. 287. Type collection: Boschfontein Forest, Lions River, Natal, South Africa, Almborn 8679 (LD, holotype; US, isotype).

Distribution: South Africa, Madagascar.

Chemistry: Atranorin, gyrophoric acid, and a fatty acid, probably protolichesterinic acid.

Diagnostic characters: cilia, marginal sorediate isidia.

Specimens examined: MADAGASCAR: Manjakatompo, Centre Moyen, Benoist 569 (LD, US), des Abbayes 30/7/1956 (REN, US, syntype of P. dolosa). Specimens from South Africa listed in Hale (1965).

PARMELIA DOLOSA Des Abbayes, 1961, p. 115. Type collection: near Ankazobe, Ambohitantely Forest, Centre Medien, Madagascar, des Abbayes 21/8/1956 (REN, lectotype; US, isotype).

Distribution: Madagascar.

Chemistry: Atranorin, gyrophoric acid, and a fatty acid, probably protolichesterinic acid.

Diagnostic characters: cilia, mostly laminal irregularly sublobulate isidia.

Specimens examined: MADAGASCAR: Manjakatompo, Benoist 1091 (LD, US).

PARMELIA PAULENSIS Zahlbr. 1909, p. 175. Type collection: near Taipas, Mt. Jaraguá, São Paulo, Brazil, Schiffner (W, holotype).

Distribution: Brazil.

Chemistry: Atranorin, norlobaridone, and "neoloxodic acid" (Kurokawa, 1969).

Diagnostic characters: cilia, marginal sorediate isidia.

Specimens examined: Since the two specimens cited in Hale (1965), one from Madagascar and one from Réunion, are apparently incorrectly determined (there has been no opportunity to re-examine these), P. paulensis is represented only by the type collection.

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A NEW FORM OF ROBINIA FROM VERMONT

Fred W. Oswald

ROBINIA PSEUDO-ACACIA f. OSWALDIAE Oswald, f. nov.

Haec forma a forma typica speciei recedit leguminibus calicibusque (sub anthese) pedicellisque (sub fructi) puniceo-purpureis et foliolis subtus petiolisque persistente pubescentibus.

This form differs from the typical form of the species in having legumes Pomegranate-purple, Indian Lake, and/or Deep Hellebore Red. Calyxes of flowers in spring, and pedicels at fruiting stage, also of the same colors. Undersides of the leaves pubescent throughout entire season, especially on the veins and lower portions, and upon the petioles. Colors matched according to COLOR STANDARDS AND NOMENCLATURE, by Robert Ridgway.

This new form was collected by the author on September 5, 1971, from the south floodbank of the Roaring Branch, approximately 1000 feet upstream from the Molly Stark Trail (Vt. Route 9) bridge, and is deposited in the herbarium of Aarhus University, Aarhus, Denmark.

This tree is named in honor of Eileen Wolde Oswald, co-discoverer with the author.

Varieties thus far described of Robinia pseudo-acacia are as follows:

- purpurea Schneid. -- young leaves purple
- aurea Kirchn. -- leaves yellow
- coluteoides Neum. -- leaflets smaller, oblong-obovate, rounded at apex, cuneate at base; very floriferous
- amorphifolia Link -- leaflets narrow, oblong
- microphylla Loud. -- leaflets small and narrow
- myrtifolia (K. Koch) Schneid. -- leaflets 11-19, oval or broadly oval, 1-1.5 cm. long, rounded or slightly emarginate at apex
- crispa P. DC. -- leaflets with undulate and curled margins
- linearis Kirchn. -- leaflets linear; of spreading slender habit
- dissecta Mottet -- leaflets linear or broader and dissected; of compact habit with short branches
- unifoliola Talou -- leaves with only one large

leaflet, occasionally 2--7

erecta Rehd. -- of columnar habit; leaves with one or a few large leaflets

dependens Rehd. -- of pendulous habit; leaves with one or a few large leaflets

inermis P. DC. -- branches unarmed

umbraculifera P. DC. -- branches forming a dense subglobose head, unarmed; rarely flowering; usually grafted high as an avenue tree and formal plantings

rehderii Kirchn. -- a low subglobose form, usually grown on its own roots

bessoniana Kirchn. -- similar to umbraculifera but with slenderer branches forming a less dense head of more ovoid outline

tortuosa P. DC. -- a slow-growing form with short twisted branches, sometimes pendulous at the tips

rozynskyana Spaeth -- leaves 25--40 cm. long, pendulous; leaflets 15--21, oblong, 3--6 cm. long; racemes long; flowers large

pendula Loud. -- with somewhat pendulous branches

ulriciana Hartwig -- with slenderer more decidedly pendulous branches

pyramidalis Pepin -- a columnar form with unarmed erect branches

stricta Link -- a pyramidal form with ascending branches

semperflorens Carr. -- flowering during the whole summer

decaisneana Carr. -- flowers light rose-color

rectissima Raber. -- with erect branches

PARMELIA AFFLUENS, A NEW SPECIES OF LICHEN IN SUBGENUS AMPHIGYMNIA WITH A YELLOW MEDULLA

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PARMELIA AFFLUENS Hale, sp. nov.

Thallus ut in P. araucariarum Zahlbr. sed medulla P+, materiis chemicis affluentibus continentibus differt.

Holotype: Peru: Tingo Maria, San Martín, H. Allard 20700, 19 February 1960 (US; isotypes in TNS, UPS).

Additional specimens examined. Peru: Haciendo Exito, Churubamba, Huanuco, Mexia 8249a (F, US); near Elena Propria, Tingo Maria, Morrow 9605 (US); Tingo Maria, Allard 21893, 22524 (US). Brazil: Manaus-Amazonas: Taruma, Xavier & Chagas 622, Punta Negra, Xavier s.n., Rio Salimoes, Xavier 615, 624 (US). India: Lasee, Himalayas, Griffith (BM).

This species has broad, marginally sorediate, eciliate lobes and a pale yellow medulla, externally indistinguishable from P. araucariarum Zahlbr. (see Hale, 1965). I had not been able to resolve the chemistry with the crystal tests available when I prepared the monograph, but thin-layer chromatography has now clarified it. The type of P. araucariarum contains atranorin, a fatty acid (apparently protolichesterinic acid), and one or more unidentified yellow pigments that form a high streak on TLC plates. One is probably entothein. The medulla reacts P-. All other specimens that I have been able to re-examine, however, are P+ red in the medulla and have highly distinctive chromatographic profiles. this population is the basis of the new species.

The best resolution is obtained in hexane-ether-formic acid (9:4:1), visualizing with H_2SO_4 and heating. Beginning from the top down the following eight spots are easily distinguished at the R_f points listed (solvent front at 10 cm): 1. atranorin (.75); 2. unknown no. 1, a large gray spot (.65); 3. unknown no. 2, a deep salmon spot (.45); 4. unknown no. 3, a small weak yellowish spot (.35); 5. unknown 4, a second yellowish spot (.24); 6. unknown 5, a brown spot (.20); 7. unknown 6, a deep orange-brown spot (.17), just below unknown no. 6; and 8, protocetraric acid (.08) (P+ red) with a dark streak below this to the point of origin. Resolution

is less satisfactory in benzene-dioxane-acetic acid with little correspondence between the spots seen with hexane: atranorin at .70, a light orange-brown spot at .50, a gray spot (= unknown no. 2?) at .43, streaks and a large streaked brown area at .18-.22, and finally protocetraric acid (.06). The main pigment is not the same as that in P. araucariarum, falling much lower on the plates.

There is minor chemical variation among the specimens tested. Mexia 8249a, Morrow 9605, Xavier s.n., and Xavier 622 are identical with the holotype chemistry described above. Allard 22524 lacks unknowns no. 3 and 5 but has a large yellow-brown spot at .30. A specimen from the Himalayas, tentatively identified as P. affluens, lacks this extra spot as well as nos. 3 and 5. This species was co-chromatogrammed with various known substances (physodalic acid, norlobaridone, stictic and norstictic acids, P. quintaria unknowns (Hale, 1971), salazinic acid, alectoronic acid, P. livida group substances, etc.) but none matched.

Parmelia affluens is known so far from Peru and Brazil, usually at mid or lower elevations. It would superficially be identified as a small specimen of P. cristifera Tayl. or even P. dilatata Vainio. The yellow medulla is, of course, the outstanding diagnostic character and a positive P+ test would differentiate it from P. araucariarum, which was described from São Paulo.

Literature Cited

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STUDIES IN THE EUPATORIEAE (ASTERACEAE). LXII.

A NEW GENUS, NEOHINTONIA.

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The single species described here as a new genus is closely related to the genera Mexianthus and Koanophyllon. The new genus Neohintonia, is the same as Mexianthus in having heads in spherical clusters with one flower per head, but the latter genus is distinct by the broad scalelike pappus, the achene constricted above, the carpopodium undifferentiated and the anther appendage reduced to two small lobes. Neohintonia is more closely related to Koanophyllon which has the same type of achene but which has more flowers per head and has a grove up the middle of the inner surface of the anther appendage. Neohintonia is similar in habit to the related South American genus, Sphaereupatorium (O. Hoffmann) Kuntze ex B.L.Robinson but the latter genus has more flowers per head and a paleaceous receptacle.

One rather distinctive feature of Neohintonia is the occurrence of capitate glands along the stylar appendages. Such glands have not been noticed in the related genera.

Neohintonia R.M.King & H.Robinson, genus novum Asteracearum (Eupatorieae). Plantae scandentes pauce ramosae. Caules teretes. Folia opposita vel ex parte alterna distincte petiolata, laminis ovatis subglabris margine serrulatis. Inflorescentiae laxe paniculatae, ramis axillaribus fasiculos sphaericos capitulorum gerentibus. Involucri squamae imbricatae 4-5 oblongae 2-seriatae ad apicem pauce hirsutae; receptacula parva glabra. Flores 1 (raro 2) in capitulo; corollae tubulares 5-lobatae, cellulis interioribus angustis parietibus sinuosis, lobis aequilateraliter triangularibus vel latioribus laevibus extus glanduliferis intus glabris; filamenta antherarum in parte superiore angusta, cellulis inferioribus quadratis inornatis, cellulis exothecialibus subquadratis vel latioribus, appendicibus antherarum breviter ephippioformibus; styli inferne non incrassati glabri, appendicibus late clavatis laevibus intus glanduliferis; achaenia prismatica 5-costata setifera parce glandulifera; carpopodia distincta brevia obturaculiformia, cellulis parvis subquadratis, parietibus parum incrassatis; pappus setiformis uniseriatus, setis ca. 25 scabris tenuibuis, cellulis apicalibus acutis.

Species typica: Eupatorium monanthum Schultz-Bip.

The genus is monotypic.

Neohintonia monantha (Schultz-Bip.) R.M.King & H.Robinson, comb. nov. Eupatorium monanthum Schultz-Bip., Seem. Bot. Voy. Herald 299. 1856. Mexico.

Acknowledgement

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STUDIES IN THE EUPATORIEAE (ASTERACEAE). LXIII.

A NEW GENUS, KYRSTENIOPSIS

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Careful examination of the genera of the Eupatorieae of Mexico shows a single species, Eupatorium nelsonii, with numerous distinctive features and which we place here in a new genus, Kyrsteniopsis. The species is Critonioid in basic features although the habit is similar to some species of Ageratina (Kyrstenia). It is after this resemblance to Ageratina that we have choosen to name the plant.

The Mexican genera with which Kyrsteniopsis should be compared are Koanophyllon, Chromolaena subgenus Osmiella, Peteravenia, Dyscritogyne and Steviopsis. Kyrsteniopsis is distinct from Koanophyllon by the broader partly deciduous involucral bracts, by the longer ungrooved anther appendage, by the style branches not enlarged at the tip and the thicker layers of epidermal cells the ribs of the achene. The last feature is particularly marked because of the prominently sclerotized bases of the setae that are embedded in the epidermis. Kyrsteniopsis differs from all genera of the Koanophyllon complex by the smooth margins of the corolla lobes with rather elongate cells. In Koanophyllon, the margins of the corolla lobes always have some short cells which are partially projecting. Kyrsteniopsis differs from Chromolaena subgenus Osmiella by the more spreading partially persistent phyllaries, the rounded or tapering carpopodium with larger rounded cells, the cordate leaf bases, and the numerous short-capitate glands over the entire outer surface of the corollas. Steviopsis is distinct from Kyrsteniopsis by its whorled leaves, its slender phyllaries and its corolla without glands. Peteravenia also lacks glands on the corolla but in addition has distinctive pappus setae which are slender at the base and broad at the tips. Dyscritogyne has few or no glands on the corolla, no distinct carpopodium, many gland-tipped setae on the achene and much more massive floral parts. Attempts to relate the genus, Kyrsteniopsis to any particular member of the previous series have failed, but there seems to be least relationship to Koanophyllon and Steviopsis.

Both B.L.Robinson (1900) in his original description and a recent collection from near Tehuacan, R.M.King 2329 indicate the flowers are yellowish. Such a coloration would be very unusual for the Eupatorieae and attempts should be made to check this in the field.

The specimens we have seen show very short anther filaments

below the collars and though variable the longest are still slightly shorter than the shortest in any related genus. One speciemen, King 2329 has an unsclerotized portion in the middle of the collars and has more small cells above the carpopodium, but there are no other obvious differences.

Kyrsteniopsis R.M.King and H.Robinson, genus novum Asteraceearum (Eupatorieae). Plantae suffrutescentes erectae parce ramosae. Caules teretes inferne glabriusculi. Folia opposita distincte petiolata, laminis ovatis vel deltoideis parce hirsutis glanduliferis basi cordatis ad apicem acuminatis margine serrulatis vel integris. Inflorescentiae laxe paniculatae; pedicelli plerumque breves hirsuti. Involucri squamae subimbricatae 20-25 valde inaequilongae ca. 4-seriatae extus subglabrae interiores oblongae obtusae; receptacula leniter convexa glabra. Flores 10-16 in capitulo; corollae anguste infundibulares 5-lobatae extus glanduliferae intus glabrae, cellulis oblongis vel linearibus parietibus interioribus sinuosis, lobis aequilateraliter triangularibus vel leviter longioribus ubique laevibus; filamenta antherarum in parte inferiore perbrevia in parte superiore angusta, cellulis inferne quadratis, parietibus inornatis, cellulis exothecialibus subquadratis, appendicibus antherarum oblongis vel ovatis; styli inferne non nodulosi glabri, appendicibus late linearibus sublaevibus; achaenia prismatica 5-lobata, costis valde setiferis interdum glandiferis; carpopodia distincta, cellulis superioribus non scleroideis cuneatis, cellulis inferioribus quadratis vel ovalibus 3-5-seriatis; pappus setiformis uniseriatus, setis ca. 30 contiguis scabris ad apicem non dilatatis, cellulis apicalibus acutis.

Species typica: Eupatorium nelsonii B.L.Robinson

The genus is monotypic.

Kyrsteniopsis nelsonii (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium nelsonii B.L.Robinson, Proc. Amer. Acad. 35: 337. 1900. Mexico.

Acknowledgement

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Reference

Robinson, B.L. 1926. IV. New Phanerogams, chiefly Gamopetalae, from Mexico and Central America. 35: 323-342.

STUDIES IN THE EUPATORIEAE (ASTERACEAE). LXIV.

THE GENUS, KOANOPHYLLON.

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The genus Koanophyllon was described over one hundred and sixty years ago in a publication of very limited distribution. This name was overlooked by us in our listing of the Eupatorian genera (King & Robinson, 1969). As yet we have not seen a copy of the original publication but we have seen a partial translation by Koster in 1816 and a reprinted version with changed pagination dated 1895. It is the Koster translation which is cited in the Index Kewensis, although the 1810 publication seems perfectly valid.

The type species, Koanophyllon tinctoria was described as a dye plant with the common name, Anil de Pernambuco. This is apparently the same plant called Eupatorium tinctorum by Pohl in manuscript which Baker (1876) and Oliver (1892) identified as Eupatorium laeve DC.

The genus typified by Koanophyllon tinctoria is Critonioid in its general features being particularly distinctive in its usually short often somewhat reflexed anther appendage with a distinct medium groove running up the inner surface. The anther appendage in some species becomes divided almost into two seperate parts and the central portion sometimes seems like a seperate lobe overlapped by the two lateral portions. Even in K. simillimum of Paraguay, where the anther appendage is almost as long as wide, the medium groove is apparent and the apex is slightly but distinctly notched. We include in this treatment of the genus only those species having such grooved anther appendages.

Genera that we relate to but exclude from Koanophyllon are Eupatoriastrum which has a short grooved appendage but has a head with 150-300 flowers and with pales, Neohintonia with a short saddle-shaped appendage and usually one flower per head, Mexianthus with one flower per head and a pappus of broad scales, and Sphaereupatorium with a short unnotched appendage and heads usually paleaous in dense spherical clusters. There are a few related species in South America that have longer ungrooved anther appendages and there is a large complex in the West Indies which have a short ungrooved appendage. These latter groups, especially the West Indian, show numerous complications which are not yet resolved. Relationships of Koanophyllon on a broader scope include Critonia which differs by its lack of glands on the leaves and corollas and the presence of lactifers in the

areoles of the leaves. Chromolaena differs most prominently by the clasping phyllaries which dehisce instead of spreading as the plant ages.

We are not establishing subgeneric concepts in Koanophyllon but certain distinctive elements are evident. One group consisting of K. pittieri and K. hylonomum has leaves that are larger and not evidently trinervate at the base, phyllaries shorter and broader and tending to dehisce and anther sacs which are usually pointed at the base. The single species K. albicaule is distinct in the broad base of the achene with a larger rounder carpopodium. Unlike others of the genus, the separation of the veins in the base of the achene in K. albicaule takes place in the area of the carpopodium instead of higher. Almost all the species of Koanophyllon have a well developed paniculate inflorescence with paniculately or spicately organized branches. The one species, K. albicaule, differs here also in the corymbose branches and it thus resembles in habit such groups as Chromolaena, Ageratina, and the West Indian complex related to Koanophyllon.

There is one striking set of variations in Koanophyllon that does not represent anything of subgeneric potential. The common species, K. solidaginoides, has a rather standard Eupatorian pappus of many slender setae. A species of extremely close relationship is notable for its complete lack of pappus, and this has been described previously as Piqueria standleyii. There is yet a third species in this complex which has been noted in collections by many workers who have sometimes called it a Trichocoronis but who have usually declined to give any name. This species with a series of many close set very short setae is named as new in this paper.

The genus Koanophyllon with its typical element in Paraguay and Brazil extends northward along the eastern slopes of the Andes and has most of its species in Central America and Mexico. Some species extend northward into the Southwestern United States and one species, K. solidaginoides, is widely distributed in both Central and South America and is known from the Galapagos.

A few observed differences in pollen should be noted. One group of species, K. solidaginoides, K. standleyii, and K. ravenii seem to have longer spines on their pollen than are seen in the rest of the genus, while K. palmeri and K. solidaginifolium have only low papillae. Also, pollen matching what we have called Type II in the genus Stevia (King & Robinson, 1968) has been observed in K.coulteri.

Koanophyllon Arruda da Camara, Discurso sobre utilidade da instituicâo de jardins nas principaes provincias do Brazil, ... p. 38? 1810.

Plants shrubs or small trees or with long arching branches,

with few to many branches. Stems terete. Leaves opposite with short distinct petioles, lamina broadly lanceolate to elliptical with base acute truncate or cordate, surface with few or no short hairs and with glands numerous to very sparce, without lactifers in the areoles. Inflorescence laxly paniculate with spreading branches paniculate to spicate. Involucral bracts 7-16 eximbricate to subimbricate, unequal to subequal, spreading with age, in two species innermost short and deciduous at maturity. Receptacle glabrous, plain to slightly convex. Flowers 6 to ca. 20 per head, corollas tubular, 5-lobed, cells of tube narrow with rather sinuous walls, lobes as wide as long or wider and appearing very thin, smooth on both inner and outer surfaces, margins of lobes with numerous short irregularly projecting cells, backs of lobes with numerous short capitate glands and sometimes with a few short hairs, without stomates. Anther collar elongate usually with numerous quadrate cells below, sometimes with annular thickenings but usually inornate, base of collar unsclerotized in K. albicaule; exothecial cells subquadrate to wider than long; anther appendages wider than long sometimes very short, apical margin slightly to strongly recurved, longitudinally grooved on the middle of the inner surface and distinctly notched apically. Style base unenlarged and glabrous; stylar appendage distinctly enlarged apically and smooth at tip, without glands. Achenes prismatic with 5 costae, costae and upper part of lateral surfaces setiferous; few or no glands; carpopodia short and distinct usually narrowed below, with small subquadrate cells in many series, walls only slightly thickened; pappus long setose, short setose or lacking, setae scabrous, apical cells acute. Chromosome number determined as X = 10 based on K. albicaule, reported as Eupatorium cf. ligustrinum DC. (Turner, Ellison and King, 1961).

Type species: Koanophyllon tinctoria Arruda da Camara

Our studies of the genus indicate that it contains the following 21 species.

Koanophyllon albicaulis (Schultz-Bip. ex Klatt) R.M.King & H. Robinson, comb. nov. Eupatorium albicaule Schultz-Bip. ex Klatt, Leopoldina 20: 89. 1884. Mexico.

Koanophyllon celtidifolia (Lam.) R.M.King & H.Robinson, comb. nov. Eupatorium celtidifolium Lam., Encyc. 2: 406. 1788. Colombia, Ecuador, Guatemala? Jamaica, Lesser Antilles, Peru, Venezeula.

Koanophyllon coulteri (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium coulteri B.L.Robinson, Proc. Amer. Acad. 36: 477. 1901. Guatemala.

Koanophyllon flexilis (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium flexile B.L.Robinson, Proc. Amer. Acad. 55: 14. 1919. Peru.

Koanophyllon hondurensis (B.L.Robinson in Standley) R.M.King & H.Robinson, comb. nov. Eupatorium hondurense B.L.Robinson in Standley, Journ. Arnold Arb. 11: 44. 1930. Honduras.

Koanophyllon huantae (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium huantae B.L.Robinson, Contr. Gray Herb. n.s. 104: 16. 1934. Peru.

Koanophyllon hylonoma (B.L.Robinson) R.M.King & H.Robinson. comb. nov. Eupatorium hylonomum B.L.Robinson, Proc. Bost. Soc. Nat. Hist. 31: 250. 1904. Costa Rica, Mexico, Panama?

Koanophyllon hypomalaca (B.L.Robinson ex Donn. Smith) R.M.King & H.Robinson, comb. nov. Eupatorium hypomalacum B.L.Robinson ex Donn. Smith, Bot. Gaz. 35: 4. 1903. Guatemala.

Koanophyllon longifolia (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium longifolium B.L.Robinson, Proc. Amer. Acad. 36: 480. 1901. Mexico.

Koanophyllon mimica (Standl. & Steyerm.) R.M.King & H.Robinson, comb. nov. Eupatorium mimicum Standl. & Steyerm., Publ. Field Mus. Nat. Hist. Chicago, Bot. Ser. 23: 186. 1944. Guatemala.

Koanophyllon palmeri (Gray) R.M.King & H.Robinson, comb. nov. Eupatorium palmeri Gray, Proc. Amer. Acad. 21: 383. 1886. Mexico.

Koanophyllon pittieri (Klatt) R.M.King & H.Robinson, comb. nov. Eupatorium pittieri Klatt, Bull. Soc. Bot. Belg. 31: 192. 1892(1893). Costa Rica, Mexico, Panama.

Koanophyllon plicata (Urban) R.M.King & H.Robinson, comb. nov. Eupatorium plicatum Urban, Symb. Antill. 5: 523. 1908. Martinique.

Koanophyllon pseuoperfoliata (Schultz-Bip. ex Klatt) R.M. King & H.Robinson, comb. nov. Eupatorium pseudoperfoliatum Schultz-Bip ex Klatt, Leopoldina 20: 75. 1884. Mexico.

Koanophyllon ravenii R.M.King & H.Robinson, sp. nov.

Herba vel frutex. Folia opposita, petiolata: lamina usque ad 7 cm. longa, usque 4.5 cm. lata, ovata, basi subcordata, margine crenata, apice acuminata; inflorescentia spiciformi-paniculata usque ad 7.5 cm. longa; capitula ca. 6 mm. alta;

involucri squamae bi-triseriatae ca. 14; flores ca. 12; corolla glandulosa, pauce hirsuta; pappus breviter multisetosus.

MEXICO: Chiapas: El Chorreadero 5.6 miles east of Chiapa de Corzo along Mexican Highway 190. Municipio of Chiapa de Corzo. Elevation 2500 feet. 18 October 1965. Plant 4 feet tall. D.E. Breedlove & Peter H. Raven 13472 (Holotype MICH !).

Paratypes: MEXICO: Chiapas: Gradual heavily wooded slope 17 kilometers north of Tuxtla Gutiérrez along road to El Sumidero. Municipio of Tuxtla Gutiérrez. Elevation 4000 feet. 30 October 1965. Flowers white. Plant 2 feet tall. D.E.Breedlove 14005 (MICH !). El Chorreadero 5.6 miles east of Chiapa de Corzo along Mexican Highway 190. Municipio of Chiapa de Corzo. Elevation . 24 October 1966. Flowers white, shrub 5 feet tall. Robert M. Laughlin 2603 (MICH !). Encañada Chacona Aguacata. Encañada Chacona Aguacata (northeast of Tuxtla Gutiérrez). October 1, 1950. Faustino Miranda 6688 (MEXU, US).

Koanophyllon simillima (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium simillimum B.L.Robinson, Contr. Gray Herb. n.s. 77: 38. 1926. Argentina, Paraguary.

Koanophyllon solidaginifolia (Gray) R.M.King & H.Robinson, comb. nov. Eupatorium solidaginifolium Gray, Smiths. Contr. Knowl. 3(5): 87. 1852. Arizona, New Mexico, Texas, Northern Mexico.

Koanophyllon solidaginoides(H.B.K.) R.M.King & H.Robinson, comb. nov. Eupatorium solidaginoides H.B.K., Nov. Gen. et Sp. 4: 126. 1818. Ed. Folio. Brazil, British Honduras, Colombia, Costa Rica, Ecuador, Honduras, Mexico, Panama, Peru, Salvador, Venezuela.

Koanophyllon standleyi (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Piqueria standleyi B.L.Robinson, Contr. Gray Herb. n.s. 104: 4. 1934. Salvador.

Koanophyllon stipulifera (Rusby) R.M.King & H.Robinson, comb. nov. Eupatorium stipuliferum Rusby, Mem. Torrey Bot. Club 4: 210. 1895. Argentina, Bolivia.

Koanophyllon tinctoria Arruda da Camara, Discurso sobre utilidade da instituição de jardins nas principaes provincias do Brazil, - - - p. 38 ? 1810. Brazil.

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STUDIES IN THE EUPATORIEAE (ASTERACEAE). LVIII.

A NEW GENUS, TAMAULIPA.

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In our studies of the Eupatorieae, the species named here as a new genus has long been recognized as distinctive. We have delayed dealing with this genus primarily to gain better insight into relationships. The problem is one of parallelisms reaching even the microscopic level. Briefly stated, Tamaulipa has the technical characters of the Critonioid series of genera but is apparently related to the Gyptoid series.

One of the basic problems in the subdivisions that we recognize in the Eupatorieae is the possibly artifical nature of the Critonioid series. It is these plants that are distinguished by their lack of specialization of all parts. The style bases and appendages are plain, the corolla lobes are smooth on both surfaces, the anther appendages and collars are not distinctive and the achenes including the carpopodia are not remarkable in any way. It is the Critonioid series that has been most difficult to resolve into its component parts and it is here that parallelism can be most difficult to recognize. We continue to recognize the Critonioids as a group primarily because of very real evidence of relationship within the group. Tamaulipa would seem to be one of the few genera having Critonioid characters that is not closely related.

Evidence of the true relationship of Tamaulipa is available from two sources. The first source is a critical survey of the Critonioid genera in which the closest resemblance is found in a group of Andean species including what is presently called Eupatorium salvia Colla with its broad rimlike carpopodium and especially Eupatorium lamifolium H.B.K. with its conical receptacle. Aside from a critical difference in phyllaries mentioned below, there are reasons for doubting any real relationship between these and Tamaulipa. There is a great geographical gap between the ranges of Tamaulipa and the Andean species and Tamaulipa is in dry areas at low elevations quite unlike anything in the Andes. There is no indication of any intermediate forms between these extremes.

By following more standard approaches to the study of the Eupatorieae, the true relationship of Tamaulipa is evident. The phyllaries are of the eximbricate type seen in the genus Conoclinium which occurs in the same geographical region. The receptacle is usually conical as in Conoclinium. Even more indicative is the pedicel which is enlarged above as in

Conoclinium, and which is hollow as in C. greggii. Tamaulipa is related to Conoclinium but differs by its smooth corolla lobes and style branches, by the pointed apical cells on the pappus setae and by the broader base of the achene with a more distinctive carpopodium. It is precisely these papillae of the corolla lobes and style branches and the blunt tips on the pappus setae that mark Conoclinium as a Gyptoid genus.

Botanists may take comfort in the fact that traditional methods could have arrived at this answer with little difficulty. We believe, however, that it is important to be certain of such results.

Tamaulipa R.M.King & H.Robinson, genus novum Asteracearum (Eupatorieae). Plantae frutescentes vel suffrutescentes erectae parce ramosae. Caules teretes leniter striati inferne glabriusculi. Folia opposita distincte petiolata, laminis deltoideis adaxialiter parce hirsutis abaxialiter densius hirsutis et glanduliferis margine subserrulatis vel dentatis. Inflorescentiae corymbosae; pedicelli hirsuti superne latiores interne cavi. Involucri squamae eximbricatae 30-35 parce pubescentes ca. 2-3-seriatae interiores subaequilongae exteriores irregulares; receptacula conica vel convexa glabra. Flores 40-70 in capitulo; corollae anguste tubulares 5-lobatae extus inferne glabrae intus glabrae, cellulis oblongis vel linearibus parietibus sinuosis, lobis aequilateraliter triangularibus crassiusculis extus glanduliferis intus laevibus; filamenta antherarum in parte superiore angusta, cellulis elongatis basilaribus quadratis, parietibus annulate ornatis, cellulis exothecialibus subquadratis, appendicibus antherarum oblongis vel ovatis; styli inferne non nodulosi glabri, appendicibus late linearibus vix papillosis; achaenia prismatica ca. 6-costata setifera; carpopodia aliquantum indistincta, cellulis parvis quadratis 3-4-seriatis in annulis angustis; pappus setiformis uniseriatus, setis ca. 35 scabris gracilibus, cellulis apicalibus acutis vel subacutis.

Species typica: Eupatorium azureum A.P.Decandolle

Chromosome number determined as X = 10 (Turner & Flyr, 1966).

The genus is monotypic.

Tamaulipa azurea (A.P.Decandolle) R.M.King & H.Robinson, comb. nov. Eupatorium azureum A.P.Decandolle, Prodr. 5: 168. 1836. Texas, Northeast Mexico.

Reference

Turner, B.L. & David Flyr 1966. Chromosome numbers in the

Compositae. X. North American species. Amer. Jour. Bot. 53: 24-33.

Acknowledgement

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STUDIES IN THE EUPATORIEAE (ASTERCAEAE). LIX.

A NEW GENUS, STEVIOPSIS.

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In Steviopsis we have an example of a single localized extremely distinctive species. Recognition of such genera presents no problem, and we establish the concept now as part of our attempt to complete the generic reorganization of the Mexican Eupatorieae. Actual relationships of the genus remain in question though some possibilities can be discussed.

Steviopsis is thoroughly distinct in its narrow whorled leaves, long pedunculate heads with eximbricate phyllaries and corolla lobes longer than wide and non-glandular. The achene is also rather distinctive, being densely setose with a poorly developed carpopodium. The species was originally named as a Stevia and vegetatively resembles some of the species of that genus. Stevia differs from Steviopsis by the papillose inner surfaces of the corolla lobes, the hairs inside the corolla, the distinctive obovate anther appendages and the five flowers per head.

In basic characters, Steviopsis is Critonioid. The corolla lobes are smooth on both surfaces, the style base has neither enlargement nor hairs and the stylar appendages are only slightly mamillose. The genus Tamaulipa has similar eximbricate phyllaries but differs in all the other distinctive features given above. The very broad flat style branches, the glabrous corollas and the restriction to the Mexican highlands have caused us to associate this genus with Dyscritogyne, but that genus has imbricated multiseriate phyllaries, more prominent anther collars with many short quadrate cells, and opposite to subopposite leaves. It is useless to seek relatives among the larger genera such as Koanophylon with its broad glandular corolla lobes, or Critonia with its imbricate stramineous phyllaries.

Steviopsis R.M.King & H.Robinson, genus novum Asteracearum (Eupatorieae). Plantae herbaceae erectae raro ramosae. Caules teretes leniter striati inferne glabriusculi. Folia verticillata breviter petiolata, laminis anguste lanceolatis breviter pubescentibus nonglanduliferis serrulatis. Inflorescentiae laxe paniculatae; pedicelli saepe breves. Involucre squamae eximbricatae 20-30 parce pubescentes ca. 2-3-seriatae interiores subaequilongae exteriores irregulares; receptacula leniter

convexa glabra. Flores 15-20 in capitulo; corollae anguste infundibulares 5-lobatae extus et intus glabrae, cellulis oblongis vel linearibus parietibus exterioribus sinuosis, lobis aliquantum elongatis laevibus; filamenta antherarum in parte superiore brevia, cellulis plerumque elongatis inferne quadratis, parietibus annulate vel intricate ornatis, cellulis exothecialibus subquadratis vel brevioribus, appendicibus antherarum oblongis; styli inferne non nodulosi glabri, appendicibus sensim taeniatis sublaevibus; achaenia prismatica 4-5-costata dense setifera et glandulifera; carpopodia indistincta, cellulis quadratis multiseriatis non scleroticis; pappus setiformis uniseriatus, setis 25-30 scabris ad apicem rigidis non dilatatis, cellulis apicalibus acutis.

Species typica: Stevia rapunculoides A.P.Decandolle

The genus is monotypic.

Steviopsis rapunculoides (A.P.Decandolle) R.M.King & H.Robinson, comb. nov. Stevia rapunculoides A.P.Decandolle, Prodr. 5: 124. 1836. Eupatorium dasycarpum A.Gray ex S. Watson, Proc. Am. Acad. 22: 420. 1887. Mexico.

Acknowledgement

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STUDIES IN THE EUPATORIEAE (ASTERACEAE). LX.

A NEW GENUS, DYSCRITOGYNE.

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The genus Dyscritogyne named here as new, provides another opportunity to test Eupatorian characters at the species level in comparison to the genus level. The genus contains two species which are unquestionably distinct, with a macroscopic difference in leaf shape and microscopic differences in corolla pubescence. The geographical ranges of the species seem to be close but not overlapping. Still, the two species are strikingly alike in their slender erect stems, short-petiolate leaves, multiseriate imbricate phyllaries, densely glandular achenes, glabrous corolla lobes, anther collars with very numerous short quadrate cells and style branches very broadly strap-shaped. It is clear that the differences between the two species are of a totally different order than those used here to distinguish the genus.

The genus Dyscritogyne would fall in the large complex we call Critonioid and is perhaps close to the genus Steviopsis of the same general region. The latter genus does have similar glabrous corolla lobes and broad style branches, but has eximbricate phyllaries and whorled leaves. The imbricate phyllaries and the scattered hairs inside the corolla of one species suggest a far more remote relationship to the so called Eupatorium niveum of the Andes. The latter species and its close relatives are distinct by the glands on their corolla lobes and by their highly developed carpopodia.

The genus is rather distinctive by its broad style branches but is even more distinct in the thickness of the base of the style. In some cases the stylar base shows very slight papillosity unlike anything seen in other genera. The generic name is inspired by these distinctive features of the styles along with the remarkably glandular achenes.

Dyscritogyne R.M.King & H.Robinson, genus novum Asteracearum (Eupatorieae). Plantae herbaceae erectae raro ramosae. Caules teretes leniter striati glabri. Folia opposita vel alterna breviter petiolata, laminis ovatis minute glanduliferis basi rotundatis vel truncatis ad apicem acutis margine subserrulatis. Inflorescentiae laxe paniculatae interdum corymbosae; pedicelli longi graciles. Involucri squamae subimbricatae ca. 35-40 glabrae valde inaequilongae ca. 4-6-seriatae basilares perbreves; receptacula plana vel leniter convexa glabra. Flores 11-16 in capitulo; corollae anguste infundibulares 5-lobatae

extus glabrae intus glabrae vel pauce hirsutae, cellulis oblongis parietibus exterioribus sinuosis, lobis aequilateraliter triangularibus extus et intus laevibus; filamenta antherarum in parte superiore incrassata, cellulis plerumque quadratis vel brevioribus, parietibus intricate ornatis, cellulis exothecialibus subquadratis vel brevioribus, appendicibus antherarum oblongis vel ovatis; styli incrassati inferne non nodulosi glabri vel pauce papillosi, appendicibus taeniatis sublaevibus; achaenia prismatica 4-5-costata valde glanduloso-setifera; carpopodia nulla; pappus setiformis uniseriatus vel biseriatus, setis ca. 35-40 rigidis scabris ad apicem non vel leniter dilatatis, cellulis apicalibus acutis.

Species typica: Eupatorium adenospermum Schultz-Bip.

Key to species of Dyscritogyne

1. Leaves narrowly ovate to lanceolate, often alternate; corollas with scattered hairs inside. D. adenosperma

1. Leaves broadly ovate, opposite; corollas glabrous inside. D. dryophila

Our studies of the genus indicate that it contains the following two species.

Dyscritogyne adenosperma (Schultz-Bip.) R.M.King & H.Robinson, comb. nov. Eupatorium adenospermum Schultz-Bip. Seem. Bot. Voy. Herald 299. 1854. Mexico.

Dyscritogyne dryophila (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium dryophylum B.L.Robinson, Proc. Am. Acad. 36: 478. 1901. Mexico.

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STUDIES IN THE EUPATORIEAE (ASTERACEAE). LXI.

ADDITIONS TO THE HEBECLINIUM COMPLEX WITH BARTLETTINA, A NEW GENERIC NAME.

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Dr. G.F.J.Pabst, Director of the Herbarium Bradeanum in Rio de Janiro, Brazil has brought to our attention that our genus Neobartlettia is a later homonym of Neobartlettia Schlechter in the Orchidaceae. The earlier name is clearly listed in Index Kewensis and we are unable to explain the oversight. We wish here to establish a new name for the genus of Asteraceae and to make certain additions to the related genera, Hebeclinium and Guayania.

In selecting our new name, we are again seeking to honor H.H.Bartlett.

Bartlettina R.M.King & H.Robinson, nom. nov. for Neobartlettia R.M.King & H.Robinson, Phytologia 21: 294-297. 1971. non. Neobartlettia Schlechter.
Type species: Eupatorium tuerckheimii Klatt.

Bartlettina brevipetiolata (Schultz-Bip. ex Klatt) R.M.King & H.Robinson, comb. nov. Hebeclinium brevipetiolatum Schultz-Bip. ex Klatt, Leopoldina 20: 90. 1884.

Bartlettina constipatiflora (Klatt) R.M.King & H.Robinson, comb. nov. Eupatorium constipatiflorum Klatt, Ann. Naturh. Hofmus. Wien 9: 355. 1894.

Bartlettina ehrenbergii (Hemsl.) R.M.King & H.Robinson, comb. nov. Eupatorium ehrenbergii Hemsl., Biol. Centr. Am. Bot. 2: 94. 1881.

Bartlettina hastifera (Standl. & Steyerm.) R.M.King & H.Robinson, comb. nov. Eupatorium hastiferum Standl. & Steyerm. Field Mus. Publ. Bot. 22: 303. 1940.

Bartlettina hemisphaerica (A.P.Decandolle) R.M.King & H.Robinson, comb. nov. Eupatorium hemisphaericum A.P.Decandolle, Prodr. 5: 158. 1836. We have seen material of this species from Copenhagen distributed by Lund which is apparently typical. This seems to be the same as the more recently named Eupatorium mexiae B.L.Robinson listed in our previous treatment.

Bartlettina hylobia (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium hylobium B.L.Robinson, Proc. Bost. Soc. Nat. Hist. 31: 249. 1904.

Bartlettina karwinskiana (A.P.Decandolle) R.M.King & H.Robinson, comb. nov. Eupatorium karwinskianum A.P.Decandolle, Prodr. 5: 163. 1836.

Bartlettina luxii (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium luxii B.L.Robinson, Proc. Amer. Acad. 36: 480. 1901.

Bartlettina maxonii (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium maxonii B.L.Robinson, Proc. Amer. Acad. 54: 251. 1918.

Bartlettina oresbia (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium oresbium B.L.Robinson, Proc. Amer. Acad. 35: 337. 1900.

Bartlettina oresbioides (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium oresbioides B.L.Robinson, Proc. Amer. Acad. 44: 618. 1909.

Bartlettina paezense (Hieron.) R.M.King & H.Robinson, comb. nov. Eupatorium paezense Hieron., Engl. Bot. Jahrb. 28: 574. 1901.

Bartlettina pansamalensis (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium pansamalense B.L.Robinson, Proc. Amer. Acad. 36: 482. 1901.

Bartlettina pinabetensis (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium pinabetense B.L.Robinson, Proc. Amer. Acad. 36: 482. 1901.

Bartlettina platyphylla (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium platyphyllum B.L.Robinson, Proc. Amer. Acad. 35: 339. 1900.

Bartlettina prionophylla (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium prionophyllum B.L.Robinson, Proc. Amer. Acad. 36: 484. 1901.

Bartlettina ruae (Standl.) R.M.King & H.Robinson, comb. nov. Eupatorium ruae Standl., Ceiba 1: 49. 1950.

Bartlettina sordida (Less.) R.M.King & H.Robinson, comb. nov. Eupatorium sordidum Less., Linnaea 4: 403. 1831.

Bartlettina tuerckheimii (Klatt) R.M.King & H.Robinson, comb. nov. Eupatorium tuerckheimii Klatt, Leopoldina 20: 95. 1884.

An additional species has been found belonging to the genus Hebeclinium. The species is the most southern of the localized members of the genus.

Hebeclinium hylophorbum (B.L.Robinson) R.M.King & H.Robinson, comb. nov. Eupatorium hylophorbum B.L.Robinson, Contr. Gray Herb. n.s. 104: 16. 1934. Peru.

An additional species of Guayania shows distinctive features including the dwarfed rosette forming habit and a corolla without hairs on the backs of the lobes.

Guayania bulbosa (Aristeguieta) R.M.King & H.Robinson, comb. nov. Eupatorium bulbosum Aristeguieta, Mem. N.Y. Bot. Gard. 9: 367. 1957. Venezeula.

Reference

King R.M. & H.Robinson 1971. Studies in the Eupatorieae (Asteraceae). XXXVI. A new genus, Neobartlettia. Phytologia 21: 294-297.

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NOVITATES ANTILLANAE. V (1)

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MISCELLANEOUS NEW SPECIES FROM THE DOMINICAN REPUBLIC.

Three years of field work in the Dominican Republic have accumulated a large number of collections, which are been worked upon as time permits; the new species here described form a continuation of the previously published paper by the author: Novitates Antillanae. IV. Mem. N.Y. Bot. Garden 21 (2): 107-157. 1971. As exploration continues in Hispaniola, one gets to realize that the flora of the island is one of the richest in the Caribbean, chiefly if we consider the species density in the various islands. Oddly enough, Hispaniola was the first place in the West Indies to be visited by botanists, and nevertheless there are still many places awaiting exploration; it is still easy to collect rare plants within a relatively short radius from the main cities in the Dominican Republic.

LONCHOCARPUS ELLIPTICUS Alain, sp. nov.

Frutex gracilis 1-2 m altus, pauciramosus, novelli tereti dense ferrugineo-furfuracei, vetustiores grisei lenticellosi; stipulae oblongae, 1 mm longae; folia simplicia elliptica vel obovato-elliptica, 2.5-5 cm longa, 1.5-3 cm lata, apice obtusa vel rotundata, basi rotundata vel obtusa nervo medio supra prominulo subtus prominente, lateralibus utroque latere 5-8, supra in sulco prominulis, subtus prominentibus, ad marginem antrorse curvatis, margine integra, supra in statu juvenili dense brunneo-pilosa, mox tenuiter pilosula, bullata, subtus dense pallide brunneo-pilosa, nervis fuscatis coriacea. Inflorescentiae cum pedunculo usque 5 cm longae, dense rufo-pilosulae, bracteae lanceolatae 2 mm longae, pedicelli primarii 1.5-2 mm longi, prophylla ovata vel deltoidea, 2 mm longa; flores subsessiles, calyx campanulatus 4 mm longus, dentibus depressis 0.2 mm altis; corolla violacea, vexillum 1 cm longum explanatum 8 mm latum, apice rotundatum vel leviter emarginatum, basi abrupte in unguiculum 0.5 mm longum contractum, ad centrum

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viridis; alae carina connatae oblongae 8 mm longae, apice rotundatae, 2.5 mm latae, ungue 2.5 mm longo; carinae petala basi libera ad medium connata, ad apicem breviter libera, apice rotundata, ungue 2 mm longo; stamen vexillare basi ipsa liberum caeterum cum aliis connatum, omnia in parte 1/4-1/5 superiore libera, antherae ovatae uniformes 0.8 mm longae, ovarium lineare 8 mm longum brevissime et dense pilosum, stylus incurvus glaber, stigma leviter capitatum; legumen non visum.

Type. On limestone rocks, near the bottom of a gorge, Hoyo de Pelempito, Baoruco Mts., Pedernales, 3-8 July 1971, Alain Liogier 18133 (holotype, NY; isotypes, US, GH, P, IJ); 6 Nov 1969, A. Liogier 16727, sterile (NY).

This species stands out in the genus for its 1-foliolate leaves; it resembles somewhat L. neurophyllus Urb., in which the leaves are 5-9-foliolate, the leaflets are glabrescent above, the inflorescence is larger and branched, densely ferrugineo-pubescent, the wings of the corolla are free from the carina. There is another species of 1-foliolate Lonchocarpus, L. monophyllus Urb., from Anse a Chaud, Barahona, which has linear-lanceolate leaves, acute at the apex; the leaves are glabrescent, with the midnerve impressed above.

Lonchocarpus pycnophyllus Urb., known heretofore from the type collection in Haiti (Anse a Pitre), has since been collected in the Cabo Rojo area, Pedernales (Alain Liogier 13739, 16633), the only known locality in the Dominican Republic; it is conspicuous because of its lanceolate, glabrescent leaflets 4-8 mm wide. Our specimen has 1-3-foliolate leaves. Add to the original description:

Legumen lineare 1.5-4 cm longum 6 mm latum, obscure brunneorubrum, apice rotundatum, breviter et sparse pilosulum.

BERNARDIA FRUTICULOSA Alain, sp. nov.

Fruticulus decumbens ca. 40 cm altus, monoecus, ramuli teretes pilosuli, vetustiores grisei glabrescentes; stipulae lineari-subulatae, ca. 1 mm longae, pilosulae; folia: petiolus 1-2 mm longus, pilosulus, lamina elliptica vel oblongo-elliptica, basi et apice rotundata vel obtusa, vel apice versus sensim angustata, 2-2.6 cm longa, 1-1.3 cm lata, nervo medio supra impresso subtus prominente, lateralibus utroque latere 3-4 supra leviter impressis subtus prominulis, venis supra nullis subtus paucis tenuibus, supra glabra vel pilis simplicibus sparsissimis obsita, in sicco

griseo-viridia, subtus ad nervos et venis parcissime pilis stellatis suffulta, pallidiora, margine breviter dentata. Inflorescentiae masculae globosae in axillis superioribus pedunculi usque 4 mm longi, pilis simplicibus pubescentes, bracteae 1-3, late ovatae vel triangulares, 1.5 mm longae et latae, acutae, flores in quaque bractea 1-3, pedicelli usque 1.5 mm longi, rubri; sepala 4 viridia in aestivatione valvata libera ovato-elliptica acuta, 1.5 mm longa dorso pilis simplicibus obsita 1-nervia, petala nulla; disci glandulae nullae, stamina libera, in aestivatione glomerulum globosum formantia, filamenta linearia 0.5 mm longa, antherae subquadratae lateraliter dehiscentes, squamulae inter filamentos minutissimae oblongae pro staminodiis estimandae, ovarii rudimentum nullum. Inflorescentiae femineae axillares paucifloraе, bracteae ovatae, ca. 1.5 mm longae pilosae; sepala 3 late ovata, 1.5 mm longa et lata, extus pilosa, petala nulla, discus basi sepalis adnatus superne liber, basim ovarium cingens lobulis inaequalibus; ovarium globosum obtuse trigonum, dense pilosum; styli multiramosi 2-2.5 mm longi; capsula non visa.

Type. Deep gorge among limestone rocks mixed with bauxite, Aceitillar-Cayo, Sierra del Baoruco, Pedernales, alt 1,300 m, 9 Feb 1969, Alain Liogier 13693 (holotype, NY; isotypes, US, GH, IJ, P).

I have seen nothing alike in this genus; the small leaves, the short globose pistillate inflorescence, the decumbent habit are good distinguishing characters; all other species have larger leaves, and usually larger inflorescence; the other endemic species in Hispaniola, B. tenuifolia Ub. has leaves 2-6 cm long, the parts are provided with 2-branched or simple hairs, the scales in the staminate flowers are at the center, the pistillate flowers have 4-5 sepals.

THOUINIDIUM INAEQUILATERUM Alain, sp. nov.

Arbor parva gracilis usque ad 8 m alta vel frutex; rami brunnei vel griseo-brunnei, sparse lenticellosi, ramuli teretes patente pilosuli brunnei; folia pari-pinnata, 1-3-juga rachis cum petiolo usque 5 cm longa pilosula; foliola opposita 1 mm longe petiolata, ovata vel ovato-orbiculata, valde inaequilatera 2.5-5 cm longa, 2-3.8 cm lata, apice rotundata vel emarginata, basi rotundata usque subcordata, latere proximo breviora, margine integerrima plana, chartacea, nervis lateralibus utroque latere 3-5, vel obsoletis, venis dense reticulatis, supra nitidis subtus opaca, glabra. Paniculae densiflorae usque 10 cm longae, adpresse pilosulae, pilis antrorsis; bracteae ovato-oblongae, 1 mm longae, pedicelli usque 2 mm longi. Flores fragantes, sepala 5, oblonga vel oblongo-elliptica, imbricata, exteriora breviora, 2 mm longa

interiora 3 mm longa, omnia apice rotundata extus pilosula brunnea margine pallidiora intus glabra; petala 5 alba, basi ungue angusto 2 mm longo munita, limbo suborbiculari 3 mm diam, utroque latere adpresse antrorse pilosa, intus supra unguem squama semiorbiculari dense pilosa munita, discus annularis crenatus; stamina 8, filamenta 1-1.5 mm longa antrorse pilosa, antherae sagittatae 1 mm longae; ovarium trilobulatum viride 3 mm longum apice sparse pilosulum, stylus columnaris apice paullo dilatato 1.5 mm longo. Fructus loculi 1.5 cm longi 1 cm lati alae 1.5-2 cm longae, 1 cm latae, reticulatae nitidae margine dorsali recto ventrali undulato, apice rotundatae vel attenuatae.

Type. On dogtooth limestone rocks, near sea level, Cabo Rojo, Pedernales, 3-7 July 1971, Alain Liogier 18114 (holotype, NY; isotypes, US, GH, P, IJ).

This tree is very common around Cabo Rojo and on the dogtooth limestone between Cabo Rojo and Oviedo, growing at altitudes from sea level to about 200 m. The white flowers are really beautiful, fragrant and visited by bees.

This species is related to T. pinnatum (Turp.) Radlk.; the main differences are as follows:

a. Leaflets obovate-oblong, the midrib central, subacute to attenuate at base; petals about 3 mm long with a claw nearly as wide as the blade, sepals oblong. T. pinnatum.
a. Leaflets ovate to ovate-orbiculate, the midrib conspicuously off-center, the distal half wider; petals 5 mm long, the claw narrow; sepals rounded. T. inaequilaterum.

CISSUS RUBRINERVIA Alain, sp. nov.

Scandens ramosa, usque 8 m longa, rami striati vetustiores tuberculati, ramuli praesertim ad nodos pilosuli, stipulae orbiculares 3-4 mm diam, folia alterna petiolo 3.5-5.5 cm longo in sicco striato, apice piloso, foliola 3, lateralia 3-5, terminale 5-6 mm longe petiolulatum, terminale rhombeum vel oblanceolatum, 6-12 cm longum, 3-5.5 cm latum, apice breve acuminatum basi longe angustatum, basalia oblique obovata, apice rotundata vel obtusa, basi angustata 4.5-6 cm longa, 2.5-4 cm lata, omnia supra nervo medio in sulco prominulo, lateralibus obsoletis vel utroque latere 3-4 leviter prominulis, subtus prominentibus, in vivo rubris, margine dentibus subulatis brunneis 1 mm longis suffulta, supra glabra opaca, subtus ad nervos pilosula, venis nullis membranacea. Inflorescentiae axillares laxiflorae cum pedunculo usque 14 cm longae pedunculi et pedicelli 2-4 mm longi, calyx depressus, margine integer, undulatus, 2 mm diam, discus bene evulutus, 4-crenatus, petala flavescentia 3 mm longa, triangularia, cucullata apice inflexa, filamenta 0.7 mm lon-

ga antherae ovatae, stylus 1 mm longus; bacca (in paratypo A. Liogier 16207) obovata 6 mm longa, stylo persistente coronata.

Type. In woods at the base of a cliff, limestone outcrops, Carlos Díaz, Cordillera Septentrional, 19 Sep 1968, Alain Liogier 12722 (holotype, NY; isotypes, US, GH, P., IJ); in thickets at the base of a cliff, Sierra de Yaroa, limestone crest facing the Yaroa valley, Puerto Plata prov., alt 800-850 m, 2 Oct 1969, Alain Liogier 16207 (NY, US, GH, P, IJ).

This plant is peculiar by its red nerves on the underside of the leaves; its red inflorescence with creamy petals is similar to many other species in this genus. In the Antilles we have three similar species, C. tuberculata Jacq., C. microcarpa Vahl, and C. rhombifolia Vahl. C. tuberculata has smaller leaves, its flowers are smaller and red, the stipules are triangular and much smaller; C. microcarpa has acuminate leaflets, smaller flowers and shorter inflorescence; C. rhombifolia has more ovate leaflets, all are also acuminate, the flowers are also much smaller and the stipules are oblong.

OSSAEA GRACILIS Alain, sp. nov.

Frutex 1.5 m altus, rami hornotini teretes pilis brevibus brunneo-furfuracei vetustiores brunnei glabrescentes; folia petiolis parium subaequilongis 2-2.5 mm longis teretibus indumento ramorum praeditis suffulta, anguste ovato-lanceolata, 1.3-2.8 cm longa, 4-8 mm lata, apice versus sensim acuminata apice ipso rotundata, basi obtusa vel rotundata, e basi trinervia nervo medio supra impresso subtus prominulo lateralibus supra vix impressis subtus leviter prominulis, nervis lateralibus supra obsoletis subtus utroque latere 8-12, tenuibus, venis subtus laxe reticulatis supra pilis brevissimis sparse strigosa, subtus ad nervos brunneo-furfuracea multo pallidiora, margine integra ciliata, membranacea. Flores axillares solitarii, pedunculi usque 3 mm longi, bracteae oblongae vel ovatae, usque 0.7 mm longae, obtusae, pedicelli filiformes 8-11 mm longi, indumento ramulorum, 1-1.5 mm sub calyce bracteolis 2 linear-oblongis 0.6 mm longis muniti; calycis tubus obovatus griseo-furfuraceus, 2.7 mm longus, lobi 4 lineares o.8 mm longi; petala rubra vel rosea, triangularia, acuta, 1.8 mm longa, basi 1 mm lata; filamenta 1 mm longa, antherae 1 mm longae, connectivo infra loculos non producto, stylus 3 mm longus, stigma convexum stylo parum crassior.

Type. Common in underbrush, in cloud forest, Monteada Nueva, "Caña Brava", alt. 1,300 m, Barahona Mts., 15 Jun 1968, Alain Liogier 11622 (holotype, NY; isotypes, US, GH, P, IJ); 29 Feb 1969, Alain Liogier 14249 (NY, GH, US, P, IJ).

This shrub at first sight reminds the collector of some spe-

cies of Clidemia, particularly C. insularis Domin (C. capillaris Griseb., not D.Don) and C. fuertesii Cogn.; the petal shape clearly belongs to Ossaea; the unique size and shape of the leaves, the capillary pedicels, the solitary flowers distinguish this species from all other Ossaea species in Hispaniola.

Considering the closeness of the two genera, Ossaea and Clidemia, I have come to question the usefulness of keeping them apart on the basis of the petal shape only, which is rounded in Clidemia and acute to acuminate in Ossaea. Though unable to find any other differences, the separation of two genera by the petal shape only seems to be a consistent character in several well-defined genera, as can be gathered from the literature on the subject.

CYNANCHUM PARVIFLORUM (R. Br.) Alain, Bull. Torr. Bot. Club 90: 191. 1963.

This species heretofore known from Puerto Rico and the Lesser Antilles has been collected by the author in several places in the Dominican Republic: Copey, Montecristi, Alain Liogier 16387; Piedra Gorda, Santiago, A. Liogier 12665, 13534; Jaiquí Picado, Santiago, A. Liogier 15214; Oviedo to Los Salados, A. Liogier 16992.

The Hispaniolan specimens have smaller leaves, but the other characteristics completely agree with the description and with the specimens available; the most important character is the stipitate gynostegium.

CYNANCHUM PENICILLATUM (Griseb.) Alain, Mem. Soc. Cub. Hist. Nat. 22: 118. 1955.

This species was until now considered as an endemic to Cuba; the specimens collected by me in the Dominican Republic show the same characters with slight variations in the location of the barbs inside the corolla lobes, these in the Cuban specimens are at the very tip of the petals on the inner side, while in the Dominican Republic specimens they are slightly below the tip. This species seems to grow always on serpentine soil. DOMINICAN REPUBLIC: Barrancón, Bonao, Alain Liogier 14870, 15177 Loma del Puerto, Jarabacoa, A. Lavastre 892; A. Liogier 12434, 15728; Sierra Prieta, Villa Mella, A. Lavastre 1982, 1333; La Manaclita, La Vega, A. Liogier 15824; La Leonor, Moncion, A. Liogier 13256.

MATELEA SYLVICOLA Alain, sp. nov.

Scandens 1.5 m alta, rami teretes striati sparse pilosi; folia petiolis 8-10 mm longis, lamina oblongo-lanceolata, 7.5-9.5 cm longa, 1.2-1.5 cm lata, apice longe acuminata, basi rotunda-

ta nervo medio supra impresso ad basim glandulas 2 oblongas brunneas obsito, subtus applanato vel prominulo, lateralibus nullis vel utroque latere 10-15, membranacea glabra margine integra; inflorescentiae sessiles 1-3-florae, pedicelli 1-2 cm longi minute pilosuli, basi bracteas 1-2 lineares usque 2.5 mm longas gerentes; sepala ovato-acuminata, 5 mm longa ad basim 2 mm lata, glabra; corolla rotacea 1.5-2 cm diam, viridis, ad centrum brunnea, usque ad medium gamopetala, lobi semi-elliptici 7 mm longi basi 5-7 mm lati utrinque glabri, utrunque praesertim supra in fundo flavescente brunneo-reticulati membranacei corona exterior valde evoluta cupuliformis 0.8 mm alta in lobis 5 oblongis 1 mm longis producta, interior laciniis filiformibus 1 mm longis reducta; pollinia reniformia 0.4 mm longa flavida, brachii breves, glandula brunnea 0.1 mm longa.

Type. In wet ravine, in forest, Ciénaga de la Culata, Constanza, alt 1,600-1,700 m, 15-16 Oct 1968, Alain Liogier 13029 (holotype, NY; isotype, US); in woods, Cabezada de la Ciénaga de la Culata, Constanza, alt 1650 m, 16 Oct 1968, Alain Liogier 13069 (NY, US).

This species reminds M. annulata Alain, but this last species has lanceolate-subulate sepals 1 cm long, the corolla lobes are ovate, 7-8 mm long, the corolla is ring-shaped, crenate at the rim, without appendages. The leaves are shorter (4-5 cm long) and not long-acuminate. M. oblongata (Griseb.) Woods. has similar leaves, but the flowers are much smaller and of different shape, always campanulate, never rotate.

MATELEA VIRIDIVENIA Alain, sp. nov.

Volubilis usque 1.5 m longa; rami teretes pilosi, non striati, ramuli dense retrorso-patenti-pilosi; folia 2-4 mm longe petiolata, oblonga vel obovato-oblonga, 8-11 mm longa, 2-4.5 mm lata, apice rotundata breviter apiculata, basi angustata, nervo medio supra leviter impresso, subtus prominulo, lateralibus nullis, supra et subtus breve patenti-pilosa, membranacea, viridia. Flores plerumque solitarii axillares, pedicelli 3-4 mm longi breviter pilosi, bracteae lineares 0.8 mm longae, sepala lineari-subulata 3 mm longa basi 0.8 mm lata, extus pilosa; corolla albescens lineis viridibus reticulata, rotata 12 mm diam, lobis 5 late triangularibus apice acutis 2 mm longis 4 mm latis infra pilosis extus pilosis membranaceis; gynostegium sessile leviter 5-angulare, 5 mm diam, coronae lobi basi liberi oblongi 2 mm longi, gynostegio longiori; pollinia ovalia 0.3 mm longa, brachiis subnullis, glandula triangulari-sagittata brunnea.

Type. Common in thickets in open place on dry dogtooth limestone along seashore, Cabo Rojo, Pedernales, 4 Nov. 1969, Alain Liogier 16637 (holotype, NY; isotypes, US, GH, P, IJ); about 5 miles E of Cabo Rojo, 8 Feb 1969, Alain Liogier 13620

fruiting specimen (NY); in thickets, km 92 from Bani to Azua, alt 80 m, 3 Nov 1969, Alain Liogier 16598 (NY, US, GH, P); on limestone, los Guanitos, 7 miles E of Cabo Rojo, Pedernales, 13 Nov 1969, Alain Liogier 16961b (NY, US, GH, P, IJ).

A. Liogier 13620 and 16961b are fruiting specimens; the description of the follicle is as follows:

Folliculi (juvenili) oblongo-lineares, apice longe acuminati, 4.5-5 cm longi, basi 10-12 mm lati, subglabri, tuberculis carnosis obtecti; semina non visa.

This species falls in the relationship of M. alainii Woods., which can be distinguished by its suborbicular leaves, its ovate acute calyx lobes, the green corolla without reticulation, the corolla lobes hyaline on the margin, much narrower and ovate-lanceolate; the pollinia are pyriform and the follicles are only 3 cm long, the corona lobes are oblong in M. viridivenia, while in M. alainii they are much reduced.

SOLANUM COELOCALYX Alain, sp. nov.

Arbor inermis, ca. 12 m alta, rami dense griseo-stellato-furfuracei, ramuli dense albido-stellato-furfuracei; folia petiolis 1.5-3 cm longis supra canaliculatis suffulta, lamina anguste elliptico-oblonga, basi inaequilatera auriculata vel rotundata et leviter excisa, apice acuta vel breviter acuminata 12-18 cm longa, 4-6 cm lata, nervo medio et lateralibus (utroque latere 6-10) supra impressis subtus prominentibus, lateralibus ad marginem anastomosantibus, venis laxe reticulato-conjunctis, supra obscure viridia sparse pilis stellatis obsita, subtus albo-grisea dense pilis stellaribus breve stipitatis obtecta, margine plana integra membranacea. Inflorescentiae plerumque axillares corymbosae, cum pedunculo 4-5 mm longo 10 mm longae dense griseo-pilosae; pedicelli usque 3 mm longi, calyx in alabastra 4-5 mm longum clausum, praeter lineas 5 longitudinales stellato-pilosum, ad anthesim irregulariter, saepe in lobulos 2 adaperiens, corolla rotacea, violacea, 2.5-3 cm diam, extus stellato-pilosa, intus glabra, lobi 5 ovati 1 cm longi; stamina 5, filamenta vix 1 mm longa, antherae lineari-lanceolatae 6-6.5 mm longae a basim angustatae; stylus 3 mm longus, basi versus stellato-pilosus, ad apicem glaber. Fructus ignotus.

Type. In a ravine, El Montazo, from Constanza to Valle Nuevo, remnants of cloud forest, alt 1,200-1400 m, 12 Apr 1969, Alain Liogier & E.J. Marcano 14716 (holotype, NY; isotypes, US, GH, P, IJ).

The most distinguishing feature of this new taxon is the calyx that does not open into 5 lobes as it does in the other species, but splits open irregularly, sometimes forming two lobes, one wider, with three sections, the other one narrower with only two sections, at other times the upper part detaching

itself irregularly like a lid with a jagged rim. This feature seems to be unique in the genus. It appears that the five lobes are well marked, suggested by the 5 glabrous lines on the closed calyx. The absence of fruiting specimens does not allow a complete diagnosis.

The presence of a tree in this genus in the West Indies is a rare case; another tree-like plant, S. plumieri Dun., has slightly lobed leaves, the flowers are sessile on the trunk; this last species is known from Plumier's drawing only, and has not been collected by modern botanists.

TABEBUIA CRISPIFLORA Alain, sp. nov.

Frutex usque 1.25 m altus, ramuli glabri verrucosi, vetustiores grisei cortice striati; folia petiolis usque 1 cm longis supra applanatis verrucosis glabris brunneis suffulta; foliola 3-4, petiolulis superioribus 4-6 mm inferioribus 1-3 mm longis, ovato-oblonga, vel obovata, basi angustato-cuneata, acuta vel obtusa, lateralia saepe inaequilatera apice rotundata ad obtusa vel breviter cuspidata, terminalia usque 7 cm longa, et 3.5 cm lata, lateralia 2.5-6 cm longa, 1.2-3.4 cm lata, nervo medio supra impresso subtus bene prominente, lateralibus utroque latere 3-5, supra obsoletis vel leviter impressis subtus prominulis venis subtus obsoletis, margine plana vel leviter recurva, utrinque glabra, supra sub lente sparse punctata, subtus pallidiora nigro-punctata et lepidota, coriacea. Inflorescentiae terminales pauciflorae, pedunculo 5-6 mm longo, corymbosae, nigro-lepidotae, bracteae lineares 5-6 mm longae; pedunculi secundarii 2, semel vel bis furcati, pedicelli usque 2.5 cm longi, bracteolas 2 lineares 2-2.5 mm longas gerentes, alabastra ovata, breviter apiculata, clausa 12 mm longa; calyx cylindraceus 1.5 cm longus ad apicem 8 mm latus, nigro-lepidotus 6-7-costatus, lobi 4, late triangulari 3-5 mm longi; corolla 3.2 cm longa, rubro-testacea, tubo 2.8 cm longo, cylindraceo, ad apicem ampliatum, lobi semiorbiculari antice rotundati 0.5 cm longi irregulariter plicati; stamina 4 mm supra basim corollae ab annulo piloso abeuntia; filamenta breviora 13 mm , longiora 16 mm longa, antherarum loculi 3 mm longi; ovarium lineare 7 mm longum, dense lepidotum, stylus 2 cm longus, glaber, stigmata suborbicularia; fructus non visus.

Type. On limestone cliff, Cueva de Boucan Calice, E of Aceitillar, Sierra de Baoruco, alt 1,100 m, Pedernales, 13 Feb 1969, Alain Liogier 13844 (holotype, NY; isotypes, US, GH, IJ, P); on the rim of a gorge, on limestone mixed with bauxite, Aceitillar-Cayo, deep gorge among pine forest, Sierra de Baoruco, Pedernales, alt 1,300 m, 9 Feb 1969, Alain Liogier 13667 (NY); 22 Feb 1969, Alain Liogier 14096 (NY, US, GH).

Among the many species of Tabebuia, the nearest seems to be T. domingensis (Urb.) Britt.; this latter has lepidote branches, the leaflets are rounded or suboblique at the apex, the

corolla is longer (up to 6 cm long); both have a ring of hairs at the level of the stamen attachment inside the corolla. This species has punctate leaves, the punctuation produced by the presence of dark scales which look like small glands in the leaf tissue. This is particularly visible in the young leaves; the inflorescence shows the same peculiarity.

The specimens from Aceitillar-Cayo have somewhat shorter leaves and some reticulation on the lower face.

TABEBUIA OPHIOLITHICA Alain, sp. nov.

Frutex gracilis vel arbor parva, 6-7 m altus; rami erecto - patenti, ramuli quadranguli cortice grisco glabri; novelli dense brunneo-lepidoti; folia petiolis usque 1.5 cm longis, supra applanatis glabris, foliola 3-5, petiolulis 3 apicalibus 10-12 mm, basalibus 1 mm longis, omnibus supra canaliculatis, oblongo-obovata vel elliptico-obovata, superiora 12-18 cm longa, 5-8 cm lata, inferiora minora 4.5-12 cm longa, 2.5 cm lata apice rotundata obtusa vel acuta, basi rotundata leviter excisa, nervo medio supra impresso, subtus prominente, lateralibus utroque latere 7-11, supra impressis subtus prominulis, venis supra obsoletis vel in foliis vetustioribus laxe reticulatis subtus patente reticulatis, margine recurva, coriacea glaberrima in sicco pallide brunnea. Inflorescentiae compactae, racemosae, multiflorae, in apice ramorum, pars basali ramorum e cicatricibus florum delapsorum nodosa, apice multiflora; alabastra ovata, clausa, apiculata, 8 mm longa, bracteae filiformes, ad basim pedunculorum 2, 6 mm longae sparse brunneo-lepidotae; pedicelli filiformes usque 2.5 cm longi; calycis tubus campanulatus sparse lepidotus, 7 mm longus, limbo bilabiato, labio superiore integro, 4 mm longo, acuto, inferiore 3-lobato, lobis 2 mm longis; corolla rosea 5.5 cm longa, tubus campanulatus ca. 3 cm longus, apice 13 mm latus, limbus in statu compresso 4.5 cm lato, 2.5 cm longo, lobi rotundati 1 cm longi, glabra, margine ciliata, stamina 5-6 mm supra basim corollae ab annulo piloso abeuntia, filamenta 8 et 12 mm longa, antherarum loculi oblongi 2 mm longi; ovarium ovato-lineare, dense lepidotum 3.5 mm longum, 4-angulare, longitudinaliter striatum, stylus 2 cm longus, glaber, stigmata suborbicularia. Fructus ignotus.

Type. In thickets at the base of a cliff, serpentine hills about 4 miles E of Gaspar Hernández, alt 50 m, 28 Sep 1969, Alain Liogier 16148 (holotype, NY; isotypes, US, GH, IJ, P).

I refer to this same species specimens from Arroyo Francés Puerto Plata, growing also on serpentine, Ekman 14385 and A. Liogier 16136, with smaller leaves, but with the same crowded inflorescence, long linear bracts, filiform peduncles.

Though we do not know the flowers of T. conferta Urb., this seems to be the nearest relative to this new species. The longer petioles and petiolules, the shorter and wider leaflets with scales on both faces distinguish these two plants.

Tabebuia haemantha (Bert.) DC. has a paniculate inflorescence, the calyx is much longer, the corolla is bright red or crimson, the petioles and petiolules are longer.

GESNERIA FILISEPALA Alain, sp. nov.

Frutex gracilis 3 m altus, rami pauci, superne cicatricibus p etiolorum delapsorum tuberculatis notati, ramuli griseo-puberuli vel pulverulenti, ad apicem dense foliosi; folia petiolis 4-5 mm longis supra leviter canaliculatis basi incrassatis suffulta, lamina obovato-oblonga, basi angustata not in petiolum protracta, apice acuta vel obtusa, raro subtruncata, 2.5-3.5 cm longa, 9-17 mm lata, nervo medio supra per totam longitudinem impresso, subtus prominente, lateralibus supra obsoletis subtus utroque latere 3-4 ad marginem arcuatis, venis supra obsoletis vel reticulatis, subtus reticulatis margine recurva, ad apicem crasse dentata vel subintegra, supra nitida, subtus opaca pallidiora. Inflorescentiae axillares 2-pluri-florae, puberulae, pedunculo 2-3 mm longo, bracteae filiformes, 10-12 mm longae, pedicelli per paria ordinati, 9-12 mm longi, pulverulenti, ad basim bracteolas binas rotundatas gerentes, calycis tubus semiglobosus, 5 mm longus, lobi subulato-filiformi, usque 15 mm longi; corolla rubra, in statu juvenili 14 mm longa, lobi 2 mm longi semiorbiculati stamina 1 cm longa, antherae orbiculares ad orem corollae sitae, per paria connatae, stylus juvenilis 5 mm longus, pilosulus, stigma capitatum; capsula globosa vel oblonga, 6-8 mm longa, 5-6 mm lata, 5-costata, nervis alteris obsoletis, calycis lobi 8-15 mm longi, filiformi-subulati.

Type. On limestone rocks in thickets, Hoyo de Pelempito, Bacruco Mts., Pedernales, alt 1,000 m, 3-8 July 1971, Alain Liogier 18132 (holotype, NY; isotypes, US, GH).

The long filiform bracts and calyx-lobes distinguish this plant from G. mornincola Urb. & Ekm., which has 1-flowered inflorescences, short bractlets above the middle of the peduncle, shorter corolla and calyx lobes. There are some similarities with G. aspera Urb., whose leaves are scabrous and calyx-lobes shorter.

GESNERIA SAXATILIS Alain, sp. nov.

Frutex usque 1.25 m altus, ramuli teretes, resina aurea obsiti, rami vetustiores griseo-rubri, cortice striato; folia petiolis 1-4 mm longis supra applanatis vel leviter sulcatis suffulta, obovata, cuneata vel elliptico-obovata, 1-2.3 cm longa, 6-10 mm lata, basi acutissima cuneata, apice ambitu obtusa vel subtruncata, margine ad apicem plus minus dentata, caetera integra, nervo medio supra per totam longitudinem impresso, subtus valde prominente, lateralibus supra obsoletis subtus utroque latere 3-4 prominulis ad marginem conjunctis, venis non vel vix manifestis; laminacoriacea. Pedunculi axillares 1-

flori, cum pedicelli 1 cm longi, infra medium bracteolas duas lineares 4 mm longas gerentes; calycis tubus turbinatus 4 mm longus, lobi 5 lineari-subulati, intus canaliculati 7 mm longi corolla rubra 13 mm longa, extrinsecus glabra, tubus cylindraceus 3 mm latus, lobi vix semiorbiculares 1 mm longi integri; stamina 12 mm longa antherae quadratae, os corollae attingentes per paria cohaerentes; stylus 10-12 mm longus, glaber, stigma capitatum apice bilobum; capsula obovato-turbinata 5 mm longa apice 4 mm lata valde 5-costata nervis alternis nullis, calycis lobi 9 mm longi, subulati.

Type. Trail between Pedernales and Aceitillar (Aceitial), alt 4,200 ft, Aug 8-22, 1946, R.A. & E. S. Howard 8120 (holotype, NY; isotypes, GH, US); Aceitillar, Pedernales, March 23, 1967, Marcano 5261; deep gorge in limestone mixed with bauxite, Aceitillar-Cayo, Sierra de Baoruco, Pedernales, alt 1,300 m, 9 Feb 1969, Alain Liogier 13672.

These specimens have been named and distributed under the name G. mornincola Urb. & Ekm. This last species is different in many aspects: the leaves are ovate-elliptic to oblong, the margins entire or obsoletely crenulate above, more or less reticulate; the bractlets are located at the middle of the peduncle or above, and only 1.5 mm long; the calyx lobes are only 4-6 mm long and the corolla is 17 mm long, with the exserted stamens and style; the capsule has faint alternate nerves, and the calyx lobes are much shorter.

Few species of Gesneria with included anthers grow in Hisp aniola: G. aspera Urb., G. parvifolia Alain and G. pulverulenta Alain. G. aspera is distinguished immediately by its scabrous leaves, and short calyx lobes; G. parvifolia has pilose leaves and the inflorescence is 1-3-flowered, the anthers are not paired; G. pulverulenta has a shorter corolla and capsule, and the vegetative parts are pulverulent, the corolla is oblique at the apex.

BEITRAG ZU SCIADOCLADUS MENZIESII (HOOK.) LINDBERG, EIN ENDEMISCHES MOOS NEUSEELANDS

Hans Hörmann

Sciadocladus ist eine sehr kleine Gattung der Familie Hypodendraceae, die ebenfalls auf nur vier Gattungen beschränkt ist. Die Familie ist im indoasiatischen Gebiet und auf den pazifischen Inseln beheimatet; Sciadocladus aber nur auf Neuseeland, Neuguinea und Neukaledonien. Sciadocladus unterscheidet sich von den noch zu obiger Familie gehörenden Gattungen durch eine glatte Kapsel (The smooth capsule at once distinguishes - - - from others of the family. Sainsbury, p. 317). Bei dem starken Wechsel der klimatischen und landschaftlichen Bedingungen auf der Inselgruppe "Neuseeland" gibt es für Moose recht günstige Standorte. Es kommen Hochgebirgslagen mit Gletschern und anderseits Fjorde und Tieflandsgebiete mit niederschlagsreichen Nothofagus- und Baumfarnwäldern vor. Der Boden baut sich auf aus Urgestein oder Kalk und auch ausgedehnte Lavafelder sind vorhanden (Herzog, p. 371). Es sind also die besten Bedingungen für Moose gegeben. Die insuläre Bedingung und die Isolierung besteht schon seit langer Zeit, so dass Endemismen in grosser Zahl vorhanden sind. Auch die beiden auf Neuseeland lebenden Sciadocladus-Arten gehören dazu. Es sind dies S. kerrii und S. menziesii. Beide sind steril nicht mit Sicherheit zu unterscheiden. Wenn jedoch die Sporophyten zur Verfügung stehen, ist ein Zweifel ausgeschlossen. Bei S. kerrii erreicht die Seta 1.5 - 3.5 cm. Länge und die Kapsel 2.0 - 2.5 mm. Die entsprechenden Masse sind bei S. menziesii viel grösser. So werden für die Seta 5 - 7 cm. und für die Kapsel 4 - 7 mm. angegegeben. COCKAYNE beschreibt die Moosvegetation der Südinsel und führt unter den wichtigsten Arten auch S. menziesii an. Da von dieser wichtigen, endemischen Art keine in die anatomischen Einzelheiten eingehende Monographie vorliegt, fühlt sich der verfasser veranlasst, dies in einer kleinen Studie, soweit es das vorliegende Material zulässt, nachzuholen.

Im Jänner 1969 botanisierte das Forscherehepaar Drs. DEGENER auf Neuseeland und achtete dabei auch auf die Moose und Flechten. Unter der Sammelausbeute war auch eine reichlich fruchtende Probe von S. menziesii, welche das Material für vorliegende Arbeit lieferte. Die Moosprobe trägt die Etikette No. 31,857 und lautet: "Minihaha Track near Fox Glacier, South Island, Dense forest. Jan. 12, 1969."

Habitus: S. menziesii ist eine robuste, glänzende Pflanze. Von einem kriechenden, rhizomartigen und dicht braunfilzigen, primären Stamm erhebt sich ein fast schwarzer Sekundärstamm. Dieser ist bis zu einer Länge von 5 - 10 cm. ohne Seitenzweige und spärlich mit Schuppenblättern bedeckt. Am terminalen Ende befindet sich ein Quirl von 4 - 8 gefiederten, dicht beblätterten Ästen. Dadurch wird der Habitus bäumchenartig und erinnert an eine Miniaturpalme. Der

astlose Stamm ist ohne Rhizoiden; nur an seiner Basis ist bis zu einer Höhe von etwa 2 cm. ein dichter Ballen glatter, purpurroter Wurzelhaare. Bei vielen Exemplaren setzt sich der Sekundärstamm noch ca. 2 cm. weiter fort und trägt abermals einen Quirl beblätterter Äste. Nur bei wenigen Exemplaren ist nach diesem zweiten Wirtel eine nochmalige Fortsetzung des Sekundärstammes von wiederum 2 cm. Länge, der mit einem dritten Quirl beblätterter Äste abschliesst.

Fortpflanzung: Die Art ist zweihäusig. Es konnten aber nur die Perichätien der Archegonien untersucht werden. Männliche Exemplare mit Pergonien fehlten. Die Perchätien sitzen an einem Quirlast, knapp neben der Ansatzstelle an dem Sekundärstamm und enthalten je 5 - 7 Archegonien. Meist entwickeln sich aber nur 1 - 2 zu einem fertigen Sporophyten. Die Archegonien haben eine Länge von 0.83[1]) mm. Davon entfallen auf die Eizelle 0.17mm., auf den langen Hals 0.63 mm. und der Rest auf einen kurzen Stiel. Eingebettet sind die Archegonien zwischen zahlreichen, fadenförmigen Paraphysen. Diese sind im Durchschnitt 17 mu dick und 100 mu lang. Nur sehr vereinzelnte sind länger oder kürzer. Als Minimum wurden 80 mu gemessen und als Maximum 350 mu.

Stamm: Über den anatomischen Aufbau des Stammes geben uns Quer- und Längsschnitt Auskunft. Der Umriss ist fünfkantig, nähert sich aber sehr der Kreisform. Der Durchmesser beträgt 1.0 - 1.2 mm. Die dunkle, purpurrote Rinde (nach STRASSBURGER "Epidermis" genannt) ist 1-2schichtig. Die einzelnen runden, im Längsschnitt langgestreckten Zellen haben einen Durchmesser von 10 mu. Ihre Wände sind 3.5 mu dick, so dass für das Lumen nur 3 mu bleiben. An die Rinde schliesst sich das orangefarbene Grundgewebe aus parenchymatischen Zellen an. Der Übergang vom Rindengewebe wird durch allmählich weitlumiger werdende Zellen vermittelt. Erst nach 8 - 10 zellreihen ist die bleibende Grösse mit einem Durchmesser von 20 - 22 mu erreicht. Auch im Grundgewebe sind die Wände mit 3.5 mu relativ dick. Ihr Lumen beträgt daher 13 - 15 mu. Im Zentrum ist ein grosser, rundlicher, weisslichgelber Zentralstrang mit 90 - 100 mu durchmesser. Die einzelnen Zellen sind polygonal mit einer lichten Weite von 6 - 8 mu und sehr zarten Wänden von höchstens 0.5 mu Dicke. Im Längsschnitt sind sie langgestreckt, denn sie dienen zur Wasserleitung. Der gesamte Zentrumstrang ist von einer Schutzscheide kleiner, ovaler Zellen des Grundgewebes umgeben. Deren Lumina sind 6 X 10 mu, wobei die Längsachse gegen das Zentrum gerichtet ist.

Blätter: Bei den Blättern müssen wir vier Formen unterscheiden: Die Blätter der Hauptäste, die wir Stammblätter nennen wollen; die Astblätter der Fiederäste; die Perichätialblätter; und die Schuppenblätter des astlosen Sekundärstammes. Stamm- und Astblätter unterscheiden sich nur durch verschiedene Grösse. Ähnlich gebaut sind auch

- -

1) Diese und die folgenden Massangaben sind das Mittel aus zahlreichen Messungen.

die Schuppenblätter. Sehr verschieden sind jedoch die Perichätialblätter. Die Stammblätter sind breit oval-herzförmig, im Mittel 2.4 mm. lang und 1.4 mm. breit. Längs der Rippe sind einige schwache Längsfalten. Der Spitzenteil ist grob gesägt. Der restliche Rand ist bis zur Basis durch vorspringende Zellecken fein gezähnelt; er ist flach, wie ein Querschnitt zeigt. Zwei - drei Zellreihen der Insertion sind rotbraun gefärbt. Die Rippe ist im Blattmittelteil nur 23 - 24 mu breit; sie endet knapp vor der Blattspitze und ist in der oberen Hälfte gesägt; an der Insertion ist sie etwa 40 mu breit; dort ist die sonst hellgelbe Rippe eine kurze Strecke aufwärts orangefarben. Die Beschreibung des Stammblattes gilt auch für das Astblatt, nur sind dort die Masse kleiner. Die Schuppenblätter sind etwas grösser, 2.6 mm. lang und 2.0 breit. Der Blattrand ist auch im Spitzenteil nur gezähnelt und die ebenfalls vor der Blattspitze endende Rippe ist viel schwächer. Die Lamina ist häutig und chlorophyllfrei und 6 - 7 Zellreihen oberhalb der Insertion sind rotbraun gefärbt. Sehr selten wurden auch Schuppenblätter von halber Grösse mit kurzer Haarspitze angetroffen. Die inneren Perichätialblätter erreichen 4.5 mm. Länge und enden mit langer Haarspitze. Diese nimmt vom Blatt 1.6 mm. ein. Die rotbraune Färbung der Basis erstreckt sich fast bis zur Blattmitte; sie reicht bei den untersuchten Blättern 2.0 mm. hoch. Der Blattrand ist ganzrandig und flach. Eine Rippe fehlt oder ist zuweilen nur schwach angedeutet. Beiderseits von der Mittellinie sind tiefe Längsfalten. Im Querschnitt sind ab und zu Doppelzellen eingestreut.

Blattzellen: Die Blattzellen sind im allgemeinen eng linear und schwach wurmförmig gebogen. Bei den einzelnen Blattarten ergeben sich jedoch geringfügige Unterschiede. Die Querwände sind fast immer sehr schief, selten ist eine Zelle mit fast geraden Querwänden eingestreut. Die Zellen sind im Mittelfeld der Stamm- and Astblätter 42 - 45 mu lang. (Nach Angaben der Literatur 60 - 100 mu; SAINSBURY p. 317) und 5 mu breit. Die Wanddicke beträgt 1.5 mu und ist ohne Perforation. Die einzelligen Zähne des Blattrandes ragen im Spitzenteil 50 mu vor. Die Insertion ist einschichtig. Dort sind die Zellen 40 - 46 mu lang und 10 mu breit. Die Wanddicke beträgt 3.0 mu und ist stark perforiert. Differenzierte Blattflügelzellen fehlen. Es steht dies im Widerspruch zu SAINSBURY, der von den Basiszellen schreibt: "forming a distinct group at the angles." Es dürfte sich bei dieser Angabe aber um einen Irrtum handeln, da auch in der Abb. von S. kerrii, deren Blätter sich ja von S. menziesii nicht unterscheiden, bei ENGLER-PRANTL Blattflügelzellen fehlen (10. Bd. Fig. 383 C). Alle Zellen mit Ausnahme der Insertionzellen sind durch erhöhte Zellecken der Querwände schwach papillös. Für die Zellen der Schuppenblät-

ter gilt die gleiche Beschreibung, nur waren sie meist 70 - 80 mu lang und ohne Papillen. Die Zellen der Perichätialblätter nehmen eine Sonderstellung ein. Sie sind zwar auch in Spitzen- und Mittelteil des Blattes langgestreckt-lineal mit schiefen Querwänden, aber ihre Länge beträgt 100 - 140 mu bei nur 3 mu Breite. Die Zellwände sind stark perforiert und etwa 3 mu dick. Die Insertion ist ebenfalls einschichtig. Drei - vier Zellreihen oberhalb beträgt die durchschnittliche Zellbreite 14 mu. Absonderlich sind im unterem Basisteil die Zellwände: Sie sind nur 1.5 mu dick und ohne Perforation!

Seta: Die Seta ist tief purpurrot und wird gegen die Kapsel etwas heller. Aus einem verdickten Fuss erhebt sich ein 60 - 75 mm. langer und nur 0.2 mm. dicker Stiel. In einem Perichätium stehen 1 - 2 Seten. Unter 52 Exemplaren wurde aber auch dieses einmal mit vier Seten festgestellt. Auch die Anzahl der Perichätien auf einer Pflanze ist gering. SAINSBURY benützt sogar diese geringe Setenzahl bei einer Pflanze in seinem Schlüssel als Trennungsmerkmal von S. kerrii. Bei ENGLER-PRANTL ist im 10. Bd. auf Seite 435 ein Exemplar von S. kerrii dargestellt; es hat 20 Perichätien und 22 Seten. Eine solche Überfülle wird bei S. menziesii auch nicht annähernd erreicht. Im Querschnitt ist unsere Seta rundlich und wir können wie beim Sekundärstamm Rinde, Grundgewebe und Zentralstrang unterscheiden. Der purpurrote Ring des Rindengewebes ist ca 20 mu dick und umfasst drei Zellreihen. Die einzelnen runden, im Längsschnitt langgestreckten Zellen haben einen Lumendurchmesser von 2 - 3 mu und eine Wanddicke von 3 - 4 mu. An die Rinde schliesst sich das gelblichhyaline Grundgewebe aus grösseren, isodiametrischen Zellen an. Der Lumendurchmesser beträgt 10 mu und die relativ dicke Wand misst 2 - 2.5 mu. Im Zentrum ist der unregelmässig rundliche Zentralstrang. Er ist recht gut ausgebildet, denn in ihm erfolgt die Leitung der Nährstoffe, da ja der Sporophyt fast ausschliesslich vom Gametophten versorgt wird. Er ist hyalin und hat einen Durchmesser von 17 mu. Seine einzelnen Zellen sind Eckigpolygonal mit einem Lumendurchmesser von 2 - 3 mu und sehr zarten Wänden.

Kapsel: Das terminale Ende der aufrechten Seta ist mehr oder weniger hakig gebogen, so dass die Lage der Kapsel horizontal bis hängend ist. Sie ist meist zylindrisch, doch kommen auch häufig solche mit deutlicher Einschnürung bei Beginn des oberen Drittels vor. Dadurch entsteht der Eindruck eines langgestreckten Kruges. Ihre Länge beträgt im Mittel 7.6 mm. bei einer grössten Breite von 1.4 mm. Die Hauptfarbe ist lederbraun, die konische, 1.2 mm. lange Apophyse ist rotbraun und den Mund umschliesst ein schmaler, schwarzbrauner Streifen. Die Kapseloberfläche, das sogenannte Epithecium, ist

sehr derbhäutig und die Apophyse besonders hart. Dies drückt sich sehr deutlich im Zellnetz der beiden aus. Die Wand der Kapselmitte hat dickwandige, rectangulare Zellen. Die Querwände sind gerade oder nur wenig schief. Die Breite des Lumens beträgt 35 mu, die Länge 80 mu. Grössere oder kleinere Zellen sind spärlich. Als Minimum der Länge wurden 52 mu gemessen und als Maximum 112 mu. Die Wandbreite beträgt für Längs- und Querwände 8 mu. Eine Perforation ist nicht vorhanden. Abweichend sind die Zellen des Kapselmundes. Zuoberst ist eine 30 mu breite Reihe gelbbrauner Zellen. Darunter befindet sich ein Kranz schwarzbrauner Zellen. Alle diese sind fast quadratisch oder zumindest isodiametrisch. Ihr Durchmesser beträgt nur 15 - 20 mu. Darunter befinden sich die lederbraunen Zellen, die anfangs ebenfalls klein sind, aber rasch an Grösse zunehmen und so den Übergang zu den Zellen der Kapselmitte herstellen. Im Basisteil werden die Zellen bei gleicher Wanddicke sehr eng; die Lumina sind dort höchstens 3 mu breit. Dadurch ist die Apophyse sehr kompakt und hart. Die Längswände sind zuweilen wurmförmig verbogen und die Querwände merklich dünner. Die Länge der Zellen in der Apophyse erreicht 70 mu, aber es sind oft beträchtlich kleinere, linsenförmige eingeschoben. Hier sind auch einige ellipsenförmige bis fast kreisrunde Spaltöffnungen vorhanden. Sie sind phaneropor mit einem Durchmesser von 33 - 37 mu und oft über die Kapseloberfläche etwas erhöht. Am besten sind sie bei polarisiertem Licht zu beobachten.

Peristom: Das Peristom setzt sich zusammen aus dem äusseren und Inneren Peristom. Das äussere besteht aus 16 schmalen, gleichseitigen Dreiecken von 0.90 mm. Länge und einer Basisbreite von 0.24 mm. Diese sogenannten Peristomzähnchen sind bis zu einer Höhe von 0.64 mm. rotbraun gefärbt; der restliche Spitzenteil ist chromgelb und wird gegen das Ende fast hyalin. Der Übergang von der dunkleren zur helleren Färbung erfolgt nur wenig vermittelt und ist auf 1 - 2 Querfelder beschränkt. Die Zähnchen sind durch Querbalken (Lamellen) in 40 - 50 Querfelder geteilt. Deren Höhe beträgt in mittleren Zähnchenteil 15 mu; sie ist in Basisnähe geringer und nimmt gegen die Spitze auf ungefähr 20 mu zu. Die Zähnchen stehen knapp nebeneinander oder sind an der Basis 1 - 3 Felder hoch miteinander verwachsen. Jeder Zahn hat auf der Vorderseite eine Zick-Zack-Mittellinie, die auch dadurch auffällt, dass ihre nächste Umgebung im Dunkelbraunen Bereich gelbbraun gefärbt ist. Der Saum ist bis weit in den Spitzenteil hinauf verfolgbar. Im braunen Zahnteil ist er sattgelb und wird gegen die Spitze hyalin. Jedes Querfeld ist im rotbraunen Zahnteil fein quer gestrichelt, wobei auf 10 mu 11 - 12 seichte Querriefen entfallen. In letzten und vorletzten Querfeld vor dem gelben Zahnteil lösen sich diese Querstriche in einzelne

Papillen auf, die aber noch genau in je einer Querlinie liegen. Diese Reihen werden im nächsten Feld schief und gehen dann in unregelmässig verstreute Papillen über. Das Innere Peristom besteht aus Grundhaut, Fortsätzen und Zilien. Die sattgalbe Grundhaut ist 0.48 mm. hoch und aus zahlreichen Platten zusammengesetzt. Aus ihr erheben sich zwischen je 2 Zähnchen des äusseren Peristoms die gelben, gekielten Fortsätze. Die Höhe des gesammten Inneren Peristoms beträgt 0.83 mm. und ist daher etwas kleiner als jene der Zähnchen. Jeder Fortsatz ist gespalten und später meist klaffend. Zwischen je zwei Fortsätzen sind drei, seltener vier, hyaline, knotige Zilien von gleicher Länge wie diese. Auch dies unterscheidet S. menziesii von S. kerrii, wo die Zilien nur die halbe Höhe der Fortsätze erreichen (ENGLER-PRANTL, Bd. 10, Fig. 383 C).

Sporen: Die chromgelben Sporen sind kugelförmig mit einem Durchmesser von 17 - 18 mu. Die derbe Exine weist eine grubige Oberfläche auf.

Deckel und Haube: Die vorliegenden Exemplare hatten alle schon Deckel und Haube abgeworfen. Daher können nur dürftige Angaben an Hand der Literatur gemacht werden. Der Deckel ist konisch und zum Unterschied von S. kerrii ohne Schnabel. Die kappenförmige Haube ist sehr klein und bedeckt nur den Deckel.

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6. Verdoorn, Fr.; Manual of Bryology. Amsterdam 1967.

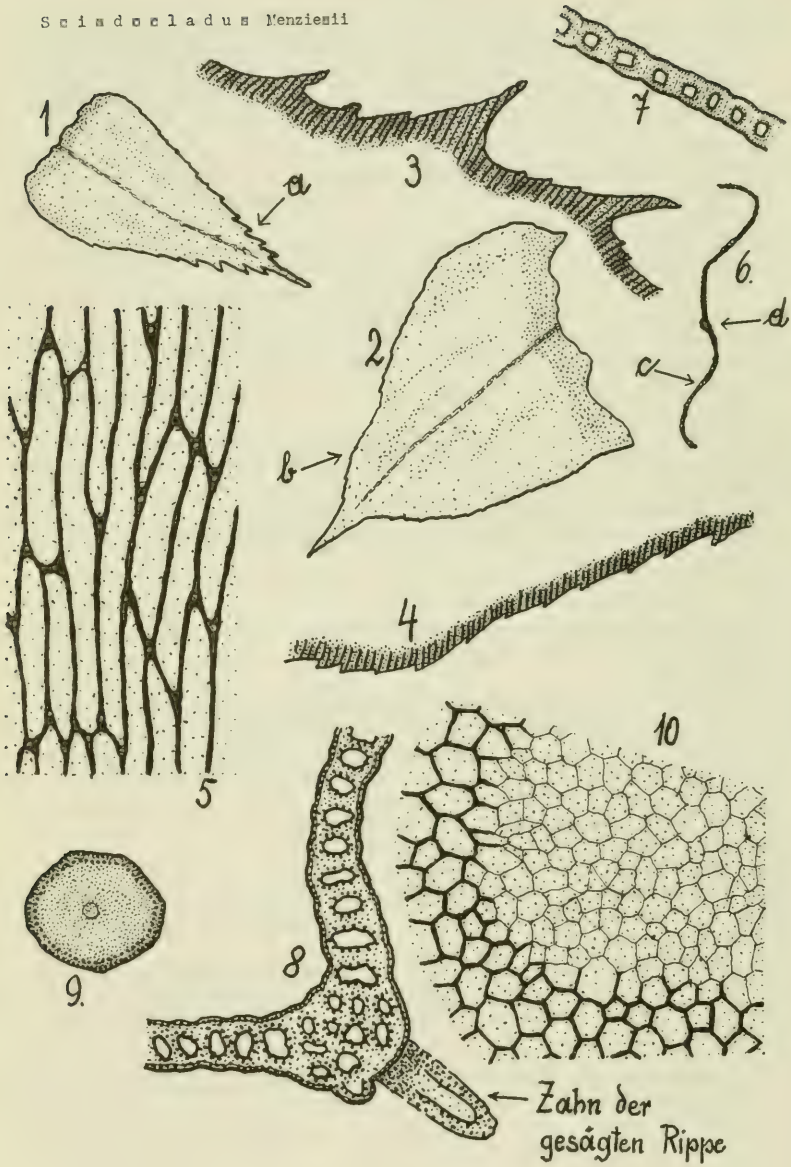
ABBILDUNGEN

Abb. 1 - 20: handzeichnungen. Abb. 21 - 25: Photos, mit der Reichert Remica III hergestellt, die durch Beihilfe der Akademie der Wissenschaften in Wien angeschafft werden konnte. (Detaillierte Erklärungen aller Abb. im Text.)

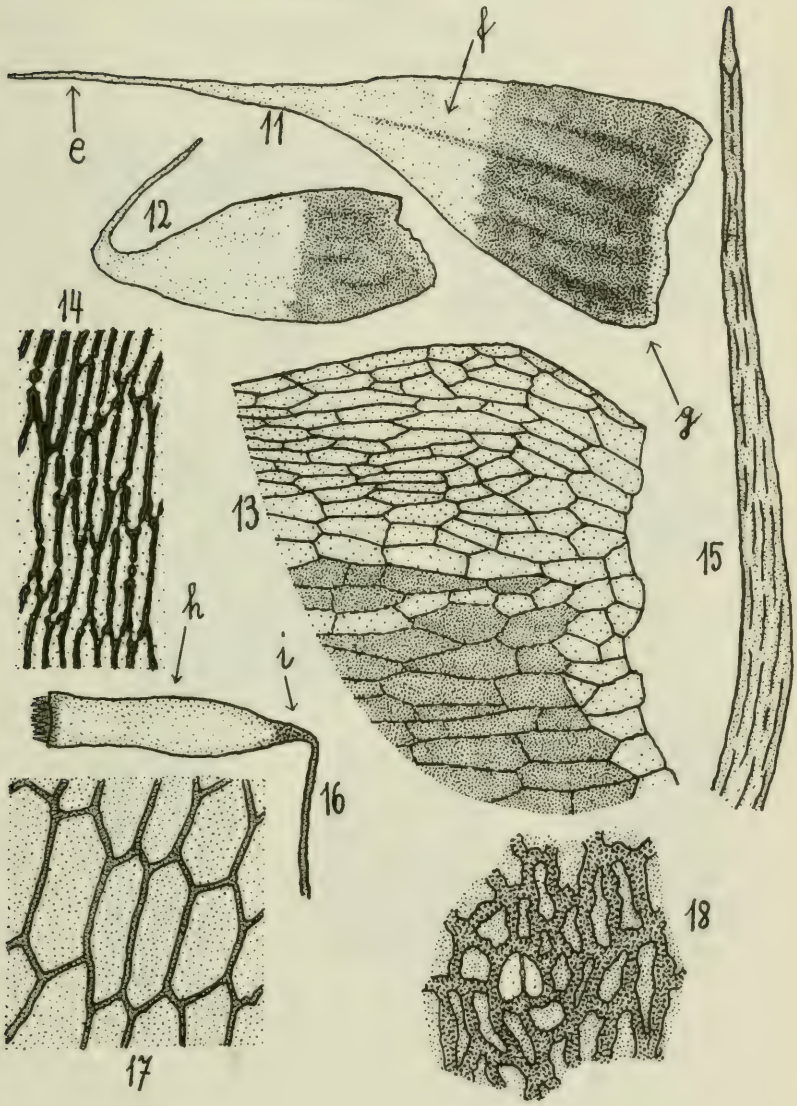
1. Stammblatt.
2. Schuppenblatt des Sekundärstammes.
3. Blattrand im Spitzenteil des Stammblattes. (Vergrösserung von "a" der Abb. 1).
4. Blattrand im Spitzenteil des Schuppenblattes. (Vergrösserung von "b" der Abb. 2.)
5. Zellen im Mittelteil des Stammblattes.
6. Querschnitt durch ein Stammblatt im Mittelteil.
7. Querschnitt durch die Zellen des Stammblattes. (Vergrösserung von "c" der Abb. 6)
8. Querschnitt durch eine Blattrippe. (Vergrösserung von "d" der Abb. 6.)
9. Querschnitt durch den Sekundärstamm. (Übersicht.)
10. Querschnitt durch den Zentralstrang des Sekundärstammes.
11. Inneres Perichätialblatt.
12. Blatt aus der Mitte des Perichätiums.
13. Zellnetz an der Basis eines Perichätialblattes. (Vergrösserung von "g" der Abb. 11.)
14. Zellnetz in der Mitte eines Perichätialblattes. (Vergrösserung von "f" der Abb. 11.)
15. Haarspitze eines Perichätialblattes. (Vergrösserung von "e" der Abb. 11.)
16. Kapsel.
17. Zellen des Epitheziums, Kapselmitte. (Vergrösserung von "h" der Abb. 16.) Um das Bild übersichtlicher zu gestalten, wurde auf die Darstellung der Wandbreite verzichtet.
18. Zellen der Apophyse mit Stoma.
19. Habitusbild der fruchtenden Pflanze.
20. Peristomzahn und Inneres Peristom.
21. Struktur eines Peristomzahnes in Basisteil.
22. Struktur eines Peristomzahnes im Spitzenteil.
23. "Plattenförmige" Struktur im Basisteil der Fortsätze des I. Peristoms.
24. Querschnitt durch die Zellen eines Perichätialblattes.
25. Querschnitt durch den Fuss der Seta (Ausschnitt.)
26. Querschnitt durch den Mittelteil der Seta. (Ausschnitt.)
27. Spore.

Anschrift des Verfassers: Hans Hörmann, a 3903 Echsenbach, Niederösterr.

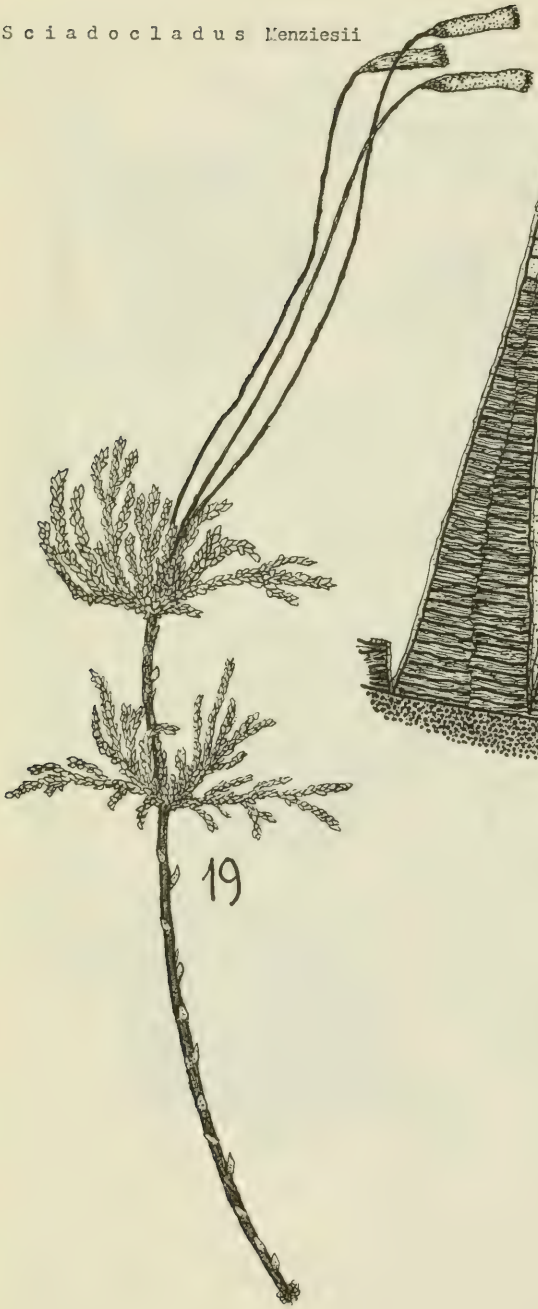
Scandocladus Menziesii

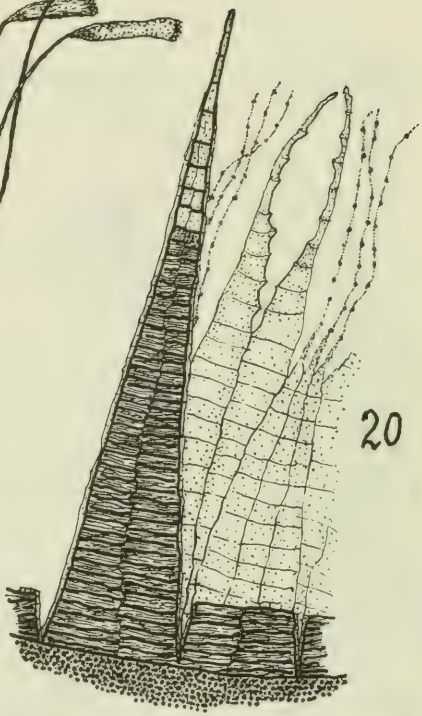


Sciadocladus Menziesii

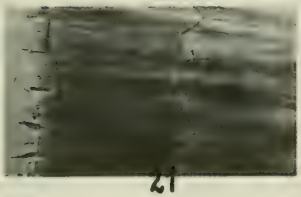


Sciadocladus Menziesii





S c i a d o c l a d u s Menziesii



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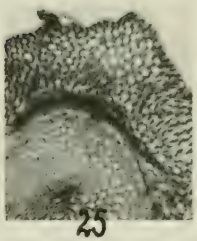

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BOOK REVIEWS

Alma L. Moldenke

"COMMON WILD FLOWERS OF MINNESOTA", illustrations by Wilma Monserud, text by Gerald B. Ownbey, x & 331 pp., illus., University of Minnesota Press, Minneapolis, Minnesota 55454. 1971. $9.75.

About 300 of this state's 1800 kinds of flowering plants are very accurately and naturally drawn by this experienced botanical artist and are given simple descriptions and habitat notes by this recognized botany professor who has had much field experience in his state. This work will serve well for adjacent areas also.

Nature lovers, teachers, and beginning students should get much joy and information from this attractive and useful book. The language used is simple and direct. A glossary and an index with both common and scientific names are appended.

"ANNUAL REVIEW OF ECOLOGY AND SYSTEMATICS", Volume I, edited by Richard F. Johnston, Peter W. Frank & Charles D. Michener, xi & 406 pp., illus., Annual Reviews Inc., Palo Alto, California 94306. 1970. $10.00.

For the christening of this new journal the well recognized editors and the also well known editorial committee reasoned that "ecological work proceeds from a systematic baseline and any informed systematic work is also ecologic".

Some of the papers follow the "latest information" style expected in annual reviews; fewer consist of a reorientation of biological ideas and facts. The fourteen papers cover a wide range of materials effectively. The papers that had the most fascination for me were Stebbins' "Adaptive Radiation and Reproductive Characteristics in Angiosperms, 1: Pollination Mechanisms", Harper, Lovell & Moore's "The Shapes and Sizes of Seeds", Clemens' "Mesozoic Mammalian Evolution", Brown & Orian's "Spacing Patterns in Mobile Animals", Brock's "High Temperature Systems" and Culberson's "Chemosystematics and Ecology of Lichen-forming Fungi".

The print is neat but small. Some split infinitives appear in some of the papers. On p. 351 teleological is misspelled. Each paper has its own bibliography and at the back of the book there is a general author index and a subject index.

"CONTROL OF INSECT BEHAVIOR BY NATURAL PRODUCTS" edited by David L. Wood, Robert M. Silverstein & Minoru Nakajima, x & 345 pp., illus., Academic Press, London WIX 6BA & New York, N. Y. 10003. 1970. $11.00.

This book consists of the revised papers that were presented before three seminars on new biochemical approaches to pest con-

trol held in Honolulu in 1968 and cosponsored by the National Science Foundation and the Japan Society for the Promotion of Science. Since many of the natural products (attractants, repellants, stimulants, deterrents, arrestants) are plant in origin, much in this work will interest botanists as well as biochemists, animal behaviorists, ecologists and entomologists.

Each paper has its own bibliography, but there is no general index. The printing is photo-offset of neat typing, but on p. 183 the genus and species names and authority are misspelled for Clerodendrum trichotomum Thunb.

"PLANT DISEASE HANDBOOK" by Cynthia Westcott, revised third edition, xiv & 843 pp., illus. Van Nostrand Reinhold Company, New York, N. Y. 10001. 1971. $19.75.

The dustjacket of this book evaluates it correctly when it states: "An indispensable guide to the diagnosis and control of 2100 plant diseases affecting trees, grasses, shrubs, flowers [obviously not composed by the learned author!] and vegetables grown in the continental U. S."

The author's preface to this new edition states that "This revision.....retains the same general format, interpolating new information where necessary. The chemicals have been updated, with a list of sources; a few taxonomic changes have been made; and a few new host plants have been added. Many recently reported diseases have been included and previously known diseases have been listed on new hosts."

The work is fully and well illustrated with the author's drawings and photographs. On p. 499 "Clerodendrin" appears as the spelling for Clerodendrum thomsonae. There is a fine selected bibliography, a helpful glossary, and a list of land grant institutions as sources of help.

Now we have to push over the earlier editions on the bookshelves of so many people and places to make room for this very excellent new one.

"BOTANICAL BIBLIOGRAPHIES - A Guide to the Bibliographic Materials Applicable to Botany" by Lloyd H. Swift, xxxvii & 804 pp., Burgess Publishing Company, Minneapolis, Minnesota 55415. (1970) 1971. $28.50.

This guide, done in photo-offset printing from the author's neatly typed manuscript, is "planned primarily for beginning graduate students in botany, but it should be useful to all classes of users of botanical literature". It is divided into five parts: 1. General bibliography with very helpful instructions on the Dewey Decimal, Library of Congress, and other systems of library classification; 2. Background bibliographic literature for botany, especially mathematic, physicochemical and general life scientific; 3. Botanical bibliographic literature that is taxonomic, ecological and physiological; 4. Bibliographic literature of applied areas of plant study as in agriculture and

horticulture; and 5. bibliographic literature of areas auxiliary to botany.

The author deserves a vote of thanks from each of the many students and workers whose horizons will be broadened or whose time will be saved because of his prodigious efforts.

"NATURE STUDY FOR CONSERVATION - A Handbook for Environmental Education" by John W. Brainerd, xiii & 352 pp., illus., The Macmillan Company, New York, N. Y. 10022. 1971. $4.95 paperback.

The very real worth of this book is indicated by its being sponsored by the American Nature Study Society and by its having the foreword written by Roger Tory Peterson before ever taking into account the author's many years of field and teaching experience. "This book is designed to help people to study nature so that they can take better care of the environment; to give them knowledge and joy in the process; to enable them to look at a bit of the land and plan for its greatest use and beauty; to ponder the role of the sun, rock, climate, water, soil, vegetation, and animal life and the interplay of these environmental factors; to make the world a better place in which the human animal can live, with pride in his handiwork and his headwork."

The first part of the book deals with concepts of conservation, ecology and outdoor education; the second part deals with such techniques as environmental analysis, observation of natural resources, recording data, identification, collection and experimentation; and the third part deals with protecting land and wise use of campus space. Bibliographies are well chosen for each chapter. The writing style is enthusiastic and conversational. The many illustrations are effective adjuncts to the text. The print is clean except for Vaccinium misspelled on p. 306. Despite the use of the terms herbivore and phytophagous the author introduced the term "plantivores" for general vegetable feeders.

This book is so constituted that it has a better chance than most to reach our young people in the schools and colleges with its important message.

"EVERGLADES" by Patricia Caulfield, 143 pp., illus., Sierra Club, San Francisco, California 94104, New York, N. Y. 10019, and Washington, D.C. 20002. 1970. $25.00.

This book is an oversized exquisite beauty that appeals most convincingly, as its predecessors do, for the protection of our scenic and ecological resources. The price is seasonably considering the format. As in the case of its previous publications, so perhaps with this one, the Sierra Club has smaller, paper-bound, but still beautifully impressive, editions at pittance prices.

The impelling photographs by the author are accompanied by short effective text selections from the writings of Peter Matthiessen. There is also a descriptive essay by John Mitchell declaring

that "There is no other wilderness like it in this country, nothing like it on this planet. That is why it must be saved, the part that is left" — the sawgrass prairies making a "sea of grass" part of the year, the hammocks with West Indian hardwood trees started from seeds in migratory bird droppings, the bayheads, the willowheads, the cypressheads about ponds, the higher slash pinelands with saw palmettos often at their feet, the Spanish moss-festooned Big Cypress Swamp, and the mangroves at the southern water's edge, all with their array of animal life.

At the end of the book "Notes on the Photographs" give brief descriptions and scientific identifications of the plates and "Acknowledgments" list the assistance of a most impressive list of conservationists and other concerned scientists.

"SYMBIOSIS" by William Trager, ix & 100 pp., illus., Van Nostrand Reinhold Company, Cincinnati, Toronto, London, Melbourne, & New York 10001. 1970. $3.50 paperback.

This is one of the Selected Topics in Modern Biology series and is far superior to the average run of the money-making paperbacks that are little more than chopped up textbook sections. The author's well-fulfilled aims are "to acquaint the beginning student of biology with the prevalence of the phenomenon of symbiosis.....to show how symbiosis may be studied and how such studies lead to better understanding of fundamental problems in biology", and to realize that the "survival of the fittest" also encompasses this mutual cooperation. This book gives in such clearcut interesting language details of many more of these symbiotic relationships than are dealt with in standard biology texts that it will be an excellent supplement for beginning students in college level biology, for alert high school students in biology, and for the interested general reader.

"THE RUST FUNGI OF CEREALS, GRASSES AND BAMBOOS" by George Baker Cummins, xv & 570 pp., illus., Springer-Verlag, Berlin, Heidelberg & New York 10010. 1971. $19.50.

This fine illustrated descriptive manual of the Uredinales on the Gramineae presents 419 species in 7 genera on a worldwide basis. About 90 percent are illustrated in uniform magnification by line drawings of uredinospores and teliospores of type material. The keys are intelligently constructed first as to host genera of grasses and secondly as to morphology. There are citations for types, synonymy, geographical ranges and first proved life cycles after inoculation. There are indexes for fungal names, grass host names, and for other aecial host names. This valuable book has been reproduced very neatly by offset printing.

ADDITIONAL MATERIALS TOWARD A MONOGRAPH OF THE GENUS CALLICARPA. XXI

Harold N. Moldenke

CALLICARPA L.

Emended synonymy: Cellicarpa Hansford, Sydowia Ann. Myc., ser. 2, Beih. 2: 685, sphalm. 1961. Sphondylococcum Schau. ex Airy Shaw in J. C. Willis, Dict. Flow. Pl., ed. 7, 1059, in syn. 1966.

Additional & emended bibliography: [Retz.], Nom. Bot. 35 & 282. 1772; W. Jones, Asiat. Research. 2: 255--256. 1799; Gaertn., Mey., & Scherb., Fl. Wettst. 2: 443. 1800; Wall., Numer. List 87. 1831; Voigt, Hort. Suburb. Calc. 464, 467, & 473. 1845; Speg., Anal. Soc. Cient. Argent. 12: 41. 1881; Solered., Syst. Anat. Dicot. 712, 714, & 715. 1899; E. D. Merr., Philip. Bur. Govt. Lab. Bull. 29: 47--48 & 58. 1905; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 1, 471 & 480. 1906; Syd., Ann. Mycol. 10: 80. 1912; Syd., Leafl. Philip. Bot. 6: 1926. 1913; Syd., Ann. Mycol. 15: 195. 1917; Hubert, Verb. Utl. Mat. Med. 65. 1921; S. Moore, Journ. Bot. Lond. 63: Suppl. 80. 1925; Stevens, Ann. Mycol. Berlin 25: 468. 1927; Stevens & Rold., Philip. Journ. Sci. 56: 53. 1935; Tharp, Veg. Tex. 67. 1939; Yamamoto, Trans. Nat. Hist. Soc. Formosa 31: 15 & 226. 1941; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 2, 471 & 480. 1941; Lam & Meeuse in Holthuis & Lam, Blumea 5: 235. 1942; Anon., Blumea 5: 767. 1945; Wyman, Shrubs & Vines Am. Gard. 113--114 & 415. 1956; Hansford, Sydowia 10: 47 & 51. 1957; Viertel, Trees Shrubs & Vines nos. 550 & 551. 1959; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 3, 471 & 480. 1959; Hansford, Sydowia Ann. Myc., ser. 2, Beih. 2: 685, 686, 688, 689, 691, 692, & 695. 1961; C. E. Lewis in Florists Publ. Co., New Pronounc. Dict. Pl. Names 13. 1964; R. E. & C. R. Harrison, Trees & Shrubs 39, pl. 93. 1965; J. & L. Bush-Brown, Am. Gard. Book, ed. 4, 269. 1965; Airy Shaw in J. C. Willis, Dict. Flow. Pl., ed. 7, 29, 51, 166, 177, 179, 576, 590, 913, 975, 1059, 1062, 1129, & 1176. 1966; Uniyal & Issar, Journ. Res. Indian Med. 4 (1): 8385. 1969; Coats, Pl. Hunters 101 & 271. 1969; J. V. Watkins, Fla. Landsc. Pl. 308, 362, & dust-jacket. 1969; DuMond, Catanea 35: 212 & 213. 1970; Furia, Biol. Abstr. 51: 11432. 1970; Hocking, Excerpt. Bot. 15A: 421. 1970; Mc Gourty [editor], 1200 Trees [Plants & Gard. 26 (2):] 55. 1970; Gibson, Fieldiana Bot. 24 (9): 179 & 182--183, fig. 34. 1970; Moldenke, Biol. Abstr. 52: 5925 & 5926. 1971; Anon., Biol. Abstr. 52 (11): B.A.S.I.C. S.35 (1971), 52 (13): B.A.S.I.C. S.33 (1971), and 52 (15): B.A.S.I.C. S.34. 1971; Farnsworth, Pharmacog. Titles 5, Cumul. Gen. Ind. sub Callicarpa (1971), 6 (6): iv & F.11032 (1971), and 7 (7): iii & title 12973. 1971; Farnsworth, Lynn Ind. 7: 228. 1971; Westcott, Pl. Disease Handb., ed. 3, 511. 1971; Moldenke, Biol. Abstr. 52: 8221. 1971; Moldenke, Phytologia 21: 504, 506, 508, & 512 (1971) and 22: 7--28 & 131--136. 1971; Nishino & al., Tetrahedron Lett. 1971 (19): 421--424. 1971.

It should be noted that the "Callicarpe" Roxb. ex W. Griff.,

Notul. Pl. Asiat. 4: 173 (1854), illustrated in his Icones pl. 447 (1854), appears to be a Geunsia since it has 5 stamens.

It would seem that the genus Rodschiedia Dennst. is much better placed as a synonym of Croton L., in the Euphorbiaceae, than as a synonym of Callicarpa, as pointed out by me in a previous installment of these notes.

Crevost & Pételot (1934) describe an unidentified species of Callicarpa as "Plante herbacée de 60 cm à 1 m, assez fréquente au Tonkin et vendue en sex chez les herboristes. Les feuilles servent à préparer une décoction contre la jaunisse qui survient chez les femmes après l'accouchement. Cette décoction passe pour favoriser la miction." They record the vernacular name "corm chay" for the plant but note that "Ne point confondre cette plante avec Sambucus Javanica, des Caprifoliacées, que l'on désigne sous la même appellation vernaculaire."

Westcott (1971) records the following fungi as attacking members of this genus [probably mostly C. americana]: black mildew (Meliola cookeana) in Florida and Louisiana and leaf-spot (Cercospora callicarpae) from South Carolina to Texas, as well as the worm, burrowing nematode (Radopholus similis) in Florida.

CALLICARPA ACULEOLATA Schau.

Additional bibliography: Hocking, Excerpt. Bot. 15 A: 421. 1970; Moldenke, Biol. Abstr. 52: 5925. 1971; Moldenke, Phytologia 20: 487 (1971) and 22: 14. 1971.

CALLICARPA ACUMINATA H.B.K.

Additional bibliography: Gibson, Fieldiana Bot. 24 (9): 182—183, fig. 34. 1970; Moldenke, Biol. Abstr. 52: 8221. 1971; Anon., Biol. Abstr. 52 (15): B.A.S.I.C. S.34. 1971; Moldenke, Phytologia 21: 444, 466, 467, & 500 (1971) and 22: 22. 1971.

Additional illustrations: Gibson, Fieldiana Bot. 24 (9): 183, fig. 34. 1970.

Ortíz describes this plant as having a stem 15 cm. in diameter. The vernacular names, "cenciento", "fruta de chacha", and "xpucyim", have been recorded for it. I have re-examined the University of Michigan specimen of J. Rzedowski 10689a and still feel that it is best identified as C. pringlei Briq., even though other specimens distributed under this same number have been cited as C. acuminata by me. The Andersons found the plant in fruit in March.

Additional citations: MEXICO: Jalisco: Anderson & Anderson 6041 (Mi). Tamaulipas: Sharp 50-5011 (N). GUATEMALA: El Petén: Ortíz 1319 (N).

CALLICARPA ACUTIDENS Schau.

Additional bibliography: Moldenke, Phytologia 20: 489 (1971) and 21: 452. 1971.

CALLICARPA AMERICANA L.

Additional bibliography: [Retz.], Nom. Bot. 35. 1772; W. Jones, Asiat. Research. 4: 256. 1799; Speg., Anal. Soc. Cient. Argent. 12: 41. 1881; Solered., Syst. Anat. Dicot. 712 & 714. 1899; Tharp, Veg. Tex. 67. 1939; Wyman, Shrubs & Vines Am. Gard. 415. 1956; Hansford, Sydowia Ann. Myc., ser. 2, Beih. 2: 695. 1961; J. V. Watkins, Fl. Landsc. Pl. 308, 362, & dust-jacket. 1969; Coats, Pl. Hunters 271. 1969; DuMond, Castanea 35: 212 & 213. 1970; Moldenke, Biol. Abstr. 52: 5925. 1971; Moldenke, Phytologia 21: 444, 452, 465, & 466. 1971.

Additional illustrations: J. V. Watkins, Fla. Landsc. Pl. 303 [in color] & dust-jacket [in color]. 1969.

Jones (1799) refers to this species as "American callicarpus". Crevost & Pételot (1934) record a "Callicarpa americana, Lin.", with the vernacular name of "nang nang" in Indochina, saying "Plante arbustive importée de l'Amérique du Sud, signalée par Loureiro en Cochinchine; arbrisseau d'ornament dont les feuilles passent, dans son pays d'origine, pour être dépuratives." It is very probable that C. candicans (Burm. f.) Hochr. is the plant being referred to here, since that is the one Loureiro apparently had in mind.

Tharp (1939) reports that in Texas C. americana is to be found in longleaf pine, coastal prairie, Edwards Plateau, oak-hickory, and pine-oak regions. DuMond (1970) describes it as common in the coastal plain area but uncommon in the piedmont. He observed it in the upper altitudinal limits of the Southeast Blue Ridge Escarpment.

Hansford (1961) asserts that the fungus, Meliola cookeana Speg., is based on Ravenel 84 from Florida as type.

Additional citations: NORTH CAROLINA: Carteret Co.: Blomquist 17031 (Mi).

CALLICARPA AMERICANA var. LACTEA F. J. Muller

Additional bibliography: Wyman, Shrubs & Vines Am. Gard. 415. 1956; Moldenke, Phytologia 21: 150. 1971.

CALLICARPA AMPLA Schau.

Additional bibliography: Moldenke, Phytologia 20: 493 (1971) and 21: 476. 1971.

CALLICARPA ANGUSTA Schau.

Additional bibliography: Moldenke, Phytologia 21: 329—330, 460, 478, & 479 (1971) and 22: 20. 1971.

CALLICARPA ANGUSTIFOLIA King & Gamble

Additional bibliography: Moldenke, Phytologia 21: 444 & 465. 1971.

CALLICARPA ARBOREA Roxb.

Additional & emended bibliography: Voigt, Hort. Suburb. Calc. 467. 1845; S. Moore, Journ. Bot. Lond. 63: Suppl. 80. 1925; Mol-

denke, Phytologia 21: 444--445 & 449 (1971) and 22: 27 & 28. 1971.

Voigt (1845) records this species as cultivated in India.

Thanks to the kindness of Miss Mary Liu, I am now able to report the Chinese-character citations for this species given by Chang (1961). They are: Kwangsi: Herb. Kwangsi Mus. 5231; S. P. Kao 55169; S. J. Liang 65995. Yünnan: H. T. Tsai 60404, 60846, 61029, & 61166.

CALLICARPA ARBOREA var. PSILOCALYX (H. J. Lam) Moldenke

Additional synonymy: Cellicarpa magna Hansford, Sydowia Ann. Myc., ser. 2, Beih. 2: 685, sphalm. 1961.

Additional bibliography: Hansford, Sydowia Ann. Myc., ser. 2, Beih. 2: 685. 1961; Moldenke, Phytologia 21: 445 & 449 (1971) and 22: 28. 1971.

Hansford (1961) says that the fungus, Asteridiella callicarpae (Stev. & Rold.) Hansf., grows on this host in the Philippine Islands. The record is based on Stevens 1291 & 1468.

CALLICARPA BARBATA Ridl.

Additional bibliography: Moldenke, Phytologia 20: 495 (1971) and 21: 39, 40, & 494 (1971) and 22: 23. 1971.

CALLICARPA BICOLOR A. L. Juss.

Additional bibliography: Moldenke, Phytologia 21: 330--331 & 340 (1971) and 22: 19. 1971.

CALLICARPA BODINIERI Léveillé

Additional bibliography: Moldenke, Phytologia 21: 445, 469, & 488. 1971.

Thanks to the kindness of Miss Mary Liu, I am now able to report the Chinese-character citations given by Chang (1951) for this species. They are: Chekiang: Herb. Cent. Univ. Chekiang 45459. Hunan: H. D. Chang 447 & 4570; S. C. Chen 1112; K. C. Ho 847, 1301, & 1338; S. C. Hsin 22; L. J. Li 159; P. H. Liang 83645. Kiangsi: E. Chiang 10081 & 10342. Kwangsi: C. H. Chung 81789; Ho, Huang, & Cha 130327; C. L. Teng 13530; H. T. Tseng 27740, 27835, 27963, & 28380. Kwangtung: S. C. Chen 1352, 2258, & 5596; C. L. Tso 22634. Kweichow: S. C. Hsin 50269, 50734, 51236, & 52017.

CALLICARPA BODINIERI var. GIRALDII (Hesse) Rehd.

Additional bibliography: Moldenke, Phytologia 21: 445, 469, 488, 491, & 492 (1971) and 22: 14. 1971.

Again, thanks to the kindness of Miss Mary Liu, I can now report the Chinese-character citations for this variety given by Chang (1951) as: Anhwei: J. C. Chin 2761, 2990, & 3204. Chekiang: W. T. Cheng 682; J. C. Chin 165; Herb. Chekiang Cent. Univ. 43372. Fukien: C. L. Chen 116. Hunan: K. C. Ho 1887; S. C. Hsin 23. Hupeh: Herb. Hupeh Cent. Univ. 101357. Kiangsu: C. L. Tso 598. Kwangsi: J. H. Chin 5265 & 6394; C. Huang 40920; C. L. Teng 13273. Kwang-

tung: H. T. Tseng 20717. Kweichow: E. Chiang 5453; H. M. Mou 223. Sikiang: K. L. Tsui 4082. Szechuan: S. F. Chan 914 & 923; Y. Chen 7653; W. P. Fang 4648, 5719, 7918, 8402, 10115, 15711, & 18036; K. L. Tsui 1963. Yünnan: E. Chiang 12095, 12180, & 12836; H. T. Tsai 5221, 58931, & 59184.

CALLICARPA BODINIERI var. LYU (Léveillé) Rehd.
Additional bibliography: Moldenke, Phytologia 20: 497—498. 1971.
The Chinese-character citations given by Chang (1961) for this variety, thanks to the translation of Miss Mary Liu, are as follows: Hunan: H. T. Chang 3385; C. T. Chen 162; H. C. Chen 3388 & 3415; K. C. Ho 1012 & 1531; P. C. Yeh 179. Szechuan: W. P. Fang 1235.

CALLICARPA BODINIERI var. ROSTHORNII (Diels) Rehd.
Additional bibliography: Moldenke, Phytologia 20: 498. 1971.
The Chinese-character citation for this variety given by Chang (1951) is W. P. Fang 10129.

CALLICARPA BREVIPES (Benth.) Hance
Additional bibliography: Moldenke, Phytologia 21: 445—446, 458, & 490 (1971) and 22: 27. 1971.
Thanks to the kindness of Miss Mary Liu, I can now report the Chinese-character citations for this species given by Chang (1951) as: CHINA: Kwangsi: S. K. Li 81075. Kwangtung: S. L. Chang 151; H. Y. Chen 6803 & 8626; L. S. Chen 41191; W. Chen 9901; C. Huang 31032 & 38085; H. T. Tseng 25123 & 28853; C. L. Tso 20166, 21643, 21713, 22495, & 22579. HONGKONG: K. C. Huh 74230. CHINESE COASTAL ISLANDS: Hainan: C. Huang 33985 & 36848; K. C. Huh 72825; T. J. Liang 62467 & 64235; H. H. Liu 27262.

CALLICARPA BREVIPES var. DENTOSA Chang
Additional bibliography: Moldenke, Phytologia 20: 498—499. 1971.
According to Miss Mary Liu, the name of the collector of the type specimen on which this variety is based is incorrectly transliterated by Chang (1951) and should be Huang 30715b.

CALLICARPA BREVIPES f. SERRULATA P'ei
Additional bibliography: Moldenke, Phytologia 20: 499 (1971) and 21: 213. 1971.

CALLICARPA BREVIPETIOLATA Merr.
Additional bibliography: Moldenke, Phytologia 20: 499 (1971) and 21: 453, 484, & 488. 1971.

CALLICARPA CANDICANS (Burm. f.) Hochr.
Additional synonymy: Callicarpa cana foliis serratis subtus tomentosis L. ex Retz., Obs. Bot. 5: 1. 1789. Callicarpa heynei Roth

ex C. B. Clarke in Hook. f., Fl. Brit. India 4: 569, in syn. 1885.

Additional & emended bibliography: [Retz.], Nom. Bot. 35. 1772; W. Jones, Asiat. Research. 4: 256. 1799; Voigt, Hort. Suburb. Calc, 467 & 473. 1845; C. B. Clarke in Hook. f., Fl. Brit. India 4: 568—569. 1885; Syd., Ann. Mycol. 10: 80. 1912; S. Moore, Journ. Bot. Lond. 63: Suppl. 80. 1925; Lam & Meeuse in Holthuis & Lam, Blumea 5: 235. 1942; Holthuis & Lam, Blumea 5: 112 & 118. 1942; H. J. Lam, Blumea 5: 767. 1945; Hansford, Sydowia Ann. Myc., ser. 2, Beih. 2: 689, 691, & 695. 1961; Moldenke, Biol. Abstr. 52: 5925 & 5926. 1971; Moldenke, Phytologia 21: 446, 449, 451, 453, 465, & 466 (1971) and 22: 19, 22, 27, & 28. 1971.

Voigt (1845) reports this species cultivated in India. Holthuis & Lam (1942) record it from Miangas island in the Talauds, and Jones (1799) refers to it as the "hoary callicarpus".

Crevost & Pételot (1934) record the vernacular names, "nang nang", "ou nga", and "sroul kraham" for this species and note that the "Directeur du Jardin Botanique de Saigon, nous a signalé que l'espèce, bien connue des Cochinchinois, leur fournit des feuilles, des tiges et des racines qui, préparées en décoction, sont absorbées par les femmes après l'accouchement pour reprendre l'appétit." Hubert (1921) says, under the name C. rheedii Kostel., "Cette plante sert, dans l'Indie, au traitement des maladies des poumons et du foie". The "Callicarpa americana, Lin." of Crevost & Pételot (1934), being based on Loureiro's record, doubtless refers to C. candicans, rather than to the true C. americana L. of the New World.

Thanks to the kindness of Miss Mary Liu, I am now able to report the Chinese-character citations for this species given by Chang (1951) as: CHINA: Kwangtung: E. Chiang 873. CHINESE COASTAL ISLANDS: Hainan: H. T. Chang 4049; C. Huang 33351; K. C. Huh 71432 & 72432; H. J. Liang 61557, 61931, 64567, 65228, & 66541; H. C. Liu 139, 1026, 3379, 4837, 5975, 26009, & 27239; H. T. Tseng 315.

Hansford (1961) records the fungus, Asteridiella vilis (Syd.) Hansf., from this host plant in the Philippine Islands, based on Clemens 6367 and Stevens 537, 1692, 1696, & 1698, the fungus, Meliola callicarpae Syd., also from this host plant in the Philippines, based on Philip. Bur. Sci. 7421, as well as 24031 & 27794, Clemens 6367, and Stevens 225, 506, 515, 976, 508, & 1683, and Meliola cookeana Speg. from this host in the Philippines, based on Baker 481 & 1813 and Stevens 537, 619, 971, & 1696.

CALLICARPA CANDICANS var. SUMATRANA (Miq.) Moldenke

Additional bibliography: Moldenke, Phytologia 21: 151--152 & 156. 1971.

CALLICARPA CAUDATA Maxim.

Additional bibliography: Moldenke, Phytologia 21: 332--334, 382, 451, 452, 454, 460, 488, & 500 (1971) and 22: 15, 16, & 23. 1971.

C. B. Robinson 299 bears printed labels which read "Representing Mamanira alba" of "Rumphius Herbarium Amboinense Vol. IV p. 124, t. 59". Rumphius' name, however, is regarded by me as applying to C. longifolia Lam.

Additional citations: MOLUCCA ISLANDS: Amboina: C. B. Robinson 299 (W—654617, W—1294194).

CALLICARPA CAULIFLORA Merr.

Additional bibliography: Moldenke, Phytologia 21: 332 & 470. 1971.

Ebalo describes this plant as a shrub, 3 m. tall, the stems 4 cm. in diameter, and the corollas violet, flowering in December. He records the vernacular name "limayap".

Additional citations: PHILIPPINE ISLANDS: Mindanao: Ebalo 792 (N).

CALLICARPA COJA Hamilt. ex Wall., Numer. List 87, hyponym. 1831.

Bibliography: Wall., Numer. List 87. 1831.

This binomial, not listed in the "Index Kewensis" nor in the "Flora of British India", is based on a Hamilton collection from Gualpara, Assam [Herb. Wallich 1826 K], was apparently considered by Wallich as a synonym of what we now call C. tomentosa (L.) Murr. and I see no reason to doubt his disposition of it.

CALLICARPA COLLINA Diels

Additional bibliography: Moldenke, Phytologia 21: 33 (1971) and 22: 27. 1971.

According to Miss Mary Liu, the Chinese-character citations for this species given by Chang (1951) are: Kiangsi: S. L. Hu 1250. Kwangtung: C. Huang 2902; S. P. Kao 52981; L. Teng 145.

CALLICARPA CRASSINERVIS Urb.

Additional bibliography: Moldenke, Phytologia 16: 363 & 452. 1968.

CALLICARPA CUBENSIS Urb.

Additional bibliography: Moldenke, Phytologia 21: 332—333, 476, 477, & 496 (1971) and 22: 14. 1971.

CALLICARPA CUBENSIS var. PARVIFLORA Moldenke

Additional bibliography: Moldenke, Phytologia 21: 332—333 & 496. 1971.

CALLICARPA CUNEIFOLIA Britton & P. Wils.

Additional bibliography: Moldenke, Phytologia 15: 20 (1967) and 21: 340. 1971.

CALLICARPA DICHOTOMA (Lour.) K. Koch

Additional bibliography: Voigt, Hort. Suburb. Calc. 467. 1845; Wyman, Shrubs & Vines Am. Gard. 415. 1956; Viertel, Trees Shrubs & Vines no. 550. 1959; R. E. & C. R. Harrison, Trees & Shrubs 39.

1965; J. & L. Bush-Brown, Am. Gard. Book, ed. 4, 269. 1965; Mc Gourty [editor], 1200 Trees [Plants & Gard. 26 (2):] 55. 1970; Moldenke, Phytologia 21: 446, 458, 459, 467, 472, 473, 480, 482—484, 486—488, & 497 (1971) and 22: 14, 22, & 26. 1971.

Additional illustrations: Viertel, Trees Shrubs & Vines no. 550. 1959.

Voigt (1845) records this species as being cultivated in India.

Thanks to the kindness of Miss Mary Liu, I can now report the Chinese-character citations given for this species by Chang (1951) as: Anhwei: J. C. Chin 2766. Chekiang: Herb. Chekiang Cent. Univ. 44032 & 105193. Fukien: S. H. Chung 4012; Y. Lin 2749. Hunan: H. T. Chang 4541 & 4546; H. C. Ho 1243; P. H. Liang 83642; C. C. Tung 112 & 251. Kiangsi: W. Chiang 9882; S. L. Hu 6394; S. C. Liu 4521; H. M. Mo 20951. Kiangsu: Herb. Kiangsu Cent. Univ. 74885; E. L. Keng 2491; C. L. Tso 815. Kwangsi: J. C. Chin 5201; C. S. Chung 84702; Herb. Kwangsi Mus. 682; Ho, Huang, & Chia 130045; S. C. Hsin 589, 1791, & 8269; Kwangsi Cent. Herb. 96330; S. J. Liang 67086, 67139, & 67155; C. L. Teng 13523; H. T. Tseng 22939 & 23862; C. Y. Wang 5127. Kwangtung: H. Y. Chen 7217 & 7260; L. H. Chen 7778 & 42071; Herb. Lingnan Univ. 1197; C. Huang 30621 & 32487; Y. Li 10653; S. J. Liang & C. Huang 31464; S. P. Kao 52729 & 53808; S. C. Liu 2498, 24679, & 24682; L. Teng 9709; C. L. Tso 20407, 21075, & 21911.

CALLICARPA DOLICHOPHYLLA Merr.

Additional bibliography: Moldenke, Phytologia 21: 333 & 459 (1971) and 22: 16. 1971.

CALLICARPA ELEGANS Hayek

Additional bibliography: Moldenke, Phytologia 21: 152, 236, 454, 459, & 472. 1971.

CALLICARPA ERIOCLONA Schau.

Additional synonymy: Callicarpa ereoclona Hansford, Sydowia Ann. Myc., ser. 2, Beih. 2: 689, sphalm. 1961. Callicarpa oreoclona Hansford, Sydowia Ann. Myc., ser. 2, Beih. 2: 695, sphalm. 1961.

Additional bibliography: Hansford, Sydowia Ann. Myc., ser. 2, Beih. 2: 689 & 695. 1961; Moldenke, Phytologia 21: 333, 464, 478, & 493 (1971) and 22: 16—18. 1971.

Hansford (1961) records the fungi, Asteridiella vilis (Syd.) Hansf. [Meliola vilis Syd., Irene vilis Syd., Irenina vilis (Syd.) Stev.] from the Philippine Islands on this host, based on Stevens 123 & 823, and Meliola cookeana Speg., also from the Philippines, based on Stevens 823.

CALLICARPA ERIOCLONA var. PAUCINERVIA (Merr.) Moldenke

Additional bibliography: Moldenke, Phytologia 21: 152 & 385. 1971.

CALLICARPA FERRUGINEA Sw.
Additional bibliography: Voigt, Hort. Suburb. Calc. 473. 1845; Moldenke, Phytologia 21: 333 & 475. 1971.

CALLICARPA FORMOSANA Rolfe
Additional synonymy: Callicarpa formosensis Hansford, Sydowia Ann. Myc., ser. 2, Beih. 2: 686, sphalm. 1961.
Additional bibliography: Syd., Leafl. Philip. Bot. 6: 1926. 1913; Syd., Ann. Mycol. 15: 195. 1917; Stevens, Ann. Mycol. Berlin 25: 468. 1927; Yamamoto, Trans. Nat. Hist. Soc. Formosa 31: 15 & 226. 1941; Hansford, Sydowia 10: 51. 1957; Hansford, Sydowia Ann. Myc., ser. 2, Beih. 2: 686, 688--689, & 691. 1961; Moldenke, Phytologia 21: 375--376, 378, 452--454, 459, 465, 466, 488, & 492 (1971) and 22: 14 & 16. 1971.
Yamamoto (1941) records the fungi, Irene formosensis Yamam. [Asteridiella formosensis (Yamam.) Hansf.] and Meliola callicarpicola Yamam., from this host in Formosa, based on Yamamoto s.n., while Hansford (1961) records the fungus, Asteridiella vilis (Syd.) Hansf. [Meliola vilis Syd., Irene vilis Syd., Irenina vilis (Syd.) Stev.] from this host in the Philippine Islands, based on Philip. Bur. Sci. 13442, 14557, 18470, 23999, 24056, 25326, & 26756 and Baker 257.

CALLICARPA FORMOSANA f. ALBIFLORA Yamamoto
Additional bibliography: Moldenke, Phytologia 16: 365 (1968) and 21: 492. 1971.

CALLICARPA FORMOSANA f. ANGUSTATA Moldenke
Additional bibliography: Moldenke, Phytologia 21: 332, 334, & 454 (1971) and 22: 16. 1971.

CALLICARPA FORMOSANA var. GLABRESCENS Moldenke
Additional bibliography: Moldenke, Phytologia 21: 334, 454, & 459. 1971.

CALLICARPA FULVA A. Rich.
Additional bibliography: Moldenke, Phytologia 21: 446 & 475 (1971) and 22: 14. 1971.

CALLICARPA FULVA var. GLABRESCENS Moldenke
Additional bibliography: Moldenke, Phytologia 14: 232--234 (1967) and 21: 475. 1971.

CALLICARPA FULVOHIRSUTA Merr.
Additional bibliography: Moldenke, Phytologia 21: 446 & 494 (1971) and 22: 23. 1971.

CALLICARPA GLABRA Koidz.
Additional bibliography: Moldenke, Phytologia 21: 39 (1971) and 22: 21 & 22. 1971.

CALLICARPA GONGALO Hamilt. ex Wall., Numer. List 87, hyponym. 1831.

Bibliography: Wall., Numer. List 87. 1831.

This binomial is not listed in the "Index Kewensis" nor in the "Flora of British India. It is based on a Hamilton collection from the Morung Hills in eastern Nepal [Herb. Wallich 1826 J] and was apparently considered by Wallich to be a synonym of what is now known as C. tomentosa (L.) Murr. I see no reason to doubt this disposition.

CALLICARPA GRISEBACHII Urb.

Additional bibliography: Moldenke, Phytologia 15: 26. 1967; J. A. Clark, Card Ind. Gen. Sp. Var. n.d.

CALLICARPA HAVILANDII (King & Gamble) H. J. Lam

Additional bibliography: Moldenke, Phytologia 20: 495 (1971) and 21: 39--40, 493, & 494 (1971) and 22: 23. 1971.

CALLICARPA INTEGERRIMA Champ.

Additional bibliography: Moldenke, Phytologia 21: 446 (1971) and 22: 14, 27, & 28. 1971.

According to Miss Mary Liu, the Chinese-character citations given for this species by Chang (1951) are: CHINA: Fukien: Y. Lin 2416. Kwangsi: J. C. Chin 8034; S. C. Hsin 310; C. Y. Wang 5005. Kwangtung: L. S. Chen 42751; E. H. Tang 802; H. T. Tseng 21107, 21650, & 25441. HONGKONG: C. L. Tso 21799.

CALLICARPA INVOLUCRATA Merr.

Additional bibliography: Moldenke, Phytologia 20: 495 (1971) and 21: 39, 40, & 494. 1971.

CALLICARPA JAPONICA Thunb.

Additional & emended bibliography: Wyman, Shrubs & Vines Am. Gard. 113--114 & 415. 1956; Viertel, Trees Shrubs & Vines no. 551. 1959; J. & L. Bush-Brown, Am. Gard. Book, ed. 4, 269. 1965; Coats, Pl. Hunters 101. 1969; McGurty [editor], 1200 Trees [Plants & Gard. 26 (2):] 55. 1970; Furia, Biol. Abstr. 51: 11432. 1970; Moldenke, Phytologia 21: 446, 453, 459, 465, 466, 472, 480, 483, & 497--500 (1971) and 22: 14 & 26. 1971.

Additional illustrations: Viertel, Trees Shrubs & Vines no. 551. 1959.

Crevost & Pételot (1934) record the Chinese name, "tú châu", for this species and comment that the plant is an "Arbrisseau de la Chine et du Japon, dont le bois est utilisé pour faire des baguettes à manger." Koyama describes it as a large shrub, growing in mixed woods, the corollas purplish-pink and the fruit rose.

According to Miss Mary Liu, the Chinese-character citations given by Chang (1951) for this species are: Hunan: S. C. Chen 3303; K. L. Ho 1631. Kiangsi: E. Chiang 10054. Shantung: C. Y. Chia 2617.

Additional citations: JAPAN: Kyushu: Koyama 7089 (N, N).

CALLICARPA JAPONICA f. ALBIBACCA Hara

Additional synonymy: Callicarpa japonica 'Leucocarpa' McGourty [editor], 1200 Trees [Plants & Gard. 26 (2):] 55. 1970.

Additional bibliography: Wyman, Shrubs & Vines Am. Gard. 415. 1956; McGourty [editor], 1200 Trees [Plants & Gard. 26 (2):] 55. 1970; Moldenke, Phytologia 21: 43. 1971.

According to McGourty (1970) this plant grows to a height of 5 feet or more, has small but abundant white fruit (misnamed "berries" by him) which persist even in autumn, and is one of the best shrubs with white fruit for cultivation in temperate regions.

CALLICARPA JAPONICA var. ANGUSTATA Rehd.

Additional synonymy: Callicarpa japonica augustata Coats, Pl. Hunters 101, sphalm. 1969.

Additional bibliography: Wyman, Shrubs & Vines Am. Gard. 415. 1956; Coats, Pl. Hunters 101. 1969; Moldenke, Phytologia 21: 446--447 & 472. 1971.

CALLICARPA JAPONICA var. LUXURIANS Rehd.

Additional bibliography: Moldenke, Phytologia 21: 447, 480, 483, & 497 (1971) and 22: 26. 1971.

CALLICARPA JAPONICA var. RHOMBIFOLIA H. J. Lam

Additional bibliography: Moldenke, Phytologia 20: 496 (1971) and 21: 35, 46, 242, & 499. 1971.

CALLICARPA JAPONICA var. TAQUETII (Léveillé) Nakai

Additional bibliography: Moldenke, Phytologia 21: 34 & 46. 1971.

CALLICARPA KOCHIANA Mak.

Additional bibliography: Hocking, Excerpt. Bot. 15A: 421. 1970; Moldenke, Phytologia 21: 447 (1971) and 22: 27. 1971.

Thanks to the kindness of Miss Mary Liu, I am now able to report the Chinese-character citations given by Chang (1951) for this species. They are: CHINA: Fukien: P. C. Chung 317; S. S. Chung 2350; S. K. Tang 252, 434, & 658. Hunan: P. H. Liang 86212. Kiangsi: C. Chiang 9999; S. C. Liu 4020 & 4456. Kwangtung: L. S. Chen 40488 & 41202; S. C. Chen 1639; E. Chiang 1622 & 11049; C. S. Chung 10780; T. Chung 168; H. T. Ho 60088; S. P. Kao 50049; S. J. Liang 60383; Liang & Huang 31600; S. C. Liu 815; T. H. Hsu 146; E. H. Tang 315, 989, 1059, & 1507; H. T. Tseng 21167, 21573, 21889, 25393, & 25807; C. L. Tso 20436. HONGKONG: H. Y. Chen 4993 & 5870; E. Chiang 609, 2987, 3174, & 32434; H. T. Tseng 16581.

CALLICARPA KWANGTUNGENSIS Chun

Additional bibliography: Moldenke, Phytologia 21: 43 & 47. 1971.

CALLICARPA LOBO-APICULATA Metc.

Additional bibliography: Hocking, Excerpt. Bot. 15A: 421. 1970; Moldenke, Phytologia 21: 47--48, 225, & 345. 1971.

According to Miss Mary Liu, the Chinese-character citations given by Chang (1951) for this species are: CHINA: Hunan: S. C. Chen 2673; Chen, Chu, & Chang 10189. Kwangsi: Herb. Kwangsi Mus. 752; S. C. Hsin 728; S. H. Hsin 2997, 21307, & 22393; C. Huang 40427; Kwangsi Cent. Herb. 96334; H. T. Tseng 22610 & 22779. Kwangtung: S. C. Chen 5519 & 5667; Kwangtung Cent. Herb. 75377. Kweichow: E. Chiang 6371. CHINESE COASTAL ISLANDS: Hainan: K. C. Huh 73173.

CALLICARPA LONGIFOLIA Lam.

Additional synonymy: Callicarpa lanceolaria var. subglabrata Schau. ex C. B. Clarke in Hook. f., Fl. Brit. India 4: 570, in syn. 1885.

Additional bibliography: Wall., Numer. List 87. 1831; Voigt, Hort. Suburb. Calc. 473. 1845; Solered., Syst. Anat. Dicot. 715. 1899; Hansford, Sydowia Ann. Myc., ser. 2, Beih. 2: 688. 1961; Moldenke, Biol. Abstr. 52: 5926. 1971; Moldenke, Phytologia 21: 445--447, 449, 451--454, 457, 461, 465, 466, 468, 469, 472, 473, 480, 483, & 488 (1971) and 22: 23 & 25--28. 1971; Anon., Biol. Abstr. 52 (13): B.A.S.I.C. S.33. 1971.

Hansford (1961) records the fungus, Asteridiella callista (Rehm) Hansf. [Meliola callista Rehm, Irenina callista (Rehm.) Hansf.] from this host in Java, based on Herb. Buitenzorg 12106.

According to Miss Mary Liu, the Chinese-character citations given by Chang (1951) for this species are: CHINA: Yünnan: H. T. Tsai 60928, 61204, 61314, & 61385. CHINESE COASTAL ISLANDS: Hainan: L. S. Chen 43543; E. Huang 35399 & 35683; K. C. Huh 72820; S. J. Liang 64465 & 66542; S. C. Liu 25599.

CALLICARPA LONGIFOLIA f. FLOCCOSA Schau.

Additional bibliography: Voigt, Hort. Suburb. Calc. 467. 1845; Moldenke, Phytologia 21: 447, 473, & 488. 1971; Anon., Biol. Abstr. 52 (13): B.A.S.I.C. S.33. 1971.

Voigt (1845) records this form as cultivated in India.

Additional citations: AROE ISLANDS: Kobroör: Buwalda 5103 (N).

CALLICARPA LONGIPES Dunn

Additional bibliography: Moldenke, Phytologia 21: 208, 387, 449, 452, 481, 483, 484, 489, & 491. 1971; Anon., Biol. Abstr. 52 (15): B.A.S.I.C. S.34. 1971; Moldenke, Biol. Abstr. 52: 8221. 1971.

Thanks to the kindness of Miss Mary Liu, I can now report the Chinese-character citations given by Chang (1951) for this species as: Fukien: C. S. Chung 3370. Kiangsi: S. C. Liu 3927 & 4729; H. M. Mo 21185 & 21320. Kwangtung: H. Y. Chen 5689, 5777, 5884, 7059, & 8666; Liang & Huang 31621; L. S. Chen 43103; S. C. Liu 25151; Y. H. Tang 962; L. Teng 95; H. T. Tseng 12008 & 25319.

CALLICARPA LONGIPETIOLATA Merr.

Additional & emended bibliography: E. D. Merr., Philip. Bur. Govt. Lab. Bull. 29: 47--48 & 58. 1905; Moldenke, Phytologia 21: 336 (1971) and 22: 20. 1971.

CALLICARPA LONGIPETIOLATA var. GLABRESCENS Moldenke

Additional bibliography: Moldenke, Phytologia 21: 209--210 (1971) and 22: 20. 1971.

CALLICARPA LONGISSIMA (Hemsl.) Merr.

Additional synonymy: Callicarpa taiwainiana Suzuki, in herb.

Additional bibliography: Moldenke, Phytologia 21: 445, 447, 468, 472, & 473 (1971) and 22: 26. 1971.

Chou found this plant in bloom in September.

According to Miss Mary Liu, the Chinese-character citations given for this species by Chang (1951) are: CHINA: Fukien: P. C. Chung 15. Kwangsi: S. C. Chen 4084; J. C. Chin 6996 & 7738; T. S. Chung 84765 & 84994; S. C. Hsin 1801 & 20015; C. Huang 29033; S. P. Kao 55338; Herb. Kwangsi Mus. 774; Kwangsi Cent. Herb. 94152; H. T. Tseng 22628, 23063, 24001, & 26827. Kwangtung: H. T. Chang 4752; H. Y. Chen 6922 & 7680; E. Chiang 1785; W. Chen 9903; E. Chiang 13591; C. Huang 30204, 30946, & 37772; C. P. Liu 143 & 365; S. C. Liu 25112; T. S. Liu 60; L. Teng 61 & 9942; C. L. Tso 22350. Szechuan: W. P. Fang 5826. HONGKONG: H. Green s.n. [Kwangtung Cent. Herb. 1171]. CHINESE COASTAL ISLANDS: Hainan: K. C. Huh 72465 & 72815; S. C. Liu 27187 & 28236; H. T. Tseng 810 & 16309.

Additional citations: CHINA: Fukien: Chou 49 (Mi).

CALLICARPA MACROPHYLLA Vahl

Additional & emended synonymy: Callicarpa macrophylla Roxb. ex Voigt, Hort. Suburb. Calc. 467. 1845. Callicarpus sp. Jones ex C. B. Clarke in Hook. f., Fl. Brit. India 4: 568, in syn. 1885.

Additional bibliography: W. Jones, Asiat. Research. 4: 255--256. 1799; Wall., Numer. List 87. 1831; Voigt, Hort. Suburb. Calc. 467. 1845; Uniyal & Issar, Journ. Res. Indian Med. 4 (1): 8385. 1969; Farnsworth, Pharmacog. Titles 6 (6): iv & F.11032. 1971; Moldenke, Phytologia 21: 447, 449--451, 456, 461, & 492 (1971) and 22: 27 & 28. 1971; Farnsworth, Pharmacog. Titles 5, Cumul. Gen. Ind. sub Callicarpa. 1971.

Jones (1799) rejects the Linnean system of plant nomenclature and proposes the alternative system of one-word native names -- for the present species he proposes "Mashandari" as the accepted name, with "bastra" and "Callicarpus sp." as synonyms. He also refers here to "American callicarpus" and "hoary callicarpus", but if intended as synonyms or not is not clear. He cites "Retz. 5: 1, no. 19".

According to Miss Mary Liu, the Chinese-character citations given for this species by Chang (1951) are: Kwangsi: J. C. Chin

5717 & 6374; Kwangsi Cent. Herb. 96332. Kwangtung: H. T. Chang 4736; H. Y. Chen 9576. Kweichow: S. W. Teng 90752 & 90986. Yünnan: H. T. Chang s.n. [Yünnan Cent. Herb. 155947]; H. T. Tsai 53291 & 60639.

CALLICARPA MAGNIFOLIA Merr.
Additional bibliography: Moldenke, Phytologia 21: 228--229 & 384. 1971.

CALLICARPA MAINGAYI King & Gamble
Additional bibliography: Moldenke, Phytologia 21: 448. 1971; Farnsworth, Pharmacog. Titles 7 (7): iii & title 12973. 1971; Nishino & al., Tetrahedron Lett. 1971 (19): 1541--1544. 1971.
Nishino and his associates (1971) describe maingayic acid, a piscicidal constituent, from this plant.

CALLICARPA MERRILLII Moldenke
Additional bibliography: Moldenke, Phytologia 21: 336--337 & 452 (1971) and 22: 23. 1971.

CALLICARPA MICRANTHA Vidal
Additional bibliography: Moldenke, Phytologia 21: 235--237 & 452. 1971.

CALLICARPA MOLLIS Sieb. & Zucc.
Additional bibliography: Moldenke, Phytologia 21: 337--339, 382, 454, & 497--500 (1971) and 22: 28. 1971.
Crevost & Pételot (1934) record the Chinese name, "bạch dương tử thụ", for this species.

CALLICARPA NUDIFLORA Hook. & Arn.
Additional bibliography: Voigt, Hort. Suburb. Calc. 467. 1845; Moldenke, Phytologia 21: 329, 341--347, 453, 461, & 488. 1971.
Voigt (1845) reports this species as cultivated in India.
Thanks to the kindness of Miss Mary Liu, I am now able to report the Chinese-character citations given by Chang (1951) for this species as: CHINA: Kwangsi: S. J. Liang 67201, 69899, & 70134; H. H. Su 69122; H. T. Tseng 21842. Kwangtung: L. S. Chen 41422; E. Chiang 872; C. Huang 31232 & 38863; C. C. Huang 499 & 1835; Y. Li 9649; E. H. Tang 1560 & 1720; Y. S. Yuen 100. HONG-KONG: H. Y. Chen 3155, 6848, 6958, & 23679; Green s.n. [Kwangtung Cent. Herb. 1178]; H. T. Tseng 16596. CHINESE COASTAL ISLANDS: Hainan: C. Fong 20276; S. J. Liang 62117, 62473, 63254, 63303, & 66369; S. C. Liu 1929, 5287, 27043, & 27748; H. T. Tseng 29; Tseng & Fong 461; Tso & Chen 44714; K. C. Huh 72814 & 72947.

CALLICARPA OSHIMENSIS Hayata
Additional bibliography: Moldenke, Phytologia 21: 379--383, 497, & 500. 1971.

CALLICARPA OSHIMENSIS var. OKINAWENSIS (Nakai) Hatus.
Additional bibliography: Moldenke, Phytologia 21: 380--383 & 500. 1971.

CALLICARPA PARVIFOLIA Hook. & Arn.
Additional bibliography: Moldenke, Phytologia 21: 384--386, 470, & 472. 1971.

CALLICARPA PEDUNCULATA R. Br.
Additional bibliography: Wall., Numer. List 87. 1831; Voigt, Hort. Suburb. Calc. 467 & 473. 1845; Holthuis & Lam, Blumea 5: 111 & 120. 1942; H. J. Lam, Blumea 5: 767. 1945; Moldenke, Phytologia 21: 448--457, 461, 469, 480, 483, 484, 491, & 492 (1971) and 22: 14, 16, & 28. 1971.

Voigt (1845) records this species as cultivated in India, while Holthuis & Lam (1942) record it from Nenoesa island in the Talauds.

The C. B. Robinson 299 specimens cited in Phytologia 21: 454 (1971) by mistake should be deleted since they represent C. caudata Maxim.

Thanks to the kindness of Miss Mary Liu, I am now able to record the Chinese-character citations given for this species by Chang (1951): CHINA: Chekiang: Chekiang Cent. Herb. 43949; J. C. Chin 1838; Shipu & Chin 14128. Fukien: P. C. Chung 37, 312, & 727; S. H. Chung 1204, 2677, & 3021; Dunn s.n. [Hongkong Herb. 3391]; E. Lin 264; S. K.Tang 97 & 435. Kiangsi: S. C. Liu 3924 & 4469; H. M. Mo 20874. Kwangsi: S. C. Chen 4209; H. Meng 8755; H. T. Tseng 21989, 22982, 23820, 24642, 26530, & 26548. Kwangtung: L. S. Chen 40911 & 42765; H. Y. Chen 5707, 5715, & 7555; S. C. Chen 48, 1438, & 1663; E. Chiang 1342, 2158, & 3592; S. C. Hsin 9804; H. H. Hsu 1031; C. Huang 32250; S. P. Kao 50349; P. H. Liang 84356; S. J. Liang 60577 & 61256; S. P. Kuo 80628; Ong & Liu 696, 2047, 23993, & 24455; E. H. Tang 650 & 1032; H. T. Tseng 12008, 20496, 25228, 25596, 25924, 26381, 26419, 28715, & 29947; Tseng & Huang 2434 & 2821; C. L. Tso 20315; Tutcher s.n. [Hongkong Herb. 10799]. HONGKONG: H. Y. Chen 4874, 4960, & 5147; L. S. Chen 40774; E. Chiang 347. CHINESE COASTAL ISLANDS: Hainan: C. Huang 23688; S. C. Liu 96, 5801, & 6029; H. T. Tseng 850, 2706, 5002, 25696, & 27690; Tso & Chen 44757. FORMOSA: Bosizan s.n.; Mori s.n. [Taiwan Cent. Herb. 75765]; Shimada s.n. [Herb. Taiwan Univ. 10988]; Taikow s.n. [Taiwan Cent. Herb. 92772 & 151891]; Taiwan Cent. Herb. 72750.

CALLICARPA PILOSISSIMA Maxim.
Additional bibliography: Moldenke, Phytologia 21: 451, 452, 454, 459--462, & 488. 1971.

According to Miss Mary Liu, the Chinese-character citation given for this species by Chang (1951) is: FORMOSA: Tanaka & Shimada s.n. [Herb. Taiwan Univ. 13419].

CALLICARPA PLATYPHYLLA Merr., Philip. Journ. Sci. Bot. 13: 57--58. 1918.

Additional bibliography: Moldenke, Phytologia 21: 462--463. 1971.

This binomial was erroneously cited to Merr., Philip. Bur. Govt. Lab. Bull. 29: 57--58 (1905) by me in a previous installment of this series of notes. It was not actually published until 1918. Merrill (1923) cites Velasco s.n. [Herb. Philip. Forest Bur. 26967], Curran s.n. [Herb. Philip Forest Bur. 17181], and Ramos s.n. [Herb. Philip. Forest Bur. 13903], all from Luzon, Philippine Islands, where he says that the species is endemic.

CALLICARPA PLUMOSA Quisumb. & Merr.

Additional bibliography: Moldenke, Phytologia 21: 463--464. 1971.

Merrill (1928) describes the calyx of this species as being "1.5 to 1.75 cm in diameter" -- but surely this is a typographic error for "mm." instead of "cm." since the corollas are described as being only 3.5--3.75 mm. long. Here is another of many examples of the confusion that can be caused by use of the metric system's abbreviations.

CALLICARPA POILANEI Dop

Additional bibliography: Moldenke, Phytologia 21: 444 & 464--465. 1971.

CALLICARPA PRINGLEI Briq.

Additional bibliography: Moldenke, Phytologia 21: 465--467. 1971.

The J. Rzedowski 10689a specimen in the University of Michigan herbarium has been re-examined by me and still seems to me to be placed best in C. pringlei Briq., in spite of the fact that other specimens of this collection have been cited as C. acuminata H.B.K. It is very probable that C. pringlei is merely a variety or form of C. acuminata.

CALLICARPA PSILOCALYX C. B. Clarke

Additional bibliography: Moldenke, Phytologia 21: 452 & 468--469. 1971.

CALLICARPA RESINOSA Wright & Moldenke

Additional bibliography: Moldenke, Phytologia 21: 475. 1971.

According to Alain Liogier and also according to Underwood, Bull. Torrey Bot. Club 32: 291--300 (1905), the "San Juan de Buenavista" of Charles Wright is definitely in Oriente, Cuba, not in Pinar del Río as previously suggested by Carabia.

CALLICARPA RETICULATA Sw.

Additional bibliography: Voigt, Hort. Suburb. Calc. 473. 1845; Moldenke, Phytologia 21: 475--477. 1971.

CALLICARPA RUBELLA Lindl.

Additional bibliography: Voigt, Hort. Suburb. Calc. 473. 1845; R. E. & C. R. Harrison, Trees & Shrubs 39, pl. 93. 1965; Coats, Pl. Hunters 101. 1969; Moldenke, Phytologia 21: 449, 451—454, 461, 467, & 480—492 (1971) and 22: 13. 1971.

Additional illustrations: R. E. & C. R. Harrison, Trees & Shrubs pl. 93 [in color]. 1965.

According to the Harrisons (1965) "For some years this half-hardy deciduous species was wrongly distributed in Australia and New Zealand under the name C. dichotoma, which is a similar but much hardier species. Lilac-purple berries [actually, drupes!] appear in late autumn and winter."

Thanks to the kindness of Miss Mary Liu, I am now able to record the Chinese-character citations given for this species by Chang (1951) as: CHINA: Hunan: S. C. Chen 1857 & 2581; H. T. Chang 4560; Cheng, Chu, & Chang 10144; K. C. Ho 1159, 1428, & 1623; S. C. Hsin 982; L. J. Li 276; P. H. Liang 519; P. C. Yeh 253. Kiangsi: E. Chiang 10159; H. M. Mo 21151. Kwangsi: J. C. Chin 5681, 5922, & 7189; S. C. Hsin 342, 634, 1716, 1736, 21428, 21623, 22213, 22429, 22436, 23133, & 25271; C. Huang 39374, 40586, & 40762; S. K. Li 81064; S. J. Liang 69482 & 69589; S. K. Li 81055 & 81086; S. J. Liang 66907; S. C. Liu 28507 & 28769; H. H. Su 68813; H. T. Tseng 22497, 22744, 22953, 23346, 26521, 26700, 27598, & 27922; C. L. Tso 23653; C. R. Wang 150. Kwangtung: H. T. Chang 44 & 4373; S. C. Chen 1686, 1797, & 5633; L. S. Chen 41181; Y. H. Chen 7049; E. Chiang 744, 772, 870, & 1155; Herb. Kwangtung Cent. Univ. 153539; S. C. Hsin 10020; C. Huang 30716, 31283, 32474, 37864, & 38433; S. P. Kao 52608 & 52877; P. H. Liang 84219, 84512, & 84605; S. J. Liang 61865; T. Lin 9585; Kwangtung Cent. Herb. 67887; S. C. Liu 23959; McClure s.n. [Herb. Lingnan Univ. 6968]; H. T. Tseng 20762, 21319, & 25640; C. L. Tso 20752, 22030. & 22323. Kweichow: E. Chiang 5315. Sikiang: W. P. Fang 6030. Szechuan: W. P. Fang 1272, 1636, 6286, & 7821. Yünnan: H. T. Tsai 54215, 60238, 60479, 61437, & 62224; Wang, Kao, & Liu 100060. HONGKONG: H. Y. Chen 6544 & 6551; L. S. Chen 41842. CHINESE COASTAL ISLANDS: Hainan: Tso & Chen 43351.

CALLICARPA RUBELLA var. DIELSII (Léveillé) Li

Additional bibliography: Moldenke, Phytologia 21: 489—490. 1971.

According to Miss Mary Liu, the Chinese-character citations given for this variety by Chang (1951) are: Chekiang: J. C. Chin 1760. Hunan: H. T. Chang 4456. Kwangsi: C. Huang 40371.

CALLICARPA RUBELLA var. HEMSLEYANA Diels

Additional bibliography: Moldenke, Phytologia 21: 454, 484, & 487—492. 1971.

CALLICARPA RUBELLA f. ROBUSTA P'ei

Additional bibliography: Moldenke, Phytologia 21: 452, 453, & 492. 1971.

CALLICARPA SACCATA Steen.

Additional bibliography: Moldenke, Phytologia 21: 493--495 (1971) and 22: 23. 1971.

CALLICARPA TOMENTOSA (L.) Murr.

Additional bibliography: Moldenke, Phytologia 22: 131--136. 1971.

Watt (1889) informs us that the bark of this species has a peculiar aromatic taste "and may probably be found to have other medicinal virtues. The Malays consider the plant as a diuretic. Drury mentions that in Upper Hindustan the root is employed in cutaneous affections. Dr. Trimen writes to the author that in Ceylon 'the leaves, roots, and bark are used locally by the natives for skin diseases; they are very bitter'....The bark, which is sub-aromatic and slightly bitter to taste, is chewed by the Singhalese instead of betel leaves."

Common and vernacular names recorded for the species include "aisar", "ambong-ambong bukit", "ambong-ambong puteh", "aroosha fibre" [the product], "bastra", "bastra coat comul", "bharngi", "cheruthekku", "derlap dapur", "eela-gas", "eella", "Filzbaum", "filzichte Wirbelbeere", "folhas de raspa macho", "groot rijfblad", "guenla", "hu kwai", "hū kwai", "illa", "ishwar", "kata kĕran", "kepayang", "kĕpayang", "khalema", "massandari", "naikumbil", "sitapoeeng", "sitapueng", "sitapuĕng", "tamah kĕrbau", "tĕpong-tĕpong", "teregam", "thin perivelam", "thin-perivellam", "tindjaoe", "tinjau", "tondi", "tondi karavatti", "tondi teregam", "tondi-teregam", "vettilai patta", "vettileipatta", "wákhora", "Wollbaum", "wollige Schönbeere", "wollige schonheere", "wollige Wirbelbeere", and "yesar".

It is worth recording here the original descriptions of some of the names involved in the synonymy of this species. For instance, Linnaeus (1747, 1749) describes Arbor malabarica Illa dicta as "Arbor inter omnes ramis, petiolis, pedunculis & foliis maxime tomentosa & crasso panno quasi obvoluta. Folia ovata, magna, acuminata, integerrima, opposita, petiolata, supranuda. Callicarpae affinis, sed distincta petalis quatuor, & staminibus receptaculo insertis." He originally described (1767) Tomex tomentosa as "fol. integerrimis lanatis". His original description of Callicarpa lanata (1767) was "Tomex tomentos. Hoc genus potest intrare genus Callicarpae, et haec. lanata CALLICARPA foliis integerrimis lanatis nominati." Wallich (1820) amplified this to read: "A pretty large tree, a native of the Circar mountains, and of the vallies between them. Trunk perfectly straight and of considerable height. Bark smooth ash-colored. Branches few and near the top, forming a small head for so large a trunk. Young shoots somewhat four-sided and covered with a grey farina. Bractes small. -- Flowers very numerous, small, purple. -- Calyx short; border four-sulcated, permanent. -- Corol. tube bent to one side. The other parts as in the genus. -- Style descending.

Obs. The wood of this tree is white, spongy, and of course not fit for much use."

The original description of Tondi teregam by Rheede tot Drakestein (1683) is as follows and is accompanied by an excellent drawing: "Arbor haec Malabarensibus Tondi Teregam, Brachmanis Tondi Karavatti, Lusitanis Folhas de raspa Macho, Belgis Groot Rijf-blad appelatur; Estque procera, sexaginta circiter pedes alta, caudice crasso, ramulis rectis, longis, atro-viridibus, lanuginosis, asperis, fungosâ intus medulla refertis, plurimis donato; lignum albicans, nigricante cortice cinctum. Radix fibrata, albicans, lactescens, rufo, intus croceo cortice tecta, inodora, saporis acris. Folia geminata ordine parallelo petiolis longis circa ramulos proveniunt, oblongo-rotunda, acuminata, in ambitu crenata, crassa, mollia, glabra, supernè viridia, & nitentia, infernè subviridia & lanuginosa, nervis aliquot è costâ mediâ crassâ, in adversa parte extuberante & lanuginosâ, in latere excutrentibus; odor suavis, sapor. aromaticus. Flosculi pediculis oblongis ex foliorum interna sede circa ramulos proveniunt, terni, aut plures simul congesti, purpurei, manubus conftricti sueveolentes, calycique viridi, lanuginoso, ac quadripartito inhaerent, quatuor acuminatis foliolis constantes; foliola haec intercedunt totidem staminula purpurascentia, medium occupante stylo pulchrè rubente, capitulo albicante. Fructus hanc arboreum nullos ferre Malabarenses testantur. Crescit locis arenosis & petrosis in Mangatti; semper vivet, Julio & Augusto mensibus flores fert, diuque superstes manet. Porro ex arboris foliis in lactis sero coctis fit oris collutio pro Aphthis. E cortice, & Radice in aqua decoctis Apozema conficitur, quod aestum febrilem temperat, hepatis ostructiones reserat, nec non herpeti, scabiei, similibusque affectibus medetur."

Hosséus (1911) describes the flowers as violet and the leaves as "dunkelgrüne Blattoberseite, graufilzige Blattunterseite", citing Hosséus 618, and giving the overall distribution of the species as "Indien, Siam".

Lam (1919) describes his C. lanata var. typica as "folia subtus dense tomentosa, chartacea vel subcoriacea; calyx dense stellato-puberulus", as compared with his var. psilocalyx "folia membranacea, subtus densiuscule tomentosa, vel subglabrata; calyx glaber vel nonnullis pilis vestitus".

The binomial, Callicarpa integrifolia, listed by me in the synonymy of this species, is a puzzling one. Its original publication by Retzius (1789) reads merely "C. integrifolia Syst. Nat. Ed. X. forte est Callicarpa tomentosa, quae in Mant. alt. p. 333. lanata dicitur." I have not been able to find the binomial mentioned anywhere in the tenth edition of the Systema Naturae of Linnaeus (1759), although "Tomex tomentos." occurs there on page 897.

Callicarpa coja, based on Herb. Wallich 1826 K, collected by Hamilton at "Gualpara" in Assam, probably belongs here, as also C. gongalo, based on Herb. Wallich 1826 J, collected by Hamilton at Sirpur in the Morung Hills of eastern Nepal. Neither of these bi-

nomials is listed in the "Index Kewensis", nor in C. B. Clarke's treatment of the genus in Hooker's "Flora of British India", but from Wallich's disposition of the names it would appear rather clear that he regarded then in this fashion.

It is well worth noting here that under Genus 136, Callicarpa, in the Linnean Herbarium, sheet number 2 is inscribed "tomentosa" in Linnaeus' own handwriting and "cana" in the handwriting of Solander. The specimen is neither C. tomentosa nor C. candicans (Burm. f.) Hochr. [as we now denominate what used to be known as C. cana L.], but actually is C. nudiflora Hook. & Arn. Sheet number 3, unidentified, is actually C. candicans. Jackson (1912) also affirms that there is a specimen in the Linnean Herbarium named as C. tomentosa by Linnaeus, but none identified as C. lanata by him.

King & Gamble (1908, 1909) compare their C. arborea var. villosa (Roxb.) King & Gamble with what is now known as C. tomentosa as follows: "The var. resembles C. lanata Linn., of Southern India and Ceylon in its leaves, but the flowers are those of C. arborea." I regard their variety as typical C. arborea Roxb.

Aganon umbellata Raf., sometimes listed as a synonym of Callicarpa tomentosa, appears to be something non-verbenaceous.

Sprengel (1825) reduces C. tomentosa L. to synonymy under what he calls C. cana L. [now known as C. candicans (Burm. f.) Hochr.] and regards C. lanata L. as a valid species with C. pedunculata R. Br., C. incana Roxb., and C. dentata Roth as synonyms. I regard C. incana Roxb. as a synonym of C. macrophylla Vahl and C. dentata Roth as a synonym of a valid C. pedunculata R. Br. Steudel (1840) reverses the situation and reduces C. lanata L. to synonymy under what he regards as a valid C. dentata Roth. Balfour (1885) lists C. cana L., C. tomentosa L., and C. americana Lour. as synonyms of what he calls C. lanata L.

Merrill (1917) notes that "Schauer has reduced Callicarpa cuspidata Roxb., which was very briefly described by Roxburgh from specimens originating in the Moluccas (probably Amboina), to the Indian Callicarpa lanata Linn. = Callicarpa tomentosa (Linn.) Murr., in which he is certainly in error. Nor is the Australian Callicarpa pedunculata R. Br., which Schauer cites as a synonym, properly placed, as it is very distinct from both Callicarpa tomentosa (Linn.) Murr. and C. cuspidata Roxb." I regard C. cuspidata Roxb. as the same as C. pedunculata R. Br.

Bakhuizen van den Brink (1921) regarded C. lobata C. B. Clarke, from Nepal, as "[?] C. tomentosae [L.] Murr. forma." He actually includes under C. tomentosa such diverse taxa as C. arborea Roxb. [which I regard as a valid species], C. integerrima Champ. [also a valid species], C. longipetiolata Merr. [a valid species], C. magna Schau. [actually C. arborea var. psilocalyx (H. J. Lam) Moldenke], etc.

[to be continued)

NUMATA & ASANO, "BIOLOGICAL FLORA OF JAPAN" AND REMARKS ABOUT PAEDERIA, PHRYMA, RABDOSIA, RAPANEA, SIGESBECKIA & VITEX

Otto & Isa Degener

One of us being familiar with the phanerogam flora of New England, the other being familiar with that of Germany and both of us having been exposed during a six weeks' tour of Japan in 1964 to the flora of its major islands, we were fascinated with Professors Makoto Numata and Sadao Asano's "Biological Flora of Japan - Sympetalae 2." The book printed in Tokyo by the Tsukiji Shokan Publishing Company on thick stock in 1970 "is the second in a series of five volumes on 'Biological Flora of Japan,' the first of which was issued in 1969. Included in this latest work are 25 families and 86 species from Caprifoliaceae to Clethraceae in sympetalae of dicotyledons." The book in bright green, cloth cover measuring 19.5 X 29 X 2.5 cm., consists of 200 pages. It is bilingual, namely in Japanese and English. It has 86 excellent, full page plates of line drawings facing the same number of pages showing a photograph of a habit of the plant with a brief annotation regarding its "Habitat" and "Life-form." Under the first, linearly arranged and briefly expressed, come Distribution, Climate, Soil, Physiography, and Vegetation; under the second, similarly arranged, Dormancy, Form, Disseminule Form, Radicoid Form, Growth Form, Sociability, Phenology and Remarks. The preface, perhaps expressed more in Japanese phraseology than in English, states that "This is not, of course, a Taxonomic flora, but ecological one mainly based on life-forms. Therefore, it does not aim at the complete enumeration of the whole flora. However, the application of this book to the Japanese flora is not restricted by the above-mentioned treatment of plants, because this is not a taxonomic flora."

As we reviewers are not ecologists, we are not capable of judging the work ecologically. Instead, we examined it taxonomically, and that involved studying the 86 beautifully executed drawings of 86 taxa. In so many cases these show in great detail not only the conventional fruit, seed and parts of flowers; but seedlings, dormant buds, bracts, stem cross sections, and the intricate branching of roots. The only figures we miss are pollen grains. We do not know whether it is stated in Japanese type, but for the sake of the mentally lazy English reader it might have been kind to have specified the family of each species in English at the head of each plate. We should have liked to see cited the author and book responsible for each scientific bi- and trinomial followed.

In leafing through the book, one of us thought he recognized New England plants; while the other thought she recognized European ones. Fascinated, one of us opened volume two of Britton & Brown's Flora and the other, *Rothmaler's Excursionsflora. Both of us seemed to recognize old friends yet, somehow, these friends looked somehow different. The explanation is found conveniently and in great detail in the up-dated reprint of Hui-Lin Li's "Floristic Relationships between Eastern Asia and Eastern North America," pp. 61, maps 56. 1971.

In short (expressing ourselves in a low, English, fog index for the Japanese reader of this review), the once-upon-a-time temperate north polar region possessed a more or less uniform mantle of vegetation. As the warmth decreased, this flora was not only killed off by frigid weather in the north but forced to emigrate southward. As these shivering survivors in Europe, Asia and Eastern North America could no longer readily exchange seeds and pollen, they began to speciate. Hence today's species depicted in Drs. Numata and Asano's fascinating tome, have for the most part close relatives in Both America and Europe. Taxonomically expressed, with of course some exceptions, these Japanese plants do not belong to the species we reviewers know, but they still do belong to the same genera.

Ignoring a few anomalies caused by man's introduction of species from one area to another, we find that of about 66 Japanese genera shown in this volume,

45 occur likewise in the Eastern United States.
35 occur likewise in Europe.
31 occur likewise in both the Eastern United States and Europe.

Tending to consider differences in plants more important than likenesses, we "splitters" prefer to alter a few of the names used:

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*On a protracted botanical excursion by railroad from Montreal to Churchill and back, one of us had the opportunity to meet Dr. & Mrs. Werner Rothmaler and the other to renew her acquaintance with the couple begun in Berlin-Dahlem, West Germany, a decade or so before. Dr. Rothmaler (Aug. 8, 1908 - April 13, 1963) of Ernst-Moritz-Arndt University, Greifswald, East Germany, we remember on the excursion as a tall, slender, very active man with blond hair he whipped into place with a toss of his head. He proved himself an astute taxonomist, readily identifying to the genus most of the plants he collected with us in Canada; why not, as explained above, when the genera are often, almost circumpolar and he knew their German representatives expertly?

Paederia mairei Lèveillè in Fedde Repert. 13: 179. 1914.
Paederia scandens var. mairei sensu Numata & Asano, ibid. 24.

Phryma asiatica (Hara) Deg. & Deg., comb. nov.
Phryma leptostachya var. asiatica Hara in Enum. Sperm. Jap. 1: 297. 1948.
Phryma leptostachya var. asiatica sensu Numata & Asano, ibid. 30.

Rabdosia inflexus (Thunb.) Deg. & Deg., comb. nov.
Ocymum inflexum Thunb. Fl. Jap. 249. 1784.
Isodon inflexus Kudo, Labiat. Sino-Jap. 127. 1929.
Isodon inflexus sensu Numata & Asano, ibid. 76.

While checking the above binomials in the Kew Index of the Marie C. Neal Herbarium in the Bernice Pauahi Bishop Museum, Honolulu, our attention was rivetted on the genus Rapanea so far as the Hawaiian Islands are involved. Hence we here intercalate some changes we judge advisable:

Rapanea alyxifolia (Hosaka) Deg. & Deg., comb nov.
Myrsine sandwicensis var. buxifolia Wawra in Flora 57: 526. 1874.
Myrsine alyxifolia Hosaka in Occas. Pap. B.P. Bish. Mus. 16: 51. 1940.

Rapanea degeneri (Hosaka) Deg. & Deg., comb. nov.
Myrsine degeneri Hosaka, ibid. 58.

Rapanea emarginata (Rock) Deg. & Deg., comb. nov.
Suttonia hillebrandii var. emarginata Rock, Indig. Trees Haw. 373. 1913.
Myrsine emarginata Hosaka, ibid. 64.

Rapanea fosbergii (Hosaka) Deg. & Deg.
Myrsine fosbergii Hosaka ibid. 46.

Rapanea fosbergii var. acuminata (Wawra) Deg. & Deg., comb. nov.
Myrsine gaudichaudii forma acuminata Wawra in Flora 57: 524. 1874.
Myrsine fosbergii var. acuminata Hosaka ibid. 47.

Rapanea helleri Deg. & Deg., nom. nov.
Myrsine lanceolata Heller in Minn. Bot. Stud. 1: 873. 1897.
Not Myrsine sandwicensis var. lanceolata Wawra in Flora 57: 526. 1874.
Suttonia angustifolia Mez in Engler, Pflzreich. 9 (IV. 236): 337. 1902.
Suttonia lanceolata Rock, Indig. Trees Haw. 379. 1913.

Myrsine angustifolia Hosaka, ibid. 42.
Not Myrsine angustifolia D. Dietr. Syn. Pl. 1: 619. 1839-52.
Not Rapanea angustifolia Merr. in Philipp. Journ. Sci. 20: 429. 1922.

We here name this species in honor of A.A. Heller, collector of the type on Kauai, to dispell some of the confusion so well untangled by Hosaka (ibid. 42-45).

Rapanea hosakana Deg. & Deg., nom. nov.
Myrsine sandwicensis var. denticulata Wawra in Flora 57: 526. 1874.
Myrsine sandwicensis var. denticulata Hillebr. Fl. Haw. Isl. 281. 1888.
Myrsine denticulata Hosaka, ibid. 49.
Not Rapanea denticulata Rusby in Phytologia 1: 72. 1934.

This species we here rename for our friend Mr. Edward Y. Hosaka.

Rapanea juddii (Hosaka) Deg. & Deg., comb. nov.
Myrsine juddii Hosaka, ibid. 39.

Rapanea kokeeensis (Hosaka) Deg. & Deg. comb. nov.
Myrsine kokeeana (sic) Hosaka, ibid. 48.

Kokee is not a person, but a locality on Kauai.

Rapanea linearifolia (Hosaka) Deg. & Deg., comb. nov.
Myrsine linearifolia Hosaka, ibid. 41.

Rapanea mezii (Hosaka) Deg. & Deg., comb. nov.
Myrsine mezii Hosaka, ibid. 34.

Rapanea petiolata (Hosaka) Deg. & Deg., comb. nov.
Myrsine petiolata Hosaka, ibid. 45.

Rapanea pukooensis (Lèvl.) Deg. & Deg., comb. nov.
Suttonia pukoensis (sic) Lèveillè in Fedde Repert. 10: 444. 1912. Type is Faurie 42 collected at Pukoo (not Puko), Molokai.
Myrsine pukooensis Hosaka, ibid. 56.

Rapanea st.-johnii (Hosaka Deg. & Deg., comb. nov.
Myrsine st.-johnii Hosaka, ibid. 37.

"Siegesbeckia," as given on the last page of the index, we prefer to spell "Sigesbeckia." We were alerted to the genus because Sigesbeckia orientalis L., is naturalized in the Hawaiian Islands and because this species, a new record for Germany, was collected by one of us in a roadside ditch in Hamburg in 1952. This specimen is deposited in Berlin-Dahlem.

Vitex rotundifolia L. f., shown on plate 99 of Numata & Asano's Flora is so similar to the plate of Vitex trifolia var. simplicifolia Gaud., as shown in Degener, Flora Hawaiiensis under Family 315 Sept. 15, 1946, that we suspect the latter trinomial wrong.

The "Biological Flora of Japan" is so beautifully and thoroughly illustrated that we look forward with expectation for the appearance of the three remaining volumes. We do hope that for each taxon shown we shall have the scientific family name as well as full citation of the literature that validated its bi- or trinomial.

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A NEW COMBINATION IN CLERODENDRUM

Harold N. Moldenke

CLERODENDRUM INDICUM f. SEMISERRATUM (Wall.) Moldenke, comb. nov.
Clerodendron semiserratum Wall., Numer. List [49], hyponym. 1829; Clerodendron siphonanthus var. semiserrata (Wall.) C. B. Clarke in Hook. f., Fl. Brit. India 4: 595. 1885.

This form is based on Wallich 1785 from Prome and Seguin, in Upper Burma, collected in 1826.

COFFEE LEAF RUST, HEMILEIA VASTATRIX, ESTABLISHED IN BRAZIL

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A profound study and a good knowledge of a disease are the first steps for its control and combat. The intention of the present article is to discuss the general biology of the coffee leaf rust and some aspects of research into it in Brazil. From this we may obtain new ideas regarding the life cycle of the fungus, its origin, its spore-dispersal and its establishment. The conclusions here made are based not on my own work, but on a critical revision of the literature. Some of the conclusions have been discussed with agronomy and biology students during the cryptogamic botany course I have been giving in the Faculty of Medical and Biological Sciences in Botucatu, São Paulo State.

Coffee is still the most important Brazilian export, accounting for 30% of the value of all exports. Since January, 1970, when Hemileia vastatrix BERK. & BR. was discovered in the State of Bahia, the coffee leaf rust caused by this fungus has threatened coffee crops and thus the progress and expansion of the Brazilian economy. It is therefore not astonishing that the Brazilian government together with the Instituto Brasileiro do Café has made and is making supreme efforts to bring the rust under control. In a very short time hundreds of scientists, especially phytopathologists and agronomy experts were induced to do research on Hemileia vastatrix (see MONTEIRO, 1970; IBC, 1970). The coffee leaf rust is at the moment considered to be enemy number one if we restrict ourselves to internal economic questions. On the other hand the fungus perhaps should also induce us to treat another aspect. It clearly shows us that any botanical, zoological, or in a general sense, ecological, question cannot be settled satisfactorily without profound and basic biological knowledge. Ingenious application makes sense only after knowing biology. One may hope, and the African Hemileia vastatrix shows us this in a quite instructive way, that "pure" biology should be studied as much as "applied" biology, also in underdeveloped countries.

The origin of Coffea arabica, Arabian (really Ethiopean) coffee, and its leaf disease, Hemileia vastatrix, are not at all obscure. Kaffa, a province in southwest Ethiopia (Abyssinia) is said to be the country of origin of Coffea arabica. Concerning the origin of Hemileia vastatrix it is assumed: "Both in Ceylon and in East Africa local study and old herbarium material suggest that the rust existed as an innocuous parasite on wild coffee, turned loose by the monoculture." (GRAM, 1960:324). It is clear that the place of origin of coffee has to be also the place of origin of its leaf disease. Hemileia vastatrix is specialized

on coffee, it has evolved along with this rubiaceous genus. Therefore, if we think about the East African region as the original center of Coffea, then it seems logical to look first for Hemileia, its disease, in the same region (see also WELLMAN, 1957). We will return to that question later when we discuss the existance of a possible intermediate host of Hemileia.

Plants of Coffea arabica that are believed to have been growing wild in East Africa were taken to southern Arabia (Yemen) and placed under cultivation there about 500 years ago. At the end of the 17th century, with the increasing popularity of coffee, the propagation of the plant spread rapidly from southern Arabia first to Ceylon (1658) and later to other places in the Asian and African tropics. In 1723 it was brought to the New World, first to Martinique and in 1727 to Brazil. To plant coffee up to the year 1868 was a profitable enterprise in many tropical countries of the Old World. However, in that year, Hemileia vastatrix, although already known in a moderate form from Africa, for the first time in history appeared as a violent disease in Ceylon. This new serious disease form of Hemileia vastatrix started to spread to coffee plantations in Asia and Africa and has recently reached the first coffee plantations of the New World. Where it passes, it destroys; control is extremely difficult and extinction of the disease in many cases means extinction of coffee.

For a better understanding of host and parasite we have to go to the center of origin of both, to East Africa. In general, the centers of origin of cultivated plants are said to be extremely important for studying and understanding genetic interaction between host and parasite. The gene-for-gene hypothesis of FLOR (1956) says that during correlative evolution of a host and its disease, both have developed a complementary genetic system. Each gene of the parasite which tends to cause virulence has caused a reaction in the host to evolve a reciprocal protective gene. Therefore, in these gene centers, which in most cases are also the centers of origin of the cultivated plants, we find a very fine controlled interaction of the host and its disease built up during millions of years. The parasite exists, but is controlled by the proper genetic system of the host (LEPPIK, 1967, 1968, 1970). This probably was also the situation with Coffea arabica and its parasite, Hemileia vastatrix, in East Africa. Hemileia has been known there for a long time (see RAYNER, 1960; GRAM, 1960); both host and parasite have lived together and have established complementary genetic systems which controlled each other. This must have been one of the reason why Hemileia vastatrix formerly had not become violent in East Africa. The same might be said for southern Arabia which lies quite close to or even within the gene center. Plant breeders knowing that the gene centers of cultivated plants are the best places to find genuine resistance to their diseases, nowadays collect wild plants of the cultivars with good perspectives for resistance in the countries of origin (see RAYNER, 1960; MEYER, 1966). It happened that Coffea arabica, once planted in places outside of its gene center and intensively cultivated in monoculture lost its immunity

and became more and more susceptible to its own parasite. Intensively cultivated plants have no time to maintain or establish genetic systems against pest-susceptibility. Plant breeders try to change the genetic of the cultivated plants all the time; the cultivars have to become better and more productive. On the other hand the parasite may suffer mutations or recombinations and may change its former complementary genetic systems too. Both host and parasite have evolved away from each other genetically until the moment that the parasite becomes violent, or in other words, the host becomes susceptible. The indication given by GRAM (1960:324) that the rust existed as an innocuous parasite on wild, viz., unbred coffee in East Africa and Ceylon, offers facts to make us think that Hemileia vastatrix was introduced into Ceylon together with coffee. Because of monoculture and long breeding the blocking gene systems there were broken and the fungus became violent. The other possibility is that the spores were blown to Ceylon by the southwest monsoons from the Horn of Africa (RAYNER, 1960:222) and could there efficently attack coffee which in the meantime had genetically changed.

The spread of the disease from Ceylon to the other coffee-producing countries is still a riddle. RAYNER (1960) and BURDEKIN (1960) brought up strong evidence that the uredospores are dispersed over long distances from one region to the other by air currents. Their ideas were mostly neglected when NUTMAN, ROBERTS and BOCK (1960) and BOCK (1962) seemed to have proved that there is almost entirely a very local dispersal of spores by water-splash. NUTMAN et al. still admitted air dispersal at a very low rate, but later on for BOCK even this seemed unlikely. Nowadays the whole complex of spore dispersal of Hemileia vastatrix is in discussion again and recent results from Brazil showed that in opposition to the statement of BOCK (1962) that there is no wind dispersal at all, spore dispersal is in fact caused by the wind. At least floating spores were found between altidudes of 100 to 1000 meters (local newspapers: Folha de São Paulo, September 30, 1971, page 26; O Estado de São Paulo, October 2, 1971, p. 15). This proves that uredospore dispersal at least within a region is caused by local air currents among other factors. We also have good reasons to believe in long-distance dispersal, so convincingly described by RAYNER (1960), particularly if we observe the spread of the disease and compare this with the directions of the winds of the world. There are two general trends to be seen. The northeast and southwest monsoon circulations during the winter and summer season over Asia might be responsible for the spread of Hemileia within the Asian and Indonesian tropics. In 1868, Hemileia was discovered as a pest in Ceylon, in 1869 already in south India, 1876 in Sumatra and Java and in 1879 it reached its most eastern point in the Fiji Islands. There, at the limits of the monsoons, the disease was brought to a stop; a more eastern spread, for example to the western coast of South America, was hindered because of another main wind direction, the trade wind zones. The trade winds between latidude 30°N and 30°S, coming from northeast

in the northern hemisphere and southeast in the southern hemisphere, are characterized by the steadiness of their direction and spead, especially over the oceans. Their general trend from east to west seems to be the reason that the disease did not spread to the east, with the exception of the places reached by the monsoons, but slowly and steadily westwards. Coming from Asia the violent rust was approaching the eastern parts of Africa: Mauritius Island in 1880, Reunion Island in 1882, Madagascar in 1886 and in 1894 it reached the African continent in Tanganyika. A further step in the western direction was Central Africa (1918) and the west coast of Africa between 1930 and 1950 (Ivory Coast, Angola and Nigeria). America was at that time still free of the pest, but RAYNER (1960) and others already warned: "Latin Americans have reason to look at the map of the winds of the world with great disquietude, for the north-east trades blow down along the coast in this part of Africa and then out across the Atlantic towards them." (p. 223). We certainly never will discover if the spores were brought by wind or by other agents to South America, but the great importance of the winds, even for long-distance dispersal (intercontinental spore dispersal discussed in SCHRODTER, 1960:222-223) cannot be ruled out. The great extension of the infected areas in the states of Bahia, Minas Gerais and Espirito Santo at the time when the disease was discovered (January, 1970), suggests that the rust probably arrived in Brazil a few years previously. Under the idea that wind may play a major role in spore dispersal, a 50 km broad safty strip between the cities of Rio de Janeiro and Belo Horizonte was established by eradicating coffee plantations just south of the infected areas. This could not stop the rust on its spread to the coffee centers in the southern states of São Paulo and Paraná. In fact the disease has already jumped the safety strip and has reached recently several places in São Paulo State and Paraná. Western countries of South America and Central America are still free of Hemileia vastatrix; at least the disease is not yet reported from there. Now they have reasons to look at the map of the winds of the world with great disquietude. Southeastern trades blow straight on from the infected Brazilian areas up to Colombia. That the rust will come to the western parts of South America and also Central America is to expected in a not too far future. Even quarantine stations and the most rigorous control will not prohibit the disease reaching its most western points on its general east-west travel around the world.

The life cycle of Hemileia vastatrix very often is said to be uncompletely known. What we principally see from the rust are a great number of uredospores, seldom a few teliospores, which germinate immediately and produce basidiospores. Pycno- or aecidiospores, common in long-cycled rusts have not yet been discovered. From what we know we may classify Hemileia biologically as a Hemi-Uredineae (WETTSTEIN, 1935:260). Whether it is an autoecious or heteroecious rust is not settled yet. One should be careful, however, about calling Hemileia a het-

eroecious rust (CARVALHO, P., 1970:21) simply because the coffee plant carries two kinds of spores only and one expects the yet "not discovered" pycno- and aecidiospores on a hypothetical intermediate host. Not all rusts produce all kinds of possible spores (which might be true for Hemileia vastatrix), and even if they do it is not the rule that they are obligately produced on different hosts (WETTSTEIN, 1935:260; ALEXOPOULOS, 1966:376-377; MAGDEFRAU, 1967:461). For a better illustrating of this idea we may first have a look at the long-cycled heteroecious stem rust, Puccinia graminis, which might serve as a model, and compare its life cycle with that of Hemileia vastatrix. Puccinia graminis produces all kinds of possible spores, viz., pycno-, aecidio-, uredo-, telio- and basidiospores. After having produced pycno- and aecidiospores on Berberis or Mahonia, the aecidiospores infect the second host, a grass of the subfamily Festucoideae. On this second host the rust repeatedly forms uredospores during the summer. In autumn the uredospores are substituted for by many teliospores, the so-called winterspores. In comparing uredo- and teliospore formation in Puccinia and Hemileia we will pay attention to the fact that uredospores are frequent and numerous in both rusts, whereas the teliospores in Puccinia are incomparably more numerous; we know they have to continue the life cycle in the next vegetative period. Teliospores in Hemileia are rarely formed (DIETEL, 1928:52). In comparison with the mass of uredospores they look surpressed and insignificant. This phenomenon perhaps needs some explication. Teliospores are said to conclude the vegetative period, or in temperate countries even to maintain the rust alive during the long winter. In tropical countries there is no real winter. Temperature may fall, precipitation and air humidity may change and the whole metabolism of plants may slow down. Hemileia is a tropical parasite living on a tropical host. Coffee normally maintains a great part of its leaves during winter. Therefore there is no necessity for Hemileia to form "winter"-spores for surviving and continuing its life cycle. Hypothetisizing, we could think that the rust during its correlative evolution with its host has strengthened the parts which have the best dispersal effect, the uredospores, and has diminuished at the same time the unnecessary winter-(telio-)spores. Pycno- and aecidiospores were completely repressed and the formerly long-cycled autoecious rust has become a short-cycled autoecious one. The few telio- and basidiospores in that case might be the remains of a formerly long-cycled rust. Exceptions with profuse production of teliospores sometimes occur (CHINNAPPA & SREENIVASAN, 1965) and might give an insight into a phylogenetically earlier condition. As a consequence of this reduction, basidiospores do not infect coffee any longer; telio- and basidiospores are a blind end of a reduced rust, which reproduces merely by uredospores.

The other possibility, existance of a second host was and is the subject of studies and searches in many coffee regions. To day Brazilian are very enthusiastic to find this intermediate

host. Eradicating this second host, they conclude, would (1) make it difficult for the rust to finish its life cycle and therefore diminuish the severity of the pest, or at least would (2) inhibit sexual recombination and hybridization. (Hyphae germinated from basidiospores form spermogonia and fuse with each other.) The first expectation can be excluded immediately. The teliospores are not frequent enough to continue the life cycle on another host in a decisive way. On the other hand it is known that uredospores are able to infect coffee during the whole year, even in winter months. Also the long-cycled Puccinia graminis shows its ability in tropical countries and in absence of the intermediate host (e.g. in Australia, DIETEL, 1928:33) to conclude and repeat its normally heteroecious cycle with only uredospores. Any alteration, viz., reduction of the leaf disease is not to be expected by combating the intermediate host. The second expectation, hindering sexual recombination, sounds at first noteworthy. Hemileia possesses quite a number of different races and as a matter of fact new races always appear (e.g. SREENIVASAN & CHINNAPPA, 1968). But perhaps there is another explanation for the appearance of these races than sexual recombination occuring on the hypothetical intermediate host. Plant breeders were very disappointed to hear that in addition to hybridization, mutation and successive selection, rusts can produce new forms also by heterocaryosis (LEPPIK, 1970:327). Dicariotic hyphae germinated from uredospores of different races of Puccinia graminis can fuse and change their nucleus (RODENHISER and HURD-KARRER, 1947; NELSON, 1956; WATSON, 1958; WILCOXSON et al., 1958; WATSON and LUIG, 1959). A similar phenomenon of fusion was found in Hemileia too (cited in CARVALHO, P., 1970:27). This author speaks about the frequently found anastomosis between hyphae germinated from uredospores. That, he concludes, although not proved yet experimentally, would indicate changing of nuclei between hyphae and could finally serve as an explanation for the variability of the fungus. One must agree with him and think of the already substantiated processes in Puccinia. An intermediate host more and more becomes superfluous. Its existence would be more interesting biologically than economically. If it ever existed and still exists, where could we find it ? Searching for the host in Brazil would be a hard job. It would be much easier to search in East Africa (which has been done extensively already), in the country of origin of both, parasite and host(s). One could even compare the flora of East Africa with that of Brazil and look for plants which are in common at both places. Plants in common should be investigated first in Brazil as potential intermediate hosts. The intermediate host has to be a plant phylogenetically older than coffee. Puccinia graminis has its origin on Berberis and Mahonia (aecial phase) and radiated later with the telial phase to phylogenetically younger grasses of the subfamily Festucoideae (LEPPIK, 1967:571). The

aecial phase is said to be the phylogenetically older phase (LEPPIK, 1967). Rubiaceae, the host of Hemileia (telial phase) are, as members of the subclass Asteridae (CRONQUIST, 1968), within the most derived Angiosperms. It would therefore be extremely difficult or impossible to make any predictions as to where we would find a phylogenetically older intermediate host since the possibilities are so numerous. The alternate host, however, is very unlikely to be of the same family, Rubiaceae.

The disease has been known for more than a hundred years. Many people have searched for an intermediate host in many places of the world without results until now. Studying the life cycle of Hemileia vastatrix and its particularities we could come to the conclusion that it indeed is a short-cycled autoecious rust and that pycno- and aecidiospores and the intermediate host on which they are produced are absent. This, however, was presumed already by DIETEL in 1928 (p.51).

After having discussed some biological aspects of Hemileia vastatrix we may mention in a few words the prospect of combatting it in Brazil. The best, and in a long run, only possible form of control is to breed resistant races of coffee. This has been attempted for many years in the Centro de Investigações das Ferrugens do Cafeeiro in Ceiras, Portugal, by Prof. B. d'OLIVEIRA and his group. Brazil also seems to be prepared. Prof. A. CARVALHO from Campinas, São Paulo State, has occupied himself in breeding resistant coffee under Brazilian conditions for about 15 years. His studies were already quite advanced when the disease (race II) arrived. Today his cultivars and hybrids are going to be tested in natural conditions to replace the old susceptible coffee plants. Principally based on his work, Brazil hopefully will overcome its financial losses and economic difficulties of the coming years.

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A Reduction of Trichantha to Columnea (Gesneriaceae

C. V. Morton

I have worked off and on with Columnea and Trichantha for many years, and at times I have been convinced that they ought to be separated and again that they ought to be united. They are separated as genera only by the presence of elongate appendages between the corolla lobes in Trichantha and the absence of these in Columnea. These appendages, of unknown function but probably connected with pollination, are peculiar, and I finally decided before publishing my "A Revision of Trichantha (Gesneriaceae)" (Contr. U. S. Nat. Herb. 38: 1-27. 1963) that they were unlikely to have arisen independently in different lines of evolution and so decided to recognize Trichantha as a genus, realizing that it was a sort of "one-character genus," since the species included were rather diverse.

No sooner was this paper in press than I received from Dr. H. E. Moore, Jr., some fresh specimens of Columnea hirta Klotzsch & Hanstein, a rather common and well-known Costa Rican species, which clearly showed appendages between the corolla lobes; these are not obvious in herbarium specimens and had not been reported. Since this species is very different from the other species placed in Trichantha and is in other respects quite typical of the section Columnea itself, it was clear that these appendages are not of fundamental importance in delimiting genera, or even an independent section.

The species of "Trichantha" vary not only in the character of the corollas but also in leaf characters. It appears that the character of the leaves of a pair being equal or strongly unequal does indicate natural subdivisions in Columnea. Therefore, in now reducing Trichantha to Columnea it is necessary to distribute the species in three sections. The three species T. moorei, T. formosa, and T. aliena, which have the leaves of a pair subequal and subregular corollas, belong in sect. Systelostoma. As mentioned above, C. hirta, with the leaves of a pair equal and the corolla strongly bilabiate, belongs in sect. Columnea. The other species, with the leaves of a pair strongly unequal and corolla subregular, fit into sect. Ortholoma.

When publishing my revision I overlooked a species that would obviously fall into Trichantha by reason of its elongate corolla appendages, one that I had myself described twenty years earlier, namely Columnea dissimilis Morton (Ann. Mo. Bot. Gard. 29: 47. 1942), the type of which was from El Valle de Antón, Province of Coclé, Panama (Allen 2483, US). In general aspect this species is different from any of the others and is probably not really at all closely allied. In my key it would go into the first arm "Corolla tube densely hirsute-tomentose," etc., and the characters of the leaves of a pair being strongly unequal

would place it near T. rosea Morton, which differs in many ways, some of the more important being:

Calyx lobes lanceolate, acuminate at apex, 2.5-3 cm. long, remotely glandular-denticulate; corolla appendages ca. 7 mm. long, orange-red pilose; corolla orange-red...C. dissimilis

Calyx lobes filiform at apex, 1.3-1.5 cm. long, deeply dissected into 2-4 pairs of linear lateral lobes up to 5 mm. long; corolla appendages 15-20 mm. long, densely rose-tomentose; corolla rose-red.....T. rosea

Seven of the species of Trichantha already have names in Columnea: Columnea dissimilis Morton, C. hirta Klotzsch & Hanst., Trichantha illepida (Moore) Morton = Columnea illepida Moore; Trichantha major Hook. = Columnea major (Hook.) Hanst.; Trichantha minor Hook. = Columnea minor (Hook.) Hanst.; Trichantha moorei (Morton) Morton = Columnea moorei Morton; Trichantha teuscheri Morton = Columnea teuscheri (Morton) Moore. The remaining species may now be transferred as follows:

Columnea aliena (Morton) Morton, comb. nov.
Trichantha aliena Morton, Contr. U. S. Nat. Herb. 38: 5. 1963.

Columnea bullata (Morton) Morton, comb. nov.
Trichantha bullata Morton, Contr. U. S. Nat. Herb. 38: 16. 1963.

Columnea clara (Morton) Morton, comb. nov.
Trichantha clara Morton, Contr. U. S. Nat. Herb. 38: 19. 1963.

Columnea elegans (Rose) Morton, comb. nov.
Trichantha elegans Rose ex Morton, Contr. U. S. Nat. Herb. 38: 23. 1963.

Columnea formosa (Morton) Morton, comb. nov.
Trichantha formosa Morton, Contr. U. S. Nat. Herb. 38: 23. 1963.

Columnea rosea (Morton) Morton, comb. nov.
Trichantha rosea Morton, Contr. U. S. Nat. Herb. 38: 7. 1963.

Columnea rosea f. latifolia (Morton) Morton, comb. nov.
Trichantha rosea f. latifolia Morton, Contr. U. S. Nat. Herb. 38: 8. 1963.

Columnea rosea f. viridis (Morton) Morton, comb. nov.
Trichantha rosea f. viridis Morton, Contr. U. S. Nat. Herb. 38: 8. 1963.

Columnea tropicalis (Morton) Morton, comb. nov.
Trichantha tropicalis Morton, Contr. U. S. Nat. Herb. 38: 13. 1963.

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Supplementary notes on the American species of Strychnos-XI

B. A. Krukoff[1] and R. C. Barneby[2]

Contents

Introduction

Since the last in this series of papers was submitted for publication 131 new collections have been studied by the senior author, largely on visits in 1970 and 1971 to six herbaria in Colombia and Brazil, six herbaria in Europe, and five in United States. An extensive and particularly interesting set of Strychnos collected largely by R.A.A. Oldeman in French Guiana was received on loan from Herb. Centre Cayenne. French Guiana has been poorly collected in recent times, a fact reflected in this collection. Nine of the 14 species of Strychnos known to occur in that country (see 7a:84, and note that S. eugeniifolia and S. oiapocensis were collected after this paper was published) were represented, and one, S. panurensis, is recorded for the first time.

No nomenclatural changes are proposed in this paper. Range extensions for ten species are noted, and a study of tendrils in the American members of the genus is presented. The following new herbarium symbol is used:

CAY: Herbier du Centre Cayenne

1. Consulting Botanist of Merck Sharp & Dohme Research Laboratories, Rahway, New Jersey

2. Honorary Curator of Western Botany, The New York Botanical Garden

TENDRILS IN AMERICAN STRYCHNOS

In his monograph of African Strychnos, Leeuwenberg (Meded. Landbouwhogeschool Wageningen 69(1):12. 1969) calls attention to three types of tendrils that occur in the genus, and suggests that they may provide useful taxonomic characters. The three types, all of which are presumed (from their axillary position) to be modified branchlets, seem not to be different except in position relative to each other. They may be described briefly as:

I. Solitary, opposed to a bract or to a developed leaf (exceptionally to a branchlet).
II. Opposite and terminal to a branchlet, forming a sort of anchor-shaped grapple.
III. Serial in 2—3 pairs at successive nodes of a leafless branchlet.

In order to test the utility of the character in the taxonomy of American Strychnos Barneby has reviewed all material of the genus preserved at NY, and below we present a summary of his findings. As was of course known to Leeuwenberg, the absence of tendrils from a specimen does not mean its absence in the species, for they are found only on particular shoots of a given plant; inevitably, therefore, much of our data is of a negative value. It appears, however, well demonstrated that Type I (solitary) is the predominant sort in American Strychnos. Type II (paired) has been seen in S. chlorantha, S. grayi, and S. nigricans. The serial type III, described by Leeuwenberg for several African species, is found with us only in S. brachistantha. Individual cases of transition from one type to another, and individual exceptions from what seems the general rule in a given species, are not infrequent. In nine species we found two types of tendril, sometimes in parts of a single collection.

Generally speaking we failed to find any strong correlation between tendril-type and major groupings within our species as these have been worked out on the basis of other morphological characters. We note with interest the diversity in tendril-type encountered in the species of subsect. Eriospermae. Assuming that this is a natural group, we conclude that at least in this context the tendril character can have no taxonomic value above the level of species. The species of sect. Breviflorae as a whole are exceptionally difficult to separate without fruits, and tendrils, if found to be truly characteristic of each species, could be useful here in determination of sterile specimens. Our study of tendrils in sect. Strychnos (Longiflorae) and Intermediae was disappointing in the sense that it shows little promise of furnishing taxonomically useful information.

TENDRILS IN SECTION STRYCHNOS
(Summary)

Solitary (type I) only.....25 species

Solitary (type I) and several exceptions (see under S. trinervis, S. peckii and S. erichsonii).....3 species
Paired (type II) only (S. chlorantha).....1 "
Paired (type II) and several exceptions (see under S. ramentifera and S. jobertiana).....2 "
Tendrils none (S. pseudo-quina).....1 "
Tendrils of these species are not known but expected to occur (S. asperula, S. lobelioides).....2 "
Specimens with tendrils are not available at NY (S. colombiensis, S. araguaensis, S. xinguensis, S. pubiflora).....4 "

Total.....38 species

TENDRILS IN SECTION ROUHAMON (AUBLET) PROGEL
(Summary)

Solitary (type I) only.....5 species
Solitary (type I) only (probably) (S. melinoniana).....1 "
Solitary (type I) and an exception (S. guianensis).....1 "
Tendrils none (S. hirsuta).....1 "
Tendrils of this species are not known but expected to occur (S. goiasensis).....1 "
Specimens with tendrils are not available at NY (S. duckei).....1 "

Total.....10 species

TENDRILS IN SECTION BREVIFLORAE PROGEL
SUBSECTION BREVIFLORAE
(Summary)

Solitary (type I) only.....5 species
Solitary (type I) and several exceptions (S. castelnaeana).....1 "
Paired (type II) only (S. grayi).....1 "
Tendrils none (S. progeliana, S. oiapocensis, S. fendleri, S. brasiliensis).....4 "
Tendrils not seen (S. rubiginosa).....1 "

Total.....12 species

TENDRILS IN SECTION BREVIFLORAE PROGEL
SUBSECTION ERIOSPERMAE Krukoff & Barneby
(Summary)

Solitary (type I) only (S. poeppigii).....1 species
Solitary (type I) and several exceptions (S. mattogrossensis, S. schultesiana).....2 "
Paired (type II) only (S. nigricans).....1 "

Serial in 2-3 pairs (type III) (S. brachistantha).....1 species
Tendrils none (S. cerradoensis, S. tarapotensis).....1 "
Tendrils of these species are not known but expected to occur (S. neglecta).....1 "
Specimens with tendrils are not available at NY (S. pachycarpa, S. malocosperma).....2 "

Total.....10 species

I. SECTION STRYCHNOS

1. chlorantha - II - Barquero 101, 102 A.
2. ramentifera - II - Froes 21817; Ducke 1762.
   I - Froes 20822.
3. colombiensis - specimens with tendrils are not available at NY.
4. asperula - tendrils of this species are not known but expected to occur.
5. romeu-belenii - I - Romeu Belem 3509.
6. rondeletioides - I - Froes 11986/2, 21283a, 21286, 22238, 23840; Black 48-2634 and many others.
7. macrophylla - I - Froes 20488, 25250; Ducke 1895, 1975.
8. barnhartiana - I - Froes 20830.
9. araguaensis - specimens with tendrils are not available at NY.
10. brachiata - I - Schultes 3602; Black 48-2948; Krukoff 10864.
11. trinervis - I - Romeu Belem 3573, 3725; Duarte 6430; Froes 12679/44, 12716/103. Exception: Klein 820 has a shoot ending in a terminal tendril, obviously an exception or teratological.
12. panamensis - I - Standley & Padilla 2559; R. S. Williams 389; Woodson et al. 1517; Pittier 4007; Allen 4573; Steyermark 99831, 101926, 101990; deBruijn 1424.
13. tabascana - I - Lundell 6095; Steyermark 41542, 45862; Standley 24302, 73143; Barquero 104.
14. divaricans - I - Ducke 2309; Black & Foster 48-3364; Ducke s.n. (Jard. Bot. Rio 22362 (photo of isotype, B; Field Neg. (8193).
15. bahiensis - I - Romeu Belem 1818, 1825, 3472, 3500, 3581, 3681, 3706, 3714.
16. eugeniifolia - I - Geijskes 1037.
17. krukoffiana - I - Ducke s.n. (1945).
18. medeola - I - Sagot 398; N. T. Silva 1758; Froes 20034.
19. toxifera - I - Froes 12073, 23172; Krukoff 7539, 8935; A. C. Smith 3678; Wilson-Browne 560.
20. tomentosa - I - Froes 23197, 23384, 23473, 23510, 23515A; Ducke 1645, 1711; Prance & Penna 2092; Lanjouw & Lindman 2743; N. T. Silva 3036; Steyermark 97583; Forest Department (Guiana) 5824.
21. diaboli - I - Forest Department (Guiana) 2473.

22. javariensis - I - Krukoff 7655; Ducke 1770; Schultes & Black 8401.
23. sandwithiana - I - Ducke s.n.; Froes 20935; Krukoff 9073, 9081.
24. jobertiana - I - Krukoff 7799; Schultes 10091; Idrobo 2627.
I plus II - Krukoff 7788, 8009.
II - Froes 12063; Krukoff 7786, 7829, 8024, 8678; Prance & Silva 58713; Steyermark 57910; Schultes & Black 8306.
25. pseudo-quina - tendrils none.
26. xinguensis - specimens with tendrils are not available at NY.
27. amazonica - I - Ducke 2007; Krukoff 9061; Pires 29; Froes 21822; N. T. Silva 1299.
28. solimoesana - I - Froes 12712/106, 19930, 20033, 20923, 23551; Krukoff 7790; Ducke 362; Romeu Belem 3703.
29. froesii - I - Ducke 2272; Froes 31328, 32169, 32395.
30. lobelioides - tendrils of this species are not known but expected to occur.
31. peckii - I - many, not listed.
III plus transition between III and I plus I - Krukoff 7631.
32. erichsonii - I - many, not listed.
Exceptions: coll. undesign. (16/VII/39) has leafless axillary shoots with solitary serial tendrils; probably a minor modification of I.
Froes 20361, 20389 have tendrils derived from a branchlet of inflorescence.
33. gardneri - I - Prance 58252.
34. pubiflora - specimens with tendrils are not available at NY.
35. bredemeyeri - I - A. C. Smith 2278; Bredemeyer s.n. (photo of the holotype at W, NY Neg. 6109).
36. mitscherlichii sens. lat. - I - many, not listed.
37. solerederi - I - Krukoff 7800, 9059, 9083, 9088, 9095, 9096.
38. darienensis - I - Froes 12069, 21064, 21805, 24378, 29641; Krukoff 8414, 10936; Schunke 3445; A. C. Smith 2837; Pires 3721; Ule 5184 (photo of the specimen at B, Field Neg. 3870, the basis of the name S. ulei).

SECTION ROUHAMON (AUBLET) PROGEL

39. guianensis - I - Oldeman B-947; Schmidt s.n.; Geijkes 1032; Stahel 98; A. C. Smith 2836.
Exception: Black & Ledoux 50-10704 has

a solitary tendril opposed to flower cymule.

40. glabra - I - A. C. Smith 2980; Krukoff 8371, 9090, 9098, 9101; Froes 22632; Maguire 56059.
41. subcordata - I - Black 49-8180; Froes 20471, 20798, 21153, 23900A, 25729; Krukoff 7957; Ducke 708; Glaziou 22753 (photo); Spruce 2087 (photo).
42. bicolor - I - Warming 1144 (photo).
43. panurensis - I - Froes 21704; Croizat 43; Wurdack et al. 41281, 43072.
44. goiasensis - tendrils of this species are not known but expected to occur.
45. duckei - specimens with tendrils are not available at NY.
46. hirsuta - tendrils none.
47. cogens - I - A. C. Smith 2272, 2444, 3598; Krukoff 8001; Froes 21261.
48. melinoniana - Lanjouw & Lindman 2621, has one detached tendril, probably type I.

SECTION BREVIFLORAE PROGEL
SUBSECTION BREVIFLORAE

49. parviflora - I - Krukoff 7798, 7819, 9072, 9087, 9104; Froes 12053.
50. castelnaeana - I - Krukoff 7548, 7588, 7592, 7596, 7600, 7602, 7781, 7808, 7811, 8679 and others.
III - (or transition to III) Froes 29036; Krukoff 7649 (sheet 2), 7653.
51. progeliana - tendrils none.
52. oiapocensis - tendrils none.
53. fendleri - tendrils none.
54. atlantica - I - Romeu Belem 3724.
55. rubiginosa - tendrils not seen.
56. parvifolia - I - Mello Filho et al. OVB-68; Romeu Belem 3704; Ducke & Lima 18; Ducke 1981; Froes & Black 24856; Froes 26981.
57. fulvotomentosa - I - Ducke 2283.
58. acuta - I - Ducke 2282; Mello Filho OVB-10; Romeu Belem 3880.
59. brasiliensis - tendrils none.
60. grayi - II - Bro. Alain 2912; Jack 5505; Bro. Leon 662; Ekman 3406.

SUBSECTION ERIOSPERMAE Krukoff & Barneby

61. pachycarpa - specimens with tendrils are not available at NY.
62. neglecta - tendrils of this species are not known but expected to occur.
63. brachistantha - III - Lundell 6266.
64. nigricans - II - Mello Filho et al. 537.
65. mattogrossensis - I - Ducke s.n. (1949); Romeu Belem 3512; Ducke 1613; Froes 20634.

I plus II - Ducke s.n. (1945), s.n. (1949).
II - Romeu Belem 3874; Froes 20034.
66. cerradoensis - tendrils none.
67. schultesiana - I - Breteler 3973.
I plus II - Breteler 4940.
68. malacosperma - specimens with tendrils are not available at NY
69. poeppigii - I - Froes 20806; Ule 5185 (photo).
70. tarapotensis - tendrils none.

CHEMICAL STUDIES OF THE AMERICAN SPECIES OF STRYCHNOS

In Supplement VII of this series (7a:87) are listed 25 species which had been studied chemically since the early thirties. In Supplement VIII (7b:78) five newly studied species were reported. Here we are able to add six more names to the list: S. romeu-belenii, S. tabascana, S. pseudo-quina, S. hirsuta, S. atlantica, and S. brasiliensis; and new data are presented under S. panamensis. For details see below.

Collection of samples for chemical assay is still actively pursued by the senior author. Collecting currently in Brazil are G. Prance, J. Murca Pires, and Nilo Silva on the Amazon, Romeu Belem in State of Bahia, and the mateiros working under direction of H. Irwin on the Central Plateau; and in Peru Jose Schunke V. A summary of progress since 1965 on chemical studies of bark of American Strychnos now in preparation by Prof. G. B. Marini-Bettolo and Dr. N. G. Bisset will be published in the next paper. Of 70 species known in America 36 have now been investigated chemically.

CHEMICAL STUDIES OF THE AUSTRALASIAN AND AFRICAN SPECIES, by N. G. BISSET

AUSTRALASIAN.

From the chemical (alkaloid) point of view, work has hardly progressed beyond the stage of acquiring basic information about the nature of the alkaloids present, and most attention has been directed towards those found in various parts of S. nux-vomica. As yet, however, no systematic chemical examination of these various parts, or of other species, has been undertaken, although this will have to be done as a first step towards obtaining an understanding of the biochemical processes which take place in relation to the plant's alkaloids. Nevertheless, a start has been made with elucidating the biosynthesis of strychnine and similar bases (see below).

Recent findings are set out in the following table:

S. NUX-VOMICA L.

Seeds: Additional alkaloids - pseudobrucine, pseudo-α-

-colubrine, pseudo-β-colubrine, and two others as yet unidentified but possibly the N-oxides of strychnine and brucine[1, 2]

Young leaves: Strychnine, β-colubrine, brucine, icajine, vomicine, novacine[3, 4]

Stem bark: Strychnine, α-colubrine, β-colubrine, brucine, pseudostrychnine, pseudobrucine[5]

Root and root bark: Strychnine, brucine, pseudostrychnine, pseudobrucine[1, 4]

Both the young leaves and the stem bark have been found to contain much alkaloid, up to 8 and 9%, respectively. It has been observed that the roots and root bark contain little or no icajine, vomicine, and novacine - the so-called N-methyl-pseudo bases - while the alkaloid mixture of the leaves comprises as much as 40% of these compounds; this finding is taken to be of possible biogenetic significance.[3, 4] Studies on the biogenesis of strychnine reveal that the roots are the probable main production centre, with little being produced in the leaves, and that there is not much transport of strychnine to the leaves.[6] This fits in with an observation by Denoël and co-workers on African Strychnos species, that loganin-type compounds, from which the non-indole part of the alkaloids is derived, are absent from the leaves.[7] The seeming absence of N-methyl-pseudo bases in the root bark and stem bark of S. nux-vomica and their presence in high proportion in the leaves therefore suggests that these bases may well be formed in the leaves, probably from alkaloids of the strychnine type.

Diaboline - the one alkaloid so far found in species from all three parts of the world where Strychnos occurs and which is an obvious candidate as a biogenetic intermediate - has been shown by radioactive tracer experiments not to be converted into strychnine in S. nux-vomica. It is therefore not a direct precursor of this base. A similar result has been obtained with N_a-deacetyldiaboline.[6]

AFRICAN.

Phytochemical and pharmacological screening of 23 species has been carried out.[8] Pronounced differences in alkaloid pattern and pharmacological effects were noted. Both convulsant (strychnine-like) and muscle-relaxant (curarizing) activities were found, implying the simultaneous presence of tertiary and dimeric quaternary alkaloids in some species.

Over 200 samples of leaves, belonging to 69 of the 75 recognized African species, have been screened for tertiary alkaloids; only about a dozen species have more than 0.1% alkaloid in the leaves. Strychnine and similar bases appear to be of rare occurrence and are probably present in only about half-a-

-dozen species, but again the alkaloid patterns show considerable variation. From an alkaloid point of view, the leaves are the least satisfactory material to work with, because of the generally low yield of alkaloids, but are easiest to obtain - in small amounts, at least - as herbarium fragments.[9]

Nevertheless, a systematic study of the various plant parts is still lacking.

A detailed review of the ethnobotany of African Strychnos is in course of publication.[10]

Recent chemical findings are set out in the following table:

S. HENNINGSII Gilg

Additional alkaloids - O-acetylhenningsoline and 8,13-dehydrodiaboline (South African material)[11]

Tsilanine and 2-methoxytsilanine and their O-demethyl derivatives (Madagascar material)[12]

The tsilanine alkaloids are evidently related to holstiine,[13] previously isolated from Congo (Kinshasa) material.

S. ICAJA Baill.

Strychnine, 4-hydroxystrychnine, pseudostrychnine, icajine, vomicine, 14-hydroxyicajine, 21,22-α-epoxyvomicine, 21,22-epoxy-N-methyl-sec.-pseudo-β-colubrine, 21,22-α-epoxy-3-methoxyvomicine, 21,22-α-epoxynovacine, 14-hydroxy-21,22-α-epoxyicajine, 14-hydroxy-21,22-α-epoxyvomicine, 14-hydroxy-21,22-α--epoxynovacine[13]

This well-known ordeal-poison plant[14] is so far unique among African species in that it exhibits convulsant activity only. The alkaloids responsible are strychnine and 4-hydroxystrychnine[15] and this is the first time that strychnine has unequivocally been shown to be present in an African Strychnos species. The other bases present have little pharmacological activity. Like S. nux-vomica, in S. icaja the N-methylated bases are found in high proportion in the leaves, while the strychnine and 4-hydroxystrychnine predominate in the root bark - the plant part used to make the poison.

S. SPLENDENS Gilg

Additional alkaloids - isostrychnosplendine and its N_a-acetyl derivative, splendoline, isosplendoline, isosplendine[16]

Of interest is the reported isolation of retuline and splendine-type alkaloids from the South American S. brasiliensis,[17] which further emphasizes the chemical relationships between the geographically separated groups of species.

1. G.B. Marini-Bettolo et al., J. Assoc. off. analyt. Chem. 51 185-191. 1968.
2. C. Galeffi et al., J. Chromatog. 45 407-414. 1969.
3. P. Sěfčovič et al., Planta med. 16 143-146. 1968.
4. W. Maier & D. Gröger, Pharm. Zentralhalle 107 883-885. 1968.
5. P.L. Rajput & C.K. Atal, Indian J. Pharm. 31 87-88. 1969.
6. Ch. Schlatter et al., Helv. chim. Acta 52 776-789. 1969.
7. A. Denoël et al., Contribution à l'étude des Strychnos du Congo Belge. Ministère des Colonies. Bruxelles. 1953.
8. F. Sandberg et al., Acta Pharm. Suecica 6 79-102. 1969.
9. N.G. Bisset & J.D. Phillipson, Lloydia 33 in press.
10. N.G. Bisset, Lloydia 33 in press.
11. M. Spiteller-Friedmann & G. Spiteller, Liebigs Ann. Chem. 711 205-220. 1968; ibid., 712 179-194. 1968.
12. R. Sarfati et al., Phytochemistry 9 in press.
13. N.G. Bisset, "Alkaloids of some African species of Strychnos", Ph.D. Thesis, University of London. 1968; Tetrahedron Lett. 3107-3110. 1968.
14. N.G. Bisset & A.J.M. Leeuwenberg, Lloydia 31 208-222. 1968.
15. F. Sandberg et al., Acta Pharm. Suecica 6 103-108. 1969.
16. M. Koch et al., Ann. Pharm. franc. 27 229-238. 1969.
17. G.B. Marini-Bettolo, Farmaco, sci. ed., 25 150-162. 1970.

1. Strychnos chlorantha Progel, Mart. Fl. Bras. 6(1):273. 1868.

Costa Rica: Puntarenas: forest road above entrance to Laguna, San Vito del Java, B. G. Schubert 1267 (US).
This collection, made on March 17, has mature fruits ± 4.3 cm in diam with shells ± 9 mm thick.

5. Strychnos romeu-belenii Krukoff & Barneby, Mem. N.Y. Bot. Gard. 20(1):22. 1969.

From the stem bark of this species (Romeu Belem 3504 - cited in 7d:179) a new indolinic alkaloid has been isolated to which the structure of 11-methoxydiaboline has been assigned (1091).

6. Strychnos rondeletioides Spruce ex Bentham, Jour. Linn. Soc. 1:104. 1856.

Venezuela: Amazonas: "7/9 km de Yavita hacia Pimichin", Steyermark & Bunting 102920.

7. Strychnos macrophylla Barbosa Rodrigues, Vellosia, ed. 2, 1: 33, pl. 2, fig. A. 1891.

Brazil: Amazonas: near Manaus, Aleixo, on terra firme, W. Rodrigues 8922 (INPA).

9. Strychnos araguaensis Krukoff & Barneby, Mem. N. Y. Bot. Gard. 20(1):24. 1969.

Brazil: Goias: Araguaina, elev. ± 300 m, Irwin et al. 21182; Mato Grosso: R.M. Harley et al. 10811 (E) (ca 290 km N. of Xavantina, dry forest), R.R. DeSantos et al. 1802 (E) (ca 310 km N. of Xavantina), 1489 (E) (ca 281 km N. of Xavantina), J.A. Ratter et al. 1199 (E) (ca 285 km N. of Xavantina).

This species was known from 3 collections and the present collections confirm the fact that it is confined to a dry low forest in a transition zone between high Amazonian forests and open savannas. S. peckii which closely resembles S. araguaensis in vegetive characters, is found in the same localities but in gallery forests.

11. Strychnos trinervis (Velloso) Martius, Syst. Mat. Med. Bras. 121. 1843.

Brazil: Paraná: Hatschbach 18992 (WAG), 20183 (WAG), 20186 (US), s.n. (1/11-1968) (US).

12. Strychnos panamensis Seemann, Bot. Voy. Herald 166. 1854.

Chromosome number : 2n=44. Voucher: Guillen 201 cited in 7a: 29 (Annals Missouri Bot. Gard. 56:474. 1969.

Guatemala: Suchitepequez: near Nahualate, Krukoff 1971/15. Panama: Canal Zone: Croat 5077, 10165. Colombia: Choco: Munic. Riosucio, Rio Truando, Romero Castaneda 6099 (COL).

From mature seeds capable of germination (Guillen 201) Strychnine (0.1%) and Brucine (0.1%) were isolated. Immature and overmature seeds were not found to contain either of the two bases. This is the first time that these two alkaloids were identified with certainty in an American species of Strychnos. (109k). For the previous work with stem bark see (109b) and (7b).

13. Strychnos tabascana Sprague & Sandwith, Kew Bull. 1927:128. 1927.

Mexico: Veracruz: Region de los Tuxtlas, 900 m, Mario Souza 3441 (MEXU); Oaxaca: Mario Souza 1722 (MEXU) Chiltepec), 1841 (MEXU) (Tuxtepec), Comisión de Dioscóreas 5491 (MEXU) (Temoxcal).

This is the first record of the species from Oaxaca, Mexico.

According to a private communication from Prof. G.B. Marini--Bettolo, from the root bark of this species (Humberto Barquero M. 104, 105 cited in 7a:30 and Boburg 101 cited in 7b:29) five alkaloids have been isolated. These are as follows: Tabascanin which is related to Retuline, an indolinic alkaloid previously found in the African species S. henningsii; Acetyl-tabascanin which is identical with Strychnosilidine recently reported in S. brasiliensis; two alkaloids, Strychnobrasiline and 10-methoxy-

-strychnobrasiline which belong to the isosplendine type present in African species S. splendens and Strychnobrasiline which was recently isolated from S. brasiliensis. (Farmaco (Ed. S.), in press).

15. Strychnos bahiensis Krukoff & Barneby, Mem. N. Y. Bot. Gard. 20(1):29. 1969.

Brazil: Bahia: Belmonte, Belem & Pinheiro 3228.

16. Strychnos eugeniifolia Monachino, Phytologia 4:209. 1953.

French Guiana: basin of Approuague River, DeGranville 100 (CAY), Oldeman B-535 (CAY).

18. Strychnos medeola Sagot ex Progel, Mart. Fl. Bras. 6(1):282. 1868.

French Guiana: basin of Approuague River: Oldeman T-77 (CAY), B-2279 (CAY). Brazil: Pará: basin of Rio Jarí, N.T. Silva 1758, 3408.

Silva 3408 is a voucher for samples of bark collected for chemical studies by Prof. Marini-Bettolo.

19. Strychnos toxifera Robert Schomburgk ex Bentham, Jour. Bot. Hook. 3:240. 1841.

Panama: Canal Zone: Barro Colorado Island, Croat 5425, 10945 (MO).

20. Strychnos tomentosa Bentham, Jour. Linn. Soc. 1:104. 1856.

French Guiana: Herb. Centre Cayenne 7930 (CAY). Brazil: Pará: Belém, Ipean, cult., N.T. Silva 3036; basin of Rio Jarí, E. Oliveira 4678 (IAN).

Silva' specimen is a voucher for the sample of leaves collected for chemical studies of Dr. N.G. Bisset.

3. Strychnos colombiensis Krukoff & Barneby, Mem. N. Y. Bot. Gard. 12(2):21. 1965.

Peru: Cuzco: prov. La Convención, Cordill. Vilcabamba, along the Mapitunari, c. 670 m, ± 4 km from Apurimac, T.R. Dudley 11486 (NA, F, NY).

Two Dudley's collections are from the same locality. Dudley 10075 cited under S. peckii shows that this species ascend the Amazon almost to its source, whereas S. colombiensis cited above was known previously only from 3 collections on the Pacific coast of southern Colombia.

25. Strychnos pseudo-quina A. St. Hilaire, Mém. Mus. Paris 9: 340. 1822.

Brazil: Goias: Irwin et al. 21584 (ca 12 km S. of Guara,

elev. ± 550 m), 23993 (Chapada dos Veadeiros); Mato Grosso: David R. Hunt & José Ferreira R. 5729 & 6110 (Serra do Roncador), G. Hatschbach 23594 & 24266 (mun. Rio Brilhante, Casa Branca), J.A. Ratter et al. 395 (E) (2 km N. of Xavantina), D.R. Gifford G.102 (E) (ca 260 km N. of Xavantina).

This species was studied chemically by Marini-Bettolo and his coworkers and nor-dihydrotoxiferine of high purity and in large amounts (6%) was isolated from the stem bark (109f).

Pollen grains of S. pseudo-quina St. Hil. were studied and their description and drawings were presented. (I.F. Marques Valio & Maria Lea Salgado Labouriau, Rev. Brasil. Biol., 24(2): 124. 1964).

27. Strychnos amazonica Krukoff, Brittonia 4:284. 1942.

Brazil: Pará: basin of Rio Jarí, Nilo T. Silva 3429; Rondônia, basin of Rio Madeira, Prance et al. 8491 (MG, INPA).

This is the first record of the species from Rondônia.

31. Strychnos peckii B. L. Robinson, Proc. Amer. Acad. 49:504. 1913.

Costa Rica: Puntarenas: El General valley, ± 900 alt., L.O. Williams 28692. French Guiana: south of Cayenne, Oldeman 1877 (CAY). Brazil: Pará: Belém, Ipean, cult. N.T. Silva 3037. Mato Grosso: G.C.G. Argent 6913 (± 280 km N. of Xavantina, swampy gallery forest), J.A. Ratter et al. 1333 (K) (± 240 km N. of Xavantina). Peru: Cuzco: prov. La Convención, about 8 km NE from Hac. Luisiana and Río Apurimac, alt. 910 m, dense rain forest, T.R. Dudley 10075 (NA).

L.O. Williams' collection is the first record of the species from Puntarenas. For our remarks on the Dudley collection, which is the new record for Peru, see under S. colombiensis, and on the two collections from Mato Grosso under S. araguaensis.

Silva's specimen is a voucher for the sample of leaves collected for chemical studies by Dr. N.G. Bisset.

32. Strychnos erichsonii Richard Schomburgk, Reisen 3:1082, hyponym. 1848; Mart. Fl. Bras. 6(1):274. 1868.

Panama: Darién: La Boca de Pierra, N. Bristan 1264 (MO). French Guiana: Oldeman 1641 (CAY) (south of Cayenne), B-2771 (CAY) (basin of Approuague), 1715 (CAY) (basin of Oyapock), Herb. Centre Cayenne 7858 (CAY) (Tampoc River). Brazil: Pará: Belém, Ipean, Pires & N.T. Silva 10439 (IAN); Amazonas: Manaus - Itacoatiara highway, Reserva Florestal Ducke, terra firme, Prance et al. 4794. Colombia: Amazonas (Quebrada Loretillo, afluente del Río Loreto-Yacú, en la frontera Colombo-Peruana, Fabriciano Diaz M. 57 (ECON).

Fabriciano Diaz 57 is a mixed collection. The specimen deposited at New York represents S. erichsonii, whereas the other sheets distributed under the same number are S. mitscherlichii var. mitscherlichii.

33. Strychnos gardneri DC., Prodr. 9:14. 1845.

Brazil: Minas Gerais: Irwin et al. 23645 (Serra do Espinhaço, elev. ± 950 m), 24182 (Chapada dos Veadeiros, elev. ± 1000 m).

36a. Strychnos mitscherlichii Richard Schomburgk, Reisen 2:451. 1848, var. mitscherlichii.

Brazil: Pará: Santarém, M. Silva & R. Souza 2570 (HAMP 37376); Acre: Rio Branco, terra firme, Vasconcelos & D. Coêlho s.n. (INPA 11048).

This is the first record of this species from the basin of Rio Tapajos and from Acre.

37. Strychnos solerederi Gilg, Bot. Jahrb. 25(Beibl. 60):40. 1898.

Colombia: Amazonas: Leticia, D.D. Soejarto 595 (K).

38. Strychnos darienensis Seemann, Bot. Voy. Herald 166. 1854.

Nicaragua: Sombrero Negro, near Rama, Carlos Berger s.n. (Jan. 1912) (NA). Panama: Canal Zone: Croat 8015 (MO). Colombia: Chocó: Río San Juan, Cuatrecasas 21442 (F). Peru: J. Schunke V. 3445 (F).

This is the first record of the species from Nicaragua.

39. Strychnos guianensis (Aublet) Martius, Syst. Mart. Med. Bras. 121. 1843.

Venezuela: Bolívar: "el drenaje de Rio Cuyuni, Steyermark et al. 104538 A. French Guiana: Oldeman B-480 (CAY) (south of Cayenne), B-2697 A (CAY) (basin of Approuague River), Oldeman T-781 (CAY) (upper Oyapoc). Brazil: Pará: basin of Rio Jarí, mata de terra firme, N.T. Silva 3156, basin of Rio Parú, Cavalcante 2529 (MG); Amazonas: W. Rodrigues 8858 (INPA) (near Manaus), Byron 266 (INPA) (Rio Auati Paraná).

40. Strychnos glabra Sagot ex Progel, Mart., Fl. Bras. 6(1):275. 1868.

Brazil: Pará: boca do Rio Juruena, fronteira Amazonas, Pará and Mato Grosso, Pires 3698; Amazonas: basin of upper Juruá, Froes 21765; Mato Grosso: Serra do Roncador, margin of Garapu airstrip, Prance et al. 59203.

The specimens listed above were mentioned previously (7b:26) as representing a possibly undescribed species akin to S. glabra, but of uncertain status due to lack of good flowers and fruits. They are interpreted here as a pubescent form of S. glabra, or possibly as pubescent branchlets of the same growing in full sunlight. They find a good match in Krukoff 9090, which in turn matches Krukoff 9062 (with immature fruits), 9098, and 9101, all from the basin of Creek Belém in drainage of Rio Solimões, Amazonas. All these specimens are from terra firme.

42. Strychnos bicolor Progel, Vidensk, Meddel. 1869:31. 1869.

Brazil: Distr. Federal: Chapada do Contagem, elev. ± 1100 m, Irwin et al. 19481; Minas Gerais: Chapada dos Veadeiros, elev. ± 1000 m, Irwin et al. 24015.

This is the first record of this species from the Federal District.

43. Strychnos panurensis Sprague & Sandwith, Kew Bull. 1927:132. 1927.

Panama: coll. undesign. 8166 (MO). French Guiana: "Fleuve Sinnamary, sur la crique Grégoire," Oldeman B-1653 (CAY).

This is the first record of this species from French Guiana.

46. Strychnos hirsuta Spruce ex Bentham, Jour. Linn. Soc. 1:106. 1856.

Brazil: Amazonas: Janauacá, L. Coêlho & D. Coêlho 37 (INPA).

Samples of this species (Pires 2636) were forwarded at our request to Istituto Superiore di Sanitá, Rome (7a:63). According to a private communication from Prof. G. B. Marini-Bettolo, bark of the lower part of the stem and bark of roots show the same composition in tertiary alkaloids. These are still under investigation.

48. Strychnos melinoniana Baillon, Bull. Soc. Linn. Paris 1:256. 1880.

Surinam: L.B.B. 12038 (U). French Guiana: Sinnamary River, Oldeman B-1235 (P). Brazil: Amazonas: near Rio Maturacá, near the Venezuela border, Steyermark 104026.

52. Strychnos oiapocensis Froes, Bol. Tecn. Inst. Agron. Norte 36:143. 1959.

French Guiana: François Halle 1133 (P) and Oldeman 1180 (CAY) (Cacao, 60 km S. of Cayenne), Oldeman B-2114 (CAY) (basin of Approuague), Oldeman 2614 (CAY) (basin of Oyapock).

54. Strychnos atlantica Krukoff & Barneby, Mem. N. Y. Bot. Gard. 20(1):61. 1969.

Brazil: Pernambuco: Andrade Lima s.n. (6/2-1970).

The collector describes the plant as "cipó vigoroso ramando nas arvores de 8-10 m."

Calyx of this species is described here for the first time (corolla is not present on the above cited specimen): calyx microscopically puberulent externally, ± 2 mm long, the free lobes up to 1.5 mm long, ovate, short-acuminate, stiffly hispidulous--ciliolate.

Samples of this species (Romeu-Belém 3712) were forwarded by us to Istituto Superiore di Sanitá, Rome (7d:183). According to a private communication from Prof. G. B. Marini-Bettolo, the root bark yielded only tertiary alkaloids.

55. Strychnos rubiginosa DC., Prodr. 9:16. 1845.

Mato Grosso: Campo Grande, J.P.P. Carauta 758 (RB); Minas Gerais: Serra do Espinhaco, elev. ± 1100 m, Irwin et al. 23152; Paraná: mun. Jaguariaiva, cerrado, Hatschbach 20402.

In 1969 we arrived at a new concept of this species and in 7b:98 we cited 14 known collections of it from the states of Piaui, Ceará, Pernambuco, Bahia and Mato Grosso. The present collections are new records of the species from Minas Gerais and Paraná.

Fruits on Irwin's collection are 2.7-3.4 cm diam.

56. Strychnos parvifolia DeCandolle, Prodr. 9:16. 1845.

(?)Rhamnus ruffus Velloso, Fl. Flum 1:96 and 2:tab. 148. 1825.

(?)Ziziphus rufa (Velloso) Martius, Flora 24, Beibl. 2, p. 65. 1841.

(?)Colubrina rufa (Velloso) Reissek, Martius Flora Bras. 11 (1):98. 1861.

Brazil: Pará: Santarém, M. Silva 1313 (MG), 1367 (MG). Paraguay: Pedersen 5122 (US).

The plant described and figured as Rhamnus ruffus by Velloso is doubtless a species of Strychnos, as recently brought out by M.C. Johnston (Brittonia 23(1):51. 1971), but its identity remains controversial. Velloso described the plant as a high--climbing vine with spines, glabrous leaves, and terminal inflorescences, evidently some member, therefore, of sect. Breviflorae.

The plate somewhat suggests S. rubiginosa, but this has pubescent foliage and is found in cerrados, not in coastal forest. Spines combined with terminal inflorescences might suggest S. nigricans or S. mattogrossensis, but the leaves illustrated cannot be reconciled with either. These leaves might illustrate those of a young stump-sprout of S. parvifolia, but do not resemble leaves of adult stems high on the vine. Inasmuch as an exact determination of Rhamnus ruffus seems unattainable in the absence of specimens, it is preferable to discard the name as ambiguous, thereby ensuring the perpetuation of the posterior but well-known S. parvifolia DC.

59. Strychnos brasiliensis (Sprengel) Martius, Flora 24 (Beibl. 2):84. 1841.

Brazil: Distr. Fed.: Jard. Bot. Rio 109208 (RB); Minas Gerais: M. Kuhlmann 2581 (K) (Sapucaí-Mirim), Emmerich 1746 (R) (Poços de Caldas), L. Mattos & N. Mattos 15170 (SP) (munic. Passa Quatro); São Paulo: Mello Filho 1270 (R) (Mojí-Guaçu); Paraná: G. Hatschbach 256, 18362, 19168 (WAG), 23061; Rio Grande do Sul: Brescia & Borsani 3333 (US). Argentina: Misiones, E. Claro s.n. (Posadas), E. Sesmero s.n. (18/5-1944), Montes 3265 (K) (Cantero); J. Couderc s.n. (Jan. 1968); Corrientes: Ibarrola 1479.

From the trunk bark (J. Couderc s.n.) spermostrychnine (I) and six new indoline alkaloids have been isolated and their structures and configurations determined. They were named: 12-hydroxy-11-methoxyspermostrychnine (II), Strychnobrasiline (III), 12-hydroxy-11-methoxystrychnobrasiline (IV), 10, 11-dimethoxystrychnobrasiline (V), Strychnosilidine (VI), and Strychnosiline (VII). (72).

64. Strychnos nigricans Progel, Mart. Fl. Bras. 6(1):280. 1868.

Brazil: Minas Gerais: Fazenda S. Marco, Belem 3788 (IAN); Guanabara: Rio de Janeiro: Grajau, Mello Filho 2682 (R).

65. Strychnos mattogrossensis S. Moore, Trans. Linn. Soc. II. 4: 392. 1895.

Brazil: Amazonas: basin of Rio Solimões, Lago Buiussú, M. Silva 2030 (MG); Maranhão: munic. Viana, Boiciquere, Froes 34923 (IAN); Rio Grande do Norte: Canguaretama, na Boca dos 7 buracas, Luiz Emygdio 1701 (R); Paraíba do Norte: Araça, Xavier 151 (R); Pernambuco: Pacatuba, Andrade Lima 68-5227; Bahia: Belém & Pinheiro 3110 and Belém 3512 (Marau), 3708 (Una), 3713 (Juçari), 3874 (vale do Rio Mucuri), Froes 12658 (basin of Rio Pardo), 12708 and 12735 (basin of Rio Santa Ana).

It is not possible to distinguish the sterile collections of S. mattogrossensis from S. nigricans. Even good flowering material is difficult to identify, but the two species are immediately distinguished by fruits. With the recent collections of

fruiting material we revised collections of this complex as it is represented in North Eastern Brazil. It now appears that S. mattogrossensis was collected in Maranhão, Ceará, Rio Grande do Norte, Paraíba do Norte, Pernambuco and Bahia, states from which there are no collections of S. nigricans. The latter species of course is well represented from Minas Gerais, Espirito Santo, Rio de Janeiro and São Paulo. For the collections mostly sterile which were identified incorrectly, or with doubts, see Appendix VII (Supplement).

67. Strychnos schultesiana Krukoff, Mem. N. Y. Bot. Gard. 12(2): 78. 1965.

Venezuela: Mérida: Breteler 3989 (WAG), 4578 (WAG); Barinas: Breteler 3155 (WAG), 4003 (WAG).

69. Strychnos poeppigii Progel, Mart. Fl. Bras. 6(1):282. 1868.

Peru: Huánuco: Tingo María, J.D. Dwyer 6265 (LA); Loreto: near Contaminá, Schunke 940.

70. Strychnos tarapotensis Sprague & Sandwith, Kew Bull. 1927: 131. 1927.

Peru: San Martín: Mariscal Cáceres, alt. 500 m, J. Schunke V. 3187.

APPENDIX VII (SUPPLEMENT)

Changes in the identifications

			Cited originally as		Cited later as	
Belem	3110	(fl.)	nigricans	(7b:70)	mattogrossensis	(11th Suppl)
"	3512	(sterile)	"	(7d:184)	"	"
"	3708	"	"	"	"	"
"	3713	"	"	"	"	"
"	3874	"	"	"	"	"
Xavier	151	"	"	(1:315)	"	"
Froes	12658	"	"	(2:23)	"	"
"	12708	"	"	"	"	"
"	12735	"	"	"	"	"
"	34923	(fl.)	"	(7b:70)	"	"
Mello Filho	1701	(sterile)	"	"	"	"
Pedersen	5122	"	brasiliensis	(7b:67)	parvifolia	"

Corrections

7d:180 Strychnos pseudo-quina not Strychnos pseudo-guina
7d:182 Strychnos guianensis not Strychnos quianensis
7b:45 Altson not Alston

BIBLIOGRAPHY

(In order to conserve space, we are citing here only papers not cited in Supplements VII - X).

7d. Krukoff, B. A. & R. C. Barneby. Supplementary notes on the American species of Strychnos X. Phytologia 19(3):176-185. 1969.

109f. Marini-Bettolo, G. B. et al. The occurrence of NOR-dihydrotoxiferine in Strychnos pseudo-quina A. St. Hil. Tetrahedron Letters 25:2009-2010. 1969.

109g. _____. A gradient method for the counter-current separation of alkaloids using a heavy organic phase. Chromatog. 45:407-414. 1969.

109h. Marini-Bettolo, G. B. Les alcaloides tertiaires des Strychnos. Bull. Soc. Pharmac. de Nancy 80:5-22. 1969.

109i. _____. Alcaloides Quaternaires des Strychnos et curares. Il Farmaco 25(2):150-162. 1970.

109j. _____. Due nuovi alcaloidi da Strychnos nux-vomica L. 16-ossi-α-colubrina e 16-ossi-β-colubrina 48:46-50. 1970.

109k. Marini-Bettolo, G. B. et al. On Strychnos alkaloids XXII. The occurrence of strychnine and brucine in an American species of Strychnos. Phytochemistry, in press.

109l. _____. 11-metossi-diabolina: un nuovo alcaloide terziario da Strychnos romeu-belenii Krukoff & Barneby. Atti Accad. Lincei Rend. Classe Sci. Fis. Mat. Nat., in press.

109m. _____. On the alkaloids of Strychnos XXIV. The alkaloids of Strychnos tabascana. Il Farmaco, in press.

110n. Iwataki, I. & J. Comin. Studies on Argentine plants XXXI Alcaloids from Strychnos brasiliensis. Tetrahedron 27: 2541-2552. 1971.

SUPPLEMENTARY NOTES ON THE AMERICAN SPECIES OF ERYTHRINA. V.

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CONTENTS

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INTRODUCTION

Since the last of this series of papers was submitted for publication 562 new collections have been examined. These were from several sources:

1. specimens examined in 1969, 1970, and 1971 during visits to eight herbaria in Colombia and Brazil, eight herbaria in Europe, two herbaria in the West Indies, and five in United States,

2. specimens collected on numerous trips in Guatemala during 1969, 1970 and 1971,

and 3. specimens collected on three trips to Mexico in 1970.

The newly examined collections have extended our knowledge of some species previously known from incomplete material; extensions of ranges are noted for twenty three species, two species (E. glauca Willdenow and E. flammea Herzog) are reduced to synonymy and two species (E. barqueroana Krukoff & Barneby and E. williamsii Krukoff & Barneby) are described as new.

FIELD STUDIES IN GUATEMALA IN 1969, 1970 and 1971

Field studies of Central American species initiated in the dry season of 1968/9 and covered in Supplement IV (7) were continued in 1969, 1970 and 1971. These had special objectives and were confined to four departments in Guatemala.

DEPT. SAN MARCOS

E. florenciae and E. tajumulcensis were described from this department in 1970 (7). Mature pods and seeds of E. florenciae and the habitat of both species however were not known and we did not have sufficient seeds for chemical studies and cultural experiments. The type localities of these two species were revisited in January and April 1970, and again in January and before 1971. All objectives were accomplished except that we still need additional seeds of E. florenciae and we still were not able to find E. tajumulcenses anywhere in Guatemala except for the type locality. These two species are usually in flower in January and in fruit toward the end of March.

DEPT. ALTO VERAPAZ

E. williamsii was collected in the season of 1968/69. I delayed describing it until this paper however as I wanted to collect additional material and to study it further in the field. E. folkersii was previously known from Coban from unsatisfactory material -- inflorescences with flowers (without leaves and fruits) and complete material of this species was obtained. The objective with E. cobanensis was to obtain a collection with

leaves, flowers and mature fruits from a single tree, and this objective was also achieved. Previous collections were of inflorescences with flowers (without any leaves) or of leaves with mature fruits or of immature leaves with inflorescences in flower. However we still lack a sufficient amount of seeds of E. cobanensis and E. williamsii for chemical studies and cultural experiments.

We are now able to give a preliminary account of the distribution of Erythrina spp. in the Dept. of Alto Verapaz.

Of six species known to occur in Alta Verapaz, three occur on "coffee elevations". E. cobanensis is the most common species in and around Coban and along the road from San Pedro Carcha to Chapultapec. E. williamsii occurs in the same general region but is much more rare, whereas E. guatemalensis is especially common along the streams from Tactic to Tucurú. From Tucurú toward Panzós (on "tierra caliente") it is replaced by E. berteroana, whereas from Panzós toward El Estor (Department Izabal) on fertile silt soils where "Cohune" palm (Orbignya cohune (Martius) Dahlgren ex Standley abounds E. folkersii makes its appearance. The latter species was found also on "tierra caliente" near Lanquin. The distribution of E. mexicana in Alta Verapaz is poorly known.

DEPT. HUEHUETENANGO

E. barqueroana is described in this paper and with this the finding of novelties on limestone soils in the muncipality of Barillas seems to have come to an end. Five species (E. berteroana, E. castillejiflora, E. barqueroana, E. huehuetenangensis and E. guatemalensis are found in this region. The first three species are found on "tierra caliente" and of these E. barqueroana is the most common. The last two are found on high elevations (1200-1800 m). The pods and seeds of E. castillejiflora are still not known.

DEPT. PETEN

The field work in this department was conducted as a part of my first trip to Mexico in 1970. For the results see under Field Studies in Mexico in 1970.

FIELD STUDIES IN MEXICO IN 1970

During the dry season of 1970, in February and March, I made three trips to Mexico for the purpose of studying Erythrina in the field.

The objective of the first trip was to investigate the Erythrina flora of Yucatán Peninsula and Petén, an area of tropical lowland with limestone bedrock. Only four collections of the

genus were known previously from this area, two from Yucatan, one from Campeche, and one from Petén, all representing E. standleyana. The itinerary (Feb. 17--24; 2764 road kilometers), disregarding side-excursions, was as follows: Huehuetenango (Guatemala), Ocotal (border of Guatemala and Mexico), Cristobal de las Casas (Chiapas), Villahermosa (Tabasco), Tenosique (Tabasco), Escarcega (Campeche), Chetumal (Quintano Roo), Belize (Belize), Flores (Peten, Guatemala), Puerto Mendes (Peten), Rio Dulce crossing and Guatemala City.

It was learned that three species of Erythrina occur in the region: in addition to E. standleyana already known, E. folkersii and E. berteroana. Of the three, E. folkersii is most common throughout the area on better soils and along water courses. Outside of northwestern Peten, a relatively inaccessible region as yet unstudied, it seems unlikely that any other Erythrina occurs in the area.

On this trip I saw for the first time living plants of E. standleyana, a small Erythrina with beautiful flowers, the pale pink standards contrasting with almost black calyces. The sympatric E. berteroana is known to hybridize freely where in contact with other members of the genus and it was not surprising to find that it is represented in the range of E. standleyana by a form with flowers of a delicate pink color. Hitherto there has been no record of Erythrina from Tabasco, but I found there the same three species as in Yucatán, with E. folkersii again the commonest. In Belize and in Guatemala E. folkersii is extremely uniform in its characters, but is represented in Tabasco by numerous races. I refer to these as "races", as they deviate from the norm in only one or two characters, for example in shape of leaflets and in pubescence or form of the calyx, but in no other particular.

The state of Chiapas yielded five species: E. chiapasana, E. goldmanii, E. berteroana, E. folkersii, and E. mexicana. In Chiapas E. chiapasana is confined to chaparral formations, often on steep slopes with unstable gravelly soil.

Altogether on this trip I obtained 28 herbarium sets representing six species, as well as substantial collections of seeds of E. standleyana and E. chiapasana for propagation and chemical assay.

The primary objectives of my second trip (March 3--11, ± 2900 road kilometers) were three: 1) to collect for the second time E. oliviae in Oaxaca Desert; 2) to seed Mexican stations in western Chiapas for E. tajumulcensis and E. florenciae, described recently from adjacent Guatemala; and 3) to study the species native to Veracruz. As I returned to Veracruz on my third trip, the results of that segment of the second will be mentioned further below. My second itinerary, disregarding side-excursions, was as follows: Tapachula (border of Guatemala with Mexico),

Arriaga (Chiapas), Las Cruces (Chiapas), Tuxtla Gutierrez (Chiapas), Matias Romero (near the border of Chiapas and Oaxaca, on the Atlantic slope), Veracruz (Veracruz), Jalapa (Veracruz), Puebla (Puebla), Oaxaca (Oaxaca), Arriaga (Chiapas) and Tapachula.

My first objective was realized by the discovery of the tree from which E. oliviae was described. Two local Mexican women well remembered Olivia Converse, the discoverer of this unique species. In western Chiapas, near the Guatemala boundary, I found (as expected) E. tajumulcensis on rich volcanic soils at the moderately high elevations suitable for cultivation of coffee. In Chiapas also, at moderately high elevations of the Pacific slope, from the border north to Arriaga and again in the central highlands north of Tuxtla Gutierrez, E. goldmanii was very common. Even in the context of its genus, this is an exceptionally spiny tree. I had the good fortune to happen on two individuals of E. lanata, small shrubs growing on a poor dry site in chaparral. The flowers are lanate and pink, the lower at full anthesis tending to reflex against the rachis of the raceme as in E. folkersii, in the African A. lysistemon Hutchison, and in one form of E. coralloides mentioned below.

My collection amounted to 56 numbers representing 10 species: E. oliviae, E. coralloides, E. lanata, E. berteroana, E. americana, E. standleyana, E. goldmanii, E. mexicana, E. folkersii and E. tajumulcensis. In addition I obtained substantial quantities of seed of six species for chemical studies and propagation.

The objectives of my third trip (March 17--22; 2808 road kilometers) were the Erythrinas of the Gulf slope from Veracruz northward (already sampled in my second trip), those of the Transverse Volcanic belt west to the Pacific, and the western Sierra Madre del Sur. I was particularly anxious to determine the northern distribution limit of E. standleyana and E. folkersii on the Gulf coastal plain, where they are the major representatives of the genus. Hitherto E. standleyana was known from Yucatán, Campeche, Petén, and Cuba, but I followed this species north in Mexico almost to Ciudad Victoria (Tamaulipas), at which point it is replaced by E. herbacea. It was learned that E. folkersii extends north in Veracruz almost to Tampico.

My itinerary, disregarding side excursions, was as follows: Mexico City, Necaxa (Puebla), María Andra (Puebla), Poza Rica (Puebla), Tuxpan (Veracruz), Tampico (Veracruz), Ciudad Mante (Tamaulipas), thence across San Luis Potosi to Guadalajara (Jalisco), Barra de Navidad (Jalisco), Tepic, Jalisco, Jiquilpan (Michoacán), Quiroga (Michoacan) and Mexico City.

E. coralloides emerged as the major Erythrina of south-central Mexico, extending from Ciudad Mexico and Puebla west to Guadalajara, and seen also between Guadalajara and Barra de

Navidad on the Pacific coast. A race of this species with fine pink flowers was collected at ± 2700 m between Jiquilpán and Quiroga in Michoacán and is now being tested horticulturally in Los Angeles and elsewhere. As in E. folkersii and E. lanata, the lower flowers of the raceme tend to reflex at full anthesis against the rachis.

On this trip I secured 18 numbers representing the five species: E. coralloides, E. americana, E. standleyana, E. folkersii and E. mexicana, as well as seed samples for propagation and chemical study.

During the season I collected altogether all but four of the fourteen species of sect. Xyphanthus and sect. Cubenses known to occur in Mexico. The range of E. herbacea and E. flabelliformis lie beyond the northern limit of my travels; and E. florenciae and E. huehuetenangensis inhabit cloud forest at great elevations in Veracruz (Jalapa), Oaxaca, and Chiapas, at levels that I did not reach. The four members of sect. Leptorhizae native to Mexico flower and fruit from July to September in the pine--oak belt at elevations of (1200) 1600-2700 m, and can only be collected much later in the year.

No discussion of E. coralloides or E. americana is attempted in this paper. These species, still under study, require further observation in the field.

SUBGENUS ERYTHRINA

SECTION DUCHASSAINGIA (WALPERS) KRUKOFF

1. Erythrina fusca Loureiro, Fl. Cochinch. 427. 1790.

Erythrina glauca Willdenow, Ges. Nat. Freunde, Berlin, Neue Schr. 3:428. 1801.

Jamaica: Proctor 16451 (IJ), 26834 (IJ), Howard et al. 14810 (IJ). Puerto Rico: Wagner 463 (IJ). Trinidad: Howard 10391 (IJ). Belize: Dwyer et al. 558 (Punta Gorda) (MO), 589 (Toledo) (MO). Guatemala: Escuintla: Krukoff 1970-136. Nicaragua: Bunting & Licht 369; Matagalpa: L. O. Williams et al. 24801 (G). Costa Rica: Guanacaste: Daubenmire 798 (F); Heredia: Jorge León 424 (US). Panama: Canal Zone: Blum 2212 (MO); Panama: Dwyer 3105 (MO). Venezuela: Mérida: L. Ruiz Teran 493 (G); Monagas: Pursell et al. 8304 (US), 8704 (US). Colombia: Cuatrecasas 27260 (US), 27515 (US); Amazonas: Schultes et al. 24045 (US). Ecuador: Guayas: Dodson & Thien 1258 (MO). Brazil: Rondônia: basin of Rio Madeira, Prance et al. 5900; Bahia: Ilheus, Belem et al. 1373, 1375, 1377. Bolivia: Pando: Rio Madeira, 6 km above Abuña, Prance et al. 5846.

About 25 collections were examined on my trip to Europe in 1969, mostly in Muséum d'Histoire Naturelle, Paris. They are not cited here as the distribution of this species in the New

World is well known. The specimens were from Puerto Rico, Nicaragua, Panama, Venezuela, Colombia, Ecuador, French Guiana and Brazil.

Among the specimens cited above are the first records of the species from Belize, from Esteli, Nicaragua and Pando, Bolivia. Previous collection from Belize were from cultivated plants.

I did not place E. glauca in synonomy in my monograph of the American species (1:224) as before doing this I wanted to see E. fusca, as it appears in the Old World, in the field. There are no differences between E. fusca as it occurs in Asia, Polynesia, Africa and the New World, in fact even its habitat is everywhere the same. The pods of this species are carried by the ocean currents.

SECTION CRISTAE-GALLI (KRUKOFF) KRUKOFF

2. Erythrina crista-galli L. Mant. 99. 1767.

Colombia: Antioquia: cult., Soejarto & Latz 2515 (COL). Brazil: São Paulo: cult., Sendulsky s.n. (11/9-1969); Santa Catarina: munic. Irani, L.B. Smith and R.M. Klein 14001. Paraguay: Woolston 891, Krapovickas & Cristobal 13238 (MO). Argentina: Corrientes: Ibarrola 1272. Chile: Santiago: Quinta Normal (cult.) M. Muñoz S. 275. Japan: Nagashima Bot. Garden (cult.), Hiroyaki Murata 1, 2.

About 40 collections were examined on my trip to Europe in 1969, mostly in Muséum d'Histoire Naturelle, Paris. They are not cited here as the distribution of this species is well known. The specimens were from Brazil, Bolivia, Paraguay, Argentina and Uruguay.

A photograph of a single flower and of a drawing of a flowering branch labelled "Erythrina crista-galli" and deposited in the Linnaean Herbarium, London, (Catalogue No. 888.4, p. 123 - Savage, S., A Catalogue of the Linnaean Herbarium. 1945) was examined and it is clear that this name is correctly interpreted.

This is the first record of the species from Chile and Japan where this species is cultivated.

In my previous papers I discuss E.x bidwillii (E. herbacea x E. crista-galli). One additional specimen of this hybrid was examined: Japan: Nagashima Bot. Garden (cult.), Hiroyaki Murata 3.

Chromosome number of this hybrid: 2n=42, voucher Lewis 7614 (GH, MO, NY) cultivated at Missouri Bot. Gard: from unrooted cutting sent by Dr. Austin Griffiths, Jr., Dept. of Arbor. & Bot. Gard., County of Los Angeles (45:474).

3. Erythrina falcata Bentham in Mart. Fl. Bras. 15(1):172. 1859.

Peru: M. Cl. Gay 1995 (1839-1840) (P); La Libertad: A. Lopez 1096 (US). Brazil: Minas Gerais: St. Hilaire s.n. (P), M. Clausen 936 (P); Federal District: Brasilia (cult.), Heringer 11715; Rio de Janeiro: A.P. Duarte 6303 (RB), M. Guillemin 929 (1839) (P), Glaziou 2906 (P), 19874 (P), Pabst et al. 7384; São Paulo: São Paulo, parque de Estado, C.P. Zoechio s.n. (SP), Sendulsky s.n.; Parana: Pabst 6709; Santa Catarina: Lourteig 2119 (P). Argentina: Venturi 3889 (MO); Salta: Humbert 21124 (P). Bolivia: D'Orbigny 497 (P). Chile: Santiago: Quinta Normal (cult.), M. Muñoz S. 274.

This is the first record of the species from Department La Libertad (Peru), and Chile where it is cultivated.

SECTION MICROPTERYX (WALPERS) KRUKOFF

4. Erythrina poeppigiana (Walpers) O.F. Cook, Bull. U.S. Dept. Agr. Bot. 25:57. 1901.

Montserrat: Proctor 18889 (MICH). Jamaica: Proctor 24685 (IJ). Haiti: Ekman H-3248 (IJ). Trinidad: Howard 10442 (IJ). Panama: Darien: Isla Saboga, Duke 10366 (MO). Guatemala: Suchitepequez, cult., Krukoff 1971-10. Venezuela: Monagas, Pursell et al. 8424 (US), Merida: L. Ruiz Teran 494 (G), 495 (G). Ecuador: San Jose de Tagua, Rio Santiago, Jativa & Epling 1161 (US). Colombia: Cundinamarca: Pacho, Garcia-Barriga & Jaramillo--Mejia 20113. Peru: Pavon 36 (1868) (P), Martinet 22 (1878) (P), San Martin: Ch. Belshawe 3254 (F). Bolivia: D'Orbigny 781 (P).

This is the first record of the species from Montserrat where apparently it was introduced and from Suchitepequez, Guatemala.

5. Erythrina ulei Harms, Verh. Bot. Ver. Brand. 48:172. 1907.

Ecuador: Napo-Pastaza: Erik Asplund 9258 (R). Brazil: Pará: basin of Rio Tocantins, Murça Pires 12851 (IAN), Rondônia: basin of Rio Madeira, Prance et al. 6188, 6285.

This is the first record of the species from Territory of Rondônia.

6. Erythrina dominguezii Hassler, Physis 6:123. 1922.

Brazil: Goias: Sidney 193 (UB) (Olaria), E.P. Heringer 10509 (perto do Rio Samambaia, cerrado), 11712 (Samambaia); Distr. Federal: Brasilia, D. Coelho s.n. (INPA 16692) (INPA). Bolivia: Weddell 3464b ("prov. de Chiquitos") (P). Argentina: Salta: Schreiter 11438.

7. Erythrina verna Velloso, Fl. Flum. 304. 1825.

Erythrina flammea Herzog, Repert. Nov. Sp. 7:57. 1909.

Brazil: Distr. Federal: cult., E.P. Heringer 10519; Minas Gerais: Vasco Gomes s.n. (10/6-1969) (UB); Rio de Janeiro: road from Rio de Janeiro to Sao Paulo, Luis Emygdio 2034 (R); Sao Paulo: cult. Sendulsky s.n. (11/9-1969).

At the time when I was working on the monograph (1) the type of E. flammea was not available to me and I placed four Steinbach's collections from Bolivia, and one very poor Kuntze' specimen from Mato Grosso under E. flammea by the protologue. E. verna was also known from insufficient material and its pods and seeds were unknown. Since that time I examined abundant material from Brazil and the holotype of E. flammea and I concluded that E. flammea cannot be maintained as a distinct species. As reinterpreted E. verna is now known from central and southern Brazil (Maranhão, Bahia, Minas Gerais, Rio de Janeiro, Guanabara, São Paulo, Mato Grosso and Acre) and eastern Bolivia (Santa Cruz).

SECTION STENOTROPIS (HASSKARL) KRUKOFF

8. Erythrina speciosa Andrews, Bot. Repos. 7: pl. 443. 1806.

Brazil: A. St. Hilaire s.n. (1816-21) (P); Bahia: Froes 12664, Blanchet 3089 (P); Distr. Fed., cult., E.P. Heringer 10524, 11692 (UB); Espirito Santo: Belem 1572; Rio de Janeiro: Gaudichaud 903 (1831/33) (P); Z.A. Trinta 852 (R); Guanabara: cult., Krukoff 1971-12, 1971-13; São Paulo: Tatiana Sendulsky s.n. (12/8-1969) (flrs red), s.n. (12/8-1969) (flrs yellowish); Parana: Rio Cambara, plan. litoraneo, Hatschbach 16798 (F, US).

SECTION EDULES (KRUKOFF) KRUKOFF

10. Erythrina schimpffii Diels, Bibl. Bot. 116:96. 1937.

Ecuador: Canar: Páramo Tambo, Amy Jean Gilmartin 161 (MO).

This is the first record of the species from the province of Canar.

11. Erythrina edulis Triana, M. Micheli, Jour. de Bot. 6:145. 1892.

Chromosome number: 2n=42, voucher: Garcia-Barriga & Jaramillo-Mejia 20112 (NY) from Colombia: Cundinamarca (46:382).

Panama: Canal Zone: cult. Blum & Dwyer 2530A. Colombia: Justin Goudot s.n. (1844) (P), J. Linden 1220 (Velez, Jan. 1843) (P); Tolima: Mariquita, Triana s.n. (1851-1857) (P); Cundinamarca: Garcia-Barriga 17517, 20112; Huila: L. Marulanda Caicedo 39 (COL). Ecuador: Benoist 2648 (P), Gilmartin 16 (MO) (Cota-

paxi); Loja: Dodson & Thien 651 (MO), 1396 (MO), Mathias & Taylor 5276 (LA), 5285 (LA); Quito: Remy s.n. (Oct. 1856) (P). Peru: M. Cl. Gay 1699 (P).

SECTION LEPTORHIZAE (KRUKOFF) KRUKOFF

12. Erythrina breviflora A. DeCandolle, Prodr. 2:413. 1825.

Mexico: Ghiesbreght 331 (P); Jalisco: W.R. Anderson & C.W. Laskowski 3825; Michoacan: Martinez 164 (US), F. Ventura A. 2462 (Uruapan, alt. ± 1325 m); Mexico: Rzedowski 20772 (alt. ± 1800 m) (MEXI); Morelos: J.M. Diaz Moreno 160 (alt. 2250 m), Ghiesbreght 160 (P), Martinez 137 (US) (near Cuernavaca), Lyonnet 2407 (US); Guerrero: Tillett 637-147 (RSA), Mario Souza 3140 (alt. 1710 m); Oaxaca: Ghiesbreght s.n. (1842) (P).

This is the first record of the species from Guerrero. Diaz Moreno's specimen is a voucher for sample of seeds for chemical studies.

13. Erythrina leptorhiza A. DeCandolle, Prodr. 2:413. 1825.

Mexico: G.L. Webster et al. 11364 (1½ km east of Chalco ± 2100 m); Mexico: Rzedowski 23969 (MICH) (Cerro del Pino, ± 2350 m), Hitchcock 7011 (POM) (± 49 km east of Mexico City on way to Puebla), Javier Penalosa 715 (CAS); Morelos: J.M. Diaz s.n.; Puebla: Frere Arsene 2372 (P).

15. Erythrina montana Rose & Standley, Contr. U.S. Nat. Herb. 20: 179. 1919.

Mexico: Durango: Hendricks 467 (MO); Nayarit: Sierra del Nayarit, M.L. Diguet s.n. (P).

Diguet's specimen has unusually long wings.

SECTION ERYTHRINA

16. Erythrina peruviana Krukoff, Brittonia 3:262. 1939.

Ecuador: Napo-Pastaza: alt. ± 880 m, Erik Asplund 19524.

This is the first record of the species from Napo-Pastaza.

17. Erythrina pallida Britton & Rose, Bull. Torrey Club 48:332. 1922.

Venezuela: Merida: Breteler 4586 (EAP).

This is the first record of the species from Merida.

18. Erythrina mitis Jacquin, Hort. Schoenb. 2:47. 1797.

Venezuela: Merida: J. de Bruijn 1282.

This is the first record of the species from Merida.

19. Erythrina buchii Urban, Repert. Sp. Nov. 17:157. 1921.

Dominican Republic: Las Abejas, Baoruco Mts., alt. 1080-1260 m, Alain H. Liogier 14170.

This is the first record of the species from Dominican Republic.

23. Erythrina amazonica Krukoff, Brittonia 3:270. 1939.

Brazil: Para: Jobert 381 (P) (Marajo), N.T. Silva 170 (UC) ("beira do Rio Tuxá, arbol media, flor rosea").

25. Erythrina corallodendrum L. var. corallodendrum.

Jamaica: Adams 8550 (UCWI), 10973 (UCWI), 12287 (UCWI) and Proctor 11718 (IJ) (all from parish Westmoreland); Dulcie Powell 979 (IJ) and Proctor 16473 (IJ) (parish St. Ann); Proctor 16184 (IJ) (parish Manchester); Proctor 27779 (IJ) (parish Clarendon); Hunter 928 (UCWI) (parish St. Catherine).

Amy M. Barry s.n. (IJ) and Proctor 16151 (IJ) cultivated in Kingston, Jamaica represent a horticultural form of the species.

25a. Erythrina corallodendrum var. bicolor Krukoff, Brittonia 3: 275. 1939.

St. Vincent: parish St. George, Proctor 25876 (IJ).

SECTION CUBENSES (KRUKOFF) KRUKOFF

26. Erythrina cubensis C. Wright, Sauv. Anal. Acad. Ci. Habana 5:336. 1869.

Cuba: Herb. Richard 615 (P).

27. Erythrina oliviae Krukoff, Phytologia 19(3):128. 1969.

Chromosome number: 2n=42, voucher: Krukoff 1970-108 (46:383).

Mexico: Puebla: km. 230/231 of the Mexico-Oaxaca highway, bank of a dry stream: Krukoff 1970-108.

This collection is from the tree from which the type collection was made. The type locality as given in the protologue is based on the collector's notes and is not accurate.

SECTION XYPHANTHUS (RAFINESQUE) KRUKOFF

28. Erythrina herbacea L. Sp. Pl. 706. 1753.

U.S.: about 27 collections were examined in Museum d'Histoire Naturelle, Paris. They are not cited here as the distribution of this species in the U.S. is well known.

Mexico: Veracruz: Gouin s.n. (1867) (P).

A photograph of the specimen deposited in the Linnaean Herbarium, London and labelled "Erythrina herbacea" was examined (Catalogue #888.1, p. 123 - Savage, S., A. Catalogue of the Linnaean Herbarium. 1945) and it is clear that this specimen is correctly named. This specimen is not the holotype of the species as it was not in the herbarium in 1753 or in 1755, and it was first recorded in 1767. The valid publication of the species was made in 1753. (B.D. Jackson, in the Index to the Linnaean Herbarium; Proc. Linn. Soc. 124. Suppl. 73. 1912).

As a result of extensive field studies in Mexico many collections, formerly cited under E. herbacea have been renamed. For details see under E. standleyana.

29. Erythrina coralloides A. DeCandolle, Prodr. 2:413. 1825.

Chromosome number: 2n=42, voucher: Krukoff 1970-132 (NY) from Mexico: Michoacan: between Jiquilpan and Quiroga (46:382).

30. Erythrina flabelliformis Kearney, Trans. N.Y. Acad. 14:32. 1894.

Mexico: Sonora: Arguelles 204 (US), Henrickson 1576 (MICH); Chihuahua: Mexia 2632 (BM).

31. Erythrina lanata Rose, U.S. Dept. Agr. N. Am. Fauna 14:81. 1899.

Chromosome number: 2n=42, voucher: McVaugh 15782 (MICH) from Mexico: Sinaloa (46:383).

Mexico: Guerrero: Mexia 2632 (CAS); Chiapas: between Ocozocoatla and Cintalapa, on a dry mountain slope in chaparral, Krukoff 1970-79, 1970-80.

32. Erythrina berteroana Urban, Symb. Ant. 5:370. 1908.

Cuba: E.H. Day 381; Isla de Pinos: Killip 44813 (US). Mexico: Veracruz, Krukoff 1970-88 and 1970-89 (Acayucan to Minutitlan), 1970-92 (near Soleapan), Andrle 3 (US) (Sierra de Tuxtla), J.V. Santos 2777 (US) (El Palmar); Tabasco: Krukoff

1970-47 and 1970-48 (between Villahermosa and Chable), 1970-50 (Tenosique); Chiapas: Krukoff 1970-40 and 1970-41 (near Tapilula), 1970-63 (near Unión Juárez), 1970-115 (between Tapachula and Huistla), 1970-65; Campeche: between Escarcega and Chetumal, Krukoff 1970-53. Guatemala: Peten: near Poptun, Krukoff 1970-58; Huehuetenango: Barillas: finca San Isidro: Krukoff 1969-281, 1969-282; Alta Verapaz: between La Tinta and Panzos, Krukoff 1970-19, 1970-22; El Progreso: Sanarate, alt. + 800 m, Krukoff 1970-1. Nicaragua: Matagalpa: Maguire 61409; Chontales: Bunting & Licht 710, 1015 (US), 1102 (US), Standley 9373 (F); Grenada: Levy 372 (1885) (P). Costa Rica: Guanacaste: Daubenmire 76 (F); Cartago: McKee 11114 (P). Panama: Duchassaing s.n. (1851) (P); Chiriquí: Dwyer & Hayden 7758A (MO); Veraguas: Dwyer & Kirkbride Jr. 7402 (MO); Los Santos: Corina Wendelhake 28 (MO); Canal Zone: Correa & Stimson 31 (MO), Lewis et al. 31 (MO), Blum 2056 (MO), 2238 (MO), Ebinger 854 (MO), Dwyer 7212 (MO), Dwyer & Hayden 7541 (MO); Panama: Mireya C. Correa A. 513 (MO), Dwyer 2103 (MO), 3097 (MO), 5017 (MO), Lewis et al. 776 (MO), Duke 5694 (MO). Colombia: Bolivar: Arno Beuther 81 (COL).

This is the first record of the species from Chontales in Nicaragua and Tabasco and Campeche in Mexico.

33. Erythrina castillejiflora Krukoff & Barneby, Mem. N.Y. Bot. Gard. 20(2):165. 1970.

Guatemala: Huehuetenango: munic. Barillas, Finca San Isidro, Krukoff 1969-248, 1969-250, 1969-276, 1969-277, 1969-278, 1969-279, 1969-280.

This species is still known from a single locality and we still were unable to collect pods or seeds. Insects and birds often damage the flowers before fruits are set.

35. Erythrina standleyana Krukoff, Brittonia 3:301. 1939.

Chromosome number: 2n=42, voucher: Krukoff 1970-54 (NY) from Mexico: Campeche: between Escarcega and Chetumal (46:382).

Mexico: J.A. Duke M3671 (MO) (vicinity of falls of El Salto), Virlet 1100 (P), Krukoff Herb. 9519, 9520, Herb. Prince Paul s.n. (M), C. Troll 229 (M) (Tecolutea-Nautla); Tamaulipas: between Tampico and Ciudad Mante, Krukoff 1970-125, Palmer 119, 130, 328 and 544, Pringle 7687 (US), Runyon 972 (US), Cottam 10564 (UT), Wiggins 13352 (DS), Kenoyer & Crum 3315 (A), R. Merrill King 4509, Viereck 754 (US), Dressler 1878 (MICH), Johnston 5228 (MICH), 5342 (MICH), Barkley & Smith s.n. (Apr. 4, 1947) (F). San Luiz Potosi: Rose & Hough 4869 (US), Palmer 219 (A, GH, NY, US), Pringle 5124 (A, F, GH, US), Kenoyer A. 188 (F), Edwards 606 (F), Rzedowski 6959 (MEXI), Barkley s.n. (Apr. 13, 1947); Hidalgo: Moore 2889 (GH); Puebla: Krukoff 1970-120 and 1970-121 (near Poza Rica), Miranda 8380 (MEXU); Veracruz Krukoff 1970-87, 1970-90, 1970-91, 1970-93, 1970-94, 1970-98, 1970-99, 1970-123, M. le Dr Gouin

s.n. (1867) (P), C.R. Orcutt 3398 (F, GH, US) (Jalapa), Dressler & Jones 14 (GH, US) (San Andres Tuxtla), Nevling & Gomez-Pompa 146 (MEXU) (Tampico-Tuxpan), G. Martínez-Calderón 1383 (MEXU) (Tres Valles-Las Maravillas); Müller 86 (K, NY), Greenman 67 (F), Purpus 6078 (UC), Seler & Seler 244 (B), LeSueur 209 (F), 210 (F), Mario Souza 2377 (MEXU), Gómez-Pompa & Riba 72 (MEXU); Oaxaca: Krukoff 1970-83 (near Matias Romero in Atlantic drainage, soon after passing a divide; Krukoff 1970-84 (near the border with the State of Veracruz); Y. Mexia 9302 (US, GH, F), Alexander 135, Rovirosa 696 (K, PH, US), L. Gonzales Q. s.n. (March 3, 1964 (MEXI); Tabasco: ± 10 km. from Villahermosa toward Chable, Krukoff 1970-46; Campeche: between Escarcega and Chetumal, Krukoff 1970-52, 1970-54 and 1970-55, E. Hernández X. et al. ES-260 (MEXU) (Escarcega-Candelaria); Yucatán: A.P. Covich 6713 (MEXU) (Laguna Chichancanab).

Previous to 1970 this species was known from 19 collections from Pinar de Rio, Cuba, 15 from Yucatan, one each from Campeche and the Island of Cozumel, Mexico, three from Belize and one collection from Peten, Guatemala.

As a result of my field studies of 1970 it emerged as one of the two major species of eastern Mexico extending north into the State of Tamaulipas (farther northward it is replaced by E. herbacea). The second major species of eastern Mexico is E. folkersii.

This species is a small shrub, the smallest member of Sect. Xyphanthus except for E. herbacea and E. flabelliformis. It is well marked by the black calyx and pink standard. Usually it is a very spiny plant but it includes also nearly spineless forms (Krukoff 1970-46, 1970-52 and 1970-56). It reproduces readily by seeds and old plants often have a colony of young plants in the neighborhood. It is almost never used for live hedges.

This is the first record of E. standleyana from Tamaulipas, Veracruz, Hidalgo, San Luis Potosí, Puebla, Tabasco, and Oaxaca. I am citing here all collections except those from Cuba, Belize, and the State of Yucatan and Campeche in Mexico. Many were previously wrongly placed with E. herbacea.

36. Erythrina atitlanensis Krukoff & Barneby, Mem. N.Y. Bot. Gard. 20(2):162. 1970.

Chromosome number: 2n=42, voucher Krukoff 1969/166 (NY) from Guatemala cited in 56:163; count based on seedlings (45:473).

Guatemala: Sololá: Krukoff 1967-1, 1969-242 and 1969-244 (near Atitlán); Krukoff 1969-241 (near San Juan La Laguna).

37. Erythrina cobanensis Krukoff & Barneby, Mem. N.Y. Bot. Gard. 20(2):164. 1970.

Chromosome number: 2n=42, voucher Krukoff 1969-195 (NY) cited in 5b:164; count based on seedlings (45:474).

Guatemala: Alta Verapez: Krukoff 1970-6 (near Cobán, alt. ± 1190 m); Krukoff 1970-7 (near San Pedro Carcha, alt. ± 1150 m); Krukoff 1970-8 and 1970-11 (near Caxux, along the road from Cobán to Sebol); Krukoff 1970-12 and 1970-138 (near Bancab, along the road from Cobán to Sebol, alt. ± 1140 m).

For the second year my efforts to collect substantial quantities of seeds were unsuccessful. On Jan. 25 and 26, 1970, a search was made for trees in flower which could provide seeds 2 1/2 months later. Especially promising were ± 30 very old trees planted as boundary markers near Bancab. In April 1970 they were visited again and it was found that during the flowering a very strong wind blew most of flowers down before the fruits were set.

38. Erythrina chiapasana Krukoff, Brittonia 3:304. 1939.

Chromosome number: 2n=42, voucher Krukoff 1969-211 (NY) from Guatemala cited in 5b:165; count based on seedlings (45: 474).

Mexico: Chiapas: Elias Guillén P. 1970/1 (Finca Las Margaritas), 1970/2 (Finca El Milagro) and 1970/3 (Finca Nuevo Mundo) (all on the way from Comitán to the Guatemalan border; Rafael Hernández M. 395 (MEXU) (cerca del (Ocotal) Ciudad Cuauhtemoc); Krukoff 1970-35, 1970-36, 1970-37, 1970-38 and 1970-39 (between Cristobal de las Casas and Buchil); R.M. Laughlin 360 (munic. Zinacantan); Ida K. Langman 3795 (near Comitán) (US); Alush Shilom Tom 1854 (munic. Amatenango del Valle); Oscar F. Clarke 415 (munic. Pueblo Nuevo Solistahuacán). Guatemala: Huehuetenango: Steyermark 50499 (above the town) (F); van Schrenck s.n. (MO); Krukoff 1970-31 (± 7 km. from the town); Standley 72790 (near Zaculeu); Williams et al. 22026 (south of the town) (F); Krukoff 1970-24 (near Aguacatán); Standley 82554 (north of Chiantla) (F); Krukoff 1971-14 (on way to Quiche); Steyermark 51777 (between Chacula and Canquintic, Sierra de los Cuchumatanes); Krukoff 1970-32 and 1970-33 (along the road from Huehuetenango and the border of Mexico, 10-20 kms. from the border).

Seven collections, for which the altitude of the places of collections are recorded, were collected between 1620 and 2010 m.

This species is very spiny even in context of its genus and is usually leafless when in flower.

39. Erythrina goldmanii Standley, Contr. U.S. Nat. Herb. 20:181. 1919.

Chromosome number: 2n=42, voucher: Krukoff 1970-72 (NY) from Mexico: Chiapas: between Tapachula and Tonela (46:383).

Mexico: Chiapas: Alush Shilom Tom 3728 and Laughlin 1999 (CAS) (munic. Venustiano Carranza); Krukoff 1970-34 and 1970-81 (San Gregorio, ± 23 km. from the Guatemalan border); Krukoff 1970-66, 1970-67, 1970-68, 1970-69 and 1970-70 (near Motozinto); Krukoff 1970-71, 1970-72 and 1970-114 (between Tapachula and Tonela); Krukoff 1970-112 and 1970-113 (between Tonela and Arriaga); Krukoff 1970-73, 1970-74 (between Arriaga and Las Cruces); Krukoff 1970-75 and 1970-76 (near Tiltepec, above Las Cruces); Krukoff 1970-77 and 1970-78 (between Las Cruces and Tuxtla Gutiérrez); Oaxaca: Miranda 5495 (MEXU) ("al N.N.O. de Tuxtla G., alt. ± 685 m, selva baja decidua"), Krukoff 1970-82 (near the border with Chiapas, between Las Cruces and Matias Romero).

This is the first record of the species from Oaxaca.

In 1939 when I was working on my monograph the species was known from 4 collections from the State of Chiapas; three additional collections were listed in the 3rd supplement in 1969 and one more in the 4th supplement in 1970.

During my field studies in Mexico in 1970 this species was found to be very common at moderately high elevations on the Pacific Coast area from the Guatemalan border to Arriaga and in the central part of the State of Chiapas north of Tuxtla Gutiérrez.

This species is very spiny, even in context of its genus. The form which is rather common in the Pacific Coast area has a black calyx.

40. Erythrina rubrinervis H. B. K. Nov. Gen. & Sp. 6:434. 1824.

Panama: Panamá: Lewis et al. 3480 (MO) (8 km. SW of Cerro Brewster, alt. ± 300 m); Darién: Kirkbride & Duke 1211 (MO) (premontane rain forest, east of Tres Bocas). Venezuela: Mérida: alt. ± 1620 m, Breteler 4586 (U), J. de Bruijn 1282 (U). Colombia: André 1771 (K), Cuatrecasas 26964 (US), Triana s.n. (1851/7) (P); Cundinamarca: Garcia-Barriga 12493 (COL) and 12498 (COL) (hacienda Patasia); Garcia-Barriga & Jaramillo-Mejia 20111 (carretera entre Pacho y Zipaquirá, alt. ± 2380 m); Michele Dumont 120 (G) (alt. ± 1480 m); Putumayo: M.L. Bristol 1212 (Valle de Sibunday, ± 1980 m) (COL).

This is the first record of the species from Panama (Panama and Darién) and Putumayo (Colombia).

41. Erythrina mexicana Krukoff, Brittonia 3:309. 1939.

Mexico: Veracruz: Krukoff 1970-86 and 1970-95; M.A. Martinez A. 345 (MEXU), J. Chavelas et al. ES-2426 (MEXU) and ES-2842 (MEXU) (all near San Lorenzo Tenochtitlan); Mario Souza 2998 (MEXU) and 3350 (MEXU) (region de las Tuxtlas, alt. 90-180 m); Marino Rosas R. 423 (MEXU) (near Huacapan, alt. ± 1205 m, muy

abundante); A. Gomez-Pompa 115 (MEXU) (Fortuno, alt. ± 180 m); Tabasco: Tenosique, Krukoff 1970-51; Chiapas: Krukoff 1970-45 (between Tapilula and the boundary line of Chiapas with Tabasco). Guatemala: Suchitepequez: Rosengarten s.n. (Kr. Herb. 15124) and Krukoff 1971-8 (finca Naranjo, alt. ± 1140 m).

This is the first record of the species from Tabasco.

According to Schultes, this species is the most common Erythrina in the departments of Textepec and Choapam. (See labels on Schultes & Reko 687 & 952).

42. Erythrina lanceolata Standley, Contr. U.S. Nat. Herb. 17: 432. 1914.

Honduras: Ocotepeque: Molina 22218, 24177 (F); Comayagua: Molina 8051, 8126 (F), 25462 (F), 25594 (F); La Paz: Molina 24331; Olancho: Standley 18386 (EAP).

This is the first record of the species from the departments of Ocotepeque, La Paz and Olancho in Honduras. The specimens are from elevations of (400)-1170-1350 m.

43. Erythrina hondurensis Standley, Field Mus. Publ. Bot. 4:309. 1929.

Nicaragua: Zelaya: Molina 2230 (GH). Honduras: Atlantida: vicinity of Lancetilla Exper. Sta., alt. ± 90 m, Antonio Molina R. & Albertina R. Molina 25602.

44. Erythrina barqueroana Krukoff & Barneby, sp. nov.

A centrali-americanis sectionis Xyphanthi speciebus omnibus foliolo terminali longe-acuminato inferne minutim reticulato--cerifero, calyce chartaceo post vexillum profunde recesso mox glabrato, legumine elongato moniliformi, necnon seminibus coccineis immaculatis absimilis.

Arbores mediocres spinosae, foliis juventute pilis 2-cruribus debillimis parce pilosulis adultis glabratis; stipulae deciduae subchartaceae lineari-acuminatae ± 1 cm longae; folii petiolus cum rachi 1--2.5 dm longus hinc inde spina conica armatus, petioluli stipella subpeltata suffulti 8--10 mm longi, sicci longitrorsus angulato-canaliculati; foliola matura chartacea superne viridia inferne reticulatim cerifera pallentia, basi late cuneata vel rarius rotundata late rhombico-ovato-acuminata, terminale (lateralibus paullo majus) ± 1.5--2.5 dm longum, 7.5--14 cm latum; racemi axis 2 dm usque longus densiuscule puberulus, pedicelli ad anthesin graciles ± 3 mm longi, fructiferi incrassati 8--14 mm longi; calycis primum parcissime puberuli tunc glabrati 13--16 mm longi hypanthium 1.5--2.5 mm longum, tubus campanulatus sursum ampliatus ad orem valde obliquum 5.5--6.5 mm diam, sinu dorsali post vexillum profunde (per ± 5 mm) recesso, dentibus minimis in crenulas obscuras

reductis; vexillum coccineum oblanceolatum apice subcucullatum fere rectum 4.6--5 cm longum ± 12 mm latum dorso glabrum; alae ± 6.5--7.5 mm longae, ungue ± 1 mm longo, lamina late oblique triangulari-acuminata margine adaxiali inflexa; carina alis vix brevior, laminis inter se connatis iis alarum subsimilibus nisi paullo angustioribus; androecii 10-meri vexillo paullo brevioris filamenta 9 ± ad medium decimum multo brevius inter se coalita; antherae fere 2 mm longae; ovarium stipitatum lanuginosum stylo superne glabrato; legumen (1) 1.5--3.5 dm longum rectum vel arcuatum ultra stipitem 3.5--8 cm longum moniliforme inter semina (4) 5-- 13 valde constrictum, apice attenuatum, valvulis coriaceis maturis nigricantibus glaberrimis; semina nitide coccinea immaculata 9--13 mm longa, hilo albido 3--5.5 mm longo.

Guatemala: Huehuetenango: municipality Barillas, Krukoff 1969-252 (NY-holotype) and 1969-253 (San Ramon, Panorama); Krukoff 1969-272 (San Ramon Ojo de Agua); Krukoff 1969-260, 1969-261 and 1969-263 (zona de Cumatz); Krukoff 1969-270 (Rio Pante, below El Jordan, zona de Ixcan).

This species is distinguished from all Central American species of sect. Xyphanthus by the combination of long-acuminate terminal leaflets glabrous when adult and minutely reticulate--waxy beneath, a chartaceous, essentially glabrous, shallowly bell-shaped calyx deeply recessed behind the banner, a long regularly moniliform pod, and seeds scarlet all over except for the white hilum. The calyx resembles somewhat that of the unrelated E. mitis. The relationship of E. barqueroana is probably with E. mexicana and E. lanceolata.

All collections cited above are from "tierra caliente". Above 1200 m this species is replaced by E. huehuetenangensis. E. barqueroana is very common on the Atlantic lowlands ("tierra caliente") in the area drained by Rio Ixcan and its tributaries in the municipality of Barillas, Huehuetenango, Guatemala. Doubtless is found also on the lowlands in the eastern Chiapas, Mexico.

We dedicate this species to Sr. Humberto Barquero M. who has given valuable assistance in field studies of Erythrinas in Costa Rica in 1969.

45. Erythrina gibbosa Cufodontis, Arch. Bot. Sist. Fitog. & Genet. 10:34. 1934.

Costa Rica: Burger & Matta 4568 (F) (Rio Coton, 1280-1350 m); Puntarenas: Burger & Liesner 7209 (F) (Oca), Raven 21741 (F), 21953 (F) (6 km. south of San Vito de Java, alt. + 1200 m); Alajuela: El Muelle, alt. ± 90 m, Burger & Matta 4314 (F); Cartago: La Fuente Peralta, alt. ± 1170 m; Anastasio Alfaro 8 (F). Panama: Bocas del Toro: Blackwell et al. 2750 (MO); Cocle: alt. + 600 m, Dwyer & Correa 8019 (MO); Darien: Rio San Jose, Stern et al. 633 (UC).

This is the first record of the species from Puntarenas, Costa Rica and from Darién, Panama.

46. Erythrina costaricensis M. Micheli, Bull. Herb. Boiss. 2: 445. 1894.

Chromosome number: 2n=42, voucher: Krukoff 1969-162 (NY) from Costa Rica: San José: near San Isidro General (46:382).

Costa Rica: Montealegre s.n. (Krukoff Herb. 9193); Puntarenas: Tonduz 6781 (US); Cartago: Turrialba: McKee 11114 (K). Panama: Colon: Howell 63. Colombia: Chocó: Haught 5449 (US); Antioquia: Soejarto & Gary Latz 2511 (Medellín, alt. ± 1350 m) (COL), L. Uribe-Uribe 1462 (Uraba, alt. ± 450 m) (COL), Sandeman 5597 (Sigovia, alt. ± 600 m) (COL); Cundinamarca: H. Garcia--Barriga & R. Jaramillo-Mejia 20134 (La Palma a Talauta, alt. ± 990 m), A. Fernandez & E. Perez-Arbelaez 454 (near La Meza, 900-1170 m) (COL); H. Garcia-Barriga 11055 (entre San Francisco & Supata ± 1395 m) (COL); H. Garcia-Barriga 11735 (COL), 12327 (COL) and 12359 (COL) (all near Guaduas, ± 1080 m); Huila: between Suaza & Acevedo, ± 1240 m, E.L. Little 8469 (COL).

This is the first record of the species from Cundinamarca and Huila.

As presently understood, this species extends from Costa Rica and Panama to Chocó on the coast, up the Cauca River valley in Antioquia and Valle and up the Magdalena River valley in Cundinamarca and Huila.

47. Erythrina folkersii Krukoff & Moldenke, Phytologia 1:286. 1938.

Mexico: Chiapas: between Tapilulu and the boundary line with the State of Tabasco, Krukoff 1970-42, 1970-43, 1970-44; Veracruz: Krukoff 1970-85, 1970-96 (near San Andrés Tuxtla), 1970-97. Belize: Cayo: Dwyer et al. 88 (MO), 160 (MO). Guatemala: Petén: Krukoff 1970-56 (between Flores and Puerto Mendes), Krukoff 1971-7 (Cansic, ± 40 km. south of Poptun); Antonio Molina R. 15838 (F) (Ceibal); Izabal: Snedaker E-163 (Finca Murciélagos) (F), Krukoff 1969-240 (near Matias de Galvez), 1969-239 (at the junction of roads, one going to Puerto Barrios and another to Matias de Galvez); Alta Verapaz: Krukoff 1970-20 and 1970-21 (between Panzós and La Tinta, below 60 m), 1970-13, 1970-14, 1970-15, 1969-33, 1969-37 and 1969-251 (near Sebol, "tierra caliente"), 1969-202.

This is the first record of the species from Petén.

In the season of 1968/9 I made two collections of leaves with a few old pods near "puerto fluvial" Sebol - a terminal of the road from Coban to Sebol. It has now been ascertained that these collections represent E. folkersii. This is the most western

known point of its distribution in Guatemala where, as in the Dept. Izabal, it occurs on fertile silt soil with stands of "Cohune" palm (Orbignya cohune (Martius) Dahlgren ex Standley.

48. Erythrina macrophylla A. DeCandolle, Prodr. 2:411. 1825.

Guatemala: San Marcos: Krukoff 1969-247 (San Cristóbal Cuchu, Aldea Guaquivil), 1970-25 (near Tejutla, alt. ± 2530 m); Quetzaltenango: ± 3 km. from Santa Maria, Krukoff 1971-11.

49. Erythrina florenciae Krukoff & Barneby, Mem. N.Y. Bot. Gard. 20(2):171. 1970.

Mexico: Graham 167 (1830) (K), M. Souza 3464 (MEXU) (Las Tuxtlas, alt. ± 1116 m); Veracruz: Jalapa: Charles L. Smith 1834 (EAP), Gilly et al. 179 (MICH); Chiapas: Miranda 9185 (MEXU) (la selva negra, alt. ± 1620 m); munic. Jitotol, alt. ± 1650 m, Breedlove 8986 (US); Oaxaca: 28 km. below Huautla de Jiménez, C. Earle Smith & N. Tejeda 4432 (MEXU). Guatemala: San Marcos: Louis O. Williams et al. 26239 (US, F), Steyermark 36469 (between Canjula and La Unión Juárez, near the southeast portion of Volcán Tacaná, alt. 6000-9000 ft.); Krukoff 1970-26, 1970-27, 1970-135, 1971-1, 1971-2 and 1971-6 (Finca Insula, ± 13 km. from San Marcos, along the road to S. Rafael Pie de la Cuesta); Krukoff 1971-3 (between San Marcos and Pajapita, above aldea Feria).

Seeds of this species are described for the first time: seeds uniformly scarlet (without a black line extending from the hilum toward the chalazal end) with snowy white hilum and often wrinkled on drying, 15-18 mm long and 9-10 mm broad.

This is the first record of this species from Mexico (Veracruz, Oaxaca and Chiapas).

After unsuccessful search at "coffee elevations" (1000-1650 m) to the south of San Marcos and on "tierra fria" to the north - in the direction of Tacana and Tutuapa - the species was finally found in a belt of the humid high forest above "coffee elevations." Some trees were more than 25 m high and about 1 m in diameter. I have not seen this species used as a live fence but found it used as boundary markers.

This species is a shy seed bearer as, although it flowers profusely, the flowers are often damaged by insects and birds.

E. florenciae as well as E. tajumulcensis are promising for cultural trials in the Los Angeles area.

50. Erythrina huehuetenangensis Krukoff & Barneby, Mem. N.Y. Bot. Gard. 20(2):172. 1970.

Chromosome number: 2n=42, voucher: Krukoff 1969-274 (NY) from Guatemala: Huehuetenango: Barillas, Finca San Isidro (46:383).

Guatemala: Huehuetenango: munic. Barillas, Krukoff 1969-273, 1969-274, 1969-283, 1969-284, 1969-301 and 1971-4 all at Finca San Isidro; Krukoff 1969-275 (Finca Chiblac); Krukoff 1969-285 (Tziquinte); Krukoff 1969-288 (along trail to Santa Elena); Krukoff 1969-286 and 1969-287 (Yulhuitz Grande); Krukoff 1969-289 and 1969-290 (Finca Maxbal); Krukoff 1969-291 (along the trail from Maxbal to Centinela); munic. (?), Steyermark 48971 (alt. 1350-1440 m) (F).

Extensive field studies in the municipality of Barillas confirmed the fact that this species abounds at high elevations (1280-1800 m). It is replaced by E. barqueroana on the lower elevations.

51. Erythrina cochleata Standley, Contr. U.S. Nat. Herb. 20:179. 1919.

Colombia: Caldas: elev. 1350-1620 m, Pennell, Killip & Hazen 8738 (NY, PH, US); Cundinamarca: vicinity of La Palma, Rio Murca, elev. 1035-1280 m, H. Garcia-Barriga 12413 (COL, NY), Garcia--Barriga & Jaramillo-Mejia 20125 (COL, NY), 20129 (COL, NY); vicinity of El Peñon, km 74 of carretera entre Guanacas y La Palma en el Paraizo, elev. 900-990 m, Garcia-Barriga & Krukoff 20067 (COL, NY), Garcia-Barriga et al. 20149 A (COL); orillas de Rio Negro, Garcia-Barriga & Jaramillo-Mejia 20136 (COL, NY), 20115 (COL, NY).

The first collection of this species from Colombia (Pennell et al. 8738) was identified as E. cochleata in 1939 (1:322), a poorly known species, which I failed to collect on my extensive field trip in Costa Rica in 1968/9 (5b:174). In 1969 I examined the second collection of it from Colombia (Garcia-Barriga 12413) and decided that it was important to study this species, as it occurs in Colombia, in the field. In April 1970 while in Bogotá on my way to Brazil I made a special one day trip with Prof. H. Garcia-Barriga to the locality where he collected this species and we found here Garcia-Barriga and Krukoff 20067 (sterile). Late in July another trip was made at my request to the same locality by Garcia-Barriga and Jaramillo Mejia and they collected complete material (5 collections cited above). I am citing here all collections of this species made in Colombia. There are no differences between E. cochleata as it occurs in Colombia and as it is represented in Costa Rica.

Incidentally, my trip with Prof. Garcia-Barriga proved to be quite interesting. On this trip for the first time I examined E. edulis and E. rubrinervia in the field which we found on high elevations, and while searching for E. cochleata we also found E. costaricensis, the second species which occurs in Costa Rica as well as in Colombia.

This species as we observed it in Colombia is a large forest tree occurring on elevations of 900-1650 m. It is usually in flower in July.

In September 1971 at my request Sr. Humberto Barquero M. made a special trip to the type locality of E. cochleata (Hacienda La Colombiana, Limón, Costa Rica) - on "tierra caliente" and he failed to find the species. It is puzzling that the best preserved collection of it, in flower, is Lankester s.n. from Peralta (elev. ± 1300 m), near Cartago which is near the divide between the Pacific and Atlantic drainage. We will try again to collect it in Costa Rica in the season of 1972.

52. Erythrina chiriquensis Krukoff, Brittonia 3:322. 1939.

Chromosome number: 2n=42, voucher: Butcher s.n. (MO) from Panama: Chiriquí, 1800 m (46:382).

Costa Rica: Alajuela: Krukoff 1969-283 (Zapote de Alfaro Ruiz), Austin Smith A-29 (F, NY) and 2238 (UC) (Zarcero); San José: along road from Frailes to Tarvaca, alt. 1280 m, Lent 1163 (F). Panama: Chiriquí: W. & C. von Hagen 2125, Dwyer 2440 A (MO) (Cerro Punta, alt. ± 2100 m).

This is the first record of the species from the province of San José, Costa Rica.

53. Erythrina globocalyx Porsch & Cufodontis, Arch. Bot. Sist. Fitog. & Genet. 10:35. pl. 1. 1934.

Costa Rica: San José: Tonduz 9715 (US), Burger & Stolze 5396 (La Palma area, NE of San Jerónimo, alt. ± 1500 m) (F), F. Tristan 824 (La Palma de San José, ± 1600 m) (BR), Rowlee & Rowlee 251 (La Palma, hedge row by road) (NY, US), Roy W. Lent 1163 (along road from Frailes to Tarvaca).

54. Erythrina smithiana Krukoff, Brittonia 3:323. 1939.

Ecuador: E.F. Anderson 2516 (RSA), Benoist 3055 (P) (St. Domingo); Guayas: Jativa & Epling 925, E.F. Anderson 2467 (RSA) (village of Pomarosa).

55. Erythrina guatemalensis Krukoff, Amer. Jour. Bot. 28:688. 1941.

Guatemala: Huehuetenango: munic. Barillas near Barillas, alt. ± 1280 m, Krukoff 1969-246; Alta Veracruz, near Tactic, alt. ± 1310 m, Krukoff 1970-4.

Seeds of this species are uniformly scarlet (without a black line extending from the hilum toward the chalazal end) - see Standley 90463 and Steyermark 42364 (cited in 5a:134), also Krukoff 1969-38, 1969-192, 1969-193 and 1969-194 (cited in 5b: 162). An error was made in the protologue as the fruits and seeds described there from Standley 69228 represent E. williamsii.

56. Erythrina steyermarkii Krukoff & Barneby, Mem. N.Y. Bot. Gard. 20(2):175. 1970.

Chromosome number: 2n=42, voucher: Krukoff 1969-145 (NY) from Costa Rica: Alajuela: San Carlos, Finca Los Ensayos (46:383).

Nicaragua: Zelaya: Molina 2230 (GH); Chontales: Bunting & Licht 1102 (US). Costa Rica: Guanacaste: Standley & Valerio 45768 (US), 46620 (US); Alajuela: Krukoff 4a (Los Ensayos, near El Zapote), Brenes 15636 (between Tilaran & El Silencio) (F), Tonduz 10896 (BR) (Santa Clara); Cartago: Standley & Valerio 46714 (US), Krukoff 8a (Finca Las Quinas, San Antonio), Jorge León 768 (Bajos de la Gloria, alt. ± 750 m) (CR, F), Burger & Ramirez 3992 (along the road from Turrialba to Moravia) (F), Lems 5063 (along road from Turrialba N to Pavones and Siquirres); Puntarenas: San Pedro M. de Oca, Orozco 947 (EAP) and 1017 (EAP).

This is the first record of the species from Nicaragua (Zelaya and Chontales) and from the provinces of Guanacaste and Puntarenas in Costa Rica.

57. Erythrina tajumulcensis Krukoff & Barneby, Mem. N.Y. Bot. Gard. 20(2):176. 1970.

Chromosome number: 2n=42, voucher: Krukoff 1969-249 (NY) (46:383).

Mexico: Chiapas: appr. 32 km. north of asphalt road (Tapachula-Tonda), along the secondary earth road, after passing Union Juarez, Krukoff 1970-60, 1970-61 and 1970-62 (March 3, flrs). Guatemala: San Marcos: near Aldea Feria, Krukoff 1969-249, 1970-28 and 1970-134.

This is the first record of the species from Mexico (Chiapas). In spite of extensive search I was unable to find this species in Guatemala except in a single locality, near Aldea Feria, at the elevation of ± 1650 m.

58. Erythrina williamsii Krukoff & Barneby, sp. nov.

Erythrina tajumulcensi Krukoff proxima sed tubo calycino post vexillum profunde fisso statim recognita.

Chromosome number: 2n=42, voucher: Krukoff 1969-199 (NY) from Guatemala count based on seedling and the plant cited as E. guatemalensis Krukoff (45:474).

Tree, usually leafy at anthesis, armed with spines; branchlets stout, aculeate; petioles 12-30 cm long, shortly pubescent when young, soon glabrous, usually spineless; petiolules 7-13 mm long and 0.7-10 mm in diam., pubescent as petioles; leaflet--blades chartaceous to subcoriaceous, pubescent with rather

short dark brown hairs when young, soon glabrous, not ceriferous beneath, paler beneath than above; terminal leaflets broadly ovate, usually about as long as broad, 11.5-15 cm long, 9-14.5 cm broad, usually shortly acuminate at apex, and rounded at base; secondaries usually 7 per side; rachis 13-32 cm long, densely and shortly pubescent with dark brown hairs, soon glabrescent proximally; pedicels up to 1 cm long, pubescent as rachis; calyx coriaceous, drying black, tubular-campanulate, up to 30 mm long on the carinal side, and 20 mm long on the vexillar side, ± 6 mm broad at base, ampliate to 11 mm at apex, at margin entire or irregularly dentate or lobed, prominantly calcarate on the upper carinal side, puberulent to shortly pubescent; standard narrowly elliptic, about 8 cm long and 1.6 cm broad, obtuse to rounded and often retuse at apex, cuneate at base; wings rounded and often subcucullate at apex, narrowed at base, usually longer than keel-petals, about 16 mm long and 3 mm broad; keel-petals abruptly acute dorsally at apex, irregularly dentate distally, not at all hastate or sagittate, clawed at base, about 12 mm long and 4 mm broad; stamens 4.5-6 cm long, separate for 1.5-2.5 cm; pistil about 4.5 cm long, the ovary and gynophore densely pubescent with spreading dark brown hairs, the style glabrous; fruit-pedicels ± 2 cm long and about 2 mm in diam.; pods subligneous, 15-28 cm long; 1.5-1.8 cm broad, irregularly constricted between some seeds, with a stipe about 5 cm long with an acumination about 2.5 cm long, 2-many-seeded; seeds scarlet with a black line extending from the hilum toward the chalazal end, about 12 mm long and 8 mm broad.

Guatemala: Alta Verapaz: J.D. Smith 1793 (US), Cook & Griggs 407 (US), Krukoff 1969-205; Krukoff 1969-32 (near Cristóbal); Standley 69228 (F), 69321 (F), 91137 (F) and Williams et al. 40260 (F) (all near Cobán); Krukoff 1969-204 (near San Pedro Carchá); Krukoff 1969-199 (NY-holotype) and 1969-201 (aldea Bangab, ± 3 km from San Pedro Carchá); Krukoff 1970-9, 1970-10 and 1970-137 (all near Caxux, along the road from Cobán to Sebol); Krukoff 1970-5, 1969-39 and 1969-40 (all near Tactic); Krukoff 1970-16, 1970-17, 1970-18 and 1970-23 (all between Tactic and Tucurú). Honduras: Morazán, alt. ± 1215 m, Williams & Molina 12809 (EAP).

The new species is related to E. tajumulcensis, but is immediately distinguished by its calyx which is conspicuously shorter on the vexillar than on the carinal side.

This species is rather common near Cobán in Alta Verapaz where it is often planted as a live hedge.

This species as well as E. cobanensis had mature flowers in January at moderately high elevations along the road from Tactic to Tucurú, while they were nearly leafless and in bud only at higher elevations along the road from San Pedro Carchá to Finca Chapultepec.

All collections of this species were made at "coffee elevations" (1050-1380 m). E. williamsii is a shy seed bearer; its pods are comparatively small with few seeds.

This species is named in honour of L. O. Williams in recognition of his work on Flora of Guatemala.

SUBGENUS CHIROCALYX (MEISNER) HARVEY

SECTION VARIEGATAE (KRUKOFF) KRUKOFF

59. Erythrina velutina Willdenow, Ges. Nat. Freunde Berlin Neue Schr. 3:426. 1801.

Erythrina aculeatissima Desfontaines, Tabl. 191. nomen. 1804.

Jamaica: Proctor 28568 (IJ), Bengry s.n. (Apr. 12, 1946) (IJ). Haiti: Yaeger s.n. (1828) (P). Antigua: H. E. Box 1410 (F). Venezuela: Grosourdy 13 (P). Colombia: Goajira: C. Saravia & D. Johnson 95 (US), Cuatrecasas & Romero-Castañeda 25475 (COL). Ecuador: Gilmartin 165 (MO); Galápogos Islands: E. Yale Dawson s.n. (US), Wiggins & Porter 187 (US), Wiggins 18735 (US). Peru: Martinet s.n. (1878) (P); Lambayeque: Woytkowski 6777 (MO). Brazil: Bahia: Estrada de Joazeiro, A.P. Duarte 10594 (RB), Rio de Janeiro; Glaziou 11881 (P), Guanabara: cult. Luiz Emygdio 2028 (R), Country undesignated: "cult. in America", coll. undesign. s.n. (P - the basis of the name E. aculeatissima).

ASIATIC AND AFRICAN SPECIES CULTIVATED IN AMERICA

1. Erythrina variegata L.

In addition to the countries enumerated in the monograph (1:336) it is apparently cultivated in Barbados (Proctor 26239 (IJ), and Grenada (Howard 10940).

2. Erythrina abyssinica Lam.

This species is cultivated in Costa Rica (Krukoff 1969-133 - Cartago, Finca Aquiares, near Turrialba).

APPENDIX I

LIST OF KNOWN AMERICAN SPECIES OF ERYTHRINA

Subgenus Erythrina

Section Duchassaingia (Walpers) Krukoff

1. fusca

Section Cristae-galli (Krukoff) Krukoff

2. crista-galli
3. falcata

Section Micropteryx (Walpers) Krukoff

4. poeppigiana
5. ulei
6. dominguezii
7. verna

Section Stenotropis (Hasskarl) Krukoff

8. speciosa

Section Edules (Krukoff) Krukoff

9. polychaeta
10. schimpffii
11. edulis

Section Leptorhizae (Krukoff) Krukoff

12. breviflora
12a. " fma. petraea
12b. " fma. oaxacana
13. leptorhiza
14. horrida
15. montana

Section Erythrina

16. peruviana
17. pallida
18. mitis
19. buchii
20. leptopoda
21. elenae
22. eggersii
23. amazonica
24. similis
25. corallodendrum var. corallodendrum
25a. " var. bicolor
25b. " var. connata

Section Cubenses (Krukoff) Krukoff

26. cubensis
27. oliviae

Section Xyphanthus (Rafinesque) Krukoff

28. herbacea
29. coralloides
30. flabelliformis
31. lanata
32. berteroana
33. castillejiflora
34. americana
35. standleyana
36. atitlanensis
37. cobanensis
38. chiapasana
39. goldmanii
40. rubrinervia
41. mexicana
42. lanceolata
43. hondurensis
44. barqueroana
45. gibbosa
46. costaricensis
47. folkersii
48. macrophylla
49. florenciae
50. huehuetenangensis
51. cochleata
52. chiriquensis
53. globocalyx
54. smithiana
55. guatemalensis
56. steyermarkii
57. tajumulcensis
58. williamsii

Subgenus Chirocalyx (Meisner) Harvey

Section Variegatae (Krukoff) Krukoff

59. velutina
59a. " fma. aurantiaca
60. grisebachii

Species reduced to synonymy since Supplement IV (1970).

E. glauca Willdenow was reduced to synonymy under E. fusca Loureiro and E. flammea Herzog under E. verna Velloso in Supplement V.

APPENDIX II (Supplement)

AUTHORS OF THE SPECIES

Krukoff, B.A. & R.C. Barneby	- castillejiflora, atitlanensis, cobanensis, barqueroana, florenciae, huehuetenangensis, steyermarkii, tajumulcensis, williamsii (9).
Porsch, Otto & Georgio Cufodontis	- globocalyx (1).

APPENDIX III (Supplement)

COLLECTORS OF THE TYPE SPECIMENS

Krukoff, B. A.	- castillejiflora, atitlanensis, cobanensis, barqueroana, florenciae, huehuetenangensis, steyermarkii, tajumulcensis, williamsii (9).
Porsch, Otto	- globocalyx (1).

APPENDIX IV (Supplement)

COUNTRIES OF ORIGIN OF THE TYPE SPECIMENS

Guatemala	- castillejiflora, atitlanensis, cobanensis, barqueroana, florenciae, huehuetenangensis, tajumulcensis, williamsii (8).
Costa Rica	- globocalyx, steyermarkii (2).

APPENDIX V (Supplement)

LIST OF SPECIES WHICH ARE KNOWN TO OCCUR IN VARIOUS COUNTRIES

Dominican Republic	- buchii (1).
Mexico	- florenciae, tajumulcensis (2).
Belize	- fusca (1).
Guatemala	- castillejiflora, atitlanensis, cobanensis, goldmanii, barqueroana, florenciae, huehuetenangensis, tajumulcensis, williamsii (9).
Nicaragua	- steyermarkii (1).
Costa Rica	- globocalyx, steyermarkii (2).
Panama	- rubrinervia (1).
Colombia	- costaricensis (1).

In Appendix V (6) substitute fusca for glauca, verna for flammea, and delete macrophylla under Mexico.

APPENDIX VI

STATISTICAL DATA ON SPECIES (AND VARIETIES AND FORMS) KNOWN TO OCCUR IN VARIOUS COUNTRIES

	Collected	Endemic
Dominican Republic	3	-
Mexico	18 + 2	8 + 2
Central America	25	
Belize	3	-
Guatemala	18	5
Nicaragua	7	-
Costa Rica	9	-
Panama	7	-
Colombia	11	
Brazil	13 + 1	2 + 1

APPENDIX VII (Supplement)

LIST OF SPECIES OF WHICH LEAVES AND/OR FLOWERS AND/OR FRUITS ARE STILL UNKNOWN

	lvs.	flrs.	frts.
34. castillejiflora	+	+	-
37. atitlanensis	+	+	+
38. cobanensis	+	+	+
45. barqueroana	+	+	+
50. florenciae	+	+	+
51. huehuetenangensis	+	+	+
55. globocalyx	+	+	+
58. steyermarkii	+	+	+
59. tajumulcensis	+	+	+
60. williamsii	+	+	+

APPENDIX VIII (Supplement)

ILLUSTRATIONS

28. oliviae	5a:129
34. castillejiflora	5b:168
37. atitlanensis	5b:168
38. cobanensis	5b:168
45. barqueroana	Supplement V
50. florenciae	5b:169
51. huehuetenangensis	5b:169
55. globocalyx	5b:169
58. steyermarkii	5b:169
59. tajumulcensis	5b:168
60. williamsii	Supplement V

APPENDIX IX (Supplement)

CHROMOSOME NUMBERS IN AMERICAN SPECIES OF ERYTHRINA

12. edulis	2n = 42
28. oliviae	2n = 42
30. coralloides	2n = 42
32. lanata	2n = 42
36. standleyana	2n = 42
37. atitlanensis	2n = 42
38. cobanensis	2n = 42
39. chiapasana	2n = 42
40. goldmanii	2n = 42
47. costaricensis	2n = 42
51. huehuetenangensis	2n = 42
54. chiriquensis	2n = 42
58. steyermarkii	2n = 42
59. tajumulcensis	2n = 42
60. williamsii	2n = 42

With the exception of E. edulis and E. chiriquensis all other seeds used in these studies were obtained in connection with my field trips in Central America and Mexico.

APPENDIX X (Supplement)

CHROMOSOME NUMBERS IN ASIATIC-POLYNESIAN-AUSTRALIAN SPECIES OF ERYTHRINA

8. E. variegata L. 2n = 42
(Monsalud s.n. from Philippines; count based on seedlings and the plant cited as E. subumbrans (Hasskarl) Merrill) (45:474).

9. E. tahitensis Nadeau 2n = 42
(Gillett s.n. (NY) and Gillett 1983 (NY) from Hawaii; count based on seedlings and the plant cited as E. sandwicensis Degener (45:474).

APPENDIX XII (Supplement)

COLLECTIONS CITED IN THE MONOGRAPH AND ITS SUPPLEMENTS

	Monog. & Suppl. 1 & 2, 1939/1940	Suppl. #3, 1969	Suppl. #4, 1970	Suppl. #5, 1971	Suppl. #3, 4 & 5	Total
I. Sect. Duchassaingia						
1. fusca	165	126	2	51	179	344
II. Sect. Cristae-galli						
2. crista-galli	135	72	-	46	118	253
3. falcata	77	60	-	18	78	155

	Monog. & Suppl. 1 & 2, 1939/1940	Suppl. #3, 1969	Suppl. #4, 1970	Suppl. #5, 1971	Suppl. #3, 4 & 5	Total
III. Sect. Micropteryx						
4. poeppigiana	122	68	-	15	83	205
5. ulei	17	7	-	4	11	28
6. dominguezii	15	4	-	6	10	25
7. verna (1 with doubts)	24	19	-	4	23	47
IV. Sect. Stenotropis						
8. speciosa	28	31	-	13	44	72
V. Sect. Edules						
9. polychaeta	2	2	-	-	2	4
10. schimpffii	6	7	-	1	8	14
11. edulis (1 with doubts)	62	65	-	15	80	142
VI. Sect. Leptorhizae						
12. breviflora	28	30	-	12	42	70
12a. " fma. petraea	5	-	-	-	-	5
12b. " fma. oaxacana	3	-	-	-	-	3
13. leptorhiza	41	29	-	6	35	76
14. horrida	15	-	-	-	-	15
15. montana	8	11	-	2	13	21
VII. Sect. Erythrina						
16. peruviana	1	3	-	1	4	5
17. pallida (1 with doubts)	26	10	-	1	11	37
18. mitis (1 with doubts)	10	15	-	1	16	26
19. buchii	5	1	-	1	2	7
20. leptopoda	8	-	-	-	-	8
21. elenae	-	2	-	-	2	2
22. eggersii	26	-	-	-	-	26
23. amazonica	15	14	-	2	16	31
24. similis	3	-	-	-	-	3
25. corallodendrum var. corallodendrum (2 with doubts)	11	7	-	9	16	27
25a. " var. bicolor	18	7	-	1	8	26
25b. " var. connata (1 with doubts)	10	-	-	-	-	10
VIII. Sect. Cubenses						
26. cubensis	40	5	-	1	6	46
27. oliviae	-	2	-	1	3	3

	Monog. & Suppl. 1 & 2, 1939/1940	Suppl. #3, 1969	Suppl. #4, 1970	Suppl. #5, 1971	Suppl. #3, 4 & 5	Total
IX. Sect. Xyphanthus						
28. herbacea (2 with doubts)	105	81	-	28	109	214
29. coralloides (3 with doubts)	29	19	-	-	19	48
30. flabelliformis	90	67	-	3	70	160
31. lanata	15	42	-	3	45	60
32. berteroana (4 with doubts)	209	80	82	48	210	419
33. castillejiflora	-	-	6	7	13	13
34. americana (7 with doubts)	62	20	-	-	20	82
35. standleyana	37	3	-	42	45	82
36. atitlanensis	-	-	11	4	15	15
37. cobanensis	-	-	8	6	14	14
38. chiapasana	2	14	22	25	61	63
39. goldmanii	4	3	1	22	26	30
40. rubrinervia	35	40	-	12	52	87
41. mexicana (1 with doubts)	19	13	15	14	42	61
42. lanceolata	25	14	2	8	24	49
43. hondurensis	11	6	-	-	6	17
44. barqueroana	-	-	-	9	9	9
45. gibbosa	28	13	3	9	25	53
46. costaricensis (1 with doubts)	41	40	12	17	69	110
47. folkersii	32	5	5	23	33	65
48. macrophylla	13	17	30	3	50	63
49. florenciae	-	-	3	17	20	20
50. huehuetenangensis	-	-	6	15	21	21
51. cochleata	4	5	-	7	12	16
52. chiriquensis	5	6	5	7	18	23
53. globocalyx	-	-	4	7	11	11
54. smithiana (1 with doubts	9	20	-	4	24	33
55. guatemalensis	1	6	11	2	19	20
56. steyermarkii	-	-	8	22	30	30
57. tajumulcensis	-	-	5	6	11	11
58. williamsii	-	-	-	26	26	26
X. Sect. Variegatae						
59. velutina	72	61	-	17	78	150
59a. " fma. aurantiaca	6	1	-	-	1	7
60. grisebachii	25	2	-	-	2	27
TOTAL	1805	1175	241	624	2040	3845

APPENDIX XIII (Supplement)

CHANGES IN THE IDENTIFICATIONS

	cited originally as	cited later as
von Schrenk s.n.	berteroana (1:295)	chiapasana (V Suppl.)
Rosengarten s.n. (Krukoff Herb. 15124)	guatemalensis (5:636)	mexicana "
Tonduz 6781	lanceolata (1:311)	costaricensis "
Montealegre s.n. (Krukoff Herb. 9193)	berteroana (1:296)	costaricensis "
Steyermark 36469	macrophylla (4:689)	florenciae "
Austin Smith A-29	berteroana (4:688)	chiriquensis "
Tonduz 9715	costaricensis (1:316)	globocalyx "
Rowlee, W.W. & H. E. 251	berteroana (1:296)	globocalyx "
Brenes 15636	costaricensis (1:316)	steyermarkii "
Standley & Valerio 45768	" "	" "
" " 46620	" "	" "
" " 46714	" "	" "
Jorge Leon 768	" (5:637)	" "
Krukoff 8a	" "	" "
Krukoff 4a	" "	" "
Brenes 15636	" "	" "
Standley 69228	guatemalensis (4:689)	williamsii "
" 69321	" "	" "
J. D. Smith 1793	" "	" "
Cook & Griggs 407	" "	" "

NOTES

Prior to 1968/1969 when field studies of Central American species were made, E. steyermarkii, described in 1970 (5b:175), was confused with E. costaricensis, whereas E. williamsii, described in this paper, was confused with E. guatemalensis.

During my field work in Mexico, discussed in this paper, E. standleyana became better known and, as a result, many specimens from Mexico (Tamaulipas, San Luiz Potosí, Hidalgo, Puebla, Veracruz and Oaxaca) confused previously with E. herbacea, were cited under E. standleyana (see under E. standleyana).

It should be noted also that inasmuch as E. glauca was placed in synonymy under E. fusca and E. flammea was reduced to synonymy under E. verna, all specimens originally cited under the above referred to two names, were renamed.

APPENDIX XIV (Supplement)

Citations of places of deposit of specimens.

COI : Bot. Inst. of the Univ. Coimbra, Portugal.

IJ : Science Museum, Kingston, Jamaica.

LISC: Centro Bot. Junta Invest. Ultramar, Lisboa.

UCWI: Bot. Dept., Univ. West Indies, Saint Andrews, Jamaica.

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(In order to conserve space, I am citing here only the papers which are not cited in Supplement III).

5a. Krukoff, B.A. Supplementary notes on the American species of Erythrina. III. Phytologia 19(3): 113-175. 1969.

5b. _____. Supplementary notes on the American species of Erythrina. IV. Field studies of Central American species. Mem. N.Y. Bot. Gard. 20(2): 159-177. 1970.

45. Lewis, Walter H. & Royce L. Oliver, In Chromosome numbers of phanerogams. 3[1]. Ann. Missouri Bot. Gard. 56: 471-475. 1969.

46. _____, In Chromosome numbers of phanerogams. 4[1]. Ann. Missouri Bot. Gard. 57: 382-384. 1970.

47. Mattos, N.F., Espécies do genero Erythrina do Estado de Sao Paulo. 7-15. pl. 1-7. Estudos Tecnicos #36. 1967.

BOOK REVIEWS

Alma L. Moldenke

"SPRINGTIME IN BRITAIN" by Edwin Way Teale, x & 406 pp., illus., Dodd, Mead & Co., New York, N. Y. 10016. 1970. $7.50.

From his returning airplane seat with his wife Nellie, the author reminisces: "As the hours dragged by, I leaned back remembering all our adventures in the Springtime of Britain. I recalled those first skylarks at Land's End, the day of rain amid the thousands of daffodils, the perfume of the hawthorn along Shakespeare's river, moonlight and the nightingale at Selbourne, waterfalls shining on the Isle of Skye, and that night of light at John o' Groats. To while away the time I began jotting down a list of chapters... Adventurers Fen, Low Nest Farm, Archaeological Rabbits, Dartmoor in the Rain."

As is true of the other writings of this gifted naturalist, this book offers charm, beauty and scientific accuracy in his interesting descriptions of the various forms of nature, including man, and of local history covered in that recent springtime journal of 11,000 miles through the lanes and bypaths of the British Isles. Surely, I must read this book again this coming spring!

"ORIGIN AND CONTINUITY OF CELL ORGANELLES" edited by J. Reinert & H. Ursprung, xiii & 342 pp., illus., Springer-Verlag, Heidelberg, Berlin and New York, N. Y. 10010. 1971. $19.80.

This is volume 2 in a series of topical volumes in developmental biology entitled "Results and Problems in Cell Differentiation". Those already in print deal with "The Stability of the Differentiated State", "Nucleic Acid Hybridization in the Study of Cell Differentiation" and "Developmental Studies on Giant Chromosomes". In its eleven papers by seventeen authors, this book contains authoritative reviews relevant to this question [of origen] on the following components of cells: mitochondria, vacuoles, desmosomes, centrioles, polar granules, golgi apparatus, endosymbionts, plastids, microtubules, lysosomes and membranes in general, with well organized contents and appraisals, with full bibliographic sources, but with few finite basic answers because more is not available yet.

There are some excellent electron microscopic prints and excellent diagrams. An overall index is conspicuous by its absence. The print is clear for reading. In p. 95 intestinal is misspelled. The last paper is entitled "Cell Organelles and the Differentiation of Somatic Plant Cells" and summarizes much of the material presented in this valuable book.

"WORLD POLLEN FLORA I CORIARIACEAE" by J. Praglowski, 31 pp., illus., Hafner Publishing Co., New York, N. Y. 10022. 1970. $5.00, paperback.

This series is edited by G. Erdtman who defines the terms to be used. B. Peterson gives a concise taxonomic treatment of this small family. Comprehensive pollen diagnosis is given for 16 species of the type and only genus and indicates that the family occupies an isolated systematic position. The illustrations are fairly good.

"THE STIPITATE HYDNUMS OF THE EASTERN UNITED STATES" by William C. Coker and Alma H. Beers, viii & 211 pp., illus., J. Cramer, Lehre 3301, Germany; Whelden & Wesley, Ltd., Codicote, Herts., England; & Stechert-Hafner Agency, New York, N. Y. 10022. Reprint 1970. Porto/Postage $15.40/$17.60.

This is a needed release of the fine original publication of 1951 from the University of North Carolina Press. The many photographs and line drawings are very clear.

The review copy was burdened with the nuisance of uncut pages.

"FLORISTIC RELATIONSHIPS BETWEEN EASTERN ASIA AND EASTERN NORTH AMERICA" by Hui-Lin Li, ii & 60 pp., illus., Morris Arboretum Monograph, Philadelphia, Pennsylvania 19118. Reprint 1971. $3.75 paperback.

This thought- and discussion-provoking work was first published in 1952 in the Transactions of the American Philosophical Society, New Series, Volume 42, Part 2. To it has been added a Foreword reaffirming "the floristic disjunction at the generic [rather than the specific] level between the two continental areas" with a few additional examples and with a bibliographic listing of 67 new sources. The plants involved are mostly deciduous, simple-leaved, woody trees, shrubs and vines without any special adaptive means for fruit or seed dispersal (possibly explaining their rather limited range in either Asia or North America) and they are "the remnants of a great mesophytic forest that extended over all the northern hemisphere and reached the arctic regions in the Tertiary".

There are 56 maps showing these distributions.

"FACETS OF GENETICS - Readings from SCIENTIFIC AMERICAN" selected and introduced by Adrian M. Srb, Ray D. Owen, & Robert S. Edgar, iii & 354 pp., illus., W. H. Freeman & Co., San Francisco, California 94104. 1970. $10 hard cloth cover, $5.45 paperback.

It is so useful to have these outstanding papers from the already outstanding "SCIENTIFIC AMERICAN" grouped topically into books and as separates.

In this book there are 35 papers arranged under the following

topics: (1) the elements of inheritance dealing with genes, chromosomes, viruses, bacteria; (2) the nature of the gene dealing with genetic code, gene and protein structure, genetics of the bacterial virus; (3) from genes to organism dealing with control of biochemical reactions, chromosome puffs, hormones, transplanted nuclei, differentiation; (4) genetics and evolution dealing with the genetic basis, ionizing radiation, mutation, DNA repair, hemoglobin, computer analysis of protein; (5) genetics and man dealing with porphyria, prevention of Rh babies, genetic records of the Dunkers, hybrid wheat, sex differences in cells, induction of cancer by viruses, hybrid somatic cells. At the end of the book there are included the usual biographical notes and bibliographies as well as a useful index.

This book and its kindred belong in the circulating and reference sections of all public, secondary school, college, and university libraries as well as on many private library shelves because they should appeal to a wide range of readers.

"BIOLOGY OF PLANTS" by Peter H. Raven & Helena Curtis, xii & 706 pp., illus., Worth Publishers, Inc., New York, N. Y. 10011. 1970. $11.95.

After the reading of each of several new botany and general biology texts over the past few decades I have seldom felt a keen urge to use them as teaching guides because they set up so many learning barriers (all that condensed and alarming chemistry and physics at the very outset, those deadening and confusing ascendencies of sporophyte and gametophyte, over-nominate taxonomy without its picture of organization, pedantic explanations involving excessive terminology) rather than the necessary inviting bridges to the wonderful world of living things.

This text is one of the rare exceptions. A teacher would have to be a really poor sort if not able to do a good to excellent job with a text like this. It is developed as follows: an introduction to the beginning of life; the cell with its chemistry, structure, energetics, and heredity; plant development including life cycles as modified by hormonal, tropic, rhythmic and environmental factors; photosynthesis and respiration; soil and water relationships to plant function and growth; genetics and evolution with emphasis on the nature and divergence of populations; diversity of plants encompassing the whole plant kingdom and its role in the ecosystem; and man and the world ecosystem dealing with agriculture, population explosion, environmental quality, pollution and famine.

At the end of each chapter there are well chosen "Suggestions for Further Reading". At the end of the book there are appendices (A - fundamentals of chemistry, B - metric system and temperature conversion scale, C - classification of organisms, D - geologic eras), a glossary with far better than average definitions, and an index.

My friends who have been teaching with this book are very grateful for it.

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ADDITIONAL MATERIALS TOWARD A MONOGRAPH OF THE GENUS CALLICARPA. XXII

Harold N. Moldenke

CALLICARPA TOMENTOSA (L.) Murr.

Additional bibliography: Moldenke, Phytologia 22: 196, 199, & 207--209. 1971.

Bakhuizen van den Brink (1921) included in the synonymy of this taxon, in addition to the names listed at the close of the previous installment of these notes, also the following: C. maingayi King & Gamble [which I regard as a valid and distinct species], C. tectonaeflora Wall. [a synonym of C. arborea Roxb.], C. vastifolia Diels [a synonym of Viburnum rhytidophyllum Hemsl.], C. vestita Wall. [a valid species], C. villosa Roxb. [a synonym of C. arborea], and C. villosa Vahl [a name of uncertain standing]. Lam (1924) also regards C. magna Schau. as a synonym of C. tomentosa.

Hasskarl (1867) regarded Tondi-teregam as questionably Callicarpa candicans (Burm. f.) Hochr. or C. macrophylla Vahl. Heyne (1927) and Deb, Sengupta, & Malick (1968) reduce C. arborea Roxb. to the synonymy of C. tomentosa. Clarke (1885) lists C. farinosa Roxb. as a synonym of what he calls C. arborea Roxb. It is based on Herb. Wallich 1826 G from Madras.

In some previous publications I regarded C. lanata var. psilocalyx H. J. Lam as typical C. tomentosa, but I now regard it as C. arborea var. psilocalyx (H. J. Lam) Moldenke.

It should be pointed out here that the Callicarpa arborea accredited to Merrill in the synonymy of C. tomentosa is actually a synonym of C. arborea var. psilocalyx (H. J. Lam) Moldenke, that credited to Roxburgh is a valid species, and that credited to Wallich is C. vestita Wall.; the C. cana credited to Gamble is a synonym of C. macrophylla Vahl, that ascribed to Linnaeus, to Sprengel, and to Vahl is C. candicans (Burm. f.) Hochr., while that credited to Wallich is in part C. longifolia Lam. and in part C. pedunculata R. Br.; the C. farinosa of Siebold & Zuccarini is C. mollis Sieb. & Zucc.; the C. integrifolia of Champion and of Forbes & Hemsley is C. integerrima Champ., while that of Jacquin is Aegiphila integrifolia (Jacq.) Jacks.; the C. lanata accredited to Hosséus is a synonym of C. arborea Roxb., that of Gamble is C. vestita Wall., that of H. J. Lam is C. arborea var. psilocalyx (H. J. Lam) Moldenke, that of Lamarck is Premna tomentosa Willd., that accredited to Ridley is C. maingayi King & Gamble, and that ascribed to Schauer, to Vahl, to Walpers, and to Zippelius is C. pedunculata R. Br. Finally, the C. tomentosa ascribed to "Auct.", to Hooker & Arnott, to Willdenow, to "sensu auct. japon.", to "sensu Matsum.", to "sensu Matsum. & Hayata", and to "Koen. ex Vahl" is C. kochiana Mak., that credited to

Bakhuizen van den Brink is in part C. arborea Roxb and in part C. integerrima Champ., that credited to Lam & Bakhuizen van den Brink is C. arborea Roxb., that of König and of Vahl is C. macrophylla Vahl, that of Lamarck and of "L. ex Sprengel" is C. candicans (Burm. f.) Hochr., that of Thunberg is C. longifolia Lam., and that credited to "L. ex Moldenke" is C. erioclona Schau. The Cornutia corymbosa Burm. f. is a synonym of what we now call Premna obtusifolia R. Br.

It is perhaps also worth mentioning here that the Willdenow (1809) reference in the bibliography of C. tomentosa is sometimes erroneously cited as "1808"; similarly, the illustration in R. Wight's work (1850) is sometimes incorrectly cited as "t. 1736". Lam (1924) cites "L., Mant. II. (1767). 331", Raizada (1966) writes it "Linn. Mant. 2: 331, 1771", Retzius (1789) cites it as "p. 333", and other authors have said "L., Mant. 2: 33. 1767" — all apparently incorrect. The Itô (1928) reference is sometimes cited as "1927" for some reason not known to me. The Dassow (1747) work is often cited as "L., Nov. Pl. Gen. 5". Curiously, the surname of this author, Carl Magnus Dassow, is written "Dassaw" in the 1747 work and "Dassow" in the 1749 reprint.

Kadambi (1950) reports that C. tomentosa grows "in sunlight with Leea aspera and species of Strobilanthes on tableland adjoining the exposed western wall" in southern tropical wet evergreen forests of the western Ghats in Mysore, India. Puri (1960) reports it from the second layer, which may be 10--25 feet tall, in tropical forests of northern Kanara on siliceous rocks, in the second story on outskirts or in clearings along with the dominant Carvia callosa in montane subtropical forests of Bhimashankar, and in the evergreen top story to 35 feet tall with dense canopy and little undergrowth in the shade. He avers that it constitutes a food plant for Orgyia postica. Balakrishnan (1964) records C. tomentosa from Madras, India.

Lam (1919) cites for his C. lanata var. typica the following specimens: MALAYA: Malacca: W. Griffith 6037, Herb. Wight 2314, Maingay 1192. PHILIPPINE ISLANDS: Luzon: Elmer 9125 (Le--908.-146-1998). GREATER SUNDA ISLANDS: Celebes: Teijsmann & DeVriese s.n. (Le--908.265-360, Le--908.266-802). Java: Herb. Rijksherb. Leid. 908.265-933. Sumatra: Junghuhn s.n. (Le--908.265-948, Le--908.266-804); Korthals s.n. (Le--908.266-823, Le--908.266-830). LESSER SUNDA ISLANDS: Timor: Decaisne s.n. (Le--908.265-1435).

Beer & Lam (1936) cite Brass 3675 & 5495 from New Guinea. Sunramanian (1966) cites Vallappatti 761 from Coimbatore, India; Panigrahi & Joseph (1966) cite their no. 14877 from Nefa; Sebastine & Ramamurthy (1966) cite their no. 16065 from Kerala, Vajravelu and his associates (1968) cite Vajravelu 19108 and Ellis, Swaminathan & Chandrabose (1967) cite 18537 & 20446 from the same state; Kammathy, Rao, & Rao (1967) cite their nos. 73830, 79933,

& 80317 and Barnes s.n. from Mysore; while Deb, Sengupta, & Malick (1968) cite Sengupta 1026a, 1187, & 1428 from Bhutan.

The Lörzing 5857 collection, cited below, is sterile — one sheet has entire-margined leaves, the other has them dentate. The plant may not be verbenaceous. Bal 15 and Lörzing 7469 are also sterile, with dentate leaf-blades.

Material of C. tomentosa (L.) Murr. has been misidentified and distributed in herbaria under the names C. arborea Roxb., C. longiloba Merr., C. macrophylla Vahl, C. macrophylla Wall., and C. tomentosa Willd. On the other hand, the Teijsmann 3525 H.B. and Yates 629, distributed as C. tomentosa, are actually C. arborea Roxb., Collector undesignated 15 is C. cubensis Urb., Hayata, Kanehira, & Tanaka 283 and E. H. Wilson 10850 are C. formosana Rolfe, Kato 284 is C. kochiana Mak., C. B. Clarke 12628 D and Kurz s.n. [Sikkim] are C. vestita Wall., and Carr 14870 & 15376 are Geunsia cumingiana (Schau.) Rolfe.

In all, 49 herbarium specimens and 4 mounted photographs of C. tomentosa have been examined by me.

Additional citations: INDIA: Bombay: E. W. Erlanson 5220 (N); J. Fernandes 114 (A); Herb. Blatter 23495 (Xa); Herb. Coll. Pharmacy s.n. [Khandolla, Nov. '91] (Pa); Santapau 1554 (N). Cochin: Meebold 12483 (S). Coimbatore: Narayana s.n. [Siruvani] (N). Kerala: Jeshoda 346 (N); Stocks, Law, &c. s.n. [Malabar, Concan] (N, S, W--2496334). Madras: Koelz 11163 (Mi); Kuntze 7591 (N, N); G. Thomson s.n. [Mont. Nilghiri & Kurg] (S). Travancore: E. W. Erlanson 5457 (N); E. K. Janaki 962 (Mi). State undetermined: Herb. T. Cooke s.n. (Mi); Herb. Mus. Bot. Stockh. 4 (S); Simons 5699 [Gowhatey] (W--261238); R. Wight 2314 (S), s.n. [Penins. Ind. Orientalis] (N). CEYLON: J. H. Fraser 122 (Du--166512, W--9975); Macrae 20 (T); J. M. de Silva 199 (N). CHINA: Chekiang: R. C. Ching 2425 (Ca--926437). THAILAND: Herb. Roy. Forest Dept. 22215 (Z); Prachantasen 25 (W--2064784); Rock 983 (W--1171537). GREATER SUNDA ISLANDS: Java: Teijsmann s.n. [1868] (Mi). Sumatra: Bal 15 (Bz--18631, Bz--18632); H. O. Forbes 1530 (Ca--529749); Lörzing 5857 (Bz--18646, Bz--18647), 7469 (Bz--18636), 13067 (Bz); Teijsmann s.n. (Bz--18698). NEW GUINEA: Papua: Brass 28841 (W--2409515); C. E. Carr 14870 (N), 15376 (N); M. S. Clemens 11195 (Ca--180886); Herre 219 (Du--188833). NEW GUINEAN ISLANDS: Misima: Brass 27693 (W--2408787). Woodlark: Brass 28719 (W--2409459). CULTIVATED: Java: Herb. Lugd.-Bat. 5745 (N--photo, N--photo, N--photo, Z--photo).

CALLICARPA TONKINENSIS Dop, Bull. Soc. Hist. Nat. Toulouse 64: 508--509. 1932.

Bibliography: P. Dop, Bull. Soc. Hist. Nat. Toulouse 64: 501,

508--509, & 512. 1932; P. Dop, Trav. Lab. For. Toulouse 1 (Art. Divers.), 21: 17. 1932; A. W. Hill, Ind. Kew. Suppl. 9: 46. 1938; Moldenke, Known Geogr. Distrib. Verbenac., ed. 1, 59 & 87 (1942) and ed. 2, 136 & 178. 1949; H.-T. Chang, Act. Phytotax. Sin. 1: 288. 1951; Anon., U. S. Dept. Agr. Bot. Subj. Index 15: 14354. 1958; Moldenke, Résumé 175 & 445. 1959; Moldenke, Phytologia 20: 496 (1971) and 21: 376. 1971.

Dop's original (1932) description of this taxon is: "Frutex 2 m. altus. Ramuli quadrangulares, graciles, puberuli mox glabri. Folia membranacea, elliptica vel paullo obovata, subacuta et non decurrentia basi, acuta vel rotundata et breviter acuminata apice, tenuissime denticulata in parte superiore, supra puberula in juventute sed glabra adulta et nigra in sicco, subtus tomento subalbido, coarctato, brevissimo pilorum stellatorum aoptimorum, obtecta, 10--14 cm. longa x 4--5 cm. lata; nervus subtus prominens; costae 20--24, tenues, utrinque conspicuae, ascendentes et ad margines recurvatae; venae numerosae, regulares, paralleles; reticulationes inconspicuae; petiolum 15--20 mm. longum. Inflorescentiae: cymae laxae, pubescentes pilis stellatis, 3--4 cm. longae et latae; pedunculi 15--18 mm. longi; flores albidi 3 mm. longi, in glomerulis multifloris densis dispositi; pedicelli subnulli. — Calyx puberulus, 1 mm. longus, dentibus 4, triangularibus, 0.3 mm. longis. Corolla glabra sed extus valde glandulosa, 2,5 mm. longa; tobus conicus; lobi 4, rotundati, 0,8 mm. longi. Stamina exserta; filamenta corollae basi inserta; antherae paullo glandulosae. Ovarium villosum; stylus stamina superans; stigma capitatum. — Fructus: drupa pubescens, nigra, 1,5 mm. lata."

The species is based on two collections, Bon 2864 and 2969, from "Lat son, dans les fôrets, Vo xa, Mont chua hac", Tonkin, Indochina. Dop comments that "Cette espèce est voisine du C. longifolia Lamarck. Elle s'en distingue par la forme des feuilles, de tomentum blanchâtre de la face inférieure, la corolle toujours glabre, les étamines moins longuement exsertes, les fruits plus petits."

Chang (1951) regards this species as a synonym of C. bodinieri Léveillé. I know nothing of it save what is stated in the cited literature.

CALLICARPA TOSAËNSIS Mak., Bot. Mag. Tokyo 6: [181]. 1892.

Synonymy: Callicarpa tosaensis Mak. apud C. K. Schneid., Illustr. Handb. Laubholzk. 2: 593. 1911.

Bibliography: Mak., Bot. Mag. Tokyo 6: [181]. 1892; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 1, 73. 1901; C. K. Schneid., Illustr. Handb. Laubholzk. 2: 593. 1911; J. Matsum., Ind. Pl. Jap. 2 (2): 530. 1912; Yanagita, Shinrin Djumoku bo Chibyô Dsusetu [Illustr. Seedlings Forest Trees] 3: fig. 287. 1927; Nakai in Nakai & Koidz., Trees & Shrubs Indig. Jap., ed. 2, 1: 460. 1927; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 2, 73. 1941; Worsdell, Ind. Lond. Suppl. 1: 160. 1941; Moldenke, Known Geogr. Distrib. Verbenac., ed. 1, 58 & 87. 1942; Hara, Enum. Sperm. Jap. 1: 186. 1948; Moldenke, Known Geogr. Distrib. Verbenac., ed. 2, 134 & 178. 1949;

Durand & Jacks., Ind. Kew. Suppl. 1, pr. 3, 73. 1959; Moldenke, Résumé 172 & 445. 1959; Moldenke, Résumé Suppl. 15: 17. 1967.

Illustrations: Yanagita, Shinrin Djumoku no Chibyô Dsusetu [Illustr. Seedlings Forest Trees] 3: fig. 287. 1927.

A common name recorded for this species is "ohba-murasaki". It is apparently endemic to Shikoku Island, Japan, the type being from Tosa on that island. Schneider (1911) says "Die C. tosaensis Mak.....kenne ich gar nicht". It is also completely unknown to me except for the information given in the cited literature.

CALLICARPA TSIANGII Moldenke, Phytologia 3: 109--110. 1949.

Bibliography: Moldenke, Phytologia 3: 109--110 & 139. 1949; Moldenke, Known Geogr. Distrib. Verbenac., ed. 2, 131 & 178. 1949; Moldenke, Phytologia 3: 461. 1951; E. J. Salisb., Ind. Kew. Suppl. 11: 40. 1953; Moldenke, Résumé 168 & 445. 1959; E. H. Walker, Bibl. East. Asiat. Bot. Suppl. 1: 235. 1960; Moldenke, Phytologia 21: 332. 1971.

A shrub, about 4 m. tall; branches medium-slender, very obtusely tetragonal, stellate-farinaceous with sordid-whitish pubescence that soon rubs off; principal internodes about 15 cm. long; leaves decussate-opposite; petioles slender, abbreviated, 2--5 mm. long, stellate-farinaceous; leaf-blades thin-membranous, somewhat lighter beneath, broadly elliptic or obovate, about 25 cm. long, 10--10.5 cm. wide when mature, long-acuminate at the apex, denticulate-margined from the widest part to about half way up to the terminal acumination, acuminate at the base, minutely puberulent above, more densely so beneath and stellate on the larger venation; midrib slender, plane above, prominent beneath; secondaries very slender, 8--10 or more per side, arcuate-ascending, not distinctly joined at the margins; tertiaries and veinlet reticulation obscure above, the larger parts subprominulous beneath; inflorescence axillary, cymose, 4--5.5 cm. long, 4.5--6 cm. wide, many-flowered, brachiate, densely stellate throughout; peduncles slender, 8--20 mm. long; foliaceous bracts absent; bractlets and prophylla linear, 1--3 mm. long, stellate-farinaceous; pedicels filiform, 1 mm. long or less, stellate-farinaceous; calyx campanulate, about 1 mm. long and wide (or less), more or less stellate-farinaceous externally, the rim minutely 4-apiculate; corolla infundibular, about 4 mm. long in all, the lobes very short, glabrous outside except for some stellate hairs near the apex.

The type of this species was collected by Ying Tsiang (no. 10081) in dense shade of mixed woods, at 700 meters altitude, Tunghuashan, Ihwang, Kiangsi, China, on June 30, 1932, and is deposited in the Britton Herbarium at the New York Botanical Garden. Material has been misidentified and distributed in some herbaria under the name C. cana L.

In all, 2 herbarium specimens, including the type, and 4 mounted photographs have been examined by me.

Citations: CHINA: Hupeh: Tsao-Fei 7 (N). Kiangsi: Tsiang 10081 (F--photo of type, N--type, N--photo of type, Sg--photo of type, Z--photo of type).

CALLICARPA VANSTEENISI Moldenke, Phytologia 4: 286--287. 1953.

Bibliography: Moldenke, Phytologia 4: 193 & 286--287. 1953; Moldenke, Biol. Abstr. 27: 3121. 1953; G. Taylor, Ind. Kew. Suppl. 12: 27. 1959; Moldenke, Résumé 187 & 445. 1959.

A shrub; branches apparently virgate, very obtusely tetragonal, very finely and obscurely puberulous; nodes annulate; principal internodes 2.2--12.5 cm. long; leaves decussate-opposite; petioles slender, 1--2 cm. long, minutely puberulent; leaf-blades thin-chartaceous or submembranous, fragile, dark-green above, lighter beneath, elliptic, 7--13 cm. long, 2.5--5 cm. wide, acuminate at the apex, appressed-serrate along the margins from near the base to the apex, acute or acuminate at the base, very lightly and obscurely puberulous-strigillose on both surfaces, especially beneath; midrib slender, flat above, prominulous beneath; secondaries very slender or filiform, about 8 per side, ascending, only slightly arcuate, mostly obscure above, very slightly prominulous beneath; veinlet reticulation indiscernible above, rather conspicuous beneath; inflorescence cymose, axillary, mostly shorter than the subtending petioles, rather densely many-flowered; peduncles very short, filiform, puberulent; inflorescence-branches and pedicels filiform, puberulent, several mm. long; bractlets linear, about 1 mm. long or less, puberulent; calyx campanulate, puberulent, its tube about 1.5 mm. long, the spreading-triangular lobes about 1.5 mm. long, attenuate at the apex; corolla small, its tube equaling the calyx, its limb bilabiate, about 4 mm. wide, densely puberulent outside; stamens exserted 4--5 mm. from the corolla-mouth; fruiting-calyx hardly enlarged; fruits drupaceous, globose, about 3 mm. long and wide, red, glabrous.

The type of this species is Van Steenis 6373, collected at Boer in Poepandji, Atjeh, Sumatra, on May 3, 1934, and is deposited in the Herbarium Bogoriense at Buitenzorg, Java. A printer's error has produced "G." vansteenisi in the Biological Abstracts (1953) reference cited above: it is obviously as error for "C." [=Callicarpa].

In all, 2 herbarium specimens, including the type, and 2 mounted photographs of this species have been examined by me.

Citations: GREATER SUNDA ISLANDS: Sumatra: Van Steenis 6373 (Bg--72798--type, N--isotype, N--photo of type, Z--photo of type).

CALLICARPA VESTITA Wall. ex C. B. Clarke in Hook. f., Fl. Brit. India 4: 567. 1885.

Synonymy: Callicarpa arborea β vestita Wall., Numer. List "49" [=50], hyponym. 1829. Callicarpa lanata Gamble ex C. B. Clarke in Hook. f., Fl. Brit. India 4: 567, in syn. 1885 [not C. lanata Hosséus, 1912, nor H. J. Lam, 1940, nor Lam., 1821, nor. L., 1767, nor Ridl., 1966, nor Roxb., 1839, nor Schau., 1870, nor Vahl, 1847, nor Wall., 1856, nor Walp., 1921, nor Willd., 1826, nor Zipp., 1841]. Callicarpa hookeri C. B. Clarke in Hook. f., Fl. Brit. India 4: 568, in nota nom. nud. 1885. Callicarpa sp. no. 3 Hook. f. & Thoms. ex C. B. Clarke in Hook. f., Fl. Brit. India 4: 567, in

syn. 1885. Callicarpa sp. no. 4 Hook. f. & Thoms. ex C. B. Clarke in Hook. f., Fl. Brit. India 4: 567, in syn. 1885. Callicarpa arborea Wall. apud Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 386, in syn. 1893 [not C. arborea L., 1966, nor "L. sensu Gamble", 1971, nor Merr., 1940, nor Miq., 1885, nor Roxb., 1814]. Callicarpa vestita "Wall. ex Clarke in Hook. f." ex Moldenke, Fifth Summ. 1: 419, in syn. 1971. Callicarpa vestita "Wall. ex C. B. Clarke", in herb.

Bibliography: Wall., Numer. List "49" [=50]. 1829; Gamble, List Trees Darj. Dist. 60. 1878; C. B. Clarke in Hook. f., Fl. Brit. India 4: 567 & 568. 1885; Watt, Dict. Econ. Prod. India 2: 27. 1889; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 386. 1893; Gamble, Man. Indian Timb., ed. 2, 525. 1902; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 1, 471. 1906; Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 21. 1921; J. M. Cowan, Rec. Bot. Surv. India 12: 68. 1929; Moldenke, Geogr. Distrib. Avicenn. 36. 1939; Moldenke, Prelim. Alph. List Invalid Names 9 & 11. 1940; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 2, 471. 1941; Moldenke, Known Geogr. Distrib. Verbenac., ed. 1, 54, 71, & 87. 1942; Moldenke, Alph. List Invalid Names 8 & 9. 1942; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 386. 1946; Moldenke, Alph. List Cit. 1: 79 (1946) and 4: 1018. 1949; Moldenke, Known Geogr. Distrib. Verbenac., ed. 2, 125, 157, & 178. 1949; Moldenke, Phytologia 4: 121. 1952; Menninger, 1954 Price List [8]. 1954; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 3, 471. 1959; Moldenke, Résumé 160, 214, 241, 243, 244, & 445. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 1: 386. 1960; Menninger, 1960 Price List Flow. Trees [2]. 1960; Yamazaki in Hara, Fl. East. Himal. 268. 1966; Moldenke, Phytologia 13: 501 & 502 (1966) and 14: 37. 1966; Deb, Sengupta, & Malick, Bull. Bot. Soc. Bengal 22: 177 & 199. 1968; Moldenke, Résumé Suppl. 17: 5. 1968; Moldenke, Phytologia 21: 225, 330, 336, 375, 387, & 449 (1971) and 22: 28. 1971.

Clarke's original (1885) description of this taxon is "C. vestita Wall. ms.; arboreous, leaves ovate acute subentire silkily white-tomentose beneath, peduncles as long as the petioles stellately tomentose. C. lanata Gamble Darjeeling List 60, not of Linn. C. arborea Wall. Cat. 1826, partly. -- Callicarpa sp. no. 3 & 4, Herb. Ind. Or. Hf. & T. Nepal; Noakote, Wallich. Sikkim, alt. 1--4000 ft., in the outer valleys and Terai, frequent; Herb. Griffith, J. D. H. (Kew Distrib. n. 6042), &c. A tree, 30 ft.; resembling C. arborea. Leaves 4--10 in., base rounded or cuneate; tomentum beneath of stellate hairs having the secondary hairs fine, long and white. Inflorescence stellately white or tawny tomentose. Calyx at flower time nearly glabrous. -- Otherwise resembling C. arborea." He refers to C. hookeri only incidentally under what he calls C. lanata L., which he says is a species "Otherwise much resembling C. arborea and Hookeri."

Durand & Jackson (1906) reduce this name to synonymy under C. vestita although the reference cited by them seems to indicate that Clarke regarded it as applying to a different, although

closely related species not specified otherwise.

Jackson (1893) credits a "Callicarpa arborea Wall." to "Wall. Cat. n. 1826, partim" and reduces it to the synonymy of C. vestita. Actually, under his no. 1826 Wallich plainly identifies the material as "Callicarpa arborea Roxb.", proposing no new homonym, and cites seven specimens, the first six of which (from Nepal, Chittagong, Silhet, Hort. Bot. Calcutta, Moulmein, and an 1825 collection from a locality whose name I cannot decipher) he regarded as typical. The seventh collection, "Bechianco Napaliae 1820", he identifies as "β vestita" -- obviously a variety of C. arborea Roxb. in his opinion. It is doubtless to this specimen that Jackson refers and it certainly should be regarded as the type collection of C. vestita.

It should also be noted that Gamble (1878) does not propose a new homonym, C. lanata Gamble, as is claimed by Clarke, Watt, and some other authors. He plainly credits the binomial to Linnaeus. However, it is claimed that the "Callicarpa lanata, Linn." of Gamble (1878) is really C. vestita. If this is so, then the information about the plant given by him refers to the latter, rather than to the former, species. He says that it is found at altitudes of 1000 to 6000 feet, "chiefly and almost entirely in old cultivations" in the Darjeeling district, and that it is distinguished from C. arborea Roxb. "by its leaves having soft white tomentum, while those of C. arborea have only a slight short stellate tomentum." He records the vernacular name "sung-a-kûng" for it.

Deb and his associates (1968) describe C. vestita as a shrub or small tree growing in the outskirts of forests and in deciduous forests, and cite Deb 280 and Sengupta 1327 from Bhutan. Yamazaki (1966) gives its overall geographic distribution as "E. Himalaya (Nepal, Sikkim)".

The Herb. Econ. Coll. Bur. Pl. Ind. 47652, cited below, was grown from seed which originated from cultivated plants in the Lloyd Botanic Garden at Darjeeling, India.

The species is obviously very closely related to C. arborea Roxb. and its var. psilocalyx (H. J. Lam) Moldenke, but may be distinguished from them by its glabrous or glabrescent calyx during anthesis, the leaves averaging narrower, and the tomentum being a bit longer, whiter, and silkier on the lower leaf-surface.

Bakhuizen van den Brink (1921) reduces both C. lanata Gamble and C. vestita Wall. to the synonymy of C. tomentosa (L.) Murr. Menninger (1954) lists plants of this species for sale to the horticultural trade at $5 per 3-foot plant.

Callicarpa vestita has been collected at altitudes of 200 to 2000 meters, fruiting in April.

It is perhaps worth noting here that the C. arborea accredited to Linnaeus and to Miquel is a synonym of C. tomentosa (L.) Murr., that credited to Merrill is C. arborea var. psilocalyx (H. J. Lam)

Moldenke, and that of Roxburgh is a valid species, and the C. lanata ascribed to Hosséus is a synonym of C. arborea Roxb., that credited to H. J. Lam is C. arborea var. psilocalyx (H. J. Lam) Moldenke, that of Lamarck is Premna tomentosa Willd., that credited to Linnaeus, to Roxburgh, to Wallich, and to Willdenow is C. tomentosa (L.) Murr., that credited to Ridley is C. maingayi King & Gamble, and that credited to Schauer, to Vahl, to Walpers, and to Zippelius is C. pedunculata R. Br.

Material of C. vestita has been misidentified and distributed in some herbaria under the names C. arborea Roxb., C. lanata L., C. tomentosa var. lanata (L.) Bakh., C. wallichiana Walp, and even Tetranthera sp. On the other hand, the Gillis 8574 [Fairchild Trop. Gard. FG. 59-759] and Pradham & Ihapa 4497, distributed as C. vestita, are actually C. macrophylla Vahl.

In all, 6 herbarium specimens and 2 mounted photographs of C. vestita have been examined by me.

Citations: INDIA: Sikkim: Kuntze 6649 (N); Kurz s.n. [Sikkim] (Bz--18679); Thomson s.n. [Sikkim] (Bz--18680, N--photo, Z--photo). West Bengal: C. B. Clarke 12628 D (Bz--18677, Bz--18678). CULTIVATED: Maryland: Herb. Econ. Coll. Bur. Pl. Ind. 47652 (Ar--19792).

CALLICARPA VILLOSA Vahl, Symb. Bot. 3: 14. 1794 [not C. villosa Baldw., 1936, nor Roxb., 1814].

Synonymy: Callicarpa foliis oblongo-ovatis integerrimis, subtus venoso-reticulatis villosis, racemis axillaribus, pedicellis multifloris Vahl ex Willd., Linn. Sp. Pl. 1: 621, in syn. 1797.

Bibliography: Vahl, Symb. Bot. 3: 14. 1794; Willd., Linn. Sp. Pl. 1: 621. 1797; Roem. & Schult. in L., Syst. Veg., ed. 15 nov., 3: 96--97. 1818; Steud., Nom. Bot., ed. 1, 137. 1821; Spreng. in L., Syst. Veg., ed. 16, 1: 421 (1825) and 5: 126. 1828; D. Dietr., Syn. Pl. 1: 429. 1839; Voigt, Hort. Suburb. Calc. 467. 1845; Schau. in A. DC., Prodr. 11: 646--647. 1847; Bocq., Adansonia, ser. 1, 3: 192. 1863; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 386. 1893; Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 21. 1921; Moldenke in Fedde, Repert.Spec. Nov. 39: 305 (1936) and 40: 112. 1936; Fletcher, Kew Bull. Misc. Inf. 1938: 413. 1938; Moldenke, Known Geogr. Distrib. Verbenac., ed. 1, 54 & 87. 1942; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 386. 1946; Moldenke, Known Geogr. Distrib. Verbenac., ed. 2, 125 & 445. 1949; Anon., Kew Bull. Gen. Index 1929-1956, p. 59. 1959; Moldenke, Résumé 160 & 445. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 1: 386. 1960; Moldenke, Résumé Suppl. 14: 6. 1966; Moldenke, Phytologia 13: 502 (1966) and 21: 453. 1971.

The original description (1794) of this plant by Vahl is "Callicarpa foliis oblongo-ovatis integerrimis, subtus venoso reticulatis villosis, racemis axillaribus, pedicellis multifloris. Habitat in India orientali? Dedit Dn. Dr. Dahl. Rami obscure tetragoni, villosi, incani. Folia petiolata, opposita, tri- vel quadripollicaria,

unicas duas vel ultra lata, supra glabra, subtus venoso-reticulata, villosa, acuminata. Pedunculi axillares, solitarii, oppositi, longitudine foliorum, superne pedunculis aliquot oppositis multifloris: flores brevissime pedicellati. Bractea linearis ad basin pedunculorum partialium. Calyx quadridentatus, parvus, uti corolla, uxtus villosus. Corollae tubus calyce parum longior. A reliquis dignoscitur pedunculis elongatis, nec brevibus dichotome ramosis. A Call. integrifolia Jacqu. hist. pag. 15. differre videtur tubo corollae multo breviore, quam habet figura Jacquini."

Jackson (1893) also gives "Ind. or.?" as the habitat for this puzzling species. Bakhuizen van den Brink (1921) reduces it to synonymy under C. tomentosa (L.) Murr., but apparently without having seen any authentic material. Willdenow (1797) calls it the "haarige Schönbeere".

The C. villosa accredited to Baldwin, mentioned above, is a synonym of C. americana L., while that of Roxburgh is a synonym of C. arborea Roxb.

Vahl's comparison of his plant with Callicarpa integrifolia Jacq. [now known as Aegiphila integrifolia (Jacq.) Jacks.] leads one to wonder if perhaps the plant originated in the New World instead of "Ind. or." and may not be an Aegiphila, too. The type will have to be examined in order to settle this matter. Nothing is known to me of the plant except what is stated in the cited bibliography. Voigt (1845) records it as cultivated in India.

CALLICARPA VILLOSISSIMA Ridl., Journ. Fed. Malay States Mus. 10: 110. 1920.

Bibliography: H. N. Ridl., Journ. Fed. Malay States Mus. 10: 110. 1920; A. W. Hill, Ind. Kew. Suppl. 6: 34. 1926; Fletcher, Kew Bull. Misc. Inf. 1938: 412. 1938; Moldenke, Known Geogr. Distrib. Verbenac., ed. 1, 60 & 87 (1942) and ed. 2, 137, 138, & 178. 1949; Anon., Kew Bull. Gen. Index 1929-1956, p. 59. 1959; Moldenke, Résumé 177, 179, & 445. 1959; Moldenke, Phytologia 14: 220. 1967.

Ridley's original description (1920) of this species is "Tree; branches thickly yellow woolly tomentose with long plumed hairs. Young leaves densely tomentose; adult leaves elliptic-acuminate, acute, base cuneate, entire above except scurfy midrib and side nerves, glabrous beneath densely tomentose with stellate and plumed hairs; midrib densely covered with plumed hairs as are 13 pairs or nerves 10 in. long, 4.5 in. wide; petiole stout, 1.5 in. long tomentose. Panicles 3 in. long and as wide, widely spreading densely tomentose. Flowers sessile or sub-sessile. Calyx short almost cup-shaped, very obscurely toothed. Corolla glabrous tube twice as long; lobes oblong rounded. Stamens 4. Tasan: Tree; deep lilac; 6851. This might be considered a variety of C. arborea but the indumentum is totally different and the flowers have a shorter calyx. The panicles are wider than in most forms. The distinctly plumed hairs are very curious."

Fletcher (1938) reduces this species to synonymy under C. ar-

borea Roxb. Nothing is known to me about it except what is given in the literature cited above.

CALLICARPA VIRIDIS Domin, Bibl. Bot. 22 [89 (6)]: 1108 & 1109, fig. 179 (right). 1928.

Bibliography: Domin, Bibl. Bot. 22 [89 (6)]: 1108 & 1109, text fig. 179 (right). 1928; A. W. Hill, Ind. Kew. Suppl. 8: 37. 1933; Worsdell, Ind. Lond. Suppl. 1: 160. 1941; Moldenke, Known Geogr. Distrib. Verbenac., ed. 1, 69 & 87 (1942) and ed. 2, 152 & 178. 1949; Moldenke, Résumé 208 & 445. 1959.

Illustrations: Domin, Bibl. Bot. 22 [89 (6)]: 1109, text fig. 179 (right). 1928.

The original description of this species by Domin (1928) is "Frutex elatus, ramis elongatis, tomento rufo-floccoso vestitis; folia opposita, breviter petiolata; petioli 1 cm vel paulo minus longi, dense floccoso-tomentosi; laminae permagnae, late ovato-ellipticae, sensim et brevius acuminatae, basi semper rotundatae, circa 17--19 cm longae et 8--9 cm latae, margine crenaturis humilibus, sed breviter apiculato-acuminatis dentatae, tenuiter membranaceae, utrinque virides, supra pilis minutis, simplicibus parce pilosulae, subtus pilis parvis, stellatis, distantibus, tantum secus costam et nervos primarios plus densis subpubescentes et glandulis parvis, aureis, crebris instructae; cymae breves, densiflorae, sub anthesi circa 1.5--2 cm longae, sub fructu usque longitudinem 3.6 cm attingentes, pedunculatae; pedunculi axillares, floccoso-tomentosi, petiolos circiter triplo superantes, insuper saepius foliorum par diminutorum gerentes; calyx circa 1.2 mm longus, dense stellato-hirsutus; corolla calycem duplo superans; antherae lineari-oblongae, saltem 1 mm longae, ad connectivum glandulis dense conspersae; drupa globosa, viva 3 mm lata..... Nordost-Queensland: Regenwälder bei Harveys Creek (Domin I.1910). Species certe distincta, cum C. pedunculata foliis basi rotundatis congrua, sed foliis multo majoribus, utrinque viridibus, cymis longius pedunculatis, drupis minoribus facile dignoscenda. A C. longifolia, cum qua foliis concoloribus, viridibus convenit, distat jam laminis basi rotundatis (nec in petiolum angustatis), cymis densifloris et corollis glabris; C. cana, quae cymis densis speciem nostram revocat, foliis rigidioribus, minoribus, basi acutis, subtus albo- vel cano-tomentosis facillime separatur."

I know nothing of this species beyond what is stated in the literature.

CALLICARPA WEBERI Merr., Philip. Journ. Sci. Bot. 12: 298--299. 1917.

Bibliography: E. D. Merr., Philip. Journ. Sci. Bot. 12: 298--299 & 382. 1917; E. D. Merr., Enum. Philip. Flow. Pl. 3: 388. 1923; A. W. Hill, Ind. Kew. Suppl. 6: 34. 1926; Moldenke, Known Geogr. Distrib. Verbenac., ed. 1, 62 & 87. 1942; H. N. & A. L. Moldenke, Pl. Life 2: 88. 1948; Moldenke, Known Geogr. Distrib. Verbenac., ed. 2, 141 & 178. 1949; Moldenke, Résumé 183 & 445. 1959; Moldenke, Phytologia 21: 445 & 448. 1971.

Merrill (1917) describes this species as "a tree 8 m high, the younger parts densely and uniformly ferruginous-pubescent with short stellate hairs, the indumentum on the older parts and on the lower surfaces of the leaves paler but equally dense. Branches terete, the younger branchlets obscurely angled. Leaves subcoriaceous, ovate to elliptic-ovate, 8 to 14 cm long, 5 to 8 cm wide, entire, base rounded to acute, apex obtuse to shortly and acutely acuminate, the upper surface smooth, shining, dark brown or olivaceous-brown, eglandular, glabrous except the midrib and lateral nerves, these sometimes minutely-stellate-pubescent, the lower surface very densely and uniformly stellate-pubescent with short, pale to ferruginous hairs, the glands not evident, the older leaves distinctly pitted or foveolate beneath; lateral nerves 7 on each side of the midrib, prominent, curved, the reticulations distinct; petioles 1.5 to 5 cm long. Cymes in the upper axils, about 8 cm long and up to 6 cm wide, long-peduncled, all parts densely pale- pr ferruginous-pubescent, dichotomously branched, the purplish flowers densely crowded; peduncles about 5 cm long; bracts linear, 5 to 6 mm long, the bracteoles similar but much smaller; pedicels about 2 mm long. Calyx cup-shaped, densely stellate-pubescent, 2 to 2.3 mm long, truncate, the teeth 4, minute, obscure. Corolla-tube puberulent externally, 4 mm long, the lobes oblong, obtuse, 1.5 mm long; stamens 4, the anthers oblong, 3 mm in length, exserted."

The type of the species was collected by Charles Martin Weber between Palawan and Balabac, bancalan, Philippine Islands, on September 26, 1916, and was deposited in the herbarium of the Philippine Bureau of Science at Manila, now lamentably destroyed. Merrill (1917) comments that "This species is an ally of Callicarpa arborea Roxb. and C. maingayi King & Gamble, differing from both, however, in many characters; and of the Philippine Callicarpa magna Schauer, differing from the latter in its smaller leaves, densely stellate-pubescent calyx, and puberulent corolla. It is apparently most closely allied to Callicarpa arborea Roxb., but its cymes are much smaller and usually but once or twice forked; its leaves smaller and fewer nerved; its flowers larger; and its ovaries are slightly glandular but not tomentose."

Nothing is known to me of this species beyond what is stated in the literature cited above.

CALLICARPA WOODII Merr., Philip. Journ. Sci. 30: 86. 1926.

Bibliography: E. D. Merr., Philip. Journ. Sci. 30: 86. 1926; A. W. Hill, Ind. Kew. Suppl. 8: 37. 1933; Moldenke, Known Geogr. Distrib. Verbenac., ed. 1, 64 & 87. 1942; H. N. & A. L. Moldenke, Pl. Life 2: 89. 1948; Moldenke, Known Geogr. Distrib. Verbenac., ed. 2, 145 & 178. 1949; Moldenke, Résumé 192 & 445. 1959; Moldenke, Résumé Suppl. 8: 3. 1964; Moldenke, Phytologia 14: 248 (1967) and 21: 330. 1971.

Merrill's original (1926) description of this taxon is as follows: "Frutex circiter 2 m altus, inflorescentiis exceptis subglaber, ramis subteretibus, glabris, ramulis rotundato-4-angulatis,

4-sulcatis, circiter 4 mm diametro, leviter cinereo-puberulis; foliis oppositis, subcoriaceis, in siccitate pallidis, oblongo-obovatis, 17 ad 30 cm longis, 7 ad 12 cm latis, distincte acuminatis, deorsum angustatis, basi acutis vel cuneatis, utrinque glabris et glandulosis vel subtus ad costa nervisque obscure puberulis, margine integris vel distanter obscureque denticulatis; nervis primariis utrinque 7 ad 9, curvatis, perspicuis, secundariis subparallelis; petiolo crasso, 5 ad 8 mm longo; cymis axillaribus, fasciculatis, sessilibus vel breviter pedunculatis, paucifloris, circiter 1.5 cm longis, dense sordide stellato-tomentosis; floribus 4-meris, pedicellis 2 ad 4 mm longis, calycis cupulatis, truncatis vel obscure et minute 4-denticulatis, longitudinaliter 4-nervosis, extus leviter stellato-pubescentibus, circiter 2.5 mm longis; corolla immatura 4.5 mm longa, 4-lobata, glandulosa; antheris 2.5 mm longis; fructibus obovoideis, 3.5 mm longis, glandulosis."

The species is based on an unnumbered specimen collected by P. Orolfo [D. D. Wood 1194] in secondary forests, at an altitude of about 50 meters, at Kampong Limbo, Sabah, on August 4, 1924, and was deposited in the herbarium of the Philippine Bureau of Science at Manila, now unfortunately destroyed.

Merrill comments that this is "A species well characterized by its glabrous, rather large, entire or very obscurely denticulate leaves, and by its short, fascicled, stellate-tomentose, few-fkiwered inflorescences which do not exceed 1.5 cm in length. It probably belongs in the general group with Callicarpa basilanensis Merr." It should also be compared critically with C. involucrata Merr.

The Pickles collection cited below is placed here tentatively, identified merely by comparison with the published description of C. woodii by Merrill (1926), since no authentic material of this species has thus far been available to me for comparison. The collector describes his plant as a sapling, 29 feet tall, the trunk 3 inches in diameter, bark smooth, gray-brown, the outer bark soft, the inner creamy-green, fibrous, and soft, the sapwood orange, the pith soft, the leaves "1/2 to 10 inches", the flowers white, borne "on the twigs, branches, and stem", the fruit "green and red", flowering and fruiting in December. He reports the vernacular name "uchong achai" for it. Only this one herbarium specimen has been examined by me.

Citations: GREATER SUNDA ISLANDS: Sarawak: Pickles s.n. [Herb. Sarawak Forest Dept. 3663] (W—2377057).

CALLICARPA WRIGHTII Britton & P. Wils. in N. L. Britton, Mem. Torrey Bot. Club 16: 97. 1920.

Bibliography: N. L. Britton, Mem. Torrey Bot. Club 16: 97. 1920; A. W. Hill, Ind. Kew. Suppl. 6: 34. 1926; Moldenke in Fedde, Repert. Spec. Nov. 39: 298 (1936) and 40: 56, 73—75, 78—80, 119, 122, 125, & 129. 1936; Moldenke, Geogr. Distrib. Avicenn. 5. 1939; Moldenke, Known Geogr. Distrib. Verbenac., ed. 1, 24 & 87. 1942; Moldenke, Alph. List Cit. 1: 3 & 109. 1946; H. N. & A. L. Molden-

ke, Pl. Life 2: 90. 1948; Moldenke, Alph. List Cit. 2: 487 (1948), 3: 867 & 929 (1949), and 4: 1043. 1949; Moldenke, Known Geogr. Distrib. Verbenac., ed. 2, 43 & 178. 1949; Alain in León & Alain, Fl. Cuba 4: 304 & 306--307. 1957; Moldenke, Résumé 50 & 445. 1959; Moldenke, Phytologia 14: 187. 1966; J. A. Clark, Card. Ind. Gen. Sp. Var. n.d.

The species has been collected in anthesis in July and December. The León, Clément, & Nestor 5380, cited below, is a mixture with C. ferruginea Sw.

In all, 9 herbarium specimens, including the type, and 5 mounted photographs of C. wrightii have been examined by me.

Additional & emended citations: CUBA: Oriente: Acuña 9869 (Es, Es); Clément 441 (Ha); León, Clément, & Nestor 5380, in part (Ha), 5599 (Ha); Shafer 4235 (Mi--photo, W--1047819).

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ADDITIONAL NOTES ON THE GENUS ACANTHOLIPPIA. II

Harold N. Moldenke

ACANTHOLIPPIA Griseb.

Additional bibliography: Solered., Syst. Anat. Dicot. 712. 1899; Briq. in Chod. & Wilczek, Bull. Herb. Boiss., sér. 2, 2: 544. 1902; D. H. Scott in Solered., Syst. Anat. Dicot. [trans. Boodle & Fritsch] 1: 630. 1908; Reiche, Fl. Chile 5: 299--301. 1910; Pereyra, Bol. Univ. Tucumán 8: 3--13. 1926; Ducloux & Albizzatti, Revist. Fac. Cienc. Quim. Univ. Nac. La Plata 4: 47--56. 1927; Pereyra, Chem. Abstr. 22: 138. 1928; Ducloux & Albizzatti, Chem. Zentr. 2: 1970. 1928; Schimmel & Co., Ann. Rep. 65. 1928; Schimmel & Co., Chem. Abstr. 22: 3951. 1928; Fester & Martinuzzi, Anal. Asoc. Quim. Arg. 40: 36--60. 1952; Fester & Martinuzzi, Chem. Abstr. 46: 11586--11587. 1952; Fester & al., Revist. Fac. Ind. & Agr. Univ. Nac. Litoral Santa Fé Arg. 21/22: 43--84. 1952; Fester & al., Chem. Abstr. 48: 6655--6656. 1954; Cabrera, Revist. Invest. Agric. 11: 327, 336, & 397. 1957; Fester, Martinuzzi, Retamar, & Ricciardi, Bol. Acad. Nac. Cienc. 40: 189. 1958; Ruiz Leal & Roig, Bol. Estud. Geogr. Mendoza 25: 170--171. 1959; Fester, Martinuzzi, Retamar, & Ricciardi, Chem. Abstr. 54: 12496. 1960; Burkart, Excerpt. Bot. A.2: 604. 1960; Fester, Martinuzzi, Retamar, Ricciardi, Romero Fonseca, & Cassano, Revist. Fac. Cienc. Agrar. Mendoza 8 (2): [45], 46, & 49. 1961; Ruiz Leal, Bot. Estud. Geograf. Mendoza 8 (32): 105, fig. A. 1961; Kariyone, Ann. Ind. Rep. Pl. Chem. 1959: 94. 1962; Hocking, Excerpt. Bot. A.4: 224. 1962; Böcher, Hjerting, & Rahn, Dansk Bot. Arkiv 22: 105. 1963; Anon., Hortic. Abstr. 35: 444. 1965; Troncoso in Cabrera, Fl. Prov. Buenos Aires 5: 123. 1965; Moldenke, Phytologia 15: 463--470. 1968; Böcher, Hjerting, & Rahn, Dansk Bot. Arkiv 22: 171. 1968; Moldenke, Biol. Abstr. 49: 3252. 1968; Anon., Biol. Abstr. 49 (7): B. A. S. I. C. S.3. 1968;

Hocking, Excerpt. Bot. A.13: 570. 1968; Moldenke, Résumé Suppl. 16: 6, 14, 23, & 24. 1968; Anon., Torr. Bot. Club Ind. Am. Bot. Lit. 3: 309. 1969; Farnsworth, Blomster, Quimby, & Schermerh., Lynn Index 6: 263, 265, & 266 (1969) and 7: 227. 1971; Heusser, Pollen & Spores Chile 62 & 81, pl. 59-676. 1971.

Troncoso (1965) describes this genus as "Nativa de las regiones áridas de la Argentina, Chile y Bolivia. Especie tipo: A. salsoloides Gris. [actualmente A. deserticola (Phil.) Mold.]." In Phytologia 7: 328 (1961), as monographer of the genus, I designated A. hastulata Griseb. as type species of the genus.

ACANTHOLIPPIA DESERTICOLA (R. A. Phil.) Moldenke

Additional bibliography: Cabrera, Revist. Invest. Agric. 11: 397. 1957; Troncoso in Cabrera, Fl. Prov. Buenos Aires 5: 143. 1965; Moldenke, Phytologia 15: 464--466 & 470. 1968; Moldenke, Résumé Suppl. 16: 6, 14, & 23. 1968; Heusser, Pollen & Spores Chile 62, pl. 59-676. 1971.

Illustrations: Heusser, Pollen & Spires Chile pl. 59-676. 1971.

Cabrera (1957) records the vernacular name "rica-rica" for this species, recording it from Catamarca and Salta, referring to it as a nanophanerophyte, and citing Cabrera 8801, Cabrera & Schwabe 65, and Gerling 8. Heusser (1971) describes the pollen of this plant as "Monad, isopolar, radiosymmetric; tricolporate, colpi lengthy, narrow, constricted at the equator, pores transverse, short and narrow, not always clearly discernible; mostly subprolate and more or less triangular with sides concave; exine ca 1 μ thick, tectate, psilate, 26--31 x 22--29 μ". He cites C. Böhme & R. González, Peine (Antofagasta), XII-1949, SGO 68321 and gives its natural distribution as "Cordillera in the provinces of Antofagasta and Atacama".

It has been collected in fruit in January. Material has been distributed in some herbaria as Verbena sp.

Additional citations: CHILE: Antofagasta: Zöllner 3076 (Ac). ARGENTINA: Catamarca: Jörgensen 1736 (W--2562148).

ACANTHOLIPPIA HASTULATA Griseb.

Additional bibliography: Pereyra, Bol. Univ. Tucumán 8: 3--13. 1926; Ducloux & Albizzatti, Revist. Fac. Cienc. Quim. Univ. Nac. La Plata 4: 47--56. 1927; Ducloux & Albizzatti, Chem. Zentr. 2: 1970. 1928; Schimmel & Co., Ann. Rep. 65. 1928; Pereyra, Chem. Abstr. 22: 138. 1928; Schimmel & Co., Chem. Abstr. 22: 3951. 1928; Fester & Martinuzzi, Anal. Asoc. Quim. Arg. 40: 36--60. 1952; Fester & Martinuzzi, Chem. Abstr. 46: 11586--11587. 1952; Fester & al., Revist. Fac. Ind. & Agr. Univ. Nac. Litoral Santa Fé Arg. 21/22: 43--84. 1952; Fester & al., Chem. Abstr. 48: 6655--6656. 1954; Cabrera, Revist. Invest. Agric. 11: 339, 343, 359, 369, & 397, fig. 1. 1957; Fester, Martinuzzi, Retamar, & Ricciardi, Bol. Acad. Nac. Cienc. 40: 189. 1958; Fester, Martinuzzi, Retamar, & Ricciardi, Chem. Abstr. 54: 12496. 1960; Kariyone, Ann. Ind. Rep. Pl. Chem. 1959: 94. 1960; Moldenke, Phytologia 15:

466--467. 1968; Farnsworth, Blomster, Quimby, & Schermerh., Lynn Index 6: 263 & 265. 1969.

Additional illustrations: Cabrera, Revist. Invest. Agric. 11: 339, fig. 1. 1957.

The flowers of this plant are described as "white" on Venturi 8300. Volatile oil and constants in this species are reported on by Ducloux & Albizzatti (1927), terpenes, alcohols, and aldehydes in volatile oil are reported on by Pereyra (1926), and d- an l-isothujone, thujone, and thujyl alcohol by Fester & Martinuzzi (1952).

Cabrera (1957) refers to the plant as a nanophanerophyte, records it from Jujuy and Salta, and cites Cabrera 7716, 8217, 8411, & 9016, Cabrera & Schwabe 48, Claren 11577, Fries 746, and Krapovickas 3126.

Additional citations: ARGENTINA: Jujuy: Venturi 8300 (N).

ACANTHOLIPPIA RIOJANA (Hieron.) Hieron. & Moldenke

Emended synonymy: Acantholippia riojana Hieron. ex Solered., Syst. Anat. Dicot. 712, hyponym. 1899.

Additional bibliography: Solered., Syst. Anat. Dicot. 712. 1899; D. H. Scott in Solered., Syst. Anat. Dicot. [transl. Boodle & Fritsch] 1: 630. 1908; Moldenke, Phytologia 15: 467—468. 1968; Moldenke, Résumé Suppl. 16: 14 & 23. 1968.

ACANTHOLIPPIA SERIPHIOIDES (A. Gray) Moldenke

Additional synonymy: Acantholippia seriphioides (A. Gray) Miers ex Moldenke, Résumé 227, in syn. 1959. Acantholippia seriphioides A. Gray ex Moldenke, Fifth Summ. 1: 377, in syn. 1971.

Additional bibliography: Briq. in Chod. & Wilczek, Bull. Herb. Boiss., sér. 2, 2: 544. 1902; Fester & al., Revist. Fac. Ind. & Agr. Univ. Nac. Litoral Santa Fé Arg. 21/22: 43—84. 1952; Fester & al., Chem. Abstr. 48: 6655—6656. 1954; Soriano, Revist. Invest. Agric. 10 (4): 330 & 347. 1956; Fester, Martinuzzi, Retamar, & Ricciardi, Bol. Acad. Nac. Cienc. 40: 189. 1958; Ruiz Leal & Roig, Bol. Estud. Geogr. Mendoza 25: 170--171. 1959; Fester, Martinuzzi, Retamar, & Ricciardi, Chem. Abstr. 54: 12496. 1960; Fester, Martinuzzi, Retamar, Ricciardi, Romero Fonseca, & Cassano, Revist. Fac. Cienc. Agrar. Mendoza 8 (2): [45], 46, & 49. 1961; Ruiz Leal, Bol. Estud. Geograf. Mendoza 8 (32): 105, fig. A. 1961; Kariyone, Ann. Ind. Rep. Pl. Chem. 1959: 94. 1962; Troncoso in Böcher, Hjerting, & Rahn, Dansk Bot. Arkiv 22: 105. 1963; Anon., Hortic. Abstr. 35: 444. 1965; Troncoso in Cabrera, Fl. Prov. Buenos Aires 5: 144--145, fig. 48. 1965; Böcher, Hjerting, & Rahn, Dansk Bot. Arkiv 22: 171. 1967; Moldenke, Phytologia 15: 468—469. 1968; Farnsworth, Blomster, Quimby, & Schermerh., Lynn Index 6: 263. 1969.

Illustrations: Ruiz Leal, Bol. Estud. Geograf. Mendoza 8 (32): 105, fig. A. 1961; Troncoso in Cabrera, Fl. Prov. Buenos Aires 5: 144, fig. 48. 1965.

Böcher and his associates (1968) refer to this plant as "A very important species in the lower part of the Atuel valley. It is

very fragrant, and its scent is distinct even on 8 years old herbarium specimens". He cites Böcher, Hjerting, & Rahn 794, 933, 1004, & 1095 and Hjerting & Rahn 3117 from Mendoza, Argentina, deposited in the Copenhagen herbarium; Wilczek & Chodat (1902) cite Wilczek 43, while Troncoso (1965) cites Cabrera 6650 and Spegazzini 3495 from Buenos Aires.

The vernacular name, "tomillo del campo", is reported by Troncoso, who states that the species is found in "Patagonia, oeste y centro del país. Habita en lomas rocosas de la zona árida del S. de la Provincia [Buenos Aires]". Collectors have found it growing in red or sandy soil, disturbed light gravel, and "wild land similar to that cleared for alfalfa cultivation, at the lowest irrigable level", in sandy-grassy regions of shrub-dunes, on hillsides with west exposure, and among Larrea vegetation. Semper refers to it as "aromatic" or "fragrant", Cabrera says "very fragrant", while Bartlett calls it "a very fragrant shrublet 1--1.5 feet tall with odor like lavender". Semper reports that it is used as tea and as a condiment. The corollas are described as "white" on Cabrera 10998, 11030, & 19430, Eyerdam, Beetle, & Grondona 24023, and Semper 118 & 617, and as "faintly purplish" on H. H. Bartlett 19936.

Fester and his associates (1952, 1958) report the presence of thymol, carvacrol, p-cymene, and citral in volatile essential oil in this plant, but "considerable variation was found in the composition of the essential oil" and possible contributory causes of these variations are discussed.

Additional citations: ARGENTINA: Buenos Aires: Cabrera & Fabris 16452 (Ip); O'Donell 1447 (N). Chubut: Kreibohm 178 (W--2568430); O'Donell 3239 (Gg--354415). La Pampa: H. H. Bartlett 19936 (Mi, N); Burkart 17486 (W--2567982), 19229 (N); O'Donell 1739 (N). Mendoza: H. H. Bartlett 19193 (Mi), 19430 (Mi), 19464 (Mi), 19478 (Mi); Cuezzo & Balegno 1992 (S); E. M. Garcia 451 (N); Lourteig 755 (N, Sd--37140); Reales 2011 (N), 2025 (N); Semper 118 (N), 617 (N). Neuquen: Cabrera 10998 (W--2567984), 11030 (W--2567973). Río Negro: O'Donell 1681 (N), 1933 (N). Santa Cruz: Eyerdam, Beetle, & Grondona 24023 (S); Herb. E. Wall 10 (Ew); O'Donell 3720 (Vi).

ACANTHOLIPPIA TRIFIDA (C. Gay) Moldenke

Additional bibliography: Fester & Martinuzzi, Anal. Asoc. Quim. Arg. 40: 36--60. 1952; Fester & Martinuzzi, Chem. Abstr. 46: 11586--11587. 1952; Fester & al., Revist. Fac. Ind. & Agr. Univ. Nac. Litoral Santa Fé Arg. 21/22: 43--84. 1952; Fester & al., Chem. Abstr. 48: 6655--6656. 1954; Moldenke, Phytologia 15: 465 & 469--470. 1968; Hocking, Excerpt. Bot. A.13: 570. 1968; Farnsworth, Blomster, Quimby, & Schermerh., Lynn Index 6: 263 & 266. 1969.

Fester and his associates (1952) report the presence of citronellol, thymol, palmitic acid, isovaleric acid, and a-terpinene

in volatile oil in the leaves of this plant.

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ADDITIONAL NOTES ON THE GENUS VERBENA. VIII

Harold N. Moldenke

VERBENA [Dorst.] L.

Additional & emended synonymy: Berbena Macer Floridos, De Virib. Herb., pr. 1, ff.xxxiii--xxxv. 1477. Verbena Tourn. ex L., Gen. Pl., ed. 1, 334, [387], [400], & [402]. 1737; ed. 6, 14. 1764. Obletia LeMonnier ex Rozier, Introd. Obs. Phys. Hist. Nat. 1: 367. 1771. Glandularia J. F. Gmel. in L., Syst. Nat., ed. 13, 2 (2): 920. 1791 [not Glandularia J. Agardh, 1848, nor P.DC., 1836]. Uwarovia Lindl. ex Pfeiffer, Nom. Bot. 2 (2): 1544, in syn. 1874. Elissia Barkley, List Ord. & Fam. Anthophyta, ed. 2, 76 & 163, in syn. 1965. Aubletia LeMonnier ex Rozier apud Dandy, Ind. Gen. Vasc. Pl. 121, in syn. 1967. Vebrena Elliovson, Complete Gard. Book South. Hemisph., ed. 6, 37, sphalm. 1970. Aubletia LeMonnier ex Moldenke, Fifth Summ. 1: 391, in syn. 1971. Glondularia Gill. & Hook. ex Moldenke, Fifth Summ. 1: 523, in syn. 1971.

Additional & emended bibliography: Macer Floridos, De Virib. Herb., pr. 1, ff.xxxiii--xxxv. 1477; A. Macer, De Virtut. Herb., pr. 1, "k"--[ki]. 1506; Anguill., Sempl. 266. 1561; A. Macer, De Virtut. Herb., pr. 6, [†7], 133--135, 164, 167, & 199--200. 1581; Durante, Herb. Nuov., ed. Rom., 469. 1585; Matth., Pl. Epit. Util. 797. 1586; Pona, Pl. Simp. Bald. Mont. 3. 1595; Matth., Herb. Aneb Byliner 380--381. 1596; Lupton, Book Notable Things. 1660; Schroder, Chymic. Dispens. 1669; Lonic., Kreuterb., pr. 1, 310--311. 1679; Rivin., Ord. Pl. Irreg. Monop. 81, pl. 56. 1690; Cupani, Hort. Cathol. 227. 1696; Tourn., Inst. Rei Herb., ed. 2, 2: 200, pl. 94. 1700; Tourn., Compl. Herb. 357--359 & 618. 1719; Tourn., Inst. Rei Herb., ed. 3, 2: 200, pl. 94. 1719; Hill., Hort. Eltham. 2: 406--408, pl. 300--302, fig. 387--389. 1732; L., Crit. Bot. 19, 89, 90, 111, & [306]. 1737; L., Gen. Pl., ed. 1, 334, [387], [394], [400], & [402]. 1737; L., Meth. Sex. Gen. Pl. 5, 17--19, 89, 90, 94, 111, [275], [288], [300], & [304]. 1737; L., Gen. Pl., ed. 2, 12, 26, & [549] (1742) and ed. 3 ["2"], 10 & [433]. 1743; Seguier, Pl. Veron. 1: 312. 1745; L., Gen. Pl., ed. 4, 10 & [463]. 1752; L., Sp. Pl., ed. 1, pr. 1, 1: 18 & 20. 1753; L., Gen. Pl., ed. 5, pr. 1, 12, [504], [511], [518], & [521]. 1754; Seguier, Pl. Veron. Suppl. 142. 1754; J. Hill, Brit. Herb. 356 & [536]. 1756; Kalm, Resa Nor. Am. 2: 248. 1756; Russell, Nat. Hist. Aleppo, ed. 1, 40. 1756; Kalm, Beschreib. Reise Nörd. Am. 2: 267. 1757; L., Syst. Nat., ed. 10, 2: 851--852. 1759; Scop., Fl. Carniol., ed. 1, 473 & 600. 1760; L., Gen. Pl.,

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It should be noted here that the original publication of Obletia is often cited to "Journ. Phys. 1: 367. 1773" [e.g., by Jackson (1894)] or "Introd. Obs. Phys. 1: 367. 1773", but Dandy (1967) states that the correct date for this work is 1771. Farnsworth (1970) refers this genus to item "15105" in the work in question, but this seems to be an error for item 15121. The Hooker & Arnott, p. 205, reference given in the bibliography of this genus is often dated "1841", but pages 193 to 288 of the work involved were issued in 1836. The Taylor (1969) reference also cited above is sometimes erroneously cited to volume "17" instead of 71.

The Glandularia of DeCandolle (1836) is a section of Psiadia Jacq. in the Asteraceae, while the Glandularia of Agardh is a section ["Tribe"] of Sargassum Agardh in the Fucaceae.

Linnaeus (1754) includes Blairia Houst. [now regarded as a synonym of Priva Adans.], Kaempfera Houst. [now regarded as a synonym of Ghinia Schreb.], and Sherardia Vaill. [now considered to be a synonym of Stachytarpheta Vahl] in his synonymy of Verbena. In his 1764 work he includes also Kempfera Houst. and Kaempferia Houst., both now placed in Ghinia. In fact, this is in essence the synonymy which he gives for Verbena in all of his works from 1742 onwards. Pfeiffer (1874) includes Vermicularia Moench, but we now reduce this to Stachytarpheta.

Since Barkley (1965) definitely reduces the generic name, Elissia, to synonymy under Verbena, I assume that he is not referring to the Ellisia P. Br. which is a synonym of Duranta L. Elissia is not listed in the "Index Kewensis" nor in any of its supplements to date. Airy Shaw (1966) places Burseria Loefl. in the synonymy of Verbena, but it certainly belongs in that of Priva Adans. instead.

In addition to the many vernacular names reported by me previously for this genus there are the following: "Eisenhart", "jaernurt", "verbenia", and "werbena". Castañeda (1965) avers that "verbena" is a vernacular name for Heliotropium indicum L. in Colombia.

Coon (1967) notes that "The flowers [of Verbena] are not noted for fragrance, yet there's a special kind of quiet, haunting odor to verbenas which you'll not get to know unless you grow them." He is undoubtedly here referring, not to the genus as a whole, but merely to xV. hybrida Voss. Martin (1946) reports no endosperm in the genus Verbena, while El-Gazzar & Watson (1970) claim that its pollen is tricolporate, not tricolpate as described by Natarajan, but obviously neither of these workers examined more than a tiny handful of the known species of the genus. It seems to me that it is dangerous to draw generic conclusions from the examination of only one or a few species. Webber (1968) notes that verbenas [again, probably referring only to xV. hybrida] were introduced into England from South America in the mid-eighteenth century and used mainly as bedding plants. Solbrig (1969) discusses the effect of reproductive strategy on population genetics information in this genus. Russell (1957) informs us that seeds of an unidentified species of Verbena were collected by W. A. Archer as his no. 10117, in Ethiopia, later planted and cultivated in Maryland as U. S. Dept. Agr. Pl. Invent. no. 196913.

Crocker (1938) reports that the seeds of two species of this genus showed 90 percent germination after twenty years' burial. Wilson (1944) reports that in Kansas vervains there is a reduction of root reserves from spring to the time of budding or flowering and then an increase to the close of the season. Cutting the plants begun when these reserves are low is more effective in their control than if begun at other times of the year.

Raven (1963) informs us that the section Glandularia of this genus is not known to have common or closely related species-pairs in the two hemispheres.

Grindal (1960) reports unnamed species of Verbena being grown as summer- and winter-flowering annuals in India.

Boughey, Bridges, & Ikeda (1968) have computerized the genus with the following characters:"Genus = Verbena; Habit life form = annual or perennial and shrub; Leaf arrangement = opposite; Inflorescence type = corymb or panicle and spike; Calyx type = pentapartite; Calyx shape = campanulate; Corolla type = pentapartite regular or 2-lipped; Stamens number = 4 or rarely 2; Ovary type = multilocular; Styles stigma number = 1 to 2; Fruit type = dry nut"

Thornberry (1966) records the following disease-causing organisms known to attack members of this genus in North America: Ascochytra verbenae Siem., Botrytis cinerea Pers., Cercospora septatissima Tracy & Earle, C. truncatella Atk., C. verbenae-strictae Pk., C. verbenicola Ell. & Ev., Cuscuta arvensis Beyr., Erysiphe cichoracearum P.DC., Heterodera marioni (Cornu) Goodey, Meloidogyne sp., Phyllosticta texensis Seaver, P. verbenicola G. Martin, Phymatotrichum omnivorum (Shear) Dug., Plasmopara halstedii (Farl.) Berl. & deT., Puccinia aristidae [with alternate hosts Aristida and Distichlis], P. vilfae Arth. & Holw. [alt. host Sporobolus]

(to be continued)

FLORA

OF THE PRAIRIE PROVINCES

Bernard Boivin

Part III--CONNATAE

In the following families constituting the Connatae, the corolla (and also usually the calyx) is made of fused parts. A few woody plants occur in the Connatae and these will be found keyed with Lignids or Woody Dicots in part I, page 39. Conversely a few herbaceous Lignids and some unusual types from part II with fused corollas are included in the keys below. Similarly some exceptional Connatae with free petals will be found keyed out at the beginning of part II, page 5, along with some unusual types such as climbers, parasites, flowers in heads or umbels, etc.

a. Corolla regular.
  b. Leaves alternate on the stem and branches ..... Group A
  bb. Opposite to verticillate, or all (or mostly) basal ..... Group B
aa. Irregular.
  c. Flower spurred ..... Group C
  cc. Not spurred.
    d. Leaves opposite or verticillate or all basal ..... Group D
    dd. Alternate ..... Group E

Group A

Sepals and petals present, the latter fused into a regular corolla. Leaves alternate.

a. Leaves trifoliate ..... 108. Menyanthaceae, p. 75
aa. Leaves not trifoliate, mostly simple.
  b. Fruit, a group of 4 nutlets, often with catchy hooks ..... 105. Boraginaceae, p. 48
  bb. Fruit a capsule, rarely a berry.
    c. Ovary inferior ..... 110. Campanulaceae, p. 80
    cc. Ovary superior.
      d. Fruit a berry or a large spiny capsule; petioles and peduncles partly fused to the stem and branching in such a way as to produce unusual arrangements of leaves, branches and inflorescences ..... 93. Solanaceae, p. 5
      dd. Capsule smaller, not spiny.
        e. Flowers yellow ..... Verbascum, p. 12
        ee. Not yellow, mostly blue or white.

f. Capsule 3-locular; style 1 with 3 stigmas .. .. 103. Polemoniaceae, p. 41
ff. Capsule 1-2 locular; stigmas 1-2.
g. Flowers solitary and nearly sessile in the axils of entire leaves .. .. Centunculus, part II-p. 137
gg. Flowers more numerous or long-pedicelled .. .. 104. Hydrophyllaceae, p. 45

Group B

Flowers regular as in Group A, but the leaves not alternate.

a. Leaves all or mostly basal.
b. Leaves trifoliate ..... 108. Menyanthaceae, p. 75
bb. Leaves simple.
c. Stemless, the flowers borne from the roots; plant stoloniferous... Limosella, p. 19
cc. Flowers gathered in an inflorescence.
d. Inflorescence spicate ... . 109. Plantaginaceae, p. 76
dd. Inflorescence racemose .... Romanzoffia, p. 48
aa. Leaves opposite or verticillate.
e. Flowers sessile, forming a spike.
f. Leaves entire ..... 109. Plantaginaceae, p. 76
ff. Serrate to lobed.
g. Leaves opposite..56. Verbenaceae, part I-p. 194
gg. Leaves verticillate ..... Veronicastrum, p. 22
ee. Flowers pedicellate; inflorescence not a spike ..... Group C

Group C

Like Group B, the flowers regular and the leaves opposite or verticillate, on a leafy stem, but the inflorescence different, and the flowers pedicellate.

a. Stem leaves only 2 ..... 92. Adoxaceae, p. 4
aa. Stem leaves more than 2.
b. Flower clusters subtended by a peltate involucre ..... 30. Nyctaginaceae, part I-p. 141
bb. No peltate involucre.
c. Ovary inferior; flower 4-merous .. .. Houstonia, part I-p. 183
cc. Ovary superior, flowers mostly 5-merous.
d. Herbs with abundant milky juice .. .. 52. Apocynaceae, part I-p. 179
dd. No milky juice.
e. Ovary 3-locular ..... Phlox, p. 42

ee. Ovary unilocular.
f. Stamens alternate with the corolla lobes; leaves with parallel nerves .. .. 107. Gentianaceae, p. 70
ff. Stamens opposite the corolla lobes; leaves pinnately nerved..80. Primulaceae, part II-p. 130

Group D

Sepals and petals present, the latter fused into an irregular corolla, and the flower spurred.

a. Flowers borne on a scape; the leaves all basal, or all submerged, or buried in the mud .. .. 97. Lentibulariaceae, p. 33
aa. Stem leafy.
b. Leaves compound .....68. Fumariaceae, part II-p. 42
bb. Leaves simple.
c. Leaves alternate ..... 95. Scrophulariaceae, p. 10
cc. Leaves opposite ..... Halenia, p. 75

Group E

Flowers as in D but not spurred and the leaves alternate or all basal, exceptionally verticillate.

a. Ovary inferior .....111. Lobeliaceae, p. 82
aa. Ovary superior.
b. Stamens 6 or 8 .....32. Polygalactaceae, part I-p. 147
bb. Stamens 5 or less.
c. Stamens 4 or less .... 95. Scrophulariaceae, p. 10
cc. Stamens 5.
d. Inflorescence branched ..... Echium, p. 58
dd. Inflorescence simple, terminal, spiciform or racemiform.
e. Flowers yellow ..... Verbascum, p. 12
ee. Petals prominently purple - reticulate ..... Hyoscyamus, p. 6

Group F

Flowers as in E, but the leaves opposite on a leafy stem.

a. Fruit a capsule.
b. Capsule 2-locular ..... 95. Scrophulariaceae, p. 10
bb. Unilocular; leaves larger..... 98. Martyniaceae, p. 35
aa. Fruit an achene or a group of 4 achenes.
c. Fruit a single achene.
d. Leaves deeply divided or compound .. .. 91. Valerianaceae, p. 4
dd. Remotely serrulate... 57. Phrymaceae, part I-p. 195
cc. Fruit a group of 4 achenes.

e. Ovary deeply lobed, each lobe maturing into a separate achene ..... 106. Labiatae, p. 59
ee. Not lobed, but breaking up into 4 achenes at maturity ..... 56. Verbenaceae, part I-p. 194

Order 50. VALERIANALES

Calyx and corolla of fused parts over an inferior or semi-inferior ovary. Flower usually regular and the ovary with as many cells as carpels.

a. Calyx lobes wanting or transformed into a pappus ..... 91. Valerianaceae
aa. Calyx lobes present ..... 92. Adoxaceae

91. VALERIANACEAE (VALERIAN FAMILY)

Mainly the characters of the order, as the other family is an unusual type of doubtful position.

1. VALERIANA L.

Calyx-lobes maturing into a plumose pappus reminiscent of many Compositae, the units of the pappus tightly coiled before maturity. Corolla with 5 lobes, but the stamens only 3.

a. Stem leaves mostly with 3-5 segments ..... 1. V. sitchensis
aa. Mostly 9-15 segments; flowers smaller ..... 2. V. dioica

1. V. sitchensis Bongard var. sitchensis -- Leaves and main branches of the inflorescence opposite, the flowers mostly alternate on the ultimate branches. Larger stem leaf larger than the basal ones. Basal leaves divided like the stem ones, the leaflets few, entire, mostly 1-3 cm wide. Flowers 5-8 mm long, whitish, gibbose ventrally towards the base and abruptly contracted into a thin stipe-like base. Pappus purplish. Early to mid summer. Wet meadows and light woods at high montane and low alpine levels. -- wMack-sAka, swAlta-BC, US -- Var. Scouleri (Rydb.) M.E. Jones -- Basal leaves larger, the largest one as large or larger than the stem leaves. Leaflets undulate-dentate. -- swAlta-sBC, US.

2. V. dioica L. var. sylvatica (Rich.) Gray (V. septentrionalis Rydb.) -- Basal leaves all or mostly entire while the stem leaves are pinnatipartite. Flowers 2-3 mm long. Bracts eciliate. Pappus white. Late spring and early summer. Low, wet ground. -- seK-(Mack)-Y, NF, NB-BC, US.

Barely distinct from its eurasian conterpart, var. dioica, the latter being generally smaller and bearing ± ciliolate bracts.

92. ADOXACEAE (MOSCHATEL FAMILY)

Stamens bifid to the base of the filament and thus seemingly twice as many as the corolla lobes. Floral parts variable in number: terminal flowers mostly with 2 sepals and 4 corolla lobes; lateral flowers mostly with 3 sepals and 5 corolla lobes.

1. ADOXA L. MOSCHATEL

Only genus and with a single species.

1. A. Moschatellina L. -- Moschatel, Townhall-Clock (Herbe musquée, Musquette) -- A small inconspicuous herb with a single pair of opposite and trifoliate stem leaves. Basal leaves more elaborately divided, often biternate. Flowers greenish and few in a small crowded cyme. Late spring and early summer. Deep woods, rare. -- Mack-Aka, wO-BC, US, Eur, (Afr).

Within our area we have checked specimens from Duck Mountain, Pasquia Hills, Candle Lake, Edmonton, Elk Island Park, Fort Saskatchewan, Widewater and Smith.

Order 51. SOLANALES

Flowers 5-merous, regular, the petals fused, the sepals fused and the carpels also fused into a superior ovary. Similar to the Gentianales but the leaves alternate and the ovary 2-(5)- locular.

a. Fruit usually a berry; each carpel with more than 2 ovules ..... 93. Solanaceae
aa. Fruit a capsule with only 2 ovules in each carpel ..... 94. Convolvulaceae

93. SOLANACEAE (NIGHTSHADE FAMILY)

Usually readily recognized by the unusual position of the flowers or inflorescence and sometimes also the leaves. Such as the inflorescence being borne halfway up the internode, or opposite a leaf, etc.

a. A shrub, often spiny ..... 1. Lycium
aa. Herbaceous. (Solanum Dulcamara is semi-shrubby).
  b. Flowers very large; fruit a spiny capsule... 6. Datura
  bb. Flowers much smaller, fruit rarely spiny.
    c. Leaves alternate.
      d. Flowers solitary and nearly opposite the leaves ..... 2. Hyoscyamus
      dd. Flowers in small panicles borne along the internodes ..... 5. Solanum
    cc. Upper leaves mostly in pairs, the smaller leaf arising from the axil of the other.
      e. Flowers rotate, mostly in small glomerules ..... 3. Chamaesaracha
      ee. Flowers smaller, funelform, solitary ..... 4. Physalis

1. LYCIUM L. MATRIMONY-VINE

Corolla tubular. Calyx not enlarged in fruit. Shrubs.

1. L. HALIMIFOLIUM Miller -- Matrimony-Vine (Lyciet) -- A shrub, often spiny, climbing or scrambling, the leaves alter-

nate on the vigorous terminal shoots, fascicled on the shorter shoots and old wood. Flowers white, similarly solitary or fascicled. Leaves dimegueth, each fascicle with one leaf much larger than the other(s). Fruit a drooping, red berry. Summer. Rarely cultivated and exceptionally escaping to waste places: Edmonton. -- NS, O, cAlta-BC, US, Eur.

2. HYOSCYAMUS L. HENBANE

Fruit a capsule opening by a terminal opercule.

1. H. NIGER L. -- Henbane (Tabac du diable, Jusquiame) -- Flowers in terminal, spike-like and leafy inflorescences, with all the leaves to one side and subopposite to the flowers. Rather coarse, softly hirsute and glutinous. Flowers yellowish with conspicuous and reticulate purple veins. Calyx lobes spinescent in fruit. Summer. Infrequent poisonous weed of roadsides and waste places in wetter situations. -- NS-(PEI)-NB-Alta-(BC), US, Eur.

3. CHAMAESARACHA Gray

Quite close to Physalis, the calyx enclosing the berry at maturity, but tightly so. Flower rotate rather than funelform. Flowers mostly in axillary glomerules.

1. C. grandiflora (Hooker) Fern. (Leucophysalis grandiflora (Hooker) Rydb.; Physalis grandiflora Hooker) -- Flower large, white, with a yellow eye. Very glutinous annual. Upper leaves mostly in 2's as in Physalis. Flowers 2.5-4.0 cm across. Peduncles reflexed to pendent after flowering. Early summer. Sandy soils, mainly disturbed, especially around last year's campfires; rare and occuring singly or only a few plants at a time. -- Q-S, US.

4. PHYSALIS GROUND-CHERRY

Calyx enlarging greatly in fruit and loosely enclosing the much smaller berry. Upper leaves mostly in 2's, the smaller leaf being borne in the axil of the larger one. Flower solitary and axillary.

a. Peduncle 1-4 cm long; perennials.
  b. Not glandular ..... 3. P. virginiana
  bb. Glandular and villous; generally larger ..... 4. P. heterophylla
aa. Shorter, about 0.5 mm at anthesis; annuals.
  c. Stem glabrous ..... 2. P. ixocarpa
  cc. Densely villous ..... 1. P. pubescens

1. P. PUBESCENS L. var. PUBESCENS (P. pruinosa AA.) -- (Batoto) -- Casual weed with an unusually large calyx, becoming 2.0-2.5 cm long in fruit, pale green, papery, ovoid. Annual with ovate or cordate and dentate leaves. Corolla yellow with 5 large purple patches. Second half of summer. Rare garden

weed: Winnipeg. -- NB-sMan, (BC), US, (CA), SA.

The more southerly and generally planicostal var. glabra (Mx.) Waterfall is glabrous or nearly so and its larger fruit is borne on a longer peduncle.

2. P. IXOCARPA Brotero -- Tomatillo -- Similar but glabrous or nearly so. Leaves smaller. Flower paler. Calyx purple along the main nerves. Late summer. Rare garden weed: Minto. -- Q-sMan, US, (CA), Eur.

3. P. virginiana Miller var. virginiana (P. viscosa AA.)-- Wild Ground-Cherry -- Stoloniferous native perennial with an inflated fruiting calyx as above. Rhizome deeply buried. Stem 1-4 dm high, puberulent to villous with spreading to retrorse hairs. Leaves up to 6 cm long, lanceolate to ovate. Fruiting calyx 2.5-4.5 cm long, green. Early summer. Light soils and a sand binder. -- swQ-sMan, US.

Native with us, but occuring mostly as a weed further east.

In the less widely distributed var. subglabrata (Mack. & Bush) Waterfall the herbage is glabrous or antrorse-pubescent.

4. P. HETEROPHYLLA Nees var. HETEROPHYLLA -- Wild Ground-Cherry (Cerise de terre sauvage) -- Taller, up to 1 m high and the pubescence partly long villous, partly shorter and glandular. Leaves broady ovate, the main ones well over 6 cm long. Summer. Rare adventive collected at Winnipeg in 1857-58. -- (NS), Q-sMan, US.

Native further east. In the planicostal var. villosa Waterfall the villosity is still longer, the hairs 2-4 mm long.

5. SOLANUM L. NIGHTSHADE

Anthers fused in a ring around the style. Filaments free. Inflorescence arising from the middle of the internode.

a. Very spiny ..... 6. S. rostratum
aa. Not spiny.
  b. Flowers blue; climbing by twining stem..1. S. Dulcamara
  bb. Flowers white or yellow or pale mauve; non climbing.
    c. Leaves pinnate ..... 2. S. tuberosum
    cc. Simple.
      d. Leaves pinnatifid ..... 3. S. triflorum
      dd. Entire to dentate.
        e. Stem and branches glabrous to appressed pubescent ..... 4. S. nigrum
        ee. Densely hirsute to glandular-hirsute ..... 5. S. sarrachoides

1. S. DULCAMARA L. -- Bittersweet, Nightshade (Douce-amère, Vigne de Judée) -- Climber with blue flowers and yellow anthers. Semi-woody at base and sometimes merely erect and non-climbing. Leaves part entire, part tripartite with the terminal lobe many times wider than the lateral ones. Some inflorescences terminal, others internodal or opposite a leaf.

Berry red. Summer. Naturalized in disturbed bush; rare: Saint-Boniface, Morden. -- NF, NS-Man, BC, US, Eur.

The Edmonton report by Moss 1959, querried by Boivin 1966, is apparently to be discounted as there was no corresponding specimen at ALTA in 1969.

2. S. TUBEROSUM L. -- Potato (Patate, Pomme de terre) -- Leaves pinnate, the leaflets ovate, entire and dimegueth, the main ones irregularly alternating with some very much smaller ones. Flowers variable in color, sterile. Summer. Cultivated and casual on dumps and shores: Morden.--PEI-Q-(O)-Man, (US, SA).

3. S. triflorum Nutt. -- Wild Tomato -- A frequently weedy native with small internodal inflorescences. Annual, hirsute, branched from the base and usually sprawling. Leaves pinnatifid, the lobes entire. Berry green, on a sharply reflexed pedicel. Summer. Native on sand dunes and gopher holes, weedy or roadsides and cultivated fields, common. -- Q-BC, US.

Native in our area, a weed east and west of us.

4. S. NIGRUM L. var. NIGRUM (var. virginicum L.; S. americanum Miller; S. interius Rydb.) -- Wonderberry, Garden-Huckleberry (Tue-chien, Bluet de jardin) -- Many of the larger leaves with 2 much smaller leaves in the axil. Annual with fairly large ovate leaves. Flowers white, 3-7 in a subumbellate inflorescence. Calyx not enlarging in fruit, about 6 mm wide, merely spreading at the base of the black berry. Second half of summer. Rare garden weed. -- (Aka, NF), NS-(PEI)-NB-BC, (US), CA, SA, Eur, Afr.

Reputed to occur in America both as a weed (S. nigrum) and as a native (var. virginicum or S. americanum), the latter reputedly differing by some 5 or 6 characters. But these are not sharp enough for practical implementation of the distinction. Thus we have noticed some very small anthers on some american specimens, smaller than on any eurasian sheet examined. But the bulk of the american and of the eurasian specimens have anthers of about average length and the character is near useless. Remarks in a similar vein would also apply to the other alleged differences. There is however a more southern and better defined var. Douglasii (Duval) Gray, taller, larger-flowered and tending to perennity.

5. S. SARRACHOIDES Sendt. (S. nigrum var. villosum AA.; S. villosum AA.) -- Much as the above, but more pubescent. Calyx enlarging in fruit, covering the lower half of the yellowish green berry. Mid summer to early fall. Rare weed, mostly gardens. -- Aka, Q-BC, US, (SA).

6. S. ROSTRATUM Dunal (Androcera rostrata (Dunal) Rydb.)-- Buffalo-Bur, Kansas-Thistle -- Densely spiny throughout, including both faces of the leaves. Annual. Spines yellow, very sharp, the larger about 1 cm long. Flowers yellow. Calyx very spiny, enlarging in fruit and enclosing the berry. Late summer. Infrequent weed. -- (PEI), Q-Man-(S)-Alta-BC, US, (CA).

6. DATURA L. THORN-APPLE

Fruit a spiny capsule.

1. D. STRAMONIUM L. -- Stinkweed, Thorn-Apple (Pomme épineuse, Herbe aux sorciers) -- A very large white flower, 1 dm long or nearly so. Large annual with large and coarsely dentate leaves. Flower terminal or in the fork of 2 branches. Fruit very spiny. Mid to late summer. Rare and fleeting weed, but may appear in great quantity: Brandon, Melf., Edm.--NS-S-(Alta-BC), US, Eur -- F. TATULA (L.) Boivin -- Flowers mauve. Stem, etc., more or less purplish: Senlac. -- PEI-NB, O, S, US, Eur.

94. CONVOLVULACEAE (CONVOLVULUS FAMILY)

Herbs climbing by twining stems. As in the Solanaceae but the ovules reduced to 2 in each carpel.

a. Yellow parasites ..... 1. Cuscata
aa. Green and merely climbing, not parasitic ... 2. Convolvulus

1. CUSCUTA L. DODDER

Yellow parasitic vines. Root evanescent. Flowers in small clusters. Rather technical genus, our only species usually subdivided in a series of 4 or 5 microspecies.

1. C. Gronovii W. (C. arvensis Beyrich, var. calycina Eng.; C. campestris Yuncker; C. Cephalanthi Eng.; C. Coryli Eng.; C. curta (Eng.) Rydb.; C. megalocarpa Rydb.; C. planiflora AA.; C. pentagona Eng., var. calycina Eng.; C. umbrosa Hooker) -- Angel's Hair -- Forming a tangle of orange-yellow filiform stems and branches over the vegetation. Leaves lacking. Flowers small, yellowish. Mid summer. Mainly along shores and in bushy places, sometimes weedy, but uncommon. -- (NS-NB)-Q-Alta-(BC), US, (CA, SA), Eur.

Our native C. Gronovii has long been segregated into an extensive series of microspecies based primarily of floral minutiae. It has never been obvious to us that any of the morphological types thus distinguished corresponded to a biological entity with a recognizably distinct behaviour and an individualized range.

As pointed out by Scoggan 1957, reports of C. Epilinum Weihe from our area have never been substantiated by herbarium specimens. As they cannot be subjected to the exercise of cartesian criticism, these reports have little scientific value, if any.

2. CONVOLVULUS L. BINDWEED

Green climbers by twining stems, with showy flowers.

a. Flowers subtended by 2 large bracts enclosing the calyx ..... 1. C. sepium
aa. No such bracts ..... 2. C. arvensis

1. C. sepium L. (f. coloratus Lange, var. americanus Sims, var. fraterniflorus Mack. & Bush, var. pubescens (Gray) Fern.; C. americanus (Sims) Greene; C. interior House) -- Morning-Glory,

Bindweed (Clochettes, Belles du matin) -- Climbing herb with large and showy white to pinkish flowers. Leaves triangular-hastate, entire. Flowers about 5 cm long, trumpet-shaped. Bracts ± 2 cm long. Early to mid summer. Mainly at the edge of forests, sometimes spreading to, or persisting in, cultivated fields. -- NF-SPM, NS-BC, US, Eur, Oc.

While our plant is obviously native in America and also occurs as a planted and rarely escaped ornamental, we are not yet satisfied that there is a sound morphological basis for the separation of native from the introduced.

An old report by Macoun 1884 of C. spithameus L. from the banks of the Belly River has never been confirmed. It may have been based originally on a more pubescent specimen of C. sepium.

2. C. AVENSIS L. -- Small Bindweed, Field Bindweed (Petit Liseron, Vrillée) -- Smaller and the peduncle with a pair of small bracts near the middle. Flower 1.5-2.5 cm long. Mid summer. Waste places and cultivated field, often merely creeping on bare ground. -- NS-(PEI)-NB-BC, US, CA, Eur.

Order 52. PERSONALES

Flowers zygomorphic. Sepals fused and petals fused. Carpels 2, fused, maturing into a capsule. Flower 5-merous, but the stamens only 2 or 4 and the corolla lobes often only 4 by the fusion of 2 of them.

a. Plant parasitic, yellowish, brownish or purplish ..... 96. Orobanchaceae, p. 32
aa. Plants green.
  b. Flower spurred.
    c. Ovary unilocular; leaves all submerged or all basal... 97. Lentibulariaceae, p. 33
    cc. Bilocular; terrestrial plants with a leafy stem ..... 95. Scrophulariaceae, p. 10
  bb. Not spurred.
    d. Leaves very large and opposite; ovary unilocular ..... 98. Martyniaceae, p. 35
    dd. Alternate or opposite; ovary bilocular ..... 95. Scrophulariaceae, p. 10

95. SCROPHULARIACEAE (FIGWORT FAMILY)

A major family of plants with a zygomorphic corolla of fused petals. Ovary bilocular and maturing into a capsule. Mostly with a square stem.

a. Leaves all basal.
  b. Scape one-flowered ..... 10. Limosella
  bb. Inflorescence a spike ..... 13. Besseya
aa. Stem leafy.
  c. Leaves whorled throughout ..... 12. Veronicastrum
  cc. Leaves alternate, or opposite, or some whorled.
    d. At least the main stem leaves alternate ..... Group A

dd. At least the main stem leaves opposite (or whorled).
e. Calyx lobes 4 ..... Group B
ee. Calyx lobes 5 or rarely 2.
f. Flower galeate, that is the corolla two-lipped and the upper lip much prolonged, its lobes obscure or reduced to small-teeth.
g. Leaves subentire ..... 17. Melampyrum
gg. Deeply dissected ..... 22. Pedicularis
ff. Corolla not galeate, the 5 lobes quite proeminent ..... Group C

Group A

Stem leaves present, all or mostly alternate.

a. Corolla lacking or vestigial ..... 13. Besseya
aa. Corolla present.
b. Flowers spurred.
c. Flowers in terminal racemes ..... 2. Linaria
cc. Flowers axillary ..... 3. Chaenorrhinum
bb. Not spurred.
d. Flower widely open and nearly regular ..... 1. Verbascum
dd. Tubular and galeate.
e. Floral bracts petaloid and often more showy than the corolla ..... 15. Castilleja
ee. Floral bracts green and smaller.
f. Calyx lobes 4; annual..... 16. Orthocarpus
ff. Calyx lobes 2 or 5; perennials ..... 22. Pedicularis

Group B

Calyx lobes 4. Stem leaves all or mainly opposite.

a. Corolla widely spreading ..... 11. Veronica
aa. Flower tubular and galeate.
b. Calyx somewhat inflated and narrowed at the throat, becoming very much inflated in fruit ..... 21. Rhinanthus
bb. Neither inflated nor constricted at the throat.
c. Leaves short and palmately veined; flowers small ..... 18. Euphrasia
cc. Leaves elongate and pinnately veined.
d. Corolla glabrous ..... 17. Melampyrum
dd. Corolla pubescent or glandular.
e. Annual; flower ± 1 cm long...19. Odontites

ee. Perennial; flower 1.2-1.7 cm long ..... 20. Bartsia

Group C

Calyx and corolla with 5 obvious lobes, the corolla not galeate. Leaves all or mainly opposite.

a. Flowers axillary, in the axils of leaves or bracts.
  b. Calyx subtended by a pair of sepal-like bractlets ..... 9. Gratiola
  bb. No accessory bractlets.
    c. Upper leaves and flowers verticillate ..... 4. Collinsia
    cc. Opposite.
      d. Leaves serrate ..... 8. Mimulus
      dd. Entire ..... 14. Agalinis
aa. Inflorescence a panicle, raceme or spike.
  e. A spike ..... 6. Chelone
  ee. Panicle or raceme.
    f. An open panicle ..... 5. Scrophularia
    ff. A raceme or a narrow racemiform panicle ..... 7. Penstemon

1. VERBASCUM L. MULLEIN

Flower nearly regular, 5-merous; the corolla rotate and with 5 distinct lobes. All 5 stamens present and fertile.

a. Leaves petiolate ..... 3. V. nigrum
aa. Sessile.
  b. Leaves long decurrent ..... 1. V. Thapsus
  bb. Not decurrent ..... 2. V. Phlomoides

1. V. THAPSUS L. -- Mullein, Wild Tobacco (Bouillon blanc, Semelles) -- The whole plant felty-tomentose. Stiffly virgate herb with a dense terminal spike of yellow flowers. Leaves gradually shorter above, oblanceolate, long cuneate into a decurrent base. Flowers less than 2 cm across. Filaments of the upper stamens long pilose with white hairs. After mid summer. Rare weed of waste places: Killarney, Saskatoon, Burmis and Pincher -- NF, NS-(PEI)-NB-BC, US, SA, Eur.

2. V. PHLOMOIDES L. -- Woolly Mullein (Cierge de Notre-Dame, Herbe de Saint-Fiacre) -- Similar, the pubescence not quite so heavy. Leaves merely cordate and clasping at base, not decurrent. Flowers larger, 3-6 cm wide. All summer. Rare railway or garden weed: Moose Jaw, Fort Saskatchewan. -- PEI, Q-O, S-BC, neUS, Eur.

The Moose Jaw collection was originally reported in the Blue Jay 20: 84. June 1962 as V. Thapsus (REG).

3. V. NIGRUM L. (V. virgatum AA.) -- Black Mullein (Bouillon noir, Cierge) -- Pubescence not felty. Leaves rounded to cordate at base. Flowers 1.5-2.0 cm across. Filamens long

pilose with purplish hairs. Mid to late summer. Rare roadside weed: Fort Saskatchewan. -- O, Alta, (US), Eur.

2. LINARIA Miller TOAD-FLAX

Corolla prolonged into a conspicuous spur on the lower side. Flowers in terminal racemes.

a. Flowers yellow and orange.
  b. Leaves linear and narrow ..... 1. L. vulgaris
  bb. Broader, the main ones at least 1 cm wide ..... 4. L. dalmatica
aa. Flowers white, mauve, pink, purple, etc., but not yellow.
  c. Peduncle 2-4 mm long ..... 2. L. canadensis
  cc. 5 mm or more; flower bicolour ..... 3. L. maroccana

1. L. VULGARIS Hill -- Toadflax, Butter-and-Eggs (Gueule de lion, Gueule de lion des champs) -- Spurred, yellow flower with an orange cushion on the lower lip. Glabrous and green perennial. Leaves linear. Flowers 2-3 cm long. Summer. Uncommon but much collected weed, originally introduced as an ornamental. -- Mack, Aka, NF-SPM, NS-BC, US, Eur.

2. L. CANADENSIS (L.) Dumont var. TEXANA (Scheele) Pennell (L. texana Scheele) -- Usually producing sterile basal shoots with shorter and opposite or verticillate leaves. Thin virgate annual with linear leaves. Flower 1.5-2.5 cm long, bluish. Summer. Rare and evanescent adventive: Alsask, Marengo. -- S, swBC, US, (CA).

The typical and more eastern phase is generally smaller, the flowers paler and commonly only half as long.

An old Canadian report of Tonella collinsioides Nutt. by Macoun 1878 was without locality or other data and was ignored by later authors, even by Macoun himself in his later papers. It was apparently based on a collection since revised to L. canadensis (MTMG)

3. L. MAROCCANA Hooker f. (L. reticulata AA.) -- Branchy annual with variable flower colour; commonly pinkish to purplish with a yellow throat. Leaves narrow, linear. Late summer. Ornamental rarely reseeding itself around gardens: Beaverlodge. -- PEI, nwAlta-neBC, (US, Afr).

4. L. DALMATICA (L.) Miller var. DALMATICA -- Similar to L. vulgaris but larger and glaucous. Commonly 1 m high. Leaves ovate to broadly lanceolate, rounded to cordate at base, over 1 cm wide. Flowers 3-4 cm long. Second half of summer. Currently popular ornamental, spreading to roadsides, ditches, etc. -- (NS), Q-BC, US, Eur.

There is also in Macedonia a geographically restricted var. macedonica (Gris.) Vandas with smaller flowers on longer pedicels.

3. CHAENORRHINUM Reichenbach

Flowers solitary in the leaf axils. Otherwise as in Linaria.

1. C. MINUS (L.) Lange -- Flower spurred, small, bluish and glandular-pubescent. Small annual, glandular-pubescent throughout. Leaves linear. Fruit also glandular-pubescent. Summer. Along railway tracks. -- NS-BC, US, Eur.

4. COLLINSIA Nutt.

Lower lobe of the corolla more or less saccate and enclosing the 4 stamens. Corolla bilabiate.

1. C. parviflora Lindley -- Blue Lips -- Small annual with the lower leaves opposite, the upper leaves and flowers verticillate. Leaves ± lanceolate, entire. Flower small, blue, solitary, on an elongate peduncle. Late spring and early summer. Hillsides and shale slopes, local: southeastern Manitoba, Cypress Hills and Rockies. -- Y-(Aka), O-BC, US.

5. SCROPHULARIA L. FIGWORT

A basic type with a bilabiate flower but neither spurred nor galeate. Normal stamens 4, with a vestigial fifth.

1. S. LANCEOLATA Pursh (S. leporella Bickn.) -- (Herbe du siège) -- Flowers in a narrow panicle of pedunculate cymes. Tall virgate herb, 1-2 m high. Stem strongly squarrish. Leaves opposite, broadly lanceolate, serrate. Inflorescence with very small bracts. Flower greenish purple. (First half of summer?). Rare railway introduction: Mortlach. -- (NS, NB)-Q-O, sS, (BC), US.

6. CHELONE L.

Calyx of 5 free sepals and closely subtended by a calycule of 2-(3) large sepal-like bracts. Flower bilabiate, with 4 perfect stamens and a fifth sterile and shorter.

1. C. glabra L. var. linifolia Coleman -- Turtlehead, Balmony (Tete de tortue, La Tortue) -- Rather large white bilabiate flowers in a terminal spike. Around 1 m high. Leaves linear. Flower 2-3 cm long. Late summer. Marshy places: Elma. -- O-seMan, US.

Leaves 1-2 cm wide, the upper gradually somewhat smaller. In the typical and eastern variety the leaves are isomegueth and somewhat larger, lanceolate and mostly 2-3 cm wide.

7. PENSTEMON Mitchell BEARD-TONGUE

Stamens 5, of which one is sterile, as in Chelone, but the genus otherwise more typical of the family, the calyx of fused sepals and lacking a calycule. Flower bilabiate, usually large and showy.

a. Flower short, (6)-10-(12) mm long.
  b. Flower blue ..... 7. P. procerus
  bb. White, drying yellow ..... 8. P. confertus
aa. Longer.
  c. Decumbent alpine shrubs; flowers opposite in a simple raceme.
    d. Leaves ovate to elliptic ..... 5. P. Davidsonii
    dd. Taller; the leaves broadly to narrowly lanceolate ..... 4. P. fruticosus
  cc. Herbs, erect or nearly so; flowers clustered to narrowly paniculate.
    e. Style exserted and conspicuously long-pilose in yellow .....3. P. eriantherus
    ee. Included and mostly not yellow-pilose.
      f. Flowers 3-4 cm long ..... 6. P. Lyallii
      ff. Flowers about 2 cm long.
        g. Corolla glabrous externally.
          h. Lower inflorescence bracts suborbicular .... 2. P. nitidus
          hh. Lanceolate ..... 9. P. albertinus
        gg. Glandular-puberulent.
          i. Flowers white; plant densely glandular-puberulent throughout... 1. P. albidus
          ii. Mauve; plant gradually less puberulent below and at least the lower and basal leaves glabrous..10. P. gracilis

1. P. albidus Nutt. -- Flowers white with a few purple lines, drying dirty gray or blackish. Herbage densely glandular-puberulent throughout. Corolla about 2 cm long, the tube gradually flaring, the lobes widely spreading, sometimes tinged pink. Late spring and early summer. Steppes and hillsides.-- sMan-sAlta, US.

2. P. nitidus Douglas var. nitidus (P. acuminatus AA.)-- Herbage heavily glaucous and the leaves somewhat fleshy. 1-3 dm high and glabrous. Leaves mainly ovate, entire. Flowers blue, about 2 cm long or slightly less. Late spring and early summer. Dry hillsides. -- swMan-seBC, US.

Grades into a more southern var. polyphyllus (Pennell) Cronq. with narrower leaves and bracts, ovate-lanceolate to lanceolate.

3. P. eriantherus Pursh var. eriantherus (P. cristatus Nutt.; P. erianthera sphalm.; P. puberulentus AA.) -- Style exserted and conspicuously pilose with yellow hairs 2-4 mm long. Herbage hirsute and glandular-puberulent throughout. Corolla 2-3 cm long, abruptly narrowed towards the middle, narrowly tubular below, nearly campanulate above, glandular-puberulent on the outside, mauve to magenta or purplish blue, tending to dry brownish. Early summer. Rocky foothill prairies. -- swAlta-seBC, wUS.

In the typical phase the glomerules are ± overlapping and the anther sacs are squarrish or transversely oblong. In the north-western U.S.A. there occur var. Whitedii (Piper) Nelson and var. argillosus M.E. Jones with a longer and moniliform inflorescence, the glomerules being distant, and oblong anthers.

Reports of P. puberulentus from Estevan were based on a sheet of P. albidus: W.P. Fraser, Estevan, June 26, 1917 (SASK).

4. P. fruticosus (Pursh) Greene (var. Scouleri (Douglas) Cronq.) -- Huge blue to mauve flowers, opposite in a terminal raceme. Decumbent shrub with erect herbaceous shoots 1-4 dm high. Leaves ± lanceolate, serrate, thickish. Flower tubular, 3-5 cm long. Late spring and early summer. Rocky outcrops in the mountains. -- swAlta-sBC, nwUS.

5. P. Davidsonii Greene var. ellipticus (Coult. & Fisch.) Boivin (P. ellipticus Coult. & Fisch.)-- Similar, more depressed and lower, with wider leaves and often smaller flowers. Erect shoots (0.5)-1.0-(1.5) dm high. Leaves ovate to elliptic, about 1 cm wide, remotely toothed. Flowers 3-4 cm long. Summer. Alpine summits and shale slides. -- swAlta-seBC, nwUS.

The leaves are entire and clearly obovate in the more western typical variety.

6. P. Lyallii Gray -- Large flowers resembling the above two, but the inflorescence slightly branched, the lower flowers being borne in cymes or umbels of 2-4 flowers. Tufted herb, the stems 3-5 dm high. Leaves narrowly lanceolate, 4-8 cm long, distantly serrate. Early summer. Rocky montane slopes. -- swAlta-seBC, nwUS.

7. P. procerus Douglas var. procerus -- Blue tubular flower 1 cm long or slightly less. Leaves narrowly lanceolate, entire. Flowers spreading to descending, tending to be in 1-2-(3) clusters. Calyx lobes cuspidate, the margin membranous and erose. Early summer. Common on moister prairies. -- Y-(Aka), swMan-BC, nwUS -- F. Jenkinsii Boivin -- Flowers pink. Hoosier. -- swS.

Grades further south into a var. formosus (Nelson) Cronq. with shorter calyx, 1.5 - 3.0 mm long.

8. P. confertus Douglas -- Flowers white, fading and drying yellow. Otherwise almost identical with the last, but perhaps a bit larger throughout, and later flowering by about 4 weeks. Montane prairies and hillside draws in the steppe; adventive at Swift Current and Devil's Lake. -- swS-swAlta-seBC, US.

9. P. albertinus Greene (P. virens Pennell) -- Calyx smallest, 2.5-4.0 mm long. Leaves ∓ lanceolate, entire to remotely serrulate towards the tip. Glabrous, but the stem puberulent. Flowers 1.5-2.0 cm long, blue, glabrous. First half of summer. Semi-open places at middle altitudes: Waterton -- swAlta-seBC, swUS.

Alberta and B.C. were included in the range of P. pseudohumilis Rydb. as given by Rydberg 1917. This species appears to range entirely south of the 49th parallel, there were no

Canadian sheets at NY in 1965, and the only Alberta sheet located, Macoun 24177, Crow Nest Lake, July 31, 1887 (CAN; DAO, photo), was subsequently revised to P. albertinus. The same also applies to the B.C. sheets, including those identified P. humilis Nutt., another more southern species also confused by some Canadian authors with P. pseudohumilis and P. albertinus. Reports by Macoun 1884 of P. glaucus Graham for the same areas were also based on P. albertinus and his Mackenzie report is similarly rated as improbable, even if its actual basis was not ascertained. The latter was supposedly a sheet at MTMG, but we noted no Mackenzie sheet of Penstemon in our 1963 survey of that collection.

10. P. gracilis Nutt. var. gracilis -- Light blue tubular flowers about 2 cm long. Leaves thickish, narrowly lanceolate, remotely serrulate. Glandular-puberulent in the inflorescence, glabrous below. Early summer. Frequent and showy prairie species. -- wO-neBC, US -- F. Scogganii Boivin -- Flowers white. Local: Lily Pond, Nipawin. -- seMan-S.

F. Scoggannii f.n., floribus albis in vivo. Type: Boivin & Laishley 13092, Réserve Forestière Whiteshell, falaise au bord du Lily Pond à l'ouest du lac Caddy, fleurs blanches, croissant avec la forme typique, 26 juin 1959 (DAO). Dr. Homer J. Scoggan is the author of an excellent Flora of Manitoba.

Known only from a limited area in Wisconsin, var. wisconsinensis (Pennell) Fassett is puberulent throughout.

Re P. Richardsonii Douglas reported from Alberta by Rydberg 1917, see comment under Rosa blanda, part I, page 68. A similar range given by Eastham 1947 was presumably based on Rydberg's.

8. MIMULUS L. MONKEY-FLOWER

Calyx strongly angular. A basic and unspecialized type with 5-merous and ± bilabiate axillary flowers. Stamens 4.

a. Flowers blue ..... 1. M. ringens
aa. Magenta or yellow.
  b. Flowers magenta..... 5. M. Lewisii
  bb. Yellow.
    c. Calyx symetrical ..... 4. M. floribundus
    cc. Bilabiate, the lateral lobes shorter.
      d. Calyx almost truncate at mouth, the lateral and lower lobes less than 0.5 mm long ..... 3. M. glabratus
      dd. Lobes broadly deltoid, the lower mostly 2-3 mm long ..... 2. M. guttatus

1. M. ringens L. var. ringens -- Monkey - Flower -- A square-stemmed herb with large blue flowers. Leaves lanceolate, sessile, clasping at base, subentire to weakly serrate. Flower 2-3 cm long. First half of summer. Wet shores, rare. -- NS-ecS, US.

We know of two Saskatchewan collections: Hudson Bay Junction (DAO)and Armit (DAO), about 25 miles to the east of the

first. Another collection is labelled T.J.W. Burgess, South Antler Creek, July 29, 1873 (MTMG; DAO, photo). Not yet confirmed by a modern collection. In so far as the Gainsborough (or South Antler) Creek crosses borders repeatedly, it is not clear if this 1873 collection should be credited to southeastern Saskatchewan, or southwestern Manitoba, or north-central North Dakota. It may occur in all three units and is, at any rate, a range extension.

In the estuaries of the Saint Lawrence and Penobscot rivers it is replaced by the generally smaller var. colpophilus Fern., the stem, internodes, leaves peduncles and calices shorter.

2. M. guttatus DC. (M. Tilingii Regel) -- Monkey-Flower -- Yellow flower punctate in marroon and densely pilose in yellow at the throat. Highly variable. Leaves ovate, dentate, more or less parallel-nerved. Flowers 1-4 cm long. Calyx sometimes purple-dotted. Mid summer. Mountain creeks and wet places: Cypress Hills, Rockies. -- sY-Aka, swS-BC, US, (CA, Eur).

3. M. glabratus HBK. var. glabratus (var. Fremontii (Bentham) Grant, var. Jamesii (T. & G.) Gray; M. Geyeri Torrey) -- Like a small version of the above. Glabrous or nearly so. Flowers 9-14 mm long. Calyx very shallowly crenate at throath, the calyx lobes otherwise not obvious. Summer. Near springs, rare or overlooked: Whitewood and Agassiz Delta. -- Q-scManseS, US, (CA).

Vicariant of the South American var. micranthus (Phil.) stat. n. (M. luteus var. micranthus Phil.; Linnaea 29: 28-1857-8; M. glabratus var. parviflorus (Lindley) Grant 1924) with abundant pubescence in the inflorescence.

4. M. floribundus Douglas -- Small annual, the calyx lobes all similar and acutish. Leaves ovate, petiolate. Calyx less than 1 cm long. Corolla 8-15 mm long. Early summer. Wet ledges of cliffs: Hillcrest. -- swAlta-sBC, wUS, (CA).

5. M. Lewisii Pursh -- Large magenta flowers 3-5 cm long. Herbage glandular-pubescent and villous. Leaves sessile, ovate to lanceolate, parallel-nerved. Peduncles elongate, at least as long as the flower. Calyx purplish. Mid summer. Along mountain brooks in Waterton. -- (seAka), swAlta-BC, wUS.

9. GRATIOLA L. HEDGE-HYSSOP

Calyx subtended by a pair of bracts similar to the calyx lobes and thus sometimes appearing as if the calyx had 7 lobes.

1. G. neglecta Torrey var. neglecta (G. virginiana AA.)-- (Herbe à pauvre homme) -- Small annual with yellow flowers and a rather thickish stem. Densely glandular-puberulent throughout. Leaves lanceolate, entire or nearly so. Peduncle nearly as long as the subtending leaf. Flower about 1 cm long. Early summer to early frosts. Dried up ponds and around small sloughs. -- NS, swQ-BC, US.

Var. glaberrima Fern. from the tidal flats of the Saint Lawrence river is glabrous throughout.

10. LIMOSELLA L. MUDWORT

Corolla nearly regular, 5-merous, small. Anthers 4, unilocular.

a. Some of the leaves with a distinct limb ... 1. L. aquatica
aa. Leaves all filiform ..... 2. L. subulata

1. L. aquatica L. -- Mudwort -- Small herb spreading by superficial stolons and forming a tangled carpet. Leaves very variable, entire, some of them reduced to the petiole. Flower purplish, basal, on peduncles arching in fruit. Early summer to early frosts. Mud flats, sometimes submerged. -- (G), K-(Mack-Aka), L-(NF), Q-BC, US, Eur.

2. L. subulata Ives -- Generally smaller and the leaves filiform, less than 0.5 wide. Flowers usually white. (Late spring?) Flats of saline sloughs; rare or overlooked: Granum, Ponoka. -- seNF, NS-sQ, sAlta neUS, Eur.

11. VERONICA L.

Flower 4-merous and only slightly asymetrical, the corolla more or less spreading. Stamens only 2. Leaves opposite, but the floral bracts mostly alternate.

a. Calyx with 2 long lobes and 3 shorter ones ..
..... 8. V. latifolia
aa. Calyx lobes 4.
b. Flowers all in axillary and opposite racemes, the main axis ending in a sterile shoot.
c. Leaves abruptly contracted at base to a petiole less than 1 cm long.
d. Leaves glabrous, oblong-lanceolate ..
..... 10. V. americana
dd. Villous, deltoid-ovate ..... 9. V. Chamaedrys
cc. Leaves sessile.
e. Leaves lanceolate, clasping at base ..... 11. V. comosa
ee. Leaves linear, cuneate at base ..
..... 12. V. scutellata
bb. Flowers solitary or in terminal racemes.
f. Flowers all solitary in the axils of alternate leaves; pedicels elongate.
g. Capsule pubescent near the edge only, glabrous or nearly so on the faces ..... 7. V. persica
gg. Capsule equally puberulent or glandular-puberulent over the whole surface.
h. Style 1 mm long or less and overtopped by the shoulders of the fruit ..... 5. V. agrestis
hh. Longer, 1.0-1.5 mm long and overtopping the shoulders

of the fruit ..... 6. V. polita

ff. Flowers all or mostly in a terminal raceme, the bracts alternate.

i. Leaves 4-12 cm long, narrowly lanceolate ..... 1. V. longifolia

ii. Much shorter.

j. Leaves gradually passing into the inflorescence bracts...4. V. peregrina

jj. Inflorescence well defined, the bracts many times shorter than the opposite leaves.

k. All leaves sessile ..... 2. V. alpina

kk. Lower ones abruptly contracted into a short petiole ..... 3. V. serpyllifolia

1. V. LONGIFOLIA L. var. LONGIFOLIA -- A tall virgate herb with opposite leaves and one (or more) dense terminal racemes of blue flowers. Densely puberulent throughout. Leaves serrate, broadly rounded to truncate at base. Flower with a distinct tube about 3 mm long. Mid summer. Infrequently escaped ornamental: Rutland, Le Pas. -- (NF), NS-(PEI)-NB-S, neUS, (Eur).

In the typical phase the leaves are generally 1-2 cm wide, lanceolate to narrowly lanceolate, cuneate to subcordate at base, while the central european var. Bachofenii (Heuffel) stat. n. (V. Bachofenii Heuffel, Flora 18: 253. 1835) has larger leaves, 2-4 cm wide, triangular-lanceolate, the middle and lower ones deeply cordate at base.

2. V. alpina L. var. unalaschcensis C. & S. -- Capsule longer, 4-6 mm long. Small erect native, 1-2 dm high, with 4-6 pairs of ovate to lanceolate sessile leaves, and a terminal raceme of blue flowers. Glandular-puberulent throughout. Leaves entire. Sepals 3-4 mm long. Style 1.0-1.5 mm long. Capsule obovate. Mid summer. Near mountain streams. -- G, (K-Mack)-Y-Aka, L, Q, wAlta-BC, US, (Eur).

In the more western var. nutans (Bong.) Boivin the leaves are ± serrulate and ± ovate.

3. V. serpyllifolia L. var. humifusa (Dickson) Vahl (V. tenella All.) -- Quite similar to the above. Stem incurved-puberulent, becoming somewhat glandular in the inflorescence. Sepals smaller and shorter than the style. Capsule half as long as wide, obreniform. Late spring and early summer. Wet montane meadows: Cypress and Rockies. -- sAka, L-(NF, NS), NB-O, swS-BC, US, (CA, SA, Eur).

Often introduced east of us, the eurasian var. serpyllifolia is appressed-puberulent and not glandular on the rachis and pedicels.

4. V. peregrina L. var. xalapensis (HBK.) St. John. & Warren (W. xalapensis HBK.) -- Neckweed -- Inflorescence not well defined. Lower leaves opposite and sterile, gradually passing into a bracteate raceme of alternate flowers. Glandular-

puberulent throughout. Leaves smallest, mostly linear and less than 4 mm wide. Styles 0.1-0.2 mm long. Summer. Frequent in exsiccated places. -- sMack-Aka, NB-BC, US, (CA, SA), Oc.

Occurring both east and west of us, var. peregrina is glabrous.

5. V. AGRESTIS L. -- Winter-Weed -- Much like the next. Sepals at first lanceolate, becoming ovate-lanceolate and 5-8mm long in fruit. Capsule somewhat bigger, ± 4 mm long. Summer. Rare garden weed: Beaverlodge. -- NF-(SPM), NS, NB-O, Alta-(BC, US), Eur, (Afr).

The inclusion of Manitoba in the range of V. agrestis by Montgomery 1954 may have been based on a collection since revised to V. polita, namely; Boivin & Mosquin 11045, Aweme, jardin de Stuart Criddle, 24 juillet 1955 (DAO).

6. V. POLITA Fries -- Similar to the following, but generally somewhat smaller. Peduncle about 1 cm long, becoming strongly recurved in fruit. Sepals broadly ovate, elongating to 4-5 mm in fruit. Style 1.0-1.5 mm long. Capsule obreniform, ± 3 mm long, each half elliptic and rounded on the shoulder. Summer and fall. Rare garden weed: Cartwright, Aweme. -- O-sMan, US, (CA, SA), Eur, (Afr).

7. V. PERSICA Poiret var. ASCHERSONIANA (Lehm.) Boivin (V. Tournefortii AA.) -- Bird's Eye, Cat's Eye -- Annual herb with the lower leaves opposite and sterile, the upper alternate and subtending solitary flowers. Peduncle longer than the subtending leaf, ascending, becoming recurved under the fruit. Flower blue, the lower lobe smaller and white. Style 2.0-2.5mm long. Each half of the capsule rhomboid with an angular shoulder. Summer. Garden weed. -- Q-O, Alta-BC, (Eur).

All four lobes are blue in var. Corrensiana (Lehm.) Boivin, also introduced in North America.

Specimens seen from Manitoba and Saskatchewan could not be determined varietally.

8. V. LATIFOLIA L. (V. Teucrium L.; V. longifolia AA.) -- Hungarian Speedwell (Teucriette) -- With a few stiffly erect subterminal racemes. Erect virgate perennial with the racemes overtopping the sterile terminal shoot. Late spring to early summer. Rare escape to open prairies: Raymore. -- O, S, US, Eur.

A variable and much subdivided species. We have not been able to determine our specimens beyond the specific level.

Our plant is often called V. Teucrium because V. latifolia L. 1753 has been variously interpreted now in the sense of V. Teucrium L. 1762 sensu lato, now in the sense of V. urticifolia Jacq. 1773 (vel sphalmate V. urticaefolia). The situation was briefly reviewed and discussed by Pennell 1935. We agree with Pennell and further we find it would be difficult to typify V. latifolia in the sense of V. urticifolia. The latter is represented in the linnean herbarium by only one sheet, no. 26.55, which was part of a shipment from Jacquin to Linné in 1768, hence is not available to typify either linnean entity. On the other hand there are many sheets of the V. Teucrium kind, and

the main one seems to be sheet 26.52 identified latifolia 19 by Linné. 19 is the number of V. latifolia in the first edition of the Species Plantarum and the sheet also bears on the back in the hand of Linné the name used in the Hortus Cliffortianus and cited as the first synonym under V. latifolia in 1753. Apparently this sheet 26.52 came from the Hortus Cliffortianus, it is the central element of the linnean concept of V. latifolia and must stand as its type specimen.

It does not appear that Linné was aware of V. urticifolia as another concept until 1768 when he received a sheet from Jacquin. Further, when V. Teucrium was created in 1762, the earlier V. latifolia was not modified by Linné; V. Teucrium was proposed as an entirely new entity rather than as a segregate of V. latifolia. V. Teucrium may have been based entirely on literature references as there seems to be no obvious type or syntype in the Linnean collection.

Therefore we see no reason to reject V. latifolia in favour of V. Teucrium and we do not accept Kerner's contention published in Oest. Bot. Zeit. 23: 367, 1873 and still accepted by some authors that V. urticifolia should be called V. latifolia.

9. V. CHAMAEDRYS L. -- Bird's Eye, Angel's Eye (Herbe à Thérèse, Petit chêne) -- Leaves deltoid-ovate and the flowers in elongated axillary racemes, like the next few. Herbage pilose and the stem heavily pilose along 2 lines on the internodes. Petioles very short. Style 4-5 mm long. First half of summer. Uncommon garden weed: Banff. -- (Aka), NF, NS-O, swAlta-BC, US, Eur.

10. V. americana Schwein. (vel sphalm. (Raf.) Schwein.)-- Brooklime, Wallink -- A soft herb of wet places, with axillary racemes and lilac flowers drying blue. Leaves 2-6 cm long, oblong-lanceolate, crenately serrate, short petiolate. Early to mid summer. Wet places flooded in spring. -- Mack-Aka, NF, NS-BC, US, (CA, eEur).

11. V. comosa Richter var. glaberrima (Pennell) Boivin (V. catenata Pennell; V. connata Raf. ssp. glaberrima Pennell; V. salina AA.) -- Similar but the shorter leaves sessile and clasping at base. Glabrous. Flowers white to pink. Fruit more or less emarginate. Summer. Springs and creeks. -- sMan-Alta, US, Eur -- Var. glandulosa (Farwell) Boivin -- Glandular in the inflorescence. -- swQ-sMan-swS (Cypress Hills), US.

12. V. scutellata L. -- Marsh Speedwell -- Similar to the above two, but the leaves long and narrow, often ribbon-like, commonly less than 5 mm wide. Glabrous. Racemes ± secund. Flowers lavender. Fruit obreniform. Summer. Grassy shores of marshes and creeks. -- Mack-Y, L-SPM, NS-BC, US, Eur -- F. villosa (Schum.) Pennell -- Puberulent, especially along the stem. -- (sMack-Y, Q)-O-(Man)-S-BC, Eur -- F. alba Boivin -- Flowers white. Lake Sasaginnigak. -- Man.

12. VERONICASTRUM Fabricius CULVER'S ROOT

Corolla tubular. Otherwise as in Veronica, the corolla with 4 lobes and the stamens 2, but the calyx lobes 4 or 5.

1. V. virginicum (L.) Farw. var. virginicum -- Culver's Root, Culver's Physic -- Generally resembling Veronica longifolia, but the flowers white and the leaves verticillate, cuneate at base. Mid summer. Grassy shores and ditches, rare: Arnaud. -- (NS), O-sMan, US.

The asiatic vicariant, var. sibiricum (L.) stat. n., Veronica sibirica L., Sp. Pl. ed 2, 1:12, 1762, has a somewhat longer corolla, ca 5 mm, and the lobes of the calyx are a little narrower.

Also known as: Herbe à quatre feuilles.

13. BESSEYA Rydb. KITTEN-TAILS

Stamens only 2 and the fruit a capsule as in Veronica. But the corolla lacking and the sepals fused most of their length.

1. B. wyomingensis (Nelson) Rydb. (B. cinerea AA.) -- With somewhat the habit of a Plantago. Lanate-villous throughout. Leaves dimegueth, the basal ones ovate, crenate, the stem-ones many times smaller. Spike dense. Calyx reduced to a bract with 2-(3) lobes at tip, standing on the outside like an accessory bract. Stamens red. Late spring and early summer. Open hillsides in the mountains: Cypress, Rockies. -- swS-Alta, US.

14. AGALINIS Rafinesque

Stigmas 2. Flower ± campanulate, slightly bilabiate, 5-merous, but with only 4 stamens.

a. Peduncle 5 mm long or less ..... 2. A. purpurea
aa. Much longer.
b. Corolla (1.8)-2.0-2.5 cm long ..... 1. A. aspera
bb. Corolla 1.0-1.5 cm long ..... 3. A. tenuifolia

1. A. aspera (Douglas) Britton (Gerardia aspera Douglas) -- A rather thin annual with large pink flowers on long axillary peduncles. Leaves linear, very strongly scabrous above. Peduncle somewhat shorter than the flower. Calyx lobes 1.5-3.0 mm long. Corolla densely puberulent on the tube but the lobes merely ciliate. Second half of summer. Wet places exundated late in the season, rare: Emerson, Stony Mountain, Pembina Hills. -- sMan, cUS.

2. A. purpurea (L.) Pennell var. parviflora (Bentham)Boivin (Gerardia paupercula (Gray) Britton, ssp. borealis Pennell) -- Peduncles short, shorter than the calyx. Otherwise much as the above. Corolla 1-2 cm long, densely puberulent throughout, sometimes obscurely so. Calyx lobes 2.0-3.5 mm long. Late summer. Exundated places. Reported for Stony Mountain. -- NS, Q-O-(sMan), neUS.

Stat. n., Gerardia purpurea L., var. parviflora Bentham, Comp. Bot. Mag. 1: 208. 1836.

Our variety has the leaves 1.0-2.5 mm wide while the planicostal var. racemulosa (Pennell) stat. n., Gerardia racemulosa

Pennell, Torreya 11: 15. 1911, has filiform leaves, 1 mm wide or less, the calyx lobes shorter, 1-2 mm long, and the corollas larger, 2.0-3.5cm long.

See also Additions and Corrections.

3. A. tenuifolia (Vahl) Raf. var. parviflora (Nutt.) Pennel (G. tenuifolia Vahl var. parviflora Nutt.) -- Flowers smaller. Peduncle about as long to somewhat longer than its flower. Calyx lobes (0.7)-1.0-(1.5) mm long. Corolla puberulent like the last. Late summer. Exundated places, rare: Lake of the Woods, Dugal's Ditch, Lettonia. -- swQ-seMan, US.

15. CASTILLEJA Mutis PAINTED CUP

Very showy herbs because the floral leaves tend to take on the color of flowers. Calyx green or petaloid. As the flowers are axillary in the upper part of the stem, the whole of the inflorescence thus becomes petaloid. Corolla elongate and strongly galeate. Calyx divided into 2 main lobes, each of which is usually bilobed again. Perennial herbs with alternate leaves, rarely annual, but then the corolla much elongated. Leaves sometimes entire, but more typically the upper leaves and especially the floral leaves digitately lobed at tip to pinnatipartite in the upper half. Our species not always clear cut.

a. Annual ..... 1. C. coccinea
aa. Perennial.
  b. Flowers 4.0-5.5 cm long ..... 2. C. sessiliflora
  bb. Shorter and more ascending.
    c. Flowers dull pink or mauve to dull violet, drying dark violet ..... 5. C. Raupii
    cc. White or yellow to bright red.
      d. Upper leaves entire, becoming coarsely trilobed in the inflorescence.
        e. Bracts reddish or scarlet at tip ..... 8. C. miniata
        ee. Whitish or yellow.
          f. Bracts white or yellowish or pinkish tinged; flowers ± 2 cm long ..... 6. C. pallida
          ff. Yellow; flowers usually longer.
            g. Calyx lobes broadly rounded ..... 7. C. occidentalis
            gg. Acute and more or less lanceolate ..... 4. C. lutescens
      dd. Upper leaves deeply divided at tip into 3-5 lobes, the lateral ones narrowly linear.
        h. Inflorescence bright red or scarlet ..... 9. C. hispida
        hh. Yellow.

i. Calyx lobes broadly rounded ..... 3. C. Cusickii
ii. Acute ..... 4. C. lutescens

1. C. coccinea (L.) Sprengel -- Fire Pink, Red Indians -- Shallowly rooted annual, 2-4 dm high. Stiffly erect and usually simple. Upper stem leaves with 3-5 linear lobes. Inflorescence white or yellow or typically scarlet. Secundary lobes of the calyx poorly developed or often lacking, the primary lobes being broadly truncate at tip. Flower 2.0-2.5-(3.0) cm long. Early summer. Grassy openings, dry or wet. -- O-sMan-seS, US.

The only Saskatchewan collection is from Buchanan (SASK). It was made half a century ago by one Mrs. F. P. Henwood and has never been confirmed.

2. C. sessiliflora Pursh -- Honeysuckle -- Flower longest, whitish, strongly falcate and often spreading at tip. Tufted perennial usually less than 2 dm high at flowering. Stem leaves narrowly trilobed. Bracts mostly green. Calyx with 4 linear lobes. Late spring and early summer. Hillsides, especially along coulées. -- swMan-sS, cUS -- F. purpurina Pennell -- Flower pink, salmon or purple. Rare: Melita. -- swMan, (US).

3. C. Cusickii Greenman (C. lutea Heller) -- Inflorescence yellowish and the narrow leaves all, or at least the upper, deeply divided into narrow lobes. Tufted and 1-3 dm high, densely puberulent and villous. Early summer. Foothill prairies. -- swAlta-(seBC), nwUS.

We have checked specimens only from Cardston (DAO).

4. C. lutescens (Greenman) Rydb. -- Calyx lobes acute, more or less lanceolate, 1-5 mm long. Densely puberulent throughout rather than villous. Otherwise much like the last and perhaps only a minor segregate. Early summer. Foothill prairies. -- swAlta-seBC, nwUS.

We have checked specimens (DAO) from Cardston and the Handhills.

5. C. Raupii Pennell -- Flower shortest, less than 2 cm long, shorter than its bract. Tufted and usually less than 2 dm high. Leaves long linear, less than 5 mm wide. Inflorescence darkening to deep violet in drying, rose to mauve or purple when fresh. Early summer. Wet open places, especially if sandy. -- K-Y-(Aka), nQ-nMan-nS-nAlta-nBC.

6. C. pallida (L.) Sprengel var. septentrionalis (Lindley) Gray -- Much as the last but tending to be larger and the inflorescence paler, white or tinged with yellow or pink. Mostly 2-4 dm high. Herbage glabrous or essentially so. Flowers ± 2 cm long. Mid summer. Open, marshy places. -- (F-Mack), L-(NF), NB-nMan, neUS.

Further to the northwest 3 other varieties occur. These are more pubescent, being hirsute to villous, at least in the inflorescence.

7. C. occidentalis Torrey (C. acuminata AA.; C. pallida AA.; C. septentrionalis AA.; C. sulphurea Rydb.) -- Like the next, but the inflorescence yellowish. Flowers and bracts

2-3-(4) cm long, the bracts sometimes purplish below, yellow at tip. First half of summer. Montane prairies. -- (swY-seAka), swAlta-seBC, wUS.

8. C. miniata Douglas (C. lauta Nelson; C. mineata sphalm; C. rhexifolia Rydb.) -- A showy virgate herb with a scarlet inflorescence with large petaloid bracts. Taller and commonly 4-6 dm high, less densely pubescent. Leaves broader, lanceolate to linear, usually 1 cm wide or somewhat less. Flowers and bracts (2)-3-4 cm long, the latter commonly trilobed. First half of summer. Edge of bluffs and open woods, very common in the mountains at all altitudes. -- seAka, wO-BC, wUS.

Somewhat variable, hence many phenotypes have been segreates under binomials of their own. Thus smaller plants from higher altitudes have been mostly termed C. rhexifolia. The various variants appear to be part of the normal variation of a single species. The extension of range into western Ontario is based on a railway introduction at Dorion.

9. C. hispida Bentham var. hispida -- Inflorescence scarlet like the last, but the upper stem leaves narrowly lobed. Also usually smaller, the flowers and bracts tending to be shorter, the latter coloured only a tip. Calyx lobes rounded at summit. Late spring and early summer. Montane prairies.-- swAlta-sBC, nwUS.

To the southwest of us it grades to a coarser var. acuta (Pennell) Ownbey, more abundantly and more stiffly pubescent, the calyx lobes acute.

16. ORTHOCARPUS Nutt.

Annual and with shorter flowers than most Castilleja species. Otherwise quite similar to the latter genus of which it is a minor segregate.

1. O. luteus Nutt. -- A stiffly erect, and usually simple, yellow-flowered annual. Glandular-puberulent throughout. Leaves numerous, narrow, entire. Inflorescence leaves green, typically trifid. Summer. Dry places, mainly on disturbed or wind-eroded soils. -- wO-BC, US.

17. MELAMPYRUM L.

Like Pedicularis, but the flowers axillary rather than racemose. Leaves entire or nearly so, pinnately veined.

1. M. lineare Desr. -- Cowwheat -- Leaves dimegueth, the main stem leaves entire, linear and usually less than 5 mm wide; upper leaves larger, lanceolate, most often around 1 cm wide and typically with a pair of sharp teeth at the widest point. Annual, branching opposite, tending to blacken in drying. Flower axillary, white and yellow, usually drying black. Mid summer. Frequent on sandy soils and granitic outcrops. -- NF-SPM, NS-(PEI)-NB-BC, US.

Larger-leaved specimens occur fairly frequently throughout the Canadian range. Varieties based on this and other characters

have been distinguished, perhaps justifiably, south of our borders.

18. EUPHRASIA L. EYEBRIGHT

Leaves palmately veined and toothed. Otherwise similar to Melampyrum and Pedicularis, the flowers galeate, the upper lip bilobed.

1. E. arctica Lange var. arctica (E. disjuncta Fern. & Wieg.; E. hudsoniana Fern. & Wieg.) -- Small annual with obovate leaves, palmately veined and palmately toothed. Usually simple and less than 2 dm high, the leaves all or mostly opposite. Flowers small, 4-6 mm long, axillary in the upper leaves, white and yellow with lavender lines. Mid summer. Usually on slightly disturbed soil in subarctic situations. -- (G-K, L-NF, NB)-Q-(O)-nMan, US, (Eur) -- Var. dolosa Boivin (E. subarctica Raup) -- Flowers not lined and usually somewhat smaller, 3-4 mm long. Alpine and subarctic. -- Mack-Aka, (nwS)- Alta(n, sw)-BC, (nwUS).

Anderson 1950 extends the range of E. subarctica to Lab. and N.F., but this may be only a reflection of the known range of E. disjuncta which Anderson treats as a partial synonym.

Our only species is doubtfully separable further into a series of minor segregates.

19. ODONTITES Ludwig

Differs from the last by its pinnately veined leaves and the entire upper lobe of the corolla.

1. O. SEROTINA (Lam.) Dum. (O. rubra Gilibert) -- Resembles Euphrasia but larger and much branched. Flowers in secund racemes, subopposite below, alternate above. Corolla about 1cm long, pink, the upper lip subentire, the lower lip shorter and tripartite. Late summer and fall. Rare weed of crops and roadsides: Gimli, Edson. -- (NF, NS-NB)-Q-Man, Alta, US, (Eur).

20. BARTSIA L.

Like a large Euphrasia, but perennial and the upper lip of the corolla neither revolute nor bilobed.

1. B. alpina L. -- Velvet-Bells -- Floral bracts, calyx and corolla purple, drying almost black, thus reminiscent of a Castilleja, but the leaves opposite. Loosely tufted perennial. Leaves ovate, crenate. Flower up to 2 cm long. First half of summer. Arctic meadows, mainly near water-courses. -- G-K, L-(NF), nQ-nMan, Eur.

Macoun 1884 extends the range by more than 1,000 miles to the mouth of the Mackenzie. The justifying specimen (MTMG) appears to be correctly identified, but it is a collection from J. Anderson and the accuracy of the localities of the latter is open to question (see under Liatris ligulistylis). Since this Mackenzie record has never been confirmed by a later collection, it is now considered erroneous.

21. RHINANTHUS YELLOW RATTLE

Calyx much enlarged, especially in fruit, completely enclosing the capsule, with only a small opening at top, the seeds being first released inside the inflated calyx, hence the rattle effect. Flower galeate, similar to the last few genera.

1. R. Crista-Galli L. (R. borealis (Sterneck) Chabert; R. Kyrollae Chabert) -- Rattle-Box, Rattle-Seed (Claquette, Graines de Boston) -- Flowers yellow and opposite in a somewhat secund raceme, but not very conspicuous, the plant more noticeable in fruit with its rattling raceme of opposite and inflated calices. Annual. Leaves lanceolate, crenate, the lateral nerves obviously ending in the sinuses. Mid summer. Prairies northward and in the mountains. -- G, K-Aka, L-NF-(SPM), NS-BC, nUS, (Eur).

A much subdivided species. We are not yet convinced that any of the proposed segregates is taxionomically significant.

22. PEDICULARIS L. LOUSEWORT

Capsule strongly asymetrical, more or less falcate, opening only or mainly on one side. Calyx regular and 5-lobed to bilabiate. Flowers strongly bilabiate, large and very showy, in terminal racemes which are mostly very dense. The upper lip of the corolla is termed "galea" in this and a few related genera.

a. Galea prolonged into a thin tubular beak at least 2 mm long.
  b. Leaves merely serrulate ..... 15. P. racemosa
  bb. Much more deeply divided.
    c. Flowers purple to red or pink ... 6. P. groenlandica
    cc. White or yellow.
      d. Corolla arched into a half circle ..... 14. P. contorta
      dd. Nearly straight ..... 7. P. lapponica
aa. Not prolonged, merely ending in a broad hood.
  e. Inflorescence diffuse, the flowers mostly axillary ..... 1. P. parviflora
  ee. Flowers in one or more well defined and rather crowded racemes.
    f. Stem leaves subopposite; plant tall and coarse ..... 4. P. lanceolata
    ff. Alternate.
      g. Flowers few, 3.0-3.5 cm long ..... 12. P. capitata
      gg. More numerous and less than 2.5 cm long.
        h. Inflorescence glabrous; flower yellow with a red tip ..... 2. P. flammea
        hh. Variously pubescent ..... Group A

Group A

Inflorescence puberulent or glandular to long lanate. Racemes crowded. Flowers less than 2.5 cm long. Galea not prolonged.

a. Rachis densely retrorse-puberulent, otherwise glabrous in the inflorescence ..... 7. P. lapponica
aa. More pubescent in the inflorescence.
b. Inflorescence bracts ciliate or puberulent.
c. Bracts long ciliate ..... 13. P. bracteosa
cc. Eciliate ..... 11. P. labradorica
bb. Lightly to densely long villous-lanate in the inflorescence.
d. Flower yellow, the gallea ± reddish.
e. Calyx bilabiate, the lips more or less crenate, but the lobes not obvious ..... 5. P. canadensis
ee. Not bilabiate, but with 5 subequal triangular-lanceolate lobes ..... 3. P. Oederi
dd. Flower light to deep pink.
f. Leaves only 1-(3) on an elongated stem ..... 9. P. sudetica
ff. Numerous on a short stem.
g. Inflorescence densely long-lanate; the calyces obscured .. .. 10. P. lanata
gg. Not so densely lanate; at least the dark nerves of the calyx clearly discernable ..... 8. P. Langsdorfii

1. P. parviflora Sm. -- Flower crowded at the tip, but the inflorescence soon elongating and the fruits becoming obviously axillary. Glabrous and purplish annual, usually branchy. Leaves pinnatifid, their ultimate lobes and those of the calyx tending to curl. Calyx laterally bilabiate, the lips irregularly crenate. Flower ± 1.2 cm long, purplish, the galea devoid of beak or subapical teeth. First half of summer. Bogs, rare. -- sK, Aka, cQ-O-(Man)-S-BC, (Eur).

The asiatic plants were recently segregated as P. hyperborea Vved. We have not yet had the opportunity of evaluating this segregate.

2. P. flammea L. -- Red Rattle -- Flower yellow with a deep red tip. Glabrous and less than 2 dm high. Calyx nearly regular and blotched in deep purple. Flower about 1.5 cm long, the galea without beak or subapical teeth. Early summer. Scattered on wet tundra. -- (G)-F-Mack, L-NF, Q-nMan, nwEur.

3. P. Oederi Vahl. var. albertae (Hultén) Boivin (P. flammea AA.) -- Resembles the above, but densely lanate in the inflorescence and somewhat glutinous. Flower bicolour, yellow with a purple red galea. Mid summer. High alpine. -- swAlta

The typical phase occurs to the northwest and differs by its flower monochrome in yellow and its inflorescence glabrous except the ciliate bracts and calices.

4. P. lanceolata Mx. -- A tall and conspicuous prairie species (2)-4-8 dm high, with the stem leaves all or mostly opposite to subopposite. Somewhat long pilose above. Calyx bilaterally bilobed; the lobes ovate and constricted at base. Flower 1.5-2.5 cm long, yellow, the galea prolonged into a short, triangular beak. Second half of summer. Boggy prairies. — O-sMan, US.

5. P. canadensis L. -- Wood-Betony, Chicken's Heads — Calyx obliquely truncate and entire or merely undulate-crenate at margin. Resembles the last, but shorter, 2-4 dm high, and the leaves alternate. Flowers 2.0-2.5 cm long, yellow, the galea with a pair of linear subapical teeth. Late spring and early summer. Around Aspen groves. — sQ-sMan, US, (CA).

6. P. groenlandica Retz. var. groenlandica -- Little Elephant, Elephant's Head -- Beak of the galea very long, upturned, giving the flower an obvious similarity to a small elephant's head, complete with trunk, lower lip and big ears. Glabrous and the whole plant tending to be purplish throughout. Calyx nearly actinomorphic, with 5 deltoid lobes. Flower small, less than 1 cm long, beak excluded. Beak of the galea (the elephant's trunk) 6-10 mm long, strongly incurved. First half of summer. Swampy places northward. — G, seK, swY, L, nQ-BC.

The B.C. material from the Cascades and all the specimens we have examined from the U.S. proved to belong to var. surrecta (Bentham) Gray, somewhat larger-flowered, the beak 10-15 mm long and mostly sigmoid or spirally coiled.

7. P. lapponica L. — Densely retrorse puberulent on the stem and especially so on the rachis of the inflorescence. Otherwise glabrous, less than 2 dm high and most often purplish throughout. Calyx obliquely truncate to laterally bilabiate, the margin entire to crenate or weakly dentate. Flowers few, yellow, about 1.5 cm long, the galea prolonged into a short beak. Early summer. Scattered on the tundra, usually in the better drained situations. — G-Mack-(Y-Aka), nL, nQ-(O)-nMan, Eur.

8. P. Langsdorfii Fischer (P. arctica Br.) -- Very showy herb with a dense raceme of long, deep pink, arched flowers. Closely similar to P. lanata but not so densely lanate. Calyx lobes triangular-lanceolate. Galea with 2 small subapical teeth; the lower lip only about half as long as the galea. Mid summer. Alpine slopes. — (G)-F, Mack-Aka, swAlta-BC.

9. P. sudetica W. — Leaves mostly basal, typically with only one stem leaf. Usually purplish and 1-2-(4) dm high, heavily lanate in the inflorescence, but otherwise glabrous. Calyx lobes 5, lanceolate, unequal in length, the sinuses still more unequal. Corolla 1.5-2.0 cm long, 2-toned, the galea purple-pink to maroon, the lower lip paler, pink to nearly white with purple dots.Galea with a pair of lanceolate subapical teeth.

Early summer. Wet calcareous tundra. -- F-Aka, (nwQ)-nO-nMan, BC, Eur.

10. P. lanata C. & S. — Very showy herb, heavily long lanate throughout, except the basal leaves and pink corollas. Taproot thick and yellow. Mostly 1-2 dm high, the dense and thick inflorescence comprising about half of the plant. Calyx lobes deltoid. Flower 2.0-2.5 cm long. Galea without subapical teeth; the lower lip about as long as the galea. Late spring to mid summer. Mountains, mainly in late snow patches. — G-Aka, nQ, swAlta-BC, (Eur).

11. P. labradorica Wirsing — Very branchy, with yellow flowers fading purplish. Partly puberulent, partly retrorse-pilose. Calyx obliquely cut, its margin more or less undulate. Flower ± 1.5 cm long. Galea with a pair of linear subapical teeth. First half of summer. Northern bogs and tundra. — G-(F)-K-Aka, L, nQ-(O)-nMan-BC, (Eur).

12. P. capitata Adams — Flowers very large, 1/5 to 1/3 the length of the plant. Stems solitary, 1-2dm high, usually leafless, glabrous to pubescent. Flowers few, 3-5 in a short terminal raceme, yellowish-white, often tinged pink. Calyx large, the 5 lobes 4-8 mm long. Galea emarginate at tip, without subapical teeth. First half of summer. Tundra. -- G-Aka, (nQ), swAlta-BC, (Eur).

13. P. bracteosa Bentham var. bracteosa -- Main leaves more or less aggregated towards the middle of the stem. Stem 4-9 dm high, leafless below. Main leaves pinnatipartite to pinnate, the upper ones much smaller, merely dentate. Bracts ciliate, abruptly long acuminate. Calyx tube shorter than the 5 lobes, the latter glandular, linear, very uneven, but less than 10 mm long. Flowers 1.5-2.0 cm long, yellow to purple. Galea without subapical teeth. Mid summer. Mountain woods: Cypress, Rockies. — Alta-BC, nwUS.

In the more western var. latifolia (Pennell) Cronq. the calyx is less pubescent and its tube is longer than the lobes.

14. P. contorta Bentham var. contorta -- Flowers recurved in a half circle. Glabrous except the inner face of the calyx lobes. Stem 2-4 dm high. Raceme lax. Calyx with 5 narrow lobes. Corolla white, drying yellow, lower lip large and ± enwrapping the galea, the latter prolonged into a tubular beak. Mid to late summer. Dry, lower alpine slopes. — swAlta-seBC, wUS.

In the southern Rockies one may encounter a var. ctenophora (Rydb.) Nels. & Macbr., somewhat villous on the calyx and the corolla pinkish or purplish.

15. P. racemosa Douglas var. alba (Pennell) Cronq. — Stem leaves less divided, merely serrate. Glabrous, 2-6 dm high. Raceme poorly defined, the lower flowers axillary. Calyx laterally bilabiate, with only 2 lobes well defined. Corolla 1.0-1.5 cm long, whitish; lower lip rather large, galea strongly arched and prolonged into a recurved beak. Second half of summer. Semi-open and springy places in subalpine forests, rare: Jasper. — swAlta-BC, wUS.

At the longitude of the Cascades it is gradually replaced by the typical pink or purplish-flowered var. racemosa.

On a dot map of Pedicularis hirsuta L. published by Hultén 1958 there is a dot at Churchill, but in 1968 no corresponding specimen could be located at S and we know of none from our area in any other herbarium.

96. OROBANCHACEAE (BROOM-RAPE FAMILY)

Differs from the Scrophulariaceae by its unilocular ovary. Flowers not spurred. Parietal placentation. Parasitic plants devoid of green pigment.

a. Glabrous herb ..... 1. Conopholis
aa. Densely glandular-puberulent ..... 2. Orobanche

1. CONOPHOLIS Wallr. SQUAWROOT

Calyx with (1)-2 partly fused bractlets at base, besides the regular bract. Calyx sinuses asymetrical, the lower deeper than the others. Otherwise rather like the more common Orobanche.

1. C. americana (L.) Wallr. -- Squawroot, Cancerroot -- A simple brownish herb, densely covered with scale-like leaves. Thick, 1-2 dm high, arising from a large woody knot on the root of the host. Inflorescence dense and spike-like. Bracts similar to the leaves. First half of summer. Very rare parasite on woody plants: Rathwell. -- NS-Q-sMan, US.

Our only known collection is in the private herbarium of A. Champagne of Saint-Boniface, a native manitoban and one of the outstanding amateur botanists in our area. The label data read: A. Champagne, Rathwell, sables, 3m. est du vill., parasite sur Juniper et Armoise, 10-10-44 (Champagne).

A range extension to Alaska by Boivin 1967 was based on a collection from Clockwan (GH). With the collaboration of Mr. R.R. Haynes of Lafayette, Louisiana this specimen has now been revised Boschniakia rossica (C. & S.) Fedtsch. Hence the more restricted range given above.

2. OROBANCHE L. BROOM-RAPE

No bractlets on the calyx, but some may be present on the peduncle. Upper and lower sinuses of the calyx about equally deep.

a. Only 1 flower ..... 3. O. uniflora
aa. Flowers numerous.
  b. Plant dark violet; flowers subsessile ..... 1. O. ludoviciana
  bb. Plant orange-brown; peduncles longer ..... 2. O. fasciculata

1. O. ludoviciana Nutt. (Myzorrhiza ludoviciana (Nutt.) Rydb.) -- Deep violet fleshy plant more than half buried next

to its host. Less than 2 dm high. Peduncles bracteolate, very short or the lower sometimes nearly as long as the tube. Mid summer. Dry hills and sand dunes, rather rare parasite, usually on Artemisia frigida. -- swMan-BC, US, (CA) -- F. albinea Boivin -- Flowers white or nearly so. Local: Val-Marie. -- swS.

F. albinea f.n., floribus fere albis. Type: Boivin & Alex 9870, Val-Marie, platières de la coulée du Français, albino, sur Artemisia frigida, 22 juillet 1952 (DAO).

2. O. fasciculata Nutt. (Anaplanthus fasciculatus (Nutt.) Walpers) -- An orange-brown, fleshy herb, usually hiding under its host. Less than 2 dm high. Peduncles bractless, all or at least the lower ones 1-3 times as long as the flower. Calyx purple tinged, its lobes triangular-lanceolate, about as long as or sometimes much shorter than the tube. Corolla yellowish with a pink tinge and pink nerves. Early summer. Uncommon parasite, nearly always on Artemisia frigida. -- Y, O-BC, US, (CA).

On rare occasions we have come across some white or nearly white individuals. These darken in drying and in the herbarium this albino looses much of its distinctiveness. On that account we have not found it practical to accord taxonomic recognition to the albino form.

3. O. uniflora L. -- Cancerroot -- Strikingly unusual herb reduced to a brownish peduncle and a single terminal flower. Less than 2 dm high and usually in small tufts. Stem very short, more or less buried, bearing a few reduced leaves. Calyx lobes variable. Corolla 1.5-3.0 cm long, yellowish to purple or blueish. Late spring to mid summer. Rocky slopes and edge of woods; very rare parasite. -- (Y-Aka), NF-SPM, NS-(PEI)-NB-O, swS-swAlta-BC, US.

97. LENTIBULARIACEAE (BLADDERWORT FAMILY)

Like the last, ovary unilocular, but the flower spurred. Placentation basal.

a. Terrestrial with blueish flowers ..... 1. Pinguicula
aa. Aquatic with yellow flowers ..... 2. Utricularia

1. PINGUICULA L.

Leaves sticky above in the manner of a fly-paper in which the insects get stuck to be eventually digested, often with the help of the involute margin.

a. Stem villous below ..... 3. P. villosa
aa. Finely glandular-puberulent; flower larger.
  b. Upper lip of the calyx trilobed, lower lip bipartite ..... 1. P. vulgaris
  bb. Upper lip trifid, lower lip somewhat more deeply bifid; flower larger ..... 2. P. macroceras

1. P. vulgaris L. -- Butterwort, Bog-Violet (Grassette, Langue d'oie) -- With a general resemblance to a Violet, but the petals fused. Stemless herb with a rosette of glistening, entire, elliptic leaves. Scape less than 2 dm high, recurved at tip over the single hanging flower. Corolla (including spur) (1.2)-1.5-(1.8) cm long, abruptly contracted into a linear and somewhat deflexed spur 4-6 mm long. Fruit about twice as long as the calyx. Early summer. Mud flats and mossy bogs northwards and in the mountains. -- G-(F)-K-Aka, L-SPM, NS, NB-BC, US, Eur.

2. P. macroceras Link -- Like the last but the calyx lobes less uneven and the corolla somewhat larger. Corolla 2.0-3.0 cm long, more gradually tapering into a direct spur 5-10 mm long. Fruit about as long or slightly shorter than the calyx. Early summer. Wet mossy places in the mountains. -- Y-Aka, swAlta-BC, (nwUS, eEur).

In the field this species may seem to be only a larger form of P. vulgaris and on this account is often lumped with the latter, but on closer examination there is ample morphological basis for the distinction and the discontinuity is obvious either in flower or in fruit.

3. P. villosa L. -- Only half as large as the above two. Stem villous below, glandular-puberulent above. Flower 7-8 mm long. First half of summer. In moss and Sphagnum hummocks of tundra and subarctic bogs. -- K-Aka, L, nQ, nMan-S-(Alta-BC), Eur.

2. UTRICULARIA L. BLADDERWORT

Aquatic and mud plants with emerged yellow flowers and submerged and finely dissected leaves which bear small, bladder-like, plankton traps.

a. Leaves and bladders minute and not readily observed ..... 4. U. cornuta
aa. Leaves finely dissected, submerged.
  b. Leaves and bladders borne on separate branches ..... 3. U. intermedia
  bb. Bladders mixed with the leaves or borne on them.
    c. Leaves and flowers less than 1 cm long ..... 2. U. minor
    cc. Much larger ..... 1. U. vulgaris

1. U. vulgaris L. var. americana Gray (U. macrorhiza LeConte) -- (Millefeuille des marais) -- Much in evidence when it covers the water of sloughs with a multitude of yellow, spurred flowers. Flowering shoot erect, bearing a raceme of flowers above the water. Leafy shoots free floating just below the surface of the water. Leaves divided into filiform segments, bearing numerous bladders, the latter commonly 3 mm long. Mid summer. Stagnant but non-alkaline waters. -- K-Aka, L-SPM, NS,

NB-BC, US, (CA).

For a discussion of the value of this cisatlantic variant, see Rhodora 43: 642-5. 1941 and also Boivin 1960 for the opposite view. In the transatlantic typical var. vulgaris the corolla spur is conic, straight or slightly incurved, gradually tapered and rounded at tip. With some allowance for an occasional intermediate, our cisatlantic plants may be recognized by their spur being infundibuliform, asymetrical and abruptly contracted into a falcate to strongly recurved and acute tip.

2. U. minor L. -- Like a diminutive form of the first. Sterile shoots creeping on the surface of the mud in shallow waters. Leaf segments flat, the main ones about 0.5 mm wide, the ultimate ones tapered, 0.2-0.3 mm wide at the base. Mid summer. Boggy waters northward. -- (G), K-Aka, L-(NF)-SPM, NS-BC, US, Eur.

2.X U. ochroleuca R. Hartman -- Hybrid of the following and rather neatly intermediate. Leaf segments irregularly divided, the ultimate ones rather elongate but little narrower, irregularly denticulate. Branches dimorphic, as the next, but with a few bladders scattered among the leaves and a few reduced leaves scattered among the bladders. Local: Churchill. -- G, K-Mack, Aka, NE, Q-Man, CB, Eur.

3. U. intermedia Hayne -- Ultimate segments minutely denticulate, linear-oblong, 0.2-0.5 mm wide. Like the last but the leaves and bladders segregated on separate branches. Flower 1.0-1.5 cm long. Mid summer. Shallow waters of boggy pools. -- G, K-Aka, L-SPM, NS, NB-BC, US, Eur.

4. U. cornuta Mx. -- Gillflower -- Seemingly reduced to (1)-2-(3) flowers on a scape and a shallow taproot. If carefully dug up, the taproot prooves to be branched and bears filiform leaves and minute bladders. Flowers 1.5-2.0 cm long. Mid summer. Peaty shores, rare: Petits Poissons River. -- L-SPM, NS, sMan-nwS, US, (CA).

An earlier report by Lowe 1943 was discounted by Scoggan 1957 as unsubstantiated. Our Manitoba report is based on the following more recent collection: A. Champagne, Sainte-Geneviève, savanne aux Sarracénies, aux sources de la rivière des Petits Poissons, 6 août 1958 (DAO). And the Saskatchewan record on G. W. Argus 461 - 62, vicinity of "Little Gull" Lake, lat. 59°01'N, long. 109°W, bog islands, 11 July, 1962 (DAO, SASK).

98. MARTYNIACEAE (UNICORN-PLANT FAMILY)

Flower zygomorphic and the capsule unilocular like the last two families, but neither carnivorous nor parasitic, the herbage green, the flower not spurred and the placenta parietal.

1. PROBOSCIDEA Schmid UNICORN-PLANT

Corolla tube short-ellipsoid. Fertile stamens 4.

1. P. LOUISIANICA (Miller) Thell. -- Unicorn-Plant, Ram's Horn (Cornaret, Corne du diable) -- Fruit very long and deeply bifid. A tall and coarse herb abundantly glandular-pubescent and glutinous. Leaves opposite, cordate and rather large, somewhat like small rhubarb leaves. Flowers up to 5 cm long, yellowish-white, in a terminal raceme. Fruit about 1 dm long, tapered at both ends. First half of summer. Rare garden weed, appearing as an impurity in seed: Nipawin. -- O, S, US, (CA).

Order 53. GERANIALES

A basic type, much as in the Caryophyllales, the floral parts in 5's and free except for the carpels. But the seeds only 1 or 2 per carpel and the leaves alternate or/and variously cut.

a. Flowers strongly zygomorphic ..... 102. Balsaminaceae
aa. Quite regular.
  b. Leaves entire ..... 99. Linaceae
  bb. Leaves toothed to compound.
    c. Leaves simple or pinnate ..... 100. Geraniaceae
    cc. Trifoliate ..... 101. Oxalidaceae

99. LINACEAE (FLAX FAMILY)

Each carpel maturing two seeds, splitting in 2 halves at maturity.

1. LINUN L. FLAX

The basic and unspecialized type of the family.

a. Flowers blue or white.
  b. Flowers erect and more or less axillary ..... 1. L. usitatissimum
  bb. Peduncles spreading or recurved; flowers in more or less secund racemes ..... 2. L. perenne
aa. Yellow.
  c. Styles fused except at tip; capsule somewhat retuse at tip ..... 3. L. rigidum
  cc. Styles free except at base; capsule abruptly short acuminate ..... 4. L. sulcatum

1. L. USITATISSIUM L. -- Flax, Linseed (Lin) -- A blue-flowered field crop. Stiffly erect glabrous annual. Leaves narrow, entire, alternate, with 3 parallel nerves. Flowers nodding in bud, soon erect, axillary at alternate nodes of the branches. Petals 1.0-1.5 cm long. Early summer. Casual on roadsides, etc. -- Mack, Aka, NF, NS-BC, US, Eur -- F. LEUCANTHUM Maly -- Flowers white. Infrequent. -- S, (Eur).

2. L. perenne L. var. Lewisii (Pursh) Eaton & Wright (L. Lewisii Pursh) -- Much like the first. Tufted perennial, (2)-4-(6) dm high with ascending stems. Flowers blue, spreading to

reflexed on the lower side of the branches. Fruit 5-7 mm wide, slightly longer than broad. Late spring and early summer. Steppes and hillsides. -- (swF), Mack-Aka, Q-BC, US, (CA) -- F. albiflorum Cock. -- Flowers white. Local. -- Alta -- Var. Lepagei Boivin (L. Lepagei Boivin; L. Lewisii Pursh f. Lepagei (Boivin) Lep.) -- Generally smaller and white-flowered. Stems 1-3 dm high. Fruit about 4 mm long, less than 5 mm wide. Inflorescence often not clearly secund. Mid summer. Sandy seacoasts. -- seK, nO-nMan.

Var. Lewisii is commonly ranked as a distinct species from L. perenne, but as pointed out by Hitchcock 1961, the morphological justification is not very impressive. In the eurasian var. perenne the flowers are dimorphic; some have styles only 1.5-2.5 mm long and overtopped by the stamens, others have styles 4-7 mm long and overtopping the stamens, and the flowers are erect or nearly so. In another eurasian variant which also occurs as a rare adventive in Ontario, var. austriacum (L.) Schiede, the inflorescence is more like that of our var Lewisii. The latter differs from the two eurasian types by its flowers all alike, the styles 4-8 mm long and much overtopping the stamens.

Plants from the Hudson Bay coasts are generally smaller and have consistently smaller and more depressed fruits. They are also all white-flowered except one collection (f. Baldwinii) from Long Island which is just as blue-flowered as the widespread prairie variant (var. Lewisii). Apart from its flower colour, this Long Island collection is quite typical of var. Lepagei, being smallish, only 2 dm high or less, and small-fruited, and may be known as: L. perenne var. Lepagei f. Baldwinii f.n., floribus coeruleis. Type: W.K.W. Baldwin 1768, Long Island, east shore, July 25-28, 1949 (Sherbrooke). Isotype at CAN. The report of var. Lewisii from Keewatin by Boivin 1967 was based on f. Baldwinii.

While we are here treating var. Lepagei as a variety, we consider it to be a marginal case within our concepts of species and variety; it could have been retained quite justifiably as a weak species. Var. Lepagei is distinguished by one constant character (fruit size and shape), one pretty nearly constant character (flower colour) and one overlapping character (overall plant size). It is also ecologically specialized to seashores.

3. L. rigidum Pursh var. rigidum (L. compactum Nelson; Cartholinum compactum (Nelson) Small; C. rigidum (Pursh) Small) -- Yellow Flax -- Annual with yellow flowers opposite the leaves or terminal. Very branchy. Sepals 4 mm long or more, all or mostly gone by fruiting time, glandular-serrulate with yellow glands. Petals very fugaceous. Capsule 4-5 mm long, slightly retuse at summit, splitting into 5 segments acute at tip. First half of summer. Wind eroded or freshly disturbed soils. -- sMan-Alta, US.

The stem in our plants is glabrous above, scabrous or lightly puberulent towards the base. In the more southern and

more puberulent var. Carteri (Small) C.M. Rogers the stem is scabrous or puberulent on the angles from base to top.

4. L. sulcatum Riddell var. sulcatum (Cartholinum sulcatum (Riddell) Small) -- Like the last. Branching near the top only. Sepals 2.5 mm long or more, still present in fruit. Capsule ± 3 mm long, its 10 segments abruptly short acuminate at tip. Second half of summer. Sandy soils. -- Q-sMan, US.

Despite various reports to the contrary, all yellow-flowered Saskatchewan specimens examined proved to belong to L. rigidum.

Our plants are perhaps to be contrasted with a Floridan var. Harperi (Small) C.M. Rogers in which the flowers are reportedly gathered in somewhat racemiform inflorescences.

100. GERANIACEAE (GERANIUM FAMILY)

Type of fruit rather unique, at dehiscence suggesting a multi-pronged fishhook. The tip of the ovary is prolonged into a very long beak and at maturity each carpel separates longitudinally from the column for most of its length, but remains attached at the top. When dry, each carpel coils upward and its single seed may then be liberated.

a. Leaves simple ..... 1. Geranium
aa. Leaves compound ..... 2. Erodium

1. GERANIUM L. CRANESBILL

Leaves simple, palmately lobed. Style column not twisted.

a. Perennials with flowers over 2 cm wide.
  b. Flowers white ..... 3. G. Richardsonii
  bb. Pink or mauve.
    c. Leaves evenly pubescent below...2. G. viscosissimum
    cc. Pubescent only along the nerves .... 1. G. pratense
aa. Annuals or biennials; flowers much smaller.
  d. Sepals small and merely acute at tip ... 6. G. pusillum
  dd. Abruptly contracted at tip into an acicular point 2-4 mm long.
    e. Pedicels longer than the calyx, some of them at least twice longer ..... 4. G. Bicknellii
    ee. Shorter, some or all of the pedicels shorter than the calyx ..... 5. G. carolinianum

1. G. pratense L. var. erianthum (DC.) Boivin (G. erianthum DC.) -- Like the next. Stem densely recurved-puberulent. Peduncles with dense, short, recurved hairs mixed with much longer spreading and glandular ones, the glands blackish. Mid summer. Montane prairies. -- Y-Aka, swAlta-nBC, eEur.

In ours the pedicels are 0.5-1.5 cm long and the filaments are long pilose in their lower half. The typical eurasian phase

is sporadically naturalized east of us and it may be distinguished by its pedicels being more variable, 0.5-2.5 cm long, their villosity not so long, and its filaments less pubescent, being merely ciliate along the dilated base.

Geranium pratense L. was collected by J.F. Higham in 1920 at Winnipeg. The label carries the acronym M.A.C., an abbreviation for Manitoba Agricultural College and there is nothing to suggest that this plant was not a cultivated ornamental. It is the basis for the Manitoba report by Scoggan 1957. This cultivated ornamental has sometimes been found as an escape in the east and it might also turn up in southern Manitoba.

2. G. viscosissimum F. & M. (var. nervosum (Rydb.) C.L. Hitchc.; G. nervosum Rydb.) -- Showy herb, less than 1 m high, with a corymbose inflorescence and large cherry-pink flowers. Stem hirsute and glandular-puberulent. Inflorescence densely glandular-pubescent, the hairs very uneven in length and the glands yellowish. Mid summer. Lower montane and foothill prairies. -- S-sBC, US -- F. album (Suksd.) St John -- Flowers white. Not to be confused with the next species with a very different type of pubescence. Local: Calgary. -- Alta-BC, (US).

Frequent in western Alberta, also occurring in the Touchwood and Cypress Hills.

3. G. Richardsonii Fischer & Trautv. -- Flowers large and white. Stem glabrous below, lightly reflexed-strigose above. Inflorescence densely glandular-villous, the hairs with a purplish head. Mid summer. In and around deciduous woods, mainly in the foothills and lower altitudes. -- wMack-Y, swS-BC, US.

4. G. Bicknellii Britton -- A very branchy annual with sepals (like most of our species) abruptly contracted into a subulate tip 2 mm long or more. Stem hirsute, becoming glandular pubescent in the inflorescence, the hairs with clear or yellowish heads. Petals pink, 5-6 mm long. Summer. Frequent, mainly on disturbed soils. -- Mack-Aka, NF, NS, NB-BC, US.

5. G. carolinianum L. var. sphaerospermum (Fern.) Breitung (var. confertiflorum AA.; G. sphaerospermum Fern.) -- Sepals rather broad, broadly ovate to suborbicular and becoming (4)-5-7-(8) mm wide in fruit. Stem and branches recurved-pubescent to reflexed-strigose, the pedicels often glandular-pubescent. Pedicels less than 1 cm long. Summer. Shores, granite outcrops, open woods and disturbed soils, sometimes weedy. -- O-BC, US.

The sepals are ± dimegueth and in our variety, the common and wide ranging one in Canada, the outer sepals are larger, ovate to suborbicular, enlarging in fruit up to (4)-5-7-(8) mm wide. The more southern typical phase barely enters Canada both east (Point Pelée) and west of us; its sepals are not so obviously dimegueth and they are narrower, being elliptic, and enlarging only up to 4-5-(6) mm in fruit; also the seeds are not quite so plump.

As will be noticed, there is a fair amount of overlap in

sepal width and in both varieties they enlarge in fruit; taxonomic distinctions based primarily on these characters would be difficult to implement. Our taxonomic distinction rests primarily on the broader shape of the sepals of our common variety.

6. G. PUSILLUM L. -- Fruit shortest, less the 1.5 cm long. Stem densely recurved puberulent, passing to densely glandular-puberulent in the inflorescence. Sepals 2-4 mm long. Stamens only 5. Summer. Rare and evanescent weed of disturbed soils: Brandon. -- Q-sMan, BC, US, Eur.

Most earlier reports of G. Robertianum L. from Manitoba were discounted by Scoggan 1957, but another report by Anderson 1949 is still to be investigated; yet it may have been based on nothing more than some earlier report discounted by Scoggan.

2. ERODIUM L'Hér. STORK'S BILL

Leaves pinnate. Column and carpels becoming spirally twisted and tangled when dry at maturity. Otherwise like Geranium, including the subulate tip of the sepals.

1. E. cicutarium (L.) L'Hér. -- Filaria, Pin-Clover (Aiguillettes, Herbe à la fourchette) -- Pedicels becoming reflexed at base and geniculate under the erect fruit. Villous and more or less glandular-pubescent throughout. Leaflets opposite, lyrate-pinnatifid. Umbels on very long peduncles and very much overtopping the foliage. Filaments petaloid. Mid to late summer. Infrequent but conspicuous weed. -- (Aka), L, (NS), NB-BC, US, CA, SA, Eur, Oc.

101. OXALIDACEAE (WOOD-SORREL FAMILY)

A primitive type of Geraniales, the carpels containing many seeds and loculicid at maturity. Leaves alternate or basal and trifoliate. Leaflets obcordate.

1. OXALIS WOOD-SORREL

Our only genus.

1. O. CORNICULATA L. (O. Dillenii Jacq.; O. europaea Jordan; O. stricta L.; Xanthoxalis Bushii Small; X. stricta (L.) Small) -- Yellow Sorrel, Sheep's Clover (Pain d'oiseau, Surette) -- Rather suggesting a Clover with its trifoliate leaves and obcordate leaflets, but the flowers regular and in few-flowered umbels. Leaflets entire, somewhat reflexed. Flowers yellow. Capsule erect on a spreading pedicel. Summer. Casual weed of disturbed soils, sometimes in woods. -- (Aka), NF, NS-BC, US, CA, (SA), Eur, Oc.

Reputedly partly native in North America, but in our experience it always seems to occur as an invader in man-made disturbances.

Quite variable and commonly subdivided into a variable number of microspecies. Small recognized 10 in 1907, but this was reduced to five by Wiegand in 1925. In 1950 Fernald also

recognized 5, but this was reduced to 3 by Gleason in 1952; the same number as Eiten in his 1955 and 1963 monographs. The characters emphasized vary from author to author, but they are mainly the pubescence, the root system, the habit, the type of inflorescence and the angle of the pedicels. Within the primary area of our studies we were unable to sift out any meaningful segregate by the means of said characters or of their various recombinations. We are therefore still unconvinced that any of the proposed segregates could be taxonomically significant.

102. BALSAMINACEAE (BALSAM FAMILY)

Flower very irregular, shaped like a "horn of plenty" and apparently made up of 6 separate parts, 3 of which are petaloid sepals, the other 3 are partly fused petals.

1. IMPATIENS L. TOUCH-ME-NOT, JEWEL-WEED

Fruit an explosive capsule which will, when touched at maturity, open abruptly and throw its seeds.

a. Flower orange ..... 1. I. capensis
aa. Pale yellow and larger ..... 2. I. Noli-tangere

1. I. capensis Meerburg (f. immaculata (Weath.) Fern. & Schub.; I. biflora Walter) -- Balsam, Touch-me-not (Chou sauvage) -- Peduncle of the inflorescence twisted around the petiole so the raceme hangs below the leaf. Very soft and juicy stem, very shallowly rooted. Flower drooping, 2.0-2.5 cm long, variable in colour, usually pale orange and often spotted in purple-brown. Spurred sepal 1.2-1.6 cm long, abruptly contracted into a spur 7-10 mm long and recurved under the sepal. Mid summer to mid fall. Wet and shaded places, preferably if exundated. -- swMack, Aka, NF-(SPM), NS-BC, US.

2. I. Noli-tangere L. (I. occidentalis Rydb.; I. pallida AA.) -- Touch-me-not (Herbe Sainte-Catherine, Pétard) -- Like the last, but the flower larger, 2.5-4.0 cm long, paler, also dotted. Spurred sepal 1.8-2.5 cm long, gradually tapered into a recurved spur ± 10 mm long. Summer. River shores and low, wet woods. -- Aka, (Man)-S-BC, (US), Eur.

Order 54. POLEMONIALES

Ovary typically 3-locular, the flower otherwise 5-merous with fused sepals and petals and 5 stamens alternating with the petals.

a. Ovary 3-locular; leaves mostly opposite ..... 103. Polemoniaceae
aa. Unilocular; leaves alternate ..... 104. Hydrophyllaceae

103. POLEMONIACEAE (POLEMONIUM FAMILY)

The typical family, the fruit a 3-locular capsule.

a. Leaves simple and entire.
  b. Leaves all or mainly opposite, at least those from the middle and lower part of the stem ..... 1. Phlox
  bb. Alternate ..... 2. Collomia
aa. Deeply dissected to compound.
  c. Leaves palmatifid ..... 3. Linanthus
  cc. Pinnately divided.
    d. Leaves pectinately dissected into very narrow segments ..... 4. Navarretia
    dd. Pinnately divided into well defined leaflets ..... 5. Polemonium

1. PHLOX L. PHLOX

Calyx tube with green ribs and hyaline internerves. Filament inserted at various levels on the corolla. Much resembling the Caryophyllaceae, but both the sepals and petals fused.

a. Annual; upper stem leaves alternate ..... 2. P. gracilis
aa. Perennial; all stem leaves opposite
  b. Tufted, 2-8 dm high ..... 1. P. pilosa
  bb. Cushion-forming and only 1 dm high or less.
    c. Calyx densely glandular-pubescent ..... 2. P. alyssifolia
    cc. More or less arachnoid ..... 3. P. Hoodii

1. P. PILOSA L. var. FULGIDA Wherry -- Sweet Williams -- Showy herb, better known as a garden plant. Pubescent, becoming densely villous above. Inflorescence a small terminal cyme. Flower colour variable. Calyx lobes very long attenuate, much longer than the tube. Corolla with a thin and long tube and large and spreading lobes. Early summer. Locally escaped from cultivation: Winnipeg. -- sMan, US.

It is very doubtful if the range of this species actually extends as far west as Saskatchewan as given by Fernald 1950.

The typical phase is densely glandular-pubescent in the inflorescence; it barely enters Canada, being known only from Amherstburg, near Windsor in southwestern Ontario.

2. P. gracilis (Hooker) Greene var. gracilis (Microsteris gracilis (Hooker) Greene) -- Upper stem leaves alternate, the middle and lower opposite, otherwise quite similar to the much more common and somewhat larger Collomia linearis. Branched in the upper part. Stem leaves glabrous or somewhat ciliate towards the base. Densely (glandular-) pilose in the inflorescence, the stem becoming gradually glabrous towards the base. Calyx green on the lobes and the nerves, hyaline on the fragile internerves. Corolla 8-15 mm long. First half of summer. Dry gravelly soils in open places, mostly hillsides; rare: Rockies. -- Y-(seAka), swAlta-sBC, US.

In the more western var. humilior (Hooker) Boivin, the stem is branched to the base and the flowers are somewhat smaller, the corolla 5-10 mm long.

3. P. alyssifolia Greene -- A very pungent perennial forming loose cushions or tufts. Leaves 1.0-2.5 cm long, long ciliate, marcescent, very stiff due to a marginal thickening, ending in a short but sharp, whitish point. Flower terminal, or axillary from a subterminal node. Late spring or early summer. Exposed rocky ridges, rare. -- swS-sAlta, US.

4. P. Hoodii Rich. -- Forming small dense cushions covered with white flowers. Herbage ± arachnoid. Leaves less than 1 cm long, somewhat pungent and with a white and thickened margin. No stipules. Flowers single at the end of the numerous branches. Spring. Common and showy on steppes and dry hillsides. -- (Mack)-Y-(Aka), swMan-Alta-(BC), US.

The habitally very similar Paronychia is merely puberulent and has very long, membranous stipules.

A collection from the Handhills is more lax, nearly glabrous, larger-flowered, etc., and is somewhat transitional to P. caespitosa Nutt., not otherwise known from our area.

2. COLLOMIA Nutt.

Calyx of uniform texture. Leaves alternate. Otherwise as in Phlox.

1. C. linearis Nutt. (Gilia linearis (Nutt.) Gray) -- Flower very narrow, about 1 cm long, but the tube 1 mm wide or less and the lobes only 1 mm long. Annual and usually virgate. Herbage densely puberulent, becoming ± glandular in the inflorescence. Calyx two-toned, the lobes green, the tube much paler, nearly white. Summer, mostly just before mid summer. Frequent in open places, especially if disturbed, or wind-eroded, or flooded in spring. -- Mack-Aka, NS-BC, US.

Native with us, but only a weedy adventive further east.

3. LINANTHUS Bentham

Leaves palmatifid. Seed becoming mucilaginous when wet. Otherwise as in Phlox.

1. L. SEPTENTRIONALIS Mason (L. Harknessii AA.) -- Leaves opposite, sessile and palmatipartite into linear segments. Small annual with small flowers on long peduncles. Late spring to mid summer. Wind-eroded steppes; introduced at Nashlyn and Medicine Hat. -- swS-sBC, US.

Native west of us.

4. NAVARRETIA R. & P.

Leaves alternate and finely dissected. Calyx lobes unequal in length.

1. N. minima Nutt. var. minima (N. intertexta (Bentham)

Hooker var. propinqua (Suksd.) Brand) -- Small pungent annual herb. Leaves bipectinatipartite into stiff and sharp pointed segments. Larger calyx lobes tripartite in the manner of the leaves. Early summer. Arroyos and playas. -- swS-sBC, US.

The other variety in Canada is var. intertexta (Bentham) Boivin which reaches its northern limit of range at Victoria, a larger plant mostly 1.0-2.5 dm high, more densely villous in the inflorescence and larger-flowered, the corolla 7-11 mm long and exserted beyond the tip of the calyx lobes.

5. POLEMONIUM JACOB'S LADDER

Similar to Phlox, but the flower slightly irregular, the stamens being deflexed towards the lower side. Leaves pinnately divided into discrete leaflets.

a. Leaflets seemingly fasciculate or verticillate ..... 3. P. viscosum
aa. Opposite to subopposite.
  b. Corolla lobes finely ciliate ..... 1. P. acutiflorum
  bb. Corolla glabrous; plant smaller ..... 2. P. pulcherrimum

1. P. acutiflorum W. (P. caeruleum L. ssp. occidentale (Greene) J.F. Davidson; P. occidentale Greene) -- Virgate perennial with pinnate leaves and large blue flowers in a thyrsoid or narrowly paniculate inflorescence. 3-12 dm high. Glabrous below, densely glandular-puberulent above. Leaflets lanceolate, mostly 1-2 cm long. Corolla lobes 1.0-1.5 cm long, ciliate or cilolate, ± pubescent dorsally, 2-3 times longer than the tube. First half of summer. Willow or Birch thickets at low altitudes. -- Mack-Aka, wAlta-BC, Eur.

2. P. pulcherrimum Hooker var pulcherrimum -- Generally smaller than the last and more branchy. 1-3 dm high, branched at least in the upper half. Leaflets all free, mostly 3-8 mm long and 5 mm wide or less, mostly suborbicular to elliptic. Corolla lobes 4-8 mm long, glabrous, generally shorter than the tube. Mid spring to mid summer. River gravels and rocky exposures in the mountains. -- Mack-(Y-Aka), sAlta-BC, (US).

The more western var calycinum is a generally larger plant, 2-5 dm high; its larger leaflets are 1-3 cm long, 0.5-1.0 cm, and the last 3 are ± connate at base; calyx lobes generally longer than the tube. We know it only from lake Oosta and Mount Alpine, both a DAO.

3. P. viscosum Nutt. var. viscosum -- Primary leaf-segments digitately divided into 2-4 sessile leaflets, hence the pseudoverticillate condition of the leaflets. Glandular-pubescent throughout. Flowers blue, rather large, in a somewhat congested terminal inflorescence. First half of summer. High alpine on rock slides in Waterton. -- swAlta-BC, US -- F. leucanthum L. Williams -- Flowers white. Waterton. -- swAlta-

swBC, US.

The more southern var. mellitum (Gray) stat. n., P. confertum Gray var. mellitum Gray, Proc. Ac. Nat. Sc. Phil. 15:73. 1853, is a more southern plant known from the Black Hills and from the Rockies, distinguished by its yellow flowers in a more elongated inflorescence.

Gilia aggregata (Pursh) Sprengel and G. congesta Hooker were both reported for Saskatchewan and Alberta by a variety of authors, and as recently as Budd 1957 and 1964. However Breitung 1959 has pointed out his inability to locate justifying specimens and we have had a similar experience. Neither was represented at SCS in 1967 and 1968.

104. HYDROPHYLLACEAE (WATERLEAF FAMILY)

Ovary reduced from the last to 2 carpels and only 1-2-locular. Flowers solitary or in cymes, often scorpioid cymes as in the Boraginaceae.

a. Flowers all or mostly solitary.
  b. Leaf lobes entire ..... 2. Nemophila
  bb. Remotely dentate ..... 3. Ellisia
aa. In scorpioid cymes.
  c. Leaves palmately lobed ..... 5. Romanzoffia
  cc. Entire or dentate to pinnately divided.
    d. Inflorescences strongly secund and recurved, the main axis distinct ..... 4. Phacelia
    dd. More or less symetrical, lacking a main axis and rather dichotomously branched ..... 1. Hydrophyllum

1. HYDROPHYLLUM L. WATERLEAF

Capsule unilocular. Otherwise resembling Phacelia.

1. H. capitatum Douglas var. capitatum -- Typically an herb with a single pinnatipartite leaf overtopping the globular inflorescence. Sometimes with 1-2 additional leaves and/or inflorescences. Hirsute throughout, including the purplish corolla. Stamens long exserted, purplish-black. Late spring and early summer. Exposed places at middle altitudes. -- swAlta-sBC, US.

In two other varieties from western U.S.A., var. alpinum Watson and var. Thompsonii (Peck) Const., the inflorescence equals or overtops the foliage.

Reports of H. viginianum L. from Manitoba are doubtful at best. There was no corresponding sheet at GH in 1965. The only relevant sheet found was formerly at the Rust Research Laboratory at Winnipeg, (now at DAO), a collection by Wallace, Selkirk, open woods, 1946. According to persons connected with this collection, there is some doubt about the correctness of

the labels of the Wallace collections and some specimens with Manitoba localities may actually have been collected in Minnesota. Selkirk is not a locality where isolated stations are commonly found and it is so far away from the rest of the range that unless and until confirmed by a later collection, this Selkirk report should be held as doubtful.

2. NEMOPHILA Nutt. BABY-BLUE-EYES

Like the next but the calyx with 10 dimegueth lobes, the smaller ones sharply reflexed.

1. N. breviflora Gray -- Solitary flowers borne opposite the leaves on reflexed pedicels. Leaves alternate, pinnatipartite. Calyx very long hispid-ciliate, otherwise glabrous. First half of summer. Mostly disturbed soil in the mountains: Waterton. -- swAlta-sBC, US.

3. ELLISIA L.

Flower solitary or mostly so.

1. E. nyctelea L. -- Aunt Lucy (Bois côtelet, Bois à côtelettes) -- Flowers partly opposite the leaves like the last, partly in terminal bractless racemes, partly axillary. Leaves opposite below, alternate above, pinnatipartite. Calyx ciliate and hispid dorsaly, enlarging in fruit. Capsule hispid. Early summer. Damp shaded places and disturbed soils. -- sMan-sAlta, US.

4. PHACELIA Juss. SCORPION-WEED

Flowers in scorpioid cymes similar to those in the Boraginaceae, that is the flowers are secund on a well defined and ± recurved main axis or on its branches. Calyx-lobes only slightly fused at base.

a. Leaves suborbicular, broadly dentate.. 8. P. campanularia
aa. More elongate and either more deeply cut or entire.
  b. Leaves entire or merely with 1-2 pairs of lobes.
    c. Virgate annual with linear leaves..1. P. linearis
    cc. Tufted perennial with lanceolate leaves ..... 2. P. hastata
  bb. More elaborately cut.
    d. Leaves compound, with pinnatipartite segments ..... 6. P. tanacetifolia
    dd. Simple or the lower ones partly pinnate at base.
      e. Perennial and not glandular or inconspicuously so on the calyx.
        f. Leaves pinnatipartite, the segments linear ..... 3. P. sericea
        ff. Leaves pinnatifid, the lobes triangular to broadly lanceolate ..... 4. P. Lyallii

ee. Annual or biennial; glandular throughout.
g. Corolla whitish and glabrous ..... 5. P. thermalis
gg. Bluish-mauve, larger and pubescent externally ..... 7. P. Franklinii

1. P. linearis (Pursh) Holz. -- Annual with most leaves tripartite into widely spreading linear lobes. Leaf sometimes with 5 lobes, the nervation reduced to 1 nerve per lobe. Anthers about level with the top of the blue corolla. Early summer. Dry open slopes at low altitude. -- swAlta-sBC, US.

There is at DAO a series of collections by R.H. White and R.M. White, (such as one P. linearis labeled Calgary) with toponyms that are more likely to represent mailing points rather than places of collection.

2. P. hastata Douglas (var. leucophylla (Torrey) Cronq.; P. heterophylla AA.; P. leptosepala Rydb.) -- Leaves with conspicuous and nearly parallel nerves imbeded in the soft pubescence. Densely villous or hispid throughout. Leaves entire or some of them with a subbasal pair of lobes or leaflets. Flowers crowded and secund in many circinate cymes. Corolla white to pink. Mainly mid summer. Open places in the mountains. -- swAlta-sBC, US.

3. P. sericea Gray var. sericea -- Perennial with leaves dissected into linear segments, (1)-2-3-(4) dm high. Leaves pinnatipartite to nearly bipinnatipartite, grayish pubescent, the segments 1-2-(3) mm wide, ± linear, obtusish to rounded at tip. Flowers in a dense thyrse of circinate cymes. Filaments long exerted and usually darker than the corolla. Late May to mid spring. Gravel ridges, rocky outcrops and talus slopes at all altitudes. -- swAlta-BC, wUS.

Some Canadian specimens are more or less intermediate to the otherwise more southern var. ciliosa Rydb., taller and larger-leaved, the segments 3-5 mm wide, rather lanceolate and acute at tip. Canadian reports of var. ciliosa and of P. idahoensis for Alberta and westward were apparently based on specimens of var. sericea (DAO, etc.). There is also west of us a var. caespitosa Brand, smaller and its leaves less dissected, the primary lobes entire or nearly so. The latter was reported for Yukon by Porsild 1951, but the relevant specimen was referred to P. mollis Macbr. by Gillett 1960.

4. P. Lyallii (Gray) Rydb. -- Like the last but the leaves less dissected and the segments broader. Pubescence not so dense and longer, the foliage green. Inflorescence short, often corymbose. Mid summer. Alpine talus slopes in Waterton. -- swAlta-seBC, nwUS.

5. P. THERMALIS Greene (P. glandulifera AA.) -- Calyx enlarging at maturity, the veins reticulate, conspicuous and much thickened, especially the marginal one. Annual, hirsute and densely glandular throughout. Rosette of very few leaves.

Stem leaves partly pinnatifid, becoming pinnate towards the base. Flower small, ± 4 mm long, barely overtopping the calyx. (Summer?). Rare weed from the levee of an irrigation ditch: Val-Marie. -- swS, US.

6. P. TANACETIFOLIA Bentham -- Leaves very much divided, pinnate, the primary segments pinnatipartite, the secondary ones dentate to pinnatifid. Annual, hirsute, the stem lightly retrorse-hirsute. Flowers light pink. All summer. Unusual and evanescent weed around gardens. -- O-BC, wUS, Eur.

Known from Brandon (1897), Regina, Saskatoon, Humboldt, Kevisville and, outside our area, at Toronto and Montney.

7. P. Franklinii (Br.) Gray -- Showy blueish-flowered biennial along roads in Jack Pine forests. Virgate from a heavy, marcescent rosette. Herbage finely glandular and long hirsute. Leaves pinnatipartite. Early summer. Casual in very dry, forested soils, especially if disturbed. -- Mack-sY, wO-BC, US.

8. P. CAMPANULARIA Gray -- California Bluebell -- With large blue flowers in secund racemes. Leaves suborbicular-ovate. Raceme lax, borne opposite a leaf. Pedicel longer than the fruiting calyx. All summer. Sometimes cultivated and rarely self-reseeding in gardens: Fort Saskatchewan. -- Alta, wUS.

5. ROMANZOFFIA Cham.

Style not lobed. Resembling some Saxifraga in habit. Cymes raceme-like, but the racemes secund.

1. R. sitchensis Bong. -- Petioles dilated at base, becoming almost bulbous in age. Leaves reniform, coarsely crenate. Flowers white on long pedicels in bractless racemes. Mid summer. Wet, alpine or subalpine cliffs. -- sAka, swAlta-BC, US.

Order 55. BORAGINALES

Like the last, the flower 5-merous and with 5 stamens, but the ovary of only 2 carpels, but 4-locular because of false partitions.

105. BORAGINACEAE (BORAGE FAMILY)

Ovary deeply 4-lobed, each lobe maturing into a separate nutlet. Herbs, often rough pubescent, even setose-hispid or almost acicular-hispid in many species. Flowers in scorpioid cymes.

a. Achenes catchy by hooked bristles.
  b. Cymes bractless ..... 2. Cynoglossum
  bb. Flowers subtended by bracts ..... 3. Lappula
aa. Achenes glabrous to tuberculate, rarely puberulent.
  c. Flowers axillary or in leafy cymes ..... Group A

cc. In bracteolate or bractless cymes, sometimes leafy towards the base.
d. Cymes bracteolate ..... Group B
dd. Bractless or bracteolate towards the base only ..... Group C

Group A

Flowers axillary, the upper leaves often reduced, but at least overtopping the calyx. Racemes irregularly leafy and bracteolate, or bractless in Plagiobotrys.

a. Flowering leaves mostly clustered in 2's or 3's ..... 7. Asperugo
aa. Alternate.
b. Annual with puberulent achenes ..... 4. Plagiobotrys
bb. Achenes glabrous; mostly perennials.
c. Corolla lobes rounded; style included ..... 14. Lithospermum
cc. Corolla lobes acute; style longer, exserted ..... 15. Onosmodium

Group B

Flowers in cymes bracteolate to the tip. Lower bracts sometimes leaf-like.

a. Pedicels recurved and longer than the calyx ..... 9. Borago
aa. Flowers erect or ascending, borne on shorter pedicels.
b. Flowers white and less than 1 cm long ..... 5. Cryptantha
bb. Blueish and mostly longer.
c. Flowers in an elongating raceme of cymes ..... 16. Echium
cc. Branching not so regular and more or less dichotomous.
d. Calyx lobes shorter than the tube ..... 11. Nonea
dd. More than twice longer than the short tube ..... 10. Lycopsis

Group C

Cymes bractless or only the lower flowers bracted.

a. Branches all or mostly internodal or opposite the leaves ..... 8. Symphytum
aa. Branches axillary.
b. Flowers blue.
c. Racemes elongate and quite bractless ..... 12. Myosotis

cc. Cymes congested and more or less clearly bracted at base ..... 13. Mertensia
bb. White or yellowish.
d. Plant glabrous ..... 1. Heliotropium
dd. Rough hirsute.
e. Corolla constricted at the throath and with 5 lobes which practically occlude the throat ..... 5. Cryptantha
ee. Corolla open at the throat ..... 6. Amsinckia

1. HELIOTROPIUM L. HELIOTROPE

Fruit shallowly lobed. Stigma sessile at the junction of the grooves.

1. H. curassavicum L. var. obovatum DC. (H. spathulathum Rydb.) -- On the shores of playas, a somewhat fleshy herb with secund racemes of white flowers. Somewhat depressed. Leaves ovate to lanceolate, mostly spatulate. Summer. Infrequent on dried up shores of alkaline sloughs. -- swMan-swS-sAlta, (US).

The typical South American phase is smaller by about half, the leaves 2-5 mm wide, the flowers ± 2 mm wide.

2. CYNOGLOSSUM L. HOUND'S TONGUE

Achenes attached near their summit and widely spreading, forming a fruit much wider than high. Achenes catchy by hooked spines.

a. Stem very leafy to the base of the inflorescence ..... 1. C. officinale
aa. Leafless or nearly so in the upper half ..... 2. C. boreale

1. C. OFFICINALE L. -- Hound's Tongue, Sheep-Bur (Langue de chien, Herbe d'Antal) -- Flowers deep red; achenes catchy, flattish, covered with hooked prickles on both faces. Rough hairy perennial. Branches curved inward, pedicels curved outward. Calyx 5-8 mm high. Summer. Infrequent weed of barnyards and sheltered spots frequented by cattle. -- NS, NB-BC, US, Eur.

2. C. boreale Fern. -- Wild Comfrey -- Quite leafless and bractless in the inflorescence and in the upper 1-(2) dm of the stem. Calyx ± 2 mm high. Flower mauve, drying blue. Early summer. Very sporadic in dry woods. -- NF, NS, NB-BC, US.

3. LAPPULA Moench STICKSEED

Like the last, the achenes are catchy by hooked spines, but said achenes are attached at the base, they are higher than broad and the spines are all or mostly peripheral.

a. Pedicels erect, shorter than the bractlets .. 1. L. echinata

aa. Spreading or reflexed; upper bractlets very short or lacking.
  b. Flower 1.5-3.0 mm across; calyx lobes acutish ..... 2. L. deflexa
  bb. Larger, 4-12 mm wide.
    c. Spines all peripheral, or sometimes with 1-2 dorsal spines; biennial ..... 3. L. floribunda
    cc. Achene with both peripheral and dorsal spines; perennial with longer style ..... 4. L. diffusa

1. L. ECHINATA Gilib. var. ECHINATA (L. Myosotis Moench) -- Stickseed, Maiden-Lip (Bardanette) -- Achenes very catchy by means of a double peripheral row of acicules with harpoon-shaped points. Branchy annual, rough-hirsute throughout. Flowers small, blue, sometimes white. First half of summer. Frequent weed of light, disturbed soils, mainly roadsides. -- swMack-Y-(Aka, NF, NS-NB)-Q-(O)-Man-BC, (US, Eur) -- Var. occidentalis (Watson) Boivin (L. occidentalis (Watson) Greene; L. Redowskii (Horn.) Greene) -- Acicules fewer, forming a single peripheral row. Sandy soils and disturbed ground. -- sMack-(Y)-Aka, (sMan)-S-Alta-(BC, US, SA, Eur) -- F. cupulata (Gray) Boivin -- Acicules fused at base for 1/3-1/2 of their length, adding a peripheral wing to the achene. Local: Medicine Hat. -- seAlta-BC, (US).

2. L. deflexa (Wahl.) Garcke var. americana (Gray) Greene (L. americana (Gray) Rydb.; Hackelia americana (Gray) Fern.; H. deflexa (Wahl.) Opiz var. americana (Gray) Fern. & Johnst.) -- Sheep-Bur (?) Blue Bur (?) -- Catchy fruits on reflexed pedicels in secund racemes. Leaf pubescence upwardly directed. Flowers small, 1.5-3.0 mm wide, and usually blue. Achene bearing all or nearly all its acicules in a single peripheral row. First half of summer. Shaded banks. -- sMack, NB-BC, US.

We are not quite sure that the two vernacular names do actually refer to this species. The typical phase is European and has larger flowers, 3-6 mm wide.

3. L. floribunda (Lehm.) Greene (Hackelia floribunda (Lehm.) Greene) -- Stickweed -- Like the last, but the larger flowers and fruits on shorter branches. Leaf pubescence upwardly directed on the upper face, but on the lower face directed upwards above the middle, downwards below the middle. Style short and inconspicuous, 0.2-0.3 mm long. Achene 4-6 mm long. Early summer. Shaded places near water. -- sAka, S-Alta-(BC), US.

Commonly confused with other species and genera, especially with L. deflexa, but the arrangement of the pubescence on the leaves is apparently very unusual, if not unique. Native in our area, but introduced in Alaska.

4. L. diffusa (Lehm.) Greene (Hackelia Jessicae (McGregor) Brand) -- Acicules both dorsal and peripheral. Leaf pubescence

variable. Style ± 1 mm long and reaching to the summit of the calyx lobes after anthesis. Flowers white or blue. Early to mid summer. Edge of mountain woods. -- swAlta-sBC, wUS.

4. PLAGIOBOTRYS Fischer & Meyer

Achenes glabrous or merely puberulent and the corolla not constricted at the throat. Otherwise resembling Lappula and Cryptantha.

1. P. Scouleri (H. & A.) Johnston var. penicillatus (Greene) Cronq. (P. scopulorum (Greene) Johnston; Allocarya californica AA.) -- Flowers axillary, subtended by linear leaves many times longer. Branchy and strigose annual. Flowers small and white, mostly 1-2 mm wide, usually overtopped by the calyx lobes. Achenes puberulent and finely glandular. Summer. Playas and saline shores. -- (Y)-Aka, (swMan)-S-Alta-(BC), US.

The typical phase is more western; its flowers are mostly 2-4 mm wide and its achenes are glabrous.

5. CRYPTANTHA Lehm.

Flowers small and white in ± bracteolate cymes.

a. Perennial with a raceme of cymes ..... 1. C. nubigena
aa. Diffusely branched annuals.
  b. Cymes bracteolate throughout ..... 3. C. minima
  bb. Only the lowest flower(s) with a bract ..... 2. C. Fendleri

1. C. nubigena (Greene) Payson var. celosioides (Eastw.) Boivin (C. Bradburyana Payson; C. sobolifera AA.) -- White flowers with a yellow center. Coarsely hirsute perennial from a heavy rosette. Basal leaves spatulate-lanceolate to oblinear, 5-8 mm wide, the stem-leaves narrower. Corolla 7-11 mm wide. Late spring and early summer. Foothill steppes and Writing-on-Stone. -- sAlta-sBC, US -- Var. Macounii (Eastw.) Boivin (C. celosioides (Eastw.) Payson var. Macounii (Eastw.) Boivin; C. Macounii (Eastw.) Payson; Oreocarya aperta AA.; O. glomerata AA.; O. Macounii Eastw.) -- Generally smaller. 1.0-2.5 dm high. Rosette leaves 5 mm wide or less, oblinear to long linear, the stem leaves narrower still. Flowers 6-8 mm wide. More widespread on rolling steppes. -- sS-sAlta, US.

Var. celosioides (Eastw.) stat. n., Oreocarya celosioides Eastw., Bull. Torr. Bot. Club 30: 240, 1903.

Var. Macounii (Eastw.) stat. n., Oreocarya Macounii Eastw., Bull. Torr. Bot. Club 40: 480, 1913; Cryptantha Macounii (Eastw.) Payson, Ann. Miss. Bot. Gard. 14: 303, 1927.

Var. nubigena resembles mainly var. celosioides because of its wider spatulate leaves, etc., but it differs by its nutlet which is smooth on both faces or at least on the ventral face, while our two varieties have nutlets rugose or tuberculate on both faces. This var. nubigena has already been reported

as C. sobolifera Payson from the Waterton area by Breitung 1957 and Moss 1959. Of the corresponding specimens Moss 3133 (ALTA, DAO) is in flower and its varietal determination is open to question, while Breitung 15712 & 17120 (ALTA) have been revised to var. celosioides.

2. C. Fendleri (Gray) Greene (C. crassipetala AA.; C. Kelseyana Greene) -- Minute white flowers usually overtopped by the pubescence. Hairs stiff and almost acicular, forming yellow tufts at the tip of the branches. Achenes small, shiny, gray with purple spots, shorter than both the calyx lobes and the longer hairs. First half of summer. Wind eroded sands. -- (seAka), swS-BC, US.

3. C. minima Rydb. -- Similar, the cymes bracted to the tip, the bracts mostly longer than the calyx. Sepals perhaps a bit longer, but mainly with the midnerve whitish, very thick and prominent, indurated. Early summer. Perhaps an overlooked native of eroded soils or possibly only an adventive at Medicine Hat. -- seAlta, US.

6. AMSINCKIA Lehm.

Cymes bractless and the corolla not constricted at the throat. Otherwise much like Cryptantha.

1. A. MENZIESII (Lehm.) Nels. & Macbr. (A. barbata Greene; A. idahoensis M.E. Jones; A. intermedia Fisch. & Mey.; A. lycopsoides Lehm.; A. tesselata AA.) -- Somewhat similar to Cryptantha Fendleri, especially the pubescence, but the flowers larger. Corolla ± 7 mm long, overtopping the pubescence. Calyx lobes elongating in fruit, becoming 4-6 mm long. Summer. Infrequent railway weed. -- Y-Aka, sMan-seS-BC, US, Eur.

A collection reported as Amsinckia tesselata Gray, Stonehouse, Neepawa, 1911 (WIN), proved to have smaller flowers and shorter calyx lobes than expected and was accordingly revised to A. Menziesii. The other collections of the latter in our area come from Estevan (DAO), Hillcrest (ALTA), South Edmonton (ALTA), and Coaldale (DAO).

7. ASPERUGO L. MADWORT

Calyx enlarging in fruit, with 10 lobes, the alternate ones reflexed and emarginate at tip.

1. A. PROCUMBENS L. -- Madwort (Portefeuille, Rapette) -- Scrambling by its stiff and reflexed hairs on the angles of the stem. Internodes dimegueth, a very long one alternating with 1 or 2 very short ones, the oblanceolate leaves thus nearly clustered in 2's or 3's. Flowers solitary and arising in the forks or from slightly outside the axils. First half of summer. Rare weed: Manitou, Banff. -- G, Y-Aka, O-Man, Alta-BC, nUS, Eur.

8. SYMPHYTUM L. COMFREY

Achene smooth, dilated at base into a thick peripheral rim.

a. Leaves long decurrent, the upper ones sessile ..... 1. S. officinale
aa. All leaves petiolate, not decurrent ..... 2. S. asperum

1. S. OFFICINALE L. -- Comfrey (Langue de vache, Grande Consoude) -- A coarse herb with long tubular flowers in bractless cymes. Limb decurrent on the petiole and for nearly the whole length of the internode. Stem retrorse-hirsute. Calyx 7-9 mm long in flower, the lobes triangular lanceolate. Corolla 15-18 mm long, whitish or sometimes pinkish. Late spring to mid summer. Rare escape from cultivation: Golden Spike. -- NF, NS, NB-O, Alta-BC, US, Eur.

2. S. ASPERUM Lepechin -- Similar and not always clearly distinct because of frequent cultigen hybrids. Stem pubescent with recurved hairs. Petiole of upper leaves sometimes winged and short-decurrent. Calyx 3-5 mm long at flowering, elongating. Flowers 10-15 mm long, pink and turning blue. Early summer. Also a rare escape: Brandon. -- (NF), NS-PEI, Q-Man, BC, (US), Eur.

More than half of the Canadian specimens examined were variously intermediate between our two species, as if the original cultivated stock was mostly of hybrid origin. Such hybrids could be called S. uplandicum Nyman (= S. peregrinum AA.), but we have not attempted to implement this distinction.

9. BORAGO L. BORAGE

Corolla open, rotate, dissected nearly to the base.

1. B. OFFICINALIS L. -- Borage, Ox-Tongue (Bourrache, Langue de boeuf) -- Large flowers on long, recurved pedicels. Spinulose-hispid throughout. Upper leaves clasping. Calyx lobes elongating to 1-2 cm. Mid to late summer. Sometimes cultivated and on occasion weedy in Manitoba: Ninette, Brandon, Saint-Norbert, Argyle, Portage; more rarely so westward: Melfort, Fort Saskatchewan. -- SPM, NS-Alta-(BC, US), Eur.

10. LYCOPSIS L. BUGLOSS

Corolla asymetrical, the tube being slightly curved.

1. L. ARVENSIS L. -- Burgloss (Chaudronnette, Face de loup) -- Non-descript weed, spinulose-hispid throughout. Pedicels mostly internodal or somewhat opposite the bracts. Corolla blue, about 8 mm long. Calyx lobed nearly to the base. Larger leaves somewhat undulate at margin and with coarser hairs on the projecting points. Summer. Infrequent weed. -- (NF) NS-Alta, US, Eur, (SA).

Known in Manitoba only from Carberry.

11. NONEA Medicus

Corolla without appendages at the throat.

1. N. VESICARIA (L.) Reich. -- Much like the last. Calyx tubular, the tube longer than the lobes. Flowers mostly axillary. Pubescence not so coarse and somewhat glandular. Mid summer. Rare weed: Swalwell. -- Alta, (neUS), Eur, Afr.

12. MYOSOTIS L.

Flowers in elongate and bractless cymes; calyx tube well developed and about as long as the lobes.

a. Calyx pubescence of straight hairs.
  b. Corolla lobes 2-4 times longer than the calyx lobes ..... 1. M. scorpioides
  bb. About the same size ..... 2. M. laxa
aa. At least in part of incurved hooked hairs.
  c. Perennial; flower 4-8 mm wide ..... 3. M. sylvatica
  cc. Annual or biennial; flower smaller ..... 4. M. arvensis

1. M. SCORPIOIDES L. -- Forget-me-not (Ne m'oubliez pas)-- Like the next with much larger flowers. Perennial. Cymes bractless. Calyx lobes shorter than the tube, Corolla 5-10 mm wide. Style elongate and just about equalling the top of the calyx lobes right after the fall of the corolla. Summer. Rare weed of cultivation, naturalized in wet places: Camp Morton. -- (Aka), NF-SPM, (NS)-PEI-Man, BC, US, Eur.

2. M. LAXA Lehm. -- Forget-me-not (Petit bleu, Grémillet) -- Blue flowers in lax and secund raceme-like cymes, bractless except toward the base. Annual or biennial. Pubescence of straight and strigose hairs. Calyx lobes about as long as the tube. Style short and not readily observed, overtopped by the achenes. Summer. Rare adventive of wet places: Lake Isle. -- (NF, NS-NB)-Q-O, Alta-BC, (US, SA), Eur.

3. M. sylvatica Hoffm. var. alpestris (F. W. Schmidt) Koch (M. alpestris F. W. Schmidt) -- (Oreille de souris, Ne m'oubliez pas) -- Blue flowers with a yellow eye in a crowded cyme, elongating in fruit. Calyx pubescence mostly of straight hairs. Early to mid summer. Alpine slopes and ridges. -- wMack-Aka, O, swAlta-BC, US, Eur -- F. Eyerdamii Boivin -- Flowers white. Local: Waterton. -- sAka, swAlta.

Native with us, but present in the East only as an escape from cultivation.

4. M. ARVENSIS (L.) Hill -- Flowers less than 2 mm wide in more elongate bractless cymes. More diffusely branched. Calyx pubescence mostly of incurved-hooked hairs. Early to mid

summer. Rare weed, usually in shaded places: Brandon, Bjorkdale. -- (G, Aka, NF)-SPM, (NS-NB)-Q-S, swBC, (neUS, Eur).

13. MERTENSIA Roth

Inflorescences short, the pedicels ± clustered and mostly bractless.

a. Herbage hirsute throughout ..... 3. M. paniculata
aa. Glabrous or the leaves ciliate and short strigose above.
  b. Very strongly glaucous maritime plant ..... 1. M. maritima
  bb. Green to slightly glaucous.
    c. Perennial from a taproot; flowers 1.0-1.5 cm long ..... 2. M. lanceolata
    cc. From a subglobular tuber; flowers 1.5-2.5 cm long ..... 4. M. longiflora

1. M. maritima (L.) S.F. Gray -- Blue Bonnet, Ice-Plant (Sanguine de mer) -- Very glaucous herb forming rosettes of prostrate stems on seashores. Somewhat fleshy and glabrous. Corolla 4-5 mm long, campanulate, blue. Early summer. Gravelly beaches at high tide. -- G-Mack-(Y)-Aka, L-SPM, NS, NB-nMan, wBC, neUS, nEur.

More northern plants (including ours) are gradually smaller and have been segregated on this basis as var. tenella Fries.

2. M. lanceolata (Pursh) A.DC. var. lanceolata (M. linearis Greene) -- Somewhat fleshy herb with blue flowers mostly in small bractless clusters at the end of the branches. Tufted perennial, the stems (1)-2-3-(4) dm long. Leaves and calyx lobes ciliate, otherwise glabrous or the leaves short-scabrous above. Mid spring to early summer. Steppes, infrequent. -- sS-swAlta-(BC), cUS.

Known in Alberta from a single collection by McCalla in 1932 at Magrath (ALTA). An early report by Campbell 1900 was based on a Canmore (MTMG) collection which is apparently a depauperate specimen of M. paniculata.

In a more southern var. secundorum Cock. the leaves are pubescent on both faces. For var. Drummondii see Additions.

3. M. paniculata (Aiton) G. Don var. paniculata (M. pilosa (Cham.) G. Don) -- Blue-flowered herb forming showy colonies in forest openings. 4-6-(10) dm high. Basal leaves cordate and very scabrous on both faces, with nearly parallel nervation, passing to the upper lanceolate leaves. Flowers in a terminal panicle of small, nodding clusters. Calyx lobes pilose dorsally. Corolla 1.5-(2.0) cm long. Early summer. In and around woods. -- K-Aka, wcQ-BC, US.

West of us, var. borealis (Macbr.) Williams has the leaves glabrous at least above. And to the northwest of us var. alaskana (Britton) Williams has narrower leaves glabrous

below, the upper ones narrowly lanceolate, and its calyx lobes merely ciliate, being otherwise glabrous. Some intermediates occur which resemble var. paniculata but for the calyx lobes glabrous dorsally; these are often identified var. Eastwoodae (Macbr.) Hultén.

4. M. longiflora Greene -- Resembling M. lanceolata, but smaller and showier. Stems mostly erect and solitary, 1-2-(3) dm high. Flower tubular, fewer and larger, usually in a single terminal cyme. Early summer, montane and piemont prairies in Waterton. -- swAlta-sBC, wUS.

14. LITHOSPERMUM L. GROMWELL, PUCCOON

Flowers yellow and axillary, usually showy. Style shorter than the corolla. Root with a deep red pigment.

a. Annual with small, pale yellow flowers ..... 1. L. arvense
aa. Perennial.
  b. Flowers large, stem usually 1-3 dm long.
    c. No axillary fascicles ..... 5. L. canescens
    cc. Branchy and with numerous axillary fascicles ..... 4. L. incisum
  bb. Flowers smaller; stem taller.
    d. Lateral nerves lacking or very weak ..... 3. L. ruderale
    dd. Larger leaves with conspicuous lateral nerves deeply impressed above ..... 2. L. officinale

1. L. ARVENSE L. -- Bastard Alkanet, Wheatthief (Charrée) -- Branches few and a flower in most of the forks. The latter tending to trichotomous. Lower leaves narrowly oblanceolate, less than 5 mm wide, the upper leaves sometimes wider. Flowers otherwise borne at the edge of the leaf axils. Corolla shorter than, to barely longer than, the calyx, bicolour, yellow with a broad bluish-black ring below the middle. Achenes pale brown, abundantly and irregularly pitted. Mid spring to early summer. Rare weed: Winnipeg, Alexander. -- (SPM), NS, O-sMan, BC, US, Eur, Oc.

2. L. OFFICINALE L. -- Gromwell (Herbe aux perles, Graines de lutin) -- Conspicuous in fruit, the latter a cluster of 4 shiny, white plump and hard achenes. Leaves narrowly lanceolate, broadest towards the middle, conspicuously nerved. Nerves few, deeply impressed above, strongly rugose below. Flowers nearly all axillary. Forks without a central flower, except perhaps 1-2 of the upper forks. Corolla small, less than twice as long as the calyx. Achenes 2-3 mm long. Late spring and early summer. Rare weed: High Bluff. -- NB-sMan, wBC, nUS, Eur.

3. L. ruderale Douglas -- Puccoon -- Similar to the last,

but the leaves broadest very near the base and tapered to the tip. Branches usually shorter than the leaves. Flowers yellow, 6-9 mm long, about twice as long as the calyx. Achenes 4-6 mm long. Early summer. Foothills and montane prairies: Cypress Hills, Writing-on-Stone and Rockies. -- swS-cCB, wUS.

4. L. incisum Lehm. (L. angustifolium Mx.; L. linearifolium Goldie; L. mandanense Sprengel) -- Flower longest; fruit on a recurved pedicel. Becoming ± branchy. Leaves long linear, acute. Early corollas 1.5-3.5 cm long. Fruits arising mostly from insignificant cleistogamous flowers. Late spring. Steppes on hillsides. -- sO-cBC, US, (CA).

5. L. canescens (Mx.) Lehm. -- Cowslip, Indian Paint -- Rather showy tufted perennial with yellow flowers fading orange. Stems mostly 1-3 dm, with 1-2 dichotomous forks in the upper part, otherwise simple. Leaves ± lanceolate, rounded at tip. Flowers 1.0-1.5 cm long, in the forks and axillary with the upper leaves. Late spring and early summer. Sandy prairies. -- O-sS, US.

15. ONOSMODIUM Mx. FALSE GROMWELL

Axillary flowers with long protruding styles.

1. O. molle Mx. var. hispidissimum (Mack.) Cronq. (O. hispidissimum Mack.) -- Extremely rough-hirsute perennial, tufted. Leaves broadly to narrowly lanceolate. Lateral nerves 2-4, very conspicuously and nearly parallel to the midnerve. 7-12 dm high. Corolla 12-16 mm long, greenish-white. Achene contracted at base into a sharply defined collar about 0.3 mm high. First half of summer. Edge of woods. -- swO-sMan, cUS -- Var. occidentale (Mack.) Johnston (O. occidentale Mack.) -- Achene without basal collar. Plant often smaller, 4-10 dm high. Mostly river valleys. -- swMan-seS-swAlta, cUS.

Our two varieties may be positively identified only when fruiting. When in flower they can still be recognized as belonging to ssp. hispidissimum (Mack.) stat. n. (O. hispidissimum Mack., Bull. Torrey Bot. Club 32:500, 1905) by their coarse pubescence, ± spreading and strongly hispid, almost acicular. By way of contrast, the more southern ssp. molle is glabrous or bears a shorter and softer pubescence. In Gleason 1952 the pubescence descriptions of O. molle and O. occidentale seem to have been inadvertently inverted.

16. ECHIUM L. VIPER'S BUGLOSS

Corolla irregular, somewhat bilabiate. Style bifid for about 0.5-1.0 mm.

a. Calyx lobes 4-5 mm long, elongating to 6-8 mm ..... 1. E. vulgare
aa. Lobes 9-12 mm long ..... 2. E. Lycopsis

1. E. VULGARE L. var. VULGARE -- Blue Devil, Blueweed

(Herbe bleue, Herbe piquante) -- Spinulose-hispid, blue-flowered herb with a terminal raceme of arching cymes. Flower about 1 cm long, pubescent outside, with 4 long-exserted stamens. Second half of summer. Infrequent and unpleasant weed. -- NF, NS, NB-BC, US, (SA), Eur.

Known from Alexander, Regina, Hoosier, Frank, High River and Lundbreck.

2. E. LYCOPSIS L. -- (E. plantagineum L.) -- Similar but the calyx longer, the flowers larger and the branching not so regular, rather dichotomous. Corolla 1.5-2.5 cm long, pubescent on the sutures only, with only 2 exserted stamens. Summer. Rare weed: Brandon.--O-sMan, (US, Eur).

The Ontario record is from Vineland (OAC).

Order 56. LAMIALES

Single family with us. Other families have alternate leaves and the ovary is barely lobed.

106. LABIATAE (MINT FAMILY)

Like the Boraginaceae, the ovary deeply 4-lobed and maturing into 4 achenes. But the leaves opposite, the stem square and the flower bilabiate.

a. Flowers all or mostly in one or more terminal inflorescences.
  b. Flowers in a globose head ..... 15. Monarda
  bb. Elongated raceme ..... Group A
aa. Axillary.
  c. Solitary or in axillary racemes ..... 2. Scutellaria
  cc. In axillary glomerules.
    d. Leaves palmatifid ..... 12. Leonurus
    dd. Less dissected, crenate to serrate ..... Group B

Group A

Flowers clearly disposed in one or more terminal inflorescences. Bracts overtopped by the flowers, or sometimes the lower ones larger and grading into the leaves.

a. Calyx strongly bilabiate, the upper lobe 3-toothed, the lower bilobed.
  b. Flowers in dense spikes; only the calyx lobes protruding beyond the large subtending bract ..... 8. Prunella
  bb. Spikes lax; bract smaller and merely covering the base of the calyx ..... 14. Salvia
aa. Weakly if at all bilabiate, one lobe sometimes larger than the others.
  c. Inflorescence a raceme of opposite flowers ..... 9. Physostegia

cc. Raceme of opposite clusters.
d. Bracts strongly contrasted with and much shorter than the leaves.
e. Perennial; spike symetrical.
f. Corolla strongly bilabiate ... 4. Agastache
ff. More obviously 4-lobed than bilabiate ..... 20. Mentha
ee. Annual; spikes secund ..... 21. Elscholtzia
dd. Lower bracts grading into the upper stem leaves.
f. Leaves narrow and entire ..... 18. Hyssopus
ff. Crenate to dentate.
g. Upper lip of the corolla not obvious ..... 1. Teucrium
gg. Both lips conspicuous.
h. Upper calyx lobe at least twice as broad as any of the other 4 ..... 7. Dracocephalum
hh. Upper calyx lobe similar to at least the next two.
i. Flowers white ..... 5. Nepeta
ii. Pink or purplish ..... 13. Stachys

Group B

Flowers in axillary clusters, overtopped by the subtending leaves, not forming obvious terminal inflorescences, although sometimes confined to the upper leaves.

a. Herb catchy by its calyx with 10 lobes hooked at tip ..... 3. Marrubium
aa. Not catchy.
b. Calyx strongly bilabiate.
c. Upper calyx lobe contrasted with the other 4 and about 3 times wider than any of them ..... 7. Dracocephalum
cc. The 3 upper lobes contrasted with the lower 2.
d. Lower lobes at least twice longer than the upper lobes, the latter reduced to mere teeth ..... 17. Melissa
dd. Lobes subequal, but the lower 2 subulate and the upper much larger ..... 16. Hedeoma
bb. Weakly if at all bilabiate and the calyx lobes all similar.
e. Corolla weakly bilabiate, more obviously 4-5-lobed.

f. Stamens 2; flowers sessile ..... 19. Lycopus
ff. Stamens 4; flowers pedicellate ..... 20. Mentha
ee. Strongly bilabiate.
g. Calyx tube many times longer than the teeth ..... 6. Glechoma
gg. Tube about as long to shorter.
h. Calyx lobes with spinulose and glabrous tips ..... 10. Galeopsis
hh. Herbaceous and pubescent to tip ..... 11. Lamium

1. TEUCRIUM L. GERMANDER

Corolla slit along the upper side and its upper lip not obvious, being reduced to two lobes on the lower lip.

1. T. canadense L. var. occidentale (Gray) McCl. & Epl. (T. occidentale Gray, var. boreale (Bickn.) Fern.) -- Wood-Sage, Head-Betony -- Flower without upper lip but with a long lower lip, the style and stamens long protruding and nearly erect. Villous herb. Calyx more or less purplish, its lobes deltoid, the upper 3 obtuse, the lower 2 acuminate. Mid summer. Wet prairies and shores, infrequent. -- Q-S (Yorkton, Lumsden, Cypress H.), BC, US, (CA).

Ours have glandular-pilose calices and the pubescence is longer on the stem and lower leaf surfaces, the hairs 0.5-1.0 mm long, and spreading to reflexed. In the more eastern typical phase the herbage is non glandular and the shorter and recurved hairs are mostly 0.2 mm long.

2. SCUTELLARIA SKULLCAP

Calyx strongly bilabiate, its lips entire and the upper lip with a strong transverse protuberance on the upper side.

a. Flowers in axillary and terminal racemes ..... 3. S. lateriflora
aa. Solitary in the axils of the main stem leaves.
b. Flower 1.6-2.5 cm long ..... 1. S. galericulata
bb. Smaller, 1 cm long or slightly less ..... 2. S. parvula

1. S. galericulata var. pubescens Bentham (var. epilobiifolia (A. Ham.) Jordal; S. epilobiifolia A. Ham.) -- Red Tops, Skull-Cap (Toque, Tertianaire) -- Herb with 2 large, blue, sigmoid flowers at each node, usually both flowers facing the same side. Corolla (16)-18-22-(25) mm long, nearly white on the lower side. Mainly mid summer. Wettish places and shores. -- Mack-Aka, L-SPM, NS-BC, US, Eur.

The typical european phase has somewhat shorter flowers,

13-18 mm long, and the herbage is glabrous or with shorter pubescence.

2. S. parvula Mx. var. Leopardii (Epling) Fern. -- Shallowly rooted, the rhizome conspicuously moniliform, the segments about 1 cm long and thinly linked. Usually 1-2 dm high and simple. Herbage finely puberulent with incurved hairs, not glandular. Leaves smallish, about 1 cm long, whitened below, the nerves strongly rugose, the middle and upper leaves mostly about 3 times longer than wide. Early summer. Peaty soil over rocky outcrops, rare: Rennie. -- seMan, US.

A single canadian collection known: J. Looman 8830, 4 mi. W. of Rennie, 7 July 1964 (DAO).

Grades freely into the more eastern typical phase which is pilose and glandular, the pilosity especially abundant and obvious on the angles of the stem and the lower leaf surfaces; leaves commonly broader, mostly ovate.

S. parvula Mx. was reported from Saskatchewan by Hooker 1838 and Macoun 1884, but this has never been confirmed and seems rather unlikely. See comments under Rosa nutkana.

3. S. lateriflora L. var. lateriflora -- Mad-Dog-Skullcap -- Flowers opposite, in secund racemes. Petioles elongate. Racemes with small leaves near the base, grading into bracts upwards. Corolla blue, 6-8 mm long, nearly straight. Mid summer. Grassy shores. -- NF, NS-S-(Alta)-BC, US.

The more western var. Grohii Boivin has smaller flowers, the corollas (4.5)-5.0-5.5-(6.0) mm long.

3. MARRUBIUM L. HOREHOUND

Calyx lobes 10. Corolla strongly bilabiate. Style and stamens included in the tube.

1. M. VULGARE L. -- Horehound, White Horehound (Marrube, Bonhomme) -- Herb catchy by the recurved tips of its calyx lobes. Felty-lanate and partly white-lanate throughout. Leaves flabellate, the palmate nervation deeply impressed above, strongly rugose below. Flowers white, in dense clusters in the axils of the upper leaves. Summer. Cultivated and rarely spreading to dry places: Shellbrook. -- (Aka), NS, Q-O, S, BC, US, SA, Eur, (Afr).

4. AGASTACHE Clayton GIANT HYSSOP

Calyx regular, but the corolla bilabiate and the 4 stamens long exserted.

1. A. Foeniculum (Pursh) Ktze. (A. anethiodora (Nutt.) Britton; A. scrophulariifolia AA.) -- Calyx with at least the lobes blue. Showy virgate herb with a bluish inflorescence, sometimes branchy. Leaves ovate, strongly discolour, almost white below. Corolla blue. Mid summer. Chernozems. -- sMack, NB-BC, US -- F. Bernardii Boivin -- A two-toned flower, the calyx lobes pink, the corolla white. Local. -- Q, S -- F.

candida Boivin -- Calyx lobes and corolla white. Local. -- Man-S.

5. NEPETA L. CAT-MINT

Calyx nearly regular, but oblique at the throat. Corolla bilabiate, the stamens not exserted beyond the corolla lobes.

1. N.CATARIA L. -- Catnip, Catmint (Herbe à chats, Chatairę) -- Soft-hairy herb with cordate leaves. Leaf-teeth ± rounded. Flowers white, mostly in a terminal racemose inflorescence, but also in smaller inflorescences terminating short branches. Mid summer. Cutivated and sometimes escaped, usually in shaded places. -- NF, NS-BC, US, Eur, (Afr).

Previous Alaska reports by Hultén 1949 and Anderson 1950, querried by Boivin 1966, were based on an Anderson collection at Sitka. In 1968 a loan request to ISC failed to produce the expected specimen. Accordingly we now assume that the substantiating sheet was in the interval revised to some other genus, hence the restricted range quoted above.

6. GLECHOMA L. GROUND-IVY

Much like the last, but the flowers in small axillary clusters.

1. G. HEDERACEA L. (Nepeta hederacea (L.) Trevisan) -- Scarlet Runner, Ground Ivy (Lierre terrestre, Lierre sauvage) -- Creeping and carpet-making herb with opposite and reniform leaves. Stem rooting at the nodes. Leaves crenate, punctate below in dark green. Flowers blue. Late spring to late summer. Cultivated and readily spreading to shaded places. -- (Aka), NF-SPM, NS-BC, US, Eur.

7. DRACOCEPHALUM L. DRAGON-HEAD

Calyx lobes dimegueth, the upper one 2-3 times as broad as any of others, the latter similar to one another.

a. Flowers in dense terminal inflorescence ..... 1. D. parviflorum
aa. In numerous axillary clusters ..... 2. D. thymiflorum

There is much nomenclatorial confusion between Dracocephalum, Moldavica and Physostegia. The last edition of the Code of Botanical Nomenclature typifies Dracocephalum by D. Moldavica L. and our treatment follows from that decision.

In 1959 Lallemantia peltata (L.) Fisch. & Mey. appeared as a fleeting impurity in experimental plots at Saskatoon (DAO). As this incident did not recur, the species is not considered to be a part, not even a casual part, of our spontaneous flora; we regard such specimens as having been cultivated by inadvertence. As a species it is readily distinguished by its broadly flattened pedicels and its dimorphic leaves in the

inflorescence, the larger ones lanceolate and subentire, the smaller ones suborbicular and coarsely serrate.

1. D. parviflorum Nutt. (Moldavica parviflora (Nutt.) Britton) -- Calyx lobes and leaf teeth stiff and sharp, almost acicular. Annual or biennial with rather dense and fat inflorescences. Flowers pink, slightly exceeding the calyx. Bracts about equalling the calyx, their teeth stiffer and more pungent than either the leaf teeth or the calyx lobes. Summer. Mainly in disturbed soils. -- Mack-Aka, NF, NS, Q-BC, US, (Eur).

2. D. THYMIFLORUM L. (Moldavica thymiflora (L.) Rydb.) -- Upper calyx lobe suborbicular. Nondescript annual or biennial with cordate to oblanceolate leaves, serrate to subentire, darker punctate below. Calyx with small, scattered, glistening glands. Mid spring to mid summer. Infrequent weed of wettish or shaded places. -- Y, O-Alta, (US), Eur.

8. PRUNELLA L. SELF-HEAL

Calyx bilabiate, the upper lip broadly and crenately 3-lobed, the lower lip of 2 lanceolate lobes.

1. P. vulgaris L. (var. lanceolata (Barton) Fern.) -- Selfheal, Carpenter-Weed (Brunelle, Herbe au charpentier) -- Leaves few, entire or nearly so and mostly oblong. Stem internodes rather elongate, but the peduncle of the compact inflorescence very short. Bracts broad, reniform, cuspidate, ciliate. Calyx often purplish. First half of summer. Shores, sometimes weedy. -- Aka, L-SPM, NS-BC, US, SA, Eur, Oc.

9. PHYSOSTEGIA Bentham

Glomerule reduced to a single flower, hence the inflorescence is a raceme of opposite flowers. Calyx regular. Corolla bilabiate with 4 included stamens.

1. P. virginiana L. var. formosior (Lunell) Boivin (P. formosior Lunell; Dracocephalum formosius (Lunell) Rydb.) -- (Cataleptique, Herbe au paralytique) -- Showy herb with a raceme of opposite flowers, pink to red-spotted. Usually virgate with a single terminal inflorescence. Leaves 1.5-4.0 cm wide, rhomboid-lanceolate. Flowers (1.5)-1.8-2.0 cm long. Mid summer. Wet woods and galerie-forests. -- wO-sMan, ncUS -- Var. Lendinghamii Boivin (P. Lendinghamii Russ., Led. & Coupl. [nomen]; Dracocephalum Lendinghamii Russ., Led. & Coupl. (nomen); D. Nuttallii AA.) -- Leaves thickish and smaller, less than 2 cm and mostly around 1 cm wide, oblong-lanceolate, rounded at base. Flowers like the first. Shores. -- sMack, swQ-wO-Alta, ncUS -- Var. parviflora (Nutt.) Boivin (P. parviflora Nutt.; Dracocephalum Nuttallii Britton) -- Flowers smaller, 1.2-1.5 cm long. Leaves like the last. Shores, often somewhat saline. -- sS, BC, US -- Var. elongata Boivin -- Flowers larger, 2-3 cm long. Leaves mostly around 1 cm wide, firm but not thick, lanceolate to narrowly lanceolate, cuneate at base. Local:

Pointe du Chien. -- (NB)-Q-cMan, US.

Sometimes cultivated and rarely escaped. The extension of var. Ledinghamii to Sainte-Anne-de-Bellevue (QFA) in Quebec is based on such an escape incident.

10. GALEOPSIS L.

Calyx more or less regular, with long spinescent lobes. Corolla strongly bilabiate. Flowers in axillary clusters.

a. Flower pinkish, 1.3-2.0 cm long ..... 1. G. Tetrahit
aa. Yellow and 2.2-3.5 cm long ..... 2. G. speciosa

1. G. TETRAHIT L. var. TETRAHIT (f. albiflora AA.) -- Hemp-Nettle (Gratte, Chanvre sauvage) -- Herb somewhat pungent, both from the stiff and coarse pubescence and the spinescent calyx lobes. Stem retrorse-hispid, slightly thickened below the nodes when fresh, narrower in drying. Leaves narrowly ovate. Corolla 15-20 mm long, exserted from the calyx by 10-15 mm, usually pale to whitish. Mid summer. Weed of disturbed soils. -- Aka, NF, (NS-PEI)-NB-Man, Alta-BC, Eur -- Var. BIFIDA (Boenn.) Lej. & Court. -- Generally smaller and the corollas shorter, 13-15 mm long, exserted from the tube of the calyx by 1 cm or less, darker coloured, pink to reddish. Much more common. -- Mack, (Aka), L-SPM, NS-BC, US, Eur.

2. G. SPECIOSA Miller -- Day-Nettle -- Flowers larger and yellow, with a purple lower lip. Second half of summer. Rare weed of waste places: Millet, Heatherdown, Fort Saskatchewan. -- Q, cAlta, Eur.

11. LAMIUM L. DEAD NETTLE

Resembling Galeopsis, but the calyx lobes are pubescent and not so pungent. Lower lip of the corolla reduced to its central lobe, the lateral lobes being more or less vestigial.

a. Upper leaves sessile, semiorbicular ..... 1. L. amplexicaule
aa. Petiolate and narrowly ovate ..... 2. L. album

1. L. AMPLEXICAULE L. -- Henbit, Henbit-Nettle (Pain de poule) -- Upper leaves semiorbicular and sessile in opposite pairs with axillary glomerules of flowers. Annual, branchy from the base. Leaves coarsely crenate, the lower petiolate and broadly ovate. Corolla about 1.5 cm long. Mid summer. Rare weed of shaded places. -- G, (L)-NF-SPM, (NS), NB-O, S-BC, US, Eur, (Afr) -- F. CLANDESTINUM (Rchb.) G. Beck -- Corolla only 2-3 mm long and plugged at the throat with a tuft of white or coloured hairs. More common. -- G, Mack, SPM, NS, O-BC, US, Eur.

2. L. ALBUM L. -- Snowflake (Marachemin, Ortie blanche) -- The pilose upper lip nearly as long as the tube. Stoloniferous and showy in flower, the latter 2-3 cm long. Stem

retrorse-hirsute. Leaves triangular-lanceolate. Flower whitish, hairy. Late spring. Sometimes spreading from cultivation: Brandon, Speers. -- (Aka, NB)-Q-S, (US), Eur, (Afr).

12. LEONURUS L. MOTHERWORT

Calyx lobes spinescent as in Galeopsis, only more so. Upper lip of the corolla entire, lower lip 3-lobed.

a. Upper leaves trilobed to broadly lanceolate ..... 1. L. Cardiaca
aa. Palmatipartite to narrowly linear ..... 2. L. sibiricus

1. L. CARDIACA L. -- Motherwort (Herbe piquante, Cardiaire) -- Main leaves palmatifid, the upper mostly trilobed or tridentate. Upper leaves not otherwise dentate and with 3 parallel nerves. Stem, petioles, etc. puberulent, especially on the angles. Flowers in dense axillary and pungent clusters. Mid summer. Cultivated and sometimes escaping to shaded places. -- NS-seS, BC, US, Eur -- Var. VILLOSUS (Desf.) Bentham -- Stem, petioles, etc. abundantly long villous. Locally escaped: Dauphin. -- Man, Eur.

2. L. SIBIRICUS L. -- (Gros tombé) -- Quite similar, but the leaves divided nearly to the base and the upper pinnately veined. Densely puberulent throughout. Upper leaves dentate to long linear and entire. Late summer. Rare escape: Dufrost. -- Q-Man, US, SA, Eur, (Afr).

13. STACHYS L. HEDGE-NETTLE

Calyx lobes undifferenciated. A middling type with bilabiate corollas in poorly defined terminal spikes.

1. S. palustris L. var. homotricha Fern. (var. nipigonensis Jennings, var. pilosa (Nutt.) Fern.; S. scopulorum Greene) -- Woundwort (Crapaudine, Ortie morte) -- Nondescript Labiate. Stem reflexed-hirsute on the angles, variously pubescent or puberulent on the faces. Leaves ± oblong-lanceolate, crenately serrate, pubescent on both faces, often villous. Calyx pubescence longer, about as long as (or longer) than the stem pubescence, coarsely hispid with hairs up to 1-3 mm long, mixed with shorter and glandular hairs. -- Mack-Y-(Aka), NB-BC, US -- F. Stevensonis Boivin -- Flowers white. Uncommon -- Man, Alta -- Var. hispida (Pursh) Boivin (S. aspera AA.; S. hispida Pursh; S. tenuifolia AA., var. aspera AA., var. hispida (Pursh) Fern.) -- Stem glabrous on the sides, hirsute on the angles only. Leaves often glabrous above. Calyx hirsute to glandular. -- Q-Man, US.

In so far as we have been able to locate them, specimens from the Otterburne area (QFA) reported by Löve 1959 as var. palustris turned out belong to var. homotricha Fern.

F. Stevensonis f.n., floribus albis. Type: G.A.

Stevenson 1332, Clear Lake, damp gravelly soil in clearing close to lake, July 21, 1957 (DAO). Paratypes: C. Frankton 1235, Cranberry Portage (DAO); G.H. Turner 3654, Fort Saskatchewan (DAO).

Var. hispida (Pursh) stat. n., S. hispida Pursh, Fl. Am. Sept. 2: 407, 1814. There is a gradual transition from S. palustris to S. hispida, and the only character with any degree of reliability is that of the glabreity of the faces of the stem in S. hispida. This does not amount to enough morphological discontinuity to justify specific rank for S. hispida.

14. SALVIA L. SAGE

Calyx strongly bilabiate, the upper lip of 3 more or less fused lobes, the lower lip of 2 distinct lobes. Stamens reduced to 2. Flowers in lax terminal racemes.

a. Flowers 2 to a node ..... 1. S. reflexa
aa. Flowers in opposite glomerules ..... 2. S. nemorosa

1. S. REFLEXA Horn. (S. lanceolata AA.) -- Flowers opposite as in Dracocephalum, but the calyx strongly bilabiate. Branchy annual. Corolla small and inconspicuous, barely longer than the calyx, the latter becoming much larger and strongly 12-nerved in fruit. Late summer and fall. Infrequent weed, adventive from further south. -- swQ-sS, US, (CA, SA, Eur, Oc).

2. S. NEMOROSA L. (S. sylvestris AA.) -- Wood-Sage -- Bracts and calyces purplish. Velvety perennial. Leaves oblong-lanceolate, cordate at base. Bracts suborbicular, strongly cuspidate. Summer. Locally escaped from cultivation: Ninette, Pincher Creek, Stavely. -- sO-(Man), Alta, US, Eur, (Afr).

15. MONARDA L. HORSE-MINT

Flowers in globose heads. Anthers only 2. Corolla strongly bilabiate, but the calyx regular.

1. M. fistulosa L. var. menthifolia (Graham) Fern. (M. mollis AA.) -- Wild Bergamot (Menthe de cheval, Bergamote sauvage) -- Flowers showy, in large globose terminal heads 4-8 cm wide. Leaves narrowly ovate to lanceolate, short petiolate. Head subtended by about 4 large bracts. Flowers magenta. Mid summer. Frequent on chernozems and in open woods. -- wO-BC, US, (CA) -- F. Russellii Boivin -- Flowers white. Herbage lighter green, the calices not purple-tinged. Local -- Man-Alta.

The late Dr. R.C. Russell was one of the pioneer students of the flora of Saskatchewan. In 1926 he wrote a preliminary checklist which remained in manuscript form. He was coauthor of a List published in 1937, revised in 1944 and 1954. He was one of our regular correspondents and his numerous collections made a substantial contribution to the preparation of this Flora.

The more eastern and typical plants are usually branched and bear more than one head, while the petiole is (6)-8-15-(25) mm long. This eastern material can be subdivided further into three geographical varieties on the basis of pubescence. Our var. menthifolia has somewhat shorter petioles (2)-3-8-(12) mm long and the usually simple stem is normally monocephalous. Our earlier attempts to recognize additional geographical variants of pubescence or flower size within our area proved to be futile.

16. HEDEOMA Pers. MOCK PENNYROYAL

Stamens 2, like the last two genera, but the inflorescence of axillary glomerules and the calyx bilabiate, being gibbose ventrally and with upcurved lobes. Upper 3 calyx lobes somewhat shorter than the lower two.

1. H. hispidum Pursh (H. hispida sphalm.) -- Corolla small and inconspicuous, not longer than the calyx. Small annual herb, simple to somewhat branchy below the middle. Leave lanceolate to linear, entire or nearly so. Calyx sigmoid. Early summer. Wind eroded hillsides and steppes. -- swQ-sAlta, US.

Of very spotty distribution east of the Missouri Coteau. We know of only one Manitoba collection: Falcon Lake (DAO).

17. MELISSA L. BALM

Calyx bilabiate, the upper lip merely 3-toothed, the lower lip of 2 lanceolate lobes. Corolla bilabiate, with 4 stamens.

1. M. OFFICINALIS L. -- Balm (Citronelle, Piment des abeilles) -- Ovate leaves dimegueth, the main ones about twice as long as those subtending glomerules of flowers. Stoloniferous perennial. Corolla white and pink, about twice as long as the long pilose calyx. Mid to late summer. Rarely spreading from cultivation: Brandon. -- sO-sMan, BC, US, Eur.

18. HYSSOPUS L. HYSSOP

Calyx almost regular, the upper 2 lobes slightly shorter than the other 3. Corolla with the lower lip much longer than the upper.

1. H. OFFICINALIS L. -- Hyssop (Hysope) -- Terminal racemes ill-defined and somewhat secund. Tufted perennial. Leaves entire and more or less lanceolate. Flowers deep purple-blue. Mid summer. Sometimes cultivated and rarely spreading to roadsides: Carmel. -- NS, Q-O, S, (US), Eur.

19. LYCOPUS L. WATER-HOREHOUND

Like the next but the flowers more crowded, sessile, and the stamens only 2. Yellow-punctate, especially on the lower leaf surfaces.

a. Leaves thickish and sessile ..... 3. L. asper
aa. Thin and tapered to a short or ill-defined petiole .
  b. Calyx lobes 1 mm long or less, subacute, overtopped by the fruit ..... 1. L. virginicus
  bb. Lobes longer and acuminate or subulate ..... 2. L. americanus

1. L. virginicus L. var. pauciflorus Bentham (L. uniflorus Mx.) -- Sprig of Jerusalum, Bugleweed -- Flowers white, minute and barely bilabiate, in small axillary clusters. Rhizome tuberous. Long and thin stolons usually present. Bracts minute and inconspicuous. Calyx lobes 5. Second half of summer. Shores. -- Mack, (Aka), L-SPM, NS-BC, US, (Eur).

Possibly widely distributed in northern Alberta but yet known to us by a single collection: E.H. Moss 10974, Glenevis, wet marshy bog, 1957 (ALTA).

In our northern variety the flowers are mostly pentamerous, the corolla lobes tend to spread and the stamens are usually slightly exserted. Grades further south into the typical phase, tetramerous, the corolla lobes erect and the stamens included. Also the rhizome not tuberous. In the area of sympatry one meets with many intermediates or hybrids which may be called X var. Sherardii (Steele) stat. n., L. Sherardii Steele, Proc. Biol. Soc. Wash. 14: 75. 1901.

2. L. americanus Muhl. var. americanus -- Similar but the rhizome not tuberous and the calyx slightly larger with lobes attenuate into stiff and more or less subulate points. Lower leaves more deeply dissected than the upper and usually pinnatifid. Bracts about as long as the calyx. Mid to late summer. Shores and wet places. -- (NF), NS-BC, US, (SA, Eur).

The widespread typical phase is ± pubescent and finely glandular. On the shores of the estuary of the Saint Lawrence River it is replaced by var. laurentianus (Rolland-Germain) Boivin, glabrous or nearly so, the lower leaves hardly more deeply toothed than the upper, the achenes very narrowly wing-margined.

3. L. asper Greene (L. lucidus Turcz. var. americanus Gray) -- Somewhat fleshy, the leaves and especially the stem thickish. Rhizome thicker near the base of the stem. Leaves tending to be rounded at base. Leaves all similar and serrate. Calyx lobes longer than the tube, acuminate and ciliate. Mid summer. Common on shores. -- Aka, Q-BC, (US).

20. MENTHA L. MINT

Calyx regular and the corolla almost regular. Stamens 4. Flowers pedicellate.

a. Flowers in axillary glomerules ..... 2. M. arvensis
aa. Forming terminal spicate inflorescences ..... 1. M. spicata

1. M. SPICATA L. -- Spearmint (Baume, Baume vert) -- Flowers barely bilabiate in terminal inflorescences. Usually branchy. Inflorescence ± moniliform. Corollas small, white to pink. Second half of summer. Rare escape from cultivation: Bjorkdale. -- (Aka, NS)-PEI-O, ecS, swBC, US, Eur.

2. M. arvensis L. (var. canadensis (L.) Briq., var. glabrata (Bentham) Fern., var. lanata Piper, var. villosa (Bentham) S.R. Stewart; M. glabrior (Hooker) Rydb.; M. Penardii (Briq.) Rydb.) -- Mint (Baume) -- Flowers barely bilabiate, in numerous axillary glomerules. Flowers pink or mauve. Summer. Common in wet places. -- (seK)-Mack-Aka, L-SPM, NS-BC, US, Eur. F. albiflora Rouleau -- Flowers white. Infrequent: Regina -- Q-O, S.

Many minor segregates have been described but the material at hand would seem to indicate that they are essentially sympatric and grade into one another.

21. ELSCHOLTZIA W.

Calyx and corolla almost regular like the last two, but the flower in terminal or axillary spikes. Stamens 4.

1. E. CILIATA (Thunb.) Hyl. -- Flowers in strongly secund spikes. Leaves and spikes long petiolate. Each glomerule subtended by a suborbicular bract about equalling the flowers. Corolla pink. Late summer and fall. Rare weed of wet and shady places: Bird's Hill. -- NB-Man, (US, Eur).

A rare weed. Its U.S. distribution was detailed by S.K. Harris, Rhodora 61: 63. 1959. In Canada, it is known from only five localities: Birds Hill, Aultsville, Mount Royal, Temiscouta County and Grand Falls.

Order 57. GENTIANALES

A basic type with fused sepals and fused petals. Differs from the Primulales by its stamens alternate with the lobes of the corolla. Ovary unilocular. Fruit a capsule.

a. Leaves opposite, simple ..... 106. Gentianaceae
aa. Leaves alternate, compound ..... 107. Menyanthaceae

107. GENTIANACEAE (GENTIAN FAMILY)

Herbs with opposite and entire leaves.

a. Flower spurred ..... 3. Halenia
aa. Not spurred.
  b. Corolla tubular ..... 1. Gentiana
  bb. Corolla rotate ..... 2. Lomatogonium

1. GENTIANA L. GENTIAN

Basic type of the family. Blue-flowered herbs with a resemblance to the Caryophyllaceae, but both the sepals and petals are fused. Flowers mostly large and conspicuous.

a. Leaves fused into a sheathing base which is commonly $\frac{1}{4}$ to $\frac{1}{2}$ the length of the blade ..... 7. G. aquatica
aa. Sheath much shorter or even reduced to a mere transnodal line.
b. Annuals with variable to very long peduncles.
c. Peduncles all or mostly shorter than the flowers.
d. Corolla with a crown of fringes in the throat ..... 11. G. Amarella
dd. No fringes ..... 10. G. propinqua
cc. Mostly many times longer than the flowers.
e. Calyx minutely papillose on the keels ..... 9. G. crinita
ee. Not papillose ..... 8. G. detonsa
bb. Perennials with the flowers subsessile, or at least much longer than the peduncles.
f. Stem leaves few, only 2-3 pairs below the inflorescence ..... 1. G. glauca
ff. Stem leaves more numerous, mostly 5-10 pairs.
g. Leaves ovate to elliptic ..... 2. G. calycosa
gg. Leaves broadly lanceolate to linear.
h. Primary lobes of the corolla no longer than the intermediate ones ..... 5. G. Andrewsii
hh. Primary lobes obviously larger and longer.
i. Calyx lobes smooth ..... 6. G. linearis
ii. Calyx lobes finely scabrous-ciliate.
j. Flowers 3.5-4.5 cm long ..... 3. G. puberulenta
jj. Smaller, 2-3 cm long ..... 4. G. affinis

1. G. glauca Pallas -- Stoloniferous perennial with basal rosettes and few stem leaves. Less than 2 dm high. Leaves ovate to narrowly obovate. Flowers green or blue, few, mostly 3-5 per plant. Mid summer. Alpine prairies. -- (Mack)-Y-Aka, swAlta-BC, (nwUS), Eur.

2. G. calycosa Gris. var. obtusiloba (Rydb.) C.L. Hitchc. -- Each stem bearing a single large terminal flower. Calyx lobes large and foliaceous, ± ovate and about as long as the tube. Flower 3.5-5.0 cm long. Mid summer. Alpine talus slopes in Waterton. -- swAlta-seBC, nwUS.

3. G. puberulenta Pringle -- (G. puberula AA.; Dasystephana

puberula AA.) -- Like the following, but the flowers larger. Leaves 2.5-4.5 cm long. Calyx lobes linear, at least half as long as the tube and commonly about as long. Late summer. On chernozems, rare. -- swO-sMan, US.

Some grading to the next species has been reported to occur in Manitoba, but we have met with none. The only specimen we have seen annotated as an intermediate, J. Fletcher, Brandon, 1895 (DAO), seems to us typical of G. puberulenta.

The Burgess collection from the Coteau de Missouri (DAO) reported by Macoun 1884 as G. puberula has since been revised to G. affinis. Similar reports by Rydberg 1922 and 1932 could have been based on Macoun.

4. G. affinis Gris. (Dasystephana affinis (Gris.) Rydb.; D. interrupta (Greene) Rydb.) -- Flowers greenish-blue and tubular, with rather short, blue lobes, the latter more or less spreading at anthesis. Leaves (1.5)-2.0-(3.0) cm long. Calyx lobes usually smallish and less than half as long as the tube, often reduced to mere teeth. Second half of summer. Moister prairie spots. -- sMan-sBC, US, (CA).

The range was extended to Mackenzie by Scoggan 1957 on the basis of a collection labelled McTavish, immediate vicinity of Fort Good Hope, July 1856 (CAN), a locality some 1200 miles from the bulk of the range.

A more recent Mackenzie report by Cody 1969 was based in part on the McTavish collection, in part on a Keele River collection (DAO). Both Mackenzie collections have unusually long calyx lobes and may represent a hitherto undescribed variant.

5. G. Andrewsii Gris. (var. dakotica Nelson; Dasystephana Andrewsii (Gris.) Small) -- Closed Gentian. Bottle-Gentian -- Flower barely opening at tip, the lobes very short, about 2 mm long. Herb 5-8 dm high. Leaves and calyx lobes ciliate, the latter dilated, usually narrowly ovate and more or less spreading. Late summer. Low prairies, rare. -- wQ-seS, US -- F. albiflora Britton (G. flavida AA.) -- Flowers white. Local: Winnipeg. -- Q-sMan, US.

The corolla is here obscurely 10-lobed. The 5 primary lobes, those that correspond to the tips of the fused petals, are the smaller ones and rather inconspicuous; they are entire, darker blue, and terminate the keels of the corolla. The 5 intermediate lobes, usually termed appendages, are fimbriate, longer and more conspicuous, paler-coloured and usually yellowish; they coincide with the folds of the corolla. These relatively larger appendages characterize G. Andrewsii.

There is a certain amount of variation in the relative length of the lobes and appendages. In specimens from the eastern part of the canadian range the corolla lobes are reduced to a broadly deltoid tip, mostly less than 0.5 mm high and usually only 1-2 mm wide. Westward, the amplitude of the variation is

gradually greater and, roughly west of the Mississippi, a majority of the specimens have lobes larger than described above. An attempt to give taxonomic expression to this situation will be found in Brittonia 19: 16-22. 1967 in which var. Andrewsii is restricted to plants with corolla lobes less than 1 mm high, while var. dakotica has longer corolla lobes.

While we have not had the opportunity to examine a large series of U.S. specimens, we note that in our area most specimens are intermediate, the lobes being mostly 2-3 mm wide but only 0.5-1.0 mm high and that our plants obviously form a single population. At least as far as our area is concerned, the distinction of a var. dakotica is very difficult to implement and essentially meaningless, being based on the establishment of an arbitrary size limit, without geographical correlation.

6. G. linearis Fröl. var. lanceolata Gray -- Closed Gentian, Bastard Gentian -- Inflorescence leaves conspicuously broader than the stem ones. Resembles the previous species. Stem leaves eciliate ± lanceolate; the inflorescence leaves broader, ovate to broadly lanceolate. Calyx lobes 5-8 mm long. Second half of summer. Open marshy places. -- NB, O-sMan, US.

The leaves are isomegueth and narrower, 1 cm wide or less, in the more eastern and typical phase.

7. G. aquatica L. (G. Fremontii Torrey; G. prostrata Haenke, var. americana Eng.; Chondrophylla Fremontii (Torrey) Nelson) -- Leaves with a broad to narrow white margin. Small annual, usually less than 1 dm, the stem simple or branched from the base and bearing a single terminal flower. Corolla conduplicate in the angles as in the previous species (but not in the following ones). Fruit long stipitate, often becoming exserted. Early to mid summer. Shores at all altitudes, but rare or overlooked. -- Mack-Aka, swS-BC, wUS, SA, Eur.

G. prostrata is often used to tag such specimens as have broader and more recurved leaves with a narrower membranous margin. Variations in stipe length appear independent from the leaf variations and may perhaps be better related to the maturation of the fruit.

8. G. detonsa Rottb. var. Raupii (Pors.) Boivin (Gentianella detonsa (Rottb.) D. Don ssp. Raupii (Pors.) J.M. Gillett) -- Fringed Gentian -- Like the following, but the keels smooth. Stem mostly 2-4 dm high and leafy in the lower half. Leaves rather narrow, mostly lanceolate to long linear and 2-5 mm wide. Corolla (3)-4-(5) cm long, the lobes erose to short-fimbriate. Mid summer. Shores and marshy places. -- Mack-(Y)-Aka, neAlta.

Two other varieties, var. detonsa and var. nesophila (Th. Holm) Boivin, are known to occur respectively north and east of us. Both have somewhat smaller flowers 2.0-3.5 cm long, are usually smaller plants 2 dm high or less, and will often bear leaves near the base only. They differ in leaf width. In var. nesophila the oblong to spatulate leaves are 5-10 mm wide while those of var. detonsa are narrower in the manner of our var. Raupii. The latter was reported for northern Ontario by Gillett 1957 on the

basis two Dutilly & Lepage (DAO) collections; both have the shorter flowers and broader leaves of var. nesophila and have been revised accordingly.

Various reports of G. barbata and of G. serrata from Alberta and further to the northwest were based mainly on specimens of var. Raupii and also partly on G. crinita var. tonsa.

9. G. crinita Fröl. var. crinita -- Fringed Gentian -- Showy annual with rather large, 4-merous, blue flower borne on a long peduncle. Leaves ± lanceolate, 5-20 mm wide. Corolla lobes abundantly fimbriate-margined. Late summer. Wettish and drying places. -- swQ-sMan, US -- Var. Browniana (Hooker) Boivin (G. procera Th. Holm) -- Leaves rather narrow, long linear and less than 5 mm wide. Flowers large, at least the central one 4-6 cm long. Corolla lobes much fimbriate. -- O-sMan, ncUS -- Var. tonsa (Lunell) Boivin (G. barbata AA.; G. Macounii Th. Holm; G. tonsa (Lunell) Vict.; Anthopogon tonsus (Lunell) Rydb.; Gentianella crinita (Fröl.) G. Don ssp. Macounii (Th. Holm) J.M. Gillett) -- Leaves narrow as in var. Browniana, but the flowers small, only 2-4 cm long and little if at all fimbriate. -- sMack-(Y), Q-seBC, (ncUS) -- F. ventricosa (Gris.) Boivin (G. ventricosa Gris.) -- Corolla greenish-yellow, short and included in the inflated calyx tube. Calyx lobes very long and connivent. Rare: Grand Rapids. -- O-cMan.

The range of typical G. crinita was extended west to eastern Saskatchewan by Scoggan 1957, but the latter now thinks (verbatim 1964) that it may have been only a lapsus calami.

10. G. propinqua Rich. var. propinqua (Gentianella propinqua (Rich.) J.M. Gillett) -- Calyx lobes conspicuously of two sizes, the two larger ones at least twice as large as the other two. Resembles the following, but the flowers not fimbriate. Stem usually branched from the base. Peduncles very uneven, usually some of them longer than the flowers. Flowers mauve, drying blue, mostly in groups of 1-3. Mid summer. Wet places in arctic and alpine or subalpine prairies. -- (F)-K-Aka, L-(NF), Q-nMan, swAlta-BC, (nwUS, Eur).

Flowers dimegueth, those terminating the stem and the main branches 1.5-2.0 cm long and about 1/3 longer than the lateral flowers. Var. aleutica (C. & S.) Boivin from southern Alaska has smaller flowers, isomegueth or nearly so, and only 1 cm long or little longer.

11. G. Amarella L. (f. Michauxiana Fern.; G. acuta Mx.; Amarella acuta (Mx.) Raf.; A. plebeia (Cham.) Greene; A. scopulorum Greene; A. strictiflora Rydb.) Greene; Gentianella Amarella (L.) Börner, ssp. acuta (Mx.) J.M. Gillett) -- Felwort -- Throat of the corolla with a ring of fimbriae. Peduncles short, shorter than the flowers, the latter mostly in groups of more than 3. Calyx lobes all narrow and similar. Flowers 1-2 cm long, their colour varying from white or yellowish to mauve or greenish or blueish. Mid summer. Common in wetter places and around Aspen groves. -- G, K-Aka, L-SPM, NB-BC, US, (CA), Eur.

Colour variations do not appear to be taxonomically

significant in this species as the flower colour in any region will normally run the whole gamut of tints from white or yellowish to blue.

Our plants could be distinguished as var. stricta (Gris.) Watson on their reputedly smaller flowers. However Hegi describes the flowers as 10-20 mm long and this happens to be the range of variation in the european as well as in the canadian specimens studied. The difference is probably statistical only, with the flowers of the european plants apparently averaging a few millimeters longer.

2. LOMATOGONIUM Braun

As in Gentiana, but the flower widely open and more or less rotate. No terminal stigma, but the stigmatic lines are borne laterally along the sutures of the ovary. Sepals practically free; petals fused near the base only.

1. L. rotatum (L.) Fries (Pleurogyne rotata (L.) Gris.) -- No terminal stigma, the ovary stigmatic in lines along the sides. Annual herb with the general presentation of a Gentiana. Peduncles elongate. Flowers showy, ± mauve. Mid summer to mid autumn. Wettish places, rare. -- G-Aka, L-NF, swNB-BC, (US), Eur -- F. albiflorum Pol. -- Flowers white. -- (G), K, Y-Aka, Q-(neO), S-Alta.

3. HALENIA Borkh. SPURRED GENTIAN

Corolla spurred.

1. H. deflexa (Sm.) Gris. var. deflexa -- Flower greenish and more or less tinged blue. Leaves broadly lanceolate. Annual herb with the general presentation of a Gentian. Mid summer. Open places in cold woods. -- L-SPM, NS, NB-BC, US, (CA).

In ours the median internodes are rather elongate, but around the Gulf of Saint Lawrence it grades into a smaller var. Brentoniana (Gris.) Gray, less than 2 dm high, the foreshortened internodes being shorter than the leaves.

108. MENYANTHACEAE (BUCK-BEAN FAMILY)

As in the Gentianaceae, but the leaves basically alternate.

1. MENYANTHES L. BUCKBEAN

Leaves trifoliate. Corolla lobes bearded inside with large hair-like processes.

1. M. trifoliata L. (var. minor Raf.) -- Bog-Bean, Beaver-Root (Herbe à canards, Trèfle d'eau) -- A palustrine herb with large trifoliate leaves, these alternate on the rhizome. Leaflets 3-10 cm long, narrowly obovate. Inflorescence a raceme of white flowers on a naked scape. Late spring and early summer. Wet places, often boggy, more usually in shallow water. -- G, K-Aka, L-SPM, NS-BC, US, Eur.

Order 58. PLANTAGINALES

Resembles the Gentianales, but the sepals are free while the petals are fused.

109. PLANTAGINACEAE (PLANTAIN FAMILY)

Herbs with small tetramerous flowers.

1. PLANTAGO L. PLANTAIN

Fruit circumcissile. Flowers in long or short spikes.

a. Leaves opposite ..... 11. P. Psyllium
aa. All basal.
  b. Leaves coarsely toothed to pinnatifid ..... 5. P. Coronopus
  bb. Entire or remotely denticulate.
    c. Leaves narrowly lanceolate to broadly ovate ..... Group A
    cc. Linear ..... Group B

Group A

Larger leaves at least 1 cm wide and with 5 or more conspicuous parallel nerves.

a. Bracts long caudate; sepals ciliate and somewhat villous ..... 7. P. lanceolata
aa. Bracts acute to rounded; sepals glabrous.
  b. Leaves ovate.
    c. Filaments very conspicuous and persistent, at least twice as long as the corolla ..... 6. P. media
    cc. About as long as the corolla and usually not obvious ..... 1. P. major
  bb. Leaves variable, ± lanceolate.
    d. Filaments exserted by 4-6 mm and more or less marcescent ..... 8. P. canescens
    dd. Only exserted by 1-2 mm and evanescent ..... 2. P. eriopoda

Group B

Leaves narrower, less than 1 cm wide, and usually less than 5 mm wide. Nerves 1-3.

a. Flowers glabrous.
  b. Leaves filiform, less than 3 mm wide ..... 4. P. elongata
  bb. At least 5 mm wide ..... 8. P. canescens
aa. Villous to long lanate.

c. Flowers short villous, leaves fleshy .... 3. P. maritima
cc. Spike buried in villous hairs, these over 1 mm long; leaves not fleshy.
d. Bracts 1-3 cm long, conspicuous and blackening in drying ..... 9. P. aristata
dd. Shorter, green and mostly not overtopping the flowers ..... 10. P. patagonica

1. P. major L. (var. asiatica AA., var. Pilgeri Domin, var. scopulorum Fries & Broberg; P. asiatica AA.) -- Rat-Tail, Plantain (Queue de rat, Plantain) -- A common rosette herb with oval leaves and 5-7 conspicuous parallel nerves. Not woolly among the greenish leaf bases. Scapes few, mostly 1-4 dm high. Corolla lobes about 1 mm long. Seeds most numerous, at least 6, and much smaller, about 1 mm long. Summer. Common weed of footpaths, spreading to shores, etc. -- (G), Mack-Aka, L-SPM, NS-BC, (US), Eur.

Perhaps only an introduced plant in North America, but exceptionally well naturalized in certain habitats. Or perhaps native on shores northward and around the Gulf of Saint Lawrence.

2. P. eriopoda Torrey var. eriopoda (P. Rugelii AA.) -- Similar but coarser, with abundant brownish wool among the reddish leaf bases. Leaves thickish and somewhat fleshy, very variable, mostly lanceolate, the nerves very rugose below, the lower face usually villous. Spike mostly 5-20 cm long. Late spring and early summer. Alkaline prairies. -- Mack-Y, seQ, Man-BC, EU, (CA).

Sometimes resembling P. major, but the seeds only 4 in number and about 2 mm long.

Keewatin reports by Hultén 1949 and Anderson 1950 have not been confirmed.

A south-central Alaska report by Scoggan 1957, repeated by Boivin 1967, may have started as a lapsus for south-central Yukon.

A Nova Scotia report by Gleason 1952 has not been checked, but is likely to be unsubtantiated as were quite a few other canadian range extensions in Gleason.

The more western var. Tweedyi (Gray) Boivin is not so coarse and somewhat smaller. Usually little if at all lanate at base. Leaves not so rugose and the nerves much buried in the leaf tissue except the midnerve. Spike about 5 cm long. Var. Tweedii was reported by Hitchcock 1959 (as P. Tweedyi Gray) from Saskatchewan and Alberta, querried by Boivin 1966. We know of no justifying specimens for our area and the only known canadian collection is from Lavington Creek (DAO) in southeastern B.C.

3. P. maritima L. (P. decipiens Barnéoud; P. juncoides Lam.; P. oliganthos R. & S.) -- Goose-Tongue (Perce-pierre, Passe-pierre) -- Leaves thick and fleshy, almost triangular in cross section. Tufted perennial. Pubescent in the inflorescence, including the corolla tube. First half of summer. Seashores and

rarely inland at salt springs at the mouth of the Red Deer (Man.) and at Heart Lake -- G-(F)-K-(Mack), Aka, L-SPM, NS-nMan, nAlta-BC, US, SA, Eur, (Afr).

4. P. elongata Pursh var. elongata (P. pusilla AA.) -- Glabrous or puberulent annual, not fleshy. Herbage green. Less than 2 dm high, the scapes commonly 5-15 cm long, overtopping the leaves, the latter filiform or narrowly ribboned, up to 3 mm wide. Spikes commonly 2-5 cm long. Flowers commonly 5-8 per centimeter. Perianth glabrous. Capsule 2-3 mm long. Late spring and early summer. Arroyos and exsiccated saline flats. -- (sw Man)-S-sBC, US.

It has been customary to place the Pacific coast plants and some of the Pacific States material into a segregate P. Bigelovii Gray, but the distinction between the two species was so poor that Cronquist ex Hitchcock 1959 was prompted to consolidate the two. We accepted this view in our Enumération of 1966-67.

A recent paper by I.J. Bassett, Can. Journ. Bot. 44: 467-479, 1966, provides a basis for a new and apparently quite workable classification of the canadian material into three geographical variants.

The typical phase as described above is the only one in our area and it ranges as far west as the Pacific coast, overlapping the range of the other two varieties.

Var. Bigelovii (Gray) stat. n., P. Bigelovii Gray, Pac. Railr. Rept. 4: 117, 1857. Smaller and the shorter spikes denser. Greenish and less than 7 cm high. Spikes less than 2 cm long and usually under 1 cm long, rather crowded, the flowers usually 10-15, per cm. Capsule 2-3 mm long. Mainly coastal from B.C. to California, but also found some distance inland. Most material formerly held as intermediate should be placed in the next variety.

Var. pentasperma (Bassett) stat. n., ssp. pentasperma Bassett, Can. Journ. Bot. 44: 470, 1966. Herbage ± reddish and the capsules bigger, 3.0-3.5-(4.5) mm long; otherwise somewhat intermediate to the first two. Mostly 5-10 cm high. Spike usually 1-3 cm long and the flowers 5-12 per cm, but appearing rather crowded because of the longer capsules. Largely sympatric to Bigelovii, but more often found somewhat inland rather than along the coast.

To complete the picture, a fourth variety, var. californica (Greene) stat. n., P. californica Greene, Bull. Cal. Ac. 1: 123, 1885, is known to occur from central California to Northern Mexico. Usually confused with the more eastern and primarily planicostal P. heterophylla Nutt.

According to Bassett, var. elongata has 12, var. Bigelovii 20 and var. pentasperma 36 chromosomes.

5. P. CORONOPUS L. -- Star-of-the-Earth, Buck's Horn (Pied de corbeau, Corne de cerf) -- Leaves coarsely toothed to pinnatipartite. Herbage hirsute. Flowers puberulent, including the corolla tube. Stigmas very long. Early summer to late fall. Rare weed: Brandon. -- G, NB, Man, BC, US, Eur.

6. P. MEDIA L. -- Lamb's Tongues, Fire-Leaves (Plantain bâtard, Plantain blanc) -- Closely resembling P. major, but the obovate leaves tapering to a winged petiole. More pubescent. Stiffly erect scapes arising from a short decumbent base and tending to form an open-ended rib-cage. Corolla lobes ± 1.5 mm long. Seed 2-4, about 1.5 mm long. Summer. Waste places, rare: Brandon. -- NB-Man, BC, (US), Eur.

7. P. LANCEOLATA L. -- Ribgrass, English Plantain (Herbe aux 5 coutures, Oreille de lièvre) -- 2-5-(10) dm high but the dense spike rather short, usually less than 3 cm long. Leaves variable, commonly lanceolate and 1-2 cm wide, long villous, white-lanate among the bases. Corolla lobes around 2 mm long. Summer. Rare weed, especially, unwelcome in lawns; Winnipeg (?) -- (Aka), NF-(SPM), NS-PEI-(NB)-Q-Man (?), BC, US, Eur.

Has been reported from Saskatchewan by Russell 1954 and Breitung 1957, but the corresponding Waskesiu Lake specimen (SASK) was revised to P. major in 1956 by Dr. C. Frankton, according to the latter's notes for a once proposed "Introduced Species of Spermatophyta in Sask."

The Manitoba reports of P. lanceolata for Oak Point and Carman could not be tied down to vouchers. They stand apparently unverifiable and we are cartesianally inclined to discount anything unverifiable.

The other Manitoba reports can be related to a sheet collected by C.H. Lee (WIN). The corner of this sheet was inscribed "Plantago lanceolata L., Man., id. Oct. 1920, I.L.C.". The initials stand for I.L. Conners, who wrote the inscription, and "id" for identified. This corner inscription was covered by a succession of labels. The first one is Manitoba Agricultural College label inscribed "C.H. Lee, plots and fields sown to grass, Summer, id. by C.H.L. & I.L.C.". This is presumably the basis for Jackson's 1922 entry of "Plantago lanceolata, Rib Grass (not thriving), intr(oduced) in gr(ain) seed." A second covering label was added later; it is of the chartated type that came into use at Winnipeg after 1950; it reads "C.H. Lee, Manitoba, cultivated fields, Summer" and is clearly the label quoted by Scoggan 1957. Presumably (but not unquestionably) this sheet was collected at the Manitoba Agricultural College, as is intimated by the heading of the first label. However it was ignored by Lowe 1943 and has not been confirmed by any later collection. We are reporting it has questionable.

8. P. canescens Adams var. cylindrica (J.M. Macoun) Boivin (P. septata Morris) -- Much as in P. eriopoda, except for the long and persistent filaments. Leaves not fleshy but heavily hirsute. Usually not woolly among the leaf bases. Spike less than 1 dm long. Early summer. Foothill and montane meadows. -- (wF), Mack-Aka, swAlta, (nwUS).

Our plants have seeds 1.0-1.7 mm long. Otherwise they differ hardly from the typical phase, an endemic of the Irkust area, with slightly larger seeds, ± 2 mm long.

9. P. ARISTATA Mx. -- Buckhorn -- Spike conspicuously long-

bracted from base to top. Villous throughout. Annual. Leaves filiform. Bracts mostly 1.0-1.5 cm long, ascending, filiform with a flaring base. Late summer. Rare weed of disturbed soils: Walsh, Manyberries. -- (Y), NS, O, sAlta-BC, US, (CA).

10. P. patagonica Jacq. (P. aristata AA.; P. Purshii R. & S.; P. spinulosa Dcne.) -- Densely soft and long villous throughout. Grayish to whitish annual with narrow leaves. Bracts green and not conspicuous, or the lower up to 1 cm long. Spike very short or up to half the height of the plant. First half of summer. Wind-eroded steppes and dried-up alluvial flats, often in great abundance, but infrequent. -- sMan-swS-BC, US, SA.

11. P. PSYLLIUM L. (P. indica L.) -- Fleawort (Oeil de chien, Pucière) -- Branchy annual with opposite leaves. Leaves linear. Spikes short, axillary on long peduncles. Bracts broadly obovate, pilose and ciliate. Mid summer. Rare and evanescent weed of disturbed soils: Brandon. -- (NS), swQ-sMan, BC, US, Eur, (Afr).

Order 59. CAMPANULALES

Resembles the Gentianales, but the ovary is inferior.

a. Anthers free; corolla regular ..... 110. Campanulaceae
aa. Anthers connate; corolla zygomorphic ..... 111. Lobeliaceae

110. CAMPANULACEAE (BLUEBELL FAMILY)

Basic and unspecialized type of the order. Single genus with us.

1. CAMPANULA L. BLUEBELL

Basic and unspecialized genus. Flower typically a "bluebell". Capsule opening by lateral pores.

a. Stem simple with a single terminal flower.
  b. Leaves entire or glandular-denticulate ..... 3. C. uniflora
  bb. Sharply dentate ..... 5. C. lasiocarpa
aa. Typically many-flowered.
  c. Stem leaves ovate to lanceolate, at least 1 cm wide.
    d. Flowers sessile and glomerulate ..... 1. C. glomerata
    dd. Pedicellate and forming a terminal and secund raceme ..... 2. C. rapunculoides
  cc. Much narrower and narrowly lanceolate to filliform.
    e. Leaves retrorsely scabrous ..... 6. C. aparinoides
    ee. Not scabrous and usually glabrous; flowers larger ..... 4. C. rotundifolia

1. C. GLOMERATA L. -- Clustered Bellflower (Ganteline d'Angleterre) -- Flowers large and sessile in a terminal and involucrated glomerule. Smaller axillary glomerules sometimes present. Stem leaves denticulate, the upper triangular and amplexicaul, the lower narrower and petiolate. Bracts of the involucre about as long as to slightly longer than the flowers, the latter ± 2 cm long. First half of summer. Naturalized from cultivation into many acres of open Oak bush at Garson. -- Man, Eur.

More commonly cultivated and escaped in North America, but not yet in our area, is cv. Speciosa with larger heads, the flowers ± 3 cm long.

2. C. RAPUNCULOIDES L. var. RAPUNCULOIDES -- Bellflower, Bluebell (Campanule, Raiponcette) -- Virgate herb with a showy and secund raceme of large blue flowers. Leaves dentate. Calyx scabrous-puberulent. Corolla 1.5-3.0 cm long. Second half of summer. Sometimes cultivated and locally spreading or established. -- (NF, NS-NB)-Q-Man, Alta, US, Eur.

Also naturalized in Eastern Canada is var. ucrainica (Besser) Koch with glabrous calyces.

3. C. uniflora L. -- Small inconspicuous herb with a single terminal flower. Stem 1-2-(3) dm high. Flower small, less than 1 cm long. Calyx lobes entire, about as long as the corolla tube. First half of summer. Arctic and alpine prairies. -- G-Aka, L, Q, (nMan), swAlta-seBC, US, Eur.

4. C. rotundifolia L. var. rotundifolia (var. arctica Lange, var. petiolata (A.DC.) Henry; C. petiolata A.DC.) -- Bluebell, Thimble (Cloches, Clochettes bleues) -- Delicate herb with large, drooping, bell-shaped blue flowers. Leaves strongly dimorphic, the rosette ones broadly lanceolate to deltoid or suborbicular, and dentate, the others linear to filiform and entire. Flowers few and often secund. Corolla tube at least 1 cm long. Early to mid summer. Dry open places. -- G-Mack-(Y)-Aka, L-SPM, (NS)-PEI-BC, US, CA, Eur -- F. albiflora Rand & Redf. -- Flowers white. Rare and local. -- NF, (SPM, NS, NB, Man, US).

Calyx lobes setaceous, less than 1 mm wide. Grades into the more western var. alaskana Gray with calyx lobes 1.5-3.0 mm wide, tending to be fewer-flowered or one-flowered, and the leaves commonly wider, ± lanceolate.

5. C. lasiocarpa Cham. -- Calyx lobes sharply and remotely laciniate-toothed in the manner of the leaves. Usually less than 1 dm high. Herbage somewhat villous, the ovary more densely so and often even white-tomentose. Flower large as in the last, but solitary and erect. Mid summer. Scattered in mountain meadows and rocky slopes. -- Mack-Aka, swAlta-BC, (US), Eur.

6. C. aparinoides Pursh (C. uliginosa Rydb.) -- Marsh-Bluebell -- A weak herb ± scrambling by its strongly retrorse-scabrous stems, leaf margins and midnerves, often forming tangled masses. Otherwise glabrous. Leaves ± linear. Flowers few, terminal and axillary on long peduncles. Corolla about 1 cm long, pale blue, its tube variable, often shorter than the lobes. Summer. Marshy places. -- NS, NB-cS, US, Eur.

111. LOBELIACEAE (LOBELIA FAMILY)

Much as in the last and often united with it. Flowers zygomorphic; anthers connate.

a. Flowers pedunculate ..... 1. Lobelia
aa. Flower topping a very long and sessile ovary ..... 2. Downingia

1. LOBELIA L. LOBELIA

Two of the anthers smaller, the anther-tube thus asymetrical and arching.

a. Leaves all basal; submerged aquatic ..... 1. L. Dortmanna
aa. Terrestrials with leafy stem.
b. Leaves linear, entire ..... 2. L. Kalmii
bb. Broader and serrate ..... 3. L. spicata

1. L. Dortmanna L. -- Water-Gladiole, Water-Lobelia (Lobélie tutélaire) -- Submerged aquatic of shallow waters with its flowering raceme protruding above the surface. Rosette leaves numerous and falcate, thickish and hollowed out by 2 tubes separated by the midnerve. Stem leaves reduced to small filiform bracts. Flowers pale blue. Mainly mid summer. Fresh water shallows. -- NF-SPM, NS-O, nS, wBC, US, Eur.

Possibly common across the extreme north, but we know it yet only from Portage-La-Loche and lakes Athabaska, Carswell, and Windrum. Two Alberta dots on a map by Hultén 1958 seem questionable.

2. L. Kalmii L. (L. strictiflora (Rydb.) Lunell) -- Lower lip of the bilabiate blue flower with a large white patch and 3 divergent lobes. Upper lobes reflexed. Small and rather gracile, weakly-rooted perennial. Lower leaves oblanceolate, the others linear. Flowers few, axillary or somewhat racemose. Mid summer. Boggy places. -- Mack, NF, NS, NB-BC.

An Alberta report by Moss 1959 of the white-flowered form, f. leucantha Rouleau, seems unsubstantiated; it is not an improbable occurrence and may have been merely speculative. Other speculative Alberta entries will be mentionned later on.

3. Lobelia spicata Lam. var. spicata (var. hirtella Gray; L. hirtella (Gray) Greene) -- Highbelia -- Habitally similar to the last but somewhat coarser, with larger dentate leaves and more numerous flowers in a denser spike. Virgate. Leaves lanceolate to obovate. Towards mid summer. Low meadows. -- NS-cAlta, US -- F. campanulata (McVaugh) Bowden -- Anthers white, sterile. Corolla blue or more often white. -- Q-Man, US.

We are somewhat perplexed by the single known Alberta occurrence, a Brinkman collection from Craigmyle (US). Besides having never been confirmed, it is removed from the rest of the range by hundreds of miles.

The commonly distinguished var. hirtella Gray is found from

Nova Scotia to Alberta and is essentially sympatric to the glabrous phase. Both varieties appear to grow frequently together, judging from the high proportion of herbarium sheets that carry a mixture of phenotypes. The recognition of var. hirtella is of no obvious intellectual import.

However, a better justified variety is the more southern var. scaposa McVaugh, its leaves strongly dimegueth, the stem leaves fewer, smaller, and very narrow, the basal leaves much larger, usually 2-3 cm wide.

L. siphilitica L. var. ludoviciana A.DC. is supposed to occur in Canada in the Turtle Mountain. The justifying specimen is Burgess 139, Turtle Mt., low open prairie, July 26, 1874 (TRT). Not only has this never been confirmed in nearly a hundred years, but the specimen itself is hardly convincing as it consists only of a stick bearing 8 leaves but no inflorescence. Further, the path followed by Burgess and the main body of the surveying party ran from Pembina, one mile south of the International boundary, westward to the southern edge of the Turtle Mtn. in North Dakota, hence to the first crossing of the Souris River. The stick referred to is therefore likely to have been collected in North Dakota. A brief description of the trip of T.J.W. Burgess will be found in Journ. Proc. Ham. Ass. 4: 117-120. 1888 and a more detailed one in Dawson's report of the boundary survey published in 1875.

2. DOWNINGIA Torrey

Ovary inferior, exceptionally long and sessile.

1. D. laeta Greene -- Small herb with ovaries often half as long as the height of the plant. (Annual?). Stem thickened towards the base. Leaves few, lanceolate. Flowers few, axillary. Corolla blueish, small, mostly shorter than the calyx lobes. Elongate ovaries resembling thickened peduncles. Summer. Arroyos, very local: Crane Lake, Skull Creek, Foremost. -- swS-seAlta-(BC), US.

Order 60. ASTERALES

Floral type of the last, but the inflorescence much reduced and the flowers congested into an involucrated head which is functionally homologous to a flower and is often popularly so called. Calyx much reduced or transformed into some kind of dispersal mechanism, usually a pappus.

a. Flowers 4-merous; anthers free ..... 112. Dipsacaceae
aa. 5-merous; anthers connate ..... 113. Compositae

112. DIPSACACEAE (TEASEL FAMILY)

Flowers in involucrated heads, like the next, but stamens only 4 and their anthers free. Each ovary subtended by a bract and enclosed in a secondary involucre of fused bractlets.

1. KNAUTIA L.

Lacks the bract which otherwise subtends each floret in this family. Calyx more or less modified into a setaceous pappus.

1. K. ARVENSIS (L.) Duby (Scabiosa arvensis L.) -- Bluebuttons, Gypsy's Rose (Oreille d'âne, Mirliton) -- Leaves opposite, the middle and upper pinnatipartite and with a larger terminal segment which is more or less toothed. Lower and basal leaves more or less entire. Herbage long villous or hirsute. Flowers mauve, pilose, the outer somewhat larger. Pappus yellowish. Towards mid summer. Sporadic escape, mostly along roadsides. -- NF, NB-BC, Eur.

CERTAMEN MELASTOMATACEIS XVIII.

John J. Wurdack
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HETEROTRICHUM DC.

The generic delimitation of Heterotrichum DC. has been a major hindrance in the treatment of the Venezuelan Miconieae. The generotype was recently indicated (Fieldiana Bot. 29: 569. 1963) as H. angustifolium DC. The reasons adduced for this selection are not valid: the foliar features given by de Candolle for both H. niveum (Desr.) DC. and H. angustifolium fit the generic description; the location of the species types is immaterial, de Candolle having done much work in Paris during his melastome research, besides having a type fragment of H. niveum and a Swartz collection of H. patens (Sw.) DC. in his own herbarium. In Bentham & Hookers' Genera Plantarum (1: 765. 1867), H. niveum was definitely indicated as the generotype, this lectotypification seeming indisputable. Swartz (Prodr. Fl. Ind. Occ. 68. 1788) cited Melastoma umbellata Miller as a synonym of M. patens Sw.; thus Swartz's name is illegitimate, the correct name for the species being H. umbellatum (Mill.) Urb. or perhaps Clidemia umbellata (Mill.) L. Wms. Urban indicated that H. niveum was a taxonomic synonym of the variable H. umbellatum.

The above discussion should be regarded as a historic footnote, since Heterotrichum DC. (1828) is a later homonym of Heterotrichum Marschall von Bieberstein (1819-1820); this homonymy was noted in DC. Mon. Melast. 68 (1829), but de Candolle assumed (incorrectly according to the present-day International Code of Botanical Nomenclature) that his taxonomic synonymization of the earlier genus of Compositae under Saussurea DC. permitted the re-use of Heterotrichum in the melastomes. The next generic name published for the complex, Octomeris Naud. (1845), included three new species, O. rostrata, O. tuberculata, and O. macrodon, as well as a "species addenda," O. bonplandii Naud. (Melastoma octona Bonpl.). Later (Ann. Sci. Nat. ser. 3 Bot. 17: 382. 1852), Naudin mentioned O. bonplandii as a "species exclusa" in his amplification of Octomeris, having already treated that species under Staphidium. Unfortunately Rafinesque (Sylv. Tell. 95. 1838) had described the genus Octonum, based on Melastoma octonum Bonpl.; thus Naudin's genus Octomeris was illegitimate, having included the type of an earlier name. Karsten (Linnaea 28: 439. 1856) described the genus Diplodonta; the type, D. setosa Karst., is a taxonomic synonym of Clidemia octona (Bonpl.) L. Wms.

As a result of the nomenclatural inadvertences above cited, most of the melastome species treated by Cogniaux under Heterotrichum DC. are left without a generic name unless Heterotrichum DC. (non Marschall von Bieberstein) should be conserved. Since

I presently have no illusions as to producing any final generic alignment in the tribe Miconieae, the Venezuelan species of Heterotrichum DC. are being treated in Miconia. Only those transfers needed for the South American species are being published. I really have no opinion as to the best generic placement of the West Indian species of Heterotrichum DC.

The use of the name Octomeris as a section of Miconia is being continued, the citation being Miconia Sect. Octomeris Triana in Benth. & Hook. Gen. Plant. 1: 764. 1867. The only original species of Octomeris Naud. treated in Miconia Sect. Octomeris by Triana (Trans. Linn. Soc. Bot. 28: 102-103. 1871) is M. tuberculata (Naud.) Triana. Probably this need not be regarded as limiting in the ultimate selection of a sectional lectotype species.

MICONIA MACRODON (Naud.) Wurdack, comb. nov.

Octomeris macrodon Naud., Ann. Sci. Nat. ser. 3 Bot. 4: 53, pl. 2, fig. 3 c. 1845.

Heterotrichum macrodon (Naud.) Planch. ex Hook. f., Bot. Mag. pl. 4421. 1849.

The lower elevation collections (up to about 500 m) have eglandular hairs, while the higher-elevation ones show more-or-less gland-tipped hairs on the young stems, petioles, and hypanthia; however, the correlation is not absolute with elevation. As noted by Naudin, there also is considerable variation in the dimensions of the vegetative pubescence, such collections as Funck 486 (P), Steyermark & Wessels Boer 100415 (US), Saer 402 (NY), and Curran 85M (NY) and 326M (NY, US) having longer (7-13 mm) patent stem hairs; pubescence intermediates between this and the form with shorter finer hairs have been collected. From my notes at Paris, the syntypes are Funck 382 and Linden 265; Naudin credited the former to "Caracas" but the label on another collection (W) reads "Cumana"; Linden's collection was from "circa urbes Truxillo et Lima," and was perhaps made in northern Trujillo or southern Lara, the furthest southwest localities in specimens seen by me being "Piedade-Sarare" and "Barquisimeto" in Lara.

MICONIA FUNCKII Wurdack, nom. nov.

Octomeris schlimii Naud., Ann. Sci. Nat. ser. 3 Bot. 17: 379. 1852.

Heterotrichum schlimii (Naud.) Triana, Trans. Linn. Soc. Bot. 28: 134. 1871. Non Miconia schlimii Triana, Trans. Linn. Soc. Bot. 28: 102. 1871.

MICONIA BRETELERI Wurdack, sp. nov.

M. funckii Wurdack affinis, ramulorum pubescentia breviore plus appressa, folia paulo plinervata floribus minoribus calycis dentibus exterioribus longe eminentibus differt.

Ramuli teretes sicut petioli foliorum venae primariae subtus pedicellique modice appresso-setulosi pilis laevibus plerumque 0.5-1(-1.5) mm longis. Petioli 1-3 cm longi; lamina

4-10(-13) X 2.5-5(-6) cm, ovata apice gradatim breviterque acuminato basi obtusa, membranacea et obscure ciliato-serrulata, ubique sparsiuscule appresso-setosa pilis gracilibus laxis plerumque 1-1.5 mm longis, breviter (0.3-0.7 cm) 7-plinervata nervulis subtus planis obscuris laxiuscule irregulariterque reticulatis (areolis ca. 0.4 mm latis). Inflorescentia terminalis plerumque triflora, pedunculo ca. 0.3 cm longo; flores 8(-9)-meri, pedicellis ca. 4-6 mm longis, bracteolis ca. 2 X 1.5 mm ovatis persistentibus ca. 2 mm infra hypanthii basim insertis. Hypanthium (ad torum) 5.5 mm longum modice appresso-setosum, pilis gracilibus laevibus 2-3 mm longis; calycis tubus ca. 2.5 mm longus, lobis ad anthesim ca. 0.5 mm longis ovatis, dentibus exterioribus linearibus gracili-setosis 4-4.5 mm eminentibus; torus glaber. Petala glabra 11-11.5 X 8-8.5 mm oblongo-obovata apice rotundato. Stamina isomorphica glabra; filamenta ca. 6 mm longa; thecae 5.5 X 0.8 mm lanceatae infra filamenti insertionem ca. 0.5 mm prolongatae, connectivo nec prolongato nec appendiculato. Stigma capitatum, ca. 1.5 mm diam.; stylus 9 X 1 mm modice glanduloso-puberulus (pilis ca. 0.15 mm longis) in ovarii collo ca. 0.8 mm immersus; ovarium 8(-9)-loculare 2/3 inferum glabrum.

Type Collection: F. J. Breteler 4910 (holotype US 2583289A), collected on a slope with secondary regrowth between La Fría and Seboruco, Edo. Táchira, Venezuela, elev. ca. 1000 m, 22 Dec. 1965. "Shrublet ca. 80 cm tall, in shade. Leaves herbaceous, thinly papery, pale green, slightly glossy. Calyx bright red. Corolla, stamens, and style white. Flowers with unpleasant smell."

Paratypes (both Edo. Merida, Venezuela): L. Ruiz Terán 3127, from El Amparo along the road to Páramo de Mariño, Distrito Tovar, elev. ca. 1460 m, 13 May 1966. "Sufrútice radicante. Hipanto primero rojo purpúreo claro, luego verde, con pelos pojo purpúreo claro. Pétalos blancos; en la yema, el borde que cubre de color rojo carmén intenso. Estambres blancos"; J. Linden 1400 (W), from "Murmuguena (Bailadores), 3000 ped., juin 1843."

Miconia funckii has patent or subdeflexed stem hairs ca. 2 mm long, the inner pair of primary veins on the larger leaves diverging 1-2.5 cm above the blade base, the petals 16.5-19 mm long, the anthers 7.5 mm long, the external calyx teeth barely (to 0.8 mm) emergent, and the torus sparsely glandular-setulose. Cogniaux' description of long calyx teeth for M. funckii (as Heterotrichum schlimii) must have been based on his and Triana's mistaken identification of Linden 1400, the type collection (Schlim 313) showing short teeth (as noted by Naudin in the original description). Several recent collections from Miranda and the Distrito Federal in Venezuela agree well with Schlim 313.

MICONIA TUBERCULATA (Naud.) Triana

Miconia rostrata (Naud.) Cogn., DC. Mon. Phan. 7: 752. 1891.

Octomeris rostrata Naud. var. villosa Naud., Ann. Sci. Nat. ser. 3 Bot. 4: 53. 1845.

The species shows minor fluctuation in length and appression of cauline pubescence and considerable variability in flower size, but the numerous collections give a continuous spectrum in these features. Actually, the holotype of Octomeris rostrata Naud. (P) has cauline pubescence strictly appressed and leaves like those in Funck & Schlim 740. The synonymy choice was first done by Triana (Trans. Linn. Soc. Bot. 28: 102. 1871). Octomeris rostrata var. villosa was overlooked by Cogniaux; the holotype (Bonpland 373, from "Cumana") has dense spreading cauline pubescence ca. 1.5 mm long and patent hypanthial hairs ca. 1 mm long, as well as the largest leaves 9-nerved. Naudin's variety fits within the species variability, the type being well matched by Linden 1159 from "Bogotá."

MICONIA ARAGUENSIS Wurdack, nom. nov.

Heterotrichum glandulosum Cogn., DC. Mon. Phan. 7: 955. 1891. Non Miconia ? glandulosa (Sw.) Naud., Ann. Sci. Nat. ser. 3 Bot. 16: 244. 1851. Non Miconia glandulosa (O. Ktze.) R. Knuth, Fedde Rep. Beih. 43: 531. 1928.

MICONIA ARAGUENSIS Wurdack var. ANGUSTIFOLIA (Cogn.) Wurdack, comb. nov.

Heterotrichum glandulosum Cogn., var. angustifolium Cogn., DC. Mon. Phan. 7: 955. 1891.

Moritz 776 (BM) and modern collections from Miranda and the Distrito Federal in Venezuela have shorter petioles and generally narrower leaf blades than in the typical variety; also the flowers are smaller (petals 8.5-9 mm long, rather than 13-15 mm; anthers 4 mm long rather than 5 mm). From the description and a single leaf of the type (BR), H. glandulosum var. parvifolium Cogn. does not seem to differ from var. angustifolium. A variant of M. araguensis with shorter pubescence has twice been collected in Depto. Santander, Colombia (Killip & Smith 15082, Uribe 6167).

MICONIA LEIOTRICHA Wurdack, nom. nov.

Heterotrichum lucidum Triana, Trans. Linn. Soc. Bot. 28: 134. 1871. Non Miconia lucida Naud., Ann. Sci. Nat. ser. 3 Bot. 16: 196. 1851.

MICONIA LAEVIPILIS Wurdack, nom. nov.

Heterotrichum racemosum Wurdack, Phytologia 8: 171. 1962. Non Miconia racemosa (Aubl.) DC., Prodr. 3: 179. 1828.

MICONIA SANTAREMENSIS Wurdack, sp. nov.

In systemate Cogniauxii M. benthamianae Triana affinis pubescentia stellata destituta foliis 3(-5)-nervatis supra sparse strigulosis petalis proportionaliter angustioribus toro ovarioque modice glanduloso-puberulo ovario 4-loculari differt.

Ramuli teretes sicut foliorum venae primariae supra et subtus petiolique modice strigulosi pilis laevibus 0.5-1.5(-2) mm longis. Petioli 0.8-1.5 cm longi; lamina (6-)8-12.5 X

(2-)3-6.5 cm oblongo-ovata apice gradatim angusteque acuto basi obtusa, membranacea et integra vel obscure undulata, supra sparse strigulosa pilis gracilibus laevibus 0.4-1 mm longis persistentibus (pilis caduce glanduliferis brevibus sparse intermixta), subtus sparsiuscule vel modice appresso-setulosa pilis gracilibus eglandulosis plerumque 0.4-1.2 mm longis, 3(-5)-nervata nervis secundariis 0.3-0.4 cm inter se distantibus nervulis subtus laxiuscule reticulatis. Panicula 4-6 cm longa et submultiflora, ramulis pedicellisque modice appresso-setulosis; flores (6-)7-meri, bracteolis 1-1.5 mm longis lanceatis strigulosis, pedicellis 0.5-1 mm longis. Hypanthium (ad torum) 2.3 mm longum dense appresso-setulosum pilis plerumque 0.4-0.8 mm longis laevibus pilis glanduliferis patentibus 0.4-0.6 mm longis modice intermixtis; calyx 0.7-0.8 mm longus truncatus, dentibus exterioribus obscuris non eminentibus; torus modice glanduloso-setulosus pilis 0.1-0.3 mm longis. Petala 8-9 X 2.7-3.2 mm obovato-oblonga (apice rotundato) glabra vel interdum setula unica glandulifera 0.2 mm longa terminata. Stamina (18-)21 paulo dimorphica glabra, antheris basim versus 4-locularibus poro unico 0.15 mm diam. paulo dorsaliter inclinato. Stamina (6-)7 maiora: filamenta 5.6-5.8 mm longa; thecae 4 X 0.9 X 0.9 mm, connectivo ad basim incrassato. Stamina (12-)14 minora: filamenta 4.7-5 mm longa; thecae 3 X 0.5 X 0.4 mm, connectivo ad basim non incrassato. Stigma paulo expansum 0.8 mm diam.; stylus glaber 8 X 0.5 mm; ovarium 4-loculare, apice conico 1 mm alto modice setuloso (pilis p.p. glanduliferis) styli collo 0.7 mm alto; semina 1.1 X 0.8 mm essentialiter laevia.

Type Collection: A. Ginzberger s.n. (holotype W), collected at "Taperinha bei Santarem, Rand der Sekundarwaldes der Terra firme," Pará, Brazil, 16 June (fr.)-22 July (fl.), 1927. "Blüten weiss."

Miconia benthamiana has cordate-based 7-9-nerved leaf blades sparsely glandular-puberulous above when young, an underlayer of stellulate hairs on the stems, inflorescences, and hypanthia, torus glabrous or very sparsely glandular-setulose, ovary apex glabrous, and ovary (6-)8-celled and almost completely inferior (the stylar collar ca. 0.3 mm high). Other more distant relatives perhaps are M. atrata (Spring) Wawra (leaf blades 7-nerved and moderately fine-setulose above; flowers 5-merous and diplostemonous; petals 3-4 mm long) and (ex char.) M. multinervia Cogn. (leaf blades 9-11-nerved; flowers 4-merous; petals 4 mm long). Gleason (Bull. Torrey Club 52: 377-378. 1925) noted that the stamen number in M. benthamiana ranged from 24 to 40; the flower size is quite variable, the petals ranging from 4-10 mm long. The anthers in both M. benthamiana and M. santaremensis are 4-celled for most of the length. After examination of an isotype (US) of Clidemia tonduzii Gleason (Brittonia 3: 116. 1939) and three recent Costa Rican collections (León 1137, Schnell 232, Jiménez 737), I can see no reason to differentiate this from Miconia benthamiana.

MICONIA PORPHYROTRICHA (Markgraf) Wurdack, comb. nov.

Heterotrichum porphyrotrichum Markgraf, Notizbl. Bot. Gart. Berl. 12: 181. 1934.

Miconia skutchii Gleason, Bull. Torrey Club 68: 250. 1941.

Miconia porphyrotricha is another relative of M. benthamiana Triana and M. santaremensis Wurdack, differing in the denser and longer (ca. 0.3 mm) underlayer of stellate hairs on the stems, petioles, veins on the lower leaf surfaces, inflorescences, and hypanthia as well as the diplostemonous flowers. In M. porphyrotricha, a variable percentage (always small) of the simple hairs is gland-tipped, but always much less than in M. benthamiana. Apparently as in some other melastomes, two color forms of M. porphyrotricha exist in Ecuador, the long simple vegetative and inflorescence hairs being purple-tinged in the typical form and yellow in some collections (Skutch 4519, Asplund 19665, both from Puyo, Napo-Pastaza); the purplish-setose form has also been collected at Puyo (Asplund 19305). The flowers are secund on the ultimate inflorescence branchlets, this feature obscure until fruiting; the ovary apex is glabrous or obscurely glandular-setulose (ca. 6 setulae 0.2 mm long) and the torus is glabrous; the anthers are 4-celled and the connective with a dorso-basal rounded appendage around the filament insertion. For additional comments, see Mem. N. Y. Bot. Gard. 16: 37. 1967.

MICONIA STRIGOSA (Triana) Wurdack, comb. nov.

Heterotrichum strigosum Triana, Trans. Linn. Soc. Bot. 28: 134. 1871.

The pubescence and floral detail combination in M. strigosa does not resemble that in other Venezuelan species hitherto placed in Heterotrichum DC. Probably M. strigosa is best placed as a distant relative of spp. 204-211 of Cogniaux' monograph, differing from all of these in the 6-merous flowers and long external calyx teeth as well as the glandular ovarial pubescence. The only Venezuelan collection of M. strigosa (Maguire, Wurdack, & Bunting 36704), probably with a fasciated inflorescence, resembles typical collections in the floral details (including a 4-celled ovary), but differs from Brazilian material (Spruce 2047, San Gabriel de Cachoeira; Rodrigues & Chagas 5474, Manaos, "estrada do igarape Tabatinga") in the erect branchlet and lower leaf surface pubescence. Two other Brazilian collections (Holt & Blake 447, Rio Cauabury; Schultes & Lopez 9921, Rio Dimití) have smaller flowers than M. strigosa, as well as 3-celled fruit, but six calyx teeth and the same pubescence (qualitatively).

MICONIA MOCQUERYSII Wurdack, sp. nov.

Sect. Miconia. M. cionotrichae Uribe et M. stipitatae Gleason affinis, foliorum supra pubescentia plerumque simplice foliis sessilibus differt.

Frutex 0.5-4 m; ramuli teretes sicut foliorum subtus venae primariae inflorescentiarum ramique pilis stipitato-stellatis (stipite plerumque ca. 1 mm longo, radiis ca. 4-5 et 0.3-0.5 mm

longis) densiuscule setulosi. Folia essentialiter sessilia, petiolis crassis ca. 0.2 cm longis; lamina 6-12(-17) X 3.5-7 (-8) cm ovata vel oblongo-ovata apice breviter (0.5-1 cm) subabrupteque acuminato basi ca. 0.5 cm cordata, distanter (ca. 2-3 mm) undulato-serrulata et gracili-ciliata, membranacea, supra sparse appresso-setosa pilis laevibus ca. 2 mm longis plerumque simplicibus (in venis primariis pilis stipitato-stellatis sparse intermixtis), subtus in venulis superficieque sparse setulosi pilis stipitato-stellatis (stipite ca. 0.7 mm longo, radiis ca. 0.3-0.5 mm longis), 5-nervata nervis secundariis plerumque 0.5-0.7 cm inter se distantibus nervulis supra invisis subtus planis et modice reticulatis (areolis ca. 0.3 mm latis). Panicula 5-8 cm longa et pauciflora; flores 5-meri sessiles in ramorum brevium extremitatibus pauciglomerati, bracteolis 3-3.5 X 0.3 mm subpersistentibus. Hypanthium (ad torum) 3 mm longum extus paulo 10-costatum modice setosum pilis gracilibus 2.5-3 mm longis (vel pro parte minore ad apicem furcatis) pilis stipitato-stellatis brevioribus sparse intermixtis; calyx ca. 0.9-1 mm longus truncatus vel paullulo (0.1 mm) 5-undulatus extus sparse setosus et stellato-puberulus, dentibus exterioribus linearibus setosis ca. 0.7-0.8 mm eminentibus. Petala 4.2 X 2 mm obovata extus apicem versus sparse appresseque stellulato-puberula. Stamina in dimensionibus anisomorphica glabra; filamenta 5.5-6.5 mm vel 4.4-4.8 mm longa; antherarum thecae 4.1-4.4 X 0.6 mm vel 3.2 X 0.5 mm subulatae poro minuto ventraliter inclinato; connectivum non prolongatum dorsaliter exappendiculatum ventraliter bilobulatum lobulis ca. 0.3 mm longis glandula unica 0.1-0.15 mm longa terminatis. Stigma truncatum 0.35 mm diam.; stylus 11 X 0.3 mm; ovarium 3-loculare et 1/2 inferum, apice truncato-conico 0.9 mm alto minute sparsissimeque glanduloso. Hypanthium fructiferum 10-costatum.

Type Collection: A. Mocquerys 986 (holotype P; isotypes P), collected at El Vigia, Edo. Merida, Venezuela, 1893-94. "Grand arbuste 4 mètres env. Fleurs roses."

Paratypes (all Colombia): Santander: Bajo Magdalena, río Carare, Puerto Parra, elev. 150 m, L. Uribe Uribe 3958; between Puerto Wilches and Puerto Santos, elev. 110-115 m, E. P. Killip & A. C. Smith 14855. Antioquia: Bajo Magdalena, Casabe, elev. 150 m, L. Uribe Uribe 5890; Río Cauca at Puerto Valdivia, elev. 240-260 m, R. D. Metcalf & J. Cuatrecasas 30088.

Both suggested relatives have petiolate leaves with the upper surface pubescence of short-stipitate stellate hairs. In general aspect except for the sessile cordate leaves, M. mocquerysii much resembles M. barbinervis (Benth.) Triana; that wide-spread species (also collected by Mocquerys [1012] at El Vigia) has petals glabrous on both surfaces, eglandular bases of the stamen connectives, and expanded stigmas. Albert Mocquerys (1860-1926) collected many Venezuelan plant specimens which are largely unstudied at Paris; he was a member of the distinguished family of European entomologists (W. Horn & E. Kahle. Über entomologische Sammlungen, Entomologen, & Entomo-Museologie.

Entomologische Beihefte Berlin-Dahlem 3: 179. 1936).

MICONIA PUNCTATA (Desr.) DC.

Urban (Fedde Rep. 17: 405. 1921) has discussed the distribution of M. punctata as amplified from Cogniaux; his general interpretation is being followed for Venezuela, although the only available flowering material from Hispaniola (Ekman 11438) shows essentially exappendiculate stamen connectives. Doubtless some subspecific segregation is needed, but Cogniaux' varietal units (one of which is var. brevifolia, the type Fendler 1841 from Colonia Tovar, Aragua) based on leaf shape do not seem satisfactory. The Poeppig Peruvian collections cited by Cogniaux as M. lepidota DC. var. grandifolia Cogn. are conspecific with material of M. punctata from Venezuelan Guayana and the Amazon basin; however Schomburgk 623 (F, W) also cited as a syntype of M. lepidota var. grandifolia is not the same as Poeppig 2458, but agrees with Guiana specimens of M. lepidota. The Martius type (M) of M. lepidota is well matched by Spruce 524 and 812 (Santarem, Pará, Brazil) and 2122 (S. Gabriel, Amazonas, Brazil); the young branchlets are alternately compressed (but not sharply quadrate), the foliar pubescence paler and the inflorescence branchlets more slender than in M. punctata.

MICONIA TRUJILLENSIS Wurdack, sp. nov.

Sect. Amblyarrhena. M. arbutifoliae Naud. et M. albertii Gleason affinis, foliis proportionaliter latioribus basaliter nervosis differt.

Ramuli obscure rotundato-quadrangulati demum teretes sicut petioli foliorum venae primariae subtus inflorescentiaque sparsiuscule vel modice pilis paulo clavatis minute barbellatis 0.15-0.4(-0.8) mm longis brunneis demum caducis setulosi. Petioli 0.4-0.7 cm longi; lamina 2.7-4.5 X 1.7-2.6 cm elliptica apice abrupte breviterque (0.3-0.4 cm) acuminato basi rotundata, coriacea et distanter appresso-ciliolata, ubique in superficie glaber, subtus in venis secundariis venulisque sparse caduceque pilis pinoideis 0.1 mm longis et glandulis 0.05 mm longis obsita, 5-nervata nervis secundariis 1-1.5 mm inter se distantibus supra obscuris venulis supra invisis subtus planis et laxiuscule reticulatis (areolis 0.7-1 mm latis). Panicula 6-9 X 6-10 cm multiflora; flores 4-meri subsessiles (pedicellis obscuris crassis ca. 0.5 mm longis), bracteolis non visis. Hypanthium (ad torum) 3 mm longum extus basim versus primum pilis clavatis barbellatis 0.1-0.15 mm longis demum caducis sparse indutum; calycis tubus 0.7 mm altus, lobis interioribus 1.1 X 2 mm ovatis, dentibus exterioribus crassis lobos interiores aequantibus. Petala pruinosa 4 X 3.2-3.3 mm obovato-elliptica apice rotundato. Stamina isomorphica glabra; filamenta (paulo immatura) 3 mm longa; thecae 2.7 X 0.6 X 0.7 mm oblongae poro paulo dorsaliter inclinato 0.3 mm diam.; connectivum ca. 0.5 mm prolongatum exappendiculatum. Stigma non expansum; stylus glaber 5.7 X 0.4-0.5 mm in ovarii apicem 0.3 mm immersus; ovarium 4-loculare et 1/2 inferum, apice conico

8-sulcato glabro.

Type Collection: J. A. Steyermark 104813 (holotype US 2591539A; isotype VEN), collected in "subpáramo y bosque debajo del Páramo de Guaramacal, entre Boconó y Guaramacal," Edo. Trujillo, Venezuela, elev. 2800 m, 24 Feb. 1971. "Tree 3-5 m tall; leaves coriaceous, deep green above, dull paler green below with elevated magenta nerves; inflorescence branches pale magenta with pale green; calyx and hypanthium dull pale green with magenta; petals white."

Both M. arbutifolia and M. albertii have plinerved leaf blades with length/width ratio (2.2-)3-5 rather than 1.4-1.65; M. arbutifolia has emergent external calyx teeth. Miconia boxii Wurdack has sessile longer and relatively narrower leaf blades and smaller flowers.

MICONIA TINIFOLIA Naud.

This Venezuelan species is well characterized by the branchlets with more-or-less definite decurrent ridges below the leaf nodes, glabrous or glabrescent leaves, and clavate styles with scarcely expanded stigmas; especially definitive are the biporose anthers, the connective more-or-less prolonged to the filament insertion and in the larger stamens with a prominent blunt descending dorsal tooth 0.6-0.9 mm long. Certainly however, there are many vegetative and flower size differences in the local populations, two of the more distinctive being formally described below. Cogniaux had already described var. parvifolia; the presumed holotype (LE, specimen annotated by Cogniaux), collected by Karsten at Boconó, Trujillo, shows more prominent than usual calyx lobes, being well matched in this feature and pubescence by Steyermark 104799 (Boconó-Guaramacal, Trujillo) which however has proportionately broader leaf blades. Another Karsten collection (W, Boconó, Trujillo) seen by me has wider leaf blades than in the original description of var. parvifolia and caducously furfuraceous (the roughened hairs 0.05-0.1 mm long) branchlets and primary leaf veins beneath; the collection is best matched by Ruiz Terán & López Figueiras 24 (Páramo de Quirora, Mérida). This latter Karsten collection has the small flowers (petals 1-1.3 mm long) with short (0.1-0.3 mm) prolongation of the large anther connectives seen in other Andean (Mérida, Ruiz Terán & López Figueiras 35 and 725; Táchira, Steyermark, Dunsterville, & Dunsterville 100969) and Cordillera Costal (D. Federal, Steyermark 91664; Aragua, Allart 434, Fendler 412; Anzoátegui, Steyermark 61691) collections; this material has nearly or quite glabrous branchlets and basally nerved or inconspicuously (to 0.5 cm) plinerved leaves without axillary vein pocules. Two other Andean variants cannot be further categorized until more extensive collections are available. One of these (Táchira, Steyermark, Dunsterville, & Dunsterville 98580 and 100978) has obtusish leaf apices and the branchlets (as in Steyermark 104799) moderately setulose with apically barbellate hairs 0.3-0.5(-1) mm long, but remote and minute calyx lobes; the other (Mérida, Ruiz Terán & López Figueiras

746, 773, 1759) also has obtusish leaf apices, but the branchlets moderately puberulous with roughened hairs only 0.1-0.15 mm long. No Colombian material of M. tinifolia has been seen; one fruiting collection (Pennell 7530, from Cauca) distributed as this species is not that, but rather perhaps near M. turgida Gleason.

MICONIA TINIFOLIA Naud. var. CAUDATA Wurdack, var. nov.

A var. tinifolia foliis proportionaliter angustioribus longe (ca. 1 cm) acuminatis triplinervatis venis primariis lateralibus basaliter ad costam membrana coalitis floribus minoribus differt.

Type Collection: J. A. Steyermark & M. Rabe 97331 (holotype US 2481531; isotype VEN), collected in cloudforest between Boconó and Guaramacal, Edo. Trujillo, Venezuela, elev. 2100-2300 m, 4 Sept. 1966. "Tree 10 m; leaves firm-membranaceous, rich green above, pale green below. Rachis, inflorescence branches, and hypanthium pale olive green; petals and filaments white."

Paratype (topotypical): Steyermark & Rabe 97338.

The typical variety has nearly or quite basally nerved and barely blunt-acuminate leaf blades (the length/width ratio 1.6-2.6, rather than 3.2-3.5) and considerably larger flowers and fruit (petals 2 X 2 mm, rather than 1.3 X 1.3 mm), as well as stamen connectives prolonged 0.6-0.8 mm (rather than 0.3 mm) to the filament insertion; to the typical variety, I have ascribed the following recent collections: Ruiz Terán & López Palacios 1580 (La Mucuy, Mérida), Ruiz Terán 1654 (Laguna de la Coromoto, Mérida), and Ruiz Terán & López Figueiras 975 (Páramo Jabón, Lara). In the small flowers and glabrous stems and foliage, var. caudata resembles much of the material discussed above under var. parvifolia Cogn. The specimens of var. caudata had earlier been determined by me as M. theaezans (Bonpl.) Cogn. subsp. theaezans var. subtriplinervia Cogn.; that species has 4-pored anthers with quite small connective appendages.

MICONIA TINIFOLIA Naud. var. RORAIMENSIS Wurdack, var. nov.

A var. tinifolia foliis distincte (0.5-0.8 cm) triplinervatis nervis primariis ad basim costa coalitis floribus paullulo minoribus antherarum connectivis non vel paullulo (ad 0.3 mm) prolongatis differt.

Type Collection: J. A. Steyermark 58877 (holotype US 1933593; isotypes F, NY), collected on the summit of Mt. Roraima, Edo. Bolívar, Venezuela, elev. 2700-2740 m, 28 Sept. 1944.

Paratypes (all Edo. Bolívar, Venezuela): Roraima, McConnell & Quelch 191, Tate 441 and 511; Ptari-tepui, Steyermark 59929.

Var. roraimensis has flowers intermediate in size between var. tinifolia and var. caudata, as well as leaf blades firmer and relatively wider (length/width ratio 2.3-2.5) than in the latter.

MICONIA TOVARENSIS Cogn.

Moritz 1741 (BM, P, W) is both topotypical and an exact match for the type collection (Fendler 419, NY, OXF); a recent collection (fruiting) of the species is Badillo 4025 (Choroni cumbre, Aragua). Certainly there has been confusion with M. cremophylla Naud. which, as to the type (Matthews 1297) has somewhat smaller foliage, narrower bracteoles (ca. 1.1 X 0.15-0.2 mm), large anther connectives dorsally at the base inconspicuously (0.1-0.15 mm) toothed, and ovary only 1/2-2/3 inferior. Triana (Trans. Linn. Soc. Bot. 28: 128. 1871) cited Fendler "1009" as questionably M. cremophylla and also Triana s. n. from Colombia (the Paris sheet unnumbered; perhaps Triana 4060 of the BM Catalogue); probably "1009" is a misprint, since one specimen (OXF) of Fendler 419 was annotated by Triana as M. cremophylla. The Colombian collection of Triana, as well as two Magdalena (Colombia) specimens, H. H. Smith 1845 and Romero Castañeda 949 (with flowers more distinctly pedicelled), show large anther connectives as in the Colonia Tovar collections of M. tovarensis, but perhaps are infraspecifically distinct. Miconia turgida Gleason, of Colombia, seems to differ from M. tovarensis only in the distinct raised interpetiolar ridges on the branchlets and more elevated ovary apices, having other vegetative and floral features the same; the stamen illustration published (Bull. Torrey Club 52: 453. 1925) is certainly not of M. turgida, but probably M. pennellii Gleason (described in the same article). To M. turgida, I have referred several recent Boyacá (Uribe 5726) and Cundinamarca (Uribe 3689, anthers semiabortive; Grant 10343; Uribe 5964, 6174) and Huila (Cuatrecasas 8481, at first determined as M. resima Naud.) collections. Two other species in this complex perhaps also should be considered: M. wurdackii Uribe is closely related to M. turgida, differing in the distinctly (outer pair of primary veins 2.5-4 mm from the margins) 5-nerved leaf blades with elevated-reticulate venules and densely pulverulent petals, but stamen and ovary features as in M. tovarensis; M. cundinamarcensis Wurdack has foliar venulation, stamen, and ovary features as in M. wurdackii (as well as pulverulent petals), but considerably smaller and relatively broader leaf blades which are more rounded at the ends. Of course, this tracing of affinities could be pursued much further from here, through the small-leaved group of M. ligustrina (Sm.) Triana and its relatives.

MICONIA ELAEOIDES Naud.

As earlier mentioned (Brittonia 9: 106. 1957), M. pallida Gleason (Bull. Torrey Club 57: 72. 1930) is synonymous with M. elaeoides. The only Venezuelan collection of M. elaeoides (Ruiz Terán & López Figueiras 1392, Páramo Portochuelo, Mérida) has vegetative pubescence scantier and more promptly caducous than in most Colombian material, as well as leaf blades slightly plinerved, but agrees in floral details; the anthers are biporose, but incompletely 4-locular. The puberulous variants of M. tinifolia (vide supra) are all different from the Portochuelo

population (which does not have a large dorso-basal connective tooth).

MICONIA THEAEZANS (Bonpl.) Cogn.

Miconia multinervulosa Cogn., DC. Mon. Phan. 7: 926. 1891.

For Venezuela, M. theaezans has been delimited as with small flowers (petals 0.9-1.2[-1.4] mm long), the calyx barely (0.1-0.2 mm) lobed, and the 4-pored anthers inconspicuously appendaged. Cogniaux ascribed to Venezuela three varieties (var. theaezans [var. genuina], var. longifolia Cogn., var. subtriplinervia Cogn.) of subsp. theaezans [subsp. viridis] and three varieties (var. lanceolata Cogn., var. parvifolia Cogn., var. integrifolia Cogn.) of subsp. flavescens Cogn. Except for formalin-treated collections, the two "subspecies" are distinguishable from dried specimens. Generally var. subtriplinervia (Mérida: Gines 1790, Gehriger 345, Mocquerys 1224, Bernardi 297, Ruiz Terán & López Figueiras 100; Trujillo, Curran 1151) can be distinguished by the foliar venation. Most of the Guayana Highland (Edo. Bolívar) collections of true M. theaezans (vide infra sub M. rupestris Ule) perhaps also belong here, but the leaf blades are generally more oblong than in Andean collections and some material shows the yellowish dried foliage of subsp. flavescens (which also has a var. subtriplinervia Cogn. from Brazil). The following collections of M. theaezans from Guayana have been seen: Chimantá Massif, Wurdack 34200, Steyermark & Wurdack 662 and 728; Ilú-tepui, Maguire 33411; Roraima, Pinkus 137, Steyermark 58723 and 58977. Among the other varieties of subsp. theaezans, the differences between var. theaezans and var. longifolia Cogn. in Venezuela are tenuous and I am inclined to place all such material (with fairly large, basally nerved, and greenish [when dried] leaf blades) in var. longifolia (D. Federal, Lara, Mérida, Barinas, Táchira, Trujillo). Several intermediates (with narrow basally or subbasally nerved leaf blades) between var. subtriplinervia and var. longifolia have been collected (Trujillo, Aristeguieta & Medina 3421; Mérida, Bernardi 95, Ruiz Terán 3124, Ruiz Terán & López Figueiras 1513).

Among the varieties of subsp. flavescens, var. parvifolia Cogn. (Trujillo, Funck & Schlim 746, BM, P) has glabrous branches, foliage (except for the minute glands beneath), and inflorescences, basally nerved and essentially entire firm leaf blades with rather lax venulation (areoles ca. 0.8-1 mm wide), and rather prominent calyx lobes (ca. 0.5 mm long). Despite the larger (than described) leaf blades, several recent Táchira (Steyermark, Dunsterville, & Dunsterville 98446 and 100755) and Mérida (Ruiz Terán & López Figueiras 1699) collections seem referable to var. parvifolia. André 1533 (NY), from Cundinamarca, Colombia, was referred by Cogniaux (after the original description) to var. parvifolia, but differs in the serrulate and shortly triplinerved (pocules slightly developed) leaf blades with quite fine (areoles 0.3-0.5 mm wide) venulation. The only Cogniaux-annotated collection (Karsten s. n., W)

of var. integrifolia seen by me actually belongs to var. lanceolata (vide infra). Most, if not all, Venezuelan collections of var. lanceolata Cogn. from Aragua and D. Federal are dioecious; specimens examined include Allart 158 (male), Allart 97 (female), Fendler 413 (male), Moritz 952 (both male and female sprigs) and Karsten s. n. (male, syntype of var. integrifolia). Perhaps var. lanceolata should be segregated specifically; some Peruvian and Bolivian material placed in M. theaezans is also dioecious, but vegetatively different from the Venezuelan specimens. The type collection of M. multinervulosa Cogn. (Fendler 415, NY) closely resembles var. lanceolata, but has hermaphroditic flowers; I do not believe that it is specifically different from M. theaezans. Another Venezuelan population in the M. theaezans complex, but with barbellate-setulose (hairs ca. 0.3 mm long on the internodes, longer at the nodes) branchlets, very large leaves, and unisexual flowers (only female known), has been collected in Trujillo (Steyermark 104655 and 104698); it seems to be related to (or perhaps the same as) M. brachygyna Gleason, but male material is needed. Ruiz Terán 3377 (El Rincón, Mérida, in bud) has foliage resembling this large-leaved taxon, but slightly different pubescence; Venezuelan material at anthesis is needed for comparison with two hermaphroditic Colombian species, M. resima Naud. and M. orescia Uribe.

Two West Indian species, M. vulcanica Naud. and M. globuliflora (Rich.) Cham. ex Triana, with the general facies of M. theaezans, were also credited to Venezuela by Cogniaux; both species are dioecious and with rather well developed calyx lobes, but I have not seen the cited collections (M. globuliflora, "prope Maracaybo," Plée; M. vulcanica, Valencia-Campanero, Fendler 2266). I am inclined to believe that the Plée material is a label mixup with his West Indian collections, M. globuliflora being a moderate-elevation species unlikely from the Zulia lowlands. The Costa Rican material (Pittier 2117) cited as M. globuliflora by Cogniaux has hermaphroditic flowers and seems better placed in M. theaezans (subsp. theaezans var. triplinervia Cogn.). As for M. vulcanica, no modern collections from Venezuela have been seen, but the possibility of the species occurring in South America perhaps exists (although the usual direct West Indian-Venezuelan linkage is with Jamaica and not the Lesser Antilles); the nodal setae (similar to those in the less pubescent forms of M. mesmeana subsp. longipetiolata Wurdack) in combination with the floral characters would be diagnostic among the Venezuelan species of Miconia.

MICONIA RUPESTRIS Ule

Despite earlier remarks about the possible synonymy (Mem. N. Y. Bot. Gard. 10[5]: 174. 1964), M. rupestris is being maintained as a distinct species, differing from the Guayana Highland populations of M. theaezans (vide supra) in the squamulose (rather than stellulate or absent) juvenile vegetative pubescence, infra-nodal branchlet setulae (usually), more lax leaf

venulation, and larger flowers (petals 2 mm long, rather than 0.9-1.2 mm) with more conspicuous calyx lobes (0.5 mm long, rather than 0.05-0.2 mm). Currently, M. rupestris is known from Roraima (only the type) and Auyán-tepui (Cardona 2671, an excellent match for Ule 8690; Steyermark 93971 and 94025; Vareschi & Foldats 4883 and 4912). While M. tinifolia Naud. closely resembles M. rupestris, it may be distinguished by the shorter calyx lobes and bipored anthers with a long dorsal connective tooth in the larger stamens, as well as (in the Guayana Highland) the markedly 3-plinerved leaf blades with inner vein axil pocules.

MICONIA BILOPEZII Wurdack, sp. nov.

Sect. Cremanium. M. resimoidi Cogn. affinis, foliis minoribus proportionaliter angustioribus distincte calloso-serrulatis antherarum thecis longioribus stigmatibus plus expansis differt.

Ramuli sulcato-rotundato-quadrati, primum sicut inflorescentiae axis et rami petiolique dense squamato-puberuli demum glabrati. Folia ascendentia; petioli 0.4-0.7 cm longi; lamina 3-5(-6) X 1-2(-2.4) cm lanceato-elliptica vel elliptica apice hebeti-acuto et mucronulato basi acuta, subrigida et calloso-serrulata, primum sparse squamato-puberula mox glabrata, trinervata nervis secundariis 1-1.5 mm inter se distantibus nervulis subtus laxiuscule reticulatis (areolis plerumque 0.7-1 mm latis). Panicula 6-10 cm longa multiflora, ramis ascendentibus; flores 5-meri hermaphroditi, pedicellis 1-2 mm longis, bracteolis ca. 1.5 mm longis obovato-ellipticis mox caducis ca. 0.7 mm infra hypanthii basim insertis. Hypanthium (ad torum) 2 mm longum glabrum; calycis tubus 0.3-0.5 mm longus, lobis interioribus ca. 0.5 X 0.5 mm, dentibus exterioribus triangularibus non eminentibus. Petala 1.9-2.1 X 1.7-2 mm suborbicularia minutissime pruinoso-granulosa. Stamina essentialiter isomorphica glabra; filamenta 2.2-2.8 mm longa; antherarum thecae 1.2-1.4 X 0.5 X 0.6 mm late 4-porosae, connectivo non prolongato ventraliter 0.1-0.15 mm bilobulato dorsaliter dente 0.1-0.2 mm longo erecto-ascendente armato. Stigma expansum 0.6-0.8 mm diam.; stylus glaber 3.7 X 0.5-0.7 mm; ovarium 3-loculare 1/2 inferum apice conico glabro.

Type Collection: M. López Figueiras & S. López Palacios 8688 (holotype US 2613343; isotype MER), collected at La Aguada on the route to Pico Bolívar, Sierra Nevada de Mérida, Distrito Libertador, Edo. Mérida, Venezuela, elev. 3300 m, 18 Feb. 1971. "Arbusto de 1 m de alto. Flores con cáliz rosado verdoso; corola blanquecino-cremosa."

Paratypes (both Edo. Mérida, Venezuela): Funck & Schlim 1071 (BM, P), Sierra Nevada de Mérida, elev. 2700 m; H. Humbert 26724 (P), Sierra del Norte, elev. 2900 m.

Miconia resimoides has entire to obsoletely crenulate leaf blades 6-12.5 X 2.5-6 cm with length/width ratio mostly 2-2.9 (rather than mostly 3.2-3.5), anthers 0.8-0.9 mm long, and stigma 0.3-0.35 mm diam. The Funck & Schlim collection was cited by Cogniaux as M. tinifolia Naud.

MICONIA BERNARDII Wurdack, sp. nov.

Sect. Cremanium. M. gleasonianae Wurdack affinis, foliis bracteolis floribusque maioribus differt.

Ramuli quadrangulati sicut petioli foliorum venae primariae subtus inflorescentiae ramulique modice vel densiuscule pilis barbellatis 0.2-0.5 mm longis patentibus demum caducis induti. Petioli 0.8-1.5 cm longi; lamina (5-)7-11 X 2-4 cm elliptico-oblonga apice hebeti-acuto vel hebeti-obtuso basi obtusa vel rotundata, coriacea et integra, primum pilis stellulato-pinoideis ca. 0.05 mm latis sparsiuscule induta mox glabrata, 5-nervata (pari exteriore tenui incluso) nervis secundariis 2-3 mm inter se distantibus nervulis subtus planis subdense reticulatis (areolis ca. 0.5 mm latis). Panicula 5-9 cm longa multiflora; flores 5-meri subsessiles (pedicellis 0.2-0.3 mm longis crassis), bracteolis prominentibus 2.7-3.2 X 2.2-2.8 mm ovato-ellipticis usque ad anthesim persistentibus. Hypanthium (ad torum) 2.3-2.5 mm longum basim versus sparse stellulato-puberulum; calycis tubus 0.1-0.2 mm longus, lobis interioribus ca. 0.5 mm altis semicircularibus, dentibus exterioribus minutis inframarginalibus. Petala 2 X 1.8-2 mm glabra suborbicularia apice retuso. Stamina essentialiter isomorphica glabra; filamenta 2.8 mm longa; antherarum thecae 1 X 0.5 X 0.5 mm late 4-porosae, connectivo paulo (0.4 mm) prolongato ventraliter paullulo bilobulato dorsaliter paulo dentato. Stigma paullulo expansum 0.6-0.7 mm diam.; stylus glaber 3 X 0.5-0.6 mm; ovarium 3-loculare et 1/2 inferum, apice conico 0.7-0.8 mm alto glabro.

Type Collection: A. L. Bernardi 3209 (holotype NY; isotypes G-DEL, NY, VEN), collected in subpáramo zone near La Trampa, "via Lagunillas-La Panamericana," Edo. Mérida, Venezuela, elev. 2050 m, 17 May 1956. "Arbolito erecto de copa redonda, follaje verde oscuro brillante; flores pequeñas, blancas. Aparentemente escasa. Corteza entera, de color gris. n. v.: Mortiño."

Paratype: W. Gehriger 474 (US), from Tabay, Mérida, elev. 2500-3200 m.

Miconia gleasoniana has leaf blades 1.5-4 X 1-2 cm, linear floral bracteoles, hypanthia only 1.3-1.4 mm long, and petals only 1.3-1.5 mm long; M. rudis Cogn. & Gleason ex Gleason has terete branchlets, longer cauline pubescence (to 1 mm long), more obvious leaf margin serrulation (teeth 0.6-0.8 mm long), and somewhat longer (0.8-1 mm) calyx lobes. Among the Venezuelan species of Sect. Cremanium, M. elaeoides Naud. differs in the more obviously toothed leaf margins, linear bracteoles, shorter calyx lobes, and more expanded stigmas, while M. tabayensis Wurdack has much larger and relatively broader leaf blades and smaller unisexual flowers.

MICONIA RUIZTERANII Wurdack, sp. nov.

Sect. Cremanium. In systemate Cogniauxii M. resimoidi Cogn. et M. microcarpae Naud. affinis, ramorum trichomatibus longioribus foliis supra bullatis differt.

Ramuli teretes sicut petioli foliorum venae primariae

subtus inflorescentiaque pilis robustiusculis 0.4-1 mm longis apice barbellatis modice armati. Petioli 0.4-0.8 cm longi; lamina 3-6.5 X 1.5-3.5 cm anguste ovata apice gradatim breviterque acuminato basi obtusa vel truncata, rigidiuscula et obscure serrulata, supra bullato-rugosa et glabra, subtus in venis secundariis pilis sparse barbellatis tenuibus 0.1-0.3(-1) mm longis sparse induta in venulis superficieque glabra, trinervata nervis secundariis ca. 2 mm inter se distantibus venulis subtus laxiuscule reticulatis (areolis ca. 0.7 mm latis). Panicula ca. 10 cm longa multiflora, ramulis oppositis; flores 5-meri, pedicellis ca. 1 mm longis, bracteolis 1-1.5 X 0.5-0.7 mm ante anthesim caducis. Hypanthium (ad torum) 1.5 mm longum, glabrum; calycis tubus 0.5 mm longus, lobis interioribus 0.5 mm longis orbicularibus, dentibus exterioribus crassis non vel paullulo (0.05 mm) eminentibus. Petala glabra, 1.2 X 0.9 mm, obovata apice paulo emarginato. Stamina paullulo dimorphica glabra; filamenta 1.8-1.9 mm longa; antherarum thecae 0.6-0.7 X 0.4 X 0.4 mm obovatae 4-porosae, connectivo 0.25-0.3 mm prolongato dorsaliter infra filamenti insertionem obscure (0.04-0.07 mm) prolongato. Stigma truncatum non expansum; stylus glaber 2.8 X 0.2-0.3 mm; ovarium 3-loculare et 1/2 inferum, apice conico 0.5 mm alto glabro.

Type Collection: L. Ruiz Terán 3204 (holotype US 2592536A; isotype MER), collected at "Las Escaleras, entre La Negrita y el puente sobre la quebrada de La Escasez, Municipio Mucuchíes, Distrito Rangel," Edo. Mérida, Venezuela, elev. ca. 2800 m, 21 June 1966. "Arbusto o arbolito 3-4 m, frecuente. Hipanto verdósulo con zonas rojas. Pétalos blancos; filamentos blancos; anteras blancas; estilo blanco. N. V.: amarillito."

Both M. resimoides and M. miocarpa have cauline pubescence less than 0.5 mm long and larger plane leaf blades. Other relatives include M. gleasoniana Wurdack (plane elliptic-oblong leaf blades) and M. acanthocoryne Wurdack (larger and plane leaf blades, essentially sessile flowers); M. tabayensis Wurdack has much finer cauline hairs and much larger plane leaf blades.

MICONIA MESMEANA Gleason subsp. LONGIPETIOLATA Wurdack, subsp. nov.

A. ssp. mesmeana petiolis longioribus laminis tenuioribus ad basim acutis subtus plerumque esetulosis differt.

Type Collection: J. A. Steyermark 105003 (holotype US 2591515A; isotype VEN), collected in virgin cloudforest between La Peña and Agua de Obispo, 22-28 km from Carache, Edo. Trujillo, Venezuela, elev. 2400-2500 m, 1 Mar. 1971. "Tree 3 m; leaves dark green above, pale green below, firmly membranaceous; rachis and inflorescence branches pale green; pedicels greenish white; calyx, petals, filaments, and anthers white."

Paratypes (all Venezuela): Lara: between Encrucijada and the road from Parque Nacional Yacambú to El Blanquito 10-15 km SSE of Sanare, Distrito Jiménez, elev. 1750-1800 m, J. A. Steyermark, F. Delascio, G. C. K. & E. Dunsterville 103519 (US, VEN). Trujillo: La Quebrada Cortijo above Humocaro Blanco,

elev. 2600-2800 m, J. A. Steyermark 55325 (NY); La Peña-Agua de Obispo, 28-34 km from Carache, elev. 2100-2400 m, J. A. Steyermark 104959 (US, VEN). Mérida: Tabay, elev. 2500-3200 m, W. Gehriger 479 (NY, US, VEN); Páramo La Sal, A. Jahn 601 (US, VEN; petioles short, flowers small); Páramo Quirora, elev. 3000 m, A. Jahn 878 (branchlet setulae obscure); Sierra del Norte, elev. 2500 m, H. Humbert 26704 (P); Páramo Canaguá, elev. 2187 m, L. Ruiz Terán 2990 (US); Páramo San José, elev. 2600 m, L. Ruiz Terán & M. López Figueiras 694 (US) and 713 (US); without definite locality, A. L. Bernardi 6206 (NY).

The typical subspecies, known in Venezuela only from Edo. Táchira, has petioles 0.2-0.4(-0.7) cm long (rather than 0.7-2 cm), the subcoriaceous leaf blades obtuse to rounded at the base and setulose along the primary veins basally beneath, and the main axis and branches of the inflorescences with simple setulae. In subsp. longipetiolata, the leaf blades are acute at the base and usually without setulae beneath (sparsely setulose in Ruiz Terán & López Figueiras 694) and the inflorescence lacks simple hairs; the vegetative branches are short-setulose at the nodes, the internodes being without simple hairs or varyingly setulose. Miconia mesmeana rather resembles M. vulcanica Naud. (vide supra, sub M. theaezans), which is dioecious. Miconia brachygyna Gleason is dioecious and with generally larger leaves and smaller flowers. The well developed calyx lobes in the flowers of M. mesmeana resemble those of M. rupestris Ule and M. resimoides Cogn.; both these species differ in the squamulose (rather than stellulate or pinoid-stellulate) young branchlet indument and esetulose branch nodes.

MICONIA MESMEANA Gleason subsp. JABONENSIS Wurdack, subsp. nov.

A subspecies typica foliis minoribus ramorum pilis simplicibus brevioribus differt.

Type Collection: L. Ruiz Terán & M. López Figueiras 920 (holotype US 2613342; isotype MER), collected at Los Pocitos de El Alto, Páramo del Jabón 15 km east of Carache, Edo. Trujillo, Venezuela, elev. 3100 m, 2 Oct. 1970. "Arbusto erecto profusa e irregularmente ramificado 1.5 m. Hipanto y pétalos blanquecino-verdosos; filamentos y anteras blancos, el conectivo cremósulo; estilo rosado en la mitad proximal, verde claro en la mitad distal."

Paratypes (both Venezuela): J. Cuatrecasas, L. Ruiz Terán, & M. López Figueiras 28213, from Páramo del Jabón, Edo. Lara, elev. 3100-3400 m; L. Ruiz Terán & M. López Figueiras 1707, from Páramo de Quirora, Mun. Estánques, Edo. Mérida, elev. 3000-3200 m.

The leaf blades in subsp. jabonensis are only 1-2.4 X 0.7-1.2 cm (rather than 3-7 X 1-2 cm) and the cauline simple hairs mostly only 0.5-0.7 mm long (rather than 1-1.5 mm). The Mérida paratype has sparse simple setulae along the primary leaf veins beneath, the other collections lacking such hairs (but stellulate-pinoid-puberulent as the Mérida material). The small leaf

blades of subsp. jabonensis give specimens quite a different aspect from that of the other subspecies, but the floral details are consonant in all and not like those in the small-foliaged species complex around M. summa Cuatr. and M. buxifolia Naud. (which have anthers qualitatively like those in M. tinifolia Naud., the large anther connectives with a prominent dorso-basal tooth). Miconia neblinensis Wurdack resembles M. mesmeana subsp. jabonensis, differing in the longer cauline pubescence, relatively wider and less distinctly serrulate leaf blades with obtuse to rounded bases, more compact inflorescences, and (at least predominantly) functionally unisexual flowers; M. neblinensis is perhaps to be expected on the Venezuelan part of Cerro Neblina, but has not yet been collected there.

ICARIA Macbride

The genus is undoubtedly a synonym of Miconia, the species well accomodated in Sect. Chaenopleura. The filaments in I. fictilis Macbride are much broadened basally (as in most of the 4-merous species of this section of Miconia and also many species in Sect. Cremanium) and apically sparsely puberulous with glands ca. 0.05 mm long (as also the connective base and style); the "winglike erect appendages" described for the anthers are actually the edges of the rimose thecae. The species is not being formally transferred to Miconia, since the specific distinctness from other rarely collected Peruvian species is questionable (cf. M. grisea Cogn., M. nitida [Don] Naud.) Madison 10350 (from Puncu ca. 30 km NE of Tambo, Prov. La Mar, Depto. Ayacucho, Peru), fruiting only, is Icaria fictilis vel aff.

HENRIETTEA RAMIFLORA (Sw.) DC.

Some of the collections (Jamaica, Wurdack, Solt & Proctor 2627; Bolívar, Venezuela, Steyermark & Nilsson 488, Steyermark, Dunsterville, & Dunsterville 104378; Amazonas, Venezuela, Maguire, Cowan, & Wurdack 29790) show sparsely puberulous styles. None of these however is the same as H. succosa (Aubl.) DC. var. guianensis Gleason (surely specifically distinct from H. succosa), which has sparse setula-tipped hairs (with minute stellulate bases) on the lower leaf surfaces and external calyx teeth projecting 1.5-2 mm but small flowers as in H. ramiflora; Sandwith 1056 (NY) is well matched by Cowan & Soderstrom 1984 and Maguire & Fanshawe 23126 (distributed as H. ramiflora). In foliage, Maguire, Cowan, & Wurdack 29790 matches well Hostmann 373 (type collection of both H. surinamensis Miquel and H. trinervia Naud.); unfortunately no stylar details have been observable in Suriname material. At present, it seems best to treat H. ramiflora as a variable wide-ranging species, especially in view of the field-observed stylar pubescence in Jamaican plants.

A useful character in sorting the species of Henriettea is the internal hypanthial pubescence. In the Venezuelan species,

one group (also including H. succosa) has the hypanthium within (below the torus) glabrous or very sparsely strigulose apically on only the faint ridges; the other species-cluster shows hypanthia within completely covered with minute downward-pointing hairs. Within each of these groups however, species definition is currently unruly.

HENRIETTELLA BRACTEOSA Wurdack, sp. nov.

In pilorum forma H. triflorae (Vahl) Triana affinis, foliis subglabris bracteis maioribus floribus 5-meris differt.

Arbor parva 3-5 m alta ; ramuli crassi quadrati primum sicut foliorum venae primariae basim versus subtus sparse laxo-strigosi pilis plerumque 1-1.5 X 0.1-0.15 mm laevibus (basi expansa minutissime muriculata) paulo compressis demum caducis. Petioli 2-5.5 cm longi; lamina 11-24 X 6-12 cm obovato-elliptica apice breviter (per 1-2 cm) subabrupteque acuminato basi acuta vel anguste obtusa, membranacea et integra (vel primum obscure calloso-serrulata), distanter appresso-ciliolata, ubique primum glandulis demum caducis 0.05 mm diam. sparse obsita in venulis superficieque alioqui glabra, breviter (1-2 cm) 5-plinervata nervis secundariis plerumque 2.5-3 mm inter se distantibus nervulis non vel paullulo evolutis. Flores 5-meri sessiles ad nodos multifasciculati bractearum paribus 3(-4) persistentibus arcte investi; bracteae 2.5-3.5 mm longae lataeque suborbiculares (apice paulo emarginato) glandulis minutis modice marginatae extus basim versus centraliter sparse strigulosae alioqui glabrae. Hypanthium (ad torum) 3 mm longum extus dense sericeo-strigosum (pilis laevibus compressis ca. 2 mm longis) intus glabrum; calyx 0.6 mm longus paulo (0.1 mm) 5-undulatus intus glaber apice dense ciliolato (0.8 mm); torus intus glaber. Petala 5 X 2.2 mm oblongo-lanceata extus carinata apice extus mucronulato et obscure puberulo alioqui glabra intus ca. 2 mm supra basim obscure porcata. Stamina isomorphica glabra; filamenta ca. 2.5 mm longa; antherarum thecae 2.6 X 0.7 X 0.7 mm oblongae poro minuto 0.2 mm diam. dorsaliter inclinato, connectivo ca. 0.2 mm prolongato non appendiculato. Stigma paullulo truncato-expansum 0.6 mm diam.; stylus glaber longe exsertum; ovarium 5-loculare ca. 1/2-2/3 inferum apice glabro conico ca. 1.2 mm alto (collo incluso) styli collo ca. 0.7 mm longo.

Type Collection: J. A. Steyermark & M. Rabe 96172 (holotype US 2469792; isotype VEN), collected on Cerro de Río Arriba, "laderas de bosque siempre verde oeste de Cerro de Humo, a lo largo de Río Santa Isabel, arriba de Santa Isabel," Peninsula de Paria, Edo. Sucre, Venezuela, elev. 600-700 m, 9 Aug. 1966. "Leaves dark green above, pale green below; calyx pale green; petals and filaments white."

Paratype: Steyermark & Agostini 91353, from Cerro Patao, Edo. Sucre, Venezuela, elev. 870 m.

Henriettella triflora (cf. Proctor 17638, from St. Lucia) has the leaf blades loosely fine-strigose on the surface above and the veins and veinlets beneath, inconspicuous floral bracts

1-1.5 mm long, 4-merous flowers, sparser hypanthial pubescence, petals ca. 10 mm long, and a completely inferior ovary; the suggested relationship is from the qualitative similarity of the vegetative pubescence. In Cogniaux' monographic arrangement, H. bracteosa would key to H. ovata Cogn. and H. verrucosa Triana or to H. parviflora (Griseb.) Triana and H. boliviensis Cogn.; all these species lack an ovarial collar around the style base and individually differ from H. bracteosa in many other particulars. Certainly related to H. bracteosa, but probably at least subspecifically distinct, is a Tobago population (D. W. Snow 5, in young fruit). One other collection (Steyermark 94896, Cerro de Humo, Sucre, elev. 1273 m) shows the vegetative features of H. bracteosa (the young leaves more obviously callose-serrulate), as well as similar bracts and hypanthium; however the petals are sparsely to moderately strigulose outside and 3.5-4 mm wide and the stamens in some (but not all) flowers have strigulose filaments. Additional material of the Cerro de Humo population is needed. The vegetative pubescence and floral bracts (but not other characters) of H. bracteosa are somewhat reminiscent of those in Clidemia conglomerata DC. Still another species of Henriettella (or Loreya?) has been collected in fruit on Cerro de Humo (Steyermark & Rabe 96352); it is perhaps related to H. sessilifolia (L.) Triana but with petiolate and acute-based leaves, and cannot be further evaluated without flowers at anthesis. One other undescribed Venezuelan Henriettella, related to H. verrucosa Triana, has been collected in fruit on Cerro Naiguatá, D. Federal (Steyermark 92005).

For the Flora de Venezuela and to avoid name changes, Henriettella (non-rostrate anthers, calyx glabrous within in Venezuelan species) is being treated as distinct from Henriettea (rostrate anthers, calyx strigulose within); certainly however, a generic transition zone exists between Henriettella ovata Cogn. and Henriettea patrisiana DC., with Henriettella parviflora (Griseb.) Triana perhaps not distinct from the latter. Henriettella seemannii Naud. has been indicated (Fieldiana Bot. 29: 566. 1963) as the generotype (from among the three species originally described by Naudin). Incidentally, I do not agree with the synonymization of Henriettea strigosa Gleason under H. seemannii (Fieldiana Bot. 29: 565-566. 1963), the former actually being in the H. patrisiana alliance; an excellent modern match for Seemann 388 (BM) is Skutch 4044 from Costa Rica.

A New Gypsophilic Sophora (Leguminosae) from Northcentral Mexico and Adjacent Texas

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The exploration of newly found gypseous outcrops in northcentral Mexico continues to yield a number of highly restricted species from a number of families. Gypsophiles in the Leguminosae are relatively rare, most of the Mexican species belonging to Astragalus or Dalea. Rudd (1968) has recently treated the Mexican species of Sophora, but unfortunately she did not have material of the previously uncollected species described here.

Sophora gypsophila sp. nov. Frutex 6--20 dm. altus. Stipulae deltoideae acutae sericeae 1--2 mm. longae caducae. Axis folii (5--)6--10 cm. longus dense pubescens pilis argenteis adpressis. Foliola laterali (8--)10--12 alterna vel raro opposita coriacea saepe ovalia (8--)10--16 mm. longa, 4--10 mm. lata supra viridia ad maturitatem glabra subtus argenteo-pubescentia. Foliolum terminale majus saepe obovoideum retusumque. Basis pedicellae bracteis 3--6 mm. longis. Bracteolae sub calyce ca. 1 mm. longae. Flores ca. 25 mm. longi. Calyx ca. 10 mm. longus pilis adpressis sinibus ca. 1--2 mm. longis. Petala purpurea.

Vexillum alis carinave longiore. Fructus coriaceus primum argenteo-pubescens demum glabratus stramineus aliquantum compressus saepe torulosus ca. 1 mm. latus 5--14 cm. longus, 3--10-spermus. Semina ovoidea 5--6 mm. longa.

Shrub 6--20 dm. tall; stipules deltoid, acute, sericeous, 1--2 mm long, caducous; leaves (9)11-13 foliolate, the rachis (5)6-10 cm. long densely pubescent with silvery, appressed hairs; leaflets alternate or less often appearing opposite, coriaceous, the lateral blades mostly oval, 4-10 mm. wide, (8)10-16 mm. long, the terminal blade somewhat larger and often obovoid and retuse at the apex, the upper surface greenish and glabrate at maturity, the lower surface, silvery pubescent bracts at base of pedicels 3-6 mm. long; bracteoles below the calyx about 1 mm. long; flowers ca 25 mm. long; calyx appressed pubescent, ca 10 mm. long, the sinuses ca 1-2 mm.; petals purple, the standard somewhat longer than the wings and keel; fruit coriaceous, silvery pubescent when young but glabrate and straw-colored at maturity, somewhat compressed and often torulose, ca. 1 cm. wide, 5-14 cm. long, 3-seeded; seeds quadrangular, 5-6 mm. long, 4-5 mm. wide, 3-4 mm. thick.

HOLOTYPE (TEX): MEXICO. Chihuahua: locally common on gypsum flats along highway 16, 8.8 miles N of the railroad crossing (ca. 20 mi S of Coyame), 7 Apr. 1971, A. M. Powell, B. L. Turner & R. E. Magill 2072. Isotypes (MEXU, MICH, US).

The species belongs to the section Calia (Berlandier) Rudd and is apparently most closely related to Sophora arizonica Wats., a species of southeastern Arizona, from which it differs in having more numerous, smaller leaflets with a dense, silvery pubescence beneath. They both possess

large flowers (ca. 25 mm. long) and their inflorescence and floral structure are similar.

In Rudd's (1968) treatment of the Mexican Sophoras, S. gypsophila would key to S. purpusii Brandeg., a species collected near Parras, Coahuila and near San Lucas, Zacatecas. It differs from the latter, however, in possessing much larger and fewer leaflets and larger flowers. Since S. purpusii is known from only three collections at two localities it is probable that it too is a gypsophile, since gypsum and anhydrite outcrops occur in the near vicinity of the sites mentioned.

In going over an early version of this manuscript Dr. Rudd called to our attention the similarity of S. gypsophila to certain unnamed collections from the Guadalupe Mountains in Texas which she thought might be related to S. arizonica. The junior author found two specimens in the Sul Ross Herbarium which indeed appear to belong to the species described here, but because of their geographical isolation and difference in fruit and seed characters we here treat this population as a new variety as follows:

Sophora gypsophila var. guadalupensis Turner & Powell, var. nov.

A varietate typica leguminibus latioribus 10-14 mm. latis, seminibus majoribus 7-10 mm. longis 6-7 mm. latis, foliolis ovatioribus paucioribus minus conspicue glabratis differt.

Differing from the species in possessing wider pods (10-14 mm. wide) and larger seeds (7-10 mm. long, 6-7 mm. wide); the leaflets are also somewhat more ovate, fewer and not so conspicuously glabrate at maturity.

HOLOTYPE (SRSC): TEXAS. Culberson Co.: "Rare shrub except locally on northwest slopes of the Guadalupe Mountains on J. C. Hunter Ranch near Dog Canyon" alt. 5000 feet, 26 Sept. 1955, Pierce Uzzell s.n. one additional sterile specimen was examined (SRSC): "low spreading shrub usually less than 3 ft. high; limestone soil of west Dog Canyon", 5 Sept. 1954, B. H. Warnock 11989.

It should be noted that the var. guadalupensis probably also occurs on gypsiferous soils since such outcrops abound in the area surrounding the type locality. We have not see flowering material of the variety but remains of the calyx at the base of the fruit suggest that the two varities are indeed quite closely related.

Sophora gypsophila should make a handsome ornamental for gardens of the Southwestern United States. Its tight branching habit (in the manner of Sophora secundiflora, Texas Mountain Laurel), silver leathery foliage and purple flowers would make it especially appealing as a hedge or border plant.

Finally, it should be noted that the authors are not certain that the var. gypsophila is confined to gypsum outcrops in the region concerned. It might also occur in the more elevated montainous habitats nearby, merely finding the much lower gypseous outcrops especially suitable for growth. It was not observed elsewhere along the road, however, and appeared to favor the more exposed barren gypseous ridges at the type locality itself.

We are grateful to Dr. Velva Rudd of the Smithsonian Institution for helpful suggestions regarding the relationships of the taxon and to Dr. M. C. Johnston for providing the Latin description. Field work was supported in part by N. S. F. grant GB 5448X.

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NAME CHANGE FOR ELEOCHARIS PYGMAEA (SÜSS.) L. T. EITEN.

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Dr. C. V. Morton of the Smithsonian Institution has kindly brought to my attention the fact that the name "Eleocharis pygmaea" was previously validly published by Torrey in 1836. This necessitates a new name for the different species, Chamaegyne pygmaea Süss., when transferred to Eleocharis.

Eleocharis chamaegyne L. T. Eiten, nom. nov.
Based on Chamaegyne pygmaea Süss., Bot. Jahr. 73: 113 (1943).
Syn.: Eleocharis pygmaea (Süss.) L. T. Eiten, Phytologia 20: 273-274 (1970), non Torrey, Ann. Lyceum New York 2: 313 (1836).

NEW TAXA AND COMBINATIONS IN MOURIRI (MELASTOMATACEAE) FROM VENEZUELA

Thomas Morley

MOURIRI ANGULICOSTA Morley, sp. nov.

Arbor glabra usque 30 m alta x 50 cm diametro; ramuli juvenes peranguste 4-alati. Laminae 3.6-7 cm longae, 1.6-2.6 cm latae, ellipticae usque ovatae vel leviter oblongae, apice abrupte acuminato vel caudato, basi acuta et abrupte attenuata; pagina inferior costae mediae angulata; petioli 2-4 mm longi. Sclerides terminales foliariae plerumque stellatae, interdum columnares; hypodermis plerumque praesens; cryptae stomatatae 25-35 μ altae, 22-65 μ latae, 20-65 in mm^2. Flores sessiles, 1 in singuli pedunculis; pedunculi 1-5 ad axillas foliorum, 1-2.6 mm longi, 2-3 paribus bractearum ovato-triangularium. Calyx ovarium inferior includens 2.2-3 mm longus; lobi calycis triangulares, 0.5-0.6 mm longi. Petala alba vel viridi-alba, anguste obovata, acuta, 3.8-4 mm longa, 1.8-2.1 mm lata. Anthera 2.5-4 mm longa; thecae antherarum 0.8-1.2 mm longae, rimis apicalibus dehiscentes; glandula 0.2-0.3 mm longa. Ovarium 1-loculare; ovula 14-19 ad eandem altitudinem affixa. Fructus rubri-aurantiacus usque ruber, depresso-globosus, calyce coronatus, 6.5-11 mm altus, 9-13 mm diametro, 1 (-2-)-spermus. Semina 6.5-7.3 mm alta, 7.6-8.4 mm lata, 5.2-5.7 mm crassa.

Type Collection: T. Morley 1156 (holotype MIN, isotypes to be distributed); moist primary forest in the Reserva Florestal Ducke, E of entry road at top of hill sloping S to headquarters buildings; common N and S of the buildings; near Manaus, Amazonas, Brazil, 21 Nov. 1966.

Paratypes: BRAZIL: Amazonas: J. A. da Costa S. 151, 9 Sept. 1968 (INPA, MIN), J. Aluizio 242, 29 Oct. 1968 (INPA, MIN), W. Rodrigues 5526, 22 Nov. 1963 (INPA), W. Rodrigues & D. Coelho 5591, 11 Dec. 1963 (INPA), W. Rodrigues & Osmarino 5713, 13 Feb. 1964 (INPA), and W. Rodrigues & Osmarino 6878, 23 Feb. 1965 (INPA), all from the Reserva Florestal Ducke near Manaus. Pará: E. Oliveira 4144, 29 Feb. 1968 (NY), Río Jarí, Monte Dourado, Planalto.

SURINAM: P. J. M. Maas & J. A. Tawjoeran s.n., L.B.B. 10808, 15 May 1965 (U, MIN), Maratakka River, Snake Creek; Stahel 218, Aug. 1944 (A, BBS, IAN, K, US For. Prod.-Madison, U, WIS), Zanderij I; Utrecht, B. W. Herb. 1506, 4 Dec. 1915 (F, K, NY, RB, S, U, US), Zanderij I.

VENEZUELA: Bolivar: J. A. Steyermark 90433, 29 Dec. 1961 (F, NY, VEN), near the Río Ichún.

This species belongs to a complex of four, all with similar leaves and somewhat similar inflorescences and flowers, all in the section Brevipedillus of the subgenus Taphroxylon. The closest relative of the new species is M. myrtifolia Spruce ex Triana, from which M. angulicosta differs in having 4-winged twigs, stellate to columnar foliar sclereids, a lesser frequency and greater depth of stomatal crypts, a hypodermis (rarely absent), a sharply angled midrib, white to greenish-white petals, and a greater number of ovules. The two other species of the complex are M. duckeana Morley and M. duckeanoides Morley (ined.). From both of these M. angulicosta differs in having a sharply angled midrib, shorter anther glands and sporangia, and white to greenish-white petals. M. duckeanoides differs further in its larger stomatal crypts; M. duckeana in its case differs additionally in its unwinged twigs, puberulence, and larger ovule number. The one collection of M. angulicosta from Venezuela, cited above, differs from all other collections examined in lacking a hypodermis within the leaf. It agrees in other respects, however, and may be regarded as a local variant of uncertain status.

MOURIRI FICOIDES Morley, sp. nov.

Arbor usque 35 m alta x 45 cm diametro; ramuli juvenes teretes vel leviter canaliculati. Laminae 10.5 -28.3 cm longae, 6.0-10.6 cm latae, elliptico-oblongae usque ellipticae vel leviter ovato-ellipticae, apice abrupte acuminato, basi abrupte attenuata vel late acuta usque rotundata; petioli 3-10 mm longi in pagina superiore. Sclerides terminales foliariae filiformes; cryptae stomatatae 70-90 μ altae, 18-35 μ latae, numerosae. Inflorescentiae cauliflorae usque ramuliflorae, non axillares, singulae 1-18-florae; pedicelli 3-10 mm longi. Calyx ovarium inferior includens 8-10 mm longus; hypanthium liberum nullum; lobi calycis 2-4.5 mm longi, 6-8 mm lati, late rotundati vel interdum late acuti vel leviter emarginati. Petala albida usque flavida, interdum rosea in parte superiore, late elliptica usque elliptico-obovata, 11-14 mm longa, 8.5-11 mm lata, apice rotundato. Filamenta 2.5-4.5 mm longa; antherae 3.5-4.5 mm altae, 2.3-3.3 mm latae ad basim; thecae antherarum hippocrepiformes, rimis longitudinaliter dehiscentibus; glandula 0.8-0.9 mm longa, subapicalis. Ovarium 5-loculare, ovula 10-12 in singulis loculis; placentae basilares in quoque loculo, ovula undique circum quamque placentam genita. Fructus edibilis, flavidus usque luteus clarus, subglobosus, calyce coronatus, 16-25 mm altus, 15-24 mm latus, 2-3 (-5-?)-spermus; semina 10-11 mm longa.

Type Collection: A. Ducke s.n., RB 25515 (holotype US; isotypes G, K, MG, P, RB, S, U, US; the same

collection under the number A. Ducke 44 is at A, F, US For. Prod.-Madison). Near small stream at km 5, Estrada do Aleixo, Manaus, Amazonas, Brazil, 17 Nov. 1931. "Arv. 30 m, calice verde, petalas externamt. brancas com ponta rosea, internamente crêm até alaranjadas pallidas, filetes brancas, connectivo atro-violaceo." A Latin translation is usually given.

Paratypes: BRAZIL: Amazonas: G. A. Black 47-1636, 10 Oct. 1947 (IAN); A. Ducke 105, 13 Dec. 1935 and 2 Dec. 1942 (A, F, IAN, K, MG, MO, NY, S, US), all from Estrada do Aleixo, Manaus; T. Morley 1150, 17 Nov. 1966 (MIN); W. Rodrigues, M. Freitas, L. Coelho s.n., INPA 27730, 11 Nov. 1969 (INPA, MIN), and "Pessoal do C. P. F.", 26 Feb. 1958 (IAN, INPA), all from Parque 10, Manaus; L. Coelho & F. Mello s.n., 14 Dec. 1955 (INPA), BR 17, km 17, Manaus; O. P. Monteiro 8, 7 Nov. 1969 (INPA, MIN, US), Reserva Florestal Ducke, Manaus; J. M. Pires s.n., 24 Nov. 1945 (UC), 8 km from Manaus; J. M. Pires & G. A. Black 751, 26 Sept. 1945 (IAN), Manaus.

VENEZUELA: Amazonas: L. Williams 14018, 27 Jan. 1942 (F, IAN, NY, US, VEN), Yavita, alt. 128 m; L. Williams 14491, 27 Feb. 1942 (A, G, RB, US, VEN), San Carlos de Rio Negro, alt. 100 m; L. Williams 15576, 27 May 1942 (A, RB, US, VEN), Capihuara, Alto Casiquiare, alt. 120 m.

This species falls unmistakably in section Cyrtotheca of the subgenus Pericrene, where it is paired with a closely related plant, M. crassifolia Sagot. The broader leaves, longer petioles, cauliflorous to ramuliflorous flowers, longer pedicels, longer calyx and ovary, wider calyx lobes and petals, shorter filaments, larger anthers, and greater ovule number of M. ficoides all distinguish it from M. crassifolia. The two make an interesting pair. M. crassifolia occurs in Surinam, French Guiana, and Amapá and eastern Pará of Brazil; M. ficoides has been found near Manaus, Amazonas, Brazil, and in southern Amazonas, Venezuela. Both species occupy regions of 2000-3000 mm or more of annual rainfall and are separated by an area of about 1500 mm or less rainfall, as shown in J. Haffer, Speciation in Amazonian Forest Birds, Science 165: 131-137, 1969. The two distributions correspond rather well to two of the forest refuges postulated by Haffer, the Imerí and the Guiana. It therefore seems likely that climatic isolation has been largely responsible for the divergence of these two species.

MOURIRI GUIANENSIS Aublet ssp. BARINENSIS Morley, ssp. nov.

Fructus 14-18 mm altus, 13-18 mm diametro in sicco, supputatus 17-22 mm x 16-22 mm in vivo; semina 9.9-11 mm longa; cryptae stomatatae 13-90μ diametro,

36-96 in mm^2.

Type Collection: F. J. Breteler 3722 (MICH, SP, U, US), Ticoporo forest reserve near Río Michay, 70° 40' W, 7° 55' N, Estado Barinas, Venezuela, 15 March, 1964.

Paratypes: VENEZUELA: Barinas: H. Jiménez Saa 1255, 2 Jan. 1971 (MIN, VEN); J. A. Steyermark, G. Bunting, C. Blanco 102075, 10 April 1968 (VEN), both from the Reserva Forestal de Caparo, 100 m elevation; A. L. Bernardi 1752, 11 Dec. 1954 (NY, VEN), Curbatico, La Vega, Poses, Ramón Díaz.

This subspecies is known only from the wet forests of Barinas, up to 300 m elevation. Its fruits are so much larger than those of typical M. guianensis that there seems no doubt that it represents a distinct taxon of at least subspecific rank. Only fruiting collections have been made so far. By contrast, fruits of typical M. guianensis are 6.5-11 mm high x 6.2-11.7 mm in diameter dry, estimated 8-14 mm x 7.5-14.5 mm fresh, with seeds 7-9.3 mm long. Stomatal crypts in the typical plants are 13-50μ in diameter, 75-400 per sq. mm, so that this character reinforces that of the fruit to some extent. Judging by the label data the plant is typically a tree 20-25 m high, whereas plants of the typical subspecies, although sometimes attaining this stature, are usually small often bushy trees to 10 m high. We await the collection of flowering material to see if the Barinas plants are still more distinct.

MOURIRI LONGIFOLIA (HBK.) Morley, comb. nov.

Myrtus longifolia HBK., Nova Gen. Sp. Plant. 7: 258. 1825.

I am indebted to Dr. Rogers McVaugh for pointing out to me that Myrtus longifolia must be a Mouriri. A careful examination of a fragment of a leaf from the type material at Paris showed him to be correct. Moreover, the anatomy was so distinctive that combined with the morphology and what was known of the fruit it was plain that the species was not synonymous with any other known species of Mouriri. The distinctive anatomical features are the single upper epidermis, the scarcity of mucilage walls in the epidermis, the absence of a hypodermis, the prevalence of tannin compounds, the filiform foliar sclereids, and the large stomatal crypts, which are 50-156μ in diameter and 40-46μ deep. The fruit which was once present with the type has long since disappeared, leaving the type sterile.

Recently a second collection of this species was made: M. Fariñas, J. Velasquez, & E. Medina 643, from Esmeralda, Amazonas, Venezuela. It agrees well with the type material. It bears fruit only; the fruit cor-

responds nicely with the description of that of the type, being pear-shaped with 5 calyx lobes, 2-locular, with 1 seed per locule. Close examination of the positions of the micropyle, the aborted ovules, and the vascular strand in the hilum did not reveal the type of placentation, although it appeared more like that of the subgenus Mouriri than that of Pericrene. The tubular midrib xylem almost certainly excludes M. longifolia from subgenus Taphroxylon. Thus the taxonomic position of this species remains unclear other than being probably in subgenus Mouriri or Pericrene.

Taking all into account, the most diagnostic features of M. longifolia are its large cordate leaves, its midrib which is flat above and angled below and which contains tubular xylem, its filiform foliar sclereids, large stomatal crypts, and pear-shaped 2-locular fruit with 1 seed per locule.

MOURIRI NIGRA (DC.) Morley, comb. nov.

Eugenia nigra DC., Prodromus 3: 268. 1828.

Mouriri plasschaerti Pulle, Rec. Trav. Bot. Neerl. 6: 283. 1909.

I am likewise grateful to Dr. Rogers McVaugh for pointing out to me that Eugenia nigra must be a Mouriri. An examination of leaf material from the type at Munich verified his belief. This material is completely typical of Mouriri plasschaerti in morphology and anatomy. The description of the other features of E. nigra also agrees with M. plasschaerti except for the number of calyx lobes and corresponding marks on the fruit, said to be four. The flowers of this species are pentamerous; the report of 4 calyx lobes is almost certainly a mistake of some kind; it is possible, but unlikely, that the material studied was atypically tetramerous.

BOOK REVIEWS

Alma L. Moldenke

"AN ILLUSTRATED FLORA OF THE NORTHERN UNITED STATES AND CANADA, VOLUMES I, II & III" by Nathaniel Lord Britton & Addison Brown, xxix & 2052 pp., illus. Facsimile replication of the 2nd revised & enlarged 1913 edition, Dover Publications, Inc., New York, N. Y. 10014. 1970. $15.00 paperback.

Even though Dr. Gleason has revised this work in 1952 and again slightly in 1958, there should be a very definite and appreciative market for this Dover reprinting. Even though Dr. Gleason' revisions have the advantages of range extensions, new introductions and newer taxonomy, this Dover printing has the familiar and still excellent drawings, as well as the numerous common names and full synonymy which are so very helpful to the amateur as well as to the specialist and are sorely missed by many in the '52 and '58 editions.

It is being sold at a bargain price! Its size is handier for field work, especially because of the smaller margins, flat opening with the pages firmly sewn in signatures, and smooth flexible covers which the printers promise "will not crack or split [for] this is a permanent book".

"THE ADAPTIVE GEOMETRY OF TREES" by Henry S. Horn, xi & 144 pp., illus., Princeton University Press, Princeton, N. J. 08540. 1971. $7.95.

The author develops a mathematical models theory of forest succession as a result of his field studies of the deciduous forest of Princeton Woods, New Jersey, the coniferous forest in the California Sierra and the mid-elevation Costa Rican rain forest. He considers measurement of light intensity, analysis of forest succession, theoretical strategies of leaf distribution with their photosynthetic response and measurement, speculations on shapes of tree crowns that are early or persistent multilayers or monolayers, and the evaluation and application of his studies. Hereby a forest's productivity, stability and diversity can be predicted and so prove valuable to foresters and plant ecologists in particular and of interest to all biologists because even a viable comparison is made with the form of those corals which are dependent photosynthetically upon their enclosed algae.

On p. 132 the family name for the tree-ferns is misspelled.

"INSECT POLLINATION OF CROPS" by John B. Free, xi & 544 pp., illus., Academic Press, London WIX 6BA & New York 10003, N. Y. 1970. $21.00.

This is an expensive but worthwhile addition to the literature of interest to many kinds of biologists — practical and professional — as, for instance, farmers, apiculturists, pollination researchers, assorted entomologists, botanists, teachers, etc. The author is from the longest functioning agricultural experiment research station in the world - Rothamsted of Harpenden, England. In the preface he states "The first part is concerned with the pollinating insects that can be used by man to supplement wild pollinators, and the ways in which this can be done most effectively. In the second part each crop is discussed in turn..... [giving] available information on: flower structure as it relates to pollination; the crop's pollination requirements; the insect species that normally pollinate it and the ability of honeybees to do so; the increased crops that have been obtained using honeybees for pollination; the behaviour of honeybees and other insects on the crop; production of nectar and pollen by the crop and its food value to honeybees; and recommendations on the number of honeybee colonies needed per hectare."

A tremendous number of references are collected in the bibliography. There are useful, but not entirely complete separate indexes for authors, animals, plants and general items. On p. 266 a tiny ceratinid bee is called a wasp. The taxonomy used is classical.

"FOREST TREES OF THE PACIFIC SLOPE" by George B. Sudworth, xv & 455 pp., illus., facsimile edition of the 1908 Forest Service of the U. S. D. A. edition. 1967. $5.00 paperback.

To teachers, to professional foresters and forestry students, and to naturalists it is a real boon to have this work easily and inexpensively available again as an unabridged replication of the original work to which has been added a new foreword by W. Metcalf of the University of California at Berkeley where Sudworth's famous field notebooks are kept and also a new table of changes in nomenclature by E. S. Harrar wherein even common names are standardized. Each species is superbly illustrated and described according to distinguishing characteristics, range, occurrence, climatic conditions, tolerance and reproduction.

This book is prepared as a "permanent", rather than as an evanescent throw-away one.

"PLANT AGRICULTURE - Readings from 'SCIENTIFIC AMERICAN'" selected and introduced by Jules Janick, Robert W. Schery, Frank W. Woods and Vernon W. Ruttan, iii & 246 pp., illus, W. H. Freeman & Co., San Francisco, California 94104. 1970. $10.00 clothbound, $4.95 paperbound.

This is another member of this excellent topical series. It wi

be of considerable value not only to the students and workers in the broad field of agriculture who may thereby be introduced to this fine journal, but also to students, workers and readers in the still broader field of biology.

There are 25 papers by recognized authors. They are grouped under the following five topics: agricultural beginnings, plant growth and development, plant environment, production technology, and food needs and potentials. As in others of this whole series biographical notes, bibliographies and a general index appear at the end of the book.

In the preface largely is misspelled.

"THE SAVORY WILD MUSHROOM" by Margaret McKenny, revised and enlarged by Daniel E. Stuntz, xxi & 242 & 16 pp., illus., University of Seattle Press, Seattle, Washington 98105. 1971. $8.95 clothbound, $4.95 paperback.

This press produced the first edition in 1962 and it has since become depleted. Therefore it is fortunate to have this field guide available again with almost twice as many species described, each provided with a clear black/white photograph and a useful description. The notes on the various mushroom toxins -- protoplasmic poisons, compounds affecting the nervous system, gastrointestinal irritants, disulfuramoids -- are updated. So are the bibliography and index. A chapter on mushroom cookery has been added. There are 64 beautifully clear color photographs of individual species at the end of the book. This excellent work is offered very appropriately as a tribute to the original author.

On p. 207 Gyromitra is spelled correctly twice but not the third time.

Since only about 11 percent of the species treated are limited to the Pacific Northwest states, this work should appeal to the many botanically interested people all over this country and Canada, as well as to mycologists around the world.

"FOUNDATIONS OF PLANT GEOGRAPHY" by Stanley A. Cain, xiv & 556 pp., illus., facsimile reproduction of the 1944 edition by Harper & Row, Hafner Publishing Company, Inc., New York, N. Y. 10022. 1971. $11.95.

How fortunate it is that this book is made easily available again! For the growing popularity and subdivisioning of the fields of ecology and evolution, this study offers valuable content background and thought orientation. The author in the preface states "I had no intention of writing a descriptive plant geography. This is rather an inquiry into the foundations of the science of plant geography. I have made an effort to survey the related fields of science for concepts and working methods which are useful in an interpretation of the phenomena of plant distribution." The main divisions of the book after the introduction are paleoecology, areography, evolution and the significance of

polyploidy.

There are a carefully compiled index, a bibliography of 720 references, a glossary of clear-cut definitions as well as several maps, diagrams and charts that are effectively expressive of ideas presented in the text.

"THE NEGEV — THE CHALLENGE OF A DESERT" by Michael Evenari, Leslie Shanan and Naphtali Tadmor, x & 345 pp., illus., Harvard University Press, Cambridge, Massachusetts 02138. 1971. $15.00.

This valuable study summarizes two decades of scientific research on making the Negev productive and habitable as some of it had been in the past, made possible by control of runoff water — which most plant associations of the natural desert ecosystems used — and use of chain wells. In addition to the abovementioned authors' monumental efforts there is a chapter on geological history by Yehoshua Yitzhaki and one on adaptations of animal life to desert conditions by Amiram Shkolnik. The two chapters on the adaptations of plants to desert conditions survey the anatomical and physiological studies of Evenari's groups and have great significance for agricultural projects.

Even though this book contains so much of scientific value applicable, at least tentatively, to deserts all over the world, much of it reads as a fascinating adventure tale. It is supplied with a fine bibliography, a useful index, many clear black/white photographs and careful diagrams.

Whatever success man has achieved consciously or unconsciously, in challenging the desert has been made by imitating the adaptations of the other creatures living in this ecosystem and by finding with his ingenuity new ways that are not destructive.

"BIOLOGY READINGS FOR TODAY'S STUDENTS" edited by Gideon E. Nelson & James D. Ray Jr., iii & 388 pp., illus., John Wiley & Sons, London, Toronto, Sydney & New York, N. Y. 10016. 1971. $4.95 paperbound.

These readings have been planned as adjuncts to the second edition of the Nelson, Robinson and Boolootian's "Fundamental Concepts of Biology" so that beginning college students — of whom many or most will not major in biology — will be oriented to today's scientific advances and problems. The aim is excellent the execution not so. There are other of these topical reprint books that have made better choices throughout, such as those from the "Scientific American".

There is no index.

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NEW SPECIES OF PARMELIA SECT. HYPOTRACHYNA (LICHENES)

Mason E. Hale, Jr.[1]

Smithsonian Institution, Washington, D.C. 20560

Parmelia addita Hale, sp. nov.

Thallus ut in P. imbricatula Zahlbr., superficie isidiatus, isidiis cylindricis, subtus rhizinosus, rhizinis dichotome furcatis, sed thallo minore, acidum echinocarpicum continente differt.

Holotype: Layang Layang, Kinabalu National Park, elev. 2600 m, M. E. Hale, no. 28342, August 1964 (US).

Chemistry: Atranorin in the cortex, barbatic acid, 4-0-demethylbarbatic acid, echinocarpic acid and associated unknowns in the medulla.

Specimen examined. PHILIPPINES: Mt. Data, Mountain Prov., Hale 26059, 26382, 26385 (US). SABAH: Along Mesilau Trail, Kinabalu National Park, Hale 28557, 29049, 29277 (US). The following specimens had fumarprotocetraric acid in place of echinocarpic acid: SABAH: Along Mesilau Trail, Kinabalu National Park, Hale 28191, 29024 (US); MALAYA: Cameron Highlands, Pahang, Hale 30196 (US).

This species belongs to the pantropical isidiate P. imbricatula complex. The Asian population characteristically lacks obtusatic acid and norobtusatic acid (which are present in the type of P. imbricatula from Brazil) and is represented by P. orientalis described below. P. addita differs from P. orientalis in producing echinocarpic acid, the basis of the P + red test in the medulla. It occurs only in Asia on oaks and pines at higher elevations. Three specimens listed above are anomolous in containing furmaprotocetraric acid instead of echinocarpic acid. They are tentatively identified with P. addita pending more detailed studies on the structure of this acid. On the average P. addita is smaller and less robust than P. imbricatula or P. orientalis, the lobes narrower and more

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[1] I wish to thank Dr. C. F. Culberson, who determined the chemistry of all specimens of Parmelia addita, P. adjuncta and P. orientalis cited.

finely branched, suggesting that the echinocarpic acid population is already diverging in morphology as well as chemistry.

Parmelia adjuncta Hale, sp. nov.

Thallus ut in P. exsecta Taylor, superficie pustulatus vel crasse isidiato-pustulatus, centro pustulorum eroso nigricanteque, subtus rhizinosus, rhizinis dichotome furcatis, sed acidum echinocarpicum continente differt.

Holotype: Virgin pine forest, about 10 km N of Mt. Data, Mountain Province, Philippines, elev. about 1800 m, M.E. Hale, no. 26085, August 1964 (US).

Chemistry: Atranorin in the cortex, barbatic acid, 4-0-demethylbarbatic acid, echinocarpic acid, and three associated unknowns in the medulla.

Specimens examined. JAPAN: Mt. Mitake, Prov. Musashi, Kurokawa 50110 (TNS, US). MALAYA: Gunong Brinchang, Pahang, elev. about 2000 m, Hale 29941, 29900 (US). PHILIPPINES: Mt. Data, Hale 26191, 26207, 26324 (US), 10 km N Mt. Data, Mountain Province, Hale 26138, 26137 (US). SABAH: Kinabalu National Park: Layang Layang, Hale 29165, ridge between East and West Mesilau Rivers, Hale 29089, East Mesilau River, Hale 28486, Sosopodon Shelter, Hale 29116b, above Kambaranga, Hale 28934 (US).

Parmelia adjuncta is morphologically closely related to P. exsecta Taylor, a widespread montane Asian species with atranorin, barbatic acid, and 4-0-demethylbarbatic acid. The type of P. exsecta (FH), however, is P- and lacks echinocarpic acid. Both of these species are Asian in distribution with P. exsecta on the whole commoner, overlapping the range of P. adjuncta with extensions into Nepal. They occur on both pines and oaks in the higher elevation forests.

Parmelia nakanishii Hale, sp. nov.

Thallus ut in P. gondylophora Hale (vide Hale, 1967, fig. 7) superficie sorediatus, subtus rhizinis dichotome furcatis, sed differt materia chemica alia continente.

Holotype: Mt. LeConte (Alum Cave Trail), Great Smoky Mountain National Park, Sevier Co., Tennessee, elev. 1960 m, S. Nakanishi, no. 205, 8 May 1971 (US; isotypes in KOBE, DUKE, TNS).

Chemistry: atranorin in the cortex, echinocarpic acid, gyrophoric acid (?), and unknown substances in the medulla.

Specimens examined: TENNESSEE: Mt. Le Conte (Alum Cave Trail), Nakanishi 200, 213, 214, 217, 219 (KOBE); Mt. Le Conte (Rainbow Falls Trail), Nakanishi 235 (KOBE).

This species adds another variable to the richly evolved sorediate Hypotrachnya species in the high elevation Abies forest of the Great Smoky Mountains, a list that now includes P. densirhizinata Kurok., P. gondylophora Hale, P. laevigata (Sm.) Ach., and P. rockii Zahlbr. The species must in general be separated by appropriate color or microchemical tests.

The large subapical, coarse and centrally eroding soralia are identical with those of P. gondylophora, but the chemistry is complex and unusual. The P+ reaction is caused by echinocarpic acid, previously known mostly from Asian species. The C+ rose test results from gyrophoric acid apparently or a closely related C+ substance. In addition there is at least one unknown that forms a very distinctive weakly white UV fluorescent salmon pink spot (near R_f .3) in hexane-ether-formic acid.

Parmelia nakanishii is restricted to the Abies fraseri forests of Mt. Le Conte at about 1900 m elevation, although several specimens now under study from Roan Mountain, Tennessee, may belong here too. It is still not known from nearby Clingmans Dome, where the predominant species are P. rockii (lecanoric and evernic acids) and P. gondylophora (fumarprotocetraric and sublimbatic acids). While the chemical structure of echinocarpic acid is still unknown it appears to be a depsidone related to fumarprotocetraric acid, showing the very close affinity between P. nakanishii and P. gondylophora. Parmelia gondylophora, as a matter of fact, is a much more widespread species, occuring commonly in the Smokies but also in the West Indies, Mexico, and Venezuela with a probable record (in US) from South Africa.

Parmelia orientalis Hale. sp. nov.

Thallus ut in P. imbricatula Zahlbr., superficie isidiatus, isidiis cylindricis, erectis, subtus rhizinosus, rhizinis dichotome furcatis, sed acidum obtusaticum et acidum norobtusaticum non continente differt.

Holotype: Doi Sutep, Chieng Mai, Thailand, elev. 100-1676 m, S. Kurokawa, no. 1650, 16 Feb. 1964 (US; isotypes in TNS, UPS).

Chemistry: Atranorin in the cortex, barbatic acid and 4-O-demethylbarbatic acid in the medulla (trace lecanoric acid present?).

Specimens examined: NEPAL: Helok-Baroya Khimty, Togashi s. n.

(TNS, US). PHILIPPINES: near Mt. Mandalagan, Negros Occid., elev. 850 m, Hale 26585 (US). MALAYA: Cameron Highlands, Pahang, Hale 30195 (US). SABAH: Kambaranga roadhead, Kinabalu National Park, Hale 28822 (US).

This chemical segregate of the P. imbricatula population lacks obtusatic and norobtusatic acids as well as echinocarpic or other P+ acids (see discussion under P. addita above). It is much closer in size and robustness to the South American P. imbricatula than is P+ P. addita. In general it seems to have a more westerly range in mainland Asia, being less common in the Philippines and Sabah than other species in the group.

Parmelia physodalica Hale, sp. nov.

Thallus ut in P. enderythraea Zahlbr., viridi-albicans, isidiis sorediisque destitutis, subtus rhizinosus, rhizinis dichotome furcatis, sed acidum physodalicum continente differt.

Holotype: Guasca, Cundinamarca, Colombia, E. Perez-Arbelaez, no. 1104, August 1931 (US) (Fig. 1).

Chemistry: Usnic acid in the cortex, physodalic acid in the medulla.

I first identified this as P. caraccensis Taylor, a similar yellow species with long linear lobes, very dense rhizine mat below, and norstictic, salazinic (tr.), glabinic, and usnic acids. Parmelia enderythraea Zahlbr. has identical chemistry but shorter more delicate lobes. The chemistry of P. physodalica, however, proved to be entirely different, physodalic acid, the first report of this depsidone in section Hypotrachyna. It is known only from the type collection growing apparently on rocks in the paramo region near Bogota.

Parmelia rachista Hale, sp. nov.

Thallus 6-12 cm latus, laxe adpresuss, corticola, cinereo-albida, lobis linearbus, dichotome ramosis, 1.5-3.0 mm latis, superne planus, nitidus, sorediis destitutus, apicem versus lobulascentibus, margine et praecipue apice dactyloideo-lobulato ut in figura 2, lobulis suberectis vel prostratis, dorsiventralibus, subtus niger, interdum lobis suberectis anguste albicantibus, rhizinosus, rhizinis dichotome furcatis. Apothecia ignota.

Holotype: Clingmans Dome, Great Smoky Mountains National Park, Swain Co., North Carolina, elev. 6600 ft., S. Kurokawa 6755 (no. 80 in S. Kurokawa, Lich. Rar. et Crit. Exs.), 24 Sept. 1966 (US; isotypes in TNS and other herbaria which received this exsiccate number

Chemistry: Atranorin in the cortex and anziaic acid and perlatolic acid (trace) in the medulla.

Specimens examined. TENNESSEE: Mt. Le Conte, Sevier Co., Nakanishi 203 (US, KOBE). NORTH CAROLINA: Clingmans Dome, Swain Co., Imshaug 22425 (MSC, US), Hale 33390, 33191, 33192, 33309 (US), Sheard 1489c, 1490f (CAN, US); Mt. Kephert, Degelius s.n. (US) (as P. lobulifera var. sanguineoreagens Degel., isosyntype). MEXICO: Tuxtepec-Oaxaca, Oaxaca, Nakanishi 378 (US, KOBE), 18 km SE San Cristobal, Chiapas, Hale 20286 (US). PANAMA: east side of Volcan Chiriqui, Chiriqui, Scholander s.n. (US). COLOMBIA: Paramo de Cruz Verde, Cundinamarca, Cuatrecasas 450Z (US).

This entity was first recognized by Degelius (Ark. f. Bot. 30A (3):63. 1941, plate 1) as P. lobulifera var. sanguineoreagens, but he designated var. luteoreagens (barbatic acid group present, =P. imbricatula) as the typical form of P. lobulifera. The C+ red test is caused of course by anziaic acid. I had been identifying these specimens with P. prolongata Kurok. (Hale & Kurokawa, 1965), but chromatographs showed that the chemistry of this species had been incorrectly determined. The holotype (Imshaug 23210, not 3233 as mistakenly given in the original publication) and Wetmore 3233 from the same locality are more complex in chemistry than had been previously thought from crystal tests. There are a number of spots on TLC plates indicating the presence of at least four distinct compounds, including perhaps minute traces of anziaic acid. The chief component (a large spot below anziaic in hexane-ether) is not yet determined. P. prolongata also produces a distinct pigment but no specimens of P. rachista contain pigments, the acetone residues being white. The lobules in P. rachista are also different, much more numerous and finely dissected than in P. prolongata (Fig. 2). Thus P. prolongata is now known only from Haiti, whereas P. rachista has a wide range in higher elevation montane forests from North Carolina to Columbia.

Literature Cited

Hale, M. E. 1967. New Taxa in Cetraria, Parmelia, and Parmeliopsis. Bryologist 70:414-422.

Fig. 1. Holotype of Parmelia physodalica (scale in mm).

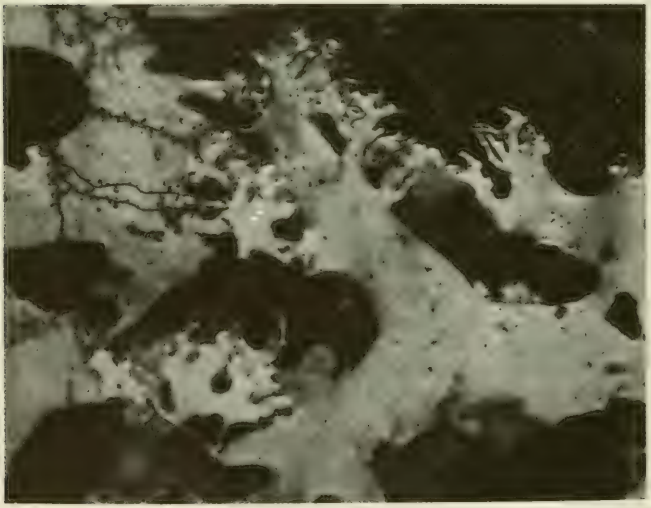


Fig. 2. Closeup of isidiate lobules of Parmelia rachista (about X10).

ADDITIONAL OBSERVATIONS ON THE MORPHOLOGY OF FRITILLARIA ERZURUMICA KASAPLIGIL

Baki Kasapligil
Biology Department, Mills College
Oakland, California

Following the publication of Fritillaria erzurumica Kasapligil, I received several other finely preserved herbarium specimens including bulbs, fully open flowers and mature fruits of this taxon from a place not far from the type locality, collected by Mr. Sabri Özyurt of the Atatürk University in Erzurum, Turkey. The newly arrived specimens (S. Özyurt No. 1429) were collected from the Northern slopes of Palandöken Mountains at a locality called Telsiz Tepe, 2500 m. above sea level, i.e. 400 m. below the type locality. Mr. Özyurt describes the habitat as mountain steppe with calcareous moist soil. I was very impressed with the large showy flowers of these specimens which were collected on May 21, 1971. The diameter of the saucer-shaped solitary flowers varies from 4 to 6 cm. while the length of the perianth segments ranges from 2.5 to 3.5 cm. All petals seem to be with entire margins without any lobation. The pistils appear fertile, giving rise to mature ovaries with abundant fertile seeds.

The capsules stipitate, reverse pear-shaped, slightly depressed at apex. Pericarp membranous, distinctly 6-angled, light brown on top, beige-colored all around except along the angles which are also light brown. Gradually tapering base of capsule is marked by a dark brown ring formed by six scars of perianth segments. The length of the capsules varies from 2.2 to 3.0 cm. and their width at the upper broad portions ranges from 1.5 to 1.8 cm.

The seeds are anatropous, flat, pyriform in outline, narrowly winged all around, 7-8 mm. long and 5-6 mm. wide. The seed coat is light brown and obscurely reticulate on both surfaces. A rudimentary type, straight embryo is approximately 1 mm. long and 0.5 mm. wide. A single vascular strand extending through the raphe reaches the chalazal end of the endosperm.

Recently, three new species of Fritillaria from eastern Turkey were published by E.M. Rix (Notes from the Roy. Bot. Gard. Edinburgh 31: 125-129, 1971). Although I have not seen the type specimen of F. alburyana Rix, the description and illustrations of this taxon show close similarities to F. erzurumica. However, the nectaries on the perianth segments of F. erzurumica are well developed and unlike the cylindrical capsules of F. alburyana, the fruit of F. erzurumica is reversed pyriform. Therefore, a closer examination of these two taxa would be desirable.

In my previous article (Phytologia 22: 1-5, Aug, 1971), the

holotype for F. erzurumica was inadvertently indicated together with its isotype. The location of the holotype of F. erzurumica as well as of F. erzurumica var. abortivus is U.C. Berkeley, while the location of the isotypes of both taxa is the Herbarium of the Atatürk University in Erzurum.

Fig. A- Fritillaria erzurumica with a slightly nodding flower and a spherical bulb. Fig. B- Another specimen of the same taxon with an ascending flower and an oval bulb. Both photographs courtesy of Mr. Sabri Özyurt.

A BOTANICAL EXPEDITION TO NICARAGUA

Frank C. Seymour

That Nicaragua is the least explored botanically of all the Central American Republics was a challenge to a party of six men who in December 1968 and January 1969 made a botanical expedition to that alluring and fascinating country.

What made Nicaragua such an alluring country? Not only was it the least explored but none of our party had ever seen the tropics before. With a very few exceptions, every plant we saw was new and strange. Our avowed purpose was to do what we could in merely seven weeks toward a collection as representative as possible of the flora of Nicaragua. As Cyrus Guernsey Pringle was our illustrious predecessor in botanical exploration in tropical America, and four of us belonged to the University of Vermont whose herbarium is called by his name, we chose to call ourselves The Pringle Expedition of 1968.

Of the six men from Vermont, R. Bruce Hamblett and A. David Moore were undergraduates majoring in botany. John T. Atwood was a graduate student, also majoring in botany. The leader of the expedition, Frank C. Seymour, was associate curator of the Pringle Herbarium. The two other Vermonters were Charles E. Nichols, a dairy farmer, and David A. Dudey, a chemist. Here were assembled a wide variety of talents all united by an interest in plants and a love of adventure.

On November 14, our first detachment started from home base, Charles Nichols and David Dudey leaving Burlington, Vermont, for the long drive to Nicaragua in a Volkswagen camper, in order that our party might have transportation there by automobile. The four others from Vermont, coming by plane, met those two in Managua, the capital of the country, sometime between November 30 and December 12. In Managua, we were joined by two students in the Escuela Nacional de Agricultura y Ganaderia (the National School of Agriculture and Animal Husbandry), Eduardo Narvaez S. and Harvey Zelaya M. Then everyone was present and operations were in full swing.

We take great pleasure in acknowledging the great courtesy of Dr. Gustavo Jarquin B., Director of the just named Escuela and his staff, affording us the use of the professor's suite in the dormitory and in putting at our disposal their herbarium and botanical laboratory for pressing and drying our collections. In appreciation, we left a set of our collections for the herbarium of the School.

Having an automobile at our disposal enabled us to reach many parts of the country which we should otherwise have missed. Many localities in western Nicaragua are connected by a system of fine hard-topped roads. Moreover, to transport thus eight men costs no more than to transport one. Economy was important to us. Each of the men who made the trip from Vermont did so at his own expense.

Fortunately, the holiday season when students could be absent from the classroom fell at the same time as the dry season in western Nicaragua. To skip for about seven weeks the rigors of a Vermont winter was another piece of good fortune. To be sure, there is no skiing in Nicaragua; not even on the highest mountains is there ever any snow.

To convey an idea of the climate of Nicaragua, figures on a thermometer mean far less than to mention that during many of the nights we needed no covering on our beds; in the coldest January nights a raincoat was an adequate cover. In Managua, we experienced one or two showers; otherwise, the sun was shining every day, all day long, from 6 a.m to 6 p.m. Although this was good for drying specimens, it was not always so good for humans. While our friends and families in Vermont were shivering with sub-zero blasts and roads were choked with snow, sweat was dripping from our brows and noses and chins, with little or no exertion on our parts.

An important item in our equipment was field presses, each consisting merely of a pair of light-weight, almost frail slats, a supply of newspapers, and one light-duty strap. With few exceptions, as in the case of orchids and bromeliads, we pressed all our specimens within a few minutes of taking them. Thus, when leaves wilted, they wilted in position without curling. Folds were adjusted in the laboratory before putting them onto the dryer. Moreover, when we returned to our base, tired and hungry, there was less work to care for the day's booty. We believe that this method improved the quality of our specimens.

Nicaragua is divided into 15 departments, rather than states. To obtain samples of the flora from every department rather than to concentrate on any one area was our goal. With the aid of our automobile, we were able to accomplish this on our first trip except that we did not reach the department of Chinandega in the extreme northwest or Comarca del Cabo in the extreme northeast. It ought to be admitted however that we did not spend more than three of four days in the department of Zelaya, on the east (Atlantic) coast, which is larger in area than all the other departments combined. In this department our automobile could help us but little as only a small part of it can be reached from the west by roads.

Geographically it is convenient to divide the land into two parts. The first, the western part, is a comparatively narrow strip of land along the Pacific Ocean, bounded on the east by mountain ranges which are a part of the enormous range extending from North America thru Central America far southward into South America. In this western strip lies Lake Nicaragua, one of the largest lakes in the world, famous for being the home of fresh water sharks. Also in this strip lies Lake Managua, a very large lake, even though much smaller than Lake Nicaragua. This western strip is extremely dry during the northern winter and therefore was so, at the time of our Expedition, in December and January. A few volcanoes are active and many of the mountains are extinct volcanoes.

If one proceeds eastward from this dry western strip of land, he crosses mountain ranges and then enters the second part, a very different and much larger part of the country, subject to heavy rainfall and characterized by rain-forests. Much of this eastern area is included in the department of Zelaya. Its vegetation is extraordinarily different from that of the western strip. Ferns, for instance, are in great abundance and variety. The same may be said of the Melastomataceae, which are relatively scarce in the west but in the east flourish in great abundance and bewildering variety.

Rather than enlarge further in a general account like this, a list of localities where we collected will be appended to this article, with more specific comments on the vegetation in each as we came to it.

The combined efforts of our eight men added up to about 8500 specimens of vascular plants, some of which came from 13 of the 15 departments. Only a brief visit of 3 or 4 days in Bluefields, Rama and El Recreo can be counted as an invasion of rain-forests. The eastern part of the country is less accessible than the western. Our experience in this first trip prepared us to reach more rain-forests another time, a year later, on our second trip. Tantalized by our tiny glimpse of rain-forests we were lured irresistably to return.

RECORD OF COLLECTIONS IN NICARAGUA OF THE PRINGLE BOTANICAL EXPEDITION 1968-1969

The following records are arranged chronologically. The numbers are in one series. Each number is used only once, whoever is the collector.

Dec. 3. Grounds of the Escuela Nacional de Agricultura y Ganaderia (National School of Agriculture and Animal Husbandry), Managua,

Dept. Managua, on Route 1, the Pan American Highway, 12 km north (actually east of this point) of the city of Managua, capital of the country. Seymour 1, a cultivated Canna. This collection serves as a record that some of our party had arrived.

Dec. 4. Tipitapa, Dept. Managua, 22 km north (actually east at this point) of the city of Managua. For our first collecting trip, we selected a locality only 10 km from our headquarters, the Escuela. Tipitapa is characterized by mile after mile of cotton fields. The soil is black and fertile. The land is very level. While many rivers in other parts of the country are dried up, streams in this area continue to flow. Altho at this season, the soil is very dry on the surface, underneath the surface, a good water supply continues. Swamps and rivers are frequent. Dudey did not come on this trip and Seymour did not collect. Atwood and Moore had not yet arrived in Nicaragua. The others collected in a pasture, along a swamp and a muddy stagnant creek. Hamblett 2-12; Narvaez 13-20; Nichols 21-36; Zelaya 37-52.

Dec. 5. Masaya, Dept. Masaya, shore of Lake Masaya. On the shore of a lake, we expected a fringe at least of well watered ground. On one side of the lake, such a fringe, if any, was exceedingly narrow. One foot from the water's edge, the soil was parched. On this side, some patches of ground were devoid of vegetation. Much of the soil was composed of volcanic clinkers,--very porous lumps of ash. Any plant must send its roots far below and between lumps to find moisture. Trucks were busy hauling away load after load of clinkers, presumably for road beds. Wigandia was one of the significant plants.

On the other side of the lake, huge blocks of lava, broken off from the cliffs above, cluttered the shore. Here grew a forest of tall trees. Dudey 53-71; Hamblett 72-90; Narvaez 91-98; Nichols 99-146; Seymour 147; Zelaya 148-161.

Dec. 6. Escuela, as described above. Located on the same kind of land as Tipitapa, they both are part of the vast plain, monotonously level, lying between the far western Cordillera del Pacifico, close to the Pacific Ocean, and the range of mountains which separates the dry western section from the region of rain-forests eastward. It is an ideal situation for the National School of Agriculture and Animal Husbandry. Nichols, only, 334-336.

Dec. 7. First stop. Not near a village, Dept. Managua, 25 km northwest of Managua on Route 12, in the Cordillera del Pacifico, which slopes abruptly westward to the Pacific Ocean. More moisture was in the soil here than in lower levels nearby. We collected on a steep roadside bank and shady clay cliff. Hamblett and Nichols 162-194.

Dec. 7. Second stop. Telica, Dept. Leon, about 15 km north of the city of Leon, on Route 26. This spot was in full view of a volcano, Cerro Negro, belching forth black smoke which proved to consist of fine ash. As we came thru the city of Leon, it being directly to windward of the volcano, people were sweeping and shoveling ash from the sidewalks.

We collected in an open field. Dudey, Hamblett & Nichols 195-210.

Dec. 7. Third stop. Telica, at a farm, near the second stop. Dudey, Hamblett & Nichols 211-229. Here a crowd of cowboys gathered about us to see what kind of queer things we were doing. Altho there was no sign of anything unfriendly, we thot it better to move on.

Dec. 8. Masachapa, Dept. Managua, on the Pacific Coast, Route 8. Below the high water mark, the beach was of fine gray sand, usually packed hard, interspersed with barely exposed ledges of volcanic rock. It is a popular bathing beach. Our scanty collections, however, were made along the roadside. Nichols 230-239; Seymour 240-242.

Dec. 8. On our return, at the Escuela, Nichols 243-244.

Dec. 9. Atwood and Moore arrived at 9:30 a.m. by plane from Vermont. Since our presses were full, we collected only a little in the vicinity of the Escuela. Atwood 253-256; Narvaez 257-260, 460; Nichols 245-252, 881; Seymour 261-263; Zelaya 264-272.

Dec. 10. First stop, Santo Tomas, Dept. Chontales, Route 7. This was rich country approaching a rain-forest. While we stopped to refuel and get bottled soda, Nichols collected 273-286; and Seymour 289-291.

Dec. 10. Second stop. Rama, Dept. Zelaya, Route 7. While waiting for the boat to take half of our party down the Escondido River to Bluefields, we collected on the riverbank and at a spot 3 km north of the city. Rama is in rain-forest area. Atwood 289-291; Hamblett 292-297; Nichols 298-307; Seymour 308-317; Zelaya 318-321.

Dec. 10. Third stop. El Recreo, Dept. Zelaya, Route 7, about 32 km west of Rama. While half of our party were on the boat going to Bluefields, the rest of us stopped here to collect in rain-forest, among rolling hills. Dudey 322-325; Hamblett 326-329, 448- 459; Narvaez 330-333, 461-463.

Dec. 11. Bluefields, Dept. Zelaya. They collected along "open jungle trail." This was genuine rain-forest with rain descending much of the time while the men collected. The soil was clay. Atwood & Moore 337-381, 882-892; Nichols 382-418; Zelaya 419-447.

Dec. 11. Rama. Atwood 897.

Dec. 12. Rama. They collected on a volcanic cone. Atwood & Moore 464-490; Nichols 491-498; Zelaya 499-500. Nichols 898-899 at

roadside.

Dec. 12. Casa Colorado, Dept. Carazo. While half of our party were in Rama, the others collected on a rather bleak mountain top in the Cordillera del Pacifico, among scrubby growth. Dudey 501 - 523; Hamblett 524-536; Narvaez 537-542; Seymour 543-578.

Dec. 13. Rama. Half of our party still in Rama collected in a rain-forest. Atwood 579-581; Atwood & Moore 582-583; Nichols 584-593, 900-904; Zelaya 594-601.

Dec. 13. Juigalpa, a few km south of the city, Route 7, Dept. Chontales. On the way back to Managua, Atwood & Moore seized the opportunity of a brief stop to collect 602-603.

Dec. 14. First stop. El Bluff near Bluefields, Dept. Zelaya. While half of our party returned to Managua, now the other half had come to Bluefields. Setting out in the pouring rain (which soon ceased), we rented a motor boat which took us across the harbor to this narrow strip of land with water on both sides, salt water on the east, fresh water on the west. The soil was very sandy and the growth scrubby. A stiff wind made pressing our specimens very difficult. Dudey 604-610; Hamblett 611-626; Hamblett & Seymour 627-630; Narvaez 631-634; Seymour 635-653.

Dec. 14. Second stop. Panta Masaya, near Bluefields. By the same boat, we who were at El Bluff reached a ridge extending intoBluefields Harbor, characterized by palms and cleared land; soil very moist. Dudey 654-671; Hamblett 672-681; Seymour 682-698.

Dec. 15. Bluefields. Only Seymour collected 699-714, in a vacant lot, a weedy spot, in the city.

Dec. 16. Bluefields. As this half of our party left to return to Managua, Seymour hastily grabbed a Cyperus, 715, in a vacant lot.

Dec. 16. Rama. Second stop. While waiting for the bus to take us to Managua, Seymour again grabbed a few plants in a vacant lot,716-726.

Dec. 16. Third stop. Escuela. Atwood & Moore 727-733; Zelaya 734-738.

Dec. 17-18. Escuela. All eight of us put specimens into press and went over those already in press.

Dec. 18. Escuela. Seymour 739.

Dec. 19. First stop. Escuela. Seymour 740-752.

Dec. 19. Second stop. Masachapa, Dept. Managua, on the Pacific Coast. The habitat was loose dry sand of the beach and scrubby growth above the beach. Only Nichols collected 753-754, 905-913.

Dec. 19. Third stop. 10 km west of La Concepcion, Route 8, still in Dept. Managua, in the Cordillera del Pacifico. Nichols 914-918.

Dec. 20. First stop. Ocotal, Dept. Nueva Segovia, the only trip to this department. All eight of us collected 3 km west of the city, mostly in the bed of a dried-up brook in a deep gorge, but also on hillsides. This was very hilly country. Atwood 755-773; Dudey 774-788; Hamblett 789-796, 798-803; Moore 804-815; Narvaez 1942-1945; Nichols 816-839, 876-879; Seymour 840-872, 2239-2240; Zelaya 873-875.

Dec. 20. Second stop. Yalaguina, Dept. Madriz. On the way back to Managua, we stopped to collect at K203, 2 km south of Yalaguina, along a river with stony bed on Route 1, the Pan American Highway. This was our only collecting in Dept. Madriz. Atwood 919-925; Dudey 925 (repeated by mistake)-927; Hamblett 797, 928-933; Moore 934-944; Nichols 945-955; Seymour 956-967; Zelaya 968-970.

Dec. 21-22. No collecting, as ventilators were all in use. We went over our specimens already in press.

Dec. 23. Matagalpa, Dept. Matagalpa. Zelaya alone, 971-979.

Dec. 23. Mechapa, Dept. Esteli, Route 1, Pan American Highway, at K129. Narvaez, Seymour and Zelaya did not go on this trip, the only one in the Dept. Esteli. Atwood 980-991; Dudey 1020-1029; Hamblett 992-993; Moore 994-999; Nichols 1000-1007.

Dec. 23. Second stop. Casas Viejas, Dept. Matagalpa, Route 1, at K73. Collected in a bog. Atwood 1008-1019; Dudey 1030-1038; Hamblett 1039-1043; Moore 1044-1055; Nichols 1056-1072.

Dec. 23. Escuela. Seymour 1073-1076.

Dec. 24. Granada, Dept. Granada, along shore of Lake Nicaragua. The soil was extremely dry except at water's edge and in a tiny cove. Atwood 1077-1097; Dudey 1098-1103; Hamblett 1104-1114; Moore 1115-1123; Nichols 1124-1142; Seymour 1143-1160.

Dec. 24. Escuela. Seymour 1161-1162.

Dec. 25. Our third trip to Masachapa, Dept. Managua. To celebrate Christmas, we did the most outrageous thing we could think of; Atwood, Dudey, Hamblett, Moore and Seymour went swimming in the Pacific Ocean! Only Seymour collected 1163-1172.

Dec. 26. No collecting. Errands filled the day.

Dec. 27. First stop. Kl36, southwest of La Virgen, Dept. Rivas, Route 16, where road crossed a brook. The soil was very dry in spite of the brook. Much collecting was in the shade. Atwood 1173-1187; Dudey 1220-1225; Hamblett 1188-1205; Narvaez 1206; Nichols 1207-1219, 1406-1407; Seymour 1226-1241; Zelaya 1242-1249.

Dec. 27. Second stop. San Juan del Sur, Dept. Rivas, Route 16. Sandy shore of Pacific Ocean near mouth of an estuary. Poor collecting. Atwood 1250; Dudey 1251-1252; Narvaez 1253-1259; Nichols 1260-1267, 1405; Seymour 1268-1269.

Dec. 27. Third stop. Santa Teresa, Dept. Carazo, Route 2. High steep clay bank and roadside-rill in mountains of the Cordillera del Pacifico. Atwood 1270-1284; Dudey 1285-1291; Hamblett 1292-1293, 1404; Moore 1296-1306; Nichols 1307-1322; Seymour 1323-1340.

Dec. 28. First stop. Escuela. Douglas Rodriguez Lacayo, not a member of our party, collected for us an epiphytic Bromeliad 1341; Atwood 1342-1346; Seymour 1347.

Dec. 28. Second stop. Managua, Route 2, K7, south of city, on the Pan American Highway, near a volcanic crater. Some soil consisted of volcanic clinkers like those at Lake Masaya. When we attempted to reach the shore of the lake which filled the bottom of the crater, the bank was so steep and the clinkers so loose that we could not get a footing; the attempt had to be abandoned. We collected on stratified sandstone and on a hill, both high above the rim of the crater. Atwood 1348; Nichols 1349-1353; Seymour 1354-1358.

Dec. 29. First stop. Masachapa again, Route 8. We collected in scrubby growth just above high water mark and along a dried-up creek in very sandy soil. Hamblett 1359; Nichols 1360-1388; Seymour 1389-1400.

Dec. 29. Second stop. 4 km southwest of El Crucero, Route 8, in the Cordillera del Pacifico, Dept. Managua. Moore 1401; Seymour 1402-1403.

Dec. 30. First stop. Boaco, Dept. Boaco, Route 9, in mountains just west of the city. We collected in rich woods and open spots. Atwood 1408-1423; Dudey 1424-1447; Hamblett 1448-1455; Moore 1456-1461; Nichols 1462-1483; Seymour 1484-1497.

Dec. 30. Second stop. City of Boaco. About pavements, Nichols 1498; Seymour 1499-1500.

Dec. 30. Third stop. Escuela. Nichols 1501-1504.

Dec. 31. First stop. Puerto Momotombo, Dept. Leon. Collected in a wide meadow on the shore of Lake Managua. Atwood 1505-1521; Dudey 1522-1535; Hamblett 1536-1539; Moore 1540-1548; Seymour 1555-1563.

Dec. 31. Second stop. Leon Viejo, Dept. Leon. Sightseeing in the partially excavated ruins of the ancient city buried many years ago in volcanic ash. The ground was parched; the soil was black, deeply covered with powdery dust. The heat was almost unbearable. Atwood 1549-1552; Seymour 1553-1554.

Jan. 1. Holiday. No collecting.

Jan. 2. Holiday. Escuela. Seymour 1564, an alga.

Jan. 3. K12 1/2, Route 1, 1/2 km east of the Escuela. Three of us collected by the roadside and in low land in rich black soil. Atwood 1565-1575; Nichols 1576-1581; Seymour 1582-1592.

Jan. 4. First stop. Juigalpa, Dept. Chontales, Route 7, 5 km southeast of the city. We collected by the roadside and in swampy woods where we should like to have stayed longer but felt we must press on to our main objective. Nichols 1593-1600; Dudey 1601-1607; Hamblett 1608-1619; Moore 1620-1634; Nichols 1635-1645; Seymour 1646-1648.

Jan. 4. Second stop. 2 km southeast of Acoyapa, Dept. Chontales. On this trip, we were attempting to reach San Carlos. Some maps showed a road all the way from Acoyapa to San Carlos. Beyond Acoyapa the road became less improved. 2 km southeast of Acoyapa, the road petered out in a swamp. Doubtless an army could get thru to San Carlos, but not an ordinary automobile. We collected in a damp low pasture and hillside, in rolling country. Atwood 1649-1660; Dudey 1661-1683; Hamblett 1684-1700; Moore 1701-1712; Narvaez 1713-1718; Nichols 1719-1752; Seymour 1753-1786.

Jan. 4. Third stop. 1 km southeast of Acoyapa. On the return trip, while other members of the party attempted to photograph a flock of vultures feeding on a dead horse, Seymour collected 1787-1798 in an open field.

Jan. 5. Sunday. No collecting. Care of specimens collected yesterday.

Jan. 6. Matagalpa, Dept. Matagalpa, Route 3. Zelaya alone, 1799-1806. This was his home town.

Jan. 7. First stop. Granada, Dept. Granada, Route 4. By 6 a. m., we were on the road. At the boat wharf, we arrived two hours too late to catch the boat to San Carlos, thanks to misinformation. Nichols 1807, Lemna minor L.

Jan. 7. Second stop. Having missed the boat for San Carlos, we set out for the Dept. Rivas and collected in that department only for the rest of the day. Without stopping again we drove to the boundary of Costa Rica, on Route 2, the Pan American Highway. Turning back, our second stop where we collected anything was 1 km north of the boundary, near the village of Penas Blancas. Most of the soil was very dry, but it was not so dry in ditches. Atwood 1808-1815; Hamblett 1816-1822; Moore 1823-1833; Narvaez 1834-1837; Nichols 1838-1849; Seymour 1850-1867.

Jan. 7. Third stop (called second stop in my notes), Route 2, K 142, near village of Sapoa. Here the stream by which we stopped was not dried up; collecting was better. Atwood 1868-1873; Hamblett 1874-1878; Narvaez 1879; Seymour 1880-1887.

Jan. 7. Fourth stop. K 137, Route 2, 5 km northwest of Sapoa by a river. This river was full, altho a few feet from it, the ground seemed parched. Nichols, in his zeal on finding a river not dried up, reached for some Salvinia and slid off the steep bank into the river. Nichols could not swim! Hamblett being nearest heard his call for help and pulled him out. Atwood 1888-1894; Narvaez 1895; Nichols 1896-1897a; Seymour 1898-1905.

Jan. 7. Fifth stop. K 97, Route 2, near village of Belen. Here the ground was so dry that we walked thru the woods in the perfectly

dry bed of a river. Atwood 1906-1908; Moore 1909-1917; Seymour 1918-1921.

Jan. 7. Sixth stop. Route 2, Puente Las Cabezas, northwest of Belen. The river did not produce as interesting a vegetation as we hoped when we sighted the bridge and decided to stop. Atwood 1922-1925; Hamblett 1926; Moore 1927-1929; Seymour 1930-1940.

Jan. 7. Seventh stop. Escuela. The indefatigable Nichols collected another number, 1941, some kind of Mistletoe.

Jan. 8. The day was occupied with caring for yesterday's collections.

Jan. 9. Having been defeated in our attempt to reach San Carlos via Acoyapa and our automobile, we concluded that there is no road to that city. Intrepid Atwood and Hamblett determined to reach San Carlos at all costs and to sample its flora. Dudey, Moore and Nichols accompanied them to the wharf in Granada. Then the latter three proceeded a short distance to Mombacho, one of the highest volvanic mountains in the country. Here they found the lush tropical vegetation which they had expected in Nicaragua but had seen only briefly in and around Bluefields, Rama and El Recreo. This mountain is 12 km southwest of Granada and rises to a height of 1222 m. The collections were made partway up the mountain. Dudey & Moore 1948-1993; Nichols 1994-2014; 2207-2212.

Jan. 9-10. The boat trip to San Carlos proved exhausting. A distance of only 155 km, which could easily have been made in half a day by automobile on a good road, took 23 1/2 hours. Probably a head wind and rough water contributed largely to the delay. The most luxurious sleeping quarters afforded were sacks of meal piled on deck. Worn out before arrival, Atwood and Hamblett hastily grabbed specimens as fast as they could for two hours and then hurried to the wharf to catch the next boat back to Granada. Under almost any other circumstances, the flora would have been intriguing. Vegetation was lush, as could be expected in an area of rain-forests. It beckons for another trip with more time to obtain a fair sample of its flora. Atwood 2015-2049a; Hamblett 2050-2072.

Jan. 10. Nichols left to return to Vermont.

Jan. 11. Managua, city street. Seymour 2015, Eragrostis cilianensis (All.) E. Mosher. This weed, wide-spread in some countries was not seen elsewhere in Nicaragua.

Jan. 11. Second stop. Santa Maria, Route 3, a few km north of Matagalpa, Dept. Matagalpa. This was one of the most beautiful spots seen in all our roaming over the country. A fashionable cool resort in the mountains, where one can escape the intense heat which prevails over much of Nicaragua. The premises are beautifully landscaped and planted with strikingly beautiful and unusual shrubs and trees. Atwood 2074, 2081-2085; Seymour 2075-2080.

Jan. 11. Third stop. Continuing northward on Route 3, passing thru the city of Jinotega, we stopped 10 km north of that city, near what is represented on the map as a lake. So far as we could see, there were only patches of open water, broken by islands of mud and vegetation. Our collecting spot was near La Bastilla and Pueblo Nuevo. The swamp bordering the lake seemed inaccessible but we were kept busy getting plants not difficult to reach, on a wooded slope. Atwood 2086; Dudey 2100-2102; Moore 2103-2116; Seymour 2117 - 2142, 2213; Zelaya 2143-2149.

Jan. 12. Returning to Santa Maria for recreation the next day, Sunday, we had more time to satisfy our curiosity roused by glimpses the day before. Atwood 2149a-2151, 2202-2206, 2214-2216; Seymour 2152-2201, 2217-2219.

From this day onward, packing and shipping our 8500 specimens demanded nearly all our time.

Jan. 16. With the shipment safely arranged at last by air-freight and some specimens stowed in the automobile to be brought to Vermont thus, Atwood and Seymour made a short foray only 2 km eastward beyond the Escuela along the Pan American Highway. One need not go far from a highway to find species new to him. Atwood 2220-2225a; Seymour 2226-2238.

Jan. 18. Hamblett took an early plane from Managua to Burlington. Atwood and Seymour followed by plane later the same day.

Of the Vermonters, only Dudey and Moore remained a few days longer to bring home our Camper and the specimens in it. As far as Mexico City, they proceeded together. Then Moore also took to the air. Dudey drove the rest of the distance, sightseeing and visiting along the way.

While the collections of Harvey Zelaya M. during the summer of 1969 are not part of the Pringle Expedition, they are being distributed together by Frank C. Seymour and are numbered in the same series. Therefore their record belongs here.

July 9. Escuela, 2241-2248. July 10. 2249-2250.

July 11. Matagalpa, Dept. Matagalpa, 2273-2283.

July 14. Escuela, 2251-2253. July 15. 2254-2258.

July 17. 2259-2264.

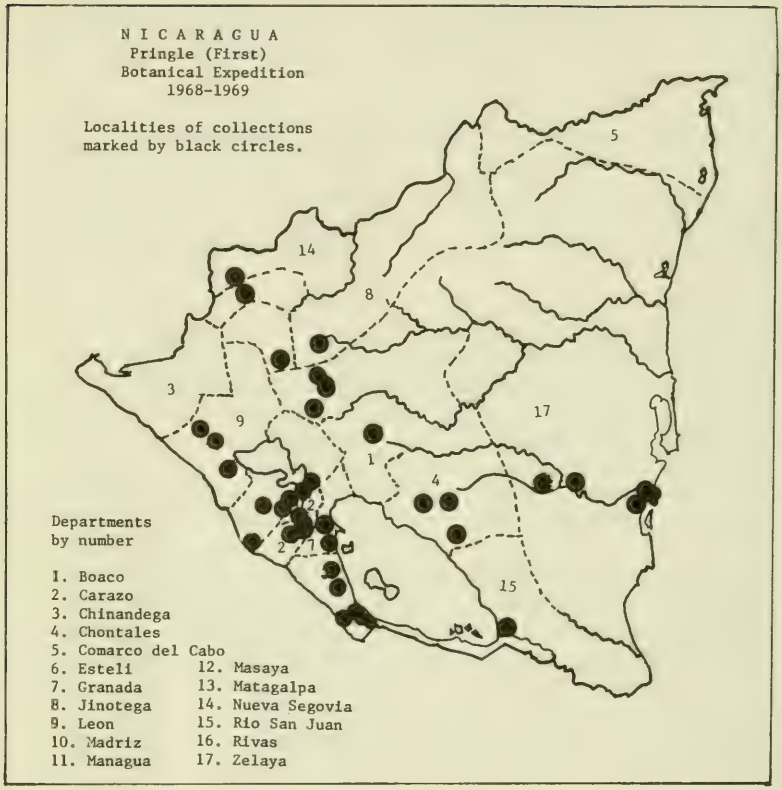
July 19. Matagalpa, 2284-2297. July 22. 2298-2305.
July 23. Matagalpa, 2306-2325. July 24. 2326-2328.

July 29. Escuela, 2265-2267. July 30. 2268-2272.

Aug. 8. Nindiri, Dept. Masaya, 2329.
Santiago, Dept. Masaya, 2330-2331.

How can we estimate the success of such an expedition? By the number of specimens collected? All together, we netted 8500, not including the 850 taken by Zelaya in the summer afterward. This is an average of 1062 per man in not quite 7 weeks. Shall we estimate success in terms of our permanent contribution to man's knowledge of a little-known part of the world? Both of these must count but also we can take into account the explorers' own evaluation. It is significant that every one of the eight men wanted to go again!

(It is intended to publish similar accounts of subsequent trips in later numbers of Phytologia. Two other trips in 1970 and 1971, respectively, have already been made. A fourth trip is planned for the summer of 1972.)


NICARAGUA
Pringle (First)
Botanical Expedition
1968-1969
Localities of collections
marked by black circles.
Departments
by number
1. Boaco
2. Carazo
3. Chinandega
4. Chontales
5. Comarco del Cabo
6. Esteli
7. Granada
8. Jinotega
9. Leon
10. Madriz
11. Managua
12. Masaya
13. Matagalpa
14. Nueva Segovia
15. Rio San Juan
16. Rivas
17. Zelaya

REVIEW

Otto & Isa Degener

Samuel H. Lamb, Naturalist of Hawaii National Park in 1936-39, published in 1971 as Bulletin 14 of the New Mexico Department of Game and Fish "WOODY PLANTS OF NEW MEXICO and their value to wildlife." The work, measuring 8½ by 11 inches, is paper bound. Its 84 pages include 113 distributional maps; 87 photographs in black and white, and 19 in color, chiefly of habit of the species; and 60 botanical line drawings. Though the author describes himself as a "forester with training in game management," the article is devoted to botany and forestry except for two pages. These, in tabular form, show what parts of what plant are eaten by deer, desert bighorn sheep, barbary sheep, elk, proghorn antelope, turkey and javelina. The plants of the area range from the Lower Sonoran Zone at about 3,000 feet elevation to the Arctic-Alpine Zone at over 13,000 feet. Because the species involved are so well described in easily accessible Floras, the author omits botanical descriptions. Instead, the bulletin is crammed with personal observations not found in Floras but deserving of inclusion, and matters of popular interest. Vernacular names follow those proposed by Kelsey & Dayton's "Standardized Names" of 1942. The scientific names are up-to-date (we do prefer, however, Vachellia farnesiana (L.) Wight & Arn., to his Acacia farnesiana" if for no other reason than the character of the legume). As botanists we regret the International Code of Botanical Nomenclature was not followed in the end spelling of a number of specific names. We should have also preferred reading the authorities for the names of the different taxa, and the names of the Plant Family to which each of the 225 taxa belong. Though the title "WOODY PLANTS OF NEW MEXICO and their value to wildlife" seems written for the manager of game, the bulletin should certainly appeal to botanists interested in the tree flora of the Southwestern United States and adjacent Mexico.

ADDITIONAL NOTES ON THE GENUS VERBENA. IX

Harold N. Moldenke

VERBENA [Dorst.] L.

Additional synonymy: Glandularia Walt. ex J. F. Gmel. in L., Syst. Nat., ed. 13, pr. 1, 2 (2): 920. 1791. Clandularia J. F. Gmel. in L., Syst. Nat., ed. 13, pr. 1, 2 (2): 1555, sphalm. 1791.

Additional & emended bibliography: J. Schröder, Pharm. Med. 4: 167--168. 1649; Micheli, Cat. Pl. Hort. Caes. Florent. 98 & 182. 1831; J. F. Gmel. in L., Syst. Nat., ed. 13, pr. 1, 2 (1): 20 & 41--42 (1789), ed. 13, pr. 1, 2 (2): 886, 920, & 1555 (1791), ed. 13, pr. 2, 2 (1): 20 & 41--42 (1796), and ed. 13, pr. 2, 2 (2): 886, 920, & 1555. 1796; Re, Fl. Segus. 8. 1805; Re, Fl. Tor. 1: 317. 1825; Tenore, Syll. Pl. Vasc. Fl. Neapol. App. 4: 86. 1831; R. A. Phil., Anal. Univ. Chil. 27: 339. 1865; Ces., Passer., & Gib., Comp. Fl. Ital. 327 (1874) and 895. 1886; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 249, 306, 350, 877, & 1032. 1893; Britton & Br., Illustr. Fl., ed. 2, pr. 1, 3: 94--97, 599, 603, 617, 618, & 635, fig. 3552--3559. 1913; Hauman, Anal. Soc. Cien. Argent. 86: 150. 1918; Gough, Gard. Book Malaya 248. 1928; Herter, Estud. Bot. Reg. Urug. 8b: 160, 170, & 201. 1933; Britton & Br., Illustr. Fl., ed. 2, pr. 2, 3: 94--97, 599, 603, 617, 618, & 635, fig. 3552--3559 (1936) and ed. 2, pr. 3, 3: 94--97, 599, 603, 617, 618, & 635, fig. 3552--3559. 1943; Cain, Found. Pl. Geogr., pr. 1, 335. 1944; J. A. Clark, Card Ind. Gen. Sp. Var. issues 183--185 (1944) and issue 191. 1945; Savage, Cat. Linn. Herb. Lond. 4. 1945; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 249, 306, 350, 877, & 1032 (1946) and pr. 2, 2: 29, 323, 895, 1161, 1178--1180, & 1248. 1946; Britton & Br., Illustr. Fl., ed. 2, pr. 4, 3: 94--97, 599, 603, 617, 618, & 635, fig. 3552--3559. 1947; J. A. Clark, Card Ind. Gen. Sp. Var. issue 231. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 1: 249, 306, 350, 877, & 1032 (1960) and pr. 3, 2: 29, 323, 895, 1161, 1178--1180, & 1248. 1960; Frei & Fairbrothers, Bull. Torrey Bot. Club 90: 352. 1963; Turrill in Curtis, Bot. Mag. 174: pl. 409. 1963; Elmore, Monog. School Am. Res. 8: [Ethnobot. Navaj.] 1--136. 1964; Hocking, Excerpt. Bot. A.7: 454--456. 1964; J. A. Clark, Card Ind. Gen. Sp. Var. issues 249 & 251. 1965; Gaiser & Moore, Surv. Vasc. Pl. Lambton Co. 100--101. 1966; J. A. Clark, Card Ind. Gen. Sp. Var. issue 257. 1968; Leandri, Adansonia, ser. 2, 8: 144. 1968; Pollak-Eltz, Anal. Anthropol. Gesell. Wien 98: 51--58. 1968; Muehlenbach, Ann. Mo. Bot. Gard. 56: 169--170. 1969; Britton & Br., Illustr. Fl., ed. 2, pr. 5, 3: 94--97, 599, 603, 617, 618, & 635, fig. 3552--3559. 1970; Bostick, Castanea 36: 206. 1971; Cain, Found. Pl. Geogr., pr. 2, 335. 1971; Stalter, Castanea 36: 174. 1971; Long & Lakela, Fl. Trop. Fla. 733, 735, 740--742, & 961. 1971; P. Duncan in E. R. Hall, Am. Forests 77 (12): 17. 1971; Hocking, Excerpt. Bot. 18 A: 444. 1971; Moldenke, Excerpt. Bot. 18 A: 445. 1971; Zochert, Nat. Hist. 80 (10): [8]. 1971; Farnsworth, Pharmacog. Titles 6 (9): xii

& title 16428. 1971; Rickett, Wild Fls. U. S. 5 (2): [455], 456, & 665, pl. 152. 1971; Moldenke, Phytologia 22: 295, & 298--314. 1972.

Savage states that in the Linnean Herbarium, under genus 35, Verbena, sheet number 14 is inscribed "Surin." with a short diagnostic note at the edge of the sheet, but is otherwise unidentified.

It should be noted that Walter (1788) does not use the name Glandularia, but Gmelin (1791) seems to attribute it to him.

Continuing Thornberry's record (1966) of disease-causing organisms known to attack members of Verbena as a genus in North America: Rhizoctonia solani Kuehn, Sclerotium bataticola Taub., Septoria verbenae Rob., Sphaerotheca humuli (P. DC.) Burr., Thielaviopsis basicola (Berk. & Br.) Ferr., and an unidentified virus. Dennis (1970) adds to this list the fungi, Meliola ambigua Pat. & Gaill. (M. lantanae Syd.) and Cercospora verbeniphila Speg. from unidentified species of Verbena. Cummins (1971) reports the aecia of Aecidium verbenicolum Ell. & Kell. on species of this genus in the United States east of the Rocky Mountains, but then reduces this to Puccinia vilfae Arth. & Holw. Streams, Shahjahan, & LeMasurier (1968) report that Verbena is second only to Erigeron annuus as the favorite host for Lygus lineolatus and Leiophron pallides in Connecticut. Westcott (1971) records the following fungi as infesting native United States species of Verbena: Erysiphe cichoracearum (a powdery mildew, general), Phymatotrichum omnivorum (root-rot, Texas), Puccinia aristidae (rust, stages 0 & I, Arizona, stages II & III on grasses), and Puccinia vilfae (rust, stages 0 & I, Indiana to Oklahoma and South Dakota, stages II & III on Sporobolus), and an unidentified virus.

Hunt (1946) reports that a rust, Cronartium flaccidum (Alb. & Schein.) Wint., causes considerable damage to Pinus sylvestris in Europe and is potentially dangerous to our hard pines in America because its uredal and telial stages may be found on a variety of alternate hosts in several plant families, as, for instance, peony, nasturtium, and verbena.

Hyland (1968)lists three unidentified specimens of Verbena collected by Viehmeyer in 1963: no. 303617 from Sedona, Arizona, with "leaves pinnate, showy perennial with lavender flowers"; no. 303618 from Rock Springs, Arizona, "at 3200 feet elevation, with pinnate leaves and lavender flowers"; and no. 303619 from volcanic cinders north of Flagstaff, Arizona, "heat and drought tolerant, with bright lavender flowers". Unfortunately, I have not as yet seen these specimens.

The flowering period of 57 taxa of Glandularia from different latitudinal and altitudinal distribution, mostly from Argentina, were studied by Schnack & Rubens (1970) in an experimental garden. The observed differences are mostly the result of the natural

selection of genotypes adapted to the habitat.

The Becks (1970) report that a population of Archilestes grandis (Odonata, Lestidae) in Oklahoma oviposited in tandem between 9:51 a.m. and 3:45 p.m. entirely on non-aquatic plants, including the stems of Verbena, but at all the sites no fallen prolarvae would have been more than 0.7 m. from water.

Guillarmod (1971) cites Dieter 829, Guillarmod 414 & 1435, and "Layd." s.n. -- the first deposited in the herbarium of the Albany Museum at Grahamtown, South Africa, the Natal Herbarium at Durban, and in the herbaria of Capetown and Strassbourg, the second in his own and the Pretoria herbaria, the third in his own herbarium, and the last in the herbarium of the University of Basutoland.

The Nevling & Gómez-Pompa 277, distributed as a Verbena, is actually Lantana camara var. mutabilis (Hook.) L. H. Bailey; T. Morley 627 is Lantana macropoda Torr.; Belshaw 3161 is Lantana trifolia L.; Johnson & Johnson 1828 and Stuessy 1031 are Priva grandiflora (Ort.) Moldenke; and Martin, Hevly, & Arms 314 and Popenoe s.n. [Lucile Drive] are mints.

An additional excluded species is:

Verbena baldwini Fitch, Univ. Kans. Nat. Hist. Reserv. 49, nom. nud. = Vernonia baldwini Torr., Carduaceae

VERBENA ABRAMSI Moldenke

Additional & emended synonymy: Verbena lasiostachys abramsii Ferris in Abrams & Ferris, Illustr. Fl. Pacific States, pr. 1, 4: 730. 1960.

Additional bibliography: Abrams, Illustr. Fl. Pacific States, pr. 1, 3: 611. 1951; Ferris in Abrams & Ferris, Illustr. Fl. Pacific States, pr. 1, 4: 730 (1960) and pr. 2, 4: 730. 1965; Hocking, Excerpt. Bot. A.11: 102, 103, & 503. 1967; Abrams, Illustr. Fl. Pacific States, pr. 2, 3: 611. 1967; Munz & Keck, Calif. Fl. 688 & 1679. 1968; Hocking, Pharmaceut. Abstr. 9 (2): entry 656 (1968) and 9 (3): entry 1068. 1968; Moldenke, Biol. Abstr. 49: 3252 & 5713. 1968; Hocking, Excerpt. Bot. A.13: 570 & 571. 1968; Moldenke, Résumé Suppl. 17: [1]. 1968; Moldenke, Phytologia 16: 183. 1968; Moldenke, Fifth Summ. 1: 65 (1971) and 2: 649, 679, & 912. 1971.

This plant has been found growing on sand-bars.

Peter Rubtzoff, in April, 1971, examined Newlon 271 in the herbarium of the University of Wisconsin and reports that "This specimen.....is identical with Jepson 9486, collected at the same place on the same day (on the same trip, acc. Jepson's notebook) and annotated and cited by Moldenke as V. lasiostachys var. septentrionalis (Phytologia 9: 472. 1964). Newlon 271, though, has been cited by Moldenke as V. Abramsi (Phytol. 8: 177. 1962). The calyx and its teeth are too long, though, to fit Moldenke's description of V. Abramsi. V. lasiostachys var. septentrionalis seems to be a better name for it, although the upper surface of leaves, in both it and Jepson 9486, tends to be scabridous, ap-

proaching in this character V. lasiostachys var. scabrida."

Additional citations: CALIFORNIA: Alameda Co.: Purer 5438 (Sd—38890). Los Angeles Co.: F. McCulloch 2063c (Sd—38894).

xVERBENA ADULTERINA Hausskn.

Additional bibliography: Moldenke, Résumé Suppl. 16: 28. 1968; Moldenke, Phytologia 15: 484. 1968; Moldenke, Fifth Summ. 1: 206 (1971) and 2: 686, 699, 710, & 912. 1971.

VERBENA ALATA Sweet

Additional bibliography: Angely, Fl. Anal. Paran., ed. 1, 570. 1965; Hocking, Excerpt. Bot. A.12: 424. 1967; Moldenke, Phytologia 15: 484. 1968; Moldenke, Fifth Summ. 1: 177, 189, & 369 (1971) and 2: 649 & 912. 1971.

VERBENA ALATA f. ALBA Moldenke

Additional bibliography: Moldenke, Phytologia 13: 181. 1966; Moldenke, Fifth Summ. 1: 177 (1971) and 2: 912. 1971.

VERBENA AMBROSIFOLIA Rydb.

Additional synonymy: Verbena ambrosifolia Rydb. ex Small, in herb.

Additional & emended bibliography: Rydb., Fl. Rocky Mtns., ed. 1, 740 (1917) and ed. 2, pr. 1, 739 & 740. 1922; Parks, Tex. Agr. Exp. Sta. Bull. 155: 112. 1937; Wyman & Harris, Navajo Ind. Ethnobot. [Univ. N. M. Bull. 366 (Anthrop. Ser. 3, 5):] 18, 23, & 44. 1941; Hocking, Excerpt. Bot. A.1: 430. 1959; Winter, Winter, & Van Bruggen, Check List Vasc. Pl. S. D. 124. 1959; Howell & Mc Clintock in Kearney & Peebles, Ariz. Fl., ed. 2, 725 & 727. 1960; W. A. Weber, Rocky Mtn. Fl. 305. 1967; Moldenke, Résumé Suppl. 16: 2 (1968) and 17: [1]. 1968; Burlage, Ind. Pl. Tex. 183, 184, 206, 228, 236, & 243. 1968; Moldenke, Phytologia 15: 484--486 (1968) and 16: 183--184 & 215. 1968; Rydb., Fl. Rocky Mtns., ed. 2, pr. 2, 739 & 740. 1969; R. A. Nels., Handb. Rocky Mtn. Pl. 239. 1969; Rickett, Wild Fls. U. S. 3 (2): 362 & 364 (1969) and 4 (3): 539 & 799. 1970; Moldenke in Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1317 & 1324--1327. 1970; Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1876 & 1877. 1970; Thilenius, U. S. Dept. Agr. Forest Serv. Res. Pap. RM.71: 42. 1971; Moldenke, Fifth Summ. 1: 42, 43, 47, 51, 52, 57, 61, 63, 74, & 369 (1971) and 2: 649--651, 654, 912, & 973. 1971.

Weber (1967) describes this species as "Flowers showy, pink; corolla-tube much exceeding the calyx; leaves very deeply pinnatifid.....Wild Verbena. A handsome species, similar to some of the cultivated verbenas. Plains and mesas." Nelson (1969) says of it "occasionally found on the high plains and lower foothills along the eastern and southern fringes of the Rockies. It is a branching plant with decumbent stems, deeply pinnatifid leaves and clusters of showy rose-purple flowers." Rickett (1969) says that it "has spreading stems which may be hairy. The short-

stalked leaves are twice pinnately cleft, bearing hairs which lie flat. The bracts are shorter than the calyx. The flowers are lavender or purplish, with a corolla-tube a little longer than the calyx, and sometimes only 1/4 inch across. April to December; in fields and deserts and on prairies through much of Texas and westward to Arizona, Colorado, and northern Mexico."

Parks (1937) avers that this is the "Western form of Common Verbena [V. bipinnatifida Nutt.] of the whole of Texas. It is found as abundantly in sections 7, 5, and 6 as Verbena bipinnatifida is found in the remainder of the state. The leaves are longer than wide. The flowers are of a deeper shade of color than the eastern relative. This species should be introduced in the central parts of the state as there is no doubt that it will maintain itself through long periods of time. It is in cultivation in many places. To obtain this plant, the seed pods should be gathered as soon as ripe, and seed planted only where it is to be grown."

The Winters & Van Bruggen (1959) state that V. ambrosifolia is found only in the dry rocky places of the western part of South Dakota and note that "The range listed by Harrington is south of S. Dak. Listed for S. Dak. by Rydb." Howell & McClintock (1960) record it from many counties in Texas.

Recent collectors have found this plant growing in gravelly or moist sandy soil, limestone soil, sandy dry soil "but slightly more moist than the surrounding area", in moist sand of drainage slopes, moist soil adjacent to the Carrizozo lava flow, hard sandy marl silt, rocky limestone loam, and shallow soils with rock or gravel, in vacant lots and desert pavement, in wash-beds and sandy fields, on banks, among large rocks, on open silty deserts, the Chihuahuan desert, alkali flats, and gypsum land, in pinyon pine - juniper associations, on open slopes, under live oaks in grassy valleys, and along roadsides, dry or sandy roadsides, roadsides bordering lava flows, and wide sandy creeks. The Mearses describe it as common with Pegamum, Linum, Aristida, Bahia, and Lesquerella in Texas, where Rowell describes it as "occasional" in tight sandy loam. Youngblood says that it is frequent in rocky sand and Waller calls it occasional in the sandy loam of prairies. In the same state Muller found it to be only "sparse" on limestone, Hawkins found it "in limestone-derived loam of playa lake bed in area of mesquite to creosotebush", while Collins found it "in deep sand dominated by mesquite and grasses". Dunn collected specimens where "everything was badly eaten back by a large flock of angora goats". In New Mexico it grows in the Upper Sonoran Zone, according to Bennett, while the Iwens describe it as "very abundant on open rangeland" and "common on range and on lava flows" in Lincoln County. Norland reports it "occasional" in Arizona.

Collectors describe the plant as an erect or decumbent perennial or as an herb from a perennial woody root, but Pruett calls it a "low annual found in sandy soil". The corollas are described as "bluish" on Hawkins 7, "rose" on Muller 8215, "lavender" on

Youngblood 21, "violet" on Devor 262, "dark-blue" on Pruett s.n., "purple" on McCracken 25 and Mitchell 58 & 129, and "deep-purple" on Rowell 5734.

The chromosome count of n = 15 was secured from Solbrig 3175 & 3213 by Solbrig.

Additional vernacular names recorded for V. ambrosifolia are "ragweed", "ragweed verbena", and "wild verbena". Burlage (1968) records that in Texas a bath of the leaves is prepared for the treatment of rheumatism and the dry leaves are rubbed on parts of the human body affected by skin diseases.

Material of this species has been distributed in some herbaria under the additional names of Verbena bipinnatifida var. bipinnatifida Devor, V. elegans var. asperata Perry, and V. imbricata Woot. & Standl. On the other hand, the O. B. Metcalfe 1231, distributed as V. ambrosifolia and so cited by Perry, is actually V. ambrosifolia f. eglandulosa Perry in at least some herbaria, while G. Nelson 30, Rosson 490b, Rowell 8770 & 10256, B. Smith 33, Stuessy 1014, and Zinn 38 are V. bipinnatifida Nutt., Stuessy 959 is V. ciliata Benth., Beaman 2667 & 4460 are V. teucriifolia Mart. & Gal., and Cory 52259 and Tharp & Janszen 49-1141 are V. wrightii A. Gray.

Additional citations: COLORADO: Denver Co.: J. M. Coulter s.n. [May 17, 1873] (Se--234376). Jefferson Co.: J. H. Ehlers 8367 (Mi). OKLAHOMA: Comanche Co.: E. J. Palmer 11750 (N). Pontotoc Co.: G. T. Robbins 2335 (N). TEXAS: Brewster Co.: T. D. Devor 262 (Lk); M. D. McCracken 25 (Lk); B. Pittman 39 (Lk); D. Youngblood 21 (Lk). Crosby Co.: L. Mitchell 129 (Lk). Culberson Co.: Mears & Mears 1563 (Au--258420); Scholl 11, in part (Ip); Solbrig 3213 (W--2607467); Tharp & Janszen 49-1169 (N). Dallam Co.: Rowell 5734 (Au--187050). Deaf Smith Co.: Waller 844 (Lk), 980 (Lk). Ector Co.: T. Collins 100 (Lk), 178 (Lk); D. Hawkins 7 (Lk). Hudspeth Co.: C. H. Muller 8215 (Mi). Jeff Davis Co.: L. Mitchell 58 (Lk). La Salle Co.: Cory 28550 (Se--113349). Loving Co.: Stuessy 184 (Au--246284, Ip). Lubbock Co.: J. Pruett s.n. [4-7-64] (Lk). Pecos Co.: C. M. Rowell 11148 (Lk). Presidio Co.: J. Reed 28 (Lk). NEW MEXICO: Chaves Co.: J. S. Martin 933 (Se--108452). De Baca Co.: Secor 62 (Au--257269). Eddy Co.: G. J. Ikenberry 90 (Lk); Rosson 1340 (Lk), 1382 (Lk, Lk). Lincoln Co.: F. A. Iwen 187 (Ws); Iwen & Iwen 13 (Ws), 33 (Ws), 294 (Ws), 330 (Ws), 335 (Ws), 383 (Rf, Ws), 398 (Ws), s.n. [T.10S; R.8E; Sec. 21] (Ws), s.n. [T63S; R.10E; Sec. 27] (Ws); Solbrig 3175 (W--2607468). Otero Co.: W. Hess 299 (Se--226438). Santa Fe Co.: H. R. Bennett 8239 (Go). Socorro Co.: D. B. Dunn 3050 (N). ARIZONA: Cochise Co.: Norland s.n. [21 Aug. 1959] (Sd--67426). MEXICO: Coahuila: Johnston & Muller 186 (Mi), 580 (Mi), 1125 (Mi); Mendiola s.n. [Saltillo Torreón] (Ip). Nuevo León: Dominguez & McCart 8263

(Au—222200); Reséndez 79 (Au--222191).

VERBENA AMBROSIFOLIA f. EGLANDULOSA Perry

Additional synonymy: Verbena ambrosifolia eglandulosa Perry ex Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1876. 1970.

Additional bibliography: Hocking, Excerpt. Bot. A.1: 430. 1959; Howell & McClintock in Kearney & Peebles, Ariz. Fl., ed. 2, 727. 1960; Moldenke, Phytologia 16: 183--184. 1968; Moldenke, Résumé Suppl. 16: 2. 1968; Moldenke in Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1317 & 1325. 1970; Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1876. 1970; Moldenke, Fifth Summ. 1: 50, 52, 57, 61, 63, & 74 (1971) and 2: 649, 650, 658, & 912. 1971.

This plant has been found growing in orchards, flowering (in addition to the months previously reported) in January and fruiting in January, May, and June. The corollas are described as "pink" on Hinton 17130 and as "periwinkle-blue" on Matthews & Matthews 394. The Matthews describe the plant as "occasional on open hillsides" and report that the flowers are very fragrant. The Mearses report it as "common with Berberis, Penstemon, and Asclepias" in Arizona. The O. B. Metcalfe 1231 collection, cited below, is cited by Perry as typical V. ambrosifolia, but I fail to see on it the characteristic glands.

The R. Runyon 2361, distributed as V. ambrosifolia f. eglandulosa, is actually V. ciliata var. longidentata Perry.

Additional citations: NEW MEXICO: Grant Co.: O. B. Metcalfe 1231 (N). ARIZONA: Coconino Co.: Matthews & Matthews 394 (Au—259895). Greenlee Co.: A. F. Brown 126 (Rf). Yavapai Co.: Demaree 41126 (Au--239069); Mears & Mears 1815 (Au—257888). MEXICO: Guanajuato: J. Rzedowski 9542 (Mi). Nuevo León: Hinton & al. 17130 (Mi).

VERBENA AMOENA Paxt.

Additional bibliography: Moldenke, Phytologia 13: 244. 1966; Moldenke, Fifth Summ. 1: 74 & 399 (1971) and 2: 672 & 912. 1971.

Latorre found this plant growing in volcanic soil at 4700 feet altitude, flowering and fruiting in May, and describes the corolla as "purple".

Additional citations: MEXICO: Coahuila: Latorre s.n. [12 May 1968] (Au--265072).

VERBENA ANDALGALENSIS Moldenke

Additional bibliography: Moldenke, Phytologia 10: 92. 1964; Moldenke, Fifth Summ. 1: 200 (1971) and 2: 912. 1971.

Thus far, this plant has been collected in flower and fruit only in March.

Additional citations: ARGENTINA: Catamarca: O'Donell & Meyer 5204 (N).

VERBENA ANDRIEUXII Schau.

Additional bibliography: Moldenke, Phytologia 13: 244. 1966; Moldenke, Fifth Summ. 1: 74, 205, & 369 (1971) and 2: 651 & 912. 1971.

Harper found this plant growing in light brown loam probably derived from volcanic breccia in pinyon-oak-juniper woodland with good drainage, fruiting in June.

Additional citations: MEXICO: Durango: C. C. Harper 37 (Mi).

VERBENA ARAUCANA R. A. Phil.

Additional synonymy: Glandularia araucana Phil. ex Moldenke, Fifth Summ. 520, in syn. 1971.

Additional bibliography: Moldenke, Phytologia 15: 485. 1968; Moldenke, Fifth Summ. 1: 192 (1971) and 2: 520, 653, & 912. 1971.

The Kreibohm 117, distributed as V. araucana, is actually V. aurantiaca Speg.

VERBENA ARENARIA Moldenke

Additional bibliography: Moldenke, Phytologia 13: 182. 1966; G. Taylor, Ind. Kew. Suppl. 14: 142. 1970; Moldenke, Fifth Summ. 1: 200 (1971) and 2: 912. 1971.

xVERBENA ARGENTINA Moldenke

Additional bibliography: Moldenke, Phytologia 13: 182. 1966; G. Taylor, Ind. Kew. Suppl. 14: 142. 1970; Moldenke, Fifth Summ. 1: 200 (1971) and 2: 912. 1971.

VERBENA ARISTIGERA S. Moore

Additional synonymy: Verbena aristigira S. Moore ex J. F. Macbr., Field Mus. Publ. Bot. 13 (5): 629, sphalm. 1960. Glandularia aristigera (S. Moore) Troncoso, Darwiniana 14: 636. 1968.

Additional bibliography: J. F. Macbr., Field Mus. Publ. Bot. 13 (5): 629. 1960; Troncoso, Darwiniana 14: 636 & 638. 1968; J. A. Clark, Card Ind. Gen. Sp. Var. issue 257. 1968; Moldenke, Phytologia 15: 485. 1968; N. F. Good, Biol. Abstr. 50: 9661. 1969; Schnack & Rubens, Bol. Soc. Argent. Bot. 13: 205. 1970; Moldenke, Fifth Summ. 1: 177, 184, 187, 189, 200, & 369 (1971) and 2: 520, 912, & 973. 1971.

Troncoso (1968) reduces V. tenuisecta Briq. to synonymy here, noting that "El estudio del tipo de Verbena aristigera Sp. Moore, que se conserva en el 'British Museum (Nat. History)', ha permitido establecer su identidad con Glandularia tenuisecta del Paraguay. El carácter 'antherarum omnium connectivo apice inappendiculato', dado por Spencer Moore para su especie, es erróneo. Las anteras del ejemplar tipo poseen apéndices glandulares, pero éstos son muy reducidos y no sobrepasan las tecas, de ahí que probablemente hayan pasado desapercibidos al autor." She cites S. Moore 1083 from Mato Grosso, Brazil, Jörgensen 2470 and Pierotti 10 from Formosa, Argentina, and Bazzi 230 from Chaco, Argentina. However, I still think that the two taxa are sufficiently

distinct to deserve separate designation. The details of leaf characters are sufficient to distinguish them. The Woolston 254, cited below, was previously erroneously reported by me as V. tenuisecta. The collector describes it as a semi-procumbent herb, 10—35 cm. tall, growing on low campos.

In addition to the months previously recorded by me for this species being found in bloom, it has been collected in anthesis in June. In fruit it has been collected in April, June, July, and September to December. Schnack & Rubens (1970) record it from Corrientes and Misiones, Argentina.

The Steinbach 321, also cited below, is not typical in its leaf characters and may actually represent some other taxon; its corollas are described as "violet" and the "caliz verde con jaspe purpurino", as it is in typical V. aristigera.

Additional citations: BOLIVIA: Santa Cruz: R. F. Steinbach 321 (N). PARAGUAY: Woolston 254 (N, S). ARGENTINA: Formosa: I. Morel 1601 (N), 1900 (N), 2438 (N), 2473 (N), 2637 (N), 3137 (N), 3262 (N), 3390 (N), 3420 (N), 3428 (N), 3467 (N), 3603 (N), 3633 (N), 3724 (N), 3823 (N), 3906 (N), 4106 (N), 4142 (N), 6351 (N), 6445 (N); A. Reales 10 (N), 48 (N); G. J. Schwarz 2911 (N). Misiones: Buratovich 84 (N, N); G. J. Schwarz 4865 (N).

VERBENA ATACAMENSIS Reiche

Additional bibliography: Moldenke, Phytologia 13: 244. 1966; Moldenke, Résumé Suppl. 16: 6. 1968; Moldenke, Fifth Summ. 1: 192 & 200 (1971) and 2: 697 & 912. 1971.

The corollas are described as having been "cream"-colored on Semper 672. This collector found the plant growing at 3000 m. altitude, flowering in May.

Additional citations: ARGENTINA: Mendoza: Semper 672 (N).

VERBENA AURANTIACA Speg.

Additional bibliography: Autran, Trab. Mus. Farmac. Fac. Cienc. Méd. Buenos Aires 13: 33. 1907; Ruiz Leal & Roig, Bol. Soc. Argent. Bot. 7: 119. 1958; Cabrera, Bol. Soc. Argent. Bot. 7: 150, 151, & 290. 1958; Moldenke, Phytologia 10: 93. 1964; Moldenke, Fifth Summ. 1: 192 & 200 (1971) and 2: 912. 1971.

The plant has been collected in fruit in January. Material has been distributed in some herbaria under the name Glandularia araucana Phil.

Additional citations: ARGENTINA: Chubut: Kreibohm 117 (W—2568451). Neuquen: O'Donell 2186 (N).

VERBENA AURANTIACA var. GLABERRIMA Moldenke

Additional bibliography: Ruiz Leal & Roig, Bol. Soc. Argent. Bot. 7: 119. 1958; Cabrera, Bol. Soc. Argent. Bot. 7: 150 & 290. 1958; Moldenke, Phytologia 8: 193. 1962; Moldenke, Fifth Summ. 1: 200 (1971) and 2: 912. 1971.

Ruiz Leal & Roig (1958) report this plant as one of many para-

sitized by Cuscuta microstyla Engelm., citing their no. 15634. They state that the stems, inflorescences, buds, and leaves of the host plant are involved in the attacks.

VERBENA AURANTIACA f. ROSEA Moldenke

Additional bibliography: Cabrera, Bol. Soc. Argent. Bot. 7: 151 & 290. 1958; Moldenke, Phytologia 8: 193. 1962; Moldenke, Fifth Summ. 1: 200 (1971) and 2: 912. 1971.

VERBENA AUSTRALIS Moldenke

Additional bibliography: Moldenke, Phytologia 8: 380 (1962) and 8: 461. 1963; Angely, Fl. Anal. Paran., ed. 1, 570. 1965; Moldenke, Fifth Summ. 1: 177 (1971) and 2: 912. 1971.

xVERBENA BAILEYANA Moldenke

Additional & emended bibliography: H. F. Roberts, Pl. Hybrid. Before Mendel 24 & 28. 1929; Moldenke, Phytologia 11: 438. 1965; Moldenke, Fifth Summ. 1: 369 (1971) and 2: 672, 673, 686, 697, 700, & 912. 1971.

VERBENA BAJACALIFORNICA Moldenke

Additional bibliography: Moldenke, Phytologia 11: 438. 1965; Moldenke, Fifth Summ. 1: 74 (1971) and 2: 912. 1971.

VERBENA BALANSAE Briq.

Emended synonymy: Verbena thymoides Chod. apud Briq. in Chod. & Hassler, Bull. Herb. Boiss., ser. 2, 4: 1059, in syn. 1904 [not V. thymoides Cham., 1832, nor Cham. & Schlecht., 1963, nor L., 1863, nor Phil., 1891].

Additional bibliography: Angely, Fl. Anal. Paran., ed. 1, 570. 1965; Moldenke, Phytologia 15: 485. 1968; Moldenke, Fifth Summ. 1: 177, 187, & 200 (1971) and 2: 702 & 912. 1971.

Woolston describes this plant as decumbent or prostrate, the corollas pale-blue, the tube dark-violet. Hatschbach states that it grows from a definite xylopodium and that the corollas are "lilac" in color.

Additional citations: BRAZIL: Paraná: Hatschbach 15345 (W--2564729); Hatschbach, Smith, & Klein 12142 (Ac). PARAGUAY: T. Rojas s.n. [Hassler 10682a] (Ws); Woolston 722 (N).

VERBENA BALLSII Moldenke

Additional bibliography: Moldenke, Phytologia 8: 199--200 & 401. 1962; Moldenke, Fifth Summ. 1: 200 (1971) and 2: 912. 1971.

VERBENA BANGIANA Moldenke

Additional bibliography: Moldenke, Résumé Suppl. 17: 12. 1968; Moldenke, Phytologia 16: 184. 1968; Moldenke, Fifth Summ. 1: 184 (1971) and 2: 912. 1971.

Additional citations: BOLIVIA: Cochabamba: Dereims s.n. [Morochoto, 18.XI.1903] (P).

VERBENA BARBATA Grah.

Additional bibliography: Moldenke, Phytologia 11: 438. 1965; Moldenke, Fifth Summ. 1: 74 (1971) and 2: 653 & 912. 1971.

xVERBENA BEALEI Moldenke

Additional bibliography: J. F. Macbr., Field Mus. Publ. Bot. 13 (5): 613. 1960; Moldenke, Phytologia 10: 93. 1964; Moldenke, Fifth Summ. 1: 369 (1971) and 2: 674, 680, & 912. 1971.

VERBENA BERTERII (Meisn.) Schau.

Additional & emended bibliography: Maund, Bot. Gard. 5: pl. 106 ["422"]. 1834-1835; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 2: 895 & 1178 (1895), pr. 2, 2: 895 & 1178 (1946), and pr. 3, 2: 895 & 1178. 1960; J. F. Macbr., Field Mus. Publ. Bot. 13 (5): 614, 616, & 625. 1960; Moldenke, Phytologia 15: 486. 1968; Moldenke, Fifth Summ. 1: 143, 184, 192, 200, & 369 (1971) and 2: 521, 619, 621, 653, 666, 667, & 912. 1971.

Emended illustrations: Maund, Bot. Gard. 5: pl. 106 ["422"] (in color) [as V. radicans]. 1834-1835.

Macbride (1960) notes that V. berterii "Differs from the Brazilian V. tenera Spreng. and the Chilean Glandularia sulfurea (D. Don) Schnack & Covas in the pubescent corolla, also from the former in leaves, from the latter in sessile appendages. Annual or perennial herb, corolla red-purple, limb bluish-lavender." He cites only Metcalf 30267 & 30322 from Peru.

The corollas on Kausel 3943 are described as having been "bluish", while those on Biese 44 were "white, somewhat blue". The plant has been collected in fruit in November.

The Edwin & Schunke 3692, distributed as V. berterii, is actually V. occulta Moldenke, while Zöllner 4399 is V. sulphurea D. Don.

Additional citations: CHILE: Bío-Bío: Pfister 2177 (Ca--1286486). Santiago: Biese 44 (N). Valparaíso: Kausel 3943 (N).

VERBENA BERTERII f. ALBIFLORA Moldenke

Additional bibliography: Moldenke, Phytologia 10: 94. 1964; Moldenke, Fifth Summ. 1: 143 & 192 (1971) and 2: 653 & 912. 1971.

It is possible that the Biese 44 specimen, cited above as typical V. berterii, is better placed in this form because the collector describes its flowers as "white, somewhat blue". It is not clear if the "somewhat blue" is the normal color of the corolla in anthesis or is just a stage in the withering of the white-flowered form.

xVERBENA BINGENENSIS Moldenke

Additional bibliography: Hitchc., Cronquist, & Ownbey, Vasc. Pl. Pacif. Northwest 4: 244--245. 1959; Moldenke, Phytologia 10: 94. 1964; Moldenke, Fifth Summ. 1: 64 (1971) and 2: 656, 679, & 912. 1971.

Hitchcock, Cronquist, & Ownbey (1959) say of this plant: "mis-

takenly considered by Moldenke to be a hybrid of V. bracteata and V. lasiostachys Link. [sic!]; the latter species is not known to occur n. of approximately the Willamette-Umpqua divide, 150 miles s.w. of Bingen, Wash." This situation, of course, was fully discussed by me in Am. Midl. Nat. 59: 342--343 (1958). As Muehlenbach has pointed out, species often appear out of their normal range along railroad tracks and elsewhere, persist for a year or two, and then disappear. This could easily have happened in this case and the two putative parents could have been growing at Bingen long enough to produce the hybrid.

The author of the name, Verbena lasiostachys, was Johann Heinrich Friedrich Link (1767--1851), so the authority after the binomial is not an abbreviation.

Additional citations: WASHINGTON: Klickitat Co.: Suksdorf s.n. [Bingen, July 9, 1898] (Se--118380--isotype).

VERBENA BIPINNATIFIDA Nutt.

Additional & emended synonymy: Verbena bipinnatifida L. ex Moldenke, Résumé Suppl. 3: 36, in syn. 1962. Verbena bipiunatifida Nutt. ex Moldenke, Résumé Suppl. 3: 36, in syn. 1962. Verbena bipinnatafida Nutt. ex Moldenke, Résumé Suppl. 18: 14, in syn. 1969. Verbena bipinnitifida Nutt. ex Moldenke, Résumé Suppl. 18: 14, in syn. 1969. Verbena bipinnatifida Torr. ex Moldenke, Résumé Suppl. 18: 14, in syn. 1969. Verbena bipinnatifa Reimsch. ex Moldenke, Résumé Suppl. 18: 14, in syn. 1969. Verbena bippinatifida Nutt. ex Moldenke, Résumé Suppl. 18: 14, in syn. 1969. Verbena bippinnatifida Nutt. ex Moldenke, Fifth Summ. 2: 654, in syn. 1971. Verbena bipinnatifida Engelm. & Gray ex Moldenke, Fifth Summ. 2: 654, in syn. 1971. Verbena bipinnatifida var. bipinnatifida Devor, in herb. Verbena beipinnalifida Nutt., in herb. Verbena bininnafillia Abrigo, in herb.

Additional & emended bibliography: S. Wats. & Coult. in A. Gray, Man. Bot., ed. 6, pr. 1, 402 (1889) and ed. 6, pr. 2, 402. 1890; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 1032 (1893) and pr. 1, 2: 1178. 1895; Robinson & Fern. in A. Gray, Man. Bot., ed. 7, 689 & 924. 1908; Britton & Br., Illustr. Fl., ed. 2, pr. 1, 3: 94 & 97, fig. 3559. 1913; Rydb., Fl. Rocky Mtns., ed. 1, 739 & 740 (1917) and ed. 2, pr. 1, 739 & 740. 1922; Britton & Br., Illustr. Fl., ed. 2, pr. 2, 3: 94 & 97, fig. 3559. 1936; Parks, Tex. Agr. Exp. Sta. Bull. 155: 112. 1937; Britton & Br., Illustr. Fl., ed. 2, pr. 3, 3: 94 & 97, fig. 3559. 1943; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 1032 (1946) and pr. 2, 2: 1178. 1946; Britton & Br., Illustr. Fl., ed. 2, pr. 4, 3: 94 & 97, fig. 3559. 1947; Abrams, Illustr. Fl. Pacif. States, pr. 1, 3: 612. 1951; Rydb., Fl. Rocky Mtns., ed. 2, pr. 2, 739 & 740. 1954; Winter, Winter, & Van Bruggen, Check List Vasc. Pl. S. D. 124. 1959; Howell & McClintock in Kearney & Peebles, Ariz. Fl., ed. 2, 725 & 727. 1960; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 1: 1032 (1960) and pr. 3, 2: 1178. 1960; R. R. Stewart,

Pakist. Journ. Forest. 11: 59. 1961; Poindexter, Trans. Kans. Acad. Sci. 65: [409] & 419. 1962; Hocking, Excerpt. Bot. A.6: 91 & 534. 1963; Maheshwari, Fl. Delhi 278—279. 1963; Srinivasan & Agarwal, Bull. Bot. Surv. India 5: 80. 1963; Thornberry, U. S. Dept. Agr. Agric. Handb. 165: 479. 1966; Abrams, Illustr. Fl. Pacif. States, pr. 2, 3: 612. 1967; Shinn, Univ. Kans. Sci. Bull. 46: 881. 1967; Hocking, Excerpt. Bot. A.13: 571. 1968; Moldenke, Biol. Abstr. 49: 4697. 1968; Moldenke, Résumé Suppl. 16: 28. 1968; Moldenke, Phytologia 16: 184, 209, & 215. 1968; Munz & Keck, Calif. Fl. 688 & 1679. 1968; Munz, Suppl. Calif. Fl. 101. 1968; A. & I. Nehrling, East. Gard. Drought-resist. Pl. 230 & 254. 1968; Pullen, Jones, & Wats., Castanea 33: 332. 1968; Whittaker & Niering, Journ. Ecol. [Brit.] 56: 528. 1968; A. L. Moldenke, Phytologia 18: 127. 1969; M. A. Rau, Bull. Bot. Surv. India 10, Suppl. 2: 63. 1969; Rickett, Wild Fls. U. S. 3 (2): 362 & [363], pl. 110. 1969; Rydb., Fl. Rocky Mtns., ed. 2, pr. 3, 739 & 740. 1969; Swink, Pl. Chicago Reg. 427. 1969; El-Gazzar & Wats., New Phytol. 69: 458, 483, & 485, fig. 1. 1970; Britton & Br., Illustr. Fl., ed. 2, pr. 5, 3: 94 & 97, fig. 3559. 1970; Moldenke in Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1317, 1324, & 1325. 1970; Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1876 & 1877. 1970; Rickett, Wild Fls. U. S. 4 (3): 539, [541], & 799, pl. 176. 1970; G. W. Park Seed Co., Park's Flower Book 1971: 75. 1971; I. Sm., Ariz. Highw. 47 (8): 4. 1971; Thilenius, U. S. Dept. Agr. Forest Serv. Res. Pap. RM.71: 42. 1971; Moldenke, Fifth Summ. 1: 27, 32, 33, 41, 43, 45, 47, 49, 51, 52, 57, 61, 63, 74, & 369 (1971) and 2: 521, 652—654, 658, 665, 671, 690, 708, & 912. 1971.

Additional & emended illustrations: Britton & Br., Illustr. Fl., ed. 1, 3: 72, fig. 3064. 1898; Robinson & Fern. in A. Gray, Man. Bot., ed. 7, 689, fig. 880. 1908; Britton & Br., Illustr. Fl., ed. 2, pr. 1, 3: 97, fig. 3559 (1913), ed. 2, pr. 2, 3: 97, fig. 3559 (1936), ed. 2, pr. 3, 97, fig. 3559 (1943), and ed. 2, pr. 4, 3: 97, fig. 3559. 1947; Rickett, Wild Fls. U. S. 3 (2): [363], pl. 110 (in color) (1969) and 4 (3): [541], pl. 176 (in color). 1970; El-Gazzar & Wats., New Phytol. 69: 458, fig. 1. 1970; Britton & Br., Illustr. Fl., ed. 2, pr. 5, 3: 97, fig. 3559. 1970.

Recent collectors describe this plant as follows: small herbs standing about 8--10 cm. tall or spreading over the ground, annuals or creeping perennials, prostrate with a spread of 9 dm. or more or semi-trailing 1—2 feet, the stems running and rooting, branched at the base, about 2 dm. long, the flowers with a faint odor, the stamens bright-yellow.

The color of the corolla is described as "pink" on Whitten 13, "lavender" on Correll 16247, Lundell & Lundell 12132, Meek 30, and Watts s.n., "light-violet" on Gould 9080, "violet" on Galloway 36 and Gipson 76, "light-lavender" on Griffin 93, "dark purple-blue" on Legg s.n., "bluish-purple" on Wilfong 27, "blue-purple" on McCracken 97 and Stewart 43, "bright blue-purple fading to blue" on Foreman 7, "medium blue-purple" on Meek 2, "showy

blue-violet" on Weaver 8, "bluish" on Hawkins 37, "dark-blue" on Owen s.n. and Pilcher 50, "blue" on Pilcher 80 & 188, Thompson 18, Weddle 68, and Whitley 4, "pale-purple" on Rowell 8037, and "purple" on Fowler 11, Leonard 14, Leverich 18, Mears 656, Mitchell 27, Patterson s.n., Runyon 4340, Rzedowsky 21919, Stuessy 1014, and Youngblood 75.

An additional common name recorded for the species is "wild sweet William".

Recent collectors have found the plant growing in open coniferous woods, open oak-mesquite woodlands, pastures, open fields, sandy upland prairie pastures with sparse grass cover, and mesquite grasslands, in post oak savannas and desert scrub on level plateaus, in red gypsum soil, hard sandy marl silt, loose black or rocky soil, rich alluvial marl, clay- or sandy-loam, tight shallow dry or limestone loam, red sandy loam, calcareous or black calcareous clay, dry alkaline soil, rocky sandy soil, fine sandy loam of root-plowed pastures, and somewhat shaded sand-clay soil, on limestone outcrops, caprock country hillsides, and caprock ledges in limestone gravel, in sandy loam and gravel, limestone and gypsum gravels, and disturbed black rocky soil, at the base of barrancas, along roadsides, in disturbed roadside areas, pastures near creeks, and sandy-clay of river-bottoms, and on chalk barrens, flowering and fruiting in January (in addition to the months previously reported).

Correll found the plants of this species "scattered infrequently", while Weaver found them "fairly frequent in red clay soil mixed with beds of legumes" and Pilcher "among mustards, mesquite, and fescue-grass". In Kansas Horr & McGregor report it "common in dry sand of roadside ditches" and Richardson & Robertson "common on grazed prairies". In Texas Mears says it is "not common in sun" in Caldwell County, Youngblood reports it an "herb frequent in black loam roadsides" in Mills County, while in Bexar County Hawkins found it "in dark gray-black not rocky sandy loam in mesquite pastureland with sparsely scattered brush grazed by cattle", in Hemphill County Meek found it in "clay soil on limestone outcrops" and in Taylor County the same collector reports it as "very common perennial herb with trailing stems in calcareous soils". Gipson found it "in red sandy loam of cleared pasturelands" in Mason County and Horn avers that it is "common in sandy disturbed roadsides" in Kent County. Cory found it "occasional in ungrazed parks" in Kerr, but "frequent on roadsides" in Tom Green County. In Dickens County it was encountered by Rowell on "sandstone ledges and sandy loam in oak shinneries", in Kendall County Waller reports it "occasional in calcareous clay loam", and in Deaf Smith County the same collector found it only "occasional on sandy loam roadsides".

In Garza County, Texas, Rowell says it is "locally frequent in red sandy loam", McCampbell reports it "occasional in pastures", Weddle says "frequent in sandy loam near park benches of roadside parks", and McCracken describes it as an "abundant perennial with spreading trailing stems in tight clay-like soil".

In Lubbock County Leonard calls it an "annual herb occasional in sandy loam", Watts avers that it is "found only in spots, actually infrequent and an annual", and Higginbotham found it "in lawns composed of grass and hard sand with a few mustard plants". Griffin calls it "locally common in limey roadsides" of Tarrant County, while Stewart refers to it as a "perennial with trailing stems common on limestone slopes and sandy soil" in Randall County.

Solbrig (1962) reports the haploid chromosome number as 15, based on Solbrig 3168, 3175, 3181, 3206, and 3212, from Santa Fe and Lincoln Counties, New Mexico, and Reeves, Brewster, and Culberson Counties, Texas. Lewis & Oliver (1961) give the diploid number as 30.

Srinivasan & Agarwal (1963) tell us that V. bipinnatifida is often cultivated in India, while Stewart (1961) maintains that it has escaped "at Abbottabad & Mansehra", in the Rawalpindi District of Pakistan. I am fairly sure, however, that in both these cases the plants being referred to are V. tenuisecta Briq., a species widely misidentified in India. The same comment applies to the record of Maheshwari (1963), who describes the plant in the Delhi area of India as "A prostrate, hirsute, perennial herb with ascending stems. Leaves divided into linear divisions, long-petiolate. Flowers lilac-purple, in dense heads elongating in fruits. Bracts equalling the sepals. Calyx lobes setaceous. Cultivated in garden beds and along slopes of private roads, forming a thick carpet and beautifying the landscape; often met as an escape in waste places near gardens. Flowers and Fruits: Winter season". He cites Maheshwari 241. All the herbarium material that I have seen thus far from India of this species complex has proved to be V. tenuisecta, a very commonly cultivated species.

Carpenter notes on the label of the collection cited below: "Typical. Flowers violet to blue, a variable species." Swink (1969) calls this species the "Dakota Verbena" and says "In our area known only from Lake County, Indiana, as cited by Deam, from a railroad embankment in the Columet District. This is based on a collection made along the Wabash Railroad near Clarke Junction (now part of Gary). Introduced from the West." Pullen, Jones, & Watson (1968) record it from Lee, Oktibbeha, and Sharkey Counties, Mississippi, while Whittaker & Niering (1968) found it growing to some extent on diorite in southeastern Arizona. Winter and his associates (1959) record it as growing on "plains and fields west of the Missouri River" in South Dakota.

Parks (1937) calls V. bipinnatifida "The native lavender verbena of most of Texas. This is the earliest and most persistent of verbenas in the state. It blooms in early spring and under normal conditions will bloom through the summer. It can be transplanted from the wild in early spring or the seed secured and planted in mid-winter. This species is very widely used as a roadside planting in parks and is the foundation from which many horticultural varieties have been derived. Commercial." The Nehrlings (1968) recommend it as an annual drought-tolerant groundcover plant. Parks' statement that this species enters largely into

the ancestry of horticultural varieties is news to me and seems a very questionable assertion. The cultivated verbenas are mostly derived from V. incisa Hook., V. peruviana (L.) Britton, and V. platensis Spreng., while the more recent cultivars with deeply dissected or bipinnatifid leaves have V. tenuisecta Briq. as one of the immediate ancestors. The only known hybrids involving V. bipinnatifida known to me are xV. oklahomensis Moldenke and xV. perplexa Moldenke, neither of which is known (to me) from cultivation at all.

The Cumbie 175 & 193, cited below, are vouchers for anatomical studies made on this species.

Shinn (1967) reports that the flowers of V. bipinnatifida are visited by the bee, Calliopsis verbenae. Thornberry (1966) notes that the species is sometimes grown for ornament and is attacked by the fungi Cercospora verbenicola Ell. & Ev. (a leaf-spot), Phymatotrichum omnivorum (Shear) Dug. (a root-rot), and Septoria verbenae Rob. (a leaf-spot) in Texas.

Material of V. bipinnatifida has been misidentified and distributed in some herbaria under the following names (in addition to those previously reported): V. ambrosaefolia Rydb., V. elegans H.B.K., V. rigida Spreng., and Hydrophyllum capitatum Dougl.

On the other hand, H. R. Bennett 8239, T. Collins 100, Devor 262, D. Hawkins 7, W. Hess 299, G. J. Ikenberry 90, L. Mitchell 58, Porter & Porter 8978, Pruett s.n. [4-7-64], Rosson 1340 & 1382, C. M. Rowell 5734 & 11148, Stuessy 184, and Waller 844 & 980, distributed as V. bipinnatifida, are actually V. ambrosifolia Rydb.; Matthews & Matthews 394 and O. B. Metcalfe 1231 are V. ambrosifolia f. eglandulosa Perry; Keil, Pinkava, & Lehto 10150b and O. B. Metcalfe 177 are V. bipinnatifida var. latilobata Perry; Brick 14 and Stroud S.23 are V. canadensis (L.) Britton; Johnson & Johnson 1649 & 1712 are V. ciliata Benth.; Cory 51256, Cumbie 53, B. Hutchins 319, McCullough 6, Ripple 51-580, R. Runyon 1576, 1577, & 2495, and Strother 263 are V. ciliata var. longidentata Perry; B. Jensen 8 and Rosson 506c are V. ciliata var. pubera (Greene) Perry; Tucker 3478 is V. elegans var. asperata Perry; Mears & Mears 1691 is V. gooddingii Briq.; T. Collins 91 (in part), Pilcher & Williams s.n. [Pilcher 117], G. T. Robbins 2449, and Swift s.n. [Fort Chadbourne, 1856] are V. pumila Rydb.; Sayid Akmad 113, Sultan-ul-Abedin 2643, and Surapat 41 are V. tenuisecta Briq.; and T. Collins 90 & 91 (in part) and Kruckeberg 4609 are V. wrightii A. Gray. Stuessy 1014 seems to be a mixture with V. ciliata.

Additional citations: ALABAMA: Dallas Co.: Small & Wherry 12586 (N). KANSAS: Barber Co.: S. Stephens 11158 (N). Kiowa Co.: Horr & McGregor 3809 (N). Logan Co.: R. L. McGregor 17251 (N); S. Stephens 11328 (N). Osborne Co.: Richardson & Robertson 782 (N).

Republic Co.: Morley 948 (N). Smith Co.: W. H. Horr. E.108 (N). Trego Co.: R. L. McGregor 17142 (W--2413340). COLORADO: Baca Co.: W. A. Weber 4588 (Se--131577). OKLAHOMA: Choctaw Co.: Hopkins, Nelson, & Nelson 328 (Se--103954); Nelson, Nelson, & Goodman 5534 (Se--139669). Comanche Co.: Hopkins, Nelson, & Nelson 801 (Se--98549). Johnston Co.: Hopkins, Nelson, & Nelson 994 (Se--136587). Love Co.: Nelson, Nelson, Goodman, & Waterfall 5695 (Se--136615). Murray Co.: Hopkins, Nelson, & Nelson 667 (Se--98536), 709 (Se--103967); Mahler 1048 (Au--249063). TEXAS: Bailey Co.: Rosson 103 (Lk). Bandera Co.: Ramirez & Cardenas 40 (Au--245206). Baylor Co.: D. W. Patterson s.n. [9 May 1966] (Lk). Bexar Co.: J. B. Carpenter s.n. [San Antonio, May 1942] (Ws); D. Hawkins 37 (Lk); Martz & Martz s.n. [June 3, 1959] (Ws); J. O. Perez 25 (Au--245169); R. Runyon 4340 (Au--268727, Au--269666). Borden Co.: Mahler 794 (Au--248972). Bosque Co.: Pilcher 138 (Lk). Brazos Co.: H. B. Parks s.n. [4-20-47] (Au--121655). Brown Co.: R. Clark 4 (Au--248401); M. A. Cole 121 (Lk); J. Johnson 5 (Au--248036); Maddalun 8 (Lk). Burnet Co.: Cumbie 175 (Lk); J. Jones 1 (Au--247678); F. Sylvester 2 (Au--217672). Caldwell Co.: Mears 584 (Au--249626). Callahan Co.: N. C. Henderson 63-126 (Au). Coleman Co.: Folkner 13 (Au--248095); Spoon 13 (Au--248060). Coryell Co.: Baize 13 (Au--244233); S. Jackson 11 (Au--248141). Cottle Co.: J. Parsons s.n. [July-August 1960] (Lk). Crosby Co.: Galloway 36 (Lk); Zinn 38 (Lk). Dallas Co.: D. S. Correll 16247 (Mi); Legg s.n. [4-6-64] (Lk); Lundell & Lundell 11315 (Se--155238), 12132 (N); J. Reverchon s.n. [Texas, May 1876] (W--2607193); Wilfong 27 (Mi). Deaf Smith Co.: Waller 1447 (Lk). De Witt Co.: Blanch 50 (Au--222198). Dickens Co.: B. S. Owen s.n. [April 19, 1964] (Lk); C. M. Rowell 10256 (Lk), 10266 (Lk); N. L. Weaver 18 (Lk). Duval Co.: Llaguno 81 (Lk). Eastland Co.: Mahler 1701 (Au--248826). Ector Co.: L. Mitchell 27 (Lk). Erath Co.: J. L. Fowler 11 (Lk). Gaines Co.: Hargrove & Tilton HT. 500677 (Lk). Garza Co.: D. Adams 81 (Lk); Berghane s.n. [April 10, 1964] (Lk); Foreman 7 (Lk); J. L. Hillman 11 (Lk); McCampbell F.4 (Lk); M. D. McCracken 97 (Lk); G. Nelson 30 (Lk); C. M. Rowell 8037 (Lk); H. Thompson 18 (Lk); Weddle 68 (Lk). Hartley Co.: York & Rodgers 336 (Lk). Hays Co.: Abrigo s.n. [March 28, 1963] (Au--219677); Bounds 174 (Au--230387); K. Peterson 114 (Au--230472). Hemphill Co.: J. M. Meek 30 (Lk). Hill Co.: Pilcher 80 (Lk). Howard Co.: Whitley 4 (Lk). Hutchinson Co.: C. Drake 22 (Au--239013). Kendall Co.: Waller 1735 (Lk). Kent Co.: R. F. Barr 9 (Lk); G. W. Horn s.n. [2 May 1964] (Lk). Kerr Co.: Cory 51759 (Mi, N). Lampasas Co.: Cumbie 193 (Lk). Llano Co.: Gentry & Barclay 18568 (Ld). Lubbock Co.: P. Brown 149

(Lk); R. Higginbotham 14 (Lk); V. B. Leonard 14 (Lk); Leverich 18 (Lk); E. L. Reed 3943 (Lk, Lk); B. Smith 33 (Lk); R. Watt s.n. [6 July 61] (Lk). Lynn Co.: Hargrove & Tilton HT.5006A1 (Lk). Mason Co.: Gipson 76 (Lk). McCullough Co.: Studhalter & Camp 1105 (Lk, Lk). Mills Co.: D. Youngblood 75 (Lk). Motley Co.: Whitten 13 (Lk). Nueces Co.: Bolen 81 (Lk). Parker Co.: McCart 8964 (Au--240365). Pecos Co.: C. M. Rowell 8770 (Lk). Randall Co.: B. Stewart 43 (Lk). Reagan Co.: Cory 53507 (Mi). Runnels Co.: Rosson 490b (Lk). San Patricio Co.: Gould & Hycka 8042 (Lk); S. Sanderson 13 (N). San Saba Co.: Calhoun 13 (Au--247941); E. Howell 1 (Au--248317). Scurry Co.: Pilcher 50 (Lk). Stephens Co.: Mahler 1645 (Au--248831). Tarrant Co.: D. Griffin 93 (Lk); Hobson s.n. [Ft. Worth, 5.15.88] (Mi). Taylor Co.: N. C. Henderson 61-940 (Go), 63-101 (Au--223074); J. M. Meek 2 (Lk). Throckmorton Co.: F. W. Gould 9080 (Lk). Tom Green Co.: Cory 50566 (Mi). Travis Co.: Collector undesignated s.n. [Austin, 4/12/35] (Lk); Ledingham 4636 (Sk); Tharp s.n. [Austin, 5/1/35] (Lk), s.n. [Austin, 5/9/35] (Lk); C. L. York 49004 (N). Uvalde Co.: Moore, Carrasco, Gongora, & McCart 9028 (Au--233334). Williamson Co.: Mears 656 (Au--249660); J. Sargent 6 (Au--247942). ARIZONA: Cochise Co.: Baad 474 (Se--237421); L. Cook s.n. [June 18, '31] (Sd--4017); W. W. Jones s.n. [Sept. 30, 1956] (Sd--47819), s.n. [22 June 1962] (Sd--52476), s.n. [23 July 1962] (Sd--52477); Kruckeberg 3864 (Se--189891). Graham Co.: Baad 637 (Se--236431); Kruckeberg 4626 (N, Se--207496). NEW MEXICO: Santa Fe Co.: H. R. Bennett 8239 (W--2445792). MEXICO: Chihuahua: F. Robert s.n. [26-I-1966] (Ip); Stuessy 1014 (Ip, N). Guanajuato: Detling 9642 (Ip). Jalisco: J. Rzedowski 21919 (Ip). Nuevo León: Reséndez 78 (Au--222193).

VERBENA BIPINNATIFIDA var. LATILOBATA Perry

Additional bibliography: Howell & McClintock in Kearney & Peebles, Ariz. Fl., ed. 2, 727. 1960; Moldenke, Phytologia 13: 183. 1966; Moldenke in Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1317 & 1324. 1970; Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1876. 1970; Moldenke, Fifth Summ. 1: 45, 53, 57, 61, 63, 74, & 369 (1971) and 2: 654 & 912. 1971.

Howell & McClintock (1960) distinguish this variety by the statement "leaves merely cleft; found in most of the range of the species". It has been found growing in pine forests, flowering and fruiting in November.

The T. Collins 178, distributed as V. bipinnatifida var. latilobata, is actually V. ambrosifolia Rydb., while G. A. Voss 486 is V. ciliata var. longidentata Perry and Huerta M. 42 is V. menthaefolia Benth.

Additional citations: ARIZONA: Graham Co.: Keil, Pinkava, & Lehto 10150b (N). NEW MEXICO: Grant Co.: O. B. Metcalfe 177 (Se--159766). MEXICO: Michoacán: Hinton 13125, in part (Se--117449).

xVERBENA BLANCHARDI Moldenke

Additional bibliography: Moldenke, Phytologia 14: 277--278. 1967; Swink, Pl. Chicago Reg. 427. 1969; Moldenke, Fifth Summ. 1: 16, 21, 34, 38, 43, 53, & 369 (1971) and 2: 651, 654, 672--674, 695, & 912. 1971.

Swink (1969) records this hybrid from Cook County, Illinois.

Additional citations: ILLINOIS: Winnebago Co.: Bebb s.n. [Fountaindale] (W--2606270).

VERBENA BONARIENSIS L., Sp. Pl., ed. 1, pr. 1, 1: 20. 1753 [not V. bonariensis Rendle, 1904, nor Schau., 1960].

Additional synonymy: Verbena bonariënsis L. ex Heimans, Heinsius, & Thijsee, Geillustr. Fl. Nederl. 908. 1965.

Additional & emended bibliography: Dill., Hort. Eltham. 2: 406, pl. 300, fig. 387. 1732; Crantz, Inst. Rei Herb. 1: 573. 1766; [Retz.], Nom. Bot. 11. 1772; J. F. Gmel. in L., Syst. Nat., ed. 13, pr. 1, 2 (1): 41 (1789) and ed. 13, pr. 2, 2 (1): 41. 1796; Balbis, Cat. Pl. Hort. Bot. Taur. 48. 1804; Balbis, Cat. Stirp. Hort. Acad. Taur. 80. 1813; Pers., Sp. Pl. 3: 347. 1819; Steud., Nom. Bot. Phan., ed. 1, 873 & 874. 1821; Voigt, Hort. Suburb. Calc. 471. 1845; Harv., Gen. S. Afr. Pl., ed. 2, 290. 1868; Vesque, Ann. Sci. Nat. Paris, ser. 7, 1: 339. 1885; Briq. in Chod. & Wilczek, Bull. Herb. Boiss., ser. 2, 2: 543. 1902; T. Peckolt, Bericht. Deutsch. Pharm. Gesell. 14: 465--466. 1904; Fyson, Fl. Nilg. & Puln. Hill-tops 1: 319 & 320 (1915) and 2: fig. 214. 1915; Lowe, Miss. State Geol. Surv. Bull. 17: 237. 1921; F. B. H. Br., Bishop Mus. Bull. 130: 247. 1935; Cheymol, Bull. Soc. Chim. Biol. 19: 1647--1653. 1937; Cheymol, Chem. Abstr. 32: 2977. 1938; Baez, Mus. Entre Ríos Cart. Herb. Paran. 43. 1938; Fischer & Harshberger, Flower Fam. Alb. 86. 1941; Savage, Cat. Linn. Herb. Lond. 4. 1945; Howell, Marin Fl., ed. 1, 233. 1949; Abrams, Illustr. Fl. Pacif. States, pr. 1, 3: 608 & 610, fig. 4340. 1951; Cabrera, Man. Fl. Alred. Buenos Aires 395. 1953; Michalowski, Serv. Tecn. Interam. Coop. Agr. Bol. 169. 1954; A. Burkart, Darwiniana 11: 383, pl. 16. 1957; Ferris in Abrams & Ferris, Illustr. Fl. Pacif. States, pr. 1, 4: 651 & 730. 1960; J. F. Macbr., Field Mus. Publ. Bot. 13 (5): 615--617, 621, & 624. 1960; Willaman & Schubert, Agr. Res. Serv. U. S. Dept. Agr. Tech. Bull. 1234: 237. 1961; M. Gray, Contrib. N. S. Wales Nat. Herb. 3: 61. 1961; Raven, Quart. Rev. Biol. 38: 161. 1963; Troncoso in Böcher, Hjerting, & Rahn, Dansk Bot. Arkiv 22 (1): 109. 1963; Balakrishnan, Bull. Bot. Surv. India 6: 87. 1964; R. Good, Geogr. Flow. Pl. 218. 1964; Radford, Ahles, & Bell, Guide Vasc. Fl. Carol. 281--282. 1964; Angely, Fl. Anal. Paran., ed. 1, 570. 1965; Ferris in Abrams & Ferris, Illustr. Fl. Pacif. States, pr. 2, 4: 651 & 730. 1965; Heimans, Heinsius, & Thijsee, Geillustr.

Fl. Nederl. 908. 1965; Ohwi, Fl. Jap. 763. 1965; Troncoso in Cabrera, Fl. Prov. Buenos Aires 5: 128--131, fig. 45. 1965; Backer & Bakh., Fl. Java 2: 596. 1965; J. W. Vickery, Contrib. N. S. Wales Nat. Herb. 3: 478. 1965; Yotaro, Gard. Pl. World 1: 131 (1965) and 3: 127, pl. 64, fig. 2. 1966; Hirata, Host Range & Geogr. Distrib. Powd. Mild. 276. 1966; Abrams, Illustr. Fl. Pacif. States, pr. 2, 3: 610, fig. 4340. 1967; H. C. D. de Wit, Pl. World High. Pl. 2: 175 & 183, pl. 108. 1967; R. K. Gupta, Season, Fls. Ind. Sum. Resorts Moos. 132 & 154. 1967; Kunkel, Cuad. Bot. Mus. Canar. 1: 23. 1967; E. Lawrence, South. Gard., ed. 2, 114, 115, 172, & 214. 1967; Rickett, Wild Fls. U. S. 2 (2): 462, [463], & 685, pl. 170. 1967; Tingle, Check List Hong Kong Pl. 38. 1967; Hung Fung, Raymondia 1: 17 & 19. 1968; Burlage, Ind. Pl. Tex. 184, 206, & 227. 1968; Moldenke, Résumé Suppl. 16: 1, 6--8, 11, 12, & 28 (1968) and 17: 6 & 7. 1968; Moldenke, Phytologia 16: 184, 194, & 196. 1968; Munz & Keck, Calif. Fl. 686, 687, & 1679. 1968; W. T. Pope, Man. Wayside Pl. 192, 194, & 289, pl. 110. 1968; Rickett, Wild Fls. U. S. 3 (2): 364, [367], & 551, pl. 111. 1969; Farnsworth, Blomster, Quimby, & Schermerh., Lynn Index 6: 266. 1969; Hansen, Bol. Mus. Munic. Funchal 24: 34. 1969; H. B. Lovell, Glean. Bee Cult. 97: 99--100 & 122. 1969; H. L. Mason, Fl. Marshes Calif., pr. 2, 676 & 877. 1969; A. L. Moldenke, Phytologia 18: 126 & 127. 1969; A. Pedersen, Bot. Tidsskr. 64: [342], 349, & 357. 1969; M. A. Rau, Bull. Bot. Surv. India 10, Suppl. 2: 63. 1969; R. J. & C. Taylor, Rhodora 71: 218. 1969; Van den Schijff, Check List Vasc. Pl. Kruger Natl. Park 80. 1969; Anon., Biores. Ind. 6: 283. 1970; El-Gazzar & Wats., New Phytol. 69: 483 & 485. 1970; Howell, Marin Fl., ed. 2, 233. 1970; Moldenke in Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. 6:] 1314 & 1318. 1970; Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. 6:] 1876 & 1877. 1970; Sykes, N. Zeal. Dept. Sci. & Indust. Res. Bull. 200: 215--216 & 314. 1970; Moldenke in Wiggins & Porter, Fl. Galáp. Isls. 505. 1971; Wiggins & Porter, Fl. Galáp. Isls. 997. 1971; Long & Lakela, Fl. Trop. Fla. 741--742 & 961. 1971; Rickett, Wild Fls. U. S. 5 (2): [455], 456, & 665, pl. 152. 1971; Moldenke, Fifth Summ. 1: 16, 18, 23, 25, 27, 30, 32, 33, 39, 47, 49, 53, 57, 64, 65, 101, 105, 120, 137, 143, 177, 184, 187, 189, 192, 200, 203--206, 231, 238, 241, 248, 252, 255, 257, 262, 264, 265, 269, 278, 281, 306, 311, 312, 328, 337, 341, 343, 344, 349--353, 369, 396, & 473 (1971) and 2: 653--655, 664, 667--670, 674, 681, 692, 696, 701, 703, 709, & 912. 1971.

Additional & emended illustrations: Dill., Hort. Eltham. 2: pl. 300, fig. 387. 1732; Fyson, Fl. Nilg. & Puln. Hill-tops 2: fig. 214. 1915; Abrams, Illustr. Fl. Pacif. States, pr. 1, 3: 608, fig. 4340. 1951; A. Burkart, Darwiniana 11: 383, pl. 16. 1957; Troncoso in Cabrera, Fl. Prov. Buenos Aires 5: 130, fig. 45. 1965; Yotaro, Gard. Pl. World 3: pl. 64, fig. 2 [in color]. 1966; Abrams, Illustr. Fl. Pacif. States, pr. 2, 3: 608, fig. 4340. 1967; H. C. D. de Wit, Pl. World High. Pl. 2: 175, pl. 108 [in color]. 1967; Rickett, Wild Fls. U. S. 2 (2): [463], pl. 170 [in color] (1968), 3 (2): [367], pl. 111 [in color], and 5 (2): [455], pl. 152 [in color]. 1971.

The literature reference, "Dill., Hort. Eltham. 2: 381", is sometimes cited for Verbena bonariensis, but appears to be erroneous since on that page it is Thlaspi bonariensis (in the Brassicaceae) which is being discussed. The reference to R. J. & C. Taylor's work (1969), given above, occurs erroneously cited to volume "17" of Rhodora.

Recent collectors describe V. bonariensis as an erect herb, to 6 feet tall, the stems and leaves rough, the calyx green below to reddish above, the corolla-hairs white, the anthers yellow-green, and the pistil green. The corolla itself is described as "deep-mauve" on Bayliss BS.2236, "lilac" on Philson, Doore, & Nash 234, "dark-violet" on Nicora 663, "blue" on Ruíz Huidobro 1695, "purple" on Clemens 41317, Sykes 1014, Vega 862, and Walker 8133, and "violet" on Schwarz 5122, Stellfeld 1678, and Strid 2816, while Crosby, Hespenheide, & Anderson 231 is said to have had it "whitish below, reddish in central region, and lavender above". The label of Sidey 3772 is inscribed "shrub 4--5 ft. tall, flowers purple", but the word "shrub" here must certainly be erroneous.

The species has been found growing along roadsides, in damp swales, and among grass on slopes, flowering and fruiting in every month of the year.

Troncoso (1965) says of this species "Originaria de la Argentina, Brasil, Paraguay y Uruguay, introducida en Centro América y S. de Estados Unidos. Común en lugares húmedos, terraplenes, etc." She cites Lanfranchi 159, Cabrera 8496, and Dawson 698 from Buenos Aires.

Philson, Doore, & Nash found the plant growing on southerly-sloping hillsides in poor dry yellow soil, the Degeners report it naturalized on Viti Levu, while Radford, Ahles, & Bell (1964) report it from old fields and waste places, infrequent in the central part of North Carolina and throughout the central part and the piedmont of South Carolina, blooming there from May to October. Macbride (1960) cites Soukup 2911 from Lima and Raimondi s.n. from Arequipa, Peru, gives the extra-Peruvian distribution as "North of Paraguay, Argentina, Brazil", and comments "said to be an introduction in Peru". Brown (1935) records the species from Rapa and Pitcairn Islands, citing Stokes 195 from Rapa and Quayle X from Pitcairn. He states that the plant is called "titania" on Rapa. Lowe (1921) records it from Hinds and Wilkinson Counties, Mississippi, the former record being based on a T. P. Bailey collection. Voigt (1845) tells us that it is cultivated in India and this is confirmed by Balakrishnan (1964), while Healy found it "in waste land near [a] river" and "established on roadsides" in New Zealand and avers that "this species was not in the Kaituna Valley in 1936--40" and "not in the district previously, and almost certainly brought in via shingle from the Wairau River". Allison comments that it is "common on the northern part" of North Island, New Zealand.

Peckolt (1904) records the species from Alagoas in addition to other Brazilian states from which I have known it previously and lists the vernacular name "camará de capoeira". He comments that "Diese Pflanze wird sowohl hier als auch in anderen Ländern als Zierpflanze kultiviert; selbst verwildert. Sie besitzt lanzettlich, gesägte Blätter. Der Blütenstand in trugdoldigen Rispen mit lebhaft lilafarbenen Blüten. Die Blätter schmecken bitter, das Dekokt derselben wird bei Wechselfieber und chronischem Katarrh benutzt." Burlage (1968) reports that the plant contains an alkaloid.

Fyson (1915) says of his pl. 214 "(doubtful.....Native of Brazil. Said to occur as an escape on the Nilgiris, but I have not seen it myself. Plants at Kew of the Himalayas and Nilgiris named by Clarke for the F. B. I. as this species, are V. venosa Gill and Hooker." Actually the co-author of the latter name is John Gillies (1747--1836), not the N. Gill who was collecting in India at about Fyson's time. Fyson's illustration is a perfect representation of typical V. bonariensis, a species which I have reason to believe has become naturalized in at least six states of India - Assam, East Punjab, Gujarat, Khasi States, Maharashtra, and Uttar Pradesh.

Sykes records the species from Niue Island, Hansen (1969) from Madeira, the Azores, and the Canary Islands, Tingle (1967) from Hongkong, and Pedersen (1969) as naturalized in Denmark. Gupta (1967) found it wild in Uttar Pradesh, India, describing its corollas as "lilac" in color. Gray (1961) reports it widespread and common generally along roadsides, in waste places, and in areas adjacent to railroad tracks in New South Wales. Ohwi (1965) comments that it is "Sometimes cultivated and naturalized in the western part of Honshu and Kyushu. — Introduced from S. America" and describes the corollas as "blue-purple". Van der Schijff (1969) states that it is "Scattered in the southern part" of Kruger National Park, citing Van der Schijff 497 and Codd 5689. In Marin County, California, according to Howell (1970), it is "locally abundant in low ground".

Lawrence (1967) tells us that in the southern United States V. bonariensis starts blooming between May 9 and June 15 and ends at about November 25. Raven (1963) maintains that it "was clearly introduced from the southern hemisphere to the northern about 1925", but this statement is completely erroneous because it was collected in the northern hemisphere long before that date, e.g., in 1924 by Stacey in California, in 1921 by the Baileys, Whetzel, Degener, and McCallan in Bermuda, in 1918 by Bailey in Louisiana, in 1905 by Harshberger in Bermuda, in 1902 by Palmer in South Carolina, in 1899 by Cuthbert in Georgia, in 1890 by Hitchcock in Jamaica, in 1886 by Burke in New Jersey, in 1879 by Mellichamp in South Carolina, in 1875 by Curtiss in South Carolina, and in 1853 by Gibbes in South Carolina.

Kunkel (1967) cites Kunkel 7977 from Grand Canaria. Hutchison 63.740-S3 was cultivated in California from Canary Islands seed.

Wilczek & Chodat (1902) cite Wilczek 55 from Brazil.

Additional vernacular names for V. bonariensis, as recorded by various authors and collectors, in addition to the ones listed by me previous to this, are "Buenos Ayres verbena", "cluster-flowered verbena", "oh-kumatsuzura", "pretty verbena", and "sanjaku-bābena". Pope (1968) states that in Hawaii it is called "oi", but his illustration (pl. 110) purporting to depict it, actually represents V. litoralis H.B.K. instead!

Hirata (1966) reports that V. bonariensis is infested at times by the fungus, Erysiphe cichoracearum P. DC., in Australia. Herbarium material of V. bonariensis has been misidentified and distributed in some herbaria as V. rigida Spreng. On the other hand, the F. Wylie s.n. [September 1947] is V. bonariensis var. conglomerata Briq., Cours 78, Dahlstrand 829, D. F. Howe s.n. [9 July 1963], and O'Donell & Rodriguez V. 283 are V. brasiliensis Vell., Cowgill 903 [Pl. Introd. 121505] is V. ovata Cham., and D'Arcy 1619, Mueller-Dombois 680518 48, and Prain s.n. [Coonoon, Feb. 11, 1899] are V. rigida Spreng.

Additional citations: SOUTH CAROLINA: Aiken Co.: A. E. Radford 514 (N). McCormick Co.: A. E. Radford 22293 (Se--199290). Newberry Co.: C. R. Bell 9767 (N). FLORIDA: Dade Co.: Gillis 9248 (Go). Gadsden Co.: J. K. Small s.n. [River Junction, May 1928] (N, N). ARKANSAS: Bradley Co.: Demaree 19552 (Se--112347). OKLAHOMA: McCurtain Co.: Prater 60 (Au--122292); C. M. Rowell 10744 (Lk). CALIFORNIA: Marin Co.: J. T. Howell 19323 (Se--112734, Se--155405). JAMAICA: Crosby, Hespenheide, & Anderson 231 (N). BRAZIL: Paraná: Stellfeld 1678 [H.F.F. 5876] (W--2527751). Rio Grande do Sul: Palacios & Cuezzo 1150 (N). BOLIVIA: Cochabamba: J. Steinbach 9681 (W--1571477). PARAGUAY: Hassler 9643 (W--950560); T. Rojas 313a (Ws); Woolston 174 (N), 785 (W--2567992). URUGUAY: H. H. Bartlett 20710 (N). ARGENTINA: Buenos Aires: R. Alvarez 221 (N), 759 (N); Boffa s.n. [20-II-45] (N), s.n. [23-II-1945] (N); Nicora 663 (W--2595178); Ruíz Huidobro 1695 (N, N, Rf), 1771 (N). Chaco: Buratovich 509 (N), 522 (N); Vega 862 (N). Corrientes: G. J. Schwarz 187 (N); Wurth 34 (N). Formosa: I. Morel 2029 (N), 3171 (N), 3181 (N), 4004 (N), 4132 (N), 4352 (N), 4449 (N), 4548 (Ac, N), 4601 (N), 4705 (N), 4863 (N), 4989 (N), 5092 (N), 5230 (N), 5655 (N), 5913 (N), 6013 (N), 6335 (N). Misiones: G. J. Schwarz 5122 (N), 5384 (N); Schwindt 37 (Se--130301). Salta: Sotelo 888 (N). Santa Fé: E. Alvarez 984 (N). KENYA: Strid 2816 (Go). SOUTH AFRICA: Cape Province: Bayliss BS.2236 (N, W--2564423); Sidey 3772 (W--2527327). Natal: Sidey 3443 (W--2410478). Transvaal: Dahlstrand 179 (Go); Repton 304a (Se--112486). MADAGASCAR: Decary 18178 (Go). INDIA: Khasi States: Hooker & Thomson s.n. [Mont. Khasia, 1-3000 ped.] (W--2496746). State undetermined:

Wight s.n. [Peninsula Ind. orientalis] (Ed). OKINAWAN ISLANDS: Okinawa: Amano 7373 (W--2156317); E. H. Walker 8133 (Rf). NEW GUINEA: Territory of New Guinea: M. S. Clemens 41317 (W--2605771). NEW CALEDONIAN ISLANDS: New Caledonia: Guillaumin 8568 (N). FIJI ISLANDS: Viti Levu: Degener & Degener 32359 (N). NEW ZEALAND: North Island: K. W. Allison s.n. [12.1940] (Nz--36676), s.n. [23. 3.62] (Nz--133500); Carse s.n. [21.II.1928] (Nz--5621); Healy s. n. [27.II.1945] (Nz--33966); Philson, Doore, & Nash 234 (N). South Island: Healy 59/509 (Nz--118245a, Nz--118245b), 66/329 (Nz--172804, Nz--172836). KERMADEC ISLANDS: Raoul: Sorensen 5 (Nz--55305). NIUE ISLAND: W. R. Sykes 1014 [Herb. Bot. Div. D.S. I.R. 169881] (Rf). CULTIVATED: California: Hutchison 63.740-S3 (W--2563186, W--2563187).

VERBENA BONARIENSIS f. ALBIFLORA Moldenke

Additional bibliography: Moldenke, Phytologia 8: 383 & 407. 1962; Angely, Fl. Anal. Paran., ed. 1, 570. 1965; Moldenke, Fifth Summ. 1: 177 & 200 (1971) and 2: 912. 1971.

VERBENA BONARIENSIS var. CONGLOMERATA Briq.

Additional bibliography: Angely, Fl. Anal. Paran., ed. 1, 571. 1965; Moldenke, Résumé Suppl. 16: 1 & 6 (1968) and 17: 7. 1968; Moldenke, Phytologia 15: 488. 1968; Moldenke, Fifth Summ. 1: 16, 25, 39, 65, 92, 177, 187, 189, 200, 350, & 369 (1971) and 2: 912. 1971.

This plant is described by recent collectors as growing 40--70 cm. tall. It was found growing at 660 m. altitude, fruiting in March and from October to January. The corolla is described as "blue" on Ibarrola 1784 & 1963 and Ruíz Huidobro 1660 and as "purple" on Ibarrola 1241. In New Zealand Parham found it "casual in waste land", while Healy found "a small colony rooted in stony flats, not seen elsewhere in C. Otago". Albers found it cultivated in Ethiopia and described it as an "ornamental cultigen". Actually it is a natural variety, not a cultivar.

Additional citations: BRAZIL: Rio Grande do Sul: Palacios & Cuezzo 287 (N), 2469 (N). PARAGUAY: Hassler 8934 (Ca--950557). ARGENTINA: Buenos Aires: Ruíz Huidobro 1666, in part (N). Corrientes: Ibarrola 1241 (N), 1784 (N), 1963 (N); Palacios & Cuezzo 2159 (N). Formosa: I. Morel 3752 (N), 3871 (N), 4201 (N), 5062 (N). NEW ZEALAND: South Island: Healy 58/226 (Nz--121340); Parham s.n. [Healy 66/245] (Nz--172671). CULTIVATED: California: F. Wylie s.n. [September 1947] (Sd--52699). Ethiopia: C. C. Albers 61109 (Au--223900).

VERBENA BRACTEATA Lag. & Rodr.

Additional & emended synonymy: Verbena bracteata Cav. ex Balbis, Cat. Pl. Hort. Bot. Taur. 48. 1804. Verbena repens Spreng. ex Steud., Nom. Bot. Phan., ed. 1, 873 & 874, in syn. 1821 [not

V. repens Bertol., 1806, nor Larrañ., 1959, nor Savi, 1825, nor Ten., 1947]. Verbena bractiosa Michx. ex A. Wood, Class-book, [ed. 42], pr. 1, 537, sphalm. 1861. Verbena braeteata Lag. & Rodr. ex Moldenke, Résumé Suppl. 18: 14, in syn. 1969. Verbena bractata Lag. & Rodr. ex Moldenke, Fifth Summ. 2: 656, in syn. 1971. Verbena bracteata Log. & Rodr. ex Moldenke, Fifth Summ. 2: 656, in syn. 1971. Verbena bracteosa Lag. ex Moldenke, Fifth Summ. 2: 656, in syn. 1971.

Additional & emended bibliography: Balbis, Cat. Pl. Hort. Bot. Taur. 48. 1804; Balbis, Cat. Stirp. Hort. Acad. Taur. 80. 1813; Pers., Sp. Pl. 3: 346. 1819; Steud., Nom. Bot. Phan., ed. 1, 873 & 874. 1821; Voigt, Hort. Suburb. Calc. 473. 1845; A. Wood, Class-book, ed. 2, pr. 1, 412 (1847), ed. 2, pr. 2, 412 (1848), ed. 10, pr. 1, 412 (1848), ed. 10, pr. 2, 412 (1849), ed. 10, pr. 3, 412 (1850), ed. 17, 412 (1851), ed. 23, 412 (1851), ed. 29, 412 (1853), ed. 35, 412 (1854), ed. 41, pr. 1, 412 (1855), ed. 41, 2, 412 (1856), [ed. 42], pr. 1, 537 (1861), [ed. 42], pr. 2, 537 (1863), [ed. 42], pr. 3, 537 (1865), and [ed. 42], pr. 4, 537. 1867; A. Gray, Man. Bot., ed. 5, pr. 1, 340 (1867) and ed. 5, pr. 2, 340. 1868; A. Gray, Field For. & Gard. Bot., ed. 1, pr. 1, 242. 1868; A. Wood, Class-book, [ed. 42], pr. 5, 537 (1868) and [ed. 42], pr. 6, 537. 1869; A. Gray, Field For. & Gard. Bot., ed. 1, pr. 2, 242. 1869; A. Wood, Class-book, [ed. 42], pr. 7, 537. 1870; A. Wood, Am. Bot. & Flor., ed. 1, pr. 1, 236 (1870), ed. 1, pr. 2, 236 (1871), and ed. 1, pr. 3, 236. 1872; A. Wood, Class-book, [ed. 42], pr. 8, 537. 1872; A. Wood, Am. Bot. & Flor., ed. 1, pr. 4, 236 (1873), ed. 1, pr. 5, 236 (1874), and ed. 1, pr. 6, 236. 1875; A. Wood, Class-book, ed. 9, 537. 1876; A. Gray, Man. Bot., ed. 5, pr. 8, 340 (1878) and ed. 5, pr. 8 [9], 340. 1880; A. Gray, Field For. & Gard. Bot., ed. 1, pr. 3, 242. 1880; A. Wood, Class-book, ed. 10, 537. 1881; O. R. Willis in A. Wood, Am. Bot. & Flor., ed. 2, 236. 1889; S. Wats. & Coult. in A. Gray, Man. Bot., ed. 6, pr. 1, 402 (1889) and ed. 6, pr. 2, 402. 1890; L. H. Bailey in A. Gray, Field For. & Gard. Bot., ed. 2, 341. 1895; W. A. Wheeler, Minn. Bot. Stud. 2: 403. 1900; Britton & Br., Illustr. Fl., ed. 2, pr. 1, 3: 94--96, 599, & 635, fig. 3557. 1913; Rydb., Fl. Rocky Mtns., ed. 1, 739 & 740. 1917; Lowe, Miss. State Geol. Surv. Bull. 17: 237. 1921; Rydb., Fl. Rocky Mtns., ed. 2, pr. 1, 739 & 740. 1922; Tidestr., Contrib. U. S. Nat. Herb. 25 [Fl. Utah & Nev.], pr. 1, 469. 1925; Pammel & King, Iowa Geol. Surv. Bull. 4 (rev.): 271 & 272, fig. 153A & 154. 1926; Britton & Br., Illustr. Fl., ed. 2, pr. 2, 3: 94--96, 599, & 635, fig. 3557. 1936; H. St. John, Fl. SE. Wash. & Adj. Ida., ed. 1, 351, 352, & 530. 1937; Wyman, Navajo Ind. Ethnobot. [Univ. N. M. Bull. 366 (Anthrop. Ser. 3, 5):] 18, 44, & 62. 1941; Britton & Br., Illustr. Fl., ed. 2, pr. 3, 3: 94--97, 599, & 635, fig. 3557. 1943; Zufall & Richtman, Pharm. Arch. 15: 1--9. 1944; Anon., Chem. Abstr. 38: 4092. 1944; Britton & Br., Illustr. Fl., ed. 2, pr. 4, 3: 94--97, 599, & 635, fig. 3557. 1947; Abrams, Illustr. Fl. Pacif. States, pr. 1, 3: 610, 612, & 616, fig. 4346. 1951; R. J. Davis, Fl. Ida.

596. 1952; Rydb., Fl. Rocky Mtns., ed. 2, pr. 2, 739 & 740. 1954; St. John, Fl. SE. Wash. & Adj. Ida., ed. 2, 351, 352, & 530. 1956; Scoggan, Nat. Mus. Canada Bull. 140: [Fl. Manit.] 463. 1957; Jacobs & Burlage, Ind. Pl. N. C. 221 & 251. 1958; Hitchc., Cronq., & Ownbey, Vasc. Pl. Pacif. Northwest 4: 244--246. 1959; Winter, Winter, & Van Bruggen, Check List Vasc. Pl. S. D. 124. 1959; Ferris in Abrams & Ferris, Illustr. Fl. Pacif. States, pr. 1, 4: 651 & 730. 1960; Howell & McClintock in Kearney & Peebles, Ariz. Fl., ed. 2, 726 & 728. 1960; J. F. Macbr., Field Mus. Publ. Bot. 13 (5): 612. 1960; Martin & Barkley, Seed Ident. Man. 37 & 58, fig. 234 & 397. 1961; Poindexter, Trans. Kans. Acad. Sci. 65: 418. 1962; St. John, Fl. SE. Wash. & Adj. Ida., ed. 3, 380. 1963; Dobbs, Fl. Henry Co. 231. 1963; Radford, Ahles, & Bell, Guide Vasc. Fl. Carol. 281 & 282. 1964; Lakela, Fl. Northeast. Minn. 110--111. 1965; Ferris in Abrams & Ferris, Illustr. Fl. Pacif. States, pr. 2, 4: 651 & 730. 1965; Heimans, Heinsius, & Thijsee, Geillustr. Fl. Nederl. 908. 1965; Beck & Allred, Great Basin Natur. 26: 9--16. 1966; Hirata, Host Range & Geogr. Distrib. Powd. Mild. 276. 1966; Mohlenbrock, Castanea 31: 224. 1966; F. H. Montgomery, Plants Sea to Sea 260 & 261, fig. 527. 1966; Thornberry, U. S. Dept. Agr. Agric. Handb. 165: 479. 1966; Abrams, Illustr. Fl. Pacif. States, pr. 2, 3: 610, 612, & 616, fig. 4346. 1967; Gilkey & Dennis, Handb. NW. Pl. 352--353. 1967; L. C. Higgins, Fl. Beaver Dam Mtns. 223. 1967; Rickett, Wild Fls. U. S. 2 (2): 462, [463], & 685, pl. 170. 1967; Shinn, Univ. Kans. Sci. Bull. 46: 790, 791, 886, 912, & 928. 1967; W. A. Weber, Rocky Mtn. Fl. 306. 1967; Wherry, Bartonia 37: 13. 1967; Boivin, Phytologia 16: 39 & 40. 1968; Boivin, Provanch. 2: 194 & 195. 1968; Burlage, Pl. Tex. 184, 206, 210, 222, & 227. 1968; Boughey, Mus. Syst. Biol. Univ. Calif. Irvine Res. Ser. 1: 82. 1968; Boughey, Bridges, & Ikeda, Mus. Syst. Biol. Univ. Calif. Irvine Res. Ser. 2: 11. 1968; Mohlenbrock, Trans. Ill. Acad. Sci. 61: 71. 1968; Munz & Keck, Calif. Fl. 687, 688, & 1679. 1968; Munz, Suppl. Calif. Fl. 101. 1968; Moldenke, Résumé Suppl. 16: 1 & 2 (1968) and 17: [1]. 1968; Moldenke, Phytologia 16: 184--185 & 192. 1968; Anon., Checklist Vasc. Pl. West-cent. Wash. 33. 1969; Anon., Biol. Abstr. 50 (11): B.A.S.I.C. S.208. 1969; Costello, Prairie World 172. 1969; Farnsworth, Blomster, Quimby, & Schermerh., Lynn Ind. 6: 266. 1969; H. L. Mason, Fl. Marshes Calif., pr. 2, 677, 679, & 877. 1969; R. A. Nels., Handb. Rocky Mtn. Fl. 239. 1969; Rickett, Wild Fls. U. S. 3 (2): [363], 364, & 551, pl. 110. 1969; Rydb., Fl. Rocky Mtns., ed. 2, pr. 3, 739 & 740. 1969; F. C. Seymour, Fl. New Eng. 456. 1969; Sutcliffe, Biol. Abstr. 50: 5883. 1969; Swink, Pl. Chicago Reg. 427. 1969; Tidestr., Contrib. U. S. Nat. Herb. 25 [Fl. Utah & Nev.], pr. 2, 469. 1969; Domville & Dunbar, John Burroughs Nat. Hist. Soc. Bull. 8: 94. 1970; Moldenke in Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1316 & 1322. 1970; Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1876 & 1877. 1970; Britton & Br., Illustr. Fl., ed. 2, pr. 5, 94--96, 599, & 635, fig. 3557. 1970; Reed & Hughes, U. S. Dept. Agr. Agric. Handb. 366: 306--307, fig. 151. 1970; Rickett, Wild Fls. U. S. 4 (3): 540, [541], & 799, pl. 176 (1970) and 5 (2): [455], 456,

& 665, pl. 152. 1971; Rowell, Southw. Naturalist 15: 415. 1971; Thilenius, U. S. Dept. Agr. Forest Serv. Res. Pap. 71: 42. 1971; Cochrane, W. E. Rich, & M. M. Rice, Mich. Bot. 10: 183. 1971; Moldenke, Fifth Summ. 1: 15--19, 21--23, 27, 30, 32, 34, 36--43, 45, 47, 49--51, 53, 57, 63--65, 75, 203--205, 369, & 396 (1971) and 2: 656, 657, 659, 664, 672, 673, 677, 679, 691, 693, 697, 698, 705, 736, 766, 913, & 967. 1971.

Additional & emended illustrations: Britton & Br., Illustr. Fl., ed. 1, 3: 71, fig. 3062 (1898) and ed. 2, pr. 1, 3: 96, fig. 3557. 1913; Pammel & King, Iowa Geol. Surv. Bull. 4 rev.: 271, fig. 154. 1926; Britton & Br., Illustr. Fl., ed. 2, pr. 2, 3: 96, fig. 3557 (1936), ed. 2, pr. 3, 3: 96, fig. 3557 (1943), and ed. 2, pr. 4, 3: 96, fig. 3557. 1947; Abrams, Illustr. Fl. Pacif. States, pr. 1, 3: 616, fig. 4346. 1951; Hitchc., Cronq., & Ownbey, Vasc. Pl. Pacif. Northwest 4: 246. 1959; Martin & Barkley, Seed Ident. Man. 37 & 58, fig. 234 & 397. 1961; F. H. Montgomery, Plants Sea to Sea 261, fig. 527. 1966; Abrams, Illustr. Fl. Pacif. States, pr. 2, 3: 616, fig. 4346. 1967; Rickett, Wild Fls. U. S. 2 (2): [463], pl. 170 [in color] (1967) and 3 (2): [363], pl. 110 [in color]. 1969; Reed & Hughes, U. S. Dept. Agr. Agric. Handb. 366: 307, fig. 151. 1970; Britton & Br., Illustr. Fl., ed. 2, pr. 5, 3: 96, fig. 3557. 1970; Rickett, Wild Fls. U. S. 4 (3): [541], pl. 176 [in color] (1970) and 5 (2): [455], pl. 152 [in color]. 1971.

Recent collectors describe this plant as an annual, with regular flowers, the stamens 4, equally inserted in the lower part of the corolla-tube. Weber (1967) describes it as "Floral bracts leaf-like, equalling or exceeding the flowers; plants usually prostrate.....Common along roadsides, on the mesas and plains" in the Rocky Mountains. It has been found growing in dry sand, limestone or prairie soil, sandy soil or sandy loam, tight sandy loam and the deep sand of moving dunes, in tight clay loam margins of playa lakes or limestone loam,in old cotton fields on deep loam, red sandy loam and limestone ledges on creek banks, in ditches on level prairie of wheat areas, in dry open ground, riparian habitats, the disturbed soil of roadsides, rocky sandy well-packed soil, cracks of pavement of old roads, scattered pine woods, in Coleogyne-Artemisia and Artemisia-pinyon-juniper plant associations.

Hitchcock, Cronquist, & Ownbey (1959) call it a "Taprooted annual or more often perennial, usually with numerous prostrate or decumbent sparsely spreading-hirsute stems 1--6 dm. long, small plants rarely single-stemmed and erect", growing in "Roadsides and other disturbed habitats; B. C. to Me., s. to Calif., Mex., and Fla., probably not native in the n.e. part of its range." Reed & Hughes (1970) refer to it as an "Annual herb, reproducing by seeds", found "In meadows, pastures, barnyards, sandy prairies, lawns, and waste places; rarely in cultivated fields. Native. Throughout most of the United States excepting northern New England and New York, northeastern Minnesota, and a large area of the Rocky Mountains; north into Canada from southern Ontario to

British Columbia; south into Mexico."

Swink (1969), in his work on the Chicago region, says that V. bracteata is found in "All 22 counties. Although the natural range of this plant, as given by the manuals, includes the Chicago region, yet the plant itself is a weed which is not a part of any native community. It is regularly found in heavily used, man-made habitats. It is frequent along railroads, occurring with Chaenorrhinum minus, Chenopodium album, Eragrostis pectinacea, Eragrostis poaeoides, Euphorbia maculata, Euphorbia supina, and Setaria viridis. In disturbed sandy soil it is found with Ambrosia artemisiifolia elatior, Cenchrus longispinus, Erigeron canadensis, Mollugo verticillata, and Plantago lanceolata. It often grows on the edges of roads, where the traffic is moderate, associating with Amaranthus graecizans and Polygonum aviculare."

Nelson (1969) reports that it "occurs as a weed in gardens, fields and along roadsides over most of North America and is found up to 7,500 feet in Colorado". Dobbs (1963) found it "Rather infrequent in dry sandy fields and on sandy embankments....perhaps more frequent along railroads" in Henry County, Illinois, while in Pope County it is said by Mohlenbrock (1968) to be only "occasional along roadsides". Boughey (1968) found it only occasional in wet places in Orange County, California, citing Johnson 11285. In the Pacific Northwest Gilkey & Dennis (1967) found it to be occasional in waste places. Lakela (1965) considers it rare in northeastern Minnesota (citing Lakela 18529), while Montgomery (1966) gives its Canadian distribution, again, as "Ont. to B. C." Lowe encountered it in dry open waste places in Grenada and Lafayette Counties, Mississippi, Wunderlin (1966) refers to it as frequent in waste ground in Carroll County, Illinois (citing Wunderlin 472), Fraser & Russell (1953) say that it inhabits dry prairies and cultivated fields in Saskatchewan, while the Winters & Van Bruggen (1959) record it as growing on the "prairies and plains over the state" of South Dakota.

Rowell (1971) avers that in Texas V. bracteata grows in "sand and clay loams particularly in disturbed areas of prairies and grasslands, often very abundant in Prairie Dog Towns and the outer edges of playa lakes", flowering there from April to late September. He records it from Armstrong, Bailey, Dallam, Dawson, Dickens, Floyd, Garza, Hartley, Hemphill, Hockley, Hutchinson, Lamb, Lipscomb, Lubbock, Lynn, Ochiltree, Parmer, Randall, Roberts, Terry, and Wheeler Counties. He also found it growing "Occasional in sandy loam near stock tanks on open prairie", "occasional in tight sandy loam near cattle tanks", and "locally abundant in disturbed areas around prairiedog towns". In the same state Collins encountered it "in deep sand of the High Plains dominated by mesquite and grasses", Trlicka & Sellars report that it is found frequently growing from cracks in pavement or in low protected areas, and Waller found it abundant in the clay-loam margins of playa lakes, occasional in sandy clay roadside ditches, and in dense stands of Bromus japonicus.

Domville & Dunbar (1970) inform us that in Ulster County, New York, V. bracteata is "frequent in waste places and along railroads, flowering in summer", Radford, Ahles, & Bell (1964) found it to be rare in waste grounds in Clay, Forsyth, Iredell, McDowell, and Orange Counties, North Carolina, flowering there from June to October, in Washington and adjacent Idaho St. John (1963) reports it common in dry places and persisting as a weed in dry farming regions in the Upper Sonoran and Arid Transition Timberless life zones, while in Arizona it is found "almost throughout the state, 1000--7500 ft., waste land and river bottoms, May--September", according to Howell & McClintock (1960). Moran describes it as occasional near the edges of drying pond beds in Baja California, Atwood found it growing with Conyza, Erigeron, Glycyrrhiza, Nicotiana, Oenothera, Solidago, and Veronica in Butte County, Montana, while Gierisch says that it is common in sandy soil of rabbitbrush communities in Colorado. In Cloud County, Kansas, McGregor found it to be common in roadside banks and at the edges of fields. In Yakima County, Washington, Andrew & Alison Moldenke describe it as a sympatric weed in horse pastures, "with no hybrids present".

Holmgren, Reveal, & LaFrance report it as locally abundant along roadsides in Utah, Holmgren & Reveal found it only infrequent in wet gravelly soil along the levees of ditches in Nevada, and Richardson & Robertson call it "abundant" in dry overgrazed pastures in Kansas and "common" on dry sandy prairies in Nebraska.

Wherry (1967) records the species from Delaware County, Pennsylvania, Higgins (1967) from Washington County, Utah (citing L. C. Higgins 623), and Wheeler (1900) from Houston County, Minnesota (citing W. A. Wheeler 635). Cochrane and his associates (1971) refer to it as infrequent along dry roadsides in Rock County, Wisconsin.

Boughey, Bridges, & Ikeda (1968) have computerized the characters of this species as follows: "Binomial = Verbena bracteata; Distribution habitat = wet places: Habit type = annual or perennial; Stem branching = diffuse; Stem length in cm. = 10 to 50; Leaf arrangement = petiolate; Leaf-shape = lobed and oblong or obovate; Leaf blade length in cm. = 1 to 4; Petiole length in mm. = 5 to 15; Petiole shape = winged; Floral bracts length in mm. = 5 to 10; Calyx length in mm. = 3 to 4; Corolla color = blue; Corolla length in mm. = 3 to 4; Fruit largest dimension in cm. = 0.2."

The corolla color is described as "light blue to purplish" by Nelson (1969), "blue, pinkish, or rarely white" by Gilkey & Dennis (1967), "purplish blue" by Reed & Hughes (1970), "light-purple" on Duncan 12696, "blue" on Bartlett & Grayson 862, Galloway 27, Moran 16110, Perdue 6093, and Reveal & Beatley 1554, "pinkish-blue" on Reveal 1504, "lavender" on Gentry & Jensen 2255, Watts s.n., and Whitehouse 9926, "pink" on Irving s.n., "blue-violet" on Holmgren & Reveal 1023, "blue-purple" on Trlica & Sellars 30, "pale-purple" on Rowell 4037 & 5384a, and "purple" on Hutchins 430 and Rowell 11529.

Additional common names recorded for V. bracteata, besides the ones previously listed by me, are "bigbract verbena", "bigtract verbena", "bracted-vervain", "creeping vervain", "largebracted vervain", "prostrate verbena", and "water cress" (as recorded on E. L. Reed 3774, probably in error).

It is worth noting here that the synonymous name, V. bracteosa Michx., is typified as follows: "In the region of Illinois and in the town of Nashville", Tennessee. The Verbena repens of Bertolini, of Larrañaga, and of Savi, referred to in the synonymy of V. bracteata, are all synonyms of Phyla nodiflora (L.) Greene, while V. repens of Tenore is a synonym of Phyla nodiflora var. rosea (D. Don) Moldenke.

Sutcliffe (1969) reports that the lace-bug, Tateonemia nigrina Champ., seems to be host-specific on Verbena bracteata in Nevada. Shinn (1967) reports that it is visited by the bee, Calliopsis andreniformis. Thornberry (1966) notes that the plant is attacked by the fungi, Puccinia vilfae Arth. & Holw. (a rust) in Nebraska and Septoria verbenae Rob. (a leaf-spot) in Idaho, Kansas, South Dakota, and Wisconsin. Hirata (1966) reports that it is attacked by the powdery mildew, Erysiphe cichoracearum P. DC., in various parts of the United States. Zufall & Richtman (1944) isolated the chemical, cornin, from the plant, while Burlage (1968) reports that V. bracteata is "valuable as an alterative in scrofulous affections and is used to stop post-partum hemorrhage" in Texas.

The H. R. Bennett s.n. [August 2, 1957] collection, cited below, bears a notation "Evidently a hybrid with V. stricta Vent. or some other species", but looks like the ordinary erect form of V. bracteata to me — I see no evidence of hybridity present.

Material of V. bracteata has been misidentified and distributed in some herbaria as V. neomexicana (A. Gray) Small. On the other hand, the D. B. Dunn 3050, distributed as V. bracteata, is actually V. ambrosifolia Rydb., E. G. Marsh 1133 and Roybal 97 are V. canescens H.B.K., E. G. Marsh 1792 is V. canescens var. roemeriana (Scheele) Perry, Mears 1744 is V. gooddingii var. nepetifolia Tidestr., Matthews & Matthews 487 is V. gracilis Desf., and Ohlenbush 40, F. Parks 51, D. W. Patterson s.n. [9 May 1966], and C. M. Rowell 10766 are V. pumila Rydb.

Additional citations: ONTARIO: Lambton Co.: C. K. Dodge s.n. [7/8/97] (Lk, Lk, Lk). SASKATCHEWAN: Maple Creek Co.: J. A. Campbell 95 (Ld). BRITISH COLUMBIA: Kootenay Co.: Mulligan & Woodbury 2064 (Se--167767). Yale Co.: Calder & Savile 9668 (Se--177278); Senn, Frankton, & Gillett 5800 (Se--141451); J. W. Thompson 14374 (Ld, Mi). NEW YORK: Suffolk Co.: E. J. Alexander s.n. [Montauk Point] (N). GEORGIA: Clarke Co.: W. H. Duncan 12696 (N). Floyd Co.: Ravenel s.n. [Rome] (N). OHIO: Gallia Co.: Bartley 2897 (N). Jackson Co.: Bartley 2739 (N). ILLINOIS: Cook Co.: H. R. Bennett s.n.

[July 6, 1957] (Se--178170). Marion Co.: Bebb s.n. [Salem, 1860] (W--2606271). Peoria Co.: V. H. Chase 17457 (Se--224219). IOWA: Winneshiek Co.: Tolstead s.n. [July 10, 1933] (Se--104170). MICHIGAN: Saginaw Co.: Davis & Davis 8953 (Se--127869). WISCONSIN: Racine Co.: Hale s.n. (W--2606305). MINNESOTA: Hennepin Co.: S. F. Blake 325 [Herb. Blake 1279] (Ld). Ramsey Co.: S. F. Blake 343 [Herb. Blake 1297] (Ld). SOUTH DAKOTA: Fall River Co.: G. N. Jones 35991 (Se--221827). Jones Co.: I. L. Wiggins 14976 (Ip). KANSAS: Cheyenne Co.: S. Stephens 11773 (N). Cloud Co.: R. L. Mc Gregor 4833 (N). Douglas Co.: W. H. Horr E.570 (N). Hamilton Co.: Croat 2073 (N). Kiowa Co.: Horr & McGregor 3790 (N). Ottawa Co.: Richardson & Robertson 711 (N). Scott Co.: S. Stephens 11325 (N). MISSOURI: Saint Louis: Muehlenbach 2660 (Rf), 2707 (Ac), 3474 (Ac). ARKANSAS: Craighead Co.: Demaree 27044 (N). Washington Co.: F. L. Harvey 62 (Mi). MONTANA: Broadwater Co.: Hitchcock & Muhlick 11825 (Se--99728). Carter Co.: W. E. Booth 2669 (Se--146593). Flathead Co.: W. E. Booth 6380 (Se--234896). Gallatin Co.: J. W. Blankinship s.n. [July 22, 1898] (Mi); Hitchcock & Muhlick 12478 (Se--100432). Lake Co.: J. H. Thomas 10792 (W--2574498). Park Co.: Hitchcock & Muhlick 13567 (Se--99729). Pondera Co.: Bartlett & Grayson 400 (Au--263469, N, Se--236934). Powell Co.: Hitchcock & Muhlick 11520 (Se--99518). Rosebud Co.: H. R. Bennett s.n. [7-25-57] (N), s.n. [August 2, 1957] (N). Sweetgrass Co.: Hitchcock & Muhlick 13305 (Se--99544). IDAHO: Butte Co.: Atwood 1143 (N). Elmore Co.: Hitchcock & Muhlick 22627 (N, Se--214642). Idaho Co.: Q. Jones 366 (Se--143782). Nez Perce Co.: Ownbey & Weber 2736b (Se--138404), 2746a (Se--135818). WYOMING: Big Horn Co.: Tresler 323 (Se--235249). Platte Co.: C. L. Porter 3987 (Se--109580). UTAH: Garfield Co.: H. Buchanan 464 (Se--202826); Holmgren, Reveal, & LaFrance 2101 (N, Se--231680). Salt Lake Co.: C. C. Albers 53034 (Au--271564). Washington Co.: C. C. Albers 51078 (Au--271517); Gentry & Jensen 2255 (N). NEVADA: Clark Co.: Clokey 8096 (Sd--34377). Lincoln Co.: Reveal & Beatley 1554 [Herb. U. S. Atomic Energy Comm. 6565] (N). Nye Co.: Reveal 1504 [Herb. U. S. Atomic Energy Comm. 6209] (N). White Pine Co.: Holmgren & Reveal 1023 (N, Se--226192). COLORADO: Boulder Co.: C. C. Albers s.n. [Boulder, 7-6-60] (Au--262064); Ewan s.n. [Pl. Exsicc. Gray. 1090] (Se--169684). El Paso Co.: A. Brown s.n. [Garden of the Gods] (N). Larimer Co.: R. Irving s.n. [7 July 1963] (Au--270915). Pueblo Co.: A. Brown s.n. [July 17, 1878] (N). Rio Grande Co.: Gierisch 928 (N). Sedgwick Co.: W. A. Weber 6407 (Se--144903). NEBRASKA: Harlan Co.: Richardson & Robertson 834 (N, N). Lancaster Co.: E. Robinson s.n. [July 3, 1935] (Se--153074). OKLAHOMA: Beaver Co.: R. Gardner 20 (Lk).

Comanche Co.: E. J. Palmer 11750a (N). Texas Co.: L. A. Quinn 103 (Lk). TEXAS: Andrews Co.: T. Collins 225 (Lk). Carson Co.: Trlica & Sellars 30 (Lk). Crosby Co.: Galloway 27 (Lk). Dallam Co.: C. M. Rowell 5384a (Lk), 5401a (Lk); Turner & Melchert 4800 (Lk). Dawson Co.: E. L. Reed 3774 (Lk). Deaf Smith Co.: Waller 741 (Lk), 747 (Lk), 1345 (Lk). Ector Co.: T. Collins 1169 (Lk); C. M. Rowell 11529 (Lk). Garza Co.: B. Hutchins 430 (Lk). Hale Co.: Whitehouse 9926 (N). Hartley Co.: C. M. Rowell 5384a (Lk). Hemphill Co.: C. M. Rowell 4037 (Lk). Hockley Co.: E. L. Reed 3058 (Lk). Hutchinson Co.: C. Drake 171 (Au--246588); Wiles 460 (Lk). Lamb Co.: Hargrove & Tilton HT.500652 (Lk). Lubbock Co.: Demaree 7704 (Lk, Lk); G. McDonald s.n. [3 August 1964] (Lk, Lk); M. Mitchell s.n. [4/14/37] (Lk); E. L. Reed 3940 (Lk, Lk, Lk, Lk); C. M. Rowell 60-024 (Lk); Studhalter 1255 (Lk, Lk, Lk); R. Watts s.n. [June 8, 1961] (Lk); Wester s.n. [May 2, 1964] (Lk). Lynn Co.: E. L. Reed 3439 (Lk). Moore Co.: Jespersen & Jespersen 2708 (Se--184128). Ochiltree Co.: C. M. Rowell 10947 (Lk); C. Wallis 4755 (Lk). Parmer Co.: C. M. Rowell 8631 (Lk). Randall Co.: C. M. Rowell 10182 (Lk). Roberts Co.: C. Wallis 4978 (Lk). Terry Co.: E. L. Reed 3774 (Lk). Wheeler Co.: C. M. Rowell 10105 (Lk). NEW MEXICO: Bernalillo Co.: Marcelline 2525 (Mi). San Miguel Co.: Studhalter & Marr S.3028 (Lk). Santa Fé Co.: Perdue 6093 (W--2451219). Sierra Co.: O. B. Metcalfe 897 (N). Taos Co.: Hein s.n. [June 30, 1946] (Ws). ARIZONA: Coconino Co.: Gaines 1049 (Se--230762), 1150 (Se--230760), 1179 (Se--230761); H. H. Rusby s.n. [Oak Creek, May 30, 1883] (Mi); P. O. Schallert s.n. [6/16/43] (Sd--30208). Gila Co.: Pinkava, Keil, & Lehto 14210 (N). WASHINGTON: Adams Co.: R. G. Jeffrey s.n. [June 22, 1946] (Se--117633). Benton Co.: C. Nelson s.n. [Sept. 11, 1954] (Se--153410). Chelan Co.: Hedgcock s.n. [July 22, 1932] (Se--97119); Purer 7792 (Sd--33690). Grant Co.: H. W. Smith 1178 (Se--221043). Spokane Co.: Suksdorf 1976 (Se--119502). Stevens Co.: Beattie 11728 (N). Yakima Co.: Moldenke & Moldenke 3124 (Ac, Au, Go, Rf). County undetermined: T. Howell s.n. [Lower Cascades, June 1885] (Se--159730). OREGON: Baker Co.: W. A. Weber 3148 (Se--117662). Deschutes Co.: Brenckle 51440 (N). Harney Co.: Cronquist 8570 (Se--211459). Umatilla Co.: E. Rogers s.n. [September 2, 1954] (Se--158604); W. A. Weber 2106 (Se--117663). Union Co.: Bartlett & Grayson 862 (N, Se--236717). CALIFORNIA: Kings Co.: D. F. Howe s.n. [17 July 1964] (Sd--60963). Mono Co.: Moldenke & Moldenke 24495 (Ac, Lk, Rf). Santa Barbara Co.: H. M. Pollard s.n. [March 30, 1959] (Au--273434). Stanislaus Co.: Bacigalupi & Constance 8701 (Se--225425). Ventura Co.: H. M. Pollard s.n. [July 25, 1959] (Au--275246). MEXICO: Baja California: R.

Moran 16110 (W--2571402a). Coahuila: E. G. Marsh 1214 (Au--213009).

VERBENA BRACTEATA f. ALBIFLORA (Cockerell) Moldenke
Additional bibliography: Moldenke, Phytologia 13: 185. 1966; Moldenke, Fifth Summ. 1: 51 & 64 (1971) and 2: 657 & 913. 1971.

VERBENA BRASILIENSIS Vell.
Additional & emended synonymy: Verbena braziliensis Vell. ex Moldenke, Alph. List Invalid Names Suppl. 1: 22, in syn. 1947; Bostick, Castanea 36: 206. 1971. Verbena braliliense Vell. ex Moldenke, Résumé Suppl. 18: 14, in syn. 1969. Verbena braziliense Mears ex Moldenke, Fifth Summ. 2: 657, in syn. 1971.
Additional & emended bibliography: Link, Enum. Pl. Hort. Berol. 2: 126. 1822; Cabrera, Man. Fl. Alred. Buenos Aires 395. 1953; J. F. Macbr., Field Mus. Publ. Bot. 13 (5): 615, 617, & 621. 1960; Hocking, Excerpt. Bot. A.6: 91 & 534. 1963; Radford, Ahles, & Bell, Guide Vasc. Fl. Carol. 281. 1964; Angely, Fl. Anal. Paran., ed. 1, 571. 1965; Rickett, Wild Fls. U. S. 2 (2): 462, [463], & 685, pl. 170. 1967; Carter & Jones, Castanea 33: 203. 1968; Munz, Suppl. Calif. Fl. 101. 1968; Pullen, Jones, & Wats., Castanea 33: 332. 1968; Moldenke, Résumé Suppl. 16: 2, 6, & 13 (1968) and 17: 7. 1968; Moldenke, Phytologia 16: 185. 1968; A. L. Moldenke, Phytologia 18: 126 & 127. 1969; Angely, Fl. Anal. & Fitogeogr. Est. S. Paulo, ed. 1, 1: xli. 1969; Hansen, Bol. Mus. Munic. Funchal 24: 34. 1969; R. J. & C. Taylor, Rhodora 71: 218. 1969; N. F. Good, Biol. Abstr. 51: 461. 1970; Moldenke in Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1314 & 1318. 1970; Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1876 & 1877. 1970; Bostick, Castanea 36: 206. 1971; Moldenke, Fifth Summ. 1: 21, 23, 25, 27, 30, 32, 33, 47, 49, 53, 57, 64, 65, 75, 101, 120, 137, 143, 177, 184, 187, 189, 192, 200, 257, 262, 350, 351, & 370 (1971) and 2: 654, 655, 657, 664, 672, 680, 681, 687, & 913. 1971.
Additional illustrations: Rickett, Wild Fls. U. S. 2 (2): [463], pl. 170 [in color]. 1967.
The Taylor (1969) reference cited above has been cited erroneously to volume "17" instead of volume 71.
The species has been collected in fruit in January and March (in addition to the months previously reported). Steinbach describes its calyx as "verdoso ocre". The corollas are said to have been "purple" on Aguilar 1139, Sota 41, and Villafañe 833, "blue" on Ruíz Huidobro 1473 and Steinbach 699, "lilac" on Luna 385 & 452 and Semper 293, "deep-pink" on Gillis 7057, "violet-blue" on Semper 384, "blue-violet" on LaRosa & Riccio 1485, and "lavender" on Bayliss BS.3045. Recent collectors have found it growing in tall-grass grassland, old fields, and on pond margins. Iltis encountered it in "shallow soil on prairie over calcareous Cretaceous rock" in Alabama, Demaree found if "common in poor soil on flats" in Arkansas, and Cory refers to it as "frequent on road

embankments" in Texas. Radford, Ahles, & Bell (1964) report it from old fields and waste places, "infrequent in the north and frequent in the south central part" of North Carolina, "common in the central part and frequent in the piedmont" of South Carolina, blooming there from May to October. In New Zealand it is said by Healy to be found "along gutters in town", while in South Africa, according to Dahlstand, it grows on "building lots with small riverheads and limited grazing, being lightly wooded with Protea caffra and with granite bottom".

Pullen, Jones, & Watson (1968) record V. brasiliensis from Amite, Calhoun, Clarke, Franklin, Greene, Hancock, Harrison, Hinds, Issaquena, Jackson, Jasper, Jefferson, Jefferson Davis, Jones, Lafayette, Lamar, Lauderdale, Lawrence, Marion, Montgomery, Perry, Pike, Quitman, Scott, Simpson, Stone, Tate, Union, Walthall, Warren, Washington, Wayne, Wilkinson, and Yazoo Counties, Mississippi. The Taylors (1969) record it from Johnston County, Oklahoma, Carter & Jones (1968) from Forrest County, Mississippi, and Macbride (1960) from Cajamarca, Cuzco, Huánuco, Junin, and La Libertad, Per.

Munz (1968) distinguishes V. brasiliensis from V. litoralis as follows:

1. Inflorescence lax, elongate; flowers distant; pubescence on rachis, bractlets, and calyx very minute, closely appressed. V. litoralis.

1a. Inflorescence dense, contracted; flowers mostly congested; pubescence of rachis, bractlets, and calyx spreading..... V. brasiliensis.

The Thomas, Thomas, & Thomas 708, distributed as V. brasiliensis, is actually V. montevidensis Spreng.

Additional citations: SOUTH CAROLINA: Horry Co.: J. A. Duke 0196 (Se--199292). Lexington Co.: A. E. Radford 27035 (N). FLORIDA: Dade Co.: Gillis 7057 (Rf). ALABAMA: Sumter Co.: Iltis & Univ. Wisc. Plant Geogr. Field Trip 25116 (Ws). MISSOURI: Saint Louis: Muehlenbach 3439 (Rf). ARKANSAS: Conway Co.: Demaree 35218 (Rf). Lafayette Co.: Demaree 58064 (Ac, Rf). LOUISIANA: Allen Par.: N. C. Henderson 63-1039 (Au--225646). TEXAS: Harris Co.: Collector undetermined 23 (Au--248743); Mears 546 (Au--249680). Jefferson Co.: C. L. Lundell 14136 (N). Orange Co.: Cory 50840 (Mi). CALIFORNIA: Yuba Co.: D. F. Howe s.n. [9 July 1963] (Sd--56769). COLOMBIA: Cundinamarca: Barkley & Wrigley 38779 (Ac). PERU: Junín: Iltis, Iltis, Ugent, & Ugent 347 (W--2558163); La Rosa & Riccio 1485 (Ac). BRAZIL: Rio Grande do Sul: Palacios & Cuezzo 714 (N). BOLIVIA: Cochabamba: R. F. Steinbach 699 (N). ARGENTINA: Buenos Aires: R. Alvarez 228 (N), 503 (N), 561 (N); Ruíz Huidobro 1473 (N); Sota 41 (N). Chaco: R. M. Aguilar 1139 (N). Córdoba: O'Donell & Rodríguez V. 283 (N); Pierotti s.n. [27/I/1944] (N). Formosa: I. Morel 2088 (N), 3902 (N), 4517 (N),

5337 (N). La Rioja: M. P. Gomez 35 [Herb. Inst. Miguel Lillo 106843] (N). Mendoza: E. M. Garcia 418 (N); Semper 293 (N, Rf), 342 (N), 384 (N); Villafañe 833 (N). Misiones: Krapovickas & Cristóbal 14692 (Ac). Salta: Luna 385 (N), 452 (N). San Luis: Varela 566 (N). Santiago del Estero: Pierotti "h" [Herb. Inst. Miguel Lillo 100888] (N). SOUTH AFRICA: Cape Province: Dahlstrand 829 (Go). Province undetermined: Bayliss BS.3045 [Komgha, Transkei] (N). MADAGASCAR: Cours 78 (W--2494549). NEW ZEALAND: South Island: Healy 61/57 (Nz--122993).

VERBENA BRASILIENSIS var. SUBGLABRATA Moldenke

Additional bibliography: Moldenke, Phytologia 15: 491. 1968; Moldenke, Fifth Summ. 1: 192 (1971) and 2: 913. 1971.

VERBENA CABRERAE Moldenke

Additional synonymy: Glandularia cabrerae Schnack & Rubens, Bol. Soc. Argent. Bot. 13: 205, nom. nud. 1970.

Additional bibliography: Moldenke, Phytologia 15: 491. 1968; Schnack & Rubens, Bol. Soc. Argent. Bot. 13: 205. 1970; Moldenke, Fifth Summ. 1: 184 & 200 (1971) and 2: 657 & 913. 1971.

The corollas on Schulz & Varela 5405 are described as having been "blue", while on Müller 145 they were "rose".

Additional citations: BOLIVIA: Santa Cruz: I. Peredo s.n. [20-I-1947] (Se--129882); R. F. Steinbach 321 (W--2533275). ARGENTINA: Catamarca: Luna Risso 259 (N); B. L. Müller 145 (N). Salta: Schulz & Varela 5405 (N). Santiago del Estero: Ruíz Huidobro 3079 (Se--130308).

VERBENA CALIFORNICA Moldenke

Additional bibliography: Munz, Suppl. Calif. Fl. 101. 1968; Moldenke, Phytologia 15: 491. 1968; Moldenke, Fifth Summ. 1: 65 & 370 (1971) and 2: 913. 1971.

Munz (1968) comments that "Moldenke has described V. californica from Keystone, Tuolumne Co. which keys out to V. bracteata, but is said to have a fruiting calyx 3.5--4 mm. long; corolla not known."

My son, Dr. Andrew R. Moldenke, has collected this plant along a small stream (Six Bit Creek) along the side of Taylor Hill, south of Chinese Camp, and I accompanied him later on his second visit to the locality. The species grows very abundantly along both forks of the stream, in an area which is in danger of eventually being destroyed either by the waters of an artificial lake or by real estate developments. It is growing in company with and closely associated with Trichostema rubrisepalum Elm., Rhamnus californica ssp. tomentella (Benth.) C. B. Wolf, Senecio foetidus Howell, Salix laevigata Bebb, Mimulus floribundus Dougl., Stachys stricta Greene, Hordeum nodosum L., Polypogon lutosus (Poir.) A. S. Hitchc., Madia citriodora Greene, Boisduvalia densiflora (Lindl.) S. Wats., Cen-

taurium venustum (A. Gray) Robinson, Juncus mexicanus Willd., and Scirpus olneyi A. Gray [A. R. Moldenke nos. 3398--3411, in sequence]. He describes the corollas as white, but pink inside the throat, and found the following bees visiting them: Anthidium edwardsii, Anthophora urbana, Chalcidoma angelarum, and Melissodes lupina [Anthidium and Chalcidoma belonging in the Megachilidae, Anthophora and Melissodes in the Anthophoridae]. He found in 1970--1971 that these were apparently the only insects of any sort visiting the flowers. It is his opinion that the locality we visited is actually the type locality of the species, even though this was described as "3 miles north of Keystone", the latter being a place name not now in use.

Additional citations: CALIFORNIA: Tuolumne Co.: R. F. Hoover 3613 (Sd--58403); A. R. Moldenke 3397 (Rf, Z); Moldenke & Moldenke 25240 (Ac).

VERBENA CALLIANTHA Briq.

Additional bibliography: Moldenke, Phytologia 16: 185, 188, & 212. 1968; Moldenke, Fifth Summ. 1: 177, 184, 187, & 200 (1971) and 2: 658, 662, 667, 683, & 913. 1971.

This plant has been collected in anthesis in April and both in anthesis and in fruit in April and December. The corollas are described as "blue" on Ibarrola 341, "violet" on Lourteig 2041 and Schwarz 425, and "purple" on Ruíz Huidobro 2105. Herbarium material has been misidentified and distributed in some herbaria under the binomial designation "Verbena soreoclada Briq."

Dr. A. Krapovickas, in a letter to me dated July 3, 1968, says "Con respecto a Verbena calliantha, solo tengo evidencia circunstancial sobre su origen híbrido. La coleccioné en un terreno donde crecían numerosos ejemplares de V. tenuisecta y V. incisa y solamente dos individuos de V. calliantha, con aspecto intermedio entre las dos primeras especies. Tengo en cultivo plantas de estas poblaciones y los dos individuos de V. calliantha fallan en la producción de semillas fértiles y en análisis citológico muestran algunas fallas en la meiosis". He states that he plans to continue his studies of this taxon. The hybrid previously described between V. tenuisecta Briq. and V. incisa Hook. is xV. trinitensis Moldenke, which see.

Additional citations: PARAGUAY: Lourteig 2041 (S); Woolston 623 (N). ARGENTINA: Corrientes: Ibarrola 341 (N); Ruíz Huidobro 2105 (N); J. G. Schwarz 425 (N). Formosa: I. Morel 6318 (N).

VERBENA CALLIANTHA var. MICROSOMA Briq.

Additional bibliography: Moldenke, Phytologia 8: 420--421. 1962; Moldenke, Fifth Summ. 1: 187 (1971) and 2: 913. 1971.

VERBENA CAMERONENSIS L. I. Davis

Additional synonymy: Verbena cameronensis L. ex Moldenke, Fifth Summ. 2: 658, in syn. 1971.

Additional bibliography: Hocking, Excerpt. Bot. A.6: 91. 1963; Moldenke, Phytologia 16: 185. 1968; Rickett, Wild Fls. U. S. 3 (2): 364. 1969; Moldenke in Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1316 & 1322. 1970; Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1876 & 1877. 1970; Moldenke, Fifth Summ. 1: 57 & 75 (1971) and 2: 658, 682, & 913. 1971.

Cory reports this species "frequent on grounds of tennis courts" in Cameron County, Texas. The corollas are described as "purple" on Rzedowski 7309 and as "blue" on Martínez-Calderón 1246. The plant has been collected in fruit in November (in addition to the other months previously reported).

Additional citations: TEXAS: Cameron Co.: Cory 51353 (Mi). MEXICO: San Luis Potosí: J. Rzedowski 7309 (Ac). Veracruz: González Quintero 278 (Ip); Martínez-Calderón 1246 (Ac).

VERBENA CAMPESTRIS Moldenke

Additional bibliography: Moldenke, Phytologia 13: 186. 1966; Moldenke, Fifth Summ. 1: 177 (1971) and 2: 913. 1971.

VERBENA CANADENSIS (L.) Britton

Additional & emended synonymy: Obletia verbenolacoea Rozier, Introd. Obs. Phys. Hist. Nat., ed. 1, 1: 367. 1771. Verbena americana tubo floris longissimo Rozier, Introd. Obs. Phys. Hist. Nat., ed. 1, 1: 367. 1771. Verbena oblaetia Retz., Svenska Vet. Akad. Stockh. Nya Handl. 34: 143--146, pl. 5. 1773. Glandularia caroliniensis Walt. ex J. F. Gmel. in L., Syst. Nat., ed. 13, pr. 1, 2 (2): 920. 1789. Clandularia caroliniensis J. F. Gmel. in L., Syst. Nat., ed. 13, pr. 1, 2 (2): 1555, sphalm. 1789. Verbena aubletia L. apud Steud., Nom. Bot., ed. 2, 2: 749. 1841. Verbena aubletii L. ex Voigt, Hort. Suburb. Calc. 472. 1845. Glandularia canadensis Small apud J. A. Clark, Card Ind. Gen. Sp. Var. issue 141. 1933. Glandularia drummondi Small apud J. A. Clark, Card Ind. Gen. Sp. Var. issue 141. 1933. Glandularia lamberti Small apud J. A. Clark, Card Ind. Gen. Sp. Var. issue 141. 1933. Verbena aubketia Jacq. ex Jacobs & Burlage, Ind. Pl. N. C. 251, sphalm., in syn. 1958. Verbena drummondii Grey ex Jacobs & Burlage, Ind. Pl. N. C. 251, in syn. 1958. Glandularia canadensis L. Small ex Poindexter, Trans. Kans. Acad. Sci. 65: 419, in syn. 1962. Verbenna frummondii Baxt. ex Moldenke, Résumé Suppl. 3: 42, in syn. 1962. Verbena canadeusis (L.) Britton ex Moldenke, Résumé Suppl. 18: 14, in syn. 1969. Verbena canadensis var. canadensis Croat ex Moldenke, Résumé Suppl. 18: 14, in syn. 1969. Verbena canadensis var. canadensis f. canadensis Croat ex Moldenke, Résumé Suppl. 18: 14, in syn. 1969. Verbena canadensis var. atroviolacea Dermen ex Moldenke in Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:]

1323. 1970. Verbena canadensis var. grandiflora (Haage & Schmidt) Moldenke in Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1323. 1970. Verbena canadensis var. lamberti (Sims) Thell. ex Moldenke in Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1323. 1970. Verbena canadensis var. compacta Dermen ex Moldenke in Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1323. 1970. Verbena canadensis atroviolacea Dermen apud Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1876. 1970. Verbena canadensis grandiflora (Haage & Schmidt) Moldenke apud Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1876. 1970. Verbena canadensis drummondii (Lindl.) Baxt. apud Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1876. 1970. Verbena canadensis lamberti (Sims) Thell. apud Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1876. 1970. Verbena canadensis compacta Dermen apud Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1876. 1970. Verbena canadensis H.B.K. ex Moldenke, Fifth Summ. 2: 658, in syn. 1971. Verbena canadensis (L.) Butt. ex Moldenke, Fifth Summ. 2: 658, in syn. 1971. Verbena canadensis (O.) Britton ex Moldenke, Fifth Summ. 2: 658, in syn. 1971. Verbenna drummondii Baxt. ex Moldenke, Fifth Summ. 2: 708, in syn. 1971.

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pr. 7, 538. 1870; A. Gray, Man. Bot., ed. 4, pr. 3, lxvi & 299. 1870; A. Wood, Am. Bot. & Flor., ed. 1, pr. 1, 235 (1870), ed. 1, pr. 2, 235 (1871), and ed. 1, pr. 3, 235. 1872; A. Wood, Class-book, [ed. 42], pr. 8, 538. 1872; Pfeiffer, Nom. Bot. 1 (1): 410. 1873; A. Wood, Am. Bot. & Flor., ed. 1, pr. 4, 235 (1873), ed. 1, pr. 4, 235 (1874), and ed. 1, pr. 6, 235. 1875; A. Wood, Class-book, [ed. 42], pr. 9, 538. 1876; A. Gray, Man. Bot., ed. 5, pr. 8, 340 (1878) and ed. 5, pr. 9 ["8"], 340. 1880; A. Gray, Field For. & Gard. Bot., ed. 1, pr. 3, 242. 1880; A. Wood, Class-book, [ed. 42], pr. 10, 538. 1881; Mayncke, Bull. Brooksville Soc. Nat. Hist. 1: [Fl. Franklin Co.] 31. 1885; S. Wats. & Coult. in A. Gray, Man. Bot., ed. 6, pr. 1, 402. 1889; O. R. Willis in A. Wood, Am. Bot. & Flor., ed. 2, 235. 1889; S. Wats. & Coult. in A. Gray, Man. Bot., ed. 6, pr. 2, 402. 1890; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 1032. 1893; L. H. Bailey in A. Gray, Field For. & Gard. Bot., ed. 2, 341. 1895; Ramírez Goyena, Fl. Nicarag. 2: 557--558. 1911; Britton & Br., Illustr. Fl., ed. 2, pr. 1, 3: 94, 96, 97, & 599, fig. 3558. 1913; Lázaro e Ibiza, Comp. Fl. Españ., ed. 3, 3: 297. 1921; Lowe, Miss. State Geol. Surv. Bull. 17: 236 & 237. 1921; J. A. Clark, Card Ind. Gen. Sp. Var. issue 141. 1933; Britton & Br., Illustr. Fl., ed. 2, pr. 2, 3: 94, 96, 97, & 599, fig. 3558. 1936; Winge, Proc. Linn. Soc. Lond. 150: 236. 1938; K. V. O. Dahlgren, Svensk Bot. Tidsk. 32: 231. 1938; Britton & Br., Illustr. Fl., ed. 2, pr. 3, 3: 94, 96, 97, & 599, fig. 3558. 1943; Cain, Found. Pl. Geogr., pr. 1, 335. 1944; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 1032. 1946; Britton & Br., Illustr. Fl., ed. 2, pr. 4, 3: 94, 96, 97, & 599, fig. 3558. 1947; Cabrera, Man. Fl. Alred. Buenos Aires 397. 1953; Jacobs & Burlage, Ind. Pl. N. C. 251. 1958; Hocking, Excerpt. Bot. A.1: 430. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 1: 1032. 1960; Emberger in Chadefaud & Emberger, Traité Bot. 2: 829, fig. 1175. 1960; R. M. Carleton, Ind. Common Names Herb. Pl. 100. 1962; E. L. D. Seymour, Wise Gard. Encycl., ed. 6, 1279. 1963; Radford, Ahles, & Bell, Guide Vasc. Fl. Carol. 281 & 282. 1964; Elmore, Monog. School Am. Res. 8: [Ethnobot. Navaj.] 1--136. 1964; J. & L. Bush-Brown, Am. Gard. Book, ed. 4, 383. 1965; H. S. Fitch, Univ. Kans. Nat. Reserv. 49. 1965; Troncoso in Cabrera, Fl. Prov. Buenos Aires 5: 133. 1965; J. E. Moore, Castanea 30: 26. 1965; Thornberry, U. S. Dept. Agr. Agric. Handb. 165: 479. 1966; Hirata, Host Range & Geogr. Distrib. Powd. Mild. 276. 1966; Yotaro, Gard. Pl. World 3: 127, pl. 64, fig. 1. 1966; Zukowski in Pawlowskiego, Fl. Polsk. 11: 65. 1967; Burlage, Ind. Pl. Tex. 184, 222, & 229. 1968; W. C. Grimm, Recog. Flow. Wild Pl. 228 & 229. 1968; Hartmann & Kester, Pl. Prop., ed. 2, 683. 1968; Marroquin, Cuad. Inst. Invest. Cient. 14: 30. 1968; Moldenke, Résumé Suppl. 16: 7, 13, 22, & 28 (1968) and 17: 7. 1968; Moldenke, Phytologia 16: 185 & 210. 1968; Khoshoo & Arora, Chromosoma 26: [259]--269, fig. 2 & 6. 1969; Khoshoo & Arora, Biol. Abstr. 50: 10213. 1969; Rickett, Wild Fls. U. S. 3 (2): [361], 362, & 364, pl. 109. 1969; Swink, Pl. Chicago Reg. 427. 1969; El-Gazzar & Wats., New Phytol. 69: 463, 483, & 485. 1970; Moldenke in Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6]: 1316, 1317, 1323, & 1324. 1970;

Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1876 & 1877. 1970; Solbrig, Princ. & Meth. Pl. Biosyst. 44 & 112. 1970; Britton & Br., Illustr. Fl., ed. 2, pr. 5, 3: 94, 96, 97, & 599, fig. 3558. 1970; Cain, Found. Pl. Geogr., pr. 2, 335. 1971; E. R. Hall, Am. Forests 77 (12): 17. 1971; Zochert, Nat. Hist. 80 (10): [8]. 1971; Moldenke, Fifth Summ. 1: 17, 19, 21--23, 25, 27, 30, 32--34, 36--41, 43, 45, 47, 49, 51, 53, 58, 61, 204, 205, 370, 390, 396, 397, 402, & 421 (1971) and 2: 521, 523, 568, 575, 649, 651--654, 656--659, 661, 664, 666, 672, 678, 679, 681, 684, 686, 692, 693, 700, 702, 708, 776, 792, & 913. 1971.

Additional & emended illustrations: Rozier, Introd. Obs. Phys. Hist. Nat., ed. 1, 1: 369, pl. 2, fig. 1--7 (1771) and ed. 2, 1: 369, pl. 2, fig. 1--7. 1777; Britton & Br., Illustr. Fl., ed. 1, 3: 72, fig. 3063 (1898) and ed. 2, pr. 1, 3: 97, fig. 3558. 1913; Blossfeldt, Art Forms Nature pl. 39. 1929; Britton & Br., Illustr. Fl., ed. 2, pr. 2, 3: 97, fig. 3558 (1936), ed. 2, pr. 3, 3: 97, fig. 3558 (1943), and ed. 2, pr. 4, 3: 97, fig. 3558. 1947; Embarger in Chadefaud & Embarger, Traité Bot. 2: 829, fig. 1175. 1960; Yotaro, Gard. Pl. World 3: pl. 64, fig. 1 [in color]. 1966; Rickett, Wild Fls. U. S. 2 (2): [463], pl. 170 [in color]. 1967; W. C. Grimm, Recog. Flow. Wild Pl. 229. 1968; Rickett, Wild Fls. U. S. 3 (2): [361], pl. 109 [in color]. 1969; Khoshoo & Arora, Chromosoma 26: 261 & 262, fig. 2 & 6. 1969; Britton & Br., Illustr. Fl., ed. 2, pr. 5, 3: 97, fig. 3558. 1970; P. Duncan in E. R. Hall, Am. Forests 77 (12): 17 [in color]. 1971; Zochert, Nat. Hist. 80 (10): [8] (in color). 1971.

Recent collectors describe this species as a rhizomatous perennial to 12 inches tall. The corollas are described as "blue-purple" on Brick 14, "rose" on Sykes 7/66, "pink-lavender" on Cronquist 4238, "deep-purple" on F. G. Meyer 2148, and "purple" on Hess & Harrison 1023. The species has been found growing in wet wooded areas, old fields, creek bottoms, pinewoods, ridge thickets, and limestone quarries, in dry rocky limestone-clay soil or reddish clay-loam, on limestone cliffs, rocky ridges, rocky hillsides, rocky open slopes, and prairies. Lowe (1921) states that it grows in dry sandy soil and dry prairie regions in Mississippi. In Kansas it was found by Croat in annually mowed native prairies with limestone outcrops, while Rosson found it in Eddy County, New Mexico, growing in riparian influence on the Chihuahuan desert. In Texas it was found by Brick to be occasional in sandy loam (Dallas County), while Hess & Harrison describe it as "common in disturbed areas of pine-oak forest" (Morris County), Stroud encountered it "in full sunlight in barditch" (DeWitt County), Mears found it growing in association with Astragalus, Berchemia, and Crataegus, and Parks describes it as "frequent on prairies, in open woods, red clay" (Wood County). Moore (1965) records it from Yell County, Arkansas, and Meyncke (1885) from Franklin County, Indiana.

Bartram (1791, 1794) describes a Verbena from the Baton Rouge area as "here is likewise a new and beautiful species of Verbena,

with decumbent branches and lacerated deep green leaves; the branches terminate with corymbi of violet blue flowers, this pretty plant grows in old fields where there is good soil." Ewan feels that this description refers to V. tenuisecta Briq., but I seriously doubt whether this South American species was introduced in Louisiana "in old fields" as early as 1791. I would judge, rather, that the reference is to V. canadensis, which has the "lacerated" leaves.

It is worth noting here that Walter's original description of this plant is "ANONYMOS caroliniensis caule procumbente, foliis laciniatis, floribus spicatis purpureis".

Additional common names recorded for V. canadensis (besides those noted by me in previous installments of this series of notes) are "Aublet's verbena", "garden verbena", "large-flowered vervain", "lazo de amor", and "prairie verbena". Carleton (1962) records the name "Rock-Mountain-vervain" under the synonymous binomial, V. montana, while Yotaro (1966) calls it the "aubletien-Eisenkraut".

Elmore (1944) avers that "It is irritating to the skin".

Thornberry (1966) records the fungi Puccinia vilfae Arth. & Holw. (a rust) as attacking Verbena canadensis in Oklahoma and Septoria verbenae Rob. (a leaf-spot) in Kansas, Louisiana, and Oklahoma; Hirata (1966) adds Erysiphe cichoracearum P. DC. (a powdery mildew).

Radford, Ahles, & Bell (1964) state that Verbena canadensis occurs along roadsides and on sandhills in widely scattered localities in the piedmont and central parts of the Carolinas, flowering there from March to May. Swink (1969) says "This is a commonly cultivated garden flower, and these collections [from Berrien and Kane Counties, in the Chicago area] may represent escapes from cultivation". Khoshoo & Arora (1969) describe what they call a hybrid between V. aubletia and V. tenuisecta -- presumably what is now called xV. wingei Moldenke. They give n = 15 as the chromosome count for what they call V. aubletia and aver that it forms bivalents during meiosis.

The Rozier work cited in the synonymy and bibliography was originally published in November, 1771. It was reprinted with original pagination and original dates in 1777 [perhaps also in 1773, according to some bibliographies]. It is sometimes cited to "Journ. de Physique" because that is what the continuation of the series was entitled from 1794 to 1823. From 1773 to 1793 it was entitled "Observ. & Mém. Physique". The article in question starts out as follows: "Description de la verveine d'Amérique. Cette plante n'a encore été décrit par aucun Auteur: elle a été démontree cette année au jardin du Roi, sous la dénomination de verbenna Americana tubo floris longissimo. M. Lemonier en a reçu la graine, il y a environ trois ans de l'Amérique Septentrionale, dans les terres de miclos. Il en a fait un genre particulier, sous le nom d'obletia verbenolacoea. La Botanique Françoise doit beaucoup à M. Oblet, & il a enrichi le jardin des plantes d'une quantité de

semences précieuses, qu'il a rapportées de Cayenne & de l'isle de France. Ce Botaniste zélé & savant nous a fair connoître des deux espèces de zinnia pauci & multi flora; il étoit juste de donner son nom à une plante aussi intéressante que celle que nous allons décrire. L'obletia est une plante vivace; on la conserve l'hiver dans l'orangerie: nous pensons que peu-à-peu on l'acoutumera à rester en pleine terre. Sa beauté la rend l'ornament d'un jardin, & elle réunit à la beauté, l'avantage d'être en fleur un très-grande partie de l'année." This is followed by a long and detailed description of the plant and an excellent illustration of it.

Lázaro e Ibiza (1921) describes the plant as it grows in Spain: "Hojas oblongas, angostadas en pecíolo, con 3 lacinias hendido-dentadas; brácteas lanceoladas, mitad que el cáliz; corola lilácea, con tubo doble largo que el cáliz, y lóbulos escotados. Fl. verano. América del Norte." His statement that the bractlets are only half as long as the calyx is curious, because this is not true of typical V. canadensis, nor of the commonly cultivated xV. hybrida Voss.

Herbarium material of V. canadensis has been misidentified and distributed in some herbaria as V. hastata L. On the other hand, the J. M. Coulter s.n. [May 17, 1873], distributed as V. canadensis, is actually V. ambrosifolia Rydb., Higginbotham 14 is V. bipinnatifida Nutt., R. Runyon 2497 is V. ciliata var. longidentata Perry, R. Runyon 2625 is V. delticola Small, and Toumey 305 is V. gooddingii var. nepetifolia Tidestr.

Additional citations: NORTH CAROLINA: Rutherford Co.: C. R. Bell 2109 (N). GEORGIA: Putnam Co.: Cronquist 4238 (Mi). FLORIDA: Duval Co.: G. H. M. Lawrence 193 (Se--120909). Jefferson Co.: Lighthipe s.n. [March 13, 1891] (N). TENNESSEE: Rutherford Co.: Sharp & Shanks 439 (Se--99271). KANSAS: Anderson Co.: Croat 1567 (N). Osage Co.: Stephens 30597 (N). MISSOURI: Jefferson Co.: F. G. Meyer 2148 (Au--121897). Saint Louis Co.: F. C. Prince 253 (Au--121874). Taney Co.: Demaree 59777 (Ac). ARKANSAS: Baxter Co.: Demaree 28934 (Au--121878), 28944 (Au--121879), 28971 (Au--121881). Benton Co.: Small & Wherry 12351 (N). Faulkner Co.: Demaree 5948 (N), 5962 (N). Fulton Co.: Demaree 25864 (Au--121877). Hot Spring Co.: Demaree 14878 (Se--202948). Lawrence Co.: Demaree 25957 (Au--121880). Marion Co.: Demaree 30110 (Au--121875). Saline Co.: Demaree 57603 (Rf). LOUISIANA: Ouachita Par.: R. D. Thomas 6516 (N). Rapides Par.: J. K. Small s.n. [Lena, May 1931] (N, Rf), s.n. [Between Alexandria and Burkie, May 1931] (N, N. Rf). OKLAHOMA: Atoka Co.: Hopkins, Nelson, & Nelson 1080 (Se--136588). Comanche Co.: Hopkins, Nelson, & Nelson 965 (Se--136590). Harper Co.: W. F. Flint s.n. [1.6.79] (N). Haskell Co.: G. Bryan 178 (Lk). Johnston Co.: Hopkins, Nelson, & Nelson 1024 (Se--

136586). Kay Co.: Flickinger 419 (Au--121873). McCurtain Co.: ElSharkawi 54 (Lk); Hess & Seibert 669 (Se--226096); Lindzey 253 (Au--121876). Payne Co.: P. Jones 31 (Lk). Pontotoc Co.: G. T. Robbins 2335 (Se--153536). TEXAS: Chambers Co.: Mears 1305 (Au--258151). Dallas Co.: Brick 14 (Lk). DeWitt Co.: Stroud S.23 (Lk). Jasper Co.: Cory 52728 (Mi), 52864 (Mi). Kendall Co.: H. B. Parks 29520 (Se--184829). Morris Co.: Hess & Harrison 1023 (Au--256823). Newton Co.: Cory 52606 (Mi). Wood Co.: Mears 1221 (Au--258338); F. Parks 50 (Lk). NEW MEXICO: Eddy Co.: Rosson 1317 (Lk). CULTIVATED: New Zealand: W. R. Sykes 7/66 (Nz--169714). North Carolina: Foust s.n. [10/25/1937] (N).

VERBENA CANADENSIS f. CANDIDISSIMA (Haage & Schmidt) Palmer & Steyerm.

Additional synonymy: Verbena canadensis candidissima (Haage & Schmidt) Palmer & Steyerm. apud Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1876. 1970.

Additional bibliography: Moldenke, Phytologia 13: 187. 1966; Moldenke in Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1316 & 1323. 1970; Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1876. 1970; Moldenke, Fifth Summ. 1: 43, 45, 58, & 370 (1971) and 2: 653, 658, 659, 784, & 913. 1971.

Stephens found this form growing in dry rocky limestone soil.

Additional citations: KANSAS: Chautauqua Co.: S. Stephens 30120 (N).

VERBENA CANESCENS H.B.K.

Additional & emended synonymy: Verbena canescens Humb. & Bonpl. ex Steud., Nom. Bot., ed. 1, 873. 1821. Verbena canexcens H.B.K. ex Moldenke, Fifth Summ. 2: 659, in syn. 1971.

Additional bibliography: Steud., Nom. Bot., ed. 1, 873. 1821; Burkart, Excerpt. Bot. A.5: 586. 1962; Hocking, Excerpt. Bot. A.6: 91 (1963) and A.9: 367. 1965; Marroquin, Cuad. Inst. Invest. Cient. 14: 30 & 56. 1968; Moldenke, Phytologia 16: 185--186 & 215. 1968; Moldenke, Résumé Suppl. 16: 2 (1968) and 17: [1]. 1968; Rickett, Wild Fls. U. S. 3 (2): 365. 1969; El-Gazzar & Wats., New Phytol. 69: 458, 483, & 485. 1970; Moldenke in Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1315, 1316, & 1321--1322. 1970; Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1876 & 1877. 1970; Moldenke, Fifth Summ. 1: 51, 58, & 75 (1971) and 2: 659--661, 684, 694, 767, 769, & 913. 1971.

Additional illustrations: El-Gazzar & Wats., New Phytol. 69: 458, fig. 7. 1970.

Rickett (1969) describes this species as "rather low, not more than a foot tall [actually it grows to 18 inches tall], with many square, hairy branches spreading sidewise. The leaves are toothed, with a stalk or a narrow part which may extend around the stem;

they are hoary. The spikes are mostly single. The corolla ranges from pink to purple, up to 1/4 inch across." He gives its flowering season in Texas as "March to October" and its habitat as "in sandy and rocky soil in open ground and woodland throughout Texas and in northern Mexico." Actually, this is the common Mexican form, rare in Texas, while var. roemeriana (Scheele) Perry is the common Texan plant.

Recent collectors have found V. canescens along roadsides, on wooded slopes of pinyon-oak, in dry rocky shrubby rangeland, flat alluvial land with halophytic Prosopis vegetation, matorral of Cordia boissieri, zacatal vegetation, and in hard, caliche, or fertile dark loamy soil, ascending to 3000 meters altitude. Cruz Cisneros found it on alluvial banks with Hilaria cenchroides, Bouteloua hirsuta, and Erioneuron avenaceus and "in pastizel de Hilaria cenchroides y Bouteloua radicosa" in Mexico, where Rzedowski found it growing on "ladera caliza con vegetación de zacatal con arbustos" and in "ladera caliza con vegetación primitiva destruída", while González Quintero encountered it on "ladera caliza con vegetación espaciada". In Coahuila it is said by Runyon to be "common on mountainsides", while Boke & Massey found it "infrequent along roadsides in pinyon-juniper woodland". In Nuevo León it is "abundant in dry gravel soil", according to Stuesst, and "in open pine forests, gypsum soil, scattered along ravines" by McGregor and his associates. Marroquin (1968) cites Alanís 172 & 189 (FCB 2486 & 2487) from the same state.

The corollas of Verbena canescens are described as "purple" on Rosas R. 856 and Runyon 1321, "blue-purple" on Rzedowski 4251, and "blue" on Boke & Massey 222, Latorre 2, and Rzedowski 24811.

It should be noted that F. W. Gould 10656 seems to be a mixture with var. roemeriana (Scheele) Perry. It has been suggested that the C. L. Smith 221 specimen in the herbarium of the University of California may represent V. pinetorum Moldenke, but I have reexamined it and am still of the opinion that it is typical V. canescens H.B.K.

Material of V. canescens has been misidentified and distributed in some herbaria as V. bracteata Lag. & Rodr. On the other hand, the Ravenel s.n. [Rome, Ga.], distributed as V. canescens, is actually V. bracteata Lag. & Rodr., H. B. Parks s.n. [College Station, 6-7-47], and Stanford, Lauber, & Taylor 2174a & 2252 are V. canescens var. roemeriana (Scheele) Perry, J. Rzedowski 11265 is V. gracilis Desf., González Quintero 1265 is V. menthaefolia Benth., Paxson & Barkley 16M839 is V. pinetorum Moldenke, N. C. Henderson 63-153 & 63-198 are V. plicata Greene, and C. M. Rowell 11228 is V. racemosa Eggert.

Additional citations: TEXAS: Hidalgo Co.: Fleetwood 7087 (Au--230983). MEXICO: Aguascalientes: J. Rzedowski 25068 (Ip, Mi). Chihuahua: F. Robert s.n. [26-I-1966] (Ip). Coahuila: Boke & Mas-

sey 222 (Mi); Fuentes C. s.n. [20/IX/1959] (Ip); F. W. Gould 10656, in part (Ip); Latorre 2 (Au--225449); E. G. Marsh 575 (Au--212499), 1133 (Au--212931), 1687 (Au--213491); E. M. Marsh 2140 (Au--213876); R. Runyon 1321 (Au--269761). Federal District: Bopp O. 213 (Ip). Hidalgo: González Quintero 2876 (Ip), 3081 (Ac). México: Cruz Cisneros 691 (Mi), 959 (Mi). Nuevo León: Alanís F. 172 (Ip); Fuentes C. s.n. [23.IX.1959] (Ip); H. Hernández s.n. [18/V/1965] (Ip); McGregor, Harms, Robinson, Rosario, & Segal 98 (N, W--2526794); Roybal 97 (Au--121976); Stuessy 262 (Au--252934). Oaxaca: C. L. Smith 221, in part (Ca--975386, Ip). San Luis Potosí: R. L. McGregor 16644 (N); J. Rzedowski 3562 (Ip), 3569 (Ip), 4251 (Au--244592), 6347 (Au--243666), 6520 (Ip), 10225 (Ip), 24811 (Ip, Mi, Mi), 24834 (Ip). Tamaulipas: R. Runyon 5740 (Au--270307). Veracruz: M. Rosas R. 856 (Ac).

VERBENA CANESCENS f. ALBIFLORA Moldenke

Additional bibliography: Moldenke, Phytologia 15: 494. 1968; Moldenke, Fifth Summ. 1: 75 (1971) and 2: 913. 1971.

VERBENA CANESCENS var. ROEMERIANA (Scheele) Perry

Additional bibliography: Hocking, Excerpt. Bot. A.6: 91. 1963; Marroquin, Cuad. Inst. Invest. Cient. 15: 56. 1968; Moldenke, Phytologia 16: 186 & 215. 1968; Moldenke, Résumé Suppl. 16: 2 (1968) and 17: [1]. 1968; Moldenke in Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1315, 1316, & 1322. 1970; Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:] 1876. 1970; Moldenke, Fifth Summ. 1: 58, 65, & 75 (1971) and 2: 659--661, 693, 702, & 913. 1971.

Runyon describes this plant as having "leaves oblong in outline, incised, hispid or rough, or imperfectly lobed, bark green, roots fibrous, fruit a small capsule, frequent in clay soil on clay slopes and hillsides in Hidalgo and Starr Counties [Texas]", flowering there from April to June; he comments also that "it occurs in dry situations throughout the Lower Rio Grande Valley, it prefers clay soil".

Other collectors have found the plant growing in sandy loam, in thorn scrub, along roadsides, and, according to Thomas, in rocky channels leading into dry lakes. Rowell describes it as occasional in rocky limestone soil in Brewster County, Texas. Marroquin (1968) cites Johnson & Barkley 16041M (FCB 102) and Painter, Lucas, & Barkley 14276 (FCB 103) from Neuvo León, Mexico. It has also been collected in anthesis in December and in fruit in July, August, and December, in addition to the months previously reported by me. The corollas are said to have been "blue" on R. Runyon 2733, "lavender" on J. H. Thomas 8185, and "pale-purple" on C. M. Rowell 5113. The Stanford, Lauber, & Taylor 2174a collection looks very much like V. neomexicana (A. Gray) Small, while Hinckley 4004 looks like it might be a hybrid between V. canescens var. roemeriana and V. neomexicana or one

of its varieties, like the unnumbered collection of the same collector and same date of collection previously reported on by me.

Material of V. canescens var. roemeriana has been misidentified and distributed in some herbaria as V. bracteata Lag. & Rodr. On the other hand, the Cruz Cisneros 691, Fuentes C. s.n. [20/IX/1959] & s.n. [23.IX.1959], and J. Rzedowski 3552, 3569, & 10225, distributed as var. roemeriana, seem to be typical V. canescens H.B.K.

Additional citations: TEXAS: Brazos Co.: H. B. Parks s.n. [College Station, 6-7-47] (Sd--65949). Brewster Co.: Hinckley 4004 (N), 4614 (N); C. M. Rowell 5113 (Lk). Brown Co.: Beson & McCart 9335 (Au--247752); S. L. Clark II.17 (Au--247751). Cameron Co.: R. Runyon 2518 (Au--268714). Coleman Co.: B. E. Holland 21 (Au--248096). Hidalgo Co.: R. Runyon 2733 (Au--268734). Kerr Co.: F. W. Gould 8260 (Lk). Kinney Co.: Strother 264 (Au--238208). Pecos Co.: Ballinger s.n. [October 24, 1959] (Au--220905). Terrell Co.: G. L. Webster 453 (Au--122356). Travis Co.: Mears 1031 (Au--255142). Uvalde Co.: Atwood 2008 (N). MEXICO: Baja California: J. H. Thomas 8185 (Ip). Coahuila: F. W. Gould 10656, in part (Au--236900); E. G. Marsh 1792 (Au--213575). Nuevo León: Reséndez 55 (Au--222207); Webster, Adams, Miller, & Miller 11154 (Au--262634). Tamaulipas: Stanford, Lauber, & Taylor 2174a (Se--147695), 2252 (Se--149141).

VERBENA CANIUENSIS Moldenke

Synonymy: Verbena canihuensis Moldenke, Fifth Summ. 2: 659, in syn. 1971.

Additional bibliography: Angely, Fl. Anal. Paran., ed. 1, 571. 1965; Moldenke, Phytologia 13: 246. 1966; Moldenke, Fifth Summ. 1: 177 (1971) and 2: 660 & 913. 1971.

Hatschbach describes this plant as creeping and rooting, with lilac flowers, growing at the edges of gallery forests, at altitudes of 760 to 800 meters. He refers to his no. 20177 as a "topotype",

Additional citations: BRAZIL: Paraná: Hatschbach 20177 (N), 22284 (Mi, N).

VERBENA CAROLINA L.

Additional & emended synonymy: Verbena polystachya H.B.K., Nov. Gen. & Sp. Pl., ed. folio, 2: 222. 1817 [not V. polystachya Jepson, 1947]. Verbena biserrata H.B.K., Nov. Gen. & Sp. Pl., ed. folio, 2: 222. 1817. Verbena veronicaefolia H.B.K., Nov. Gen. & Sp. Pl., ed. folio, 2: 222--223. 1817 [not V. veronicaefolia J. E. Sm., 1845]. Verbena biserrata Humb. & Bonpl. ex Steud., Nom. Bot. Phan., ed. 1, 873. 1821. Verbena polystachya Humb. & Bonpl. ex Steud., Nom. Bot. Phan., ed. 1, 873. 1821. Verbena veronicaefolia Humb. & Bonpl. ex Steud., Nom. Bot. Phan., ed. 1, 874. 1821.

[to be continued]

BOOK REVIEWS

Alma L. Moldenke

"MANUAL OF THE TREES OF NORTH AMERICA Volumes I & II" by Charles Sprague Sargent, xxvi & 934 pp., illus., 2nd replication edition. Dover Publications, Inc., New York, N. Y. 10014. 1965. $6.00 the set, paperback.

Like the first facsimile edition of 1961, this one is thoughtfully dedicated to the memory of the great dendrologist-author. His first edition appeared in 1905, his revision which this copies appeared in 1922. It includes 66 families with 185 genera and 717 species growing in the United States (including Alaska) and Canada. There are reproduced very clearly the nearly 800 excellent drawings which alone are worth more than the modest price of the publication. There are a synoptical key to families, an analytic leaf character key to genera, and species keys with the text. There is a wealth of detail in the text, the glossary, and the index.

Bringing this work up-to-date there is a Table of Changes in Nomenclature, of several pages, which has been added by E. S. Harrar, Dean of the School of Forestry at Duke University.

These volumes in permanent binding are additional evidence of the great service to botanical literature rendered by this publishing house.

"A FLORA OF TROPICAL FLORIDA -- A Manual of the Seed Plants and Ferns of Southern Peninsular Florida" by Robert W. Long and Olga Lakela, xvii & 962 pp., illus., University of Miami Press, Coral Gables, Florida 33124. 1971. $29.50.

"The chief objective of this book is to provide a means for identifying the approximately 1650 species of flowering plants, gymnosperms, ferns and fern allies known to grow without cultivation in southern Florida" where the most conspicuous ecologic formations "are the scrub forests, hammocks and tree islands, freshwater swamps, dry pineland, wet or low pineland, the mangroves, salt marshes, wet prairies, dry prairies, coastal strands and dunes, pond and river margins, marine communities, and ruderal communities". The flora represents 179 families and 762 genera.

Joseph Ewan compiled a valuable and interesting "History of Botanical Collecting in Southern Florida" as an introduction. There are 125 full-page, fine line-drawings, appendices with a floral author list, an abbreviations list, a list of English equivalents for Latin specific names, a glossary, and a full index.

There should be considerable demand for this book.

When I turned this book over to my husband for comments he noted that Petitia domingensis has escaped from cultivation in Dade County and Stylodon carneus occurs in Palm Beach County. The cor-

rect name for what the authors call "Lippia geminata" is L. alba (Mill.) N. E. Br.

Eriocaulon compressum var. harperi occurs in Lee County. He cannot agree that Lachnocaulon eciliatum, L. floridanum, and L. glabrum are all synonyms of L. anceps, but of the three only L. glabrum occurs in the area covered by the book.

Although double author-citations are used throughout the book, the authors have failed to use them as required for Avicennia germinans. Although subspecific taxa are listed under Lantana and Vitex, the following from the area are ignored: Citharexylum fruticosum var. subvillosum and var. villosum, Lantana camara var. mutabilis, and Phyla nodiflora var. reptans. The true Vitex trifolia does not occur in the area -- the taxa there are var. subtrisecta and var. variegata, only the latter being listed in the book. Lantana odorata is not a straight synonym of L. involucrata, but is now regarded as var. odorata of that species, differing in leaf-shape and flower-color.

He cannot agree that Lantana depressa should be reduced to mere varietal rank under L. ovatifolia (with a new epithet used for it instead of retaining the original!). Stachytarpheta urticaefolia has escaped in Broward County; Verbena canadensis has also been found there. Premna odorata and Aegiphila elata have both escaped in Dade County, while Clerodendrum thomsonae has escaped in Broward County.

Based on considerable field observation and collecting in this area, it seems to him that the all-yellow color-form of Pinguicula pumila (var. buswellii) from Collier County and the glaucous-leaved form of Serenoa repens (f. glauca) from Palm Beach County are worthy of at least incidental mention. But they are ignored.

"ECO-CRISIS" edited by Cecil E. Johnson, 182 pp., John Wiley & Sons, Inc., London, Sydney, Toronto, & New York, N. Y. 1970. $3.45 paperback.

"This book of readings deals with the ecological realities that today's college students will have to face." It will also appeal to concerned high school students and general readers.

The sixteen excerpts, including those from Peter Farb's "Man Versus Nature", Paul Ehrlich's "Population Bomb", Linus Pauling's "The Scientist's Appeal for Peace", Paul B. Sear's "Deserts on the March", and Rachel Carson's "Silent Spring", cover this field effectively and needfully ominously.

"INTRODUCTORY BOTANY", 2nd Edition, by Arthur Cronquist, ix & 885 pp., illus., Harper & Row, Publishers, Evanston, Illinois, San Francisco, London, & New York, N. Y. 10016. 1971. $14.95.

This is one of a very few excellent texts in a market glutted with mediocre, uninspiring and often error-tinged botany books.

This one covers a great deal of material masterfully and explains it all clearly. There are fine illustrations and careful glossary and indexing.

Modernizings of the decade-old fine first edition include: new chapters on respiration and molecular genetics, revision of the one on photosynthesis, the role of electron microscopy in cytology, plants' place in making and keeping the earth habitable, new information -- especially re microtubules -- on mitosis, virus structure and reproduction, ancestry of the gymnosperms, phyletic position of the Phycomycetes, and the new subclasses for the angiosperms.

"THE BIOSPHERE -- A Scientific American Book" edited by Dennis Flanagan, viii & 134 pp., illus., W. H. Freeman Co., San Francisco, California 94104. 1970. $6.50 clothbound, $3.25 paperbound.

This excellent book consists of eleven papers from the "SCIENTIFIC AMERICAN", all published in the September 1970 issue. The fine introductory one by G. Evelyn Hutchinson describes the biosphere with its "grand-scale cyclic mechanisms of life on the earth". It is followed by others on the energy, water, carbon, oxygen, nitrogen, and mineral cycles. These are followed by ones on human food, energy, and materials production as processes in the biosphere. The illustrative material is of very high quality. There are the usual short notes on the authors, pertinent bibliography and general index.

This book provides (as do all others in this series) quality supplementary reading for the general biology and ecology courses on our campuses in strong contrast to the many little paperbacks (each containing usually only one or two redeeming articles) that really offer nothing more than the standard texts.

"HOW TO KNOW THE FERNS -- A Guide to the Names, Haunts, and Habits of our Common Ferns" by Frances Theodora Parsons, facsimile of the 2nd edition of 1899, xiv & 215 pp., illus., Dover Publications, Inc., New York, N. Y. 10014. 1961. $3.00 paperback.

This book came to my desk a bit late for reviewing, but I must make mention of how well the beautiful drawings reproduced, how charming the first chapter on "Ferns as a Hobby" still is, how pleasant and accurate the plant descriptions are, and how good it is to have this "old timer" available again and at such a reasonable price!

"MUSHROOMS OF THE WORLD" by Lucius von Frieden, 439 pp., illus., Bobbs-Merrill Co., Indianapolis, Indiana, & New York, N. Y. 1969. $12.95.

The English-languaged mycophiles and mycologists are fortunate in that "I Funghi De Tutti I Paesi" of 1964 has been translated

by Ronald Strom. Now so many more sets of the 186 beautiful color plates by Laura Maggiora are available. With each plate there is a page of descriptive text, detailed classification as to edibility, and a note on for what it might be easily mistaken.

There is an interesting and accurate introduction on mushroom form and growth and on identifying edible species, on gathering, keeping and cooking -- with recipes -- mushrooms. Sensible precautions about mushroom poisoning are given as is also a delightful explanation for the amateur of the different scientific names sometimes appearing for the same species. For this American edition there have been given some changes in nomenclature so that some synonymy is available. On p. 19 "are" is used for "is", on p. 11 "seeds" are equated with spores, and in the description for pl. 186 "grow" is misspelled. These are just minor flaws in a truly wonderful book.

"PLANT GROWTH" by Arthur G. Gentile, 144 pp., illus., Natural History Press, Garden City, New York 11530. 1971. $5.95.

The dust jacket states that this book is planned as an introduction for the layman -- student, amateur botanist, and serious gardener.

There is no question of accuracy of content because the author is a good botanist and because the volume had the consultant services of Dr. Richard M. Klein. It just reads like a simplified, curtailed and not particularly interesting text-book. The illustrations are just ordinary familiar text figures. The general references listed make better reading than the book itself.

The price asked for this little book is outrageous.

"ENVIRONMENT -- Resources, Pollution & Society" edited by William W. Murdock, vii & 440 pp., illus., Sinauer Associates, Inc., Stamford, Connecticut 06905. 1971. $5.95 paperback.

This group of original papers by functioning scientists is divided into three groups -- population and resources, environmental degredation, and environment and society. All is well enough presented to make useful collateral reading by college students and by the intelligent concerned public. It is well indexed. Each paper ends with well chosen references.

On p. 7 biomass is misspelled.

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