F530
26

# Rhodora

JOURNAL OF THE

## NEW ENGLAND BOTANICAL CLUB



VOLUME 69

1967

The New England Botanical Club, Inc.

Botanical Museum, Oxford St., Cambridge 38, Mass.

# Rhodora

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Conducted and published for the Club, by



Vol. 69 January-March, 1967 No. 777

CONTENTS:



*(Continued on Inside Cover)*

The New England Botanical Club, Inc.

Botanical Museum, Oxford St., Cambridge 38, Mass.

CONTENTS: — *continued*



**RHODORA.—A quarterly journal of botany, devoted primarily to the flora of North America and floristically related areas. Price, $6.00 per year, net, postpaid, in funds payable at par in United States currency in Boston; single copies (if available) $1.80. Back volumes 1-58, with a few incomplete, can be supplied at $5.00 per volume. Volume 59— available at $6.00. Somewhat reduced rates for complete sets can be obtained upon application.**

**Scientific papers and notes, relating directly or indirectly to the plants of North America, will be considered by the editorial committee for publication. Articles concerned with systematic botany and cytotaxonomy in their broader implications are equally acceptable. All manuscripts should be double-spaced throughout. Please conform to the style of recent issues of the journal. Illustrations can be used only if the cost of engraver's blocks is met through the author or his institution. Forms may be closed five weeks in advance of publication. Extracted reprints, if ordered in advance, will be furnished at cost.**

**Address manuscripts and proofs to Albion R. Hodgdon,**
**Dept. of Botany, Nesmith Hall, University of New Hampshire, Durham, New Hampshire.**

**Subscriptions and orders for back issues (making all remittances payable to RHODORA) should be sent to RHODORA, Botanical Museum, Oxford Street, Cambridge, Mass. 02138.**

Second Class Postage Paid at Boston, Mass.

# Rhodora

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Vol. 69 January-March No. 777

## DIPLOID DRYOPTERIS DILATATA FROM QUEBEC

DONALD M. BRITTON

In eastern North America, ferns allied to *Dryopteris dilatata* (Hoffm.) A. Gray include *D. spinulosa* (O. F. Muell.) Watt (4×), *D. intermedia* (Muhl.) A. Gray (2×), *D. dilatata* (Hoffm.) A. Gray (2×) from the Lake Superior basin, and *D. campyloptera* Clarkson (4×) from the Appalachians. The last two are referrable to *D. spinulosa* var. *americana* (Fisch.) Fernald of Gray's Manual (Fernald, 1950). The distribution of *D. campyloptera* has been considered to be from high elevations in the mountains of North Carolina and Virginia in the south, north to Maine, Nova Scotia, the Gaspé Peninsula, Newfoundland, Labrador, Ungava (Fort Chimo) (Dutilly, Lepage and Duman, 1953), south along the east coast of Hudson's Bay and James Bay (Dutilly, Lepage and Duman, 1958; Dutilly and Lepage, 1963) to Mt. Sherrick (Potter, 1934), and Lake Kelvin (Dutilly and Lepage, 1963). Also, there have been a few collections in interior Quebec (Dutilly and Lepage, 1964). Cytological determinations of chromosome number have been made by Wagner (1963) from material collected at Mountain Lake, Virginia; Walker (personal communication) from material collected in Rutland Co., Vermont and Quebec Co., Quebec; Britton (1962) from Mt. Washington, N. H. and Britton (unpublished) from Yarmouth, Nova Scotia. These have all been tetraploid.

Diploid specimens are now well known from the Lake

Superior basin. I have studied cytologically nearly 100 plants from the Pigeon River on the Minnesota border of Ontario to Batchawana River which is approximately 50 miles north of Sault Ste. Marie, Ontario. The diploid taxon in Ontario was mapped by Soper (Britton and Soper, 1966). Wagner and Hagenah (1962) refer to this taxon as "Lake Superior '*D. dilatata*' " and suggest that it may be a distinct species, whereas I consider it to be conspecific with *D. dilatata* of British Columbia (Britton, 1962), which in turn is probably conspecific with the diploid *D. dilatata* of Great Britain, called *D. assimilis* S. Walker (Walker, 1961; Walker and Jermy, 1964).

The discovery in the Clay Belt of Quebec, near Amos, of a member of this alliance was reported by Morton in Baldwin *et al.* (1962). These were named by Morton, *D. dilatata* ssp. *campyloptera* (Baldwin, 1962; Morton, 1965). Through the kindness of Father André Asselin of Amos College, I was sent in 1965 two plants from Lac Beaudoin near Amos. These were both diploids, *not* tetraploid as one might expect from the published ranges given above. To study more plants of this taxon and to search for the tetraploid taxon, Dr. Hugh Dale and the author visited Amos in June. Under the able guidance of Father Asselin, we collected specimens from Lac Beaudoin, Lac Beauchamp and Lac Legendre. Twelve specimens of *D. dilatata* were studied cytologically and were diploid ($n=41$). No tetraploids were found, and no hybrids of *D. dilatata* were discovered, although *D. spinulosa*, *D. intermedia* and *D.* × *triploidea* were also abundant in the area.

Wagner and Hagenah (1962) have published a key to separate the diploid taxon from the tetraploid, but it is quite unsatisfactory for my material. According to them, the diploid has an average exposure length of 33-37 microns, whereas the range for averages of different tetraploids is 37-40 microns. Ten collections of the diploid from Lake Superior studied by this author had average values from 36-41 (average of lengths of 20 exospores in Permount) whereas the tetraploids from New Hampshire and Nova Scotia varied from 37-41. There was a cluster of values for different diploids around 37 and 38 microns, and one specimen was as high as 41.4. One tetraploid was as low as 37.4. Wagner (1963) reported a tetraploid which was as low as 35.9. Accordingly, it is impossible to separate the diploid from the tetraploid by average spore lengths alone.

The other characteristics in the key have also failed to separate the diploids from the tetraploids. Out of the first 30 collections of the diploid laid out at random on a laboratory bench, 17 were *not* "ovate and very broad", but matched the shape of some of the tetraploids. Nine did not have a petiole to midrib ratio approaching one to one ("average 95%, range 75-115%" Wagner and Hagenah, 1962). Sixteen did not have approximate to overlapping segments, and the petiole scales were variable in most. I know of no simple way to distinguish between the two taxa other than by chromosome number.

It will require further cytological work to determine the ploidy of the Quebec, Labrador, Gaspé and Newfoundland plants which have been referred to as *D. spinulosa* var. *americana* (Fisch.) Fernald. However, it is clear that the diploid which is allied to *D. dilatata* and which is so abundant along the north shore of Lake Superior, extends nearly 300 miles to the east. This is less than 100 miles south of Lake Kelvin, and is approximately 300 miles W. N. W. of Quebec Co., Quebec where the nearest tetraploid was collected. It may well be, that it is the diploid which extends up the coast of James Bay to the tree line at Fort Chimo in Ungava. If this is the case, the tetraploid may be the less common of the two taxa in Quebec. A further possibility is the occurrence of a region in Quebec where the diploid and tetraploid occur together.

The specimens collected by Morton (Baldwin *et. al.*, 1962; Morton, 1965) in the Clay Belt and ascribed to sub-species *campyloptera* (Clarkson) Morton should be identified as *Dryopteris dilatata*.

DEPARTMENT OF BOTANY,
UNIVERSITY OF GUELPH,
GUELPH, ONTARIO, CANADA.

LITERATURE CITED

BALDWIN, W. K. W., *et al.* 1962. Report on Botanical Excursion to the Boreal Forest Region in Northern Quebec and Ontario. Natl. Mus. of Canada, Dept. of Northern Affairs and National Resources, Canada.

BRITTON, D. M. 1962. *Dryopteris dilatata* (Hoffm.) A. Gray in North America. Rhodora **64:** 207-212.

__________ and J. H. SOPER. 1966. The cytology and distribution of *Dryopteris* species in Ontario. Canad. Jour. Bot. **44:** 63-78.

DUTILLY, A., and E. LEPAGE. 1963. Contribution à la flore du versant sud de la Baie James, Québec-Ontario. Contr. of the Arctic Inst., the Catholic Univ. of America, Washington, D.C. No. 12F, 1-199.

__________. 1964. Randonnée botanique à travers la péninsule Québec-Labrador. Le Naturaliste Canadien **91:** 197-240.

__________, and M. DUMAN. 1953. Contribution à la Flore du Bassin de la Baie d'Ungava. Contr. of the Arctic Inst., the Catholic Univ. of America. No. 4F, 1-104.

__________. 1958. Contribution à la flore des îles (T.N.O.)et du versant oriental (Qué.) de la Baie James. Contr. of the Arctic Inst., the Catholic Univ. of America. No. 9F, 1-199.

FERNALD, M. L. 1950. Gray's Manual of Botany, American Book Co., New York.

MORTON, C. V. 1965. Recent Fern Literature. Am. Fern Jour. **55:** 85-89.

POTTER, D. 1934. Plants collected in the southern region of James Bay. Rhodora **36:** 274-284.

WAGNER, W. H. JR. 1963. Pteridophytes of the Mountain Lake Area, Giles County, Virginia, including notes from Whitetop Mountain. Castanea **28:** 113-150.

__________ and D. J. HAGENAH. 1962. *Dryopteris* in the Huron Mountain Club area of Michigan. Brittonia **14:** 90-100.

WALKER, S. 1961. Cytogenetic studies in the *Dryopteris spinulosa* complex. II. Am. Jour. Bot. **48:** 607-614.

__________ and A. C. JERMY. 1964. *Dryopteris assimilis* S. Walker in Britain. Brit. Fern Gaz. 9(5): 137-140.

# TAXONOMIC FERN NOTES. V. NEW COMBINATIONS IN PERUVIAN SPECIES OF THELYPTERIS.

ROLLA TRYON

The following new combinations are made in order to have suitable names for the species of *Thelypteris* in Peru. Many of the Andean species of the genus that are widely distributed in tropical America have been transferred to *Thelypteris* by, among others, Ching, Morton, and Proctor. However, few of the strictly Andean species that properly belong in *Thelypteris* have been placed there. In addition to the basionym, the name in *Dryopteris* and sometimes other synonyms are given for purposes of reference or explanation.

**Thelypteris aspidioides** (Willd.), comb. nov.
*Ceterach aspidioides* Willd. Sp. Pl. **5**: 137. 1810.
*Dryopteris aspidioides* (Willd.) C.Chr. Ind. Fil. 253. 1905.

**Thelypteris assurgens** (Maxon), comb. nov.
*Dryopteris assurgens* Maxon, Jour. Wash. Acad. Sci. **34**: 24. 1944.

**Thelypteris Bangii** (C.Chr.), comb. nov.
*Dryopteris Bangii* C.Chr. Danske Vid. Selsk. Skr. VII, **4**: 333. 1907.

**Thelypteris biformata** (Rosenst.), comb. nov.
*Dryopteris biformata* Rosenst. Fedde Repert. **7**: 300. 1909.

**Thelypteris boqueronensis** (Hieron.), comb. nov.
*Dryopteris boqueronensis* Hieron. Hedwigia **46**: 329. 1907.

**Thelypteris coarctata** (Kze.), comb. nov.
*Aspidium coarctatum* Kze. Bot. Zeit. 1845: 287.
*Dryopteris coarctata* (Kze.) C.Chr. Ind. Fil. 258. 1905.

**Thelypteris consobrina** (Maxon & Morton), comb. nov.
*Dryopteris consobrina* Maxon & Morton, Bull. Torrey Club **65**: 356. 1938.

**Thelypteris deflexa** (Presl), comb. nov.
*Nephrodium deflexa* Presl, Rel. Haenk. **1**: 36. 1825.
*Dryopteris Lindigii* C.Chr. Ind. Fil. 275. 1905, *nom. nov.* for *N. deflexum* Presl; not *Dryopteris deflexa* (Kaulf.) C.Chr. 1905.
*Thelypteris Lindigii* (C.Chr.) Alston, Jour. Wash. Acad. Sci. **48**: 233. 1958.

**Thelypteris densa** (Maxon), comb. nov.
*Dryopteris densa* Maxon, Jour. Wash. Acad. Sci. **34**: 25. 1944.

**Thelypteris dumetorum** (Maxon), comb. nov.
*Dryopteris dumetorum* Maxon, Jour. Wash. Acad. Sci. **34**: 26. 1944.

**Thelypteris ensiformis** (C.Chr.), comb. nov.
*Dryopteris ensiformis* C.Chr. Danske Vid. Selsk. Skr. VII, **10**: 269. 1913.

**Thelypteris falcata** (Liebm.), comb. nov.
*Meniscium falcatum* Liebm. Danske Vid. Selsk. Skr. V, **1**: 183. 1849.
*Dryopteris falcata* (Liebm.) C.Chr. Danske Vid. Selsk. Skr. VII, **10**: 270. 1913; not *Dryopteris falcata* (L.f.) O.Ktze. 1891.
*Dryopteris Jurgensenii* (Fée) Maxon & Morton, Bull. Torrey Club. **65**: 360. 1938.

**Thelypteris furva** (Maxon), comb. nov.
*Dryopteris furva* Maxon, Jour. Wash. Acad. Sci. **34**: 24. 1944.

**Thelypteris gigantea** (Mett.), comb. nov.
*Meniscium giganteum* Mett. Fil. Lechler. 1: 19. 1856.
*Dryopteris gigantea* (Mett.) C.Chr. Ind. Fil. 267. 1905; not *Dryopteris gigantea* (Bl.) O.Ktze. 1891.
*Dryopteris simplicifrons* C.Chr. Ind. Fil. 486. 1906, *nom. nov.* for *M. giganteum* Mett.

**Thelypteris glandulosolanosa** (C.Chr.), comb. nov.
*Dryopteris glandulosa-lanosa* C.Chr. Dansk. Bot. Ark. **9** (3): 61. 1937.

**Thelypteris Herzogii** (Rosenst.), comb. nov.
*Dryopteris Herzogii* Rosenst. Meded. Rijks Herb. Leiden **19**: 15. 1913.

**Thelypteris Jamesonii** (Hook.), comb. nov.
*Nephrodium Jamesonii* Hook. Sp. Fil. **4**: 66. 1862.
*Dryopteris Jamesonii* (Hook.) C.Chr. Danske Vid. Selsk. Skr. VII, **10**: 227. 1913.

**Thelypteris laevigata** (Kuhn), comb. nov.
*Phegopteris laevigata* Mett. ex Kuhn, Linnaea **36**: 112. 1869.
*Dryopteris laevigata* (Kuhn) C.Chr. Ind. Fil. 273. 1905.

**Thelypteris Leprieurii** (Hook.), comb. nov.
*Nephrodium Leprieurii* Hook. Sp. Fil. **4**: 106. 1862.
*Dryopteris Leprieurii* (Hook.) O.Ktze. Rev. Gen. **2**: 813. 1891.

**Thelypteris leucothrix** (C.Chr.), comb. nov.
*Dryopteris leucothrix* C.Chr. Smiths. Misc. Coll. **52**: 377. 1909.

**Thelypteris Linkiana** (Presl), comb. nov.
*Grammitis Linkiana* Presl, Tent. Pterid. 209. 1836, based on the description of *Gymnogramma polypodioides* by Link, Hort. Bot. Berol. **2**: 50. 1833; not *Gymnogramma polypodioides* (Raddi) Spreng. 1827.
*Gymnogramma diplazioides* Desv. Mém. Soc. Linn. Paris **6**: 214. 1827, as *diplazoides*.
*Dryopteris diplazioides* (Desv.) Urban, Symb. Antill. **4**: 21. 1903; not *Dryopteris diplazioides* (Mett.) O.Ktze. 1891.
*Dryopteris Linkiana* (Presl) Maxon, Jour. Wash. Acad. Sci. **14**: 199. 1924.

*Thelypteris diplazioides* (Desv.) Proctor, Bull. Inst. Jamaica Sci. Ser. **5:** 59. 1953; not *Thelypteris diplazioides* (Moritz ex Mett.) Ching, 1936.

**Thelypteris longifolia** (Desv.), comb. nov.

*Meniscium longifolium* Desv. Mém. Soc. Linn. Paris **6:** 223. 1827.

*Dryopteris longifolia* (Fée) Hieron. Hedwigia **46:** 351. 1907, *illegit.*

*Dryopteris Desvauxii* Maxon & Merton, Bull. Torrey Club **65:** 369. 1938, *nom. nov.* for *M. longifolium* Desv.

**Thelypteris lugubriformis** (Rosenst.), comb. nov.

*Dryopteris lugubriformis* Rosenst. Fedde Repert. **7:** 299. 1909.

**Thelypteris Macbridei** (Maxon), comb. nov.

*Dryopteris Macbridei* Maxon, Jour. Wash. Acad. Sci. **34:** 25. 1944.

**Thelypteris macrotis** (Hook.), comb, nov.

*Nephrodium macrotis* Hook. Sp. Fil. **4:** 86. 1862.

*Dryopteris macrotis* (Hook.) O.Ktze. Rev. Gen. **2:** 813. 1891.

**Thelypteris membranacea** (Mett.), comb, nov.

*Phegopteris membranacea* Mett. Fil. Lechler. **2:** 22. 1859.

*Dryopteris membranacea* (Mett.) C.Chr. Ind. Fil. Suppl. 35. 1913.

**Thelypteris mollis** (Mett.), comb. nov.

*Phegopteris mollis* Mett. Ann. Sci. Nat. V, **2:** 242. 1864.

*Dryopteris permollis* Maxon & Morton, Bull. Torrey Club **65:** 372. 1938, *nom. nov.* for *P. mollis* Mett.; not *Dryopteris mollis* (Jacq.) Hieron. 1907.

**Thelypteris nemoralis** (Sod.), comb. nov.

*Nephrodium nemorale* Sod. Crypt. Vasc. Quit. 267. 1893.

*Dryopteris nemoralis* (Sod.) C.Chr. Ind. Fil. 279. 1905.

**Thelypteris nervosa** (Kl.), comb. nov.

*Polypodium nervosum* Kl. Linnaea **20:** 386. 1847; not *Polypodium nervosum* Boj. Hort. Maurit. 419. 1837, *nomen nudum.*

*Dryopteris nervosa* (Kl.) C.Chr. Ind. Fil. 279. 1905.

**Thelypteris nitens** (Desv.), comb. nov.

*Polypodium nitens* Desv. Mém. Soc. Linn. Paris **6:** 240. 1827.

*Dryopteris nitens* (Desv.) C.Chr. Danske Vid. Selsk. Skr. VII, **10:** 142. 1913.

**Thelypteris Pavoniana** (Kl.), comb. nov.

*Polypodium Pavonianum* Kl. Linnaea **20:** 386. 1847.

*Dryopteris Pavoniana* (Kl.) C.Chr. Ind. Fil. 283. 1905.

**Thelypteris peruviana** (Rosenst.), comb. nov.

*Dryopteris peruviana* Rosenst. Fedde Repert. **7:** 298. 1909.

**Thelypteris phacelothrix** (C.Chr. & Rosenst.), comb. nov.

*Dryopteris phacelothrix* C.Chr. & Rosenst. Fedde Repert. **11:** 56. 1912.

**Thelypteris pilosula** (Mett.), comb. nov.

*Aspidium pilosulum* Mett. Fil. Hort. Bot. Lips. 130. 1856, based on the description of *Aspidium lasiesthes* by Mett. *op. cit.* 90; not *Aspidium lasiesthes* Kze. 1850; not *Aspidium pilosulum* Wall. Cat. no. 337. 1829, *nomen nudum.*

*Dryopteris pilosula* Hieron. Hedwigia **46:** 332. 1907.

*Dryopteris pilosula* (Mett.) C.Chr. Danske Vid. Selsk. Skr. VII, **4:** 277. 1907.

The earlier publication of the name *Aspidium pilosulum* by Kunze, Linnaea **23:** 229. 1850, was without description. Accordingly, the "new combination" by Hieronymus in Dryopteris, with description, is actually a new name for a new species. Christensen's acceptable combination, then, becomes a later homonym.

**Thelypteris pteroidea** (Kl.), comb. nov.

*Polypodium pteroideum* Kl. Linnaea **20:** 389. 1847.

*Dryopteris pteroidea* (Kl.) C.Chr. Ind. Fil. 287. 1905.

**Thelypteris Rolandii** (C.Chr.), comb. nov.

*Dryopteris Rolandii* C.Chr. Danske Vid. Selsk. Skr. VII, **10:** 258. 1913.

**Thelypteris Rosei** (Maxon), comb. nov.

*Dryopteris Rosei* Maxon, Smiths. Misc. Coll. **65** (8): 10. 1915.

**Thelypteris Rosenstockii** (C.Chr.), comb. nov.

*Dryopteris Rosenstockii* C.Chr. Danske Vid. Selks. Skr. VII, **4:** 304. 1907.

**Thelypteris Rusbyi** (C.Chr.), comb. nov.

*Dryopteris Rusbyi* C.Chr. Smiths. Misc. Coll. **52:** 390. 1909.

**Thelypteris Standleyi** (Maxon & Morton), comb. nov.

*Dryopteris Standleyi* Maxon & Morton, Bull. Torrey Club. **65:** 368. 1938.

**Thelypteris subandina** (C.Chr. & Rosenst.), comb. nov.

*Dryopteris subandina* C.Chr. & Rosenst. Fedde Repert. **12:** 472. 1913.

**Thelypteris tristis** (Kze.), comb. nov.

*Polypodium triste* Kze. Linnaea **9:** 47. 1834.

*Dryopteris tristis* (Kze.) O.Ktze. Rev. Gen. **2:** 814. 1891.

**Thelypteris Warmingii** (C.Chr.), comb. nov.

*Dryopteris Warmingii* C.Chr. Danske Vid. Selsk. Skr. VII, **10:** 227. 1913.

GRAY HERBARIUM, HARVARD UNIVERSITY.

# A RECONSIDERATION OF SIDOPSIS RYDBERG AND NOTES ON MALVASTRUM A. GRAY (MALVACEAE)

David M. Bates

The monotypic genus *Sidopsis* was based by Rydberg (1932) on *Sida hispida* Pursh (1814). Although Rydberg erroneously cited Elliott (1822) as the author of *S. hispida,* Elliott, himself, clearly attributed the species to Pursh, leaving no doubt as to the correct authority of the binomial. Similarly, there is no doubt that Rydberg intended his genus to apply to a small, yellow-flowered annual of the midwestern and eastern United States, generally recognized either as *Malvastrum angustum* Gray (1849) or as *Sphaeralcea angusta* (Gray) Fern. (1939), for he cited Gray's name in synonymy, and his description certainly applies to that species. Though Rydberg's intention is clear, the fact that he chose to base his genus on *S. hispida* creates a problem, for Pursh's species has not been typified nor has there been agreement on its identity, and consequently the status of *Sidopsis* is questionable. It is doubtful whether this problem will ever be solved to everyone's satisfaction, since type material apparently has not been preserved; however, taking all facets of the problem into consideration, it is possible to arrive at a reasonable determination of *S. hispida.* Irrespective of the nomenclatural disposition of *S. hispida* and in turn that of *Sidopsis,* there is the question of whether or not the species to which Rydberg applied his name deserves generic recognition.

Pursh described *S. hispida* in the following manner: "S. hispido-pilosa; foliis lanceolatis serratis, pedunculis solitariis axillaribus longitudine petiolorum, calyce exteriore filiformi. In sandy plains of Georgia. *Lyon* *v.s. in Herb. Lyon.* Flowers yellow." Consideration of Pursh's entry involves several factors, the first being its applicability to Malvaceae of the eastern United States, for though both the collector and the site of the type collection have been questioned, there seems little doubt that the collection must have been taken from the eastern or at most midwestern regions of the country. The comparison of Pursh's description with that which I have drawn from collections of *M. angustum* reveals no serious discrepancies. *Malvastrum angustum* is copiously but not conspicuously pubescent with rather coarse, stiff, mostly appressed hairs. If the term "pilose" is taken in the sense of denoting open-hairiness, as it may be, then *M. angustum* may be characterized as hispid-pilose. The leaves of *M. angustum* are often lanceolate although they tend, in general, to be linear to narrowly oblong-lanceolate. Likewise they are serrate, remotely so, with only four to six serrations on either margin. The flowers are solitary in the axils, but, as in many Malvaceae, they often appear glomerate on greatly reduced axillary branches. The presence or absence of these axillary branchlets may only be a reflection of the age and/or vigor of the plants and not an indication of genetic differences. In any event, collections of *M. angustum* have often been made that have only solitary, primary axillary flowers. The pedicels of this species, however, are usually shorter than, rather than equal to, the subtending petiole — at least at anthesis — but in fruit they often exceed the petiole slightly. The involucral bracts are filiform and the corollas are yellow. Finally, Pursh described *S. hispida* as a perennial, whereas, *M. angustum* is certainly an annual, but the distinction between annual and perennial duration is often not easily made, and the rather ligneous character of the lower stems may have been misleading.

Besides the description itself, a further characterization of *S. hispida* is implied by Pursh's inclusion of it in the genus *Sida* L. rather than in *Malva* L. During Pursh's time these genera were distinguished primarily by the presence or absence of involucral bracts, these being present in *Malva* and absent in *Sida*. Even today this is a valid difference with the few exceptions which for other reasons are not pertinent to this discussion. Pursh must have been aware of this difference; he cited, as the basis of his genera, Schreber's edition of Genera Plantarum (1791) where this distinction was clearly made. It can only be assumed that in aspect Pursh's plant was so *Sida*-like that he chose to emphasize this feature rather than the presence of involucral bracts in assigning it to a genus. This is further brought out by Pursh's placement of *S. hispida* between *S. spinosa* L. and *S. rhombifolia* L., species which may be considered representative of the mean expression of the genus.

Among the North American species of Malvaceae, only those of the genus *Malvastrum* Gray (1849), as I shall define it below, exhibit both this *Sida*-like aspect and fit Pursh's description in other respects. It is from among these that *S. hispida* must be sought. Besides *M. angustum*, five other species of *Malvastrum* occur in the United States. Two of these, *M. aurantiacum* (Scheele) Walp. and *M. bicuspidatum* (S. Wats.) Rose, are found only west of the Mississippi and probably do not need to be considered. Nevertheless, they may also be eliminated on morphological grounds: both have broadly ovate leaves, and the former has stalked, deltoid-ovate involucral bracts, while the latter has dense, canescent pubescence. The other three species are confined to southern regions of Florida and Texas but may occasionally be found in coastal regions of the Gulf Coast. They occur south of the probable collection site of *S. hispida*, but, because of their weedy nature, it is not inconceivable that sometimes they might be carried further north. The leaves of all three species are predominantly ovate to broadly ovate and only rarely, in the inflorescence, might they be termed lanceolate. One, *M. americanum* (L.) Torr., has in addition dense, elongate, spicate inflorescences which are at variance with Pursh's characterization. The other two species, *M. coromandelianum* (L.) Garcke and *M. corchorifolium* (Desr.) Britton ex Small, although amply distinct from *M. angustum*, can be distinguished from it with respect to Pursh's description only on the basis of the leaf conformation. It seems unlikely, however, that Pursh would have redescribed *M. coromandelianum*, for that species was already well known (as *Malva tricuspidata* Aiton). In any event, a consideration of the problem on a purely morphological basis demonstrates that *S. hispida* corresponds more closely to *M. angustum* than to any other species of *Malvastrum*.

Other questions pertinent to the problem of identity of *S. hispida* concern the geographical area of the type collection and the identity of the collector. Both have been questioned (Kearney, 1950; Ewan and Ewan, 1963), largely because no species answering the description of *S. hispida* has been collected in Georgia. I have not seen any specimens nor am I aware of any reports of *M. angustum, M. coromandelianum,* or *M. corchorifolium* from either the Carolinas or Georgia. Further, Professor Wilbur H. Duncan of the University of Georgia has informed me that he has no record of any of these species from Georgia. It would appear, whether or not *S. hispida* and *M. angustum* are actually synonymous, that *S. hispida* was not collected in Georgia, at least as it is presently bounded. If they are synonymous, then it is also unlikely that the collection was made in "sandy plains," for *M. angustum* is primarily adapted to dry, limestone barrens. Ewan and Ewan (1963), accepting *S. hispida* and *M. angustum* as the same, suggested that Aloysius Enslen and not John Lyon was responsible for the type collection. Enslen's collections, taken through Georgia and lower Louisiana, were thought more likely to include *S. hispida* than those of Lyon. But the Enslen herbarium in the Naturhistorisches Museum, Vienna, does not include any specimens of *S. hispida,* according to the information kindly supplied to me by Mr. Kurt Fitz of that institution, nor are any species of *Sida* included in a handwritten catalogue of 1822 enumerating the Enslen collections.

Perusal of John Lyon's Journal (Ewan and Ewan, 1963) shows that he had the opportunity to collect *M. angustum,* and there is therefore, no compelling reason to credit the collection to another. In the summer of 1803 Lyon crossed the Chattahootchee River near what is now Columbus, Georgia, and journeyed westward to Tuckaubatchee on the Tallapoosa River. This locality is now in Alabama but in 1803 was still part of Georgia. These travels took Lyon just south of Tallapoosa County where Mohr (1901) reported a collection of *M. angustum* taken by E. A. Smith in August 1873 from the central pine belt. Lyon, himself, reported of his travels on August 20th, the day before reaching Tuckabatchee, that he "proceeded along a high, dry barren ridge in the forepart of the day." Certainly both the area and the habitat were favorable for a collection of *M. angustum* (and in "Georgia," no less). Perhaps a more likely site for the type collection, however, was in the vicinity of Nashville, Tennessee, an area where *M. angustum* has been collected rather commonly. Lyon visited this region in 1807 and again in 1809 and in both instances had ample opportunity to collect this species. With respect to the only other possibility, *M. coromandelianum,* it is evident that Lyon's travels were entirely to the north of its natural range. Except for the remote probability of Lyon's happening upon a chance introduction, it is impossible for him to have collected it.

The consideration of evidence now available permits one of two choices. Either *S. hispida* may be accepted as the same as *M. angustum,* or it may be treated as a dubious name. Although Gray (1849), probably following Hooker (1834), originally felt that these two names might apply to the same species, he later (1897) changed his mind and excluded *S. hispida* from *M. angustum.* Fernald (1939) likewise rejected the two names as being synonymous, stating, "In view of the complete doubt about the identity of *Sida hispida* Pursh, which antedated Elliott by seven years and which was presumed by the latter author to be his plant [It could not have been, for Elliott clearly had a species of *Sida.*], it is quite unwise to force upon the plant of dry barrens and hills of the Mississippi basin the name of an unidentified plant of Georgia and possibly South Carolina. I am, therefore, retaining for the plant of the Mississippi basin the first name which unquestionably belongs to it. If and when Pursh's type is found and positively identified with *Sphaeralcea angusta* [Fernald made the transfer from *Malvastrum* to *Sphaeralcea* for nomenclatural, not taxonomic, reasons as will be brought out below] Pursh's name will be justified; at present its use would be questionable." It is unlikely, however, that *Sida hispida* will ever be typified, for Lyon's herbarium apparently has not been preserved and the few extant collections which can be attributed to him do not include this species; thus, there will always be grounds for rejecting *S. hispida* if one is disposed to do so. I feel, however, that the evidence available is strong enough so that one may state with reasonable certainty that *S. hispida* and *M. angustum* have been applied to the same species. If one accepts the premise that the type collection was not made in Georgia proper, and this seems logical in view of the fact that no species answering the description of *S. hispida* is known from that state, then there is no obstacle in accepting these names as synonymous. On a morphological basis they correspond more closely than any of the other possibilities discussed, and the known travels of John Lyon put him in a favorable position to make the type collection. The question then turns to the generic disposition of the species. For reasons which will be summarized below, I prefer to recognize it in *Malvastrum*, as *M. hispidum* (Pursh) Hochreutiner, rather than in *Sidopsis* or some other genus.

In 1849 Gray proposed a number of generic changes in the Malvaceae, among them the establishment of *Malvastrum*, erected largely to provide a clearer distinction between *Sida* and *Malva*. Although Gray was successful in giving both *Sida* and *Malva* more precise definition, his description of *Malvastrum* was vague and the genus rapidly became a repository for diverse elements with little in common except carpels with solitary, ascending ovules, style branches equal in number to the carpels with capitate rather than decurrent stigmas, and, in general, an involucre of three bracts. Even at its inception *Malvastrum* included representatives of at least three genera. Of the eight species enumerated by Gray, the first three, *M. coccineum* (Pursh) Gray, *M. munroanum* (Dougl.) Gray, and *M. grossulariaefolium* (Hook. and Arn.) Gray, belong to *Sphaeralcea* St. Hil.; the fourth, *M. fremontii* Torr. ex Gray, to *Malacothamnus* Greene; and the last, *M. angustum*, if considered distinct, to *Sidopsis*. The remaining three belong to *Malvastrum* sensu stricto. In subsequent years many species, principally from the Americas, were added, and occasionally from this large complex small genera were segregated, e.g., *Tarasa* Phil., *Urocarpidium* Ulbr., *Malacothmanus* Greene, and *Eremalche* Greene. In general, these gained little recognition until Kearney (1935, 1951, 1955) and more particularly Krapovickas (1951, 1954, 1957a, 1957b) were able to show, largely through a correlation of chromosome numbers and morphology, with emphasis on carpel characters, the validity of recognizing additional genera in what had been considered *Malvastrum*. Their redefinition of *Malvastrum* restricted it to about twelve species which, except for the now ubiquitous *M. coromandelianum* and *M. americanum*, are found only in the Americas. I would restrict *Malvastrum* even further and remove from it *M. lacteum* (Ait.) Garcke and *M. subtriflorum* (Lag.) Hemsley. This concept of *Malvastrum* has left many species formerly included in the genus in taxonomic limbo, and this rather considerable residue presents many interesting problems. I am currently preparing a monograph of the South African species previously referred to *Malvastrum*, as well as a short paper giving generic recognition to *M. lacteum* and *M. subtriflorum*. There remain, however, the acaulescent species from the Andes and a miscellaneous assemblage of species, principally from South America, that require individual evaluation.

Even in a restricted sense, however, *Malvastrum* is not free from problems, for it has not been typified properly to preserve its usage. *Malvastrum* was conserved over the South African *Malveopsis* Presl, and the lectotype chosen by Miss Green (1935) was *M. coccineum*. But as I have pointed out above, *M. coccineum* is a *Sphaeralcea*, and therefore, *Malvastrum* is a nomenclatural synonym of *Sphaeralcea* when so typified. It was on this basis and not for taxonomic reasons, that Fernald (1939) transferred *M. angustum* to *Sphaeralcea*, for there is no doubt that *Malvastrum* and *Sphaeralcea* are generically distinct. Nevertheless, if the lectotype is not changed, a new name must be found for those species still referred to *Malvastrum*.

Kearney (1947, 1955) recognized this and suggested that *M. coromandelianum* should be selected as the lectotype. In this conclusion he has been supported by Krapovickas (1957b) and Borssum Waalkes (1960). To my knowledge such a proposal has never been formally submitted to the General Committee, but, for reasons I shall elucidate in a forthcoming note, I doubt that *M. coromandelianum* can be accepted as the lectotype. Fortunately, there is an alternative solution which I believe is acceptable and which will preserve the usage of *Malvastrum*; and I am therefore continuing to use the name. Interestingly, this whole problem would not have arisen if more thought and effort had been given to working out the identity of *Malveopsis*. Having reviewed the pertinent references and available herbarium material, I am convinced that *Malveopsis*, based on *Malva anomala* Link and Otto, may be regarded as a synonym of *Anisodontea*, Presl, a name I am reviving for those South African species previously referred to *Sphaeralcea*.

Perhaps the most serious handicap in attempting to delimit and to evaluate genera and their relationships within the tribe Malveae is the absence of adequate descriptions at both a specific and generic level. Considering the redefinition of *Malvastrum*, it seems appropriate to include here an adequate working description of the genus before discussing briefly the relationships of the species included in it. I have incorporated in this description data from my description of *M. hispidum*, but, as will be evident from the discussion of this species' relationship to other species of the genus, this does not greatly extend the perimeters of *Malvastrum*.

**Malvastrum** Gray, Mem. Am. Acar., ser. 2, 4: 21. 1849.

*Sidopsis* Rydberg, Fl. Pr. Pl. Centr. N. Am. 541. 1932.

Annual or perennial herbs or subshrubs, generally less than 1 (-2.5) m. tall, the branches spreading or erect; variously pubescent, the hairs simple or stellate, often pustular-based and generally with few radiate or appressed arms. Leaf blades mostly 1.5-9 cm. long, linear-lanceolate to oblong, lance- or deltoid-ovate, unlobed or obscurely 3-lobed, acute or sometimes obtuse, crenate to serrate, subcordate, truncate, or cuneate, ventrally plane or with nerves impressed, glabrate to copiously pubescent, dorsally with nerves generally raised, more densely pubescent; petioles mostly shorter than the blades; stipules 3-9 (-14) mm. long, filiform or subulate (or asymmetrically oblong-ovate), often caducous or drying early. Flowers axillary and/or terminal, solitary, in cymose clusters, or in dense spikes, sometimes conspicuously bracteated, erect at anthesis and in fruit, opening briefly in the late morning or early afternoon. Involucral bracts 3, spreading or appressed, mostly free or only basally adnate to the calyx tube, filiform to narrow-lanceolate or oblanceolate, 3-8 mm. long, but sometimes elliptic-ovate, then 7 $\times$ 3.5 to 10 $\times$ 5 mm. long and broad, or stalked and with an abruptly expanded, deltoid-ovate blade, 4-7 mm. long, up to 4.5 mm. broad. Calyx generally angled or winged in bud, often hispid, 4-7 (-11) mm. long at anthesis, to 10 (-14) mm. long in fruit, often drying brown, scarious, the lobes 2.5 $\times$ 2 to 7 $\times$ 5 mm. long and broad, deltoid to cordate-ovate, acute or acuminate, principal nerves 3; nectaries 5, free, usually obscure. Corollas yellow to orange-yellow, mostly scarcely exceeding the calyx; petals 3 $\times$ 2 to 9 $\times$7 (to 15 $\times$ 11) mm. long and broad, obovate, at the apex slightly oblique, shallowly emarginate, narrowed evenly to a non-auriculate base, glabrous except for few spreading hairs along the basal margin or at the union with the staminal column. Staminal column yellowish, included, up to 3 (-6) mm. long, glabrous or puberulent at the base between the petals; filaments terminal or arising over the upper 1 mm. or so, to 1 (-2) mm. long; anthers 5 to ca. 36 (-51), yellowish then reddish after dehiscence. Style branches 5-16, exserted and recurved within the anthers before or at anthesis; stigmas capitate, expanded, papillate. Carpels as many as the style branches, free from one another in a flat whorl about a central columella, each with a single, ascending ovule. Fruit exposed or clasped by the calyx, 3-10 mm. in diameter, reddish-brown or tan, sometimes glabrous but generally with few to many, erect, simple or bifurcate, hispid hairs and often with stellulate pubescence as well; mature carpels varying from ca. 1 $\times$ 1 to 4.5 $\times$ 4.5 mm. long and broad, angular-orbicular to transverse-elliptic in outline, laterally compressed, armed or unarmed, the lateral edge rounded or sharp, sometimes raised in a slight wing or prolonged dorso-apically into ascending, horizontal or deflexed, laterally flattened knobs or spines, the lateral walls often fused ventro-apically and sometimes forming an indehiscent or partially dehiscent erect knob or spine, smooth below or with a raised, transversely radiate pattern of thickenings, the dorsal wall often canaliculate; carpels indehiscent, partially dehiscent along the midvein basally, or completely dehiscent into two free valves, glabrous within, with or without a small ventro-apical endoglossum. Seeds 0.9 to 2.8 mm. long, asymmetrically to nearly symmetrically reniform, glabrous, black or reddish-brown or -black. Chromosome number, $n = 6, 12, 18$.

It is difficult to estimate how many species *Malvastrum* actually comprises, for the species or species-complexes included in it have not been carefully studied. The above description has been drawn principally from notes made during my tenure as a National Science Foundation Postdoctoral Fellow at the British Museum (Natural History) and the Royal Botanic Gardens, Kew. My primary purpose at that time was to attempt to estimate generic variation within the Malvaceae tribe Malveae, and although such a survey naturally involved observations of a great number of species, its orientation was not that of monographic work at a specific level, and therefore was not particularly occupied with delimiting species. On the other hand, such a survey could not help but lead to conclusions concerning the constitution of genera. In the case of *Malvastrum,* it seems that the species, on the basis of morphological comparisons, conveniently fall into four groupings or series.

The largest of these series in terms of apparent number of species, and for this reason perhaps to be considered the modal expression of the genus, includes the following species; *M. coromandelianum* (L.) Garcke [*M. tricuspidatum* (Ait.) Gray], $2n = 24$ (Skovsted, 1935, 1941, Krapovickas 1949, 1951, 1954, Roy & Sinha 1961); *M. corchorifolium* (Desr.) Britton ex Small [*M. rugelii* S. Wat.]; *M. americanum* (L.) Torr. [*M. spicatum* (L.) Gray], $2n = 24$ (Skovsted, 1935, 1941, Krapovickas, 1951, 1954); *M. interruptum* K. Schumann, $2n = 36$ (Krapovickas, 1954); and *M. spiciflorum* (Hassler) Krapov., $2n = 12$ (Krapovickas, 1954). Morphological differences within this series are associated primarily with the character of the inflorescence, pubescence, and size and ornamentation of the carpels, but within this grouping there is a continuity of expression largely expressed in the modal values given in the generic description. *M. corchorifolium* probably should not be recognized at a specific level, for it differs from *M. coromandelianum* only in having carpels that are spineless or essentially so. Throughout the Caribbean islands, numerous forms occur with varying spine development so that any line drawn between the two species is quite arbitrary. A difference of similar magnitude separates *M. americanum* and the Argentinian *M. interruptum.* In the former the spikes are naked and the flowers are subtended by bifid bracts, whereas in *M. interruptum* the inflorescences are leafy and the bracts are in pairs. Cytologically, however, these two species are distinct, *M. americanum* being tetraploid and *M. interruptum* hexaploid.

Within this series the only diploid species of the genus has been reported: *M. spiciflorum* endemic to Argentina. Except for the fact that chromosome numbers of all species of the genus are apparently based on the number 6, nothing is actually known of the cytological relationships among them, though it may be predicted that some genomic duplication must exist. On morphological grounds there seem to be no stronger correlations between species at a given ploidy level than between species at different levels, and certainly it would be unwarranted at this time to speculate on phylogenetic relationships on the basis of the few counts available. Nevertheless, it seems improbable that the diploid *M. spiciflorum,* notable for its extremely small, unarmed carpels, reduced number of stamens, and small floral parts, is ancestral to any of the known species.

The other series include species which vary from this modal grouping in a few conspicuous characters, but in no case do they become so extreme as to suggest that further generic segregation might be called for. One of these series comprises the North American (Texas) *M. aurantiacum* (Scheele) Walp. [*M. wrightii* Gray] and the South American (Bolivia, Paraguay, Argentina) *M. amblyphyllum* R. E. Fries, $2n = 24$ (Krapovickas, 1954). These species are distinctive primarily in their large floral parts and fruits. In *M. amblyphyllum* the involucral bracts may be linear-lanceolate but sometimes are elliptic-ovate, whereas in *M. aurantiacum* the bracts are stalked, with an abruptly expanded blade. In both species the bracts nearly equal the calyces, which even in flower are often 10 mm. long. Similarly, the petals are larger and the anthers more numerous. The carpels vary from 3.5-4.5 mm. long and broad, each with two dorso-apical projections and a spinescent and fused ventral region. The flowers are mostly solitary in the axils, but in *M. amblyphyllum* may reach three in number on reduced axillary branchlets. Despite a rather high degree of similarity in conspicuous characters, it is probable that this series does not represent a natural alliance. In general aspect, particularly in the actual conformation of the carpels, *M. amblyphyllum* seems to tie in with the *M. coromandelianum* series, whereas it is more difficult to relate *M. aurantiacum* to any of the other species in particular.

The third series may be designated the *M. scoparium* series, for this was the first species named in a complex of species or forms running from western North America (Arizona) to Bolivia and Peru and the Galápagos Islands. Besides *M. scoparium* (L'Hér.) Gray, names most commonly encountered which belong to this complex are *M. bicuspidatum* (S. Wats.) Rose, *M. guatemalense* Standl. and Steyerm., *M. scabrum* (Cav.) Gray, *M. depressum* (Benth.) Svenson, *M. dimorphum* J. T. Howell, *M. scoparioides* Ulbr., and *M. guaraniticum* Hassler. It is difficult to suggest where species lines ought to be drawn in this series, but it may not be amiss to suggest that all should be included under *M. scoparium* with the major variants, if they can be shown to have geographical continuity, recognized at a subspecific level. This series of forms has as its unifying characteristic a carpel conformation in which there are two dorso-lateral spines projecting outward in more or less horizontal fashion with a deep acute sinus between them. Ventro-apically there may be no projection or a small to quite prominent awn. Variation in the prominence of the awns or spines and considerable differences in pubescence (for the most part an unreliable taxonomic criterion in the Malveae) as well as some miscellaneous differences, such as the length of the petals or number of flowers in the inflorescence, have formed the basis for recognizing most of the species.

Skovsted (1935) reported for *M. scoparium* a chromosome number of $2n = 24$, but later (1941), for *M. scabrum*, a species of the same complex, reported $2n = 42$. I have examined voucher material of *M. scoparium*, kindly lent by

Dr. Skovsted of the Botanical Museum and Herbarium, Copenhagen, and it is correctly determined. Unfortunately there is no material of *M. scabrum*, but there is little doubt that the identification was erroneous and was probably only that under which the species was received as seed from the botanical garden in Bucharest. Not only is the count at variance with all others reported in the genus, but the illustration of the mitotic complement presented by Skovsted (1941) is at variance with those which he and, later, Krapovickas (1954) have given for other species of *Malvastrum*. Skovsted (1941) also pointed out that species of *Malvastrum* with 24 somatic chromosomes (the only true species of *Malvastrum* which he had) are distinctive cytologically. Not only are the chromosomes distinct in their size and shape, but also they are arranged in irregular but characteristic fashion during mitosis. It is more than likely that in this case "*M. scabrum*" was actually a species of *Malva*. The number $2n = 42$ is common in that genus, and the comparison of illustrated karyotypes shows them to be remarkably similar.

The last series to be considered includes only *M. hispidum*. Rydberg's description of *Sidopsis* in his floristic account of the plains and prairies of central North America was brief and included no discussion of the reason for providing this species with generic recognition. He did note in his description, however, the completely dehiscent nature of the carpels. Kearney (1951) stressed this character, together with the *Sida*-like aspect of the species, to maintain it as generically distinct. *Sidopsis*, however, is not the only genus of Malveae characterized by ascending ovules in uniovulate, completely dehiscent carpels. Others are *Malacothamnus* Greene, *Tarasa* Phil., and *Nototriche* Turcz. The first of these belongs to a phylogenetically distinct alliance (Bates, 1963) including *Phymosia* Desv. and *Iliamna* Greene, with a base chromosome number of $x = 17$; *Tarasa* and *Nototriche* belong to a series of genera including among others *Sphaeralcea* St. Hil., *Urocarpidium* Ulbr., and *Eremalche* Greene, with a base number of $x = 5$. In these generic groupings it is not simply the mode of carpel dehiscence which delimits genera. Admittedly, the nature of carpel dehiscence is a useful diagnostic feature, but, in fact, these are natural genera differing from one another in many characters of somewhat more subtle nature. It is probable that carpel characters, in general, have been accorded greater importance than they deserve in classification of the Malveae. This certainly has been the case in *Sidopsis*. In carpel characteristics *M. hispidum* differs from other species of the genus only in having a smaller number — 5-6 instead of (7-) 8 (-16) — and complete dehiscence. Variation in carpel numbers is often greater in other related genera, and in *Sida* there is a similar pattern with some species 5-carpellate but most 7- or more-carpellate. Similarly, the mode of carpel dehiscence loses much of its importance in view of the nearly complete dehiscence in *M. americanum*. The carpels of this species dehisce along the midvein from the ventro-basal junction with the columella around the dorsal wall and nearly to the ventro-apical junction. Here, however, dehiscence is stopped by a slight fusion of the valves. In what forms a genus of remarkable uniformity, there seems no justification for emphasizing these slight carpellary differences, (better reflective of specific limits), to maintain *Sidopsis* as distinct from *Malvastrum*.

With the exception of the fruiting characters only the narrow leaves of *M. hispidum* actually broaden the limits of *Malvastrum*, but these correspond to the basic unlobed pattern common to all species. In addition, *M. hispidum* shares with other species particular characteristics, such as the unusual 4-armed hairs of *M. coromandelianum*, or with all species a similar pattern of floral structure and probably floral behavior. Although I have had the opportunity of observing only *M. coromandelianum*, *M. americanum*, and *M. hispidum* in a living state, there is every reason to believe, considering the relationship of style branches and anthers at or just before anthesis, that autogamy is the commonest form of reproduction in the genus. It certainly is in the above three species. In fact, *M. hispidum* is often cleistogamous and the other species may be functionally so, for even before the flower opens, in the late morning or early afternoon, the pollen has been shed and has coated the stigmas.

Besides a high degree of morphological similarity to other species of *Malvastrum, M. hispidum* shares the same base chromosome number. Counts have been made from microsporocytes of bud collections made in Kentucky *(Bates 2704)*, Missouri *(Bates 2688, 2690, 2691)*, and Kansas *(Bates 2702)*. Localities for these collections are listed in the citation of specimens and voucher material is deposited in the L. H. Bailey Hortorium. In all cases, $2n = 36$. At metaphase pairing was complete, and segregation in anaphase 1 showed no abnormalities. This is the second hexaploid reported in *Malvastrum*; however, *M. hispidum* and *M. interruptum* are distinct morphologically and quite likely have been derived independently.

The description of *M. hispidum* following has been drawn primarily from collections made during the summer of 1965. These collections, in themselves, provide a reasonable sampling of the species through most of its range, but have been supplemented by examination of dried specimens from the following herbaria: the L. H. Bailey Hortorium and the Wiegand Herbarium, Cornell University; the Gray Herbarium, Harvard University; the Herbarium, University of Illinois; the Royal Botanic Gardens, Kew; the British Museum (Natural History); and the Botanischer Garten und Institut für Systematische Botanik der Universität Zürich. To those who permitted me to examine material in their care, I wish to express my appreciation.

**Malvastrum hispidum** (Pursh) Hochr., Ann. Conserv. Jard. Bot. Genève **20:** 129. 1917.

*Sida hispida* Pursh, Fl. Amer. Sept. 452. 1814.

*Malvastrum angustum* Gray, Mem. Am. Acad., ser. 2, **4:** 22. 1849.

*Malva perpusilla* Nutt. ex Gray, loc. cit., pro syn.

*Malveopsis hispida* (Pursh) Kuntze, Rev. Gen. Pl. **1:** 72. 1891.

*Sidopsis hispida* (Pursh) Rydb., Fl. Pr. Pl. Centr. N. Am. 541. 1932.

*Sphaeralcea angusta* (Gray) Fern., Rhodora. **41:** 435. 1939.

Erect, annual herbs 1.5-4.5 (-6) dm. tall, simple or branched, the branches ascending, arising from near but not at the base, progressively shorter distally, rarely exceeding the leader; stems and branches slender, terete, greenish distally, generally reddish-brown proximally, copiously pubescent with appressed, mostly 4- (rarely 6-) armed hairs, the arms to 0.75 (-1.2) mm. long, generally in subparallel pairs oriented parallel to the long-axis of stems and branches. Leaf blades yellowish-green, up to 5.5 cm. long × 1.3 cm. broad, linear to narrow-oblong or lanceolate, the apex acute or obscurely mucronate, the base cuneate to narrow-obtuse, the margins usually with 4-6 pairs of evenly spaced, bristle-tipped serrations, rarely subentire, the nerves 1-3 from the base, the surfaces plane, mostly inconspicuously appressed-pubescent above and below, the hairs 4-armed above, 4-7-armed below, simple to 4-armed marginally; petioles generally less than 1/3 the length of the blades; stipules spreading, 2-7 mm. long, narrow-subulate to filiform, simple-ciliate, drying and turning brownish early. Flowers erect at anthesis and in fruit, solitary in the axils but sometimes glomerate, especially distally, by the reduction in internode length; pedicels erect, mostly less than 10 mm. long at anthesis, to 17 mm. long and finally patent in fruit. Involucral bracts 3, free, (2.6-) 4-6.8 mm. long, filiform, linear, or very narrow-subulate, mostly thickened with a slight groove ventrally, dorsally hispid with simple to 2- or 4-armed hairs, in fruit becoming brownish, reflexed. Calyx at anthesis (2.8-) 4.3-7.2 mm. long, in fruit 9-12.5 mm. long, copiously hispid with sessile, appressed, 4-6-armed hairs, the lobes in bud through fruit plicate-winged at the margins, overhanging the whitish tube, (1.2-) 2.8-5.8 mm. long × (1-) 2-5.8 mm. broad at anthesis, 8-10 mm. long × 8-12 mm. broad in fruit, (narrowly to) broadly cordate-ovate, abruptly acuminate to subcuspidate, marginally simple- or bifurcate-ciliate, puberulent within, the tube glabrous within with 5 obscure nectaries at the base opposite the lobes; drying brown and scarious. Corolla included within or slightly exceeding the calyx, the petals yellow, 2.8 × 1.5 to 4.5 × 3.2 mm. long and broad, obovate, obliquely shallow-emarginate apically, gradually cuneately narrowed to a non-auriculate base, but sometimes with a few simple, hispid hairs along the basal margins. Staminal column shorter than the petals, ca. 2-3 mm. long, yellow, glabrous or glabrate, the filaments to 0.5 mm. long, terminal; anthers 8-13 (-16), bright yellow. Ovary composed of 5 (-6) free carpels in a flat whorl, each with a single ascending ovule. Style to 4 mm. long, glabrous, the branches as many as the carpels (occasionally a branch may be bifurcate at the apex), recurved within the anthers before or at anthesis; stigmas capitate, papillate, yellow. Fruit 5.6-7.6 mm. in diam. in a star-like whorl with broad, deep sinuses between adjacent carpels. all free surfaces copiously pubescent with sessile, erect, simple or bifurcate hairs, often with a reddish base, these at the apex up to 1 mm. long; carpels yellowish- to reddish-brown, 2.6 × 2.6 to 3 × 3.5 mm. long and broad, more or less orbicular but the base often truncate, laterally compressed with rounded lateral edges, plane without lateral venation; midvein present; smooth within, lacking an endoglossum; loculicidally dehiscent, from the ventro-apical and -basal edge to the dorsal edge, into two free valves. Seeds 2.1 × 2 to 2.5 × 2.5 mm. long and broad, rounded and nearly symmetrically reniform, glabrous, reddish-black or sometimes grayish. Chromosome number, $n = 18$.

TYPE. In the absence of authentic Lyon material, Pursh's description (1814) may serve as type.

DISTRIBUTION. East of the Mississippi *M. hispidum* occurs in Kentucky, Tennessee, and Illinois and has been reported from Tallipoosa County, Alabama (Mohr, 1901). In Kentucky it has been collected just southwest of Lexington, and in Tennessee seems to be confined to the area about Nashville. It has not been collected since before the turn of the century in Illinois (Jones & Fuller, 1955) but at that time was found in northern regions of the state about Ottawa and Rock Island. To the west of the Mississippi the species is found in its greatest concentration in Missouri and eastern and central Kansas. To the north it reaches Iowa, but I have seen records only for the immediate vicinity of the Mississippi, and although it is reported from Nebraska (Steyermark, 1963, among others) I have not seen any collections actually made there. To the south of Missouri it may be found in the Ozarks of northern Arkansas, and it has been collected south of Oklahoma City, Oklahoma. This latter area is just to the north of the Red River where Nuttall is reported by Gray (1849) to have collected the species.

Throughout its range *M. hispidum* is exceeding local. Although populations may consist of dense stands, most of those which I have seen could be included in a few square meters. The largest population observed, *(Bates 2672)* which in fact consisted of a number of sub-populations, could be bounded by a square with sides about twenty meters. With the exception of my collection (2700) in southeastern Kansas where I found this species growing in clay-loam, all were taken in areas about limestone outcrops, either in crevices of the outcrops themselves or in soils (often cherty) overlying them. It seems that this type of habitat is most common to the species, although Steyermark (1963) reported it may occasionally be found in "open alluvial ground in valleys, and along gravel bars." It is probable that *M. hispidum* is only adventive in such habitats.

REPRESENTATIVE SPECIMENS. KENTUCKY. Jessamine Co.: High Bridge, dry limestone soil along roadsides and waste fields, 17 Aug. 1942, *McFarland 13* (BH, CU, GH); Common along roadside, Kentucky highway 33, 0.3 mile e. of United States highway 68, 26 Aug. 1965, *Bates 2705* (BH). Woodford Co.: Road's edge, Kentucky highway 33, 0.8 mile west of Woodford-Jessamine county line, 26 Aug. 1965, *Bates 2704* (BH). TENNESSEE: Davidson Co.: Vicinity of Nashville, in August, *Gattinger* (BM, CU, GH, K); Cedar glades near La Vergne, 27 July 1938, *Svenson 9362* (GH). Rutherford Co.: Railroad track, La Vergne, July 1894, *Ruth* (ILL); Dry cedar glade, La Vergne, 20 Aug. 1922, *Svenson 202a.* (GH). Wilson Co.: Limestone barrens, Lebanon, 30 Aug. 1947, *Sargent 93* (GH). ILLINOIS: La Salle Co.: Barrens, Ottawa, 29 Sept. 1882, *Seymour* (ILL), Sept. 1881, *Boltwood* (GH). Rock Island Co.: Growing abundantly among the debris of an old limestone quarry near Rock Island Arsenal, in 1866, *Parry* (GH), in 1862, (BH). IOWA: Muscatine Co.: Banks of the Mississippi River near Davenport, *Barnes* (ILL). MISSOURI: Callaway Co.: Common in loamy soil of limestone outcrop, county highway AA, ca. 1.0 mile e. of junction with United States highway 54, 6 miles n. of Jefferson City, 22 Aug. 1965, *Bates 2688* (BH). Greene Co.: Dorchester near Springfield, 7 Sept. 1887, *Blankenship* (CU). Jasper Co.: Locally abundant in limestone barrens near Webb City, 25 Sept. 1920, *Palmer 19155* (GH); Rocky barrens, Webb City, 6 Aug. 1920, *Bush 9068* (GH). Jackson Co.: Common in barrens, Independence, 6 July 1900, *Bush 768* (K); Rocky places, Lee's Summit, 14 Aug. 1898, *Mackensie 323* (GH), 13 Sept. 1927, *Bush 11550*A (K, Z); Greenwood barrens, 30 Aug. 1905, *Bush 3285* (GH); Rare in crevices of limestone, road cut, Missouri highway 7, 0.8 mile n. of junction with United States highway 50, 22 August 1965, *Bates 2690* (BH); Locally common in loamy soil of limestone ridge, road cut, Missouri highway 150, ca. 1.3 miles e. of Greenwood, 22 Aug. 1965, *Bates 2691* (BH). Lincoln Co.: Cuivre River State Park, common in crevices of limestone outcrop, Missouri highway 147, 0.3 mile n. of junction with Missouri highway 47, 21 Aug. 1965, *Bates 2672* (BH); Cuivre River State Park, banks and flats above dry limestone creek bed, below Missouri highway 147, 0.3 mile n. of junction with Missouri highway 47, 21 Aug. 1965, *Bates 2686* (BH). St. Louis Co.: Stony hills, *Eggert* (ILL); St. Louis, in 1832, *Drummond* (lectotype *Malvastrum angustum* Gray, GH; isotypes BM, K); St. Louis, *Englemann* (GH, K). ARKANSAS: Boone Co.: Harrison, rocky hillsides, 24 Oct. 1914, *Palmer 6910* (CU). KANSAS: Bourbon Co.: 7 miles s. of Uniontown, 20 Sept. 1937, *Horr & Franklin E180* (GH, ILL); Rare along roadside in clay-loam, Kansas, highway 3, just s. of Petersburg, 24 Aug. 1965, *Bates 2700* (BH); Locally common in limestone soils, Kansas highways 7, 39, 5 miles w. of Hiatville, 24 Aug. 1965, *Bates 2702* (BH). Douglas Co.: Without locality, 16 Aug. 1895, *Hitchcock* (GH). Reno Co.: Without locality, July 1891, *Carlton* (ILL). Riley Co.: Without locality, stony hills, 27 Aug. 1895, *Norton* (GH). OKLAHOMA: Johnston Co.: Tishomingo, granite barrens, 10 Sept. 1914, *Palmer 6491* (CU).

BAILEY HORTORIUM
CORNELL UNIVERSITY, ITHACA, NEW YORK

LITERATURE CITED

BATES, D. M. 1963. The genus Malacothamnus. Ph.D. thesis, University of California, Los Angeles.

BORSSUM WAALKES, J. VAN. 1960. The typification of the genus Malvastrum. Taxon **9**: 212-213.

ELLIOTT, S. 1822. *Sida. In* A sketch of the Botany of South Carolina and Georgia **2**: 159-162. J. R. Schenck. Charleston.

EWAN, J. and N. EWAN. 1963. John Lyon, nurseryman and plant hunter, and his journal, 1799-1814. Trans. Am. Philos. Soc., n. ser. **53**(2): 1-69.

FERNALD, M. L. 1939. New species, varieties and transfers. Rhodora **41**: 423-461.

GRAY, A. 1849. *Malvaceae. In* Plantae Fendlerianae Novi-Mexicanae. Mem. Am. Acad., ser. 2, **4**: 15-25.

__________. 1897. *Malvastrum. In* Synoptical Flora of North America. **1**(1): 308-313.

GREEN, M. L. 1935. *In* International Rules of Botanical Nomenclature, ed. 3. p. 145. Gustav Fischer, Jena.

HOOKER, W. J. 1834. Notice concerning Mr. Drummond's collections, made chiefly in the southern and western parts of the United States. Journ. Bot. Hooker **1**: 183-202.

JONES, G. N. and G. D. FULLER. 1955. *Malvastrum. In* Vascular Plants of Illinois. p. 322. University of Illinois Press, Urbana.

KEARNEY, T. H. 1935. The North American species of Sphaeralcea subgenus Eusphaeralcea. Univ. Calif. Pub. Bot. **19**: 1-128.

__________. 1947. Type of the genus Malvastrum. Leafl. West. Bot. **5**: 23-24.

__________. 1950. Notes on Malvaceae. op. cit. **6**: 51-52.

__________. 1951. The American genera of Malvaceae. Am. Midl. Nat. **46**: 93-131.

__________. 1955. Malvastrum A. Gray — a re-definition of the genus. Leafl. West. Bot. **7**: 238-241.

KRAPOVICKAS, A. 1949. Las especies de "Sphaeralcea" de Argentina y Uruguay. Lilloa **17**: 179-222.

——————. 1951. Monteiroa, nuevo género de Malvaceae. Bol. Soc. Argent. Bot. **3:** 235-244.

——————. 1954. Estudio de las especies de "Anurum", nueva sección del género "Urocarpidium" Ulbr. (Malvaceae). Darwiniana **10:** 606-636.

——————. 1957a. Números cromosómicos de Malváceas Americanas de la tribu *Malveae*. Rev. Agron. Noroeste Agr. **2:** 245-260.

——————. 1957b. Las especies de Malvastrum sect. Malvastrum de la flora Argentina. Lilloa **18:** 181-195.

MOHR. C. 1901. *Malvastrum*. *In* Plant life of Alabama. Contr. U.S. Nat. Herb. **6:** 616.

PURSH, F. 1814. *Sida* and *Malva*. *In* Flora Americae Septentrionalis. **2:** 452-454.

ROY, R. P. and R. P. SINHA. 1961. Meiotic studies in some malvaceous species. Curr. Sci. Bangalore. **30:** 26-27.

RYDBERG, P. A. 1932. *Sidopsis*. *In* Flora of the Prairies and Plains of Central North America. p. 541. New York Botanical Garden, New York.

SCHREBER, J. C. D. VON. 1791. *Sida* and *Malva*. *In* Genera Plantarum. **2:** 463, 466. Francofurti ad Moenum.

SKOVSTED, A. 1935. Chromosome numbers in the Malvaceae. I. Jour. Genetics **31:** 263-296.

——————. 1941. Chromosome numbers in the Malvaceae. II. Compt. Rend. Lab. Carlsb. Physiol. **23:** 195-242.

STEYERMARK, J. A. 1963. *Sphaeralcea*. *In* Flora of Missouri. p. 1050. Iowa State University Press, Ames.

# NOTES ON THE FLORA OF COÖS COUNTY, NEW HAMPSHIRE, II.

During the summer of 1965 I made more than a thousand collections in Coös County and after these were processed this winter I finally had a chance to evaluate the catalogue of Pease's Flora of Northern New Hampshire. The county is divided into 43 organized and unorganized townships which vary greatly in the number of taxa cited from them. At the top of the list are Shelburne and Randolph, each being represented by over 800 taxa. At the other end of the scale are thirteen unorganized townships which are represented by less than 100 taxa each, Dix Grant is cited five times, Colebrook Academy Grant three and Pease had seen no specimens from Erving Location.

For this reason Erving Location became my first objective last summer. Through the kindness of the International Paper Company and Mr. W. A. Ruck I was able to travel their Phillips Brook Road and make collections in the location at three periods during the summer. The township is now better represented than several townships located on main highways.

Colebrook Academy Grant seemed to be the logical target for 1966. However townships are not always the stable entities we picture them to be. This grant was a small area bounded on three sides by Pittsburg and on the fourth side by the Province of Quebec. It no longer appears on the U. S. G. S. map of the quadrangle, having apparently been absorbed by Pittsburg. The loss of this township to the county is compensated by the appearance on the more recent maps of the Mount Washington region of Chandler Purchase. This is an unlikely-looking strip five miles long and only a half mile wide extending from Millen Hill near Jefferson Notch southward to Mount Pleasant in the Presidential Range. I have seen no specimens collected in Chandler Purchase.

Town lines are not sacrosanct. On editions of the U. S. G. S. maps published since about 1925 many of the town boundaries have been drastically changed from those shown on earlier editions. On the 1896 sheets for Mount Washington and Crawford Notch the western boundary of Cutts Grant extends up the western side of the Dry River valley, crosses the ridge of the Presidential Range between Mount Pleasant and Mount Franklin and continues to a point northwest of the summit of Mount Monroe. The northern boundary follows a zig-zag course to Boott Spur and the eastern boundary extends down the eastern side of Dry River. Thus Cutts Grant includes a portion of the Crawford Path, the summits of Mount Franklin and Mount Monroe and the headwall of Oakes Gulf, some of the prime botanical areas of the Mount Washington region. On the Crawford Notch sheet of 1946 the western boundary of Cutts Grant is at least a half mile east of the ridge of the Presidential Range. Its northernmost point is at an elevation of about 4100 feet on the southern slopes of Mount Franklin. The northern boundary extends across to Gulf Peak, about a mile south of Boott Spur. Little if any of the present limits of the grant is above timberline. Prof. Pease in his citations retains the old boundaries of the township; thus of over one hundred taxa cited from the grant the number collected from within its present limits can be counted on the fingers of one hand and none of them are strictly mountain species. The alpines were all collected in Sargent Purchase.

The southern boundary of Hadley Grant has also been shifted on the more recent maps. While the number of taxa involved is much less, a number cited from Hart Ledge in this township were actually collected in Hart Location which is in Carroll County rather than Coös. This is unfortunate since some of the taxa are southern elements unknown elsewhere in Coös County.

Some interesting finds in my 1965 collections and a few changes which should be made in the Pease Flora follow.

*Equisetum arvense* L., forma *campestre* (C. F. Schultz) Klinge. Millsfield, moist ditch beside road to Big Millsfield Pond, *Harris 27271b* (65). This form with a strobilus terminating a green vegetative stem is new to the County.

× *Esuisetum litorale* Kuhlewein. Erving Location, moist ground, *Harris 27520* (65). The third township for the County.

*Equisetum variegatum* Schleich., var. *variegatum*. Erving Location, wet ground, *Harris 27815* (65). This taxon appears in Pease's list of Species Exclusae. My collections of this and the previous species were verified by Dr. Rolla Tryon. *Pease 39615* (59) from Stratford cited in the Flora as var. *Jesupi* is also var. *variegatum* and var. *Jesupi* should be retired to the list of Species Exclusae.

*Bromus Dudleyi* Fern. Martin Location, damp woods Dolly Copp, *Harris 1822* (33). The third collection from the County; better late than never!

*Eragrostis poaeoides* Beauv. Berlin, roadbed of Grand Trunk Railway, *Harris 27677* (65). *Pease 29851* (42) from Milan cited as *E. pectinacea* should be changed to this species. These are the second and third collections from the County.

*Lolium multiflorum* Lam., var. *diminutum* Mutel. Millsfield, roadside, *Harris 28262* (65). First collection in the County.

*Triticum aestivum* L. Milan, roadbed of Grand Trunk Railway, *Harris 27618* (65); Berlin, roadbed of Grand Trunk Railway, *Harris 27685* (65). One previous collection from the County.

*Secale cereale* L. Columbia, roadside Cilley Hill, *Harris 28306* (65); Cambridge, roadside rte. #16, *Harris 27254* (65). New to the County.

*Digitaria sanguinalis* (L.) Scop. Columbia, roadside U. S. rte. #3, *Harris 28351* (65). Third and most northern collection from the County; *D. Ischaemum* is the common crab-grass for the area.

*Echinochloa crusgalli* (L.) Beauv., forma *longiseta* (Trin.) Farw. Millsfield, roadside rte. #26, *Harris 28279* (65). New to the County.

*Scirpus atrovirens* Willd., var. *georgianus* (Harper) Fern., forma *viviparus* Vict. Erving Location, moist ground, *Harris 28179* (65). Three previous collections from the County.

*Arisaema Stewardsonii* Britt. Colebrook, damp ground along Mohawk River, *Harris 27241* (65). A new native species for the County.

*Cypripedium acaule* Ait. forma *acaule*. Millsfield, moist woods on road to Big Millsfield Pond, *Harris 27345* (65); Dummer, moist woods on woodroad to Dummer Ponds, *Harris 27229* (65). While Pease indicates that forma *albiflorum* is general in the County, he cites no collections of the pink-flowered form from north of Randolph. There is no question that forma *albiflorum* is the commoner of the two in the northern portion of the County but a little searching will usually disclose that the typical form is present as well.

*Salix pentandra* L. *Pease 33769* (48) from Colebrook cited as *S. fragilis* is *S. pentandra*, a new introduced willow for the County.

*Ulmus americana* L., forma *pendula* (Ait.) Fern. Dummer, woods Dummer Hill, *Harris 27736* (65). New to the County.

*Polycnemum majus* (Schimp.) R. Br. Berlin, roadbed of Grand Trunk Railway, *Harris 27670* (65). While my collection of this nondescript species is somewhat immature I am sure that there is no question of its identification. The genus is not included in Gray's Manual but does appear in the New Britton & Brown on the basis of collections made in Ontario. The species is not represented in the herbarium of the New England Botanical Club and there are no specimens from North America in the Gray Herbarium. My collection is a good match of European material in the Gray Herbarium.

*Mirabilis nyctaginea* (Michx.) MacM. Berlin, near Grand Trunk Railway, *Harris 27629* (65). This collection adds the Nyctaginaceae to the flora of Coös County. The station is well established on the outskirts of Berlin and must have been growing there for several years.

*Lychnis Flos-cuculi* L. Carroll, roadside rte. #302 one quarter mile east of Bethlehem line, *William Countryman 840* (65). First collection from the County.

*Silene pumilio* Wulf. The station of this species on the Ammonoosuc Ravine Trail, reported by me last year, came through the winter well. This summer I visited the Mountain Valley Nursery in Jefferson Meadows and found the plant for sale there. Thus a source of supply for this obviously planted species was not far from Mount Washington.

*Silene Cserei* Baumg. Berlin, roadbed of Grand Trunk Railway, *Harris 27649* (65). One previous collection from the County. This species grows with, and closely resembles, *S. Cucubalus*. It is probably more common in New England than present collections indicate.

*Ranunculus repens* L. Erving Location, moist ground, *Harris 27473* (65). The third collection for the County.

*Chelidonium majus* L. Berlin, roadside Prospect Street, *Harris 27628* (65). A flourishing colony; it seems strange that there has been only one other collection of this species made in the County.

*Arabis laevigata* (Muhl.) Poir. This species should be placed in the list of Species Exclusae; the only collection, Lancaster, *Pease 39124* (58), is *A. glabra*.

*Ribes hirtellum* Michx., var. *saxosum* (Hook.) Fern. Northumberland, *Hodgdon, Lincoln & Steele 11239* (59). New to the County.

*Pyrus Aucuparia* (L.) Gaertn. Whitefield, Bray Hill Road, *Pease 34381* (49). New to the County.

*Potentilla Robbinsiana* Oakes. The entire Mount Washington population of this rare species is located in Sargent Purchase, not Cutts Grant as cited in Pease. In June of 1964 I moved six plants from the acre or two on which it occurs to another area which resembles its home site. In June 1965 five of the plants had survived the winter and I found the remains of the sixth; only one of the survivors bore flowers.

*Filipendula rubra* (Hill) Robins. Dummer, swale Dummer Hill, *Harris 27742* (65). One previous collection from the County. This is an escape from cultivation. The farms on Dummer Hill were all abandoned fifty years ago and the swale in which I found the plant is a considerable distance from any of these old farms. The colony consisted entirely of basal leaves. When I planted some hardy perennials at my camp on the hill about fifteen years ago I accidentally introduced a few plants of this species and my plants too produce only basal leaves.

*Rubus ravus* Bailey. *R. tavus,* the last taxon on page 190, should read *R. ravus.*

*Lotus corniculatus* L. Milan, pasture Spruceville, *Harris 27867* (65). This makes a fourth township for this species which was added to the County flora last year.

*Oxalis europea* Jord., forma *villicaulis* Wieg. Milan, roadbed of Grand Trunk Railway, *Harris 27614* (65). The second collection from the County.

*Viola papilionacea* Pursh, var. *albiflora* Grover. Dummer, Dummer Hill, *Harris 27188* (65). This violet has escaped from the garden and become thoroughly established in the lawn at our camp; new to the County.

*Epilobium angustifolium* L., forma *albiflorum* (Dumort.) Haussk. Erving Location, roadside bank, *Harris 27803* (65). A fourth township for the County. I normally take a dim view of reporting every white-flowered form seen of common species but this produced the most spectacular floral display I found in Erving Location. The bank was covered entirely by tall plants of this color form for a distance of about 150 feet.

*Panax trifolius* L. Dummer, along road up Dummer Hill, *Harris 27180* (65). The third township in the County for this species.

*Convolvulus sepium* L., forma *coloratus* Lange. Berlin, roadside rte. #16, *Harris 27625* (65). Prof. Pease did not differentiate between this form and forma *sepium.* In his citations for the species the following are definitely forma *coloratus:* Colebrook *10887* = M *3927* (07); Northumberland *12212* (09); *Lancaster 12122* (09); Berlin *16127* (14); M Location *12186* = M *4074* (07); Whitefield *Deane* (96).

*Mentha arvensis* L., forma *lanata* (Piper) S. R. Stewart. Stark, ledges Crystal Falls, *Harris 28354* (65). The second collection for the County.

*Veronica peregrina* L., var. *peregrina.* Jefferson, weed in beds of Mountain Valley Nursery, *Harris 27703* (65). New to the County.

*Rhinanthus Crista-galli* L. Randolph, Bog Dam road between Camp 18 and Camp 19, *Harris 27713* (65). Species previously known only from Pittsburg.

*Rudbeckia serotina* Nutt., forma *homochroma* (Steyerm.) Fern & Schub. Dummer, our field Dummer Hill, *Harris 27851* (65). New to the County.

*Rudbeckia serotina,* forma *pleniflora* (Moldenke) Fern. & Schub. Dummer, our field Dummer Hill, *Harris 27852* (65). Second collection from the County.

*Leontodon autumnalis* L., var. *pratensis* (Link) W. D. J. Koch. G Grant, *Pease 40005* (62). New to County.

*Hieracium paniculatum* L., forma *glandulosum* R. Hoffm. Dummer, Dummer Hill, *Harris 28231* (65). Second collection for the County.

STUART K. HARRIS, BOSTON UNIVERSITY

# STUDIES IN THE EUPATORIEAE, (COMPOSITAE)

## I — III

R. M. King

Since the death of Prof. B. L. Robinson over thirty years ago, the tribe Eupatorieae has not been critically studied. During this period great numbers of collections, much research, and many modern techniques have become available to botanists. The present study initiates an attempt to incorporate these new materials and methods in formulating a modern conspectus of the genera and species of the tribe. Grateful acknowledgement is extended to the directors of the following herbaria who generously loaned me this material: A, CAS, DS, G, GH, K, MICH, NY, P, PH, POM, RENO, RM, RSA, SMU, UC, US, USFS, and W.

### I. PLEUROCORONIS

R. M. King and H. Robinson, Phytologia 12: 468-469. 1966. (Type species, *Hofmeisteria pluriseta* A. Gray.)

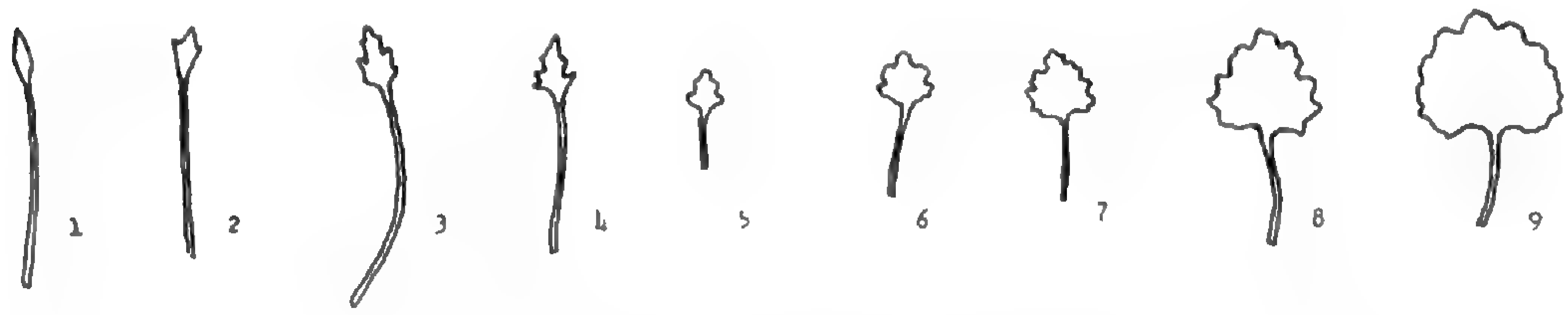
Woody sub-shrub. Leaves simple to compound, petiolate, serrate, opposite in lower portions of plant becoming alternate above. Peduncles not strongly differentiated, bearing alternate leaves. Inflorescence polycephalic. Heads turbinate or cylindrical, 25-30-flowered Phyllaries in multiple series, outer one short, ovate, inner lanceolate. Corollas slender, regular, 5-lobed, white, tubular, glandular on the outer surface. Anthers elongate with large erect appendages, exothecial cells isodiametric or slightly wider than long. Pollen spherical, tricolpate, distinctly spinose. Style branches elongate, slightly enlarged at the tip, cells at the surface slightly bulging; basal node of style glabrous. Pappus of 3-16 long scabrate setae with intervening short erosely dentate squamae, sometimes bearing numerous additional setae in a distinct inner series. Achenes narrowly ellipsoid to obpyramidal, 4-5-ribbed, lateral surfaces densely pubescent, subcuticular cells without minute punctations except on the ribs; carpopodium somewhat rounded, usually asymmetric, cells vertically elongate, basal foramen shallow, indistinct. Basic chromosome number, as determined from one species, $X = 9$ pairs.

The species of *Pleurocoronis* can be distinguished by the following key

Leaves dissected .................................................................. *P. gentryi*
Leaves simple ..........................................................................................

Petioles more than twice as long as leaf blades, leaves small, narrowly ovate with usually five or less teeth ................................ *P. pluriseta*

Petioles always less than twice as long as leaf blades, leaf blades deltoid to reniform, usually with 15 or more marginal teeth ............ ........................................................................................ *P. laphamioides*




Figs. 1-9, Leaves of *Pleurocoronis*. Figures 1-4, *P. pluriseta*. 1. *Orcutt 1889* (US). 2. *Woodcock 1889* (US). 3. *Coville & Funston 207* (US). 4. *Brandegee 1889* (US). Figures 5-9. *P. laphamioides*. 5. *Mason 1975* (US). 6. *Wiggins 17080* (US). 7. *Wiggins 17080* (US). 8. *Johnston 3630* (US). 9. *Palmer 208* (US).

1. **Pleurocoronis gentryi** (Wiggins) R. M. King & H. Robinson Phytologia **12**: 470. 1966.

*Hofmeisteria gentryi* Wiggins Contr. Dudley Herb **4**: 25. 1950.

MEXICO: BAJA CALIFORNIA: Sierra Giganta above Puerto Escondido, April 21, 1938. *H. S. Gentry 3742* (Holotype DS! Isotype GH!).

Plants 4-6 dm tall. Stems few-branched, striate, gray-barked with dense glandular hairs on the younger portions; evanescent in older regions. Leaves thin. Petioles glandular, slender 12-15 mm long. Blade broadly ovate in outline 12-22 mm wide, 15-25 mm long, bipinnately or tripinnately divided; densely hispid on both surfaces. Heads turbinate, 10-12 mm tall (including style branches) *ca* 25-flowered. Phyllaries *ca* 25, mostly 3-nerved. 2-7 mm long, 0.5-1 mm broad. Florets 5-6 mm long. Stamens 5. Anthers (including appendages) *ca* 1.5 mm long *ca* 240 $\mu$ wide, appendage *ca* 385 $\mu$ long *ca* 220 $\mu$ wide. Filaments 2.5-3 mm long *ca* 50 $\mu$ wide. Style branches purplish, greatly exserted at maturity *ca* 2.5-3 mm long *ca* 225 $\mu$ wide. Setae 4-6, 5-6 mm long. Squamae 4-6, 1-1.5 mm long. Achenes narrowly prismatic, dark brown *ca* 3 mm long. Pollen *ca* 18 $\mu$ in diameter. Chromosome number not determined.

SPECIMENS EXAMINED: MEXICO: BAJA CALIFORNIA: 10 mi s of Mission Dolores, *Wiggins, Carter, & Ernst 300* (DS, MICH). Arroyo de San Matias near Rancho San Matias, *Carter & Sharsmith 4207* (UC). Arroyo Gabilan, *Carter & Ferris 4080* (UC). vicinity of Portezuelo, e of La Victoria, *Carter & Ferris 3910* (UC). Pilon de las Parras, w of Loreto, *Carter & Sharsmith 4236* (UC). Arroyo Tabar, w of Puerto Escondido, *Carter & Sharsmith 4247* (UC). Mesa de Alta Gracia, sw of La Cumbre de Alta Gracia, *Carter 4890* (UC).

2. **Pleurocoronis pluriseta** (A. Gray) R. M. King & H. Robinson.

Plate 1338. *Pleurocoronis gentryi* Holoytpe (DS) *Gentry 3742.*

Phytologia **12**: 469. 1966.

*Hofmeisteria pluriseta* A. Gray, Pacif. Rail. Rep. **4**: 96, 1857.

UNITED STATES: ARIZONA: Bill Williams Fork, *J. M. Bigelow* in 1853-54. (Holotype GH! isotypes; NY!; P!; PH!).

*Hofmeisteria viscosa* Nelson Bot. Gaz. 37: 263. 1904.

UNITED STATES: NEVADA: "The Pockets", April 30, 1902, *Leslie N.*

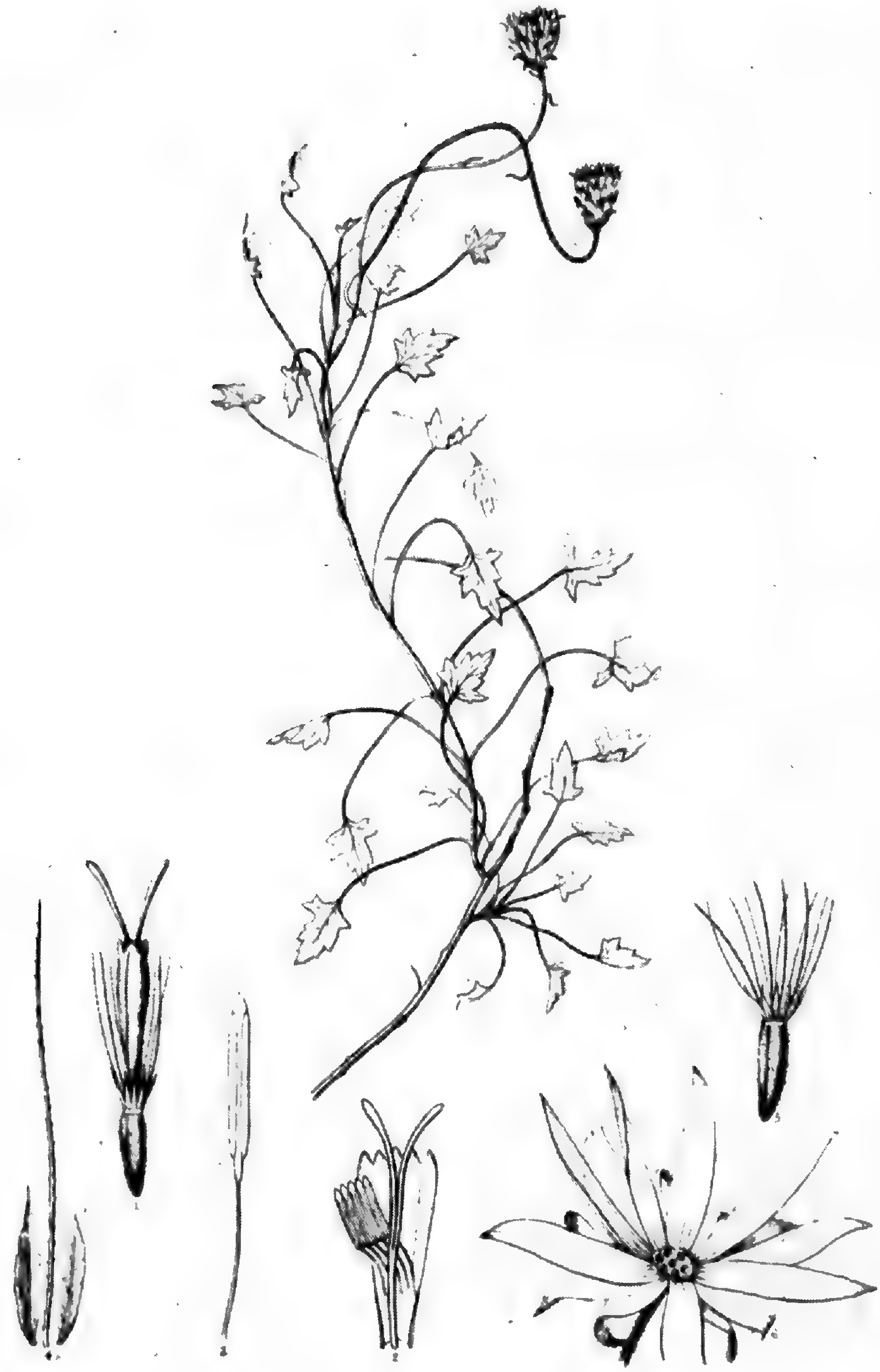


Fig. 10. *Pleurocoronis pluriseta* (From A. Gray, Pacific Rail. Rep. **4**: 96, 1857).

*Goodding 671* (Holotype RM!).

Plants 2.5-5 dm tall. Stems few-branched, erect, striate, with evanescent puberulence. Leaves thin. Petioles with glandular hairs; narrow, 2-5 cm long. Blades glabrous or rarely with glandular hairs, ovate to lanceolate, 1.5-5 mm wide, 3-10 mm long, entire or more frequently with 5 or less teeth. Petioles always twice as long as the blades. Inflorescence a loose corymb. Heads 6-11 mm tall (including style branches), *ca* 30-flowered. Phyllaries *ca* 25, outer surface glandular; striate, the apex acute, 0.5-1 mm broad, 2.5-6 mm long. Florets 4-5 mm long. Stamens 5. Anthers (including appendages) *ca* 1.5 mm long, *ca* 220 $\mu$ wide, appendage *ca* 220 $\mu$ wide, *ca* 330 $\mu$ long. Filaments *ca* 2 mm long *ca* 65 $\mu$ wide. Style branches, *ca* 1.5 mm long. Squamae 10-12, 1-2 mm long. Setae 10-12(16), 2.5-5 mm long. Achenes narrowly prismatic; dark brown to black, 3-4 mm long. Pollen *ca* 18 $\mu$ in diameter. Chromosome number $N = 9$ II (Raven unpublished).

REPRESENTATIVE SPECIMENS EXAMINED: UNITED STATES: ARIZONA: COCONINO CO.: Havasupai Canyon, *Clover 6085* (MICH). Separation Canyon, *Clover 4219* (MICH). MOHAVE CO.: Grand Canyon National Monument, *W. P. Cottam.* May 5, 1952 (CAS). YUMA CO.: Tule Tank, *Shreve 5936* (DS); *Benson & Darrow 10804* (POM). Palm Canyon, *Benson & Darrow 10853* (POM). Sierra de la Gila, Gila Desert, *Monnet 1088* (CAS, P, US). CALIFORNIA: IMPERIAL CO.: Painted Gorge, Carisso Mts., *Ferris & Rossbach 9633* (DS, F, GH, RSA, UC). Between Coyote Wells and Jacumba, *MacFadden 14461* (CAS). 4.9 m n e of Mountain Springs, *Raven 11550* (SMU). Indian Picture Rocks, *F. M. Reed 5358* (P). INYO CO.: Pleasant Cañon, *Hall & Chandler 6917* (POM, UC). Surprise Canyon, *Ferris 7994* (A, DS, POM, UC). Titus Canyon, *Eastwood & Howell 7773* (CAS). Echo Canyon, *Coville & Gilman 146* (US). Death Valley, *Coville & Funston 207* (US). Inyo Mts., *Austin 461* (UC). East of Ophis Mine, Slate Mts., *Alexander & Kellogg 1133* (DS, UC). Darwin Springs, *C. L. Hitchcock 6208* (DS, NY, RSA, UC) Saline Canyon, *Train 671* (US). RIVERSIDE CO.: Andreas Cañon *Stark 4983* (RSA, TEX, UC). Painted Canyon, *Peirson 7173* (RSA); *Munz & Keck 9346* (GH, POM); *McGregor 735* (DS); *Ferris & Rossbach 9572* (DS, F, GH, MICH, RSA, UC). Tahquitz Canyon, *Peirson 1213* (RSA). 5 m s w of Palm Desert, *Breedlove 1887* (DS). Cottonwood Springs, *Stark 3751* (DS, RSA, UC, US). Palm Springs, *Parish 4122* (DS, GH, NY, PH, UC, US). Palm Canyon, *F. M. Reed 3866* (UC) *3870* (UC). Marshall Cañon, 11 km w of Coachella, *Hall 5795* (DS, F, G, GH, NY, PH, POM, UC). Near Indio, *Hall 5992* (DS, G, UC, US). Joshua Tree National Monument, *Hitchcock & Muhlick 23261* (UC). Eagle Cañon, 4 m east of Palm Springs, *E. C. Jaeger* March 18, 1922 (DS). Devil's Canyon, *Johansen & Ewan 7107* (DS, UC). SAN BERNARDINO CO.: 3.8 mi e of Hayden, *Wolf 10753* (DS, G, NY, RSA, TEX, UC). Carlyle Mine, Pinto Mts., east of 29 Palms, *Munz 15648* (DS, GH, POM, UC, US). Calico, *Parish 9813* (A, DS, G, GH, UC). Sheep Springs Canyon, *Hitchcock & Muhlick 23293* (DS, G, UC). Camp Cady, *Hall 6130* (DS, UC). 39 m from Needles, *Ferris 7230* (DS, GH, NY, POM). 1 m s of 29 Palms, *Alexander & Kellogg 952* (DS, UC, US). Whipple Mts., *Alexander & Kellogg 1226* (DS, UC). 10 m NW of Riggs, *Munz & Hitchcock 10957*

(POM). Painted Cañon, *Howell 3299* (CAS). 10 m e of Daggett, *Munz & Keck 7864* (NY, POM). 17 m from Vidal on old road to Needles, *Wolf 3190* (DS, RSA, UC, US). SAN DIEGO CO.: 15 mi e of Banner, *Gould 2270* (RSA, SMU, TEX). Palm Cañon, *Gander 5320* (SMU, UC); *Epling & Robison* April 8, 1932 (DS, RSA, UC, US). San Felipe Wash, *Eastwood 2279* (CAS, GH, POM, UC, US). The Narrows, *Gander 9212* (RSA). NEVADA: CLARK CO.: Valley of Fire, *Maguire, Maguire & Maguire 5011* (GH, UC); *5012* (GH, UC); *Clokey 5954* (DS, G, MICH, NY, PH, POM, RENO, SMU, TEX, UC, US, USFS, W); *Train 1885* (DS, F, RENO, UC); *Eastwood & Howell 9010* (CAS, NY, UC). Black Canyon, 5 m s of Hoover Dam, *Ferris 13384* (DS, NY). North of Cottonwood Peak, *Gullion 537* (UC). Petrified forest, Canyon w of Logan, *Heller 10460A* (A, DS, F, G, GH, NY, US). Hiko Wash, *Train 1370* (RENO, SMU, UC). Hemingway Wash., Lake Mead, *Maguire 17724* (POM, UC). Lake Mead, *Clover 8234* (MICH, SMU). LINCOLN CO.: Muddy Valley, *Kennedy & Gooding 54* (DS, NY, PH, UC, US). UTAH: "southern part of state" *Dr. Edward Palmer* in 1877 (NY, US).

MEXICO: BAJA CALIFORNIA: Cucopa Mts., *MacDougal 127* (NY). San Luis Gonzaga Bay, *I. M. Johnston 3326* (CAS, GH, NY, UC, US). El Cañon de los Osos, 4 m n of Gaskills Tanks, *Epling & Darsie* February 21, 1933 (UC). Santa Mariá, *T. S. Brandegee* May 15, 1889 (F, GH, PH, UC, US). ¾ m s of Puertocito, *Wiggins & Wiggins 15867* (DS, MICH, TEX). SONORA: Cholla Bay, Punta, Penasco, *Raven 11665* (NY).

3a. **Pleurocoronis laphamioides** (Rose) R. M. King & H. Robinson var. **laphamioides** Phytologia **12**: 470. 1966.

*Hofmeisteria laphamioides* Rose, Contr. U. S. Nat. Herb. 1:79, 1890. MEXICO: BAJA CALIFORNIA: San Pedro Martir Island, February 13, 1890, *Edward Palmer 148* (holotype US!; isotypes CAS!; F!; GH!; NY!).

*Hofmeisteria pluriseta* A. Gray var. *laphamioides* I. M. Johnston Proc. Calif Acad 4. 12: 1186. 1924.

Plants 0.5-1.5 m tall. Stems often branched, erect, striate, glabrous or rarely with glandular hairs. Leaves thin. Petioles glandular, narrow 1-2.5 cm long. Blades glandular, deltoid to reniform or orbicular, 4-28 mm wide and long, margin indented usually with 15 or more teeth. Petioles always less than twice as long as blades. Inflorescence in corymbs or cymes. Heads 8-12 mm tall (including style branches), *ca* 30-flowered. Phyllaries *ca* 25, striate, 0.5-1 mm broad, 2.5-6 mm long. Florets 4-5 mm long. Stamens 5. Anthers (including appendages) *ca* 1.5 mm long, *ca* 220 μ wide, appendage *ca* 220 μ wide, *ca* 330 μ long. Filaments *ca* 2-2.5 mm long *ca* 65 μ wide. Style branches *ca* 1.5 mm long, *ca* 250 μ wide. Squamae 10-12, 1-2 mm long. Setae 10-12, 2.5-5 mm long. Achenes narrowly ellipsoid; dark brown to black, 3-4 mm long. Pollen *ca* 18 μ in diameter. Chromosome number not determined.


Plate 1339. *Pleurocoronis laphamioides* Holotype (US) *Palmer 148.*

SPECIMENS EXAMINED: MEXICO: BAJA CALIFORNIA: Salsipuedes Island, *I. M. Johnston 3521* (CAS). San Marcos Island, *I. M.*

*Johnston 3630* (CAS, GH, NY, UC, US); *Moran 3955* (DS, UC). Angel de La Guarda Island, *I. M. Johnston 3376* (CAS). San Pedro Martir Island, *I. M. Johnston 3157* (CAS, F, GH, K, UC, US); *I. M. Johnston 3162* (CAS, DS, F, GH, NY, UC, US); *Dr. Edward Palmer 406* in 1887 (GH, US). San Bartolome Bay, *Rose 16213* (NY, US). Las Animas Bay, *I. M. Johnston 3516* (CAS, GH, NY, UC, US). San Francisquito Bay, *Rose 16755* (NY, P, US). Santa Rosalia, *Dr. Edward Palmer 208* in 1889 (GH, US). 10 m e of La Purisima, *Wiggins 11459* (GH). Bahia de los Angeles, *Wiggins & Wiggins 14889A* (DS). Bahia de los Angeles, *Wiggins & Wiggins 14820* (CAS, DS, MICH, TEX). Cerro Tordillo and vicinity, *Gentry 7452* (DS, MICH); *Gentry 7453* (DS, MICH). vicinity of Aguaje de San Andreas, *Gentry 7463* (DS, MICH). Rinconado de San Hipolito, *Gentry 7805* (DS). Las Tinajas, *Gentry 7545* (DS, MICH) 4 m s of Barrill, *Harbison 41602* (RSA). SONORA: Kino Point *Long 80a* (GH, US). Libertad, *Graham 3831* (DS). Punta Sargento, *Wiggins 17080* (US). San Pedro Nolasco Island, *Moran 4043* (DS).

**3b. Pleurocoronis laphamioides** (Rose) R. M. King & H. Robinson var. **pauciseta** (I. M. Johnston) R. M. King, *comb. nov.*

*Hofmeisteria pluriseta* var. *pauciseta* I. M. Johnston, Pro. Calif. Acad. **4.** 12: 1187. 1924.

MEXICO: SONORA: San Pedro Nolasco Island, April 17, 1921. *I. M. Johnston 3134* (Holytype CAS!; isotypes GH!; NY!; UC!; US!).

*Hofmeisteria laphamioides* Rose var. *pauciseta* (I. M. Johnston) Blake, Contr. U. S. Nat. Herb. **23:** 1430. 1926.

The variety *pauciseta* differs from the variety *laphamioides* in having only 5 or 6 setae on the pappus instead of 7-16.

SPECIMENS EXAMINED: MEXICO: BAJA CALIFORNIA: Isla Carmen, *Wiggins 17512* (US). Espiritu Santo, *Rose 16868* (US). Purisima, *Brandegee in* 1889 (NY). 10 m e of La Purisima, *Wiggins 11459* (DS). SONORA: San Pedro Nolasco Island, Moran *4043* (UC).

The following collections may be regarded as intermediate between *P. pluriseta* and *P. laphamioides* and I have annotated the following specimens as *P. pluriseta*: UNITED STATES: ARIZONA: PIMA CO.; Dripping Wells, Puerto Blanco Mt., *Gould, Darrow & Haskell 3019* (CAS, GH). MEXICO: BAJA CALIFORNIA: Isla Angel de La Guarda, *Moran 7254* (DS). Turtle Bay, Revillagigedo Islands, *Mason 1975* (F, K) and I have annotated the following specimens as *P. laphamioides*. UNITED STATES: ARIZONA: PIMA CO.: Dripping Springs, *Darrow, Haskell, & Gould 2435* (CAS). *McClintock 52-80* (CAS). Dripping Wells, Puerto Blanco Mts., *Gould, Darrow & Haskell 3019* (UC). MEXICO: BAJA CALIFORNIA: Turtle Bay, Revillagigedo Islands, *Mason 1975* (CAS, US). SONORA: 7 m n w of Quitovac, *Wiggins 8328* (DS, MICH, US).

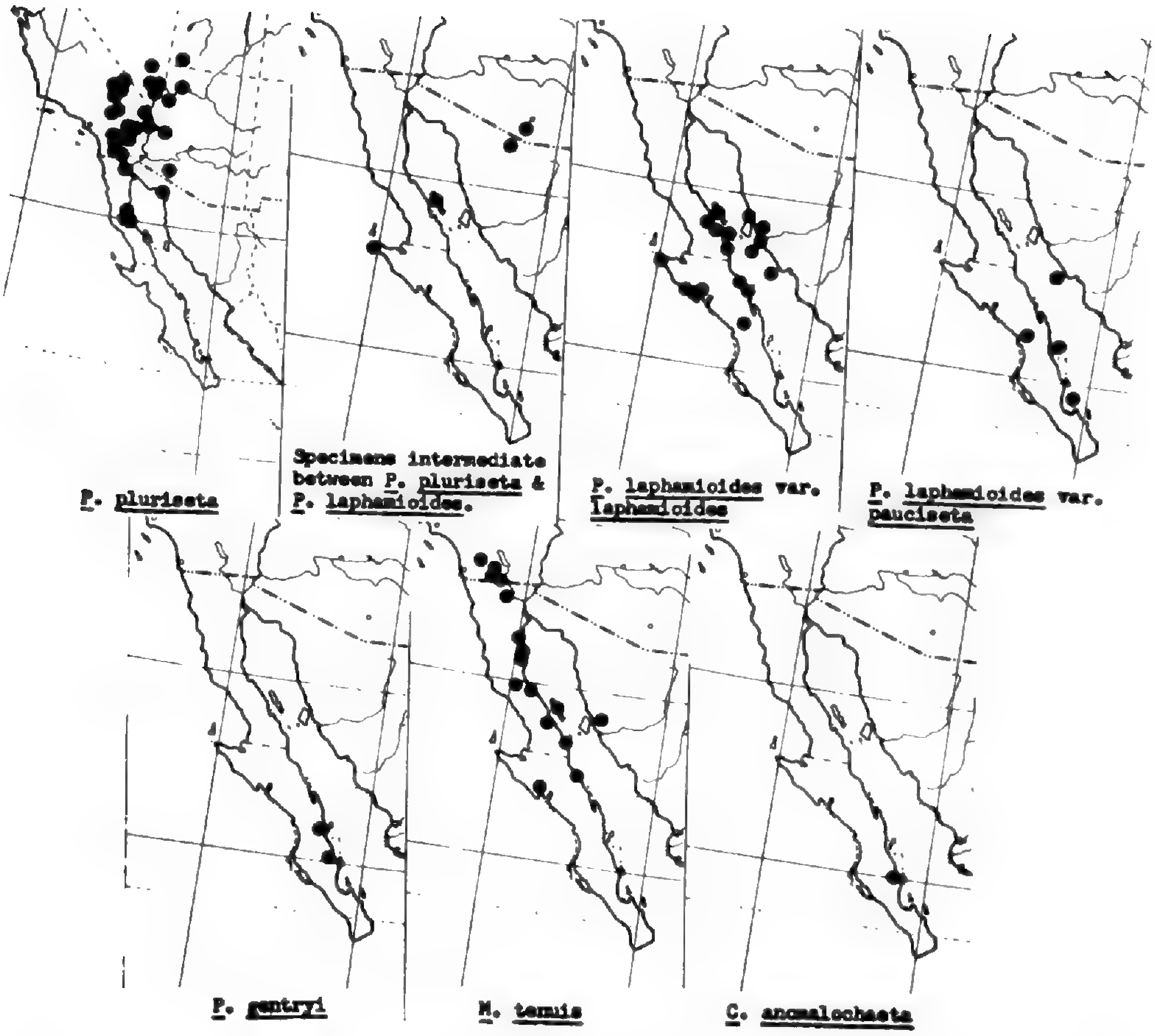



Fig. 11. Distribution of *Pleurocoronis, Malparia,* and *Carterothamnus.*

## MALPARIA

S. Watson, Proc. Amer. Acad. **24**: 54, 1889 (Type species, *Malparia tenuis* S. Watson).

Slender annual to slightly woody sub-shrub. Leaves simple, narrow, mainly sessile, sub-entire, opposite in lowermost nodes becoming alternate above. Peduncles not strongly differentiated. Inflorescence polycephalic. Heads nearly cylindrical few, rather small, *ca* 30-flowered, in loose cymose panicles. Phyllaries in several series, lanceolote, the tips acute to acuminate. Receptacle flat, naked. Corolla slender, regular, tubular, 5-lobed, glandular on the outer surface. Anthers elongate with large erect appendages. Pollen spherical, distinctly spinose. Style branches filiform, thickened toward apex and exserted at maturity. Pappus in a single series, squamae overlapping setae. Achenes slender, prismatic, 5-ribbed. Carpopodium with a very large foramen, often born laterally. Cells of carpopodium quadrate. Chromosome number determined as $X = 10$ pairs. (Raven unpublished)

**1. Malparia tenuis** S. Watson Proc. Am. Acad. **24:** 54. 1889

MEXICO: BAJA CALIFORNIA: Near Los Angeles Bay, Dec. 1887 *Dr. Edward Palmer 567* (Holotype, GH!; Isotypes NY!; US!).

*Hofmeisteria tenuis* (Wats.) I. M. Johnston Proc. Cal. Acad. Sci. 4, 12: 1188. 1924.

Plants 1-4 dm tall. Stems erect, striate, often reddish, sparingly branched to very branched in certain large individuals, finely puberulous to nearly glabrous. Leaves puberulous to nearly glabrous, up to 5.0 cm long, 0.3-3.0 mm wide. Heads 5-6 mm in diameter, 7.0


Plate 1340. *Malparia tenuis* Holotype (GH) *Palmer 567.*

mm to 1.4 cm tall (including the projecting florets). Phyllaries 20-25, puberulous, 12-15 mm wide, 0.4 - 1.2 cm long. Florets 20-30, ochroleucous or whitish; corolla narrow, tinged with pink, 5-6 mm long; stamens 5, anthers 2 mm long (including appendage) *ca* 0.25 long; wide, pappus setae 3, reddish brown, 5 mm long, pappus squamae 3, reddish brown, 0.5 mm long, pollen spherical, *ca* 18 $\mu$ diameter, achenes dark brown or black, 3 mm long. Chromosome number determined as $n = 10$ pairs. (Raven unpublished)

REPRESENTATIVE SPECIMENS EXAMINED: UNITED STATES: CALIFORNIA: IMPERIAL CO.: upper end of Painted Gorge, Carisso Mts., *Ferris & Rossbach 9614* (DS). Fish Mt. *E. C. Jaeger* April 10, 1926 (POM). Split Mt. Canyon, Fish Creek Mts., *Ferris 9696* (DS). Split Mt., Colorado Desert, *T. S. Brandegee* April 1905 (DS, UC, US). Mt. Signal, *Abrams 3189* (DS, NY, POM); *E. M. Wilson* April 3, 1949 (DS). SAN DIEGO CO.: Yagin Pass, Borrego Valley, *Ripley & Barneby 10077* (CAS).

MEXICO: BAJA CALIFORNIA: Bahia de San Luis Gonzaga, *Wiggins & Wiggins 18166* (CAS, DS, MICH). 18 m s of San Filipe, *Wiggins &Wiggins 15815* (DS, MICH, TEX). 35 m n of San Felipe, *Wiggins & Wiggins 18161* (CAS, DS). 15 m n of San Felipe, *Wiggins & Wiggins 15785* (DS). 5 m w of Barril, *Wiggins 7830* (DS, F, GH, MICH, NY, UC, US). near Barrie, *Shreve 6991* (MICH, PH, UC). Puerto Refugio, Angel de la Guarda Island, *Copp 135* (DS). Angel de la Guarda Island, *I. M. Johnston 4205* (CAS). 2.5 m w of Agua Dulce, *Moran 10215* (DS). Las Tinajas, *Gentry 7609* (DS, MICH, UC). 65.5 m s of San Felipe on the road to Laguna Chapala, *Wiggins & Ernst 697* (DS, MICH) 3 m n of San Felipe, *Olmsted 1167* (RSA). 6 m s e of Tres Enriques, *Thorne & Henrickson 32579* (MICH, RSA). 10 m n of Santa Rosalia, *Reed 6261* (POM). 2.7 m n of San Felipe, *Raven 14764* (DS, RSA). Cucopa Mts., *MacDougal 175* (NY). Bahia de Los Angeles, *Cowan 2304* (US). San Francisquito Bay, *I. M. Johnston 3563* (CAS, GH, K, NY, UC). SONORA: Libertad Bay Inn, *Long 73* (US).

## CARTEROTHAMNUS

R. M. King *gen. nov.* (Compositarum — Eupatorieae — Eupatoriinae) Suffrutex; Capitula homogama discoidea; flores omnes hermaphroditi, fertiles, regulares; antherae ad apicem appendiculatae; receptaculum paleaceum; achaenia 5 costata. Species typica: *Carterothamnus anomalochaeta* R. M. King

**Carterothamnus anomalochaeta** R. M. King sp. nov. Suffrutex; pauci-ramosus, erectus; folia alterna, lamina tenuis, orbicularis vel reniformis, profunde fissa, 1-5-2 cm lata, 1-1.25 cm longa, petiolus usque ad 1.5 cm longus; inflorescentia simplex; receptaculum paleis caducis inter flores instructum; involucri bracteae 30-40, multiseriatae, aequales, usque ad 2.5 mm longae, paleis *ca* 25, *ca* 4 mm longis; corolla glabra; pollen asperatum; achaenia 5 angulata, prismatica, 1-1.2 mm longa; pappus polysetaceus, seta unica elongata ceteris brevibus.

Scandent subshrub; stems few-branched, erect, terete, striate, glandular pubescent in younger portions; leaves alternate, blades thin, orbicular or reniform, 3-7 cleft two thirds or more in to base, lobes oblong, glandular pubescent on both surfaces, 1.5-2 cm wide, 1-1.25 cm long, petioles up to 1.5 cm long; inflorescence monocephalic; peduncles terete, striate, minutely glandular, up to 3 cm. long, rarely with setaceous bracts; heads discoid, campanulate, *ca* 7 mm high (including style branches), *ca* 7 mm wide, *ca* 50 flowered; receptacle convex with a slight depression in the center, paleaceous; phyllaries 30-40, in 3-4 series, thin, unequal, glandular on the outer surface, ovate-lanceolate, apex acute, margins erosely dentate, *ca* 1 mm wide, up to 2.5 mm long; pales *ca* 25, narrowly lanceolate, *ca* 4 mm long; florets perfect, glabrous fertile, regular, 5 lobed, white?, stamens 5; anthers appendaged, obtuse, *ca* 100 $\mu$ wide, *ca* .75 mm long; style branches 2, greatly exserted at maturity, club-shaped, 1.5-2 mm long; style tube *ca* 1.5 mm long; pollen tricolpate, spherical, distinctly spinose, *ca* 13 $\mu$ in diameter; achenes prismatic, 5-ribbed, ribs setose 1-1.2 mm long, dark brown; carpopodium symmetrical, basal foramen prominent with a clean margin, cells quadrate, rather thick-walled; pappus in one series, consisting of about 10-12 short setae 0.5-0.75 mm long and one long barbed seta ca 2.5 mm long; chromosome number not determined.

*Carterothamnus* possesses two characteristics that would indicate relationship with *Hofmeisteria*, its monocephalic inflorescence and glabrous corolla. *Carterothamnus* differs from *Hofmeisteria* in the shape of its carpopodium, surface of its pollen, number of flowers in each head, shape of the phyllaries, and especially in the possession of a paleaceous receptacle. Paleaceous receptacles are rare in the tribe Eupatorieae, being found in only 3-4? other genera. The pappus of *C. anomalochaeta* seems unique in the Eupatorieae. It is approached only by certain species of *Stevia* which have one long seta and several short squamae.

The genus is named in honor of Annetta Carter, distinguished botanist of the University of California at Berkeley.

Holotype: *Annetta Carter 4812.* (US *no.* 2, 466, 373) Arroyo del Potrero, between Portezuelo de la Cuesta de los Dolores and Rancho Agua Escondido (*ca* 90 km easterly from Villa Constitucíon). Sierra de la Giganta, Baja California, Sur, Mexico, ca. Lat. 25° 06′ N., Long. 110° 57′ — 110° W. Altitude *ca* 450 meters. A scandent clump on north facing cliff. In the "narrows" of the canyon. 19 October


Plate 1341. *Carterothamnus anomalochaeta* Holotype (US) *Carter 4812.*

1964. Isotype at UC. Paratype: same locality *Carter 5147* July 17-20 1966.

CATONSVILLE COMMUNITY COLLEGE
CATONSVILLE, MARYLAND

# THE IDENTITY OF PSORALEA MULTIJUGA ELL. (LEGUMINOSAE).

Robert L. Wilbur[1]

It was with a sense of guilt that I noted in Barneby's most impressive treatment of the North American species of *Astragalus* (Mem. N.Y. Bot. Gard. 13: 544-545. 1964.) that the identity of *Psoralea multijuga* Elliott was still in question nine years after I had examined the type.

Vail (Bull. Torrey Club 21: 118. 1894) reported that Elliott's type had been examined by both Drs. Britton and Small and had "proved to be *Astragalus glaber* Michx." *Astragalus glaber* Michx. is a later homonym of an Old World species named by Lamarck in 1783; the southeastern species is now called *Astragalus michauxii* (Kuntze) F. J. Hermann. Small (Man. Se. Fl. 710. 1933.) listed *P. multijuga* Ell. in the synonymy of *Tium michauxii* (Kuntze) Rydb.

Weatherby (Rhodora 44: 249. 1942.) in a paper concerned with the types in Elliott's Herbarium felt that in spite of its resemblance to the species now known as *A. michauxii*, its inflorescence appeared quite different. Weatherby concluded that he "did not recognize it; [and that]: it should have further investigation."

Barneby (op. cit. p. 545.) felt that "Elliott's description of its 'trailing stem' and especially its monospermous germ are impossible to reconcile with the erect growth habit and 30-40 ovules" of *A. michauxii*. He pointed out that since there was an *Astragalus multijugus* DC. dating from 1825, there was little likelihood that Elliott's name could affect the nomenclature of this or any other Astragalus. In passing it might be noted that Elliott did not describe *P. multijuga* as possessing a "trailing" stem but one "apparently 1-2 feet high" and, lacking fruit, he merely surmised from the appearance of the young "germ" [=ovary] that it

[1]Grateful acknowledgement is made for NSF Grant 18799 which was held while this paper was prepared.

would be 1-seeded. Elliott apparently had no first hand familiarity with any of the included species of *Astragalus* with the possible exception of *A. villosus.* Even *A. canadensis* was described as prostrate.

I had the privilege of examining the type specimen of *P. multijuga* in the Charleston Museum (CHARL) in August 1957. The specimen there bears a manuscript name, as reported by Weatherby, with the genus questioned. It also bears the name of the Mr. Gourdine who had collected it "some years ago" in the vicinity of Abbeville, South Carolina. Both the collector and the locality were indicated by Elliott in his Sketch.

Elliott's *P. multijuga* is not *Astragalus michauxii* (=*A. glaber* Michx.) but *A. canadensis* L. The specimen is the top of a young plant about 2 dm long with two flowering racemes and two more with flowers in bud. The calyx lobes of the type are about 3.5-3.7 mm long and about twice as long as the moderately appressed villous calyx tube (c. 1.5-1.7 (2.2) mm long). The leaflets are sparsely strigillose beneath and the stipules are about 6.5 mm long. Elliott reported that "under the microscope" the leaves beneath were "apparently covered with minute black glands." The leaves do appear minutely mottled but the spots are definitely not psoralioid glands but appear to be cellular occlusions which caused some puckering upon drying. The specimen hence seems to fall within the range of variation allowed in *A. canadensis* L. or *A. canadensis* var. *carolinianus* (L.) M. E. Jones. However, as previously reported (N.C. Agri. Expt. Sta. Tech. Bull. **151.** p. 225. 1963.), the proposed varieties of this species in eastern North America lack discrete geographical ranges and the variation of morphological characters upon which the varieties were based seems almost continuous. Barneby (op. cit. p. 604.) stated that there "is evidently some correlation between certain types of variation and dispersal patterns, but no reliable method of separating named geographic races . . .".

Elliott (Sk. Bot. S.C. & Ga. **2:** 225-226. 1822.) included five species of *Astragalus* (*A. carolinianus, A. canadensis, A. glaber, A. obcordatus* and *A. villosa* as a species of

*Phaca)*. There are specimens of at least the first four species in Elliott's herbarium but it is not surprising that he failed to identify the imperfect type specimen of *P. multijuga* with the two scrappy specimens from Muhlenberg now in his herbarium representing *A. carolinianus* and *A. canadensis*.

DUKE UNIVERSITY
DURHAM, NORTH CAROLINA

# SOUTHEASTERN LIMIT OF FAGUS GRANDIFOLIA

DANIEL B. WARD[1]

The American beech, *Fagus grandifolia* Ehrh., occurs throughout eastern North America from eastern Wisconsin and Upper Michigan to Cape Breton Island, Nova Scotia, south to eastern Texas and western Florida (Little, 1953; Fowells, 1965). It reaches its southeastern limit in a series of isolated populations in Columbia County and northern Alachua County, Florida, as noted by Kurz & Godfrey (1962). These isolated stands have now been found to be somewhat more extensive than previously believed, and without exception to be in a state of rapid decline. The source of a recent erroneous extension of range into central peninsular Florida has been traced.

American beech apparently is entirely absent from the lower Coastal Plain of southeastern Georgia (Duncan, 1950). It is common in southwestern Georgia and in the panhandle of Florida west of Leon County, but is again lacking in the low, pine flatwoods fringing the Florida Gulf Coast. East of Leon County beech seemingly does not occur for approximately 70 miles, to within a short distance of Lake City, Columbia County.

The absence of an otherwise widespread species in the area between Leon and Columbia counties is a frequent feature of plant and animal distribution in Florida. This area, bordered to the east by the Suwannee River and containing toward the west the much smaller Aucilla River, was occupied during Pleistocene interglacials by an embayment of the Gulf of Mexico (MacNeil, 1950). At times of maximum inundation this embayment extended across southeastern Georgia, isolating peninsular Florida from the mainland by the "Suwannee Strait."

The disjunct populations of American beech in Columbia and Alachua counties are all south and east of this long-

[1]I am indebted to W. D. Rice of Lake City for guidance to several of the beech stands noted here and to Marshall Crosby of Gainesville for assistance with the measurement of the Santa Fe grove.

vanished barrier. They are not widely scattered, but occur rather in two clusters, near Lake City, Columbia County, and between Bland and Sante Fe, Alachua County[2].

All Columbia County stands are small and show little or no evidence of natural reproduction. A stand in Lake City, well known around the turn of the century and the probable source of several early collections (the earliest — A. W. Bitting, 22 June 1892 [FLAS]), is now reduced to a few trees near Alligator Lake. Scattered trees are said to occur on the Doug Epperson farm about 2 miles west of Lake City. Two trees, the larger 18 inches dbh., have been seen along the bank of a dry ox-bow channel of Falling Creek, 5 miles northwest of Lake City.

Further south, in Alachua County, two stations are known for American beech. One, on the Carl Doke farm, one-half mile east of Bland, consists of a solitary large tree; although fruits are produced abundantly, no seedlings have been observed.

The second Alachua County stand forms what is believed to be the southeasternmost stand for American beech. It covers several acres along the slopes and on the precipitous banks of a small, forking stream, a tributary of the Santa Fe River, north and south of Florida Highway 236, 2 miles west of the town of Santa Fe. Over most of the area the trees are widely scattered, but along a portion of the stream course and on the terrace between two small forks it is the dominant species, to the near exclusion of other woody plants.

Within the Santa Fe stand 115 trees have been measured

[2]The range of *Fagus grandifolia* appears in the past to have extended at least 40 miles south and 35 miles east of the present southernmost station. Dr. W. A. Watts, Trinity College, Ireland (pers. comm.), in analyzing a twelve meter core from the bed of Mud Lake, east of Ocala, Marion County, has found indisputable *Fagus* pollen in quantities too large to attribute to long-distance wind drift. Between the 11 and 12 meter levels *Fagus* made up one to two percent of the tree pollen, and trace amounts were found upward in the core to a level of approximately 5.8 meters. Watts estimates that these horizons date far back into the Pleistocene, and are very probably older than the last interglacial period.

and mapped. The tally is not exhaustive for specimens in the smaller diameter classes, but is probably close to complete for the larger individuals. Excluding those under 4 inches dbh., the average diameter for the remaining 97 was 14.8 inches. Three of these were greater than 25 inches in diameter, with the largest attaining 27.4 inches. The distribution of individual trees in diameter classes approximated a normal curve, with far fewer small individuals than would be anticipated in a vigorously reproducing population; only 7 trees were tallied with diameters between 2 and 6 inches.

The distance and time by which these populations have been separated from the extensive stands of the Pleistocene mainland have not resulted in consequential morphological divergence. W. H. Camp, during his never-published study of variation within *Fagus grandifolia*, annotated Lake City material with a subspecific designation corresponding to var. *caroliniana* (Loud.) Fern. & Rehder, the Coastal Plain variant sometimes known as white beech. He similarly annotated specimens from throughout West Florida, including isotypic material of forma *mollis* Fern. & Rehder from Tallahassee, Leon County.

A recent mapping of the distribution of American beech (Fowells, 1965) has indicated a disjunct station in west-central peninsular Florida. Through the courtesy of E. L. Little, this record was learned to be based upon a specimen on deposit at the University of North Carolina (UNC). This specimen has since been examined; it is labeled "Crystal Springs, Pasco County, Florida, April 13, 1915, T. G. Harbison 11829," and it is indisputably American beech. A Crystal Springs does exist in Pasco County, but neither beech nor the association in which it is likely to occur is to be found there at the present time. With the assistance of H. E. Ahles, Harbison's 1915 field books were perused. In that year Harbison did travel through Florida, as well as other southern states, and his notes do not always specify his whereabouts on a given date. However, his railroad schedules, livery rentals, certain non-Florida or non-Peninsular species collected simultaneously with the

*Fagus (Quercus borealis, Carya pallida)*, and other indications of his route, clearly demonstrate that Harbison's Crystal Springs was the town by that name in Copiah County, Mississippi, where American beech occurs abundantly.

DEPARTMENT OF BOTANY
UNIVERSITY OF FLORIDA, GAINESVILLE

LITERATURE CITED

DUNCAN, W. H. 1950. Preliminary reports on the flora of Georgia. 2. Distribution of 87 trees. Am. Midl. Nat. 43: 742-761.

FOWELLS, H. A. 1965. Silvics of forest trees of the United States. U.S. Dept. Agr. Handb. 271: 172-180.

KURZ, H., & R. K. GODFREY. 1962. Trees of Northern Florida. Univ. of Florida Press, Gainesville, 311 pp.

LITTLE, E.L. 1953. Check list of the native and naturalized trees of the United States. U. S. Dept. Agr. Handb. 41: 183-184.

MACNEIL, F. S. 1950. Pleistocene shore lines in Florida and Georgia. U. S. Geol. Surv. Prof. Paper 221-F.

# FLAGELLATES AND DESMIDS

# NEW TO MASSACHUSETTS

EDGAR E. WEBBER

The many lakes, ponds, and marshy areas in Massachusetts provide numerous and varied habitats for phycological studies. The freshwater algal vegetation of the eastern and southeastern regions of the state has been investigated rather thoroughly (Webber, 1963). Published accounts of the algae of western Massachusetts, however, appear to be limited to those by West (1889) and Webber (1964).

A variety of interesting flagellates and desmids has been collected from two locations in the Amherst, Massachusetts area. These locations are a roadside seepage area adjacent to State Route 9, one mile southeast of Amherst, and Hawley Bog, Hawley, Mass.

Because many of the algae collected from these two locations have not been recorded from Massachusetts, a report of their presence in the state is warranted to attain accurate distributional data for such species.

Flagellates were determined after Prescott (1962), while Irénée-Marie (1938) was consulted for the majority of desmid identifications.

## EUGLENOPHYTA

*Euglena acus* var. *rigida* Hueb. Plate I. fig. 1.

Cells 62$\mu$ × 100$\mu$, elongated, tapering posteriorly, rigid while in motion, with two rod-shaped paramylon bodies. Common. Amherst.

*Phacus helikoides* Poch. Plate I, figs. 2, 3.

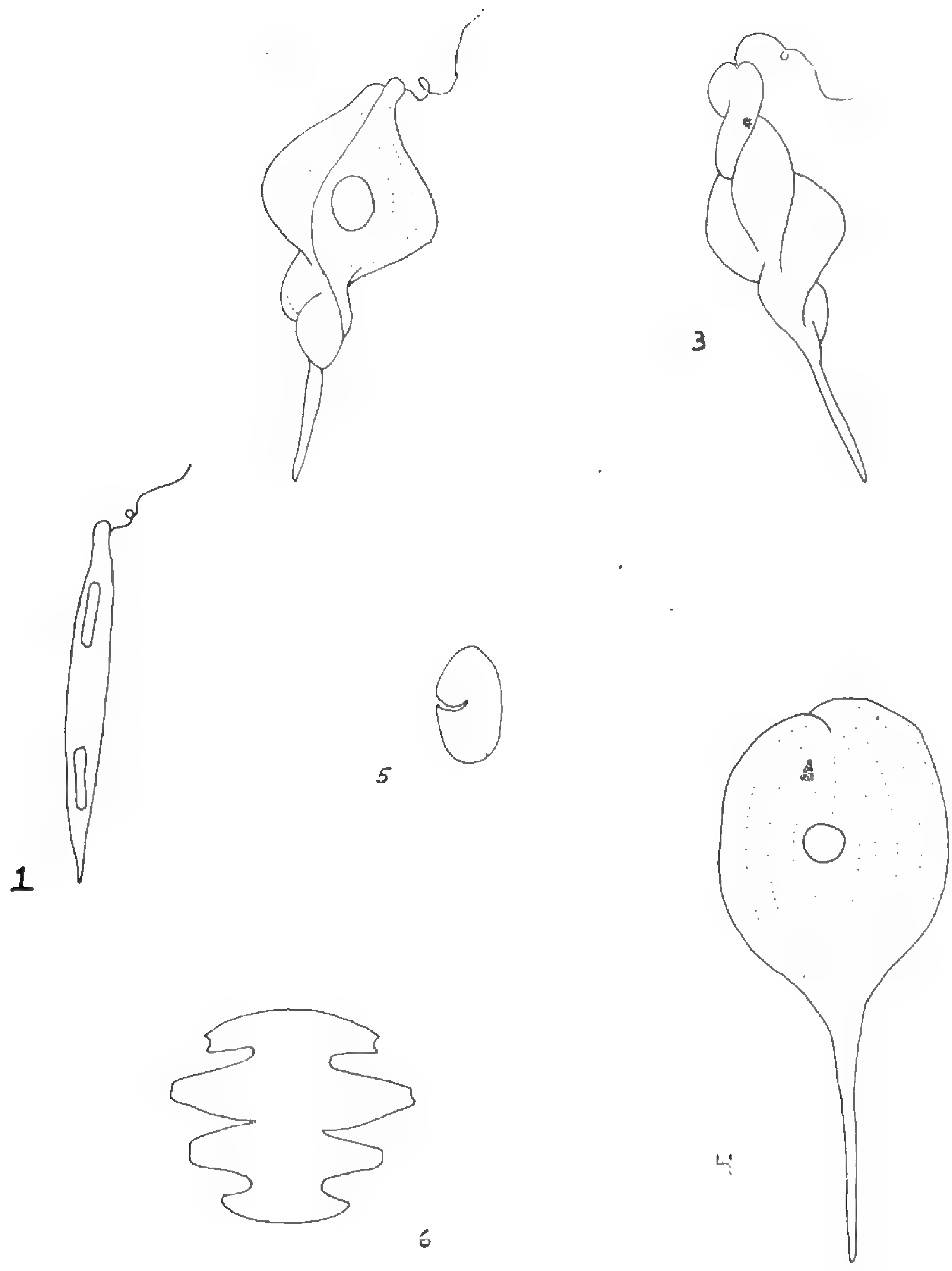
Cells 49-55$\mu$ × 100-111$\mu$, elongate-pyriform, twisted throughout but tapering posteriorly to a straight caudus slightly less than ½ the length of the cell, periplast longitudinally striated, one large and centrally placed circular paramylon body. Common. Amherst.

*P. longicauda* (Ehrenb.) Dujardin Plate I, fig. 4.

Cells 31-62$\mu$ × 112-136$\mu$, ovoid, broadly rounded anteriorly, tapering posteriorly to a straight caudus as long as the cell body, periplast longitudinally striated, one central circular paramylon body. Common. Amherst.

*P. pyrum* (Ehrenb.) Stein

Cells 18.6 $\mu$ × 37$\mu$, ovoid-pyriform, tapering posteriorly to a




Figs. 1-6, all × 450. Fig. 1: *Euglena acus* var. *rigida;* figs. 2, 3: *Phacus helikoides;* fig. 4: *P. longicauda;* fig. 5: *Hemidinium nasutum;* fig. 6: *Micrasterias pinnatifida* forma *rhomboidea.*

straight caudus, anteriorly with a conspicuous papilla on either side at the point of flagellar attachment, periplast ribbed and spiralling posteriorly to the right, paramylon not observed. Common. Hawley.
*Leptocinclis acuta* Prescott

Cells $12\mu \times 31\mu$, pyriform, tapering posteriorly, periplast spirally striated, paramylon as two lateral plates. Rare. Amherst. First record for Massachusetts.

*Trachelomonas armata* var. *longispina* (Playf.) Defl.

Test $31\mu \times 44\text{-}55\mu$, broadly rounded, beset with short spines anteriorly and a mixture of short and long spines posteriorly. Common. Amherst.

*T. horrida* Palmer

Test $24\mu \times 44\mu$, ovoid, completely covered with numerous spines of varying length. Common. Amherst.

*T. volvocina* Ehrenb.

Test $24\mu$ dia., spherical and smooth. Common. Amherst.

## Pyrrhophyta

*Hemidinium nasutum* Stein Plate I, fig. 5.

Cells $18.6\mu \times 31\mu$, elliptical and flattened, transverse furrow incomplete. Common. Amherst. First record for Massachusetts.

## Chlorophyta

Because many of the desmids collected are ubiquitous and, therefore, well known, they are presented in list form. Those particular species new to Massachusetts are so indicated. Desmids were collected at the Amherst location, unless otherwise noted.

*Closterium abruptum* West

*C. Kuetzingii* Breb.

*C. libellula* Focke var. *intermedium* Roy & Bis.

*C. setaceum* Ehrenb.

*C. ulna* Focke

*Staurastrum avicula* Breb. var. *subarcuatum* (Wolle) West

*S. biennianum* var. *ellipticum* Wille

*S. controversum* Breb. (Irénée-Marie, 1938, pl. 55, fig. 12; pl. 56, fig. 11.) First record for Massachusetts.

*S. crytoserum* Breb.

*S. dejectum* Breb.

*S. Dickei* Ralfs. Hawley.

*S. furcatum* Ehrenb. var. *pisciforme* (Breb.) Turner (Irénée-Marie, 1938, pl. 55, figs. 9, 10.) First record for Massachusetts.

*S. gracile* Ralfs

*S. Johnsonii* West & West var. *depauperatum* G. M. Smith (Irénée-Marie 1938, pl. 53, figs. 2, 3.) First record for Massachusetts.

*S. paradoxum* Meyen

*S. pentacerum* (Wolle) G. M. Smith. Hawley.

*S. polymorphum* Breb.

*S. setigerum* Cleve.

*Micrasterias pinnatifida* (Kuetz.) Ralfs

*M. pinnatifida* forma *rhomboidea* Brunel Plate I, fig. 6.
Rare. Hawley. First record for Massachusetts.
*M. rotata* (Grev.) Ralfs
*Pleurotaenium nodosum* (Bailey) Lundell
*P. nodulosum* Breb.
*Xanthidium antilopaeum* (Breb.) Kuetz. var. *hebridarum* West & West

DEPT. OF BOTANY, PENNSYLVANIA STATE UNIVERSITY
THE BEHREND CAMPUS, ERIE, PA.

LITERATURE CITED

IRÉNÉE-MARIE, FR. 1938. Flore desmidiale de la region de Montreal. Laprairie, Canada.

PRESCOTT, G. W. 1962. Algae of the western Great Lakes area. Revised edition. W. C. Brown Co., Dubuque, Ia.

WEBBER, E. E. 1963. The ecology of some attached algae in Worcester County, Massachusetts. Amer. Midl. Natur. **70**:175-186.

————. 1964. A rare bluegreen alga from Massachusetts. Rhodora. **66**:163-164.

WEST, W. 1889. List of desmids from Massachusetts, U. S. A. Jour. Roy. Microscop. Soc. pp. 16-21.

STIPULICIDA IN GRAY'S MANUAL RANGE — Pine barrens on white sands along the Blackwater River in Isle of Wight, Nansemond, and Southampton counties of Virginia yielded many species which were then new to the Manual Range when Professor M. L. Fernald and his colleagues collected in this region more than twenty years ago. Dr. Henry K. Svenson and the writer were working on the distribution of some of these species which extend into Virginia from the south when we discovered an area in the southwestern corner of Isle of Wight County where Fernald apparently had not collected. Here is an oak-pine "barren" with turkey oak and loblolly pine the dominant trees and understories of ericaceous shrubs, creeping blueberry, *Vaccinium crassifolium,* and *Pyxidanthera barbulata.*

Dr. Svenson discovered a low, annual member of the Caryophyllaceae to be common in open areas of white sand and the plant was previously unknown to him and the writer. It is *Stipulicida setacea* Michaux and is now known from Virginia, the Carolinas, Georgia, Florida, and Mississippi. The genus is endemic to the southern coastal plain and has a second species ranging from Florida to Mississippi.

Some associates of the *Stipulicida* in Virginia are *Gaylussacia baccata, Vaccinium elliottii, V. tenellum,* and *V. vacillans.* Where turkey oak stands are dense, understories include *Kalmia angustifolia, Pyxidanthera,* and *Vaccinium crassifolium,* but *Stipulicida* is absent.

Specimens of the *Stipulicida, Svenson and Harvill 13932,* will be deposited in the Gray Herbarium and the herbaria of Longwood College, University of North Carolina, and Virginia Polytechnic Institute. The number belongs to the junior collector's series.

A. M. HARVILL, JR.
LONGWOOD COLLEGE, FARMVILLE, VIRGINIA

ADDITIONS TO THE FLORA OF THE BIMINI ISLAND GROUP, BAHAMA ISLANDS. — Howard (Ecol. Monogr. 20:317-349. 1950) listed the flora of the Bimini Island Group in his excellent study of the vegetation of those islands. Recent field work on the Biminis has turned up the following additions:

1. *Paspalum millegrana* Schrad. South Bimini Island. Along dirt road between airport and Federal Aviation Agency Station. Common. Also occurring in scattered clumps all along road from ferry landing to airport. 13 July 1964. *Stimson 722.*
2. *Eleocharis geniculata* (L.) R. & S. South Bimini Island. Growing in shallow water at edges of and along shore of small pond on northern end of the island north of road to airport. Common in this place. 12 July 1965. *Stimson 708.*
3. *Tillandsia aloifolia* Hook. South Bimini Island. "Blackland" forest between Cavelle Pond and north coast of island. Only one plant seen here. 30 March 1965. *Stimson 1110.* South Bimini Island. "Blackland" forest north of road to airport about 1/5 mile west of airport. Common. 31 March 1965. *Stimson 1119.*
4. *Tillandsia balbisiana* Schultes. South Bimini Island. Edge of halophytic *Avicennia* swamp near north edge of eastern lobe of Cavelle Pond. Epiphytic on fallen branch. 30 March 1965. *Stimson 1113.*

Specimens of these collections are deposited in the herbarium of Duke University; duplicates have been distributed to other herbaria.

William R. Stimson
Department of Botany, Duke University,
Durham, North Carolina

ALLIUM AMPELOPRASUM IN MISSISSIPPI — The discovery of *Allium ampeloprasum* L. as a wild plant means that Mississippi is the seventh state in the eastern United States in which this species is known to occur. Fernald (1950), Gleason (1952), and Gleason and Cronquist (1963) listed the species as occurring in Virginia. James (1956) added records for Tennessee. North Carolina and South Carolina were included by Ahles, Bell, and Radford (1958) and Browne (1961, 1963) reported the species from Kentucky and Illinois.

During the summers of 1964 and 1965, field work connected with my study of the vascular flora of Mississippi revealed *A. ampeloprasum* at three sites. At all locations the plants were flourishing. Apparently this native of Europe is well able to compete with our native vegetation and establish itself as a weed in this part of the country.

Specimens cited: Mississippi. Tishomingo County. Roadside ditch between Iuka and J. P. Coleman State Park. June 18, 1964. *Thomas M. Pullen 64469.* Lafayette County. Dry roadside bank in Holly Springs National Forest about two miles south of Denmark Fire Tower. May 31, 1965. *Thomas M. Pullen 6589.* State Highway 30 right-of-way four miles northeast of Oxford. June 22, 1965. *John M. Herr, Jr.* Voucher specimens are deposited in the herbarium of the University of Mississippi.

THOMAS M. PULLEN[1]
DEPARTMENT OF BIOLOGY,
THE UNIVERSITY OF MISSISSIPPI, UNIVERSITY.

---

[1]This work was supported by the Committee on Faculty Research of the University of Mississippi. I wish to thank Dr. E. T. Browne, Department of Botany, University of Kentucky for verifying my identification.

LITERATURE CITED

AHLES, H. E., C. R. BELL, and A. E. RADFORD. 1958. Species new to the flora of North or South Carolina. *Rhodora* **60:** 10-32.

BROWNE, E. T. 1961. Some new or otherwise interesting reports of Liliaceae from the southeastern states. *Rhodora* **63:** 304-311.

—————. 1963. *Allium ampeloprasum* L. in Illinois. *Castanea* 28: 170-172.

FERNALD, M. L. 1950. *Gray's Manual of Botany.* ed. 8. American Book Co.: New York.

GLEASON, H. A. 1952. *The New Britton and Brown Illustrated Flora.* New York Botanical Garden: New York.

—————, and A. Cronquist. 1963. *Manual of Vascular Plants of Northeastern United States and Adjacent Canada.* Van Nostrand: Princeton, N. J.

JAMES, R. L. 1956. Introduced plants in northeast Tennessee. *Castanea* **21:** 44-52.

## AN ANNOTATED BIBLIOGRAPHY OF MEXICAN FERNS George Neville Jones. University of Illinois Press, Urbana and London, 1966. pp. XXXIII-297. $5.00

Students of American ferns have been given a firm foundation by this publication of Dr. Jones. The bibliography proper (authors and titles) occupies 237 pages with more than 1200 entries with approximately 3000 cross references. The feature that immediately commends itself is the brief paragraph after almost each item, indicating its relation with the ferns of Mexico (in this book the term "ferns" is used in a wide sense, comprising all the cryptogams belonging to the Tracheophyta), and obviously enhances the value of the bibliography.

Titles of periodicals are abbreviated following the principles and rules laid down in Appendix V, Guide to the Citation of Botanical Literature, in the 1956 edition of the International Code of Botanical Nomenclature, and some additional principles derived from L. Schwarten and H. W. Rickett, Abbreviations of Periodicals cited in the Index to American Botanical Literature (Bull. Torrey Club 74: 348-356. 1947).

In addition to the selection of authors-titles of taxonomic and phytogeographic significance many articles on morphology, ecology, exploration, economic botany, bibliography, biography, etc. have been included in the General Index. A Geographical Index has entries referring to each state of Mexico. A Biographical Index lists names and dates of 180 botanists associated with collections or papers about Mexican ferns. Finally, a Systematic Index cites the genera of ferns with pertinent references.

There can be no doubt that the author's statement "Botanists and others not particularly interested in the ferns of Mexico may find this biblography useful" will be amply fulfilled. This publication will be a real aid to those botanists interested in the study of American ferns in general and Mexican ferns in particular.

RAMON RIBA,
GRAY HERBARIUM, HARVARD UNIVERSITY.
INSTITUTO DE BIOLOGÍA, UNAM, MEXICO CITY

NEWS ANNOUNCEMENT — FLORA NORTH AMERICA LAUNCHED — FLORA NORTH AMERICA, as the project will be called, was officially launched on 30 January 1967 when the newly formed Editorial Committee held its first meeting at the Smithsonian Institution in Washington, D. C. This three-day meeting, convened by William L. Stern (Smithsonian), Chairman *pro tem.* of the Steering Committee, was attended by all members of the Editorial Committee:

Peter H. Raven, Chairman, Stanford University
Stanwyn G. Shetler, Secretary, Smithsonian Institution
John H. Beaman, Michigan State University
Kenton L. Chambers, Oregon State University
Robert Kral, Vanderbilt University
Walter H. Lewis, Missouri Botanical Garden
John T. Mickel, Iowa State University
Roy L. Taylor, Canada Department of Agriculture, Ottawa
John H. Thomas, Stanford University

Also attending were Robert F. Thorne (Rancho Santa Ana

Botanic Garden), Chairman of the Advisory Council, and Vernon H. Heywood (University of Liverpool), Secretary of FLORA EUROPAEA, who served as a consultant in the discussions and gave a concluding public lecture, "FLORA EUROPAEA, Its Conception and History," on 1 February. The purpose of the project is to prepare a concise diagnostic manual to the vascular plants of the continental United States, Canada, and Greenland, and the Editorial Committee dealt at least in a preliminary way with a large range of questions concerning the roles of the respective committees, the functioning of the Editorial Committee and its secretariat, the solicitation of authors and advisors, and the format, arrangement, timetable, and funding for FLORA NORTH AMERICA. It is expected that the first 12 to 18 months will be occupied getting the project fully organized and the working procedures implemented. This will be followed by the second phase of intensive writing and editing for the first volume. Tentatively, four volumes, followed by a fifth comprising a theoretical symposium on the North American flora, are anticipated. The whole effort is expected to last 12-15 years. A full progress report on FLORA NORTH AMERICA will be published at an early date. The Editorial Committee wil convene its next meeting at College Station, Texas, in August 1967, when the American Institute of Biological Sciences holds its annual meetings at the Agricultural and Mechanical College of Texas. The first meeting was financed by the Smithsonian Office of Systematics (Richard S. Cowan, Director).

STANWYN G. SHETLER
SMITHSONIAN INSTITUTION, WASHINGTON, D. C. 20560

# NEW TAXA IN THE GENUS ALSOPHILA

RAMON RIBA

During a taxonomic revision of the *Alsophila swartziana* group two new species and a variety were found, which are described as follows.

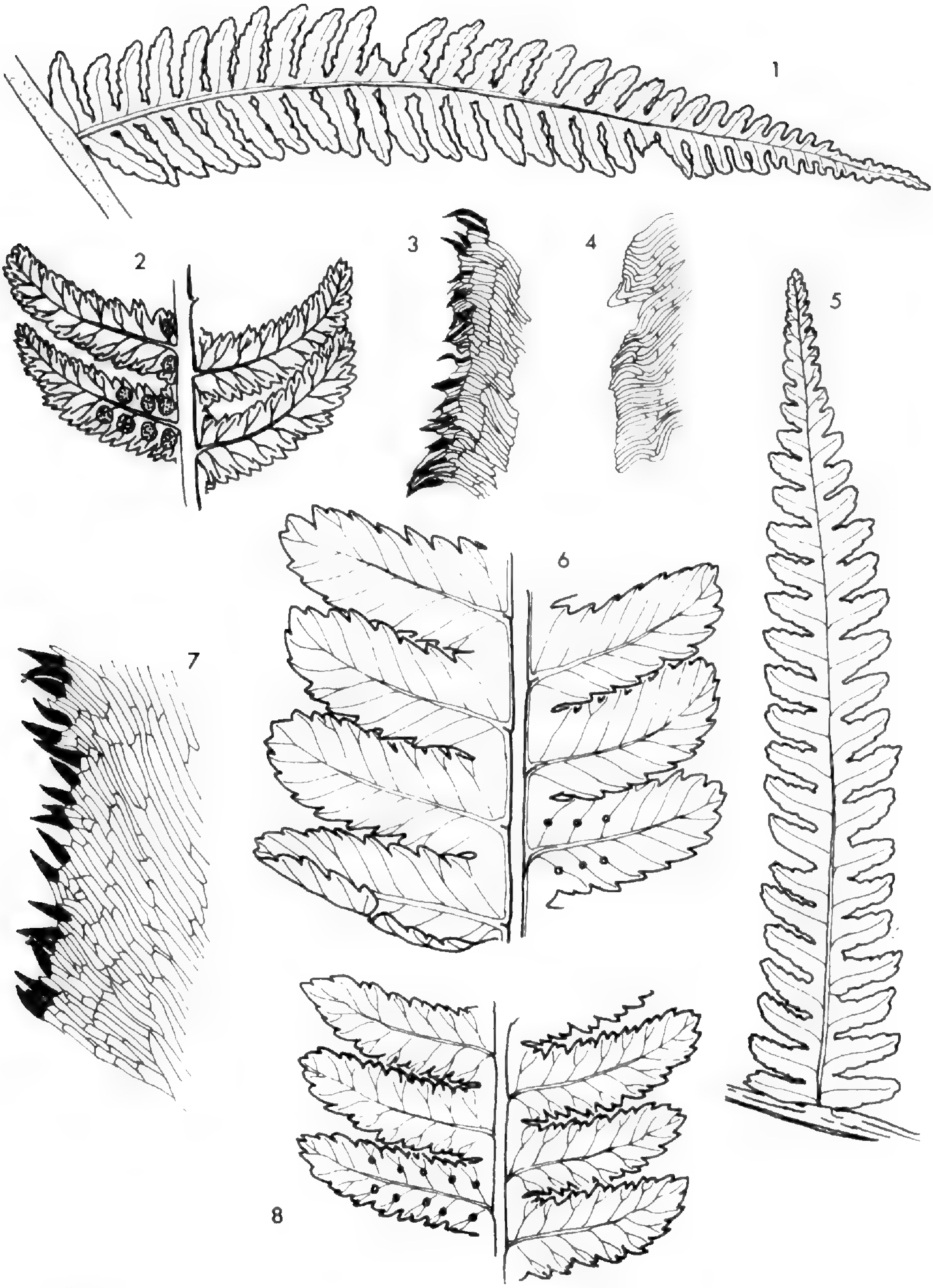
*Alsophila tryonorum* Riba, spec. nov. Figs. 1-4

Species *A. conjugatae* et *A. trichiatae* affinis. Petiolus crassus aculeatus squamatus valde pubescens, squamis lanceolatis basaliter truncatis bicoloribus denticulis fuscis tenuibus, trichomatibus biformibus rigidis et catenulatis. Lamina bipinnato-pinnatifida 3.0-3.5 m. longa 1.4-2.0 m. lata. Pinnae sessiles lineari-ovatae 70-100 cm. longae 35-40 cm. latae, rhachides secundariae pubescentes trichomatibus biformibus rigidis et catenulatis, pinnulae sessiles pinnatifidae lanceolatae longe acuminatae 13-20 cm. longae 1.5-2.7 cm. latae, costae subter squamatae et pubescentes, squamis tenuibus parvis orbiculatis apiculatis, trichomatibus biformibus aliquot rigidis plerumque flexoosis multis catenulatis. Segmenta supra pubescentia in costulis venis et inter venis, subter valde pubescentia in costulis et venis, trichomatibus rigidis ad margines vix ciliatis, venae 11- 13-jugae obliquae venulis 1- 2-jugis, sori 7- 10-jugi ad furcam venarum vel basaliter plerumque in venulis basalibus inserti.

*Holotypus:* Cuesta de Fusagasugá, Dept. Cundinamarca, COLOMBIA, 2540 m. Feb. 18, 1940, *Cuatrecasas 8036* (US).

*Paratypi:* VENEZUELA. Aragua: Colonia Tovar and vicinity, *Fendler 49* (pars) (F, GH, MO, US), *Pittier 9345* (GH, NY, VEN, US); between El Portachuelo and Ocumare, *Pittier 11394* (VEN, US); between Maracay and Choroni, *Pittier 13902* (GH, VEN, US). COLOMBIA. Antioquía: Páramo de Sonsón, *Bro. Daniel 3437* (US); La Ceja, *Bro. Daniel 683* (US); Cundinamarca: Cuesta de Fusagasugá, *Cuatrecasas 8071* (F, GH, US); Tolima: Caldas Termales, Santa Rosa de Cabal, *Dryander 2742* (US); Honda-Ruíz, prov. de Soledad, *Mayar 75* (US); Cauca: Popayán, *Yepez 175* (F, US); Valle del Cauca: Hoya del Río Digua, *Cuatrecasas 14982* (F, GH); Putumayo, between San Francisco and Sachamate, *Ewan 16673* (GH, US). ECUADOR. Napo: Río Chingual, *Acosta 13247* (F); *Sodiro* (NY); Nanegal, *Sodiro* (US).

This species shows an evident relation with *A. trichiata* Maxon because of the similarity of the distribution of the pubescence. However, in *A. trichiata* the rigid trichomes are longer and the catenate trichomes of the petiole are not so abundant as in *A. tryonorum;* the petiole scales in *A.*




Figs. 1-4. *Alsophila tryonorum* Riba. 1. — Pinnule, × 0.5; 2. — Ultimate segments, × 1.5; 3. — Border of crozier scale, × 20; 4. — Border of petiole scale, × 20. All from the holotype. Figs. 5-7. *Also-*

*trichiata* have a margin with contiguous dark denticulations, while in *A. tryonorum* the margin has very few dark denticulations or none, except in crozier scales where the dark denticulations are always present. Another relation is with *A. conjugata* Spruce in the similarity of the petiole scales together with the abundant winged trichomes and bullate scales in the lower surface of the segments. However, the petiole in *A. conjugata* is glabrous, while in *A. tryonorum* it is strongly pubescent with rigid and catenate hairs.

This species is named after Dr. Rolla M. Tryon and Dr. Alice F. Tryon for their contributions to the taxonomy of the ferns.

*Alsophila estelae* Riba, spec. nov. Figs. 5-7

Petiolus gracilis aculeatus squamatus, pubescens solum adaxiale latere, squamis lanceolatis, basaliter brunneis denticulis fuscis, trichomatibus rigidis. Lamina bipinnato-pinnatifida 1.2-1.5 m. longa 55-60 cm. lata, rhachis pubescens. Pinnae sessiles, lineari-ovatae acuminatis 25-30 cm. longae 10-11 cm. latae, rhachides secundariae pubescentes trichomatibus rigidis, pinnulae sessiles pinnatifidae lineari-lanceolatae acuminatae 5-6 cm. longae 1.0-1.2 cm. latae costae subter pubescentes et vix squamatae, trichomatibus biformibus rigidis et catenulatis, squamis tenuibus parvis orbiculatis. Segmenta supra pubescentia in costulis, subter pubescentia in costulis et venis trichomatibus rigidis et adpressis, squamata in costulis, squamis bullatis, ad margines vix ciliatis, venae 7-8-jugae obliquae plerumque simplices, sori 2- 4-jugi in medio venarum.

*Holotypus:* Mount Horeb, ca. 3/4 mile South (air) of Green Hill, on trail to Woodcutters Gap, Portland Parish, JAMAICA, 3700 ft. December 31, 1966, *Riba 214* (MEXU). Isotypus: GH.

*Paratypi:* Mount Hybla, Cinchona, St. Thomas Parish, *J. P. (Jamaican Plants) 49* (GH, IJ); same locality as holotype, December 28, 1966, *Riba 196* (GH, MEXU).

*Alsophila estelae* is one of the most graceful tree ferns in Jamaica. At first sight it can be easily confused with *A. swartziana*, a species that grows in the same place. However, the slender trunk (3-4 m. tall and ca. 4-6 cm. thick) and the crown of small leaves make that species clearly dis-

*phila estelae* Riba. 5. — Pinnule, ×2; 6. — Ultimate segments, × 5; 7. — Border of petiole scale, × 60. All from the holotype. Fig. 8. *Alsophila scabriuscula* Maxon var. *guatemalensis* Riba, ultimate segments, × 3. From the holotype.

tinctive in the field. *Alsophila estelae* is easily differentiated from *A. swartziana* (beside the characters already mentioned) by the usually simple rather than forked veins and by the position of the sorus when, rarely, the veins are forked. Then the sorus is borne below the fork in *A. estelae* rather than at the fork as in *A. swartziana*. In addition, *A. estelae* lacks the flat scales or winged trichomes near the base of the sori which are characteristic of *A. swartziana*.

This species is named for Mrs. María Estela Riba.

*Alsophila scabriuscula* Maxon var. *guatemalensis* Riba, var. nov. Fig. 8

Differt a forma typica sinu inter segmenta fertilia acuto vel anguste quadrangulari segmentis 6-7 mm. longis. Segmenta crenato-dentata vix duplicato-dentata, costulae et venae subter pubescentes trichomatibus longis flexuosis, venae 7- 8-jugae, sori 5- 6-jugi, receptaculum parvum sessile paraphysibus longis flexuosis.

*Holotypus:* Between Ixcan and Finca San Rafael, Sierra de los Cuchumatanes, Dept. of Huehuetenango, Guatemala, July 24, 1942, *Steyermark 49417* (F).

*Paratypi:* Alta Verapaz, between Cubilquitz and Hacienda Yaxcabnal, *Steyermark 44829* (GH, US); Izabal, along Río Frío, *Steyermark 39942* (F, US); along Río Tameja, *Steyermark 41802* (GH, US); Sierra del Mico, between Los Amates and Izabal, *Kellerman* 7163 (F).

The differences between this variety and var. *scabriuscula* are in the sinuses, which in the variety *guatemalensis* are acute to narrowly quadrangular, and in the smaller size of the leaves and their parts. In the variety *scabriuscula* the sinuses are widely quadrangular and the leaves are larger with the ultimate segments up to 17 mm. long.

Although the two varieties occur in the same general region, they are distinct as demonstrated by the characters given above. Additional collections in the future may show intergradation between the two variants, but with the material that I have, they can stand as varieties.

This paper was completed during the tenure of a John Simon Guggenheim Fellowship, which is gratefully ackowledged.

GRAY HERBARIUM, HARVARD UNIVERSITY
AND INSTITUTO DE BIOLOGIA, MEXICO

## A CORRECTION

Since the publication of the article entitled Botanical Notes from the Pringle Herbarium I (Rhodora 68:514ff. 1966), my attention has been called to an error which ought to be corrected. *Eleusine indica* (L.) *Gaertner* was reported from Hartford, Vermont. "Hartford Ctr., Vermont" is the way the hand-written or hand-printed label reads. It is not in the hand of the collector himself. However, the same collector, E. J. Dole, collected three other specimens of the same species, of the same number, on the same date (or exactly one year later!) in Hartford, Connecticut. It is probable that the specimens all came from the same locality, namely, Hartford, Conn. The error must have occurred in copying the label. The abbreviations, Vt. and Ct., look much alike. Also the handwriting of the collector, which is on one of the labels, is very difficult to read. Consequently *Eleusine indica* remains unknown in Vermont.

FRANK C. SEYMOUR
PRINGLE HERBARIUM.
UNIVERSITY OF VERMONT, BURLINGTON

# INDICATIONS OF POSSIBLE MID-CENOZOIC HYBRIDIZATION IN THE ASPENS OF THE COLUMBIA PLATEAU

BURTON V. BARNES

Trembling aspen, *Populus tremuloides* Michaux, is the most widely distributed tree species in North America (Strothmann and Zasada 1957). Although several species and varieties of western aspens have been recognized, *Populus tremuloides* Michx. for many years has been the accepted name embracing this genetically variable taxon (Little 1953). One would expect major physiological differences and some related morphological differences throughout its vast range; an indication of the former is given by Pauley, Johnson, and Santamour (1963). They reported the results of a seed source experiment of aspens initiated in 1950-1952 in eastern Massachusetts, in which aspens from the Northeastern States, Lake States, Northern, Central, and Southern Rocky Mountains, Washington, and the Yukon territory were compared. Although the initial survival percentage was acceptable to high (41-100%), all western sources exhibited slow growth and were clearly ill-adapted to the environment of Weston, Massachusetts. Only 2 of the 549 individuals were alive in 1962. This experiment suggested that surprising differences may exist between western and eastern aspens.

The purpose of this paper is to introduce other evidence indicating that certain individuals as well as a population of aspen from the Columbia Plateau[1] may not be as closely related to eastern quaking aspen as we have tacitly assumed. Two clones of quaking aspen from northern Idaho resembling hybrids between *P. grandidentata* and *P. tremuloides*

[1]For purposes of this paper, the "Columbia Plateau," because of its relevance in mid-Cenozoic geology and flora, is used to designate the general area from which the author's collections and *Populus* fossils collected by numerous investigators were made. As used here it embraces what are now parts of California, Nevada, Oregon, Washington, Idaho, and Montana (Fenneman 1931).

in Lower Michigan are hereinn described. Morphological differences between a group of aspen clones from northern Idaho, Washington, and western Montana, considered here as part of the eastern edge of the Columia Plateau, are compared and contrasted with clones from Michigan.

## METHODS AND MATERIALS

During the summers of 1959 and 1960 collections of leaves and twigs of aspen clones for a personal study herbarium were made in northern Idaho, western Montana, and Washington as time and circumstances permitted. Observations of growth habit, phenology, and sex were also made. Opportunities for detailed study of the leaf and twig samples were delayed until March of 1966 when I had returned to the University of Michigan and resumed the investigations of natural hybridization in the aspens. Examination of the clones of the western specimens led to an unexpected discovery, namely that two of the western clones were evidently hybrids between *P. grandidentata* and *P. tremuloides* in leaf and bud characteristics. This discovery prompted a systematic study of 30 western clones sampled.

The early leaves from the central portion of shoots 1-3 in long were selected and the blade width and length, petiole length, and number of teeth per leaf side were determined. Up to 20 leaves were taken per clone for measurement; the average number was 18. The terminal buds of at least four shoots of each clone were examined and the presence and distribution of pubescence observed and recorded. Comparisons were made between these western clones and the bigtooth and quaking aspen clones sampled in northern Michigan (Barnes 1959). The latter group consisted of 21 bigtooth clones and 31 trembling aspen clones growing on two sites. Means of blade width and length, petiole length, and number of teeth for the two groups are not entirely comparable due to minor differences in sampling. However, the site differences are so great that only very general comparisons of leaf size can be made in any event. Number of teeth and pubescence on terminal buds have proved to be more reliable characteristics, and are thus apparently better phenotypic indicators of hybridity in Michigan aspens than

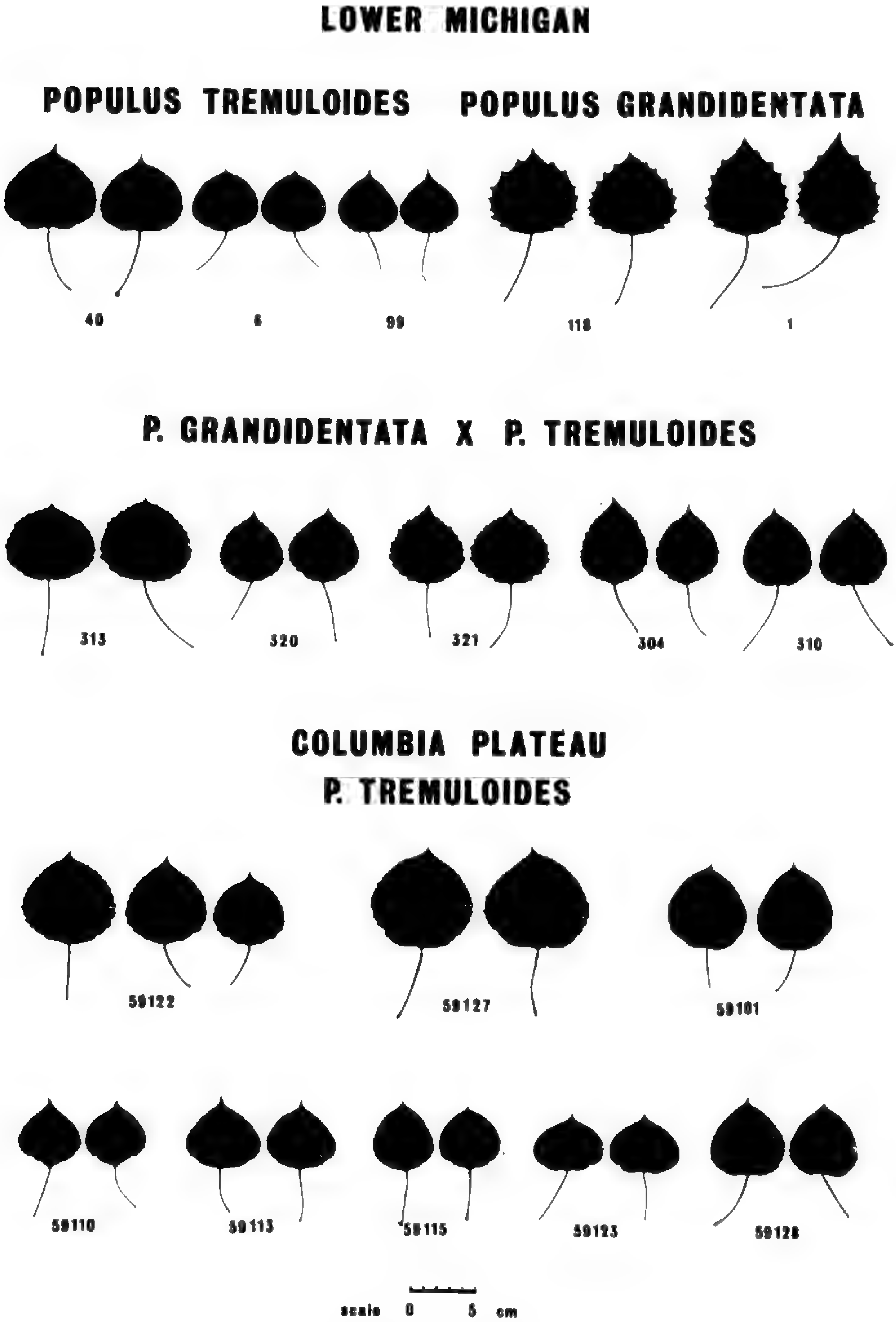



Fig. 1. Comparison of leaf size, shape and dentation of *P. grandidentata*, *P. tremuloides* and hybrids between them from Lower Michigan and "*P. tremuloides*" from the Columbia Plateau.

the leaf dimensions. Pubescence of buds collected Aug. 10-13, 1966 was studied on 50 clones of quaking aspen in Iron Co. and 20 clones in Washtenaw Co., Michigan.

## RESULTS AND DISCUSSION

Silhouettes of leaves from the central portion of shoots from clones 59122 and 59127 from Kootenai County, Idaho are illustrated in Fig. 1 (lower left). Representative leaves of Lower Michigan *P. tremuloides, P. grandidentata,* and natural hybrids[2] between them and leaves from six clones of quaking aspen from Idaho and Washington are also shown. It will be noted that Idaho clones 59122 and 59127 are like various natural hybrids in Michigan (Fig. 1). Although the Michigan hybrids exhibit great morphological variability, the most consistent diagnostic morphological characters are those of tooth number and bud pubescence which in presumed $F_1$ hybrids are approximately intermediate between those of the parents. There is, however, considerable variation even in these traits, and it is not yet known what amount of variation in these traits is attributable to maternal effects, introgression, and additive and non-additive gene action. For the aspens studied in Lower Michigan the average number of teeth of *P. grandidentata* clones was approximately 10, natural hybrids 18, and *P. tremuloides* 30. Means and ranges of tooth number and the means of leaf dimensions of the respective populations are presented in Table 1.

*Populus grandidentata* exhibited dense pubescence on all bud scales. Terminal buds in winter condition of *P. tremuloides* of Lower Michigan sites were glabrous except for rare clones having minute pubescence on the basal scales. Nearly all the terminal buds from the 70 clones collected in mid-August 1967 exhibited sparse pubescence on the upper portion of the basal bud scales. Many *P. tremuloides* clones showed bud scales which have ciliate margins. Natural hybrids have pubescence on almost all bud scales but it is usually much less dense than in *P. grandidentata;* the

[2]The term "natural hybrid" is used here to include $F_1$ hybrids, later generation segregates and introgressants; we are as yet unable to determine precisely the parentage of each hybrid clone.

pubescence tends to become more dense on the basal scales.

Using leaf dimensions and morphology, and bud characteristics, one would be clearly unable to separate the two Idaho clones (59122 and 59127, Fig. 1) from natural aspen hybrids of Lower Michigan. The average number of teeth per leaf side of both western clones was 19.5. The average tooth number of 25 natural Michigan hybrids reported by Barnes (1961) was 17.6. The Idaho clones had moderate to dense pubescence on the lower terminal bud scales, and in 59122 the pubescence extended downward completely coating the shoot produced the year of collection. No pubescence was observed on the upper bud scales except for a few fine hairs along their margins. This condition is somewhat different from most Lower Michigan hybrids. The latter typically have fine pubescence on both lower and upper bud scales. In pubescence the two Idaho clones closely resembled the putative introgressant Michigan clone 310, but both western clones had markedly fewer teeth (Fig. 1).

The most striking difference between all of the Michigan and the specimens of western trembling aspens was the presence of moderate to dense pubescence on the basal scales of terminal buds of all clones of the latter. Some western clones exhibited pubescence not only on lower scales but the upper as well. Furthermore, clone 59108 exhibited pubescence on the shoots produced the year the collection was made. This feature has never been reported or observed for immature or mature shoots of any eastern *P. tremuloides*. All of the western collections were made in July, August, or September, so that this apparently was not merely juvenile pubescence which would disappear later. The axillary buds, where present, were also pubescent on the lower scales, but to a lesser degree than on terminal buds.

It is unknown to what extent aspen clones of the Columbia Plateau or other geographic regions of the West exhibit pubescent buds. At the request of the author, Mr. R. Dennis Harr sent a sample of buds from eight clones of quaking aspen from Larimer County, Colorado. Terminal buds of these clones were much more glabrous than those of the Columbia Plateau collections, but two did have a moderate amount of pubescence on the lower scales. Minute pubescence was also found on lower terminal bud scales on most of the Colorado specimens. Terminal buds of Lower Michigan quaking aspens were even less pubescent. The Colorado and Michigan collections seem more alike than are the Colorado and Columbia Plateau clones.

A comparison of the leaf dimensions and tooth number per leaf side of 30 western clones and the Lower Michigan clones in Table 1 indicates no major or systematic difference between them. Leaf dimensions are apparently highly influenced by the local environment, and hence clones from sites in both regions should be grown under controlled conditions to assess the differences. Tooth number is probably somewhat less susceptible to environmental modification. Tooth number, however, is positively correlated with leaf size. The correlation coefficient of the relationship between leaf area and tooth number of *P. tremuloides* on the Pellston plain site (indicated in Table 1) was significant, $r = .65$ ($P<.05$). Also, the size of leaves and number of teeth of clones on the Moraine site are larger than the respective attributes of clones on the Pellston plain. Since tooth numebr is positively correlated with leaf size one might expect the western clones, the leaf sizes of which are larger, to have as many or more teeth than the clones from the Michigan sites. However, the number of teeth of the western clones was somewhat less (25.3) than that of clones from both of the Michigan sites (30.5). The difference was not statistically significant ($P>.40$) because of the great variation within both groups. These data do indicate, however, that some clones have markedly larger and fewer teeth than would typically be expected of Michigan *P. tremuloides;* other clones exhibited no difference whatsoever. Obviously, systematic studies throughout the range of *P. tremuloides* coupled with progeny tests under controlled conditions are needed to evaluate the differences and determine their causes.

Although the western clones were originally sampled and cursorily identified as typical of eastern *P. tremuloides*, systematic differences are now clearly evident. Descriptions of western aspens in floras and dendrology texts provide no evidence of differences in pubescence of the buds (Jepson, 1909; Kirkwood, 1930; Longyear, 1927; Preston, 1940; Sudworth, 1908). Illustrations of western aspen leaves, however, do indicate the lower tooth numbers discussed. Sudworth (1908), for example, illustrated both an eastern *P. tremuloides* and a western *P. tremuloides* from Colorado. Number of teeth per leaf side of the eastern aspen was approximately 33 in contrast to about 22 for the Colorado aspen. This, however, might be due to chance sampling of clones not representative of the populations.

How can we account for the observed differences between the western and Michigan populations of quaking aspen? One explanation would be clinal evolutionary differentiation along gradients running from west to east. Another hypothesis is hybridization and flow of genes from a western taxon or taxa having pubescent buds and few large teeth into the mid-Cenozoic quaking aspen. It is not the purpose of this paper to attempt an answer to this question through lengthy speculative arguments. However, a brief review of the taxonomy of western aspens is made below and some evidence indicating that hybridization of aspens could have taken place in the Columbia Plateau is presented.

The western aspen, *P. aurea*, was described by Tidestrom (1911) as a species which "formed forests throughout Colorado, Utah, and adjoining territory. . . ." This taxon differed from *P. tremuloides* Michaux in floral characteristics and in the fall coloration of leaves. The leaves were described as serrate and the buds ("gemmis") were termed glabrous, gummy, and conical. Other authors doubted the validity of this taxon (Daniels, 1911; Preston, 1940; Clokey, 1951) and it was subsequently considered synonymous with *P. tremuloides* Michx. by Little (1953). The plants originally described by Tidestrom were from the central and southern Rockies and may be more closely related to eastern *P. tremuloides* than the populations in the Columbia Plateau. The collections by Harr having buds somewhat similar to Michigan populations of *P. tremuloides* tend to support this.

Tidestrom (Piper and Beattie 1915) also recognized another species, *P. vancouveriana* Trelease. He distinguished this species from eastern *P. tremuloides* and western *P. aurea* by the "peculiar dentition of the leaves. The teeth are much larger than in any of its immediate allies and besides being crenulate are depressed so that each tooth viewed from the edge forms a double curve." The number of teeth was not reported. The buds were described as "smooth, conical, gummy, dark purple." Without examination of the type specimen it is difficult to draw any firm conclusions about the extent to which this taxon resembles clones of the Columbia Plateau.

One explanation for the existence of the larger-toothed, pubescent Idaho clones is that they are recent hyrids or introgressants between western *P. tremuloides* and the eastern *P. grandidentata*. The westernmost occurrence of *P. grandidentata* is in southeastern Manitoba (Slabaugh 1958). Thus the nearest localities are about 1,000 miles northeast of the Idaho "*P. tremuloides*" clones. Since *P. grandidentata* sheds pollen later than *P. tremuloides* where the two are sympatric and under the prevailing westerlies, this hypothesis seems most unlikely.

Another possibility is that there were situations in the mid-Cenozoic period parallel to the ones now taking place commonly in the southern part of Lower Michigan — conditions promoting natural hybridization and introgression between *P. grandidentata* and *P. tremuloides*. This hypothesis would necessitate the existence of a western taxon similar to the present-day eastern *P. tremuloides* in having many teeth and essentially glabrous buds, and the contemporaneous presence of a large-toothed aspen with pubescent buds like those of *P. grandidentata*.

During the Miocene period, a mixed deciduous forest, the "Arcto-Tertiary Geoflora," characterized the Columbia Plateau (Chaney 1959). Several species of *Populus*, at least two of which were aspens, i.e., members of Section Leuce, flourished in this region together with beech, maples, oaks, ashes, and willows. An aspen leaf termed *Populus lindgreni* Knowlton by LaMotte (1936)[3] and a leaf described by Chaney and Axelrod (1950)[4] as *Populus washoensis* Brown both closely resemble the leaves of modern *P. grandidentata.* Chaney and Axelrod (1959) considered the *Populus lindgreni* Knowlton as illustrated by LaMotte (1936) to be synonymous with *P. washoensis* Brown. The leaf named *P. voyana* by Chaney and Axelrod (1959)[5] is similar to leaves of modern *P. tremuloides.* Thus, if the two aspens were sympatric, hybridization might have taken place and some genes from the large-toothed aspen became incorporated in the populations of trembling aspen of the Columbia Plateau. After some hybridization between these species, extinction of the typical large-toothed aspen member took place along with most of the other mesophytic members of the community due to the rise of the Cascade Mountains. Further gene exchange was thus prevented so that unless first generation hybrids have been perpetuated asexually, the present quaking aspen clones could be introgressants possessing some genes of the fossil species.

Before accepting the above hypothesis, other facts should be investigated. Besides such leaves as resemble the modern *P. grandidentata*, the fossil record also exhibits a variety of leaves of the genus *Populus* which have been termed *Populus eotremuloides* Knowlton and *P. lindgreni* Knowlton.

These Chaney and Axelrod (1959) considered to be closely related to *P. balsamifera* and *P. heterophylla*, respectively. Most of the specimens illustrated by Chaney (1959), LaMotte (1936), and Smith (1941) do not resemble typical modern *P. tremuloides* of Michigan. Their illustrations resemble *P. tremula* and hybrids similar to those between Michigan *P. grandidentata* and *P. tremuloides.* The array of forms, including early leaves, late leaves, and leaves from

---

[3]Plate 4, Fig. 1. *Populus lindgreni* Knowlton. Pleisotype. U.C. Mus. Palaeobot., No. 956.

[4]Plate 18, Fig. 7. *Populus washoensis* Brown. Hypotypes U.C.M.P., Paleobot. Coll. No. 2927. Blue Mountains.

[5]Plate 18, Fig. 4. *Populus voyana* Chaney and Axelrod. Hypotype, U.C.M.P., Paleobot. Coll. No. 562. Trout Creek.

Table 1. Leaf dimensions and number of teeth on leaves of aspen clones from Michigan and Idaho, Montana and Washington.

| Taxon | Location | Number of Clones | Leaf Dimension in cm: Blade Width | Blade Length | Petiole Length | Number of Teeth per leaf side: Mean | Range |
|---|---|---|---|---|---|---|---|
| *P. grandidentata* | Michigan, Moraine site[1] | 18 | 7.1 | 8.1 | 5.8 | 10.4 | 7-13 |
| *P. tremuloides* | Michigan, Moraine site | 10 | 5.1 | 4.8 | 3.8 | 32.7 | 28-36 |
| *P. tremuloides* | Michigan, Pellston plain site[2] | 21 | 4.2 | 4.5 | 3.3 | 29.4 | 22-39 |
| *P. tremuloides* | Lower Michigan[3] | 31 | 4.5 | 4.6 | 3.5 | 30.5 | 22-39 |
| *P. tremuloides* | Northern Idaho, western Montana, Washington | 30 | 5.0 | 5.3 | 3.9 | 25.3 | 19-33 |

[1]SE¼, Section 6, T36N, R3W, Cheboygan County, Michigan.

[2]S½, Section 25 and N½, Section 36, T37N, R4W, Emmet County, Michigan.

[3]Clones from Moraine and Pellston plain sites combined.

Table 1. Leaf dimensions and number of teeth on leaves of aspen clones from Michigan and Idaho, Montana and Washington.

various positions along the shoot, indicate a need for thorough study of *Populus* species in the Arcto-Tertiary-Geoflora of the Columbia Plateau and their relationships to aspens of other regions of the West, as well as those of eastern North America. The Asian race of *P. tremula*, known as *P. tremula* var. *davidiana* Schneider and a taxon resembling the Asian aspen with pubescent buds, *P. sieboldii* Miq., may also have been in the Arcto-Tertiary-Geoflora. Graham (1965) reported that leaves of *P. washoensis* Brown resemble both *P. grandidentata* and the *P. tremula* of eastern Asia. Thus, the aspens of the Columbia Plateau may be the progeny of a complex of several related species whose influence may yet be tracable through biosystematic studies.

Another important problem to be resolved is the time and circumstances of hybridization if, in fact, such did occur. Did it occur before the Arcto-Tertiary Geoflora reached the Columbia Plateau, or did it occur initially in Miocene times in the Columbia Plateau when conditions were such that gene exchange was possible? Finally, the possibility of actual existence of a large-toothed, pubescent aspen in modern-day stands having relicts of this Miocene flora should be explored.

SCHOOL OF NATURAL RESOURCES
UNIVERSITY OF MICHIGAN, ANN ARBOR

LITERATURE CITED

BARNES, BURTON V. 1959. Natural variation and clonal devolopment of *Populus tremuloides* and *P. grandidentata* in northern Lower Michigan. Ph. D. Thesis, University of Michigan, 334 p.

——— 1961. Hybrid aspens in the lower peninsula of Michigan. Rhodora **63**(755): 311-324.

CHANEY, RALPH W. 1959. Miocene floras of the Columbia Plateau. Part I. Composition and interpretation. P. 1-134, *In* Contributions to paleontclogy. Carnegie Institution of Washington Publ. No. 617.

——— and DANIEL I. AXELROD. 1959. Miocene floras of the Columbia Plateau. Part II. Systematic considerations. P. 135-224, *In* Contributions to paleontology. Carnegie Institution of Washington Publ. No. 617.

CLOKEY, IRA. W. 1951. Flora of the Charleston Moutains, Clark County, Nevada. Univ. Calif. Publ. in Botany 23. 260 p.

DANIELS, FRANCIS POTTER. 1911. The flora of Boulder, Colorado, and vicinity. Univ. Mo. Studies 2 (2): 1-311.

FENNEMAN, NEVIN M. 1931. Physiography of western United States. McGraw-Hill Book Co., Inc. New York, 534 p.
103 p. + 22 plates.

GRAHAM, ALAN. 1965. The Sucker Creek and Trout Creek Miocene floras of Southeastern Oregon. Kent State Univ. Bull. 53(12): 103 p. + 22 plates.

JEPSON, WILLIS LINN. 1909. The trees of California. Cunningham, Curtis and Welch, San Francisco, 228 p.

KIRKWOOD, J. E. 1930. Northern Rocky Mountain trees and shrubs. Stanford University Press, California, 340 p.

LAMOTTE, ROBERT SMITH. 1936. The Upper Cedarville flora of northwestern Nevada and adjacent California. 5: 57-142 + 14 plates, *In* Contributions to paleontology, Middle Cenozoic floras of western North America. Carnegie Institution of Washington Publ. No. 455.

LITTLE, ELBERT L., JR. 1953. Check list of native and naturalized trees of the United States (including Alaska). U.S.Dep.Agr. Ag. Handbk. 41. 472 p.

LONGYEAR, BURTON O. 1927. Trees and shrubs of the Rocky Mountain region. G. P. Putnam's Sons, New York. 244 p.

PAULEY, S. S., A. G. JOHNSON, and F. S. SANTAMOUR, JR. 1963. Results of aspen screening tests: I. Seed sources of quaking aspen (*P. tremuloides* Michaux). Minn. For. Notes No. 136. 2 p.

PIPER, CHARLES V., and KENT R. BEATTIE. 1915. Flora of the northwest coast. The New Era Printing Co., Lancaster, Pa. 418 p.

PRESTON, RICHARD J. 1940. Rocky Mountain trees. Iowa State College Press, Ames, Iowa. 285 p.

SLABAUGH, PAUL E. 1958. Silvical characteristics of bigtooth aspen (*Populus grandidentata*). U.S.F.S. Lake States For. Expt. Sta. Station Paper 63. 16 p.

SMITH, HELEN V. 1941. A Miocene flora from Thorn Creek, Idaho. Am. Mid. Nat. 25: 473-522.

SUDWORTH, GEORGE B. 1908. Forest trees of the Pacific coast. U.S. Govt. Printing Office, Washington. 441 p.

TIDESTROM, IVAR. 1911. Notes on *Populus*, Plinius. Am. Mid. Nat. 2: 29-35.

# PHYSALIS IN MEXICO, CENTRAL AMERICA AND THE WEST INDIES[1, 2]

U. T. WATERFALL

Linnaeus established *Physalis* in 1753 with a total of nine species. The genus was known to authors before Species Plantarum under *Solanum* as, for example, "Solanum vesicarium indicum minimum" (Hermanno, 1679), and under *Alkekengi*, as illustrated by "Alkekengi indicum minimum" (Tournefort, 1716).

Miller (1768) described several species from Mexico, although few of his names have been identified with Mexican species in any account of the flora written since that time. Reinstated are the neglected Miller names *P. cordata* and *P. maxima* for relatively common species, with further discussion presented later.

The complexity of the genus, and the wide range of variability frequently encountered, the ambiguity of many of the earlier descriptions, as well as the unavailability of some of the types to those not so fortunate as to be able to make a trip to Europe to study them, have resulted in some duplication of names, as will become evident on perusal of the treatment of the species.

An example of a completely unrecognized name in the area under consideration is *P. glutinosa* Schlecht. Type material (HAL) shows this to be the very distinctive taxon

[1]National Science Foundation Grant GB-3642 provided funds for the author's travel to study types, and other historically significant specimens, in major European herbaria in August, 1965. Special thanks are due the curators, and other officials, of the herbaria of the British Museum (Natural History) and the Royal Botanic Gardens, Kew in London, and those in Stockholm, Berlin, Brussels, and Paris for their aid, kindnesses, and other consideration.

[2]In specimen citations, the symbols used to indicate herbaria are the standard ones of Lanjouw and Stafleu (1964) with the addition of the symbol MEXP for the Herbarium of the Instituto Polytécnico Nacionál, Laboratorio de Botánica Fanerogámica, Mexico, D. F. To the Curators of all these herbaria the author is most grateful for the loan of their valuable specimens.

known in American herbaria as *Cacabus mexicanus* S. Wats., or as *Physalis eximia* Standley.

Some specific names might better be forgotten, if that were possible, or relegated to *nomina confusa.* For example, *P. Coztomatl* Dunal (1852) might very well be a form of *P. viscosa* L., but, observing the long, attenuate lobes of the flowering calyx, as shown on a photograph of the Sessé and Mociño Plate, one might with equal logic conclude it to be *P. orizabae* Dunal.

*Physalis dentata* Dunal (l. c.) is probably *P. acutifolia* (Miers) Sandwith; however, the Field Museum photograph, allegedly of this species, from "Types of the Berlin Herbarium", is not the large-flowered, long-pedicelled species from the Pavon Herbarium in the Boissier Herbarium at Geneva as shown by the Field Museum photograph, Negative No. 31435. The Berlin specimen, which I did not see personally when I was there, appears to be *P. chenopodifolia* Lam., a completely different species.

No study of the genus can be made without considering the limitations of related genera. Somewhat varying dispositions have been made of them in the past. One of the problems concerns the placement of those species having flowers in axillary fascicles, but fruits in enlarging, inflated calyces. These vary from species having axillary fascicles of 3-7 flowers, sometimes reduced to one, as in *P. arborescens* L. (*P. mayana* Standley) to those with (1-) 2-5 flowers per fascicle as in *P. chimalteca* Standley and Steyermark. In this group of species the corolla is more deeply lobed than is usual in the genus. In Wettstein (1891) these species would key to *Withania*, a genus said by him to occur in the tropics and subtropics of the Old World. In Standley (1924) they would key to *Athenaea* (although Standley and Steyermark have described several of them under *Physalis*); in Sleumer (1950) they would go to *Withania* emend. They are here referred to *Physalis.*

The equation of *Cacabus mexicanus* S. Wats. with *Physalis glutinosa* Schlechtendal is not intended to imply that *Cacabus* is synonymous with *Physalis*. *Physalis glutinosa* has enlarging fruiting calyces, much inflated about the fruit in the manner characteristic of *Physalis*. Its corolla is campanulate, similar to those found in many species of *Physalis*, but larger than usual. In *Cacabus, sens. str.*, the calyx rather closely invests the fruit.

Not only does the well-developed fruiting calyx of *Cacabus hondurensis* (Donn.) Smith remove it from that genus, but the peculiar seeds mentioned by Standley (1931) seem to justify his disposition of it as the monotypic genus *Eutheta*.

*Margaranthus* in fruit cannot be distinguished from small-fruiting species of *Physalis*, as the fruiting calyx enlarges similarly in both, but the pentangular-urceolate corolla of *Margaranthus* is quite distinctive. Dunal (1852) placed *Margaranthus* with genera of the *Solanineae* having longitudinally dehiscent anthers. Wettstein (1891) placed it in the *Lyciinae*. Sleumer (1950) returned it to "*Solaninae* Wettst. em."

To the present author it seems so closely related to *Physalis* that it should not be placed in a different subtribe. However, it is, for the time at least, not treated with *Physalis*.

Measurements given here are to be considered as generalized indication of size, but not necessarily as absolute quantities. No doubt in natural populations some deviation from them will be found. Width-measurements given for corollas mean the greatest width, *i. e.*, the width across the limb of fully expanded corollas. The length of calyces includes the calyx lobes, although these are usually given separately, too.

PHYSALIS L., Species Plantarum 182. 1753; *Alkekengi* Tourn. ex Hall, Enum. Stirp. Helv. 2:508. 1742; *Herschellia* Bowdich, Excurs. Mader. 159. 1825; *Quincula* Raf., Atl. Journ. 145. 1832; *Alicabon* Raf., Sylva Tellur. 56. 1838; *Pentaphiltrum* Reichb., Das Herbarienbuch 121. 1841; *Boberella* Krause, in Sturm, Fl. Deutschl. ed 2 (10):54. 1903.

Plants annual or perennial with herbaceous stems, rarely arborescent, from a few centimeters tall to 3 meters tall, equally wide and densely branched with stems as much as 3 cm in diameter; rhizomatous structures present in some species; leaves petioled, alternate, but sometimes two or even three apparently together due to internode reduction; leaf blades usually ovate, but varying to linear; leaf margins from toothed, often coarsely and irregularly so, to entire; vestiture including long multicellular ("jointed") hairs, short hairs, stipitate or sessile glands, or branched or stellate trichomes, often more than one kind intermixed on the same plant; flowers pedicelled, usually single in the leaf-axils, but sometimes several and fascicled, rarely some of them in false racemes due to leaf and internode reduction; flowering calyces varyingly 5-lobed, on pedicels shorter than the calyx to several times its length; corollas plicate, from rarely tubular-expanded and apically constricted to often more or less campanulate to campanulate-rotate, or the limb even more or less reflexed; corollas usually yellowish, often with 5 darker, contrasting maculations occupying varying amounts of the area above the lower tubular part, these maculations usually discrete, sometimes more or less coalescing, solid in color, or each consisting of several to many separate spots; sometimes the maculations not strongly contrasting, sometimes absent; varying amounts of hair usually present in the tube near the point of filament-divergence, sometimes as 5 hairy pads, sometimes very few hairs present, or none, sometimes these areas more or less glandular; stamens 5, anthers dehiscing longitudinally, oblong or linear-oblong to ovate, yellow to blue, violet or greenish blue, or sometimes so tinged or lined; filaments slender and filiform to nearly as wide as the anthers; style filiform, the stigma capitate to nearly truncate; fruit a 2-carpellate, few-seeded to many-seeded berry, which, however, often has a thin dryish pericarp; fruit usually sessile in the calyx which is usually inflated around it, but the berry rarely growing large enough to be tightly invested by the calyx; sometimes a short gynophore is present; fruiting calyx often invaginated basally; fruiting pedicels usually elongating; seeds nearly orbicular to reniform, usually more or less punctate to irregularly reticulate.

KEY

1. Corolla 5-lobed; flowers several to 1 or 2 in leaf axils.
   2. Corolla 8-12 mm long and 10-15 (-20) mm wide.
      3. Flowers usually several in the leaf axils; fruits may be single; stem hairs more or less spreading.
         4. Stem hairs dendritic. .................................. 1. *P. arborescens.*
         4. Stem hairs simple. .................................. 7. *P. melanocystis.*
      3. Flowers usually 1-2; fruits usually single; stem hairs antrorsely appressed (also see *P. melanocystis* var. *cernua*), some simple, some more or less dendritic. .................................. .................................. 2. *P. porphyrophysa.*
   2. Corolla (15-) 18-22 mm long and (25-) 30-45 mm wide.
      5. Calyx lobes more or less elongate.
         6. Calyx prominently hairy at anthesis. ................ 3. *P. amica.*
         6. Calyx essentially glabrous. ........................ 4. *P. amphitrica.*
      5. Calyx subtruncate to more or less short-lobed.
         7. Calyx prominently hairy at anthesis. .......... 5. *P. calidaria.*

7. Calyx essentially glabrous. .......................... 6. *P. chimalteca.*

1. Corolla apically 5-angled with shallow sinuses, or subtruncate; flowers solitary (excepting sometimes, by stem and leaf reduction, in *P. angustior* and *P. aggregata*).
  8. Corolla campanulate with a long limb, to tubular-campanulate, to subtubular and apically constricted, 22-35 mm long.
    9. Corolla limb not expanded.
      10. Plant nearly glabrous. .................................. 8. *P. constricta.*
      10. Plant prominently vestite, the hairs at least partly capitate-glandular. ................................................ 9. *P. campula.*
    9. Corolla limb more or less expanded.
      11. Herbage greenish. ....................................... 10. *P. glutinosa.*
      11. Herbage cinereous-vestite. ............................ 11. *P. cinerea.*
  8. Corolla open-campanulate to rotate or reflexed-rotate at full anthesis, smaller (except *P. amphitrica*).
    12. Corolla bluish; indument scale-like. ................ 52. *P. lobata.*
    12. Corolla yellowish to whitish to bluish-tinged, rarely bluish, but then indument not scale-like.
      13. Fruiting calyx 10-ribbed, subequally 10-angled, or teretish.
        14. Indument of stellate hairs, rarely partly dendritic. ........ ....................................................................... 12. *P. viscosa.*
        14. Indument various but not stellate, sometimes dendritic or partly so, sometimes none.
          15. Flowering pedicels shorter than the calyx to 2-3 times its length, usually 1-10 mm long, but in rare cases some of them becoming 15-30 mm long.
            16. Anthers large, (2-) 2.2-4 mm long.
              17. Vestiture of stems, petioles and pedicels in part of spreading, jointed hairs 2-3 mm long.
                18. Leaf blades ovate, usually broadly so, sometimes narrowly so.
                  19. Blades of principal cauline leaves (8-) 12-20 cm long, smaller ones one-third to one-fourth as large.
                    20. Some of the hairs tipped with reddish glands; throat of corolla densely hairy; anthers blue.
                      21. Corollas 25-35 mm wide. .......................... ...................................... 14. *P. stapelioides.*
                      21. Corollas 15-22 mm wide. ........................... .................................. 25. *P. Sancti-josephi.*
                    20. Hairs not tipped with reddish glands; throat of corollas nearly glabrous; anthers yellow. ........................ 22. *P. luteoanthera.*
                  19. Blades of principal cauline leaves usually 2-6 cm. long.
                    22. Only a few long hairs on stems and peti-

oles; principal leaf blades usually 2-6 cm long.

23. Flowering calyces prominently hairy; anthers with only a tinge of blue. .................................................. 21. *P. gracilis.*

23. Flowering calyces with only a few long hairs; anthers blue. .................................................. 43. *P. philadelphica.*

22. Stems, leaves and petioles with abundant long hairs; leaf blades usually 1.5-2 cm long.

24. Anthers bluish, or so tinged or lined; leaf blades entire or with 1-3 coarse teeth on each side.

25. Leaf blades oval to ovate, entire, principal ones 5-6 cm long. .................................................. 29. *P. latecorollata.*

25. Leaf blades ovate to hastate-ovate or hastate-deltoid with 1-3 coarse teeth on each side. ........ 30. *P. philippensis.*

24. Anthers yellow; leaf blades irregularly several-toothed. .... 33. *P. tehuacanensis.*

18. Leaf blades lanceolate-ovate to linear-lanceolate. .................................................. 31. *P. caudella.*

17. Vestiture various, or absent, but not including jointed hairs 2-3 mm long.

26. Anthers yellow, not bluish tinged or lined.

27. Corolla prominently dark maculate.

28. Leaf blades ovate, sometimes apically attenuate.

29. Flowering calyx with short multicellular hairs 0.2-0.3 mm long. .... 16. *P. ingrata.*

29. Flowering calyx with multicellular hairs ca. 0.5-1.0 mm long (or glabrous in some extremes).

30. Hairs (when present) ca. 1 mm long, more or less spreading; leaves often longer than the internodes. .................................................. 21. *P. gracilis*

30. Hairs of flowering calyx ca. 0.5-0.7 mm long, antrorsely curled; principal cauline leaves often one-half to one-third as long as the internodes. .................................................. 41. *P. longicaulis.*

28. Leaf blades ovate-lanceolate to linear-lanceolate. .......................... 32. *P. virginica.*

27. Corolla immaculate, or with spots only slightly differentiated in color.
31. Fruiting calyces usually 2-3 cm long.
32. Fruiting calyx nearly filled by berry, open apically. ................ 26. *P. Muelleri.*
32. Fruiting calyx inflated around the berry, apically closed or nearly closed. ............. .................................... 36. *P. hederaefolia.*
31. Fruiting calyces ca. 1 cm long.
33. Leaf blades deltoid to ovate-deltoid, expanding abruptly from the petiole. ........ ..................................... 34. *P. microphysa.*
33. Leaf blades lanceolate to lanceolate-ovate, gradually expanding from the petiole. ......................... 42. *P. Rydbergii.*
26. Anthers bluish, purple, violet or greenish-blue, or so tinged or lined (sometimes fading in drying).
34. Some of the flowers in few-flowered, terminal, apparently false racemes, formed by shortening of internodes and reduction of leaves.
35. Corollas 13-15 mm wide. .............................. ........................................... 17. *P. aggregata.*
35. Corollas 20-29 mm wide. ............................... ........................................... 24. *P. angustior.*
34. Flowers solitary.
36. Corollas prominently marked with 5 dark patches, these sometimes confluent basally.
37. Flowering calyx with divergent hairs.
38. Fruiting calyx evenly covered with hairs, or hairs more abundant on principal veins, but also scattered between them.
39. Fruiting calyx usually 30-40 mm long and 20-25 mm wide; anthers ca. 4 mm long.
40. Leaf blades more or less cordate, principal ones usually 6-9 cm long, apices often somewhat lunate-attenuate. ........ 23. *P. peruviana.*
40. Blades rarely semicordate, usually 4-5 cm long, apices sometimes slightly one-sided, but not lunate-attenuate. .................. 18. *P. lassa.*
39. Fruiting calyx (15-) 20-25 (-30) mm long and (11-) 13-18 (-20) mm

wide; anthers 2.5-3 (-4) mm long.
41. Corollas 10-30 mm wide when fully open; maculations 3-7 mm long.
42. Corollas 2-3 cm wide; flowering calyces 8-9 mm wide at base of lobes. ........... 24. *P. angustior.*
42. Corollas 10-18 mm wide; flowering calyces 4-7 (-8) mm wide at base of lobes.
43. Principal leaf blades 6-10 cm long .... 25. *P. Sancti-josephi.*
43. Principal leaf blades 2-7 cm long.
44. Vestiture of flowering calyx including jointed hairs 0.5-1 mm long. .... 27. *P. sordida.*
44. Flowering calyx densely vestite with jointed hairs 1-1.5 mm long. ...................... .................... 28. *P. Pennellii.*
41. Corollas 8-9 mm wide; maculations ca. 1 mm long. ................................ ........................ 46. *P. minimaculata.*
38. Fruiting calyx with a few hairs, often on ribs, or none.
45. Fruiting pedicels 1-2 cm long.
46. Anthers dark blue to purplish. .... ................................ 31. *P. caudella.*
46. Anthers yellowish, tinged or lined with light blue or violet. ................ ............................ 32. *P. virginiana.*
45. Fruiting pedicels 2-5 mm long. ........ ............................ 43. *P. philadelphica.*
37. Flowering calyx with appressed hairs or none.
47. Blades of principal leaves ca. ovate.
48. Hairs of stems, petioles and pedicels antrorse; plants perennial.
49. Fruiting pedicels 4.5-5 cm long. ............................ 13. *P. Mcvaughii.*
49. Fruiting pedicels 1-2 cm long.
50. Leaf surfaces with a few scattered appressed hairs, or glabrate. ................ 15. *P. orizabae.*
50. Surfaces or young leaves, or all leaves, greyish with abundant,

more or less antrorsely appressed hairs. ............................................... 19. *P. chenopodifolia.*

48. Shorter hairs of stems, petioles and pedicels retrorse, sometimes none. .... ............................ 43. *P. philadelphica.*

47. Leaf blades lanceolate to linear-lanceolate.

51. Many of the leaf blades more or less hastate, or with 1-3 large teeth, basal or as far up as the middle of the blade. .............. 20. *P. hastatula.*

51. Leaves neither hastate, nor with 1-3 large teeth on basal half of blade. ................................ 32. *P. virginiana.*

36. Corollas immaculate, or with spots light colored and not strongly contrasting.

52. Stems, petioles and pedicels with spreading hairs, some gland-tipped. .................... ............................................. 27. *P. sordida.*

52. Stems, petioles and pedicels with few, short, appressed hairs, or none.

53. Fruiting pedicels 6-7 mm long; hairs retrorse. .......... 44. *P. michoacanensis.*

53. Fruiting pedicels (7) 10-25 mm long; hairs retrorse or none.

54. Vestiture more or less abundant and greyish. ........ 19. *P. chenopodifolia.*

54. Plant with few short hairs, or glabrous. ........................ 45. *P. angulata.*

16. Anthers small, 0.5-1.8 (-2) mm long.

55. Corollas (6-) 5-15 (-20) mm wide and 5-9 mm long.

56. Stems spreading-hairy.

57. Corollas 15-20 mm wide; anthers dark blue. ........................................... 35. *P. parvianthera.*

57. Corollas 8-10 mm wide; anthers yellow. ........ ................................................. 42. *P. Rydbergii.*

56. Stems glabrous, or with few, short, upwardly appressed hairs.

58. Principal leaves 1.2-4 mm long, broadly ovate to reniform. ............................ 39. *P. Mimulus.*

58. Principal leaves 5-11 cm long, ovate, lanceolate-ovate, or narrower. ...... 45. *P. angulata.*

55. Corollas small, 5-7 mm wide and 5-7.5 mm long.

59. Fruiting calyx 20-35 mm long.

60. Fruiting calyx with smooth ribs. .................... ........................................... 43. *P. philadelphica.*
60. Ribs of fruiting calyx with more or less tooth-like lamellations developing at the bases of some of the hairs, or replacing the hairs. ...................................................... 47. *P. ampla.*
59. Fruiting calyx 5-20 mm long.
61. Fruiting calyx 13-20 mm long. ......................... ................................................. 48. *P. Lagascae.*
61. Fruiting calyx 5-11 mm long.
62. Corolla 5-10 mm long; fruiting pedicels (5-) 10-15 mm long, usually longer than the fruiting calyx. .......... 51. *P. sulphurea.*
62. Corolla ca. 3.5 mm long; fruiting pedicels ca. 5 mm long, shorter than the fruiting calyx. .............................. 49. *P. microcarpa.*
15. Flowering pedicels usually (10-) 15-40 mm long, several times the length of the flowering calyx.
63. Anthers yellow.
64. Corolla yellowish, sometimes with slightly contrasting spots, sometimes drying bluish.
65. Leaf blades ovate to narrowly lanceolate and sometimes more or less hastate, margins entire or with 1-2 usually obscure teeth on each side. ......................................................... 37. *P. glabra.*
65. Leaf blades usually ca. ovate, if lanceolate then usually with several teeth on each margin; stems more or less vestite. .... 38. *P. crassifolia.*
64. Corollas purplish, violet or bluish, the throat yellow. ........................................... 40. *P. purpurea.*
63. Anthers bluish or bluish-green, at least on their margins.
66. Corollas campanulate-funnelform; anthers usually 1-2.5 mm long, not twisted. ........ 45. *P. angulata.*
66. Corollas rotate to reflexed-rotate; anthers usually 2.5-3.5 mm long, sometimes twisted at maturity. ......................................................... 50. *P. acutifolia.*
13. Fruiting calyx 5-angled.
67. Flowering calyx large (5-) 7-10 (-14) mm wide at base of lobes.
68. Hairs more or less dendritic or branching. .................. .................................................................. 53. *P. Hintonii.*
68. Hairs not dendritic.
69. Calyx lobes narrow, long-attenuate.
70. Leaves cordate. ......................... 54. *P. Greenmanii.*
70. Leaves not cordate, varyingly narrowed basally. ........................................................... 55. *P. Pringlei.*

69. Calyx lobes deltoid or ovate to lanceolate, acuminate.
71. Leaf blades ca. ovate.
72. Stem hairs long, spreading, jointed; stems herbaceous.
73. Fruiting calyx only a little longer than wide. ............................................. 55. *P. Pringlei.*
73. Fruiting calyx 1.5-2 times longer than wide. ........................................ 57. *P. subrepens.*
72. Stems glabrescent, the few hairs short, appressed; stem lignescent. ...... 62. *P. jaliscensis.*
71. Leaf blades deltoid-ovate, sometimes subhastate, principal ones 15-25 mm long and 12-20 mm wide. ............................................. 30. *P. philippensis.*
67. Flowering calyx usually 2-5 (-6) mm wide at base of lobes.
74. Fruiting calyx narrow, about twice as long as wide.
75. Flowering pedicels 8-45 mm long.
76. Corollas prominently maculate; anthers bluish.
77. Pedicels 15-40 mm long; herbaceous vine. ................................... 58. *P. volubilis.*
77. Pedicels 8-15 mm long; stems lignescent. ................................ 61. *P. lignescens.*
76. Corollas immaculate, or spots not contrasting; anthers yellow or greenish-yellow. .... ................................... 59. *P. viridoflava.*
75. Flowering pedicels 3-5 mm long. ................................... 56. *P. angustiphysa.*
74. Fruiting calyx as long as wide to 1.5 times longer than wide.
78. Vestiture dense, of more or less branching, jointed hairs. ........................... 77. *P. vestita.*
78. Hairs unbranched, or none.
79. Fruiting calyx densely greyish short-hairy (as usually all herbage); gynophore and inside of fruiting calyx capitate-glandular. ............................................ 68. *P. ignota.*
79. Fruiting calyx glabrous or variously vestite, but not densely greyish short-hairy; inside of fruiting calyx not capitate-glandular excepting sometimes in *P. turbinata.*
80. Calyx lobes caudate-subulate to subulate - attenuate.
81. Flowering pedicels 15-75 mm long; stems, petioles and pedicels usually

more or less pilose, longer hairs 1.5-4 mm long. ........................ 63. *P. maxima.*

81. Flowering pedicels usually 1-15 mm long; stems, petioles and pedicels glabrous to variously vestite, but not long-pilose.

82. Corollas immaculate, or with obscure markings with edges sometimes diffuse.

83. Corollas small, 4-8 mm long; well-developed fruiting calyces usually 40-65 mm long. ........................................................ 64. *P. nicandroides.*

83. Well-developed corollas (8-) 10-15 mm long and (10-) 15-25 mm wide; fruiting calyces usually 20-35 mm long. .... 69. *P. foetens.*

82. Corollas with small contrasting maculations ca. 2 mm long and 1 mm wide, or smaller in *P. latiphysa.*

84. Corollas 4-6 mm long; anthers 1-1.8 mm long.

85. Fruiting calyx 15-23 mm wide. ............................ 70. *P. subulata.*

85. Fruiting calyx (25-) 30-40 mm wide. ............ 67. *P. latiphysa.*

84. Corollas (8-) 10-15 mm long; anthers (1.5-) 2-3 mm long. ............................................... *P. foetens.*

80. Calyx lobes ovatish to narrowly triangular - attenuate, but not subulate.

86. Fruiting calyx hairy.

87. Well-developed fruiting pedicels 20-45 cm long. .............................................................. 60. *P. longipedicellata.*

87. Fruiting pedicels 3-12 mm long.

88. Corolla maculate, spots strongly contrasting.

89. Hairs of stem short, antrorsely appressed or curled; flowering calyx two-thirds or three-fourths divided into narrowly lanceolate-triangular lobes 4-5 mm long; fruiting calyx obscurely 5-angled. ...............................................19. *P. chenopodifolia.*

89. Stem-hairs more or less spread-

ing; flowering calyx usually divided no more than half way.

90. Leaf blades more or less translucent when dry; some of the hairs with brownish glands. .... 75. *P. leptophylla.*

90. Leaves thicker, opaque; hairs usually without brownish glands.

91. Fruiting calyx 15-30 (-32) mm long.

92. Anthers bluish.

93. Lobes of fruiting calyx ovate-deltoid to lanceolate. .. 74. *P. pubescens.*

93. Lobes of fruiting calyx narrowly lanceolate, tips approaching subulate. 71. *P. angustiloba.*

92. Anthers yellow, 1.2-1.6 mm long. ................................ 72. *P. turbinatoides.*

91. Fruiting calyx 30-40 mm long. ........ 73. *P. turbinata.*

88. Corolla immaculate, or with spots not contrasting.

94. Anthers blue. .... 69. *P. foetens.*

94. Anthers yellow, sometimes tinged with green or blue. .................................. 76. *P. hylophila.*

86. Fruiting calyx glabrous or essentially so.

95. Fruiting calyx 25-35 mm long.

96. Lobes of fruiting calyx 7-13 mm long.

97. Corolla maculations prominent; fruiting calyx usually gradually terminated apically. ................................................ 65. *P. cordata.*

97. Corolla maculations not prominent, their edges often diffuse; fruiting calyx more or less porrect. .................. 66. *P. porrecta.*

96. Lobes of fruiting calyx 4-6 mm long. ................ 78. *P. clarionensis.*

95. Fruiting calyx 10-18 mm long.

98. Anthers 1.3-2 mm long; fruiting

calyx 15-18 mm long. .................... .................................. 79. *P. minuta.*

98. Anthers ca 1 mm long; fruiting calyx 10-13 mm long.

99. Young parts sparingly short-hairy; leaf blades ovate to oblong-ovate or ovate-lanceolate. ............................ 80. *P. carnosa.*

99. Plant glabrous; leaves reniform to ovate. ........ 39. *P. Mimulus.*

THE SPECIES

1. **Physalis arborescens** L., Species Plantarum, ed 2:261. 1762; *P. mayana* Standley, Field Mus. Publ. Bot. 8:42. 1920.

Shrubby, 0.5-2 m high, more or less tomentose with somewhat dendritic hairs, leaf blades ovate to rhombic ovate, somewhat acuminate, entire to irregularly few-toothed, sometimes undulate, rarely salient-toothed; blade gradually narrowed to a petiole 1-4 cm long; principal blades (6-) 9-12 cm long and (4-) 6-8 cm wide; lower leaf surfaces usually densely dendritic-hairy or stellate-hairy, upper surfaces less so; flowers in axillary fascicles of 3-7, sometimes reduced to 1, maturing at different times, the inflorescence probably representing a reduced branch, often maturing only 1 fruit; flowering calyx more or less herbaceous, oblong-hemispheric or short-oblong to nearly square, 5-7 mm long, divided above into ca. ovate lobes ca. 3 mm long, on pedicels 6-12 mm long; corolla 8-12 mm long, prominently dark-maculate, divided into lobes 3-5 mm long; anthers yellow, ca. 4 mm long and 1.5 mm wide, their filiform filaments ca. 2 mm long; fruiting calyx ovoid, 2-3.5 cm long and 1.8-2.5 cm wide, slightly to densely covered with simple or 2-branched to stellate trichomes; fruiting pedicels 10-15 mm long; berry 7-11 mm in diameter, sessile on the somewhat invaginated calyx-base.

SELECTED SPECIMENS. MEXICO: CAMPECHE: *Houstoun* HS 295 76, left side (BM); VERA CRUZ: 2 km south of Tampico, Feb. 1910, *Palmer 379* (BM, F, GH, NY, US); YUCATAN: Chichankanab, *Gaumer 24381*, type collection of *P. mayana* Standley, (Type: F, Isotype: US); Mérida-Uxmal road, *Lundell 8083* (MICH, US).

The Houstoun collection in the Sloane Herbarium of the British Museum can be taken as the LECTOTYPE of the species. Linnaeus (l.c. supra) referred to Miller's Dictionary, t. 206, f. 2, and stated "Habitat in Campechia". The eighth edition of Miller's Dictionary refers to the same figure and says, "The eighth sort was discovered by the late Dr. Houstoun growing naturally in Campeachy from whence he sent seeds to England".

This collection is obviously the same species later described from Yucatan as *P. mayana.*

2. **Physalis porphyrophysa** Donnell-Smith, Bot. Gaz. **61:** 377. 1916. Shrub, 1-3 m tall, "subscandent" according to some collectors; young stems densely vestite with short, antrorsely curled hairs, glabrescent; leaf blades ca. ovate, slightly rhombic-ovate, or somewhat narrower, margins entire to slightly and irregularly undulate, larger ones 8-15 cm long and 5-7 cm wide, gradually narrowed to a short petiole ca. 1-3 cm long; hairs of the lower leaf surfaces abundant, simple, variously branched and stellate, the few on the upper surfaces usually simple; flowers in axillary fascicles of (1-) 2-4 (only a few flowering specimens seen), often only one maturing a fruit; flowering calyx 4-5 mm long, herbaceous, divided above into more or less triangular lobes ca. 2 mm long, pedicels 5-10 mm long, filiform, only slightly thickened near the base of the calyx; no expanded corollas seen, but some collectors state "flowers yellow"; a dissected pre-anthesis corolla appears slightly maculate, has oblong anthers ca. 3 mm long on short filiform filaments; fruiting calyx 10-ribbed, usually 25-35 mm long and 18-25 mm wide, sometimes purplish at maturity, on pedicels 6-12 mm long; berry ca. 12-15 mm in diameter, subsessile or on a short stipe up to 1.5 mm long on the invaginated calyx-base.

SPECIMENS SEEN. GUATEMALA: Uaxactun, arroyo, Mar. 20, 1931, *Bartlett 12163* (MICH, US); Apr. 7, 1931, *Bartlett 12519a* (MICH, US); on Maya ruins, Apr. 26, 1931, *Bartlett 12759* (MICH, US); south bank of Motagua River, June 19, 1909, *Deam 6357* (GH, MICH, US, VT); vicinity of Zacapa, Dec. 1906, *Pittier 1754* (Type: US); Zacapa, small subscandent shrub in hedge, Oct. 7-16, *Standley 74616* (F, NY, US).

3. **Physalis amica** Standley & Steyermark, Field Mus. Publ. Bot. **23:** 231. 1947.

Herbaceous, ca. 1-7 m tall, branched, stems villose with jointed hairs, tending to be glabrescent; leaf blades ca. ovate somewhat acuminate, larger ones 6-7 cm long and 4-5 cm wide, their petioles ca. 1 cm long; leaf surfaces with scattered, jointed, more or less appressed flattened hairs, these sometimes reduced to bases only; flowers in axillary fascicles of 2-5 (probably reduced branches), sometimes only one; flowering calyx somewhat chartaceous, ca. 7 mm long, divided above into lanceolate or lanceolate-ovate lobes 1.5-3 mm long; pedicels ca. 1 cm long, prominently thickened upward to a width of 2-4 mm at base of calyx; pedicels and calyx villosulose; corolla nearly rotate, ca. 15 mm long and 30 mm wide, its lobes 5-8 mm long, broadly triangular to ovate-triangular, without obvious dark spots, matted-hairy in the tube; anthers bluish, oblong, ca. 3 mm long and half as wide; filaments filiform, ca. 3 mm long; fruit unknown.

GUATEMALA: vicinity of San Rafael, upper narrow reaches of stream, Feb. 20, 1940, *Steyermark 36175* (Type: F).

4. **Physalis amphitrica** (Bitter) Standley & Steyermark, Field Mus. Publ. Bot. **23**: 229. 1947; *Saracha amphitrica* Bitter, Repert. Sp. Nov. 20: 362. 1924.

Herbaceous, 1-3 m tall, branched, stem sometimes weak and trailing, or said to be shrubby by a few collectors, glabrous, or with a few hairs when young; leaf blades ovatish, acuminate, the larger ones usually 8-15 cm long and 4-8 cm wide, their petioles 1-2.5 cm long; leaf surfaces with a few short, jointed, flattened hairs, these sometimes reduced to mere bases; flowers in axillary fascicles of 2-5, sometimes only 1 evident, but abscission scars of others present; calyx at anthesis somewhat thin-chartaceous, glabrous outside, or with lobes slightly short-hairy, on pedicels 8-20 mm long, filiform, enlarged apically beneath the calyx; corolla yellowish or greenish-yellow, 20-25 mm long, ca. twice the length of the calyx, divided ca. half way into ovate to lanceolate, sometimes slightly acuminate lobes, with greenish-purplish markings near their bases, matted-hairy inside near the tube; anthers bluish to purplish, ca. 3-4 mm long, on filaments ca. 5 mm long; fruiting calyx seldom collected, 3.5 cm (immature) to 5.5 cm long and 3.5 cm wide, reticulate-veined, much inflated around the small berry.

SELECTED COLLECTIONS. MEXICO: CHIAPAS: Siltepec, Jan., 1937, *Matuda 254* (F, MICH, US): Boquerón, Sept., 1913, *Purpus 6671* (BM, GH, F, NY, UC, US). GUATEMALA: Chiquihuite, branched herb or shrub 5-10 ft., damp forest, Mar. 8, 1939, *Standley 68133* (F, US); above Mujulia, Feb. 1, 1941 (F); moist rocky slopes around waterfall, Río Negro, Volcán Tajumulco, *Steyermark 37660* (F, NY).

5. **Physalis calidaria** Standley & Steyermark, Field Mus. Publ. Bot. **23**: 231-232. 1947.

Herb, 1-2 m tall, young stem with few to many short brownish antrorsely curled hairs, glabrescent; leaf-blades ovate to elliptic, gradually to abruptly acuminate, their margins entire to slightly acuminate, larger ones 8-15 cm long and 5-7 cm wide on petioles 15-35 mm long; blades sparsely appressed short-villosulose above and more or less curled-villosulose to appressed-villosulose on the abaxial surface, more abundantly so on midribs and veins, petioles similarly vestite; flowers in axillary fascicles of usually 4-5, some of them sometimes abscissed at petiole bases; calyx short-hairy on outside, subtruncate, usually 4-10 mm long, its apex sinuate-margined with sepal-projections ca. 1.5-2 mm long, broadly expanding to the tube; corolla light yellow, with 5 slightly contrasting darker spots, rotate-campanulate, 15-20 mm long and 20-35 mm wide when fully expanded, very short-hairy externally and with 5 more or less confluent, densely hairy pads surrounding and above the point of insertion of the filaments; corolla divided about half-way into ovate to deltoid-ovate lobes; anthers 2.5-3 mm long, on slender filaments 4-5 mm long, glabrous or with a few basal hairs; fruiting calyx glabrous, 10-angled, the 5 principal ones more prominent and basally auricled, a prominent reticulum between the 10 ribs; berry 8-10 mm in diameter, the surrounding calyx 25-30 mm long and 22-25 mm wide.

COLLECTIONS SEEN. GUATEMALA: Dept. of Quetzaltenango, 8000 ft., Feb. 4, 1941, *Hunnewell 17233* (GH); slopes of Volcán de Zunil, Feb. 3, 1941, *Standley 85932* (F); Fuentes Georginas, western slope of Volcán de Zunil, 2850 m, Mar. 4, 1939, *Standley 67488* (Type: F); between Todos Santos and Finca el Porvenir, lower to middle slopes of Volcán Tajumulco, Mar. 1, 1940, *Steyermark 36988* (F).

6. **Physalis chimalteca** Standley & Steyermark, Field Mus. Publ. Bot. **23**: 232. 1947.

Coarse herb, possibly woody below, herbarium specimens 0.5 m long, being tops of plants; stems glabrous, or slightly vestite above with appressed and more or less antrorsely curled hairs; leaf blades ovate, acuminate, larger ones 8-12 cm long and 4-8 cm wide, margins entire or with 1 to 3 large teeth or very shallow lobes on each side, petioles of larger leaves 1-2 cm long; leaf surfaces with a few flattened, jointed, usually appressed hairs, these sometimes reduced to bases only; flowers in axillary fascicles of (1-) 2-4, only one maturing a fruit in the few seen; calyx at anthesis thin-chartaceous, glabrous externally, the 5 shallow lobes marginally ciliate, the pedicel filiform, erect 8-10 mm long; corolla rotate to reflexed-rotate, densely covered externally with short, antrorsely appressed hairs; corolla 15-20 mm long, the upper 8-10 mm divided into lanceolate or ovate-lanceolate lobes, each basally with an area of a few discrete dark spots, below which matted hairs extend into the tube; anthers 2.5-3 mm long on filiform filaments 3-5 mm long; fruiting calyx 2.5-5 cm long and 2-3 cm wide, glabrous, reticulate-veined, berry oily, ca. 1 cm in diameter, sessile on the invaginated calyx.

SPECIMENS SEEN. MEXICO: CHIAPAS: Siltepac, Jan. 1937, *Matuda 250*, (F, MICH, US). GUATEMALA: Volcano Actenango, Feb. 7, 1907, *Kellerman 6610* (F); San Miguel Uspantan, April 1892, *Heyde et Lux* 3435 (F); above Las Calderas, common on slopes of Volcán de Acatenango, Jan. 3, 1930, *Standley 61803* (Type: F); ibid, *Standley 61965* (F); slopes of Volcán de Zunil, wet forested quebrada, Feb. 3, 1941, (F).

7. **Physalis melanocystis** (Robinson) Bitter, Repertorium Specierum Novarum **20**: 369-370. 1924; *Withania melanocystis* Robinson, Proc. Amer. Acad. **26**: 171. 1891.

Woody, branched, height not determinable from collections; vestiture of short, unbranched, spreading or antrorse-appressed hairs; leaf blades lanceolate to ovate-lanceolate or rhombic-lanceolate, principal ones 4-10 cm long and 1.5-5 cm wide on petioles 5-20 cm long; flowers in axillary fascicles of (1-) 3-6; corolla 8-10 mm long and 12-18 mm wide, its limb rotate or rotate-reflexed when fully expanded, divided above into ovate to deltoid-ovate lobes 3-6 mm long; maculations not strongly contrasting; anthers yellowish, 3-4 mm long, on filaments 1-2 mm long; flowering pedicels 4-10 mm long; fruiting calyx 17-25 mm long and 15-18 mm wide on pedicels 10-15 mm long; berry spheric, 10-13 mm in diameter.

7a. var. **melanocystis**

Vestiture of short, unbranched, dense, more or less spreading hairs, principal leaf blades 4-7 cm long and 1.5-3 cm wide on petioles 5-10 mm long.

SPECIMENS SEEN. MEXICO: SAN LUIS POTOSI: Tamasopo Canyon, 1890, *Pringle 3285* (GH, US); rocky limestone woods, Espinazo del Diablo, Tamosopo Canyon, Aug. 7, 1934, *Pennell* 17959 (US); Bitter (l.c. supra) cites *Schiede 1189* (B) from Papantla, VERACRUZ.

7b. var. **cernua** (Donn.-Smith) Waterfall, comb. et stat. nov., *Athenaea cernua* Donn. Sm., Bot. Gaz. **48**: 297. 1909.

A var. *melanocystis* differt caulibus trichomatibus curtis antrorso-adpressis; foliis majoribus 7-10 cm longis et 3-5 cm latis, petiolis 1-2 cm longis.

SPECIMENS SEEN. GUATEMALA: shaded bank of Motagua River, Gulan, June 15, 1909, *Deam 6279* (G, US). MEXICO: GUERRERO: Acapulco, Dec. 1955, *Paray 1813* (MEXP).

Although the two varieties are similar, the appressed vestiture and larger leaves of var. *cernua* seem to adequately distinguish it from the more northern var. *melanocystis*. Future collecting should find intermediate localities for the species.

8. **Physalis constricta** Waterfall, sp. nov.

Herba subglabra; foliis ovatis, majoribus 5-6 cm longis et 30-45 mm latis, margine inaequaliter magnodentato vel integerrimo, petiolis 15-25 mm longis; calycibus anthesi 11-12 mm longis et 6-7 mm latis, lobis triangularibus vel ovatis, 3-4 mm longis; pedicellis 4 cm longis; corollis 20-26 mm longis, mediis ca. 10 mm latis, sursum gradatim attenuatis, apertis constrictis, 5 mm latis; antheris 4 mm longis, filamentis filiformibus; calycibus fructiferis 28 mm longis et 20 mm latis, inflatis.

MEXICO: OAXACA: in 1842, *Ghiesbreght s.n.* (Type: P).

This distinctive species is characterized principally by its long, semitubular corollas, 20-26 mm long, expanded to a width of ca. 10 mm above the calyx and gradually narrowed above, then constricted into an aperture ca. 5 mm wide, essentially unlobed, and without a limb, and by its long, erect pedicels, ca. 4 cm long; although the plant is nearly glabrous, the stem has a few short jointed hairs present, and the upper surfaces of some of the leaves have a few capitate-glandular ones present.

If the corolla both expanded and constricted more abruptly, and if it were pentangular above, it would be reminiscent of a large species of *Margaranthus*. The corolla is not funnelform and Ipomoea-like as in *Cacabus*, sens. str.; the fruiting calyces are similar to those found in *Physalis*. One has the alternatives of creating for it a new genus in the *Solaneae-Lyciinae* of Wettstein in Die Natürlichen Pflanzenfamilien, of placing it in *Margaranthus* as an anomalous species, or of treating it as an anomalous species of *Physalis*. Believing that the latter disposition better indicates its possible relationships, the author is so treating it.

9. **Physalis campanula** Standley & Steyermark, Field Mus. Publ. Bot. **23**: 18-19. 1943.

Branching herb, only ends of branches collected; herbage covered with spreading jointed hairs of varying lengths, some capitate-glandular; stems glabrescent; leaf blades ca. ovate, the larger ones 5-7 cm long, sometimes with 1-3 irregularly shaped teeth or lobes on each margin, attenuate; most branch leaves 3-5 cm long with entire margins; petioles 1-4 cm long; flowers solitary; flowering calyx nearly oblong, 8-10 mm long and 7-8 mm wide, the upper 3-5 mm differentiated into deltoid acuminate lobes 3-5 mm long with ciliate margins; corolla immaculate, tubular, somewhat swollen above the calyx and slightly constricted at the minutely 5-dentate apex, 17-18 mm long and 8-9 mm wide; anthers ca. 3 mm long, bluish, on filaments 5-7 mm long, equally inserted near the base of the corolla with tomentose areas extending 1-2 mm above the point of insertion; fruiting calyx (only 1 approaching maturity) 25 mm long and 17 mm wide, the berry ca. 1 cm in diameter.

GUATEMALA: Volcán Tacana, along Quebrada Canjula between Sibinal and Canjula, Feb. 18, 1940, *Steyermark 36067* (Type: F).

10. **Physalis glutinosa** Schlechtendal, Linnaea **19**: 310-311. 1846; *Cacabus mexicanus* S. Watson, Proc. Amer. Acad. Arts & Sci. **18**: 127. 1883; *Physalis eximia* Standley, Field Mus. Publ. Bot. **17**: 273-274. 1937.

Herbaceous, or perhaps somewhat woody below, branched, as much as 1.3 m tall and broad, or "in crevices of cliffs, half-woody, hanging"; herbage somewhat glutinous-vestite with spreading, jointed, flattened hairs 1-1.5 mm long intermingled with shorter ones, many of the hairs capitate-glandular, sometimes only a few long ones present; leaf blades ovate, sometimes cordate, larger ones 3-6 cm long and 2-5 cm wide, rarely sub-rotund; branches often have only smaller leaves; leaf margins dentate-sinuate, often with 5-10 irregularly shaped teeth on each side, sometimes nearly entire; leaf surfaces often spreading-hairy below and appressed hairy above, sometimes only along the principal veins below and reduced above to a few short hairs or hair-bases; petioles of principal leaves 2-6 cm long; flowers axillary, solitary, large; flowering calyx oblong or ovate-oblong, often 5-8 mm wide at base and 8-12 mm wide at base of calyx lobes, and 10-18 mm long, the upper one-fourth to two-thirds divided into narrowly triangular, sometimes acuminate, lobes 4-11 mm long; corolla campanulate to subcampanulate, 20-35 mm long and 3-4 cm wide when fully expanded, limb not reflexed, not at all 5-lobed, yellowish distally, with 5 large purplish-splotched areas which may cover most of the corolla, these rarely seemingly absent in herbarium specimens; anthers yellow with a slight bluish tinge, 3.5-5 mm long and 1.3-2 mm wide on slender glabrous filaments 10-15 mm long; style 2-3 cm long; pedicels 7-20 mm long; fruiting calyx 10-ribbed, hairy, 25-45 mm long and 20-30 mm wide on pedicels 10-23 mm long; berry 12-20 mm in diameter.

10a. var. **glutinosa**

Corolla limb maculate with 5 large purplish, often nearly contiguous, areas; vestiture rather dense, often giving the plant a slightly greyish appearance.

SELECTED SPECIMENS. MEXICO: DURANGO: grasslands with sparse growth of oak scrub, 14 miles w of Durango, June 21, 1950, *Maysilles 7014* (MICH); Durango and vicinity in 1896, *Palmer 313* (BM, F, GH, NY); mountainside, 5 miles sw of Durango, 3 feet tall, corolla pale maroon inside, *Waterfall 15409* (BM, F, GH, HAL, NY, OKLA, P, S, SMU); GUANAJUATO: many stemmed, half-woody, hanging to 1 meter, hills 24 miles w of Xichu, June 14, 1957, *McVaugh 14813* (MICH); HIDALGO: Mineral del Monte, Cuesta Blanca, in humosa terra inter rupes porphyriticas ferratas, July 1836, *Ehrenberg 585* Type: HAL); Pachuca to Real del Monte, May 1828, *Graham 268* (BM); hills above Pachuca, Aug. 5, 1898, *Pringle 7576* (F, VT); SAN LUIS POTOSI: in 1878, *Parry & Palmer 650* (GH, NY, P); in montibus San Migueliteo in 1876, *Schaffner 704* (Type collection of *Cacabus mexicanus* Watson: GH, NY); ZACATECAS: south slope of La Bufa, Aug. 10, 1948, *Dressler 112* (GH); plant 5 ft. broad and high, hills, Oct. 26, 1888 *Pringle 1742* (F, GH, NY, UC, VT).

var. **eximia** (Standley) Waterfall, comb. et stat. nov., *P. eximia* Standley, Field Mus. Publ. Bot. **27**: 273-274. 1937.

MEXICO: CHIHUAHUA: Majalca, June 24, 1935, *LeSueur 894* (Type: F); *LeSueur 115*, Aug. 18-20, 1935 (F, GH, UC).

This taxon is similar to var. *glutinosa*, but with the corolla immaculate, or nearly so, and the plant less densely vestite, appearing greener.

11. **Physalis cinerea** Waterfall, sp. nov.

Planta cinerea; foliis ramealibus ovatis inaequalibus, 2-3 cm longis 15-25 mm latis; corollis immaculatis campanulatis 25-30 mm longis; antheris flavis 3-4 mm longis et 1.5-2 mm latis; filamentis 10-12 mm longis.

*Physalis cinerea* is similar to *P. glutinosa*, but is smaller and is cinereous with short, stiffly spreading, flattened, jointed hairs, some of which are capitate-glandular; principal leaf blades (from branches only) are smaller than in *P. glutinosa;* flowering calyx 10-12 mm long and 5-8 mm wide, divided about one-third to one-fourth way into deltoid, slightly acuminate lobes; no dark spots are evident in the specimens seen, but this characteristic is sometimes lost in drying; mature fruits unknown.

MEXICO: SAN LUIS POTOSI: in the region of San Luis Potosí, alt. 6000-8000 ft., *Parry & Palmer* 649 (Type: NY, Isotype: GH).

12. **Physalis viscosa** L., Species Plantarum 183. 1753; *P. curassavica* L., ibid. 182, *P. pensylvanica* L., Sp. Pl., ed. 2: 1670. 1762; other synonymy listed under the varieties.

Since several of the varieties are extra-limital, no inclusive species description is here included.

12a. var **cinerascens** (Dunal) Waterfall, Rhodora **60:** 136. 1958; *P. pensylvanica* L., var. *cinerascens* Dunal in D. C. Prodromus 13(1); 435-436. 1852; *P. curassavica* L., var. *integrifolia* Dunal, l.c. 438; *P. mollis* Nutt., var. *cinerascens* (Dunal) Gray, Proc. Amer. Acad. Arts & Sci. **10:** 66. 1875; *P. cinerascens* (Dunal) Hitchc., Spring Flora of Manhattan 32. 1894; *P. mollis* Nutt., var. *parviflora* Rydb., Mem. Torr. Bot. Club **4:** 355. 1896; *P. saltillensis* Fernald, Proc. Amer. Acad. Arts & Sci. **35:** 568-569. 1900.

Perennial, 5-80 cm tall, erect to decumbent, covered to a greater or lesser degree with stellate, or somewhat dendritic, hairs of varying size; principal leaf blades 1.5-7 cm long, and 1.5-5 cm wide on petioles 1-5 cm long; leaf-margins dentate, undulate or entire; corolla yellowish, dark-maculate, 9-15 mm long, and 8-16 mm wide, reflexed-rotate when fully expanded, on pedicels 7-35 mm long; fruiting calyx 15-35 mm long and 15-28 mm wide, half to three-fourths filled by the berry, on pedicels 8-40 mm long.

SELECTED SPECIMENS. MEXICO: CHIAPAS: Escuintla, May 13, 1936, *Matuda 239* (MICH, US, VT); Hacienda Monserrate, Sept. 1923, *Purpus 9212* (GH, NY, UC); CHIHUAHUA: Aldama, May 15-17, 1908, *Palmer 240* (F, GH, MICH, NY, US); COAHUILA: Sierra de Santa Rosa s of Muzquiz, July 8, 1938, *Marsh 1269* (F, GH); near Saltillo, Sept. 1898, *Palmer 332* (Type of *P. saltillensis*: (MICH, NY, US); Parras, July 1910, *Purpus 4601* (F, GH, UC, US); along arroyo in desert, 18 miles ne of Saltillo, Aug. 6, 1957, *Waterfall 13230* (F, HAL, MICH, OKL, OKLA, S, SMU); DISTRITO FEDERAL: Apr. 10, 1938, *Balls* 4144 (BM, UC, US); GUANAJUATO: Silao, May 19, 1891, *Pringle 5148* (GH, VT); with *Prosopis* and *Acacia*, 14 miles se of Leon, Aug. 16, 1957, *Waterfall 13880* (OKLA); HIDALGO: valley near Tula, July 16, 1896, *Pringle 6362* (BR, F, GH, NY, UC, US, VT); MEXICO: Vallée de Mexico, 1865, *Bourgeau 112* (BR, GH, US); MORELIA: *Arsène sin. num.* (F); NUEVO LEÓN; w of Linares, Aug. 8, 1930, *Bartlett 10831* (F, GH, MICH); Hacienda Pablillo, Galeana, *Taylor 44* (F, GH, NY); desert between mountains, 22 miles w of Monterrey, *Waterfall 15316* (OKL, OKLA, SMU); OAXACA: San Geronimo, July 1-5, 1895, *Nelson 2770* (GH, US); PUEBLA: San Luis Tultitlanapa, *Purpus 3583* (UC); QUERETARO: San Juan del Rio, Aug. 18, 1905, *Rose et al 9534* (NY, US); desert hillside, 2 miles ne of Zimapan, Aug. 20, 1957, *Waterfall 14121* (OKL, OKLA, P, SMU); SAN LUIS POTOSÍ: region of San Luis Potosí, 1878, *Parry* and *Palmer 641* (GH, NY, US); along arroyo running through shrubs, 25 miles ne of San Luis Potosí, Aug. 20, 1959, *Waterfall 15709* (OKLA, SMU); TAMAULIPAS: circa Matamoros urbem, 1831, *Berlandier 2316* (Lectotype: GH, Isolectotype: F); Tampico, Jan. 1-31, 1910, *Palmer 126* (BM, F, GH, NY, US); in canyon 4 km w of Miquihuana, Aug. 4, 1941, *Stanford, et al 674* (GH, OKLA, UC); ZACATECAS: near Concepcion del Oro, Aug. 11-14, 1904, *Palmer 318*, (NY); YUCATAN: in 1895, *Gaumer 482* (NY); Chichen Itza, June 6, 1932, *Steere 1008* (F, MICH).

The type collection, *Berlandier 2316* from near Matamoros, has slightly sinuate-dentate leaves. There are collections with entire, often relatively broader, leaves which appear to belong to a distinct phase, but there are many intermediates. Indeed the type itself is intermediate between the phase with entire margins and the one with dentate leaves. Since the two occur from Kansas to central Mexico, no nomenclatural differentiation is made here.

12b. var. **spathulaefolia** (Torr.) Gray, Proc. Amer. Acad. Arts & Sci. **10**: 67. 1875; *P. lanceolata* Michx. var. *spathulaefolia* Torr., Bot. Mex. Bound. 153. 1859.

Leaf blades ovate to lanceolate or spathulate, basally tapering, petioled.

MEXICO: TAMAULIPAS: en las dunas que separan la Laguna Madre y el Golfo, Rancho El Mezquite, Mar. 13, 1963, *Gonzales 55* (MEXP).

12c. var. **sinuatodentata** Schlechtendal, Linnaea **19**: 309 1846.

*P. curassavica* L., var. *sinuato-dentata* (Schlecht.) Dunal in D. C., Prodromus 13 (1): 438. 1852.

This is very similar to var. *cinerascens*, but appears to be a weakly differentiated local variety from coastal sand dunes near Vera Cruz. It consists of small plants having dendritic or fasciculate hairs in addition to the stellate ones, coarsely dentate leaves varying to entire, and elongate cord-like rhizomes.

SPECIMENS EXAMINED. MEXICO: VERACRUZ: Mexico, *Ehrenberg* (Type: HAL); VERA CRUZ, 1853, *Muller 175* (NY) in collibus arenosis pr. Veracruz, July 1828, *Schiede 190* (HAL); sand dunes, Veracruz, June 24, 1901, *Pringle 8517* (F, NY, OKLA, P, UC, US, VT).

12d. var. **yucatanensis** Waterfall, var. nov.

Planta vestita, trichomatibus dendriticis vel stipato-stellatis ad 2 mm longis.

This variety is characterized primarily by the spreading dendritic trichomes of the stem, petioles, pedicels and calyces, the longer ones 0.5-2 mm long, some of them stipitate, the basal one-third to two-thirds unbranched; similar hairs present to a greater or lesser extent on the leaf blades where they are often smaller.

SPECIMENS SEEN. MEXICO: YUCATAN: Chichankanab, *Gaumer 1798* (Type: F, Isotypes: BM, NY, US); *Gaumer 482* (BM, F, GH, US) not all duplicates are this species), Chichankanab, *Gaumer 1518* (F, US); Izamal, *Gaumer 2427* (F); 2 ft. high, Izamal, *Gaumer 23166* (F); Mérida, *Rivas 16* (F); Tirul, Mar. 6, 1903, *Seler 3911* (F, GH); Chichen Itza, June 6 & 29, 1932, *Steere 1008 & 1647* (F) Muna, July 22, 1932, *Steere 2109* (F).

13. **Physalis Mcvaughii** Waterfall, sp. nov.

Frutex, 1.5-2.5 m alta; trichomatibus paucis brevibus; foliis ovatis vel rhombico-ovatis, attenuatis, majoribus 7-13 cm longis et 4-9 cm latis, integerrimis vel paucidentatis, petiolis 1.5-5.5 cm longis; calycibus floriferis 8-9 mm longis et 10-15 mm latis ad basim loborum; calycis lobis deltoidibus 3-5 mm longis; pedicellis 25-30 mm longis; corollis maculatis campanulato-rotatis vel reflexo-rotatis, 11-13 mm longis et 20-25 mm latis; antheris violaceis, 2.7-3.5 mm longis, filamentis 3-4 mm longis; calycibus fructiferis decagonatis, 25-45 mm longis et 25-35 mm latis; pedicellis fructiferis 4-5.5 cm longis; baccis 15-20 mm latis.

This nearly glabrous species of *Physalis* is characterized by its large fruiting calyces, 10-angled, but with the primary angles more prominent than the secondary ones, borne on long pedicels 4-5.5 cm in length. The hardened stems appear to be of a persistent herbaceous type becoming woody.

SPECIMENS SEEN. MEXICO: JALISCO: shrub 2 m high, precipitous mountainsides with tall wet mixed forest of firs and deciduous trees, 3-5 miles nw of San Miguel de la Sierra, Nov. 8, 1962, *McVaugh 22034* (Type: MICH); steep mountain slopes in moist fir forest, Nov. 12-13, 1952, *McVaugh 14064* (MICH); single-stemmed shrub 1.5-2.5 m high, fir forest on steep mountainsides 11-12 miles s of El Rincon, *McVaugh 21512* (MICH).

14. **Physalis stapelioides** (Regel) Bitter, in Fedde, Spec. Nov. 18: 5-7. 1922; *Saracha stapelioides* Regel, Supplm. Hort. Bot. Petropol. 18. 1864; *Saracha stapeliaflora* Dcne., Catal. Mus. d'Hist. Nat. Paris 7. 1863 (nomen nudum); *Physalis acuminata* Greenman, Amer. Acad. Arts & Sci. 35: 311. 1900.

Suffrutescent, or "soft-shrubby", the collected branch-ends sometimes herbaceous, 1-3 m high, stem as much as 3 cm thick; herbage with jointed, spreading hairs, some as much as 2-3 mm long, others much shorter, some capitate-glandular, the glands often reddish or brownish; leaf blades ca. ovate, acuminate, in two ranges of contrasting sizes, the larger ones, especially on the main stem, 10-20 cm long and 8-15 cm wide on petioles 4-13 cm long, smaller ones often 6-8 cm long and 4-5 cm wide on petioles 2-3 cm long; branch-ends with only smaller leaves sometimes collected; leaf surfaces usually with a few appressed hairs; flowers single; flower buds large immediately prior to anthesis, as much as 10 mm long and 7-8 mm wide; calyx at anthesis oblong to oblong-flaring, 10-15 mm long, the upper one-third to one-half divided into lanceolate to lanceolate-ovate acuminate lobes, 8-9 mm wide basally to sometimes 12-13 mm wide at base of calyx lobes; corolla light yellow, 15-25 mm long and 25-35 mm in diameter when fully expanded, pentangular with slight sinuses between the somewhat acuminate apices, conspicuously maculate with 5 clusters of discrete spots, densely matted-hairy in the tube below the maculations; anthers oblong-ovate, bluish, 4-5 mm long on glabrous filaments 4-7 mm long; fruiting calyx 10-angled, the sinus-veins not prominent, sometimes 2-branched, covered with long and short hairs, some glandular-capitate, ca. ovate, 25-40 mm long, on pedicels 10-25 mm long; berry oily, 12-20 mm in diameter, sessile, or essentially so, on the invaginated calyx-base.

SELECTED COLLECTIONS. MEXICO: DISTRITO FEDERAL: loose bushy shrubs to 10 ft. tall and as much through, in open places in forest, Desierte de los Leones, 10000 ft altitude, Mar. 28, 1938, *Balls 4060* (BM, GH, MICH, UC, US); GUERRERO: by stream in oak and pine forest, Teotepec, May 20, 1939, *Hinton 14299* (F, GH, US); top of Sierra Madre near Chilpancingo, Dec. 24, 1894, *Nelson 2229* (GH, US); HIDALGO: between Pachuca and Real del Monte, *Rose, et al, 8677* (US); JALISCO: simple shrub to 2 m, abundant in fir zone at head of Barranca de la Rosa, northeastern slopes of Nevado de Colima below Canoa de Leoncito, Oct. 10, 1952, *McVaugh 13417* (MICH, OKLA); soft shrub to 8 ft. branches over 1 inch diameter, pine-fir forest, north slope of Nevado de Colima, Aug. 25, 1957, *Straw & Gregory 1241* (MICH); MEXICO: Sierra de las Cruces, Oct. 23, 1892, *Pringle 5315* (*P. acuminata*, Type: GH, Isotype: F); Under cliffs, Sierra de las Cruces, 10000 ft, Sept. 12, 1904, *Pringle 13128* (F, GH, MICH, OKLA, US, VT); MICHOACAN: pine-fir forests, mountains w of Cerro San Andres, 8-10 miles nw of Ciudad Hidalgo, Mar. 19, 1949, *McVaugh 9940* (F, OKLA); VERACRUZ: Orizaba, *Botteri 220* (GH).

15. **Physalis orizabae** Dunal, in D.C. Prodrumus 13 (1): 452. 1852; *P. subintegra* Fernald, Proc. Amer. Acad. Arts & Sci. **35**: 567-568. 1900.

Perennial from a woody, sometimes slender elongate, base, 15-45 cm high; vestiture of short antrorsely curled hairs often intermixed with varying amounts of long jointed hairs, 1-2 mm long, the latter often more abundant on the pedicels and calyces; leaf blades broadly to narrowly ca. ovate, principal ones usually 3-5 cm long and 2-3 cm wide their margins usually entire, but sometimes with 1-3 irregularly shaped teeth on each side; blades often with only a few scattered, often appressed, hairs; petioles of principal leaves 1-2 cm long; calyx at anthesis oblong to more or less campanulate, 6-10 mm long and 5-10 mm wide at base of lobes, upper one-third to one-half divided into lanceolate to ovate-deltoid, sometimes acuminate, lobes; vestiture of calyx of varying amounts of long flattened jointed hairs, more or less spreading; pedicels 10-15 mm long; corolla yellowish, prominently maculate, 12-22 mm long and 15-30 mm in diameter when fully rotate-opened, tomentose in the throat, and with jointed, appressed hairs on the outside; anthers nearly oblong, bluish or violet, 2.2-3 mm long on glabrous, somewhat thickened, filaments 3-5 mm long; fruiting calyx 10-angled or 10-ribbed, often large when fully developed, 2-4 cm long and 18-35 mm wide on pedicels 10-15 mm long; berry 1-2 cm in diameter, sessile to subsessile on the barely invaginated calyx.

SELECTED COLLECTIONS: MEXICO: AGUASCALIENTES: oak forests near summit of Sierra del Laurel, 10 miles se of Calvillo (somewhat questionably referred to this species), *McVaugh 18439* (MICH, OKLA); DURANGO: Tejamen, Aug. 21-27, 1906, *Palmer 480* (F, GH, NY, US); in pine woods 3 miles sw of El Salto, *Waterfall 16186* (F, GH, OKLA, SMU); DISTRITO FEDERAL: Sierra de Ajusco, 9000 ft, June 6, 1904, *Pringle 13277* (F, GH, MICH, OKLA, UC, US, VT); HIDALGO: Real del Monte, May 27, 1827, *Berlandier 248* (BM); Sierra de Pachuca, July 21, 1901, *Rose & Hay 5576* (GH, NY, US); JALISCO: cut-over and grazed mountainsides in oak zone, se slopes of Cerro

Gordo, 12 miles se of Tepatitlan, Aug. 29, 1958, *McVaugh 17508* (MICH); near Huejuquilla, Aug. 25, 1897, *Rose 2577* (GH, US); MEXICO: Carboneras, Río Verde, Temascaltepec, June 26, 1935, *Hinton 7717* (F, GH, MICH, NY, US); Sierra de las Cruces, 10000 ft, Sept. 10, 1899, *Pringle 8225* (Type of *P. subintegra:* GH, Isotypes: BR, F, OKLA, UC, US, VT); MICHOACAN: w of Tancitaro, July 19, 1940, *Leavenworth 296* (F, MICH, NY); near Hamburg Courts, Lago Patzcuaro, Aug. 20, 1949, *White 238* (OKLA, US); MORELOS: in mountains near Cuernavaca, Aug. 10, 1949, *White 234* (OKLA, US); NUEVO LEÓN: in open woods, San Francisco Canyon, 15 miles sw of Pueblo Galeana, *Mueller 346* (F, GH, MICH); OAXACA: nw slope of Mt. Xempoaltepec, 8000 to 10000 ft, *Nelson 681* (GH, US); PUEBLA: in pine woods, San Manuel de la Sierra, Sierra Negra, 10400 ft, *Balls 4464* (BM, UC, US); abundant near San Martin, July 14, 1929, *Mexia 2654* (BM, F, MICH, NY, UC); QUERÉTARO: Zimapan, *Cottam 10439* (US); mountainside 34 miles se of San Juan del Rio, Aug. 18, 1957, *Waterfall 14020* (F, GH, MICH, OKLA, P, SMU); SAN LUIS POTOSÍ: Alvarez, July 13-23, 1904, *Palmer 225* (GH, US); TAMAULIPAS: top of mountains, Santa Rita Ranch, April 7, 1926, *Runyon 1051* (US); TEPIC: Sierra Madre between Dolores and Santa Gertrudis, Aug. 1897, *Rose 2049* (GH, NY, US); VERACRUZ: between Banderilla and Jalapa, Feb. 15, 1943, *Gilly et al 146* (MICH); ad radices montis Orizaba, Sept. 1828, *Schiede, sin num* (Type: HAL).

This variable species shows increasing variation at the lower altitudinal and the northern geographic limits of its range. Even near the center of its range the vestiture, size of fruits and of flowers vary considerably. The TYPE, from the foot of Mt. Orizaba, has abundant spreading hairs on the flowering calyces and pedicels. The type of *P. subintegra,* from Sierra de Las Cruces, has spreading to antrorsely curled hairs on the flowering calyces and pedicels and develops the extreme in large thick fruiting calyces. Some collections show the vestiture of the leaves and young stems varying toward shorter, denser, more appressed hairs, approaching *P. chenopodifolia (P. puberula)* in that respect.

16. **Physalis ingrata** Standley, Field Mus. Publ. Bot. **17:** 391. 1938.

Plant herbaceous, or woody below, from a woody root; stems 15 cm (in Type) to 60 cm tall, vestiture of short, retrorse-spreading to spreading hairs; leaf blades ovate, the principal ones 3-5 cm long and 18-25 mm wide, their surfaces more or less vestite with short, spreading to somewhat appressed hairs; petioles 7-20 mm long; flower-buds prior to anthesis ca 6 mm long and 5-6 mm wide; flowering calyx broadly oblong to hemispheric or somewhat campanulate, 6-9 mm long and 5-6 mm wide at base of the lanceolate-ovate to deltoid, slightly acuminate, calyx lobes, which are 3-5 mm long; pedicels 7-12 mm long; corolla campanulate, yellowish, dark-maculate, 10-12 mm long and 7-12 mm wide; anthers nearly oblong, 3-4 mm long, yellow with a bluish or greenish-blue tinge, on glabrous filaments 3-4 mm long; fruiting calyx (immature) 17-20 mm long and 11-12 mm wide; berry ca. 8 mm in diameter, sessile or on a stipe as much as 0.5 mm long on the slightly invaginated calyx-base.

HONDURAS: on rocky hillside above Siguatepeque, July 14, 1936, *Yuncker, et al 5865* (Type: F, Isotype: GH); *Yuncker; et al 5794* (F, GH).

17. **Physalis aggregata** Waterfall, sp. nov.

Planta herbacea, trichomatibus articulatis, brevibus, apice capitato-glanduliferis, et etiam paucis longioribus, 0.5-1.5 mm longis; foliis lanceolatis vel ovato-lanceolatis, integerrimis vel paucidentatis, 6-10 mm longis et 3-5.5 mm latis, petiolis 2-4.5 cm longis; floribus aggregatis; calycibus floriferis 5-7 mm longis et 5-7 mm latis; calycis lobis ovatis, 3-3.5 mm longis; pedicellis 4-6 mm longis; corollis 9-10 mm longis et 13-15 mm latis; antheris flavis vel violaceo-flavis, 2.5-3 mm longis; filamentis 3-4 mm longis; calycibus fructiferis 15-20 mm longis et 12-13 mm latis; baccis 10-11 mm latis.

MEXICO: OAXACA: Rancho de Calderón, 5500 ft, San Juan, *L. C. Smith 771* (Type: GH).

This peculiar species, known only from the type collection, is characterized by its aggregations of 3-7 flowers to form an inflorescence (apparently by branch-reduction, the axis, and sometimes bracteal leaves, present), although the first-formed flowers are solitary and axillary; the jointed trichomes are of two kinds, a dense layer of short, often capitate-glandular ones, and scattered longer ones 0.5-1.5 mm long; the rather immature flowering calyx is nearly filled by the berry.

18. **Physalis lassa** Standley & Steyermark, Field Mus. Publ. Bot. **23**: 19-20. 1943.

Perennial, stems herbaceous, or woody below, 30-60 cm tall, from a woody base, densely covered with flat, jointed spreading hairs tapering apically on the TYPE, but some hairs having small capitate glands in some of the associated material; leaf blades ovate, acute, sometimes subcordate, more or less densely covered with soft spreading hairs above and below, lighter colored below, margins entire, or rarely with 1 or 2 repand teeth on each margin; principal blades 3.5-7 cm long and 2-4 cm wide on petioles 1-2 cm long, sometimes slightly winged in the upper part; flowering calyx oblong to flaring-oblong, 8-11 mm long and 5-7 mm wide at base of lobes, upper one-third to two-thirds divided into narrowly deltoid or ovate-lanceolate to ovate-deltoid lobes, on pedicels 6-8 mm long; corolla yellowish, dark-maculate, tomentose in the throat, 10-15 mm long and 12-15 mm wide when fully open; anthers bluish, oblong, ca. 4 mm long and 1 mm wide on filaments of about equal length; fruiting calyx 10-ribbed or slightly 10-angled, 25-35 mm long and 17-25 mm wide; berry 10-15 mm in diameter, essentially sessile on the slightly (2.5 mm) invaginated calyx base.

SELECTED SPECIMENS. MEXICO: GUERRERO: vicinity of Acapulco, Feb. 1895, *Palmer 510* (GH, US, NY); GUATEMALA: Sierra de las Minas near San Geronimo, Mar. 3, 1907, *Kellerman 6656* (F); hillside, 7200 ft, near Tecpam, July 20, 1933, *Skutch 481* (MICH, US); damp oak forest nw of Jalapa, Nov. 16, 1940, *Standley 77476* (F); between Jalapa and Montanya Miramundo, 1500-2000 m, Dec. 7, 1939, *Steyermark 32868* (Type: F); Cerro Pixpix above San Ildefonso Ixtahuacan, Aug. 15, 1942, *Steyermark 50638* (F).

19. **Physalis chenopodifolia** Lamarck, Tableau Encycl. 2: 28, no. 2401. 1793; *P. puberula* Fernald, Proc. Amer. Acad. Arts and Sci. **36**: 502. 1901.

Plant herbaceous from a woody base, more or less cinereous with short, antrorsely curled hairs; leaf blades usually ca. ovate with margins irregularly coarse-dentate to repand-dentate with 1-10 teeth on each margin, or entire; calyx at anthesis oblong to flaring-campanulate, 6-10 mm long and 3-6 mm wide at base of lobes, divided one-third to two-thirds into usually narrowly deltoid-lanceolate, gradually attenuate lobes; pedicels 3-10 mm long; corolla yellowish, prominently dark-maculate, 12-20 mm long and 15-30 mm wide when fully rotate-expanded, tomentose in the throat; anthers tinged bluish or bluish-green, 2-2.5 mm long, on slender filaments 2-5 mm long; fruiting calyx 10-ribbed or slightly 5-angled with intermediate ribs or angles, 20-30 mm long and 15-20 mm wide on pedicels 1-2 cm long; berry 10-15 mm wide.

19a. **var. chenopodifolia**

Blades of principal leaves 3-7 cm long and 2-5 cm wide on petioles 10-35 mm long; plant rather cinereous with antrorsely curled hairs.

SELECTED COLLECTIONS. MEXICO: DISTRITO FEDERAL: perennial in clumps, Tlalnepantla, 7300 ft, June 9, 1901, *Pringle 8511* (F, GH, NY, UC, US, VT); MEXICO: Nanchititla, Feb. 22, 1933, *Hinton 3431* (BM, GH, F); Sacro Monte, Amecameca, *Pringle 9147* (Type of *P. puberula:* GH, Isotypes: F, US, VT); GUANAJUATO: base of hills, 34 miles north of Querétaro, Aug. 23, 1961, *Waterfall 16551* (GH, MICH, OKLA, UC, US); Pachuca, July 1905, *Rose et al 8768* (F, GH, NY, US); MICHOACAN: Morélia, 2200 m, Sept. 5, 1912, *Arsène 8658* (NY); PUEBLA: Rancho Posadas près de Puebla, July 25, 1909, *Nicolas 209* (GH, NY, P); near Calchicomula, July 24, 1901, *Rose et al 5655* (GH, NY, US); QUERÉTARO: in dense clumps, stony flats with acacias, mimosas and cacti, 8 miles e of Querétaro, Aug. 23, 1961, *Waterfall 16521* (BM, F, GH, HAL, MICH, OKLA, UC, US); TLAXCALA: Mt. Malinche, Tecarona, 8500 ft, June 21, 1938, *Balls 4861* (UC).

The extreme with irregularly toothed leaves is represented by the type collection of *P. chenopodifolia* (P), while the type of *P. puberula* has leaves with entire margins.

19b. var. **chenopodifolia**, forma **immaculata** Waterfall, f. nov. Corolla immaculata vel subimmaculata.

MEXICO: TLAXCALA: sunny banks between cultivation, Mt. Malinche, June 21, 1938, *Balls 4861* (Type: US).

19c. var. **viridis** Waterfall, var. nov.

Planta paucivestita, laminis plus minusve viridibus, integerrimis vel paucidentatis, 30-50 mm longis et 15-27 mm latis.

MEXICO: DURANGO, Otinapa, July 25-Aug. 5, 1906, *Palmer 420* (Type: US; Isotypes: F, GH, NY, UC).

SELECTED COLLECTIONS. MEXICO: CHIHUAHUA: limestone hillside 32 miles s of Parral, Aug. 9, 1956, *Waterfall 12519* (F, GH, HAL, MICH, OKLA, P, S, SMU, US); COAHUILA: oak and juniper assn. on a mountain 24 km nw of Fraile, July 15, 1941, *Stanford, et al 370* (GH, NY); DURANGO: *Palmer 420*, cited under "Type"; grassland with scattered pines, 19 miles sw of Durango, Aug. 10, 1957, *Waterfall 13434* (F, GH, MICH, NY, OKL, OKLA, SMU, UC, US); TAMAULIPAS: in arroyo 19 km sw of Miquihuana, Aug. 11, 1941, *Stanford et al* 918 (GH, NY); in pine forest 3 mi n of Miquihuana, July 14, 1949, *Stanford, et al 2438* (US).

This species varies into its northern extreme with vestiture less abundant, but present in varying quantities, leaves usually entire, their blades somewhat smaller than in var. *chenopodifolia.*

19d. var. **exigua** Waterfall, var. nov.

Planta parvior, laminis parvis, inaequaliter paucidentatis vel integerrimis.

MEXICO: SAN LUIS POTOSI: Charcas, July-Aug., 1934, *Lundell 5398* (Type: MICH; Isotype: US).

SELECTED SPECIMENS. MEXICO: DURANGO: open pine-oak woods 5.5 mi w of Durango, Aug. 12, 1957, *Waterfall 13617* (OKLA); GUANAJUATO: subhumid oak forest on steep slopes, 14.5 mi from Guanajuato on road to Dolores Hidalgo, July 5, 1955, *Johnston 2626* (OKLA); valley near Tula, July 16, 1896, *Pringle 7334* (GH, US, VT); QUERÉTARO: cliff sides and top, 15 mi se of San Juan del Rio, Aug. 17, 1957, *Waterfall 13962* (BM, F, GH, MICH, OKLA, P, SMU); SAN LUIS POTOSÍ: region of San Luis Potosí, in 1878, *Parry & Palmer 642* (GH, NY, P, US); *Lundell 5398*, Type, cited above.

This variety is characterized by the small leaf blades, the principal ones 10-25 mm long and 5-15 mm wide, with margins coarsely and irregularly few-toothed, or, rarely, subhastately lobed, on petioles 3-10 mm long. In kind of vestiture it tends toward the coarser trichomes of *P. orizabae*.

19e. var. **glandulosa** Waterfall, var. nov.

Planta viscida, trichomatibus articulatis capitato-glandulosis vel attenuatis.

MEXICO: QUERÉTARO: cliffs on steep mountainsides, 22 miles ne of Zimapan, Aug. 20, 1957, *Waterfall 14170* (Type: OKLA); Isotypes (MICH, US).

20. **Physalis hastatula** Waterfall, sp. nov.

Planta herbacea perennis; caulibus 9-10 dm longis, procumbentibus vel suberectis et ramosis, subglabris vel trichomatibus paucis brevibus antrorsis; foliis lanceolatis vel angusto-lanceolatis, subhastatis vel integerrimis, principalibus 4-6 cm longis et 3-4 mm latis, petiolis 12-22 mm longis; calycibus floriferis 4-6 mm longis et 3-4 mm latis ad basim loborum; calycis lobis lanceolatis, 3-4 mm longis; pedicellis 4-7 mm longis; corollis maculatis, 8-10 mm longis et 3-4 mm latis; antheris violaceis, 1.5-2 mm longis, filamentis 2.5-4 mm longis; calycibus fructiferis decagonatis subtilibus, 17-23 mm longis et 12-15 mm latis, baccis 7-10 mm latis.

SPECIMENS SEEN. MEXICO: JALISCO: prostrate, vine-like, a few plants in shade of north-facing rocks, Cerro La Campana, near km 36 sw of Ojuelos on road to Aguascalientes, Aug. 9-12, 1958, *McVaugh 16778* (Type: MICH, Isotype: OKLA); bushy, near km 31 sw of Ojuelos on road to Aguascalientes, Aug. 13, 1958, *McVaugh 16889* (MICH, OKLA).

This species is characterized by being nearly glabrous, having narrow leaves with a large subbasal tooth or small lobe on each side, sometimes 2 teeth, sometimes entire, and by the 10-angled fruiting calyx with the primary angles more prominent than the secondary ones.

21. **Physalis gracilis** Miers, Annals and Magazine of Natural History, ser. 2, 4 : 37. 1849; *P. Schiedeana* Dunal in DC., Prodromus 13 (1): 452. 1852.

Herbaceous, 60-120 cm tall, erect or reclining on bushes to procumbent and, sometimes, repent, more or less vestite with flat, jointed, usually spreading hairs ca. 1-1.5 mm long, sometimes glabrate or nearly glabrous; leaf blades ovate, sometimes broadly so, principal ones 3-10 cm long and 2-8 cm wide, surfaces spreading-hairy, or appressed-hairy or glabrous, entire to irregularly few-toothed, petioles 2-6 cm long; flowering calyx usually spreading-hairy, sometimes glabrous, 5-10 mm long and 4-7 mm wide at base of calyx lobes which tend to be ovate-deltoid and are 2-3 mm long; flowering pedicels 7-15(-20) mm long; corolla maculate, 10-13 mm long and 13-16 mm wide when open-reflexed, hairy pads below the five spots; anthers yellowish, sometimes with a slight bluish tinge which may be more pronounced in fresh material, 3-4 mm long on filaments 2-5 mm long; fruiting calyx 10-ribbed to nearly terete, 22-30 mm long and 14-25 wide on pedicels 10-20 mm long; berry nearly spheric, 8-15 mm in diameter, sometimes slightly stipitate on the invaginated calyx base.

SELECTED COLLECTIONS. MEXICO: CAMPECHE: Yohaltun, Jan. 4, 1901, *Goldman 538* (US): moist soil along river, Champoton, July 7-15, 1932, *Steere 1767* (MICH); DISTRITO FEDERAL: Canada de Contreras, June 1, 1963, *Galvan s.n.* (OKLA); HIDALGO: Real del Monte, Aug. 1840, *Galeotti 1199* (BR, P); MORELOS: perennial, climbing among shrubs to 12 ft, wet banks, barranca near Cuernavaca, June 1895, *Pringle 6319* (BM, BR, F, GH, NY, UC, US, VT); NAYARIT: Sierra Madre near Santa Teresa, Aug. 10, 1897, *Rose s.n.*, (US); OAXACA: Zacuapan, Nov.-April, 1840, *Galeotti 1190* (BR); PUEBLA: near Tehuacan, Dec. 22, 1895, *Pringle 7034* (GH, VT); SAN LUIS POTOSÍ: Tamazunchale, Nov. 26, 1937, *Kenoyer 826* (F); 2 km nw of Tampacan, Mar. 27, 1959, *Rzedowski 10268* (OKLA); TABASCO: along Rio Grijalva n of Villahermosa, Sept. 24, 1944, *Gilly et al 330* (MICH); in second growth, La Palma, Balancan, June 1-6, 1939, *Matuda 3312* (F, GH, MICH, NY); VERACRUZ: Maltrata, May 12, 1937, *Matuda 1359* (GH, MICH, US); stems creeping, barranca of Texolo, 3000 ft, April 30, 1899, *Pringle 8142* (BM, BR, F, NY, P, UC, US, VT). BRITISH HONDURAS: at edge of forest, Mountain Pine Ridge, San Agustin, July-Aug. 1936, *Lundell 6836* (GH, MICH, NY, OKLA, US). COSTA RICA: Los Diamontes, Dec. 2, 1953, *Heiser 3781* (F). EL SALVADOR: vicinity of San Salvador, Jan. 4, 1922, *Standley 19142* (GH, NY, US); procumbent, moist thicket, vicinity of Metapan, Jan. 29-Feb. 1, 1947, *Standley & Padilla 3130* (F). GUATEMALA: weedy stream side, Quezaltenango, Oct. 8, 1934, *Skutch 1399* (GH); Esquintla, *Donnell-Smith 2089* (US); procumbent in damp thickets 43 km ne of Coban, 1200 m, *Standley 70076* (F, US); prostrate in semi-chaparral, across river from Sayaxche, May 5, 1942, *Steyermark 46312* (F, MICH, NY, US); Sierra de los Cuchumatanes, Huehuetenango, July 24, 1942, *Steyermark 49464* (F, US). HONDURAS: vicinity of San Marcos de Colon, Jan. 12-22, 1949, *Standley 15763* (F): elongate herb on shrubs in wet thicket, near Yuscaran, Dec. 11, 1946, *Standley et al 1157* (F); weed along road, Montanya Santa Barbara near Lake Yojoa, Aug. 7, 1948, *Williams & Molina 14476* (F, GH); along railroad near Ceiba, July 14, 1938, *Yuncker, et al 8414* (BM, F, GH, NY, US). NICARAGUA: path in rain forest, Jinotega, Cerro la Florida, Dec. 5, 1958, *Hawkes, et al 2166* (F).

*P. Schiedeana* Dunal is typified by (HAL) by a slightly more hairy phase than is the type of *P. gracilis*. The species varies from this to nearly glabrous material.

*P. Galeottiana* Walpers, Repert. Bot. Syst. Lipsiae 574. 1842-1848, *nom. nov.* for *P. glabra* Mart. & Gal., Acad. Roy. des Sci. . . . Belgique, Bull. **12**: 132-133. 1848, may be conspecific. The Type, *H. Galeotti 1197* (BR), Cordillera, Zacuapan, Vera Cruz, June-Oct. 1840, consists of two short vegetative branches, one with two "pairs" of leaves, and one with a single leaf. It is possible that they represent the glabrous extreme of *P. gracilis,* in which case this name has priority for the species *sens. lat.* However, it hardly seems desirable to base a species name on the slight evidence presented by inadequate vegetative material, so, unless a flowering and/or fruiting isotype should be found, and shown to belong to this species, it is proposed that the name *P. gracilis* Miers, based on adequate type material, be retained.

The nearly glabrous phase may resemble *P. philadelphica,* but may be separated from it by the longer pedicels of *P. gracilis.*

22. **Physalis luteoanthera** Waterfall, sp. nov.

Herbacea, ad 1 m alta; caulibus tenuiter erectis vel procumbentibus; pilis longis, articulatis; foliis ovatis integerrimis vel undulato-dentatis, principalibus 6-10 cm longis et 4-6 cm latis; petiolis 15-45 mm longis; calycibus floriferis 7-10 mm longis et 6-10 mm latis ad basim loborum; calycis lobis late ovatis, 2-3 mm longis; corollis luteis, maculatis, 12-13 mm longis et 17-23 mm latis; antheris luteis, 3-4 mm longis; filamentis 2-3 mm longis; calycibus fructiferis ca. 25 mm longis et 19-22 mm latis; pedicellis fructiferis 10-13 mm longis; baccis 8-10 mm latis.

TYPE: *Steyermark 33726* (F), shaded thickets, lower south-facing slopes of Volcan Santa Maria between Finca Pirineos and Los Positos, Dept. of Quezaltenango, Guatemala.

COLLECTIONS SEEN. EL SALVADOR: vicinity of Ahuachapan in wet thicket near stream, Jan. 16-25, 1947, *Standley & Padilla 2774* (F). GUATEMALA: *Steyermark 33726*, Jan. 8, 1940, the Type, referred to above.

23. **Physalis peruviana** L., Species Plantarum ed. 2: 1670. 1762; *P. latifolia* Lamarck, Tableau Encyclopédique et Méthodique . . . Bot. 2: 29. 1793; *P. peruviana* L., var. *latifolia* (Lam.) Dunal in DC., Prodromus 13(1): 440. 1852.

Perennial, 0.3-1 m tall, tomentose to villous, hairs jointed, often diverging at right angles to the stem; leaf blades ovate, 5-10 cm long and 4-7 cm wide, their apices often somewhat lunate-attenuate, their bases often more or less cordate, margins entire, or with few irregular teeth; leaf surfaces with jointed hairs, somewhat appressed, more abundant on lower surfaces and along the principal veins; petioles 1-4 cm long; flowering calyx oblong to oblong-campanulate, 8-9 mm long and 4-6 mm wide at base of the triangular to ovate-attenuate calyx lobes into which the upper half of the calyx is divided; flowering pedicels 6-8 mm long; corolla 10-14 mm long and 12-15 mm wide, maculate; anthers bluish, 3.5-4 mm long, on filaments 2-4 mm long; fruiting calyx densely soft-hairy, 10-ribbed or slightly 10-angled, 3-4 cm long and 2.5-3 cm wide; berry 12-20 mm long and 10-15 mm wide on the invaginated (3-5 mm) calyx base.

SELECTED COLLECTIONS. BERMUDA: Dec. 1915, *Collins 442* (GH, NY); herbaceous shrub, Berry Hill Road, Paget, Sept. 12, 1963, *Manuel 281* (GH). HAITI: shrub or woody herb, Oriana Road, *Holdridge 824* (NY). JAMAICA: New Castle, Sept. 9, 1908, *Britton 3311* (NY); above Newcastle, alt. 4000 ft, Feb. 4, 1956, *Stearn 191* (GH).

24. **Physalis angustior** Waterfall, sp. nov.

Frutex vel herbaceo-frutex, 1-2 m altus; pilis densis, articulatis, partim glanduliferis; foliis ovatis, apice lunato-attenuatis, principalibus 6-10 cm longis et 4-8 cm latis; petiolis 3-5 cm longis; floribus singulis vel 2-3-aggregatis; calycis lobis lanceolato-attenuatis, 5-9 mm longis; pedicellis 12-20 mm longis; corollis luteis, maculatis, 15-20 mm longis et 20-29 mm latis; antheris violaceis, 3-4 mm longis; calycibus fructiferis 25-30 mm longis et 15-20 mm latis; pedicellis fructiferis 15-30 mm longis; baccis 14-16 mm longis et 12-15 mm latis.

TYPE: *Pringle 7731*, on cliffs, Sierra de Tepoxtlan, 7500 ft, Mar. 14, 1889, (VT); Isotype: (US).

COLLECTIONS SEEN. MEXICO: MORELOS: *7731;* shaded ledges, Sierra de Tepoxtlan, May 5, 1900, *Pringle 8275* (F, GH, MEXP, NY, UC, US, VT); on cliffs of Sierra de Tepoxtlan, 7500 ft, Nov. 20, 1902, *Pringle 11056* (F, GH, US, NY).

*Physalis angustior* differs from *P. peruviana* in its aggregations of flowers, its smaller, narrower fruiting calyx and its more woody habit.

25. **Physalis Sancti-josephi** Dunal in DC., Prodromus 13(1): 451. 1852.

Herbaceous, probably coarse and tall, collected tops 40-50 cm long, covered with varying densities of jointed hairs of varying lengths, the longer 1-1.5 mm long, many of them tipped with small reddish-brown glands; leaf blades ovate, slightly attenuate apically, margins usually with 1-several irregularly shaped and variable-sized teeth or undulations on each side, sometimes entire; principal blades 6-10 cm long and 4-8 cm wide, on petioles 3-8 cm long; flowering calyces 6-10 mm long and 6-9 mm wide at base of lobes, upper 2.3-5 mm divided into lanceolate or ovate-lanceolate, somewhat acuminate lobes; flowering pedicels 5-10 mm long; corolla yellowish, maculate, 10-20 mm long and 15-22 mm wide when fully expanded; anthers bluish, 2-3 mm long, on filiform filaments 3-5 mm long; fruiting calyx with 5 prominent angles and 5 intermediate angles or ribs, 25-35 mm long and 18-25 mm wide, prominently reticulate, the principal veins usually dark-colored; fruiting pedicels 8-15 mm long; berry 8-15 mm in diameter.

COLLECTIONS EXAMINED. MEXICO: SAN LUIS POTOSI: Alvarez, July 15-23, 1904, *Palmer 220* (F, GH, MICH, NY, UC, US); herb in oak grove, 2200-2400 m, Sierra de Alvarez, July 30-31, 1934, *Pennell 17841* (NY, US); orilla de camino, km 33 de la carretera San Luis Potosí-Río Verde, July 29, 1954, *Rzedowski 3574* (MEXP); LOCALITY UNDETERMINED: pr. San Jose del Oro, reg. frig., June 1831, *Schiede sin num* (Type: HAL).

26. **Physalis Muelleri** Waterfall, sp. nov.

Herba perennis 25-45 cm alta; trichomatibus brevibus, ad 0.5 mm longis, partim capitato-glanduliferis; foliis ovatis, inaequaliter magnodentatis, principalibus 4-8 cm longis et 2.8-5.5 cm latis; petiolis 15-35 mm longis; calycibus floriferis 6-8 mm longis et ca. 5 mm latis ad basim loborum; calycibus lobis ovato-deltoideis vel lanceolato-attenuatis 2-4 mm longis; pedicellis 5-6 mm longis; corollis luteis, maculatis, 10-12 mm longis et 12-15 mm latis; antheris luteis 3.5-4 mm longis, filamentis 3-5 mm longis; calycibus fructiferis decacostatis, trichomatibus brevibus, partim capitato-glanduliferis; calycibus fructiferis 17-22 mm longis et 15-18 mm latis; pedicellis fructiferis 10-15 mm longis; baccis 10-14 mm latis.

TYPE: Diente Canyon, mountains near Monterrey, Nuevo León, July 6, 1933, *Mueller 129* (Type: GH, Isotype: F).

This species, known only from the type locality, is characterized by its large yellow anthers, dark-maculate corolla, 10-angled or 10-ribbed fruiting calyx covered with short spreading hairs, many of them capitate-glandular, open apically, and nearly filled by the berry; also by the ovate leaves, coarsely and irregularly salient-dentate, with much of the vestiture capitate-glandular.

27. **Physalis sordida** Fernald, Proc. Amer. Acad. Arts & Sci. **35**: 568. 1900.

Stems herbaceous, 10-50 cm tall from a woody base growing from a horizontal rootstock 3-5 cm below the surface of the earth; herbage covered with usually brownish, flat, jointed, spreading hairs, up to ca. 1 mm long, some glandular-capitate; leaf blades suborbicular to ovate or lanceolate-ovate, the principal ones 3-7 cm long and 2.5-6 cm wide with vestiture similar to the stem, but less abundant and, sometimes, more appressed, margins coarsely and irregularly salient-dentate to repand-dentate to subentire, on pedicels 1.5-5 cm long; corolla yellowish, with 5 darker, but not strikingly contrasting, maculations, 10-13 mm long and 10-15 mm wide when fully rotate or rotate-reflexed, nearly pentagonal in outline, with shallow sinuses; anthers yellow, or tinged with blue or green, 3-4 mm long on somewhat thickened filaments of about equal length; fruiting calyx 10-angled or 10-ribbed, 15-30 mm long and 13-20 mm wide; berry spheric to ovoid, 10-15 mm in diameter, sessile, or essentially so, on the invaginated calyx base.

SELECTED COLLECTIONS. MEXICO: DISTRITO FEDERAL: hillside near Guadalupe, 7400 ft, July 25, 1904, *Pringle 8976* (F, GH, MEXP, NY, UC, VT); DURANGO: Inde, 2000 m. Aug. 1927, *Reko 5272* (US); GUANAJUATO: Aug. 1899, *Lugis 417* (US); HIDALGO: valley near Tula, 6800 ft, Sept. 22, 1901, *Pringle 9526* (F, GH, MEXP, NY, US, VT); MEXICO: near Guadelupe, Sept. 1903, *Rose and Painter 6841* (NY, US); OAXACA: Boca de Leon, Telixtlahuaca, 7500 ft, *Smith 637* (Type: GH); Mt. Alban, near Oaxaca, Aug. 7, 1949, *White 225* (OKLA, US); PUEBLA: vicinity of San Luis Tultitlanapa, July 17, 1908, *Purpus 3580* (BM, F, GH, NY, UC, US); SAN LUIS POTOSÍ: in montibus San Miguelito in 1876, *Schaffner 699* (GH); TAMAULIPAS: in narrow, deep, moist arroyo in hills 19 km se of Miquihuana on road to Palmillas, Aug. 11, 1941, *Stanford et al 839* (GH, NY); ZACATECAS: south slope of La Bufa, Aug. 10, 1948, *Dressler 101* (GH). HONDURAS: Selguapa, Dept. Comayagua, Mar. 22, 1945, *Rodriguez 2551* (F).

The collection from Honduras is somewhat dubiously referred to this concept, yet it seems closer to it than to any other.

In the northern part of its range this species approaches *P. hederaefolia* var. *puberula*, but here its bluish-tinged anthers tend to distinguish it.

28. **Physalis Pennellii** Waterfall, sp. nov.

Herbacea, perennis, 5-20 cm alta; trichomatibus articulatis, longis et brevibus ad 1.5 mm longis, partim glanduliferis; foliis ovatis vel lato-ovatis vel subrotundis ad basim, principalibus 13-32(-40) mm longis et 12-25(-30) mm latis, inaequaliter paucidentatis vel undulatis vel integerrimis; petiolis 5-11(-20) mm longis; calycibus floriferis hemiglobosis, dense longipilosis, 4-5 mm longis et 4-5 mm latis ad basim loborum; calycis lobis deltoideis vel ovato-deltoideis, 2-3 mm longis; pedicellis 3-6 mm longis; corollis luteis, maculatis, 7-13 mm longis et 10-14 mm latis; antheris violaceis, ca. 2.5 mm longis; calycibus fructiferis 10-costatis, 15-20 mm longis et 11-13 mm latis; pedicellis 9-15 mm longis; baccis 8-12 mm latis.

TYPE: *Pennell 17523* (US); rocky limestone west of Santa Ana, above Potrero, Sierra de Catorce, July 24, 1934; Isotype: (NY).

SPECIMENS EXAMINED: MEXICO: GUANAJUATO: Aug. 1947, *Kenoyer 2476* (GH); SAN LUIS POTOSÍ: Charcas, July-Aug. 1934, *Lundell 5399* (MICH, US); *Pennell 17523* cited under "Type".

*Physalis Pennellii* is most nearly related to *P. sordida* Fern., but is a more dwarf plant with a mixture of longer hairs on the herbage, and with a more densely long-hairy flowering calyx.

29. **Physalis latecorollata** Waterfall, sp. nov.

Herba perennis ca. 30 cm alta; caulibus villosis, pilis articulatis, ad 2-3 mm longis; foliis ovalibus vel ovatis, integerrimis, principalibus 50-60 mm latis et 38-42 mm latis, petiolis 15-25 mm longis; calycibus floriferis 8-9 mm longis et 7-8 mm latis; pedicellis 5-7 mm longis; corollis maculatis, 33 mm latis; antheris violaceis, 3 mm longis; filamentis filiformibus, 5-7 mm longis; calycibus fructiferis ignotis.

TYPE: *Garcia sin num* (MEXP) MEXICO: OAXACA: orilla de arroyo, campamento Rio Molino cerca de San Miguel Suchistepec, Oaxaca, alt. 2350 m, Sept. 20, 1965,

30. **Physalis philippensis** Fernald, Proc. Amer. Acad. Arts & Sci. 35: 568. 1900.

Stems 15-20 cm long, several-branched, herbaceous from a woody root; vestiture of flattened, spreading, jointed hairs of varying sizes, the longer stem-hairs 2-3 mm long; leaf blades ovate to rhombic-ovate to hastate-ovate, 15-20 mm long and 15-20 mm wide, usually with 1-3 irregularly shaped teeth, spreading-hairy to appressed-hairy on both sides, on petioles 6-12 mm long; calyx at anthesis hemispheric or more widely spreading, 5-8 mm long and 8-10 mm wide at base of the ovate-lanceolate to deltoid calyx lobes, 3-4 mm long; pedicels 5-8 mm long; corolla 12-15 mm long and 20-25 mm wide, the limb with 5 prominent violet or purplish markings, the broad, flaring tube tomentose within above the point of stamen-insertion; corolla slightly lobed, the sinuses 3-5 mm deep; anthers bluish or violet, oblong, 3-4 mm long, on slender, glabrous, violet or bluish filaments 4-6 mm long; fruit unknown.

SPECIMENS EXAMINED. MEXICO: OAXACA: Sierra de San Filipe, 9000 ft, June 1, 1894, *Pringle 5621* (Type: GH, Isotype: VT).

31. **Physalis caudella** Standley, Field Mus. Publ. Bot. **17**: 273. 1937.

Perennial, apparently from a deep, not-collected rhizome, indument of varying amounts of long jointed hairs (1-) 1.5-3 mm long, or of long and short hairs mixed in varying proportions; principal leaf blades 4-8 cm long and (6-) 15-40 mm wide, ovate-lanceolate to linear-lanceolate, on petioles 5-20 mm long; margins of blades entire to irregularly undulate to saliently few-toothed; flowering calyx 6-12 mm long and 4-6 mm wide at base of lobes, the upper 4-7 mm divided into more or less elongate lobes; flowering pedicels 5-10 mm long; corolla prominently reddish-blue or purplish maculate, 11-18 mm long; anthers bluish, reddish-blue or blue-green, ca. 3 mm long; fruiting calyx (2-) 2.5-5 cm long and (2-) 2.5-3 cm wide, divided above into lobes (6-) 10-15 (-17) mm long, its pedicel ca. 1 cm long.

31a. var. **caudella**

Leaf blades ovate to oblanceolate-ovate or lanceolate-falcate, often basally inequalateral, principal ones 4-8 cm long and 13-40 mm wide; fruiting calyx 3-5 cm long and 2.5-3 cm wide.

SPECIMENS EXAMINED. MEXICO: CHIHUAHUA: pine-oak slope, Cajurichi, Río Mayo, Sept. 13, 1936, *Gentry 2710* (Type: F, Isotypes: GH, US); Mojarachic, July 28, 1940, *Knobloch 8013* (US); near San Juanito, July 26, 1937, 7800 ft, *Shreve 8023* (F); Salto de Babicora, July 18, 1937, *LeSueur 1448* (F).

31b. var. **parva** Waterfall, var. nov.

Planta nana, foliis angustis, principalibus 4-6 cm longis et 6-12 (-15) mm latis; calycibus fructiferis 18-20 mm longis et 10-15 mm latis.

TYPE: *Townsend and Barber 122* (F), Isotypes: (BM, GH, NY, OKLA, P, UC, US, VT), MEXICO near Colonia Garcia in the Sierra Madres, 7200 ft, July 11, 1899.

Representatives of this taxon bear a striking resemblance to the type of *P. virginiana* var. *polyphylla* (Greene) Waterfall from Piedra in southern Colorado. However, the latter has yellow anthers, moderately darkened areas on the corolla, and vestiture consisting wholly of short, antrorse hairs, whereas the newly-described taxon includes plants with bluish anthers, purplish maculations, and vestiture of spreading, jointed hairs, long and short intermixed.

32. **Physalis virginiana** Miller, Gardener's Dictionary, ed. 8, no. 4, 1768.

Since this is a complex species, with its distribution principally to the north, in the United States, only the synonymy pertaining to the taxa studied here is given, and also only descriptions of these taxa.

The nearest relationship of the Mexican varieties of *P. virginiana* to other Mexican taxa appears to be with *P.*

*caudella.* The following key may be used to separate the varieties of these two species.

a. Anthers blue or violet; long villous hairs more or less abundantly intermixed with shorter ones.
  b. Fruiting calyces large, 3-5 cm long & 25-30 mm wide; leaves broad, principal ones 4-8 cm long & 13-40 mm wide.
    *P. caudella* var. *caudella.*
  b. Fruiting calyces smaller, 18-20 mm long & 10-15 mm wide; leaves narrower, principal ones 4-6 cm long & 6-15 mm wide.
    *P. caudella* var. *parva.*
a. Anthers yellow, or with a slight bluish tinge; vestiture short and appressed, or plant glabrous, or with a few long stiff hairs.
    c. Vestiture short and appressed or plant glabrous.
      d. Plant large, usually 50-60 cm tall, single-stemmed.
        *P. virginiana* var. *sonorae.*
      d. Plant small, usually 10-30 cm tall, several-stemmed.
        *P. virginiana* var. *nana.*
    c. Vestiture of few long rigid jointed hairs, short ones usually present on sepal tips only.
        *P. virginiana* var. *longiseta.*

32a. **Physalis virginiana** Miller, var. **sonorae** (Torr.) Waterfall, Rhodora **60**: 154. 1958; *P. pumila* Nutt., var. *sonorae* Torr., Bot. Mex. Bound. 153. 1859; *P. longifolia* Nutt., Trans. Am. Phil. Soc. (n.s.) **5**: 193-194. 1836; *P. lanceolata* Michx., var. *laevigata* Gray, Proc. Am. Acad. Arts & Sci. **10**: 68. 1875; *P. lanceolata* Michx., var. *longifolia* (Nutt.) Trel., Rep. Ark. Geol. Surv. 4: 207. 1891; *P. rigida* Pollard & Ball, Proc. Biol. Soc. Wash. **13**: 134-135. 1900.

Herbaceous perennial, 30-60 cm tall, single-stemmed, often branching above, glabrous, or with short, antrorse hairs, especially on the calyces and younger parts; leaf blades lanceolate to narrowly lanceolate, principal ones 4-7 cm long and 10-16 mm wide on petioles 15-25 mm long; corolla yellow or greenish-yellow, maculate, but not as dark and prominently so as in *P. caudella;* anthers yellow.

COLLECTIONS EXAMINED. MEXICO: CHIHUAHUA: Oct. 1911, *Stearns 14* (F); SAN LUIS POTOSÍ: in 1878 (atypical, bluish anthers) *Parry & Palmer 643* (NY); lugares incultos, Zaragosa, July 7, 1954, *Rzedowski 3520* (OKLA); SONORA: Santa Cruz, Oct. 22, 1893, *Mearns 2620* (US); Fronteras, June 1850-2, *Thurber 418* (Type: GH, Isotype: F).

32b. var. **nana** Waterfall, var. nov.

Herba perennis; caulibus ramosis ad basim, 5-30 cm longis; trichomatibus brevibus, antrorsis, paucis vel nullis; foliis lanceolatis vel ovato-lanceolatis, principalibus 3-5 cm longis et 1-2 cm latis; petiolis 1-2 cm latis.

TYPE: *Waterfall 16600* (OKLA), Isotypes: (F, GH, US), grassy silty flats 38 miles se of Saltillo in NUEVO LEON, MEXICO Aug. 25, 1961,

SELECTED COLLECTIONS. MEXICO: COAHUILA: grassy flat east of Puerto de Aire at southern end of Sierra de la Encantada, Sept. 1, 1941, *Stewart 1316* (GH); NUEVO LEÓN: wet depression in calcareous desert 16 miles n of Matehuala, Aug. 21, 1959, *Waterfall 15753* (F, MICH, OKLA, SMU); *Waterfall 1660*, Type listed above; SAN LUIS POTOSI: alkaline soil in desert near Km 549, 36 miles s of Matehuala Sept. 27, 1958, *McVaugh 18209* (MICH); calcareous desert, 10 miles s of intersection of Highways 80 & 57, 74 miles north of San Luis Potosi, Aug. 20, 1959, *Waterfall 15715* (OKLA, SMU); SINALOA: vicinity of Mazatlan, Apr. 6, 1910, *Rose et al 14095* (NY, US); ZACATECAS: on road from Concepcion del Oro south of Cardono, 7 miles n of San Tiburcio, Sept. 2-3, 1938, *Johnston, I. M. 7360* (GH).

One of the above collections, *McVaugh 18209*, exhibits a vertical, elongate, hardened, corm-like rootstock, 25 mm long and 6 mm wide, dug from 11-13 cm below the surface of the earth. Other collections could have been broken away from above such a structure.

32c. var. **longiseta** Waterfall, var. nov.

Planta 15-45 cm alta; caulibus longisetis, trichomatibus paucis; foliis lanceolatis vel linearo-lanceolatis, principalibus 5-8 cm longis et 1-2 cm latis; petiolis 3-10 mm longis; calycibus fructiferis 2-3 cm longis et 15-25 mm latis; pedicellis 1-2 cm longis, saepe incrassatis in parte superiore.

TYPE: *Palmer 53* (US), Isotypes: (F, GH, NY, UC), Río Verde, San Luis Potosí, June 2-8, 1904.

COLLECTIONS SEEN. MEXICO: SAN LUIS POTOSI: Type, cited above; region of San Luis Potosí in 1887, *Parry & Palmer 647* (GH, NY, US).

TO BE CONTINUED

*Volume 69, No. 777 including pages 1-120, was issued March 31, 1967.*

# Rhodora

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Conducted and published for the Club, by



Vol. 69 April-June, 1967 No. 778

CONTENTS:



*(Continued on Inside Cover)*

The New England Botanical Club, Inc.

Botanical Museum, Oxford St., Cambridge 38, Mass.

CONTENTS: — *continued*



RHODORA.—A quarterly journal of botany, devoted primarily to the flora of North America and floristically related areas. Price, $6.00 per year, net, postpaid, in funds payable at par in United States currency in Boston; single copies (if available) $1.80. Back volumes 1-58, with a few incomplete, can be supplied at $5.00 per volume. Volume 59—available at $6.00. Somewhat reduced rates for complete sets can be obtained upon application.

Scientific papers and notes, relating directly or indirectly to the plants of North America, will be considered by the editorial committee for publication. Articles concerned with systematic botany and cytotaxonomy in their broader implications are equally acceptable. All manuscripts should be double-spaced throughout. Please conform to the style of recent issues of the journal. Illustrations can be used only if the cost of engraver's blocks is met through the author or his institution. Forms may be closed five weeks in advance of publication. Extracted reprints, if ordered in advance, will be furnished at cost.

Address manuscripts and proofs to Albion R. Hodgdon,
Dept. of Botany, Nesmith Hall. University of New Hampshire,
Durham, New Hampshire 03824

Subscriptions and orders for back issues (making all remittances payable to RHODORA) should be sent to RHODORA, Botanical Museum, Oxford Street, Cambridge, Mass. 02138.

Second Class Postage Paid at Boston, Mass.

Manufactured by
THE LEXINGTON PRESS, INC.
Lexington, Mass.

Rhodora

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Vol. 69 April-June No. 778

# TAXONOMIC AND GENETIC RELATIONSHIPS OF EASTERN NORTH AMERICAN SPECIES OF ELYMUS WITH SETACEOUS GLUMES[1]

George L. Church

In the grass genus *Elymus*, the origin of populations that exhibit varying degrees of reduction in glume structure is considered to have occurred frequently through natural hybridity between *Elymus Hystrix* L. (*Hystrix patula* Moench) and other sympatric species. Although spikes of *E. Hystrix* usually are recognized by the absence of glumes or the presence of reduced stubs, individuals showing occasional bristle-like glumes are not uncommon (fig. 17). Moreover, Great Lakes populations may be encountered that consist of spikes with the usual divergent spikelets and also the unusual development of long, filamentous or setaceous pairs of glumes at each rachis node (fig. 25 center). Such populations might have arisen through natural crosses between typical glumeless *E. Hystrix* and some other species with well developed glumes.

[1]These studies were greatly facilitated by generous support from the Section for Systematic Biology of the National Science Foundation — grants GB-180 and G-9046. Loans from the herbaria at the University of Minnesota, Michigan, North Dakota and Wisconsin have been much appreciated in addition to courtesies extended by the directors of the herbaria at Harvard University, the New York Botanical Garden, United States National Museum, University of North Carolina at Chapel Hill, the Canadian Department of Agricuture at Ottawa and the University of Montreal. For assistance in the breeding program, I wish to thank Bruce W. Fowles, David J. McLaughlin, and Amanda K. Sherrill.

Growing sympatrically with these variable populations are some well-established species, previously unrecognized in the Great Lakes area; i.e., *E. diversiglumis* Scribn. & Ball and *E. Wiegandii* Fern. Both of these species may have narrow or setaceous glumes and together with the sympatric *E. canadensis* L. var. *canadensis* they have been regarded as being involved in natural hybrid species complexes with *E. Hystrix.*

The first part of this treatise deals with taxonomic reassessments of these species. The second part is a report of experiments in interspecific hybridization that have been useful in interpreting the degree of genetic barriers existing between the species concerned, as well as in indicating patterns of natural hybridity by which new taxa might originate. A second paper records the currently active process of speciation involving *E. Hystrix* and components of *E. virginicus* L. in the Pine Hills area of southern Illinois.

All the known species of eastern American *Elymus* are tetraploid ($2N = 28$) and apparently differ only slightly in genomic structure. It has been demonstrated in previous studies that such usually diverse and widespread species as *E. canadensis* var. *canadensis* and *E. virginicus* var. *virginicus* will hybridize freely even though the $F_1$ is sterile (Church 1954, 1959). Partly fertile populations, intermediate between these species, have been reported to have arisen through introgressive hybridization in Iowa (Pohl 1959) and Texas (Brown and Pratt 1960).

Still further evidence of genetic fluidity in the Hordeae tribe, of which *Elymus* is a member, is presented in the many cases of intergeneric hybrids, both artificial and natural; i.e., *Elymus* and *Hordeum* (Bowden 1958, Pohl 1966), *Elymus* and *Sitanion* (Stebbins et al 1954), *Elymus* and *Agropyron* (Stebbins 1956 and Dewey 1966), *Agropyron* and *Hordeum* (Gross 1960), and *Agropyron* and *Sitanion* (Boyle 1963 and Dewey 1964). As far as is known to the author, the only report of a probable natural hybrid involving *Hystrix* is that with *Agropyron* reported by Dore (1950). There is an adequate basis, then, for suspecting that *E. Hystrix (Hystrix patula)* has played a role in either the interspecific or intergeneric hybrid origin of new taxa — a hypothesis that provides a large part of the framework for the present studies.

## TAXONOMIC RELATIONSHIPS

### 1. *Elymus diversiglumis* Scribn. & Ball

In their study of *Elymus* in Minnesota, Booher and Tryon (1948) suggested the hypothesis that populations in the area of "E. interruptus" with reduced glumes might well be a product of hybridity of *E. canadensis* var. *canadensis* and *Hystrix patula*.

In a later paper deading with *Elymus* (Church 1954), preliminary studies indicated that the commonly recognized *E. interruptus* of the Great Lakes region of North America is a very different taxon from *E. interruptus* Buckley of Texas (1862), contrary to treatments in current manuals (Hitchcock and Chase 1950, Fernald 1950, Stevens 1950, Gleason 1952, Frazer and Russell 1954, Scoggan 1957). Wiegand (1918) in his study of eastern North American *Elymus*, however, clearly understood *E. diversiglumis* Scribn. & Ball as the species with subulate, unequal glumes in the northern Great Plains. Rydberg (1922) likewise recognized *E. diversiglumis* in his *Flora of the Rocky Mountains and Adjacent Plains*. Bowden (1964), in conference with the present author, also recognizes *E. diversiglumis* in his extensive treatment of *Elymus* in Canada. It will be demonstrated here that the misunderstood "interruptus complexes" of the central United States and adjacent Canada undoubtedly are composed of *E. diversiglumis* and of occasional introgressants of this species with *E. canadensis* var. *canadensis*.

The original description of *E. diversiglumis* published by Scribner and Ball (1901) is clear in stating that the "empty glumes are subulate — varying from a mere point to 1.5 cm in the same spikelet." The unequal pairs of subulate glumes that are so characteristic of specimens from central Minnesota (figs. 2 left, 5) are readily matched by those in the TYPE specimens from Crook County in northeastern Wyoming. *Elymus diversiglumis* is particularly abundant along clearings and road-cuts in the oak-aspen forests of the Itasca Park region of central Minnesota where it flourishes in company with *E. canadensis* var. *canadensis.* It may be distinguished in late July by well-seeded, deeply arched and silvery-hirsute spikes that have matured two to four weeks in advance of those of var. *canadensis* (figs. 9 vs. 11).

In searching for additional distinguishing features for *E. diversiglumis,* it has been noted that specimens from any part of the range indicated in the list of citations always possess a palea with an obtuse apex, usually augmented by a median tuft of hairs — quite in contrast to the acute, denticulate or retuse palea apices of *E. canadensis* var. *canadensis,* as indicated in the key to species. The two taxa are similar in exhibiting 6 or 7 nodes and leaves 6-10 mm in width. With very few exceptions, however, the distinct pilosity of the upper surface of *diversiglumis* leaves separates them from those of var. *canadensis.* When populations are encountered with the glumes falling below 0.8 mm in width and the striations not continuing clearly to the base, hybridity between the two taxa may be suspected.

The fact that *diversiglumis* and var. *canadensis* may hybridize to give rise to sterile $F_1$ offspring that in turn may produce fertile backcrosses to var. *canadensis* has been demonstrated by the author (Church 1959) and is more fully documented below. Such fertile introgressants and sterile, integrading forms appear occasionally, as might be expected, in disturbed areas.

Populations selected for study were distributed in woodland areas adjacent to, or within a few miles of, the following lakes in central Minnesota: — McCraney, Itasca, Gull, Long, Round and Mille Lacs. Along the disturbed aspen and oak woodland of the La Salle Trail and new Route 92 through Itasca Park in Hubbard County, for example, abundant stands of *E. diversiglumis* are established. Most specimens appear like those in figs. 5, 9 and 2 (left) which breed true from seeds grown in the greenhouse. An infrequent sample (2340)[2] may give rise to forms with wider

[2]Citations in the text refer to the author's specimens on file in the Brown University Herbarium.

glumes approaching those of *E. canadensis* var. *canadensis* figs. 6, 11) with which it is a common associate. Still other forms (2327) have paleas as long as those in var. *canadensis* (9.5 mm) and narrow but striated glumes equal in length (22 mm). This intermediate form is quite sterile. Even some typical *diversiglumis* forms (2328) may be at least 50% sterile. On the other hand, on a stretch of gravel roadside west from Itasca Park to McCraney Lake (Route 113), sympatric populations of *E. diversiglumis, E. canadensis* var. *canadensis* and *E. Hystrix* were remarkably distinct. However, on an extensively cut *Tilia* woodland near the shore of McCraney Lake, an unusually tall, vigorous and aggressive stand of *E. diversiglumis* (2461) was encountered. Although it possessed the usual spikelet characters of *E. diversiglumis* (cf. key), its wide leaves and strongly drooping spikes simulated these features of *E. Wiegandii.* Seed grown descendants maintain the same vigor in outdoor plots in Providence.

Again, a disturbed terrain has facilitated the spread of apparent hybrid forms (2514) of *E. diversiglumis* in the extensively bulldozed woodland roads adjacent to Gull Lake in Crow Wing County. The plants have glumes approaching those of var. *canadensis* in appearance, high percentages of shrivelled pollen and low seed set.

In spite of the above instances of apparent interspecific hybridity in Minnesota, on an isolated bluff, Elk Mound (Dunn County) in western Wisconsin, the undisturbed woodland glades harbor both taxa, morphologically distinct, in closely adjacent sites.

Further support for the integrity of *E. diversiglumis* has been presented by Frère Jean-Paul Bernard (of the Institution des Sourds-Muets, Montreal) who has made careful studies of *Elymus* in the Otterburne region of Manitoba, and to whom the author is greatly indebted for sending an unpublished manuscript (1958). Frère Bernard tested the hypothesis that *E. diversiglumis* might be a shade adapted form of *E. canadensis* var. *canadensis* by studying transplants of the former species to open, exposed habitats. No changes in morphological features were noted. Likewise, the present author, in the course of genetical studies, has observed only increased vigor of growth of typical representatives of *E. diversiglumis* transferred to open field plots. The importance of field observations is further emphasized by Frère Bernard who states, "Sur le terrain, la pubescence des lemmas parait blanche soyeuse à première vue chez l'*E. diversiglumis*, tandis qu'elle est plutôt terne chez l'*E. canadensis* (toutefois, cette distinction s'efface plus ou moins durant le séchage de spécimens)." Bernard also notes the aggressiveness of this species: "l'auteur a observé des touffes de cette espèce à glumes sétacées croissant en bordure d'un chemin traversant un secteur déboisé depuis quelques années."

In recognition of the appropriateness of the Scribner and Ball designation for the taxon with unequal glumes found in the Great Lakes region and with scattered stations westward to Wyoming and Saskatchewan, the following modification and expansion of the original description is presented:

*Elymus diversiglumis* Scribner & Ball (U.S.D.A. Bull. Agrost. **24**: 48-49. Fig. 22. 1901.). TYPE: *T. A. Williams 2653* (US!), Wyoming, Crook County, Bear Lodge Mountains, rich, open woods at 6000 feet.

CULMS robust (70) 120 (160) cm high, glabrous; LEAVES 5-15 mm wide, usually pilose above (rarely, slightly scabrous), sheaths overlapping except in the tallest specimens; SPIKES flexuous and broadly to deeply arched at maturity, (8) 15 (24) cm long; RACHIS flattened, margins ciliate, internodes (3) 5-6 (10) mm long; SPIKELETS usually two per node and containing 2-3 florets and frequently an additional, terminal sterile floret; GLUMES 2-15 (20) mm long, 0.1-0.5 mm wide, very unequal in length, sometimes lacking, setaceous from an indurated base; LEMMAS (7) 9 (12) mm long, silvery hirsute, rarely hirtellous, the awn 2-3 times the length of the body and widely divergent at maturity; PALEA (8) 8.5 (9) mm long, slightly shorter than the lemma, the apex obtuse, usually with a small, median, spatulate projection covered with a tuft of hairs denser than those of the body; STAMENS (2) 2.5 (3.5) mm long.

Range: borders of mixed woodlands, clearings and disturbed areas, including river terraces; frequent in Minnesota with scattered stations in Wisconsin, Iowa, Ontario, Manitoba, Saskatchewan, North Dakota and eastern Wyoming.

SPECIMENS EXAMINED: SASKATCHEWAN: Saskatoon, *Macoun & Herriot 42962* (CU, SASK), *Fraser 12-77* (SASK); Assiniboia, Oxbow, *Dore*

& *Boivin 13324* (DAO); Montagne a l'Original, *Boivin 8362* (DAO). MANITOBA: Turtle Mountain, *Burgess 2229* (DAO); Beauséjour, *Dore 12800* (DAO); Indian Reserve, Prairie Meadow, *A. & D. Löve 6229* (DAO, MT); Riding Mountain Park, *Rowe 416, Halliday 32-157* (CAN, DAO), *Lovaas 61-27* (DAO); Otterburne, *Bernard 50-132, 54-572, 58-441, 536, 568, 607* (MT); Kleefeld, *Bernard 56-5422, 58-617* (MT); Stuartburn, *Bernard 58-568* (MT.); Clear Lake, *Halliday 157-1932* (CAN). ONTARIO: Rainy River District, *Dore 9118* (CAN, DAO); Thunder Bay District, *Lindsay 1251* (DAO). WYOMING: Crook County, *Williams 2653* TYPE, *2679* (US), NORTH DAKOTA: Dunn County, *Swallen 5799* (US), *Stevens & Moir* (NDA); Bottineau County, *Brannon 85150* (US), *Stevens 2512* (NDA); Pembina County, *Bergman* (MIN), *Stockbridge 974* (NDA); Cavalier County, *Stevens* (NDA). MINNESOTA: Beltrami County, *275174* (MIN); Clearwater County, *277388* (MIN), *Moore & Huff 18986* (DAO-MIN), *Church 2310-16, 2435* (BRU); Polk County, *64722, 64724* (MIN); Mahnomen County, *Church 2461* (BRU); Hubbard County, *Grant 2914* (IND, MO, MIN, NY), *2714* (MIN, US), *275776* (MIN), *Church 2328, 2340-47* (BRU); Becker County, *Grant 3901* (GH, MIN), *Church 2354-56, 2470, 2480* (BRU); Ottertail County, *371975* (MIN); Crow Wing County, *64727* (MIN), *Church 2360, 2506, 2512* (BRU); Stearns County, *64723* (MIN); Hennepin County, *Wheeler 1224* (GH, MIN, US); Scott County, *64726* (MIN). IOWA: Emmet County, *Wolden 530* (ISC). WISCONSIN: Bayfield County, *Weber* (WIS); Chippewa County, *Ebert* (WIS); Dunn County, *Myer 132* (WIS), *Church 2570* (BRU); Juneau County, *Truman* (WIS); Vilas County, *Stearns 570* (WIS); Polk County, *Baird* (WIS); Burnett County, *Shinners 4471* (WIS).

SPECIMENS INDICATING PROBABLE INTROGRESSION OF *E. diversiglumis* INTO *E. canadensis* var. *canadensis:* SOUTH DAKOTA: Lawrence County — *Martin 477* (US) — This specimen from Spearfish Canyon, roughly 25 miles from the TYPE locality in adjacent Wyoming, has rather thin, slightly pilose leaves and very narrow, setaceous glumes as in *E. diversiglumis.* The glumes are quite equal in length, however, and the 10.5 mm long paleas have acute, truncate or slightly concave apices — all of which features typify *canadensis* var. *canadensis.*

WYOMING: Crook County — Whereas the TYPE specimens, *Williams 2653* (US), from the Bear Lodge Mountains are easily matched by those from Welcome, *Williams 2679* (US), it is noteworthy that *Williams 2681* from the same "rich gulches" is nearer to *E. canadensis* var. *canadensis* in the bidentate apices of the paleas and the glabrous leaves. The collections of *Griffiths 925* and *942* (US) from Hulett are likewise regarded as forms of var. *canadensis* with setaceous glumes.

*Elymus occidentalis* Scribn. (1898) is a name cited by Hitchcock and Chase (1950) as a synonym for what is treated here as *E. diversiglumis.* Examination of the TYPE specimen, *Nelson 4470* (US) from

Albany County, Wyoming, reveals simply a dry river terrace form of *E. canadensis* var. *canadensis*.

## 2. *Elymus Wiegandii* Fern.

The description of *E. Wiegandii* published by Fernald (1933) makes quite clear the distinction between this species and *E. canadensis* var. *canadensis*. Hitchcock and Chase (1950), however, regard this species as one of many variants of *E. canadensis* var. *canadensis*. Bowden (1964) reduces *E. Wiegandii* to a variety of *E. canadensis*. On the other hand, Voss (unpublished) recognizes the specific distinctness of *E. Wiegandii* as it occurs sparingly in Michigan. Throughout its range, along shaded streams or alluvial river terraces, *E. Wiegandii* is readily identified by its lax spikes, hanging pendant from the time of emergence from the uppermost of the glaucous, usually overlapping leaf-sheaths (fig. 10). The culms are vigorous, bearing 9-12 leaves, 10-22 mm wide, dark green and frequently pilose on the upper surface. The glumes are usually less than 1 mm wide and the bases abruptly narrowed, indurated but not terete. Probably because of the fact that the glumes are frequently less than 0.5 mm wide, especially in populations in the Great Lakes area, the species has often been confused with *E. diversiglumis* or lumped under so-called *E. interruptus*.

*Elymus Wiegandii* may be distinguished at once from *E. diversiglumis* (cf. key) by the pendant, rather than deeply arched spikes (fig. 13) (a feature often obscured in mounted specimens), the usually wider and always greater number of leaves, the usually glabrous and overlapping leaf sheaths and the bidentate (rather than obtuse) dense-hairy apices of the paleas. The ranges of the two species overlap geographically in the broadest limits of the Great Lakes area, but *E. diversiglumis* is a plant of more open and drier terrain than the shaded, wet thickets of *E. Wiegandii*.

In the same areas of Minnesota that yielded so many stations for *E. diversiglumis* as well as *E. canadensis* var. *canadensis* and *E. Hystrix* (Itasca Park and Mille Lacs), several newly reported sympatric and ecologically distinct stands of *E. Wiegandii* are noteworthy as indicated in the following list: —

LAKE ITASCA: drainage in wet, coniferous woods, west of Park Road, — 2305; north boundary of Itasca Park, wet, mixed hemlock woods — 2438.

TULABY LAKE: drainage, mixed woods near Route 113 — 2493.

MILLE LACS LAKE: north of Garrison, shore road through mixed woodlands, wet, shady forest — 2517 (whole plant glaucous); north of Garrison, sandy, wet clearing under oaks — 2522; south of Vineland, shore road, mixed woodland — 2293-94, 2297-99, 2302.

ROUND LAKE: north of Brainerd, edges of sandy, wet, dense, mixed woods — 2500, 2502.

RICE LAKE: Lum Park, brook-dissected, oak-birch woods, near shore — 2499 (whole plant glaucous).

Likewise in New England and eastern Canada, the shaded, alluvial habitat of *E. Wiegandii* is in contrast to the more open and drier woodland-border habitat characteristic of *E. canadensis* var. *canadensis*. Pilosity of the adaxial leaf surfaces is a frequent but not too constant feature of *E. Wiegandii* in New England and Quebec as well as the midwest (Fassett 1951). Two populations collected by the author in closely adjacent stations in southwestern Wisconsin (Castle Rock Woods), illustrate the differences between superficially similar representatives of the two species. Both 2580 *(E. Wiegandii)* and 2579 *(E. canadensis* var. *canadensis)* are robust plants (ca. 120 cm tall) with pilose upper leaf surfaces, mostly overlapping sheaths, and paleas 10-12 mm long with bidenticulate apices. *E. Wiegandii,* however, has 10-12 nodes, leaves about 18-20 mm wide, sheaths glaucous, spikes pendant and glaucous, glumes ca. 17 mm long and 0.5 mm wide. This population (2580) grows on the edge of a shady, rich woodland resting on an abandoned alluvial terrace! In contrast, 2579 *(E. canadensis* var. *canadensis)* has 7-9 nodes, leaves 9-12 mm wide, the margins moderately inrolled, sheaths green, glumes 21-30 mm long and 0.8-1.0 mm wide. Although the habitat is within ca. 25 feet of a shady, alluvial thicket, the plants are confined to an open, dry roadside. Furthermore, the author has observed many other stations of *E. Wiegandii* in the field and invariably the habitat is a rich, alluvial soil in the shade. Although some forms of *E. canadensis* var. *canadensis* may be found on the moist lake shores of Lake Michigan, the contrasting habitat factors to those of *E. Wiegandii* are sand and full sunlight. On the whole, *E. Wiegandii* appears to be less capable of standing competition on open areas than either *E. canadensis* var. *canadensis* or *E. diversiglumis* and under greenhouse conditions it becomes quickly reduced in size much more than any other species of *Elymus* of this study.

The greatest concentration in the range of *E. Wiegandii* lies along the tributaries of the Connecticut and St. Lawrence Rivers, spreading out across New York and northern Pennsylvania and extending northward across northern New England to the Canadian Maritimes. More recently, several stations have been reported in the drainage systems of the Rainy, Mississippi, and Red Rivers in Ontario, Michigan, Wisconsin, and Minnesota with scattered stations westward in Iowa, the Dakotas, Wyoming and Manitoba. The most recently reported collections are from the banks of the rivers draining into James Bay on the Ontario side (Dutilly & Lepage 1963).

The following citations of specimens examined by the author indicate a much wider geographic range for *E. Wiegandii* than was known to Fernald in 1933: —

MANITOBA: Assiniboine, *Krivda* (DAO); Sans Souci, *Bernard 499, 5477* (MT); Otterburne, *Bernard 504, 525* (MT). ONTARIO: Rainy River County, *Dore 9175* (BRU, DAO); Thunder Bay County, *Garton 2063* (US), *Williamson 2239* (PENN); Carleton County, *Rolland 31* (US), *Dore 10, 541*, (BRU, DAO); Cochran County, *Dutilly & Lepage 36350, 36809, 38397* (LCU). QUEBEC: Champlain County, *Gagnon* (DAO); Huntington County, *Dore & Cody* (DAO), *Bassett & Frankton* (DAO); Pontiac County, *Dore 9028* (BRU, DAO); Brome County, *Dore 6* (GH); Vaudreuil County, *Ray 28420* (MT); Gatineau County, *Dore 15241* (DAO, MT), *Dore 5* (GH); St. Maurice County, *Stanislas 142* (MT); Stanislas County, *Marie-Victorin 7331* (MT); Richelieu County, *Marie-Victorin 6367* (MT); Portneuf County, *Marie-Victorin 45064* (GH, MT); Rimouski County, *Lepage 3260* (GH); Gaspe County, *Dore 47879* (US); Deux Montagne County, *Louis-Marie 2910* (US); Lac St. Jean County, *Kennedy 3* (GH); Terrebonne County, *Rolland-Ger-*

*main 6061* (MT), *Rouleau 2528* (MT), Gray Ex. *1405* (GH, ISC), *Church 2528, 2532* (BRU); Bonaventure County, *Collins 5116* (GH), *Collins et. al.,* (GH, NY), *Rousseau 32528* (GH), *Marie-Victorin 32350, 33763, 48988* (DAO, GH), *Church 2533-36* (BRU), *Raymond 56069* (DAO); Sherbrook County, *Dore 345* (DAO); Drummond County, *Verret* (DAO). NOVA SCOTIA: Pictou County, *Smith 11677* (DAO, GH), *Erskine 53430* (DAO). NEW BRUNSWICK: Victoria County, *Marie-Victorin 46549* (GH, MT); Kings County, *Svenson & Fassett 3012* (GH); Madawaska County, *Dore 47951* (DAO). MAINE: Aroostock County, *Fernald 197* TYPE (GH), *Church 2537* (BRU); Piscatiquis County, *Parlin 1793* (GH), *Church 2538, 2540* (BRU); Kennebec County, *Fernald & Long 12748* (GH); Oxford County, *Parlin 2038* (GH); Somerset County, *Fernald & Long 490* (US). NEW HAMPSHIRE: Coos County, *Pease 10685* (GH), *Church 2376* (BRU); Grafton County, *Church 2226, 2231* (BRU); Sullivan County, *Cowden* (NEBC). VERMONT: Orleans County, *Church 2408* (BRU); Caledonia County, *Congdon* (GH); Bennington County, *Church 2210-12, 2217-19* (BRU); Rutland County, *Church 2263-64* (BRU), *Carpenter 3* (NEBC, US), *Kirk 1036* (US); Windham County *2214-16* (BRU), *Wheeler* (GH); Chittenden County, *Church 2250* (BRU), *James* (NY). MASSACHUSETTS: Hampden County, *Church 2526* (BRU); Hampshire County, *Church 2200-04* (BRU); Franklin County, *Church 2207* (BRU). CONNECTICUT: New Haven County, *Blewitt 35* (GH). NEW YORK: St. Lawrence County, *Phelps 134* (GH, NY); Washington County, *Dobbin & Burnham* (GH); Essex County, *House 25976* (GH); Columbia County, *McVaugh 2087* (PENN); Monroe County, *Hitchcock 16024* (US); Schoharie County, *Whitney 1844* (TEX); Tompkins County, *Wiegand 9295* (GH, NY, US); Madison County, *House 2860* (GH); Chemung County, *Axtell & Smith 2667* (CU, US); Onondago County, *Lippert 295* (SYR); Rensselaer County, *House 24015* (SYR); Oneida County, *1789* (SYR). PENNSYLVANIA: Warren County, *Wahl 9873* (GH, PENN); McKean County, *Fogg et. al. 19781* (PENN); Susquehanna County, *Glowenka 9399* (PENN); Wayne County, *Gress & Honesdale* (PENN); Wyoming County, *Glowenka 9281* (PENN). MICHIGAN: Houghton County, *Farwell 11007* (MICH); Chippewa County, *Dodge* (MICH); Oakland County, *Farwell 1556a* (MICH). WISCONSIN: Lincoln County, *Seymour 13129-30, 14464* (WIS), *Iwen 339* (WIS), *Church 2560* (BRU); Polk County, *Brenner* (WIS); Chippewa County, *Davis* (WIS); Eau Claire County, *Kunz 356* (WIS), *Fassett 22286-7* (WIS); Dane County, *Cheney* (WIS), *Hale* (WIS); Vernon County, *Iltis & Koeppen 11922* (WIS); Richland County, *Iltis & Koeppen 11841* (WIS); Grant County, *Fassett 28971-2, 26493* (WIS), *Church 2580, 2589* (BRU), *Iltis et. al. 13847* (WIS). MINNESOTA: Kittson County, *Moore 11604* (ISC, MIN); Cook County, *Butters & Abbe 1024* (GH, MIN); Beltrami County, *Pamel 72, 329* (ISC); Clearwater County, *Church 2305* (BRU); Carlton County, *Moore & Butters 3472* (GH, MIN); Becker County, *2438, 2493* (BRU); Crow Wing County, *Church 2499, 2517, 2522* (BRU); Aitkin County, *Church 2500* (BRU). IOWA: Dickinson County, *Thorne 13223* (ISC); Emmet County, *Wolden 566* (ISC). NORTH DAKOTA: Bottineau County, *Stevens* (NDA); Ward County, *Crosby* (NDA); Benson County, *Hitchcock 5064* (US), *Lunell 1020620* (US); Pembina County, *Stevens* (US); Barnes County, *Perrin 1346* (US), *Stevens & Moir* (US); Ransom County, *Stevens* (US); Cass County, *Stevens* (NDA), *Stevens 114* (DAO, NDA, US, WIS), *Bergman & Stevens* (NDA), *Stevens 1677* (GH); Sioux County, *Stevens 1559* (NDA, US). SOUTH DAKOTA: Roberts County, *Ball & Over 2224* (ISC), *Johnson 10* (GH, TEX). WYOMING: Crook County, *Ownbey 2377* (MIN, US), *Griffiths 925, 942* (US).

3. *Elymus canadensis* L.

a. var. *canadensis*

In central Minnesota, sympatric populations of var. *canadensis* and *E. diversiglumis* may occasionally give rise to variants with narrow glumes (ca. one half mm in width) that represent introgressants from the latter species. It has been noted further that *E. Wiegandii*, characterized by narrow glumes (cf. key), remains distinct from sympatric var. *canadensis*. In both cases, var. *canadensis* is distinguished by the stiff, glabrous leaves with involute margins, the erect or broadly arched spikes and the one mm wide glumes.

b. var. *brachystachys* (Scribn. & Ball) Farwell

Plants of this variety with compact spikes and glabrous lemmas were raised from seed collected in Llano County, Texas. They differed from the TYPE material *(Palmer 420* US!) in possessing glumes that were frequently approximately only one half mm in width. Since Scribner and Ball (1901) in their original description of this taxon had cited collections from Oklahoma to as far north as Michigan, it was thought by the author that *Elymus* populations with narrow glumes arising from hybridity with var. *brachystachys* might presently be encountered in the Great Lakes area. The search, particularly at the stations reported by Farwell (1920), proved to be unrewarding. However, since earlier collections of var. *brachystachys* from Texas had segregated for several variations in reduction of glume width (Church 1954), it appears that a process of speciation leading to varieties with narrow glumes might be occurring in the far South, involving a component of *E. canadensis,* but in an obviously distinctly different pattern from that which produces introgressants of *diversiglumis* into var. *canadensis* in Minnesota.

c. var. **interruptus** (Buckley) comb. nov. Based on *E. interruptus* Buckley, Acad. Nat. Sci. Phila. Proc. 1862:99. Llano County, Texas.

Since the name of this taxon has been misapplied to very different northern species with setaceous glumes, a revision of Buckley's original description is presented.

CULMS, slender, tufted 50-80 (100) cm high; LEAVES 15-20 cm long, 5-8 mm wide, scabrous and often glaucous; SHEATHS not exceeding nodes, margins usually ciliolate; SPIKE erect, (6) 8-15 cm long; RACHIS glabrous except for scabridulous margins; INTERVALS between spikelets on rachis (6) 8-14 mm long; GLUMES (15) 20 (30) mm long, equal, glabrous or scabridulous, base indurated and often terete, usually less than 0.5 mm wide at the middle of the body; SPIKELETS of 2, 3 or 4 florets with an additional, terminal, sterile floret; LEMMAS 8-9 mm long, glabrous and the awns 15-20 mm long, straight at maturity, margins scabridulous; PALEAS (7) 8 (9) mm long with the apices narrow, truncate and ciliolate. Rocky, open woodlands in Llano County, Texas.

The TYPE specimens collected by *Buckley* (PH!) consist of two culms about 60 cm high. The glumes are 20-22 mm long, 0.4-0.5 mm wide and the indurated bases have 2-3 nerves. The ISOTYPE (GH!) has even narrower, i.e., setaceous, glumes. Additional specimens from Llano County: *Wolf 3123* (US), *Smith* (US *1019698*), *Church and Brown 1041* (BRU), *Reverchon* (US *64974*).

Although var. *interruptus* appears to be restricted to Llano County, it is sympatric with var. *brachystachys* with which it shares a short (ca. 60 cm) stature and a time of floret maturity two months in advance of northern varieties growing in the same field plots in Providence. The two varieties are undoubtedly closely related, but they are distinguishable on morphological grounds (cf. figs. 3, 4, 7, 8). On the other hand, examination of figs. 9, 15, 1, and 2 will reveal the striking differences between var. *interruptus* and *diversiglumis* and clear the confusion that has existed between these taxa.

4. **Elymus Svensonii** sp. nov.

In searching records for further information concerning the range of both *E. diversiglumis* and *E. canadensis* var. *interruptus*, the case of the latter variety reported from an isolated station in Tennessee was noteworthy (Svenson 1941). Examination of the specimen on file in the Brooklyn Botanic Garden Herbarium revealed a plant quite distinct from either of the above taxa. Through the kindness of the collector, Dr. Henry K. Svenson, the author was able to find the exact area on the steep banks of the Cumberland River in Tennessee, the only station known in the state or elsewhere. The plants were scattered rather thickly in the edge of a high, limestone cliff woodland over a distance of not more than fifty feet. Although house-lots were laid in contact with the summit, the plants were spread down the river embankment, rather out of reach.

Since the population is unique in taxonomic features, it seems appropriate that it be described as a new species and named in honor of the original collector, Dr. Svenson.

**Elymus Svensonii** sp. nov. Planta tota glauca; 80-100 cm alta; culmo basi 2 mm lato; laminis 6-8 mm latis at 15-25 longis, supra minusve villosis, vaginis plerumque non excedentibus, auriculis rubidis — siccis fusco-brunneis; spicis erectis, arcuantibus, 12-16 cm longis, rachi applanato, sinuosissimo et segmentis racheos 8-12 mm longis; spiculis geminatis, in 3-4 floribus constantibus; glumis setosis, variatim 1-18 mm longis, plerumque mediostriatis, basi induratis subteretibus; geminis saepe in longitudine inaequalibus aut omnino deficientibus; lemmatibus 9-10 mm longis et aristis deinde valde curvatis 12-20 mm longis; palea 8-9 mm longa, apice lata, truncata aut parum convexa et margine breviter ciliata.

Entire plant glaucous; CULMS 80-100 cm high and the bases 2 mm in diameter; LEAVES 6-8 in number, 6-10 mm wide and 15-25 cm long, usually slightly villous above — the margins smooth or scabrellous; LEAF SHEATHS usually not overlapping and the auricles dark-red becoming reddish-brown on drying; SPIKE at first erect becoming broadly arched, 12-16 cm long; RACHIS, flattened, conspicuously sinuous, internodes 8-12 mm long, margins hirtellous; SPIKELETS, 2 at each node, composed of 4-5 florets and closely adpressed to the curves of the rachis internodes, florets not readily disarticulating from the pedicel joints; GLUMES, setiform usually with a median striation, indurated and nearly terete at the base, usually in unequal pairs 1-18 mm long, occasionally lacking; LEMMA 9-10 mm long, the widely divergent awn 12-20 mm long; PALEA 8-9 mm long, apex broad, truncate or slightly concave, margins villous; ANTHERS ca. 5 mm long; LODICULES asymmetrically bi-lobed, the larger lobe acute with margin ciliolate.

Known only from the TYPE locality: steep limestone bluffs on the Cumberland River at the end of an abandoned road off McGavock Pike and ca. 0.9 mile from the intersection with Lebanon Pike, just north of Donelson, Davidson Co., Tennessee.

HOLOTYPE: *Church 2527* (BRU) (figs. 12, 1 and 2). ISOTYPES: (GH, US). PARATYPES: *Svenson 9452* (BKL, MO).

*Elymus Svensonii* bears some resemblance to *E. Hystrix*, but differs from the latter species in exhibiting variable glumes, consistently arched rather than erect spikes, closely adpressed rather than divergent spikelets, usually a greater number of florets per spikelet, divergent rather than straight lemma awns (figs. 12, 1, 2).

Specimens in the United States National Herbarium collected by Gattinger in 1885 and labeled "precipices on the Cumberland Riv. near Nashville" (US 1021371) could, of course, have come from a station quite similar to that of *E. Svensonii*. *Asprella Hystrix* Willd. has been added to the label at some later date. The plants are not too well preserved, and probably represent *E. Hystrix* with vestigial glumes similar to another Gattinger collection (US 1021372) designated with no locality other than Nashville.

5. *Elymus Hystrix* L.
(Sp. Pl. 560. 1753, Virginia. Clayton.)

There is no more distinctive species in moist, shady wooded areas of the eastern United States than what has for a long time been recognized as *Hystrix patula* Moench. The widely spreading spikelets, falling quickly at maturity and the usual lack of glumes certainly appear to constitute sufficient bases for generic designation (fig. 17). Yet morphological variations of the common form are not unknown. For example, populations with pubescent lemmas have been designated as *H. patula* var. *Bigeloviana* (Fern.) Deam. Equally common are forms that exhibit occasional filiform glumes. Most striking of all are populations in which long, filiform glumes are found all along a rather sinuous rachis of rather closely compacted nodes (fig. 25). The latter variations are known throughout the range but are particularly frequent in the Carolinas as is indicated in the citations that follow.

SPECIMENS EXAMINED: NEW MEXICO: Colfax County, *Silveus 4928* (TEX). OKLAHOMA: Adair County, *Wallis 7606* (TEX). ARKANSAS; Petit Jean Mts., *Scully 974* (US); Baxter County, *Demaree 29337* (TEX); Randolph County, *Demaree 29190* (US); Sharp County, *Demaree 26890A* (US). MISSOURI: Jasper County, *Palmer 3781* (MO). ILLINOIS: Knox County, *Chase 1840* (US); Peoria County, *Chase 12053* (US). WISCONSIN: Burnett County, *Shinners 4475* (WIS); Calumet County, *Strandberg 376* (WIS); Dane County, *Cottam 184* (WIS); Grant County, *Iltis 13789* (WIS); Green County, *Struik* (WIS), *Fell 58438* (WIS); Lafayette County, *Coogan 149* (WIS); Rock County, *Fell 57938* (WIS); Sauk County, *Stowell* (WIS), *Church 2576* (BRU); Vernon County, *Iltis 6449* (WIS), *Marks* (WIS). INDIANA: Cass County, *Deam 25895* (US); Sullivan County, *Deam 25683* (US). OHIO: Coshocton County, *Moldencke 13124* (US). NOVA SCOTIA: Pictou County, *St. John 1387* (GH). MARYLAND: Prince Georges County, *Maxon 5988* (GH). WASHINGTON, D. C.: High Island, *Pollard 446* (US). VIRGINIA: Bedford County, *Curtiss* (GH); Culpepper County, *Allard 1787* (GH); Greensville County, *Fernald & Long 8029* (GH). NORTH CAROLINA: Alamance County, *Ramseur 2277* (DUKE), *Bell 4149* (DUKE); Anson County, *Radford 13146* (NCU); Davidson County, *Radford 12828, 7069* (NCU); Durham County, *Bloomquist 14526* (UNC), *793, 797* (DUKE); *Godfrey & Fox 51163* (DUKE, UNC); *Wilbur 6193* (DUKE, GH, US); Granville County, *Batson 334* (NCU), *Fox 4912* (DUKE); Haywood County, *Silveus & Bloomquist 9765* (TEX); Lee County, *Beard 1072* (NCU); Macon County, *Quaterman 1442* (DUKE); Orange County, *Bloomquist et. al. 402* (GH), *Radford & Stewart 681a, 212a* (NCU); Person County, *Bell 14652* (NCU); Rockingham County, *Radford 13639* (DUKE); Rowan County, *Horton 1407* (NCU); Stanley County, *Ahles 16222* (NCU); Union County, *Ahles 27513* (NCU); Wake County, *Boyce 1620* (NCU), *Godfrey 48127* (GH), *Brown 51207* (TEX). SOUTH CAROLINA: Abbeville County, *Radford 26037;* Chesterfield County, *Radford 12397* (DUKE, NCU); Edgefield County, *Radford 26361* (NCU); Kershaw County, *Radford 23669* (NCU); Lancaster County, *Ahles 31356* (NCU); McCormick County, *Radford 22327* (NCU); Newberry County, *Bell 9235* (NCU); Saluda County, *Radford 23123* (NCU).

The author has examined in the Linnean Herbarium in London the Savage indexed sheet 100.8 upon which the name *Elymus Hystrix* is based. Three specimens are rather young since the glabrous spikes are barely out of the terminal leaf sheaths. Leaves and sheaths are dark green and slightly pilose. Glumes are entirely lacking. The spike rachis is thin and straight with ciliolate margins and the internodal distances are ca. 5 mm. The straight awns are ca. 2½ times the length of the 10 mm long lemmas. Paleas are 9 mm long and the apices are acute and slightly notched.

Except for the fact that the Linnean specimens are immature and do not exhibit the spreading spikelets, they are quite similar to those selected over the wide eastern United States range. The many variations listed above, however, indicate rather strongly that they must be the product of some pattern of hybridity with other species of *Elymus*, perhaps arising pandemically in the eastern United States.

The experimental studies reported later will present a further basis for evaluating the phylogenetic position of *E. Hystrix* in the relationships of *Elymus* species. It will be demonstrated that employment of the original Linnean name (Bowden 1964) is quite justifiable on genetic as well as on morphological grounds.

Key to Eastern North American *Elymus**

1. Pairs of glumes mostly unequal in length, often setaceous, reduced to pointed stubs or lacking (if paleas 9-12 mm long and apices bidentate, cf. *E. Wiegandii)*
   2. Spikes erect at maturity; spikelets usually widely divergent from the rachis and readily falling when dry; glumes lacking or occasionally present as filiform bristles at some or all nodes; paleas 8 (9-10) mm long, apices obtuse or truncate, often pilose on the upper margin. .................................................. *E. Hystrix.*
   2. Spikes slightly to broadly arched at maturity; spikelets more or less adpressed to the rachis; glumes setaceous, 0.1 mm-0.5 mm wide, tapering from an indurated base.
      3. Lemmas densely hirsute; paleas (7.5) 8 (9) mm long, apices obtuse with median tuft of hairs; upper leaf surface usually pilose; entire plant green otherwise. ............ *E. diversiglumis.*
      3. Lemmas glabrous; paleas 8-9 mm long, apices narrow and truncate or retuse, cilolate; entire plant glaucous. ................ ............................................................................ *E. Svensonii.*
1. Pairs of glumes essentially equal in length.
   4. Spikes abruptly pendant on emergence from the leaf sheaths, the latter usually glaucous and overlapping; leaf blades commonly pilose above, 12-28 mm wide; glumes (0.2) 0.5 (1.2) mm

wide, often setaceous with base narrowed and indurated; paleas (9) 11 (12) mm long, apices bidentate. ............ *E. Wiegandii.*

4. Spikes erect or becoming slightly to broadly arched at maturity.
 5. Glume bases clearly indurated.
  6. Glumes 0.8-2 mm wide, swollen on half or all of the adaxial surface as well as the abaxial base, sometimes bowed and disarticulating along with the spikelets in age; paleas 6-8 (8.5) mm long, apices obtuse, truncate or slightly emarginate; spikes erect. ............................................ *E. virginicus.*
   7. Glumes 1-2.7 cm long, spike at times partly included in sheath. ........................................................ var. *virginicus.*
   7. Glumes 2.7-1.0 cm long, spike well exerted. ........................ ..................................................................... var. *glabriflorus.*
    8. Spikelets glabrous. .................................. f. *glabriflorus.*
    8. Spikelets hirsute. .......................................... f. *australis.*
  6. Glumes 0.2-1.0 mm wide, indurated for 1-3 mm adaxially, striated middle area more or less convex.
   9. Paleas 5.5-6.5 mm long, apices obtuse; rachis internodes 1.5-3.0 mm long, whole spike villous, lemmas rarely glabrescent. ......................................................... *E. villosus.*
   9. Paleas (7) 8.5 (9) mm long.
    10. Apices bidentate; rachis internodes (3) 4-5 (7) mm long; glumes scabrous to hispidulous. ........................... ..................................................................... *E. riparius.*
    10. Apices truncate or slightly retuse; rachis internodes (6) 8 (9) mm long; glumes 0.2-0.5 (0.6) mm wide; lemmas glabrous; leaf-sheath margins usually ciliate. ....................................... *E. canadensis* var. *interruptus.*
 5. Glume bases thin and striated or indurated for only 1.0 mm; body of glume not thickened adaxially.
  11. Spikes (7) 10-20 (30) cm long broadly arched at maturity; spike internodes (4) 5 (7) mm long; paleas (8.5) 9-12 (14) mm long, apex very acute and usually bidentate; lemmas hirsute or hirtellous; glumes (0.7)-1.0 mm wide; maturity in July and August. ............................................ ............................................... *E. canadensis* var. *canadensis.*
   12. Plants green. ................................................ f. *canadensis.*
   12. Plants glaucous. ......................................... f. *glaucifolius.*
  11. Spikes (7) 10-12 (15) cm long, essentially straight at maturity; spike internodes (2) 4 (5) mm long; paleas (7) 9-10 mm long, apex acute and truncate or bidenticulate; lemmas glabrous or scabrous; glumes 0.5-1.0 mm wide; maturity in late May and June. ............................................ .......................................... *E. canadensis* var. *brachystachys.*

*Leaf measurements are from the third leaf beneath the spike. Spikelet measurements are taken from the mid-spike area. Extremes of measurements are indicated in parentheses.

Plate 1342.

Fig. 1. (left to right) *E. diversiglumis* 2476; *E. Svensonii* 2527; *E. canadensis* var. *interruptus* 1041. Fig. 2. Same as fig. 1, but greater magnification.

Scale shown in millimeters

Plate 1343.


Fig. 3. *E. canadensis* var. *interruptus* 1041. Fig. 4. *E. canadensis* var. *brachystachys* 1028. Fig. 5. *E. diversiglumis* 2328. Fig. 6. *E. canadensis* var. *canadensis* 2300.

Scale shown in millimeters

Plate 1344.

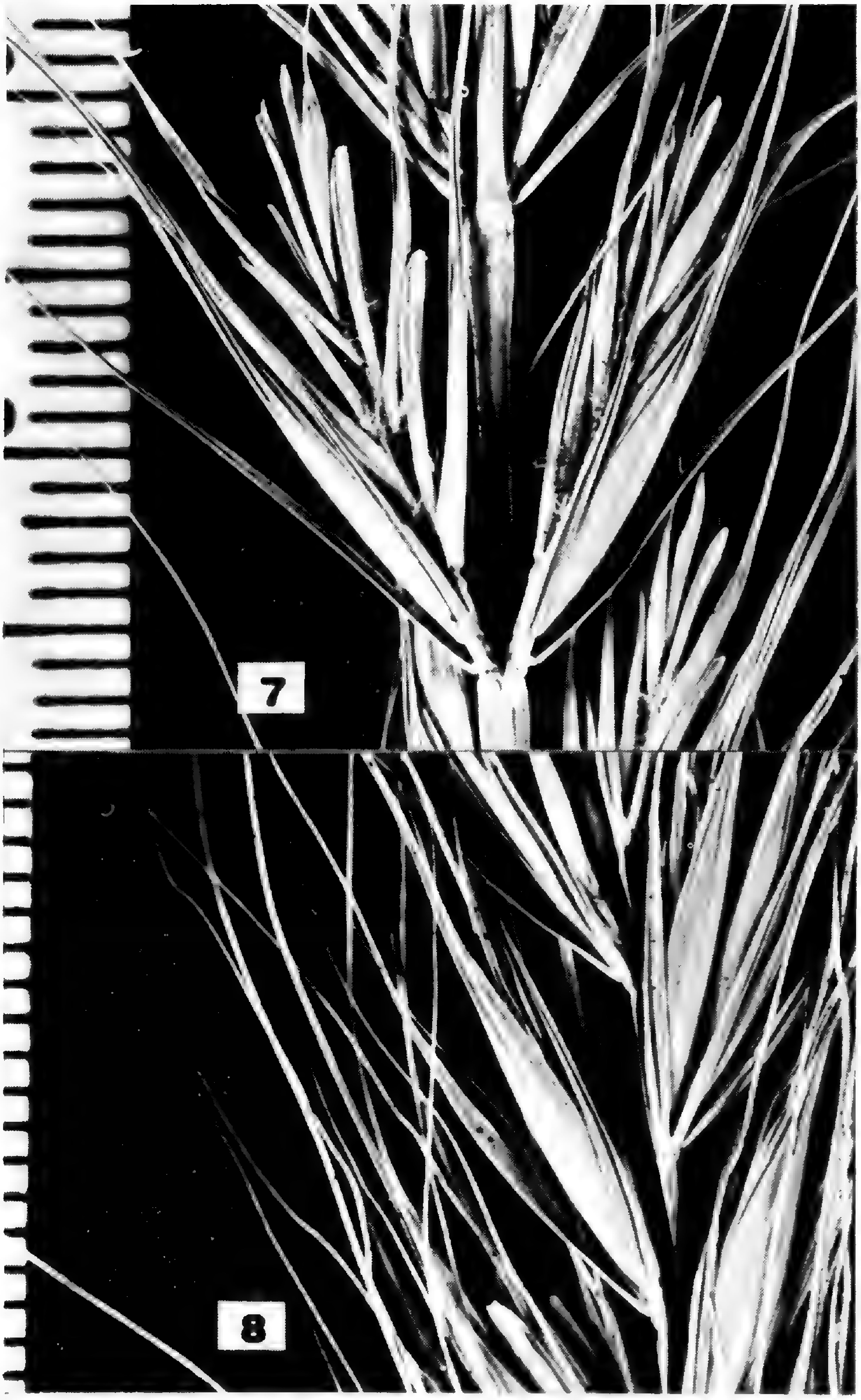



Fig. 7. *E. canadensis* var. *interruptus* 1041. Fig. 8. *E. canadensis* var. *brachystachys* 1028.

Scale shown in millimeters

Plate 1345.


Fig. 9. *E. diversiglumis* 2508. Fig. 10. *E. Wiegandii* 2522. Fig. 11. *E. canadensis* var. *canadensis* 2300. Fig. 12. *E. Svensonii* 2527.

Plate 1346.


Fig. 13. *E. Wiegandii* 2522. Fig. 14. *E. virginicus* var. *glabriflorus* f. *glabriflorus* 2660. Fig. 15. *E. canadensis* var. *interruptus* 1041. Fig. 16. (left to right) *E. virginicus* var. *virginicus* 2557; *E. canadensis* var. *canadensis* 2554.

Plate 1347.


Fig. 17. (left to right) *E. canadensis* var. *canadensis* 2300 (pistillate); experimental $F_1$; *E. Hystrix* 2463 (staminate). Fig. 18. Backcross of 2300 *(E. canadensis* var. *canadensis)* staminate to experimental hybrid 2300 *(E. canadensis* var. *canadensis)* × 2328 *(E. diversiglumis)*.

Scale shown in millimeters

Plate 1348.

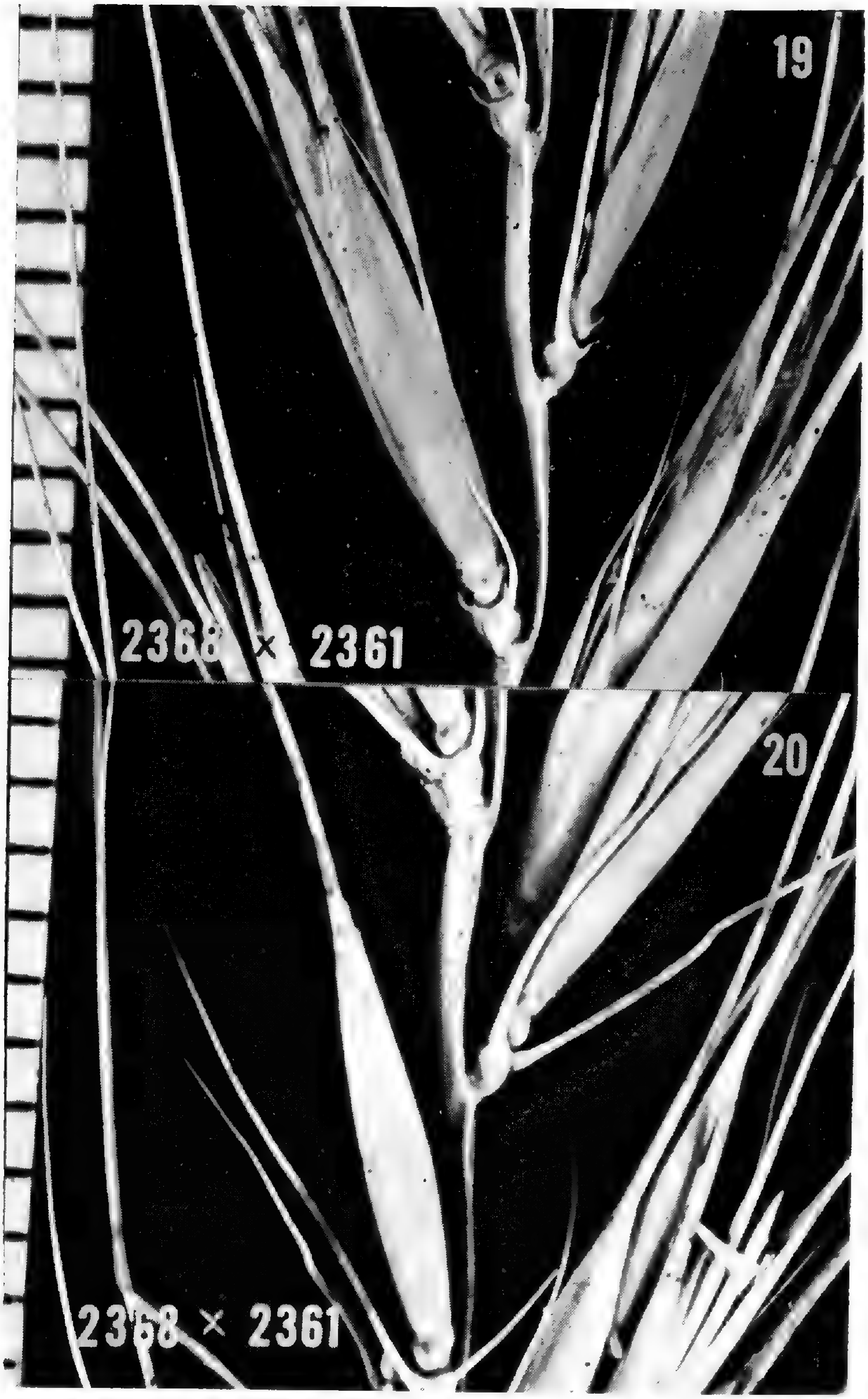



Fig. 19. Experimental cross of 2368 *(E. Hystrix)* × 2361 *(E. diversiglumis.)* Fig. 20. Another region of the same spike as fig. 19. Scale shown in millimeters

Plate 1349.

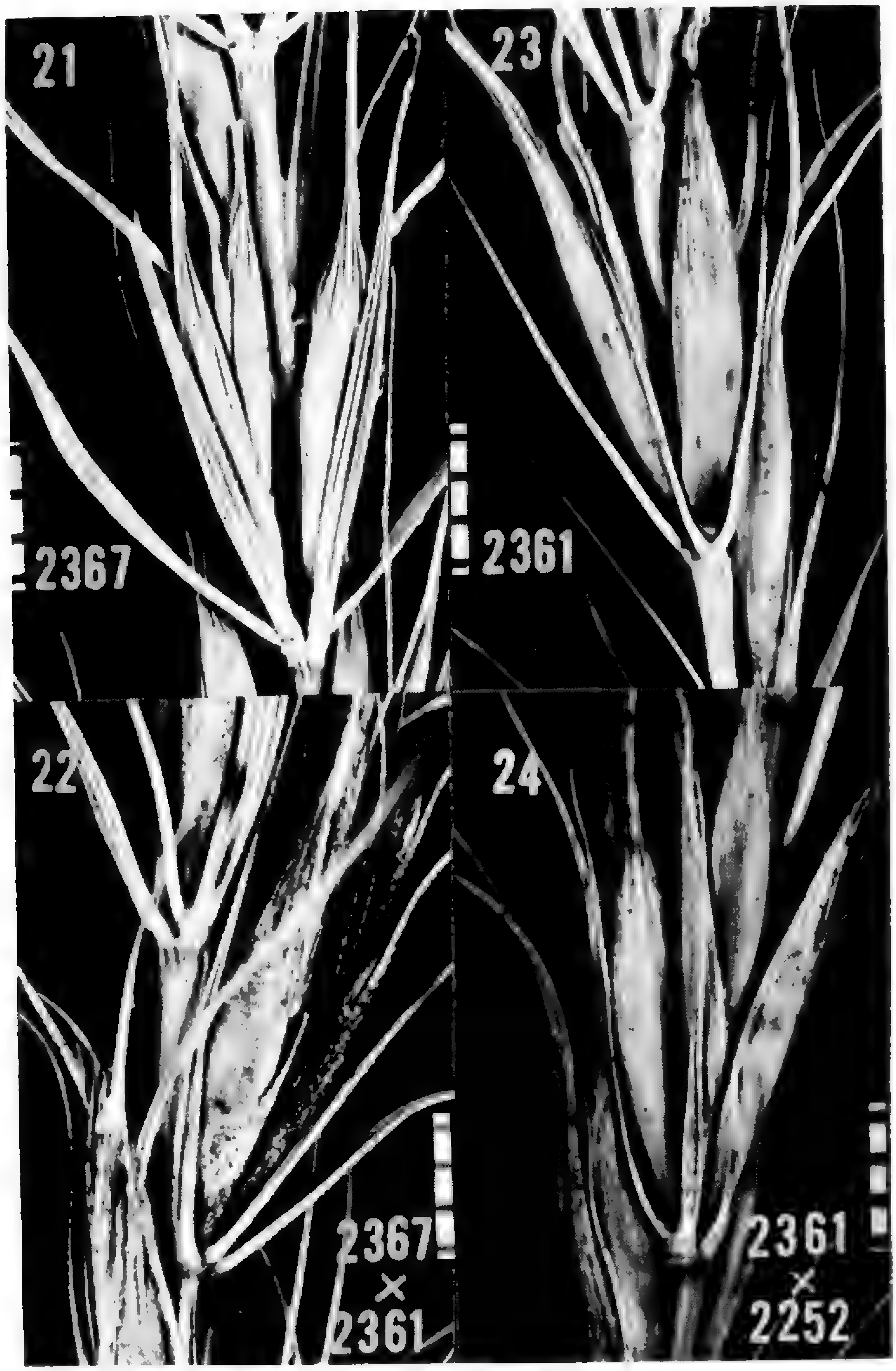



Fig. 21. *E. riparius* 2367. Fig. 22. Experimental cross of 2367 *(E. riparius)* × 2361. *(E. diversiglumis)*. Fig. 23. *E. diversiglumis* 2361. Fig. 24. experimental cross of 2361 *(E. diversiglumis)* × 2252 *(E. canadensis* var. *canadensis)*.

Scale shown in millimeters

Plate 1350.


Fig. 25. *E. villosus* 2700; two spikes of the same population of *E. Hystrix* 2699. Scale shown in millimeters. Fig. 26. Pollen-mother-cell of *E. diversiglumis* 2461, late first meiotic anaphase showing bridges.

## GENETIC RELATIONSHIPS

In testing the hypothesis that *E. Hystrix* and *E. canadensis* var. *canadensis* might cross to give rise to hybrid populations with setaceous glumes in Minnesota (Booher and Tryon 1948), experimental crosses between representative strains were made in order to learn the extent of the genetic barriers existing between them. However, since populations of *Elymus* with setaceous glumes may be found also in the following cases, similar experimental crosses were made with the hope of obtaining data indicative of the origin of the taxa involved: — *E. canadensis* var. *interruptus* in Texas, *E. Svensonii* in Tennessee and *E. virginicus* var. *glabriflorus* in Illinois.

METHODS. Since none of the strains employed was self-sterile, pistillate parents were emasculated and pollination was effected by dusting the stigmas liberally with pollen collected in cellophane bags that had covered the staminate spikes.

Results of the crosses are indicated by numbers separated by colons and represent in the following order: — $F_1$ seedlings obtained, seeds obtained from the cross, florets emasculated. Numbers in square brackets indicate original seedlings obtained in contrast to preceding number of surviving mature plants. In cases where no square brackets are used, all seedlings grew to mature plants. Two numbers alone indicate: — mature plants: seeds planted.

Cytological data, when given, are based on the examination of at least 50 pollen-mother-cells (p.m.c.'s) in the stages reported. Chiasma frequencies represent average chiasmata per bivalent chromosome at diakinesis or first meiotic metaphase.

1. Crosses of *E. Hystrix* with *E. canadensis* var. *canadensis*.

On the edge of mixed woodlands in the Brainerd-Mille Lacs Lake area, fertile specimens have been collected that have the general appearance of var. *canadensis* but which possess glumes reduced in width or length and yet not identifiable as setaceous. With the thought that such strains might be introgressants of *E. Hystrix* into var. *canadensis*, crosses between these taxa were attempted. Because of the difficulty in emasculating the readily deciduous florets of *Hystrix*, it was not often possible to use this species as the pistillate parent. The following strains were crossed, all with no success: 2300 (var. *canadensis*), Mille Lacs Lake, × 2368 *(Hystrix)*, Nerstrand Woods (0:90); 2300 (var. *canadensis*) × 2306 *(Hystrix)*, Itasca Park (0:104); 2669 *(Hystrix)*, Pine Hills — Illinois, × 2300 (var. *canadensis*) (0:100).

In contrast to results with the above strains, a vigorous $F_1$ was obtained from the cross of 2300 (var. *canadensis*) × 2463 *(Hystrix)* from McCraney Lake woods (14:14:43), even though the reciprocal cross failed (0:46). Figure 17 shows the parents and the $F_1$. It can be noted that the latter plant has the thin, flattened rachis of *Hystrix*, the hirsute lemmas of var. *canadensis* and the setaceous, uni-striated, basally indurated glumes that are obviously intermediate.

Cytological observation of p.m.c.'s of the $F_1$ above revealed chiasma frequencies of 1.80 as contrasted with 2.00 for 2300 (var. *canadensis*) and 1.99 for 2463 *(Hystrix)*. Roughly 30% of both first and second meiotic divisions in the hybrid exhibited an average of 4 univalent laggards and 2 bridges and yet the young pollen was remarkably free from cytoplasmic extrusions. Nine vigorous hybrid plants flourished while surrounded by parental strains in an outdoor plot for five years but continued to remain sterile. Consequently, formation of introgressants from parental backcrossing to the hybrid appears to be precluded.

Still further evidence of the existence of strong genetic barriers between populations of the above taxa is revealed in the failure of a cross of strains from the Pine Hills woodland of southern Illinois: 2669 *(E. Hystrix)* × 2659 (var. *canadensis)* (0:84) and the reciprocal (0:91).

2. Crosses of *E. diversiglumis* with *E. Hystrix*

A cross between 2316 *(diversiglumis)* from Itasca Park and 2513 *(Hystrix)* from Gull Lake was a failure (0:5:98) as was the reciprocal (0:6:104). A similar strain 2317 *(diversiglumis)* from Itasca Park crossed reciprocally with 2463 *(Hystrix)* from McCraney Lake likewise was a failure (0:96), (0:32). Employing 2368 *(Hystrix)* from Nerstrand Woods in a reciprocal cross with 2501 *(diversiglumis)* from Itasca Park still resulted in failure (0:104), (0:112). However, the use of 2361 *(diversiglumis)* from Gull Lake as the staminate parent in a cross with 2368 *(Hystrix)* produced a vigorous $F_1$ plant (1:3:222). This plant strongly resembled *Hystrix* with a few filiform glumes (figs. 19 and 20) and revealed a chiasma frequency of 1.85. In the examination of ca. 500 pollen-mother-cells, 10% showed univalent laggards, extrusions and bridges. Sixteen seeds produced an $F_2$ of 4 plants, entirely sterile, although still resembling the *Hystrix* parent.

3. Crosses of *E. diversiglumis* with *E. canadensis* var. *canadensis*

Striking success attended a cross of a very vigorous 2461 *(diversiglumis)* from McCraney Lake with 2523 (var. *canadensis*) from Mille Lacs Lake (13[20]:20:46). Of the surviving $F_1$, half were fertile *diversiglumis* and half were sterile var. *canadensis*. Since 2461 *(diversiglumis)* showed some meiotic irregularities (fig. 26), it was heterozygous, probably for genes from var. *canadensis* acquired through previous natural hybridity. In this case the above experimental cross represented a backcross, a fact that would explain the segregation of progeny in the $F_1$. The reciprocal cross 2523 × 2461 (6:37:67) produced a fertile $F_1$ resembling *diversiglumis* but with equal glumes 0.3 mm wide and ribbed to the indurated base. Still further evidence of the heterozygosity of this same 2461 *(diversiglumis)* is the fact that another cross with 2300 (var. *canadensis*) from Mille Lacs Lake used as the pistillate parent resulted in two $F_1$ plants (2:3:66), one essentially like var. *canadensis* and the other a vigorous *diversiglumis* with intermediate glumes. However, the latter segregate yielded only 6 seeds out of 380 florets.

The employment of another strain of *diversiglumis*, less vigorous but free from meiotic irregularities, demonstrated more strikingly how partially fertile strains, intermediate with var. *canadensis*, might arise through introgression. In a cross of 2300 (var. *canadensis*) Mille Lacs Lake with 2328 *(diversiglumis)* Itasca Park, the $F_1$ (2[3]:24:80) was definitely intermediate with respect to glumes and paleas, but revealed laggards, bridges and extrusions in 30% of the 100 p.m.c.'s examined and a seed set of only 15%. The backcross made with 2300 (var. *canadensis*) pollen produced a vigorous plant (1:1:32), still possessing intermediate glumes but yielding a higher seed set of 25%. This experimental backcross closely resembles natural populations exhibiting a similar degree of intermediate morphology and partial sterility (2327, 2340, 2514) that have been collected in the Itasca Park and Round Lake areas.

The use of an allopatric strain of var. *canadensis* from Vermont demonstrated a lower level of genetic barriers with respect to the vigorous 2361 *(diversiglumis)* from Itasca Park. This cross of 2361 with 2252 (var. *canadensis*) from Vermont (figs. 23 and 24) yielded an $F_1$ (20:32:76) that had narrow, but rarely setaceous glumes and was 40% fertile. The backcross made with 2361 *(diversiglumis)* pollen produced a rather weak, sterile $F_1$.

4. Cross of *E. diversiglumis* with *E. riparius*

Although not frequently encountered in the Great Lakes area, *E. riparius* is a species with distinctly terete and indurated bases to the glumes, a character which might contribute to setaceousness of the glumes of sympatric species with which it might hybridize. However, the $F_1$ (4:26:98) of the cross of 2367 *(riparius)* from Nerstrand Woods with 2361 *(diversiglumis)* from Itasca Park (figs. 21 and 22) was completely sterile.

5. Crosses of *E. Wiegandii* with *E. canadensis* var. *canadensis*

All attempts at hybridization between strains of both *E. Wiegandii* and var. *canadensis* met consistently with failure: — 2522 *(Wiegandii)* Mille Lacs area with 2519 (var. *canadensis*) Mille Lacs Lake and reciprocal (0:27), (0:26); 2522 *(Wiegandii)* with 2317 (var. *canadensis)* Itasca Park and reciprocal (0:20), (0:29); 2511 (var. *canadensis*) Round Lake with 2522 *(Wiegandii)* (0:54); 2550 (var. *canadensis*) Lake Michigan shore with 2522 *(Wiegandii)* (0[8]:8:57); 2519 (var. *canadensis*) Mille Lacs Lake with 2538 *(Wiegandii)* from Itasca Park (0:31); 2300 (var. *canadensis*) Mille Lacs Lake with 2517 *(Wiegandii)* Mille Lacs Lake (0:58); 2522 *(Wiegandii)* Mille Lacs with 2523 (var. *canadensis*) Mille Lacs (0[4]:20:148); 2550 (var. *canadensis*) Lake Michigan shore with 2522 *(Wiegandii)* Mille Lacs (0[2]:8:57).

In the cases listed in which a few $F_1$ seedlings developed and then died, the failure was associated with an intense formation of anthocyanin pigment.

The above experimental data certainly substantiate the recognition of *E. Wiegandii* as a species very distinct from *E. canadensis* var. *canadensis*.

6. Crosses of *E. Wiegandii* with *E. Wiegandii*

Certain strains of *E. Wiegandii* from the Mille Lacs Lake area (2499, 2517, 2522) exhibited lagging univalents, bridges and a chiasma frequency of 1.90 in 300 p.m.c.'s examined. Yet fertility in terms of percentage of seeds was not greatly reduced. Since the above data suggested the existence of genetic barriers between populations in central Minnesota, experimental crosses between the following sympatric strains were made: — 2502 *(Wiegandii)* Brainerd crossed with 2522 *(Wiegandii)* Mille Lacs (32:32:70) and the reciprocal (36:36:70). The complete fertility of the $F_1$ is indicative of the taxonomic identity of the strains.

By way of comparison with the sympatric cross, an allopatric cross was made between 2438 *(Wiegandii)* from Itasca Park and 2536 *(Wiegandii)* from Mattapedia, Quebec (20:21:42) and the reciprocal (14:14:28). Examination of the pollen-mother-cells revealed chiasma frequencies ranging from 1.70 to 2.00 and irregularities in meiosis were rare. Yet, in contrast to the sympatric crosses, the Minnesota with Quebec crosses were largely sterile. A similar correlation between geographic range and genetic barriers has been found in crosses of *E. canadensis* var. *canadensis* from Vermont with strains from Minnesota. For example, in the cross of 2252 (var. *canadensis*) from Vermont with 2300 (var. *canadensis*) from Mille Lacs, no seeds were obtained (0:212). With respect to the implied limits of genetic barriers between strains in the above tests, the strains of *Wiegandii* are more closely related to each other than are the interregional strains of var. *canadensis*.

7. Crosses of *E. Wiegandii* with *E. diversiglumis*

In broadly sympatric populations of *E. diversiglumis* and *E. Wiegandii*, both species may exhibit characters in common; i.e., very drooping spikes, glaucous, dark green adaxially pilose leaves and varying degrees of setaceous glumes. Although other characters may be found to separate these species (cf. key), experimental crosses were made to test the possibility of natural interspecific hybridity. As can be seen from the following data, however, all such crosses were failures: 2522 *(Wiegandii)* Mille Lacs Lake with 2328 *(diversiglumis)* Itasca Park (0:86) and reciprocal (0:40), 2361 *(diversiglumis)* Itasca Park with 2517 *(Wiegandii)* Mille Lacs Lake (0:70), 2514 *(diversiglumis)* Gull Lake with 2517 *(Wiegandii)* Mille Lacs Lake (0:58), 2438 *(Wiegandii)* Itasca Park with 2328 *(diversiglumis)* Itasca Park (0:32).

In a cross of 2355 *(diversiglumis)* from Cotton Lake with 2522 *(Wiegandii)*, 7 seedlings were obtained (7:7:40). In the course of a month, however, an intense anthocyanin pigmentation developed in all plants and death ensued after two months. A similar barrier was noted above in a cross of *E. Wiegandii* and *E. canadensis* var. *canadensis*.

8. Crosses of *E. Svensonii* with *E. Hystrix*

Since the Tennessee endemic *E. Svensonii* resembles *E. Hystrix* to some extent, it seemed logical to test the relationship of these species, again by means of artificial hybridization. The vigorous strain 2368 of *Hystrix* from Nerstrand Woods, Minnesota was employed in making reciprocal crosses. The cross with pistillate *Hystrix* resulted in a vigorous, intermediate, partly fertile $F_1$ (3:4:24). These plants were still surviving three years later in outdoor plots. The $F_2$ of three plants (3:27) segregated as follows: a sterile, glaucous *Hystrix*, a partially fertile, green *Hystrix* and a fertile intermediate. The latter segregate was still vigorous, though largely sterile, after five years in an outdoor plot. Chiasma frequencies in the intermediate member of the $F_2$ were 1.90 compared to 2.00 for both parents. Pollen of this hybrid appeared normal. A few seeds from the first year plants produced 6 plants (6:48) all resembling *Hystrix*. These $F_3$ segregates were sterile.

The reciprocal cross (i.e., with *Svensonii* as the pistillate parent) produced a vigorous but largely sterile $F_1$ (9:16:22) which resembled a *Hystrix* with adpressed instead of spreading spikelets at maturity. The two seeds obtained produced an $F_2$ (2:58) that resembled a glumeless *Hystrix* like the staminate parent but possessed reflexed awns and glaucous foliage like the pistillate parent. Ten $F_3$ plants resembled *Hystrix* very closely, were intensely glaucous and mostly fertile, although they remained in a vegetative state for the first year.

9. Crosses of *S. Svensonii* with *E. canadensis* var. *interruptus*

Since the endemic *Svensonii* has been confused with var. *interruptus* (Hitchcock and Chase 1950), crosses between these taxa were made to determine the degree of possible genetic relationship. The cross of 1041 (var. *interruptus*) from Texas with staminate 2527 *(Svensonii)* produced a vigorous, intermediate $F_1$ (9[11]:33:90) which was still thriving after five years in the field. The $F_2$ consisted of 8 vigorous plants (8[11]:18): — one fertile var. *interruptus*, two fertile *Svensonii* and five partly fertile intermediates. The latter forms had spikes with slightly sinuous rachises, widely separated nodes (an *interruptus* character), glaucous foliage and very setaceous glumes (*Svensonii* features). The chiasma frequency of the intermediates was 1.87. More than 50% of the p.m.c.'s examined had bridges and univalent laggards, in contrast to normal meioses in the parents. The four seeds obtained from the $F_2$ did not germinate.

The cross made with *Svensonii* as the pistillate parent also produced a vigorous $F_1$ (32[37]:96:293) and again intermediate in appearance. The $F_2$ (8:36:96) segregated equally to give partly fertile intermediates and sterile, vegetable plants. The single $F_3$ plant (1:8:25) obtained was stunted and sterile. The chiasma frequency of the $F_1$ was 1.86, very close to that of the reciprocal cross. In some 800 p.m.c.'s examined, irregularities proved to be relatively infrequent.

10. Crosses of *E. Svensonii* with *E. diversiglumis*

Crosses with 2428 *(diversiglumis)* from Itasca Park were failures (0:108), reciprocal (0:125). Similar crosses with 2355 *(diversiglumis)* from Cotton Lake, Minnesota were likewise failures (0:158), reciprocal (0:110).

11. Crosses of *E. Svensonii* with *E. virginicus* var. *virginicus*

Since it has been demonstrated that various strains of *E. virginicus* var. *virginicus* have genes in common with many other species (Stebbins and Snyder 1956, Church 1959), reciprocal crosses were made with *Svensonii* in order to probe further into the genetic background of this Tennessee endemic. The cross with pistillate 2542 (var. *virginicus*) from Texas, produced a husky, partly fertile, intermediate $F_1$ (27:29:129). The $F_2$ (23:38) was entirely glaucous like the staminate 2527 *(Svensonii)* parent, but segregated into several categories as to width of glumes. Most of the latter forms were sterile except for one with glumes only slightly wider than those of *Svensonii* and a seed set of 15%. Cytological studies of the p.m.c.'s in the intermediates of the $F_1$ revealed a chiasma frequency of 1.82. Laggards and extrusions in 50% of the division stages appeared to be the cause of much of the shrivelled pollen.

The reciprocal cross (18:19:150) produced intermediate plants with glumes much nearer to var. *virginicus* than to *Svensonii* in form and width. The few seeds obtained failed to germinate (0:14). Chiasma frequency was 1.84 and laggards, bridges and extrusions were common in all later stages of meiosis.

A cross with 2641 (var. *virginicus*) from Michigan employed as the staminate parent produced only a single, stunted sterile $F_1$ plant (1[4]:6:116).

12. Crosses of *E. canadensis* var. *interruptus* with *E. diversiglumis*

Although the taxonomic confusion between var. *interruptus* and *diversiglumis* has been clarified earlier in this paper, it is of interest to present now the degree of genetic barriers between these taxa as based on the data from experimental hybrids. The cross of 1041 (var. *interruptus*) from Llano County, Texas with 2461 *(diversiglumis)* from McCraney Lake, Minnesota as the pistillate parent was relatively successful (17[24]:41:268) in the production of a rather intermediate $F_1$ which, however, was completely sterile. Chiasma frequency was 1.83 and in all stages of meiosis examined, ca. 40% of the p.m.c.'c revealed laggards, bridges and extrusions. The cross made with 1041 (var. *interruptus*) as the pistillate parent again resulted in a completely sterile $F_1$ (3:3:70) with narrow glumes and hirsute lemmas. A cross attempted with 2450 *(diversiglumis)* from Itasca Park, Minnesota as the pistillate parent was a complete failure (0:134).

13. Crosses of *E. canadensis* var. *interruptus* with *E. virginicus* var. *glabriflorus* f. *glabriflorus*

The variety *glabriflorus* of the widespread *E. virginicus* is found mostly below the 40 degree parallel in North America and is distinguished from northern varieties by much longer and thinner glumes. Forms with glabrous or hirsute lemmas are both common (cf. key to species). In Union County, southern Illinois, strains of both forms have been found with very setaceous glumes, the origin of which might be due to introgression from some other southern species. Introgression between *E. canadensis* var. *interruptus* and strains of *E. virginicus* var. *glabriflorus* in Texas has been demonstrated by Brown and Pratt (1960). Hence it was considered appropriate to study the relationships between these two taxa further through experimental hybridization. A cross of 2603 (f. *glabriflorus*) from Illinois as the pistillate parent was made with 1041 (var. *interruptus*) from Texas. The $F_1$ plants were intermediate in morphology (7:11:81) and had a seed-set of ca. 5%. The $F_2$ generation of 13 plants segregated as follows:- 3 fertile f. *virginicus*, 4 fertile var. *interruptus* and 6 slightly fertile intermediates. However, the few seeds from the intermediates failed to germinate. The reciprocal cross produced a fairly similar $F_2$ population of 14 plants that segregated in a similar pattern as follows:- 6 partly fertile f. *virginicus*, one fertile var. *interruptus* and 7 partly fertile intermediates that continued to segregate in the $F_3$! Although a surprising degree of genetic compatibility was demonstrated between the allopatric strains of this experimental cross, none of the experimental hybrids resemble the aberrant populations of f. *glabriflorus* with setaceous glumes in Union County, Illinois.

14. *Cross* of *E. villosus* with *E. Hystrix*

Although *E. villosus* is quite distinct from other eastern species of *Elymus* in its smaller florets and very compact spikes, the narrow glumes with terete bases suggest that its possible role in the ancestry of natural hybrid populations of *E. virginicus* or *E. Hystrix* should not be overlooked. Furthermore, a natural, bigeneric hybrid between *E. villosus* and *Hordeum jubatum* L. has been described recently from Iowa (Pohl 1966).

A cross between 2520 *(E. villosus)* and sympatric 2521 *(E. Hystrix)* from moist, woodland borders in central Minnesota was a failure (0:94 and reciprocal 0:94).

15. Cross of *E. villosus* with *E. virginicus* f. *glabriflorus*

Again in Union County, Illinois, *E. villosus* grows sympatrically with *E. virginicus* var. *glabriflorus* f. *glabriflorus* or with f. *australis*. Since the strains of *E. villosus* came to anthesis 3 to 4 weeks earlier than those of *E. virginicus* var. *glabriflorus*, experimental crosses were difficult to arrange. However, a cross of pistillate 2652 *(E. virginicus* f. *glabriflorus)* with 2676 *(E. villosus)* produced only one intermediate plant that was stunted and sterile (1:8:21). Another cross of pistillate 2647 (f. *australis*) with 2678 *(E. villosus)* produced seedlings that died after 3 months (3:4:60).

16. Cross of *E. villosus* with *E. virginicus* var *virginicus*

A cross of 2678 *(E. villosus)* and 2600 *(E. virginicus* var. *virginicus)* produced only 5 stunted and sterile $F_1$ plants (11:16:93). The reciprocal cross produced only inviable seeds (0:6:97).

Within the limits of these data, then, *E. villosus* appears to be quite isolated genetically from both *E. Hystrix* and *E. virginicus.*

## Discussion and Summary

It has been demonstrated that the frequently encountered populations of *Elymus* with very unequal, setaceous glumes in the mixed woodlands of central Minnesota are composed mainly of *E. diversiglumis,* a recently overlooked species. *E. diversiglumis* is quite aggressive in the Minnesota segment of its range, but is distributed sparingly with no obvious phenotypic variations in Wisconsin, Wyoming, the Dakotas and Manitoba. In the disturbed habitats of woodland road embankments, however, forms with wider and longer than typical glumes may be found in vigorous, thick stands that reveal rather low levels of fertility in terms of seed formation (20-50%). Such putative hybrids may exhibit also irregular meioses in the pollen-mother-cells (fig. 26).

Attempts at recreating these aberrant forms of *E. diversiglumis* by crossing sympatric *E. canadensis* var. *canadensis* and *E. Hystrix* resulted mostly in failures. However, a sterile, intermediate $F_1$ was obtained that resembled *E. Hystrix* with abundant, filiform glumes (fig. 17), but it did not duplicate any natural populations encountered in Minnesota. Furthermore, any close genetic relationship between *E. diversiglumis* and sympatric *E. Hystrix* does not exist in the light of the failure of most of the experimental crosses between these species. On the other hand, the rare, nearly sterile $F_1$ plant that did appear (figs. 19 and 20) resembled forms of *E. Hystrix* elsewhere in the range. This variant has not yet been found in Minnesota. The $F_2$ plants were all typically awnless *E. Hystrix* and quite sterile.

Experimental crosses between *E. diversiglumis* and the usually genetically isolated *E. riparius* (figs. 21 and 22) presented intermediate forms whose pattern of origin appears parallel to but not duplicative of that of the aberrant *E. diversiglumis* forms noted above.

It was through crosses and backcrosses of strains of *E. canadensis* var. *canadensis* and *E. diversiglumis* that the production of experimental hybrids that duplicated natural aberrant forms ultimately was made. Populations of *E. diversiglumis* with unusually wide glumes would appear, then, to exhibit introgression from *E. canadensis* var. *canadensis* (fig. 18). The genetic evidence presented indicates that many of the strains of *E. diversiglumis* employed in experimental crosses were already heterozygous for genes from *E. canadensis* var. *canadensis* and that, in effect, backcrosses had been made. Such a pattern of introgressive hybridization would appear to be continuing in central Minnesota. Of further interest is the apparent fact that introgression operates most effectively only with sympatric strains of *E. canadensis* var. *canadensis,* since a strain of the latter from Vermont contributed to the complete sterility of the experimental hybrids (fig. 24).

Since it has been noted that *E. Wiegandii* in some of its characters resembles both *E. diversiglumis* and *E. canaden-*

*sis* var. *canadensis*, it seemed appropriate to determine the degree of genetic barriers existing between all three sympatric species. The evidence of failure of experimental crosses indicates clearly that not only is *E. Wiegandii* not involved in hybrid complexes of *E. diversiglumis* but that genetic isolation from *E. canadensis* var. *canadensis* also is quite strong. The reduction of *E. Wiegandii* to a variety of *E. canadensis* (Bowden 1964) is not supported by the genetical basis for species integrity presented in this study.

Returning to *E. Hystrix* as a source of genetic control over the appearance of reduced or setaceous glumes in hybridizing populations, the discovery of *E. Svensonii*, with irregular sized, bristly glumes, afforded the opportunity through breeding experiments to probe the genetic relationship of this isolated endemic to not only *E. Hystrix* but to *E. canadensis* var. *interruptus* and *E. diversiglumis*. While clearly isolated genetically from *E. diversiglumis*, it is significant that *E. Svensonii* crossed reciprocally with both *E. Hystrix* and *E. canadensis* var. *interruptus* and that the intermediate $F_1$ produced a segregating $F_2$ in all cases, even though the $F_3$ was sterile. In particular, the fact that the $F_2$ of *E. Svensonii* and *E. Hystrix* segregated for fertile *E. Hystrix* and partly fertile intermediates would appear to indicate that *E. Hystrix* played a role in the origin of *E. Svensonii*, perhaps in the not too distant geological past.

Various components of *E. virginicus* appear to be able to combine with either *E. Svensonii* or *E. canadensis* var. *interruptus* to produce hybrids with setaceous glumes. When *E. virginicus* var. *virginicus* was crossed with *E. Svensonii*, the $F_2$ segregated not only for the parents but intermediates as well. In the cross of *E. virginicus* var. *virginicus* f. *virginicus* with *E. canadensis* var. *interruptus*, partly fertile intermediates with more or less setaceous glumes continued to segregate even in the $F_3$.

In contrast to the demonstrated genetic affinities between *E. Svensonii*, *E. Hystrix* and components of *E. virginicus*, *E. villosus* appears to be quite isolated from *E. Hystrix* and both forms of *E. virginicus* var. *glabriflorus*.

In these studies, it is apparent that the opportunities for the evolution of new taxa with setaceous glumes are more frequent in the relatively southern ranges of species of *Elymus*. A striking instance of the process of speciation, currently operating, will be presented in a second paper involving *E. Hystrix* and *E. virginicus* in southern Illinois.

DIVISION OF BIOLOGICAL AND MEDICAL SCIENCES
BOTANICAL LABORATORIES
BROWN UNIVERSITY, PROVIDENCE, RHODE ISLAND

LITERATURE CITED

BERNARD, FRÈRE JEAN-PAUL. Personal Communication.

BOOHER, L. E. and R. M. TRYON. 1948. A study of *Elymus* in Minnesota. Rhodora **50**: 80-91.

BOWDEN, WRAY M. 1958. Natural and artificial × *Elymordeum* hybrids. Can. Jour. Bot. **36**: 101-123.

——————. 1964. Cytotaxonomy of the species and interspecific hybrids of the genus *Elymus* in Canada and neighboring areas. Can. Jour. Bot. **42**: 547-601.

BOYLE, W. S. 1963. A controlled hybrid between *Sitanion hystrix* and *Agropyron trachycaulum*. Madroño **17**(1): 10-16.

BROWN, WALTER V. and GENE A. PRATT. 1960. Hybridization and introgression in the grass genus *Elymus*. Amer. Jour. Bot. **47**(8): 669-676.

BUCKLEY, S. B. 1862. *Elymus interruptus*. Acad. Nat. Sci. Phila. Proc. 1862: 99.

CHURCH, G. L. 1954. Interspecific hybridization in eastern *Elymus*. Rhodora **56**: 185-197.

——————. 1959. Introgressive hybridization in Minnesota species of *Elymus*. Proc. Ninth Int. Bot. Cong., Montreal, 2:73.

DEWEY, DOUGLAS R. 1964. Natural and synthetic hybrids of *Agropyron spicatum* × *Sitanion hystrix*. Bull. Torr. Bot. Club **91**: 396-405.

——————. 1966. Synthetic *Agropyron-Elymus* hybrids. I. *Elymus canadensis* × *Agropyron subsecundum*. Amer. Jour. Bot. **53**(1): 87-94.

DORE, W. G. 1950. Supposed natural hybrid between *Agropyron* and *Hystrix*. Can. Field Naturalist **64**(1): 39-40.

DUTILLY, ARTHÈME and E. LEPAGE. 1963. Contribution à la Flore du Versant Sud de la Baie James, Quebec-Ontario. Contrib. Arctic Inst. 12F.

FARWELL, O. A. 1920. Notes on the Michigan flora. Mich. Acad. Sci. Rept. **21**: 357.

FASSETT, N. C. 1951. Grasses of Wisconsin. Univ. Wis. Press.

FERNALD, M. L. 1933. Types of some American species of *Elymus*. Rhodora **35**: 187-198.

———. 1950. Gray's Manual of Botany, 8th edition.

FRAZER, W. P. and R. C. RUSSELL. 1954. List of the flowering plants of Saskatchewan. Univ. of Saskatchewan, Saskatoon.

GLEASON, H. A. 1952. Illustrated Flora of the Northeastern United States and Adjacent Canada.

GROSS, A. T. H. 1960. Distribution and cytology of *Elymus macounii* Vasey. Can. Jour. Bot. **38**: 63-67.

HARRINGTON, H. D. 1954. Manual of the Plants of Colorado. Denver.

HITCHCOCK, A. S. and AGNES CHASE. 1950. Manual of the Grasses of the United States, 2nd edition.

POHL, RICHARD W. 1959. Morphology and cytology of some hybrids between *Elymus canadensis* and *E. virginicus*. Proc. Iowa Acad. Sci. **66**: 155-159.

———. 1966. × *Elyhordeum iowense*, a New Intergeneric Hybrid in the Triticeae. Brittonia **18**(3): 250-255.

RYDBERG, P. A. 1922. Flora of the Rocky Mountains and Adjacent Plains. New York.

SCOGGAN, H. J. 1957. Flora of Manitoba. National Museum of Canada Bull. 140.

SCRIBNER, F. LAMSON. 1898. USDA Bull. Agrost. **13**: 49.

——— and CARLETON R. BALL. 1901. USDA Div. Agrost. Bull. **24**: 47-49.

STEBBINS, G. L. and A. VAARAMA. 1954. Artificial and natural hybrids in the Gramineae, tribe Hordeae. VII. Hybrids and allopolyploids between *Elymus glaucus* and *Sitanion* spp. Genetics **39**: 378-395.

——— and L. A. SNYDER. 1956. Artificial and natural hybrids in the Gramineae, tribe Hordeae. IX. Hybrids between western and eastern North American species. Amer. Jour. Bot. **43**:(4): 305-312.

STEVENS, O. A. 1950. Handbook of North Dakota Plants. North Dakota Agricultural College.

SVENSON, H. K. 1941. Notes on the Tennessee Flora. Brooklyn Bot. Gard. Contrib. **93**: 115.

WIEGAND, K. M. 1918. Some species and varieties of *Elymus* in eastern North America. Rhodora **20**: 81-90.

VOSS, EDWARD G. *Elymus* in unpublished notes and keys to the Triticeae in Michigan.

# FLORAL ANATOMY OF RHEXIA VIRGINICA (MELASTOMATACEAE)

RICHARD H. EYDE AND JAMES A. TEERI

Contradictory comments concerning the flowers of *Rhexia* L. are found in the two current manuals of our northeastern flora. The description in Gray's Manual (Fernald, 1950) clearly implies an inferior or partially inferior ovary: "Hypanthium urceolate, adherent to the ovary below and continued above it." In contrast, Gleason and Cronquist (1963) report "hypanthium free from the ovary." From serial sections of flowers we have learned that this point of confusion is caused by a developmental peculiarity; viz., cell layers in the fruit wall separate prior to dehiscence in such a way that the partially inferior ovary can appear superior. Flowers of *Rhexia* have unilocular anthers, another unusual feature; therefore we have thought it worthwhile to describe in some detail the reproductive structures of one species, *R. virginica* L.

This investigation originated from conversations between the first author and Dr. John J. Wurdack, a specialist in the taxonomy of Melastomataceae at the Smithsonian Institution, and was carried out during the summer of 1966 while the second author was supported by the Smithsonian Institution's Summer Program for Students. Dr. Wurdack assisted by supplying specimens and information and by reading our manuscript critically.

Flowers, flower buds, and developing fruits were obtained from plants of *Rhexia virginica* var. *virginica* cultivated in the garden of Dr. and Mrs. J. J. Wurdack in Beltsville, Maryland, these plants having been obtained originally from natural stands in the vicinity. A voucher specimen *(Wurdack 2534)* has been deposited in the U.S. National Herbarium.

Serial sections 10-15$\mu$ thick were prepared with a rotary microtome, after fixing in formalin-acetic acid-ethanol, dehydrating in a t-butanol series, and embedding in "Paraplast." The sections were stained with tannic acid, ferric chloride, safranin, and fast green. Altogether, more than 50 flowers and developing fruits were prepared in this manner. For 3-dimensional examination of the vascular pattern, we cleared about 20 flowers, utilizing both the chloral-lactophenol method of Amann (Bersier & Bocquet, 1960) and the simultaneous clearing and staining method of Fuchs (1963). Fuchs' procedure, involving prolonged immersion of the material in 10-15% NaOH, had to be modified somewhat, for concentrations of this strength tend to macerate the softer floral tissues. We found that a 5% solution of NaOH could be used, thus reducing the maceration to within tolerable limits. Cleared flowers were dehydrated with an ethanol series and transferred to toluol for examination, thereby hardening the tissues enough to permit manipulation with camel's-hair brushes.

Line drawings were prepared by the second author with the aid of a Wild M5 Stereomicroscope and drawing attachment. Photographs are by Jack Scott, Smithsonian photographer.

*Rhexia virginica* is an erect perennial herb (often somewhat woody), widely distributed in eastern North America. The flowers, produced throughout the summer in open cymes, are conspicuous for their four showy purple petals and bright yellow stamens. These are borne near the summit of an urceolate hypanthium, which terminates in four short calyx lobes, the lower part of the hypanthium being partially adnate to a four-locular inferior ovary. The locules are in the same radii as the petals — as Eichler (1878) emphasized, this is an exception for the family — and each contains a massive axillary placenta with many bitegminous ovules. The tabular upper part of the hypanthium surrounds an elongate style with truncate stigma. Before anthesis the petals, like those of other Melastomataceae, are tightly overlapped in the configuration known as "right contort," or "right convolute," to use Eichler's (1878, p. 480) term.[1]

Prominent multicellular trichomes with globose glandular heads occur on the exposed abaxial surfaces of petals, on the exterior of the hypanthium, and on the superior part of the ovary. Although Holm (1907) found trichomes of two kinds on the leaves and stems of *Rhexia virginica*, all of the floral trichomes are alike. They resemble Holm's Fig. 6, except that the glandular heads are not papillose. Elsewhere in the Melastomataceae, a family noted for the great diversity of its trichomes, the *Rhexia* type has been figured from at least three genera, *Dissotis* (Feissly, 1964, Fig. 13), *Comolia* (Pflaum, 1897, Fig. 17) and *Sonerila* (Palézieux, 1899, Fig. 13B). *Feissly's* drawings convey quite accurately the dense cytoplasm of the head. This terminal structure does not usually persist through microtechnical procedures; almost all of the trichomes in our sections were "decapitated."

Before the flower opens, the stamens are bent inward in the manner characteristic for the family (Fig. 1), with their apices inserted in eight pockets around the upper part of the ovary. Ziegler's (1925) illustrations show that the pockets ("Gruben") in Melastomataceae with dimorphic stamens are of two depths, those ensheathing the long antesepalous stamens being much deeper than those ensheathing the antepetalous stamens. Adjacent pockets in *Rhexia* differ slightly in depth, even though all stamens are superficially alike, and cross sections through the tips of the incurved anthers indicate that the antesepalous stamens are actually a bit longer than their neighbors (Fig. 14).

[1]In order to appreciate the right-handedness of the configuration, it is necessary to imagine a "bug's-eye" view from inside the corolla or to hold up page 7 of Eichler's *Blüthendiagramme* and view his Fig. 1E through the opposite side by transmitted light. The normal botanist's-eye view of a flower bud, from above and outside the corolla, shows each petal overlapping its neighbor to the left. Readers who are interested in the history of this rather puzzling convention should consult Appendix C of B. Daydon Jackson's "A Glossary of Botanic Terms." (For additional confusion, see also Schoute, 1935, p. 25.)

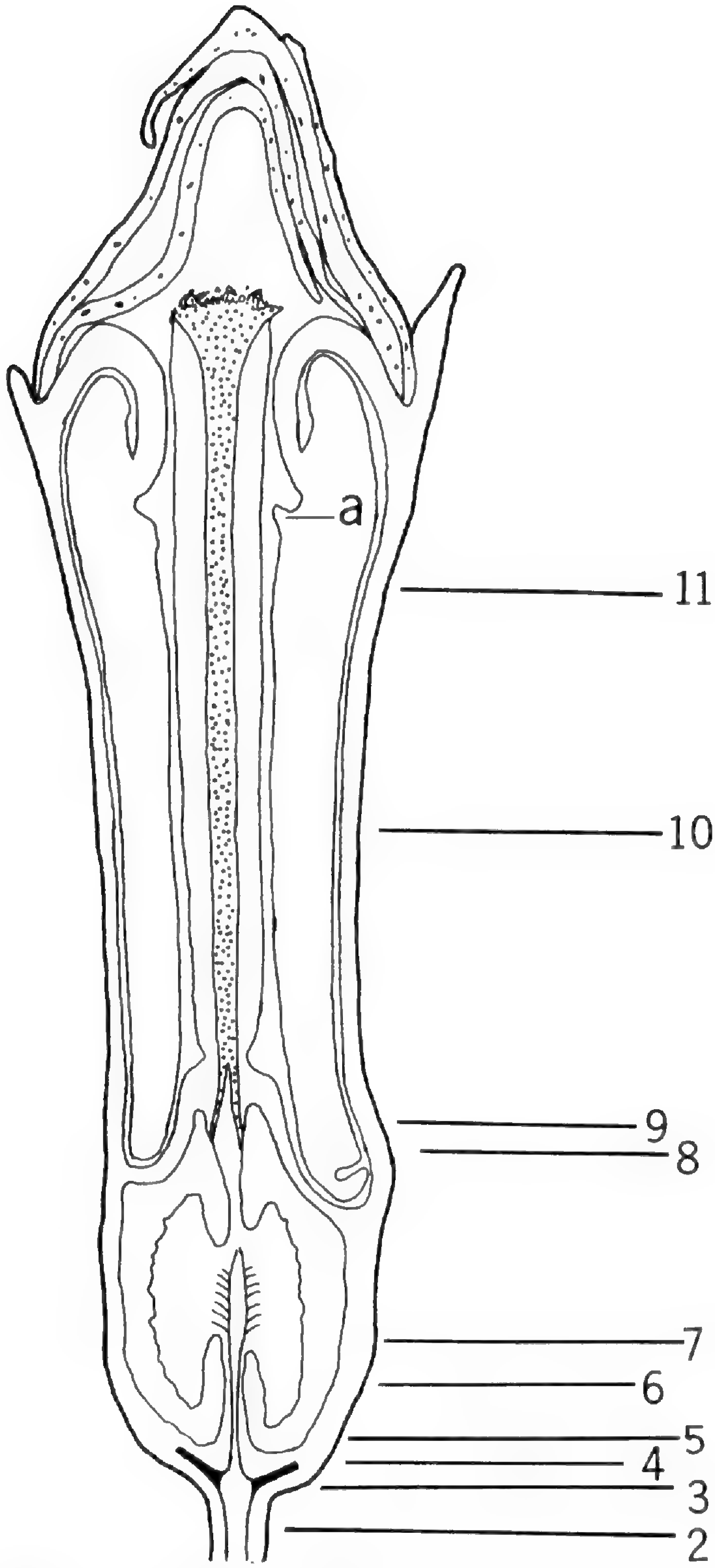
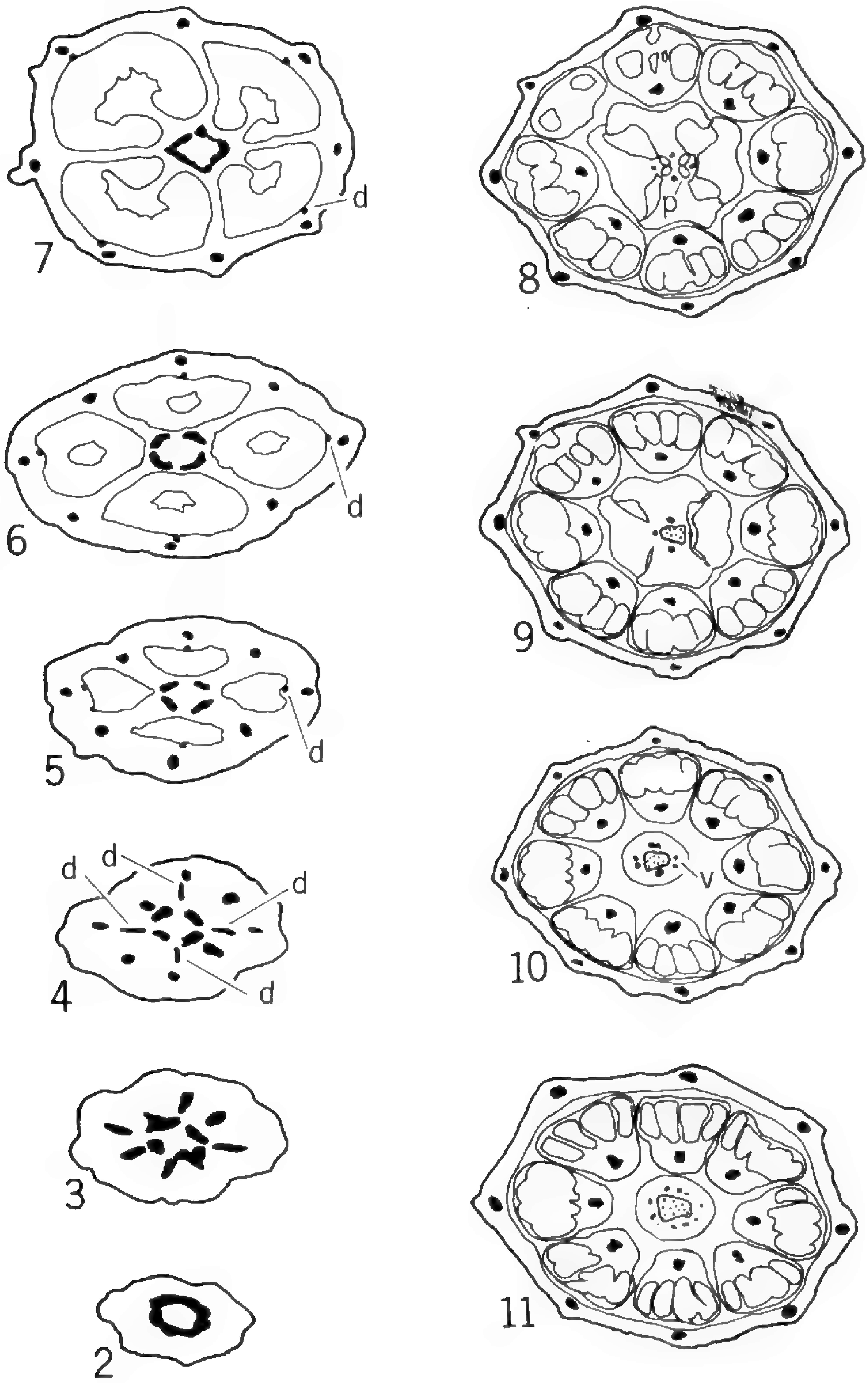



Fig. 1. Flower of *Rhexia virginica* before anthesis; diagram of longitudinal section. Numerals indicate levels of the sections in Fig. (Legend continued to foot of page 169)


7
d
8
p
6
d
9
5
d
10
v
4
d
d
d
d
3
11
2

VASCULAR SYSTEM

Melastomataceae is one of several families with internal phloem. This character can be observed in some of the floral vascular bundles of *Rhexia* when they are completely differentiated, but the position of phloem elements is somewhat variable and difficult to establish in many cross sections; therefore we have illustrated the vascular system in Fig. 1-11 without indicating xylem and phloem.

Major features of vasculation in the *Rhexia* flower can best be understood by following cross sections from base to apex, beginning with the vascular cylinder of the peduncle (Fig. 2). The lowermost vascular strands to separate from this cylinder are eight large bundles that pass through the hypanthium to perianth members and stamens. Our Fig. 3 shows six of the eight separating a bit lower than the other two (which in this case lead to two calyx lobes). We have found this "six-and-two" pattern to be common, but it seems to have no special significance. The next bundles to separate from the central cylinder are the four dorsal carpellary bundles (indicated by the letter d in Fig. 4-7). The dorsals consist of only a few cells in cross section and are therefore easily overlooked. They originate just below the locules and remain immediately adjacent to the locules throughout their length, ultimately ending in the "roof" of the ovary, below the styles.

It can be seen in cleared preparations that the central axis of the flower contains an anastomosing complex of longitudinal bundles from which numerous transverse placental bundles branch in ladder-like fashion (Fig. 1). The complex originates from the basal vascular cylinder, and represents the combined ventral bundles of the four carpels; however, individual ventrals are not clearly distinguishable below the stylar level. Instead, many cross sections show an almost complete vascular cylinder in the axis (Fig. 7); others show four patches of vascular tissue in a more or less square arrangement (Fig. 5, 6). In successively higher sections taken above the placentae, the amount of central vascular tissue decreases until only four slender strands remain in the superior part of the ovary, where they alternate with the four pollen transmitting tracts. (We have not attempted to show the distal continuation of the central vascular system in Fig. 1, but see Fig. 8-11). In the style the tracts merge in a broad column of transmitting tissue and each of the vascular strands divides, yielding four pairs of ventral carpellary bundles (Fig. 10) that branch irregularly below the stigma, forming an irregular ring in cross section (Fig. 11).

Four of the eight hypanthial bundles pass into the calyx lobes as midveins. The other four divide at the perianth level into three strands, a central strand supplying a petal and two lateral strands passing into the adjoining calyx lobes. In addition, each hypanthial strand provides a bundle to a stamen, this separation also occurring at the perianth level. All of these longitudinal bundles are united in the upper part of the hypanthium by a continuous transverse vascular complex that underlies the torus.

In common with many genera of Melastomataceae, *Rhexia* has a prominent appendage (Fig. 1) on the abaxial side of each stamen, vascularized exactly as Wilson (1950, Fig. 14) portrayed it. Wilson's interpretation that the vascularized appendages are vestiges of primitive telomes has not convinced other botanists (Eames, 1961, p. 133, 134; James, 1956, p. 209, 210; Leinfellner, 1958).

Floral vasculature of *Rhexia* resembles closely that of *Aciotis fragilis*, which Morley (1953, p. 264 and Fig. 44) chose as an example of a relatively unmodified member of the family. A difference worth noting, however, is that the

---

2-11. In many flowers, the dorsal appendage (a) of the anther is longer than the example shown here. Trichomes have been omitted from this and succeeding drawings.

Fig. 2-11. Cross sections of an unopened flower (cf. Fig. 1). Some of the diagrams include features from more than one section, and Fig. 7-11 are oriented somewhat differently from Fig. 2-6. All dorsal carpellary bundles (d) are labeled in Fig. 4, only one of the four in Fig. 5-7. p = pollen transmitting tissue (Fig. 8; stippled in Fig. 9-11); v = ventral carpellary bundles. Further explanation in text.

Plate 1351.

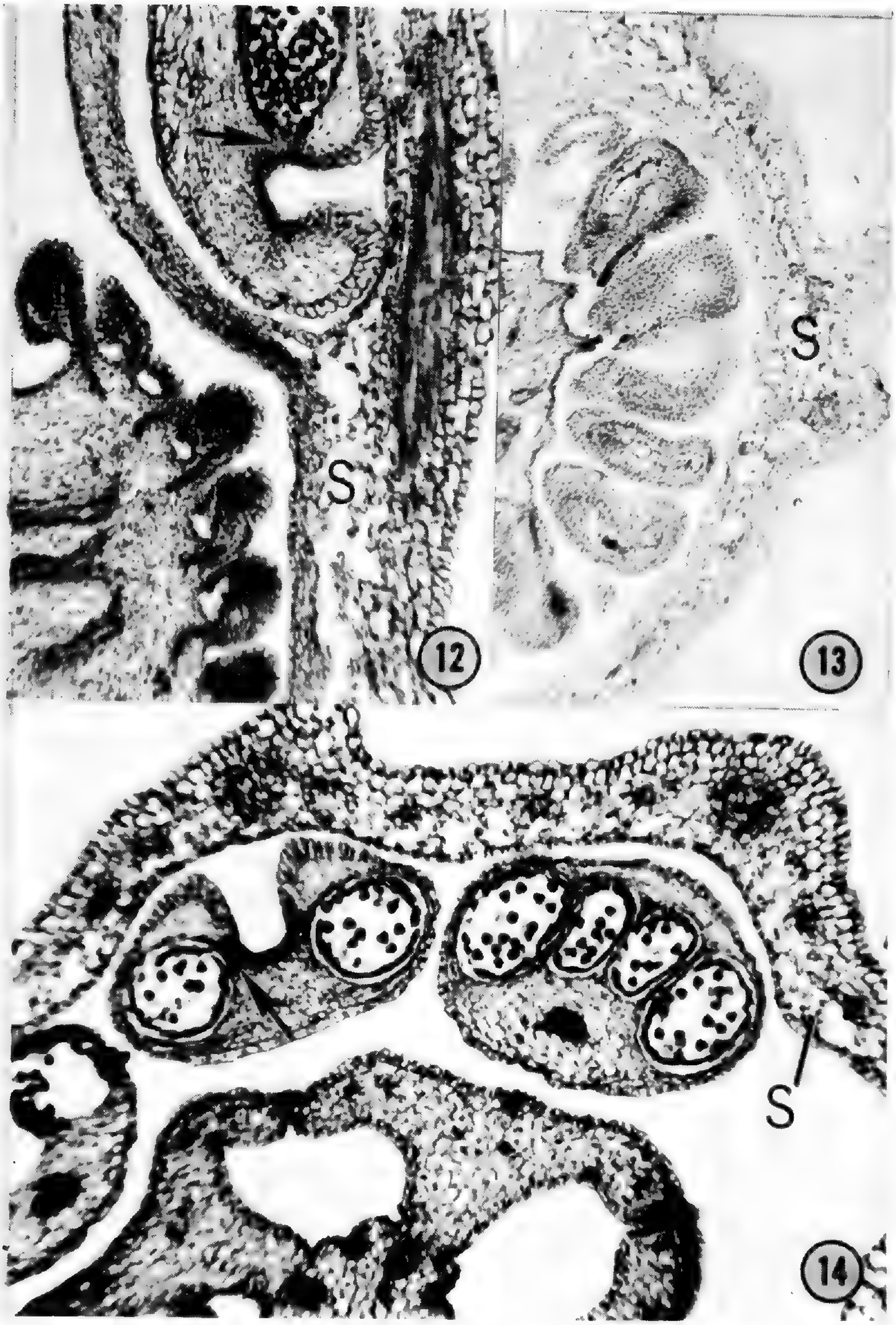



Fig. 12-14. Flowers of *Rhexia virginica* before anthesis, showing aerenchyma (s) of ovary wall and hypanthium. Arrows on anthers indicate "Öffnungsgewebe" of Ziegler (see text). — Fig. 12. l.s., ×85. — Fig. 13. x.s. through inferior part of ovary, ×60. — Fig. 14. x.s. through hypanthium and anthers. Section passes through pore in antipetalous anther, but pores of adjoining anthers are below plane of section; this suggests a slight dimorphy in length of stamens, ×90.

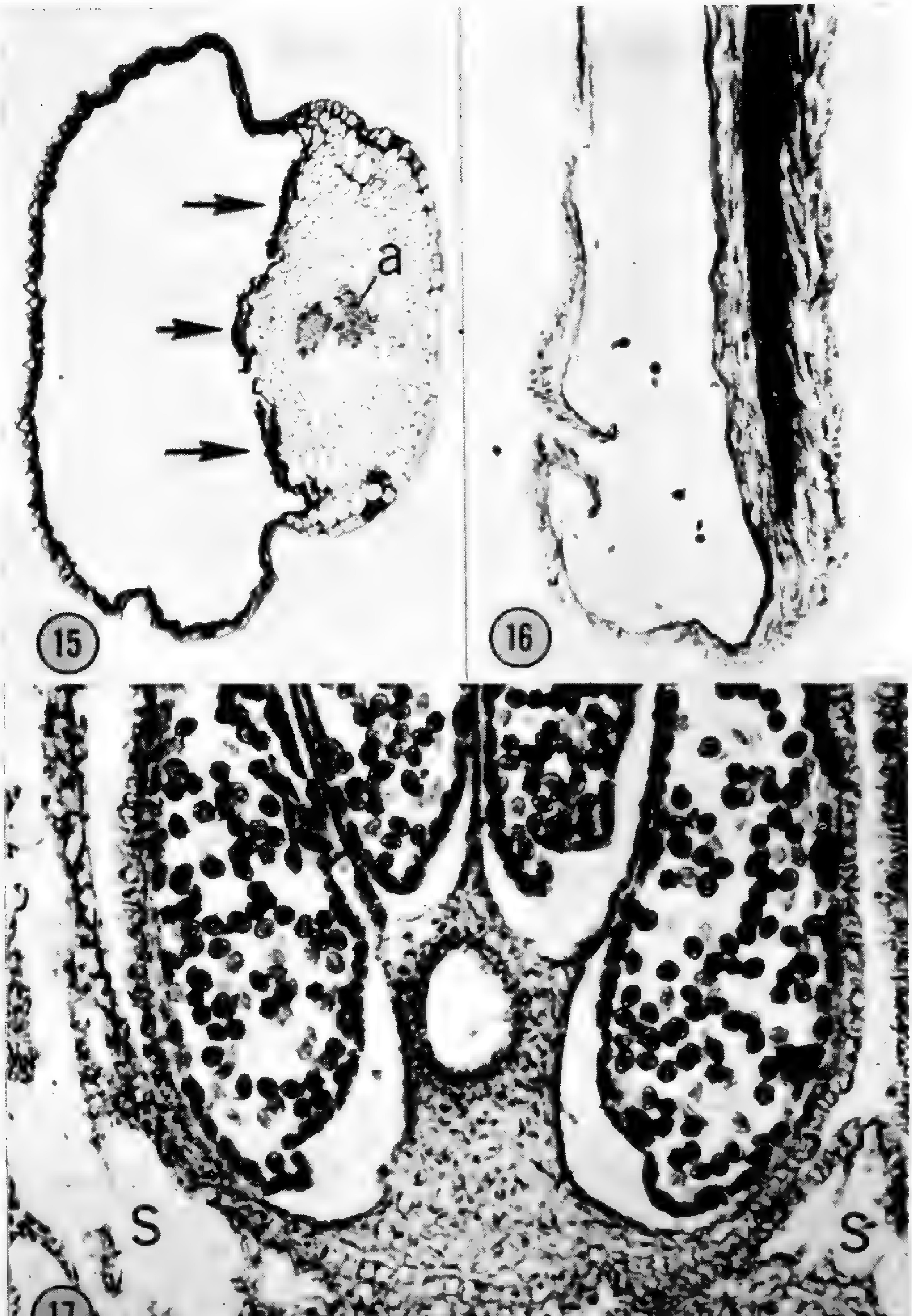



Fig. 15-17. Stamens of *Rhexia virginica.* — Fig. 15. Empty anther, x.s. showing crushed remnants of septa (arrows); vascular tissue on right (a) supplies dorsal appendage, $\times 70$. — Fig. 16. Tip of anther, median l.s. showing pore, a few remaining pollen grains, $\times 55$. — Fig. 17. Tip of anther before anthesis, l.s. roughly paradermal to hypanthium, showing pore (center) and four sporangia. Separation of aerenchyma tissue (s) has been exaggerated in the preparation of sections, $\times 220$.

dorsal carpellary bundles in *Aciotis,* and in other genera that Morley figures, extend into the styles; whereas in *Rhexia* the dorsals terminate at the stylar base, and the ventral complex supplies the style.

## HISTOLOGY OF OVARY WALL

In its basal, inferior portion, where carpellary tissues merge indistinguishably with hypanthial tissue, the compound ovary wall of an immature flower comprises 8-12 cell layers. The free portion is thinner, about six cell layers in most places. It is thinnest along the midline of each carpel (Fig. 8, 9, 14), where the cells do not enlarge appreciably during growth, a phenomenon related to the presence of the poorly differentiated dorsal bundle. Dehiscence of the mature fruit begins along these dorsal midlines, and is thus loculicidal.

During development, druses become abundant in cells of the gynoecium, as elsewhere in the flower. Other types of crystals, tannin cells, and isolated sclereids are absent.

Cells of the very young ovary wall are rectangular in outline when examined in transverse or longitudinal sections, and the epidermal layers retain this appearance as the flower develops (except where papillae and multicellular trichomes develop on the outer epidermis). Cells of the layer subjacent to the outer epidermis also remain rectangular in outline. In the inferior part of the ovary, however, the deeper cell layers develop intercellular spaces (Fig. 12, 13). The result is a tissue much resembling the spongy mesophyll of leaves, the individual cells being very irregular in form. Similar developmental changes take place in the free portion of the hypanthium (Fig. 14), but not in the superior part of the ovary wall. The aerenchymatous zone is one of irregular cell contact, where separation occurs quite easily during the preparation of sections (see especially Fig. 17). In the same manner, tissues in the inferior part of the ovary can separate — beginning in the radii between the staminal pockets — when flowers and fruits dry under natural conditions or in a plant press. To an observer aided only by hand lens and razor, the ovary may then appear completely superior.

ANTHER

Unilocular anthers are known to occur in several plant families, but the unilocular condition is brought about in most cases by the ontogenetic union of two locules (Maheshwari, 1950, p. 39). The condition found in *Rhexia* — four locules uniting at maturity to form one — is rare.[2] As in some other Melastomataceae (cf. *Centradenia, Heeria;* Ziegler, 1925), sporangia develop in a parallel arrangement. *Rhexia* is believed to be the only genus of the family, however, in which all three septa regularly deteriorate before anthesis (see James, 1956, p. 204, for comments on this point by Asa Gray and contemporaries). At early stages of development each septum is made up of three or more cell layers, but the cells gradually disintegrate through the activity of the uninucleate tapeta. Eventually the tapetum of one sporangium is juxtaposed to that of the neighboring sporangium with only fragments of cell walls between them. Rupture of these tenuous partitions occurs more or less simultaneously throughout the length of the anther (Fig. 8-11), and the central septum persists no longer than the others. The breaks occur toward the adaxial side, so that cross sections prepared after pollen has escaped show the flattened remnants of septa on the connective side (Fig. 15).

At the time of dehiscence, the anther wall comprises two cell layers, neither of which has the irregular banded wall thickenings of the "endothecium" or "fibrous layer"[3] in a typical textbook anther. Some local modification of the epi-

[2]Eames (1961, p. 114) gives as examples *Arisaema, Callitriche, Clusia,* but cites no references. We have come across published comments on anther development only for *Callitriche.* Anthers of the latter have a very different form from those of *Rhexia,* and unilocularity develops only near the apex; the lower part of the anther is bilocular at maturity (Hegelmaier, 1864, p. 39).

[3]See Eames (1961, p. 125, 138) for a discussion of these terms. Some Melastomataceae do have a fibrous layer. In lacking a fibrous layer, *Rhexia* resembles *Melastoma malabathricum* and *Mouriri guianensis.* (Subramanyam, 1948; Venkatesh, 1955).

dermal cells takes place during development, those at the base of the anther becoming papillose, and those surrounding the pore becoming transversely elongate (Fig. 12, 14, 16), but overall thickening of the cell walls is negligible.

Pollen emerges through a solitary pore located near the apex of the anther on its adaxial side. The pore is circular to elliptical in sectional outline (Fig. 17) and only about .05 mm in diameter.[4] It originates as a distinct depression early in the development of the anther. About five layers of cells surrounding the interior of the pore and separating it from the sporogenous tissue remain small and stain densely throughout the development of the anther (Fig. 12, 14). Ziegler (1925) used the term "Öffnungsgewebe" to describe an identical tissue in *Centradenia*, the anthers of which are histologically similar to those of *Rhexia*. The small size and dense appearance of the cells invite comparison with the "resorption tissue" by which anthers of certain Ericaceae dehisce. To judge from publications on Ericaceae, however, cells surrounding the *Rhexia* pore differ in two ways: (1) they lack the calcium oxalate crystals of ericaceous resorption tissue (Matthews & Knox, 1926), and (2) they do not "become converted into an amorphous, apparently fluid mass" (Copeland, 1943).

In most families with poricidal anthers, a derivation from septicidal dehiscence is evident upon inspection, for the pores are in pairs, are somewhat elongate along the lateral furrows, and open with the aid of a fibrous layer (Leclerc du Sablon, 1885). Complete transitions can be shown in some plant groups from anthers opening longitudinally to anthers opening apically (see, for instance, Venkatesh, 1957). A similar progression has been proposed for Melastomataceae (Venkatesh, 1955) but the evidence involves only *Memecylon* and *Mouriri*, genera rather remote from *Rhexia* and its allies. Anthers of *Memecylon* open the "normal" way, by two complete longitudinal slits; whereas the two slits in *Mouriri* are restricted toward the apex, supposedly

[4]Pore size is one of the characters used by James (1956) to subdivide *Rhexia* into two series of species.

indicating an evolutionary stage through which all poricidal Melastomataceae have passed. As far as we are aware, however, no one has illustrated a series of transitional forms[5] between the paired, linear openings of *Mouriri* and the solitary, circular, centrally situated pore of *Rhexia.* One might therefore propose a somewhat different explanation: that the small, rounded pore evolved as a new structure, beginning as a functionless subapical indentation between the outer anther sacs and assuming its present importance when longitudinal dehiscence was lost. Additional comparative studies of melastomataceous anthers would be very desirable.

Geotropism in the androecium of *Rhexia* deserves comment. Open flowers are oriented with floral axis away from the vertical and toward the horizontal position. Since the emerging anthers are reflexed and the pore is located on the adaxial side, the apical end of the lowermost anther (nearest the earth's surface) hangs downward with its pore directed outward. All of the other anthers are brought into positions approximately parallel to this one by a counterclockwise (as viewed from outside) twisting of the filaments, the filament farthest from the earth twisting 180°. It is interesting that in *Monochaetum,* a genus placed next to *Rhexia* in Cogniaux's (1891) monograph of Melastomataceae, the pore is located on the abaxial side of the anther. Nevertheless, the outward orientation of all pores becomes the same as in *Rhexia,* because in *Monochaetum* the lower stamens twist and the uppermost stamen does not (Troll, 1922; Ziegler, 1925). According to Ziegler, the upper filaments of *Tibouchina* twist like those of our *Rhexia* flowers. The result is the same in the three genera: all pores open toward insect visitors.

Leggett (1881) reported that the lower part of the *Rhexia* anther acts as a bellows, causing puffs of pollen to

[5]Dr. Wurdack suggests *Miconia* as a genus to examine for such transitional forms, but he adds that an adequate range of fluid-preserved material would be hard to obtain.

emerge forcefully from the pore when pressed by a bumblebee's "foot" or a pointed object in a botanist's hand. We have verified this in company with Dr. Wurdack, using a dissecting needle to apply the pressure and observing the resulting puff of pollen through a stereomicroscope. Dr. Wurdack suggests that in nature the pollen gathering behavior of the bee may be more complex than this simple observation would indicate, for he has noticed an unusually vigorous buzzing of bumblebees while they are visiting his *Rhexia* plantings. Vibrations by bee visitors are known to play a role in the floral biology of *Melastoma malabathricum* (Pijl, 1954) and of some other plants in which anthers have apical pores (Michener, 1962). The older literature describes additional complexities in the behavior of insects visiting Melastomataceae (for review, see Harris, 1905, p. 229). Accordingly, the floral biology of *Rhexia* might well be worth the attention of an enterprising graduate student with a flair for cinematography.

DEPARTMENT OF BOTANY
SMITHSONIAN INSTITUTION, WASHINGTON, D. C.

DEPARTMENT OF BOTANY
UNIVERSITY OF NEW HAMPSHIRE, DURHAM

LITERATURE CITED

BERSIER, J. -D. and G. BOCQUET. 1960. Les methodes d'éclaircissement en vascularisation et en morphogénie végétales comparées. Arch. Sci. **13**: 555-566.

COGNIAUX, A. 1891. Mélastomacées, Vol. 7, 1256 pp. *In* A. and C. de Candolle, Monographiae Phanerogamarum. Paris, G. Masson.

COPELAND, H. F. 1943. A study, anatomical and taxonomic, of the genera of Rhododendroideae. Am. Midland Nat. **30**: 533-625.

EAMES, A. J. 1961. Morphology of the angiosperms. New York, McGraw-Hill. xiii + 518 pp.

EICHLER, A. W. 1875, 1878. Blüthendiagramme construirt und erläutert. Leipzig, W. Engelmann. viii + 575 pp. [Erster Theil, 1875; Zweiter Theil, 1878]

FEISSLY, C. 1964. Sur l'ornementation du tube calicinal de quelques Osbeckiées Africaines. Bull. Soc. Neuchâteloise Sci. Nat. **87**: 137-170.

FERNALD, M. L. 1950. Gray's Manual of Botany. Ed. 8. New York, American Book Co. lxiv + 1632 pp.

FUCHS, C. 1963. Fuchsin staining with NaOH clearing for lignified elements of whole plants or plant organs. Stain Technol. **38**: 141-144.

GLEASON, H. A. and A. CRONQUIST. 1963. Manual of vascular plants of northeastern United States and adjacent Canada. Princeton, N. J., Van Nostrand. li + 810 pp.

HARRIS, J. A. 1905. The dehiscence of anthers by apical pores. Missouri Bot. Gard. Ann. Rep. **16**: 167-257.

HEGELMAIER. F. 1864. Monographie der Gattung *Callitriche*. Inauguralabhandl. Naturwiss. Fak. Univ. Tübingen. Stuttgart. 64 pp., 4 pl.

HOLM, T. 1907. Morphological and anatomical studies of the vegetative organs of *Rhexia*. Bot. Gaz. **44**: 22-33; pl. 1, 2.

JAMES, C. W. 1956. A revision of *Rhexia* (Melastomataceae). Brittonia **8**: 201-230.

LECLERC DU SABLON. 1885. Recherches sur la structure et la déhiscence des anthères. Ann. Sci. Nat., 7. sér. Bot. **1**: 94-134; pl. 1-4.

LEGGETT, W. H. 1881. Fertilization of *Rhexia virginica* L. Bull. Torrey Club **8**: 102-104.

LEINFELLNER, W. 1958. Zur Morphologie des Melastemaceen-Staubblattes. Österr. Bot. Zeitschr. **105**: 44-70.

MAHESHWARI, P. 1950. An introduction to the embryology of angiosperms. New York, McGraw-Hill. x + 453 pp.

MATTHEWS, J. R. and E. M. KNOX. 1926. The comparative morphology of the stamen in the Ericaceae. Trans. Proc. Bot. Soc. Edinburgh **29**: 243-281.

MICHENER, C. D. 1962. An interesting method of pollen collecting by bees from flowers with tubular anthers. Rev. Biol. Trop. **10**: 167-175.

MORLEY, T. 1953. The genus *Mouriri* (Melastomataceae); a sectional revision based on anatomy and morphology. Univ. Calif. Publ. Bot. **26**: 223-312.

PALÉZIEUX, P. DE. 1899. Anatomisch-systematische Untersuchung des Blattes der Melastomaceen mit Ausschluss der Triben: Microlicieen, Tibouchineen, Miconieen. Bull. Herb. Boissier **7**, Appendix 5. 85 pp., 3 pl.

PFLAUM, F. 1897. Anatomisch systematische Untersuchung des Blattes der Melastomaceen aus den Triben: Microlicieen und Tibouchineen. Dissertation. K. Bayr. Ludwigs-Maximilians-Universität, München. 91 pp., 2 pl.

PIJL, L. VAN DER. 1954. *Xylocopa* and flowers in the tropics. III — Observations on some Papilionaceae, *Melastoma*, *Calotropis*, *Cassia* and some orchids, with general considerations. K. Nederl. Akad. Wetensch. Proc. C. **57**: 553-562.

SCHOUTE, J. C. 1935. On corolla aestivation and phyllotaxis of floral phyllomes. Verh. K. Akad. Wetensch. Amsterdam, Afd. Natuurkunde (Sect. 2). Deel 34, No. 4, 77 pp.

SUBRAMANYAM, K. 1948. An embryological study of *Melastoma malabathricum* L. Jour. Indian Bot. Soc. **27**: 11-19.

TROLL, W. 1922. Über Staubblatt- und Griffelbewegungen und ihre teleologische Deutung. Flora **115**: 191-250; Taf. IV-VI.

VENKATESH, C. S. 1955. The structure and dehiscence of the anther in *Memecylon* and *Mouriria*. Phytomorphology **5**: 435-440.

———. 1957. The form, structure, and special ways of dehiscence of anthers of *Cassia* — III. Subgenus *Senna*. Phytomorphology **7**: 253-273.

WILSON, C. L. 1950. Vasculation of the stamen in the Melastomaceae with some phyletic implications. Am. Jour. Bot. **37**: 431-444.

ZIEGLER, A. 1925. Beiträge zur Kenntnis des Androeceums und der Samenentwicklung einiger Melastomaceen. Bot. Arch. **9**: 398-467.

# THE PERSISTENCE OF THE DOUBLE-FLOWERED FORM OF CELANDINE POPPY.

In September of 1917 Karl Sax of the Bussey Institution sent to the editors of *Genetics* an article entitled "The Inheritance of Doubleness in *Chelidonium majus* Linn." which was published in that journal the following year (*Genetics* 3: 300-307. 1918). The origin of the material Sax studied was not specified beyond the fact that "a double- and a single-flowered plant growing near the Bussey Institution were transplanted and reciprocal crosses made." Sax does not make clear whether the plants he obtained were under cultivation or spontaneous as a portion of the weedy flora. Apparently no herbarium specimens were prepared of the material studied and spontaneous plants were not found, recorded or preserved by Palmer in his study of the spontaneous flora of the Arnold Arboretum grounds (*Journal Arnold Arb.* **11**: 100. 1930). Across South Street from the headquarters and the greenhouses of the Bussey Institution the Arnold Arboretum built a house which was occupied by E. H. Wilson from its construction until his death in 1931 and subsequently by Karl Sax. To the rear of this house is a low marshy area of land which has served as a dumping ground for greenhouse soils, pruning debris and discarded plants from the nurseries and experimental plots. Recently it has been possible to fill this marshy area more rapidly and so a routine examination of the area was made for unusual plants which might be effected by changes of soil level or of drainage or which should be preserved from damage through the filling process. This survey revealed a small population of *Chelidonium majus* with single- and double-flowered plants intermixed. We suspect that these are the descendants of the plants Sax had studied and had discarded in the swampy area. A set of specimens was prepared to record the presence of the double-flowered form in 1966 and in the process of preparing labels for these specimens a problem of nomenclature of the form and a conflict of names was discovered.

References to a double-flowered form of *Chelidonium majus* in the literature are numerous but specimens of such forms are exceedingly rare in herbaria. J. Gilbert in 1798 (*Histoire des Plantes de Europe* 1: 167. 1798) acknowledged that in cultivation a double-flowered form was produced. De Candolle (*Regni Vegetabile Systema Naturale* 2: 99. 1821) refers to both simple and double forms in his treatment of *Chelidonium majus*. Nicholson in the first edition of the *Dictionary of Gardening* (1: 310. 1884) noted that there was "also a double-flowered form." Henslow (*British Wild Flowers in Their Natural Colours and Form* 18. 1910) stated "*C. grandiflorum* from Dahuria, *C. laciniatum* from South Europe, and the double form of our own wild species are cultivated as garden plants." However, the treatment of the genus in *Flora Europaea* (1: 251. 1964) makes no mention of the double-flowered form, and no name for this appears in the contemporary European floras examined. It has been possible to check the herbaria at Edinburgh, Kew, and the British Museum and no double-flowered specimens were found.

The date of the introduction of the double-flowered form into the United States is not recorded and the extent of its distribution is unknown. None of the editions of Gray's *Manual of Botany* or of the Britton and Brown *Illustrated Flora* or the local floras examined makes any mention of the existence of a double-flowered Celandine Poppy. There are only two such specimens in the herbarium of the New England Botanical Club: one from Milton, Massachusetts collected in 1917, and one from Fairfield, Connecticut collected in 1937. No specimens have been found in herbaria at New York, Washington, or Philadelphia.

Bailey's *Manual of Cultivated Plants* (p. 428. 1949) calls *Chelidonium* a monotypic genus in temperate Europe and Asia comprising a biennial or perennial herb, often in old gardens, sometimes double-flowered. An inquiry to the Bailey Hortorium was answered with the information that several European nurseries offered seed of a "Chelidonium majus florepleno" and that a varietal name had been published in 1955. I am grateful to the staff at the Bailey Hortorium for the suggestions which prompted a search of various nursery catalogues and seed lists of botanical gardens. A seed list from the botanical garden at Antwerp for example (1963 *Delectus Sporarum Seminum Fructuum, Hortus Botanicus Antverpiensis,* p. 12. 1963) shows that the name "Chelidonium majus L. flore-pleno" is still in use in the 1963 edition, although no valid publication of the name can be found.

The description of the double-flowered variety was pubished by André Lawalrée in 1955 (*Brussels Bull. Jard. Bot. de l'Etat* B **25**: 409, 410. 1955) with the name *Chelidonium majus* var. *pleniflorum* Lawalrée. He indicated the variety had up to 20 petals with 7-14 stamens. The holotype in the Brussels herbarium was collected by *J. Tijskens s. n.* in May 1953 in the district Campinien, Bonheiden along the route to Malines above the village of Kiwit in Belgium. A search of the scanty European collections in the Gray Herbarium then revealed one double-flowered specimen collected by Keinheinz near Potsdam in 1962. This discovery prompted an examination of Parey's *Blumengärtnerei* where (2nd ed. **1**: 679. 1958) the treatment of *Chelidonium* prepared by C. R. Jelitto used the name *C. majus* var. *plénum* Wehrh. a reference we found repeated in the seed list of the Leiden Botanical Garden issued in 1954 *(Hortus Botanicus Academicus Lugduno-Batavus, Delectus Seminum* 19. 1954). Finally, the description of the double-flowered form by H. R. Wehrhahn was found in *Die Gartenstauden* (**5**: 464. 1930) as *Chelidonium majus* L. "var. *plenum* hort. Mit gefüllten Blüten. Merkwürdig ist, dasz alle (auch die hier nicht genannten Formen) völlig samenbeständig sind."

This tortuous search for a name, an authority and a description comprising valid publication was given in detail to indicate the significance and the close relationship of horticultural and botanical literature. Perhaps the double-flowered *Chelidonium majus* existing as a cultivated plant should be regarded as a cultivar and named as *Chelidonium majus* 'Plenum.' Its existence as a weed persisting in a dump area indicates it is also a part of the local flora of Massachusetts and as such its correct name had to be sought and found in the literature of cultivated plants in Europe.

The correct name for a double-flowered Celandine Poppy is: **Chelidonium majus** L. var. **plenum** Wehrhahn, *Die Gartenstauden* 5: 464. 1930.

*C. majus var. pleniflorum* Lawalrée, Brussels Bull. Jard. Bot. de l'Etat 25: 409, 410. 1955.

*C. majus* L. 'Flore-pleno' Hort. lacking known valid publication.

Specimens seen. United States. Massachusetts: Jamaica Plain, *R. A. Howard 16101* (NEBC), Milton, *N. T. T. Kidder s. n.* (NEBC). Connecticut: Fairfield, *E. H. Eames 11829* (NEBC).

The persistence of the collection from which Sax may have obtained his material for a period of 50 years led us to re-examine the nature of the double-flowered form. Sax's breeding experiments were not repeated but a simple count was made of floral parts of mature double flowers selected from 100 different plants. These showed petals ranging in number from 12 to 22 in individual flowers, averaging 18. 19, while the stamens of the same flowers ranged in number from 6 to 19 and averaged 11.52. The average total number of petals and stamens in the double forms was 29.71. From his breeding experiments Sax had concluded that the double-flowered form was recessive and the variation in petal number and of stamen number was greater than in the single-flowered forms. However, he found that the sum of the petal number and the stamen number was about the same in all individuals whether single- or double-flowered. The mean sum of the petals and the stamens of the double-flowered forms in Sax's report was 29.49.

There appears to have been little change in the population of the double-flowered Chelidonium when left alone for 50 years.

RICHARD A. HOWARD
ARNOLD ARBORETUM
JAMAICA PLAIN, MASS.

# PALYNOLOGICAL NOTES ON AMERICAN SPECIES OF HELIANTHEMUM (CISTACEAE)

Robert L. Wilbur and James D. Perry[1]

Heydacker (1963) presented palynological evidence purportedly demonstrating that certain American species of the cistaceous genus *Helianthemum* Mill. *sens. lat.* were actually generically distinct and should be considered instead as members of the New World segregate *Crocanthemum* Spach *sens. str.* Since one of us (Daoud and Wilbur, 1965) recently concluded otherwise in connection with a revision of the North American species, an investigation of the pollen of the twenty species recognized from that area and *H. brasiliense* Lam. from eastern South America was undertaken in an effort to evaluate Heydacker's contention.

*Crocanthemum* was originally described by Spach (1836) to include those American species which he thought possessed only petaliferous flowers. Those American species which he believed to have both petaliferous and apetalous flowers were assigned to his genus *Heteromeris* while species thought to be characterized by only apetalous flowers comprised his genus *Taeniostema.* These three New World genera were judged to be clearly separable from the Old World genera in that they supposedly possessed the combination of alternate, estipulate leaves and short, erect styles.

Many authors have treated all the American representatives of *Helianthemum sens. lat.* as members of the segregate *Crocanthemum sens. lat.* characterized by the above mentioned alternate, estipulate leaves and short, straight styles. Britton (Ill. Fl. N. U.S. 2: 539-541. 1913), Bicknell (Bull. Torrey Club **40:** 613-616. 1913), Janchen (Österr. Bot. Zeitschr. **71:** 266-270. 1920 and Engler and Prantl's Nat. Pflanzenfam. 2 Aufl. 21: 289-313. 1925) and Barnhart (Small's Man. Se. Fl. 878-880. 1933) have all employed *Crocanthemum* in this broadened concept rather than in

[1]Work on this paper was carried out with the support of the National Science Foundation Grant G18799.

the original restricted usage for species supposedly characterized by the presence of only petaliferous flowers.

Fernald (Rhodora 43: 609-615. 1941) has presented the most careful appraisal of the generic status of *Crocanthemum* known to us. He concluded that there was no justification for the generic segregation of the American species since the morphological features examined supposedly characterizing the genera prove highly inconstant. Such a failing would also cast doubt upon the naturalness of the same groups treated as subgenera or sections. The generic and infrageneric classification of the Cistaceae is not presently in a satisfactory state and doubtless can only be improved by the acquisition of comparative data from numerous botanical subdisciplines. Cytological data on this family are accumulating from the Mediterranean area and Europe and offers promise of providing another useful guide for supraspecific classification within the Cistaceae when a larger percentage of the species have been examined. Only one count has been reported for the approximately forty-five species of the family found in this hemisphere. It seems likely, judging from the limited data already obtained, that systematically meaningful clues to relationship may be derived from detailed palynological studies but in our opinion reclassification is unwarranted until a much broader survey of the family has been undertaken.

Brizicky (1964), like Fernald, concluded that there was not yet sufficient evidence to support the generic segregation of the American species but noted Heydacker's palynological evidence supposedly favoring the retention of apparently all American species within a special section ["tribu"] of *Helianthemum* except for *H. carolinianum* (Walt.) Michx. and *H. brasiliense* (Lam.) Pers. The supposedly very distinctive pollen of these two species convinced her of the validity of *Crocanthemum's* claim for generic recognition.

Heydacker (1963) studied the pollen of 55 species of the Cistaceae and concluded that the palynological evidence supported the recognition of the following seven genera:

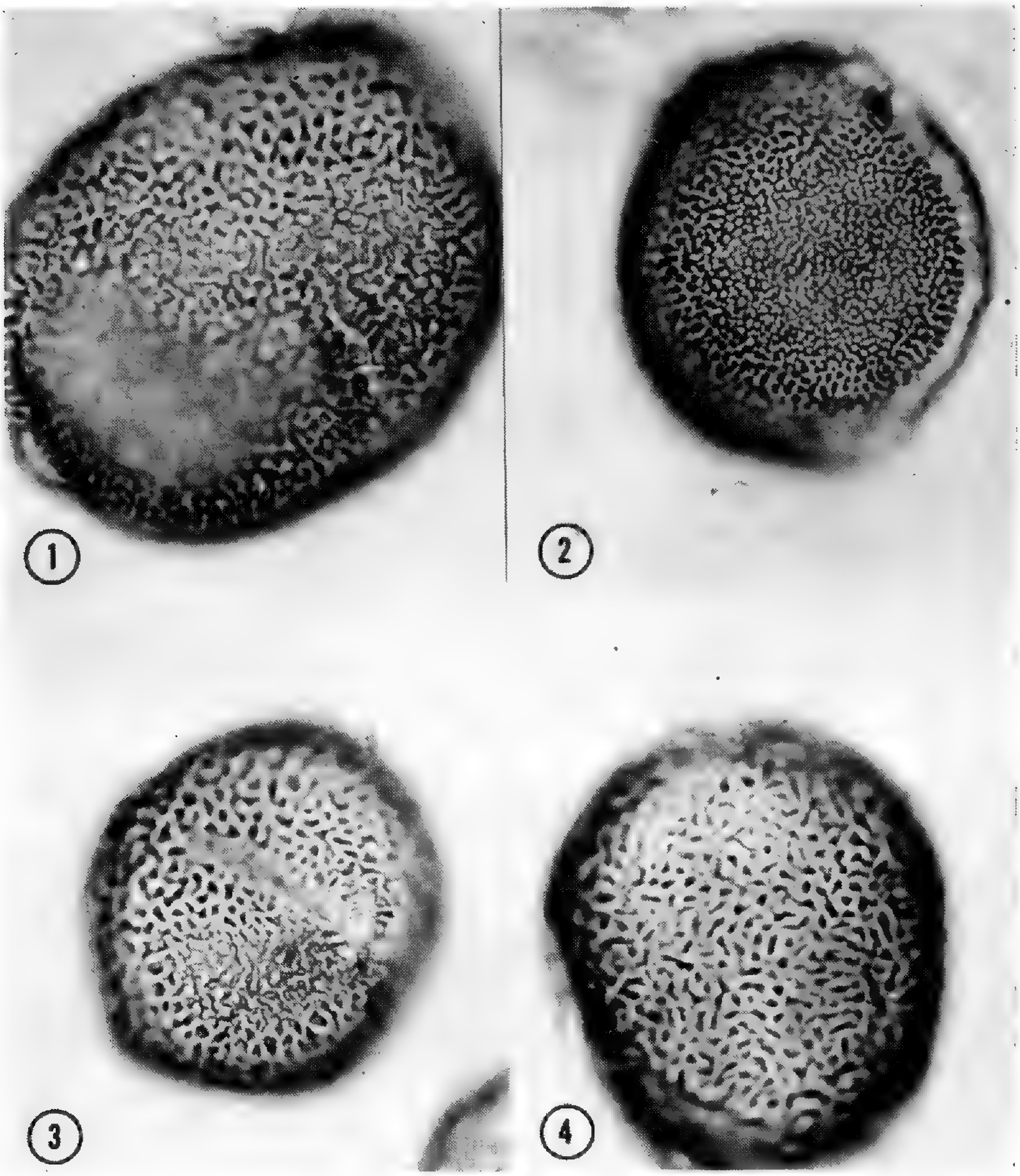
*Cistus* L., *Crocanthemum* Spach, *Fumana* (Dun.) Spach, *Halimium* (Dun.) Spach, *Helianthemum* Mill., *Hudsonia* L. and *Lechea* L. Unfortunately, Heydacker did not name more than a quarter of the species examined and it is not possible to learn from her account how many species in each genus or how many specimens of each species were examined. Surprisingly enough, Heydacker concluded from palynological evidence that the small Old World genus *Tuberaria*, which is often included within *Helianthemum* itself, is not worthy of generic recognition and on the basis of its pollen might better be included within *Cistus* rather than *Helianthemum*. This conclusion is startlingly in contradiction to the evidence provided by the morphology of the flower and fruit. In contrast Jean and Pons (1963) concluded that palynology supported generic status for *Tuberaria* but demonstrated it to be more similar to *Helianthemum* than to *Cistus*.

The pollen of *Helianthemum* was said by Heydacker to be more elongate than that of the other cistaceous genera and also to be the largest in the family (approximately 80 $\mu$ long). She found that the American representatives of *Helianthemum* examined did not conform with their European congeners, for grains of the former often were equiaxial or even shorter than wide. The ratio of polar to equatorial measurements (P/E) of the European representatives was reported to be from 1.2-1.6. The exine proved variable but in the pictured example was striate and rather finely ridged at the base of the elevated striations.

The pollen of *Crocanthemum*, of which both *C. brasiliense* (Lam.) Spach and *C. carolinianum* (Walt.) Spach were examined, was said to be very distinctive. She reported the pollen to be subspherical or slightly short-axial with a P/E ratio of about 0.8. The thickened exine was reportedly reticulate with rather thick or enlarged bases to the elevated network.

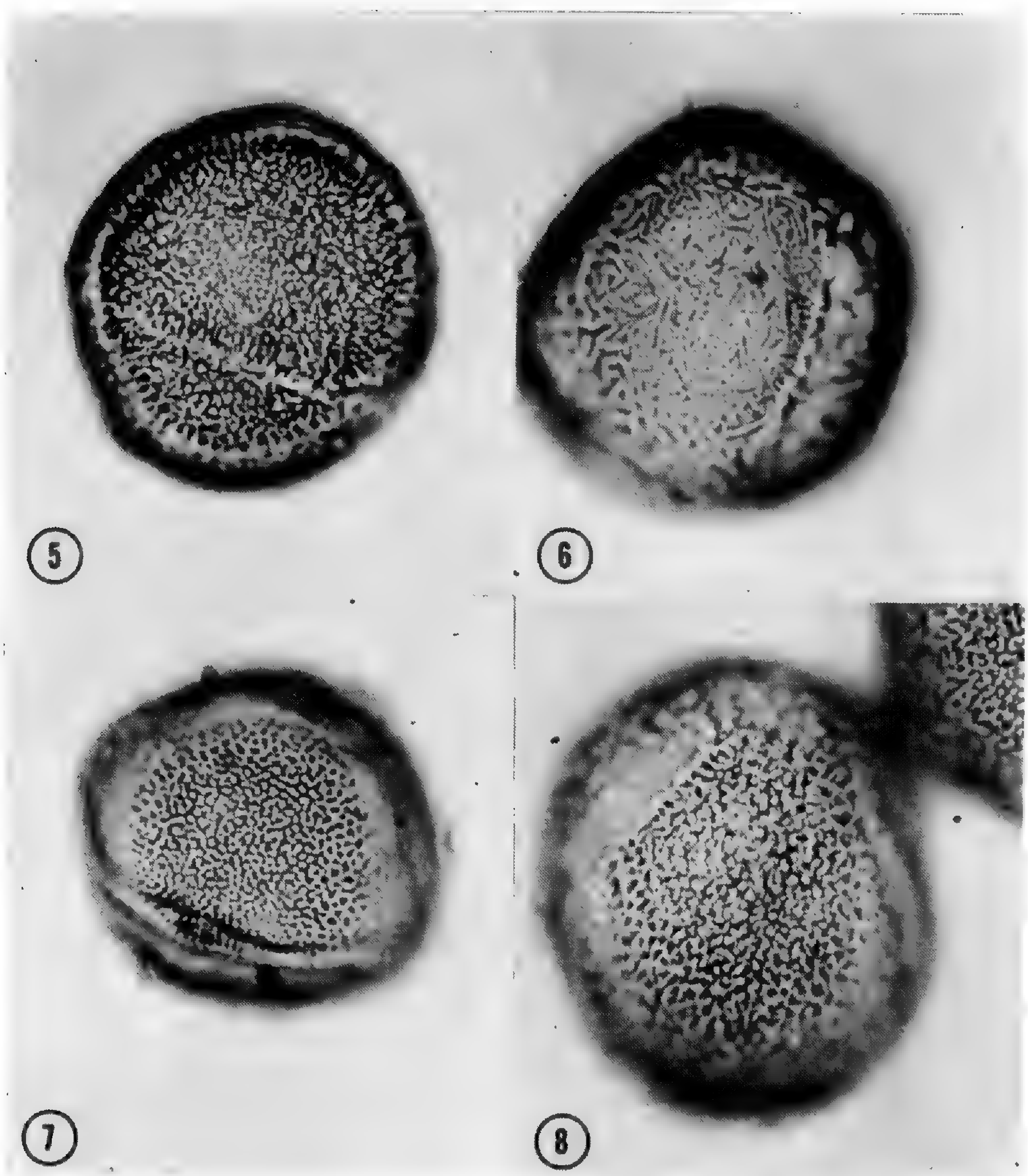
The pollen for our study was prepared for examination by the acetolysis method of Erdtman (1960) from anthers carefully excised from chasmogamous flowers. The prepa-

Plate 1353.




Figs. 1-4. Fig. 1. *Helianthemum brasiliense.* Fig. 2. *H. corymbosum.* Fig. 3. *H. arenicola.* Fig. 4. *H. carolinianum.*

Plate 1354.



Figs. 5-8. Fig. 5. *Helianthemum concolor.* Fig. 6. *H. canadense.* Fig. 7. *H. nutans.* Fig. 8. *H. greenei.*

ration of the slides was made by Mrs. Shirlee Cavaliere and Mrs. Myra Stewart of Professor D. A. Livingstone's laboratory. We are most appreciative of their assistance. The advice and aid of Dr. Livingstone were most helpful but any mistakes or errors contained in this paper are to be attributed to the authors alone.

A Spencer microscope with 10 X oculars and a 44 X objective was used for measurements which were made to the nearest optical line (1 line = 1.52 $\mu$). Data for Table 1 were obtained by measuring at least 40 fully expanded pollen grains from each collection. In the case of *Helianthemum chihuahuense,* grains allowing a polar diameter measurement were scarce; therefore fewer polar than equatorial diameter measurements were taken. Pollen-wall ornamentations were compared by photographs at 1500 X. Collectors and collection numbers are given in the table.

The information presented in Table 1 in our opinion offers no palynological support for those who contend that the American species are divisible into two or more genera. The ratio of polar/equatorial measurements of *H. carolinianum* and *H. brasiliense* are matched by the P/E ratio of numerous other American species. Variability of the P/E ratio of *H. carolinianum* and *H. brasiliense* was greater than that indicated by Heydacker, ranging from 0.7-1.2 in contrast to the 0.8 reported in her paper. All of the American species studied with a P/E ratio of 0.6-1.2 were lower than or equalled only the lowermost range of that reported for the Old World species of 1.2-1.6. These data, if substantiated with a more meaningful sample, would give only slight additional support to those who have argued that the American species as a group are generically distinct from their Old World relatives. The sculpturing of the exine of *H. brasiliense* and *H. carolinianum* fails also to support the separation of those two species from the remaining American species. Although *H. brasiliense* possessed the coarsest sculpturing of any American species, the sculpturing of *H. carolinianum* was matched by that of several other American species. We cannot confirm Hey-

TABLE 1

| SPECIES AND LOCALITY | SCULPTURING | POLAR DIMENSION ($\mu$) | | | EQUATORIAL DIMENSION ($\mu$) | | | P/E RATIO |
|---|---|---|---|---|---|---|---|---|
| | | Mean | St. Dev. | Range | Mean | St. Dev. | Range | |
| H. arenicola Chapm.: Franklin Co., Fla. Eyles 8270 | Coarsely reticulate | 45.1 | 3.6 | 39.4-51.6 | 48.4 | 2.7 | 44.0-53.1 | 0.7-1.2 |
| H. argenteum Hemsl.: San Luis Potosi, Mexico. Schaffner 606 | Finely reticulate | 34.2 | 1.9 | 30.4-36.4 | 37.6 | 2.8 | 31.9-42.5 | 0.7-1.1 |
| H. bicknellii Fern: Webster Mass. Knowlton | Finely reticulate | 44.0 | 2.4 | 39.4-48.6 | 50.6 | 3.1 | 45.5-57.7 | 0.7-1.1 |
| H. brasiliense (Lam.) Pers.: Cerro, Departmento de Montevideo, Uruguay. Herter 257 | Coarsely reticulate, ridges thickened | 50.9 | 2.5 | 45.5-54.6 | 56.6 | 4.2 | 51.6-66.8 | 0.7-1.1 |
| H. canadense (L.) Michx.: Pine Grove, Mass. Gilbert | Elaborately striate | 50.0 | 2.0 | 45.5-54.6 | 51.7 | 2 1 | 48.6-54.6 | 0.8-1.1 |
| H. carolinianum (Walt.) Michx.: Screven Co., Ga. Harper 2081 | Coarsely reticulate | 47.8 | 3.4 | 38.0-54.6 | 51.8 | 2.9 | 45.5-57.7 | 0.7-1.2 |
| H. chihuahuense S. Wats.: Hidalgo, Mexico. Rose 9235 | Moderately reticulate | 42.5 | 0.3 | 41.0-44.0 | 46.2 | 3.6 | 42.5-57.7 | 0.7-1.0 |
| H. concolor (Riley) Ortega: Coalcoman, Mexico. Hinton 12960 | Coarsely reticulate | 44.2 | 1.8 | 41.0-47.0 | 46.2 | 2.0 | 42.5-50.1 | 0.8-1.1 |
| H. corymbosum Michx.: Chatham Co., Ga. Harper 2173 | Finely reticulate | 44.0 | 1.9 | 41.0-48.6 | 48.1 | 1.9 | 45.5-51.6 | 0.8-1.1 |
| H. coulteri S. Wats.: Mexico. Pringle 6672 | Finely reticulate | 40.2 | 2.3 | 36.4-44.0 | 45.5 | 2.3 | 41.0-50.1 | 0.7-1.1 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| H. dumosum (Bickn.) Fern.: Barnstable Co., Mass. Woodward & Fernald 15287 | Moderately reticulate | 45.8 | 2.2 | 41.0-48.6 | 50.1 | 2.8 | 45.5-54.6 | 0.8-1.1 |
| H. georgianum Chapm.: Travis Co., Texas. B. C. Tharp 16041 | Moderately reticulate | 47.2 | 1.5 | 44.0-48.6 | 49.7 | 1.5 | 48.6-51.6 | 0.9-1.0 |
| H. glomeratum (Lag.) Lag. ex Dunal: Guatemala. Skutch 1119 | Moderately reticulate | 36.9 | 2.0 | 33.4-42.5 | 38.4 | 1.6 | 34.9-41.0 | 0.8-1.2 |
| H. greenei Robins.: Santa Cruz Island, Calif. Hoffman. | Fine, very densely arranged reticulations | 36.9 | 2.0 | 33.4-42.5 | 38.4 | 1.6 | 34.9-41.0 | 0.8-1.2 |
| H. nashii Britt.: Lake Co., Fla. Curtiss 6620 | Moderately reticulate | 41.8 | 3.0 | 39.4-48.6 | 46.7 | 2.9 | 42.5-51.6 | 0.8-1.1 |
| H. nutans T. S. Brandeg.: Baja California. Moran 10232 | Finely reticulate | 41.5 | 2.8 | 36.4-48.6 | 48.1 | 3.0 | 41.0-53.1 | 0.7-1.2 |
| H. patens Hemsl.: Jalisco, Mexico. McVaugh 16849 | Finely reticulate | 39.7 | 2.3 | 36.4-42.5 | 43.3 | 2.0 | 39.4-48.6 | 0.7-1.1 |
| H. pringlei S. Wats.: N.E. Sonora Mexico. White 3513 | Finely reticulate | 42.1 | 2.5 | 39.4-48.6 | 47.3 | 2.2 | 42.5-51.6 | 0.8-1.1 |
| H. propinguum Bickn.: Nantucket Island, Mass. Bicknell | Moderately reticulate | 44.1 | 2.6 | 36.4-47.0 | 48.8 | 3.8 | 42.5-56.1 | 0.6-1.1 |
| H. rosmarinifolium Pursh: Oliver Ga. Curtiss 6838 | Finely reticulate | 42.5 | 3.6 | 36.4-48.6 | 44.6 | 2.5 | 41.0-48.6 | 0.7-1.2 |
| H. scoparium Nutt.: Del Monte, Calif. Abrams 5208 | Moderately reticulate | 43.1 | 1.7 | 39.4-45.5 | 47.4 | 2.5 | 42.5-51.6 | 0.8-1.1 |

dacker's claim that *Crocanthemum* is generically characterized by enlarged bases of the exine columns since those of *H. brasiliense* were indistinctly, if at all, swollen and those of *H. carolinianum* were, in our material, clearly not enlarged basally. Swollen bases to the exine columns of a more pronounced degree were noted in *H. nutans, H. greenei* and *H. georgianum.* Electron microscopy, perhaps of the surface scanner type, would doubtless provide more convincing evidence but from what we have observed it would not appear that palynology offers much promise for guidance in the reclassification of the American species of *Helianthemum s.l.* We would conclude therefore that there is no palynological basis yet suggested which would support the separation of *H. brasiliense* and *H. carolinianum* from the other American species or for the maintenance of the generic segregate *Crocanthemum.*

The pollen of the species of *Helianthemum* illustrated by Jean and Pons (1963) in their study of the Cistaceae of France was clearly striate and unlike the reticulate pattern exhibited by all American species examined in this study except *H. canadense.* The pollen of *H. canadense* was also conspicuously striate but unlike the European species illustrated exhibits a very broken surface since the grooves and ridges in one area tend to run in a different direction than those in another. The pollen of *H. canadense* examined by us was by far the most distinctive of the species examined but should doubtless be reinvestigated to determine whether its apparent uniqueness is consistent or an artifact in preparation.

In passing we would like to comment upon Brizicky's (1964) transfer of Grosser's *Halimium* section *Spartioides* to *Helianthemum* apparently with the same circumscription and the same three species as it originally contained. It is not believed that the following statement quoted from Abrams (1951) constitutes valid publication of the transfer of the section from either *Halimium* (Pflanzenreich IV. 193 (Heft 14) 33. 1903) or *Crocanthemum* (Nat. Pflanzenfam. ed. 2. 21: 305. 1925): "The Pacific States species belong to the section *Spartioides*, characterized by the broom-like habit and the absence of cleistogamous flowers." To attribute this as constituting a new combination by Abrams would be in our opinion contrary to Article 33 of the Code. The two sections of the exclusively American subgenus *Lechioides* (Dunal) Reichenb. were contrasted as follows:

Flowers usually dimorphic; eastern N. and S. America, the West Indies, Mexico, Central America and Chile ...... Sect. *Lechioides*
Flowers homomorphic, broomlike subshrubs; western North America (California and Baja California) and Chile ................ ............................................ Sect. *Spartioides* (Grosser) Brizicky

This infrageneric classification does not seem satisfactory since there actually are no characters mentioned by Brizicky or known to us which bind the species together. The alleged broomlike habit of the species of Section *Spartioides* actually does not even cover all of the extremely diverse growth forms that are included within *H. scoparium*. Homomorphic species which apparently would be included in section *Lechioides* are the Mexican and non-spartioid *H. nutans* T.S. Brandeg. and *H. patens* Hemsl. Fewer than one per cent of the specimens of *H. carolinianum* (Walt.) Michx. of section *Lechioides* seen had any cleistogamous flowers. It seems to us most unlikely that *H. scoparium* and *H. greenei* will be separated as a group from all the other North American species when enough is known to establish a biologically sound infrageneric classification. In any event the formation of an infrageneric classification might better wait for the discovery of features which bind species into definable groups.

DEPARTMENT OF BOTANY
DUKE UNIVERSITY
DURHAM, NORTH CAROLINA

REFERENCES CITED

ABRAMS, LEROY. 1951. *Helianthemum* in Illustrated Flora of the Pacific States 3: 122-123.

BRIZICKY, GEORGE K. 1964. The genera of Cistaceae in the southeastern United States. Jour. Arn. Arb. 45: 346-357.

DAOUD, H. S. and ROBERT L. WILBUR. 1965. A revision of the North American species of Helianthemum (Cistaceae). Rhodora **67**: 63-82, 201-216, 255-312.

ERDTMAN, G. 1960. The acetolysis method. A revised description. Svensk Bot. Tidskr. **54**: 561-564.

HEYDACKER, FRANCOISE. 1963. Les types polliniques dans la famille des Cistaceae. Pollen et Spore **5**: 41-49.

JEAN, MARIE-THERESE and ARMAND PONS. 1963. Contribution a l'étude palynologique des Cistacées de la flore de France. Ann. Sci. Nat. Bot. ser. **12**. **4**: 159-204.

# A SPURLESS FORM OF AQUILEGIA CANADENSIS L.

ROBERT B. LIVINGSTON

An area with great diversity of habitat and supporting a large population of columbines has been noted in an extensive juniper pasture in East Deerfield, Massachusetts. In May, 1962, I observed *Aquilegia canadensis* forma *flaviflora* Britton ex House in the pasture, and in 1963 I collected the salmon colored, forma *Phippenii* Munz. Further it was found that columbines from the area attained markedly different heights when transplanted into a relatively uniform home garden.

In May, 1964, I again visited the Deerfield pasture and found a plant whose flowers were completely spurless. Munz (1946) reported that: "Plants with spurless flowers have been found in Boylston, Massachusetts, by school children, May 14, 1913, and at St. Johnsbury, Vermont, May 20, 1896, *Francis P. Perry*." Since spurless forms of the red columbine have been noted at least twice previously in New England it appears reasonable to designate this plant as a new form.

*Aquilegia canadensis* var. *canadensis* forma **ecalcarata,** Livingston forma nov. Similar to *Aquilegia canadensis* L. proper with the following exceptions: Flowers pendant; petals yellow, 7-9 mm. long, 4-5 mm. wide, oblong-obtuse, spurless, spur replaced with small cupule near base, cupule 1.5-2 mm. deep, interior red; stamens about 1 cm. long, exceeding the twisted styles; basal leaves mostly biternate, deep green and glabrous above, light green and glaucous beneath, usually with node-like swellings at or below mid petiole.

Forma a varietate typica differens his sequentibus: Flores pendentes; petala lutea, 7-9 mm long., 4-5 mm. lat., oblonga-obtusa, sine calcari, pro quo cupula parva prope basim substituta est, cupula 1.5-2 mm. profundite, intra rubra; stamina c. 1 cm. long., stylos tortos excedentia; folia basalia plerumque biternata, maxime viridia glabraque supra, dilute viridia glaucaque infra, inflatione nodiformi ad aut infra partem petiolo mediam plerumque praedita.

Figure 1. *Aquilegia canadensis* f. *ecalcarata*. Habit, flower, and all parts except staminodia 2/3 X; staminodia 1 1/3 X.

TYPE in the Herbarium of the University of Massachusetts, collected in East Deerfield, Hampshire County, Massachusetts, adjacent to exposed field stone in rocky pasture, about 1/4 mile west of River Road, 1 1/2 miles north of the Sunderland bridge where it crosses the Connecticut River, *Livingstone 3291*. Original plant collected May 20, 1964, and propagated vegetatively in greenhouse from vegetative offshoots. Type is original plant. One clonal offshoot transplanted back to original site, June, 1965, another retained in home garden as source of seed and to provide additional clonal material.

DEPARTMENT OF BOTANY
UNIVERSITY OF MASSACHUSETTS, AMHERST

LITERATURE CITED

MUNZ, PHILIP A. 1946. *Aquilegia* The cultivated and wild columbines. Gentes Herbarum Vol. 7, Fasc. 1: 1-150.

# A NEW STATUS FOR AN EASTERN NORTH AMERICAN SCIRPUS

ALFRED E. SCHUYLER[1]

Among plants that Fernald originally described from southeastern Virginia were those he named *Scirpus atrovirens* var. *flaccidifolius.* Although he pointed out most of their unique characteristics in his original description (1938), other authors (Beetle, 1947; Gleason, 1952) have not given these plants any taxonomic recognition. They resemble plants of *S. atrovirens* Willd., *S. hattorianus* Mak.,[2] and *S. georgianus* Harp., but differ consistently from them in several characteristics and are recognized here as:

**Scirpus flaccidifolius** (Fern.) Schuyl., stat. et comb. nov.

*Scirpus atrovirens* var. *flaccidifolius* Fern., Rhodora **40:** 396. 1938. (*Fernald & Long 8109,* GH; ISOTYPES, PH, US).

*Scirpus flaccidifolius* has lax and reclining mature culms with inflorescences that lop over in contrast to the nearly upright mature culms of *S. atrovirens, S. hattorianus,* and *S. georgianus* (collectively referred to as related species in this discussion). The primary inflorescence rays become relatively long at maturity (about 30 cm in *Fernald & Long 10544,* GH) in comparison with those of related species. The lower leaf sheaths and blades are nearly smooth or somewhat nodulose-septate, but not conspicuously so as is usually the case with *S. atrovirens.* The small glomerules of spikelets (fig. 1) rarely contain more than 15 spikelets, and individual spikelets (fig. 2) are relatively wide (mostly 2-3 mm). Related species frequently have more than 15 spikelets per glomerule and consistently narrower spikelets.

---

[1]I am grateful to Hans Wilkens for help in the field, maintaining transplants of our collections, and reading the manuscript; to Ruth Patrick and H. Radclyffe Roberts for reading the manuscript; and to Morton Gilbert and Jay Sacks for their photographic services.

[2]The distinctions of this species from *S. atrovirens* and *S. georgianus* were recently pointed out by myself (1967).

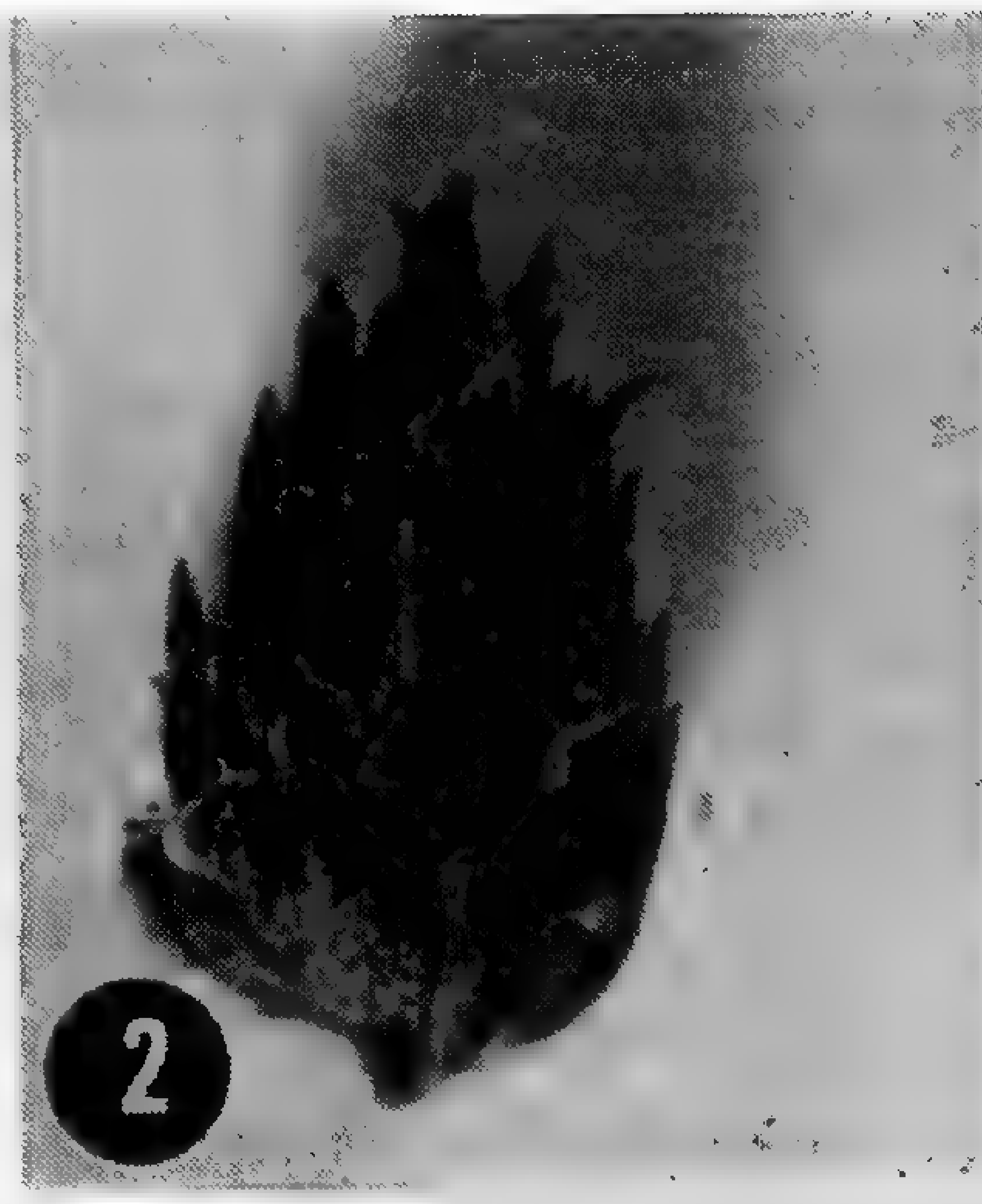





Figure 1. Inflorescence of *S. flaccidifolius* (*Fernald & Long 10141*, PH).

Figure 2. Spikelet of *S. flaccidifolius* (*Fernald & Long 10140*, GH).

Figure 3. Achene and bristles of *S. flaccidifolius* (*Fernald & Long 10140*, GH).

The blackish scale color is similar to the scale color of *S. hattorianus* but differs from the usually brownish scale color of *S. atrovirens* and *S. georgianus*. Many of the scales are slightly mucronate, particularly those from lower portions of the spikelets, whereas those of related species are all mucronate. The bristles (fig. 3) are frequently longer than the achenes, resembling *S. atrovirens* in this respect, but differing from *S. hattorianus* which usually has bristles shorter than to about equaling the achenes. The presence of 6 bristles distinguishes *S. flaccidifolius* from *S. georgianus*, which either lacks bristles or has up to 3 short ones. The achenes (fig. 3) are mostly 1-1.2 mm long and compare closely in length with those of *S. atrovirens* but are generally longer than those of *S. hattorianus* and *S. georgianus*.

The chromosome number of $n = 27$ was comparatively easy to determine from meiotic material of *S. flaccidifolius* collected in Northampton Co., North Carolina (*Schuyler & Wilkens 3858*, PH). This number differs from the 28 units observed in meiotic figures from plants of *S. hattorianus* collected in Berks Co. (*Wilkens 10270*, PH) and Northampton Co., Pennsylvania (my no. *3735*, PH), and Cattaraugus Co., New York (my no. *3443*, PH[3]). It has been difficult to obtain results from meiotic material of *S. atrovirens* (my experience being comparable to that reported by Hicks, 1928) and no definite number can be reported here. In meiotic material of *S. georgianus*, three different numbers, 25 (New Jersey: Burlington Co., my no. *3863*, PH), 26 (New Jersey: Burlington Co., my no. *3846*, PH), and 27 (Pennsylvania: Lehigh Co., my no. *3852*, PH), have been observed and obviously indicate the need for further cytological investigation of this species.

While collecting in southeastern Virginia and northeastern North Carolina during the spring of 1966, Hans Wilkens and I found *Scirpus flaccidifolius* growing in or near previously reported localities (Fernald, 1938 & 1940), and also found it at other places near Fontaine Creek farther

[3]Although previously cited as *S. atrovirens* (Schuyler, 1964), subsequent study has shown that the plant is *S. hattorianus*.

downstream from where it had been collected previously. Although all of the localities we found were in the vicinity of large streams (e.g., Nottoway River, Meherrin River, and Fontaine Creek), none were in the low areas close to the margins of these streams; instead they were in somewhat higher areas, though still in the wet, swampy bottomlands associated with these streams. We further noticed that *S. flaccidifolius* grew abundantly where there was evidence of human disturbance such as clearings for power lines near the Nottoway River and roadside clearings in bottomlands near Fontaine Creek. However it was also observed growing in a more natural area on the east side of the Meherrin River near Haley's Bridge along a small meandering stream through bottomland woods south of highway no. 730. It is likely that further collecting will extend the range of *S. flaccidifolius,* but at the present time only the following collections are known:

VIRGINIA: SUSSEX CO. SW of Homeville, bottomland swamp, Nottoway River, *Fernald & Long 10141* (GH, PH); E of the Nottoway River, in wet clearing for power lines along highway no. 40, *Schuyler 3855* (PH). SOUTHAMPTON CO.: near Haley's Bridge, wooded alluvial bottomland of Meherrin River, *Fernald & Long 8109* (GH, PH, US). GREENSVILLE CO.: SE of Taylor's Millpond, wooded bottomland of Fontaine Creek, *Fernald & Long 10140, 10544* (GH, PH); SE of Taylor's Millpond, along road near bridge over Fontaine Creek, *Schuyler & Wilkens 3859* (PH). NORTH CAROLINA: NORTHAMPTON CO.: 1.7 mi WNW of Margarettsville, along road S of Fontaine Creek, *Schuyler & Wilkens 3858* (PH); Rich Square, along stream, *Blomquist* (PH).

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA
PHILADELPHIA, PENNSYLVANIA

LITERATURE CITED

BEETLE, A. A. 1947. *Scirpus.* North American Flora **18**: 481-504.

FERNALD, M. L. 1938. Noteworthy Plants of Southeastern Virginia. Rhodora **40**: 364-424.

—————. 1940. A Century of Additions to the Flora of Virginia. Rhodora **42**: 419-498.

GLEASON, H. A. 1952. The New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada. The New York Botanical Garden, New York. 3 v.

Hicks, G. C. 1928. Chromosome Studies in the Cyperaceae, with Special Reference to *Scirpus*. Bot. Gaz. **86**: 295-317.

Schuyler, A. E. 1964. Notes on Five Species of *Scirpus* in Eastern North America. Bartonia No. **33**: 1-6.

————————. 1967. *Scirpus hattorianus* in North America. Not. Nat. No. 398: 1-5.

# PHYSALIS IN MEXICO, CENTRAL AMERICA AND THE WEST INDIES

U. T. WATERFALL

Continued from Vol. 69, No. 777

33. **Physalis tehuacanensis** Waterfall, sp. nov.

Herba, perennis, 22-27 cm alta; trichomatibus articulatis, partim capitato-glanduliferis, ad 1.5-2 mm longis; foliis ovatis vel deltoideo-ovatis, inaequaliter magno-dentatis vel sinuato-dentatis, principalibus 12-30 mm longis et 12-30 mm latis, petiolis 12-35 mm longis; calycibus floriferis 5-6 mm longis et 4-5 mm latis, lobis lanceolatis vel ovato-lanceolatis 2-2.5 mm longis; pedicellis 4-6 mm longis; corollis luteis, immaculatis, 8-9 mm longis et 10-11 mm latis; antheris luteis, 2.7-3.5 mm longis; filamentis 1.5-3 mm longis; calycibus fructiferis 15-18 mm longis et 14-16 mm latis; pedicellis 8-10 mm longis; baccis 10-11 mm latis.

TYPE: MEXICO: PUEBLA: *Smith, Peterson & Tejeda 3992* (F), Isotype (US), Tehuacan city dump, July 20, 1961.

This species is characterized by the long, coarse, multicellular hairs, intermixed with shorter ones, many of the trichomes tipped with reddish-brown glands, by the coarsely and irregularly dentate leaves, with the hairs of the blade appressed, and especially abundant on the veins, those on the petioles spreading, by the yellow anthers and the yellowish, immaculate (but possibly faded) corolla. It is known only from the type locality in the state of Puebla.

34. **Physalis microphysa** Gray, Proc. Amer. Acad. Arts & Sci. **21**: 402. 1886; *P. campanulata* T. S. Brandegee, Plantae Mexicanae Purpusianae, IV. Univ. Calif. Publ. Bot. **4**: 278. 1912.

Plant herbaceous, several-stemmed from a woody base, the stems 15-60 cm long; herbage rather densely covered with varying lengths of flat, jointed, spreading, tapered hairs, and some capitate-glandular ones, up to 2 mm long, the longer ones often, but not always, the least abundant; leaf blades reniform to ovate or subhastate, the principal ones 12-20 mm long and 10-23 mm wide, rarely smaller, the widest, reniform ones on the lower part of the stems; margins entire, or each side with 1-3 teeth, irregular in shape and size; vestiture of blades more or less appressed, seldom as long as that of the stems; petioles usually 5-12 mm long, but lower ones up to 6 cm long, abruptly expanding onto the blade; flowering calyx bristly hairy, 4-6 mm long and 4-6 mm wide at base of lobes, divided one-half to two-thirds of its length into lanceolate, slightly acuminate, lobes; corolla white with a slight yellowish or greenish tinge, apparently immaculate, or slightly light-green maculate, 8-10 mm long and 12-20 mm wide when rotate-expanded, more or less pentangular in outline, on pedicels ca. 2 mm long; anthers yellow, ovate to ovate-oblong, 1-1.5 mm long, on slender glabrous filaments 2-3 mm long; fruiting calyx teretish, ovate-oblong to campanulate, 9-12 mm long and 8-12 mm wide, open to open-flaring apically; fruit with thin, dry pericarp, 3-7 seeds in each locule, sessile in the calyx.

SELECTED COLLECTIONS. MEXICO: CHIHUAHUA: limestone ledges, Santa Eulalia Mts., Aug. 14, 1885, *Pringle 317* (Type: GH, Isotypes: BR, F, OKLA, UC, US, VT); limestone, Canyon del Rayo, northern end of Sierra del Diablo, July 25-29, 1941, *Stewart 917* (GH); COAHUILA: near Saltillo, June 1, 1947, *Hinton 16703* (US); arroyo banks, Canyon del Pajarito, Sierra de la Madera, Cuatro Cienegas, Sept. 6, 1939, *Muller 3158* (UC); SAN LUIS POTOSÍ: *Purpus 5313* (Type of *P. campanulata*: UC, Isotypes: F, GH, US).

35. **Physalis parvianthera** Waterfall, sp. nov.

Planta herbacea, 25-40 cm alta; caulibus villosis, pilis articulatis plus minusve viscidis; foliis deltoideo-ovatis vel ovatis vel lanceolato-ovatis, plus minusve villosis, integerrimis vel paucidentatis, majoribus 25-30 mm longis et 20-30 mm latis; petiolis 10-14 mm longis; calycibus floriferis villosis, 4-5 mm longis et 5-6 mm latis, dentibus ca. 1-1.5 mm longis, lanceolato-attenuatis; pedicellis 3-5 mm longis; corollis luteis, immaculatis, 7-10 mm longis et 15-20 mm latis; antheris violaceis 1.5-1.8 mm longis, filamentis filiformibus; calycibus fructiferis teretibus, parvis, 8-9 mm longis et 5-7 mm latis; pedicellis fructiferis 6-8 mm longis.

TYPE: *Paray 1614* (MEXP) MORELOS: Sierra de Chalchi, cerca de Tepcztlan, Aug. 1955.

The small nearly terete fruiting calyx, immaculate yellow corollas, small violet anthers and soft vestiture characterize *P. parvianthera.* Its nearest relative, *P. microphysa,* has larger yellow anthers, longer calyx lobes, a somewhat sparser, harsher vestiture and usually smaller leaves. The "small-anthered" reference is made in comparison with *P. microphysa.*

36. **P. hederaefolia** Gray, Proc. Amer. Acad. Arts & Sci. **10:** 65. 1875.

Herbaceous perennial, 1-5 dm tall, with a varying mixture of long jointed hairs and short trichomes, or with short hairs only, vestiture viscid or not, glandular-capitate or not, rarely partly stellate (a distinguishing characteristic of var. *cordifolia*), antrorse or spreading; leaf blades subreniform to ovate, rarely ovate-lanceolate, margins coarsely and irregularly salient-dentate to shallowly few-lobed, to undulate or entire, principal ones 20-50 (-80) mm long and 15-40 (-60) mm wide on petioles 10-45 mm long; flowering calyces 5-9 mm long and 4-6 mm wide at base of lobes, upper 2-4 mm divided into deltoid to lanceolate lobes, on pedicels 2-7 (-15) mm long; corolla maculate, obviously to obscurely so, 7-10 mm long and 10-17 mm wide, the limb reflexed when fully expanded; anthers usually yellow, sometimes with a violet tinge, 2-4 mm long, on slightly thickened filaments, 1-5 mm long; fruiting calyx 10-angled or 10-ribbed, varyingly vestite, 12-25 mm long and 9-17 mm wide on pedicels 5-10 mm long; berry 9-15 mm wide.

36a. var. **hederaefolia**; *P. Palmeri* Gray, Synoptic Flora 2(1): 235. 1888.

Vestiture including long, jointed hairs.

SELECTED COLLECTIONS. MEXICO: CHIHUAHUA: plowed field, Sitenapuchi, July 7, 1955, *Pennington 510* (OKLA); COAHUILA: Hermanas, Apr. 20, 1939, *Marsh 1629* (F, GH, OKLA); among shrubs on toboso-flat, 4 km w of San Juan, sw of Sierra de las Cruces, July 11, 1941, *Stewart 810* (GH); along shallow watercourse in desert, 70 miles w of Saltillo, Aug. 7, 1957, *Waterfall 13289* (F, MICH, OKL, OKLA, SMU, US); DURANGO: desert, 68 miles sw of Torreon, Aug. 11, 1959, *Waterfall 15389* (OKLA, SMU, US); NUEVO LEÓN: rolling hills, 75 miles s of Laredo, Sept. 17, 1942, *Gentry 6743* (GH, UC, US); SAN LUIS POTOSI: ex convalli San Luis Potosi, in 1877, *Schaffner 401* (NY); SONORA: vicinity of Hermosillo, Mar. 8, 1910, *Rose et al 12537* (GH, NY, US); canyon de la Bellota, Sierra de la Cabellera, Oct. 7-10, 1941, *White 4693* (MICH); TAMAULIPAS: in canyon 4 km w of Miquihuana, Aug. 4, 1941, *Stanford et al 674* (OKLA, US, not the GH duplicate).

36b. var. **puberula** Gray, Proc. Amer. Acad. Arts & Sci. **10**: 65. 1875.

Short-vestite; with short antrorse hairs only, or with varying amounts of glandular-capitate trichomes.

SELECTED COLLECTIONS. MEXICO: CHIHUAHUA: rocky hills near Chihuahua, May 21, 1885, *Pringle 15*, (BM, BR, F, GH, MICH, NY, UC, US, VT); gravel desert with *Larrea & Fouquieria*, 30 miles s of Chihuahua, Aug. 8, 1956, *Waterfall 12486* (F, MICH, OKLA, S, SMU, US); calcareous stony hillside, 11 miles n of Parral, *Waterfall 12509* (F, MICH, OKLA, SMU, US); stony grassland, 148 miles s of Ciudad Juarez, Aug. 8, 1961, *Waterfall 16092* (BM, F, GH, MICH, NY, OKLA, P, S, UC, US, VT); COAHUILA: Torreon, Oct. 13-20, 1898, *Palmer 463* (BM, F, GH, MICH, NY, UC, US); limestone hillside, 10 miles n of Saltillo, Aug. 25, 1961, *Waterfall 16625* (OKLA); DURANGO: Durango and vicinity, April to Nov. 1896, *Palmer 165* (BM, F, GH, NY, UC, US); desert, 68 miles sw of Torreon, Aug. 11, 1959, *Waterfall 15388* (F, OKLA, SMU, UC); stony hillside with grass, cacti and yuccas, 19 miles sw of Durango, Aug. 15, 1959, *Waterfall 15523* (F, MICH, OKLA, SMU, US);

NUEVO LEÓN: arroyo in desert between mountains, 22 miles w of Monterrey, Aug. 10, 1959, *Waterfall 15317* (OKLA); SONORA: Puerto de los Aserraderos, Aug. 4-9, 1940, *White 3224* (GH, MICH); ZACATECAS: near Concepcion del Oro, Aug. 11-14, 1904, *Palmer 318* (GH, NY, US); stony mountainside, 2.2 miles se of Sombrerete, Aug. 15, 1959, *Waterfall 15569* (OKLA, SMU).

36c. var. **cordifolia** (Gray) Waterfall, Rhodora **60:** 158. 1958; *P. Fendleri* Gray var. *cordifolia* Gray, Synopt. Fl. N. Amer. 2(1): 395. 1878; *P. Fendleri* Gray, Proc. Amer. Acad. Arts & Sci. **10:** 66. 1875.

Varying quantities of stellate hairs, or flat branched trichomes, present, at least on the calyx lobes.

COLLECTIONS SEEN. MEXICO: BAJA CALIFORNIA: 64 miles se of Ensenada, Aug. 26, 1960, *Broder 350* (US).

37. **Physalis glabra** Bentham, Botany of the Voyage of the Sulphur, 39-40. 1844; *P. hastata* Rydberg, Mem. Torr. Bot. Cl. 4:363. 1895.

Several-stemmed from a woody base, usually herbaceous, sometimes woody, 10-100 cm long, glabrous or nearly so; leaf blades narrowly lanceolate to ovate, sometimes basally lobed or hastate, sometimes undulate-margined or few-toothed, rarely with 5-7 teeth on each margin; blades of principal leaves 20-40 mm long and 7-30 mm wide on petioles 12-25 mm long; flowering calyx 3-5 mm long and 3-5 mm wide on pedicels 10-20 mm long; corollas 7-15 mm long and 9-20 mm wide, reflexed-rotate when fully open, usually yellowish, rarely drying with a bluish tinge (then resembling *P. crassifolia* var. *versicolor*), sometimes with a tendency toward slightly darker spots near base of limb; pedicels 15-30 mm long; anthers yellow, 2-2.5 mm long on rather thick filaments 2-4 mm long; fruiting calyx 10-ribbed, 10-23 mm long; 11-20 mm wide, half-filled by the berry; fruiting pedicels 17-30 mm long.

SELECTED COLLECTIONS. MEXICO: BAJA CALIFORNIA: islands off the coast and on mainland, San José del Cabo, March-June 1897, *Anthony 353* (F, GH, OKLA, UC); Todos Santos, Jan. 28, 1890, *Brandegee 422* (Type of *P. hastata* Rydb.: UC, Isotype: GH); San José del Cabo, Sept. 14, 1930, *Jones 27313* (BM, GH, NY, UC, US).

38. **Physalis crassifolia** Bentham, Botany of the Voyage of the Sulphur, 40. 1844; *P. pedunculata* Greene, Pittonia 1:268-269. 1889, non *P. pedunculata* Mart. & Gal. Bull. Acad. . . . Belgique **12**:132. 1845; *P. Greenei* Vasey & Rose, Contr. U.S. Natl. Herb. 1:18. 1890; other synonymy under subordinate taxa.

Perennial, usually herbaceous, sometimes woody-stemmed, sometimes flowering and fruiting the first year of growth, hence apparently annual, 10 cm to 4 dm tall; plant variously vestite with few to abundant, usually short hairs often tipped with viscid or oily glands; leaf blades ovate, margins entire or toothed, principal ones (1-) 2-6 (-10) cm long and 1-5 (-7) cm wide on petioles 1-4 (-6) cm long; flowering calyx rarely oblong, 5-9 mm long and 3-5 mm wide, the deltoid to broadly lanceolate teeth 1-3 mm long; flowering pedicels usually 1-3 cm long; corolla yellow and immaculate, or with slightly darkened spots, rarely bluish, or becoming bluish when dry, 8-30 mm long and 8-20 mm wide when fully expanded, at which time it is reflexed-rotate to funnelform, slightly sinuate-margined; few to numerous trichomes within near top of corolla tube; anthers yellow, 2.5-3.5 mm long, on filaments 4-14 mm long; fruiting calyx 10-ribbed, the ribs usually smooth, sometimes muriculate; fruiting calyx glabrous to somewhat hairy, 1-6 cm long and 8-35 mm wide, on pedicels 5-40 mm long, usually much inflated around the berry.

The disposition of individual collections in this complex, and the concept and delimitation of taxa, present problems not easily solved. *P. crassifolia, sens. str.,* is not far removed from *P. glabra* Benth., here retained as a separate species. In the broad sense, some of the collections — those with pedicels shorter than usual — may approach *P. hederaefolia* Gray.

Much of the material considered here is perennial, sometimes even becoming shrubby. Some of it reproduces as an annual, or produces flowers and fruit during its first year of growth. Since this difference has been used by some authors as a major one of value for the separation of species, it is not surprising to find annual material described as species under the names *P. Greenei* Vasey & Rose, *P. flava* Wiggins, and *P. filipendula* Brandegee. However, other tropical, or subtropical, plants are known to flower and fruit the first year, with herbaceous stems, then proceed to become more or less woody, and persist as perennials. The author postulates the possibility of such an occurrence in this complex population of Baja California and the adjacent mainland of Mexico. Under such an interpretation, *P. Greenei* would largely be referred to var. *crassifolia* of the following treatment, but some of the material of var. *versicolor* and some of var. *infundibularis,* flowering the first year, would be similar. Therefore the name is not placed under varietal synonymy.

Since *P. Greenei* Vasey & Rose is a substitute name for *P. pedunculata* Greene, non Mart. & Gal., 1845, l.c. supra, it might be pertinent here to comment that the type of *P. pedunculata* Mart. & Gal. (BR, specimen in flower only) appears to belong to the concept of *Brachistus Pringlei* S. Wats., 1890.

Other notable variation within the species-concept includes the size, shape and color of the corolla, the amount and kind of vestiture, the length of the pedicels, and the size of the fruiting calyx.

In much of the material the corolla is reflexed-rotate when fully expanded, although most of the corollas found on collections are not in this condition. I. M. Johnston proposed his var. *infundibularis* for plants with large, usually funnelform corollas, the vestiture varying greatly. Wiggins proposed the name *P. flava* for somewhat similar material with large yellow corollas and muriculate fruiting calyces. Some of the material referred to var. *infundibularis* may have slightly darkened maculations, only slightly differentiated from the surrounding yellow corolla, but the type material seems to have wholly yellow corollas, as is characteristic of the species-complex. Since *P. flava* seems to represent an extreme with a brighter yellow corolla and less glandular herbage than the type of var. *infundibularis*, but not of the whole population, it is referred to synonymy under that taxon. Many sheets of annual material, with smaller, rotate corollas, have been referred to var. *crassifolia.*

Rydberg proposed the name *P. versicolor* for material with the corolla drying bluish, the leaves thin and toothed, and with extra long pedicels and small calyces. Sometimes material with thick, entire leaves has the corolla drying bluish, and there is intergradation in pedicel-length and calyx-size. Nevertheless, the taxon is retained here in the varietal category. To its synonymy are referred *P. versicolor* var. *microphylla* Rydberg, based on second-growth material probably produced during unfavorable growing conditions, and *P. sonorensis* Standley, a phase usually with a yellow corolla, which has persisted until it has become shrubby.

At first consideration *P. filipendula* Brandegee would appear quite distinct by virtue of its large fruiting calyces. However, it does have the yellow anthers of the *P. crassi-*

*folia* complex. The corolla exhibits a tendency toward the development of darker maculations, but that occurs elsewhere in the complex. In other species-complexes (*P. virginiana, sens. lat.*, for example) there have developed extremes with unusually large fruiting calyces. Nomenclatural recognition has been given to one such development as *P. virginiana* forma *macrophysa* (Rydberg) Waterfall. It is postulated that a similar situation occurs in *P. crassifolia, sens. lat.*, the representatives being proposed later in this paper for nomenclatural recognition under the name var. *crassifolia* subvar. *amplifolliatus* (follis: bag, bellows), based on a type obviously related to subvar. *crassifolia*, forma *muriculata* by virtue of the muriculate ribs of the fruiting calyx but including material with smooth ribs such as is present in the type of *P. crassifolia*.

38a. var. **crassifolia.** *P. cardiophylla* Torrey, Bot. Mex. Bound. 153. 1859; *P. crassifolia* var. *cardiophylla* (Torr.) Gray, Synoptic Flora 2(1):235. 1878.

Corolla 8-12 (15) mm long, reflexed-rotate when fully open; flowering calyces usually 4-6 mm long on pedicels from somewhat longer than, to 6-7 times the length of the flowering calyx.

38b. var. **crassifolia** forma **crassifolia**

Ribs of fruiting calyx smooth.

SELECTED COLLECTIONS. MEXICO: BAJA CALIFORNIA: Cedros Island, March-June 1897, *Anthony 306* (BM, F, GH, NY, UC, US); volcanic rocks, San Quintin, April 7, 1936, *Epling & Stewart sin. num.* (F, NY, US); Valley of Palms, Apr. 8, 1882, *Jones 3726* (BM, MICH, NY, UC, US); Magdalena Bay, Revillagigedo Islands, May 30, 1925, *Mason 1952* (US); abundant on dunes, Bahia Magdalena, *Solis 41* (US); sandy hills and flats 25 miles north of Punta Prieta, April 15, 1931, *Wiggins 5362* ( GH, MICH, NY, UC, US); 9 miles east of San Ignacio, Nov. 3, 1946, *Wiggins 11358* (GH, UC, US). SONORA: arroyos and milpas, San Bernardo, Rio Mayo, Feb. 23, 1935. *Gentry 1344* (F, GH, UC); Papago Tanks, Nov. 17, 1907, *MacDougal sin. num.* (US); gravelly bed of arroyo de San Francisco, El Travelo, north of Alamos, *Pennell 19503* (US).

38c. var. **crassifolia** forma **muriculata** (Greene) Waterfall, comb. et stat. nov., *P. muriculata* Greene, Bull. Calif. Acad. 1:209. 1885.

Ribs of fruiting calyx more or less muriculate.

SELECTED COLLECTIONS. MEXICO: BAJA CALIFORNIA: Cape San Quentin, May 10, 1885, *Greene 5109* (Type of *P. muriculata*: UC, Isotype: US); Cedros Island, April 1, 1897, *Brandegee, sin. num.* (UC); vicinity of Loreto, Nov. 14, 1962, *Carter 4453* (UC); San Quintin, April 7, 1936, *Epling & Stewart, sin num.* (F, US); sandy wash 5 miles south of Miller's Landing, April 17, 1931, *Wiggins 5401* (GH, MICH, NY, UC, US); sandy arroyo 1.5 miles sw of La Paz, alt. 15 ft., Dec. 2, 1959, *Wiggins 15723* (GH, UC).

38d. var. **crassifolia** subvar. **amplifolliata** Waterfall, subvar. nov.; incl. *P. filipendula* Brandegee.

Calycibus fructiferis magnis, inflatis, 30-35 mm longis et 25-30 mm latis, costis muriculatis vel levibus.

The principal characteristic differentiating subvar. *amplifolliata* from subvar. *crassifolia* is the large, inflated fruiting calyx, about one-fourth filled by the berry; its ribs may be muriculate or not; the corollas may be immaculate, or with slightly contrasting maculations.

TYPE: *E. W. Nelson and E. A. Goldman 7405*, Santa Anita, Jan. 11, 1906, (GH); Isotype (US).

SELECTED COLLECTIONS. MEXICO: BAJA CALIFORNIA: *Nelson and Goldman 7405*, type cited above; San José del Cabo, Oct. 4, 1890, *Brandegee sin num.* (type of *P. filipendula*) (UC); San José del Cabo, Jan. 20, 1923, *Jones 24393* (F, GH).

38e. var. **versicolor** (Rydberg) Waterfall, Rhod. **60**:160. 1958; *P. versicolor* Rydb., Bull. Torr Bot. Club **22**:307. 1895; *P. versicolor* var. *microphylla* Rydb., Bull. Torr. Bot. Club **22**:307. 1895; *P. genuicaulis* A. Nels., Bot. Gaz. **47**:430. 1909; *P. sonorensis* Standley, Field Mus. Publ. Bot. **22**:102. 1940.

Flowering calyces usually 3-4 mm long on pedicels 5-10 times their length; corollas similar to those of var. *crassifolia,* in shape and size, yellow to greenish-yellow, sometimes whitish toward their periphery, often drying with a bluish tinge; leaves usually dentate and thin.

SELECTED COLLECTIONS. MEXICO: BAJA CALIFORNIA: among loose rocks on beach, San Francisco Island, Gulf of California, May 30, 1921, *Johnston 3952* ( GH, NY, UC, US); Los Angeles Bay, Nov. 22-Dec. 20, 1887, *Palmer 561* (BM, GH, NY, UC, US); canyon about a mile from beach, 35 miles s of Punta Prieta, Oct. 29, 1946, *Wiggins 11302* (GH, UC, US); CHIHUAHUA: in cultivated field in valley, Guasaremos, Río Mayo, Aug. 5, 1936, *Gentry 2358* (F); SINALOA: annual with thickened corm, wet wash with jungle growth, Imala, Nov. 29, 1939, *Gentry 5090* (GH, MICH, NY); annual on rocky volcanic slope with coastal thorn forest, Cerros de Navachiste about Bahia Topolobampo, Sept. 26-30, 1954, *Gentry 14305* (US); vicinity of Culiacán, April 21, 1910, *Rose et al 14959* (US); SONORA: on malpais hill, Lower Sonoran thorn forest, Bachoco, 12 miles e of Cajeme, Feb. 20, 1937 (Type of *P. sonorensis* Standley), *Gentry 3011* (F); Guaymas, July 1887, *Palmer 94* (Type of *P. versicolor* var. *microphylla* Rydberg: NY; Isolectotypes: GH, UC, US); Guaymas in 1887, *Palmer 622* (Type of *P. versicolor* Rydberg: US, Isotype: GH); embankment in low area near river, 9 miles s of Navajoa, Aug. 17, 1956, *Waterfall 12818* (F, GH, MICH, NY, OKL, OKLA, P, SMU, US); mesquite-grassland, 9 miles w of La Angostura, Aug. 19, 1941, *White 4018* (GH, MICH, NY, US); grassy Olneya-Prosopis-Cercidium plain, 11 miles e of Willard, between Hermosillo and Colorado, Sept. 5, 1941, *Wiggins & Rollins 298* (GH, MICH, NY, UC, US).

38f. var. **infundibularis** I. M. Johnston, Proc. Cal. Acad. Sci. ser. 4, **12**:1156-1157. 1924; *P. flava* Wiggins, Contr. Dudley Herb. **3**:73. 1940.

Corolla usually funnelform, sometimes the limb more expanded, usually 15-20 mm long, uniformly yellowish, or with slightly contrasting maculations.

SELECTED COLLECTIONS. MEXICO: BAJA CALIFORNIA: common on silty flat forming dense oily clumps one to two ft. high, Angel de La Guardia Island, Gulf of California, June 30, 1921, *Johnston 4203* (Type: GH, Isotype: US); Puerto Refugio, Jan. 26, 1940, *Dawson 1026* (MICH); southeast side of Cedros Island, Aug. 16, 1932, *Howell 10692* ( GH, US); desert washes and slopes, 5-10 miles n of Catavina, Mar. 7, 1930 (GH, MICH, NY, UC, US).

39. **Physalis Mimulus** Waterfall, sp. nov.

Planta herbacea, glabra; foliis lateovatis vel reniformibus, majoribus 12-40 mm longis et 16-25 mm latis, paucis undulato-dentatis, petiolis 10-32 mm longis; calycibus floriferis 2-2.5 mm longis et ca. 2.5 mm latis; calycis lobis deltoideo-lanceolatis, 0.6-0.9 mm longis; pedicellis 3-6 mm longis; corollis maculatis, 3-4 mm longis et 4-6 mm latis; antheris violaceis, 1-1.3 mm longis, filamentis filiformibus; calycibus fructiferis 10 mm longis et 8-9 mm latis.

TYPE: MEXICO: COLIMA: Socorro Island, March 1889, *C. H. Townsend, s.n.* (US).

The specific name alludes to the resemblance of post-anthesis calyces, and of the broad leaf blades with few, irregular, low, undulate dentations, to certain species of *Mimulus*.

40. **Physalis purpurea** Wiggins, Contr. Dudley Herb. **3**:74, pl. 19, figs. 9-10. 1940.

Herbaceous, perennial or persisting annual, erect, branched, 25-75 cm tall, spreading-puberulent, especially on the stems, petioles and pedicels; leaf blades ovate to ovate-deltoid, bases sometimes oblique, rarely cordate, margins coarsely and irregularly dentate to sinuate-dentate; principal blades 2.5-5 cm long and 2-5 cm wide on petioles 2-5 cm long; flowering calyx 4-5.5 mm long and 3-4 mm wide at base of lobes, upper 1-2 mm divided into broadly lanceolate to deltoid lobes, on peduncles 17-25 mm long; corolla violet or purplish, the throat yellowish, hairy within near the top of the tube, reflexed-rotate when fully expanded, 7-11 mm long and 9-13 mm wide; anthers yellow, 1.5-3 mm long, on filaments 4-6 mm long; fruiting-calyx 10-ribbed, 23-30 mm long and 17-24 mm wide, on pedicels 2-4 cm long; berry nearly spheric, 10-18 mm wide.

This species is related to the *P. crassifolia* complex, approaching it through *P. crassifolia* var. *versicolor*. It is probably as distinct in its direction of divergence as is *P. glabra* in a different direction.

COLLECTIONS SEEN. MEXICO: SONORA: Bahia San Carlos, Feb. 8, 1940, *Dawson 1063* (F, MICH); bed of creek, 5 km w of Pilares de Nacozari, Nov. 19, 1939, *Drouet et al 3680* (F); bases of cliffs e of Guaymas, Dec. 3, 1939, *Drouet et al 3841* (F, US); bases of cliffs e of Guaymas, Dec. 3, 1939, *Drouet et al 3854* (F, MICH, NY, UC,US); hills w of tannery in shade of shrubs on basaltic slopes, Oct. 21, 1939, *Gentry 4671* (F, GH, MICH, NY, OKLA, UC, US).

41. **Physalis longicaulis** Waterfall, sp. nov.

Planta herbacea, e radice lignosa fusiforme; caulibus procumbentibus glabris vel trichomatibus paucis antrorse adpressis; caulibus 3-9 dm longis; foliis ovatis, principalibus 17-25 (-35) mm longis et 17-24 mm latis, magne et inaequaliter paucidentatis; foliis oppositis; internodis 6-9 cm longis; petiolis 5-15 mm longis; corollis maculatis, 7-10 mm longis et 8-12 mm latis; pedicellis 15-25 mm longis; antheris luteis, ca 2.5 mm longis; filamentis filiformibus, 3-5 mm longis; calycibus fructiferis 17 mm longis et 11 mm latis, pedicellis 30 mm longis; baccis ca. 6 mm latis.

TYPE: *C. H. & M. T. Mueller 135,* Diente Canyon, mountains near Monterrey, NUEVO LEÓN, MEXICO July 1933 (F).

This species is peculiar in its small, opposite, or seemingly opposite, leaves, the pairs separated by long internodes, and in the small fruiting calyx.

42. **Physalis Rydbergii** Fernald, Proc. Amer. Acad. Arts & Sci. **35**:569. 1900.

Stems herbaceous or woody below, several from a woody root, 15-30 cm tall, covered with short, fine, divergent multicellular hairs, some of them capitate-glandular; leaf blades lanceolate to ovate-lanceolate or rhombic-lanceolate, principal ones 10-15 mm long and 3-7 mm wide, tapering to a petiole 3-8 mm long, both surfaces covered with hairs similar to the stem-hairs, margins subentire, or with 1 to several teeth of varying size and shape; flowering calyx oblong to oblong-campanulate, 4-5 mm long and 2-2.5 mm wide at base of lobes, the upper 1-1.5 mm divided into ovate to deltoid lobes; pedicels 5-7 mm long; corolla yellowish, immaculate, or slightly maculate and fading in drying, 7-9 mm long, 6-8 mm wide, probably wider if fully expanded; anthers yellow, ca. 2 mm long on filaments 3-4 mm long; fruiting calyx 8-12 mm long and 8-10 mm wide, oblong-ovate, open at the apex, nearly filled by the berry.

COLLECTIONS EXAMINED. MEXICO: SINALOA: Ymala, Sept. 25 to Oct. 8, 1891, *Palmer 1713* (Type: GH, Isotypes: GH, NY, US).

This unique species is still known only from the type collection.

43. **Physalis philadelphica** Lamarck, Encycl. Méthod. Botanique 2: 101. 1786; *P. chenopodifolia* Wildenow in L., Species Plantarum, ed 4: 1023-1024, 1797, non *P. chenopodifolia* Lamarck, Tabl. Encycl . . . 28. 1793; *P. ixocarpa* Brotero ex Hornemann, Hortus Regius Botanicus Hafniensis, Suppl. 26. 1819; *P. aequata* Jacq. f. ex Nees, Linnaea **6**: 470. 1831; *P. laevigata* Mart. & Gal., Bull. Acad. . . . Belgique **12**: 131. 1845; *P. philadelphica* Lam. var. *minor* Dunal in DC., Prodromus 13(I): 450. 1852.

Annual, 15-60 cm tall, glabrous to sparsely vestite with short appressed hairs, and, sometimes, long pilose ones; leaf blades 2-7 cm long, ovate to ovate-lanceolate, margins dentate to sinuate-dentate to entire; petioles one-half the length of the blade to equalling it; corolla yellowish, maculate, 10-18 mm wide, rotate-reflexed when fully extended; anthers blue, or yellowish with bluish margins, ca. 3 mm long, usually strongly twisted after dehiscence; fruiting calyx 10-ribbed, 2-3 cm long, often well-filled by the fruit which may be slightly oily at maturity, and is sessile in the calyx; fruiting peduncles 3-8 mm long.

The type of *P. philadelphica* Lamarck, in the Lamarck collections (P), is the same as *P. ixocarpa.* It has a few short hairs on young parts, but does not have long ones.

Rydberg's reference (1896:337) of perennial material to this taxon, which he attempted to differentiate from *P. ixocarpa,* pertains to collections of the variable *P. virginiana* complex of eastern North America. Some of them the author has seen and has referred to var. *subglabrata* (Mac. & Bush) Waterfall.

SELECTED COLLECTIONS. MEXICO: CHIAPAS: Los Lagos, 34 miles se of Comitan, Jan. 17-20, 1952, *Carlson 2228* (MICH, NY, UC); 3 miles e of Teopisca, June 12, 1960, *King 2866* (MICH, NY, UC); CHIHUAHUA: canyon, La Cienegita, Rio Mayo, Sept. 10, 1936, *Gentry 2633* (F, GH, UC, US); 3 miles w of Cd. Camargo, 4000 ft., Aug. 2-5, 1939, *White 2274* (GH, MICH); COAHUILA: La Novia, between Laguna de Leche and Magueyal, Aug. 30, 1941, *I. M. Johnston 8635* (GH); Saltillo, June 1898, *Palmer 325* (GH, NY, US); DISTRITO FEDERAL: Lago de Texcoco, Oct. 21, 1962, *Rzedowski 16273* (OKLA); DURANGO: Durango and vicinity, April to Nov. 1896, *Palmer 288* (BM, F, GH, NY, UC, US); GUERRERO: Rio Balsas, Aug. 26, 1910, *Orcutt 4387* (F);

HIDALGO: Real del Monte, *Berlandier 225* (P); Ixmiquilpan, July 1905, *Rose et al 9068* (NY, US); JALISCO: along lumber road, 11 miles from Atenquique, April 3, 1951, *McVaugh 11743* (MICH); barranca near Guadalajara, June 1886, *Palmer 1* (BM, GH, NY, US); grassland with desert shrubs, 11 miles se of Lagos de Mareno, *Waterfall 13872* (OKLA); MEXICO: in 1865, *Bourgeau 872* (NY, P, US); MICHOACAN: Ario in 1840, *Galeotti 1188*, Type collection of *P. laevigata* Mart. & Gal. (BR, P); Balsas, Huetamo, Mar. 23, 1934, *Hinton 5823* (MICH, NY, US); MORELOS: valley below Cuernavaca, 4000 ft, Sept. 16, 1900, *Pringle 8446* (F, GH, NY, UC, US, VT); NUEVO LEÓN: Rio Santa Catarina, Monterrey, June 17, 1934, *Pennell 16790* (NY, US); wet depression in calcareous desert, 16 miles n of Matehuala, Aug. 21, 1959, *Waterfall 15750* (OKLA, SMU); OAXACA: valley about Cuicatlan, Nov. 3, 1894, *Nelson 1874* (GH, US); Tomellin Canyon, 3500 ft, Dec. 9, 1895, *Pringle 6263* (BM, F, GH, NY, UC, US, VT); PUEBLA: vicinity of San Luis Tultitlanapa, July 1908, *Purpus 3581* (UC); QUERÉTARO: vicinity of Querétaro, in 1912, *Basile 203* (US); SAN LUIS POTOSÍ: region of San Luis Potosí, in 1878, *Parry & Palmer 640* (GH, NY, US); calcareous desert, 74 miles n of San Luis Potosí, Aug. 20, 1959, *Waterfall 15717* (OKLA, SMU); SINALOA: Fuerte, Mar. 27, 1910, *Rose et al 13575* (US); Mazatlán, Jan. 1889, *Wright 1253* (F, GH, UC, US); TABASCO: San Juan Bautista, Jan. 28, 1907, *Collins & Doyle 267* (US); TAMAULIPAS: valley near Miquihuana, Aug. 8, 1941, *Stanford et al 801* (GH, NY, UC); TLAXCALA: Tlaxcala, June 23, 1938, *Balls 4902* (BM, NY, UC, US); VERACRUZ: Orizaba, July 24, 1866, *Bourgeau 2694* (BR, GH, OKLA, P); Cordoba, Aug. 1936, *Matuda 261* (MICH); Jalapa, in 1894, *Smith sin. num.* (MICH). COSTA RICA: Cartago, cultivated, Oct. 6, 1953, *Heiser 3608* (F); EL SALVADOR: in sand along stream, Ahuachapan, Jan. 9-27, 1922, *Standley 20244* (GH, NY, US). GUATEMALA: open slopes in pine-oak forest, e of Quiche, Nov. 20-Dec. 4, 1940, *Grant 657* (F, GH); near Amatitlan, Dec. 29, 1938, *Standley 61335* (F, US); damp thicket, sea level, San Jose, Jan. 30, 1939, *Standley 64015* (F); Coban, April 19, 1941, *Standley 90935* (F). CUBA: Havana, May 7, 1914, *Ekman 734* (NY); HAITI: Massif de la Selle, Port-au-Prince, Feb. 2, 1926, *Ekman 5495* (NY). JAMAICA: Hope Road, Jan. 13, 1898, *Harris 6983* (MICH). NEVIS: Charlestown, Mar. 9, 1959, *Proctor 19451* (GH).

The above citations all refer to var. *philadelphica* forma *philadelphica*. The following is a forma containing plants which develop long jointed hairs in varying abundance, especially about the sepals and pedicels. Not all duplicates of the same collection will exhibit the same degree of density of long hairs, but most collections do not have them in any quantity.

43b. forma **pilosa** Waterfall, forma nov.

Forma *philadelphica* simillima, sed calycibus et pedicellis plus minusve pilosis.

TYPE: *Paul C. Standley 79899* Finca la Alameda near Chimaltenango, GUATEMALA, Dec. 11-22, 1940 (F).

SELECTED COLLECTIONS. MEXICO: CHIHUAHUA: arroyo, Sierra Bajura, Río Mayo, Dec. 28, 1934, *Gentry 1207* (F). GUATEMALA: in field near Antigua, *Melhus & Goodman 3489* (F); *Standley 79899*, type, cited above; Jalapa, Nov. 28, 1939, *Steyermark 32159* (F).

43c. var. **parviflora** Waterfall, var. nov.

Var. *philadelphica* simillima, sed flores minores, corollis 3-5 mm longis et 6-7 mm latis; antheris violaceis, 1.2-1.5 mm longis.

TYPE: partial shade nearly south of Cerro Sanganguey, 12 miles se of Tepic, NAYARIT, Aug. 16-18, 1959, *Feddema 582* (MICH, Isotype: OKLA).

COLLECTIONS EXAMINED. MEXICO: JALISCO: low marshy area about 1 mile w of Ayo el Chico, Aug. 23, 1958, *McVaugh 17219* (MICH); NAYARIT: *Feddema 582*, cited as Type.

43d. var. **immaculata** Waterfall, var. nov.

Var. *parviflora* simillima, sed corollis immaculatis vel subimmaculatis.

TYPE: *U. T. Waterfall 16115* silty flat in desert, 14 miles ne of Parral, CHIHUAHUA, Aug. 10, 1961 (OKLA, Isotypes: GH, US).

COLLECTIONS EXAMINED. MEXICO: CHIHUAHUA: flood plain of Río Conchos near Valle de Zaragosa, May 19, 1955, *Pennington 328a* (OKLA); *Waterfall 16115*, Type, cited above; GUANAJUATO: ditch in cornland, 11 miles se of Salamanca, Aug. 16, 1957, *Waterfall 13907a* (OKLA); JALISCO: stony hilltop in desert scrub, 7 miles se of Lagos de Mareno, Aug. 15, 1957, *Waterfall 13860* (OKLA, SMU); SONORA: Río Bavispe, Colonia Oaxaca, July 25, 1938, *White 672* (GH, MICH); Río Bavispe, June 27-29, 1940, *White 2888* (GH, MICH).

44. **Physalis michoacanensis** Waterfall, sp. nov.

Planta herbacea; caulibus multirameis, 1 m altis, puberulis; foliis ovatis vel rhomboideo-ovatis, basi inaequalibus, marginibus integerrimus, majoribus 6-11 cm longis et 3-5 latis, petiolis 3-6 cm longis; calycibus floriferis 3-4 mm longis et 3-4 mm latis ad basim loborum; calycis lobis ovato-lanceolatis vel deltoideo-lanceolatis, 1.5-1.8 mm longis; pedicellis 3-5 mm longis; corollis maculatis vel parvimaculatis, reflexo-rotatis, 8-10 mm longis et 8-9 mm latis, ostiis dense longitrichomatibus; antheris violaceis, 2-2.2 mm longis; calycibus fructiferis subteretibus, 30-25 mm longis et 20-25 mm latis; pedicellis 5-8 mm longis; baccis 8-10 mm latis.

TYPE. *Rogers McVaugh 17931* (MICH, Isotype: OKLA) abundant in partial shade, old lava flows 4 miles nw of Apatzingan, in sparse woodland of *Cordia, Amphipterygium, Apoplanesia*, elev. 300 m, MICHOACÁN: MEXICO, Sept. 16, 1958.

45. **Physalis angulata** L., Species Plantarum 1: 183. 1753. Annual, 25-100 cm tall, branched, glabrous or with a few short, antrorsely appressed hairs; leaf blades usually ovate to ovate-lanceolate, narrower in var. *lanceifolia*, usually deeply and irregularly incised-toothed, or undulate-toothed, sometimes entire, principal ones 5-11 cm long and 3.5-8 cm wide, on petioles 4-8 cm long; flowering calyx usually (3-) 4-7 mm long, divided above into deltoid to broadly lanceolate, sometimes slightly acuminate lobes (1.5-) 2-3 mm long, width 2-4 mm at base of lobes, on pedicels 5-10 mm long; corolla immaculate, or with indistinct spots, somewhat hairy on the inside of the tube, 6-12 mm long and 7-12 mm wide when fully expanded; anthers bluish or violet, (1-) 2-2.5 mm long on slender filaments 3-5 mm long; fruiting calyces 10-angled or 10-ribbed, 20-35 mm long and 17-22 mm wide, on pedicels (7-) 10-25 mm long; berry 10-12 mm in diameter on a gynobase ca. 1 mm long.

The concept of *P. angulata* has contained different kinds of plants at different times. Some are incompatible with the current delimitation of the species, while others, based on obvious, but inconsequential variation, have resulted in the description, or reinterpretation, of taxa not retained here.

The specific name itself seems to have resulted in misinterpretation. Some authors have apparently thought it referred to the fruiting calyx, and have separated material with 10-ribbed fruiting calyces. If one considers only the evidence of Linnaeus' intention, as indicated in Species Plantarum itself, it is noted that the specific names are generally taken from a species-characterization, either that of Linnaeus himself, or of one of the cited references. In this case we find "Physalis ramosissima, ramis angulatis glabris", indicating that the name refers to the branches, not the fruiting calyx. The first-cited reference is Hortus Cliffortianus which reads "5. Physalis annua ramosissima, ramis angulosis glabris, foliis dentato-serratis . . . Crescit in Carolina".

In the herbarium of the Linnaean Society in London (the author is grateful to its director, Mr. O'Grady, for his courtesies) is to be found, as a part of the Linnaean Herbarium, a sheet of *P. angulata* (labelled 247.9). The specimen is nearly entire-leaved, anthers are light blue, fruiting calyx 10-ribbed with the primary ribs larger, flowering pedicels are 6-12 mm long and fruiting pedicels 15-20 mm long; the fruiting calyx is ca. 30 mm long and 23 mm wide.

The Riksmuseum in Stockholm has in its Linnaean Herbarium a similar specimen, one with entire leaves or with leaves having 1 or 2 teeth on each margin. A notation on the back of the sheet indicates that it was raised in the botanical gardens in Uppsala.

Link in 1821 (Enumeratio Plantarum Horti . . . Berolinensis) described *P. dubia* . . . "calycibus demum angulatis pulverulento-subtomentosis . . ." from Brasil. Nees (Linnaea **6**: 471. 1831) renamed the species *P. Linkiana* based on *P. dubia* Link of which he says "Nomen mutandum erat, ob Physalidem Gm. antiquiorem". Of the calyx he only says, "sub lente scabriusculus". Asa Gray (Proc. Amer. Acad. Arts and Sci. **10**: 64. 1875) transferred the name "*Linkiana*" to the varietal status. In 1891 Otto Kuntze (Rev. Gen. Plant. . . . 2: 452) transferred Link's "*dubia*" to the varietal status under *P. angulata*. In 1962 Stehlé (Bull. Soc. Bot. France **109**: 28) reduced "*Linkiana*" to the status of a forma under *P. angulata*.

There does not seem to be a type extant to represent *P. dubia* Link. It seems doubtful if a plant described as having calyces "pulverulento-subtomentosis" could belong to the concept of *P. angulata* as characterized either by the two extant collections from the Linnean Herbarium, or by representatives of the population in the eastern United States on which the citation in Hortus Cliffortianus was based. The flowering calyces of *P. angulata* vary from glabrous to having varying amounts of short, appressed hairs, but usually these are sparse. It seems possible that *P. dubia* could have referred to material now called *P. Lagascae*. In any event, in the absence of a type to which the name *P. dubia* can be tied, it seems dubious, if a pun is permitted, that it should be assigned to *P. angulata*. Following this course of action, none of the names listed in the preceding paragraph can be used, since they all spring from *P. dubia*. It should be noted, however, that in the varietal and formal category, the name has pertained to the extreme of *P. an-*

*gulata* with large-toothed leaves. In the following treatment both this and the entire-leafed extreme are considered as var. *angulata.*

45a. **P. angulata** L., var. **angulata;** *P. ramosissima* Miller, Gardener's Dictionary: 12. 1768; *P. capsicifolia* Dunal, in D. C. Prodr. 13(1): 449. 1852; *P. angulata* var. *capsicifolia* (Dunal) Griseb., Kar. 96: 1857; *P. angulata* var. *ramosissima* (Miller) O. E. Schulz, in Urban, Symb. Ant. 6: 143. 1909; *P. angulata* forma *ramosissima* (Miller) Stehlé, Bull. Soc. Bot. France **109:** 28. 1962.

Leaves ovate to ovate-lanceolate or oblongish, coarsely and irregularly toothed to entire; flowering calyx usually 4-7 mm long, with lobes 2-3 mm long; corolla usually immaculate, sometimes with indistinct spots, usually 6-12 mm long; anthers usually 2-2.5 mm long.

SELECTED COLLECTIONS. MEXICO: BAJA CALIFORNIA: San José del Cabo, April 1899, *Grabendorfer sin num* (UC); JALISCO: near Chapala, Oct. 5, 1903, *Rose & Painter 7628* (US); MICHOACÁN: Zarzamora, *Hinton 15035* (F, GH; the US duplicate is *P. philadelphica*); TABASCO: alrededores del Barrio de Santa Cruz, San Juan Bautista, Aug. 13, 1888, *Rovirosa 263* (NY); VERACRUZ: Cordoba, Aug. 1938, *Matuda 2240* (MICH). BRITISH HONDURAS: Jones Bank, Belize River, March 1933, *Lundell 4002* (F, MICH). COSTA RICA: Guapiles, Mar. 12, 1924, *Standley 37388* (US). EL SALVADOR: dry hillside, Laguna de Olomega, Dept. de San Miguel, Feb. 20, 1922, *Standley 21054* (GH, US). NICARAGUA: Bahia de Bluefields Río Escondido, Mar. 26, 1949, *Molina 1990* (F). PANAMA: Changuinola, Jan. 25, 1921, *Carleton 74* (US); San José Island, Jan. 1, 1946, *I. M. Johnston 993* (GH); around Culebra, Nov. 1911, *Pittier 4782* (F, GH, US). ANAGDA: rocky plain, *Britton & Fishlock 1044* (NY). ANTIGUA: near St. John, Feb. 4, 1913, *Rose et al 3257* (NY). BAHAMAS: creek, Andros, June 6, 1890, *Northrop 616* (NY). BARBADOS: Waterford in 1900, *Bovell sin num* (NY). BERMUDA: south road, Aug. 16, 1913, *Collins 280* (GH, NY). CUBA: sand dunes, Laguna de Cortes, Mar. 11, 1911, *Britton & Cowell 9863* (GH, NY); Bayate, Oriente Province, Aug. 1, 1914, *Ekman 2348* (NY); near river s of Havana, June 23, 1914, *Leon 4325* (NY). DOMINICAN REPUBLIC: near Puerto Libertador, Manzanilla Bay, *Howard 9635* (GH, NY). GRENADA: wooded hillside near Victorial, *Proctor 17222* (GH). GUADELOUPE: in 1893, *Duss 2590* (NY). HAITI: Gonave Island, Mar. 3-14, 1920, *Leonard 3065* (GH); Bassin Blue, Apr. 16, 1929, *Leonard 14705* (GH, NY). JAMAICA: Saint Ann's Bay, Mar. 27-30, 1908, *Britton 2484* (NY); Windsor estate, Aug. 22, 1956, *Proctor 10503* (GH). PUERTO RICO: edge of marsh, Mayaguez, March 31, 1913, *Britton 2353* (NY); Cerro Ventana, Vieques Island, Feb. 20, 1914, *Shafer 2983* (NY). ST. CROIX: Catherine's Rest, April 9, 1896, *Ricksecker 361* (NY, UC). ST. KITTS: cane fields, *Britton &*

*Cowell 755* (NY). ST. THOMAS: *Eggers 295* (GH, NY). ST. VINCENT: *G. W. Smith 368* (NY). MARTINIQUE: in 1879, *Duss 1930* (NY). TORTOLA: Sea Cow Bay, *Britton 683* (NY). TRINIDAD: *Britton et al 1057* (G).

In attempting to account for another name, it may be of interest to note that *P. Halicacabum* Crantz, Inst. Rei Herb. 367. 1766, is described as "P. ramosissima ramis angulatis glabris, foliis ovatis dentatis", and that under it is "Beta, Alkekengi indicum glabrum capsicifolia". The first phrase seems only slightly modified from Linneaus' in Species Plantarum, and the appended variety is exactly the same. Therefore it seems probable that the name should be included in the synonymy of *P. angulata,* despite its referral to *P. Alkekengi* in Index Kewensis.

45b. **Physalis angulata L., var. lanceifolia** (Nees) Waterfall, Rhodora **60:** 163-164. 1958; *P. lanceifolia* Nees, Linnaea **6:** 473. 1831.

Leaves lanceolate to linear-lanceolate; corolla usually 4-6 mm long; anthers usually 1-2 mm long.

SELECTED COLLECTIONS. MEXICO: CAMPECHE: Palizada, July 25-28, 1939, *Matuda 3867* (GH, MICH, OKLS, US); SINALOA; vicinity of Labradas, Sept. 9, 1925, *Ferris & Mexia 5149* (GH); Mazatlan, Sept. 1932, *Ortega 7074* (F, NS); SONORA: bed of Rio de Sonora, vicinity of Hermosillo, Mar. 5, 1910, *Rose et al. 12421* (US).

46. **Physalis minimaculata** Waterfall, sp. nov.

Planta annua, ramosa; caulibus pubescentibus; foliis ovatis, basi inaequalibus, margine inaequaliter magnodentatis, principalibus 3-5 cm longis et 2-2.5 mm latis, petiolis 2-4 mm longis; calycibus floriferis 3.5-4 mm longis et 3-3.5 mm latis ad basim loborum; calycis lobis 1.5-2 mm longis; pedicellis 4-6 mm longis; corollis minimaculatis, rotatis vel reflexo-rotatis, 7-10 mm longis et 8-9 mm latis; antheris violaceis, oblongis, 2-2.5 mm longis; filamentis crassis; calycibus fructiferis decangulatis, subtilibus, ca. 18 mm longis et 12 mm latis.

TYPE: *Rogers McVaugh 17902* (MICH). MEXICO: MICHOACÁN: bushy annual to 60 cm high, flowers white, old lava flows 4 miles nw of Apatzingan in sparse woodland of *Cordia, Amphiterygium* and *Apoplanesia,* elev. ca. 300 m, Sept. 16, 1958.

47. **Physalis ampla** Waterfall, sp. nov.

Planta herbacea; caulibus glabris vel antrorse paucitrichomatibus; foliis ovatis, integerrimis vel undulato-dentatis; principalibus 4-6 cm longis et 3-4 cm latis; petiolis 3-5 cm longis; calycibus floriferis 4-5 mm longis et 3-4 mm latis ad basim loborum; calycis lobis late ovatis vel deltoideo-ovatis, 1-1.5 mm longis; pedicellis 3-8 mm longis;

calycibus vestitis, pilis antrorsis, articulatis, ca. 1 mm longis; corollis immaculatis, 5-6 mm longis et 4-6 mm latis; antheris violaceis, ca. 1 mm longis; calycibus fructiferis decacostatis, 30-35 mm longis et 25-30 mm latis, glabris vel paucitrichomatibus; pedicellis 5-10 mm longis; baccis 10-12 mm latis.

TYPE: *T. S. Brandegee sin. num.* MEXICO: SINALOA: vicinity of Culiacán, Sept. 12, 1904 (UC); also examined: *Brandegee*, Oct. 10, 1904, vicinity of Culiacán.

This species is characterized by the small corollas, hairy calyces, short pedicels and large, inflated fruiting calyces which are glabrous or have a few hairs, these often growing from the more or less deltoid lamellations on the calyx ribs.

48. **Physalis Lagascae** Roemer & Schultes, in Linnaeus Systema Vegetabilium 4: 679. 1819.

Annual, 10-90 cm tall, stems vestite in varying degrees with jointed hairs up to 2-4 mm long; leaf blades ovate to ovate-lanceolate, often somewhat rhombic and inequilateral at bases, margins entire to irregularly dentate or sinuate; principal blades 2-4 cm long on petioles 1-3 (-4) cm long; flowering calyx divergently long-hairy, 3-4 mm long and 2.5-3 mm wide at base of calyx lobes, which are nearly deltoid and 0.7-1.5 mm long, pedicels 2-5 mm long; corolla maculate, but the spots usually not strongly contrasting and sometimes apparently immaculate, 5-7 mm long and 5-6 mm wide when fully open, hairy in the tube; anthers bluish or violet, 1.2-1.5 mm long, on filaments ca. 1.5 mm long; fruiting calyx 10-ribbed, the ribs sometimes with projections that appear to be lamellate hair-bases, or with hairs having such bases, sometimes glabrous, 13-20 mm long and 12-20 mm wide on pedicels 3-6 mm long; berry nearly spheric, 6-10 mm wide.

48a. var. **Lagascae**; *P. micrantha* Link, Enumeratio Plantarum Horti . . . Berolinensis 1: 181. 1821-22; *P. parviculea* Blake, Contrib. U. S. Natl. Herb. **24**: 20. 1922.

Plant varyingly hairy, often abundantly so on the stem, the hairs persistent.

SELECTED COLLECTIONS. MEXICO: DURANGO: Durango and vicinity, Sept. 1896, *Palmer 622* BM, F, GH, UC, US); JALISCO: steep rocky hills 2 miles nw of Tequila, Sept. 3, 1960, *McVaugh 18629* (MICH); precipitous mountainsides with arborescent *Ipomoea* above the west end of Lake Chapala, Nov. 8, 1959, *McVaugh 377* (MICH); near farmland, 42 miles e of Guadalajara, Aug. 18, 1959, *Waterfall 15634* (BM, F, MICH, NY, SMU); MICHOACAN: on mountainside above Lake Chapala, near Km 543, Sept. 23, 1958, *McVaugh 18181* (MICH); MORELOS: valleys below Cuernavaca, Sept. 1900, *Pringle 8447* (F, GH, NY, OKLA, UC, US, VT); NAYARIT: steep mountainsides 2 miles ne of Santa Maria del Oro, Sept. 15, 1960, *McVaugh 19035* (MICH); QUERETARO: silty flats with shrubs and cacti, 8 miles e of Querétaro, Aug. 23, 1961, *Waterfall 16548* (OKLA); SINALOA: stony hillside, 57 miles ne of Mazatlán, Aug. 16, 1956, *Waterfall 12770* (OKLA); ZACATECAS: hills 5 miles sw of Jalpa, Aug. 30, 1960, *McVaugh 18513* (MICH). EL SALVADOR: Cerro de San Jacinto near San Salvador, Feb. 8, 1922, *Standley 20611* (GH, NY, US). GUATEMALA: dry riverbed, Los Amate, Dept. of Izabel, May 9, 1919; Type of *P. parviculea* Blake, *Blake 7318* (GH, US); grassy slopes around Ipala, Oct. 23, 1939, *Steyermark 30334* (F). HONDURAS: vicinity of El Zamorano, April 14, 1949, *Standley 19002* (F). PANAMA: Sabanas, Dec. 2, 1921, *Heriberto 281* (US). MARTINIQUE: in 1899, *Duss 4050* (NY).

48b. var. **glabrescens** Schulz, in Urban Symbolae Antillanae 6: 147. 1909.

Similar to var. *Lagascae*, but less hairy, glabrate, the stems with few hairs or none.

SELECTED COLLECTIONS. MEXICO: CHIAPAS: in grassy field, Nov. 27, 1949, *Matuda 17225* (F); GUERRERO: Coyuco-Ziranderangio, May 1, 1934, *Hinton 5928* (NY); MEXICO: Cumbre-Tejupilco, Sept. 6, 1935, *Hinton 8418* (MICH, US); MICHOACAN: Tacupa, Mar. 23, 1934, *Hinton 5821* (BM); VERACRUZ: région d'Orizaba, *Bourgeau 2940* (P); YUCATAN: Chichankanab, *Gaumer 9426* (F, GH, US). COSTA RICA: San Ramon, April 10-16, 1938, *Brenes 22847* (NY). EL SALVADOR: San Salvador, Dec. 20, 1921, *Standley 19662* (GH, NY, US); old corn field, San Vicente, Mar. 2-11, 1922, *Standley 21724* (GH, NY, US); wet forest, Sonsonate, Mar. 18, 1922, *Standley 22363* (GH, US). GUATEMALA: damp field, Zacapa, Oct. 7, 1940, *Standley 73608* (F); damp thicket, Jutiapa, Oct. 24, 1940, *Standley 75631* (F). HONDURAS: gravel stream bed, near El Zamorano, Aug. 13, 1947, *Standley 12177* (F). NICARAGUA: Managua, Aug. 1932, *Garnier 1164* (US); moist thicket, Chichigalpa, July 12, 1947, *Standley 11275* (F). PANAMA: near Matias, Dec. 30, 1923, *Standley 28920* (US). CUBA: Type collection of var. *glabrescens*, *Wright 3636* (GH, US, NY, P); Havana, Sept. 1916, *Leon 6806* (NY); on crotch of tree, Baracoa, ORIENTE, Nov. 30, 1910, *Shafer 7691* (NY).

The usage of the name *P. Lagascae* introduces the question of the identity of *P. minima* L. In Species Plantarum, page 183-184, this species follows *P. pubescens* as "8. Physalis ramosissima, pedunculis fructiferus folio longioribus. Hort. Cliff. 62. Roy. lugdb. 427. Solanum vesicarium indicum minimum. Herm. ludgb. 569. t. 571. Pee-inota-inodien. Rheed. mal. 10. t. 140. f. 71. Habitat in Indiae aridis sordidis".

There is no *P. minima* in the Linnaean material at Stockholm. Neither is there any in the Hortus Cliffortianus herbarium at the British Museum. Paul Hermann, Horti Academici lugduno-Batavia Catalogus . . . 1679-1686 ("Herm. lugdb.") describes material from Malabar and Ceylon, and has an accompanying illustration showing calyces with spreading hairs. Heinrich van Rhede tot Drakestein, Hortus Malabaricus . . . ("Rheed. mal.") in his tab. 71 shows elongate apiculate fruiting calyces, the upper one-fourth to one-third divided into free, divergent calyx-tips. No hairs are shown on the drawing, but then neither are they for *P. pubescens*, so it is probable that this characteristic simply was not illustrated. It also shows corolla lobes rather deeply incised, but perhaps this is artistic liberty. In any event, it does not resemble anything I have seen.

One might assume that *P. minima* is a *nomen confusum* and that it should be dropped altogether. Or one might conclude that, whatever it is, it refers to Asiatic material, not West Indian and New World. After all, Linnaeus did say "habitat in India" not "in India utraque" which would have intentionally included the West Indies. Furthermore his references are to Asiatic works. True, New World material has been identified as *P. minima*, but it was for this material that *P. Lagascae* was established. Attempting to form a concept of *P. minima by* examining Asiatic material currently so referred is fruitless. In the rather extensive collections at the Kew Herbarium there is under this name material of both *P. angulata* and *P. pubescens*, as well as material with small 10-ribbed fruiting calyces, some of which is very similar to that referred herein to *P. Lagascae*. The elucidation of this material awaits further study.

49. **Physalis microcarpa** Urban & Ekman, in Urban Plantae Haitiensis, Arkiv for Botanik **21A**(5): 59. 1927.

Annual 15-30 (-60) cm tall, slightly branched to much-branched, erect to nearly prostrate, hairs few, short, antrorsely curled; leaf blades ovate or rhombic-ovate to lanceolate, principal ones 25-35 (-45) mm long and 11-30 (-40) mm wide, on petioles 12-45 mm long, their margins usually entire, sometimes slightly and irregularly repand-dentate, bases sometimes inequilateral, apices often somewhat attenuate; flowering calyces 1.2-2.5 mm long and 1-2 mm wide, divided above into lobes 0.4-0.8 mm long, pedicels 0.5-2 mm long; corolla 2.8-3.5 mm long, immaculate, tube slightly hairy within; anthers 0.3-0.7 mm long, bluish or violet, sometimes yellowish (perhaps due to fading), on filaments 0.5-1.0 mm wide, nearly terete, slightly 10-ribbed, sometimes slightly angled, on pedicels 1.5-4 mm long; fruit 4-6 mm wide.

SELECTED COLLECTIONS. CENTRAL AMERICA: moist sandbar, Metepan, Jan. 29, 1947, *Standley and Padilla 3337* (F). GUATEMALA: brushy rocky slope, Jutiapa, Oct. 24, 1940, *Standley 75090* (F); damp thicket, above Chiquimula, Oct. 14, 1940, *Standley 74334* (F). HONDURAS: weed in field along Río Yeguare e of El Zamorano, Dec. 10, 1946, *Standley 1465* (F); Tegucigalpa, Nov. 29, 1949, *Standley 24792* (F). HAITI: Jean Rabel, Jan. 27, 1929, *Leonard 21614* (GH, NY). SANTO DOMINGO: Llanura de Vega prope Monte-Cristi, April 3, 1926, *Ekman 5841* (Type: *S*); common weed in field, Valle del Ciabo, Nov. 4, 1930, *Ekman 16125* (GH, NY).

50. **Physalis acutifolia** (Miers emend. Sandwith) Sandwith, Kew Bull. **14**: 232. 1960; *Saracha acutifolia* Miers, Ann. & Mag. Nat. Hist., ser. **2**, **3**: 449. 1849; *P. Wrightii* Gray, Proc. Amer. Acad. Arts & Sci. **10**: 63. 1875.

Annual, nearly glabrous, the few hairs short, stiff, flattish and appressed; leaf blades ovate-lanceolate to linear-lanceolate, principal ones usually 4-12 cm long, on petioles 1.5-7 cm long; leaf margins usually irregularly and often coarsely dentate, sometimes regularly and saliently dentate; flowering calyx usually 4-5 mm long on pedicels 5-12 times its length; corolla light yellow, sometimes with a greenish tinge, rotate with short tube, 15-23 mm wide when fully open, with 5 hairy pads near base of limb alternating with the stamens; anthers usually ca. 3 mm long, yellow with a blue or a blue-green tinge; filaments slender, slightly longer than the anthers; fruiting calyx ca. 2-2.5 cm long and 1.7-2 cm wide, on pedicels 2.5-6 cm long sometimes nearly filled by the fruit.

SELECTED COLLECTIONS. MEXICO: BAJA CALIFORNIA: east base of Cerro de la Giganta, Oct. 7, 1951, *Carter & Kellogg 3129* (UC); CHIHUAHUA: Candelaria, Oct. 24, 1911, *Stearns, sin. num.* (US); Janos, Aug. 26, 1939, *White 2576* (GH, MICH); SINALOA: Culiacan, Sept. 23, 1904, *Brandegee sin num* (UC); rocky volcanic slopes with coastal plain forest, 24 miles n of Los Mochis, Oct. 3, 1954, *Gentry 14409* (US); Elota, Nov. 1925, *Ortega 5633* (GH, US); SONORA: thorn forest 3 miles s of Navajoa, Sept. 16, 1959, *Gentry 17824* (US); Guaymas, in 1887, *Palmer 175* (GH, NY, US); 37 miles w of Hermosillo, Aug. 28, 1941, *Wiggins & Rollins 146* (GH, MICH, NY, UC, US); Horconcitos, Río Bavispe, Sept. 5, 1940, *White 3714* (MICH).

It is quite possible that *P. dentata* Dunal in DC. Prodromus 13(1): 441-442. 1852, should be referred to this taxon. A photograph, Negative 31435 of the Field Museum of Natural History, shows leaves, large corollas, and post-anthesis nodding calyces, as well as the long pedicels, of *P. acutifolia*. The label only says "Nueva Espana". It was probably collected by Mocino in 1791 on his trip from Tepic to Los Alamos to Aguascalientes.

51. **Physalis sulphurea** (Fernald) Waterfall, comb. nov., *Margaranthus sulphureus* Fernald, Proc. Amer. Acad. Arts & Sci. **35**: 566-567. 1900.

Annual, 10-35 cm tall, little-branched above, but sometimes several-stemmed from the base, stems becoming thick, hollow, up to 5-10 mm wide when pressed flat, glabrous, or with a few antrorsely appressed hairs on younger parts, sepals and pedicels; leaf blades ovate to elliptic-lanceolate, principal ones 1.5-6 cm long and 1-4 cm wide, often basally inequilateral and sometimes decurrent into a slightly alate petiole 5-25 mm long, margins entire or irregularly repand-dentate; flowering calyx quadrate to oblong-campanulate, 2-3 mm long and 2-4 mm wide, divided above into deltoid lobes 0.7-1.5 mm long, on pedicels 4-10 mm long; corolla immaculate, or with barely discernible spots, somewhat hairy within the tube, 5-7.5 mm long and 6-8 mm wide, possibly wider if fully expanded; anthers bluish or violet, oblong to ovate, 1-1.5 mm long on filaments 1-2 mm long; fruiting calyces 7-13 mm long, nearly terete or 10-ribbed, thin, the veins obscure, on pedicels (5) 10-15 mm long; berry 5-9 mm in diameter.

In describing *Margaranthus sulphureus*, Fernald cited two collections, *Bourgeau 111* and *Pringle 8215*. The latter, valley of Mexico, alt. 2250 m, Federal District, Oct. 4, 1889 is selected as LECTOTYPE (GH), with a second sheet as ISOLECTOTYPE (GH).

Most of the corollas are unexpanded, but one or two do have the limb expanded. They definitely are not the urceolate corollas of *Margaranthus*, but correspond well to those of *Physalis*.

At one time in the course of this study, the author was of the opinion that *P. Eggersii* O. E. Schulz in Urban, Symbolae Antillanae was synonymous with *Margaranthus sulphureus* Fernald, and consquently annotated a few sheets of this taxon in several European herbaria as *P. Eggersii.* However, a sheet of the type collection of *P. Eggersii, Eggers 1057,* Water Island prope St. Thomas (P), proves to be not *P. sulphureus,* but appears to be an extreme of *P. Lagascae* var. *glabrescens.*

COLLECTIONS SEEN. MEXICO: DISTRITO FEDERAL: *Pringle 8215* cited above as type; wet soil, Valley of Mexico, 7300 ft, July 7, 1901, *Pringle 9426* (GH); JALISCO: west end of Lake Chapala, July 14, 1940, *Hitchcock & Stanford 7167* (GH, US); MEXICO: orilla de Lagunas de Zumpangos, May 5, 1963, *Cruz-Cisneros 603* (MEXP); San Juan Citlaltepec, Orillas de la Laguna de Zumpango, 2250 m, May 5, 1963, *Rzedowski 16000* (OKLA); MICHOACÁN: southeast shore of Lake Patzcuaro, 2200 m, July 15, 1941, *Schery 130* (MICH, US); LOCALITY UNDETERMINED: *Bourgeau 111* (BR, OKLA, P, U:), see discussion above; *Schaffner 362* (P).

52. **Physalis lobata** Torrey, Ann. Lyc. Nat. Hist. New York **2**: 226-227. 1828; *Quincula lobata* (Torr.) Raf., Atlantic Journal **1**: 145. 1832; *P. sabaena* Buckley, Proc. Acad. Sci Phil. **14**: 6. 1863; *Chamaesaracha physaloides* Greene, Bull. Torr. Bot. Club **9**: 122. 1882; *Quincula lepidota* A. Nels. Bot. Gaz. **47**: 450. 1909.

Perennial, branching from the base, spreading or procumbent; indument of varying amounts of crystalline vesicles, flattening when dried, sparse or abundant enough to give the plant a scurfy appearance; leaf blades ovate-lanceolate to linear-lanceolate, cuneately narrowing to a winged petiole, principal ones usually 4-10 cm long and 0.5-3 cm wide, usually pinnatifid, sometimes sinuate or entire; corollas blue or violet, rotate, 1.5-2 cm broad, with 5 hairy pads alternating with the bases of the filaments; anthers 1.5-2 mm long, yellow, on slender filaments; style twisted and bent to one side; flowering calyx 3-4 mm long, divided into triangular lobes 1.5-2 mm long, on pedicels 1-3 (-5) mm long; fruiting calyx 1.5-2 cm long, pentagonal-ovoid ,inflated; fruiting pedicel 1-2.5 (-3) cm long; berry spheric-ovoid, 4-7 mm in diameter, sessile, or essentially so, on the invaginated base of the calyx.

SELECTED COLLECTIONS. MEXICO: CHIHUAHUA: 28 miles s of Camargo, June 21, 1950, *Dressler 1125* (GH); silty flat in desert, Aug. 9, 1961, *Waterfall 16110* (OKLA, MICH); 3 miles n of Jiminez, Aug. 1, 1939, *White 2176* (GH, MICH); COAHUILA: Sabinas, May 21, 1902, *Nelson 5776* (F, GH, US); Torreon, Oct. 13, 1898, *Palmer 461* (BM, F, NY, UC, US); SONORA: playa, 2 miles w of Cerro Colorado, n of Sierra Pinacate, Apr. 28, 1951, *Kamb 2016* (UC); Charco, Feb. 213, 1910, *Lumholtz 19* (GH); TAMAULIPAS: Nuevo Laredo, June 1935, *Clark 6623* (NY).

*P. lobata* reaches the southern limit of its distribution in northern Mexico, extending from southwestern United States, where it is abundant in western Oklahoma, western Texas, New Mexico and parts of Arizona.

53. **Physalis Hintonii** Waterfall, sp. nov.

Herba perennis, 30-55 cm alta; trichomatibus dendriticis, ad 1 mm longis; foliis ovatis, pauci-undulatis, principalibus 5-9 cm longis et 3-6 latis, petiolis 10-35 mm longis; calycibus floriferis 10-16 mm longis et 9-14 mm latis ad basim loborum; calycis lobis deltoideo-ovatis, 5-10 mm longis; corollis maculatis, 13-18 mm longis et 17-20 mm latis; antheris violaceis, 3-4 mm longis; filamentis 3-5 mm longis; calycibus fructiferis pentangulatis, ad apicem apertis, 25-35 mm longis et 18-22 mm latis; baccis ca. 1 cm latis.

*P. Hintonii* is easily recognized by its spreading dendritic (several-branched) hairs, its large flowering calyx with broad sepals, and its oblongish fruiting calyx usually little constricted, and apically open.

TYPE: *George B. Hinton 8457* (NY), Tejupilco, Dist. of Temascaltepec, Estado Mexico, Sept. 17, 1935; Isotypes (NY, US).

COLLECTIONS SEEN. MEXICO: MEXICO: *Hinton 8457* cited above as type; Tejupilco, Temascaltepec, 1340 meters, Sept. 2, 1933, *Hinton 4686* (NY, US); same location, Aug. 21, 1935, *Hinton 8198* (US); Cumbre, Tejupilco, Temascaltepec, *Hinton 8200* (F, US).

54. **Physalis Greenmanii** Waterfall, sp. nov.

Planta herbacea, 1-2 m alta; trichomatibus articulatis, ad 1-3 mm longis; foliis ovatis, acuminatis vel lunato-acuminatis, cordatis, integerrimis, principalibus 6-10 cm longis et 3.5-6.5 cm latis, petiolis 1.3-5 cm longis; pilis laminis paucis, adpressis; calycibus floriferis 8-10 mm longis et ca. 7 mm latis ad basim loborum; calycis lobis ovatis vel ovato-lanceolatis, attenuatis, 5-7 mm longis; pedicellis 5-10 mm longis; corollis maculatis, 10-14 mm longis et 15-18 mm latis; antheris violaceis, 3-4 mm longis, filamentis filiformibus; calycibus fructiferis pentangulatis, 25-40 mm longis et 25-30 mm latis, calycis lobis longe acuminatis; pedicellis fructiferis 7-10 mm longis; baccis 10-12 mm latis.

*P. Greenmanii* is characterized by its cordate leaves with few, long and short, strongly appressed hairs, the stem with spreading, more or less intertwined jointed hairs of varying lengths, the longest 1-3 mm long, by the large light — yellow, prominently mottled-maculate corolla, and by its rather large, 5-angled fruiting calyx abruptly narrowed to long-acuminate lobes.

TYPE: *C. G. Pringle 8104* (US), about thicket near Jalapa, 3-6 ft tall, 4000 ft altitude, Veracruz, Mexico, April 27, 1899; Isotypes: (F, GH, MEXP, NY, UC, US, VT).

This must be the collection referred to by Greenman (1900) as *P. glutinosa* when, after describing *P. Pringlei* and citing specimens, he said "From *P. glutinosa* on the other hand, *P. Pringlei* differs in the leaves . . . not cordate." The collection cited above, presumably available to Greenman, was originally labelled "*P. glutinosa* Schlecht.", the identification probably having been based on a reading of Schlechtendal's original description, but the plant not conspecific with the type of *P. glutinosa* and other material so referred in this paper, noting particularly the large, non-reflexed corolla, 20-35 mm long, of the latter species. It is interesting to note that no material in American herbaria has been heretofore correctly referred to *P. glutinosa,* since that species is the same as the one we have called *Cacabus mexicanus* and *Physalis eximia.* Greenman's comparison to his newly described species was pertinent, but since the specimens he thought to be *P. glutinosa* were not that species, they require another name.

55. **Physalis Pringlei** Greenman, Proc. Amer. Acad. Arts & Sci. **35**: 311-312. 1900.

Herbs, (45 cm-) 1-1.7 m tall; vestiture of glutinous jointed spreading hairs of varying lengths, some with brownish capitate glands; leaf blades ovate, somewhat narrowed, sometimes unequally so, to the petiole, not cordate, usually 4-8 cm long, each margin with 1-3 irregular teeth or small lobes, or entire, sparsely appressed-hairy, often with more abundant hairs along the veins; petioles usually 1-3 cm long; calyx at anthesis oblong or oblong-flaring, 7-10 mm long and 5-8 mm wide at base of lobes, the upper one-third to one-half divided into ovate to lanceolate, acuminate lobes; corolla yellow, marked with 5 somewhat confluent, strongly darkened areas, with tomentum between these and the point of stamen insertion, usually 15-20 mm long and 18-22 mm wide when fully expanded, slightly rotate-pentangular in outline; anthers bluish, oblong, 2.2-3 mm long on glabrous filaments 3-4 mm long; fruiting calyx ovate to oblong-ovate, 5-angled with intermediate ribs or slight angles, with vestiture similar to stem but more sparse, 2.5-4 cm long and 18-25 mm long and 10-15 mm wide, sessile, or essentially so, on the invaginated base of the calyx.

55a. var. **Pringlei**

Calyx lobes acuminate, often prominently so; leaf margins irregularly sinuate, or with few irregular teeth or small lobes.

SELECTED COLLECTIONS. MEXICO: DISTRITO FEDERAL: Sierra de Ajusco, 8500 ft, Oct. 2, 1895, *Pringle 6216* (BR, F, GH, NY, OKLA, P, UC, US, VT); GUANAJUATO: cliffs, Acambaro, Oct. 6, 1904, *Pringle 13448* (GH, US); JALISCO: rocky outcrop in mountains e of Mamantlan, about 15 miles sse of Autlan, July 30, 1949, *Wilbur 1988* (MICH); MEXICO: near Cima, Sept. 1903, *Rose & Painter 7172* (GH, NY, US); An Angel, al sur del Xitle, Sept. 15, 1952, *Rzedowski 1759* (MEXP); NUEVO LEÓN: upper San Francisco Canyon, 15 miles sw of Pueblo Galena, May 17, 1934, *Mueller 432* (F, GH, MICH); OAXACA: Sierra de Clavellinas, 3-5 ft., 9000 ft alt., Oct. 18, 1894, *Pringle 6001* (Type: GH, Isotypes: BM, BR, NY, UC, US, VT).

55b. var. **curtiloba** Waterfall, var. nov.

A var. *Pringlei* differt calycibus curtioribus, laminis integerrimis.

TYPE: *Edward Palmer 144* (US) San Ramon, DURANGO, Apr. 21 to May 9, 1906, Isotypes: (F, GH, NY, UC).

COLLECTIONS EXAMINED. MEXICO: CHIHUAHUA: canyon slope in pine-oak forest, Arroyo Hondo, Sierra Charuco, Apr. 16-30, 1948, *Gentry 8074* (MICH, UC, US); DURANGO: *Palmer 144* cited above as type; SONORA: vicinity of Alamos, Mar. 19, 1910, *Rose et al 13104* (GH, NY, US).

56. **P. angustiphysa** Waterfall, sp. nov.

Planta herbacea; trichomatibus longis, articulatis, mollibus, divaricatis; foliis ovatis vel late ovatis, inaequaliter paucidentatis, principalibus 4-5 (-10) cm longis et 3-4 (-6) cm latis; calycibus floriferis 3-4 mm longis et 3-4 mm latis ad basim loborum; calycis lobis lanceolatis vel late lanceolatis, 2-2.5 mm longis; corollis luteis, maculatis, 8-9 mm longis et 12-14 mm latis; antheris violaceis 2-2.5 mm longis, filamentis filiformibus, 3-4 mm longis; calycibus fructiferis pentangulatis, 23-27 mm longis et 10-18 mm latis; baccis 10-13 mm longis et 6-8 mm latis.

TYPE: *Julian A. Steyermark 51977* (US). GUATEMALA: lower brushy slopes, La Sierra (Tujimach) across river from San Juan Atitlan, Dept. Huehuetenango, Sept. 8, 1952; Isotypes: (F, US).

COLLECTIONS EXAMINED. MEXICO: MICHOACAN: by stone fence in llano, 1 meter high, Zitacuaro-Coyota, Aug.. 25, 1938, *Hinton 13156* (F, MICH, NY); NAYARIT: precipitous mountainsides, *Carpinus-Magnolia* forest, in ravines, 8 miles w of Tepic, Sept. 10, 1960, *McVaugh 18872* (MICH). GUATEMALA: *Steyermark 95177* cited above as Type.

The fruiting calyx is often twice as long as wide. The type collection has long, soft, somewhat tangled, jointed, spreading hairs. However, McVaugh's collection from Nayarit has larger leaves and less dense vestiture than the type.

57. **Physalis subrepens** Waterfall, sp. nov.

Planta herbacea, 50-60 cm longa; caulibus tenuibus adscendentibus vel procumbentibus, interdum repentibus ad nodis inferioribus; trichomatibus articulatis ad 2 mm longis; foliis ovatis vel late ovatis, acuminatis, interdum subcordatis, paucidentatis vel undulatis vel integerrimis, principalibus 3-8 cm longis et 1.8-6 cm latis; petiolis 22-45 mm longis; calycibus floriferis 7-10 mm longis et 5-7 mm latis ad basim loborum; calycis lobis lanceolatis vel triangularibus, acuminatis, 4-5 mm longis; corollis luteis, maculatis, 9-14 mm longis et 15-20 mm latis; antheris violaceis, 2.7-3 mm longis, filamentis fliliformibus, 2.5-3 mm longis; calycibus fructiferis pentangulatis et pentacostatis, 20-28 mm longis et 12-18 mm latis; pedicellis fructiferis 10-20 mm longis; baccis 8-12 mm latis.

TYPE: *C. G. Pringle 13591* (VT) barranca below Trinidad Iron Works, 5500 ft, Hidalgo, Aug. 21, 1905; Isotypes: (F, GH, MICH, OKLA, UC, US).

COLLECTIONS EXAMINED. MEXICO: DISTRITO FEDERAL: Contreras, June 1, 1963, *Galvan s. n.* (MEXP); HIDALGO: Barranca near Honey Station, July 16, 1904, *Pringle 13440* (GH, MICH, US, VT); *Pringle 13591*, Type, cited above; VERACRUZ: Lomogrande, Mount Orizaba, 9300 ft, April 29, 1938, *Balls 4404* (UC).

58. **Physalis volubilis** Waterfall, sp. nov.

Herba perennis; caulibus adscendentibus vel procumbentibus, interdum ad basim lignosis, e radice lignose fusiforme; pilis articulatis ad 1 mm longis; foliis ovatis vel late ovatis, acutis vel acuminatis, saepe cordatis, integerrimis, principalibus 25-50 mm longis et (15-) 20-40 mm latis, petiolis 10-30 mm longis; calycibus floriferis 8-10 mm longis et ca. 5 mm latis ad basim lobis; calycis lobis anguste linearibus, 4-6 mm longis; pedicellis 15-40 mm longis; corollis luteis, maculatis, 12-15 mm longis et 15-25 mm latis; antheris violaceis, 2.5-3.5 mm longis; calycibus fructiferis anguste ovatis, 25 mm longis et 10 mm latis vel 28 mm longis et 15 mm latis; baccis 8-11 m latis.

TYPE: *Wm. C. Leavenworth 519* (GH), vine, common locally in open pine woods, large tubers on roots, 2 miles above Tancitaroi, 7000 ft, MICHOACÁN, Aug. 10, 1940; Isotypes: (F, MICH, NY).

SELECTED SPECIMENS. MEXICO: MEXICO: Meson Vieja, Dist. Temascaltepec, Apr. 29, 1932, *Hinton 570* (US); MICHOACAN: procumbent in clearing in oak-pine forest, Zitacuaro-Cacique, 2600 meters, June 6, 1938, *Hinton 11928* (MICH, NY, US); *Leavenworth 519*, Type, cited above; prostrate from a small tuber, runners rooting at nodes, black volcanic ash in pine forest, 3.5 miles n of volcano Paricutín, June 14, 1950, *Turner 1895* (MICH); vine, very common, about 5 miles from Uruapan, Km 63-64 on Mexico 241, Aug. 22, 1949, *White 239* (OKLA).

*Physalis volubilis* differs from *P. subrepens* by having narrower flowering calyces, longer flowering pedicels (15-40 mm long in *volubilis,* but only 5-12 (-15) mm long in *subrepens,* and usually entire leaves as compared with the usually toothed leaves of the former.

It is possible that *J. Rzedowski 10021* (OKLA) belongs here. It is somewhat atypical, and, collected from "orilla de camino, Potrerillos, Municipio de Xilitla, San Luis Potosí, Feb. 28, 1959," it is well out of the range indicated by the cited collections. However, it may be that it awaits collecting in the intermediate areas.

59. **Physalis viridoflava** Waterfall, sp. nov.

Planta perennis e radice lignose fusiforme; caulibus herbaceis, prostratis, breve antrorse vestitis, trichomatibus articulatis; foliis ovatis vel late ovatis, interdum inaequalibus, integerrimis, principalibus 25-35 mm longis et 20-28 mm latis, petiolis 10-24 mm longis; calycibus floriferis 5-7 mm longis et 3-4 mm latis ad basim loborum calycis lobis anguste lanceolatis, attenuatis, 3-5 mm longis, pedicellis 20-35 mm longis; corollis viridoflavis, immaculatis, 10-12 mm longis et 18-20 mm latis; antheris flavis vel viridoflavis, 2.5-3 mm longis, filamentis filiformibus 2.5-3 mm longis; calycibus fructiferis immaturis pentangulatis.

TYPE: *David P. Gregory* and *George Eiton 99* (MICH), in relatively undisturbed pine forest, on route 110 at km 59-60, 20 miles due WSW of Jiqyilpan, and several miles S of Mazamitla, JALISCO, MEXICO, June 18, 1966; Isotype: (NY).

This species, growing from a fusiform, or thicker, woody root, has long pedicels, greenish-yellow corollas with no evident maculations (collector says "with chocolate-brown circular areas toward center"), anthers yellow or green, (collector says "green") and matted hairs in the throat of the corolla. Only immature fruiting calyces are known, but they are 5-angular.

60. **Physalis longipedicellata** Waterfall, sp. nov.

Planta perennis, herbacea, 1 m alta, ramosa; trichomatibus mollibus, articulatis ad 2 mm longis, majoribus 0.3-0.6 mm longis; foliis late ovatis vel lanceolatis, interdum inaequilateris, ad apicem attenuatis; marginis pauci-dentatis vel undulatis vel integerrimis; foliis principalibus 6-10 cm longis et 3-6 cm latis, petiolis 3-6 cm longis, angustissime alatis; corollis ignotis; calycibus fructiferis pentangulatis, vestitis, 22-26 mm longis et 20-24 mm latis lobis lanceolatis, attenuatis, 6-8 mm longis; pedicellis fructiferis 20-45 mm longis; baccis 1 cm latis.

TYPE: *Rogers McVaugh 13828* (MICH), in pine-oak-fir forests, steep slopes near summits, Sierra de Manantlan near Aserradero el Cuarton, 15-20 miles se of Autlan, JALISCO MEXICO, Nov. 2, 1952; Isotype: (OKLA).

The name refers to the long pedicels as compared with other species having a 5-angled, hairy fruiting calyx.

This large, branched, soft-hairy plant has large leaves, entire, with few shallow undulations, or a few coarse teeth, sometimes only 1 or 2 per leaf; the fruiting calyx is abundantly covered with short hairs intermixed with a few long jointed hairs up to 2 mm long.

61. **Physalis lignescens** Waterfall, sp. nov.

Frutex; trichomatibus brevibus, divaricatis vel antrorse crispis; foliis ovatis vel deltoideo-ovatis, integerrimis vel pauce undulatodentatis, principalibus 3.5-6 cm longis et 2.5-4 cm latis, petiolis 1-2 cm longis; calycibus floriferis 4-6 mm longis et 3.5-6 mm latis ad basim loborum; calycis lobis lanceolatis vel ovato-lanceolatis, 2.5-3 mm longis; pedicellis 8-15 mm longis; corollis luteis, maculatis, 13-16 mm longis et 20-22 mm latis; antheris violaceis, 2-2.5 mm longis, filamentis 4-6 mm longis; calycibus fructiferis (immaturis) 28 mm longis et 15 mm latis; baccis 8-9 mm latis.

TYPE: *Rogers McVaugh 13454* (OKLA), steep mountainsides in pine-oak forest (zone of broad-leaved trees in barrancas), ne slopes of the Nevado de Colima, below Canoa de Leoncito, 2250-2550 meters, JALISCO, Oct. 12, 1952.

SPECIMENS EXAMINED. MEXICO: JALISCO: *McVaugh 13454*, Type, cited above; open pine-covered ridges and slopes in mountains e of Mamantlan about 15 miles sse of Autlan by way of Chante, July 22, 1949, *Wilbur 1776* (MICH).

62. **Physalis jaliscensis** Waterfall, sp. nov.

Frutex; caulibus 1.5-2.5 m. altis, glabris vel pauce brevitrichomatibus ex partis junioribus; foliis ovatis vel lanceolato-ovatis, attenuatis vel lunato-attenuatis, integerrimis vel pauce undulatis, principalibus 6-9 cm longis et 2-5 cm latis, petiolis 1-3 cm longis; calycibus floriferis 8-11 mm longis et 7-10 mm latis ad basim loborum; calycis lobis deltoideis vel lanceolato-deltoideis, ad apicem attenuatis, 4-6 mm longis, pedicellis 20-35 mm longis; corollis luteis, maculatis, 13-15 mm longis et 18-25 mm latis, campanulato-rotatis; antheris violaceis, 3-3.5 mm longis, filamentis 3-3.5 mm longis; calycibus fructiferis pentangulatis, 25-30 mm longis et 20-26 mm latis, pedicellis 35-45 mm longis; baccis 10-15 mm longis.

TYPE: *Rogers McVaugh 21512* (MICH), fir forest, steep mountainsides and barrancas 1-2 miles n of sawmill "La Cumbre" on the divide above headwaters of Río Mascoto, 25-30 km se of Talpa de Allende, Nov. 29, 1960, Isotype: (OKLA).

SPECIMENS SEEN. MEXICO: JALISCO: *McVaugh 21512*, type, cited above; abundant along lumber road, steep slopes in pine forest, Sierra del Halo, near a lumber road leaving the Colima highway 7 miles ssw of Tecalitlan, 3 miles from highway, Aug. 14, 1957, *McVaugh 16172* (MICH, OKLA).

63. **Physalis maxima** Miller, Gardener's Dictionary, ed 8; no. 15. 1768.

Annual, 0.6-1.5 meter tall; vestiture of short, spreading, more or less viscid hairs, and some capitate- glandular ones, often with larger, longer hairs 1.5-4 mm long on petioles, pedicels and stems; leaf blades ovate, coarsely and irregularly porrect-dentate to sinuate-dentate to entire or with 1 or 2 teeth on each margin; principal blades 6-10 (22) cm long and 4-9 (16) cm wide, bases slightly to strongly unequal, petioles 2-12 cm long; flowering calyces 5-8 mm long, divided into subulate, or subulate-attenuate lobes 3-6 mm long, these often long pilose; flowering pedicels (3-) 10-25 (-75) mm long, often pilose; corollas white or whitish, slightly to moderately maculate, 6-8 mm long and 10-15 mm wide when fully open, tube hairy within; anthers slightly bluish-tinged or wholly yellow, 2.5-3 mm long, on slender filaments 2.5-4 mm long; fruiting calyx strongly 5-angled, 40-60 cm long and 25-40 cm wide, vestite in varying degree, but tending to be glabrate, lobes subulate-acuminate, 10-15 mm long; slender fruiting pedicels (10-) 20-30 (-80) mm long, usually reflexed; berry 1-2 cm in diameter, spheric to spheric-oblong.

*Physalis maxima* is characterized by its large fruiting calyces, long pedicels, white corollas, long, narrow, attenuate calyx lobes, and long hairs, especially on calyces, pedicels, petioles and upper stem. However, all these characteristics are variable, most particularly length of pedicels and calyx lobes, and the presence of long hairs. As the calyx lobes and pedicels become shorter, and the long hairs disappear, the plants approach those referred to *P. nicandroides* var. *attenuata*.

The material in the Sloane Herbarium of the British Museum has only a few scattered long hairs. HS 146 15c (lower right) has one fruiting calyx 55 mm long and 40 mm wide and another 55 mm long and 38 mm wide; flowering pedicels are 20-25 mm long; a calyx, just after the corolla has fallen, is 7 mm long with very narrow calyx lobes 5 mm long; fruiting pedicels are 22 mm long. HS 294 53 has flowering pedicels 25-40 mm long; a young fruit has pedicels 50 mm long; anthers yellow, 3 mm long.

Neither of these, nor another, HS 296 7, apears to be the same as the one photographed as The Bailey Hortorium negative no. 5097, labelled "Type" with the annotation that the pasted strip below the specimen is in Miller's hand, and that on the reverse Solander pencilled "E. Vera Cruz, Houstoun, 1730".

*P. maxima* has not been recognized as a part of the Mexican Flora since Miller originally described it from the Houstoun Vera Cruz collections. Most of the material seen has either been unnamed, or has been referred to *P. nicandroides.*

SELECTED COLLECTIONS. MEXICO: BAJA CALIFORNIA: Cape Region, Oct. 18, 1902, *Brandegee s. n.* (UC); CHIAPAS: Hacienda Monserrate, Sept. 1926, *Purpus 9262* (UC); CHIHUAHUA: milpa margin, LaCienegita, Río Mayo, Sept. 10, 1936, *Gentry 2632* (F, GH, UC, US); COLIMA: subshrub over 1 meter high, alluvial plain, 18 km s of Manzanillo, Sept. 9, 1935, *West 3531* (GH, UC); GUERRERO: llano, Santa Barbara, Coyuca, Sept. 30, 1935, *Hinton 8503* (BM, F, GH, MIVB, NY, UC); Acapulco, Aug. 1866, *Thiebaut 1098* (P); JALISCO: along dry ditch in forest, 10-16 miles ne of Autlan, Oct. 2, 1960, *McVaugh 19767* (MICH); MEXICO: Rincon del Carmen, Sept. 16, 1932, *Hinton 1740* (F); MICHOACÁN: Barranca de Río Cancita, 9 miles se of Apatzingan, Sept. 18, 1958, *McVaugh 17981* (MICH, OKLA); MORELOS: near Yautepec, Aug. 27, 1903, *Rose & Painter 6583* (US); NAYARIT: Maria Madre, Tres Marias Islands, Oct. 21, 1925, *Ferris 5582* (US); roadside in semi-deciduous tropical forest on seaward — facing mountainsides, 12-13 miles s of Las Varas, Sept. 20, 1960, *McVaugh 19226* (MICH, OKLA); OAXACA: valley of Oaxaca, July 14, 1897, *Pringle 7474* (GH, US, VT); SINALOA: Culiacán, Sept. 19, 1904, *Brandegee s. n.* (UC); sandy soil along river near Fuerte, Mar. 7, 1910, *Rose et al 13576* (US); SONORA: Sierra de Alamos, Mar. 18, 1910, *Rose et al 13059* (NY, US); VERACRUZ, *Houston s. n.* (Photo: MICH, NY); YUCATAN: 1917-1921, *Gaumer 24310* (F, GH); ZACATECAS: pastured hills 5 miles s of Jalpa, Aug. 30, 1960, *McVaugh 18508* (MICH). COSTA RICA: Cartago, Nov. 1887, *Cooper 6002* (US). GUATEMALA: dry slopes on hill bordering Laga Retana, Dept.

Jutiapa, Nov. 26, 1939, *Steyermark 31975* (F). HONDURAS: sand-bar along Río Chiquito, Comayagua, Mar. 12-23, 1947, *Standley et al 5956* (F); Quebrada de Santa Clara ene of El Zamorano, Aug. 6, 1949, *Standley 22280* (F); moist thicket, vicinity of Tegucigalpa, Oct. 7, 1949 (F). NICARAGUA: near shore of Lake Nejapa, near Managua, *Maxon et al 7560* (US); vicinity of Chichigalpa, July 12, 1947, *Standley 11346* (F).

64. **Physalis nicandroides** Schlechtendal, Linnaea **19**: 311. 1846.

Annual, 1-2 meters tall, branched above; stems, petioles and pedicels viscid-pubescent with short, spreading, jointed hairs 0.3-0.8 mm long, some of which may be capitate-glandular; leaf blades ovate, often broadly so, more hairy below than above, veins of the lower surface often appressed-hairy, margins coarsely and irregularly angulate-sinuate-dentate, bases unequal, sometimes joining the petiole 1 cm higher on one side than on the other; principal leaves 6-12 cm long and 5-10 cm wide on petioles 2-4 cm long; flowering calyx 5-7 mm long, divided into subulate-acuminate lobes 3-4 mm long, pedicels 2-3 mm long; corolla white, greenish-white or slightly yellowish, maculate, but often faded, or indistinct, 4-8 mm long and 6-8 mm wide, tube hairy within; anthers blue tinged or faded to yellowish, 1.5-2 mm long, on filaments 2-2.5 mm long; fruiting calyx strongly 5-angled, 30-45 mm long and 23-40 mm wide, the body nearly as broad as long, somewhat hairy, but tending to be glabrate, subulate-acuminate lobes 10-15 mm long; fruiting pedicels 5-25 mm long, reflexed; the dry, thin-walled berry nearly spheric, 12-22 mm in diameter, sessile on the invaginated base of the calyx.

64a. var. **nicandroides**

Fruiting pedicels short and thick, 5-10 (-13) mm long and (1-) 1.5-2 mm thick.

SELECTED COLLECTIONS. MEXICO: DURANGO: Durango, Nov. 1896, *Palmer 914* (GH, UC, US); GUANAJUATO: near Dolores Hidalgo, Aug. 10, 1947, *Kenoyer 1925* (GH); JALISCO: abundant, Cuesta de San Marcos, 15 km sse of Actlan de Juarez, Nov. 7, 1959, *McVaugh & Koelz 342* (MICH, OKLA); low ground near Lake Chapala, 2 miles w of Tizapan, Aug. 18, 1961, *Waterfall 16394* (F, OKLA, S, US); MEXICO: Luvianos, Temascaltepec, Aug. 26, 1932, *Hinton 4529* (US); MICHOACAN: Morélia, Nov. 1912, *Arsène 8576* (BM, F, GH, NY, US); NAYARIT: Tepic, Jan. 5 to Feb. 6, 1892, *Palmer 2035* (GH, US); OAXACA: suburbs of Oaxaca, Oct. 1, 1894, *Smith 708* (F, UC, US); SAN LUIS POTOSI: hill 20 miles s of intersection of Highways 80 & 57, 64 miles ne of San Luis Potosí, Aug. 20, 1959, *Waterfall 15712* (BM, F, GH, MICH, NY, OKLA, P, SMU, UC); SINALOA: in 1927, *Ortega 6694* (F); VERACRUZ: in 1855, *Muller 564* (NY); YUCATAN: Common, Izamal, *Gaumer 1446* (F. GH, US); LOCALITY UNDETERMINED: Hacienda de la Laguna, Sept. 1828, *Schiede 606* (HAL: Type). COSTA RICA: forest, Santa Maria de Dota, Dec. 26, 1925, *Standley & Valerio 43321* (US). GUATEMALA: Guatemala, in 1939, *Aguilar 141* (F); near Lake Retana, Oct. 10, 1944, *Melhus & Goodman 3784* (F). HONDURAS: brushy bank, Tegucigalpa, Sept. 6, 1951, *Standley 28697a* (F); El Banco, Comayagua, Sept. 29, 1951, *Williams 18335* (F, US).

64b. var. **attenuata** Waterfall, var. nov.

Pedicellis fructiferis tenuibus, 10-25 mm longis, plerumque 0.5- 1.0 mm latis.

SELECTED COLLECTIONS. MEXICO: BAJA CALIFORNIA: Todos Santos, Oct. 4, 1889, *Brandegee s.n.* (UC); CHIHUAHUA: southwestern Chihuahua, in 1885, *Palmer 226* (GH,NY,US); GUERRERO: Ilano, Coyuco, July 10, 1935, *Hinton 8035* (US); MORELOS: near Cuernavaca, July 29, 1906, *Pringle 13776* (GH, MICH, OKLA, US, VT); NAYARIT: precipitous mountainside in forest, 7-8 miles w of Mazatan, Sept. 14, 1960, *McVaugh 19027* (MICH); OAXACA: Coyula, Aug. 13, 1895, *Smith 616* (GH); TAMAULIPAS: Victoria, in 1907, *Palmer 240* (GH). COSTA RICA: La Balsa & Cateratas de San Ramon, Alajuela, Oct. 25, 1925, *Brenes 4550* (NY); San Jose, Aug. 1932, *Valerio 225* (F). GUATEMALA: brushy rocky slope, between Zacapa and Chiquimula, Oct. 9, 1940, *Standley 73840* (F); wet thicket, e of Cuilapa, Nov. 25, 1940, *Standley 78317* (F). HONDURAS: Geguare, Morazan, Aug. 1934, *Rodriguez 319* (F); moist thicket near Tegucigalpa, Oct. 7, 1949, *Standley 24120* (F, US).

Representatives of this taxon are not frequently collected in Mexico, the cited collections being the only ones seen from each of the Mexican states. It is more frequent in Central America.

65. **Physalis cordata** Miller, Gardener's Dictionary, ed 8, Physalis 14. 1768.

Annual, erect to sometimes decumbent, 15-80 cm long, appearing glabrous, but sparse, very short, antrorse trichomes usually present, rarely with a few long hairs, leaf blades ovate, or rarely broader, often acuminate apically and inequilateral basally, margins several-toothed; principal blades 3-8 cm long and 2.5-8 cm wide on petioles 3-9 cm long; flowering calyx 5-6 mm long, divided about half way into narrow acuminate segments, pedicels 4-10 cm long; corolla yellowish, maculate, hairy in the throat, 5-10 mm long and 9-22 mm wide when fully expanded; anthers bluish or greenish-blue, 1.8-3 mm long, on slightly to densely hairy filaments of about the same length; fruiting calyx 5-angled, often somewhat turbinate, cordate-based, glabrous, 25-43 mm long and 20-25 mm wide, the teeth narrow, acuminate, 7-10 mm long, sometimes somewhat porrect; berry nearly spheric, 7-15 mm in diameter; fruiting pedicels 10-25 mm long.

*P. cordata* is another of Miller's species not recognized in the American flora since its description based on Houstoun's Vera Cruz collections.

Much of this material has been labelled *P. turbinata* in herbaria, but it is not that species as here interpreted. See discussion under *P. turbinata.*

A few sheets belonging to this species-concept were seen by the author in the preparation of his earlier study of Physalis (Waterfall, 1958), and in making subsequent identifications. They were referred by him to *P. pubescens* var. *glabra* (Michx.) Waterfall, based on *P. obscura* Michx. var. *glabra* Michx. The TYPE, studied in Paris in August, 1965, is on a small, pasted-on square of paper in the lower left hand side of a sheet, the remainder of whis is var. *viscido-pubescens* Michx., i.e., *P. pubescens* L. The type of var. *glabra* represents a few-haired extreme of *P. pubescens,* differing only in its degree of hairiness. It has an obviously hairy, short-toothed fruiting calyx on pedicels 5-8 mm long not a glabrous, long-toothed fruiting calyx on pedicels usually 15-25 mm long, or longer, as does *P. cordata.*

In the Sloane Herbarium of the British Museum of Natural History in London is preserved the Houstoun material from Vera Cruz on which Philip Miller based his *P. cordata.* It has the characteristic fruiting calyces, long fruiting peduncles, and long petioles of this species-concept, as is well-illustrated by a photograph, from negative 5099, in the herbarium of the Bailey Hortorium.

SELECTED COLLECTIONS. MEXICO: CHIAPAS: Esperanza, Esquintla, Apr. 13, 1947, *Matuda 16489* (F); GUERRERO: Acapulco, March 1895, *Palmer 510* (GH); JALISCO: coastal plain, 4 miles n of Bahia Navidad, Nov. 1960, *McVaugh 20843* (MICH, OKLA); NAYARIT: roadside and thickets between banana plantations, 15 km se of San Blas, Aug. 25, 1959, *Feddema 958* (OKLA); OAXACA: *Galeotti 1236* (P); SINALOA: Sante Fe, Dec. 1921, *Ortega 4384* (US); VERACRUZ: negative 5089 of the Bailey Hortorium photographs of Philip Miller collections, is probably of one of the Houstoun collections, as is the specimen in the Sloane Herbarium of the British Museum labelled HS 294 54, listed in Ray's Hist. 356 as "Alkekengi americanum anuum lamiifolia fructu cordato, Houst."; YUCATAN: Izamal, *Gaumer 23170* (F). COSTA RICA: near Port Limon, May 27, 1911, *Pittier 3637* (NY, US); near Turrialba, Cartago, Nov. 16, 1953, *Heiser 3735* (F).

EL SALVADOR: Laguna de Maquigue, La Union, Feb. 18, 1922, *Standley 20958* (GH, US); between San Martin and Laguna de Ilopango, San Salvador, Apr. 1, 1922, *Standley 22560* (GH, US). GUATEMALA: Quiriga, Izabal, May 15, 1922, *Standley 24073* (GH, US); lower slopes of Volcán de Zunil, Feb. 3, 1941, *Standley 85842* (F). HONDURAS: wooded swamp, near Juticalpa, Olancho, Mar. 5, 1949, *Standley 17709* (F); Lancetilla Valley near Tela, Atlantida, *Standley 55683* (F, US). NICARAGUA: moist thicket, Chichigalpa, July 12, 1947, *Standley 11410* (F). PANAMA: wooded hillside near Catival, Colon, Jan. 9, 1924, *Standley 30236*. BAHAMAS: Spring Point, Acklin's Island, Jan. 8, 1906, *Brace 4256* (NY). BERMUDA: *Brown & Britton 386* (GH, NY, UC). CUBA: south of Providencia, Aug. 19, 1930, *Leon 14653* (GH, NY); near Cienfuegos, Jan. 25, 1903, *Pringle 40* (VT). CURACAO: Patrick, Mar. 20, 1913, *Britton & Shafer 3072* (NY). DOMINICAN REPUBLIC: Santo Domingo (Ciudad Trujillo), Feb. 24, 1930, *Ekman 14329* (GH). GRENADA: Aug. 16, 1905, *Broadway s.n.* (GH). GUADELOUPE: in 1898, *Duss 3984* (NY). HAITI: south of Jean Rabel, Jan. 27, 1929, *Leonard 12695* (NY). JAMAICA: Windsor Estate, Aug. 26, 1956, *Proctor 15689* (GH). PUERTO RICO: near Catano, Feb. 14, 1927, *Britton 8832* (NY). TORTOLA: *Fishlock 299* (GH). VIRGIN GORDA: Jan. 6, 1919, *Fishlock 200* (NY).

66. **Physalis porrecta** Waterfall, sp. nov.

Planta annua, 0.4-1.3 m alta; caulibus sparse et inaequale vestitis; trichomatibus articulatis, plus minusve planis; foliis ovatis, marginibus inaequaliter magnodentatis vel integerrimis, principalibus 5-11 cm longis et 4-7 cm latis, petiolis (2-) 3-7 cm longis; calycibus floriferis 5-7 mm longis, lobis 1.5-4 mm longis anguste attenuatis, pedicellis 4-5 mm longis; corollis 7-10 mm longis et 12-15 mm latis, maculis pallido-fulvis, marginibus diffusis; antheris luteis vel violaceis, 1.8-2.3 mm longis, filamentis 2-4 mm longis; calycibus fructiferis glabris, pentangulatis, 3-5 cm longis et 2.2-3 cm latis, lobis porrectis, rostris 7-13 mm longis; pedicellis fructiferis 6-15 mm longis; baccis 12-15 mm latis.

TYPE: *Alexander F. Skutch 2931* (US), edge of forest, vicinity of El General, Prov. San Jose, alt. 1160 meters, COSTA RICA, Nov. 1936; Isotypes: (GH, NY).

SELECTED COLLECTIONS. MEXICO: OAXACA: vicinity of Cafetal Concordia, April 1, 1933, *Morton & Makrinius 2556* (US). COSTA RICA: *Skutch 2931*, type, cited above; moist forest, El Munceo, Río Navarro, Provincia de Cartago, Mar. 6, 1926, *Standley & Valerio 51093* (US). GUATEMALA: clearing in forest, Volcan Zunil, Dept. Quezaltenango, Aug. 7, 1934, *Skutch 970* (US); barranca above Duenas, Dept. Sacatepequez, Jan. 21, 1939, *Standley 63252* (F, US); bushy rocky slope, near divide on road from Zacapa to Chiquimula, Oct. 9, 1940, *Standley 73738* (F).

*P. porrecta* is characterized by its usually abruptly beaked fruiting calyx, its yellowish corollas varying from immaculate to obviously marked, but usually inconspicuously so, with brownish spots, their margins often diffused, anthers varying from yellow to bluish or greenish-blue, and with vestiture usually more abundant on one side of the stem than on the other, branches and petioles sometimes with the inner side vestite, and the outer side glabrous, or nearly so.

67. **Physalis latiphysa** Waterfall, Rhodora **60**:169. 1958.

Annual 15-45 cm tall, branched, more or less villous or glandular-villous, leaves ovatish, thin, entire to few-toothed, acuminate, principal ones 5-7 cm long and 3-5 cm wide on petioles 1.5-7 cm long; flowering calyces 3-4 mm long, divided half way into lanceolate or narrowly lanceolate lobes, on pedicels 3-8 mm long; corollas yellowish with small, dark maculations, 3-4 mm long; fruiting calyces strongly 5-angled, sparsely appressed-hairy, 2.5-4 cm long and (2.5-) 3-4 cm wide with linear-subulate lobes 7-10 mm long extending 5-7 mm beyond the calyx-body; fruiting pedicels 1-1.5 cm long; berry 13-17 mm in diameter.

SPECIMENS EXAMINED. MEXICO: SONORA: between Tepapa and Batuc, Sept. 28, 1934, *Wiggins 7503* (MICH, US).

The principal range of this species is in southern Arizona (Waterfall, 1958), but more material should be found in northern Sonora.

68. **Physalis ignota** Britton, Mem. Torr. Bot. Club **16**:100-101. 1920; *P. pentagona* Blake, Contr. U.S. Natl. Herb. **24**:20-21. 1922.

Erect annual, 10 cm to 1 meter tall, usually densely covered with short, more or less glutinous, nearly straight to antrorsely curled, multicellular hairs; leaf blades ovate to rhombic-ovate, sometimes acuminate, margins entire to repand-denate, surfaces with vestiture similar to that of the stem, but more sparse, or nearly glabrous with concentrations along the midrib and principal veins, principal blades 4-12 cm long and 3-8 cm wide on petioles 2-7 cm long; flowering calyx oblongish to campanulate, 5-8 mm long and 3-6 mm wide at base of lobes, upper one-fourth to two-thirds divided into ovate-lanceolate to narrowly lanceolate-attenuate lobes; flowering pedicels 3-7 mm long; corollas yellowish, immaculate, campanulate, 6-10 mm long and 4-10 mm wide, sparsely hairy in the throat; anthers yellow or bluish tinged, oblong, 2-2.5 mm long, on filaments of about equal length; fruiting calyces strongly 5-angled, usually densely and evenly covered with short, erect, jointed hairs; fruiting pedicels 7-15 mm long; berry spheric to ovoid, 9-15 mm long, capitate-glandular, as is the inside of the fruiting calyx; gynophore 1-2 mm long.

SELECTED COLLECTIONS. COSTA RICA: Las Canas, Guanacaste, Nov. 12, 1953, *Heiser 3722* (F). EL SALVADOR: sand along river, San Miguel, Feb. 24, 1922, *Standley 21092* (GH, NY, US); sand along stream, San Salvador, Mar. 30, 1922, *Standley 23156* (GH, US, NY). GUATEMALA: dry riverbed, Los Amates, Izabel, May 9, 1919, *Blake 7313* (Type collection of *P. pentagona* Blake: US); sand bars, Los Amates, May 24, 1922, *Standley 24418* (GH, NY, US); gravelly slope, Jutiapa, Oct. 24, 1940, *Standley 75054* (F); Río Selguapa, Comayagua, Mar. 21, 1945, *Rodriguez 2530* (F); weedy field, El Zamorano, Morazan, July 26, 1949, *Standley 21740* (F). NICARAGUA: summit of Sierra de Managua, May 14, 1947, *Standley 8682* (F); wet thicket, Chichigalpa, July 12, 1947, *Standley 11155* (F). PANAMA: San Carlos, Dec. 5, 1938, *Allen 1136* (GH, NY, US). SAN SALVADOR: Aug. 1922, *Calderon 1134* (US). CUBA: Cienfuegos, Oct. 27, 1928, *Jack 6566* (NY); Playa de Mariano Habana, Nov. 28, 1915, *Leon 6864* (NY); Nuevitas, Mar. 31, 1909, *Shafer 1127* (NY).

TO BE CONTINUED

*Volume 69, No. 778, including pages 121-240, was issued June 30, 1967.*


Plate 1338. *Pleurocoronis gentryi* Holotype (DS) *Gentry 3472.* The above plate replaces the one incorrectly shown in Rhodora Vol. 69 on p. 37.

# Rhodora

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Conducted and published for the Club, by



Vol. 69 June-September, 1967 No. 779

CONTENTS:



*(Continued on Inside Cover)*

The New England Botanical Club, Inc.

Botanical Museum, Oxford St., Cambridge 38, Mass.

**CONTENTS: — *continued***

Rhodora

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Vol. 69 July-September No. 779

# A PRELIMINARY REVISION OF TRAGIA (EUPHORBIACEAE) IN THE UNITED STATES[1]

KIM I. MILLER AND GRADY L. WEBSTER

The genus *Tragia* (Crotonoideae — Acalypheae) comprises about 150 species of nettle-like plants which are widely distributed in tropical and subtropical or warm-temperate regions of both the New World and Old World. It is by far the largest and most diverse of the 19 genera of subtribe Plukenetiinae recognized by Pax and Hoffman (1919), and various generic segregates have been proposed during the past 150 years.

In the New World, the center of diversity of *Tragia* is in Brazil, and only about 20 species have been recorded from North America. These include some taxa of particular phylogenetic interest, however, for *T. bailloniana* from Mexico and Central America may be one of the most primitive species in the genus. The present study has been deliberately restricted in scope to include only those taxa represented in the United States, because it seems to us that the collections available from Mexico are at present inadequate to serve as the basis of even a preliminary treat-

1. This study incorporates part of a doctoral dissertation submitted by the senior author in partial fulfillment of the requirements for the Doctor of Philosophy degree at Purdue University. Investigations were supported by grants from the Purdue Research Foundation and (for the junior author) the National Science Foundation and the John Simon Guggenheim Memorial Foundation while at the Gray Herbarium, Harvard University. The assistance of Dr. Lillian Miller and Miss Jeanie Taylor is gratefully acknowledged.

ment (at least in the absence of field work in critical areas of the Mexican plateau). Mexican specimens of the *T. nepetifolia* complex have been examined in order to relate them to those from the United States, and it is hoped that a revision of the Mexican species can eventually be added to the present work in order to account for all of the North American taxa.

NOMENCLATURAL HISTORY

The genus *Tragia* was originally established by Plumier (1703) on the basis of the American species designated by Linnaeus as *T. volubilis.* The first comprehensive revision of the group was that of Baillon (1858), who recognized no less than 10 genera within the concept of *Tragia* held by A. Jussieu (1824). Doubtless Baillon's disposition was extreme, but some of the taxa such as *Leptorachis, Ctenomeria, Bia,* and *Zuckertia* are very distinctive and have been regarded as worthy of generic status by a few workers.

The first detailed enumeration of all the taxa of *Tragia* in anything approaching a modern sense was that of Mueller Argoviensis (1865, 1866), who accepted *Leptorachis* as a distinct genus and recognized 11 sections to accommodate the 49 species then known for *Tragia.* In the 'Flora Brasiliensis' (1874), Mueller reduced *Leptorachis* to a section of *Tragia,* a disposition which was followed by Bentham (1880) and Pax (1890).

In the last general revision of *Tragia,* Pax and Hoffmann (1919) reduced the number of sections to 9 while accepting 123 species, 58 of these American and 65 Old World; only one species, *T. volubilis,* was recorded for both the Eastern and Western Hemispheres, and it is presumed to be American in origin. Pax and Hoffmann rather slavishly followed Mueller in placing the U. S. taxa of *Tragia* into two sections: *Leucandra* and *Eutragia*; they thus perpetuated Mueller's error in putting specimens of *T. ramosa* in two different sections under two species names *(T. ramosa* and *T. nepetifolia).* However, by recognizing *T. teucriifolia* [*T. brevispica*] and *T. amblyodonta* as distinct, they raised the number of species occurring in the United States to 11.

Johnston (1962) has reviewed some of the systematic problems presented by the taxa in the Southwest, which he refers to as 'noseburns' (from the effects of the stinging foliage on grazing stock). He has correctly pointed out that the distinction between sections *Leucandra* and *Tragia,* at least as construed by Pax and Hoffmann, is very weak. It seems clear that this supposed sectional distinction, at least as applied to taxa in the United States, cannot be maintained.

On the basis of his inability to find stable, geographically correlated morphological characters in the Southwestern noseburns, Johnston has placed all of the plants in the complex under a single species name, *T. nepetifolia* Cav., and relegated no less than 18 names to synonymy. It is indeed evident that the noseburns are bewilderingly variable in habit and leaf shape as well as in number of flower parts. The plasticity of individual plants in responding to environmental variations and the large amount of intra- and interpopulation diversity, together with the often fragmentary nature of available herbarium specimens, results in a baffling pattern of variation which frankly cannot always be untangled even after the most intensive study.

Nevertheless, a detailed analysis of specimens from throughout the southern United States, combined with field studies in the Gulf States and Texas (Miller 1964), has shown that there are morphologically recognizable taxa among the noseburns which do have distinctive geographical ranges. Consequently, we are unable to concur with Johnston's conclusion that the Southwestern noseburns all belong to a single species. Amalgamation of all these populations into one species appears to be contradicted by the geographical correlations noted above as well as by *(inter alia)* the following facts: (1) the chromosome complement in at least one taxon, *T. amblyodonta,* appears to be decaploid ($n = 55$), whereas the other noseburns investigated cytologically are tetraploids ($n = 22$); (2) peculiar horned fruits similar to those of the widespread tropical vine *T. volubilis* occur only on plants with the leaf shape and flowers of *T. brevispica*; (3) the female calyx-lobes of plants assigned to *T. betonicifolia* are on the average much longer than those of related species; (4) typical specimens of *T. ramosa* have styles which are slender and much smoother (scarcely or not papillate) than those of related taxa, including *T. nepetifolia*.

On the basis of all of the evidence, we have concluded that 5 species of noseburns should be distinguished where Johnston has recognized only one; this results in a total of 13 species for the United States instead of the 9 or 10 which would be recorded in accordance with his concept. It must be admitted that the system presented here is not an especially tidy one, as a considerable number (ca. 5-10%) of the specimens examined remain dubious or unassignable, and the disposition of some of the taxa (in particular *T. leptophylla*) is still doubtful. However, the degree of difficulty encountered in annotating the often fragmentary herbarium specimens or in identifying them by means of a key should not be confused with the problem of whether there are really any distinctions between the wild populations. Our conclusion that there are 5 U. S. species of noseburns in the *T. nepetifolia* complex is not founded on irrefutable proofs, but it is at least a reasonable hypothesis which is deserving of criticism and verification by systematists in the Southwest.

## MORPHOLOGY

GROWTH FORM. All of the U. S. species of *Tragia* are perennial herbs with a woody taproot and alternate leaves. The stems may be either erect, decumbent, or twining; within a single species both twining and non-twining types may occur. At one end of the spectrum, such species as *T. nigricans* and *T. saxicola* have never been observed to twine, while on the other hand *T. glanduligera* and *T. cordata* are always twining. In *T. ramosa* and some related species there appears to be considerable amplitude of habit, as otherwise similar plants may be either erect, decumbent or twining. These differences, which may reflect ecotypic variation in some instances and simple adaptability in others, need to be more carefully studied.

LEAVES. The leaves of *Tragia* are quite variable in both size and shape, but within a broad range are sufficiently distinctive to present useful taxonomic characters. The petioles, which vary in length from less than 1 mm in *T. urens* to over 8 cm in *T. cordata*, have 5 free vascular traces. The leaf-blades vary from linear and entire in some forms of *T. urens* to serrate or dentate in most species, while in the rare *T. laciniata* the blades are tripartite with coarsely toothed lobes. Stomata occur on both upper and lower surfaces, but are more numerous below (they may be restricted to areas along the major veins on the upper surface). Most of the stomata are of the 'rubiaceous' type as defined by Metcalfe and Chalk (1950), but sometimes they may approach the 'cruciferous' type (Miller 1964). The stomata of *T. amblyodonta* are outstanding in being strikingly larger than those of related species: mean values are $26.6\mu$ for the upper epidermis and $22.0\mu$ for the lower, as opposed to $20.7\mu$ and $18.3\mu$ in *T. nigricans*, the species with the next largest stomata. It seems probable that this larger stomatal size of *T. amblyodonta* is correlated with its high degree of polyploidy.

The most striking feature of the leaves of *Tragia* is the presence of characteristic stinging hairs, which have been described by Rittershausen (1892) and Knoll (1905). These hairs consist of an elongated central cell, which according to Knoll is of subepidermal origin, surrounded by 3-5 'jacket-cells'. An extremely sharp-pointed crystal at the distal end of the central cell acts as the piercing agent when the end of the hair is touched. The stinging hairs are much alike in all U. S. species of *Tragia*, although there is a tremendous variation in the painfulness of the sting; *T. amblyodonta* appears to be the worst offender, whereas *T. urens*, despite its suggestive epithet, stings little or not at all. Possibly the most important variable is the quantity and nature of the proteinaceous poisoning element which is released when the end wall of the cell pulls back and permits the sharp crystal tip to penetrate the skin. Stinging hairs are also found on the stems, inflorescence axes, calyces, and ovaries, and may be very prominent on the ripened fruit.

Unicellular hairs are also present on the stems and leaves, usually intermixed with the stinging ones. Long-stalked multicellular glandular hairs occur on the inflorescences of *T. glanduligera* intermixed with both other types; this condition is common in various tropical taxa but is not known in other U. S. species, although a few minute short-stalked glandular hairs may be found on the inflorescence.

INFLORESCENCE. In all of the U. S. taxa of *Tragia*, the inflorescence is an androgynous raceme (fig. 1) with one female flower (rarely two) at the base and 3-20 (or more) male flowers at the distal nodes. Our representatives have all flowers solitary in the axil of the subtending bract, but some tropical species may have several male flowers per bract. The staminate bracts are entire and more or less cucullate, while the female may be either entire or 3-lobed.

The position of the racemes of the U. S. species is consistently opposite the leaves, as pointed out by Johnston (1962), so that the racemes are actually terminal and the main stem axis is thus a sympodium. In some tropical species the situation is more complicated because the racemes terminate lateral branches (e.g., in *T. mexicana*), and the inflorescence pattern in temperate species is apparently derived by reduction. *Tragia urens* shows an approach to the condition in some of the tropical species in that the racemes are borne terminally on lateral leafy branches as well as at the upper nodes of the main stem; in this species, therefore, the lower part of the stem appears to be monopodial while the upper part is sympodial.

FLOWERS. The staminate pedicel is articulate, and the basal portion persists after the fall of the male calyx. The male pedicel is supplied with 2 vascular traces and the female with 5 (Miller 1964). The flowers are apetalous, the perianth being represented by a gamophyllous calyx; the union of the calyx-lobes may be slight, but it is always

Plate 1356.

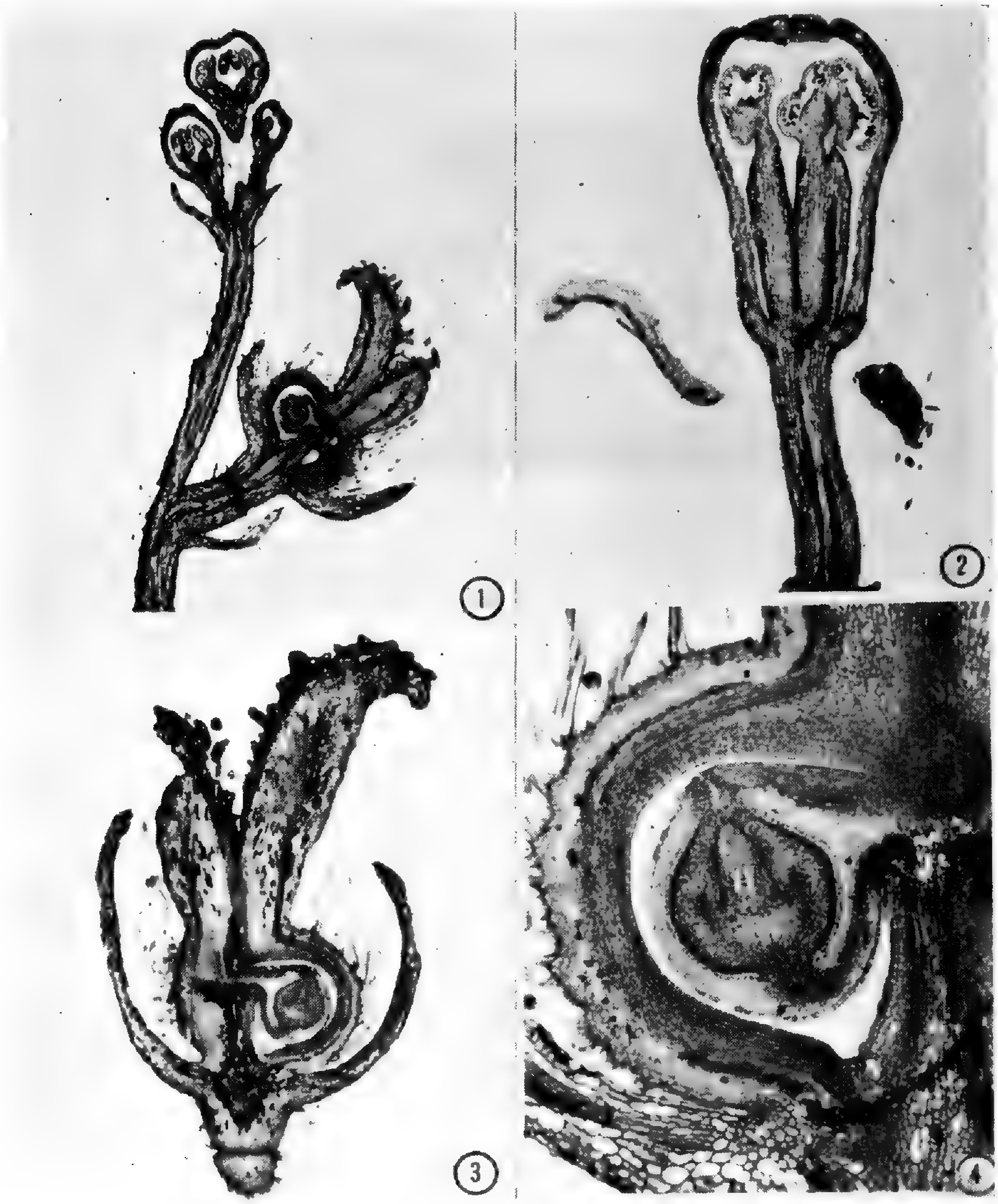
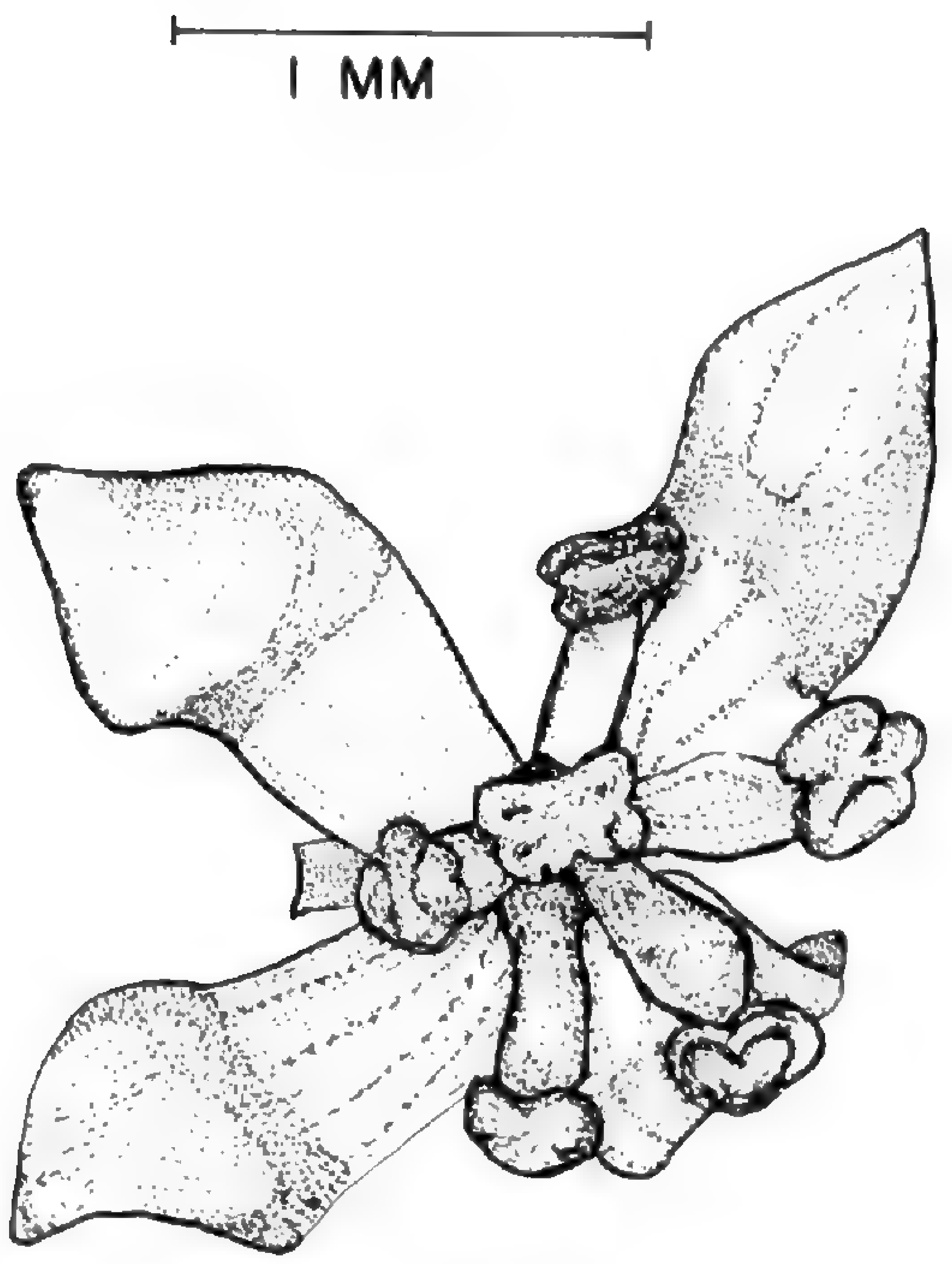



Fig. 1. Longitudinal section of inflorescence, *Tragia nigricans*, showing androgynous arrangement of flowers, × 20 (*K. & L. Miller 1173*).

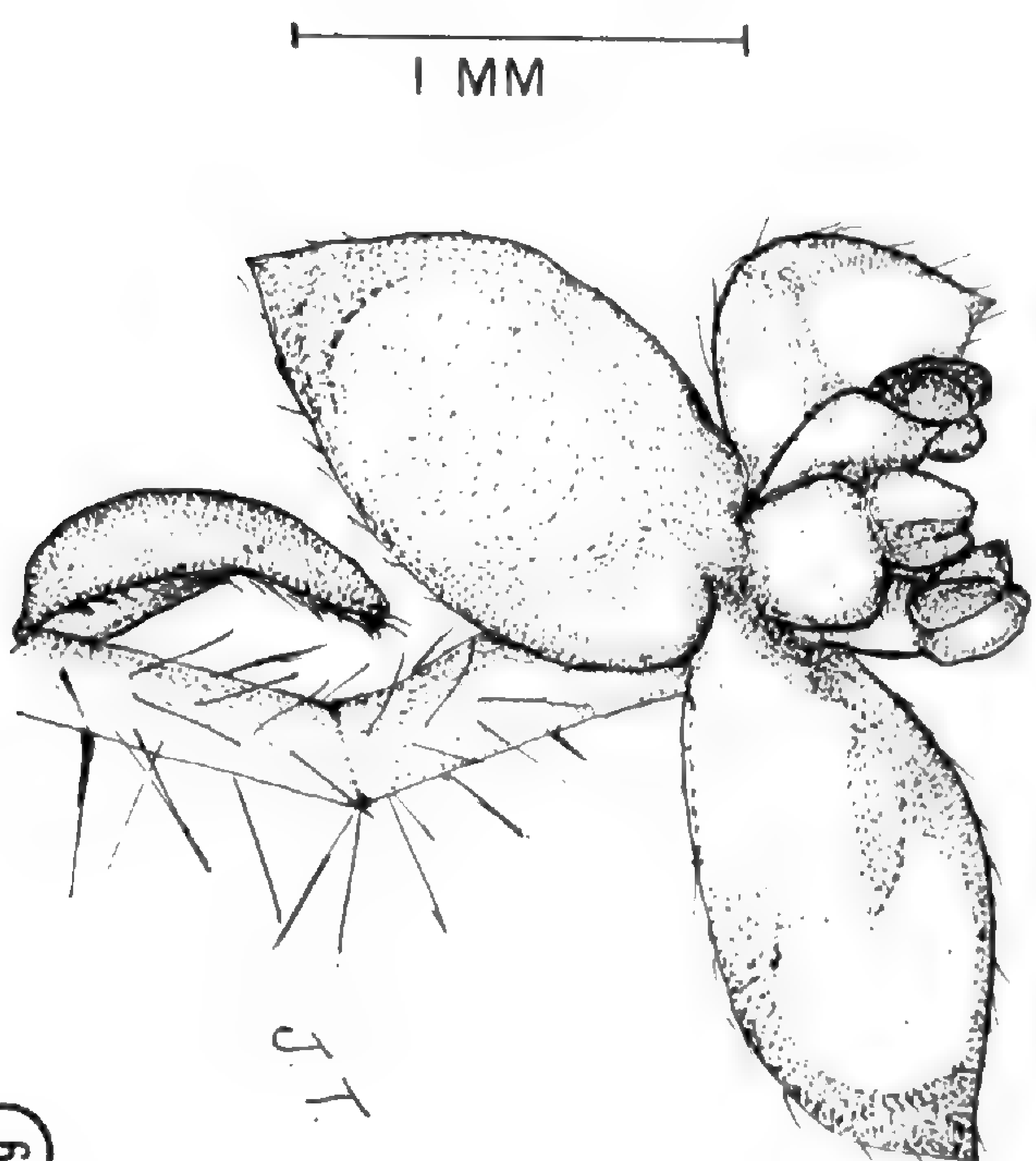
Fig. 2. Longitudinal section of staminate flower, *Tragia nigricans*, showing connate filaments, × 60 (*K. & L. Miller 1173*).

Fig. 3. Longitudinal section of pistillate flower, *Tragia urticifolia*, showing papillate stigmatic surface, stigmatoid tissue in stylar column and single anatropous ovule, × 30 (*K. & L. Miller 848*).

Fig. 4. Longitudinal section of ovary, *Tragia urticifolia*, showing anatropous ovule and obturator, × 100 (*K. & L. Miller 848*).




5




6

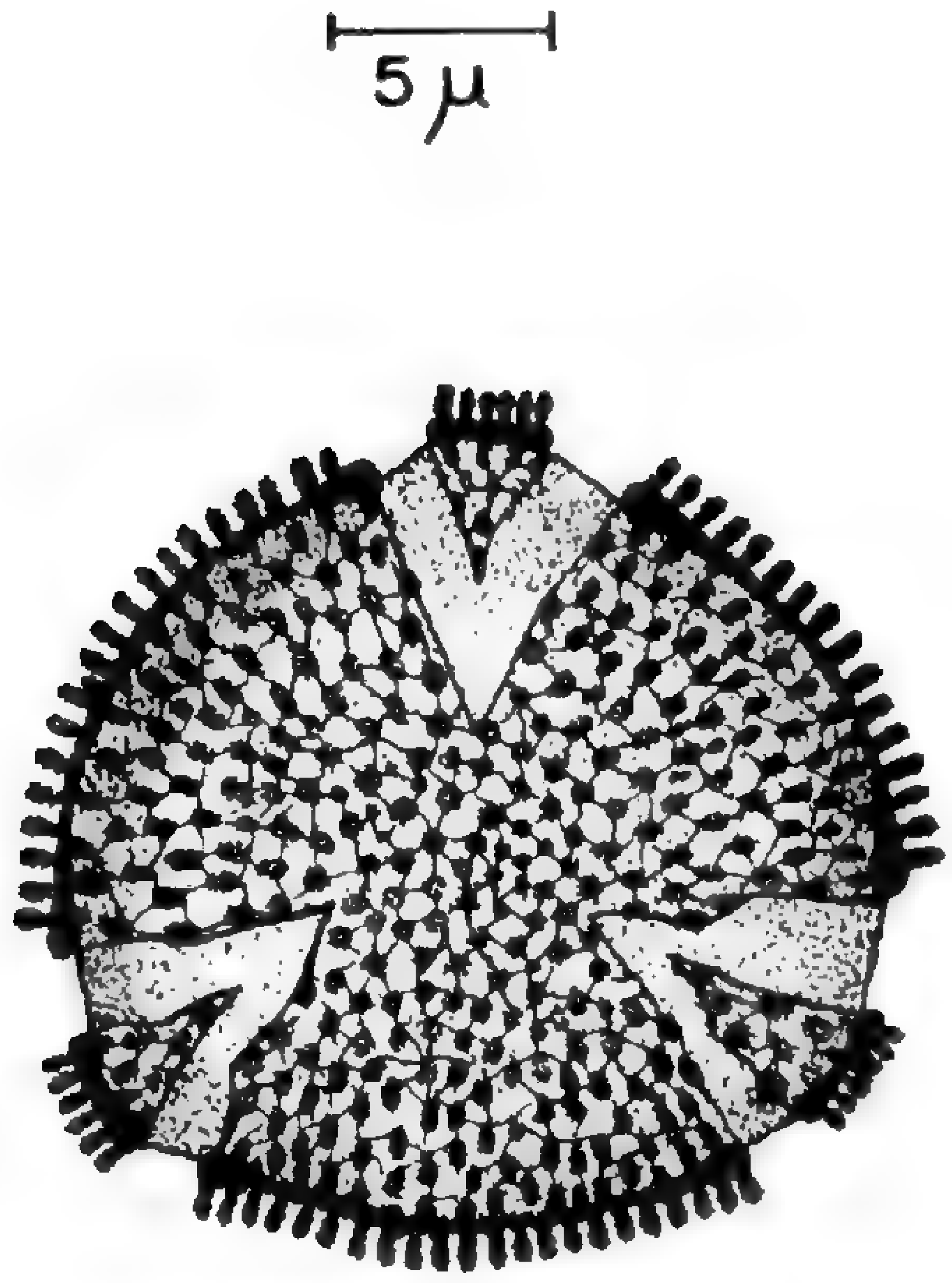
Fig. 5. Terminal staminate flower, *Tragia ramosa* (*K. & L. Miller 1341*).

Fig. 6. Staminate flower, *Tragia urticifolia*, from near the middle of the staminate portion of the inflorescence (*K. & L. Miller 848*).

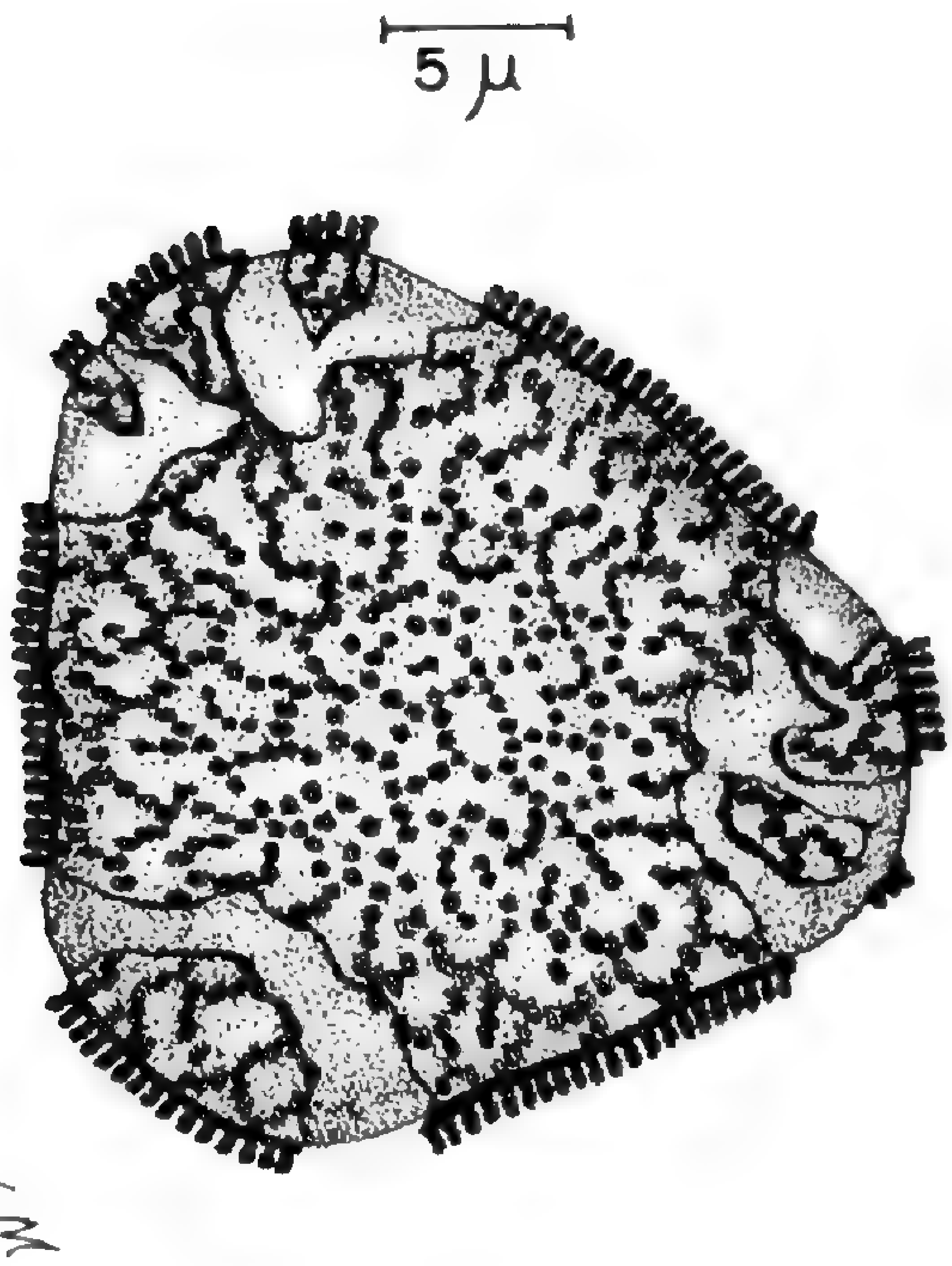
evident, and the lobes never disarticulate separately from the receptacle. The staminate flowers (fig. 2) have mostly 3 or 4 valvate calyx-lobes per flower, but the number may fluctuate within a single inflorescence, depending on the species. The pistillate calyx nearly always consists of 2 whorls of 3 lobes each, which unlike the male are imbricate in the bud. Both male and female calyx-lobes usually possess 3 veins which are however more elaborately branched in the female.

ANDROECIUM. In the vast majority of plants of *Tragia* in the United States, the androecium consists of 3 to 5 stamens (fig. 6), the number varying over this range within a single inflorescence in many species. However, *T. smallii* and *T. urens* ordinarily have only 2 stamens (very rarely 3). The filaments, which may be thickened and fleshy or rather slender, are supplied with a single vascular trace; in most species, they are connate only at the base, but in *T. nigricans* they may be fused for half or more their length. There is usually a small pistillode in the center of the flower between the connate bases of the stamens.

The stamens and calyx-lobes of the terminal male flower are commonly more numerous than those of the axillary flowers of the inflorescence, there being usually 4 to 6 calyx-lobes and 5 to 8 stamens (fig. 5). Johnston (1962) described this terminal flower as "probably representing the monstrous joining of 2 or more flowers". However, such terminal flowers were found to occur more or less regularly in most of the U. S. species, although of course they might not be evident on partially-grown racemes. It is rather difficult, therefore, to see how the terminal flowers are any more "abnormal" than are e.g. the first-produced cyathia of *Euphorbia*, which may often have an increased number of floral parts (Croizat, 1942). It is possible, as Johnston suggests, that the larger number of parts of terminal male flowers may have added to the taxonomic confusion, since both Mueller (1866) and Pax and Hoffmann (1919) separated *T. ramosa* (as *T. stylaris*) into a separate section




7




8

Fig. 7. Pollen grain, *Tragia ramosa* (*K. & L. Miller 1341*).

Fig. 8. Pollen grain, *Tragia smallii* (*K. & L. Miller 865*).

from *T. nepetifolia* on a supposed difference in stamen number.

POLLEN GRAINS. The most extensive previously published treatment of the microspores of *Tragia* is that of Punt (1962), who described the variation among 8 species, and also contributed some interesting speculations about taxonomic relationships in the subtribe Plukenetiinae. Punt distributed the 8 species of *Tragia* studied into 4 morphological groups: (1) inaperturate, intectate, pilate *(T. fallax, T. sellowiana):* the '*Tragia fallax* type'; (2) tricolpate, intectate, pilate *(T. geraniifolia, T. ramosa, T. tristis, T. volubilis):* the '*Tragia tristis* subtype' (groups 2, 3, and 4 all being placed in the '*Plukenetia* type'); (3) tricolporate, intectate, reticulate *(T. stolziana):* the '*Plukenetia verrucosa* subtype'; and (4) tricolpate, tectate, psilate *(T. capensis):* the '*Plukenetia volubilis* subtype'.

TABLE 1. POLLEN SIZE IN NORTH AMERICAN SPECIES OF *Tragia*[2]

| *Section* TRAGIA | *Voucher* | *Diameter in polar view* ($\mu$) range | mean |
|---|---|---|---|
| *T. amblyodonta* | Miller & Miller 1178 | 21.3-26.4 | 23.4 |
| *T. betonicifolia* | Miller & Miller 1350 | 19.6-23.0 | 21.2 |
| *T. brevispica* | Cory 54778 | 18.7-22.1 | 20.7 |
| *T. cordata* | Demaree 15378 | 21.3-25.5 | 24.0 |
| *T. glanduligera* | Lundell & Lundell 10665 | 18.7-25.2 | 20.1 |
| *T. laciniata* | Peebles et al. 5641 | 17.0-20.4 | 19.0 |
| *T. nepetifolia* | Tucker 2449 | 17.0-20.4 | 18.4 |
| *T. nigricans* | Miller & Miller 1173 | 23.0-25.5 | 24.5 |
| *T. ramosa* | Miller & Miller 1167 | 17.9-22.1 | 19.9 |
| *T. saxicola* | Curtiss 2517 | 22.1-26.4 | 24.8 |
| *T. urticifolia* | Miller & Miller 848 | 22.1-27.2 | 24.6 |
| Section LEPTOBOTRYS | | | |
| *T. smallii* | Miller & Miller 865 | 25.5-28.1 | 26.9 |
| *T. urens* | Miller & Miller 776 | 20.4-26.4 | 22.9 |

Miller (1964) investigated the pollen of the 13 taxa occurring in the United States, using the glycerine jelly method of Wodehouse (1935) rather than the acetolysis method of Punt (Table 1). This led to the discovery that

2. [Table 1] Parameter estimates are based on measurements of 30 grains per specimen.

the tricolpate grains of the U. S. taxa have operculate colpi, a feature not mentioned by Punt, whose acetolyzed preparations evidently did not show any traces of the opercula. Because of the distinctness of the pila at outermost focus, most of the U. S. species (fig. 7) would fall into Punt's *Tragia tristis* subtype. However, it is actually extremely difficult to decide if these grains are truly intectate, as the pila may be proximally fused.

Two U. S. species, *Tragia smallii* and *T. urens*, were found to differ from any of those described by Punt. In these two plants of the southeastern United States the pollen grains (fig. 8) are rounded-triangular in optical section and have very broad pore-like colpi with net-like incrustations apparently representing the operculum of other species. The pila are furthermore partially united into an extremely fine reticulum, so that in some respects the grains might fit into Punt's *Plukenetia volubilis* subtype.

Examination of other neotropical species of *Tragia* indicates that most of them clearly fall into one or another of the groups listed above. Particularly interesting is *T. bailloniana*, which alone among the American taxa observed is distinctly reticulate, with even-margined colpi. It would therefore go into the *Plukenetia verrucosa* subtype adjacent to such African species as *T. stolziana* and *T. pungens*.

Punt (1962) has suggested that sect. *Bia* might perhaps be best treated as a distinct genus because of the inaperturate grains. However, in view of the rather wide spectrum of morphological variation which has already come to light, it would appear that the pollen of this section is not much more aberrant than that of some sections with colpate grains. Furthermore, such a genus would be extremely difficult to distinguish on the basis of floral characters. Because of the imperfect correlation between pollen characters and taxonomic boundaries, it still seems best to retain all of the sections of *Tragia* within a single genus.

GYNOECIUM. The gynoecium in *Tragia* is of a type rather widespread in the subfamily Crotonoideae, with 3 united carpels and a single anatropous ovule in each locule (fig. 3).

The styles are elongated, often with a conspicuously papillate stigmatic surface, and may be united up to half or more their length. The conducting tissue in the stylar canal is prolonged into each locule as a cap-like obturator appressed to the micropylar end of the ovule. An extension of the obturator, which is made up of closely packed filamentous cells, projects into the micropyle and is in contact with the nucellus. As in most genera of Euphorbiaceae, the obturator of *Tragia* is transient and atrophies during development of the seed.

The solitary pendent anatropous ovule (fig. 4) is typical of that found in many genera of the Crotonoideae, tribe Acalypheae: it is crassinucellate, with two thick integuments, both of which contribute to the formation of the micropyle. A peculiarity which the *Tragia* ovule shares with that of many Acalypheae is the very massive inner integument and the expanded chalazal region which is supplied with distinct vascular traces. The nucellus in Euphorbiaceous ovules of this kind lacks a beak, and as if in compensation the obturator often provides a direct contact between the tip of the nucellus and the transmitting tissue in the style.

FRUIT. The fertilized gynoecium of *Tragia* develops into a dry thin-walled capsule which dehisces more or less explosively at maturity. At dehiscence the cocci first separate septicidally and from the columella; the lateral walls split open along the line where the carpel and columella were attached; and the cocci also split on the abaxial side (loculicidally), allowing the seed to be thrown from the separated coccus. The vasculated exocarp of the coccus is in most species formidably armed with a dense array of stinging hairs; the non-vasculated endocarp is composed of radially elongated sclerified cells.

SEEDS. At the time of formation of the proembryo, the nucellus has been reduced to a plug adjacent to the micropyle, and the inner integument and chalaza are still massive. However, as the embryo develops the inner integument becomes partially replaced by endosperm; in the mature seed its outer epidermis has become the hard palisade layer. The collapsed layers of the outer integument become flattened on the seed surface. The mature seeds are nearly spherical, with a smooth or slightly roughened more or less mottled coat.

CYTOLOGY. Miller (1963) first published counts of chromosome numbers in the genus *Tragia* for 5 U. S. species. With the addition of one species and correction of identifications, verified counts for 6 species are presented here (Table 2). It is obvious that the results presented here are barely a start, since only one population has been counted for each species, and 7 of the 13 U. S. species are still entirely unstudied. However, the chromosome studies do warrant the following observations.

TABLE 2. CHROMOSOME NUMBERS IN *Tragia* (Miller, 1963)[3]

| | *Voucher* | *2n* |
|---|---|---|
| Section TRAGIA | | |
| *T. amblyodonta* | Miller & Miller 1178 | ca. 110 |
| *T. brevispica* | Miller & Miller 1076 | 44 |
| *T. ramosa* | Miller & Miller 1167 | 44 |
| *T. urticifolia* | Miller & Miller 848 | 44 |
| Section LEPTOBOTRYS | | |
| *T. smallii* | Miller & Miller 882 | 44 |
| *T. urens* | Miller & Miller 776 | 44 |

The six counts reported clearly establish that the base number in *Tragia* sect. *Tragia* and sect. *Leptobotrys* is $x = 11$. No counts are yet reported from species belonging to the other seven sections, and such information is particularly to be desired since the results might help to evaluate the status of taxa such as sect. *Bia*. Since no chromosome counts have been reported for any of the other 18 genera of Plukenetiinae recognized by Pax and Hoffmann, knowledge of the base number is not of any assistance in determining intergeneric relationships.

The finding of $n = 55$ in *T. amblyodonta* is interesting, since the other five U. S. taxa counted all agree in having

3. [Table 2] Two of the chromosome numbers reported in Miller (1963) were based on misdetermined specimens. The count reported for *T. glanduligera* was actually made on material of *T. brevispica*, and that reported for *T. ramosa* represented *T. amblyodonta*.

$n = 22$. This provides some support for our decision to recognize *T. amblyodonta* as a distinct species, rather than sinking it in *T. nepetifolia* as was done by Johnston (1962). The greater stinging capacity of *T. amblyodonta* would appear to be correlated with this in some way (larger cell size?).

## RELATIONSHIPS

In the treatment of Pax and Hoffmann (1919), all of the U. S. species of *Tragia* were placed in sect. *'Eutragia'* except for *T. ramosa* and *T. brevispica,* which went into sect. *Leucandra.* As Johnston (1962) has pointed out, this disposition of *T. ramosa* and *T. brevispica* was based on an untenable supposed distinction in stamen number; since stamen numbers of 3-6 occur in all the noseburns, they cannot be separated into two sections by means of this character. Probably sect. *Leucandra,* if it is a valid taxon at all, will have to be characterized on some other basis; and in any event it is not represented by any species in the United States.

On the other hand, two U. S. species, *T. urens* and *T. smallii,* do seem to be rather sharply set off from their congeners by male flowers with only 2 stamens that produce a different sort of pollen. Although Mueller (1866) recognized a sect. *Leptobotrys* for *T. urens,* Pax and Hoffman (1919) merged it with their sect. *Eutragia.* We believe that this group originally recognized by Baillon and Mueller should be resuscitated in order to emphasize the considerable morphological gap between *T. urens, T. smallii* and the Southwestern noseburns.

The remaining 11 U. S. species must all be referred to sect. *Tragia,* but they do not seem to represent a cohesive phyletic unit, as at least 2 species may have their closest relationships outside our area (in Mexico). The nearest species to *T. cordata* may be *T. affinis* of western and central Mexico; the latter is strikingly similar in habit and leaf-shape, even though its male flowers (with 13-18 stamens) are very different. *Tragia glanduligera* is a primarily Mexican species which only enters extreme southern

Texas, and its immediate relationships must be with some taxon to the south.

The core of 9 species left after peeling off the elements mentioned does present the picture of a probably monophyletic — though certainly not a homogeneous — group. It may be analyzed into 1 cluster and 3 isolated species: (1) the noseburns proper, comprising *T. amblyodonta*, *T. betonicifolia*, *T. brevispica*, *T. nepetifolia*, *T. ramosa*, and *T. saxicola;* (2) *T. nigricans;* (3) *T. laciniata;* and (4) *T. urticifolia.* Relationships in the noseburn complex remain to be exactly elucidated, partly because of its tremendous unexplained variability. Hybridization between the noseburns — all of which are at least partly sympatric except for *T. saxicola* — may possibly account for some of the difficulty, although we have found it impossible to distinguish morphological aberrancy due to interspecific crossing from the protean plasticity of unhybridized populations. Cultivation under controlled conditions and experimental crosses will be necessary to have even a chance of resolving this problem. It does appear that ecological preferences may act to separate the taxa to some extent: for example, in Texas *T. betonicifolia* and *T. urticifolia* tend to occur on sandy or granitic soils, whereas *T. amblyodonta* and *T. brevispica* are usually found on limestone.

A further complication in assessing relationships among the noseburns is that several species also extend into Mexico. At least *T. amblyodonta*, *T. brevispica*, and *T. ramosa* are known to go south of the Rio Grande; and the population of *T. nepetifolia* in Arizona represents only a small northernmost extension of a primarily Mexican population. Although we have examined a considerable number of Mexican specimens, we have not attempted to account for the Mexican representatives of the noseburn complex in this paper, beyond establishing the typical element associated with the name *T. nepetifolia.* It is possible that thorough study of the Mexican taxa may reveal the name *T. nepetifolia* to be camouflaging as many different species as has proved to be the case in Texas.

Pax and Hoffmann (1919) remarked on the parallelism evident between the temperate or subtropical representatives of sect. *Tragia* in North and South America, pointing out 4 pairs of vicarious species: *T. pinnata* — *T. laciniata*, *T. bahiensis* — *T. glanduligera*, *T. geraniifolia* — *T. nepetifolia*, and *T. tenella* — *T. amblyodonta* (southern taxon listed first in each pair). There is also a certain resemblance between *T. paxii* of Argentina (Lourteig & O'Donell, 1941) and *T. brevispica* of Texas, particularly with regard to the crested fruits. It would appear that all these cases are indeed parallelisms, in the sense that the taxa involved are in each instance more closely related to species in their own area than to the antipodal vicariant; on the other hand, the overall resemblance between the taxa of Texas — northern Mexico with those of Argentina probably does reflect a genetic continuity in the past analogous with the bipolar distribution of *Prosopis* (Johnston, 1940) and a number of other subtropical taxa of the New World.

## SYSTEMATIC TREATMENT

Approximately 2,500 specimens of *Tragia* were examined during this study. We wish to express our appreciation for the courtesies extended by the directors of the institutions listed below in allowing us to borrow or examine their material.

ARIZ University of Arizona, Tucson; BM British Museum (Natural History), London; FLAS University of Florida, Gainesville; G Conservatoire et Jardin Botaniques, Geneva; GA University of Georgia, Athens; GH Gray Herbarium, Harvard University, Cambridge; IA State University of Iowa, Iowa City; ISC Iowa State College, Ames; K Royal Botanic Gardens, Kew; KANU University of Kansas, Lawrence; KY University of Kentucky, Lexington; LL Texas Research Foundation, Renner; M Botanische Staatssammlung, Munich; MA Instituto Cavanilles, Madrid; MICH University of Michigan, Ann Arbor; MO Missouri Botanical Garden, St. Louis; NCSC North Carolina State University, Raleigh; NMC State University of New Mexico, University Park; NY New York Botanical Garden, New York; P Muséum National d'Histoire Naturelle, Paris; PH Academy of Natural Sciences, Philadelphia; PUL Purdue University, Lafayette; SMU Southern Methodist University, Dallas; TEX University of Texas, Austin; UARK University of Arkansas, Fayetteville; UNM University of New Mexico, Albuquerque; USF University of South Florida, Tampa.

Future collectors of *Tragia* are hereby admonished to take careful notes on variation seen within natural populations, with particular reference to the following characters: (1) proportion of plants showing twining habit; (2) virulence of stinging hairs (this demands a certain amount of *noblesse oblige* on the part of the investigator); (3) color of male flowers; (4) presence of winged fruits (in populations from Texas).

A more complete list of specimen citations has been provided by Miller (1964), together with statistical analyses of some of the data. A tabulation of the historically important Lindheimer collections is presented here as an appendix. Measurements of specimens have been made on dried material except for the flowers, which were examined after being boiled. Voucher specimens for pollen and chromosome studies are deposited at the Kriebel Herbarium, Purdue University (PUL). Synonyms and descriptions refer primarily to the taxa as represented in the U. S., and do not necessarily apply to the genus as a whole.

**TRAGIA** L. Sp. Pl. 2: 980. 1753; Gen. Pl. ed. 5, 421. 1754.

Perennial herbs, sometimes becoming suffrutescent, erect or decumbent to trailing or twining. Stems solitary to many from the woody crown of the taproot, alternately branched; pubescence of stiff stinging hairs intermingled with soft spreading hairs. Leaves alternate, petiolate or sessile; margins entire to serrate, coarsely toothed to divided; stipules lanceolate, acute, entire, ciliate, usually persistent. Plants monoecious; inflorescences [in most U. S. taxa] opposite the leaves at the upper nodes (actually terminal, but soon surpassed by the branch from the axil of the subtending leaf); racemes androgynous, the lower 1 (2) flowers pistillate, the remaining 2-20+ staminate; individual flowers bracteolate. Flowers apetalous; calyx-lobes 3-6; disk absent in the the flowers of both sexes. Staminate flowers pedicellate, abscission zone below the middle of the pedicel, the basal portion persistent; stamens 2-6 (8) [more in some extralimital taxa]; filaments connate at least at the base, anthers free; pistillode small. Pistillate flowers pedicellate, abscission zone below the middle of the pedicel, the entire structure with the calyx and columella usually persistent; staminodia absent; ovary usually of 3 carpels, subglobose, hispid to densely hispid with stiff stinging hairs; ovules solitary in each locule, anatropous, with two integuments, obturator penetrating into the exostome in contact with the nucellus; styles 3, spreading or coiling outward at anthesis, united at the base and up to 1/2 or more their length, stigmas smooth or papillate. Fruit an explosively dehiscent capsule, the cocci separating from a persistent columella; columella with 3 interlocular points apically. Seeds one per locule; seed coat dry, crustaceous, smooth or slightly rough, brownish black or with a tawny mottling, ecaruncu-late; endosperm whitish; embryo straight, cotyledons foliaceous and considerably broader than the terete radicle.

### KEY TO THE TAXA

A. Stamens 3-4 (rarely 5); calyx-lobes of staminate flowers usually 3, sometimes 4 (rarely 5) .................................. Section *Tragia*

B. Stamens 2; calyx-lobes of staminate flowers usually 4 or 5 (rarely 6) .................................................... Section *Leptobotrys*

### Section Tragia

1. Leaf blades undivided ............................................................ (2)
1. Leaf blades 3-divided ............................................ 10. *T. laciniata*
2. Inflorescence without conspicuous stalked glandular hairs .... (3)
2. Inflorescence with conspicuous stalked glandular hairs ............... ........................................................................ 1. *T. glanduligera*
3. Filaments of the stamens connate only at the base ............... (4)
3. Filaments of stamens connate 1/3 — 1/2 or more their length; leaf blades deeply and sharply toothed, cuneate at the base .... ........................................................................ 11. *T. nigricans*
4. Persistent base of the staminate pedicel usually conspicuously shorter than the subtending bract .......................................... (5)
4. Persistent base of the staminate pedicel usually almost equalling in length or exceeding the subtending bract; stigmatic surfaces conspicuously papillate; ovary densely pubescent with stinging hairs ........................................... 3. *T. urticifolia*
5. Calyx-lobes of the pistillate flower shorter than the gynoecium ........................................................................................ (6)
5. Calyx-lobes of the pistillate flower longer than the gynoecium; bracts of the staminate flowers strikingly long, (1-) 2 mm; staminate flowers 14-75 per inflorescence .... 4. *T. betonicifolia*
6. Leaf blades rounded to acute, scarcely acuminate, not broadly ovate with a deeply cordate base; seeds less than 4 mm long; plants twining or not ........................................................... (7)
6. Leaf blades broadly ovate, more than half as long as broad, acuminate, deeply cordate at the base; seeds more than 4 mm long; plants always twining ................................ 2. *T. cordata*
7. Leaf blades ovate to triangular or lanceolate, the broader ones more or less cordate to truncate at base ........................... (8)

7. Leaf blades suborbicular to oblong, truncate or rounded at the base; stigmatic surfaces only slightly papillate; plants never twining (restricted to extreme southern Florida) .................... ........................................................................................ 9. *T. saxicola*

8. Stigmatic surfaces distinctly papillate, styles connate only at the base or slightly higher; leaf blades broadly triangular to ovate ........................................................................................ (9)

8. Stigmatic surfaces not or scarcely papillate (slightly so in aberrant specimens with narrowly lanceolate leaf-blades); styles connate 1/3 to 1/2 their length and usually terminating in slender, recurved tips; leaf blades usually 2-4 times as long as broad ........................................................................ 7. *T. ramosa*

9. Plants not densely pubescent on the stem and leaves ............ (10)

9. Plants copiously to densely pubescent, especially on young stems, the entire plant having a greyish-green cast; leaf blades crenate to serrate or dentate, bases truncate to sagittate; ovary very densely pubescent with stinging hairs .. 8. *T. amblyodonta*

10. Leaf blades coarsely serrate-dentate; staminate calyx often reddish; staminate flowers 8-35 per inflorescence; ovary pubescent with stinging hairs (but usually not very densely); fruits monomorphic (all wingless and 3-seeded); plants erect to decumbent ............................................................ 6. *T. nepetifolia*

10. Leaf blades serrate; staminate calyx never reddish; staminate flowers 3-6 (-10) per inflorescence; ovary densely pubescent with stinging hairs; fruits usually dimorphic, either 3-seeded and wingless or 1-seeded and crested or winged; plants very often twining ........................................................ 5. *T. brevispica*

Section LEPTOBOTRYS

1. Leaf blades blunt-toothed or lobed, bases of lower leaves truncate; seeds 4.0-4.5 mm long; inflorescences opposite the leaves throughout. .................................................................... 12. *T. smallii*

1. Leaf blades entire, blunt-toothed, or lobed, cuneate at the base; seeds 3.0-4.0 mm long; inflorescences terminating leafy lateral branches, opposite the leaves only toward the tip of the main stem. ........................................................................... 13. *T. urens*

Section 1. TRAGIA

Sect. *Eutragia* Muell. Arg. Linnaea 34: 182. 1865; DC. Prodr. 15 (2): 932. 1866.

Perennial herbs, erect, decumbent, or twining; stems and foliage with more or less severely stinging hairs; leaves serrate or dentate, or sometimes deeply lobed or divided; inflorescences opposite the leaves; female flowers 1 or 2 per raceme; staminate flower with 3 or 4 (rarely 5) calyx-lobes; stamens 3-6, filaments more or less cylindrical, somewhat thickened, free or connate; pollen grains distinctly colpate; pistillode subglobose; pistillate flower with 6 (very rarely 5) calyx-lobes; styles free or connate below, smooth or papillate; seeds 2-5.5 mm long.

LECTOTYPE: *Tragia volubilis* L. (designated by Britton and Wilson, Sci. Surv. Porto Rico 5: 491-492. 1924).

This group of about 30 species almost equally divided between North America and South America is here construed nearly as defined by Pax and Hoffmann (1919), except that *T. urens* and *T. smallii* are removed to sect. *Leptobotrys*, while *T. ramosa* and *T. brevispica* are transferred here from sect. *Leucandra*. It seems probable that additional neotropical species of sect. *Leucandra* (those with a low stamen number) will be transferred to sect. *Tragia* when a more thorough study is made.

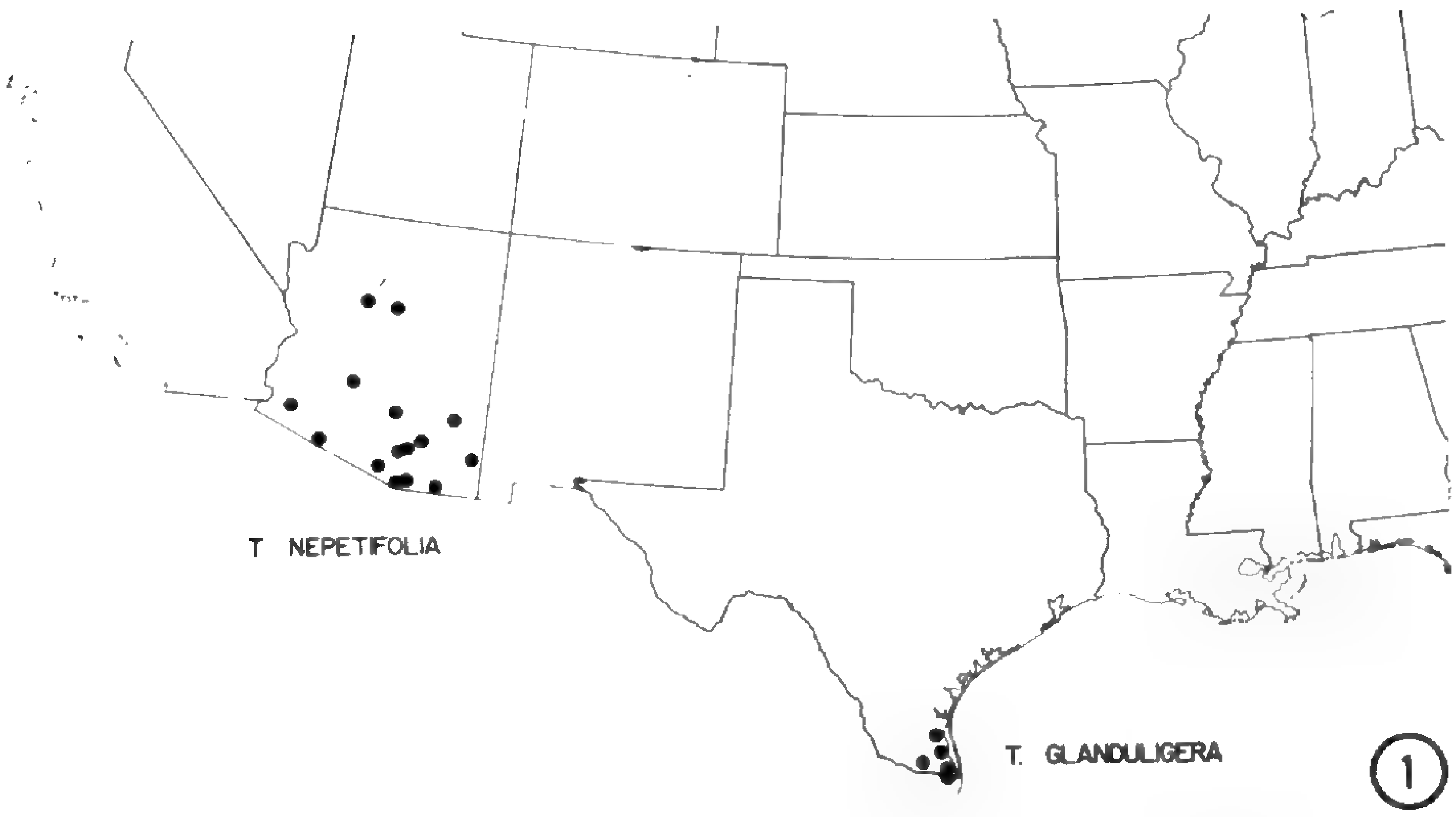
The more or less weedy 'noseburn' species placed together in *T. nepetifolia* by Johnston (1962) are here distributed into species 5-8; *T. betonicifolia*, although treated by Shinners (1958) as a variety of *T. urticifolia*, has often been mistaken for *T. ramosa* and may be regarded as a peripheral member of the 'noseburn' group. At least the first two species, *T. glanduligera* and *T. cordata*, appear to be more closely related to extra-limital taxa than to any U. S. species; in an eventual revision of all of the taxa of sect. *Tragia* they would therefore probably go into separate subsections or series from the remainder (species 3-11).

1. **Tragia glanduligera** Pax & Hoffm. Pflanzenreich IV. 147. IX [Heft 68]: 55. 1919. (Fig. 17)

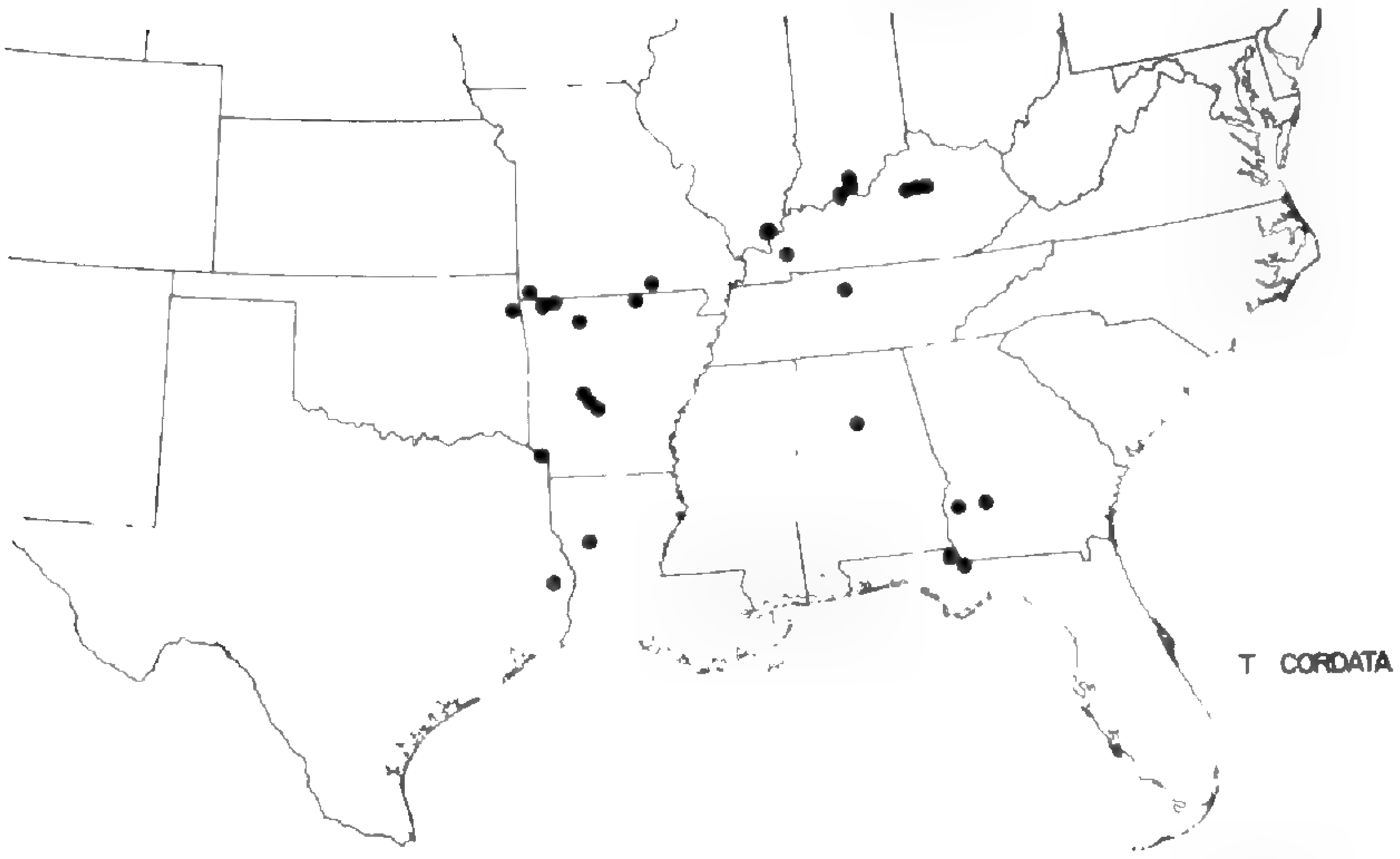
LECTOTYPE: Yucatan, *Gaumer 731* (GH!; isotypes F, MO!).

Stems few to many from the crown of the woody taproot, 1-2 mm in diameter near the base, up to a meter or more long, green to purplish-green, many-branched, trailing and twining; upper internodes 12-35 mm long, lower internodes 20-35 mm long. Leaf blades elliptic to ovate, 2.5-4.0 cm long, 1.5-2.0 cm broad, apically acute to acuminate, basally truncate to cordate, margins crenate to serrate, thin, green, pubescent, ciliate; petioles 6-22 mm long; stipules lanceolate to narrowly ovate, entire, 1.5-4.5 mm long, 0.5-1.2 mm broad at the base, persistent, ciliate, abaxially pubescent. Racemes with the lowermost 1 (2) nodes pistillate, the remaining 10-30 nodes staminate; bracts of the pistillate flowers lanceolate, ca. 0.9-2.0 mm long, ciliate, acute,

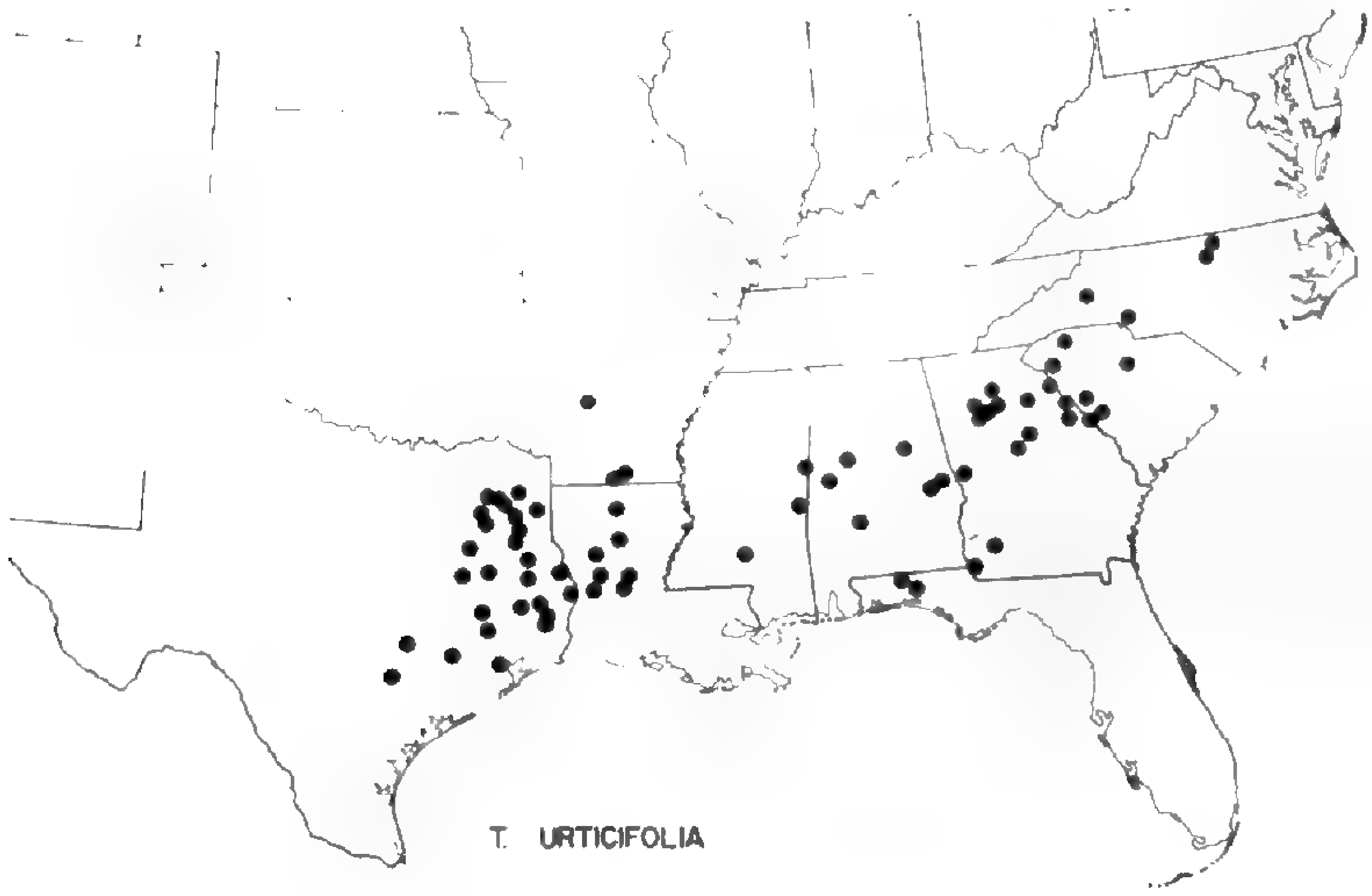

Fig. 17. Habit, *Tragia glanduligera* (*M. C. Johnston 542235*).




1




2




3

Map 1. Distribution of *Tragia glanduligera* and *Tragia nepetifolia.*
Map 2. Distribution of *Tragia cordata.*
Map 3. Distribution of *Tragia urticifolia.*

entire or three-lobed, abaxially sparsely pubescent; bracts of the staminate flowers lanceolate, subcucullate, ca. 0.5-1.5 mm long, pubescent, entire. Glandular hairs present over entire inflorescence. Staminate flowers: pedicels slender, 1-2.0 mm long, lower persistent part ca. 0.3-0.7 mm long; calyx-lobes 3, broadly oblanceolate to obovate, 0.7-1.2 mm long, abaxially pubescent, entire, spreading to reflexed at anthesis; stamens 3; filaments thickened and fleshy, 0.2-0.4 mm long, connate basally. Pistillate flowers: pedicels 1.0-2.3 mm long, becoming 3-7 mm in fruit; calyx-lobes 6, lanceolate to narrowly ovate, 0.7-1.5 mm long at anthesis, 1.2-2.3 mm long in fruit, acute, entire, ciliate, abaxially sparsely pubescent; styles connate about 1/3 their length, stigmatic surfaces papillate. Fruit 2-2.5 mm long, 4-5 mm broad; columella 1.5-2 mm long; seeds nearly spherical, 1.9-2.2 mm long, brownish-black when mature.

DISTRIBUTION: restricted in the U. S. to extreme southern Texas in dry sandy soil (Map 1).

REPRESENTATIVE SPECIMENS: — TEXAS: CAMERON CO., Las Palmas Plantation ca. 4 mi SW of Brownsville in a palm grove, *Correll 14848* (LL); Resaca del Rancho Viejo, *Cory 51454* (NY, SMU); 2.4 mi N of Lozano, *Johnston 2758* (SMU); 3 mi east of Harlingen near Arroyo Colorado, *Johnston 3640* (TEX); Camp Perry (Boy Scout Camp), *Johnston 542235* (TEX); palm grove S of Brownsville, *Lundell & Lundell 10002* (SMU); N of Los Fresnos in mesquite brush, *Lundell & Lundell 10665* (LL, SMU, TEX); Brownsville, *Tharp 1870* (TEX). HIDALGO CO., La Joya, *Walker s.n.* (2/II/1942) (TEX). KENEDY CO., Norias Division of King Ranch a few miles W of La Calandria, *Johnston 541069* (SMU). WILLACY CO., *Tharp s.n.* (26/VI/1941) (TEX).

Pax and Hoffmann (op. cit. 56) cited collections of Berlandier, Gaumer, and Valdez when describing this species. The Berlandier specimens are somewhat atypical and it is not certain that they are conspecific. The Valdez collection is perhaps equally representative, but as the Gaumer collection is more widely distributed it has been chosen as the lectotype.

*Tragia glanduligera* is a primarily Mexican species of the Gulf coastal lowlands between Yucatan and the Rio Grande, crossing into Texas only in four of the southernmost counties. Specimens from further north which have been reported as *T. glanduligera* (Jones, Rowell, & Johnston


Fig. 18. Habit, *Tragia cordata* (*M. E. Wharton 9369*).

1961) actually belong to *T. brevispica*, a species which clearly differs in its non-glandular inflorescence, more sharply toothed leaves, and larger dimorphic fruits. The glandular inflorescence and diminutive seeds (smaller than those of any other U. S. species) easily distinguish *T. glanduligera* from other taxa occurring in Texas.

2. **Tragia cordata** Michx. Fl. Bor. Amer. **2**: 176. 1803. (Fig. 18)
TYPE: Kentucky, 'entre Danville et Beards' town', *Michaux* (P!).
*Tragia macrocarpa* Willd. Spec. Pl. **4**: 323. 1805; based on the same type.
*Tragia Michauxii* Baill. Étud. Gén. Euphorb. 460. 1858; based on the same type.

Stems solitary or few from the crown of the woody taproot, 1.5-3 mm in diameter near the base, up to 1.5 m or more long, green to yellowish-green, few to many-branched, trailing and twining; upper internodes 2-7.5 cm long, lower internodes 3-10 cm long. Leaf blades broadly ovate, 4.5-13 cm long, 3.6-10 cm broad, apically acuminate, basally cordate, margins coarsely serrate, thick, green, pubescent, ciliate; petioles 1.5-8.5 cm long; stipules lanceolate to narrowly ovate, entire, 1.8-10 mm long, 0.4-2.1 mm broad at the base, persistent, ciliate, abaxially sparsely pubescent. Racemes with the single lowermost node pistillate, the remaining 20-60 nodes staminate; bracts of the pistillate flowers lanceolate, ca. 1.6-2 mm long, ciliate, acute, entire or three-lobed, abaxially sparsely pubescent; bracts of the staminate flowers lanceolate, subcucullate, ca. 1.5-2 mm long, pubescent, entire. Staminate flowers: pedicels slender, 1.5-2.2 mm long, lower persistent part ca. 0.7-1 mm long; calyx-lobes 3(91%) (4), oblanceolate to narrowly obovate, 0.7-1.5 mm long, abaxially pubescent, entire, spreading to reflexed at anthesis; stamens 3 (96%) (4); filaments thickened and fleshy, 0.2-0.5 mm long, connate basally. Pistillate flowers: pedicels 1-1.5 mm long, becoming 2.5-3 mm in fruit; calyx-lobes 6 (96%) (-7), elliptic to ovate, 1.5-2 mm long at anthesis, 2-3 mm long in fruit, acuminate, entire, ciliate, abaxially pubescent; styles connate 1/4-1/3 their length, stigmatic surfaces papillate. Fruit 5-7 mm long, 11-13 mm broad; columella 2.2-3.4 mm long; seeds nearly spherical, 4.3-5.3 mm long, brownish-black with a tawny mottling when mature.

DISTRIBUTION: Indiana to Missouri and east Texas more or less following the eastern deciduous forests (Map 2).

REPRESENTATIVE SPECIMENS: — ALABAMA: JEFFERSON CO., Birmingham, *Earle 2074* (NY). ARKANSAS: HOT SPRINGS CO., Magnet Cove, *Demaree 22407* (SMU). FLORIDA: JACKSON CO., Florida

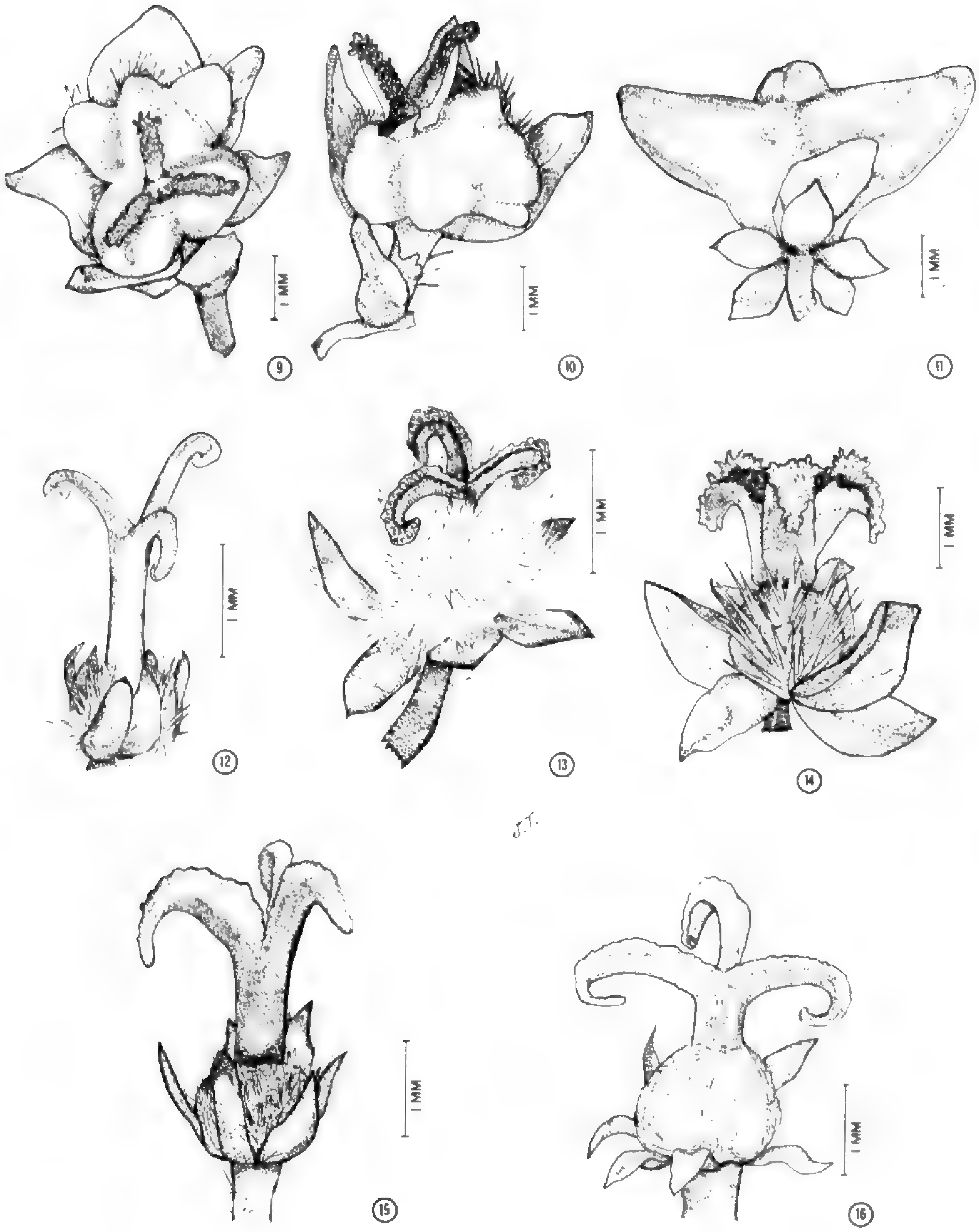
Caverns State Park, *Beck 225* (FLAS, GA). GEORGIA: LEE CO., along Fowlton Creek near Armena, *Thorne & Muenscher 8413* (GA). ILLINOIS: POPE CO., Golconda, *Forbes* (F). INDIANA: CRAWFORD CO., roadside 1/4 mi W of Leavenworth, *Deam 18583* (NY). KENTUCKY: LYON CO., Skinframe Creek, *Eggleston s.n.* (14/VI/1909) (NY). MISSOURI: MCDONALD CO., rocky ground, uncommon, *Bush s.n.* (24/VII/1893) (NY). OKLAHOMA: DELAWARE CO., Little Kansas, DEMAREE *22407* (SMU). TENNESSEE: DAVIDSON CO., woods near Nashville, *Gattinger 2518* (KANU, NY, PH, SMU, UARK). TEXAS: BOWIE CO., 3 mi N of Texarkana, *Correll 15249* (LL).

*Tragia cordata,* which attains the northernmost latitude of any species in the genus, is not easily confused with any of the other U. S. taxa: it is set apart by the vining habit, large deeply cordate leaves, and large fruits and seeds. Its closest affinities would appear to be with Mexican species such as *T. affinis* Rob. & Greenm.

3. **Tragia urticifolia** Michx. Fl. Bor. Amer. 2: 176. 1803. (Figs. 6, 14, 19)

TYPE: Georgia [ex Michaux, loc. cit.], *Michaux* (P!).

Stems solitary or few from the crown of the woody taproot, 3-4 mm in diameter near the base, 25-65 cm tall, green to yellowish-green, simple to few-branched, erect to decumbent; upper internodes 8-30 mm long, lower internodes 12-60 mm long. Leaf blades triangular-lanceolate to narrowly ovate, 2.7-6.7 cm long, 0.9-3.2 cm broad, apically acute, basally cordate to truncate, petioles 3-11(-17) mm long; stipules lanceolate to narrowly cordate, entire, 2-5 mm long, 0.6-1.6 mm broad at the base, persistent, ciliate, abaxially pubescent. Racemes with the lowermost 1 (2) nodes pistillate, the remaining 11-40 nodes staminate; bracts of the pistillate flowers lanceolate, ca. 1-1.5 mm long, ciliate, acute, entire or three-lobed, glabrous or abaxially sparsely pubescent; bracts of the staminate flowers lanceolate, subcucullate, ca. 0.7-1.5 mm long, pubescent, entire. Staminate flowers: pedicels slender, 1.5-2 mm long, lower persistent part ca. 1-1.8 mm long, as long as or exceeding the bract; calyx-lobes 3 (93%) (4), oblanceolate to narrowly ovate, 1.2-2.1 mm long, abaxially pubescent, entire, spreading to reflexed at anthesis; stamens 3; filaments thickened and fleshy, 0.3-0.8 mm long, connate basally. Pistillate flowers: pedicels 0.5-1 mm long, becoming 3-4 mm in fruit; calyx-lobes (5) 6 (86%), lanceolate to ovate, 1.3-2.2 mm long at anthesis, 2-3 mm long in fruit, acute, entire, ciliate, rarely abaxially pubescent; styles connate 1/3-1/2 their length, stigmatic surfaces




Figs. 9 and 10. Early stage in development of winged fruit, *Tragia brevispica* (*K. & L. Miller 1076*).

Fig. 11. Mature one-seeded winged fruit, *Tragia brevispica* (*K. & L. Miller 1076*).

Fig. 12. Pistillate flower, *Tragia ramosa* (*K. & L. Miller 1341*).

Fig. 13. Pistillate flower, *Tragia amblyodonta* (*K. & L. Miller 1178*).

Fig. 14. Pistillate flower, *Tragia urticifolia* (*K. & L. Miller 848*).

Fig. 15. Pistillate flower, *Tragia smallii* (*K. & L. Miller 865*).

Fig. 16. Pistillate flower, *Tragia urens* (*K. & L. Miller 776*).


Fig. 19. Habit, *Tragia urticifolia* (*K. & L. Miller 848*).

very papillate. Fruit 3.5-4.5 mm long, 7-8 mm wide; columella 2-2.8 mm long; seeds nearly spherical, 3-4 mm long, brownish-black when mature.

DISTRIBUTION: North Carolina south to northern Florida and west to Texas and Arkansas, typically in dry sandy soil in open woods and fields (Map 3).

REPRESENTATIVE SPECIMENS: — ALABAMA: TALLADEGA CO., Childersberg, *Hood 4680* (FLAS). ARKANSAS: GARLAND CO., near Hot Springs, *Palmer 29069* (UARK). FLORIDA: OKALOOSA CO., Crestview, *West s.n.* (27/IX/1950) (FLAS). GEORGIA: BAKER CO., bank of Cooleewahee Creek at Newton, *Thorne 5695* (GA, IA). LOUISIANA: WINN PARISH, 10 mi W of Winnfield, *Webster & Wilbur 3266* (NCSC, SMU). MISSISSIPPI: LAUDERDALE CO., 18 mi SW of Quitman on Rt. 18, *Miller & Miller 872* (PUL). NORTH CAROLINA: GRANVILLE CO., 0.5 mi W and 2 mi N of Hester, *Ahles & Leisner 17499* (TEX). SOUTH CAROLINA: EDGEFIELD CO., ca. 3 mi. W of Owdoms, *Miller & Miller 844* (PUL). TEXAS: BASTROP CO., Bastrop State Park, *Correll & Johnston 17433* (LL): SALINE CO., Redhills Lake, *Miller & Miller 915* (PUL).

*Tragia urticifolia* is a very distinct species although it has been misinterpreted by some writers of floras. Gleason (1952), in 'Britton & Brown's New Illustrated Flora', reversed the distinction between *T. urticifolia* and *T. nepetifolia* when he stated that '*Tragia nepetifolia* is similar in habit but the persistent pedicel-base of the staminate flowers is as long as the bract, the short filaments are as wide as the anthers, and the styles are scarcely connate.' These statements pertain to *T. urticifolia* and not to *T. nepetifolia*, as he intended. Gleason also attributed a much wider distribution to *T. urticifolia* than actually exists.

The only species which is at all close to *T. urticifolia* is *T. betonicifolia*, which is largely allopatric, overlapping with *T. urticifolia* only in eastern Texas and in Arkansas. Although *T. betonicifolia* seems sufficiently distinct to be regarded as a separate species (as discussed below), it doubtless may be regarded as the western vicariant of *T. urticifolia*.


Fig. 20. Habit, *Tragia betonicifolia* (*J. Hancin 1311*).

4. **Tragia betonicifolia** Nutt. Trans. Amer. Phil. Soc. (n.s.) **5:** 173. 1837. (Fig. 20)

TYPE: 'Arkansas', Red River, *Nuttall* (BM!).

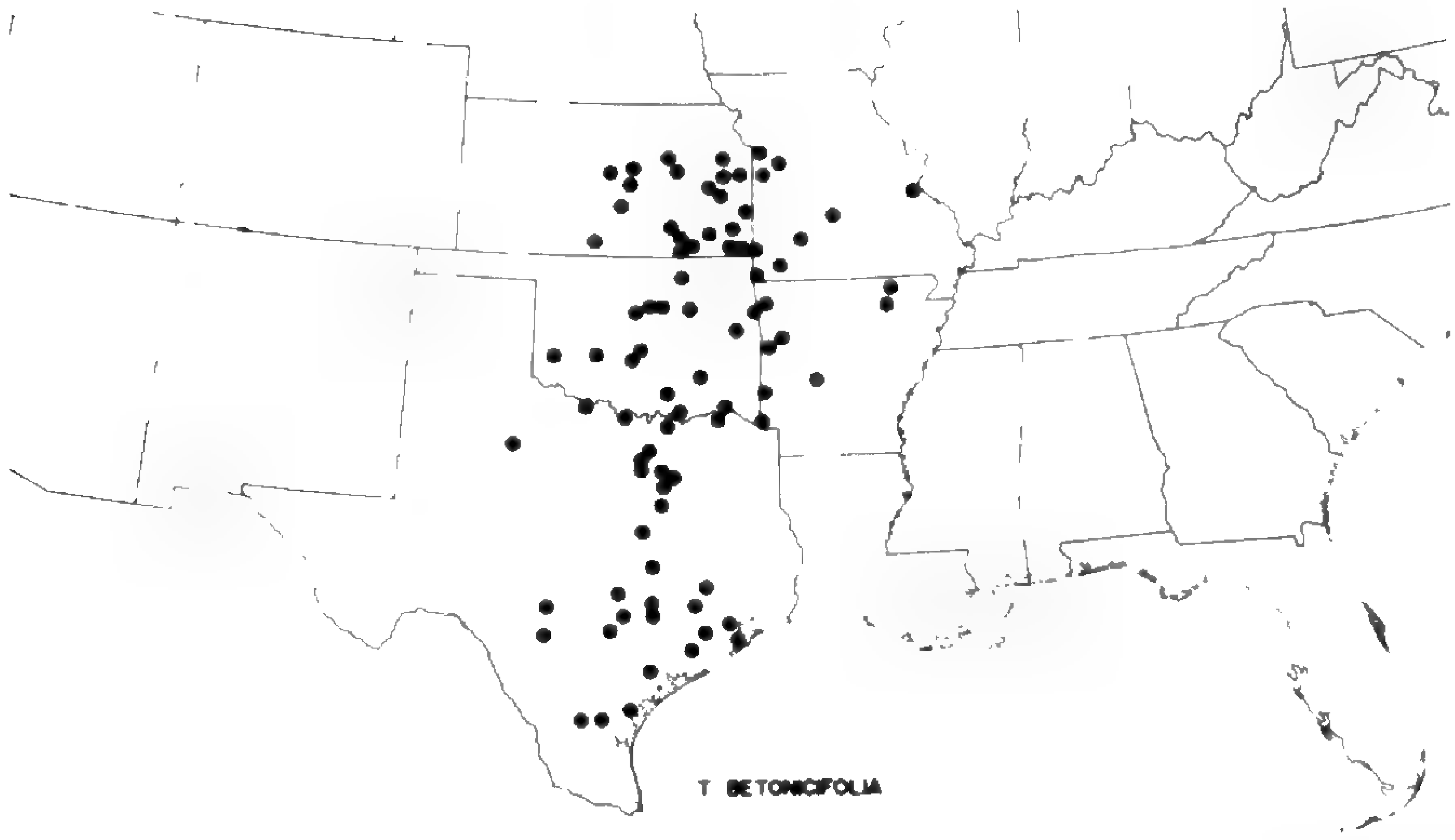
*Tragia urticifolia* var. *texana* Shinners, Field & Lab. **19:** 183. 1951.

TYPE: 6 mi NW of Grapevine, Tarrant Co., Texas, *Shinners 11133* (SMU!)

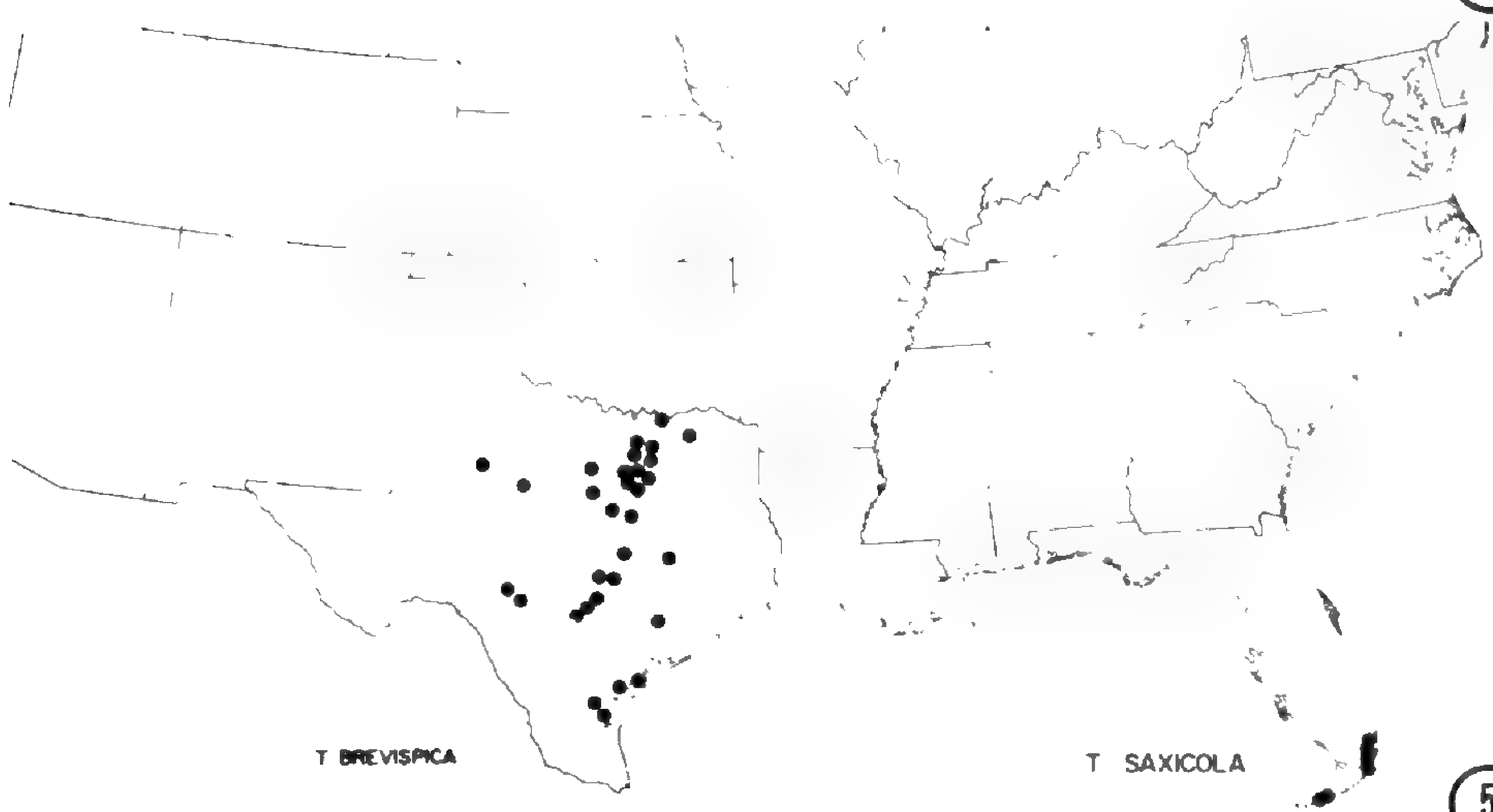
Stems few to many from the crown of the woody taproot, 1-2.5 mm in diameter near the base, 20-50 cm tall, green to yellowish-green, few-branched to many-branched, erect or decumbent to trailing; upper internodes 10-30 mm long, lower internodes 15-45 mm long. Leaf blades ovate, ovate-lanceolate to triangular-lanceolate, 1.5-5.5 cm long, 0.9-3.5 cm broad, apically acute, basally cordate to truncate, margins sharply serrate, thick, green, pubescent; petioles 0.8-3.5 cm long; stipules ovate to ovate-lanceolate, attenuate, entire 2.5-6 mm long, 0.5-2.5 mm broad at the base, persistent, ciliate, abaxially sparsely pubescent. Racemes with the lowermost 1 (2) nodes pistillate, the remaining 14-75 nodes staminate; bracts of the pistillate flowers lanceolate, ca. 1.5-2 mm long, ciliate, acute, entire or three-lobed, abaxially sparsely pubescent; bracts of the staminate flowers lanceolate, subcucullate, ca. 1-2 mm long, pubescent, entire. Staminate flowers: pedicels slender, 0.7-1 mm long, lower persistent part ca. 0.3-0.6 mm long; calyx-lobes 3 (68%)-4 (26%) (5), oblanceolate to narrowly obovate, 1.2-2.3 mm long, abaxially pubescent, entire, spreading to reflexed at anthesis; stamens 3 (71%)-4 (27%) (5); filaments thickened, 0.4-1 mm long, connate basally. Pistillate flowers: pedicels 0.7-1 mm long, becoming 3-4 mm in fruit; calyx-lobes 6, lanceolate, 1.8-3.0 mm long at anthesis, 3-5 mm long in fruit, acute to attenuate, entire, ciliate, abaxially sparsely pubescent; styles connate only at the base or up to 1/3 their length, stigmatic surfaces papillate. Fruit 4-5 mm long, 7-9 mm broad; columella 2.5-3 mm long; seeds nearly spherical, 3-4 mm long, brownish-black with a tawny mottling when mature.

DISTRIBUTION: open woods, fields, and roadsides, usually on dry sandy soil, Texas north through Oklahoma and Arkansas to Kansas and Missouri (Map 4).

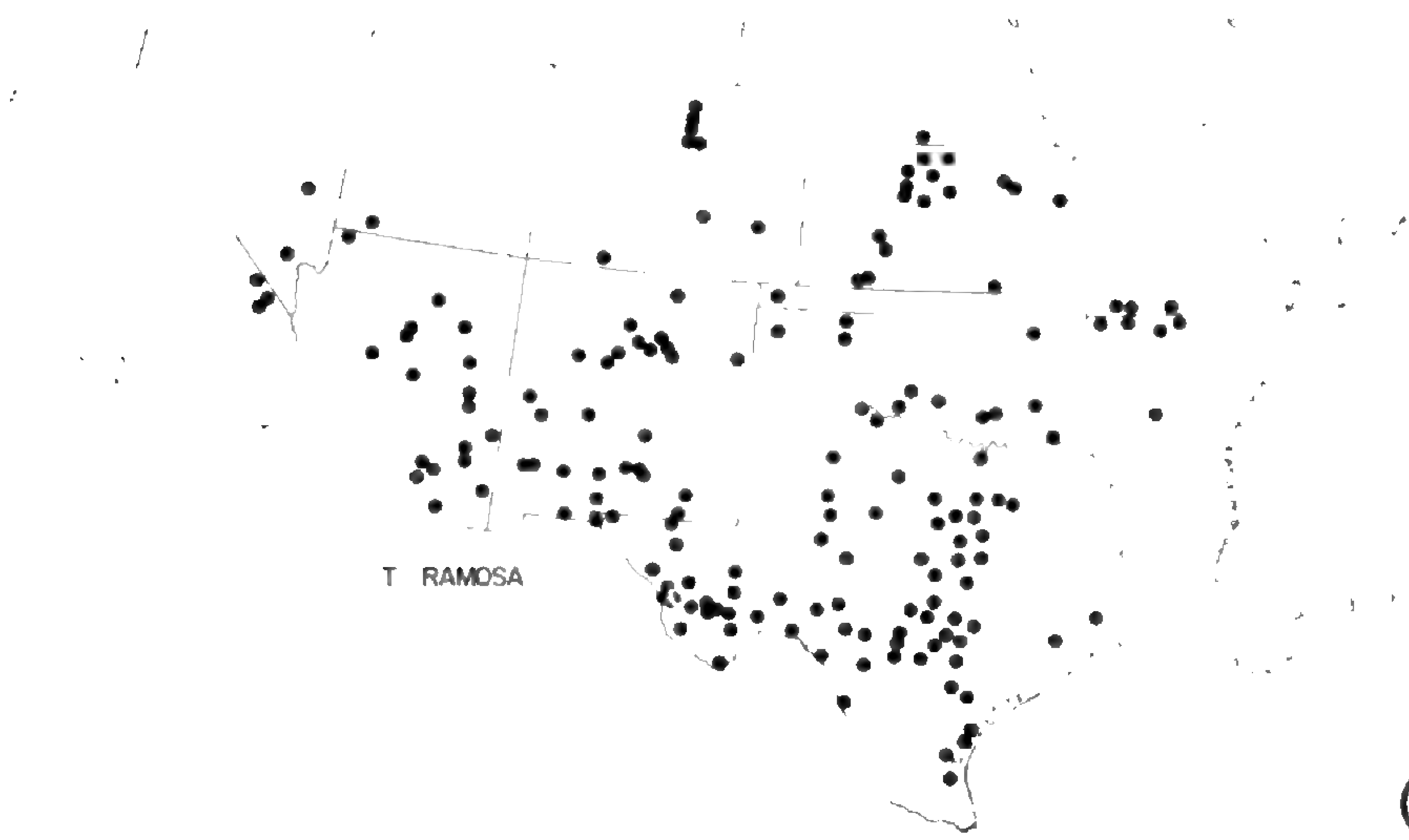
REPRESENTATIVE SPECIMENS: — ARKANSAS: FRANKLIN CO., Horseshoe Mountain (Little Short Mountain), *Iltis & Iltis 5400* (MICH, SMU). RANDOLPH CO., Ravenden Springs, clay thickets, *Demaree 29217* (SMU). KANSAS: MCPHERSON CO., McPherson State Park, *McGreggor 10739* (KANU). Ellsworth Co., 1 mi E of Terra Cotta, *McGreggor 12396* (KANU). MISSOURI: JASPER CO., near old mines, Webb City, *Demaree 40340* (SMU); 2 mi NE of Webb City, *Miller & Miller 1350* (PUL). OKLAHOMA: ATOKA CO., 10 mi S of Kiowa, *Matlock*




4




5




Map 4. Distribution of *Tragia betonicifolia*.
Map 5. Distribution of *Tragia brevispica* and *Tragia saxicola*.
Map 6. Distribution of *Tragia ramosa*.

*114* (SMU). JOHNSTON CO., 10 mi S of Tishomingo along Highway 99, *Robbins 3066* (SMU). TEXAS: LEE CO., 2.5 mi SW of Giddings, *Cory 55763* (SMU). TARRANT CO., E of Euless on Bear Creek N of Highway 183, *Whitehouse 16138* (SMU).

Although Shinners described this species as a variety of *T. urticifolia,* it is readily separable from that plant by the length of the bracts subtending the staminate flowers and by the pistillate calyx-lobes. In *T. betonicifolia* the persistent base of the staminate pedicel is greatly exceeded by the subtending bract, whereas in *T. urticifolia* the pedicel base usually equals in length or exceeds the subtending bract. The calyx-lobes of the pistillate flower in *T. betonicifolia* are usually more lanceolate and always longer than those of *T. urticifolia* (and of most related taxa); the entire gynoecium of *T. betonicifolia* is enveloped by the calyx at anthesis, but in *T. urticifolia* and most other U. S. species of *Tragia* the top of the ovary and the styles are protruding at this stage.

Both Fernald (1950) and Gleason (1952) referred the Missouri populations of *T. betonicifolia* and *T. ramosa* to *T. urticifolia,* but the latter species is not known to enter Missouri. The specimens from the New York Botanical Garden designated as having been used for the illustrations in Gleason's manual actually represent two Missouri collections of *T. betonicifolia.*

5. **Tragia brevispica** Engelm. & Gray, Jour. Boston Soc. Nat. Hist. 5: 262. 1845. (Figs. 9-11, 21)[4]

TYPE: Texas, 'Black, clayey soil, in the prairies west of the Brazos.

4. The typification of *Tragia brevispica* presents unusual intricacies even for this genus, and it is with some reluctance that we have adopted it in place of the name *T. teucriifolia.* Engelmann and Gray, in their original publication, based the name on Lindheimer 307, which according to Blankinship (1907) belongs to Fascicle II of the Lindheimer collections (see the appendix to this paper), made in 1844. The only specimen examined with a label corresponding to the locality data cited by Engelmann and Gray is in the Paris Herbarium, and it seems possible that this sheet was sent on exchange by Gray, who did not bother to retain the original label. The specimens at


Fig. 21. Habit, *Tragia brevispica* (*E. Whitehouse 16302*).

May — July' [1844], *Lindheimer 307* [Fascicle II] (GH, lectotype!; MO, NY, P, SMU, isotypes!)

*Tragia teucriifolia* Scheele, Linnaea **25**: 586. 1852.

TYPE: Texas, 'am Rande von Gebüsch und im Pflanzengestrüpp an sonnigen Stellen bei Neubraunfels, Julio — Septbr., 1846', *Lindheimer 522* [Fascicle III] (GH, MO, TEX!).

*Tragia nepetifolia δ teucriifolia* (Scheele) Muell. Arg. in DC. Prodr. **15(2)**: 934. 1866.

Stems solitary or few from the crown of the woody taproot, 1-2 mm in diameter near the base, 20 cm tall up to a meter or more long, green to yellowish-green, few to many-branched, erect to trailing and twining; upper internodes 10-20 mm long, lower internodes 20-35 mm long. Leaf blades broadly triangular, 1.8-5 cm long, 1.3-3 cm broad, apically acute, basally truncate to shallowly cordate, margins finely and shallowly serrate, thin, green, pubescent, ciliate; petioles 7-30 mm long; stipules lanceolate to ovate, entire, 1.4-3 mm long, 0.7-1.4 mm broad at the base, persistent, ciliate. Racemes with the lowermost node pistillate, the remaining 3-6(10) nodes staminate; bracts of the pistillate flowers lanceolate, ca. 1-1.4 mm long, ciliate, acute, entire or three-lobed; bracts of the staminate flowers lanceolate, subcucullate, ca. 1-1.8 mm long, ciliate, entire. Staminate flowers: pedicels slender, 1-1.5 mm long, lower persistent part ca. 0.4-0.7 mm long; calyx-lobes 3 (25%)-4 (70%) (5), ovate to obovate, 1-1.5 mm long, abaxially pubescent, entire, spreading to reflexed at anthesis; stamens 3 (31%), 4 (54%)-5 (15%); filaments slender, thickened and fleshy, 0.3-0.6 mm long, connate basally. Pistillate flowers: pedicels 0.5-1 mm long, becoming 2-4 mm in fruit; calyx-lobes 6, ovate, 1.3-2.0 mm long at anthesis, 1.8-3.5 mm long in fruit, acute, entire, ciliate or abaxially pubescent; styles connate only at the base or up to 1/3 their length; stigmatic surfaces papillate. Fruits often of two kinds on the same plant; some 3-seeded, typically dehiscing, 3.5-4 mm long, 6.5-7.0 mm broad; other fruits with 1-3 distinct wings, more or less indehiscent; columella 1.8-2.8 mm long; seeds nearly spherical, 2.8-3.8 mm long, brownish-black with a tawny mottling when mature.

DISTRIBUTION: limestone regions of central Texas, extending into northern Mexico (Map 5).

---

Paris, Harvard, Missouri Botanical Garden, and New York herbaria all seem to belong to the same gathering, representing a plant which is more narrow-leaved than other individuals collected by Lindheimer in later years. There are no fruits on any of the sheets of *Lindheimer 307*, and the flowers are not sufficiently characteristic so that we can be absolutely positive of the specific identity of *T. brevispica* with *T. teucriifolia*.

REPRESENTATIVE SPECIMENS: — TEXAS: COLLIN CO., 6 mi S of Frisco on McDonald Farm, *Wagner 114* (SMU). ELLIS CO., along White Rock Creek, 11 mi S of Italy, *Correll & Johnston 17366* (LL). MCLENNAN CO., *Smith 240* (TEX). REAL CO., 4 mi N of Leakey, *Miller & Miller 1165* (PUL). SAN PATRICIO CO., Welder Wildlife Refuge, *Miller & Miller 1076* (PUL). TARRANT CO., Fort Worth, Bluebird Avenue, *Cory 54778* (KANU, LL, SMU). TRAVIS CO., Austin, Albers' herb garden, *Warnock W1076* (TEX); Pecan Springs, E of Austin, *Lundell & Lundell 8939* (LL).

Mueller (1866) treated *T. teucriifolia* as a variety of his all-inclusive *T. nepetifolia,* but may not have examined any specimens of the type collection, as he cited *Lindheimer 307* only under his var. *ramosa.* Johnston (1962) does not even recognize the taxon at the subspecific level. Our own concept, in contrast, is essentially in agreement with that of Pax and Hoffmann (1919), who accepted *T. teucriifolia* as a distinct species and placed it closest to *T. ramosa.* The commonest forms of *T. brevispica* appear very different from *T. ramosa* because of their twining stems, broader rather bluntly toothed leaves, papillate styles, and dimorphic fruits. However, occasional specimens are encountered which are difficult to place in one species or the other. Because of the extraordinary plasticity of *T. ramosa,* it is not easy to exclude the possibility that such 'aberrant' or 'intermediate' specimens may simply be imperfect herbarium samples of that widespread species. On the other hand, *T. brevispica* and *T. ramosa* are widely sympatric over much of central Texas, and it would not be surprising if occasional hybridization occurred. Such specimens as e.g. *Tharp et al. 51-953* from NW Travis County (TEX *89561*) might possibly represent interspecific crosses. Without careful field observations, however, we would not want to positively specify a hybrid origin for any specimens examined in this study.

Despite the confusion of *T. brevispica* with *T. ramosa,* it may actually be more closely related to the Mexican *T. nepetifolia,* which in our area is known only from southern Arizona. The Arizona race of *T. nepetifolia* has leaves and female flowers rather similar to those of *T. brevispica,* but clearly differs in its reddish male flowers, non-twining habit, and monomorphic fruits. The south Texas and Mexican twining species *T. glanduligera* is not sympatric with *T. brevispica* as far as can be determined from available records, but their ranges approach closely in the Corpus Christi area and it seems possible that they may overlap slightly. However, *T. glanduligera* is certainly not closely related to *T. brevispica,* and is easily distinguished by its glandular inflorescence, more finely toothed and less deeply cordate leaves, and smaller seeds.

The growth habit of *T. brevispica* appears to show considerable lability in response to environmental conditions. Plants growing in open areas are more or less erect (the type collection being of this kind), while those in shade are normally trailing with much longer internodes and broader leaves. Both the erect and trailing forms develop the characteristic winged fruits.

6. **Tragia nepetifolia** Cav. Icones Pl. **6:** 37, pl. 557 fig. 1. 1801. (Fig. 22)

TYPE: Mexico, Hidalgo, 'inter Ixmiquilpan et Zimapan', *Née* (MA, photographs!).

*Tragia nepetifolia* Σ *genuina* Muell, Arg. in DC. Prodr. **15(2):** 934. 1866.

Stems few to many from the crown of the woody taproot, 1-2 mm in diameter near the base, 15-40 cm tall, green to purplish-green, few to many-branched, erect, decumbent or trailing; upper internodes 10-25 mm long, lower internodes 15-50 mm long. Leaf blades triangular to ovate, 1.8-4 cm long, 0.9-2.7 cm broad, apically acute, basally truncate to cordate, margins irregularly coarsely toothed, thin, green, pubescent, ciliate; petioles 3-25 mm long; stipules lanceolate to narrowly ovate, entire, 2-5 mm long, 0.7-2 mm broad at the base, persistent, ciliate, abaxially pubescent. Racemes with the single lowermost node pistillate, the remaining 8-35 nodes staminate; bracts of the pistillate flowers lanceolate, ca. 1.3-1.6 mm long, ciliate, acute, entire or three-lobed, abaxially sparsely pubescent; bracts of the staminate flowers lanceolate, subcucullate, ca. 1.3-1.6 mm long, pubescent, entire. Staminate flowers: pedicels slender, 1.4-1.7 mm long, lower persistent part ca. 0.5-0.7 mm long; calyx-lobes 3(79%) -4 (21%), elliptic to ovate, 1-2 mm long, glabrous or abaxially pubescent, entire, spreading to reflexed at anthesis; stamens (2) 3(88%)-4

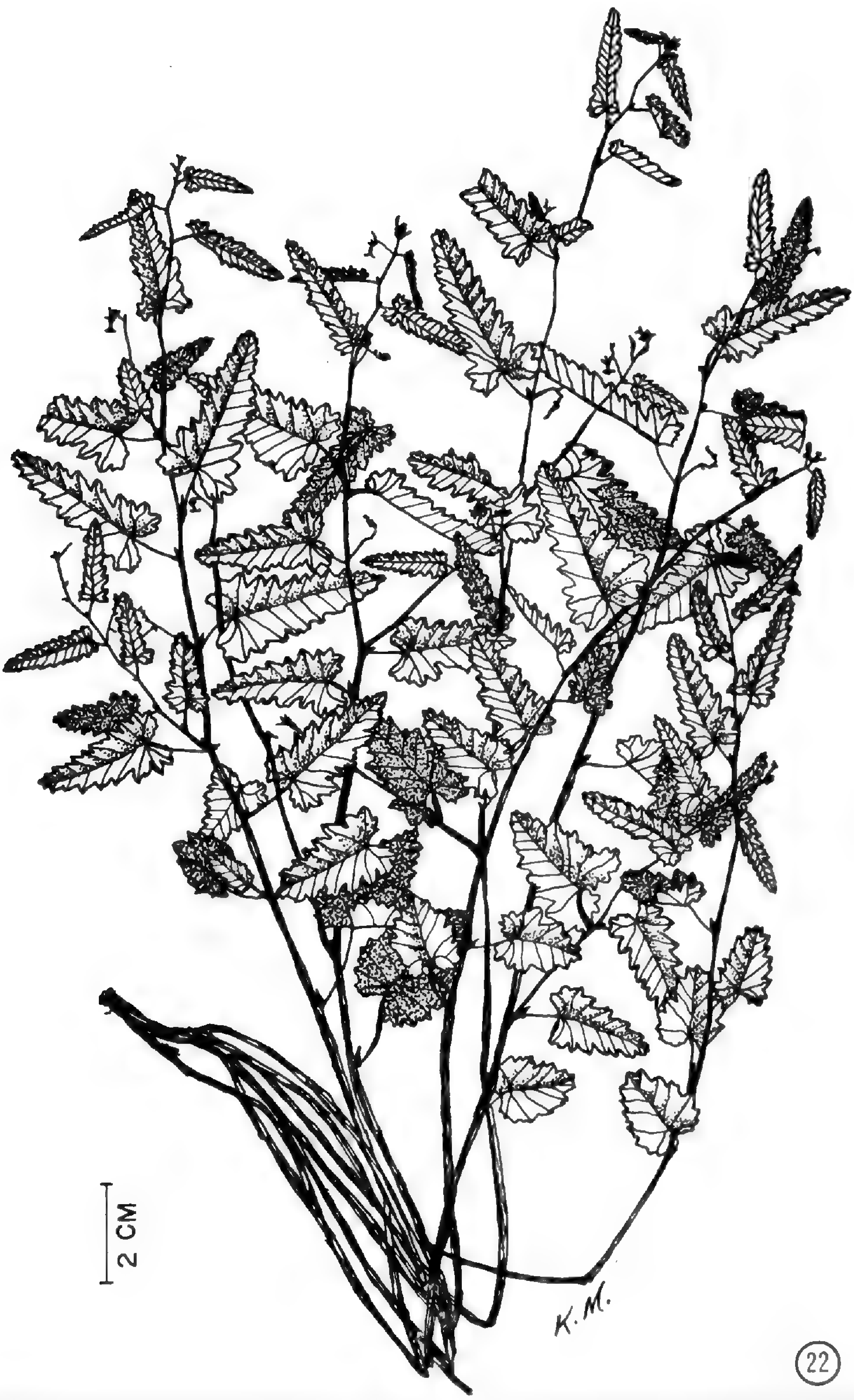



Fig. 22. Habit, *Tragia nepetifolia* (*T. H. Kearney & R. H. Peebles 10320*).

(11%); filaments thickened and fleshy, 0.3-0.6 mm long, connate basally. Pistillate flowers: pedicels 1.3-1.6 mm long, becoming 2.9-3.3 mm in fruit; calyx-lobes 6, lanceolate to narrowly ovate, 1.4-2.3 mm long at anthesis, 2-3.5 mm long in fruit, acute, entire, ciliate, abaxially pubescent; styles united only at the base or up to 1/3 their length, stigmatic surfaces papillate. Fruit 3-4.5 mm long, 6-8 mm broad; columella 2-2.7 mm long; seeds nearly spherical, 3-4 mm long, brownish-black with a tawny mottling when mature.

DISTRIBUTION: southern Arizona and possibly New Mexico south into central and western Mexico (Map 1).

REPRESENTATIVE SPECIMENS: — ARIZONA: GRAHAM CO., Turkey Creek, 6 mi W of Point of Pines, 70 mi E of San Carlos, *Bohrer 439* (ARIZ). MARICOPA CO., Camp Creek, *Harrison & Hastings 6615* (ARIZ). PIMA CO., Sabino Canyon, Santa Catalina Mountains, *Kearney & Peebles 10320* (ARIZ); Baboquivari Canyon, *Kearney & Peebles 14982* (ARIZ). SANTA CRUZ CO., Patagonia Mountains, cliffs E of the old Flux Mine, ca. 5000 feet, *Niles, Mason & Williams 172* (ARIZ). YUMA CO., Castle Dome Mountains, *Arnold s.n.* (16/IX/1937) (ARIZ).

MEXICO. CHIHUAHUA: above Tinaja Canyon, W of Vieja Casas Grandes, *Tucker 2449* (ARIZ). HIDALGO: hills above El Salto, *Pringle 11303* (MICH). JALISCO: 18 mi S of Valparaiso, *McVaugh 17685* (MICH).

As pointed out by McVaugh (1961), the name *T. nepetifolia* has been 'loosely interpreted by recent botanists . . . to apply to a wide variety of herbaceous plants with the stems erect or nearly so . . . from Arizona and eastern United States to Guatemala.' The responsibility for this state of affairs rests mainly on Mueller (1866), who rather ineptly combined most of the taxa in the noseburn complex under the name *T. nepetifolia* while at the same time placing part of the specimens of *T. ramosa* under a different species name in another section of the genus. Johnston (1962) rectified the confusion with regard to *T. ramosa* but by combining all the noseburn taxa arrived at a concept of *T. nepetifolia* even more inclusive than that of Mueller.

Part of the difficulty in defining the limits of *T. nepetifolia* has been due to uncertainty with regard to its typification. Fortunately, through the courtesy of Dr. F. Bellot Rodriguez, director of the Instituto Cavanilles at Madrid, we have obtained photographs of the two sheets which presumably served as the basis of Cavanilles' description. Johnston (1962) cited *'Sessé and/or Mociño'* as the collectors of the type, but as indicated by Mueller (1866), the specimens were actually collected by Née between Ixmiquilpan and Zimapan.

These specimens of Née, which are rather accurately (though somewhat crudely) depicted in Cavanilles' plate, have a leaf shape suggestive of *T. betonicifolia* or *T. urticifolia,* and rather closely match the Mexican specimens cited above. The Arizona population referred by us to *T. nepetifolia* agrees with the Mexican plants fairly well, although it differs in having generally more bluntly toothed leaves and a tendency to reddish male flowers. It is possible that these Arizona plants represent a distinct subspecies of *T. nepetifolia* or even a distinct species, but until the Mexican populations have been thoroughly studied there seems little utility in creating a special taxon for the small outlying race in Arizona.

As noted under *T. brevispica,* that species is rather similar to *T. nepetifolia* in some respects but differs in its twining habit and dimorphic fruits. The two species are allopatric in the United States, although further exploration may show their ranges to overlap in Chihuahua or northern Nuevo León. The bulk of the U. S. specimens which have passed as *T. nepetifolia* really belong to *T. ramosa,* which typically differs in its narrower more finely toothed leaves, greenish male flowers, and slender smooth styles. Both species are allopatric over much of the state of Arizona, and detailed studies of their habitat preference would probably be rewarding.

7. **Tragia ramosa** Torr. Ann. Lyc. N. Y. **2**: 245. 1828. (Figs. 5, 12, 23)

TYPE: 'sources of the Canadian' [evidently in SE Colorado], Long's Expedition, *James* (NY!).

*Tragia angustifolia* Nutt. Trans. Amer. Phil. Soc. (n.s.) **5**: 172. 1837.


Fig. 23. Habit, *Tragia ramosa (C. L. & G. York 55234)*.

TYPE: 'on the prairies of the Red River, in arid situations', *Nuttall* (K, lectotype!; NY, isotype!).[5]

*Tragia scutelariifolia* Scheele, Linnaea **25**: 587. 1852. TYPE: New Braunfels, Texas, July 1846, *Lindheimer 521* [Fascicle III] (B, not seen, perhaps destroyed).

*Tragia ramosa* var. ? *leptophylla* Torr. Bot. Mex. Bound. 201. 1859. LECTOTYPE: Texas, 'near Howard's Springs' [SW Crockett Co.], *Bigelow* (NY!). PARATYPE: 'New Mexico' [probably also from W Texas], *Wright 1796* (G, NY!).

*Tragia stylaris* Muell. Arg. Linnaea **34**: 180. 1865.

*Tragia stylaris α latifolia* Muell. Arg. loc. cit. Type: New Mexico, *Fendler 776* (G!).

*Tragia stylaris β angustifolia* Muell. Arg. loc. cit. TYPE: New Braunfels, Texas, July 1846, *Lindheimer 521* [Fascicle III] (G!).

*Tragia stylaris γ leptophylla* (Torr.) Muell. Arg. op. cit. 181.

*Tragia nepetifolia ξ ramosa* (Torr.) Muell. Arg. in DC. Prodr. **15** (2): 934. 1866.

*Tragia nepetifolia β latifolia* Muell. Arg. loc. cit. TYPE: 'Novo Mexico' [probably W. Texas], *Wright 1794* (G, GH, syntypes!).[6]

---

5. Johnston (1962) suggested that the type of this taxon might be at BM. No sheets labelled as such were seen there, but specimens matching those at Kew and New York were mingled on one of the sheets of *T. betonicifolia*. In view of the labelling confusion of the BM specimens, choice of the Kew collection as lectotype seems desirable.

6. The two sheets of *Wright 1794* at the Gray Herbarium apparently represent several different collections made during 1851 and 1852, as no less than 4 different species are included: *T. amblyodonta*, *T. brevispica*, *T. nepetifolia* and *T. ramosa*. The specimens could have come from widely separated areas between eastern Sonora and the Pecos River, as indicated in the tabulation of localities by Wooton (1906). Unless Wright's original labels are discovered, which now seems unlikely, it may be impossible to clarify the origin of this melange of taxa. The presence of material of *T. amblyodonta* resembling that of *Wright 1793* suggests that perhaps part at least of *Wright 1794* came from the Pecos River Valley, but this is only a presumption, and cannot be true for the fragments representing *T. nepetifolia*, which does not enter Texas.

Mueller (1866) also cited Mexican specimens of Aschenborn, Hartweg, and Virlet d'Aoust with his description of var. *latifolia*. It is possible that one of the elements contained in *Wright 1794* may represent the same subspecific taxon as the Mexican collections, but until the Mexican variants of *T. nepetifolia* are straightened out, it seems best to regard all of these collections as syntypes.

*Tragia nepetifolia θ angustifolia* Muell. Arg. loc. cit. TYPE: Texas, *Berlandier 2542* (G!).

*Tragia nepetifolia η scutellariifolia* (Scheele) Muell. Arg. loc. cit.

*Tragia ramosa α latifolia* (Muell. Arg.) Pax & Hoffm. Pflanzenr. IV. 147. IX. [Heft 68]: 40. 1919.

*Tragia nepetifolia* var. *leptophylla* (Torr.) Shinners, Southw. Nat. 6: 101. 1961.

Stems solitary or few to many from the crown of the woody taproot, 1-2 mm in diameter near the base, 12-50 cm tall, green, purplish-green or yellowish-green, simple to many-branched, erect, decumbent, trailing, sometimes with a tendency to twine; upper internodes 3-30 mm long, lower internodes 7-40(60) mm long. Leaf blades linear-lanceolate to ovate or basal leaves sometimes reniform, 1-4 cm long, 0.4-2 cm broad, apically acute, basally truncate to cordate, margins serrate, thin, green, pubescent, ciliate; petioles 2-20 mm long; stipules lanceolate to ovate, entire, 1.2-4.5 mm long, 0.5-1.8 mm broad at the base, persistent, ciliate, rarely abaxially sparsely pubescent. Racemes with the lowermost 1(2) nodes pistillate, the remaining 2-20 nodes staminate; bracts of the pistillate flowers lanceolate, ca. 1.5-2 mm long, ciliate, acute, entire or three-lobed, sometimes abaxially sparsely pubescent; bracts of the staminate flowers lanceolate, subcucullate, ca. 1.2-1.8 mm long, pubescent, entire. Staminate flowers: pedicels slender, 0.7-2 mm long, lower persistent part ca. 0.4-1.5 mm long; calyx-lobes 3(42%), 4(49%)-5(7%) (6), oblanceolate to narrowly obovate-oblong, 1-2.2 mm long, abaxially pubescent, entire, reflexed or spreading at anthesis; stamens (2) 3(20%) 4(35%) 5(31%) 6(11%) (7-10), filaments thickened and fleshy, 0.3-1 mm long, connate basally. Pistillate flowers: pedicels 1-1.5 mm long, becoming 2-2.5 mm in fruit; calyx-lobes (5) 6(97%) (7), lanceolate to elliptic-lanceolate, 0.8-2.5 mm long at anthesis, 1.5-3 mm long in fruit, acute, entire, ciliate, abaxially pubescent; styles connate up to 1/3 their length; stigmatic surfaces not papillate (except slightly so in aberrant specimens). Fruit 3-4 mm long, 6-8 mm broad; columella 1.5-2.6 mm long; seeds nearly spherical, 2.5-3.5 mm long, brownish-black with a tawny mottling when mature.

DISTRIBUTION: open areas, often in disturbed habitats, Missouri and Arkansas west to California, Nebraska and Colorado south into Mexico (Map 6).

REPRESENTATIVE SPECIMENS: — ARIZONA: GILA CO., 10 mi S of Pine, *Peebles & Fulton 9460* (ARIZ). ARKANSAS: BENTON CO., Glade, *Demaree 6911* (UARK). CALIFORNIA: SAN BERNARDINO CO., New York Mountains, *Alexander & Kellogg 1326* (ARIZ). COLORADO: BOULDER CO., Steamboat Mountain, 2 mi NW of Lyons, *Weber 3906*

(TEX). KANSAS: MEADE CO., 11.5 mi E and 18 mi S of Meade, *Horr & McGreggor 3870* (LL, KANU). MISSOURI: STE. GENEVIEVE CO., 1 mi N of Bloomsdale, *Hubricht B1526* (ARIZ). NEBRASKA: FRANKLIN CO., Look-out Mountain, *Tolstead 411275* (TEX). NEVADA: CLARK CO., Wilson's Ranch, *Clokey 8013* (GA, NCSC, NY, SMU). NEW MEXICO: GRANT CO., Mangas Springs, 18 mi NW of Silver City, *Metcalfe 65* (ARIZ). OKLAHOMA: KIOWA CO., Entrance to Quartz Mountain State Park, *Miller & Miller 1341* (PUL). TEXAS: TRAVIS CO., Knob Hill, 12 mi W of Austin, *Miller & Miller 922* (PUL). UTAH: WASHINGTON CO., 5 mi E of Virgin, *Hitchcock 3019* (PH).

When the inflated concept of *T. nepetifolia* held by Mueller (1866) and Johnston (1962) is dissolved into its components, probably the majority of the *Tragia* collections west of the Mississippi River are referable to *T. ramosa*. Although Torrey originally described the species in 1828, he later (in the Botany of the Mexican Boundary Survey) confused it with *T. urticifolia*. Mueller (1866) partially resolved the confusion by pointing out that *T. urticifolia* differed in its more coarsely papillate styles but introduced several new misunderstandings which have obscured relationships among the noseburn taxa up to the present time: (1) he applied the epithet *ramosa*, when transferring it to varietal status under *T. nepetifolia*, not to Torrey's plant but rather to specimens of *T. brevispica*; (2) he included specimens of *T. ramosa* in 3 different varietal names under *T. nepetifolia*; and (3) he placed other specimens of *T. ramosa* in the 3 different varieties of his *T. stylaris* in a different section. He thus succeeded in divorcing the epithet *ramosa* from any of the plants to which it should properly be applied, and as a result the application of the name *T. ramosa* has remained highly confused. Pax and Hoffmann (1919) actually managed to improve on Mueller's malpractice by using Torrey's epithet *ramosa* twice: once for a species placed in sect. *Leucandra*, and again for a variety of *T. nepetifolia*. Judging from their citations of specimens, Pax and Hoffmann applied the name *T. nepetifolia ramosa* mainly to the typical subspecies or race of *T. nepetifolia*, and not to the population here associated with Torrey's name. Shinners (1958) on the other hand did apply the name *T. nepetifolia ramosa* to the plants here accepted as *T. ramosa.*

Shinners has more recently (1961) proposed to call the common Texas noseburns *T. nepetifolia* var. *leptophylla.* This is correct on strictly nomenclatural grounds, but it would be rather unfortunate if the epithet *leptophylla* were generally taken up, as the collections of Bigelow and Wright represent very aberrant plants of rather dubious status. No similar specimens to the original collections of *leptophylla* have ever been found, and it is possible that the small scraps gathered by Bigelow and Wright might be hybrids or even unusual growth forms of some species other than *T. ramosa.*

Fortunately, we believe that the question as to the status of var. *leptophylla* is rather academic, since *T. ramosa* is certainly not conspecific with *T. nepetifolia.* In distinct contrast to that species, *T. ramosa* has long, thin, nearly smooth styles, greenish male flowers, a more densely hispid ovary, and typically narrower more sharply toothed leaves. Because of its broad spectrum of variability, *T. ramosa* does include forms which may be difficult to distinguish from any of the other taxa of noseburns, especially in the absence of good flowers and fruits. Furthermore, occasional interspecific crosses may occur which obscure the specific lines; a possible cross with *T. brevispica* has already been cited, and the discovery of crosses with *T. betonicifolia* and *T. amblyodonta* would not be surprising.

Johnston (1962) was correct in exposing as worthless the supposed difference in stamen number used by Mueller and by Pax and Hoffmann to segregate *T. stylaris* into a different section. Actually the number of stamens in non-terminal male flowers varies from 3-5, while in terminal flowers it may reach up to 10 (a figure larger than that recorded by any previous workers). Future quantitative studies on taxa of the noseburns should clearly specify the position of male flowers measured in order to insure an accurate estimate of the range of variation in stamen number.


Fig. 24. Habit, *Tragia amblyodonta* (*K. & L. Miller 1178*), A-E. Variation in leaf shape. A, *T. L. Steiger 421;* B, *B. L. Turner 1023;* C, *B. C. Tharp s.n.* (10/VII/41); D, *B. H. Warnock 46805;* E, *L. H. Shinners 19583.*

8. **Tragia amblyodonta** (Muell. Arg.) Pax & Hoffm. Pflanzenr. IV. 147. IX. [Heft 68]: 51. 1919. (Figs. 13, 24)

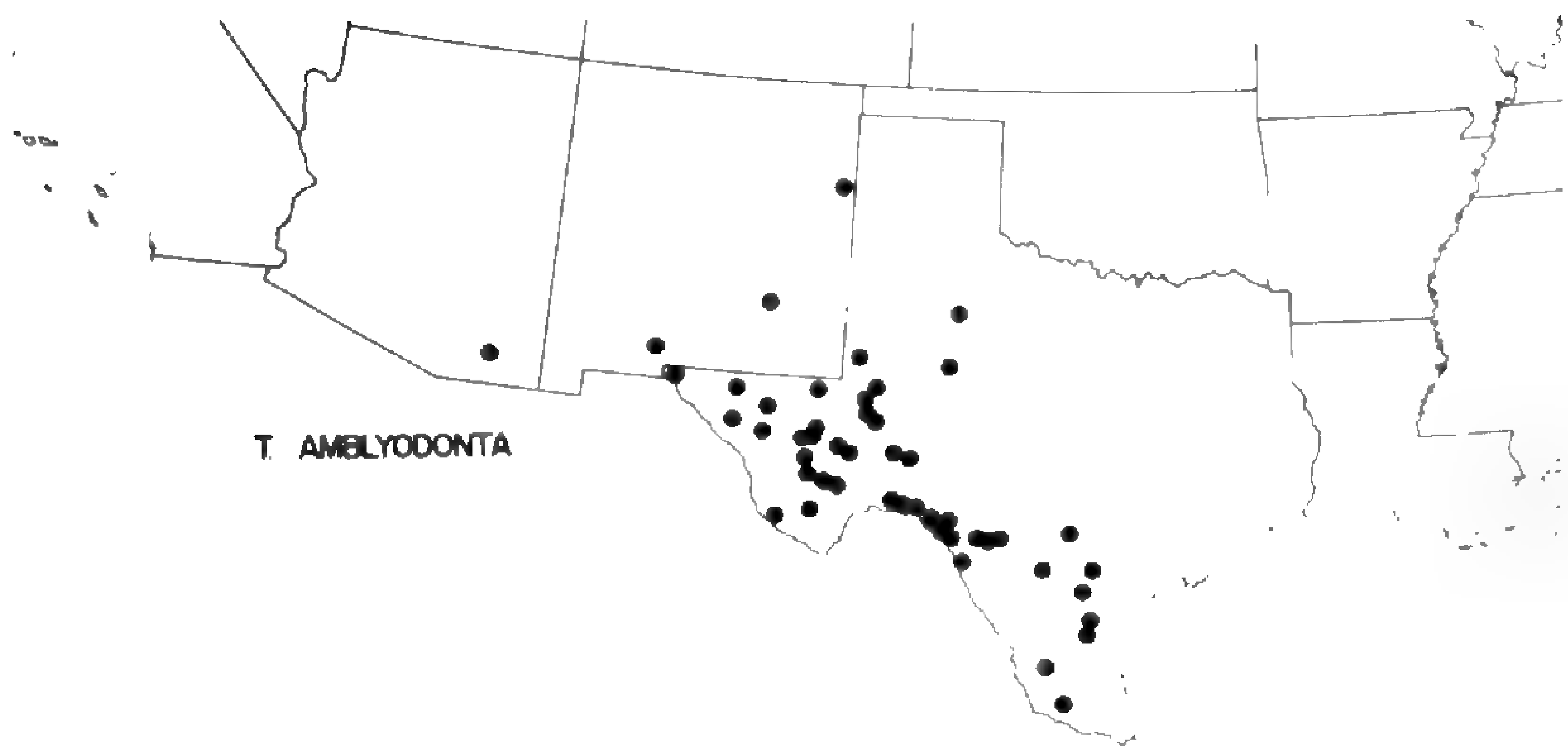
*Tragia nepetifolia* $\gamma$ *amblyodonta* Muell. Arg. in DC. Prodr. **15 (2)**: 934. 1866.

TYPE: Texas, 'alluvial soil, bottom of the San Pedro R. [Devil's River], July 6' [1852], *Wright 1793* (G, holotype!; data from isotype, GH!).

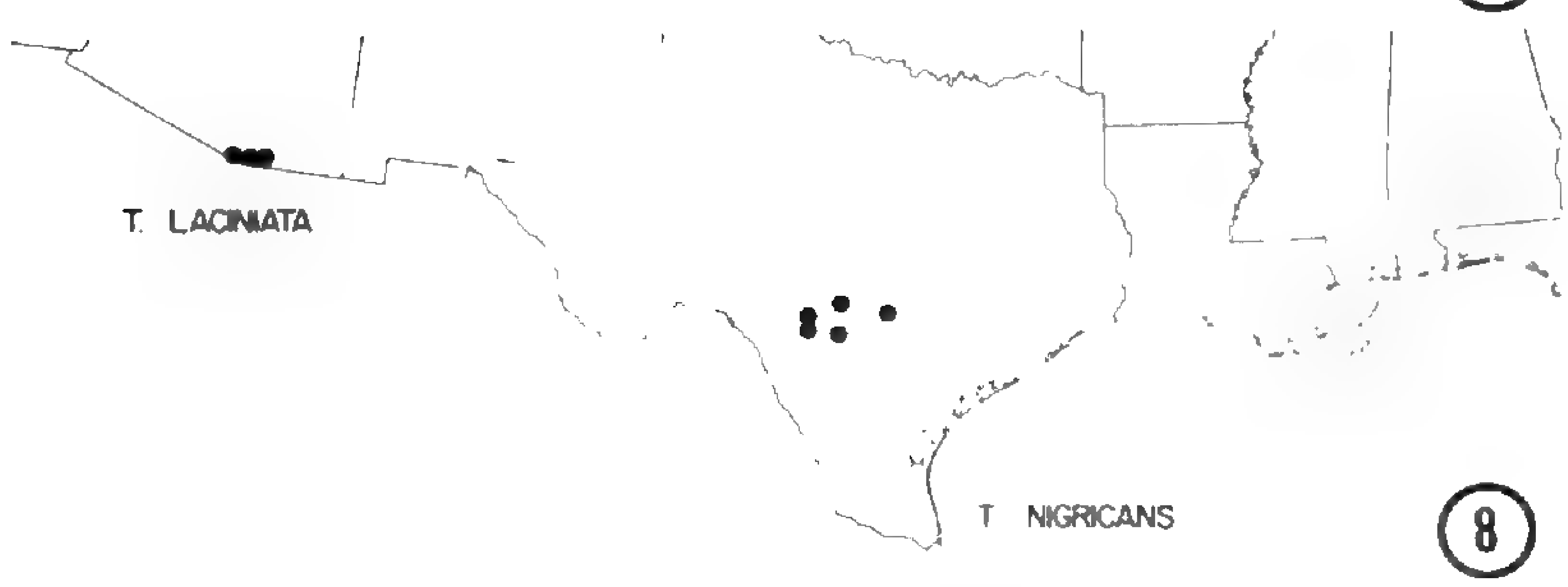
Stems few to many from the crown of the woody taproot, 1-1.6 mm in diameter near the base, 12-50 cm tall, green to grayish-green, few to many-branched, erect, decumbent or trailing; upper internodes 10-28 mm long, lower internodes 15-35 mm long. Leaf blades ovate, triangular or hastate, 1-4.5 cm long, 0.8-3 cm broad, apically acute to obtuse, basally truncate, cordate to hastate, margins crenate to serrate, thick, green, pubescent, ciliate; petioles 4-18(30) mm long; stipules ovate to rhombic-lanceolate, entire, 1-3.5(4.5) mm long, 0.6-1(1.6) mm broad at the base, persistent, ciliate, abaxially pubescent. Racemes with the lowermost 1 (2) nodes pistillate, the remaining 3-30 nodes staminate; bracts of the pistillate flowers lanceolate, ca. 0.9-1.3 mm long, ciliate, acute, entire or three-lobed, abaxially sparsely pubescent; bracts of the staminate flowers lanceolate, subcucullate, ca. 0.9-1.5 mm long, pubescent, entire. Staminate flowers: pedicels slender, 0.7-1 mm long, lower persistent part ca. 0.2-0.4 mm long; calyx-lobes 3(55%)-4(41%) (5), oblanceolate to obovate, 0.9-1.9 mm long, abaxially pubescent, entire, spreading to reflexed at anthesis; stamens (2) 3(67%)-4(28%) (5); filaments thickened and fleshy, 0.2-0.7 mm long, connate basally. Pistillate flowers: pedicels 0.3-0.4 mm long, becoming 1.5-2 mm in fruit; calyx-lobes (5) 6 (92%), lanceolate to narrowly elliptic, 1-2.3 mm long at anthesis, 2-3.5 mm long in fruit, acute, entire, ciliate, abaxially pubescent; styles connate only at the base or up to 1/3 their length, stigmatic surfaces papillate. Fruit 3-4.5 mm long, 5.5-8 mm broad; columella 1.8-2.5 mm long; seeds nearly spherical, 2.6-3.6 mm long, brownish-black with a tawny mottling when mature.

DISTRIBUTION: rocky areas, usually on limestone, southwest Texas to New Mexico, Arizona and Nevada (Map 7).

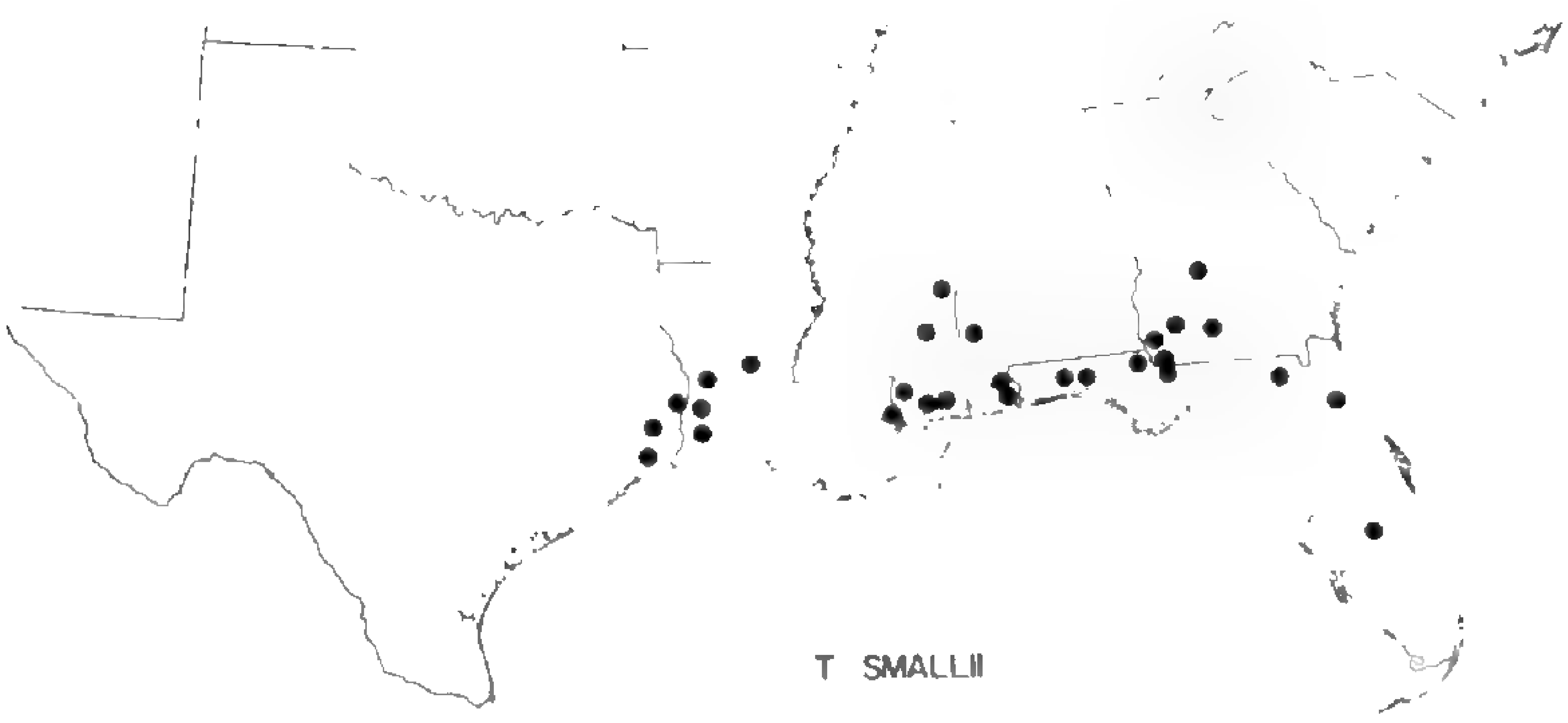
REPRESENTATIVE SPECIMENS: — ARIZONA: COCHISE CO., Tombstone, *Loomis & Peebles 5348* (ARIZ). NEW MEXICO: CATRON CO., Beaverhead, *Castetter 7104* (ARIZ). CHAVES CO., 20 mi S of Roswell, *Earle & Earle 291* (NY). DONA ANA CO., *Dunn 8463* (UNM). QUAY CO., San Juan, *Hershey 4010* (UNM). TEXAS: EL PASO CO., Scenic Drive above El Paso on Mt. Franklin, *Warnock 5752* (TEX). JIM HOGG CO., 7 mi N of Petroleum, *Tharp, Follansbee & Thompson 51-1533* (TEX). JIM WELLS CO., Alice-San Diego, *Tharp s.n.* (19/IV/1931) (TEX).



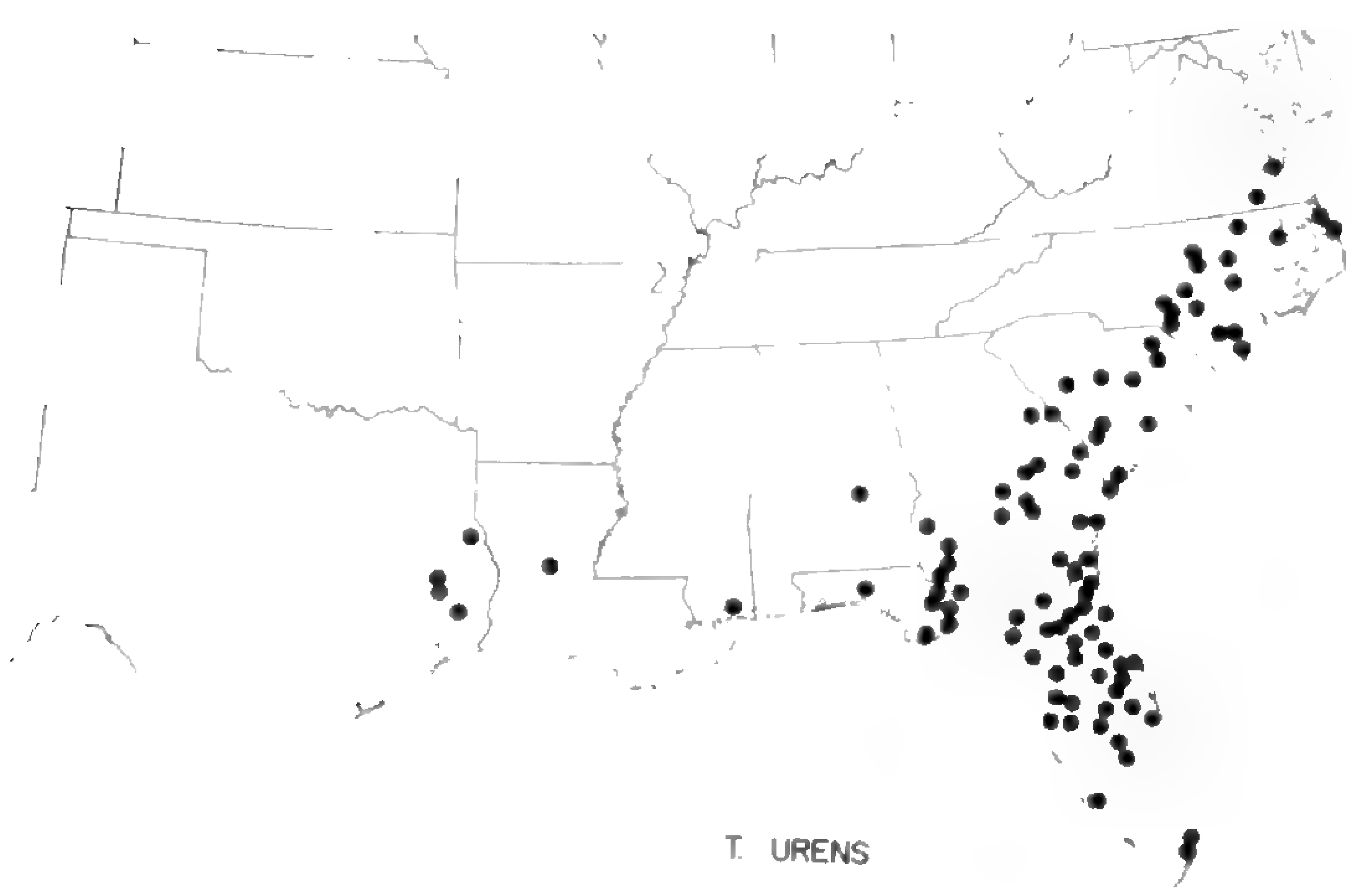

(7)




(8)




(9)




(10)

Map 7. Distribution of *Tragia amblyodonta*.
Map 8. Distribution of *Tragia laciniata* and *Tragia nigricans*.
Map 9. Distribution of *Tragia smallii*.
Map 10. Distribution of *Tragia urens*.

KLEBERG CO., 12.5 mi S of Kingsville a few miles W of Naval Air Station, *Johnston 541558* (TEX). LIVE OAK CO., Three Rivers, just N of town, *Thompson & Turner 24* (TEX). PECOS CO., 2 mi E of Ft. Stockton, *Warnock 46134* (TEX). TERRELL CO., 20 mi E of Dryden, *Parks, Turner & Warnock 72* (TEX). VAL VERDE CO., 1 mi N of the bridge over the Pecos River on Rt. 90, *Miller & Miller 1178* (PUL).

This plant was given specific status by Pax and Hoffmann under dubious auspices, since they did not see the type collection and misapplied the name to specimens of *T. glanduligera.* Shinners (1958), perhaps misled by this, suggested that var. *amblyodonta* might be the same as *T. teucriifolia* [*T. brevispica*]. In fact, *T. amblyodonta* has little in common with *T. brevispica*; it is occasionally viny but scarcely ever really twining. Typical specimens of *T. amblyodonta* are distinctive because of the greyish cast (due to denser pubescence) and broad shallowly few-toothed leaves. Sometimes one may encounter specimens with the dense pubescence of *T. amblyodonta* combined with the leaf shape of *T. ramosa.* We have no convincing evidence that such collections are interspecific hybrids, but it would not be surprising in view of the fact that *T. ramosa* appears to be the most closely related species.

As pointed out earlier, *T. amblyodonta* appears to differ from other U. S. species of *Tragia* in having a higher chromosome number: $2n = 110$ instead of 44. Correlated with this are larger stomata and pollen grains than are found in the other species. Additional cytological investigations on populations of *T. amblyodonta* would be desirable, in order to determine whether the apparent chromosomal difference is really a constant one.

9. **Tragia saxicola** Small, Fl. Southeast. U. S. 702. 1903. (Fig. 25)

TYPE: Florida, Dade County, rocky pine woods between the Everglades and Biscayne Bay, *A. H. Curtiss 2517* (NY!).

Stems few from the crown of the woody taproot, 0.7-1.2 mm in diameter near the base, 12-35 cm tall, green or yellowish-green, few to many-branched, erect; upper internodes 8-18 mm long, lower internodes 10-38 mm long. Leaf blades suborbicular, oblong to broadly ovate, 1.2-3 cm long, 1-2.2 cm broad, apically rounded to acute,


Fig. 25. Habit, *Tragia saxicola* (*A. H. Curtiss 2517*).

basally subcordate to cordate, margins crenate-dentate to serrate, thin, green, pubescent, ciliate; petioles 5-13 mm long; stipules lanceolate to narrowly ovate, entire, 1.5-4 mm long, 0.6-1.5 mm broad at the base, persistent, ciliate, abaxially pubescent. Racemes with the single lowermost node pistillate, the remaining 12-20 nodes staminate; bracts of the pistillate flowers lanceolate, ca. 0.8-1.4 mm long, ciliate, acute, entire or three-lobed, abaxially sparsely pubescent; bracts of the staminate flowers lanceolate, subcucullate, ca. 0.8-1.2 mm long, pubescent, entire. Staminate flowers: pedicels slender, 1.5-1.9 mm long, lower persistent part ca. 0.5-0.7 mm long; calyx-lobes 3(68%)-4(32%), obovate, 1.0-1.5 mm long, abaxially pubescent, entire, spreading to reflexed at anthesis; stamens 3(81%)-4(19%); filaments slender, thickened and fleshy, 0.4-0.6 mm long, connate basally. Pistillate flowers: pedicels 0.9-1.2 mm long, becoming 3.2-3.7 mm in fruit; calyx-lobes 6, lanceolate to ovate-lanceolate, 1.5-2.0 mm long at anthesis, 2.0-3.0 mm long in fruit, acute, entire, ciliate, abaxially pubescent; styles connate only at the base or up to 1/3 their length, stigmatic surfaces slightly papillate. Fruit 3.0-4.0 mm long, 6.0-7.0 mm broad; columella 1.7-2.1 mm long; seeds nearly spherical, 2.4-3.0 mm long, brownish-black with a tawny mottling when mature.

DISTRIBUTION: restricted to extreme southern Florida and the Keys typically in pine woods on limestone (Map 5).

REPRESENTATIVE SPECIMENS — FLORIDA: DADE CO., Lone Pine Key, *Atwater M-160* (GA); Biscayne Bay, *Curtiss 2517* (FLAS, GA, KANU, NY, PH, UARK). MONROE CO., Big Pine Key, *Eyles & Eyles 8192* (NCSC), *Killip 41089* (NO), *Killip 42441* (IA), *Small 3782, 3955* (NY).

This geographically isolated member of the noseburn complex is distinctive in habit because of its slender wiry stems and broad sharply toothed leaves, but in reproductive characters it is not very different from the Texas noseburns. Possibly *T. betonicifolia* is the closest species vegetatively, but the pistillate calyx of *T. saxicola* is more like that of *T. ramosa.* A relationship with *T. urticifolia* also seems evident, but that plant has narrower leaves and longer persistent staminate pedicels.

10. **Tragia laciniata** (Torr.) Mull. Arg. Linnaea **34**: 182. 1865; in DC. Prodr. 15(2): 933. 1866. (Fig. 26)

*Tragia urticifolia* var. *laciniata* Torr. Bot. U. S. Mex. Bound. 200.


Fig. 26. Habit, *Tragia laciniata* (*R. H. Peebles et al. 5641*).

1858. LECTOTYPE: 'New Mexico', *Wright 1795* (NY!).

Stems few to many from the crown of the woody taproot, 1.3-1.5 mm in diameter near the base, 25-50 cm tall, green to purplish-green, few to many-branched, erect to decumbent; upper internodes 15-20 mm long, lower internodes 20-30 mm long. Leaf blades 3-divided, 2.5-4 cm long, the segments acute, their margins irregularly coarsely toothed, thin, green, pubescent, ciliate; petioles 7-18 mm long; stipules lanceolate, acute, entire, 1-2.8 mm long, 0.6-1.2 mm broad at the base, persistent, ciliate or abaxially sparsely pubescent. Racemes with single lowermost node pistillate, the remaining 10-20 nodes staminate; bracts of the pistillate flowers lanceolate, ca. 0.5-1.5 mm long, ciliate, acute, entire or 3-lobed; bracts of the staminate flowers lanceolate, subcucullate, ca. 0.5-1.5 mm long, pubescent, entire. Staminate flower: pedicels slender, 0.8-1.6 mm long, lower persistent part ca. 0.3-0.7 mm long; calyx-lobes 3(90%) (4), obovate to oblanceolate, 1-1.4 mm long, abaxially pubescent, entire, spreading to reflexed at anthesis; stamens 3; filaments slender, 3.5-4 mm long, connate basally. Pistillate flower: pedicels 0.6-1 mm long, becoming 2.5-3 mm in fruit; calyx lobes 6, lanceolate, 2-2.4 mm long at anthesis, 2.5-3 mm long in fruit, acute, entire, ciliate; styles connate 1/4-1/2 their length, stigmatic surfaces papillate. Fruit 3.5-4 mm long, 6-7 mm broad; columella 2-2.3 mm long; seeds nearly spherical, 3-3.2 mm long, brownish-black when mature.

DISTRIBUTION: Arizona and Sonora, Mexico, perhaps extending into New Mexico. All material examined was from Arizona, and the provenance of the Wright specimen is uncertain, as the label 'New Mexico' on his collections was used very loosely (Map 8).

REPRESENTATIVE SPECIMENS: — ARIZONA: *Clark 12540* (UNM). SANTA CRUZ CO., Sycamore Canyon, *Kearney & Peebles 14455* (ARIZ); Nogales to Ruby, *Kearney & Peebles 14916* (ARIZ, NY); between Nogales and Arivaca, *Peebles, Harrison & Kearney 5641* (ARIZ). (NEW MEXICO?): *Wright 1795* (PH).

*Tragia laciniata* is vegetatively the most distinctive of the U. S. species; the three-parted leaves are quite unmistakable. Pax and Hoffmann (1919) note its similarity to the South American *T. pinnata*, but the resemblance is probably due to parallelism. In reproductive characters *T. laciniata* agrees with members of the noseburn complex and is perhaps closest overall to some of the forms of *T. nepetifolia.*

11. **Tragia nigricans** Bush in Small, Fl. Southeast. U. S. 702. 1903; Missouri Bot. Gard. Report. 17: 122. 1906. (Fig. 27)

TYPE: Texas, upper Hondo, common in woods, June 1885, *Reverchon 1594* (NY, syntype!).

Stems solitary or few from the crown of the woody taproot, 1-2 mm in diameter near the base, 15-55 cm tall, purplish-green to grayish-green, turning black in drying, simple or few-branched, erect; upper internodes 9-19 mm long, lower internodes 13-45 mm long. Leaf blades oblong to oblong-lanceolate, 3-7 cm long, 1-2.5 cm broad, apically and basally acute, margins deeply dentate, thick, green, pubescent,

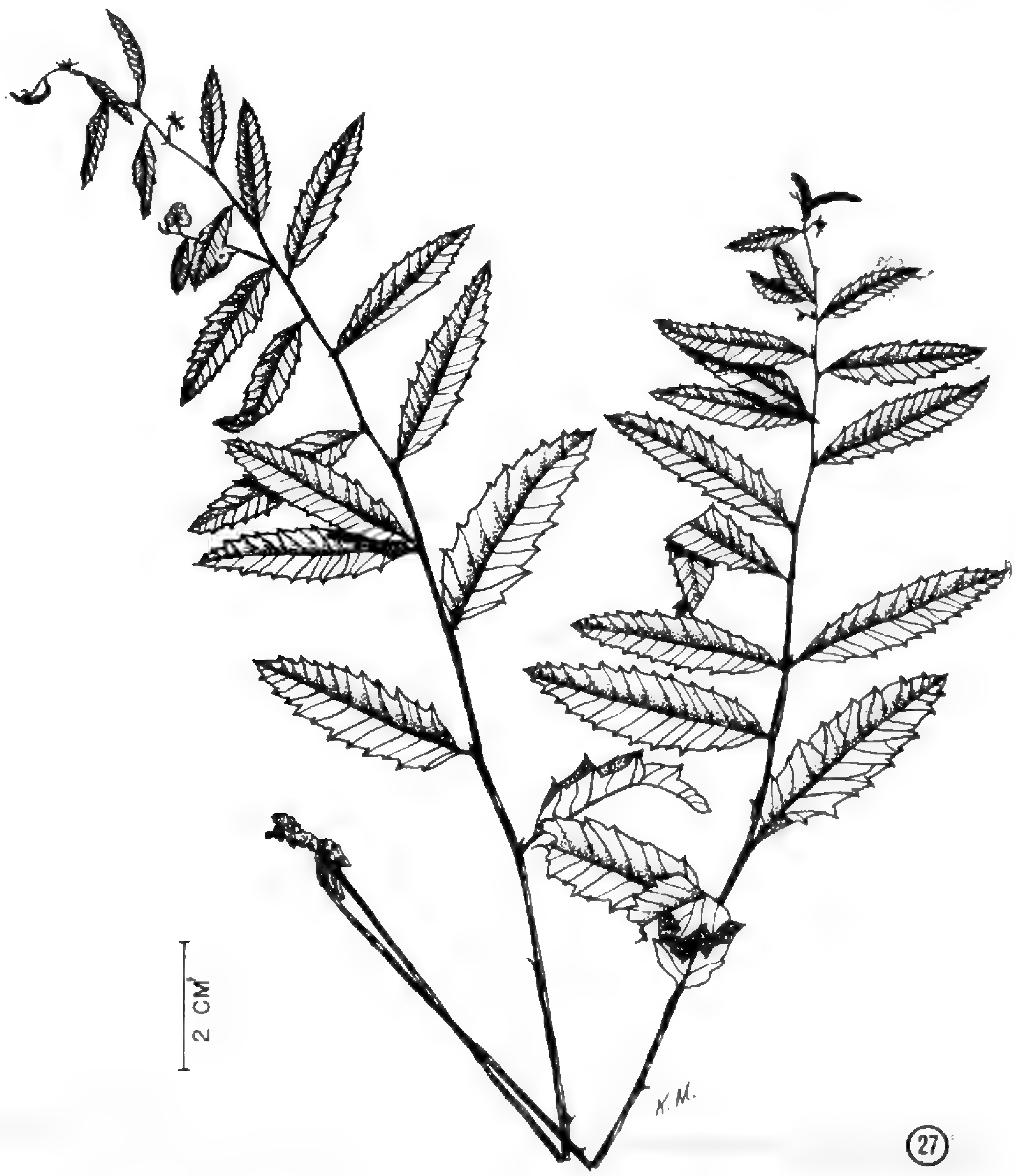



Fig. 27. Habit, *Tragia nigricans* (*K. & L. Miller 1173*).

ciliate; petioles 1-5 mm long; stipules lanceolate, attenuate, entire, 2.5-6 mm long, 0.5-1 mm broad at the base, persistent, ciliate. Racemes with the single lowermost node pistillate, the remaining 2-5 nodes staminate; bracts of the pistillate flowers lanceolate, ca. 2-2.6 mm long, ciliate, acute, entire or three-lobed; bracts of the staminate flowers lanceolate, ca. 1-2 mm long, pubescent, entire. Staminate flowers: pedicels slender, 1.3-1.6 mm long, lower persistent part ca. 0.2-0.4 mm long; calyx-lobes 3(64%)-4(32%) (5), oblanceolate to narrowly ovate-oblong, 1.5-2.5 mm long, abaxially pubescent, entire, reflexed at anthesis; stamens (3) 4(48%)-5(49%) (6); filaments slender, 0.7-1.3 mm long, connate 1/3-1/2 or more their length. Pistillate flowers: pedicels 0.7-1 mm long, becoming 2-3 mm in fruit; calyx-lobes (5) 6(96%), narrowly rhombic-lanceolate, 1-2.3 mm long at anthesis, 2.4-4 mm long in fruit, acute, entire, ciliate; styles connate only at the base, stigmatic surfaces very slightly papillate. Fruit 3-3.5 mm long, 6.5-7 mm broad; columella 1.7-3.2 mm long; seeds nearly spherical, 2.5-3.2 mm long, brownish-black when mature.

DISTRIBUTION: restricted to a small area in south central Texas, in rocky soil of open woods and fields (Map 8).

REPRESENTATIVE SPECIMENS: — TEXAS: COMAL CO., Fischer's Store, *Palmer 12194* (TEX). KERR CO., limestone river bluffs near Kerrville, *Palmer 33811* (NY). MEDINA CO., Upper Hondo, *Reverchon 1594* (SMU). REAL CO., ca. 4 mi N of Leakey on Ranch Road 336, *Miller & Miller 1164* (PUL); Leakey, *Palmer 10162* (M). UVALDE CO., Garner State Park, *Miller & Miller 1173* (PUL), *Turner 3855* (TEX).

*Tragia nigricans* is one of the most distinctive species of the genus of those occurring in the U. S. The paucity of existing herbarium material may be misleading insofar as indicating the range and relative abundance of the species; additional localities on the Edwards Plateau may be expected. The general form of the leaves and the unique way in which the filaments in the staminate flowers are united one-half or more their length to form a cylinder set *T. nigricans* apart from the other U. S. species.

Section 2. LEPTOBOTRYS (Baill.) Muell. Arg. Linnaea 34: 183. 1865; DC. Prodr. 15(2): 946. 1866.

*Allosandra* Raf. Aut. Bot. 51. 1840. LECTOTYPE: *Allosandra lanceo-*

*lata* Raf. (superfluous name for *Tragia innocua* Walt. = *T. urens* L.).

*Leptobotrys* Baill. Étud. Gén. Euphorb. 478. TYPE: *Leptobotrys discolor* Baill. (= *T. urens* L.).

Low perennial herbs, not twining; stem with stinging hairs but plants not severely stinging; leaves entire or rather coarsely and irregularly toothed or lobed; inflorescences opposite leaves or terminal on lateral leafy branches; staminate flower with 4 or 5 (rarely 6) calyx-lobes; stamens 2 (rarely 3); filaments thickened and fleshy, connate basally; pollen grains 'pseudocolpate', the operculum diffuse; pistillode flattened between the filaments, laminar; pistillate flower with 6 calyx-lobes; styles connate below, ventrally more or less papillate; seeds 3-4.5 mm long.

This section is here delimited so as to include only the two species of the Southeastern United States: *T. smallii* and *T. urens*.

Although Mueller (1866) and at first Pax (1890) accepted *Leptobotrys* as a section of *Tragia*, primarily on the basis of the androecium of only 2 stamens, Pax and Hoffmann (1919) submerged it as a synonym of their sect. *Eutragia*. The discovery of the characteristic pollen configuration in both *T. urens* and *T. smallii*, together with the androecial difference, would seem to justify reviving the section again. *Tragia urens*, with its peculiarly shaped leaves and tendency to monopodial stems, is furthermore very different from the other U. S. species in habit. However, *T. smallii* closes the gap to some extent, since it agrees better with the noseburn Tragias in leaf shape and inflorescence.

Although the taxa of sect. *Leptobotrys* do not appear to have any close ties with the North American representatives of sect. *Tragia*, it is not obvious which of the neotropical taxa of *Tragia* is closest. The similarity in pollen in sect. *Bia* is suggestive, but the male flowers of that group are very different by virtue of their many stamens and well-developed disk glands. Perhaps some of the South American species of sect. *Leucandra* (sensu Pax and Hoffmann, 1919) are most nearly related, but this is hardly more than a guess in our present state of knowledge.

12. **Tragia smallii** Shinners, Field & Lab. **24**: 37. 1956. (Figs. 15, 28)

TYPE: Louisiana, Vernon Parish, 1 mi S of Mayo. *McVaugh 8461* (SMU, holotype!; TEX, isotype!).

*Tragia betonicifolia* sensu Small, Fl. S. E. U. S. ed. 2, 702. 1913; and Pax & Hoffm. Pflanzen. IV. 147. IX. [Heft 68]: 62. 1919; non Nutt. (1837).

Stems solitary to few from the crown of the woody taproot, 1-2 mm in diameter near the base, 12-25 cm tall, purplish-green to grayish-green, simple to few-branched, erect; upper internodes 6-35 mm long, lower internodes 7-16 mm long. Leaf blades orbicular to elliptic, 2-4 cm long, 0.8-2.5 cm broad, apically rounded to acute, basally rounded to obtuse, margins coarsely serrate or crenate to lobed,

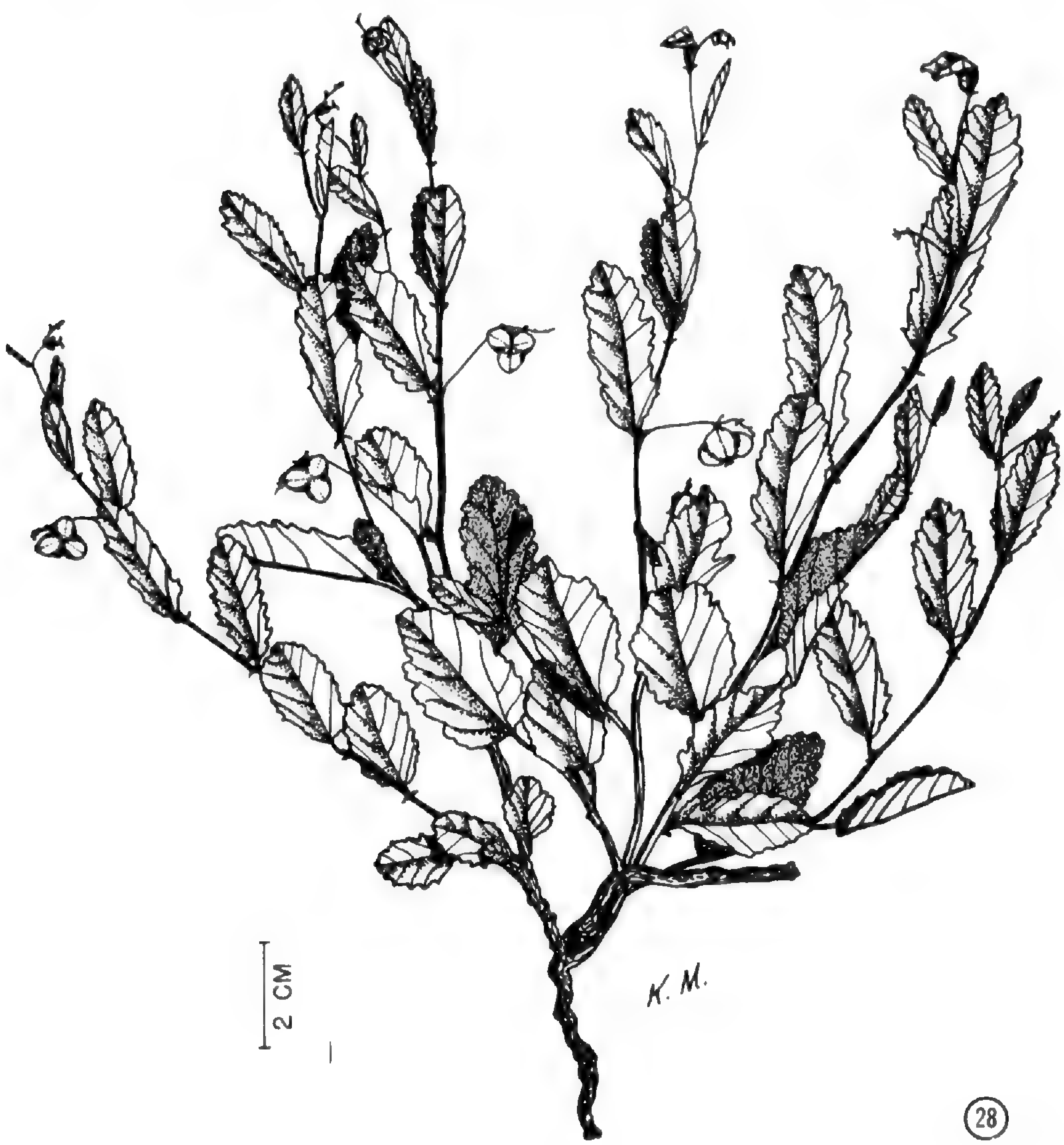



Fig. 28. Habit, *Tragia smallii* (*K. & L. Miller 865*).

thick, green, pubescent, ciliate; petioles 1-4 mm long; stipules lanceolate to narrowly ovate, entire, 1.5-3.8 mm long, 0.7-1.5 mm broad at the base, persistent, ciliate, pubescent. Racemes with the lowermost 1 (2) nodes pistillate, the remaining 4-11 nodes staminate; bracts of the pistillate flowers lanceolate, ca. 1.5-2.5 mm long, ciliate, acute, entire or three-lobed, sometimes abaxially sparsely pubescent; bracts of the staminate flowers lanceolate, subcucullate, ca. 0.8-1.2 mm long, pubescent, entire. Staminate flowers: pedicels slender, 1.5-1.9 mm long, lower persistent part ca. 0.4-0.6 mm long; calyx-lobes 4(50%)-5 (40%) (6), lanceolate to narrowly ovate, 0.9-1.5 mm long, abaxially pubescent, entire, spreading at anthesis; stamens 2(95%) (3); filaments thickened and fleshy, flattened laterally, 0.2-0.5 mm long, connate basally. Pistillate flowers: pedicels 0.5-1 mm long, becoming 2.8-3.4 mm in fruit; calyx-lobes 6, linear, 1.3-1.7 mm long at anthesis, 1.5-2.3 mm long in fruit, acute, entire, ciliate, abaxially pubescent; styles connate about 1/4 their length, stigmatic surfaces roughened but not papillate. Fruit 5-7 mm long, 9-13 mm broad; columella 2.2-3.2 mm long; seeds slightly elongated, 4-4.5 mm long, brownish-black with tawny mottling when mature.

DISTRIBUTION: Florida to east Texas along the gulf coast typically in dry sandy soil at the edge of woods and along roadsides (Map 9).

REPRESENTATIVE SPECIMENS: — ALABAMA: BALDWIN CO., 3 mi N of Foley, *Whitehouse 24262* (SMU). FLORIDA: HIGHLANDS CO., Sebring, *Garrett s.n.* (10/V/1948) (FLAS). GEORGIA: DECATUR CO., 1.3 mi SSW of Faceville, *Thorne & Davidson 17122* (IA). LOUISIANA: Vernon Parish, 2 mi W of Leander, *Webster & Wilbur 3249* (SMU). MISSISSIPPI: LAUDERDALE CO., 18 mi SW of Quitman on Route 18, *Miller & Miller 865* (PUL). TEXAS: HARDIN CO., 7 mi S of Kountze, *Whitehouse 23253* (SMU). NEWTON CO., 3 mi N of the junction of Route 63 and Farm Road 692, *Thompson & Turner 151* (TEX).

Shinners was correct in giving a new name to the plant which Small (1913) and Pax and Hoffmann (1919) had confounded with *T. betonicifolia* of Nuttall; the latter occurs only to the west of the range of *T. smallii*. Vegetatively, *T. smallii* resembles *T. saxicola* to some extent, but its pollen grains agree closely with those of *T. urens*. Since it furthermore has staminate flowers with only 2 stamens and a flattened pistillode, it would appear to belong closest to *T. urens*.

13. **Tragia urens** L. Spec. Pl. ed. 2: 1391. 1763. (Figs. 16, 29)

*Ricinus parvus urens, foliis quercinis, virginianus* Plukenet, Alm. bot. 320, t. 107. f. 5. 1696. (No type present in Herb. Sloane, BM).

*Tragia innocua* Walt. Fl. Carol. 229. 1788. (No type present in Herb. Walter, BM).

*Tragia urens α subovalis* Michx. Fl. Bor. Amer. 2: 175. 1803. TYPE: Herb. Michaux (P!).[7]

*Tragia linearifolia* Ell. Sketch. 2: 563. 1824. TYPE: southern Georgia (not seen).

*Tragia urens β lanceolata* Michx. loc. cit. (based on *T. innocua* Walt.).

*Tragia urens δ linearis* Michx. loc. cit. TYPE: Herb. Michaux (P!).

*Allosandra lanceolata* Raf. Aut. Bot. 51. 1840.

*Allosandra verbenifolia* Raf. loc. cit.

*Leptobotrys discolor* Baill. Étud. gén Euphorb. 479, t. 2, f. 17, 18. 1858. SYNTYPES: *Michaux, Leconte, Noisette* (P!).

*Tragia discolor* (Baill.) Muell. Arg. in DC. Prodr. 15 (2): 946. 1866.

*Tragia discolor α subovalis* (Michx.) Muell. Arg. loc. cit.

*Tragia discolor β cuneata* [f.] a, *latifolia* Muell. Arg. loc. cit. TYPE: Carolina, *Bosc* (not seen).

*Tragia discolor β cuneata* [f.] b, *lanceolata* (Michx.) Muell. Arg. loc. cit.

*Tragia discolor δ* linearis (Michx.) Muell. Arg. in DC. Prodr. 15 (2): 947. 1866.

*Tragia urens* var. *α innocua* (Walt.) Pax and K. Hoffm. Pflanzenr. IV 147. IX [Heft 68]: 58. 1919.

Stems solitary or few from the crown of the woody taproot, 1-2.2 mm in diameter near the base, 20-50 cm tall, purplish-green to grayish-green, few to many-branched, erect; upper internodes 7-15 mm long, lower internodes 10-25 mm long. Leaf blades broadly oblanceolate to linear, 2-8 cm long, 2-14 mm broad, apically acute to rounded, basally acute to attenuate, margins entire, round-toothed to lobed, thick, green, pubescent, ciliate; petioles 0-2 mm long; stipules linear to lanceolate, entire, 1.5-6 mm long, 0.3-1.1 mm broad at the base, persistent, ciliate, pubescent on both surfaces. Racemes with the lowermost 1 (2) nodes pistillate, the remaining 3-45 nodes staminate; bracts of the pistillate flowers lanceolate, ca. 1-2.5 mm long, ciliate, acute, entire or three-lobed, abaxially sparsely pubescent; bracts of the staminate flowers lanceolate, subcucullate, ca. 1-1.5 mm long, pubescent, entire. Staminate flowers: pedicels slender, 1.3-2 mm long, lower persistent part ca. 0.3-0.6 mm long; calyx-lobes 4(73%)-5(27%), broadly lanceolate to ovate, 1-1.5 mm long,

7. There are 3 specimens on 2 sheets of *T. urens* in the Michaux Herbarium at Paris; these presumably represent the types of the varieties described in Michaux's book, but the individual specimens are not labelled with the varietal epithets.


Fig. 29. Habit, *Tragia urens* (*K. & L. Miller 776*).

abaxially pubescent, entire, spreading at anthesis; stamens 2(91%) (3); filaments thickened and fleshy, 0.2-0.4 mm long, connate basally. Pistillate flowers: pedicels 0.6-1 mm long,. becoming 3.5-4 mm in fruit; calyx-lobes 6, linear, 1-1.5 mm long at anthesis, 1.5-1.8 mm long in fruit, acute, entire, ciliate, abaxially pubescent; styles connate 1/4-1/3 their length, stigmatic surfaces roughened but not papillate. Fruit 3-4 mm long, 7-8 mm broad; columella 1.9-2.6 mm long; seeds slightly elongated, 3-4 mm long, brownish with a tawny mottling when mature.

DISTRIBUTION: Virginia south to Florida and west to east Texas, in dry sandy soil oı woods and clearings (Map 10).

REPRESENTATIVE SPECIMENS: — ALABAMA: MONTGOMERY CO., Montgomery, *Sargent s.n.* (16/V/1955) (SMU). FLORIDA: DADE CO., South Miami, *Moldenke 5857* (NY). GEORGIA: RANDOLPH CO., 1 mi W of Coleman, *Thorne & Muenscher 8154* (IA). LOUISIANA: RAPIDES PARISH, Alexandria, *Hale s.n.* (NY). MISSISSIPPI: JACKSON CO., Ocean Springs, *Tracy 4728* (NY). NORTH CAROLINA: PENDER CO., ca. 15 mi NW of Wilmington on U. S. 421, *Miller & Miller 776* (PUL). SOUTH CAROLINA: ALLENADE CO., 3.5 mi E of Sycamore, *Radford 5347* (NCSC). TEXAS: HARDIN CO., 4 mi W of Silsbee, *Thompson & Turner 103* (TEX). VIRGINIA: SOUTHAMPTON CO., 2 mi SW of Sebrell, *Smith & Hodgdon 1069* (ARIZ, FLAS, GA, IA, ISC, KY, NCSC, NO, NY, PH, SMU, TEX, UARK).

Linnaeus based *T. urens* on the treatment by Plukenet, citing Virginia as the type locality. Since there is no specimen of Plukenet in the Sloane Herbarium (BM), the species must be typified by the illustration and description. The picture, although rather crude, is sufficiently characteristic — when taken in conjunction with the locality —to fix the application of the name. The specific epithet is not very appropriate, since *T. urens* is the least painfully stinging of the U. S. species (hence Walter's substitute name); it seems possible that Plukenet may have somehow confounded reports of the stinging qualities of *T. urticifolia* in providing his original description.

As delimited here, the varieties proposed by Michaux and the *T. linearifolia* of Elliott do not seem worthy of maintaining at any taxonomic level. Long linear entire leaves occur sporadically throughout the range of the species and certainly do not appear to show any correlations with geographic distribution or with reproductive differences. The names of Rafinesque are as usual difficult to dispose of. The epithet and description of *Allosandra verbenifolia* Raf. are somewhat suggestive of *T. smallii*, and it is possible that it could prove to be the earliest name for that plant. However, we have not been able to locate any specimens of *T. smallii* collected by Baldwin or Ware, as mentioned by Rafinesque; the only Baldwin collection examined (NY) proves to be *T. urens*. Until a type specimen is discovered, it seems quite unwarranted to take up a name as vaguely characterized as *Allosandra verbenifolia*.

In many ways *T. urens* is the most isolated of the U. S. species. Although its pseudocolpate pollen is shared by *T. smallii*, together with the low stamen number, it is vegetatively unlike that species in producing some of its inflorescences at the tip of leafy branches which give a 'pinnate' effect to the main stems. The inflorescence pattern approaches that of neotropical species such as *T. mexicana* more closely than does that of the other U. S. taxa. Furthermore, two collections were examined in which the plants were entirely pistillate; the inflorescences have 6-10 or more female flowers instead of only 1 or 2. Inflorescences with several pistillate flowers also occur in sects. *Zuckertia* and *Bia*, and it is thus of some interest that the inaperturate pollen grains in the latter group show a similarity to those of *T. urens*. It would appear that *T. urens* is a phytogeographically isolated taxon in the United States, with a completely different origin from the noseburn complex in Texas and adjacent states.

DEPARTMENT OF BIOLOGY
APPALACHIAN STATE TEACHERS COLLEGE,
BOONE, NORTH CAROLINA (28607)
DEPARTMENT OF BOTANY
UNIVERSITY OF CALIFORNIA, DAVIS (95616)

## APPENDIX

A TABULATION OF THE LINDHEIMER COLLECTIONS OF *Tragia* (based on examination of herbarium sheets and correlations by Blankinship (1907).

| Fascicle | Fascicle no. | Collector's no. | Date | Identity & herbaria |
|---|---|---|---|---|
| I | 176 | | 1843 | *T. betonicifolia* (MO) |
| II | 307 | | 1844 | *T. brevispica* (GH, NY, P, SMU) |

| | | | | |
|---|---|---|---|---|
| III | 521 | 298 | 1846 | *T. ramosa* (G, GH, MO, PH, SMU) |
| III | 522 | 299 | 1846 | *T. brevispica* (GH, MO, TEX) |
| | | | | *T. urticifolia* (PH) |
| IV [?] | '307' | | 1847-48 | *T. brevispica* (G, M, MO, NY, P) |
| IV | '521' | | 1847-48 | *T. ramosa* (GH) |
| V | 1154 | 139 | 1849 (Aug) | *T. brevispica* (GH, MO, PH, SMU) |
| V | 1155 | 138 | 1849 (Jl) | *T. brevispica* (GH, MO, PH, TEX) |
| V | 1156 | 74 | 1849 (Jl) | *T. brevispica* (GH) |
| V | 1156 | 74 | 1849 (Jl) | *T. ramosa* (GH, MO, SMU, TEX) |
| V | 1156 | 128 | '1847' | *T. urticifolia* (MO) |

## LIST OF REFERENCES

BAILLON, H. E. 1858. Étude générale du groupe des Euphorbiacées. 684 pp. Victor Masson, Paris.

BENTHAM, GEORGE, & J. D. HOOKER. 1880. Euphorbiaceae, *in* Genera Plantarum **3(1)**: 239-340.

BLANKINSHIP, J. W. 1907. Plantae Lindheimerianae. Part III. Ann. Report Missouri Bot. Gard. **18**: 123-223.

CROIZAT, LEON. 1942. Peculiarities of the inflorescence in the Euphorbiaceae. Bot. Gaz. **103**: 771-779.

FERNALD, M. L. 1950. Gray's Manual of Botany, 8th ed. 1632 pp. American Book Co., New York.

GLEASON, H. A. 1952. The new Britton and Brown illustrated flora, vol. 2. 655 pp. Lancaster Press.

JOHNSTON, I. M. 1940. The floristic significance of shrubs common to North and South American deserts. Jour. Arnold Arb. **21**: 356-363.

JOHNSTON, M. C. 1962. The noseburn (*Tragia*, Euphorbiaceae) of western Texas. Rhodora **64**: 137-142.

JONES, F. B., C. M. ROWELL, & M. C. JOHNSTON. 1961. Flowering plants and ferns of the Texas coastal bend counties. 146 pp. Welder Wildlife Foundation.

JUSSIEU, ADRIEN. 1824. De Euphorbiacearum generibus medicisque earumdem viribus tentamen. 118 pp. Didot, Paris.

KNOLL, F. 1905. Die Brennhaare der Euphorbiaceen-Gattungen *Dalechampia* und *Tragia*. Sitzungsb. Math. Nat. Kl. Kais. Akad. Wiss. Wien **114**: 29-48.

LOURTEIG, A., & C. A. O'DONELL. 1941. Tragiae Argentinae. Lilloa **6**: 347-380.

MCVAUGH, ROGERS. 1961. Euphorbiaceae novae Novo-Galicianae. Brittonia **13**: 145-205.

METCALFE, C. R. & L. CHALK. 1950. Anatomy of the Dicotyledons. 1500 pp. in 2 vols. Clarendon Press, Oxford.

MILLER, K. I. 1963. Preliminary studies on the genus *Tragia* (Euphorbiaceae). Proc. Indiana Acad. Sci. **72**: 257.

__________. 1964. A taxonomic study of the species of *Tragia* in the United States. 161 pp. Unpublished Ph.D. dissertation, Purdue University.

__________, & G. L. WEBSTER. 1962. Systematic position of *Cnidoscolus* and *Jatropha*. Brittonia **14**: 174-180.

MUELLER, JEAN. 1865. Euphorbiaceae. Linnaea **34**: 1-224.

MUELLER, JEAN. 1866. Euphorbiaceae [except Euphorbieae] in De Candolle, Alphonse. Prodromus systematis naturalis regni vegetabilis. **15(2)**: 189-1286.

__________. 1874. Euphorbiaceae [part II, Acalypheae through Euphorbiaceae], in Martius, Flora Brasiliensis 11(2): 293-752.

PAX, F. 1890. Euphorbiaceae, in Engler & Prantl, Naturl. Pflanzenf. 3(5): 1-119.

______, and K. HOFFMANN. 1919. Euphorbiaceae — Acalypheae — Plukenetiinae, in Engler, A. Das Pflanzenreich IV. 147. IX, [Heft **68**]: 32-101.

PLUMIER, C. 1703. Novo plantarum Americanarum genera. 73 pp. Boudot, Paris.

PUNT, WILLEM. 1962. Pollen morphology of the Euphorbiaceae with special reference to taxonomy. Wentia **7**: 1-116.

RITTERSHAUSEN, PAUL. 1892. Anatomisch-systematische Untersuchung von Blatt und Axe der Acalypheen. 123 pp. Inaugural-Dissertation, Munich.

SHINNERS, L. H. 1958. Spring flora of the Dallas — Fort Worth area, Texas. 514 pp. Dallas.

________. 1961. *Tragia nepetaefolia* var. *leptophylla* instead of var. *ramosa* (Euphorbiaceae). Southw. Nat. **6**: 101.

SMALL, J. K. 1913. Flora of the southeastern United States. 2nd ed. 1394 pp. New York.

WODEHOUSE, R. P. 1935. Pollen grains. 574 pp. McGraw-Hill, New York.

WOOTON, E. O. 1906. Southwestern localities visited by Charles Wright. Bull. Torr. Bot. Club **33**: 561-566.

# SEVENTEENTH REPORT OF THE COMMITTEE ON PLANT DISTRIBUTION

The sixteenth report treated the Cyperaceae with the exception of the genus *Carex*. The present report deals with the Rosaceae with the exception of the genus *Crataegus*. It was felt by the committee that the New England Crataegi were still not sufficiently understood to make their inclusion meaningful in the present report. However an alphabetical list of Crataegi found in the Herbarium of the New England Botanical Club and in the Gray Herbarium is included together with the states in which they occur but no attempt has been made to arrange the species in distributional categories. In genus Rubus the work of A. R. Hodgdon and F. L. Steele has been followed (see "Rubus subgenus Eubatus in New England", Rhodora 68: 474-513 (1966) ) in which many of the species recognized by Fernald in Gray's Manual 8th ed. have been reduced to synonomy or to a hybrid category. This treatment seems to us to be more realistic than that of the Manual with its multiplicity of species.

The data for these reports have been compiled from the material in the Herbarium of the New England Botanical Club, the Gray Herbarium and the Herbarium of the Peabody Museum at Salem. Except as otherwise indicated, nomenclature follows that of Gray's Manual 8th ed.

## PRELIMINARY LISTS OF NEW ENGLAND PLANTS, XLI

The sign + indicates that an herbarium specimen has been seen, the sign − that a reliable printed record has been found and the sign * is used for those plants which are not native in the New England area.

### ROSACEAE

| | Me. | N.H. | Vt. | Mass. | R.I. | Conn. |
|---|---|---|---|---|---|---|
| Agrimonia gryposepala Wallr. | + | + | + | + | + | + |
| A. parviflora Ait. | | | | | | + |
| A. pubescens Wallr. | | + | + | + | + | + |
| A. rostellata Wallr. | | | | + | | + |

| | Me. | N.H. | Vt. | Mass. | R.I. | Conn. |
|---|---|---|---|---|---|---|
| A. striata Michx. | + | + | + | | | |
| Alchemilla minor Huds. | + | | | + | | + |
| Amelanchier arborea (Michx. f.) Fern. | + | + | + | + | + | + |
| A. Bartramiana (Tausch) Roemer | + | + | + | + | | |
| A. canadensis (L.) Medic. | + | + | + | + | + | + |
| A. gaspensis (Wieg.) Fern. & Wieg. | + | | | | | |
| A. humilis Wieg. | + | + | | | | |
| A. intermedia Spach | + | | + | + | | |
| A. laevis Wieg. | + | + | + | + | + | + |
| A. nantucketensis Bickn. | | | | + | | |
| xA. neglecta Egglest. (A. Bartramiana × laevis) | + | + | + | + | | |
| A. sanguinea (Pursh) DC. | + | + | + | + | | + |
| A. stolonifera Wieg. | + | + | + | + | + | + |
| A. Wiegandii Nielsen | + | | | | | |
| *Aruncus dioicus (Watt.) Fern. | | | | + | | |
| Chaenomeles lagenaria (Loisel.) Koidz. | | | | + | | |
| Crataegus anomala Sarg. | + | | | + | + | + |
| C. arnoldiana Sarg. | + | + | + | + | | + |
| C. basilica Beadle | + | + | + | + | + | + |
| C. Beckwithae Sarg. | | — | — | | | |
| C. biltmoreana Beadle | | | — | | | |
| C. Brainerdii Sarg. | + | + | + | + | | + |
| C. Brainerdii var. asperifolia (Sarg.) Egglest. | + | + | + | + | | |
| C. Brainerdii var. cyclophylla (Sarg.) Palmer | | | + | | | |
| C. Brainerdii var. Egglestoni (Sarg.) Robins. | | | + | + | | |
| C. Brainerdii var. scabrata (Sarg.) Egglest. | | | + | + | | |
| C. brumalis Ashe | + | + | | + | + | + |
| C. Brunetiana Sarg. | + | + | + | + | | |
| C. Brunetiana var. Fernaldii (Sarg.) Palmer | + | | | | | |
| C. chadsfordiana Sarg. | | | | — | | |
| C. chrysocarpa Ashe | + | + | + | + | + | + |
| C. chrysocarpa var. Bicknellii (Egglest.) Palmer | | | | + | | |
| C. chrysocarpa var. phoenicea Palmer | + | + | + | + | + | + |
| C. crus-galli L. | | | + | + | + | + |

| | Me. | N.H. | Vt. | Mass. | R.I. | Conn. |
|---|---|---|---|---|---|---|
| C. crus-galli var. exigua (Sarg.) Egglest. | | | | | | + |
| C. dilata Sarg. | | + | + | + | + | + |
| C. Dodgei Ashe | + | + | + | + | + | + |
| C. Faxoni Sarg. | | + | | + | | + |
| C. Faxoni var. praetermissa (Sarg.) Palmer | | | — | | | |
| C. flabellata (Spach) Kirchn. var. Grayana (Egglest.) Palmer | + | + | + | + | | + |
| C. foetida Ashe | | | + | + | | + |
| C. fretalis Sarg. | + | + | + | + | | + |
| C. Holmesiana Ashe | | + | + | + | | + |
| C. Holmesiana var. villipes Ashe | | | + | + | | |
| C. Idaea Sarg. | + | + | + | + | | |
| C. insolens Sarg. | | | + | | | |
| C. intricata Lange | | + | + | + | + | + |
| C. intricata var. straminea (Beadle) Palmer | | | | + | + | + |
| C. irrasa Sarg. var. Blanchardii (Sarg.) Egglest. | | | + | | | |
| C. Jesupi Sarg. | | | + | | | + |
| C. Jonesae Sarg. | + | + | | | | |
| C. lemingtonensis Sarg. | + | + | + | + | | |
| C. levis Sarg. | + | + | + | + | + | + |
| C. littoralis Sarg. | | | | | | + |
| C. macrosperma Ashe | + | + | + | + | + | + |
| C. macrosperma var. acutiloba (Sarg.) Egglest. | + | + | + | + | | |
| C. macrosperma var. demissa (Sarg.) Egglest. | | + | | | | |
| C. macrosperma var. matura (Sarg.) Egglest. | | + | + | + | | |
| C. macrosperma var. pentandra (Sarg.) Egglest. | + | + | + | + | | |
| C. media Sarg. | | | | | | + |
| C. membranacea Sarg. | | | | | | — |
| *C. monogyna Jacq. | + | + | | + | + | + |
| C. Oakesiana Egglest. | | | + | | | |
| *C. Oxyacantha L. | | | | + | | |
| C. pedicellata Sarg. | + | | + | + | | + |
| C. pedicellata var. albicans (Ashe) Palmer | | | + | + | | + |
| *C. Phaenopyrum (L. f.) Medic. | | | | + | | |
| C. pilosa Sarg. | | | | — | | |

| | Me. | N.H. | Vt. | Mass. | R.I. | Conn. |
|---|---|---|---|---|---|---|
| C. Porteri Britt. var. caerulescens (Sarg.) Palmer | | | | + | | |
| C. Pringlei Sarg. | + | | + | + | | |
| C. Pringlei var. exclusa (Sarg.) Egglest. | | | — | | | |
| C. pruinosa (Wendl.) K. Koch | + | + | + | + | + | + |
| C. pruinosa var. dissona (Sarg.) Egglest. | | | | + | | + |
| C. pruinosa var. latisepala (Sarg.) Egglest. | | | | + | | + |
| C. punctata Jacq. | | | + | + | | + |
| C. punctata var. aurea Ait. | | | + | | | |
| C. Randiana Sarg. | + | | | | | |
| C. rotundata Sarg. | | | | | | — |
| C. rugosa Ashe | | | | + | | |
| C. shirleyensis Sarg. | | | | + | | |
| C. schizophylla Egglest. | | | | + | | |
| C. spatiosa Sarg. | | | | | | — |
| C. Stonei Sarg. | | | | + | | |
| C. submollis Sarg. | + | + | + | + | | + |
| C. suborbiculata Sarg. | | | | | | — |
| C. succulenta Link | + | + | + | + | + | + |
| C. succulenta var. macracantha (Lodd.) Egglest. | + | + | + | + | + | + |
| C. succulenta var. neofluvialis (Ashe) Palmer | | | | | | + |
| C. Websteri Sarg. | | + | | | | |
| Dalibarda repens L. | + | + | + | + | | + |
| *Duchesnea indica (Andr.) Focke | | | | | | + |
| *Exochorda grandiflora Hook. | | | | + | | + |
| *Filipendula hexapetala Gilib. | + | | | + | | + |
| *F. rubra (Hill) Robins. | + | + | + | + | | + |
| *F. Ulmaria (L.) Maxim. | + | + | + | + | | + |
| *F. Ulmaria var. denudata (Hayne) Maxim. | + | | | | | |
| xFragaria Ananassa Duchesne | + | + | + | + | + | + |
| F. vesca L. | + | + | + | + | + | + |
| F. vesca var. americana Porter | + | + | + | + | + | + |
| F. virginiana Duchesne | + | + | + | + | + | + |
| F. virginiana var. terrae-novae (Rydb.) Fern. | + | + | + | + | | |
| Geum aleppicum Jacq. var. strictum (Ait.) Fern. | + | + | + | + | + | + |
| G. canadense Jacq. | + | + | + | + | + | + |

| | Me. | N.H. | Vt. | Mass. | R.I. | Conn. |
|---|---|---|---|---|---|---|
| G. canadense var. camporum (Rydb.) Fern. & Weath. | + | + | | + | | + |
| G. laciniatum Murr. | + | + | + | + | + | + |
| G. laciniatum var. trichocarpum Fern. | + | + | + | + | + | + |
| G. macrophyllum Willd. | + | + | + | | | |
| G. Peckii Pursh | | + | | | | |
| xG. pulchrum Fern. | | + | + | | | |
| G. rivale L. | + | + | + | + | + | + |
| *G. urbanum L. | | | | + | | |
| G. virginianum L. | | | | + | + | + |
| *Kerria japonica (L.) DC. | | | | | + | + |
| *Physocarpus opulifolius (L.) Moench | + | + | + | + | + | + |
| Potentilla anserina L. | + | + | + | | | |
| P. argentea L. | + | + | + | + | + | + |
| P. argentea var. pseudosalabra Wolf | | + | | + | | |
| P. arguta Pursh | + | + | + | + | | + |
| P. canadensis L. | + | + | + | + | + | + |
| P. canadensis var. villosissima Fern. | | | | — | | |
| *P. canescens Bess. | | | + | | | + |
| P. Egedei Wormsk. var. groenlandica Polunin | + | + | | + | + | + |
| P. erecta (L.) Räuschel | | | | — | | |
| P. fruticosa L. | + | + | + | + | | + |
| P. gracilis Dougl. | | — | | | | |
| *P. gracilis var. pulcherrima (Lehm.) Fern. | | + | | | | |
| *P. intermedia L. | | + | + | + | | + |
| *P. millegrana Engelm. | + | | | | | |
| P. norvegica L. | + | + | + | + | + | + |
| P. norvegica var. labradorica (Lehm.) Fern. | | + | | | | |
| P. palustris (L.) Scop. | + | + | + | + | | + |
| P. palustris var. villosa (Pers.) Lehm. | + | + | | + | | |
| P. pectinata Raf. | + | + | | | | |
| *P. recta L. | + | + | + | + | + | + |
| *P. reptans L. | | | | + | | |
| P. Robbinsiana Oakes | | + | | | | |
| P. simplex Michx. | + | + | + | + | + | + |
| P. simplex var. calvescens Fern. | + | + | + | + | + | + |
| P. tridentata Ait. | + | + | + | + | + | + |
| *P. verna L. | | | | | | + |
| Prunus alleghaniensis Porter | | | | | | + |

| | Me. | N.H. | Vt. | Mass. | R.I. | Conn. |
|---|---|---|---|---|---|---|
| P. americana Marsh. | | + | + | + | + | + |
| *P. Avium L. | + | | + | + | + | + |
| *P. cerasifera Ehrh. | | + | + | + | | |
| *P. Cerasus L. | | + | | + | + | + |
| P. depressa Pursh | + | + | + | + | | |
| *P. domestica L. | | | + | + | | + |
| P. Gravesii Small | | | | | | + |
| *P. Insititia L. | + | + | + | + | | + |
| *P. Mahaleb L. | | | | + | | + |
| P. maritima Marsh. | + | + | | + | + | + |
| P. nigra Ait. | + | + | + | + | | + |
| P. pensylvanica L. f. | + | + | + | + | + | + |
| *P. Persica (L.) Batsch | | | + | + | + | + |
| P. serotina Ehrh. | + | + | + | + | + | + |
| P. susquehanae Willd. | + | + | + | + | + | + |
| P. virginiana L. | + | + | + | + | + | + |
| *P. spinosa L. | | | | + | | |
| Pyrus americana (Marsh.) DC. | + | + | + | + | | + |
| P. arbutifolia (L.) L. f. | | | | + | + | + |
| xP. arnoldiana (Rehd.) W. J. Bean | | | | + | | |
| *P. Aucuparia (L.) Gaertn. | + | + | | + | + | + |
| *P. baccata L. | + | | | | | + |
| *P. communis L. | | + | + | + | | + |
| P. decora (Sarg.) Hyland | + | + | + | + | | |
| P. decora var. groenlandica (Schneid.) Fern. | + | | | | | |
| P. floribunda Lindl. | + | + | + | + | + | + |
| xP. magdaburgensis Schoch | | | | + | | |
| *P. Malus L. | + | + | + | + | + | + |
| P. melanocarpa (Michx.) Willd. | + | + | + | + | + | + |
| xP. mixta Fern. | | | | + | | |
| xP. pinnatifida Ehrh. | + | + | | | | |
| *P. prunifolia Willd. | + | | + | + | | + |
| xP. Shurangiaca Ilse | | | | + | | |
| xP. Soulardi Bailey | | | | | | + |
| *Rhodotypus scandens (Thunb.) Makino | | + | + | + | | |
| Rosa acicularis Lindl. | | + | + | | | + |
| R. acicularis var. Bourgeauiana Crepin | + | + | + | — | | |
| R. blanda Ait. | + | + | + | + | | + |
| *R. canina L. | | | | + | + | + |
| R. carolina L. | + | + | + | + | + | + |

| | Me. | N.H. | Vt. | Mass. | R.I. | Conn. |
|---|---|---|---|---|---|---|
| R. carolina var. grandiflora (Baker) Rehd. | | + | + | + | + | + |
| R. carolina var. villosa (Best) Rehd. | + | + | + | + | | + |
| *R. cinnamomea L. | + | + | + | + | + | + |
| *R. Eglanteria L. | + | + | + | + | + | + |
| *R. gallica L. | + | + | + | + | + | + |
| R. johannensis Fern. | + | | + | | | |
| *R. micrantha Sm. | + | | | + | + | + |
| *R. multiflora Thunb. | + | | | + | + | + |
| R. nitida Willd. | + | + | + | + | + | + |
| R. palustris Marsh. | + | + | + | + | + | + |
| *R. rubrifolia Vill. | + | | | + | | |
| *R. rugosa Thunb. | + | + | + | + | + | + |
| R. setigera Michx. | | | | | | + |
| R. setigera var. tomentosa T. & G. | | | | + | | + |
| *R. spinosissima L. | + | + | + | + | | + |
| R. virginiana Mill. | + | + | + | + | + | + |
| Rubus allegheniensis Porter (R. pugnax Bailey, R. saltuensis Bailey) | + | + | + | + | + | + |
| R. allegheniensis × hispidus (R. biformispinus Blanch., R. jactus Bailey, R. laevior (Bailey) Fern., R. permixtus Bailey) | + | | + | + | | |
| R. allegheniensis × pensilvanicus (R. alumnus Bailey, R. paulus Bailey) | + | | | + | | |
| R. allegheniensis × setosus (R. abbrevians Blanch., R. aculiferus Fern., R. frondisentis Blanch., R. glandicaulis Blanch., R. sceleratus Brainerd) | + | + | + | | | + |
| R. allegheniensis × vermontanus (R. ravus Bailey) | + | + | | | | |
| R. allegheniensis var. Gravesii Fern. | + | + | | + | | + |
| R. allegheniensis var. neoscoticus (Fern.) Bailey | | + | | + | | |
| R. allegheniensis var. plausus Bailey | + | + | | + | | + |
| R. allegheniensis var. populifolius Fern. | | | | + | | |
| R. arenicola Blanch. (R. Brainerdii Rydb., R. curtipes Bailey, | | | | | | |

| | Me. | N.H. | Vt. | Mass. | R.I. | Conn. |
|---|---|---|---|---|---|---|
| R. pauper Bailey, R. perpauper Bailey) | + | + | | + | | + |
| R. argutus Link (R. Blakei Bailey, R. jugosus Bailey, R. paludivagus Fern.) | + | | | + | | |
| *R. bifrons Vest. | | | | + | + | + |
| R. canadensis L. | + | + | + | + | | + |
| R. Chamaemorus L. | + | + | | | | |
| R. cuneifolius Pursh | | + | | | | + |
| R. elegantulus Blanch. (R. amicalis Blanch., R. multiformis Blanch.) | + | + | + | + | | |
| R. elegantulus × vermontanus (R. multilicius Bailey) | + | | | | | |
| R. Enslenii Tratt. (R. Baileyanus Britt.) | + | + | | + | + | + |
| R. flagellaris Willd. (R. felix Bailey, R. scambens Bailey) | + | + | + | + | + | + |
| R. frondosus Bigel. (R. bellobatus Bailey, R. insulanus Bailey, R. multispinus Blanch., R. recurvans Blanch.) | + | + | + | + | + | + |
| R. hispidus L. (R. cubitans Blanch.) | + | + | + | + | + | + |
| R. hispidus × setosus (R. adjacens Fern., R. Blanchardianus Bailey, R. jacens Blanch., R. tholiformis Fern., R. trifrons Blanch., R. trifrons var. pudens (Bailey) Fern.) | + | + | + | + | | + |
| R. hispidus × ? (R. spiculosus Fern.) | | + | | | | |
| R. hispidus var. obovalis (Michx.) Fern. | + | + | + | + | + | + |
| *R. idaeus L. | + | | + | + | + | + |
| R. idaeus var. canadensis Richards | + | + | + | + | | + |
| R. idaeus var. Egglestonii (Blanch.) Fern. | | | + | | | |
| R. idaeus var. heterolasius Fern. | + | | | | | |
| R. idaeus var. strigosus (Michx.) Maxim. | + | + | + | + | + | + |
| *R. illecebrosus Focke | + | | | | | + |
| R. Jaysmithii Bailey (R. tetricus Bailey) | + | + | + | + | + | + |

| | Me. | N.H. | Vt. | Mass. | R.I. | Conn. |
|---|---|---|---|---|---|---|
| *R. laciniatus Willd. | | | + | + | | + |
| xR. neglectus Peck (R. idaeus var. strigosus × occidentalis) | | + | + | + | | + |
| R. occidentalis L. | + | + | + | + | + | + |
| R. odoratus L. | + | + | + | + | + | + |
| R. pensilvanicus Poir. (R. amnicola Blanch., R. avipes Bailey, R. barbarus Bailey, R. facetus Bailey, R. floricomus Blanch.) | + | + | + | + | + | + |
| R. pensilvanicus × vermontanus (R. miscix Bailey) | + | | + | + | | |
| *R. phoenicolasius Maxim. | | | | + | + | + |
| R. pubescens Raf. | + | + | + | + | + | + |
| R. pubescens var. pilosifolius A. F. Hill | + | | | + | | |
| R. recurvicaulis Blanch. (R. arundelanus Blanch., R. arundelanus var. Jeckylanus (Blanch.) Bailey, R. plicatifolius Blanch.) | + | + | + | + | + | + |
| R. recurvicaulis × setosus (R. arcuans Fern.) | + | | | + | | |
| R. recurvicaulis × vermontanus (R. severus Brainerd) | | + | | | | |
| R. semisetosus Blanch. (R. ascendens Blanch., R. hispidoides Bailey, R. ortivus Bigel., R. perinvisus Bailey) | + | | | + | | + |
| R. setosus Bigel. (R. Lawrencei Bailey) | + | + | + | + | + | + |
| R. setosus × vermontanus (R. Groutianus Blanch., R. Parlinii Bailey, R. univocus Bailey) | + | + | + | + | + | + |
| *R. triphyllus Thunb. | | | | + | | |
| R. vermontanus Blanch. (R. tardatus Blanch.) | + | + | + | + | | + |

For the synonomy of species of *Rubus* which are recognized in Gray's Manual, 8th ed. but are not treated as distinct species by Hodgdon and Steele, see Rhodora **68**: 510-512 (1966). The following two taxa were unintentionally omitted from the latter list of Rejected Species.

R. flavinanus Blanch. = hybrid involving allegheniensis
R. floricomus Blanch. = pensilvanicus

| | Me. | N.H. | Vt. | Mass. | R.I. | Conn. |
|---|---|---|---|---|---|---|
| Sanguisorba canadensis L. | + | + | + | + | | + |
| *S. minor Scop. | + | | | + | + | + |

| | Me. | N.H. | Vt. | Mass. | R.I. | Conn. |
|---|---|---|---|---|---|---|
| *S. officinalis L. | + | | | | | |
| Sibbaldia procumbens L. | | + | | | | |
| *Sorbaria sorbifolia (L.) A. Br. | + | + | + | + | | + |
| Spiraea alba DuRoi | | | + | | | |
| *S. japonica L. f. | | + | | + | + | + |
| S. latifolia (Ait.) Borkh. | + | + | + | + | + | + |
| S. latifolia var. septentrionalis Fern. | + | + | | | | |
| *S. prunifolia Sieb. & Zucc. | | | | + | | + |
| S. tomentosa L. | + | + | + | + | + | + |
| Waldsteinia fragarioides (Michx.) Tratt. | + | + | + | + | | — |

The geographical areas and the numbering of the categories in this report are the same as in previous reports. The majority of the species treated are woody. The family contains some of the most perplexing taxa in our flora.

I. GENERALLY DISTRIBUTED. — *Amelanchier laevis, A. stolonifera, Fragaria vesca* and its variety *americana, F. virginiana, Potentilla norvegica, Prunus pensylvanica, P. virginiana, Pyrus floribunda, P. melanocarpa, Rosa carolina, R. palustris, R. virginiana, Rubus allegheniensis, R. canadensis, R. hispidus, R. hispidus* var. *obovalis, R. idaeus* var. *strigosus, R. pensilvanicus, R. recurvicaulis, R. setosus, R. vermontanus, Spiraea latifolia, S. tomentosa.*

*Fragaria vesca* var. *americana* has more stations in northern Maine than the species. *Rubus hispidus* and var. *obovalis* are not represented in Aroostook County but Hodgdon and Steele give the ranges of both taxa throughout New England at low altitudes. Our map shows no collection above 45°. The same is true of var. *obovalis* which does have one station north of 45°. There is need of more collecting.

Ia. GENERAL EXCEPT MAINE COAST EAST OF KENNEBEC RIVER. — *Rubus occidentalis.*

Ib. GENERAL EXCEPT WASHINGTON COUNTY COAST OF MAINE. — *Agrimonia gryposepala, Geum aleppicum* var. *strictum, Rubus idaeus* var. *canadensis.*

Ic. GENERAL EXCEPT CAPE COD. — *Geum rivale, Potentilla fruticosa, P. palustris* var. *villosa, Rosa nitida, Rubus odoratus, R. pubescens.*

*Potentilla fruticosa* in general grows on sweet or neutral soils, but not exclusively. It seems to thrive except in extremely acid situations. *Rosa nitida* is rare west of the Connecticut River.

Ie. GENERAL EXCEPT CAPE COD AND WASHINGTON COUNTY COAST. — *Agrimonia stricta, Geum laciniata, Potentilla arguta, Prunus nigra.*

*Geum laciniatum*, while widely distributed, is sporadic. *Prunus nigra* is apparently absent from southeastern Massachusetts and mainland Rhode Island and Connecticut except the Housatonic drainage area.

IIa. NORTHERN — NO STATIONS OR NOT MANY SOUTH OF 43°. — *Amelanchier Bartramiana*, × *A. neglecta (Bartramiana* × *laevis)*, *A. Wiegandii*, *Geum macrophyllum*, *Prunus depressa*, *Pyrus decora*, *Rubus elegantulus*.

IIb. — NORTHERN — NUMEROUS STATIONS SOUTH OF 43°. — *Amelanchier sanguinea*, *Dalibarda repens*, *Fragaria virginiana* var. *terrae-novae*, *Potentilla tridentata*, *Pyrus americana*.

*Potentilla tridentata* is a northern species found chiefly at higher elevations but locally in sterile acid areas, even at sea level. *Pyrus americana* is northern, becomes uncommon in southern New England and is apparently absent from southeastern Massachusetts.

III. ARCTIC-ALPINE. — *Geum Peckii*, *Potentilla norvegica* var. *labradorica*, *P. Robbinsiana*, *Pyrus decora* var. *groenlandica*, *Rubus Chamaemorus*, *R. pubescens* var. *pilosifolius*, *Sibbaldia procumbens*.

*Rubus Chamaemorus* occurs on the Washington County coast of eastern Maine and also in the White Mountains of New Hampshire.

IV. SOUTHERN — GENERAL SOUTH OF 45°. — *Amelanchier canadensis*, *Geum canadensis* and var. *camporum*, *Potentilla simplex* var. *calvescens*, *Rubus Enslenii*, *R. frondosus*, *R. Jaysmithii*.

IVa. SOUTHERN — GENERAL SOUTH OF 45°, BUT NOT ON THE MAINE COAST EAST OF THE KENNEBEC RIVER. — *Prunus susquehannae*, *Rubus arenicola*, *R. flagellaris*.

IVb. SOUTHERN — GENERAL SOUTH OF 45°, BUT NOT IN WASHINGTON COUNTY. — *Potentilla canadensis*, *P. simplex*, *Prunus serotina*.

IVd. SOUTHERN — GENERAL SOUTH OF 45°, BUT NEITHER ON CAPE COD NOR IN WASHINGTON COUNTY. — *Amelanchier arborea*, *Geum laciniatum* var. *trichocarpum*.

V. CHIEFLY THE THREE SOUTHERN STATES. — *Geum virginianum*, *Prunus americana*, *Rubus semisetosus*.

Although *Rubus semisetosus* belongs here, it also occurs sparingly on the coast of Maine and southern New Hampshire.

Va. CHIEFLY THE THREE SOUTHERN STATES. BUT NOT IN WESTERN MASSACHUSETTS. — *Pyrus arbutifolia*, *Rubus argutus*. *Pyrus arbutifolia* is a southern species, occurring in eastern Mass., R.I., and Conn., apparently only within fifty miles of the coast.

Vb. CHIEFLY THE THREE SOUTHERN STATES, BUT NOT CAPE COD. — *Agrimonia pubescens*, *A. rostellata*, *Sanguisorba canadensis*.

VI. SOUTHWESTERN NEW ENGLAND — CHIEFLY WEST OF THE CONNECTICUT VALLEY. — *Agrimonia parviflora*, *Rubus cuneifolius*.

VII. WESTERN NEW ENGLAND — CHIEFLY WEST OF THE CONNECTICUT VALLEY. — *Waldsteinia fragarioides. Waldsteinia* has two isolated stations in Maine, both in Kennebec County.

VIII. COASTAL PLAIN. — *Amelanchier nantucketensis.*

IX. CALCIPHILE. — *Amelanchier gaspensis, A. humilis, Rosa blanda, R. johannensis. Amelanchier gaspensis* has two stations in the Aroostook River valley. *A. humilis* has been found at four stations in the Champlain valley.

X. MARITIME. — *Potentilla Egedei* var. *groenlandica, P. pectinata.*

XI. MARITIME WITH INLAND STATIONS. — *Prunus maritima.*

XII. MISCELLANEOUS. — *Amelanchier intermedia* is northern. There are only six stations, three on the eastern Maine coast, the other three at Rutland and Bellows Falls, Vt. and Florida, Mass. *Potentilla anserina* is also a northern species. It occurs frequently in the river valleys of Aroostook County, Maine and on the shores of Lake Champlain. There are also Maine collections from Mattawamkeag on the Penobscot River and from Mt. Desert and Cape Elizabeth on the Maine coast. There are a few other stations in Vermont and a collection from Plainfield, N. H. on the Connecticut River.

*Prunus alleghaniensis* is a southern species with only four stations, Lisbon in eastern Connecticut and Botsford, Bridgeport and Lyme in the western part of the state. *Prunus Gravesii* is known only from Groton and Noank in eastern Connecticut where it is apparently an endemic.

*Rosa acicularis,* a western species, is represented by specimens from Randolph and Stratford Hollow, and Plainfield, N. H., Weybridge and Hartland, Vt., and Southbury, Connecticut. The var. *Bourgeauiana* has been collected at Matinicus, West Bath and Chebeague Island on the Maine coast, Randolph, N. H., Arlington, Ferrisburg, Manchester, Middlebury and Weybridge, Vt., and on the Blue Hills Reservation, Mass., where it was probably introduced. *Rosa carolina* var. *grandiflora* occurs at Shelburne, N.H. and is occasional in the three southern states. The var. *villosa* might be classified as general but it is very sporadic with two stations in Me., one in N.H., one in western Vt., four in eastern Mass., and two in the Quinnipiac Valley, Conn.

*Rubus allegheniensis* var. *neoscoticus* is represented by a specimen from Plymouth, Mass. and one from Errol, N. H., the determination of which is questionable. *Rubus idaeus* var. *heterolasius* is known only from the central Maine coast. The var. *Egglestonii* is very local, occurring in Windsor and Townsend, Vt. *Rubus illicebrosus* is represented from Portland, Me. and Huntington, Conn.

*Spiraea alba* is known only from four stations in northwestern Vermont.

XIIIa. INTRODUCED SPECIES — NORTHERN TENDENCIES. — *Filipendula Ulmaria, Rosa spinosissima, Sorbaria sorbifolia.*

XIIIb. INTRODUCED SPECIES — SOUTHERN TENDENCIES. — *Chaenomeles lagenaria, Duchesnea indica, Filipendula rubra, Fragaria Ananassa, Kerria japonica, Physocarpus opulifolius, Potentilla argentea, P. intermedia, P. millegrana, P. recta, P. verna, Prunus Avium, P. Cerasus, P. domestica, P. insititia, P. persica, Pyrus Acuparia, P. communis, P. Malus, Rosa canina, R. cinnamomea, R. Eglanteria, R. gallica, R. rugosa, Rubus idaeus, R. phoenicolasius, Spiraea japonica.*

XIIIc. INTRODUCED SPECIES — SPORADIC. — *Alchemilla minor, Aruncus dioicus, Exochorda grandiflora, Filipendula hexapetala, F. Ulmaria* var. *denudata, Gillenia trifoliata, Geum pulchrum, G. urbanum, Potentilla gracilis* var. *pulcherrima, P. repens, Prunus cerasifera, P. Mahaleb, P. spinosa, Pyrus baccata, P. pinnatifida, P. prunifolia, P. Soulardi, Rhodotypus scandens, Rosa multiflora, R. setigera* and var. *tomentosa, Rubus laciniatus, R. triphyllus, Spiraea prunifolia.*

XIIId. INTRODUCED SPECIES — LOCAL. — *Sanguisorba minor, S. officinalis.*

R. C. BEAN
A. F. HILL
R. J. EATON
S. K. HARRIS

A CORRECTION in the 16th Report of the Committee on Plant Distribution:

In the Sixteenth Report (*Rhodora* 65:26), the occurrence of *Eleocharis palustris* (L.) R. & S. var. *palustris* in Rhode Island and Connecticut based on single specimens each was stated to be doubtful. The inclusion of plus (+) signs opposite this species under "R. I." and "Conn." on p. 27 is therefore an error, and they should be deleted. Actually the two pertinent specimens involved have been re-examined and in our opinion should be referred unhesitatingly to *E. palustris* var. *major* Sonder.

R. C. BEAN
A. F. HILL
R. J. EATON
S. K. HARRIS

# PHYSALIS IN MEXICO, CENTRAL AMERICA AND THE WEST INDIES

U. T. WATERFALL

Continued from Vol. 69, No. 778

69. **Physalis foetens** Poiret, in Lamarck, Encyclopédie Méthodique. Botanique . . . Supplement 2:348. 1817.

Annual, 10-65 cm tall, spreading-hairy with varying mixtures of short hairs and longer, multicellular ones, many terminating in glands; leaf blades ovate to ovate-lanceolate, coarsely and irregularly toothed, sometimes saliently, sometimes sinuately so; principal blades 2-10 cm long and 15-55 mm wide, on petioles 1-5 cm long; flowering calyx hairy, often densely so, 4-8 mm long and 2.5-6 mm wide at base of lobes, upper 2-4 mm divided into usually lanceolate lobes, attenuate or subulate tipped; flowering pedicels 2-6 mm long; corolla immaculate, or with slight, and not obvious spots, (8-) 10-15 mm long and 12-25 mm wide when fully expanded; anthers violet or bluish, 1.5-3 mm long, on slender, often blue, filaments 2-5 mm long; fruiting calyx 5-angled, basally cordate, hairy in varying amounts, (15-) 22-49 mm long and (13-) 18-40 mm wide, the upper 4-10 mm divided into attenuate or subulate-toothed lobes; fruiting pedicels 5-10 mm long, reflexed; berry nearly spheric, thin-walled, 10-15 mm in diameter.

*P. foetens* is nearest *P. subulata*, differing in its immaculate, or nearly immaculate, larger corollas, larger anthers, and its more abundant glandularity.

SELECTED COLLECTIONS: MEXICO: DISTRITO FEDERAL: Sierra de Ajusco, 8500 ft, Oct. 2, 1895, *Pringle 6219* ( BR, F, GH, MEXP, NY, UC, US, VT) ; DURANGO: Durango, 1896, *Palmer 695* (US) ; GUANAJUATO: near Dolores Hidalgo, Aug. 10, 1947, *Kenoyer 1939* (GH); HIDALGO: near Tequixquiac, Aug. 30, 1903, *Rose & Painter 6644* (NY, US) ; JALISCO: 5 miles s of Ojuelos on road to Lagos de Moreno, July 19, 1955, *Weintraub & Roller 67* (MICH) ; MEXICO: cerca de Totolcingo, municipio de Acolman, July 18, 1965, *Rzedowski 20217* (MEXP) ; OAXACA: Oaxaca, Sept. 25, 1930, *Russell 220* (US) : San Luis Tultitlanapa, near Oaxaca, July 1908, *Purpus 3582* (BM, F, GH, NY, UC, US) ; QUERETARO: silty flats with shrubs and cacti, Aug. 23, 1961, *Waterfall 16547* (F, MICH, OKLA, US) ; SAN LUIS POTOSI: in arenosis circa Morales, 1867, *Schaffner 701,* (GH) ; SINALOA: Rosario, Apr. 4, 1910, *Rose et al 14580* (US); VERACRUZ: Mt. Orizaba, Aug. 15, 1891, *Seaton 372* (F, NY, US).

*Bourgeau 352* (BR, GH, P, US) Cacubaya, Vallée de Mexico, July, 1865-1866, is a collection that was in the Poiret Herbarium, accepted by him as *P. foetens.*

70. **Physalis subulata** Rydberg, Bull. Torr .Bot. Club **22**: 306. 1895. Annual, 10-60 cm tall, spreading-hairy with varying mixtures of short and longer, multicellular trichomes, few or many terminating in glands; leaf blades ovate to broadly ovate, sometimes basally oblique, margins irregularly and coarsely dentate, sometimes sinuately so; principal leaf blades 3-7 cm long and 2.5-6 cm wide on petioles 1.5-3 (-5) cm long; flowering calyx hairy, 3-4.5 mm long, upper one-half to two-thirds divided into lanceolate, often subulate-tipped, lobes, on pedicels 1.5-3 (-5) mm long; corolla yellowish, maculate, 6-7 mm long and 5-11 mm wide when fully expanded; anthers violet or bluish, (0.3-) 1-1.5 (-2) mm long on filaments 2-3 mm long; fruiting calyx hairy, 5-angled, basally cordate, 2-3 cm long and 2-2.5 cm wide, the upper 6-10 mm divided into narrow teeth, usually subulate-tipped; fruiting peduncles 5-7 (-10) mm long, reflexed; berry nearly spheric 6-10 mm in diameter.

70a. var. **subulata**

Leaves usually coarsely and irregularly dentate to sinuate-dentate. SPECIMENS EXAMINED. MEXICO: CHIHUAHUA: waste grounds, Guerrero, Sept. 8, 1887, *Pringle 1344* (Type: GH; Isotypes: F, NY, US, VT); DURANGO: Tejamen, Aug. 21-27, 1906, *Palmer 494* (F, GH, NY, US); Durango, Sept. 1896, *Palmer 634* (F, GH, NY, UC, US).

70b. var. **neomexicana** (Rydberg) Waterfall, comb. nov., *P. neomexicana* Rydb., Mem. Torr. Bot. Club **4**:325-326. 1895; *P. foetens* var. *neomexicana* (Rydb.) Waterfall, Rhodora **60**: 168. 1958.

This has the small maculate corollas of *P. subulata,* not the large, immaculate, or sometimes slightly maculate, corollas of *P. foetens,* the closest relative. The var. *neomexicana* also has leaves less deeply, and more regularly toothed than either var. *subulata,* or *P. foetens.*

COLLECTIONS EXAMINED. MEXICO: BAJA CALIFORNIA: Palm Valley, May 30, 1883, *Orcutt s.n.* (US).

71. **Physalis angustiloba** Waterfall, sp. nov.

Planta herbacea, ad 1 meter alta; trichomatibus mollibus, articulatis, partim glanduliferis, ad 1 mm longis; foliis ovatis, cuspidatis, inaequaliter magnodentatis vel integerrimis, principalibus 4-11 cm longis et 2.5-10 cm latis, petiolis 2-7.5 cm longis; calycibus floriferis 3.5-6 mm longis et 3-5 mm latis ad basim loborum; calycis lobis 2-3.5 mm longis lanceolato-attenuatis vel angustioribus; pedicellis 2-5 mm longis; corollis luteis, maculatis, 9-15 mm longis et 13-15 mm latis;

antheris violaceis, 2-3 mm longis; calycibus fructiferis pentangulatis, 25-30 mm longis et 18-28 mm latis, vestitis; pedicellis fructiferis 3-5 (-15) mm longis; baccis 10-13 mm latis.

TYPE: *Rogers McVaugh 21141* (MICH) bushy annual 1 meter high, sandy soil in tropical deciduous forest, hills 2 miles n of La Cuesta, road to Talpa de Allende, JALISCO, Nov. 19, 1960, Isotype: (OKLA).

COLLECTIONS SEEN. MEXICO: AGUASCALIENTES: oak forest near summit, Sierra del Laurel, 10 miles se of Calvillo, *McVaugh 18439* (MICH, OKLA); GUERRERO: llano, San Antonio, Montes de Oca, Oct. 25, 1937, *Hinton 11541* (GH, MICH, NY); JALISCO: *McVaugh 21141* type, cited above.

Each of the 3 collections cited above present differences which tempt one to assign each to a different species. Perhaps future collections will clarify the situation.

72. **Physalis turbinatoides** Waterfall, sp. nov.

Planta herbacea; trichomatibus mollibus, articulatis, partim glanduliferis; foliis ovatis, cuspidatis, inaequaliter et magne paucidentatis, principalibus 5-9 cm longis et 3-6 cm latis; petiolis 3-6 cm longis; calycibus floriferis vestitis, 2.5-3 mm longis et 2-2.8 mm latis ad basim loborum; calycis lobis anguste lanceolatis, 1.5-2 mm longis, pedicellis 3-5 mm longis; corollis immaculatis vel pallido-immaculatis, 5-6 mm longis et 5-7 mm latis; antheris luteis, 1-1.5 mm longis, filamentis filiformibus, 1-2 mm longis; calycibus fructiferis plus minusve vestitis praesertim ad venis, 24-32 mm longis et 15-20 mm latis, lobis attenuatis, 6-10 mm longis; baccis 8-11 mm latis.

TYPE: *C. G. Pringle 7263* (VT) near Cuernavaca, 5000 ft, MORELOS, MEXICO Sept. 22, 1896; Isotype: (GH).

73. **Physalis turbinata** Medicus, in Acad. . . . Theod. - Palat. 4: 189-190, t. 5, fig. 2. 1780; *Alkekengi barbadense* . . . Dillenius, Johannes Jacobus, Hortus Elthamensis, 10, t.9, f.9. 1732; *Physalis barbadensis* Jacquin, Nickolaus Joseph, Miscellanea Austriaca Sive Plantarum Selectarum, 1781; *P. hirsuta* var. *barbadensis* (Jacq.) Dunal in D. C. Prod. 13(1): 446. 1852.

Annual, 15-100 cm tall, stems spreading-hairy, the trichomes jointed, often gland-tipped; leaf blades ovate, often attenuate-tipped, margins entire to irregularly, often sinuate-dentate, 1-15 teeth on each side; principal leaf blades 5-11 cm long and 4-8 cm wide, appressed, jointed hairs in varying abundance on both sides, sometimes restricted to the veins, sometimes some reduced to mere bases; petioles of principal leaves 2-7 cm long; flowering calyx (3-) 4-6 mm long, upper one-half to two-thirds divided into narrowly lanceolate lobes; flowering pedicels 4-6 mm long; corollas yellowish, maculate, hairy in the throat, 6-12 mm long and 7-15 mm wide; anthers bluish, 2-2.8 mm long on filaments 3-4 mm long; fruiting calyx 5-angled, cordate-based, pubescent, 3-4 cm long and 2-3 cm wide, its lobes 5-10 mm long and usually somewhat attenuate; fruiting pedicels 5-15 mm long; berry nearly spheric, 9-13 mm in diameter, on a gynophore 1-2 mm long, the gynophore and lower inner surface of the fruiting calyx sometimes with gland-tipped hairs.

This species is similar to *P. pubescens,* and tends to merge with it in its extreme manifestations, but the flowers and fruiting calyces are larger, and the latter have longer, and usually narrower calyx lobes, in this characteristic resembling *P. cordata,* which, however, has glabrous fruiting calyces, *P. porrecta,* and some phases of *P. ignota.* The occasional presence of gland-tipped hairs inside the fruiting calyx near its base is also reminiscent of *P. ignota.*

Much material identified with the name *P. turbinata* in the past is here referred to *P. cordata* Miller. If the species-concepts of the two were identical, this course would be necessary due to the priority of the latter name. But the original concept of *P. turbinata* Medic. specifies a hairy plant, this actually being a proposed new name for *Alkekengi barbadense nanum, alliariaefolia* Dillenius, Hort. Elth., the specific name being taken from part of the Dillenius description of the fruiting calyx, "ab initio angustiores, postia ampliores magis . . . angulosae, pentagone nempe . . . in mucronem longiorum productae . . . in quibus acini latent grandiusculi turbinati . . ."

It is to such material, which has usually passed as large *P. pubescens,* that the name *P. turbinata* is here applied.

SELECTED COLLECTIONS. MEXICO: COLIMA: Colima, Aug. 1897, Palmer 121 (MICH, UC, US); GUERRERO: second barranca east of Temisco, north of Río Balsas, Adama, Nov. 6, 1937, *Mexia 8760* (F, GH, NY); JALISCO: wet banks near Guadalajara, Sept. 27, 1902, *Pringle 11643½* (F, GH, US); MICHOACAN: pine forest on precipitous slopes 3 miles below lumber camp at Dos Aguas, Sept. 15, 1958, *McVaugh 17865* (MICH); SINALOA: short tree forest, sand valley in foothills, Comedero, Jan. 27, 1940, *Gentry 5391* (NY); YUCATAN: *Gaumer 482* (MICH, UC, this number is *P. viscosa* var. *yucatanensis* at BM, F, GH, US). BRITISH HONDURAS: San Andres, Corozay, July 1933, *Lundell 4932* (MICH). GUATEMALA: bank of river, Gulan, Jan. 17, 1905, *Deam 387* (GH). HONDURAS: Amapala, Valle, Sept. 11, 1945, *Rodriguez 3375* (F); between Juticalpa and airport, Mar. 14, 1949, *Standley 18018* (F). PANAMA: near Madden Dam, Rio Chagres, Canala Zone, July 30, 1935, *Seibert 554* (GH, NY). COSTA RICA: Mar. 1900, *Pittier 16082* (GH, NY, US); CUBA: San Jose, Santa Clara, June 1941, *Howard 5170* (GH, NY). DOMINICAN REPUBLIC: bank of Maimon River, Piedra Blanca, La Vega, Jan. 18, 1946, *Allard 14748* (NY). HAITI: Marmelada, du Nord, Dec. 18, 1925, *Leonard 8110* (NY). PUERTO RICO: Rio Piedras, May 4, 1899, *Heller 1277* (NY). ST. VINCENT: near Palmyra, *Smith 1328a* (GH). TORTOLA, V.I.: April 1913, *Fishlock 5* (NY).

74. **Physalis pubescens** L., Species Plantarum 1:183, 1753; *P. villosa* Miller, Gard. Dict. ed 8, 1768; *P. obscura* Michx., var. *glabra* Michx. & var. *viscido-pubescens* Michx., Flora Boreali-Americana 1:149. 1803; *P. hirsuta* Dunal in D. C., Prod. 13(1): 445. 1852; *P. viscido-pubescens* (Michx.) Dunal, l.c.; *P. floridana* Rydberg in Small, Flora of the Southeastern U. S. 983. 1903; *P. pubescens* var. *minutifolia* O. E. Schulz in Urban, Symbolae Antillanae . . . 6:145. 1909; *P. pubescens* var. *glabra* (Michx.) Waterfall, Rhodora **60**:165. 1958 (See discussion under *P. cordata*).

Annual, 8-90 cm tall, usually villous and sometimes viscid, varying to more or less glabrate; leaf blades ovate, often acuminate, bases sometimes inequilateral, margins usually irregularly several-toothed, sometimes entire or with 1-few teeth, surfaces varyingly soft-hairy with vestiture more abundant, and appressed, on the veins of the abaxial surface, sometimes nearly glabrous; principal blades usually 4-9 cm long and 2-4 cm wide on petioles 2-7 cm long; flowering calyx usually 4-10 mm long and 3-12 mm wide at base of lobes; upper 1-4 mm of calyx divided into ovate-deltoid to lanceolate lobes; flowering pedicels 3-6 mm long; corolla yellowish, dark-maculate, more or less matted-hairy in the throat below the maculations, 7-10 (-12) mm long and 10-15 mm wide; anthers bluish or violet, 1.5-3 mm long on filaments 2-3 mm long; fruiting calyx 5-angled, usually prominently so, usually soft-hairy, 18-30 mm long and 13-22 mm wide on pedicels 5-13 mm long; berry 10-18 mm in diameter, sessile or subsessile on the invaginated calyx-base.

*Physalis pubescens* var. *minutifolia* O. E. Schulz is here considered as an unusually small extreme of the species, rather than as a distinct variety. It would be interesting to check further to see if there could be a geographic population in the Barbados similar to the type of the proposed variety.

SELECTED COLLECTIONS. MEXICO: BAJA CALIFORNIA: San José del Cabo, Jan. 20, 1928, *Jones 24393* (F, GU); CHIAPAS: Cerro del Boqueron, Sept. 1913, *Purpus 6993* (NY, UC); CHIHUAHUA: southwestern Chihuahua, 1885, *Palmer 140* (GH, NY, US); JALISCO: Barranca of Guadalajara, Aug. 4, 1902, *Pringle 8630* (BM, F, GH, NY, UC, US, VT);

MICHOACAN: semi-desert scrub, 4 miles w of Apatzingan, Aug. 8, 1941, *Leavenworth 1381* (F); NAYARIT: moist tropical forests, precipitous mountainsides, 12 miles w of Tepic, Sept. 8, 1960, *McVaugh 18854* (MICH); Maria Madre Island, May 1897, *Nelson 4255* (F, GH, US); NUEVO LEON: wooded hillsides, 19 miles w of Linares, *McGregor et al 214* (KANU); OAXACA: Tomellin Canyon, Dec. 17, 1895, *Pringle 7004* (GH, MEXP, VT); PUEBLA: Cerro de Coatepe, Aug. 1907, *Purpus 2711* (UC); SINALOA: Culiacan, Oct. 20, 1904, *Brandegee s.n.* (UC); San Blas, Mar. 24, 1910, *Rose et al 13382* (NY, US); thickets, Villa Union, Apr. 2, 1910, *Rose et al 13885* (NY, US); SONORA: creek w of Pilares de Nacozari, Nov. 19, 1939, *Drouet et al 3678* (F); TAMAULIPAS: Victoria, 1907, *Palmer 53* (F, UC, US); TEPIC: ravine, Acaponeta, Apr. 9, 1910, *Rose et al 14231* (GH, NY, US); VERACRUZ: Remudadero, March 1923, *Purpus 9001* (F, GH, NY, UC, US); YUCATAN: *Gaumer 23514* Kancabconot, Jan. 1917 (F, GH, NY, US). BRITISH HONDURAS: river bank, Stann Creek District, Jan. 27, 1937, *Gentle 1918* (GH, MICH, NY, US). COSTA RICA: La Lola, Limon, Oct. 21, 1953, *Heiser 3654* (F); wet meadow, San Jose, *Standley 41220* (US). EL SALVADOR: San Salvador, Dec. 20, 1921, *Standley 19552* (GH, NY, US). GUATEMALA: Quiriga, Izabal, May 15, 1922, *Standley 24074* (GH, NY, US); Río Ixcan, Huehuetenango, July 23, 1942, *Steyermark 49330* (F, US). HONDURAS: banana field, La Fragua, Atlantida, Dec. 7, 1927, *Standley 52657* (F, US). NICARAGUA: El Recreo, Zelaya, Apr. 23, 1949, *Standley 19110* (F). PANAMA: San Jose Island, Jan. 10, 1946, *I. M. Johnston 1105* (GH, US); Gorgana Beach, Aug. 7, 1938, *Woodson et al 1694* (GH, NY). BAHAMAS: New Providence, Apr. 7, 1904, *Britton 123* (NY). CUBA: Sierra de Cabra, Pinar del Rio, Mar. 6, 1911, *Britton et al 9811* (NY); San Pedro, Isle of Pines, Feb. 15, 1916, *Britton et al 14334* (NY); Sierra Maestra prope Daiquiri, Oriente, Oct. 28, 1916, *Ekman 8075* (NY). DOMINICAN REPUBLIC: Sierra de Ocoa, Ciudad Trujillo (Santo Domingo), Feb. 28, 1929, *Ekman 11709* (NY — as var. *minutifolia*). HAITI: St. Michel de l'Atalaye, Nov. 20, 1925 (GH, NY). JAMAICA: New Market, Sept. 13, 1907, *Britton 1602* (NY). PUERTO RICO: sand dunes, Catano, Feb. 14, 1914, *Britton & Cowell 1552* (NY). TOBAGO: Charlotteville, Jan. 20, 1953, *Hunnewell 19986* (GH). TORTOLA, V.I.: *Fishlock 285* (GH).

75. **Physalis leptophylla** Robinson & Greenman, Proc. Amer. Acad. Arts & Sci. 29: 389-390. 1894.

Annual, 0.5-1 meter tall; vestiture of soft, somewhat tangled, multicellular hairs of different lengths up to 1 or 1.3 mm long, some with elongate, terminal glands; leaf blades thin, ovate, acuminate, principal ones 4-8 cm long and 2.5 -6 cm wide, on petioles 2-8 cm long; margins of blades entire, or rarely with a few irregular, shallow teeth; surfaces of blades glabrous, or nearly so, but margins more or less ciliate, bases somewhat inequilateral; flowering calyx 2-3 mm long and 2-4 mm wide at base of the ovate-deltoid lobes fromed from the upper 1-1.5 mm of the calyx, pedicels 1-2 (-3) mm long; corolla light yellow or cream-colored, with brown or purplish maculations, glabrous, or nearly so, within, 5-9 mm long and 6-10 mm wide; anthers violet to purplish, ovate to oblong, 0.8-1.5 mm long, on filaments 2-3 mm long; fruiting calyx thin, 5-angled, but seldom prominently so, 12-20 mm long and 10-15 mm wide, on pedicels 3-5 mm long; berry 4-8 mm long, sessile to subsessile on a calyx invaginated 1-1.5 mm.

SELECTED COLLECTIONS. MEXICO: BAJA CALIFORNIA: near spring, north side of Cerro de la Giganta, Distritio del Sur, Nov. 28, 1947, *Carter et al, 2073* (UC, US); CHIHUAHUA: canyon, Guasaremos, Rio Mayo, Aug. 25, 1936, *Gentry 2442* (F, GH); COLIMA: steep hills, 14 miles wnw of Santiago in ravines, Nov. 7, 1960, *McVaugh 20782* (MICH, OKLA); DURANGO: shady canyon bottom, 10 miles w of Tamazula, Dec. 18, 1939, *Gentry 5270* (GH, NY); GUERRERO: Cutzamala, Coyuca, Sept. 26, 1936, *Hinton 8493* (US); JALISCO: along stream in steep moist ravines, 9 miles n of road junction at w end of Bahia de Navidad, Dec. 12, 1959, *McVaugh & Koelz 1730* (MICH, OKLA); Barranca of Tepic, Oct. 11, 1893, *Pringle 5455* (GH, US, VT); MEXICO: Bejucos, Temascaltepec, Nov. 13, 1933, *Hinton 5204* (US); SINALOA: under shrubs, 64 miles s of Culiacan, *Breedlove 1549* (US); SONORA: moist shady soil under trees or shrubs, Alamos, Oct. 28, 1939, *Gentry 4771* (F, MICH, NY, OKLA, UC, US). GUATEMALA: brushy rocky slope between Zacapa and Chiquimula, Oct. 9, 1940, *Standley 7381* (F).

In its extremes, *P. leptophylla* tends to merge with *P. pubescens.*

76. **P. hylophila** Standley, Journ. Wash. Acad. Sci. **14**: 243. 1924.

Annual, 30-90 cm tall, stems soft-hairy with jointed whitish, more or less viscid trichomes, the longer ones 1-2 mm long, often tipped with pinkish or light brown glands, sometimes intermixed with shorter hairs which also may be glandular-capitate; leaf blades ovate, often acuminate, margins entire or with a few, irregularly sinuate teeth; young blades with varying amounts of hair similar to that of the stems but often appressed on the veins, more or less glabrate; principal blades 2.5-4 cm long and 2-2.5 cm wide, but all specimens examined have lost lower, possibly larger, leaves; petioles 1-2.5 cm long; flowering calyx 3-5.5 mm long and 3-5 cm long; corolla yellowish, apparently immaculate or with spots not strongly contrasting, tube glabrous within; corolla 6-7 mm long and 7-8 mm wide when fully expanded; anthers yellowish, light greenish-yellow or bluish tinged, 1.1-1.3 mm long, on filaments 3-4 mm long; fruiting calyx 5-angled, but not strongly so, and with intermediate ribs, hairy, 14-16 mm long and 10-12 mm wide on pedicels 3-5 mm long.

*Physalis hylophila* is similar to *P. leptophylla* in its small anthers, corolla tube essentially glabrous internally, and in having hairs often gland-tipped. They differ in *P. leptophylla* having contrastingly maculate corollas, smaller flowering calyces, lighter colored anthers, and a smaller, less obviously 5-angled fruiting calyx.

COLLECTIONS EXAMINED. MEXICO: SONORA: under large trees on lower slope of mountain w of Alamos, Dec. 12, 1939, *Drouet & Richards 3971* (F). EL SALVADOR: wooded slope along lake, Laguna de Maquigue, La Union, Feb. 18, 1922, *Standley 20971* (Type: US; Isotypes: GH, NY). PANAMA: El Real, Darien, Oct. 7, 1938, *Allen 956* (F, GH, NY, US).

77. **Physalis vestita** Waterfall, sp. nov.

Planta herbacea, multicaulis e radice lignose elongata; caulibus 15-65 cm longis, lanatis, probabiliter adscendentibus vel decumbentibus, interdum ad basim fruticosis; foliis ovatis, dense canis lanosovestitis, integerrimis vel inaequaliter paucidentatis vel undulatis, principalibus 25-40 mm longis et 15-28 mm latis, petiolis dense vestitis, 10-35 mm longis; calycibus floriferis dense vestitis, 3-4 mm longis et 4-5 mm latis; calycis lobis deltoideis, 1 mm longis; pedicellis floriferis 4-6 mm longis; corollis pallidoluteis, maculatis, tubis intus vestitis, 7-10 mm longis et 10-13 mm latis; antheris coeruleis vel violaceis, 3-4 mm longis; filamentis filiformibus, 2.5-4 mm longis; calycibus fructiferis pentangulatis, dense vestitis, 15-22 mm longis et 13-18 mm latis; pedicellis fructiferis 7-13 mm longis; baccis 8-10 mm latis.

TYPE: *J. N. Rose 13766* (US) vicinity of Mazatlan, Mar. 3, 1910, Sinaloa; Isotypes: (F, GH, NY).

COLLECTIONS SEEN. MEXICO: SINALOA: Mazatlan, Nov. 20, 1926, *Jones 22515* (F); cliff facing the ocean, Signal Hill, Mazatlan, Sept. 16, 1925, *Mexia 32* (UC); *Rose 13766*, Type, cited above.

78. **Physalis clarionensis** Waterfall, sp nov.

Planta herbacea; ramis 15-45 cm longis, glabris; foliis ovatis, acuminatis, inaequaliter crasse dentatis, principalibus 2-5 cm longis et 15-25 mm latis, petiolis 10-22 mm longis; calycibus floriferis glabris, 3.5-4 mm longis et 2-4 mm latis ad basim loborum; calycis lobis deltoideo-lanceolatis, 2 mm longis; pedicellis floriferis 4-5 mm longis; corollis pallido-luteis, obscure maculatis, jugulis glabris, 5-6 mm longis et 8-9 mm latis; antheris coeruleis vel violaceis, 1.5 mm longis; filamentis filiformibus, 2-3 mm longis; calycibus fructiferis pentangulatis, glabris, 23-27 mm longis et 16-18 mm latis; calycis lobis ovatis, mucronatis, 4-6 mm longis, pedicellis fructiferis 5-10 mm longis; baccis 10 mm latis.

TYPE: *A. W. Anthony 411* (UC), Clarion Island, off the coast of Lower California, March-June, 1897; Isotypes: (F, GH, US).

*Physalis clarionensis* resembles some phases of *P. angulata,* but has prominently 5-angled fruiting calyces in contrast to the 10-ribbed ones of the latter species, and has maculate corollas, smaller than usual for *P. angulata,* as well as small anthers. Except for its relatively small corollas and anthers and 5-angled fruiting calyces, it might seem referable to *P. philadelphica (P. ixocarpa).*

The specific name refers to the Clarion Islands, the type locality.

79. **Physalis minuta** Griggs, Torreya 3: 138-139. 1903.

Herbaceous, annual, stems 15-35 cm tall; vestiture of very short, appressed, antrorsely curled hairs; leaf blades ovate to lanceolate-ovate, principal ones 10-25 cm long and 6-12 mm wide on petioles 7-20 (-50) mm long; flowering calyx 2-3 mm long, divided one-fourth or one-fifth into attenuate lobes; corolla 4-5 mm long, immaculated or with slightly contrasting spots; anthers 1.3-2 mm long, yellowish or bluish tinged; fruiting calyx 5-angled, 15-18 (-20) mm long and 12-15 mm wide on filiform pedicels 4-10 mm long; berry 7-8 mm in diameter, sessile, or nearly so, on the invaginated calyx-base, which is minutely and sparsely capitate-hairy.

Griggs, in describing this species, emphasized the alleged minute size of the corolla, basing the specific name on it. Speaking of them he said ". . . they would hardly be noticed except on careful search or by accident . . . corolla very small, about 2 mm in diameter when fully expanded . . ."

On a sheet of the type collection (US) there is one opened corolla, irregularly flattened and pressed out on only one side, measuring 2.5 mm from its center to the margin of the one pressed lobe, therefore, 5 mm in diameter. On a duplicate sheet (GH) there are two pressed corollas, well-flattened; one is ca. 4 mm long and the other is ca. 5 mm long.

Griggs must have been overly impressed by the minute *undeveloped* flower buds. In *Physalis* old plants reflowering under unfavorable conditions may produce small flower buds which either fall unopened, or, sometimes, produce small undeveloped flowers. This is another characteristic complicating the taxonomy of the genus.

In any event, this species is *not* characterized by extremely small flowers, although it is in the small-flowered series, so this emendation to the description is necessary to permit future identification of the species, and to prevent its being redescribed in the future on the basis of young, vigorous plants with well-developed flowers.

It might also be noted that the type collection is of material from which the larger leaves have fallen.

COLLECTIONS EXAMINED. MEXICO: COLIMA: along road between El Ciruelo and Cuyutlan, Manzanillo, Mar. 11, 1943, *Gilly et al 11* (MICH); GUERRERO: Acapulco, Oct. 1894 to March 1895, *Palmer 304* (Type: US; Isotype: GH); Acapulco, *Thiebaut 1101* (P). COSTA RICA: Braxilito Bay, July 2, 1932, *Howell 10205* (GH, US); Murcielago Bay, July 2, 1932, *Howell 10211* (F); la base de Salises, July 1890, *Pittier 2634* (BR, US); sand beach, 5 km east of Puntarenas, Aug. 24, 1958, *Sauer, 2336* (WIS). HONDURAS: vicinity of El Zomorano, Morazan, July 21, 1949, *Standley 21520* (F). NICARAGUA: shady places, Asseradores Islands, Jan. 15, 1903, *Baker 147* (GH, MICH, NY, UC, US); sandy field, sea level, Corinto, Chinandege, July 19, 1947, *Standley 11555* (F).

80. **Physalis carnosa** Standley & Steyermark, Field Mus. Publ. Bot. **23**: 19. 1943.

Herbaceous, much-branched, prostrate or decumbent, stems 15-20 cm long; vestiture of very short, antrorsely curled, appressed hairs; leaf blades succulent, ovate to rhombic-ovate, principal ones 15-25 mm long, on petioles 5-12 mm long, nearly glabrous, or with a few hairs similar to the stem-hairs; flowering calyx 2-2.5 mm long, upper one-third or one-fourth divided into narrowly triangular to ovate-triangular lobes; flowering pedicels ca. 2 mm long; corolla 3-4 mm long, immaculate (but possibly faded); anthers 0.8-1.2 mm long, bluish-green, on filiform filaments ca. 1.5 mm long; fruiting calyx 5-angled, 10-13 mm long and 7-9 mm wide on pedicels 4-5 mm long; berry ca. 6 mm in diameter.

TYPE: *Julian A. Steyermark* 37766, sand dunes, alt. 1-2 meters, Ocos, San Marcos, GUATEMALA, Mar. 15, 1940. (F).

DEPARTMENT OF BOTANY AND THE RESEARCH FOUNDATION
OKLAHOMA STATE UNIVERSITY
STILLWATER, OKLAHOMA

## LITERATURE CITED

No attempt is made in the following list to duplicate the many citations made under the species names and their synonyms.

DUNAL, FELIX. 1852. *Physalis* in DeCandolle's Prodromus Systematicus Naturalis Regni Vegetabilis. Paris: Crapalet.

GREENMAN, J. M. 1900. Proc. Amer. Acad. Arts & Sci. **35**: 311-312.

HERMANN, PAUL. 1679-1686. Horti Academici lugduno-Batavia Catalogus . . . Pl. 571.

LANJOUW, J. & F. A. STAFLEU. 1964. Index Herbariorum, Regnum Vegetabile 31(1), ed. 5.

RYDBERG, P. A. 1896. The North American Species of *Physalis* and Related Genera. Mem. Torr. Bot. Club **4**: 297-374.

SLEUMER, H. 1950. Estúdios sobre el género *Dunalia*. Lilloa **23**: 117-142.

STANDLEY, P. C. 1924. Trees and Shrubs of Mexico. 1277-1288.

STANDLEY, P. C. 1931. Eutheta. Field Mus. Publ. Bot. **8**: 324.

WATERFALL, U. T. 1958. A Taxonomic Study of the Genus *Physalis* in North America north of Mexico. Rhodora **60**: 107-114; 128-142; 152-173.

# PINE HILLS ELYMUS

George L. Church

The wide variation from stout filaments to mere stubs in the glume structure of occasional populations of *Elymus Hystrix* L. strongly suggests that the origin may lie in the hybridization and introgression of the common glumeless forms with some other species of *Elymus* possessing well-developed glumes (Church 1967). In fact, experimental hybrids between *E. Hystrix* and *E. canadensis* L. var. *canadensis,* although sterile, exhibit spikes with abundant and setaceous glumes, intermediate between those of the parents. Also noteworthy is the fact that the same strain of glumeless *E. Hystrix* has been crossed with *E. Svensonii* Church, an endemic Tennessee species with long, setaceous glumes, to produce a partly fertile $F_2$. *Elymus Svensonii* in turn was crossed with *E. virginicus* L. var. *glabriflorus* (Vasey) Bush f. *glabriflorus,* a common form with relatively broad glumes in southeastern United States, to produce a vigorous, intermediate and segregating $F_2$ (Church 1967). Hence it seemed reasonable to expect that in habitats where *E. Hystrix* and f. *glabriflorus* were sympatric, natural hybridization might give rise to partly fertile plants variously intermediate between the parents.

An appropriate location in which to study hybridization of these two taxa was found on the limestone bluffs immediately adjacent to the Mississippi River drainage area near La Rue, Union County, Illinois. Fortunately, the area is maintained as a wildlife reservation by the University of Southern Illinois and through the kindness of Professor J. W. Voigt, the author was able to locate the station where collections of *Elymus* with setaceous glumes had been made. Here one may find *E. Hystrix* and abundant stands of *E. virginicus* that exhibit considerable variation in glume structure, and these populations constitute the major part of the present study.[1]

A diagram of the Pine Hills area, based on a tracing of the geological survey map of the region (Alto Pass Quad. U.S.G.S.), is shown in figure 1. In the upper section, the bluff of Devonian, sandy limestone rises a sheer 500 feet in places on the west side, as indicated by the contour lines. Immediately adjacent is a low, springy marsh through which the Big Muddy River (left middle) cuts through to the Mississippi River (lower left). The heavy line at the lower right represents Illinois Route 3, from which a dirt road leads eastward across a ditch and old railroad bed to the foot of the bluff. At this point the path continues through mixed, dense woodland northward, skirting the bluff, before it turns westward (upper left) and rises from the moist, shady low area to the dry wooded crest. Here the forest dominants include the Post Oak (*Quercus stellata* Wang.), Black Hickory (*Carya buckleyi* Sarg.), and Red Cedar (*Juniperus virginiana* L. var. *crebra* Fern. and Grisc.) particularly on the edges of dry, hilltop prairies. The name of the locality, however, stems from the rare stands of the southern Shortleaf Pine (*Pinus echinata* Mill.) just back from the bluff edges (Mohlenbrock and Voigt 1959, Voigt and Mohlenbrock 1964).

The *Elymus* populations are confined largely to the edges of woodlands all along the path as is indicated in figure 1. From the author's observations during two collecting trips in 1960 and 1961, *E. Hystrix* is confined largely to the shady moist woodlands at the swamp level of the trail, with occasional stands at the beginning of the higher and drier woodlands (upper left, fig. 1, "Government Rock", under one mile scale). Scattered along the lower trail but much more abundantly on the upper dry bluff area are stands of *E.*

---

[1]These studies were greatly facilitated by generous support from the Section for Systematic Biology of the National Science Foundation — grants GB-180 and G-9046. For assistance in the breeding program, I wish to thank Roger W. Farrington, Michael S. Greenwood and Susan R. McGunigle.

*virginicus* var. *glabriflorus* which is readily distinguished from other varieties by longer glumes, longer lemma awns and well-exserted spikes (Fernald 1933). It is distinguished also from *E. canadensis* L. var. *canadensis*, with which it could be confused, by the indurated, non-striated bases of the occasionally bowed glumes, the shorter, obtuse (rather than clearly bi-dentate) tipped paleas and the very erect spikes.

One variant of var. *glabriflorus* has scabridulous glumes and lemmas: it is forma *glabriflorus* and will often be referred to in the remainder of this paper as f. *glabriflorus*. The other variant of var. *glabriflorus* has densely hirsute glumes and lemmas: it is forma *australis* and will often be referred to as *f. australis*. Both taxa grow in close association (figs. 1, 3, 4).

Quite unique among all *Elymus* at Pine Hills are populations with very setaceous glumes that appear to be natural hybrids of *E. Hystrix* and either f. *glabriflorus* or f. *australis* (fig. 4). The glume structure has, in fact, been the basis of former identification of these stands as representatives of *E. canadensis* L. var. *interruptus* (Buckl.) Church, a very different taxon (Mohlenbrock and Voigt 1959, Church 1967). These putative hybrids lie in greatest concentration at the first part of the path along the dry bluff just above the moist basal section (fig. 1). The locality would appear to be an area where *E. Hystrix* and *E. virginicus* come into contact. Here the cut and scraped margins of woodland paths offer a disturbed and therefore favorable habitat for the spread of hybrids between these parents.

## THE NATURAL HYBRIDS

A study of the variable populations with respect to spikelet structure, cytology of meiosis of the pollen-mother-cells and fertility, measured by percentage of mature seeds, has presented two basic types: — *a*, those with glabrous lemmas, represented by 2670[2] (fig. 4) and *b*, those with

[2]Numbers refer to the author's collections in the Brown University Herbarium.

hirsute lemmas 2662 (fig. 4). As the diagram in figure 1 indicates, the putative hybrids are closely associated with either f. *glabriflorus* or f. *australis;* 2652, 2613 respectively (fig. 4).

Within group *a,* some populations have glumes that are heavily indurated and bowed at the base but taper to a setaceous awn and in these features resemble f. *glabriflorus,* 2595 (fig. 7). The longer (8 mm.) paleas, with truncate apices, however, suggest an *E. Hystrix* relationship. Based on a normal average of two seeds per spikelet, only 4% seed is formed. Much more frequent are forms (2668, 2670, figs. 2 and 4) with setaceous glumes, 0.2-0.5 mm. wide and pairs unequal in length, 12-15 or 18-30 mm. long. The reduction of occasional glumes to stubs and the partly spreading spikelets again suggest an *E. Hystrix* parentage. The ciliate margins of the paleas, on the other hand, are characteristic of f. *glabriflorus.*

Examination of pollen-mother-cells (at least 50 in each stage) reveals chiasma frequencies of 1.73-1.92 (median 1.90), two or three bridges at first meiotic anaphase and extrusions in ca. 25% of the mature pollen. Seed set is ca. 50% (20-60%).

In addition to the hirsute lemmas, the *b* group of putative hybrids is characterized consistently by filiform glumes of various lengths and a pronounced, overall glaucous appearance, which is frequently a characteristic of *E. Hystrix,* (2669 — fig. 6). Cytological irregularities are comparable in nature and frequency to those found in group *a,* with the exception of the appearance of 3-4 accessory chromosomes in the early stages of pollen-mother-cell meiosis.

Three specimens collected as living plants (2251, 2653, 2662) had seed sets of 0, 20, and 35%. It is significant that root-divided clones of these plants, grown in greenhouse pots and surrounded by closely grouped pots of *E. Hystrix* and f. *australis,* increased in seed set over three years as much as 80%. Evidence, then, for the possible origin of new forms by introgressive hybridization is rather convincing.

The following study is an attempt to demonstrate the ancestry of the hybrids by experimental crosses between the putative parents.

## EXPERIMENTAL HYBRIDS

### 1. *E. Hystrix* crossed with *E. virginicus* var. *glabriflorus* f. *glabriflorus*

*Sympatric crosses.* A cross of 2669 *(E. Hystrix)* with pistillate 2652 (f. *glabriflorus*) produced a single intermediate $F_1$ plant (1:3:220),[3] (fig. 5). The $F_2$ (17:17)[4] segregated to give 15 fertile plants resembling f. *glabriflorus* and 2 intermediates resembling the $F_1$. One of the intermediates was sterile and the other 30% fertile. The latter had culms 60 cm. tall compared to parental culms of 100 cm., spikes 6 cm. long compared to 10-12 cm., glume width 1 mm. compared to the extremes of lacking or 1.5 mm. in the parents. The ratio of lemma body to awn length was 1:4 as in *E. Hystrix* compared to that of 1:3 in f. *glabriflorus.*

The essentially reciprocal cross (5:5:43) (fig. 6) resulted in an $F_1$ characterized by more setaceous (0.3 mm. wide) glumes, unequal in length and with indurated bases. These plants resembled rather closely natural hybrids such as 2670 (fig. 4) but were sterile. Other crosses with the same strains were failures (0:110).

*Allopatric crosses.* A collection of 2368 *(E. Hystrix)* from Rice County, Minnesota, consisted of vigorous plants with frequent vestigial glumes on the spikes. Material grown from seed in the greenhouse, however, was quite free of glumes and was employed successfully in crosses with f. *glabriflorus* from Pine Hills (figs. 9 and 10).

---

[3]Three numbers in ( ) indicate: — surviving seedlings: seeds planted: florets emasculated. Occasional numbers in [ ] indicate original numbers of seeds germinated as opposed to number of surviving plants.

[4]Two numbers in ( ) indicate: — plants obtained: $F_1$ seeds planted, unless otherwise specified, as in failure of original cross.

In the case of crosses employing 2607 (f. *glabriflorus*), one produced a single, sterile $F_1$ plant (1:1:64) but the other (fig. 9) (1:2:42) gave rise to a partly fertile, intermediate plant (glumes 0.4 mm. wide) that strongly resembled many of the wild, putative hybrids from Pine Hills (2670, fig. 4). The $F_2$ (8:60) consisted of 2 partly fertile plants like f. *glabriflorus* and 6 intermediates with filiform glumes. One of the latter plants produced seeds (20:224) from which 4 $F_3$ individuals arose; these have remained vegetative.

The number of progeny obtained (10:51:121) was even greater in another cross in which 2603 (f. *glabriflorus*) was used as the pistillate parent (fig. 10), this collection being substantially identical to 2607. Again, the $F_1$ strongly resembled wild forms (2670, fig. 4) except for a slightly higher frequency of stubs among the setaceous glumes of the experimental hybrids. Three of this $F_1$ were fertile, 4 were sterile and the rest failed after the seedling stage. The survivors were ca. 15% fertile compared to 55% for the parents growing under the same greenhouse conditions.

Studies of the pollen-mother-cells revealed an average chiasma frequency of 1.91 compared with 1.98 for the parents. Although one or two bridges occurred in 40% of the first meiotic anaphases, less than 5% of the pollen showed extruded chromatin in the cytoplasm.

The $F_2$ (18[24]:43:274) consisted of 3 sterile plants resembling f. *glabriflorus*, one partly fertile *E. Hystrix*, 6 seedlings that failed and 8 partly fertile intermediates that looked very much like the $F_1$.

The reciprocal of the preceding cross produced an $F_1$ (4[5]:20:162) that consisted of one sterile and 3 intermediates that were 25% fertile. The $F_2$ (14:20) of 10 plants have remained vegetative for 3 years. The other survivors were ca. 12% fertile and resembled *E. Hystrix* with filiform glumes.

2. *E. Hystrix* crossed with *E. virginicus* var. *glabriflorus* f. *australis*

*Sympatric crosses.* In attempts to reproduce the natural hybrids with hirsute lemmas (2662, fig. 4), 2669 *(E. Hystrix)* was crossed with three morphologically identical strains 2613, 2647 and 2648 (all f. *australis*) with no success (0:110, reciprocal 0:77).

*Allopatric crosses.* The seeds of a cross of 2647 (f. *australis*) from Pine Hills with 2368 *(E. Hystrix)* from Minnesota failed to germinate (0:4:60). A similar failure resulted from a cross of the same 2647 with 2642 *(E. Hystrix)* from Michigan (0:5:56).

In the cross of pistillate 2669 *(E. Hystrix* from Pine Hills) with 2615 (f. *australis* from Tennessee) 3 plants were obtained (3:3:30). One of this $F_1$ remained vegetative, but the other two produced spikes that were glaucous like the pistillate parent but had hirsute lemmas inherited from the staminate parent. The long, setaceous glumes of irregular lengths gave these plants an appearance closely resembling some of the natural hybrids at Pine Hills 2662, fig. 4). After having remained sterile for 4 years, one of the spikes had a seed set of 18% which was apparently the result of selfing in this $F_1$.

Intermediate $F_1$ plants were also obtained when the same strain of *f. australis* from Tennessee was crossed with strains of *E. Hystrix* outside of Illinois. Pistillate 2615 (f. *australis*) crossed with 2643 (*E. Hystrix* from Michigan) resulted in 8 vigorous, intermediate $F_1$ plants (8:12:214), only one of which was fertile (2%).

The cross of pistillate 2369 *(E. Hystrix* from Wisconsin) with 2615 (f. *australis*) produced even more vigorous $F_1$ plants (3:5:18). These intermediates were sterile during the first year. In the second year, 19 spikes of this same $F_1$ were bagged and 24 seeds were harvested from 2578 florets. Ten $F_2$ plants were obtained (10:24). Although they were considerably less vigorous than the $F_1$, they exhibited a wide range of combinations of glume structure and lemma surface. Some plants resembled *E. Hystrix* in having no glumes but the lemmas were very hirsute. Several resembled the natural hybrids with hirsute lemmas from Pine

Hills mentioned above. All $F_2$ plants were sterile except one that was bagged and yielded 2 seeds in 480 florets.

3. *E. Hystrix* crossed with *E. virginicus* var. *virginicus*

Since the Pine Hills population 2600 (var. *virginicus*, fig. 3) with wide, indurated glumes and included spikes did not appear to play a direct role in the origin of the hybrid forms under study, only a few attempts at crossing with sympatric *E. Hystrix* were made and all of these were failures.

Among a series of unsuccessful allopatric crosses, the hybrid obtained by pollinating 2614 (var. *virginicus*) from Tennessee with 2642 *(E. Hystrix)* from Michigan yielded one fertile intermediate plant (1:1:72). Six surviving $F_2$ plants exhibited a variety of glume structures from setaceous to moderately wide and striated. The setaceous glume forms had a seed set of 10% compared with ca. 100% for the parents. One $F_2$ plant closely resembled *E. Hystrix* with occasional filiform glumes and was quite fertile.

4. Natural Hybrid *E. Hystrix* × *E. virginicus* f. *glabriflorus* crossed with f. *glabriflorus*

A representative of the natural hybrid population 2668 is shown in figures 2 and 8. It has a spike 20 cm. long, spreading spikelets and setaceous (0.2-0.3 mm. wide) glumes of unequal lengths. Sympatric crosses employing 2659 (f. *glabriflorus*) pollen were made, but the seedlings obtained all died at an early stage (0[9]:31:131). One cross (fig. 8), however, was particularly successful (12:16:63). This $F_1$ was intermediate between the parents and ca. 50% fertile. In comparison the parents were 10% (2668) and 90% (2659). The $F_2$ (12:42) segregated to give 4 fertile plants resembling 2668, 3 partly fertile plants resembling f. *glabriflorus* and 5 intermediate forms closely resembling the $F_1$ (fig. 8). These $F_2$ intermediates had an average seed set of 60% (with a range of 0-90%).

The reciprocal cross with the same 2668 and 2663 (f.

*glabriflorus*, similar to 2659) produced 2 intermediate $F_1$ plants (2:3:54) (fig. 2). One of these intermediates produced a single seed that gave rise to a partly fertile $F_2$ which resembled f. *glabriflorus* except for a glaucous appearance like that of the staminate 2668 (natural hybrid).

The data seem to indicate strongly, then, that 2668 is a hybrid and the experimental crosses with f. *glabriflorus* represent backcrosses with one of its parents. No allopatric crosses were made.

5. Natural Hybrid *E. Hystrix* × *E. virginicus* f. *australis* crossed with *E. Hystrix*

*Sympatric crosses.* A cross of pistillate 2657 (Natural Hybrid from Pine Hills) and 2669 *(E. Hystrix)* was a failure (0:50). However, the reciprocal cross gave a single, intermediate plant (1:3:59). Whereas the parental strain of the Natural Hybrid had setaceous glumes (0.2 mm. wide) with frequent striations, the $F_1$ plant had mostly filamentous, non-striated glumes and was strikingly fertile (40 seeds from 104 florets). The surviving $F_2$ of 38 plants has flourished in greenhouse pots for 3 years and has increased in fertility (as measured by seed set on 25 spikes) from 22-39%. The glumes of this $F_2$ are practically all filamentous from an indurated base or occasionally reduced to stubs and very rarely marked by a fine striation. This experimentally produced hybrid population had an even greater resemblance to strains of *E. Hystrix* with variable glume structure than did the parental strain 2657 (Natural Hybrid).

*Allopatric crosses.* Another strain 2653 (Natural Hybrid) was pollinated with 2643 *(E. Hystrix)* from Michigan with even greater success (10:28:67) than in sympatric crosses. The 2643 parent had quite glabrous lemmas and no glumes. The $F_1$ in this experimental cross had glumes more reduced and setaceous than those of the Natural Hybrid 2653. In the $F_2$ (38:90), 22 of the plants remained vegetative and the rest were intermediate in appearance like the $F_1$. Only 3 seeds arose in the $F_2$.

6. Natural Hybrid *E. Hystrix* × *E. virginicus* f. *australis* crossed with f. *glabriflorus*

*Allopatric cross.* In a cross of pistillate 2694 (f. *glabriflorus* from North Carolina) with 2651 (Natural Hybrid from Pine Hills), an $F_1$ of 2 plants was obtained (2:3:116). One of these had glumes approaching those of f. *glabriflorus* in width, hirsute lemmas like the Natural Hybrid and was sterile. The other plant had hirsute lemmas but setaceous glumes and a seed set that increased from 10% to 35% in the same potted individual after 4 years. The $F_2$ of 10 plants (10:18) exhibited considerable variation in glume structure but very few seeds. A reciprocal cross (2:9:45) had glumes intermediate between those of the parents but was quite sterile.

7. Experimental intervarietal hybrids of *E. virginicus*

Reciprocal crosses of 2600 (var. *virginicus* from Pine Hills) and sympatric 2663 (f. *glabriflorus*) failed (0:11:60 and (0:8:58). Reciprocal crosses of 2600 (var. *virginicus*) and allopatric 2615 (f. *australis* from Tennessee) did not even produce any seeds (0:64 and 0:90). As far as this limited data are concerned, these forms of *E. virginicus* appear genetically isolated from var. *virginicus*.

The question to arise next is the degree of isolation between f. *glabriflorus* and f. *australis*. After several failures, a cross of 2609 (f. *glabriflorus*) pistillate from Pine Hills and sympatric 2613 (f. *australis*) resulted in a single plant (1[8]:8:34). This $F_1$ individual had a seed set of 17% compared with parental yields of 53% pistillate and 49% staminate. Two $F_2$ survived (2:17). They had hirsute lemmas and were fertile. In the reciprocal cross with 2613 (f. *australis*) as the pistillate parent, 4 $F_1$ plants were obtained (4[10]:17:131). In contrast to the overall hirsute appearance of the spike in f. *australis*, these $F_1$ individuals were hirtellous only on the lemmas and were 20% fertile. The $F_2$ (0:18) was a failure.

In a cross of 2648 (f. *australis* from Pine Hills) with allopatric 2688 (f. *glabriflorus* from Virginia) as the pistillate parent a rather high percentage of seed was obtained (10:18:27). These $F_1$ plants were hirsute like f. *australis* but were stunted and sterile.

8. Crosses of *E. canadensis* L. var. *canadensis* with sympatric *E. virginicus* f. *australis*

Since *E. canadensis* var. *canadensis* is known to cross fairly readily with strains of *E. virginicus* in other areas (Church 1958, 1967), it was thought appropriate to test the degree of genetic isolation between representatives of these taxa at Pine Hills. A cross of 2611 (var. *canadensis*, fig. 3) with staminate 2597 (f. *australis*) produced 8 seedlings that died at an early stage of development (0:8:82). The reciprocal cross failed. Although these data are limited, genetic barriers between these taxa appear strong.

## CONCLUSIONS AND SUMMARY

Examination of Chart A presents a summary of the results of the experimental crosses of *Elymus* species as they relate primarily to the origin of the Pine Hills, Illinois hybrid populations of *E. Hystrix* crossed with sympatric *E. virginicus f. glabriflorus* or f. *australis*. Chart B indicates the genetic compatibility of these parents and their hybrids from selected areas of their range in eastern United States.

Natural Hybrid *E. Hystrix* × *E. virginicus* f. *glabriflorus*

The data presented indicate clearly that the origin of forms of *E. virginicus* with setaceous glumes and glabrous lemmas lies in natural hybridization between *E. Hystrix* and *E. virginicus* f. *glabriflorus*. In sympatric parental populations (Chart A), barriers to hybridity are quite strong as is evident from the high percentage of failures or sterility in the $F_1$. Since, however, partly fertile intermediates resembling natural hybrids appear in the $F_2$

from even a single $F_1$ plant, the origin of natural hybrids is demonstrated. Although similar barriers to crossing are encountered when allopatric *E. Hystrix* is employed, (Chart B) partly fertile forms similar to the natural hybrids have appeared in both the $F_1$ and $F_2$. Again the parents of the wild hybrids are identified.

In a series of the allopatric crosses of *E. Hystrix* with f. *glabriflorus*, it is noteworthy that in over half of the cases sterility was not encountered until the $F_2$ was fully developed. Probably related to these results is the fact that out of 10 inter-strain allopatric crosses of f. *glabriflorus*, only 5 gave offspring with seed set over 60%. The implied existence of genes that make for intra-specific incompatibility might also explain the lack of uniform results in all allopatric crosses of *E. Hystrix* with f. *glabriflorus*.

Of particular significance is the fact that the natural hybrids cross readily with sympatric f. *glabriflorus* (Chart A), and the offspring are still intermediate in appearance but with a much higher average of wider (0.5 mm. rather than 0.2 mm.) glumes and fewer reduced stubs than appear in the natural hybrid parent. The seed set of 25% would seem to be sufficient to maintain such back-crossed or introgressed (*E. Hystrix* into f. *glabriflorus*) populations under field conditions and thereby establish the basis for the evolution of a new taxon through further back-crossing and attendant increased fertility.

Natural Hybrid *E. Hystrix* × *E. virginicus* f. *australis*

It has been more difficult to produce the type *b* (hirsute lemmas) natural hybrids than in the case of type *a* (glabrous lemmas). Although the *b* type hybrids are encountered frequently at Pine Hills, barriers to crossing between the sympatric *E. Hystrix* and f. *australis* populations are very strong. However, experimental partly fertile hybrids, closely resembling the natural hybrids were obtained in the $F_1$ in the case where the f. *australis* parent came from Tennessee (Charts A and B).

Furthermore, the fact that partly fertile hybrids similar to those at Pine Hills appeared in the $F_2$ of experimental crosses in which neither parent came from Illinois, certainly is indicative of significant genetic compatibility between these taxa in broad segments of their ranges.

Finally, the fact that the experimental crosses of the natural hybrids to either sympatric or allopatric *E. Hystrix* resulted in $F_2$ plants resembling the parental natural hybrids but with increased fertility, is strong evidence of the ability of the natural hybrids to become the basis of new taxa under field conditions as in the case of the type *a* hybrids considered above.

The varieties of *E. virginicus*

Since the major effort of the program of experimental hybridization has focused on *E. Hystrix*, the data pertaining to the varieties of *E. virginicus* per se are rather limited. However, there would appear to be definite genetic barriers between f. *glabriflorus* and f. *australis* in all cases reported (Charts A and B), although in one instance these were not reached until the $F_2$. In spite of the fact that f. *australis* appears as merely a robust, hirsute variant of *E. glabriflorus* var. *glabriflorus*, studies so far show strong genetic isolation from not only f. *glabriflorus* (Chart A) but also from the common var. *virginicus* (Chart B).

The evolutionary status of *E. Hystrix*

In the large number of inter-generic hybrids, natural or artificial, that have been reported in the Hordeae tribe of the Gramineae, all are sterile (Church 1967). In contrast, the many experimental hybrids involving *E. Hystrix* in these studies maintain at least partial fertility in the $F_2$. It seems unjustifiable, therefore, to maintain this species in a separate genus (*Hystrix patula* Moench).

As previously noted, many of the segregates of experimental crosses of *E. Hystrix* with *E. virginicus* f. *glabriflorus* are intermediate in glume structure between the parents. It should be noted further that these hybrids vary in spikelet structure: the majority have spikelets of several florets more or less adherent to the rachis but others have spreading spikelets of few florets. These latter segregates resemble *E. Hystrix* except for the abundant filiform glumes. Such "glumed forms" of *E. Hystrix* are encountered in many parts of the range of the species (Church 1967). Samples of such a population from North Carolina (2698) have been observed to breed essentially true from seed with varying percentages of seed set in the progeny of the two generations studied. In general, the spikes have an appearance suggesting introgression from f. *glabriflorus* into *E. Hystrix* rather than the reverse pattern of gene flow that is indicated in the Pine Hills natural hybrids. Both of the putative parents lie well within the range of populations like 2698 in both North and South Carolina, and it is possible that hybrids intermediate between *E. Hystrix* and *E. virginicus* var. *glabriflorus* have arisen in this eastern part of their range as they have in Pine Hills.

It is conceivable, on the other hand, that populations of *E. Hystrix* with glumes represent a primitive condition of the species, in which case the glumeless condition might be the result of subsequently established mutations occurring in populations ecologically isolated from other *Elymus* species. Possibly the glumeless condition is basically homozygous recessive, since in a cross of *E. virginicus* f. *glabriflorus* with staminate *E. Hystrix*, only one of 20 $F_2$ plants was identical to *E. Hystrix* with glumes entirely missing in addition to being 50% fertile.

The strikingly different overall appearance between *E. Hystrix* and *E. virginicus* var. *glabriflorus* f. *glabriflorus* (or f. *australis*) masks their strong genetic affinity. However, a parallel case within the genus is presented by the facility with which strains of *E. virginicus* var. *virginicus* and the very different appearing *E. canadensis* var. *canadensis* will cross in some instances to produce $F_1$ populations, some of which are slightly fertile (Brown and Pratt 1960, Church 1958, Pohl 1959).

In relation to *E. Hystrix* attention is directed also to *E. californicus* Gould, an endemic of the San Francisco area, which was formerly placed in the genus *Hystrix* (Gould 1947). The somatic chromosome number of 56 (Stebbins, G. L. in Myers, E. M. 1947) would indicate that this species is octoploid in contrast to the somatic complement of 28 for *E. Hystrix*. The author has succeeded in raising a few plants of *E. californicus* in the greenhouse at Brown University but in two growing seasons they have not reached maturity and, therefore, crossing experiments between these two species remain for future study.

BROWN UNIVERSITY
BOTANICAL LABORATORIES
DIVISION OF BOTANICAL AND MEDICAL SCIENCES
PROVIDENCE, RHODE ISLAND

LITERATURE CITED

BROWN, W. V. and G. A. PRATT. 1960. Hybridization and introgression in the grass genus *Elymus*. Amer. Jour. Bot. **47(8)**: 669-676.

CHURCH, G. L. 1958. Artificial hybrids of *Elymus virginicus* with *E. canadensis, interruptus, riparius* and *wiegandii*. Amer. Jour. Bot. **45(5)**: 410-417.

———— 1967. Taxonomic and Genetic Relationships of Eastern North American Species of *Elymus* with Setaceous Glumes. Rhodora **69**: 121-162.

FERNALD, M. L. 1933. Types of some American species of *Elymus*. Rhodora **35**: 187-198.

GOULD, F. W. 1947. Nomenclatorial Changes in *Elymus* with a Key to the Californian Species. Madroño **9**: 120-128.

MOHLENBROCK, R. H. and J. W. VOIGT. 1959. A Flora of Southern Illinois. Southern Illinois University Press.

POHL, R. W. 1959. Morphology and cytology of some hybrids between *Elymus canadensis* and *E. virginicus*. Proc. Iowa Acad. Science **66**: 157-159.

STEBBINS, G. L. in Myers W. M. 1947. Cytology and Genetics of Forage Grasses. Bot. Rev. **13**: 319.

VOIGT. J. W. and R. H. MOHLENBROCK. 1964. Plant Communities of Southern Illinois. Southern Illinois University Press.

Plate 1357.

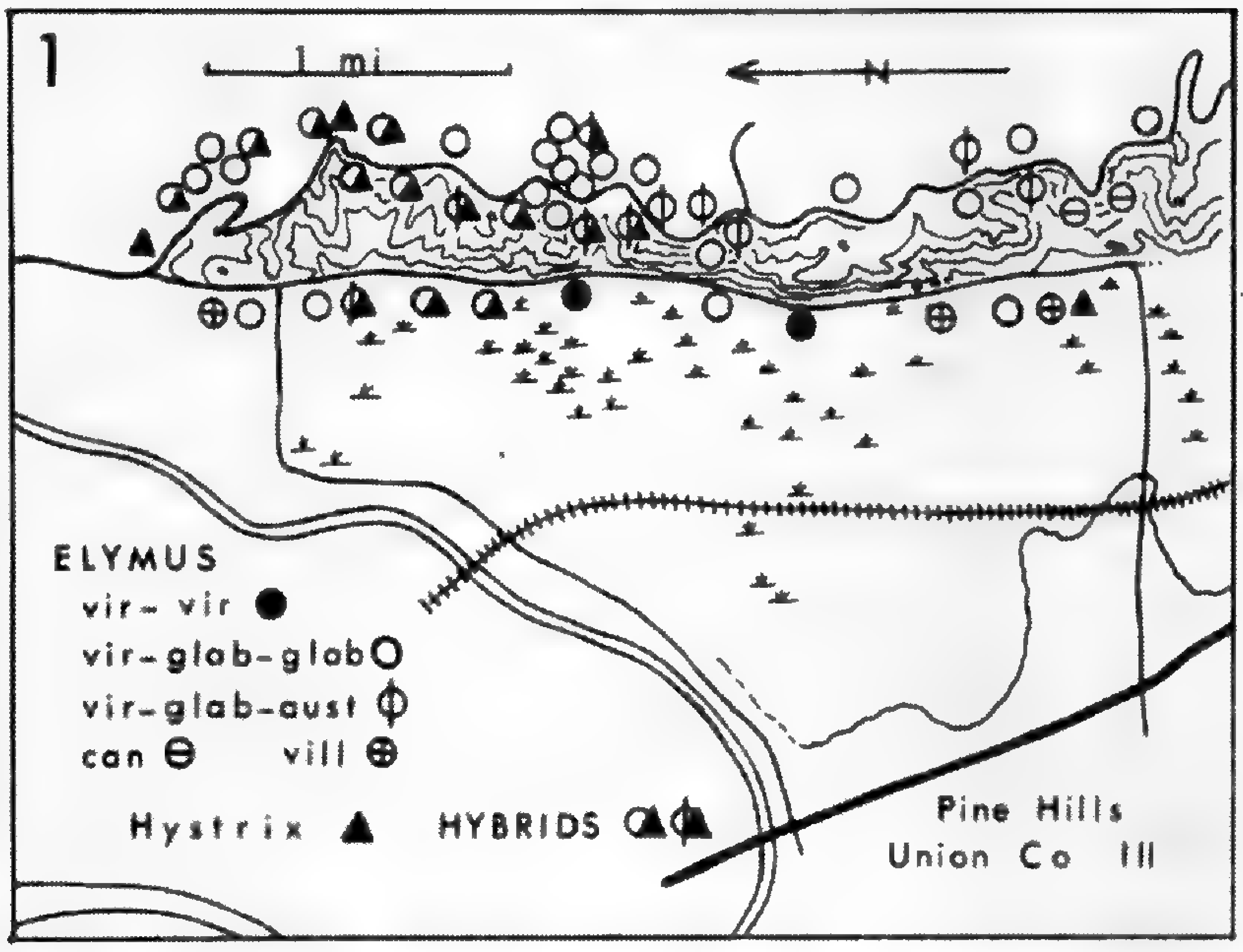




Fig. 1. Topographic diagram of the Pine Hills area showing distribution of parental and hybrid species of *Elymus:* see text for explanation.

Fig. 2. left to right — *E. virginicus* f. *glabriflorus* 2663; experimental $F_1$; natural hybrid of *E. Hystrix* × *E. virginicus* f. *glabriflorus* 2668.

Plate 1358.

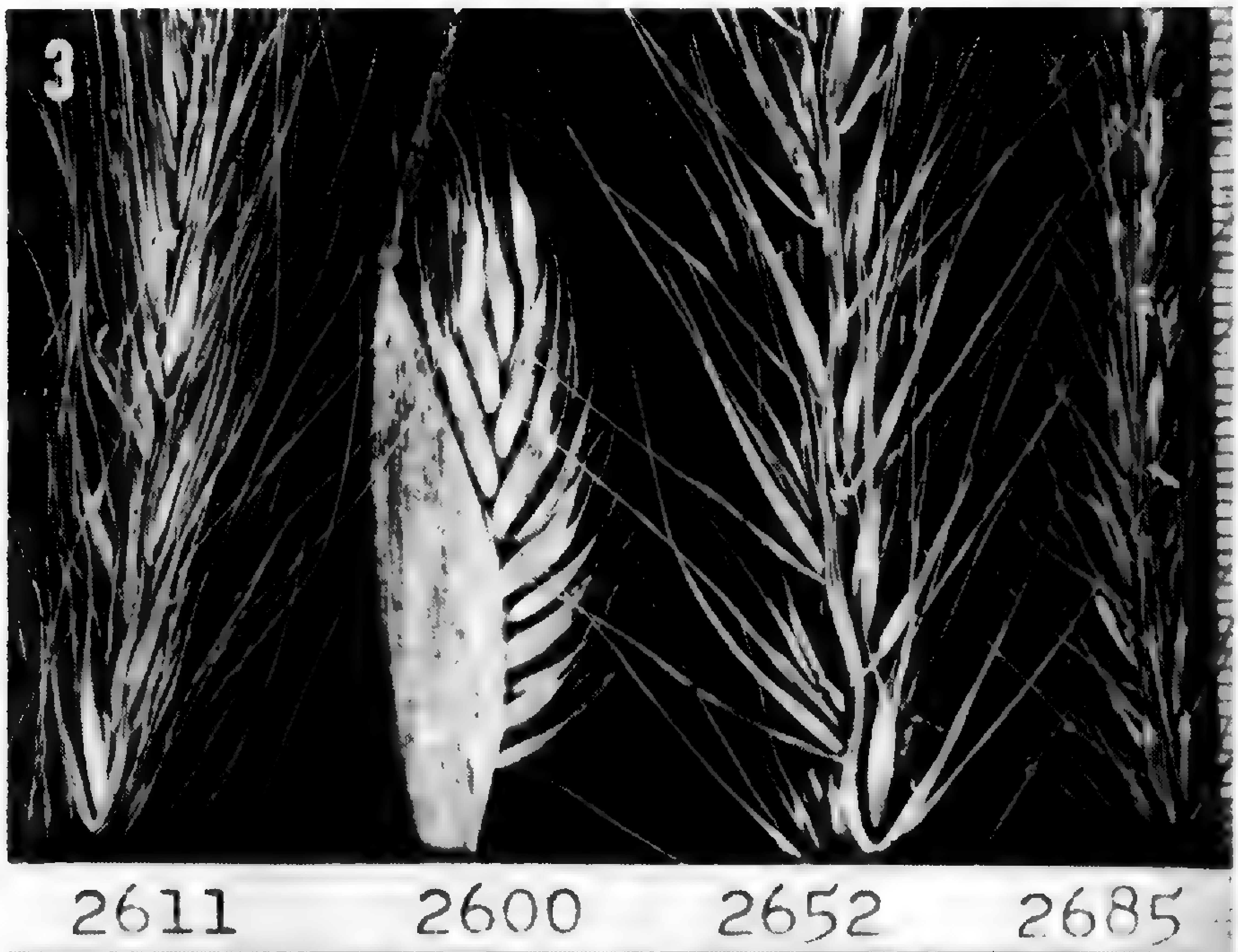




Fig. 3. left to right — *E. canadensis* var. *canadensis* 2611; *E. virginicus* var. *virginicus* 2600; *E. virginicus* f. *glabriflorus* 2652; *E. villosus* 2685.

Fig. 4. left to right — *E. virginicus* f. *glabriflorus* 2652; natural hybrid *E. Hystrix* × *E. virgincus* f. *glabriflorus* 2670; natural hybrid *E. Hystrix* × *E. virginicus* f. *australis* 2662; *E. virginicus* f. *australis* 2613.

Plate 1359.


Fig. 5. experimental $F_1$ of *E. virginicus* f. *glabriflorus* 2652 (pistillate) × *E. Hystrix* 2669.

Fig. 6. left to right — E. *Hystrix* 2669 (pistillate — one spikelet removed at each node for clarity); experimental $F_1$; *E. virginicus* f. *glabriflorus* 2656 (staminate).

Plate 1360.


Fig. 7. natural hybrid *E. virginicus* f. *glabriflorus* × *E. Hystrix* 2595.

Fig. 8. left to right — natural hybrid *E. Hystrix* × *E. virginicus* f. *glabriflorus* 2668 (pistillate — some spikelets removed); experimental hybrid (probable backcross); *E. virginicus* f. *glabriflorus* 2659 (staminate).

Plate 1361.


Fig. 9. left to right — *E. Hystrix* 2368 (pistillate, some spikelets removed); experimental $F_1$ hybrid; *E. virginicus* f. *glabriflorus* 2607 (staminate).

Fig. 10. left to right — *E. virginicus* f. *glabriflorus* 2603 (pistillate); experimental $F_1$ hybrid; *E. Hystrix* 2368 (staminate — some spikelets removed).

## SYMPATRIC CROSSES

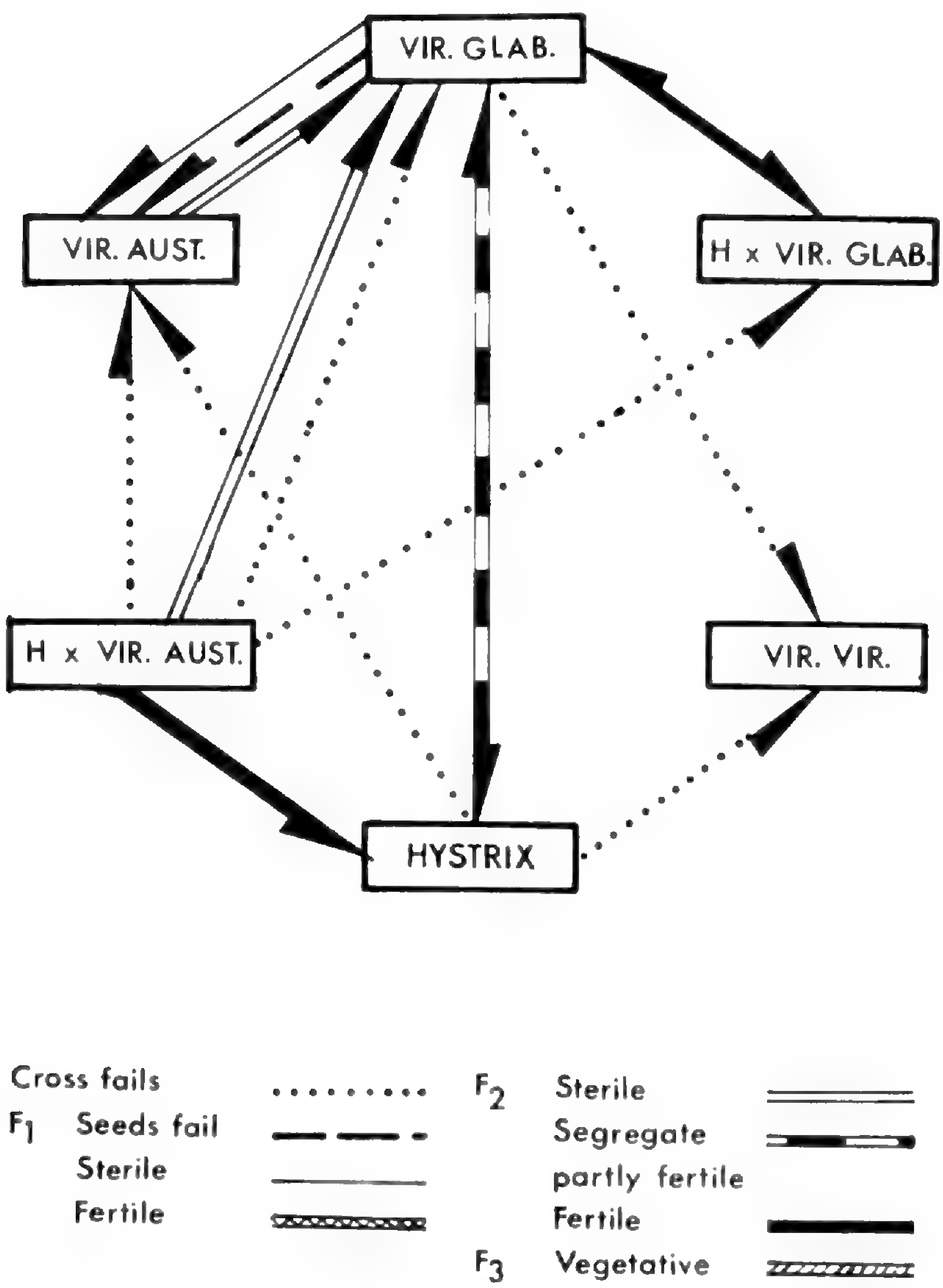



Chart A

## ALLOPATRIC CROSSES

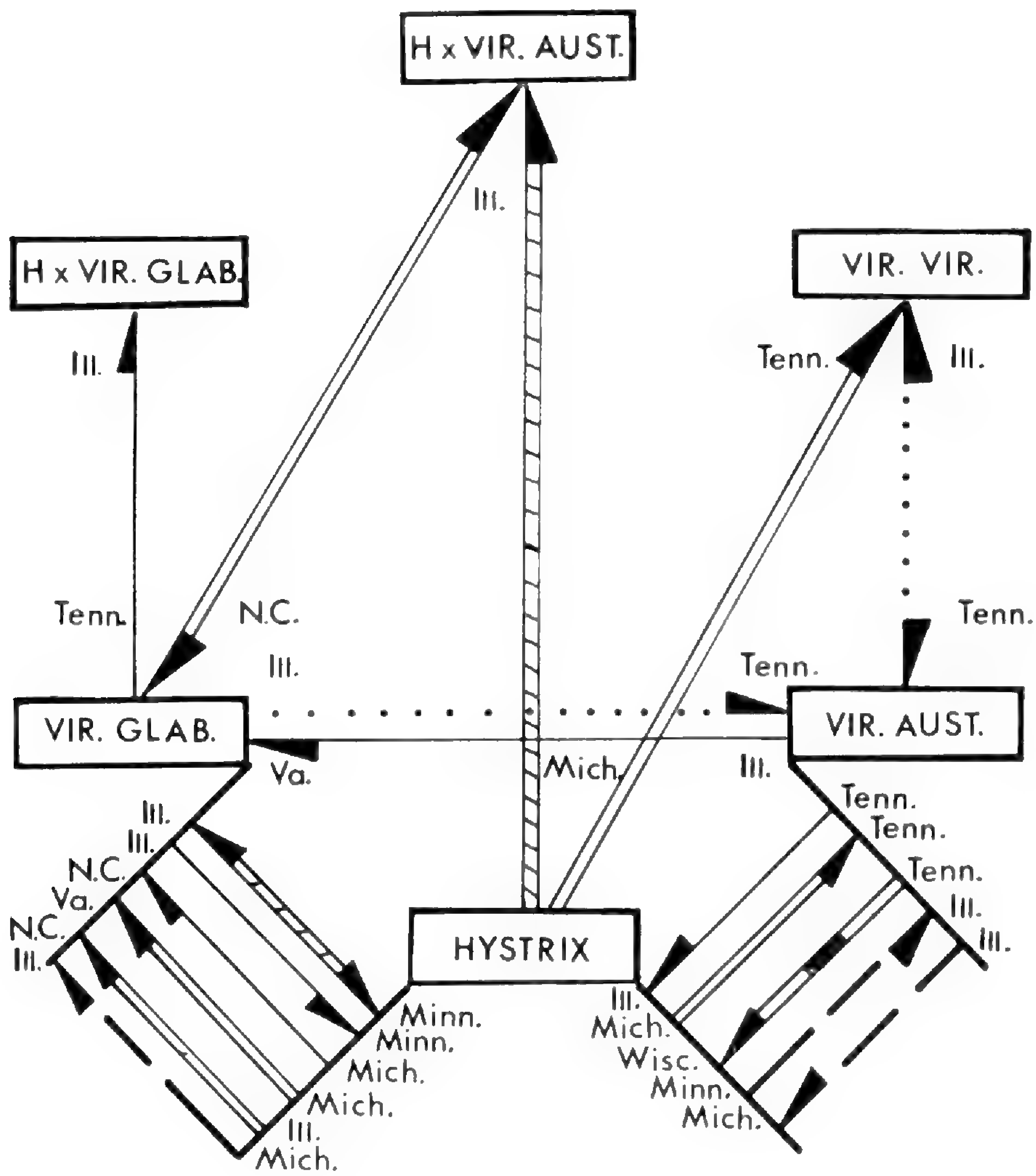



Chart B

HYSTRIX — *Elymus Hystrix*
VIR VIR — *Elymus virginicus* var. *virginicus*
VIR GLAB — *Elymus virginicus* var. *glabriflorus* f. *glabriflorus*
VIR AUST — *Elymus virginicus* var. *glabriflorus* f. *australis*
H × VIR GLAB — Natural Hybrid between *Elymus Hystrix* and *E. virginicus f. glabriflorus*
H × VIR AUST — Natural Hybrid between *Elymus Hystrix* and *E. virginicus* f. *australis*

STUDIES IN THE EUPATORIEAE, (COMPOSITAE)

IV

R. M. King

## HOFMEISTERIA

Walpers in Walp. Repert. **6**: 106. 1846. (Type species *Helogyne fasciculata* Benth.) *Podophania* Baill. Bull. Soc. Lin. Paris. **1**: 268. 1880. (Type species *Phania* ? *dissecta* Hook. & Arn.)

Woody sub-shrubs or perennial herbs. Leaves in 2/5 phyllotaxy (usually congested at flowering nodes, appearing whorled). Inflorescence monocephalic. Heads broadly campanulate, (100) 150-175 (250) flowered. Phyllaries numerous, multiseriate, densely imbricated, narrowly lanceolate. Receptacle convex, naked. Florets discoid, perfect, 5 lobed, white, pink, or lavender, glabrous, narrowly tubular. Stamens 5, appendaged. Pollen tricolpate, surface nearly smooth. Pappus in a single series, usually consisting of setae and intervening squamae. Achenes narrowly prismatic, 5 ribbed, ribs setose, sub-cuticular cells of ribs and lateral walls with many minute punctations, carpopodium somewhat flaring, with many rows of short or transversely elongate cells; basal foramen prominent with an even margin. Chromosome number determined from one species as $X = 18$ (Kyhos, unpublished), $X = 19$ (Turner & Flyr 1966).

The species of *Hofmeisteria* may be distinguished by the following key:

1. Anther appendages appressed, not visible at 10 × magnification .......... 2
1. Anther appendages erect, visible at low magnification .......... 3
   2. Pappus of 12-15 setose bristles of rather uniform length .......... 1. *H. dissecta*
   2. Pappus of 5-6 long setae with intervening short, very lacerate

squamae ........................................................ 2. *H. sinaloensis*
3. Pappus consisting of 5-6 long setae with essentially no intervening members ........................................................................ 4
3. Pappus consisting of 3-5 long setae with distinct intervening groups of short setae or squamae ............................................ 6
4. Leaves only lobed and dentate, not dissected .... 3. *H. standleyi*
4. Leaves dissected ........................................................................ 5
5. Segments narrow with few teeth restricted distally ........... ............................................................................ 4. *H. schaffneri*
5. Segments broad with many teeth ................ 5. *H. urenifolia*
6. Leaf lamina broad ................................................ 6. *H. fasciculata*
6. Leaf lamina narrow, filiform ...................................................... 7
7. Peduncles highly differentiated, arising from a cluster of leaves ............................................................... 7. *H. crassifolia*
7. Peduncles not highly differentiated, not arising from a cluster of leaves ............................................................... 8. *H. filifolia*

1. **Hofmeisteria dissecta** (Hook. & Arn.) R. M. King and H. Robinson. Phytologia 12: 466. 1966.

*Phania? dissecta* Hook. & Arn. Bot. Beech. 433. 1841 Acapulco, Guerrero, Mexico. *D. Sinclair sn* (Holotype K!)

*Eupatorium dissectum* (Hook. & Arn.) Benth. Bot. Sulph. 113. 1844. Not *Eupatorium dissectum* A. Gray, Proc. Am. Acad. 18: 100. 1883.

*Podophania Ghiesbreghtiana* Baill. Bull. Soc. Lin. Paris 1: 268. 1880. Mexico, without precise locality, *Ghiesbreght 315* in Oct. 1844, (Holotype P! isotype fragment F!)

*Podophania dissecta* (Hook. & Arn.) B. L. Robinson Proc. Amer. Acad. 47: 192. 1911.

Herb to 1 m. tall; dichotomously branched; leaves opposite, tripinnately dissected, blades triangular in outline, up to 7 cm long, 6-7 cm wide; peduncles up to 10 cm long; heads 6-7 mm high, 5-6 mm wide, 100-150 flowered; phyllaries unequal, striate, *ca* 50; corolla tube white, *ca* 3.5 mm long; the anthers (including appendanges) *ca* .75 mm long, *ca* 100 $\mu$ wide; appendages very small, cucullate; filaments *ca* 2 mm long; style branches greatly exserted at maturity *ca* 2.5 mm long; style tube *ca* 2.5 mm long; pappus usually of 12-15 scabrate setae equaling the length of the corolla; achenes dark brown, *ca* 2 mm long; pollen *ca* 11 $\mu$ in diameter; chromosome number not determined.

Plate 1362.

Plate 1362. *Hofmeisteria dissecta,* Holotype (K), *Sinclair s.n.*

SPECIMENS EXAMINED: MEXICO: COLIMA: n. edge of Colima City, *Langman 3212* (MEXU, PH); Manzanillo, *Palmer 1371* in 1891 (GH 2 sheets, NY, US); GUERRERO: Pungarabato, Coyuca, *Hinton 5453* (GH, K, NY, US); 20 miles s of Chilpancingo, *Cronquist 9703* (MEXU, MICH, NY, TEX, US); Acapulco, *Howell 8506* (CAS); 30 miles n e of Acapulco, *R. M. King 4176* (F, MICH, NY, TEX, UC, US); Temisco, Barranca del Consuelo, *Mexia 8812* (CAS, F, G, NY, UC, US); Rincón de la Via, *Kruse 73* (MEXU); El Calabaral, *Langlassé 470* (G, GH, K, MICH, US); JALISCO: 8 miles s e of Pihuamo, *McVaugh & Koelz 1511* (MICH); 9 miles w of Bahia de Navidad, *McVaugh & Koelz 1723* (MICH); 2.5-4 miles n of La Cuesta, *McVaugh 21218* (MICH); MEXICO: Pungarancho, Temascaltepec, *Hinton 3127* (GH, K, US); MICHOACÁN: Chila, 8 km n w of Aquila, *Rzedowski 17943* (MICH); La Salada, *Nelson 6928* (GH, NY, US). Trojes, Coalcomán, *Hinton 12292* (K, MICH, NY, P, UC, US); SINALOA: San Ignacio, *Ortega 4972* (GH, MEXU, US).

2. **Hofmeisteria sinaloensis** H. S. Gentry, Brittonia **6**: 329. 1948. Capadero, Sierra Tacuichamona, Sinaloa, Mexico. Feb. 18, 1940. *H. S. Gentry 5615* (Holotype MICH! isotypes DS! GH! NY! US!).

Three to four dm tall, forming irregular spreading clumps; few branched, older wood glabrous, the younger pubescent; leaves alternate, pinnately dissected in 3 or rarely 5 lobed, thin leaflets; peduncles slender, 7-9 cm long, sparingly pubescent; heads 7-8 mm high, 6-7 mm wide *ca* 150 flowered. Phyllaries unequal, 5 nerved *ca* 60. corolla tube white, 3.5-4 mm long, the anthers *ca* 1.25 mm long (including appendages) *ca* 110$\mu$ wide, appendages very small, cucullate; filaments 1.5-2 mm long; style branches greatly exserted at maturity, *ca* 3 mm long; style tube *ca* 3 mm long; pappus usually of 5-6 long scabrate setae equaling the length of the corolla, and 6-10 short intervening lacerate squamae usually less than .5 mm long; achenes *ca* 2 mm long, dark brown or black; pollen *ca* 16 $\mu$ in diameter; chromosome number not determined.

SPECIMENS EXAMINED: MEXICO: SINALOA: Capadero, Sierra Tachuichamona, *Gentry 5581* (DS, F, GH, MICH, NY, US); 12 miles e of Esquinapa, along highway 15, *Gentry, Barclay & Arguelles 19466* (US).

Plate 1363.

Plate 1363. *Hofmeisteria sinaloensis,* Holotype (MICH), *Gentry 5615.*

3. **Hofmeisteria standleyi** (Blake) R. M. King and H. Robinson, Phytologia **12:** 467. 1966.

*Fleischmannia standleyi* Blake Contr. U.S. Nat. Herb. **22:** 590. 1924. Mexico: Sonora, Sierra de los Alamos, March 19, 1910. *J. N. Rose, P. C. Standley & P. G. Russell 13073* (Holotype U:! *isotype* NY!)

*Fleischmannia urenifolia* (Hook. & Arn.) Benth. and Hook. var. *Mexiae,* B. L. Robinson, Contr. Gray Herb. **96:** 18. 1931. Mexico: Jalisco, Hacienda del Ototal, east of San Sebastian, alt. 1500 meters, "herb growing in crevices of rock near water, steep wooded slope of narrow cañon." February 15, 1927. *Ynes Mexia 1684a* (Holotype GH! isotypes CAS! F! G! UC! US!).

Perennial herb ascending from a procumbent stem 25-50 cm tall; few branched, rather densely pilose; leaves alternate; blades ovate, 2-4 cm long, 1.7-2.7 cm wide, acute or obtuse, unequally 4-6 toothed on each side or sometimes 3 lobed; peduncles up to 10.5 cm. long; heads 8-9 mm high, 8-11 mm wide, *ca.* 150 flowered; phyllaries unequal, 3 nerved, *ca.* 60; corolla tube white or tinged with purple 4.5-5 mm long; the anthers (including appendages) *ca.* 1.75 mm long *ca* 125 $\mu$ wide, appendages obtuse, *ca* 220 $\mu$ long; filaments *ca.* 2.5 mm long; style branches greatly exserted at maturity 1.5-2 mm long; style tube 3-3.5 mm long; pappus consisting of 5-7 scabrate setae *ca* 4.5 mm long and short intervening lacerate-margined squamae; achenes dark brown or black, 1.75-2.0 mm long; pollen *ca* 18 $\mu$ in diameter; chromosome number not determined.

SPECIMENS EXAMINED: MEXICO: JALISCO: Hacienda del Ototal. e of San Sebastian, *Mexia 1684* (CAS, F, MICH, NY); NAYARIT: 10 miles s e of Ahucatlan, *McVaugh 15179* (MICH); SINALOA: Africa, Sierra Tacuichamona *Gentry 5690* (DS, GH, MICH); San Ignacio, *Oretega 288* (MEXU); Cerro de la Silla, San Ignacio, *Montes & Salazar 288* (US).

4. **Hofmeisteria schaffneri** (A. Gray) R. M. King and H. Robinson, Phytologia **12:** 467. 1966.

*Fleischmannia Schaffneri* A. Gray, Proc. Am. Acad. **41:** 101, 1881. San Luis Potosí "In montibus umbrosis humidis

Plate 1364.

Plate 1364. *Hofmeisteria standleyi*, Holotype (US), *Rose, Standley and Russell 10073.*

Plate 1365.


Plate 1365. *Hofmeisteria schaffneri*, Holytype (GH), *Schaffner 349.*

prope San Francisco." August 1876, *J. G. Schaffner 349* (Holotype GH! isotype NY!).

*Ca* 25-35 cm tall; stems few branched glandular pubescent; leaves chiefly alternate, the blades triangular in outline *ca* 1 cm long and wide, dissected, lobes oblanceolate; peduncles up to 10 cm long; heads 9-10 mm high, 8-11 wide, *ca* 150 flowered; phyllaries unequal violaceous; striate, *ca* 50. corolla tube white or pink, 4.5-5 mm long; the anthers *ca* 1.5 mm long (including appendages) *ca* 125 $\mu$ wide, appendages obtuse *ca* 125 $\mu$ long; filaments 1.5-2 mm long; style branches greatly exserted at maturity 3-3.5 mm long; style tube *ca* 3 mm long; pappus consisting of 4-7 long maroon scabrate setae 4-4.5 mm long with a very short crown of intervening lacerate-margined squamae; achene, *ca* 1.5 mm long, dark brown; pollen 17-18 $\mu$ in diameter; chromosome number not determined.

SPECIMENS EXAMINED: MEXICO: JALISCO: Real Alto, trail to Arroyo del Jaguay, *Mexia 1752* (CAS, DS, F, G, GH, MICH, NY, UC, US). 7-8 miles n w of Los Volcanes, *McVaugh 12205* (MEXU, MICH, US). Chiquilistlan, *Jones 259* (US). SAN LUIS POTOSÍ, *M. Urbinox sn* (MEXU).

5. **Hofmeisteria urenifolia** (Hook. & Arn.) Walp. in Walp. Rep. **6**: 106. 1847.

*Phania? urenifolia* Hook. & Arn. Bot. Beech. Voy. 297. 1840. *Beechey*, Mexico without precise locality (Holotype K!).

*Helogyne urenifolia* Walp. in Walp. Rep. 4: 457. 1848, by typographical error.

*Phania urenaefolia* Benth. & Hook. f. Gen. Pl. 2: 243. 1873.

*Fleischmannia urenaefolia* Benth. & Hook. f. ex Hemsl. Biol. Cent. Am. Bot. 2: 91. 1881.

*Fleischmannia Langlassei* B. L. Robinson, Proc. Am. Acad. **41**: 273. 1905. Mexico: Michoacán, Arroyo de Barrabas, *E. Langlassé 27* (Holotype GH! isotypes G!, P!, US!)

*Fleischmannia urenifolia* (Hook. & Arn.) Benth. & Hook. f. var. *typica* B. L. Robinson, Contr. Gray Herb. **96**: 17. 1931.

Plate 1366.

Plate 1366. *Hofmeisteria urenifolia,* Holotype (K), *Beechey s.n.*

Perennial herb 25-30 cm tall; stems few branched, striate, glabrous; leaves alternate, the blades trifid or pinnately trisect, up to 4.5 cm long and wide; peduncles up to 5 cm long; heads 9-10 mm high, 8-11 mm wide, 150-175-flowered; phyllaries unequal, usually 3-nerved, *ca* 50; corolla tube white or pink, 4.5-5 mm long; the anthers (including appendages) *ca* 1.25 mm long *ca* 125 μ wide; appendages obtuse *ca* 125 μ long; filaments 1.5-2 mm long; style branches greatly exserted at maturity, *ca* 3 mm long; style tube 2-2.5 mm long; pappus consisting of 5-7 maroon colored, scabrate setae 4-4.5 mm long and a low crown of very short lacerate-margined squamae; achenes dark brown, 1-1.2 mm long; pollen 15-16 μ in diameter; chromosome number not determined.

ADDITIONAL SPECIMENS EXAMINED: MEXICO: CHIAPAS: Monserrate, *Purpus 218* (GH, US); *10213* (NY); *10218* (UC). DURANGO: 3-15 km toward El Salto, *McVaugh 23609* (MICH); 50-54 road road miles w s w of El Salto, *McVaugh 11564* (MEXU, MICH, US). GUERRERO: Tierras Blancas, *Hinton 10143* (K, MICH); Chilacoyte, *Hinton 14178* (F, NY, UC, US, W). JALISCO: Hacienda del Ototal, e of San Sebastian, *Mexia 1684* (CAS, DS, GH, UC); Barranca of Beltram, *Pringle 5492* (GH); Saltillo, *M. E. Jones* June 1, 1892 (POM). NAYARIT: 3 km n w of El Ocotillo, *McVaugh 23529* (MICH). SINALOA: 0.9 mi w of El Palmita, *Breedlove 1719* (MICH).

6. **Hofmeisteria fasciculata** (Benth.) Walp. in Walp. Repert. **6**:106. 1846.

*Helogyne fasciculata* Benth. Bot. Voy. Sulph. **20**: 14. 1844. Mexico: Baja California, Bay of Magdalena *Hinds* in 1841 (Holotype K!)

*Hofmeisteria fasciculata* (Benth.) Walp. var. *Xanti* A. Gray, Brewer & Watson Bot. Calif. **1**:299. 1876. Mexico: Baja California: Cape San Lucas. August 1859 — January 1860, *L. J. Xantus 46* (Holotype GH!; isotypes K! US! P!)

*Hofmeisteria pubescens* S. Watson, Proc. Amer. Acad. **24**: 54. 1889. Mexico: Baja California: Muleje *Dr. Edward Palmer 422* on December 25, 1887. (Holotype GH!)

*Hofmeisteria fasciculata* (Benth.) Walp. var. *Grayi* T. S. Brandeg. Zoe 5: 160. 1903. Mexico: Baja California: between San Jose del Cabo and Cabo San Lucas, *Purpus 208* (Holotype UC!; isotype US!)

*Hofmeisteria fasciculata* (Benth.) Walp. var *pubescens* (Wats.) B. L. Robinson, Proc. Amer. Acad. 47: 192. 1911.

Forming clumps to 6-7 dm. tall; usually few-branched, glabrous to densely pubescent; leaves opposite below, alternate above, rather fleshy, lobed to bipinnatisect, glabrous to densely pubescent, blades 1.5-4 cm long and wide, peduncles up to 20 cm long, bearing scattered setaceous bracts. Heads 8-11 mm high, *ca* 1 cm wide, *ca* 150-flowered. Phyllaries unequal, striate, *ca* 100. Corolla tube white, pink or lavender, 4-4.5 mm long, the anthers *ca* 1.75 mm long (including appendage) 120-130 $\mu$ wide, appendages obtuse *ca* 250 $\mu$ long; filaments 1.5 - 2 mm long style branches greatly exserted at maturity *ca* 3-3.5 mm long; style tube 2.5-3 mm long; pappus of 2-3 long scabrate setae 4.5-5 mm long and 3-4 short squammae with lacerate margins .5-1.0 mm long; achenes dark brown or dull black 2-2.5 mm long; pollen *ca* 18 $\mu$ in diameter; chromosome number determined as $n = 18$ (Kyhos unpublished) *19* (Turner & Flyr 1966).

SPECIMENS EXAMINED: MEXICO: BAJA CALIFORNIA: Catalina Island, *I. M. Johnston 4102* (CAS); Muertos Bay, *Moran 3562* (DS, US); Arroyo del Salto, *Moran 7143* (CAS, DS, GH, TEX); 29 mi n of San Luis Gonzaga, *Moran 8210* (DS, RSA); Puerto Escondido, *Dawson 1103* (DS, F); *ca* 23 kms s of Loreto, *Carter, Alexander & Kellogg 1998* (DS, UC, US); 8 kms n of San Juanico, *Gentry 4313* (DS); Malaucita to La Cruz, *Nelson & Goldman 7304* (US); between Rancho Santa Isabel and Santa Rosalillita, *Carter & Ferris 3419* (DS, GH, MEXU, TEX, UC, US); San Francisquito Bay, *I. M. Johnston 3574* (CAS); San Francisco Island, *Moran 3729* (DS, UC); *Collins, Kearney, & Kempton 192* (US); *ca* 18 kms of Loreto, *Carter & Ferris 3874* (UC). San Lucas, *Johansen 535* (CAS, DS); Arroyo Salado nr San Jose del Cabo, *Purpus 408* (GH); San Jose del Cabo, *Purpus 262* (K, US); Barrill, *Harbison 41604* (RSA); Punta Frailes, *Dawson 1143* (MICH); El Coyote, *Porter 113* (CAS, DS, G, MEXU, TEX, UC); south side of Punta Gasparino, *Constance 3189* (DS, F, GH, MICH, UC, US); Aqua Verde, *Rose 16577* (GH, NY, US); San Benito, *T. S. Brandegee* April 10, 1889 (UC); 16 mi s of Puertocitos, *J. R. Hastings & R. M. Turner 63-139* (DS); ¾ mi s of Puertocitos, *Wiggins & Wiggins 15864* (DS, MICH, TEX); Santa Maria Bay, *Rose 16265* (NY, US); *Moran 3536* (DS); Espiritu Santo, *Collins, Kearney & Kempton 140* (US); *Rose 16867*

Plate 1367.

Plate 1367. *Hofmeisteria fasciculata,* Holotype (K), *Hinds 1841.* in 1887.

(US); one mi n of Coyote Cove Bahia de la Concepcion, *Wiggins 17411* (DS); Punta Santa Domingo, *Wiggins & Wiggins 18270* (CAS, DS, MEXU, MICH); Bahia de la Concepcion, *Wiggins & Wiggins 19000* (DS, MICH, RSA); Concepcion Bay, *Rose 16680* (NY, US); Tortuga, *I. M. Johnston 3600* (CAS); opposite Pond Island, Angel de la Guarda Island, *I. M. Johnston 4233* (CAS, DS, GH, NY, UC, US); Las Animas Bay, *I. M. Johnston 3493* (CAS, DS, GH, NY, UC, US); San Nicholas Bay, *I. M. Johnston 3714* (CAS, DS, F, GH, NY, UC, US); Puerto Ballandra, Carmen Island, *I. M. Johnston 3814* (CAS, GH, UC, US); Bahia de los Angeles, *Carter, Alexander & Kellogg 2540* (DS, UC, US); between Bahia de los Angeles and San Borja, *Cowan 2322* (TEX, US); 3.5 mi w of Bahia de los Angeles, *Wiggins & Wiggins 16018* (DS, MICH, TEX); 1.5 mi w of Bahia de los Angeles, *Wiggins & Wiggins 14792* (CAS, DS); Los Angeles Bay, *I. M. Johnston 3456* (CAS, US); 4 mi s of Todos Santos, *Thomas 7788* (US); 11 mi s of Todos Santos, *Whitehead 874* (DS); 17 mi s of Todos Santos, *Shreve 7227* (F, MICH); Mulege, *Wiggins & Wiggins 18223* (CAS, DS, MEXU, MICH, TEX); La Paz, *Wiggins 14569* (CAS, DS, GH); *M. E. Jones 24080* (DS, F, GH, K, MICH, NY, PH, POM, RSA, SMU, TEX, UC); *T. S. Brandegee 275* (F, NY, PH); *Edward Palmer 137* in 1890 (GH, MEXU, NY, UC, US); Santa Cruz Island, *Moran 3843* (DS, UC); Cerralvo Island, (DS, UC); Monoserrate Island, *Moran 3888* (DS, UC); Santa Catalina Island, *Moran 3871* (DS, UC); Isla San Jose, *Wiggins 17679* (US); *Wiggins, Carter & Ernst 365* (DS, UC); *Moran 3788* (DS, UC); Pichilinque Island, *Rose 16526* (US); Ildefonso Island, *Moran 4136* (DS, UC); *I. M. Johnston 3744* (CAS, DS, F, GH, NY, UC, US); San Marcos Island, *Moran 3995* (DS, UC); *Ferris 8654* (DS, MICH, NY, POM, RSA, US); Coronados Island, *I. M. Johnston 3765* (CAS, GH, US); Carrisalitos, Magdalena Plain, *Gentry 4447* (DS, GH); Magdalena Island, *Moran 10808* (DS, MEXU, MICH, RSA, UC); *T. S. Brandegee* January 1889 (DS, UC); *Orcutt 12* (US); Magdalena Bay, *Mason 1897* (CAS, GH, US); *T. Crocker* August 9, 1932 (CAS, DS, GH). Isla Danzante, *Wiggins 17553* (US); *Carter & Sharsmith 4262* (UC); *Wiggins 17550* (DS); Carmen Island, *Dr. Edward Palmer 875* in 1890 (GH, NY, US); *Rose 16618* (NY, US); *Carter & Ferris 3717* (UC); Isla Partida, *I. M. Johnston 322* (CAS, DS, GH, NY, UC, US); near Santa Rosalia, *Shreve 7062* (F, GH, MICH); Santa Agueda, 5 m w of Santa Rosalia, *Shreve 6539*a (MICH); 10 mi n of Santa Rosalia, *F. M. Reed 6265* (POM); 5 mi w of Santa Rosalia, *Ferris 8716* (DS, US); Santa Rosalia, *Edward Palmer 178* in 1889 (CAS, F, GH, NY, UC, US). SONORA: Puerto de Lobos, *Pringle 5960* (GH); Tepoca Bay, *I. M. Johnston 3303* (CAS, GH, US).

7. **Hofmeisteria crassifolia** S. Wats. Proc. Am. Acad., 24: 53. 1889. "In crevices of rocks in high mountains about

Guaymas, Sonora, Mexico" *Edward Palmer 309* in 1887 (Holotype GH! isotypes DS! NY! US!)

Suffrutescent, brittle plants 6-25 cm tall. Stems woody, glabrous, many-branched. Leaves alternate, linear, once or twice pinnatifid, triangular in outline, glabrous, succulent. Blade 1-1.5 cm long. Petioles 1.3-5 cm long, glabrous. Peduncles solitary, erect, glabrous with scattered setaceous bracts, 1-3 mm long, 5-18 cm tall. Heads broadly campanulate to subhemispherical, 8 mm to 1 cm high, *ca* 250 flowered. Phyllaries glabrous, *ca* 100, 1-3 nerved, imbricated, linear-lanceolate, apex attenuate to acuminate. Florets pinkish, tubular, 5-lobed 4-4.5 mm long. Stamens 5. Anthers (including appendages) *ca* 1.3 mm long ca 165 $\mu$ wide, appendage *ca* 240 $\mu$ long *ca* 145 $\mu$ wide. Filaments *ca* 3 mm long *ca* 45 $\mu$ wide. Style-branches 2, greatly exserted at maturity, *ca* 2 mm long *ca* 120 $\mu$ wide. Pappus of 5 full length bristles nearly as long as the corolla often with 2 or 3 shorter supplementary bristles. Squamellae unequal, 10-16, 1-4 between each bristle, 1-2.5 mm long. Achenes 4-5 angled, narrowly obprismatic, dull black, 1.5-2 mm long. Pollen tricolpate, spherical, nearly smooth, *ca* 13 $\mu$ in diameter. Chromosome number not determined.

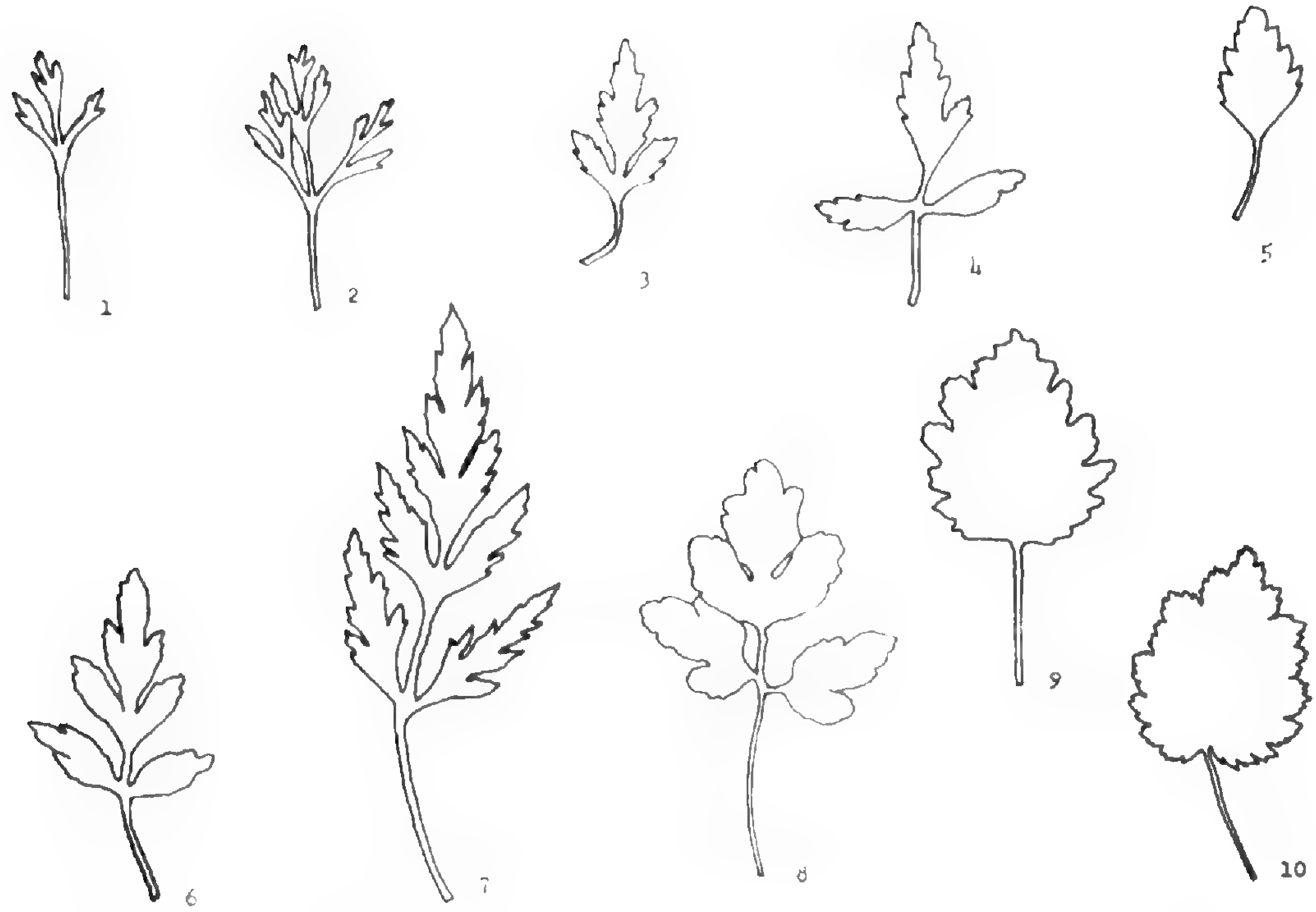
SPECIMENS EXAMINED: MEXICO: SONORA: Guaymas, *L. H. Bailey 265* (F); *Palmer 165* in 1890 (CAS, GH, NY, US); *T. S. Brandegee* May 12, 1892 (F, PH); *T. S. Brandegee sn* in 1893 (NY); *Dr. Eisen* April 1892 (DS); San Pedro Nolasco Island, *I. M. Johnston 3142* (CAS, GH, K, NY, US); San Pedro Bay, *I. M. Johnston 4307* (CAS, US).

8. **Hofmeisteria filifolia** I. M. Johnston Proc. Cal. Acad. Sci. **12**: 1185. 1924. "partially shaded rock crevices in Palm Cañon, Angel de la Guarda Island," Baja California, Mexico. *I. M. Johnston 3418* (Holotype CAS! isotypes DS! GH! NY! US!)

Herbaceous perennial with numerous stems forming dense rounded clumps 1-6 dm tall; stems strictly branched above, striate, densely covered with glandular hairs; leaves alternate or sometimes opposite basally, lower leaves palmately five-parted into filiform lobes, these simple or three-

Plate 1368.


Plate 1368. *Hofmeisteria crassifolia,* Holotype (GH), *Palmer 309*



Leaves of *Hofmeisteria*. Figures 1-2, *H. schaffneri*. 1. *McVaugh 12205* (MICH). 2. *McVaugh 12205* (MICH). Figures 3-8, *H. urenifolia*. 3. *McVaugh 23609* (MICH). 4. *Hinton 14272* (F). 5. *Langlassé 27* (GH). 6. *Mexia 1684* (GH). 7. *McVaugh 11564* (MICH). 8. *McVaugh 23529* (MICH). Figures 9-10, *H. standleyi*. 9. *McVaugh 15179* (MICH). 10. *Mexia 1684* (MICH).

parted, 4-7 cm long, 2-6 cm wide; lobes 0.5-1 mm wide, 2-20 mm long; peduncles slender, 1.5-9 cm long, with scattered setaceous bracts 1-3 mm long; heads *ca* 8 mm high 4-5 mm wide, *ca* 160 flowered; phyllaries unequal, 3-nerved *ca* 50. corolla tube pale pink or white 3.5 - 4 mm long; the anthers *ca* 1.75 mm long (including appendages) *ca* 165 $\mu$ wide, appendages short, blunt *ca* 100 $\mu$ long; filaments *ca* 1.5 mm long; style-branches slightly exserted at maturity 2-2.5 mm long; style-tube *ca* 2.5 mm long; pappus usually of 3 long scabrate setae 2.5 - 3 mm long and 8-10 short erosely dentate squamae 0.25 - 0.5 mm long; achenes *ca* 3 mm long, dark brown or black; pollen *ca* 18 $\mu$ in diameter; chromosome number not determined.

SPECIMENS EXAMINED: MEXICO: BAJA CALIFORNIA: Angel de la Guarda Island, *Moran 10391* (CAS, DS, MICH, RSA, UC, US);

Figure 11

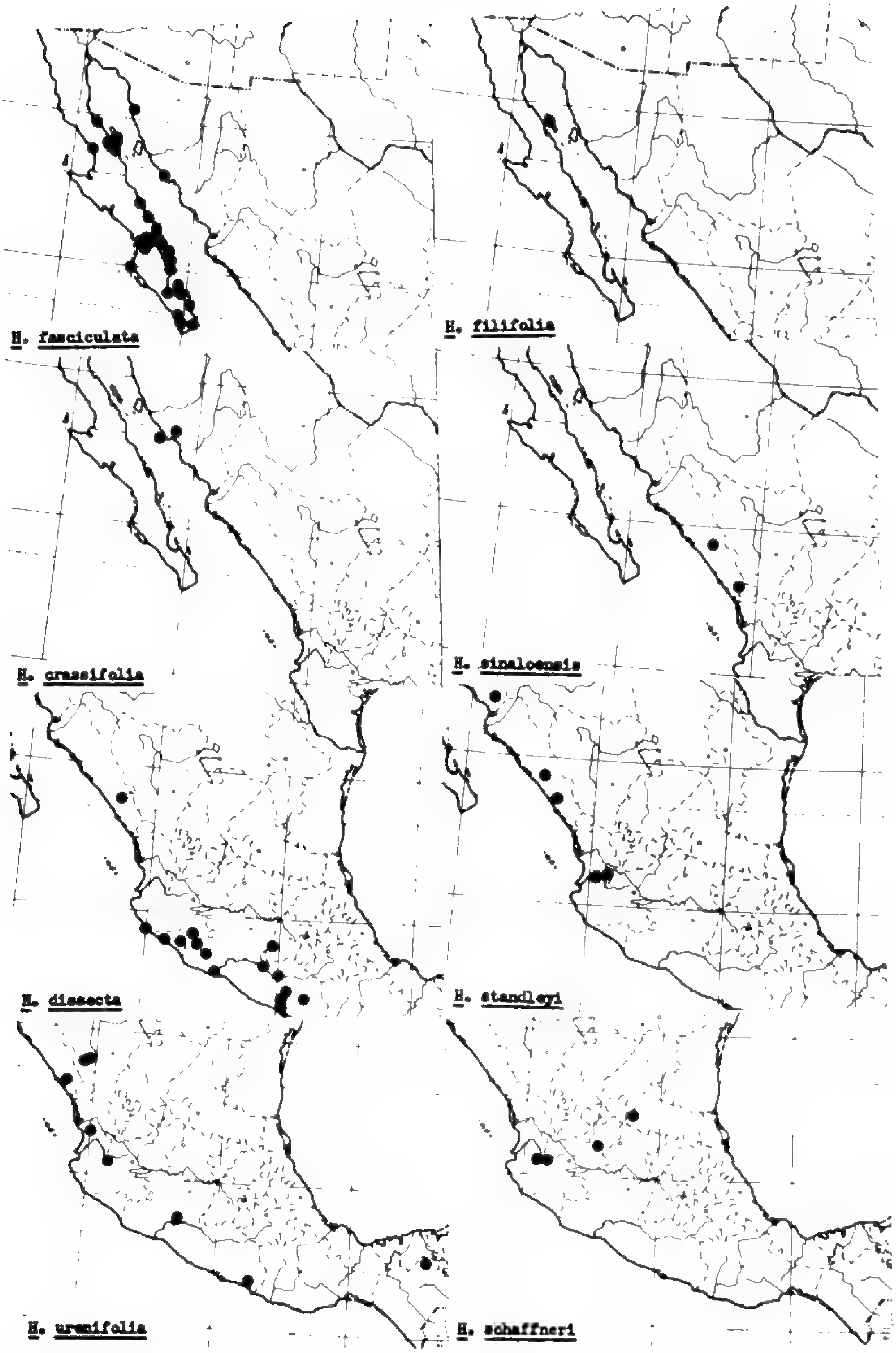



Fig. 11. Distribution of *Hofmeisteria.*

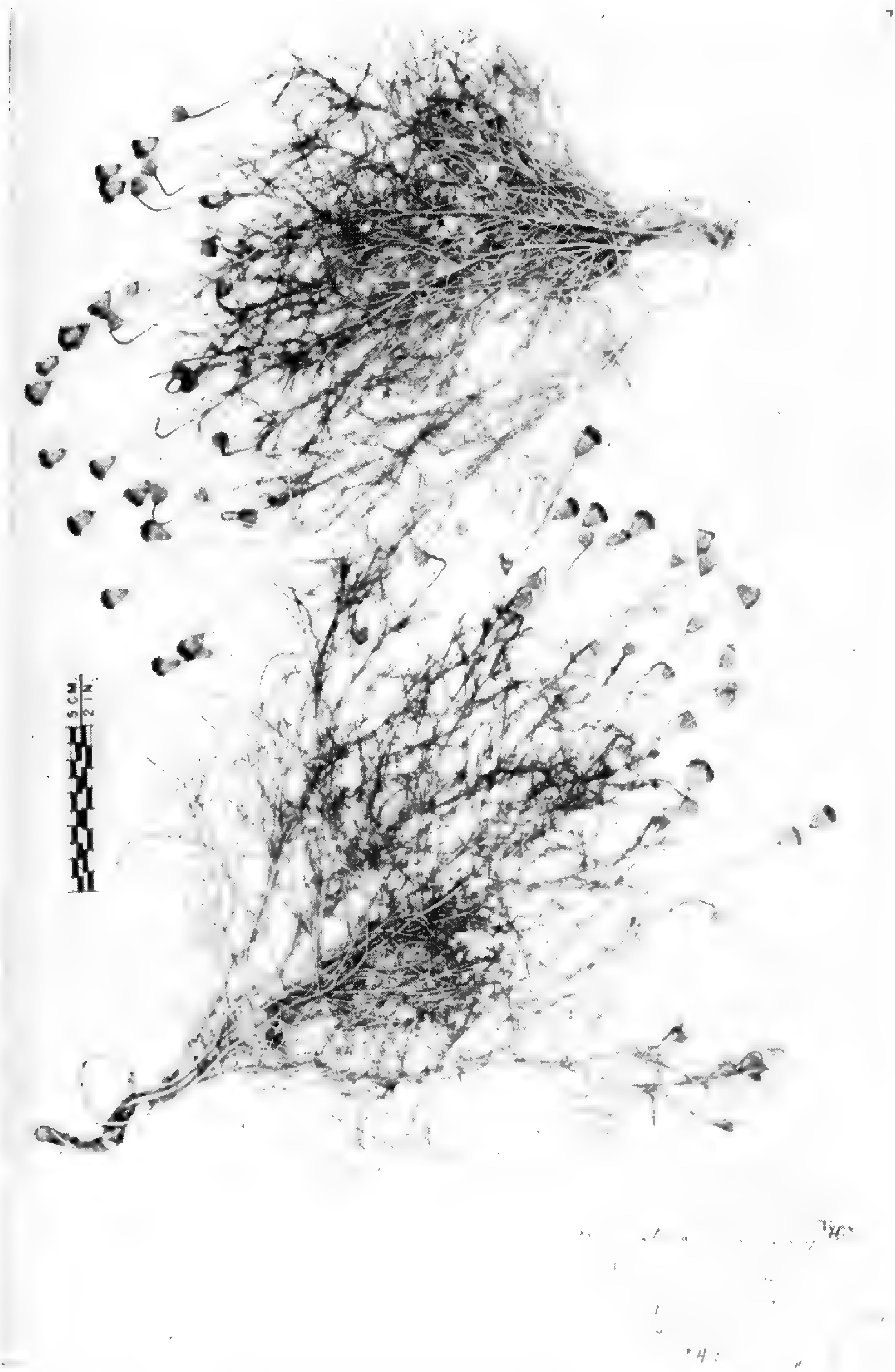


Plate 1369. *Hofmeisteria filifolia,* Holotype (CAS), *Johnston 3418.*

*I. M. Johnston 3377* (CAS, GH, K, US); *I. M. Johnston 3364* (CAS, US); *Moran 10439* (DS, UC); *Moran 7213* (CAS, DS, MEXU, MICH, NY, RSA, US, W).

DEPARTMENT OF BOTANY
SMITHSONIAN INSTITUTION
WASHINGTON, D. C. 20560

LITERATURE CITED

TURNER, B. L., and D. FLYR. 1966. Chromosome numbers in the Compositae. X. North American species. Amer. J. Bot. 53 (1) 24-33.

# FURTHER CHANGES AND ADDITIONS TO THE FLORA OF PORTO RICO AND THE VIRGIN ISLANDS

BROTHER ALAIN H. LIOGIER

After the publication of the nomenclatural changes and additions to the Flora of Porto Rico (cf. Rhodora **67**: 315-361. 1965), several more changes have come to my attention, and by revising the literature and going through the herbaria, I have found more additions to the Flora of the area covered by Britton and Wilson. As in my previous paper, I shall give the page and after the valid name, I shall cite in parenthesis the name used by Britton and Wilson in the Flora. This list is to be used as a supplement to the Flora, and reference must be made to the previous citation by Britton and Wilson. Several errors have been made in my previous paper, and they are corrected here.

**Volume I of the Flora** (Scientific Survey, vol. V).

p. 18. Limnobium spongia Rich. To be added: Añasco, *Sintenis 5779.*

p. 32. Trichachne affinis Swallen, Rhodora **65**: 365. 1963. To be added: *Hess 428.*

p. 34. Digitaria diversifolia Swallen, Rhodora **65**: 366. 1963. To be added: Juana Díaz.

p. 51. Lasiacis maculata (Aubl.) Urb. (*Lasiacis sorghoidea* H. & C.).

p. 53. Echinochloa spectabilis (Nees) Link (*Echinochloa polystachya* Hitchc.).

p. 67. Chloris barbata Sw. (*Chloris inflata* Link; *Chloris paraguayensis* Steud.).

p. 75. Eragrostis tenella (L.) Beauv. ex R. & S. (*Eragrostis amabilis* Wr. & Arn.).

p. 77. Rhynchelytrum repens (Willd.) C. E. Hubb. (*Tricholaena repens* Nees).

p. 108. Scleria melaleuca C. & S. (*Scleria pterota* C. Presl ex C. B. Clarke).

p. 113. Calyptrogyne rivalis (Cook) León replaces *Calyptrogyne occidentalis* Maza (*Calyptronoma rivalis* Bailey).

p. 117. Coccothrinax alta Becc. replaces *Coccothrinax argentea* of Britton & Wilson.

p. 139. Tillandsia setacea L. (cited by Britton and Wilson as *T. tenuifolia L.*).

p. 139. Tillandsia tenuifolia L. To be added: Maricao, collected by Winters. This is the species that has been cited as *Tillandsia pulchella* Hook. (cf. Phytologia 8: 20. 1962).

p. 145. Commelina virginica L. (*Commelina elegans* HBK.).

p. 161 Curculigo capitulata (Lour.) O. Kuntze (*Molineria hortensis* Britt.).

p. 272. Atriplex littoralis (Jacq.) Fawc. & Rendle (*Atriplex pentandra* Standl.).

p. 305. Nymphaea jamesoniana Planch. (*Castalia jamesoniana* Britt. & Wils.).

p. 326. Lepidium pinnatisectum (O. E. Schulz) C. L. Hitchc. To be added: Mayagüez.

p. 328. Brassica hirta Moench. (*Sinapis alba* L.).

p. 329. Rorippa islandica var. hispida (Desv.) Butt. & Abbe (*Radicula palustris* Moench; *Rorippa palustris* Bess.).

p. 329. Nasturtium officinale R. Br. (*Sisymbrium nasturtium-aquaticum* L.; *Rorippa nasturtium-aquaticum* Hayek).

p. 336. Crataeva tapia L. include as a synonym *Crataeva gynandra* L.

p. 341. Rubus coronarius Sweet. To be added: Cayey.

p. 353. Acacia macracantha H. & B. ex Willd. in L.; include as a synonym: *Poponax macracanthoides* Britt. & Rose, Sci. Surv. 6: 538.

p. 352. Acacia polyacantha Willd. in L. (*Acacia suma* Buch.-Harm ex Voigt).

p. 354. Acacia scleroxyla Tuss. To be added: Padre de las Casas *(Holridge 78).*

p. 378. Caesalpinia bonduc (L.) Roxb. (*Caesalpinia crista* or modern authors).

p. 378. Caesalpinia major (Medic.) Dandy & Exell (*Caesalpinia bonduc* of modern authors).

p. 386. Crotalaria mucronata Desv. (*Crotalaria striata* DC., not *C. saltiana* Andr.).

p. 386. Crotalaria lotifolia var. eggersii Senn. To be added: Vieques, St. Thomas.

p. 387. Crotalaria sagittalis var. fruticosa (Mill.) Fawc. & Rendle. To be added: Bayamón.

p. 387. Crotalaria berteriana DC. Cultivated at Mayagüez Experimental Station.

p. 390. Dalea carthaginensis (Jacq.) Macbr. (*Parosela domingensis* Millsp.; *Dalea domingensis* DC.).

p. 391. Tephrosia sessiflora (Poir.) Urb. (*Cracca brevipes* Kuntze).

p. 391. Tephrosia purpurea (L.) Pers. (*Cracca purpurea* L.).

p. 408. Lonchocarpus sericeus var. glabrescens Benth. (*Lonchocarpus domingensis* DC.).

p. 409. Geoffrea inermis W. Wright (*Andira inermis* HBK.).
p. 424. Lablab niger Medic. (*Dolichos lablab* L.).
p. 431. Oxalis rugeliana Urb. To be added: Coamo.
p. 437. Kallstroemia pubescens (G. Don) Dandy (*Kallstroemia caribaea* Rydb.).
p. 442. Galphimia glauca Cav. (*Galphimia gracilis* Benth.; *Thryallis glauca* Kuntze).
p. 440. Stigmaphyllon ledifolium (HBK.) Small (*S. diversifolium* A. Juss).
p. 444. Malpighia linearis Jacq. (*Malpighia angustifolia* L.).
p. 457. Zanthoxylum bifoliolatum Leon. To be added: Maricao.
p. 465. Guarea guidonia (L.) Sleumer (*Guarea guara* P. Wils.).
p. 494. Sapium jamaicense Sw. To be added: Luquillo Mts.
p. 467. Cedrela mexicana Roem. (*C. odorata* L.).
p. 477. Phyllanthus tenellus Roxb. To be added: Maricao.
p. 498. Euphorbia heterophylla L. (*Poinsettia heterophylla* Kl. & G.).
p. 499. Euphorbia geniculata Ortega (*Poinsettia geniculata* Kl. & Garcke).
p. 498. Euphorbia cyathophora Murr. (*Poinsettia cyathophora* Kl. & Garcke).
p. 501. Chamaesyce hyssopifolia (L.) Small includes *C. nutans* (Lag.) Small, as a synonym.
p. 504. Chamaesyce adenoptera (Bertol.) Small ssp. pergamena (Small) Burch (*Chamaesyce monensis* Millsp.).
p. 504. Chamaesyce turpinii (Boiss.) Millsp. (*Chamaesyce anegadensis* Millsp.; *Chamaesyce portoricensis* Millsp.).
p. 510. Comocladia dentata Jacq. To be added: Bayamón, Luquillo, Mayagüez.
p. 510. Comocladia cuneata Britt. To be added: Vega Baja (*Britton, Brown & Chardon 6821*).
p. 510. Conserve: Metopium toxiferum (L.) Krug & Urb. (*Metopium linnaei* Engl., in part).
p. 515. Ilex hypaneura Loes. To be added: El Verde, Luquillo Mts. *(Alain 10846)*.
p. 526. Allophylus racemosus Sw. (*Allophylus occidentalis* Radlk.).
p. 536. Colubrina elliptica (Sw.) Briz. & Stern (*Colubrina reclinata* Brongn.).
p. 536. Colubrina rufa var. antillana M. C. Johnst. To be added: Cambalache.
p. 544. Triumfetta rhomboidea Jacq. (*Triumfetta bartramia* L., nom. illegit.).
p. 549. Abutilon crispum Medic. (*Gayoides crispum* Small).
p. 553. Sida setifera Presl (*Sida aggregata* Presl).
p. 551. *Sida alba* L. is synonym to Sida spinosa L.
p. 558. Malachra alceifolia var. fasciata (Jacq.) Robyns (*Malachra fasciata* Jacq.).

p. 559. Urena lobata var. sinuata (L.) Hochr. (*Urena sinuata* L.).
p. 560. Pavonia spicata Cav. (*Malache scagra* Vogel; *Pavonia scabra* Ciferri).
p. 561. Hibiscus phoeniceus Jacq. (*Hibiscus brasiliensis* L., nom. nudum).
p. 565. Montezuma grandiflora (DC.) Urb. (*Montezuma speciosissima* Sessé & Moc.).
p. 567. Gossypium barbadense L. (*Gossypium peruvianum* Cav.; *Gossypium brasiliense* Macf.).
p. 567. Gossypium hirsutum L. var. punctatum (Schum.) Hutch. (*Gossypium purpurascens* Poir.).
p. 577. Doliocarpus major Gmel. in L. (*Doliocarpus brevipedicellatus* Garcke).
p. 611. Consolea moniliformis (L.) Britt. (*Opuntia moniliformis* L.).
p. 611. Consolea rubescens (Salm-Dyck ex DC.) Lam. (*Opuntia rubescens* Salm-Dyck).
p. 612. Pilosocereus nobilis (Haw.) Byles & Rowley (*Cephalocereus nobilis* Britt. & Rose).
p. 613. Leptocereus grantianus Britt. To be added: Culebra Isl.
p. 620. Daphnopsis americana ssp. caribaea (Griseb.) Nevl. (*Daphnopsis caribaea* Griseb.)

**Volume II.** (Scientific Survey Vol. VI).

p. 3. Conostegia hotteana Urb. & Ekm. To be added: Luquillo Mts.
p. 17. Ossaea scalpta (Vent.) DC. (*Ossaea domingensis* Cogn.).
p. 27. Mitropsidium sintenisii (Kiaersk.) Burret (*Calytropsidium sintenisii* Kiaersk.).
p. 40. Myrtus ? bellonis (Krub & Urb.) Burret (*Eugenia ? bellonis* Krug & Urb.).
p. 41. Zyzygium grande (Wight) Walp. To be added: Yauco.
p. 45. Ludwigia leptocarpa var. meyeriana (O. Kuntze) Alain. To be added: Manatí, Cabo Rojo, Bayamón, Humacao.
p. 58. Ardisia crenulata Vent. (*Ardisia serrulata* Mez, as to the portorican plant).
p. 62. Jacquinia arborea Vahl (*Jacquinia basbasco* Mez, in part).
p. 72. Manilkara albescens (Griseb.) Cron. To be added: Lajas.
p. 80. Jasminum fluminense Vell. (*Jasminum azoricum* sensu Britt. & Wils. in the Flora).
p. 80. Jasminum multifiorum (Burm. f.) Andr. (*Jasminum pubescens* Willd.).
p. 114. Ipomoea spiralis House (cited as *I. spirillus* in Rhodora **67**: 347, typographic error).
p. 124. Cordia obliqua Willd. To be added: Mameyes.
p. 128. Cordia wagnerorum Howard. To be added: Luquillo Mts. Cf. Journ. Arn. Arbor. **47**: 137. 1966.

p. 162. Stachys arvensis (L.) L. To be added: Cayey.
p. 166. Solanum nodiflorum Jacq. (*Solanum nigrum* sensu Britt. & Wils.; *Solanum caribaeum* Dunal).
p. 171. Solanum quitoense Lam. To be added: Toro Negro.
p. 171. Solanum woodburyi Howard. To be added: Luquillo Mts. Cf. Journ. Arn. Arbor. **47**: 138. 1966.
p. 189. Buchnera longifolia HBK. (*Buchnera elongata* Sw., as to the Portorican plant).
p. 190. Utricularia gibba L. (*Utricularia obtusa* Sw.).
p. 196. Tabebuia heterophylla (DC.) Britt. includes *Tabebuia pallida* Miers, as synonym.
p. 241. Psychotria guadaloupensis (DC.) Howard (*Psychotria grosourdyana* Urb.).
p. 245. Psychotria nervosa Sw. (*Psychotria undata* Jacq.).
p. 253. Diodia apiculata (Willd.) R. & S. (*Diodia rigida* C. & S.).
p. 265. Coccinia grandis (L.) J. O. Voigt (*Coccinia cordifolia* Cogn.).
p. 297. Conyza chilensis Spreng. To be added: Yauco.
p. 303. Eclipta prostrata (L.) L. (*Verbesina alba* L.).
p. 419. Polypodium attenuatum H. & B. To be added: Luquillo Mts.
p. 419. Polypodium triseriale Sw. To be added: Tortola Isl.
p. 427. Hypolepis nigrecens Hook. To be added: Jayuya.
p. 453. Asplenium rutaceum (Willd.) Mett. The presence of this species in Puerto Rico has been confirmed by Maxon.
p. 468. Thelypteris sprengelii (Kaulf.) Proctor (*Dryopteris sprengelii* Kuntze, not *Thelypteris balbisii* Ching).
p. 480. Thelypteris rudis (Kuntze) Proctor. To be added: Jayuya.
p. 480. Thelypteris asplenioides (Sw.) Proctor. To be added: Jayuya.
p. 480. Thelypteris cordata (Fée) Proctor (*Dryopteris* cordata Urb.). The presence of the species in Puerto Rico has been confirmed: Utuado.
p. 480. Thelypteris resinifera (Desv.) Proctor (*Dryopteris panamensis* C. Chr.). To be added: Carolina.
p. 504. Hymenophyllum contortum v. d. Bosch (*Hymenophyllum crispum* HBK., sensu Maxon in Flora of Porto Rico).
p. 507. Hymenophyllum lanatum Fée. Replaces *Hymenophyllum hirsutum* (L.) Sw.; this last species is not found in Puerto Rico.
p. 507. Hymenophyllum fucoides Sw. To be added: Mt. Guilarte.
p. 507. Hymenophyllum protrusum Hook. To be added: Luquillo Mts.
p. 508. Salvinia rotundifolia Willd. To be added: Mayagüez.
p. 512. Lycopodium verticillatum L.f. (*Lycopodium setaceum* Lam.).

THE NEW YORK BOTANICAL GARDEN
BRONX, NEW YORK

## NOTES FROM THE PRINGLE HERBARIUM, II.

Since my previous article under this general title, information has continued to come to this Herbarium, indicating species which have not hitherto been reported in The Flora of Vermont, E. J. Dole, Editor, 1937. The list, only a part of which is given here, is longer than the earlier one; the other names are being left for subsequent mention.

1. PUCCINELLIA DISTANS (L.) Parl. var. ANGUSTIFOLIA (Blytt) Holmb.

Burlington, Vermont, 21 June 1966, *F. C. Seymour 24501* (VT); 7 Sept. 1966, same collector, *24,960* (VT). This alkali-loving plant has been found this year in two widely separated spots on the Campus of the University of Vermont. Near the Bailey Library it was growing abundantly, forming a sparse lawn in hard baked soil, introduced undoubtedly in building operations. The other collection was from a roadside on Redstone campus, the women's part of the University campus. With much alkali soil in this State, this species might be expected. The strange fact is that it apparently has not been found before.

2. POA TRIVIALIS L.

Wolcott, Vermont, Town Hill, meadow, 23 June 1966, *Russell Kinerson, Jr.* (VT). Newbury, 9 July 1966, *F. C. Seymour 23,949*. Another grass new to the State. So far north, it may be indigenous. See Gray's Manual, ed. 8, 1950, M. L. Fernald, p. 118, where it is said to be "indig. northw."

3. SCIRPUS POLYPHYLLUS Vahl.

Newfane, Vermont, 17 Aug. 1911, *L. A. Wheeler* (NEBC). This is a southern species with its northernmost limit in "w. N.E." according to Gray's Manual, l.c. p. 274. Newfane is probably its northernmost known station. Found among unidentified specimens, this specimen was unrecognized probably because it had not previously been known in Vermont. It has been found in Buckland and Amherst, Massachusetts, both in or near the Connecticut River valley and is more frequent in Connecticut from the Connecticut River

Valley westward. Newfane is only about 28 miles north of Buckland.

4. CAREX BUSHII Mack.

Huntington-Richmond, Vermont, near the town line, in a pasture, 19 June 1964, *Thomas G. Siccama* and *Alan N. Railsback* (VT). In the course of ecological studies dealing with the flora of Camel's Hump, these research students found the specimen so near the town line that it is uncertain in which of the two towns it was located. The other nearest known stations are Mount Desert, Me., and Connecticut. Since the habitat is a pasture, it may have been introduced with live-stock.

5. ALNUS GLUTINOSA (L.) Gaertner, BLACK ALDER OF EUROPE.

Essex Jct., Vermont, 20 Sept. 1965, *William J. Gabriel* (VT). Dr. Gabriel is Associate Geneticist in the U. S. Forest Service, Northeastern Forest Experiment Station, Burlington, Vt. He discovered a single large tree growing with the much smaller *Alnus rugosa* (Du Roi) Spengel. To find in that locality this species which is introduced from Europe is a bit surprising. In Pringle Herbarium is a specimen of *A. glutinosa* collected in cultivation in Burlington in 1901 by L. R. Jones. Conceivably the noncultivated tree could have come from the cultivated one in an almost adjacent city.

6. GEUM VERNUM (Raf.) T. & G.

"Vermont" (VT). The only specimen in Pringle Herbarium is mounted on a sheet which has the characteristic size, quality, etc. of the very early collections of Joseph Torrey, former President of the University of Vermont. The sheet bears no other indication of locality than merely "Vermont". The specimen was identified, apparently by the collector, as *Geum album.* By an unknown hand, it was labeled *Geum canadense* Jacq. The very distinct long stipe of the receptacle and very small calyx mark it unmistakably as *G. vernum.* As the species is known in the State of New York, it is to be expected that further exploration will rediscover the now unknown locality where it grows in Vermont. For the present this remains as the only known specimen from New England.

7. EUONYMUS EUROPAEUS L.

Woodstock, Vermont, 16 Oct. 1966, *Isabell R. Oktavec (Mrs. Frank)* (VT). This species of Spindle-tree, escaping from cultivation in a number of places in New England, has made its debut in Vermont as indicated by the specimen cited.

8. OENOTHERA PILOSELLA Raf.

Danville, Vermont, 14 July 1907, *E. J. Dole* (VT); Hartland, 1 July 1911, *Nancy Darling* (VT). This plant with its showy flower is indigenous in the Midwest and is treated by L. H. Bailey in his Manual of Cultivated Plants, 1949, p. 738. Spreading from cultivation, it has become established in the East. The specimens cited although collected some years ago, were previously unrecognized and are now the only known specimens from Vermont.

9. ANTHRISCUS SYLVESTRIS (L.) Hoffm., CHERVIL.

Braintree, Vermont, 25 June 1966 (VT). As a group was returning from the annual meeting of the Vermont Botanical and Bird Club, Mrs. Roberta G. Poland spotted from the moving car something unusual. In the party were Dr. & Mrs. Burdette Poland, Dr. & Mrs. Benjamin Shaub, Miss Marion L. Smith, Mrs. Mabel McIntosh and the writer of this article. None of us was able to identify in the field this accidental introduction of a white-flowered Umbellifer. The only other collections from New England which the writer has been able to find in herbaria are from Stony Brook Reservation and the region of Boston and Milton, both in Massachusetts.

10. CENTAUREA AUSTRIACA Willd.

Dorset, Vermont, 6 & 22 Sept. 1966, *A. H. Gilbert* (VT). The collector reports a few plants growing near farm buildings "persisting for several years" but not reproducing. This species is not reported in Gray's Manual, 8 ed. or in Britton & Brown's Illustrated Flora, 3 ed. Apparently it is a very rare adventive from Eurasia. Of the species described in the books mentioned, *Centaurea austriaca* most nearly resembles *C. nigra* L. with its entire to slightly lobed leaves and with its feather-like (pectinate) outer bracts of the involucre. In *Centaurea austriaca,* however, the body of the outer bracts is long attenuate or acuminate, not ovate as in *C. nigra.*

FRANK C. SEYMOUR,
PRINGLE HERBARIUM,
UNIVERSITY OF VERMONT,
BURLINGTON 05401

---

# HALESIA CAROLINA L. IN KENTUCKY, INDIANA, AND OHIO[1]

EDWARD W. CHESTER

While studying the genus *Halesia,* new data has been found concerning the occurrence of *H. carolina* L. in three states where the presence of the species has been considered questionable. Most current manuals, *e.g.,* Small (1933), Fernald (1950), Gleason (1952), and Gleason and Cronquist (1963), do not include Kentucky within the range of this species. McFarland (1942) omits the species from his list of Kentucky plants and no specimens from naturally-occurring plants are present in the Kentucky State Herbarium (Dr. Edward Browne, personal communication, 1966). Gibson (1961) includes *H. carolina* in the state flora without specific locality. Braun (1943) reports the species from Harlan County and Garman (1913) notes its presence at "Star Lime Works, Lyon County." Braun (personal communication, 1966) reports that the Harlan County population is probably now extinct due to destructive logging and mining in the area. Herbarium specimens have been examined from McCracken and Marshall Counties on the Tennessee River in western Kentucky and from Lawrence County on the Big Sandy River in eastern Kentucky.

[1]Contributions from the Botanical Laboratory, The University of Tennessee, N. Ser. 270.

The Lyon County record is considered authentic due to its proximity to documented stations even though voucher specimens are not available. Additional stations may be expected in counties adjacent to the Tennessee River and possibly in the extreme eastern section of the state.

*Halesia carolina* L. reaches the northernmost limit of its natural range in southern Ohio where it is known from only two counties. The species is rare there and had previously been reported only from Scioto County (Schaffner, 1932; Jones, 1943; Braun, 1961); additional specimens have been observed from Pike County.

Brendel (1858) first reported *H. carolina* from Indiana "Near Evansville on the Ohio River." Coulter (1899) also reported the species from this area but Deam (1940) specifically excluded the species from his *Flora of Indiana* since neither Coulter's nor Brendel's report could be authenticated. Fernald (1950) credits the species to southern Indiana without specific locality, but other manuals (Small, Gleason, Gleason and Cronquist) exclude this state from its range. Specimens have been examined from two counties, Vanderburgh and Perry. It should be noted, however, that all specimens examined were collected before 1860, and due to expansion of Evansville and disturbance of surrounding areas, it is quite possible that the species is now extinct in that area. Further exploration in southern Indiana, especially along the Ohio River, may possibly yield other stations.

The following specimens were examined (herbarium abbreviations follow Lanjouw and Stafleu, 1964; appreciation is extended to the curators of the respective herbaria for use of their material):

KENTUCKY: LAWRENCE COUNTY: Louisa, 1837, *C. W. Short s.n.* (TEX). MARSHALL COUNTY: 2 mi. s. of Tenn. River between Calvert City and Paducah, 22 Sept., 1945, *W. H. Duncan 6186* (GA, MO). MCCRACKEN COUNTY: along the banks of the Tennessee River, 2 May, *R. J. Fleetwood, s.n.* (DPU). OHIO: PIKE COUNTY: Hay Hollow, Jackson Twp., 4 Oct., 1964, *Floyd Bartley s.n.* (OS); e. of Omega, Scioto River, 16 Aug., 1965, *C. S. Johnson 147* (NCU). SCIOTO COUNTY: Porter Twp., 13 April, 1929, *Conrad Roth s.n.* (PH). INDIANA:

VANDERBURGH COUNTY: near Evansville on Indiana Bank of Ohio River, 1848, *C. W. Short s.n.* (MO); near Evansville, 1850, *C. W. Short s.n.* (GH); banks of Ohio River near Evansville, 1858, *C. W. Short s.n.* (PH).

UNIVERSITY OF TENNESSEE
KNOXVILLE 37916

LITERATURE CITED

BRAUN, E. LUCY, 1943. An annotated catalog of the spermatophytes of Kentucky. John S. Swift Co., Inc., Cincinnati. 161 p.

———, 1961. The woody plants of Ohio. State University Press, Columbus, Ohio. 362 p.

BRENDEL, FREDERICK, 1958. The trees and shrubs in Illinois. Trans. of the Ill. State Agr. Soc. **3**: 588-604.

COULTER, STANLEY, 1899. A catalogue of the flowering plants and the ferns and their allies indigenous to Indiana. 24th Annual Report of Dept. of Geology and Nat. Res. of Ind. 1073 p.

DEAM, C. C., 1940. Flora of Indiana. State of Indiana, Dept. of Cons. W. B. Buford Printing Co., Indianapolis. 1236 p.

FERNALD, M. L., 1950. Gray's manual of botany, 8th ed. American Book Co., New York. 1632 p.

GARMAN, H., 1913. The woody plants of Kentucky. Kentucky Agr. Exp. Station, Bull. **169**. 62 p.

GIBSON, DOROTHY, 1961. Life forms of Kentucky flowering plants. Amer. Midl. Nat. **66**: 1-60.

GLEASON, H. A., 1952. The new Britton and Brown illustrated flora of the N.E.U.S. and adjacent Canada. Lancaster Press, Lancaster, Pa. 3 vols.

GLEASON, H. A., and A. CRONQUIST, 1963. Manual of Vascular Plants of N.E.U.S. and adjacent Canada. D. Van Nostrand Co., Inc., Princeton, New Jersey. 810 p.

JONES, C. H., 1943. Studies in Ohio floristics II. Rare plants in Ohio. Castanea **8**: 81-108.

LANJOUW, J., and F. A. STAFLEU, 1964. Index herbariorum, Part 1, the herbaria of the world. 5th ed. Utrecht, Netherlands. 251 p.

MCFARLAND, F. T., 1942. A catalogue of the vascular plants of Kentucky. Castanea **7**: 77-108.

SCHAFFNER, JOHN, 1932. A revised catalog of Ohio vascular plants. Ohio Biol. Survey Bull. **25**, 5(2): 89-215.

SMALL, J. K., 1933. Manual of the southeastern flora. Univ. of North Carolina Press, Chapel Hill, 1554.

# PETALOSTEMON FOLIOSUS IN ALABAMA

In his revision of the genus *Petalostemon* (Leguminosae), Wemple (1965) suggested that *P. foliosus* Gray is perhaps now restricted in distribution to the Central Basin of Tennessee, although it was previously known to occur in northern Illinois as well. This assertion was based upon the observation that all herbarium specimens of the plant which he examined, collected in the past 50 years, were taken from limestone glades in Middle Tennessee.

The purpose of this note is to report the discovery, August 23, 1966, of two populations of *Petalostemon foliosus* on limestone outcrops in northern Alabama, an area in which the plant was not previously known to occur. One of these is a small population, consisting of only a few plants, located in Franklin County, near Russellville, along county road 79, 0.4 mile south of the intersection with Alabama Route 24 *(Baskin and Caudle 509)*. The other is an extensive population, consisting of hundreds of individuals, located in Morgan County, near McKendry, along Cedar Grove Church Road, 0.3 mile north of county road 55 *(Baskin and Caudle 517)*. Documentary collections from both these locations have been deposited in the herbaria of Vanderbilt University and The New York Botanical Garden.

The occurrence of *Petalostemon foliosus* in northern Alabama is not surprising in view of the environmental and floristic similarities of the two areas. Both are characterized by shallow, rocky soil which is subject to wide fluctuations in moisture content, being extremely wet during the late winter and early spring and becoming very dry during the summer months. The ecological similarities of the areas have been described by Rollins (1963) in connection with his studies of evolution in *Leavenworthia* (Cruciferae). Although no comprehensive survey of the floristic affinities of the two areas has been made, several examples of species with restricted ranges are known to occur both in the glades of Central Tennessee and northern Alabama. Other species of legumes naturally distributed in both areas include *Astragalus tennesseensis* Gray, *Psoralea subacaulis* T. & G., and *Petalostemon gattingeri* Heller.

JERRY M. BASKIN AND CAROL CAUDLE
VANDERBILT UNIVERSITY
NASHVILLE, TENNESSEE

LITERATURE CITED

ROLLINS, REED C. 1963. The Evolution and Systematics of *Leavenworthia* (Cruciferae). Contribution from The Gray Herbarium of Harvard Univ. No. CXCII.

WEMPLE, D. K. 1965. Revision of the genus *Petalostemon* (Leguminosae). Unpublished Doctoral thesis, Iowa St. Univ. Library, Ames.

*Volume 69, No. 779 including pages 241-384, was issued Sept. 29, 1967*

# Rhodora

JOURNAL OF THE

## NEW ENGLAND BOTANICAL CLUB

Conducted and published for the Club, by



Vol. 69 October-December, 1967 No. 780

CONTENTS:



*(Continued on Inside Cover)*

The New England Botanical Club, Inc.

Botanical Museum, Oxford St., Cambridge 38, Mass.

CONTENTS: — *continued*

# Rhodora

JOURNAL OF THE

## NEW ENGLAND BOTANICAL CLUB

Vol. 69 October-December 780


# ANNOTATED CHECKLIST OF THE DICOTYLEDONS OF TORTOLA, VIRGIN ISLANDS

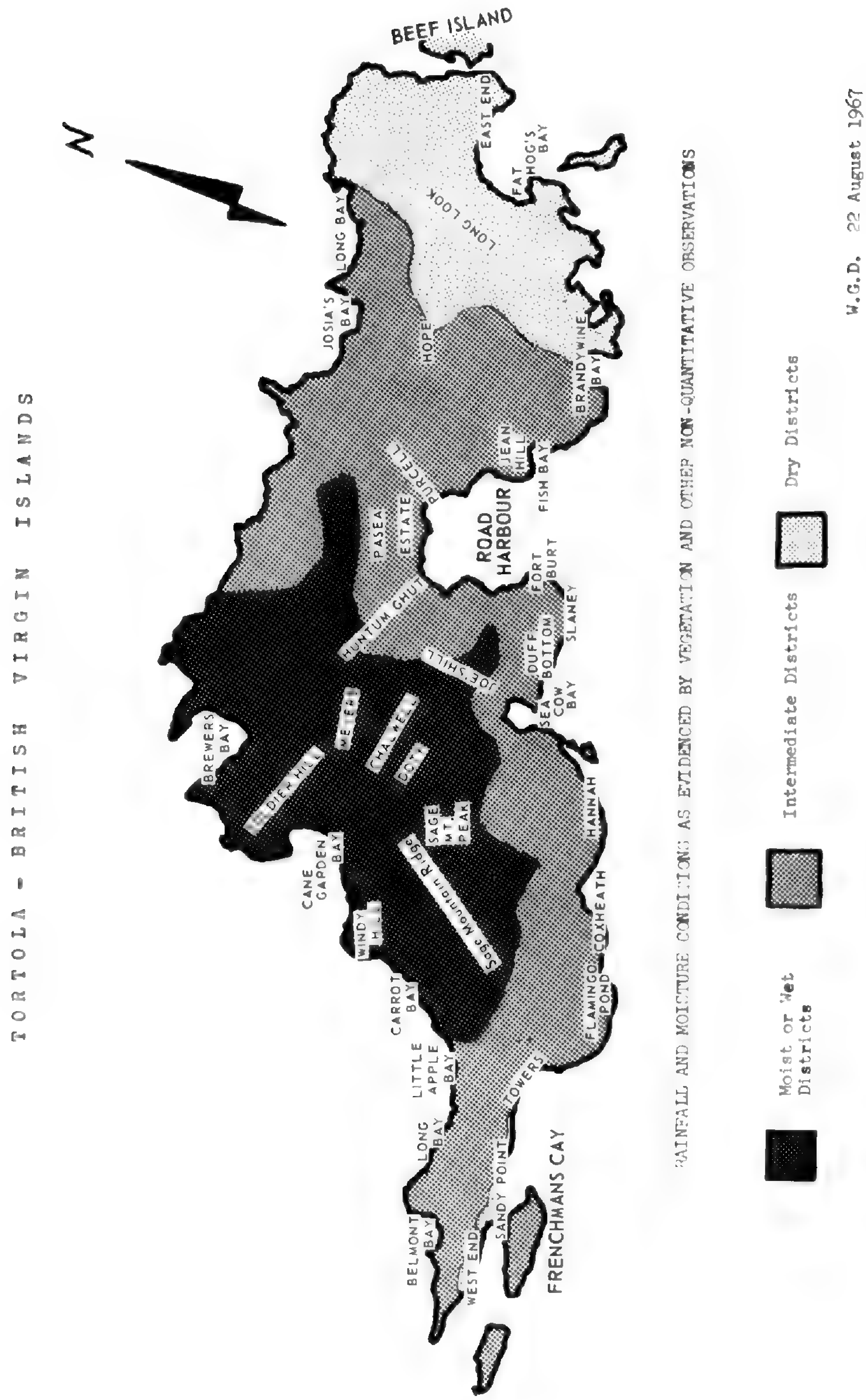

W. G. D'ARCY


SITUATION: Tortola (18° 23′ — 18° 28′ N latitude and 64° 33′ — 64° 43′ W longitude) is 11½ miles long and 3½ miles wide at its widest points, the axis of the island running east north east and west south west. It is the largest of the British Virgin Islands, which are located at the northeast extremity of the Caribbean Sea. Surrounding Tortola itself are a number of small cays which shelter the island from the direct effects of ocean swells. Beef Island and Frenchman's Cay, the nearest, are separated from Tortola by only a few yards of water, and have recently been connected by bridges. With the exception of Anegada and St. Croix, which are separated by distance and geology from the rest of the group, the Virgin Islands, British and American, are separated by very short sea distances.

TABLE I
Distances Between Major Islands — British and U.S. Virgin Islands

| | Statute Miles | Kilometers |
|---|---|---|
| Tortola - Virgin Gorda | 5 | 7 |
| Tortola - St. John | 1½ | 2½ |
| Tortola - St. Thomas | 9 | 14 |
| St. John - St. Thomas | 2 | 3 |

GEOLOGY: The geology of the island has been well described in other literature (Kemp & Meyerhoff 1926 & 1927, Martin-


TORTOLA - BRITISH VIRGIN ISLANDS
N
BEEF ISLAND
EAST END
FAT HOG'S BAY
LONG LOOK
LONG BAY
JOSIA'S BAY
HOPE
BRANDYWINE BAY
JEAN HILL
FISH BAY
PURCELL
PASEA ESTATE
ROAD HARBOUR
FORT BURT
SLANEY
HUNTUM GHUT
JOE'S HILL
DUFF BOTTOM
SEA COW BAY
BREWERS BAY
SAGE MT. PEAK
HANNAH
CANE GARDEN BAY
Sage Mountain Ridge
WINDY HILL
COXHEATH
CARROT BAY
FLAMINGO POND
LITTLE APPLE BAY
TOWERS
LONG BAY
SANDY POINT
FRENCHMANS CAY
BELMONT BAY
WEST END
RAINFALL AND MOISTURE CONDITIONS AS EVIDENCED BY VEGETATION AND OTHER NON-QUANTITATIVE OBSERVATIONS
Moist or Wet Districts
Intermediate Districts
Dry Districts
W.G.D. 22 August 1967

Kaye 1959). It is essentially the West Indies Cretaceous formation which uplifted and metamorphosed in Eocene times with many resulting intrusions of igneous material such as quartz, granite and hornblende into the predominant limestone structure. The Virgin Islands present an extremely local and varied geological pattern. Strata are usually tilted and folded, and cliffsides show a patchwork effect. Several different types of rock are to be found underfoot in the space of a few yards. No fossils have been found on Tortola, but their presence is to be expected as a number of references are made to fossils on the American Virgins. Fossils on the adjacent Coki Point, St. Thomas, are only visible when the rock is wet, and similar structures may yet be found on Tortola.

PHYSIOGRAPHY: The mountain ridge forming the mass of the island drops steeply to the sea in most places, but is dissected by many sizable ghuts or ravines which fan out into large flat bottoms before meeting the sea. The ridge top consists of a broken and eroded peneplane of 800-1200 feet (240-360 m.) elevation with a higher ridge, Sage Mountain, reaching 1700 feet (450 m.) in the western third of the island. Martin-Kaye (1959) describes two other peneplanes, but they are difficult to see. Suggestion of a peneplane at 400-600 feet (120-180 m.) gives rise to a number of promontories extending seaward between the ghuts and bottoms.

CLIMATE: A number of climatic factors strongly influence the pattern of vegetation. **Seasons:** Seasons are not strongly marked by temperature or length of day, but there is a significant seasonal change in vegetation independent of rainfall, e.g. *Sabinea florida* blooms in the early part of the year, *Hibiscus sabdariffa*, *Eupatorium* spp. and *Melochia nodiflora* are winter bloomers, *Myrciaria floribunda* blooms in the autumn and *Acacia macracantha* is usually deciduous in January or February. Rainfall variations often alter leaf drop or blooming for about a month forwards or backwards, but the usual effect is to influence amount of flowering or set of fruit. Although a seasonal pattern of rainfall

TABLE II

Climate of the Virgin Islands

| | *Jan.* | *Feb.* | *Mar.* | *Apr.* | *May* | *June* | *July* | *Aug.* | *Sept.* | *Oct.* | *Nov.* | *Dec.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hours of Daylight[1] | $11^h 13'$ | $11^h 40'$ | $12^h 07'$ | $12^h 38'$ | $13^h 03'$ | $13^h 13'$ | $13^h 03'$ | $12^h 38'$ | $12^h 08'$ | $11^h 39'$ | $11^h 14'$ | $11^h 03'$ |
| Temperature[2] | | | | | | | | | | | | |
| Maximum | 88 | 90 | 90 | 95 | 90 | 92 | 93 | 95 | 93 | 92 | 92 | 92 |
| Minimum | 59 | 60 | 60 | 64 | 67 | 65 | 66 | 61 | 60 | 60 | 65 | 59 |
| Mean | 76.7 | 77.0 | 77.9 | 79.3 | 80.2 | 81.3 | 81.8 | 82.3 | 81.8 | 80.4 | 79.5 | 77.8 |
| Rainfall[3] | 3.26 | 2.45 | 2.14 | 2.79 | 4.99 | 4.06 | 4.00 | 4.88 | 6.23 | 6.38 | 6.53 | 4.23 |

[1]21st day of month. Tables of Sunrise, Sunset and Twilight, Supplement to The American Ephemeris, 1946. United States Naval Observatory, Washington, D. C.

[2]Degrees Fahrenheit, Cruz Bay, St. John. From Climatography of the United States No. 86-45, Decennial Census of United States Climate, Climatic Summary of the United States, Supplement for 1951 through 1960, p. 35. Years of record, 14.

[3]Inches of rain at the Experiment Station, Road Town. Taken from Agricultural Department records.

can be shown statistically, it is far from dependable and cannot be regarded as an important seasonal determinant. Farmers expect rain in October and plant accordingly but are often disappointed. Very heavy rains sometimes fall in May, but these too are irregular. From February to May, there is seldom much rain, and sometimes none at all. Winds are generally higher in the winter months, but the relation to seasonal vegetation patterns was not observed. **Rainfall:** Rainfall records are available only for the Experiment Station at Road Town, and these are assumed to indicate the general fluctuations at other points on the island. More important than seasonal fluctuations are periods of drought. Howard and Proctor (1958) assume that 4.0 inches of rain are necessary in each month for optimum plant growth in the West Indies. During the 63 year period between 1901 and 1964, 442 or 58% of months had less than four inches of rain, and 182 or 24% of months had less than two inches of rain; 64% of years had three or more months with less than two inches. Approximately one year in five has an extended drought which lowers the water table, turns wells brackish and which has a drastic effect on agriculture and vegetation in general. The effects of this drought pattern are much less pronounced in normally wet districts; and in the very dry districts, it has imposed an almost xerophytic vegetation. Geographic rainfall patterns must be considered in connection with wind and altitude. **Wind:** The easterly trade wind is almost continuous, and it is a rare day that it is absent altogether. Its drying effects are strikingly in the xerotic appearance of promontories at lower elevations. Fish Bay and Jean Hill, Duffs Bottom and Slaney Point are good examples where adjacent tracts with the same rainfall show very different patterns due mainly to the wind. Wind is probably the major factor in the persistence of the *Croton* scrub on abandoned pastures, as similar areas with some shelter are largely covered with *Eugenia biflora.* **Altitude:** Sage Mountain, with its 1710 foot elevation is the principal land feature influencing precipitation. Reference should be made to the rainfall map of the island. Sage Mountain is frequently shrouded in cloud mists and provides the temperature drop to initiate precipitation. The trade winds tend to direct precipitation to the west and north sides of the ridge, and when winds are high, much of the rain falls in the sea between Tortola and St. Thomas. Higher moisture levels are needed to result in precipitation to the east of Sage Mountain, and this tends to follow the mountain ridge as far east as Hope. Some of this rain falls on lower levels, and because of the wind again, more of it falls on the north side, giving Brewers Bay and Cane Garden Bay districts a flourishing agriculture. East of Hope, and at sea level east of Brandywine Bay, rainfall is light, and there are frequent periods of several months without significant rain. Neither Virgin Gorda nor Beef Island has sufficient elevation to induce much rain and they have a chronic drought problem. Someone facetiously suggested the solution to Tortola's water problem is to move Sage Mountain to Beef Island: it would undoubtedly have the desired result. Local residents frequently state that the island is "drying up"; this belief no doubt stems from memories of very high rainfall in the 1930's, but reference to statistics from 1901 to the present indicate no trend in the amount of rainfall.

HISTORY OF CULTIVATION: Artifacts found on Tortola indicate that in pre-Columbian times it was settled by Arawaks, an agrarian people. Dutch buccaneers took possession of the island in 1648, but it was not until 1700 that English planters from Anguilla made the first agricultural settlement. Slaves were brought in and almost the whole of the island was cleared for cotton, sugar, pasture and minor crops. Evidence of the extent of this cultivation is still to be found in half buried stone terracing in much of the present day mountain forest. With the end of slavery and the sugar era in the middle of the last century, much of this cleared land grew back into forest, although promontories and other areas of low rainfall achieved little more than a scrub vegetation and more promising lands remained devoted to subsistence farming. Charcoal cutting and cattle raising have been traditional occupations on Tortola, but were accelerated in this century by government cattle and pasture programs. Planting of pasture grasses, especially the all-excluding pangola grass, has inhibited reforestation in many areas. On the south side near the top of the ridge, in spite of high rainfall, the strong winds have maintained open pasture and krumholz situations, whereas on the north, large areas of shrubs and some forest have reappeared.

Early in this century, the government established a factory at the Experiment Station to encourage sugar, cotton and limes. Today, some sugar is cultivated for making local rum. In 1947, government cotton support was withdrawn and cultivation ceased, but *Gossypium* spp. are naturalized and wild trees are to be seen scattered throughout the island. Limes are no longer cultivated as a commercial crop, but plantation remnants in Cane Garden Bay provide a small household export to St. Thomas, and lime trees are a naturalized species. During the 1930's, tobacco was extensively cultivated in Free Bottom and other areas, but no plants are to be seen on the island today. Coconuts have been cultivated from time to time and are to be seen in many parts of the island. Over the centuries many other crops have been cultivated, and today bananas, yams, cassava, tanias, pidgeon peas, okra and peppers are standard crops exported on a household scale. The island is now a net importer of most of these crops. Scattered specimens of *Tectona grandis, Theobroma cacao, Citrus sinensis* and other species result from earlier agriculture attempts. *Mangifera indica* and *Carica papaya* are widely naturalized, the wild trees producing very inferior fruit. Judging from its present frequency, *Annona muricata* was probably cultitivated on an extensive scale for hog food. Introductions of *Peltophorum inerme, Azadirachta indica* and the widespread use of *Samanea saman* as a pasture tree reflect British colonial agricultural direction: while these species may occur on the American Virgins, they are not at all common there. Cultivation, forest clearing and the prevailing practice of burning off pastures have had a disastrous effect on the soil. Every sizable rain discolors Road Harbour with soil washed down from the hills, and the hillsides are again too dry for satisfactory growth in a few days. Sage Mountain forests, steep ghuts and rocky seaside cliffs fare much better as they have not had the same loss through soil disturbance, and therefore support a larger flora than the cultivated or pasture hillsides. On Camanoe, Peter Island and other cays are undisturbed areas which support floras comparable to areas of much higher rainfall on Tortola. Sage Mountain Forests: Once covering most of the central parts of the island, the forest is now reduced to a few dozen acres on the north and western parts of the ridge. Widely scattered standing boles of *Manilkara balata* left untouched by charcoal cutters attest to the former extent of forest in even recent times. Sage Mountain peak itself and Chalwell peak are now completely devoid of original vegetation. Probably very little of the present mountain forest is aboriginal, but most of it qualifies as sub-climax rain forest (Beard 1942, 1944, Stoffers 1956). *Ficus trigonata*, *Tetragastris balsamifera*, *Manilkara balata*, the luxuriant development of *Clusia rosea* trees, and the steep inarable condition of the summit argue for an aboriginal condition, but *Heliconia caribaea* and *Syzygium jambos* suggest disturbance at some time. The presence of buried terracing at 1300 foot elevation on the north side is unarguable. The forest has been described (B.V.I. Report, 1964) as xerophytic rain forest, a formation characterized (Beard 1944) by peeling desiccated tree bark and small, much-cutinized leaves. These xeromorphic features are not conspicuous in the Tortola forests today, although Beard's description may have applied to areas which have since been cut off. The forest is no doubt modified to a considerable extent by the prolonged dry periods, and the unhappy term "xerophytic rain forest" might better be replaced by the appellation "aridulate rain forest." The almost complete absence of epiphytic orchids and the complete absence of gesneriads, and the fact that most visitors fail to penetrate the dense barrier of shrubs that surrounds the forest, and hence never see it at all, seem to be the main reasons for local avoidance of the term rain forest. *Philodendrons*, *Aechmeas*, *Peperomias* and *Marcgravia rectiflora* are frequent epiphytes. There are indications that the forest is expanding: *Cyathea arborea, Heliconia caribaea, Cecropia peltata, Acnistus arboreus, Cupania americana* and *Syzygium jambos,* characteristic species of Pioneer Rain Forest (Stoffers 1956), are found in fairly extensive areas at the periphery of the old formation. With the general decline of agriculture on the island, pastures are not being extended, and the competition of bottled cooking gas is fast reducing charcoal cutting. Sage Mountain peak and a substantial neighboring acreage have been planted to restore the forest, and if this does not re-establish the former flora, it will help provide humidity conditions favorable to natural extension of the present forest. Continued illegal charcoal cutting or establishment of proposed residential housing on the mountainsides will limit such expansion.

FLORISTIC AFFILIATIONS: Although species are often not represented on all islands in the group, it is usual for a species to be found on more than one. The offshore Puerto Rico islands, Culebra, Icacos and Vieques, have essentially the same physical structure and flora as the Virgin Islands, which is a xerophytic extension of the Puerto Rico flora. Only perhaps 60 species of plants are found in the islands which are not found in Puerto Rico, and these include several endemics. A few plants clearly originate in the islands to the south and were not reported for Puerto Rico by Britton and Wilson (1923 & 1925). *Morisonia americana* is a striking example which occurs throughout the Virgin Islands and south to Venezuela. *Chaetocalyx scandens* was found on Tortola in 1965 and comes from the islands to the south. Some Tortola plants have widespread origins, e.g. *Croton ovalifolius* (South America and Greater Antilles), *Solanum elaeagnifolium* (Mexico and S. U.S.), *Diodia apiculata* (Anegada and Hispaniola) and *Stigmaphyllon diversifolium* (Cuba and Hispaniola), but there are not many. Of course, many species have been brought to the island and naturalized through the agency of man, e.g. *Pedilanthus tithymaloides* (probably pre-Columbian), *Kalanchoë verticillata, Tamarindus indica, Haematoxylon campechianum,* and *Syzygium jambos.* While floristic affiliation is principally with Puerto Rico, the islands form a link in the ecological chain of windswept small islands stretching from the Bahamas to Tobago; many species are common throughout, and they reflect the xeric and saline habitats offered in this group of islands. One species of the archipelago conspicuously wanting in the wild state on Tortola is *Casuarina equisetifolia* which has not reproduced on any of the low seaside areas such as Sandy Point or Beef Island. Proximity is the principal reason for the greater affinity with Puerto Rico: Tortola is separated from Anguilla, the nearest of the Leeward Islands, by 92 miles (79 km.) of open sea, while between Tortola and Puerto Rico the farthest open distance (Culebra to Vieques) is only 9 miles (14 km.).

ENDEMISM: While a number of endemics have been reported for other Virgin Islands, Tortola has only one, *Calyptranthes kiaerskovii,* based on a sterile collection by Eggers in 1879. Even for the Virgin Islands as a whole, Britton & Wilson (1923 & 1925) note only about 20 endemics, and some of them, e.g. *Salvia thomasiana,* are suspect. It is possible that further observations will turn up additional endemics on Tortola, but the number cannot be large. The presence of endemics on neighboring islands and the author's own observations seem to indicate the possibility of endemics in a number of genera: *Zanthoxylum, Malpighia, Brunfelsia, Galactia, Forestiera* and *Tephrosia.* One species, *Tillandsia lineatispica,* which was reported as a St. John endemic on the basis of a single Eggers collection was found to be plentiful on Peter Island and Camanoe. *Piptocoma antillana* was found on Virgin Gorda and is plentiful on Peter Island, but is a rare plant on other Virgin Islands, the east end of Puerto Rico and Hispaniola, and its scant distribution begs the question of whether it is a relic or an expanding endemic. Small cays like Peter Island and Camanoe are well worth future attention as they have undergone less disturbance than the larger of the Virgin Islands.

PREVIOUS COLLECTORS: *Richard, Louis-Claude,* (1754-1821). Collected on Tortola and St. Thomas in 1786-87, depositing in the Muséum National d'Histoire Naturelle, Paris. Reference to his collections was not made for this

TABLE III

Plants Growing Wild (indigenous, naturalized or escaping)

| Major Families | Genera | Species |
|---|---|---|
| Leguminosae | 47 | 73 |
| Mimosaceae | *12* | *17* |
| Caesalpiniaceae | *7* | *15* |
| Fabaceae | *28* | *41* |
| Compositae | 33 | 43 |
| Euphorbiaceae | 18 | 34 |
| Rubiaceae | 18 | 24 |
| Malvaceae | 12 | 24 |
| Convolvulaceae | 7 | 21 |
| Myrtaceae | 9 | 19 |
| Boraginaceae | 5 | 18 |
| Solanaceae | 7 | 16 |
| Acanthaceae | 7 | 14 |
| Amaranthaceae | 8 | 12 |
| Verbenaceae | 7 | 11 |
| Labiatae | 7 | 10 |
| Capparaceae | 3 | 10 |
| Total Major Families | 188 | 329 |
| Minor Families (79) | 161 | 221 |
| Total Wild Plants | 349 | 550 |
| Cultivated Plants | | 111 |
| Total Dicotyledons | | 661 |

checklist. L.-Cl. Richard was later professor of botany at the École de Medicine in Paris. His son, Achille Richard, was author of Essai sur la Flore de Cuba, included in the work of Ramon de la Sagra on that country. *Schomburgk, Sir Robert Herman* (1804-65). Not to be confused with his younger brother Sir Otto Schomburgk who collected in the Guyanas, Sir Robert lived on Anegada in the 1830's, and although he made no collections, his papers provided a useful introduction to further study. See Kemp (1926). *Grisebach, August Heinrich Rudolph* (1814-79). His monumental Flora of the British West Indies makes no mention of Tortola. He worked with collections in the British Museum, Kew Museum (sic.), the Academy of Stockholm and extensive other collections, and it is fair to assume he came across no Tortola items. *Eggers, Baron Heinrich Franz Alexander* (1844-1903). Resident of St. Croix and St. Thomas from 1869 to 1887, he visited Tortola over the Christmas season of 1887. While he took only 68 specimens, the localities recorded indicate he travelled widely during his brief stay. His Flora of St. Croix (1879) and other publications are important studies of the West Indies flora. *Fishlock, Walter Charles* (1875-1932). Born at Bathford, near Bath, England, he was a student gardener at Kew and then was employed in Hyde Park, London. On May 2, 1902, he arrived at the Experiment Station on Tortola, established the year before, and in about 1912 became Curator of the Station. In August 1919 after taking leave, he became Senior Curator in the Department of Agriculture, the Gold Coast. He collected extensively, sending specimens to Kew, New York Botanical Garden and other institutions. Older residents of the island credit him with introduction of many economic plants. His Handbook of the Virgin Islands contains little botanical information but is useful from a historical point of view. Most of his collections were published by Britton & Wilson (1923 & 1925). *Britton, Nathanial Lord* (1859-1934). Director of the New York Botanical Garden for many years, he was a towering leader in American botany. He was instigator of the now discarded American Code of nomenclature, and his publications follow this system. Between 1913 and 1923 he visited Tortola a number of times, sometimes accompanied by his wife, a distinguished bryologist, and by John Shafer, also of the New York Botanical Garden. This work was in preparation for his Botany of Porto Rico and the Virgin Islands, and while collecting was extensive, Tortola seems to have received less attention than any other major island in the study. Fishlock accompanied Britton on his Tortola excursions, and many of the Britton and Wilson reports are based on Fishlock collections. Britton's collections are deposited in the Herbarium of the New York Botanical Garden. *Velez, Ismael* (1908—). Velez visited Tortola for about two weeks in 1950, collecting herbaceous species for his Lesser Antilles weed study (1957). His specimens are deposited with the Imperial College of Agriculture, Trinidad and with the Inter American University of Puerto Rico, his present address. In publishing his study Velez did not indicate on which of the Virgin Islands he collected a species. *Little, Elbert L., Jr.* (1907 —). As Dendrologist with the United States Department of Agriculture, Forest Service, he spent a number of years in Puerto Rico, visiting Tortola on July 19, 20 & 21, 1954. He collected 35 numbers of trees and other woody plants in preparation for his excellent Common Trees of Puerto Rico and the Virgin Islands (1964). His specimens are deposited with the United States National Museum.

ORIGIN OF THE CHECKLIST: The author visited the island several times between 1959 and 1961 and was a resident for five years between 1961 and 1966. Only the final two or three years of residence was devoted to botanical work, and such work was necessarily secondary to other pursuits. A complete flora and vegetational study was envisaged, but this goal was interrupted early in 1966 when the author left the island for business reasons. All parts of the island were visited several times and over 800 numbers of vascular plants were collected. Virgin Gorda, St. John, St. Thomas and many of the smaller cays were visited several times with some collections taken. Tortola has been badly neglected in botanical literature, and it seems better, in spite of insufficient work, to provide a preliminary checklist of the plants growing there than to wait until an opportunity for more study presents itself. The checklist includes 106 new reports by the author, as well as 11 by Eggers and 24 by Fishlock which had been overlooked in previous literature, or over 25% new reports in all.

Specimens were sent to the Arnold Arboretum, the British Museum (Natural History), The Institute of Jamaica, the University in Copenhagen and to the University of Florida and a complete set of specimens is retained by the author. Dr. R. A. Howard of the Arnold Arboretum, Mr. George Proctor of the Jamaica Institute and Dr. W. T.

Stearn of the British Museum (N.H.) very kindly provided identification of plants they received; and Dr. A. Skovsted of the University in Copenhagen kindly supplied a list of plants collected by Eggers. Dr. Elbert L. Little, Jr., of the United States Forest Service, Bro. Alain Liogier of Manhattan College, Dr. Ismael Velez of the Inter American University of Puerto Rico, Mr. J. E. Dandy of the British Museum (N.H.), M. G. Aymonin of the Museum National d'Histoire Naturelle, Paris, and Sir George Taylor, Kew, sent helpful correspondence.

Gratitude is due to Mr. Malcolm Winter, Superintendent of Agriculture, for much advice and for permission to take specimens from the Experiment Station. Many householders were kind enough to supply plants from their grounds, and especial thanks must go to Mr. Rowan Roy, Mrs. A. A. Hurt and Mrs. Robert P. Nevin. Mr. Norman Kerr was most helpful with his thorough botanical background and took part in several collecting trips. Dr. Richard A. Howard, Director, The Arnold Arboretum, was steadily encouraging in his prompt and helpful correspondence, and without his free assistance, this checklist would not have emerged. Dr. D. B. Ward and Mr. John Beckner, University of Florida, patiently read this paper and offered many suggestions.

CHECKLIST FORMAT: Families follow the order of Britton & Wilson. Genera are listed alphabetically and species alphabetically within genera. Nomenclature is taken mainly from Flora of Barbados, Bro. Alain Liogier's list and from Britton and Wilson, but in a few cases, reference to current monographs suggested other usage. Only names used by Britton and Wilson or widely used at the present time are indicated in synonomy. Unless otherwise indicated, citations are for Tortola. The author's own collections are indicated by number only, and when no other citation is given, this is a new report for the species. A good description of the plant may usually be found in Britton and Wilson (1923 & 1925) or Little and Wadsworth (1964) when these authors are cited as finding a species on Tortola. Place names in the text are taken from the maps D.O.S. 346

(Series E 837), First Edition 1959, but Eggers and Fishlock collections are cited with place names as supplied.

UNIVERSITY OF FLORIDA, GAINESVILLE 32601

BIBLIOGRAPHY

ANON. British Virgin Islands, Reports for the Years 1961 and 1962. Her Majesty's Stationery Office, London 1964.

BEARD, J. S. The Natural Vegetation of the Island of Tobago, British West Indies. Ecological Monographs, Vol. **14**, No. 2.

BEARD, J. S. Montane Vegetation in the Antilles. The Caribbean Forester, Vol. **3**, No. 2, January 1942.

BRITTON, N. L. and PERCY WILSON. Botany of Porto Rico and the Virgin Islands, Scientific Survey of Porto Rico and the Virgin Islands, Vols. **V & VI**: New York Academy of Sciences, 1923 & 1925.

EGGERS, BARON H. F. A. The Flora of St. Croix and the Virgin Islands. Bulletin of the United States National Museum, No. **13**, Washington, 1879.

FISHLOCK, W. C. The Virgin Islands, B. W. I., A Handbook of General Information, London, 1912.

GLEASON, H. A. and MEL. T. COOK. Plant Ecology of Porto Rico. Scientific Survey of Porto Rico and the Virgin Islands, Vol. **VII**: Part 1, New York Academy of Sciences, 1927.

GOODING, E. G. B., A. R. LOVELESS, and G. R. PROCTOR. Flora of Barbados. Her Majesty's Stationery Office, London, 1965.

HOWARD, R. A. & G. R. PROCTOR. The Vegetation on Bauxite Soils in Jamaica. Journal of the Arnold Arboretum, Vol. **38**: 1-50, 151-169, Cambridge, Mass., 1958.

KEMP, JAMES F. and HOWARD A. MEYERHOFF. Geology of the Virgin Islands, Culebra and Vieques, Scientific Survey of Porto Rico and the Virgin Islands, Vol. **IV**, New York Academy of Sciences, 1926 & 1927.

LITTLE, ELBERT L., JR. and FRANK H. WADSWORTH. Common Trees of Puerto Rico and the Virgin Islands. United States Department of Agriculture, Forest Service, Agriculture Handbook No. 249, Washington 1964.

LIOGIER, BRO. ALAIN. Nomenclatural Changes and Additions to Britton and Wilson's "Flora of Porto Rico and the Virgin Islands." Rhodora Vol. **67**: 315-361, 1965.

MARTIN-KAYE, P. H. Reports on the Geology of the Leeward and British Islands. Castries, St. Lucia, 1959.

MILLSPAUGH, CHARLES FREDRICK. Flora of the Island of St. Croix. Field Columbian Museum Publication **68**, Chicago 1902.

MOLDENKE, HAROLD N. A Resumé of the Verbenaceae, Avicenniaceae, Stilbaceae, Symphoremaceae and Eriocaulaceae of the World as to Valid Taxa, Geographic Distribution and Synonymy. Private Publication, Yonkers, N. Y. 1959.

STOFFERS, A. L. The Vegetation of the Netherlands Antilles. Uitgaven "Natuurwetenschappelijke Studiekring Voor Suriname en de Nederlandse Antillen," No. 15, Utrecht, 1956.

VELEZ, ISMAEL. Herbaceous Angiosperms of the Lesser Antilles. Inter American University of Puerto Rico, 1957.

## CHECKLIST OF DICOTYLEDONS ON TORTOLA, VIRGIN ISLANDS

### Family 1. CASUARINACEAE

Casuarina Adans.

**Casuarina equisetifolia** J. R. & G. Forst. A few cultivated specimens; Government House, Experiment Station, Pasea Hall Estate.

### Family 2. PIPERACEAE

Peperomia Ruiz & Pav.

**Peperomia glabella** (Sw.) A. Dietr. Common at higher elevations. Tolerates a wide range of sunlight. Sometimes as an epiphyte with *Epidendrum ciliare*. *111, 112*. Britt. & Wils.

**P. humilis** (Vahl) A. Dietr. Rare on undisturbed rocks and cliffs. Seen at Huntum's Ghut (110 m.), and at west end of Brewers Bay (sea level). *466, 467, 468, 469, 470; Fishlock 243*. Britt. & Wils.

**P. magnoliaefolia** (Jacq.) A. Dietr. In shade, Sage Mt. forests. *87; Fishlock 369*. Britt. & Wils.

**P. pellucida** (L.) H. B. K. A common street weed in Road Town. *150, 152; Fishlock 230*. Britt. & Wils.

Piper L.

**Piper amalago** L. Common in shady ghuts. *148, 169; Fishlock 149; Eggers 3189*. Britt. & Wils.

Pothomorphe Miq.

**Pothomorphe peltata** (L.) Miq. Occasional at upper elevations. *465; Fishlock 338*. Britt. & Wils.

### Family 3. ULMACEAE

Celtis L.

**Celtis iguanaea** (Jacq.) Sarg. *Momisia iguanaea* (Jacq.) Rose & Standley. *Fishlock 360, Fishlock 361*, and *Fishlock 409* (Huntum's Ghut). Britt. & Wils.

**C. trinerva** Lam. Britt. & Wils.

Trema Lour.

**Trema micrantha** (L.) Blume. *Fishlock 219* (Lower Estate). Little & Wads., Britt. & Wils.

Family 4. MORACEAE

Artocarpus Forst.

**Artocarpus altilis** (Parkinson) Fosberg. *Artocarpus incisa* L. f. *Artocarpus communis* Forst. Cultivated, chiefly in moist districts. "Breadfruit." The seeded form, "Breadnut," is rarely cultivated. Little & Wads.

Cecropia L.

**Cecropia peltata** L. Common on moist forest slopes out of the wind. "Trumpetwood." Little & Wads.

Ficus L.

**Ficus citrifolia** Mill. *Ficus laevigata* Vahl. Common. A fine avenue occurs at Little Apple Bay. "Fig Tree." *Fishlock 418* (Belleview). Little & Wads., Britt. & Wils.

**F. trigonata** L. *Ficus crassinervia* Desf. In Sage Mountain forests. *666*. Little & Wads., Britt. & Wils.

Family 5. URTICACEAE

Fleurya Gaud.

**Fleurya aestuans** (L.) Gaud. Very rare. Single plants seen at Callwoods, Cane Garden Bay, and at the Experiment Station. *212*, *Fishlock 244* (Lower Estate). Britt. & Wils.

Pilea Lindl.

**Pilea herniarioides** (Sw.) Lindl. Rare. Seen on Joe's Hill, and on walls, Cane Garden Bay. May not be distinct from *Pilea microphylla*. *215, 216, 217*.

**P. microphylla** (L.) Liebm. Common cultivated. "Everlasting." *Fishlock 375* (Slaney Point).

**P. nummulariaefolia** (Sw.) Wedd. Very rare. Seen only at roadside, Experiment Station. *782, 783, 784*.

**P. sanctae-crucis** Liebm. Common in mountain forests and coming down to 100 m. in Long Bush and Huntum's Ghuts. *100*, *Fishlock 245* (Joe's Hill). Britt. & Wils.

**P. tenerrima** Miq. Occasional patches seen in moist years. *293, 294, 295, 296*. Britt & Wils.

Family 6. PROTEACEAE

Grevillea R. Brown

**Grevillea robusta** Cunn. The single fine specimen in the Road Town Experiment Station was surveyed at 49 feet tall on 25th April, 1965.

Family 7. LORANTHACEAE

Dendropemon Blume

**Dendropemon caribaeum** Krug & Urban. *Phthirusa caribaea* (Krug & Urban) Engler. Common. This mistletoe seems particularly partial to *Citrus*. *831*. *Fishlock 397* (Old Plantation). Britt & Wils.

Family 8. ARISTOLOCHACEAE

Aristolochia L.

**Aristolochia littoralis** Parodi. *Aristolochia elegans* Mast. Cultivated and escapes. "Dutchman's Pipe." *355*.

**A. trilobata** L. *Fishlock 433* (Long Bay).

Family 9. POLYGONACEAE

Antigonon Endl.

**Antigonon leptopus** Hook. & Arn. Common in thickets, roadsides and towns; moist and dry districts. "Coral Vine," "Coralita." *235*.

Coccoloba L.

**Coccoloba microstachya** Willd. *Coccolobis obtusifolia* Jacq. *771, 772* (Beef Island); *Fishlock 142* (woods). Little & Wads., Britt. & Wils.

**C. uvifera** (L.) L. *Coccolobis uvifera* (L.) Jacq. Common along sea-coasts. Also plentiful near Meyers (300 m.). "Sea Grape." Little & Wads., Britt. & Wils.

**C. venosa** L. Common in shady ghuts, mostly at lower elevations. "Chiggery Grape." *149*. Little & Wads., Britt. & Wils.

Family 10. CHENOPODIACEAE

Atriplex L.

**Atriplex pentandra** (Jacq.) Standley. Occasional along the sea shore. *105, 184*.

2. Chenopodium L.

**Chenopodium ambrosioides** L. Commonly cultivated as a medicinal, escapes, and naturalized at Cane Garden Bay. "Wormgrass." *329*. *Beta vulgaris* L. (beetroot) is sometimes cultivated.

Family 11. AMARANTHACEAE

Achyranthes L.

**Achyranthes aspera** L. *Achyranthes indica* (L.) Mill. *Centrostachys indica* (L.) Standley. *Centrostachys aspera* (L.) Standley. Perhaps the most annoying and troublesome weed on the island, covering abandoned cultivation very quickly. The form *A. indica* is perhaps more common on level ground in dry areas; and *A. aspera* occurs on level and sloping ground at higher elevations where there is more rainfall. They are distinct in appearance. "Man Catcher." *673*; *Fishlock 209* (Pasea Hall Estate). Britt. & Wils.

Alternanthera Forsk.

**Alternanthera ficoidea** (L.) R. Br. ex R. & S. *Achyranthes ficoidea* (L.) Lam. Britt. & Wils.

**A. ficoidea var bettzickiana** (Mich.) Baker. *Achyranthes bettzickiana* (Regel) Standley. Cultivated as an ornamental and occasionally escaping.

**A. paronychioides** St. Hil. *Achyranthes polygonoides* (L). Lam. sensu Britt. & Wils. *Alternanthera paronychoides* St. Hil. Plentiful in sandy pastures and roadsides, disturbed areas. Perhaps more common in dry sections and near the sea. It is a very different plant from *A. ficoidea* var *bettzickiana.*

Amaranthus L.

**Amaranthus caudatus** L. Commonly cultivated and escaping in wet years. "Caterpillar." *325.*

**A. crassipes** Schlechter. *Fishlock 242* (Experiment Station). Britt. & Wils.

**A. dubius** Mart. A troublesome weed in towns and gardens. Sometimes cooked as greens. "Spinach." *Fishlock 134* (Experiment Station). Britt. & Wils.

**A. spinosus** L. A troublesome streetside weed. *795; Fishlock 134* (Experiment Station). Britt. & Wils.

Celosia L.

**Celosia argentea** L. *Celosia cristata* L. Frequently cultivated as an ornamental.

**C. nitida** Vahl. *Fishlock 431* (Belmont); *Eggers 3178* (in fruticetis maritimis). Britt. & Wils.

Chamissoa H. B. K.

**Chamissoa altissima** (Jacq.) H. B. K. Common in thickets along the sea coast. The tips of the spikes are quite pink. *240.*

Gomphrena L.

**Gomphrena decumbens** Jacq. *Gomphrena dispersa* Standley. A common weed.

**G. globosa** L. Occasionally cultivated. "Bachelors Button."

Iresine P. Browne

**Iresine angustifolia** Euph. Common in older secondary thickets, hillsides. *581, 582, 583, 584, 585; Fishlock 61* (Great Mountain). Britt. & Wils.

Philoxerus R. Brown

**Philoxerus vermicularis** (L.) Beauv. *Philoxerus vermicularis* (L.) Nutt. A common halophyte, covering extensive areas at Sandy Point and on Beef Island. Britt. & Wils.

Family 12. NYCTAGINACEAE

Boerhaavia L.

**Boerhaavia diffusa** L. *Boerhaavia coccinea* Mill. A common and troublesome weed, waste places and gardens. "Pigweed." *Fishlock 143* (waste places), *Fishlock 144* (Experiment Station). Britt. & Wils.

**B. erecta** L. Rare, but occurring in much the same way as *B. diffusa. Fishlock 145* (Experiment Station). Britt. & Wils.

Bougainvillea Comm. ex Juss.

**Bougainvillea spectabilis** Willd. Seen growing wild near the sea at Fort Burt, probably rooting from refuse. Many forms and colors of this, *B. peruviana* H. & B. and *B. glabra* Choisy are grown as ornamentals.

Commicarpus Standley

**Commicarpus scandens** (L.) Standley. Seen near the sea at Coxheath and Little Apple Bay. *256* (Virgin Gorda), *231; Eggers 3173* (West End). Britt. & Wils.

Mirabilis L.

**Mirabilis jalapa** L. Cultivated and naturalized. Widespread in moist areas but not frequent. "Four O'Clock." *Fishlock 226* (Road Town). Britt. & Wils.

Pisonia L.

**Pisonia fragrans** Dumont-Cours. *Torrubia fragrans* (Dumont-Cours.) Standley. A common tree in forests and villages near sea level. "Water Mampo." *284; Fishlock 402.* Little & Wads.

**P. subcordata** Sw. The common pasture tree of Tortola. Occurs at all elevations in forests and villages. "Mampo." Little & Wads., Britt. & Wils.

Family 13. BATACEAE

Batis L.

**Batis maritima** L. A common halophyte on coastal flats. Plentiful at Slaney, Sandy Point and Beef Island. *219, 220, 221;* Fishlock s.n. (saline soil). Britt. & Wils.

Family 14. PHYTOLACCACEAE

Petiveria L.

**Petiveria alliacea** L. A common weed, often occurring with *Rivina humilis* and *Achyranthes aspera.* "Garlic Weed." *735, 736, 737, 738; Fishlock 133* (Experiment Station). Britt. & Wils.

Phytolacca L.

**Phytolacca rivinoides** Kunth & Bouche. A single immature plant growing in virgin forest at Arundel Estate was tentatively identified as this species. *368.*

Rivina L.

**Rivina humilis** L. Common in thickets and secondary growth, lower elevations. "Cat's Blood." *Fishlock 179* (Lower Estate). Britt. & Wils.

Trichostigma A. Rich.

**Trichostigma octandrum** (L.) H. Walter. Festooning in thickets in ghuts and secondary growth, lower elevations. Sometimes high climbing. *Fishlock 161* (Road Town). Britt. & Wils.

Family 15. AIZOACEAE

Mollugo L.

**Mollugo verticillata** L. *228* (Virgin Gorda). Britt. & Wils.

Sesuvium L.

**Sesuvium portulacastrum** L. A common halophyte on coastal flats. *726.*

Trianthema L.

**Trianthema portulacastrum** L. A common weed in the dry Long Look-East End section. *Fishlock 487* (waste grounds). Britt. & Wils.

Family 16. PORTULACACEAE

Portulaca L.

**Portulaca oleracea** L. A common weed in all areas. Often occurring as a halophyte forming part of the behind-the-beach cover. "Purselane." *Fishlock 193* (cultivated). Britt. & Wils.

**P. pilosa L.** Waste places and forming large masses within the range of salt spray. "Rice Plant."

**P. pilosa** var. **hortualis** Bailey. Cultivated and escapes by vegetative means. "Jump-up-and-kiss-me."

**P. quadrifida** L. A weedy species chiefly of dry areas. The leaves are usually quite red. *Fishlock 268* (Experiment Station). Britt. & Wils.

**P. rubricaulis** H. B. K. *Portulaca phaeosperma* Urban. Widespread but rare along the south coast. *313.*

**P. umbraticola** H. B. K. Widely cultivated, but probably introduced in the last two or three years. *13.*

Talinum Adans.

**Talinum paniculatum** (Jacq.) Gaertn. Rare. Seen only on rocks over the sea, Josia's Bay. *252, 253, 254; Fishlock 417* (Belleview). Britt. & Wils.

**T. triangulare** (Jacq.) Willd. A low, yellow flowered form is common near the sea in western parts of Tortola. A taller (to 8 dm.), pink flowered form is cultivated and occasionally escapes. *Fishlock 233* (Experiment Station).

Family 17. BASELLACEAE

Basella L.

**Basella alba** L. *Basella rubra* L. Ceylon spinach, grown for greens, often escapes but is not long persistent.

Anredera Juss.

**Anredera leptostachys** (Moq.) Steen. *Boussingaultia leptostachys* Moq. Festooning in thickets, moist districts up to about 300 m. *259; Fishlock 248* (Experiment Station). Britt. & Wils.

Family 18. NYMPHACEAE

Nymphaea L.

**Nymphaea ampla** (Salisb.) DC. *Castalia ampla* Salisb. In the freshwater pond below Windy Hill in Carrot Bay. This seems to be an intermediate between *N. ampla* and *N. pulchella* (DC.) Britt. as it has 60-70 stamens and 20-23 petals. *727, 728, 729.*

**N. zanzibarensis** Casp. *Castalia zanzibarensis* (Casp.) Britt. Rarely cultivated in lily ponds.

Family 19. MENISPERMACEAE

Cissampelos L.

**Cissampelos pareira** L. Climbing in thickets and forests, moist districts. Sometimes employed as a medicinal. "Pistocle." *489; Fishlock 306* (Lower Estate). Britt. & Wils.

Family 20. ANNONACEAE

Annona L.

**Annona glabra** L. Common in salt marsh areas. "Pond Apple." *Fishlock 389* (Old Plantation). Little & Wads., Britt. & Wils.

**A. muricata** L. Very common throughout the island. It is one of the dominant trees in the dry eastern district. Used medicinally, in confections and as pig food. "Soursop." Little & Wads., Britt. & Wils.

**A. reticulata** L. Occasionally cultivated along the north coast, and growing wild on the hillsides above Cane Garden Bay. Usually cooked before eaten. "Custard Apple." *331.* Little & Wads.

**A. squamosa** L. Common on open hillsides. It is one of the dominant trees in dry eastern districts. "Sugar Apple." Britt. & Wils.

Family 21. LAURACEAE

Cassytha L.

**Cassytha filiformis** L. Only one small patch seen at Towers near Sandy Point, near the Eggers location. *346; Eggers 3174* (West End).

Licaria Aubl.

**Licaria salicifolia** (Sw.) Kosterm. *Acrodiclidium salicifolium* (Sw.) Griseb. Little & Wads.

Nectandra Roland.

**Nectandra coriacea** (Sw.) Griseb. Occasional in moist ghut hillsides. Seen in Johnson's and Purcell Ghuts. *204; Fishlock 5.* Little & Wads.

Ocotea Aubl.

**Ocotea floribunda** (Sw.) Mez. In Sage Mountain forests. *Fishlock 72* (Sage Mt.). Little & Wads., Britt. & Wils.

**O. leucoxylon** (Sw.) Mez. Fairly common, Doty and Sage Mountain. *199, 724, 542, 705, 706, 756, 757; Fishlock 451* (Sage Mt.); *Eggers 3210.* Little & Wads., Britt. & Wils.

Persea Mill.

**Persea americana** Mill. *Persea persea* (L.) Cockerell. Cultivated in moister districts, especially in mountain districts where it may escape. "Pear." *703.* Little & Wads.

Family 22. PAPAVERACEAE

Argemone L.

**Argemone mexicana** L. An occasional weed and in roadsides. *Fishlock 10* (Experiment Station).

Family 23. BRASSICACEAE

Brassica L.

**Brassica integrifolia** (West) O. E. Schultz. Rare. A clump of Brassica was seen growing wild at Hope one year: it may have been this species. Britt. & Wils.

Cakile Mill.

**Cakile lanceolata** (Willd.) O. E. Schultz. Rare along sandy sea coasts. Seen in numbers at Little Apple Bay. *Fishlock 272* (Brandywine Bay, *Fishlock 441* Long Bay). Britt. & Wils.

Lepidium L.

**Lepidium virginicum** L. Not common. Regularly seen along the Joe's Hill-Soldier Hill road. *Fishlock 223* (Road Town). Britt. & Wils.

*Brassica oleracea* var. *capitata* (cabbage), *Brassica caulorapa* (kohlrabi). *Brassica chinense* (Chinese cabbage), *Brassica rapa* (turnip) are all grown as market vegetables, *Raphanus sativus* (radish) is sometimes grown for its large tuber-like roots which are boiled for stews. All are rarely spontaneous but not persistent.

Family 24. CAPPARACEAE

Capparis L.

**Capparis baducca** L. *Fishlock 412* (Huntum's Ghut). Britt. & Wils.

**C. cynophallophora** L. Common at lower elevations, especially by the sea. "Black Wattie." *796; Fishlock 96, Fishlock 476* (Harbours). Little & Wads., Britt. & Wils.

**C. flexuosa** (L.) L. Common in thickets, lower elevations. Sometimes high climbing. "Bottle Wiss." *Fishlock 74* (Harbours). Britt. & Wils.

**C. indica** (L.) Fawcett & Rendle. Common along the south coast east of Road Harbour but rare elsewhere. *88; Fishlock 97* (Harbours). Little & Wads., Britt. & Wils.

**C. portoricensis** Urban. One tree seen on the Fort Hill and another at the top of the road leading down to Long Bay East.

Cleome L.

**Cleome gynandra** L. *Gynandropsis gynandra* (L.) Briq. Tall (to 1 m.) and very showy. Occasional in moist districts and on garbage dumps. It covers over an acre of waste grounds at Little Apple Bay. "Massambee." Used to prepare the West Indian vegetable dish "Calaloo." *279*.

**C. rutiosperma** DC. *Cleome ciliata* Schum. & Thom. Occurring as a weed, usually prostrate or scandent. *Fishlock 58*, and *Fishlock 159* (Experiment Station). Britt. Wils.

**C. speciosa** H. B. K. Much like *C. gynandra* but less common. Seen by roadsides in Free Bottom.

**C. viscosa** L. *Cleome icosandra* L. A common weed occurring almost everywhere on the island. "Wild Massambee." *Fishlock 132* (Experiment Station). Britt. & Wils.

Morisonia L.

**Morisonia americana** L. Only one tree seen (Pleasant Valley), but reported to be common around Sea Cow Bay. "Wild Mesple." *154, 264*. Britt. & Wils.

Family 25. MORINGACEAE

Moringa Adans.

**Moringa oleifera** Lam. *Moringa moringa* (L.) Millspaugh. *Moringa pterygosperma* Gaertn. Occasional along roadsides. Cultivated and clearly naturalized. *811.*

Family 26. CRASSULACEAE

Kalanchoë Adans.

**Kalanchoë brasiliensis** Camb. Cultivated chiefly in dry eastern districts. *28, 30, 32.*

**K. laxiflora** Baker. Commonly cultivated. It is larger and showier than *Kalanchoë pinnata* and the tips of the petals have minute serrations. They may be varieties of the same species. *15, 16, 17, 18.*

**K. pinnata** Pers. *Bryophyllum pinnatum* (Lam.) Kurze. Common in all districts. "Love Plant." *21, 22, 25, 26, 27, 29; Fishlock 359* (Huntum's Ghut). Britt. & Wils.

**K. somaliensis** Hooker f. A widely cultivated trailer. Not seen to flower on Tortola. "Hen & Chickens." *607.*

**K. verticillata** Elliot. Occasionally cultivated and naturalized at East End. "Reptile." *19, 20.*

Family 27. ROSACEAE

Chrysobalanus L.

**Chrysobalanus icaco** L. Common at upper elevations; the most common shrubby species around Doty. Harvested for pig food. "Coco Plum." Britt. & Wils.

Species of *Rosa* (rose) are frequently cultivated around homes.

Family 28A. LEGUMINOSAE — MIMOSACEAE

Acacia Mill.

**Acacia farnesiana** (L.) Willd. *Vachellia farnesiana* (L.) Wight & Arn. Little & Wads., Britt. & Wils.

**A. macracantha** Humb. & Bonpl. ex Willd. Widespread and common, forming forests on sandy bottoms near the sea. "Casha." *286.* Britt. & Wils.

**A. muricata** (L.) Willd. *Senegalia muricata* (L.) Britton & Rose. Seen on hillsides between Road Town and Fat Hog Bay. *9, 838; Fishlock 421* (Belleview). Britt. & Wils.

**A. riparia** H. B. K. *Senegalia westiana* (DC.) Britton & Rose. A very troublesome weed species, often the first woody growth on abandoned hillside farming, and sometimes forming impenetrable thickets 20 m. across. "Catch-and-keep." *241; Fishlock 183* (waste places). Britt. & Wils.

**A. tortuosa** (L.) Willd. *Fishlock 200* (Pasea Hall Estate). Little & Wads., Britt. & Wils.

Adenanthera L.

**Adenanthera pavonina** L. A few large trees along Long Bush ghut near sea level and a few along the Christophers-Doty road. May have been planted but some small seedlings were found in the second location. Little & Wils.

Albizia Durazz.

**Albizia lebbeck** (L.) Benth. *Albizzia lebbeck* (L.) Benth. A few tall trees (15 m.) at Carrot Bay. *71.* Little & Wads.

Calliandra Benth.

**Calliandra caracasana** (Jacq.) Benth. *Anneslia portoricensis* (Jacq.) Britt. Occasionally throughout the island but common in dry eastern districts. *153, 448; Fishlock 581* (Edney's); *Eggers 3185.* Britt. & Wils.

Desmanthus Willd.

**Desmanthus depressus** Humb. & Bompl. *Acuan depressum* (H. & B.) Kuntze. Widespread. May not be distinct from *Desmanthus virgatus.* Britt & Wils.

**D. virgatus** (L.) Willd. *Acuan virgatum* (L.) Medic. Throughout the island but common only in dry eastern districts, where it reaches a height of 2 m. *323; Fishlock 205.* Britt. & Wils.

Inga Mill.

**Inga fagifolia** (L.) Willd. *Inga laurina* (Sw.) Willd. Common at middle and higher elevations. The pods are sometimes cooked as a vegetable. "Spanish Oak." *213.* Little & Wads., Britt. & Wils.

Leucaena Benth.

**Leucaena leucocephala** (Lam.) DeWit. *Leucaena glauca* (L.) Benth. Common secondary growth on abandoned farming. "Wild Tamarind." *Fishlock 177* (Lower Estate). Little & Wads., Britt. & Wils.

Mimosa L.

**Mimosa ceratonia** L. *Lomoplis ceratonia* (L.) Raf. Common on moist hillsides. Large colonies were seen along the Road Town-Meyers road. *Fishlock 267* (Huntum's Ghut). Britt. & Wils.

**M. pudica** L. Seen only once in a pasture, Experiment Station.

Pithecellobium Bentham in Mart.

**Pithecellobium unguis-cati** (L.) Bentham in Mart. Common, especially so at East End and at Flamingo Pond. The Tortola plants have red seed arils, although plants with white seed arils were seen in St. Thomas.

Pongamia Vent.

**Pongamia pinnata** (L.) Merr. One fine tree on Government House grounds. *437.*

Prosopis L.

**Prosopis juliflora** (Sw.) DC. *Neltuma juliflora* (Sw.) Raf. Widespread and common, forming forests on sandy bottoms near the sea. Occurs much as *Acacia macracantha* but is more common in eastern parts of the island. "Casha." *Fishlock 392* (Old Plantation). Little & Wads., Britt. & Wils.

Samanea Merrill

**Samanea saman** (Willd.) Merrill. *Pithecellobium saman* (Jacq.) Benth. Planting of this tree as a pasture tree has had the strong encouragement of the Agriculture Department and it is becoming widespread. *12.* Little & Wads.

Family 28B. LEGUMINOSAE — CAESALPINIACEAE

Bauhinia L.

**Bauhinia monandra** Kurz. *Caspareopsis monandra* (Kurz) Britton & Rose. A common ornamental tree, occasionally spontaneous. "Napoleon's Hat." *234.* Little & Wads.

**B. purpurea** L. Only one tree seen; Treasure Isle Hotel grounds. "Poor Man's Orchid." *391.*

**B. tomentosa** L. *Olvesia tomentosa* (L.) Welw. A few shrubs, cultivated and escaped. Pasea Hall Estate. *388.*

Caesalpinia L.

**Caesalpinia bonduc** Roxb. *Guilandina bonduc* L. Children at East End were seen playing with large yellow seeds like those of this species but plants were not seen.

**C. crista** L. *Guilandina crista* (L.) Small. Forming thickets along the south coast. Seeds were grey in all stages of development. Used medicinally. "Nickers." "Ram Goat Bush."

**C. melanosperma** (Eggers) Urban. *Guilandina melanosperma* Eggers. Reported only by Eggers. Endemic to Tortola, St. Croix and Mona.

**C. pulcherrima** (L.) Sw. *Poinciana pulcherrima* L. Commonly cultivated and seemingly naturalized in Baughers Bay. "Dwarf Poinciana."

Cassia L.

**Cassia alata** L. *Herpetica alta* Raf. A few scattered plants and occasionally cultivated. Seen wild at Hannah and Long Look. "Sasparilla." *739; Fishlock 396* (Old Plantation). Little & Wads.

**C. antillana** (Britt. & Rose) Alain, *Chamaefistula antillana* Britton & Rose. Plentiful and showy at higher elevations and around Sage Mountain forest. Not seen below about 80 m. *147; Fishlock 282* (Leonards). Britt. & Wils.

**C. bacillaris** L. f. *Chamaefistula bacillaris* (L. f.) G. Don. Not seen. The Eggers specimen should be checked. *Eggers 3188.*

**C. bicapsularis** L. *Adipera bicapsularis* (L.) Britton & Rose. Common in all districts. Used medicinally. "Pissy bed." *Fishlock 291* (Experiment Station). Britt. & Wils.

**C. fistula** L. Two or three small specimens at the Experiment Station.

**C. glandulosa** var. **swartzii** (Wickstr.) MacBride. *Chaemaecrista swartzii* (Wickstr.) Britt. & Rose. Common, especially at higher elevations. "Scampesina." *262; Fishlock 283* (Leonards). Britt. & Wils.

C. **grandis** L. f. One specimen on Pasea Hall Estate and another behind the Road Town Police Station. Although both trees flower well, they have very seldom produced seed.

C. **obtusifolia** L. *Emelista tora* (L.) Britton & Rose. Common after dry spells. *297, 312; Fishlock 325* (Experiment Station). Britt. & Wils.

C. **occidentalis** L. *Ditremexa occidentalis* (L.) Britton & Rose. A very common weed around towns. "Stinking Weed." *352, Fishlock 191* (Lower Estate). Britt. & Wils.

Delonix Raf.

**Delonix regia** (Bojer) Raf. Widely cultivated. Sometimes spontaneous but probably not persistent. "Flamboyant." Little & Wads.

Haematoxylon L.

**Haematoxylon campechianum** L. Seen only in the Sea Cow Bay-Duff Bottom area, where it is common. "Dyewood Tree." *156; Fishlock 36* (Sea Cow Bay). Britt. & Wils.

Hymenaea L.

**Hymenaea courbaril** L. Scattered specimens in moist districts. Children seem to enjoy the dry powdery pods. "Locust." Little & Wads., Britt. & Wils.

Parkinsonia L.

**Parkinsonia aculeata** L. Along south coast roadsides and plentiful at Towers. *812; Fishlock 396* (Old Plantation). Little & Wads., Britt. & Wils.

Peltophorum Walp.

**Peltophorum inerme** (Roxb.) Naves. *Peltophorum ferrugineum* (Dcne.) Benth. *Peltophorum dubium* (Spreng.) Taub. *Peltophorum pterocarpum* (DC.) Baker. A number of fine trees in the Road Town area. *233.*

Tamarindus L.

**Tamarindus indica** L. Common throughout the island, large trees occurring in moist bottoms. Because of its resistance to hurricane, it is a common surveying marker in land deeds. *230.* Little & Wads., Britt. & Wils.

## Family 28C. LEGUMINOSAE — FABACEAE

Abrus Adans.

**Abrus praecatorius** L. *Abrus abrus* (L.) W. F. Wright. Common almost everywhere. Tortolians seem generally unaware of the poisonous nature of the seeds and they are common children's playthings. "Jumbie Bead." *298, 829; Fishlock 250* (Road Town). Britt. & Wils.

Aeschynomene L.

**Aeschynomene americana** L. Only one plant seen on a donkey path, Sage Mt. *541.* Britt. & Wils.

**A. sensitiva** Sw. *Fishlock 126* (Experiment Station). Britt. & Wils.

Alysicarpus Desv.

**Alysicarpus vaginalis** (L.) DC. A common weed throughout the island. *357, 358, 359, 360, 361; Fishlock 265* (Slaney Point). Britt. & Wils.

Andira Lam.

**Andira inermis** (Wright) DC. *Andira inermis* H. B. K. A very common tree throughout the island. "Pictod." *Fishlock 111* (Experiment Station). Little & Wads., Britt. & Wils.

Arachis L.

**Arachis hypogaea** L. Spontaneous near candy shops, probably from seed dropped by children. Not known to be cultivated at the present time.

Cajanus DC.

**Cajanus cajan** (L.) Millsp. *Cajan cajan* (L.) Millsp. Several varieties are widely cultivated. "Pigeon Pea." *454.* Britt. & Wils.

Canavalia DC.

**Canavalia maritima** (Aubl.) Thou. *Canavali maritima* (Aubl.) Thou. Plentiful on sandy sea coasts. *Fishlock 175* (Lower Estate) as *C. lineata.* Britt. & Wils.

Centrosema (DC.) Benth.

**Centrosema virginianum** Benth. *Bradburya virginiana* (L.) Kuntze. Common throughout the island, roadsides and thickets. *Fishlock 160* (Lower Estate). Britt. & Wils.

Chaetocalyx DC.

**Chaetocalyx scandens** (L.) Urban var. pubescens (DC.) Rudd. One small colony seen by the roadside, Fish Bay. This is a stray from the Leeward Islands. *316.*

Clitoria L.

**Clitoria ternatea** L. Widespread but not plentiful. *299, 722; Fishlock 195* (Experiment Station). Britt. & Wils.

Cracca L.

**Cracca caribaea** (Jacq.) Benth. *Benthamantha caribaea* (Jacq.) Kuntze. Only one plant seen beside road leading into Paraquita holding ground. *414; Fishlock 393* (Old Plantation). Britt. & Wils.

Crotalaria L.

**Crotalaria incana** L. Common by roadsides and as a weed in cultivated lands. *482; Fishlock 195* (Experiment Station). Britt. & Wils.

**C. retusa** L. Thickets and pastures, moist districts. *534; Fishlock 30* (Experiment Station).

**C. verrucosa** L. A common weed, mainly at lower elevations. *404; Fishlock 308* (Purcells). Britt. & Wils.

Dalbergia L. f.

**Dalbergia ecastophyllum** (L.) Taub. *Ecastophyllum ecastophyllum* (L.) Britton. Plentiful in the salt pond at Cane Garden Bay. Also seen at Long Bay East. *10, 372.* Britt. & Wils.

Desmodium Desv.

**Desmodium axillare** (Sw.) DC. *Meibomia axillaris* (Sw.) Kuntze. A large colony in a clearing, Sage Mt. forest. A procumbent vine to 4 m. long. *762, 763.*

**D. canum** (Gmel.) Schinz & Thell. *Meibomia supina* (Sw.) Britton. A common weed throughout the island. *7.*

**D. glabrum** (Mill.) DC. *Meibomia mollis* (Vahl) Kuntze. Rare, seen on Kingstown Hill. *741; Eggers 3177.* Britt. & Wils.

**D. procumbens** (Mill.) Hitchc. *Meibomia procumbens* (Mill.) Britt. In thickets and waste places. *405, 406, 407, 408.*

**D. scorpiurus** (Sw.) Desv. *Meibomia scorpiurus* (Sw.) Kuntze. *Fishlock 150* (Experiment Station). Britt. & Wils.

**D. tortuosum** (Sw.) DC. *Meibomia purpurea* (Mill.) Vahl. *Desmodium purpureum* (Mill.) Fawcett & Rendle. Common in pastures. *8.* Britt. & Wils.

**D. triflorum** (L.) DC. *Sagotia triflora* (L.) Duch. & Walp. A common weed in most parts. *362, 363, 364, 365, 366.*

Dolichos L.

**Dolichos lablab** L. Two forms of this species occur: a small (6 dm.) bushy plant with white or rarely blue flowers is cultivated and sparingly naturalized, "Bonavist Bean;" and a long (to 10 m.) vine closely resembling *Pueraria lobata* with large erect purple racemes which is rampant on trees and ruins in moist districts. Large masses seen in Long Bush Ghut and on Chalwell Estate. *157* (white form), *564, 565, 566* (purple form); *Fishlock 167,* (Experiment Station). Britt. & Wils.

Erythrina L.

**Erythrina corallodendrum** L. Rarely cultivated. *155.* Little & Wads.

**E.** sp. Two trees, Experiment Station, unarmed, with white flowers and seeds, the stigma not resembling the anthers. "White Immortelle." *725.*

**E. variegata** var. **orientalis** (L.) Merrill. *Erythrina indica* Lam. This tree, with vicious spines, red flowers and stigmas resembling the anthers is a favorite ornamental, growing rapidly wherever it can be protected from cattle. "Immortelle." *724.*

Galactia P. Browne

**Galactia dubia** DC. Infrequent along the south coast, perhaps more plentiful towards the west. *460.*

**G. eggersii** Urban. Endemic to Tortola, St. John and St. Thomas. Not seen. *Eggers 3179.*

**G. striata** (Jacq.) Urban. Infrequent along the south coast. *257.* Britt. & Wils.

Gliricidia Kunth

**Gliricidia sepium** (Jacq.) Kunth. *Gliricidia sepium* (Jacq.) Steud. Very common in the Road Harbour area. Much used for fence-posts, which sprout. May be naturalized. *159,* Little & Wads.

Indigofera L.

**Indigofera suffruticosa** Mill. Common, roadsides and recently trimmed pastures. *575; Fishlock 142*, and *Fishlock 164* (Experiment Station). Britt. & Wils.

Macroptilium (Bentham) Urban

**Macroptilium lathyroides** (L.) Urban. *Phaseolus lathyroides* L. Widespread but rather rare. Seen in Baughers Bay and Sea Cow Bay. *Fishlock 289* (Experiment Station). Britt. & Wils.

Phaseolus L.

**Phaseolus lunatus** L. A small seeded white-flowered variety is cultivated and sparingly naturalized.

Pictetia DC.

**Pictetia aculeata** (Vahl) Urban. Common in eastern parts of the island. "Thumb Tack." *14, Fishlock 123* (Beef Island). Little & Wads.

Piscidia L.

**Piscidia piscipula** (L.) Sarg. *Icthyomethia piscipula* (L.) Hitch. Common near the sea, especially along the south coast. "Dogwood." *4, 5; Fishlock 41* (Harbours). Britt. & Wils.

Rhynchosia Lour.

**Rhynchosia minima** (L.) DC. *Dolicholus minimus* (L.) Medic. Common on fences and in thickets on hillsides. *425, 785; Fishlock 165* (Experiment Station). Britt. & Wils.

**R. reticulata** (Sw.) DC. *Dolicholus reticulatus* (Sw.) Millsp. *Fishlock 53* (Great Mountain), *Fishlock 162* (Experiment Station). Britt. & Wils.

Sabinea DC.

**Sabinea florida** (Vahl) DC. Usually in ghutsides at higher elevations, although occasionally seen near sea level in moist districts. Perhaps the most spectacular species in the Tortola flora, and certainly worthy of cultivation. When it blooms in January or March the entire shrub is a mass of blue or mauve. "Wattapania." *Fishlock 35* (Sage Mt.) Britt. & Wils.

Sesbania R. Brown

**Sesbania grandiflora** (L.) Pers. *Agati grandiflora* (L.) Desv. Both pink and white forms are rarely cultivated.

Sophora L.

**Sophora tomentosa** L. Britt. & Wils.

Stylosanthes Sw.

**Stylosanthes hamata** (L). Taubert. Forming large masses at Chapel Hill (East End), Pasea Hall Estate and Fort Burt. Generally near the sea. *196, 197, 198.* Britt. & Wils.

Tephrosia Pers.

**Tephrosia cinerea** (L.) Pers. Occasional near the sea along the south coast. Seen at Welk Point and on Wickham's Cay. *455, 456, 457, 458 459; Fishlock 259* (Slaney Point), *Fishlock 425* (West End). Britt. & Wils.

**T. aff. senna** H. B. K. det. Proctor. Hillsides and pastures. Common. Proctor notes longer, coarser hairs on the pods than **T. senna.** *483, 484, 485, 486, 487.*

Teramnus P. Browne

**Teramnus labialis** (L. f.) Spreng. Commonly festooning on trees and sometimes completely covering fences and shrubs. *637; Fishlock 153,* and *Fishlock 276,* Experiment Station). Britt. & Wils.

Vigna Savi

**Vigna antillana** (Urban) Fawcett & Rendle. Although a conspicuous plant, it was not seen by the author on Tortola. Britt. & Wils.

**V. luteola** (Jacq.) Benth. *Vigna repens* (L.) Kuntze. In occasional patches along the sea coasts. Seen at Purcell, Cane Garden Bay and in Road Town. *332;* Fishlock s.n. Britt. & Wils.

*Phaseolus vulgaris* L. (red bean) and *Vigna unguiculata* (L.) Walp. (black-eye pea) are occasionally grown for food and *Lathyrus odoratus* L. (sweet pea) is rarely grown for ornament from imported seed.

Family 29. OXALIDACEAE

Oxalis L.

**Oxalis corniculata** L. *Xanthoxalis corniculata* (L.) Small. Common in cultivated fields, Doty-Sage Mountain area. *205, 206, 207.* Britt. & Wils.

Family 30. ERYTHROXYLACEAE

Erythroxylum P. Browne

**Erythroxylum rotundifolium** Lunan. *Erythroxylon brevipes* DC. Very plentiful in light woods, moist districts. When in flower, the woods are full of scent and bees. *Fishlock 156* (Lower Estate).

Species of *Impatiens* of the Family BALSAMINACEAE are rarely grown from imported seed under the name of "Lady's Slipper."

Family 31. ZYGOPHYLLACEAE

Guaiacum L.

**Guaiacum officinale** L. At one time a plentiful wood, only planted trees are to be seen on Tortola at the present time. A number of wild trees are growing on Tamarind Point, Beef Island. "Lignum Vitae." *42.*

Kallstroemia Scop.

**Kallstroemia maxima** (L.) T. & G. *Fishlock 131* (Experiment Station). Britt. & Wils.

**K. pubescens** (G. Don) Dandy. *Kallstroemia caribaea* Rydberg. A common and troublesome weed in all parts of the island. *Fishlock 131A* (Experiment Station). Britt. & Wils.

Tribulus L.

**Tribulus cistoides** L. Seen only in three places: Chapel Hill, Little Apple Bay, and at Towers where it covers large areas. "Cocklehorn." *696, 697, 698, 699; Fishlock 437* (West End); *Eggers 3176.* Britt. & Wils.

Family 32. MALPIGHIACEAE

Bunchosia Rich. ex Juss.

**Bunchosia glandulosa** (Cav.) DC. Common at the edges of thickets and in light woods, moist districts. *Fishlock 404* (Kingstown). Britt. & Wils.

Byrsonima Rich. ex Juss.

**Byrsonima coriacea** var. **spicata** (Cav.) Nied. *Byrsonima spicata* (Cav.) DC. Open pastures, north side of Sage Mountain. *197, 704; Fishlock 380* and *Fishlock 450* (Sage Mt.). Little & Wads., Britt. & Wils.

Heteropteris Kunth

**Heteropteris purpurea** (L.) Kunth. *Banisteria purpurea* L. Festooned in thickets, Jean Hill and Fish Bay. *118, 809, 810.* Britt. & Wils.

Malpighia L.

**Malpighia glabra** L. One bush seen at Pleasant Valley was destroyed by road building before a specimen could be taken.

**M. punicifolia** L. A few planted shrubs, Baughers Bay and Kingstown Hill. "Barbados Cherry."

Stigmaphyllon A. Juss.

**Stigmaphyllon diversifolium** A. Juss. *Stigmaphyllon ledifolium* (H. B. K.) Small. *793* (Baughers Bay).

**S. periplocifolium** (Desf.) Juss. *Stigmaphyllon lingulatum* (Poir.) Small. *Fishlock 196* (Experiment Station). Britt. & Wils.

Species of *Stigmaphyllon* were seen commonly along roadsides at lower elevations and the sea coast, but the species were not distinguished.

Family 33. RUTACEAE

Amyris L.

**Amyris elemifera** L. Occasional along the south coast and in eastern sections. *806* (Camanoe), *463* (Peter Island).

Citrus L.

**Citrus aurantifolia** (L.) Swingle. *Citrus aurantifolia* (Christm.) Swingle. Widely cultivated and naturalized almost throughout the island. The Tortola fruits are small but the juice seems far more concentrated than that of larger fruits grown on other islands. "Lime." Little & Wads.

**C. aurantium** L. A few cultivated trees, Road Town. "Bitter Orange."

**C. limon** (L.) Burm. *Citrus limonum* Risso. *Citrus limonia* Osbeck. Only one or two trees at East End. The fruit was not examined.

**C. paradisi** Macfayden. *Citrus maxima* (J. Burm.) Merrill. *Citrus grandis* (L.) Osbeck. A few cultivated trees, Road Town. "Grapefruit."

**C. sinensis** (L.) Osbeck. Occasionally cultivated, moist districts. Tortola oranges have a thick, rough or tubercled rind; and have a hint of lemon flavor. "Sweet Orange." Little & Wads.

Murraya Koenig ex L.

**Murraya exotica** L. *Chalcas exotica* (L.) Millsp. Often cultivated for its fragrant flowers and long naturalized at the sides of ghuts. *Fishlock 189* (Experiment Station). Britt. & Wils.

Triphasia Lour.

**Triphasia trifolia** (Burm. f.) P. Wilson. Common throughout the island, very numerous on hillsides above Road Town, and forming hedges at Little Apple Bay. "Sweet Lime." *158.* Britt. & Wils.

Zanthoxylum L.

**Zanthoxylum martinicense** (Lam.) DC. Moist districts at all elevations. "Yellow Prickle." Several trees of *Zanthoxylum* on Cane Garden Bay hillsides may not be this species. *Fishlock 480* (Sage Mt.); *Eggers 3227.* Little & Wads., Britt. & Wils.

Family 34. SIMAROUBACEAE

Picramnia Sw.

**Picramnia pentandra** Sw. *Fishlock 113* (Huntum's Ghut), *Fishlock 284* (Purcells). Little & Wads., Britt. & Wils.

Suriana L.

**Suriana maritima** L. On reefs and coastal sands, south side of Tortola. Seen on Road Reef, in Fish Bay, and in Hog Valley Bay. *104.*

Family 35. BURSERACEAE

Bursera Jacq.

**Bursera simaruba** (L.) Sarg. Lower elevations throughout the island, but only at sea level does the bark fully display its characteristic copper colour. A fine grove is to be seen at Cane Garden Bay. Regularly sprouting from fenceposts made of the branches. "Turpentine Tree." *52; Fishlock 394* (Old Plantation). Little & Wads., Britt. & Wils.

Tetragastris Gaertn.

**Tetragastris balsamifera** (Sw.) Kuntze. In ghuts, Sage Mountain forests. *665.*

Family 36. MELIACEAE

Azadirachta A. Juss.

**Azadirachta indica** A. Juss. A number of very fine specimens on the western edge of Road Town, some of them probably spontaneous. "Neme Tree." *6.*

Cedrela P. Browne

**Cedrela odorata** L. *Cedrela mexicana* M. J. Roem. Widespread but not common. "Red Cedar."

Melia L.

**Melia azedarach** L. Common throughout the island, but more so at lower elevations. When the tree is cut down it usually sprouts again. Used for tool handles. "Liláe." *70; Fishlock 169* (copses). Little & Wads.

Swietenia Jacq.

**Swietenia mahagoni** (L.) Jacq. *Swietenia mahagoni* Jacq. Three or four thirty foot trees at the Experiment Station. "West Indian Mahogany." Little & Wads.

Over the past few years, many acres of *S. mahagoni*, *S. macrophylla* King and a hybrid have been planted by the Agricultural Department in an attempt to restore something of the former rain forest on Sage Mountain peak. At time of writing, these were doing well and had reached a height of about 1 m.

Family 37. EUPHORBIACEAE

Acalypha L.

**Acalypha chamaedrifolia** (Lam.) Muell.-Arg. Britt. & Wils.

**A. hispida** Burm. f. Frequently cultivated.

**A. wilkesiana** Muell.-Arg. Frequently cultivated. "Copperleaf," "Spotted Heart." *288*.

Adelia L.

**Adelia ricinella** (L.) Britt. Ricinella ricinella (L.) Britt. *Fishlock 14* (Clifton Hall), *Fishlock 38* (Coastal hills). Britt. & Wils.

Alchornea Sw.

**Alchornea latifolia** Sw. *Fishlock 95* (Sage Mt.). Britt. & Wils.

Argythamnia Sw.

**Argythamnia candicans** Sw. Plentiful in Belmont Bay; not seen elsewhere. *304*, *305*, *306*. Britt. & Wils.

**A. fasciculata** (Vahl) Muell.-Arg. *Ditaxis fasciculata* Vahl. Rare. Seen only along the main road at Pasea Hall Estate and at Flamingo Pond. *409*, *668; Fishlock 395* (Old Plantation). Britt. & Wils.

Breynia Forst.

**Breynia nivosa** (W. G. Smith) Small. Although probably not spontaneous, it may be seen long persistent on former house sites and in old ruins. Not common. *354*.

Chamaesyce S. F. Gray

**Chamaesyce articulata** (Aubl.) Brit. *Chamaesyce vahlii* (Willd.) Wilson. *Euphorbia articulata* Aubl. Rather rare, seen growing along roadsides at lower elevations. *342; Fishlock 263* (Slaney Point). Britt. & Wils.

**C. blodgettii** (Englm.) Small. *Euphorbia blodgettii* Englm. The only record for this plant in the Lesser Antilles. *Fishlock 222* (Lower Estate). Britt. & Wils.

**C. buxifolia** (Lam.) Small. *Euphorbia mesembrianthemifolia* Jacq. Commonly growing on or immediately behind beaches. *62; Fishlock 262* (Slaney Point). Britt. & Wils.

**C. hirta** (L.) Millsp. *Euphorbia hirta* L. A troublesome weed everywhere, but less common than *C. hyssopifolia*. *77; Fishlock 235* (Experiment Station). Britt. & Wils.

**C. hypericifolia** (L.) Millsp. *Euphorbia hypericifolia* L. *Fishlock 9* and *144* (Experiment Station). Britt. & Wils.

C. **hyssopifolia** (L.) Small. *Euphorbia hyssopifolia* L. A troublesome weed everywhere. *78.*

C. **prostrata** (Ait.) Small. Occurs with *C. serpens,* but not so plentiful. *79.*

C. **serpens** (H. B. K.) Small. Forming a mat on road verges, especially common east of Road Harbour. Although perennial, it seems to disappear completely in dry seasons. *80.*

Codiaeum Juss.

**Codiaeum variegatum** (L.) Blume. One of the most common ornamentals. The many forms seen suggest this is a complex of species. "Croton."

Croton L.

**Croton astroites** Dryand. Occurring with C. rigidus but less common. "Black Maran." *C. astroites* and *C. rigidus* are reported to hybridize on other islands, but no evidence was seen of this here. *46; Fishlock 245* (Pasea Hall Estate). Britt. & Wils.

C. **betulinus** Vahl. Very widespread but rather rare. *821; Fishlock 44* (Sea Cow Bay). Britt. & Wils.

C. **lobatus** L. A common weed in Road Town streets and occasional in moist districts. *34; Fishlock 277* (Experiment Station). Britt. & Wils.

C. **ovalifolius** Vahl. Common on dry hillsides, roadsides and in towns. The form seen commonly at Long Look has larger, softer and less pubescent leaves than forms seen in the Road Harbour area and on Beef Island. *797, Fishlock 125* (Experiment Station). Britt. & Wils.

C. **rigidus** (Muell.-Arg.) Britton. One of the most troublesome and ubiquitous woody weeds on the island, one of the dominant species in rather stable association on abandoned hillside pastures. "Maran." *45; Fishlock 39* (Sea Cow Bay). Britt. & Wils.

Dalechampia L.

**Dalechampia scandens** L. Fairly common, often in dry areas. *803.* Britt. & Wils.

Euphorbia L.

**Euphorbia heterophylla** (L.) A. Rich. *Poinsettia heterophylla* (L.) Kl. & Garke. A widespread and troublesome weed. *Fishlock 2* (Experiment Station), *Fishlock 213* (Road Town). Britt. & Wils.

E. **lactea** Haw. Rarely cultivated. Several fine abandoned trees on Peter Island. *672.*

E. **milii** Ch. des Moulins. *Euphorbia splendens* Hook. Occasionally cultivated. "Crown of Thorns." *786.*

E. **petiolaris** Sims. *Aklema petiolare* (Sims) Millsp. Occurs mainly in western parts of the island. *83; Fishlock 42* (Sea Cow Bay). Little & Wads., Britt. & Wils.

E. **pulcherrima** Willd. *Poinsettia pulcherrima* (Willd.) Graham. Very commonly planted at lower elevations.

**E. tirucalli** L. One small tree at Doty and an avenue of large trees beside the sea at Towers. *209.*

Gymnanthes Sw.

**Gymnanthes lucida** Sw. *Eggers 3181.*

Hippomane L.

**Hippomane mancinella** L. Rare, growing right at the edge of the sea. Because of the appealing appearance and smell of the fruit, this is the most dangerous poisonous plant growing in the West Indies. Britt. & Wils.

Hura L.

**Hura crepitans** L. Common in woods at lower elevations. "Sandbox Tree." Little & Wads.

Jatropha L.

**Jatropha curcas** L. *Curcas curcas* (L.) Britt. & Millsp. Rare. A large stand seen at Carrot Bay and a few plants in pastures at Free Bottom. "Physic Nut."

**J. gossypifolia** L. *Adenoropium gossypifolium* (L.) Pohl. A common weed, especially in disturbed areas near the sea. "Wild Physic Nut." *680; Fishlock 192, 428* (waste places). Britt. & Wils.

**J. integerrima** Jacq. *Jatropha hastata* Jacq. Occasionally cultivated. *141.*

**J. multifida** L. *Adenoropium multifidum* (L.) Pohl. Increasingly cultivated but not seen to escape.

Manihot L.

**Manihot utilissima** Pohl. *Manihot manihot* (L.) Cockerell. Widely cultivated as a market crop, and occasionally spontaneous. "Cassava." Britt. & Wils.

Margaritaria L.

**Margaritaria nobilis** L. f. *Phyllanthus nobilis* (L. f.) Muell.-Arg. *Fishlock 423* (Belleview); *Eggers 3229.* Little & Wads., Britt. & Wils.

Pedilanthus Poiteau

**Pedilanthus tithymaloides** (L.) Poit. *Pedilanthus padifolius* (L.) Poit. *Pedilanthus angustifolius* Poit. Four subspecies grow on Tortola: *Pedilanthus tithymaloides* ssp. *angustifolius* (Poit.) Dressler; ssp. *padifolius* (L.) Dressler; ssp. *parasiticus* (Kl. & Gke.) Dressler; ssp. *tithymaloides.* All four have been commonly seen both in cultivation and unattended, and it is difficult to say whether they are spontaneous. They are long persistent after cultivation, perhaps over thirty years.

Phyllanthus L.

**Phyllanthus acidus** (L.) Skeels. *Cicca disticha* L. *Cicca acida* (L.) *Merr.* Occasionally cultivated for fruit. Seen only in Road Town, Long Bush Ghut and Sea Cow Bay. Some of these trees were certainly spontaneous. "Gooseberry Tree." *535; Fishlock 350* (Road Town). Little & Wads., Britt. & Wils.

**P. amarus** Schum. & Thonn. This and *P. niruri* are very much alike and were not distinguished during the author's stay. One or both of them were a common weed almost everywhere. *523, 524, 525, 526, 527.*

**P. niruri** L. *Fishlock 147* (Experiment Station). Britt. & Wils.

Ricinus L.

**Ricinus communis** L. Common in waste places near the sea. *345; Fishlock 190* (Lower Estate). Britt. & Wils.

Tragia L.

**Tragia volubilis** L. Common throughout the island. *Fishlock 196* (Experiment Station). Britt. & Wils.

Unidentified species of *Sapium* were recorded by Eggers (3204), and by Little & Wads.

Family 38. ANACARDIACEAE

Anacardium L.

**Anacardium occidentale** L. Cultivated in dry areas, especially eastern districts. "Cherry." *145.* Little & Wads., Britt. & Wils.

Comocladia P. Br.

**Comocladia dodonaea** (L.) Urban. In thickets and woods, south side of Tortola. This plant produces a strong "poison ivy" reaction. "Thumb Tack," "Poison Ash." *Fishlock 103* (harbours). Britt. & Wils.

Mangifera L.

**Mangifera indica** L. Widely cultivated and naturalized in moist districts. "Mango." Little & Wads., Britt. & Wils.

Spondias L.

**Spondias mombin** L. Scattered trees in moist districts. Seen at Sea Cow Bay and Belleview Ghut. "Ghut Plum," "Hog Plum." *Fishlock 414* and *443* (Experiment Station). Little & Wads., Britt. & Wils.

**S. purpurea** L. Rarely cultivated, a few specimens in Baughers Bay. *Eggers 3225* (in forest, Carrot Bay). "Jamaica Plum."

S. sp. Rarely cultivated, a fine specimen in front of Treasure Isle Hotel and a few in Baughers Bay. "Paradise Plum."

Family 39. AQUIFOLIACEAE

Ilex L.

**Ilex urbania** Loes. *Fishlock 78* (Sage Mountain). Britt. & Wils.

Family 40. CELASTRACEAE

Cassine L.

**Cassine xylocarpa** Vent. *Elaeodendron xylocarpum* (Vent.) DC. Seen only near sea level between Road Town and Fish Bay. "Poison Tree." *168; Fishlock 255* and *475* (Slaney Point).

Crossopetalum

**Crossopetalum rhacoma** Crantz. *Rhacoma crossopetalum* L. Dry hillsides. *774* (Camanoe); *Fishlock 266* and *427*. Britt. & Wils.

Schaefferia Jacq.

**Schaefferia frutescens** Jacq. Dry forests and thickets at lower elevations. Plentiful at Flamingo Pond. *679; Fishlock 257* (Slaney Point), *Fishlock 391* (Old Plantation). Britt. & Wils.

Family 41. STAPHYLEACEAE

Turpina Vent.

**Turpina paniculata** *Vent. Fishlock 453* (Sage Mountain). Little & Wads., Britt. & Wils.

Family 42. SAPINDACEAE

Cardiospermum L.

**Cardiospermum corindum** L. Rare, seen at Flamingo Pond and at the top of Joe's Hill road. *96, 180.*

**C. halicacabum** L. *Eggers 3180.*

Cupania L.

**Cupania americana** L. A few trees in upper Huntum's Ghut and plentiful in Sage Mountain forests. *597.*

Melicoccus Browne

**Melicoccus bijugatus** Jacq. *Melicocca bijuga* L. A most plentiful tree, pastures and woods at lower elevations. "Genip." Little & Wads.

Paullinia L.

**Paullinia pinnata** L. Wet pastures, mountain districts; mostly on the north side of Chalwell, and Sage Mountain. "Guard Wiss." *260, Fishlock 490* (s. l.). Britt. & Wils.

**P. plumieri** Triana & Planchon. Reported by Brit. & Wils. on the basis of an incomplete collection by Shafer (1158).

Serjania Plum.

**Serjania polyphylla** (L.) Radlk. Common in moist districts, especially in hillside thickets. *Fishlock 69, Fishlock 258* (Belleview).

Family 43. SABIACEAE

Meliosma Blume

**Meliosma herberti** Rolfe. Britt. & Wils.

Family 44. RHAMNACEAE

Colubrina Rich.

**Colubrina arborescens** (Mill.) Sarg. *Colubrina Colubrina* (Jacq.) Millsp. Common at lower elevations, especially behind beaches on the north side of the island. *61; Fishlock 98* (Harbours). Little & Wads., Britt. & Wils.

**C. reclinata** (L'Hér.) Brongn. Years ago the bark of this tree was exported to other islands and to Europe, but it is rare now, and Tortola must import part of its requirements from Jost Van Dykes. "Mabi." *807* (Camanoe), *191; Fishlock 251* (Duff Bottom), Fishlock 404a (Kingstown). Little & Wads., Britt. & Wils.

Gouania Jacq.

**Gouania lupuloides** (L.) Urban. Common in thickets, moist districts. *285; Fishlock 243* (Lower Estate). Britt. & Wils.

Krugiodendron Urban

**Krugiodendron ferreum** (Vahl) Urban. Occasional in thickets, mostly hillsides over the sea. "Ironwood." *195*. Little & Wads., Britt. & Wils.

Reynosia Griseb.

**Reynosia uncinata** Urban. Britt. & Wils.

Ziziphus Torn. ex L.

**Ziziphus reticulata** (Vahl) DC. *Sarcomphalus reticulatus* (Vahl) Urban. *Eggers 3182*. Little & Wads., Britt. & Wils.

**Z. rignonii** Delp. *Sarcomphalus domingensis* (Spreng.) Kr. & Urban. Britt. & Wils.

## Family 45. VITACEAE

Cissus L.

**Cissus caustica** Tussac. Climbing on large trees in open pastures, north side of Sage Mountain, *669*.

**C. sicyoides** L. Common on fences, trees and in thickets. "Pudding Vine." A variant with red petioles and calices, orange pistils and stamens, and pink or red fruits occurs on hillsides, Cane Garden Bay, Ballast Bay and Sophie Bay. *53, 107, 108; Fishlock 188* (Lower Estate). Britt. & Wils.

**C. trifoliata** (L.) L. Common near the sea. In moist parts of West End and Belmont it covers all other vegetation at times. *91*; *Fishlock 407* (Sophie Bay). Britt. & Wils.

Vitis L.

**Vitis vinifera** L. Occasionally cultivated for ornament and food.

## Family 46. TILIACEAE

Corchorus L.

**Corchorus aestuans** L. A common weed in moist years. *93*. Britt. & Wils.

**C. hirsutus** L. A common weedy shrub in pastures and near the sea, chiefly in eastern districts. *190, 192; Fishlock 47* (Sea Cow Bay). Britt. & Wils.

**C. siliquosus** L. A common weed. *278, 750*. Britt. & Wils.

Triumfetta L.

**Triumfetta bartramia** L. Britt. & Wils.

**T. lappula** L. *Fishlock 301*. Britt. & Wils.

**T. semitriloba** Jacq. A troublesome weed throughout the island; especially common in Jackass Ghut and Long Trench. All three *Triumfettas* were observed to intergrade on burr characters. *266, 267, 268, 269, 330, 367, 413, 644, 646, 647, 650; Fishlock 20* (Experiment Station). Britt. & Wils.

Family 47. MALVACEAE

Abelmoschus Medic.

**Abelmoschus esculentus** (L.) Moench. *Hibiscus esculentus* L. Widely planted as a market vegetable. "Okra."

Abutilon Mill.

**Abutilon hirtum** (Lam.) Sweet. Uncommon. Seen on Frenchmans Cay. *68.*

**A. indicum** (L.) Sweet. Seen mostly east of Road Town. *Fishlock 220* (Pasea Hall Estate). Britt. & Wils.

**A. umbellatum** (L.) Sweet. Very common weed in abandoned cultivations and roadsides, lower elevations. *67, 411.* Britt. & Wils.

Althaea L.

**Althaea rosea** Cav. Rarely cultivated. "Hollyhock."

Bastardia Kunth

**Bastardia viscosa** (L.) Kunth. Plentiful, waste places. *415, 416, 417, 418, 419.*

Gossypium L.

**Gossypium arboreum** L. *Gossypium purpurascens* Poir. Baughers Bay. Cultivation of cotton ceased when Government support was withdrawn in 1947, but it is persistent in many places, and seems to be naturalized. Other species may well be present.

Hibiscus L.

**Hibiscus sabdariffa** L. Rarely cultivated from local seed for ornament and for its red fruits which are used for jellies and drinks. A form with yellow flowers and fruits was seen in Road Town: it may be another species. "Sorrel."

**H. vitifolius** L. Common in Road Town, but not seen elsewhere. "Wild Cotton." *764; Fishlock 181* (Road Town). Britt. & Wils.

A number of species and hybrids of this genus are widely cultivated for ornament and sometimes escape.

Malachra L.

**Malachra alceifolia** Jacq. In occasional clumps, roadsides. *319; Fishlock* (Paraquita Bay). Britt. & Wils.

**M. capitata** L. In occasional clumps, roadsides. *326.*

Malvastrum A. Gray

**Malvastrum americanum** (L.) Torrey. *Malvastrum spicatum* (L). A. Gray. Common in eastern districts. Very plentiful in the bottom, Long Bay East. *412.*

**M. corchorifolium** (Desv.) Britt. Common in eastern districts. Very plentiful in Paraquita Bay. *393, 394, 395, 396, 397.*

**M. coromandelianum** (L.) Garke. *Fishlock 24* (Experiment Station). Britt. & Wils.

Malvaviscus Dill. ex Adans.

**Malvaviscus arboreus** Cav. Occasionally cultivated. *387.*

Pavonia Cav.

**Pavonia spinifex** (L.) Cav. Common in thickets and shaded roadsides. *Fishlock 290* (Pasea Hall Estate). Britt. & Wils.

Sida L.

**Sida acuminata** DC. *Fishlock 488* (hillside). Britt. & Wils.

**S. acuta** Burm. f. *Sida carpinifolia* L. f. A very common, troublesome weed almost everywhere. "Wireweed." *300, 825, 826, 827, 828; Fishlock 27* (Experiment Station).

**S. ciliaris** L. Widespread but not very common. Seen at Doty and a large patch at Chapel Hill (East End). *301, 302, 303.* Britt. & Wils.

**S. eggersii** E. G. Baker. This arboreal Sida is endemic to Tortola and Culebra. Not seen. *Eggers 3183* (Coxheath 300′). Britt. & Wils.

**S. glabra** Mill. Britt. & Wils.

**S. glomerata** Cav. A common, troublesome weed. *Fishlock 203* (Pasea Hall Estate). Britt. & Wils.

**S. humilis** Cav. Widespread but not common. Usually in shady, well trimmed pastures and cultivation. Not troublesome. *587, 588, 589, 590, 591; Fishlock 1* (Experiment Station).

**S. salviaefolia** Presl. *Sida erecta* Macf. Rare. Seen only once at Slaney Point, but not collected. Britt. & Wils.

**S. urens** L. Widespread but rare. Seen on hillside at Doty and in Brewers Bay. *430.*

Thespesia Soland.

**Thespesia populnea** (L.) Soland. Common along sea shores. "Heiteheite."

Urena L.

**Urena lobata** L. Widespread but more common at higher elevations, growing in disturbed pastures, Chalwell and Doty. *382, 383, 384, 385, 386; Fishlock* (Pasea Hall Estate). Britt. & Wils.

Wissadula Medic.

**Wissadula amplissima** (L.) R. E. Freis. *449; Fishlock 202* (Pasea Hall Estate). Britt. & Wils.

Family 48. BOMBACACEAE

Ceiba Mill.

**Ceiba pentandra** (L.) Gaertn. Scattered throughout the island. Several quite large (12 m.) trees are growing in villages in dry eastern districts. "Silk Cotton Tree." Little & Wads.

Family 49. STERCULIACEAE

Ayenia Loefl.

**Ayenia insularis** Cristobal. *Ayenia pusilla* L. Britt. & Wils.

Guazuma Adans.

**Guazuma ulmifolia** Lam. *Guazuma guazuma* (L.) Cockerell. Rare, seen only in Huntum's Ghut at about 100 m. elevation. *723; Fishlock 355* (Huntum's Ghut). Little & Wads., Britt. & Wils.

Helicteres L.

**Helicteres jamaicensis** Jacq. A few scattered bushes along the south coast between Road Town and Coxheath. *181, 671; Fishlock 252* (Slaney Point). Britt. & Wils.

Melochia L.

**Melochia nodiflora** Sw. A common and troublesome weed. *639; Fishlock 15* (Experiment Station).

**M. pyramidata** L. *Moluchia pyramidata* (L.) Britton. Common but most plentiful in moist districts. *640, 641, 642, 643; Fishlock 12* and *163* (Experiment Station). Britt. & Wils.

**M. tomentosa** L. *Moluchia tomentosa* (L.) Britt. Common throughout the island, but most common on dry hillsides where it attains an ornamental appearance. *193; Fishlock 43* (Sea Cow Bay). Britt. & Wils.

Theobroma L.

**Theobroma cacao** L. Occasionally cultivated for its pods in moist districts. "Cocoa."

Waltheria L.

**Waltheria indica** L. *Waltheria americana* L. Plentiful in Long Bay East and in Paraquita Bay. *392.*

Family 50. MARCGRAVIACEAE

Marcgravia L.

**Marcgravia rectiflora** Tr. & Pl. Plentiful in dense forests, Sage Mountain. Several specimens were also seen on rocks on the east side of Chalwell peak in full sun and wind. *438, 439, 440, 441, 442, 443, 444, 445, 446, 447; Fishlock 472* (Sage Mt.); *Eggers 3239* (High Bush 1500'). Britt. & Wils.

Family 51. GUTTIFERAE

Calophyllum L.

**Calophyllum antillanum** Britt. *Calophyllum brasiliense* Camb. A few trees seen near Pasea Hall Estate. "Wild Mammee."

Clusea L.

**Clusia rosea** Jacq. Scattered trees around the island and plentiful in mountain forests. Only in the mountains does it seem to adopt its renowned strangling epiphytic habit. "Pitch Apple," "Wild Mammee." Little & Wads., Britt. & Wils.

Mammea L.

**Mammea americana** L. Plentiful at upper elevations, rarely down to sea level. This is the author's favorite fruit of the island, but it is little esteemed locally and often left to rot on the ground. "Mammee Apple." Little & Wads., Britt. & Wils.

Family 52. BIXACEAE

Bixa L.

**Bixa orellana** L. Only a few trees in Sea Cows Bay (not seen) and in Huntum's Ghut. One tree in Huntum's Ghut has been there over 30 years. "Roucou." *161.*

Family 53. COCHLOSPERMACEAE
Cochlospermum Kunth

**Cochlospermum vitifolium** (Willd.) Spreng. *Maximiliania vitifolia* (Willd.) Krug & Urban. Until recently there was only one fine specimen in Little Apple Bay, but new introductions may make this an important ornamental. They are all of the double-flowered form. *149.*

Family 54. FLACOURTIACEAE
Casearia Jacq.

**Casearia decandra** Jacq. Seen only along the roadside between Joe's Hill and Meyers. *84; Fishlock 420* (Fort Hill). Little & Wads., Britt. & Wils.

**C. guianensis** (Aubl.) Urban. Common in thickets and along roadsides, upper elevations. "Wild Coffee."

**C. sylvestris** Sw. Common in ghuts and along roadsides, moist districts. "Wild Coffee." *64; Fishlock 413* and *157* (Huntum's Ghut); *Eggers 3209* (High Bush 1000′). Little & Wads., Britt. & Wils.

Samyda L.

**Samyda dodecandra** Jacq. Not at all common; seen only in undisturbed ghuts leading into Road Harbour. *1; Fishlock 246* (Lower Estate). Britt. & Wils.

Family 55. TURNERACEAE
Turnera L.

**Turnera ulmifolia** L. Seen only on Long Bay Hill, where it was plentiful. *183.*

Family 56. PASSIFLORACEAE
Passiflora L.

**Passiflora foetida** L. Seldom to be seen in dry seasons, but in a wet year it is very plentiful on roadside fences, garbage dumps, and other waste places. "Love-in-the-Mist." *592; Fishlock 7* (Experiment Station). Britt. & Wils.

**P. laurifolia** L. Seen in light woods, Sage Mountain above Carrot Bay. *702.*

**P. multiflora** L. Occurs rarely in moist districts. *599* (West End). Britt. & Wils.

**P. rubra** L. In open places, north side of Sage Mountain. *186, 196.*

**P. suberosa** L. *Passiflora pallida* L. Common in thickets almost everywhere. *113, 253, 462* (Peter Island); *Fishlock 152* (Experiment Station). *Fishlock 264* (Slaney Point). Britt. & Wils.

Family 57. CARICACEAE
Carica L.

**Carica papaya** L. Commonly planted for food and naturalized in moist districts. The wild forms are strikingly different in appearance from those cultivated. They are tall and thin with branching and twining stems, and tiny, very sweet fruit. "Paw-paw." "Papai." Little & Wads.

Several species of *Begonia* are cultivated in houses and gardens for ornament. They are of the Family BEGONIACEAE.

Family 58. CACTACEAE

Hylocereus Britt. & Rose

**Hylocereus trigonus** (Haw.) Safford. Common in the Long Trench district and also seen on Jean Hill at 50 m. Used to flavor rum in making the traditional "Miss Blyden" Christmas drink, and also for making tarts and pies. "Strawberry." Britt. & Wils.

**H. undatus** (Haw.) Britt. & Rose. Seen only at Brittanic Hall, Road Town, where it appears as if naturalized.

Mammillaria Haw.

**Mammillaria nivosa** Link. *Neomammillaria nivosa* (Link.) Britt. & Rose. Seen only on cliffs overhanging the south coast road between Road Town and West End. *776, 777.* Britt. & Wils.

Melocactus Link & Otto

**Melocactus intortus** (Mill.) Urb. *Cactus intortus* Mill. Common along seacoasts. Sometimes cooked for food. "Barrel Cactus." "Dildo." Britt. & Wils.

Nopalea Salm-Dyck

**Nopalea cochenillifera** (L.) Salm-Dyck. Commonly cultivated for ornament and medicinal use. Very long persistent after cultivation, it is to be seen around old ruins and abandoned house sites giving the appearance of having naturalized. "French Prickly Pear." *834.*

Opuntia Mill.

**Opuntia antillana** Britton & Rose. Two or three patches seen at East End. Seldom flowering. "Bull Suckers." *109.* Britt. & Wils.

**O. dillenii** (Ker-Gawl.) Haw. Widespread and fairly plentiful. "Dildo," "Prickly Pear."

**O. repens** Bello. One of the most noisome weeds of pastures. "Suckers." Britt. & Wils.

**O. rubescens** Salm-Dyck. *Consolea rubescens* (Salm-Dyck) Lemaire. Common along sea coasts. An almost spineless form occurs at Coxheath. "Dildo." Little & Wads., Britt. & Wils.

Pereskia Mill.

**Pereskia grandifolia** Haw. Sometimes cultivated for ornament.

Pilosocereus Lemaire

**Pilosocereus royenii** (L.) Byles & Rowley. *Cephalocereus royenii* (L.) Britt. & Rose. Common near the sea. "Pipe Organ Cactus." "Dildo." Little & Wads., Britt. & Wils.

Selenicereus Britt. & Rose

**Selenicereus grandiflorus** (L.) Britt. & Rose. Rarely seen in gardens. Britt. & Wils. reported it as naturalized on Tortola.

Family 59. MELASTOMATACEAE

Clidemia D. Don

**Clidemia hirta** (L.) D. Don. Very plentiful in thickets and becoming a pest in pastures, upper elevations. *Fishlock 370* (Doty). Britt. & Wils.

Miconia Ruiz & Pav.

**Miconia fothergilla** Naud. *Eggers 3198.*

**M. laevigata** (L.) DC. Very plentiful in thickets and roadsides, upper elevations. *85, 353; Fishlock 366* (Joe's Hill). Britt. & Wils.

**M. mirabilis** (Aubl.) L. O. Wms. *Tamonea guianensis* Aubl. Britt. & Wils.

**M. prasina** (Sw.) DC. *Eggers 3205* (Sage Mountain). Little & Wads., Britt. & Wils.

**M. thomasiana** DC. Sage Mountain forests. Leaves growing in the wind are strikingly coriaceous while those in sheltered forest are membranaceous. *711, 712; Fishlock 93* and *463* (Sage Mt.). Britt. & Wils.

Tetrazygia L.

**Tetrazygia angustifolia** (Sw.) DC. Plentiful on windswept south side of Sage Mountain. *101; Fishlock 32* (Sage Mt.); *Eggers 3194.* Britt. & Wils.

**T. elaeagnoides** (Sw.) DC. Little & Wads., Britt. & Wils.

Family 60. LYTHRACEAE

Ammania L.

**Ammania latifolia** L. Seen only by the main road at Hannah. *162, 163, 164; Fishlock 388* (Old Plantation). Britt. & Wils.

Ginoria Jacq.

**Ginoria rohrii** (Vahl) Koehne. Plentiful on Frenchman's Cay and around Little Apple Bay. Occasional plants at Fish Bay, Kingstown Bay and the Fort Hill, which bloom when leafless. Very showy when in flower, and often cut for its flowers. "Sugar Ant." *50, 182; Fishlock 399* (Old Plantation), *Fishlock 400* (Baughers Bay). Britt. & Wils.

Lagerstroemia L.

**Lagerstroemia indica** L. Frequently grown for ornament and perhaps spontaneous. "Queen of Flowers."

Family 61. PUNICACEAE

Punica L.

**Punica granatum** L. Both red and yellow forms are widely planted for ornament and escapes are sometimes seen. Fruit is very poor as the climate is too warm. Nevertheless, the remains of what seems to be a long abandoned plantation are to be seen on Jean Hill.

Family 62. COMBRETACEAE

Buchenavia Eichl.

**Buchenavia capitata** (Vahl) Eichl. Mountain forests. *705.* Little & Wads., Britt. & Wils.

Bucida L.

**Bucida buceras** L. Common in pastures and woods at lower elevations, especially along the south coast west of Road Town. "Gregre." A valuable wood for boat building.

Conocarpus L.

**Conocarpus erecta** L. Common on reef formations and occasional along the sea coast. The leaves are green. "Buttonwood." *75, 76; Fishlock 99* (Harbours). Little & Wads., Britt. & Wils.

Laguncularia Gaertn. f.

**Laguncularia racemosa** (L). Gaertn. f. Very common in marshy ground beside salt water. A favorite charcoal wood at lower elevations. "White Mangrove." *247; Fishlock 217* (Pasea Hall Estate).

Quisqualis L.

**Quisqualis indica** L. Cultivated. A fine hedge is growing at Government House. "Rangoon Creeper."

Terminalia L.

**Terminalia catappa** L. Very common by beaches and other coastal areas. "Almond." *Fishlock 102* (Pockwood Pond). Little & Wads., Britt. & Wils.

Family 63. MYRTACEAE

Aulomyrcia Berg.

**Aulomyrcia citrifolia** (Aubl.) Amsh. *Myrcia citrifolia* (Aubl.) Urban. Little & Wads., Britt. & Wils.

Calyptranthes Sw.

**Calyptranthes kiaerskovii** Krug & Urban. The lone Tortola endemic species to date. Based on a single sterile collection by Eggers; *3217*, location not given.

Eucalyptus L'Hérit.

**Eucalyptus camaldulensis** Dehn. *Eucalyptus rostrata* Schlechtendal. Several large trees at Government House and a few scattered elsewhere, e.g., Hannah, Belleview. Both E. camaldulensis and E. tereticornis Smith may be represented at Government House. They were planted by the Agricultural Department many years ago. *2.*

Eugenia L.

**Eugenia axillaris** (Sw.) Willd. Seen only behind the beach, Long Bay East. *390.*

**E. biflora** (L.) DC. *Eugenia lancea* Poir. One of the most common and troublesome weedy shrubs in pastures and hillsides. The wood is used for fish pot frames. "Birch Berry." *63, 102, 836.* Britt. & Wils.

**E. cordata** (Sw.) DC. Plentiful along Joe's Hill-Meyers Road. Flowers, mostly above the leaves, have an unusual but pleasant fragrance. *214; Fishlock 405* (Hog Valley Point). Britt. & Wils.

**E. monticola** (Sw.) DC. *Fishlock 120* (Belleview). Britt. & Wils.

**E. procera** (Sw.) Poir. *Fishlock 422* (Belleview), *Fishlock 491* (ravine). Britt. & Wils.

**E. pseudopsidium** Jacq. Seen at Doty and at Long Bay East near the sea. The shiny red or yellow fruits are very striking in appearance. "Wild Guava." *273, 379, 623.* Britt. & Wils.

**E. rhombea** (Berg) Krug & Urban. Seen only in Belleview Ghut (150 m.). *208.*

**E. sessiliflora** Vahl. *Fishlock 406* (Hog Valley Point). Britt. & Wils.

**E. sintensii** Kiaersk. Britt. & Wils.

Myrcia DC

**Myrcia splendens** (Sw.) DC. *Fishlock 454.* Little & Wads., Britt. & Wils.

Myrcianthes Berg.

**Myrcianthes fragrans** (Sw.) McVaugh. *Anamomis fragrans* (Sw.) Griseb. Britt. & Wils.

Myrciaria Berg

**Myrciaria floribunda** (West) Berg. *Eugenia floribunda* West. Widespread. Although not planted, most trees receive some attention from farmers, as the fruits are esteemed for making the traditional Christmas rum drink, "Guavaberry." *194; Fishlock 119, 324* (Belleview); *Eggers 3235* Britt. & Wils.

Another yellow fruit, seemingly a Myrtaceae and also called "Guavaberry," harvested in much the same way and at the same time as *M. floribunda,* is used for making tarts. Plants were not seen.

Pimenta Lindl.

**Pimenta racemosa** (Mill.) J. W. Moore. *Amomis caryophyllata* (Jacq.) Kr. & Urban. Occasional in ghuts at middle elevations, and very plentiful in Jackass Ghut. The fragrance is noticeable several yards away. "Bay-Rum-Tree." *718; Fishlock 493* and *494.* Little & Wads., Britt. & Wils.

**P. racemosa** var **grisea** (Kiaersk.) Fosberg. *Amomis grisea* (Kiaersk.) Britton. Occasional in mountain forests. The bruised leaves emit a strong citronella odour. "Cinnamon Tree." *Fishlock 79* (Sage Mt.); *Eggers 3196.* Britt. & Wils.

Psidium L.

**Psidium amplexicaule** Pers. Plentiful in the Chalwell-Sage Mountain area. "Mountain Guava." *146; Fishlock 372* (Doty); *Eggers 3190.* Britt. & Wils.

**P. guaiava** L. Rarely cultivated. It is a troublesome weedy species around Doty and Chalwell Estate. "Guava." Little & Wads., Britt. & Wils.

Syzygium Gaertn.

**Syzygium jambos** (L.) Alston. *Jambosa jambos* (L.) Millsp. *Eugenia jambos* L. Forming large copses in pastures and on the edges of the forest, north side of Sage Mountain. *761; Fishlock 88* (Sage Mountain). Little & Wads., Britt. & Wils.

Family 64. LECYTHIDACEAE

Couroupita Aubl.

**Couroupita guianensis** Aubl. The fine tree at the Experiment Station is a continual object of curiosity. It was surveyed at 51 feet on 25th April, 1965. "Cannonball Tree."

Family 65. RHIZOPHORACEAE

Rhizophora L.

**Rhizophora mangle** L. Coastal in salt swamps and on reefs. "Red Mangrove." *246; Fishlock 236* (Pasea Hall Estate). Little & Wads., Britt. & Wils.

Family 66. ONAGRACEAE

Ludwigia L.

**Ludwigia erecta** (L) H. Hara. *Jussiaea erecta* L. Scattered clumps in marshy roadsides. *143, 248, 249, 250; Fishlock 16* and *289* (Turnbulls).

**L. octovalvis** (Jacq.) Raven. *Jussiaea angustifolia* Lam. Scattered clumps in marshy roadsides. This and *L. erecta* are often found together. *830.* Britt. & Wils.

Family 67. ARALIACEAE

Dendropanax Dcne. & Pl.

**Dendropanax arboreum** (L.) Dcne. & Pl. A few scattered trees, mostly in the open, south side of Sage Mountain. *251; Fishlock 455* and *456* (Sage Mt.). Little & Wads., Britt. & Wils.

Didymopanax Dcne. & Pl.

**Didymopanax morototoni** (Aubl.) Dcne. & Pl. Fairly plentiful, north side of Sage Mountain. *99.* Little & Wads.

Polyscias Forst.

**Polyscias filicifolia** (Moore) Bailey. Commonly planted as a hedge or specimen shrub. "Angelica," "Croton."

**P. guilfoylei** (Bull) Bailey. Commonly planted in moist districts, long persistent after cultivation. *567, 568, 569.*

Family 68. UMBELLIFERAE

Anethum L.

**Anethum graveolens** L. Widely cultivated for flavouring and medicinal purposes. Naturalized in moist districts. "Anise" (dill). *Fishlock 66* (Todmans). Britt. & Wils.

Foeniculum Mill.

**Foeniculum vulgare** Mill. *Foeniculum foeniculum* (L.) Karsten. Common in upper districts, especially from Hope to Doty, growing in pastures and roadsides and one of the most plentiful plants in abandoned cultivation. "Wild Fennel." *608, 609, 610.*

Pimpinella L.

**Pimpinella anisum** L. Rarely cultivated from imported seed and locally persistent for a short time. (dill).

*Daucus carota* L. (carrot) and *Petroselinum crispum* (Mill.) Mansfield (parsley) are cultivated as market vegetables.

Family 69. MYRSINACEAE

Ardisia Sw.

**Ardisia obovata** Desv. *Icacorea guadalupensis* (Duch.) Britton. Common in thickets and forests, north side of Chalwell, Doty, and Sage Mountain. *49, 203; Fishlock 340* (Joe's Hill); *Eggers 3228.* Little & Wads., Britt. & Wils.

Myrsine L.

**Myrsine guianensis** (Aubl.) Kuntze. *Rapanea guianensis* Aubl. *Fishlock 462* (Sage Mt.). Little & Wads., Britt. & Wils.

Family 70. THEOPHRASTACEAE

Jacquinia L.

**Jacquinia arborea** Vahl. *Jacquinia barbasco* (Loefl.) Mez. From Paraquita Bay eastward, and common on Beef Island; rare elsewhere. *117.* Britt. & Wils.

**J. berterii** Spreng. Plentiful on Peter Island, Camanoe and perhaps Beef Island, but not seen on Tortola itself. *488, 800.*

**J. revoluta** Jacq. *Fishlock 75* (upper slopes of Sage Mt.). Britt. & Wils.

Family 71. PLUMBAGINACEAE

Plumbago L.

**Plumbago auriculata** Lam. *Plumbago capensis* Thunb. A common ornamental. Because of dry conditions on the island, it is usually a tight formed, profusely flowering dwarf shrub.

**P. scandens** L. Common by roadsides and in thickets, all but the driest areas. *533; Fishlock 249* (Experiment Station). Britt. & Wils.

Family 72. SAPOTACEAE

Bumelia Sw.

**Bumelia obovata** (Lam.) A. DC. Near the sea and on dry promontories. Common in Baughers Bay. "Pintop." *167, 586; Fishlock 446* (Baughers Bay); *Eggers 3186.* Britt. & Wils.

Chrysophyllum L.

**Chrysophyllum argenteum** Jacq. Common in thickets and forests, mountain districts. *211, 667; Fishlock 478* (Sage Mountain). Little & Wads., Britt. & Wils.

**C. cainito** L. Only three fine trees near the Burial Ground, Road Town. "Star Apple."

Dipholis A. DC

**Dipholis salicifolia** (L.) A. DC. *Fishlock 401* (Baughers Bay). Little & Wads., Britt. & Wils.

Manilkara Adans

**Manilkara balata** (Aubl.) Dubard. *Manilkara nitida* (Sessé & Moq.) Dubard. *Manilkara bidentata* (A. DC.) Chev. Seen living only in dense forest, Sage Mountain. Many large boles dot the mountain hillsides, indicating the former extent of the Forest. *716; Fishlock 471* (Sage Mt.). Little & Wads., Britt. & Wils.

**M. zapota** (L.) Royen. *Sapota achras* Mill. Hillsides, Sea Cow Bay and in Road Town. "Mesple."

Mastichodendron (Engl.) H. J. Lam.

**Mastichodendron foetidissimum** (Jacq.) Lam. *Sideroxylon foetidissimum* Jacq. Little & Wads.

Family 73. SYMPLOCACEAE

Symplocos Jacq.

**Symplocos martinicensis** Jacq. Thickets and pastures, wet mountain areas. *97, 714; Fishlock 453* (Sage Mt.). Little & Wads., Britt. & Wils.

Family 74. OLEACEAE

Forestiera Poir.

**Forestiera eggersiana** Krug & Urban. Endemic to Virgin Islands, Culebra and Vieques. Rare, seen only at Pleasant Valley and Kingstown Hill. Both trees were staminate. *290.*

**F. segregata** (Jacq.) Krug & Urban. *Eggers 3175* (West End in fruit). Britt. & Wils.

Jasminum L.

**Jasminum fluminense** Vell. *Jasminum azoricum* L. Cultivated and sometimes escaping. *389.*

**J. officinale** var **grandiflorum** (L.) L. H. Bailey. *Jasminum grandiflorum* L. Widely cultivated; not known to escape.

**J. pubescens** (Retz.) Willd. Seen only on a wall at Britannic Hall, Road Town, where it was seemingly spontaneous.

**J. sambac** (L.) Soland. Seen only at Harrigan's (Joe's Hill), where it was seemingly spontaneous.

Family 75. APOCYNACEAE

Allamanda L.

**Allamanda cathartica** L. Frequently cultivated. "Yellow Allamanda." *343.*

Catharanthus G. Don

**Catharanthus roseus** (L.) G. Don. *Vinca rosea* L. Cultivated and a common wildflower. White forms seem to stand more salt and red forms more drought. One of the few really "animal proof" ornamentals on the island. "Stinky Toes." *596; Fishlock 307* (Norton Valley). Britt. & Wils.

Nerium L.

**Nerium oleander** L. One of the commonest and most easily grown ornamentals. Not spontaneous. "Oleander." *224.*

Plumeria L.

**Plumeria alba** L. Very common in coastal rocks and cliffs. "Sea Oleander." "Frangipani." Little & Wads., Britt. & Wils.

**P. rubra** L. Occasionally cultivated. Both white and red forms are to be seen at Government House and Pasea Hall Estate. It is slow growing and has spectacular bloom, probably because of the dry climate. "Frangipani." Little & Wads.

Prestonia R. Brown

**Prestonia agglutinata** (Jacq.) Woodson. *Echites agglutinata* Jacq. Rare in coastal thickets. *292* (Belmont Bay); *Fishlock 25* (Slaney Point). Britt. & Wils.

Rauwolfia L.

**Rauwolfia nitida** Jacq. *Rauwolfia tetraphylla* L. sensu Britt. & Wils. Seen only in Cane Garden Bay. *Fishlock 430* (Belmont). Little & Wads. "Bitter."

**R. viridis** R. & S. *Rauwolfia lamarckii* A. DC. A very common and troublesome weedy shrub throughout the island. "Bitter Ash."

Thevetia L.

**Thevetia peruviana** (Pers.) K. Schum. *Cerbera thevetia* L. Seen only in one patch on the road from Soldier Hill to Cane Garden Bay (ca. 100 m.). "Yellow Oleander."

Urechites Muell.-Arg.

**Urechites lutea** (L.) Britton. Scattered in coastal areas. Common in Duff Bottom. The sap is very poisonous, as the author learned to his discomfort. "Wild Allamanda." *775* (Beef Island); *Fishlock 474* (Baughers Bay). Britt. & Wils.

Family 76. ASCLEPIADACEAE

Asclepias L

**Asclepias curassavica** L. Occasional plants, moist districts. "Hittie McWanie." *281, 282, 283; Fishlock 304* (Purcells). Britt. & Wils.

Calotropis R. Brown

**Calotropis procera** (Ait.) Ait. f. Conspicuous in pastures and waste places. "Cow Heel."

Cryptostegia R. Brown

**Cryptostegia grandiflora** R. Br. Widely cultivated and sparingly naturalized. It is highly resistant to attacks of *Cuscuta* sp. "Purple Snake." "Purple Allamanda."

Cynanchum L.

**Cynanchum decaisneanum** (Schlechter) Alain. *Metastelma decaisneanum* Schlechter. Coastal rocks and thickets. Seen at Fish Bay. *227*.

**C. parviflorum** Sw. *Metastelma parviflorum* R. Br. Coastal rocks and thickets, mostly in eastern districts. *318* (Beef Island). Britt. & Wils.

Matelea Aubl.

**Matelea maritima** (Jacq.) Woodson. *Ibatia maritima* (Jacq.) Dcne. Isolated plants throughout the island. *69; Fishlock 465* (Fish Bay); *Eggers 3240.* Britt. & Wils.

**Stephanotis floribunda** A. Brongn. and *Hoya carnosa* (L. f.) R. Br. are rarely cultivated.

Family 77. CONVOLVULACEAE

Cuscuta L.

**Cuscuta americana** L. Britt. & Wils.

**C. globulosa** Bentham. *Fishlock 489 det. Yuncker.*

**C.** sp., "Yellow Love," is a common and serious pest throughout the island. (Distinctions between the above two species are slight and they are frequently confused. See Yuncker; Mem. Torr. Bot. Club vol. 18, pp. 217-222 (1931-32).)

Evolvulus L.

**Evolvulus glaber** Spreng. Britt. & Wils.

**E. sericeus** Sw. Britt. & Wils.

Ipomoea L.

**Ipomoea acuminata** (Vahl) R. & S. *Ipomoea cathartica* Poir. Common near the sea. Britt. & Wils.

**I. batatas** (L.) L. Commonly cultivated for market. "Potato."

**I. nil** (L.) Roth. Seen only along the roadside between Welk Point and Fat Hog Bay. *315.*

**I. pes-caprae** (L.) Roth. Common on coastal sands. "Beach Morning Glory." *Fishlock 294* (Pasea Hall Estate). Britt. & Wils.

**I. quamoclit** L. *Quamoclit quamoclit* (L.) Britt. Rarely cultivated.

**I. repanda** Jacq. *Exogonium repandum* (Jacq.) Choisy. Common at upper elevations in woods and thickets. *511; Fishlock 339* (Joe's Hill). Britt. & Wils.

**I. steudelii** Millsp. *Exogonium arenarium* Choisy. Seen at Welk Point and common on Camanoe. *765.*

**I. tiliacea** (Willd.) Choisy. Rare, seen at top of Joe's Hill and at Flamingo Pond. *496, 751.* Britt. & Wils.

**I. triloba** L. Common in eastern districts. "Pig-Vine." *317.*

**I. tuba** (Schlechter) G. Don. *Calonyction tuba* (Schlechter) Colla. A few large patches seen near the sea; Fish Bay, Towers and Carrot Bay.

Jacquemontia Choisy

**Jacquemontia jamaicensis** (Jacq.) Hallier f. Rare. Seen only beneath coconut trees on Wickhams Cay. *431.* Britt. & Wils.

**J. nodiflora** (Desv.) G. Don. Very common along the south coast. *320, 336; Fishlock 261* (Slaney Hill). Britt. & Wils.

**J. pentantha** (Jacq.) G. Don. A common weed in all districts. A purple form grows on Jean Hill. *121; Fishlock 204* (Pasea Hall Estate). Britt. & Wils.

Merremia Dennst.

**Merremia aegyptia** (L.) Urban. *Ipomoea aegyptia* L. Common in moist districts, especially on the north side. *314; Fishlock 278* (Experiment Station). Britt. & Wils.

**M. dissecta** (Jacq.) Hall. f. *Ipomoea dissecta* (Jacq.) Pursh. Not very common. Seen at Windy Hill and Belmont beach. *638; Fishlock 197* (Clifton Hall). Britt. & Wils.

**M. quinquefolia** (L.) Hall. f. *Ipomoea quinquefolia* L. A common and troublesome weed in moist districts. Britt. & Wils.

**M. umbellata** (L.) Hall. f. *Ipomoea polyanthes* R. & S. Common in cultivated areas and roadsides. "Yellow Morning Glory." *72, 740; Fishlock 308* (Purcells). Britt. & Wils.

Porana Burm. f.

**Porana paniculata** Roxb. Very long persistent after cultivation, but probably not spontaneous. *648.*

Stictocardia Hallier f.

**Stictocardia tiliaefolia** (Desr.) Hall. f. *Rivea campanulata* (L.) House. *Fishlock 275* (Experiment Station). Britt. & Wils.

Turbina L.

**Turbina corymbosa** (L.) Raf. Plentiful in Ballast Bay. *122.*

Family 78. BORAGINACEAE

Bourreria P. Browne

**Bourreria succulenta** Jacq. Scattered trees throughout the island. In eastern districts, leaves are hispid, scabrous, but in the west they are glabrous and membranaceous; a result of rainfall differences. "Chinkwood." *237, 291; Fishlock 118* s.l. Little & Wads., Britt. & Wils.

Cordia L.

**Cordia alliodora** (R. & P.) Oken. *Cerdana alliodora* R. & P. Scatte·ec high in ghuts. "Spanish Elm." *126, 218; Fishlock 106* (Lower Estate), *Fishlock 121* (Purcells Mountain). Little & Wads., Britt. & Wils.

**C. collococca** L. *Cordia glabra* L. Occasional in thickets and ghuts, mostly lower elevations. "Manjack." *Fishlock 416* (Experiment Station). Britt. & Wils.

**C. nitida** Vahl. Occasional at all elevations. "Red Manjack." *142, 179; Fishlock 410* (Huntums Ghut.). Little & Wads., Britt. & Wils.

**C. obliqua** Willd. Plentiful in eastern districts; not seen elsewhere. Mucilage from the pink drupes is used to seal envelopes. "Sticking Tree." *3.*

**C. polycephala** (Lam.) Johnst. *Varronia corymbosa* (L.) Desv. A troublesome woody weed in wet mountain districts, rarely seen down to sea level. "Black Sage." *124, 210, 730; Fishlock 114* (Belleview), *Fishlock 216* (Experiment Station); *Eggers 3234* as C. *ulmifolia* Juss. var *ovata* DC. Britt. & Wils.

C. **ricksecker** Millsp. *Sebesten rickseckeri* (Millsp.) Britt. Very plentiful along the south coast. "Dog Almond," "Black Manjack." *51.* Little & Wads., Britt. & Wils.

C. **sebestena** L. *Sebesten sebestena* (L.) Britton & Small. Very rarely cultivated. One spontaneous plant was found at Coxheath. *226; Fishlock 398* (Old Plantation).

C. **sulcata** *DC.* Occasional at all elevations. "White Manjack." *Fishlock 447* (Experiment Station). Little & Wads., Britt. & Wils.

Heliotropium L.

**Heliotropium amplexicaule** Vahl. *Cochranea anchusaefolia* (Poir.) Gürcke. Cultivated under the name of "Verbena."

H. **angiospermum** Murray. *Schobera angiosperma* (Murr.) Britt. A common and troublesome weed. "White Tip." *554, 555, 556, 557, 558; Fishlock 139* (Experiment Station). Britt. & Wils.

H. **crispiflorum** Urban. Large patches on Beef Island. Not seen elsewhere. *787.*

H. **curassavicum** L. Plentiful beside the sea. Britt. & Wils.

H. **indicum** L. *Tiaridium indicum* (L.) Lehm. Common, especially near the coast. *Fishlock 26* (Experiment Station). Britt. & Wils.

Tournefortia L.

**Tournefortia bicolor** Sw. Pastures, Doty and Sage Mountain.

T. **gnaphalodes** (L.) R. Br. *Mallotonia gnaphalodes* (L.) Britt. *Heliotropium gnaphalodes* L. Rather rare. Coastal reefs and beaches. *481.*

T. **hirsutissima** L. Plentiful at upper elevations. *198; Fishlock 444* (ravines). Britt. & Wils.

T. **microphylla** Bert. Common along roadsides and in thickets, south side of the island. *Fishlock 297* (Pasea Hall Estate). Britt. & Wils.

T. **volubilis** L. *Eggers 3172* (West End).

## Family 79. VERBENACEAE

Avicennia L.

**Avicennia germinans** (L.) L *Avicennia nitida* Jacq. Occasional in coastal thickets. "Salt Pond." *Fishlock 218* (Pasea Hall Estate). Little & Wads., Britt. & Wils.

Citharexylum L.

**Citharexylum fruticosum** L. Common in thickets and hillsides at lower elevations. "Fiddlewood." *553; Fishlock 198* (Clifton Hall). Little & Wads., Britt. & Wils.

Clerodendrum L.

**Clerodendrum aculeatum** (L.) Schlecht. *Volkameria aculeata* L. Coastal thickets, more common along the south coast. Occasionally high climbing. "Privet." *41; Fishlock 184.* Britt. & Wils.

C. **speciosissimum** Paxt. A common ornamental in Road Town.

C. **thompsonae** C. Balfouri. A common ornamental. "Danish Flag."

Lantana L.

**Lantana arida** Britton. Moldenke 1959.

**L. camara** L. A yellow and red flowered form is common in thickets and as a weed in most districts, "Yellow Sage;" a purple and buff flowered form with larger leaves and heavier construction occurs in Road Town. *43, 311; Fishlock 45* (Sea Cow Bay). Britt. & Wils.

**L. involucrata** L. Common in coastal thickets. "Button Sage." *232; Fishlock 46* (Sea Cow Bay).

**L. reticulata** Pers. Moldenke 1959.

Petraea Houst. ex L.

**Petraea volubilis** Jacq. A common ornamental. "Queen's Wreath."

Priva Adans.

**Priva lappulacea** (L.) Pers. A common weed. *548, 549, 550, 551, 552; Fishlock* (Experiment Station). Britt. & Wils.

Stachytarpheta Vahl

**Stachytarpheta jamaicensis** (L.) Vahl. *Valerianoides jamaicense* (L.) Kuntze. *Fishlock 158* (waste places). Britt. & Wils.

Tectona L. f.

**Tectona grandis** L. f. *Tektona grandis* L. (Tectona is conserved). A few widespread trees planted many years ago by the Agricultural Department. "Teak." *236*. Little & Wads.

Verbena L.

**Verbena chamaedrifolia** Juss. Cultivated. "Verbena."

Vitex L.

**Vitex agnus - castus** L. A common ornamental, probably spontaneous.

**V. divaricata** Sw. Little & Wads.

Family 80. LABIATAE

Coleus Lour.

**Coleus amboinicus** Lour. Scattered in all parts of the island. Large patches were seen at Fort Burt, Huntums Ghut (110 m.) and Hope. Seldom flowering. "Wild Thyme." *606; Fishlock 108A*. Britt. & Wils.

**C. blumei** Benth. Commonly cultivated. Naturalized but rarely found, in ghuts. Seen in Belleview ghut (ca. 200 m.). "Joseph's Coat." Britt. & Wils.

Hyptis Jacq.

**Hyptis capitata** Jacq. Plentiful in wet mountain districts. *427; Fishlock 333* (Joe's Hill); *Eggers 3221*. Britt. & Wils.

**H. pectinata** (L.) Poit. Plentiful in moist seasons, roadsides and hillside pastures. *398; Fishlock 305* (Purcells); *Eggers 3223*. Britt. & Wils.

**H. suaveolens** (L.) Poit. Seen only in a large patch on the Fort Hill (30 m.). *328*.

Leonotis R. Brown

**Leonotis nepetaefolia** (L.) R. Brown. A very common weed. *Fishlock 122* (waste places). Britt. & Wils.

Leonurus L.

**Leonurus sibiricus** L. A common weed. "Rabbit Food." *239; Fishlock 6* (Experiment Station). Britt. & Wils.

Leucas R. Brown

**Leucas martinicensis** (Jacq.) R. Br. *Fishlock 473* (Baughers Bay). Britt. & Wils.

Ocimum L.

**Ocimum basilicum** L. Cultivated and perhaps spontaneous. "Basil."

**O. micranthum** Willd. Fairly common, especially along the south coast. "Wild Basil." *450, 451, 452, 453; Fishlock 292* (Pasea Hall Estate). Britt. & Wils.

Salvia L.

**Salvia occidentalis** Sw. Plentiful in moist districts. *Fishlock 52* and *288* (Great Mountain). Britt. & Wils.

**S. serotina** L. Mountain districts. Seen at Cane Garden Bay. Many plants of this species could not be distinguished from the St. Thomas endemic *S. thomasiana* Urb. using Britt. & Wils. key and text. *333, 339, 340.* Britt. & Wils.

Thymus L.

**Thymus vulgaris** L. Cultivated. "Thyme."

Family 81. SOLANACEAE

Acnistus Schott.

**Acnistus arborescens** (L.) Schlechtendal. Common in wet mountain districts. Seen in thickets at Meyers and Chalwell Estates.

Brunfelsia L.

**Brunfelsia americana** L. Cliffs and thickets near the coast, and on open hillsides above Road Town. Plants on Tortola exhibit considerable variation in aspect, leaf form, tube length, and berry size, and further investigation might show more than one species is represented. *344, 598; Fishlock 40* (Sea Cow Bay).

**B. undulata** Sw. Widely cultivated for ornament.

Capsicum L.

**Capsicum frutescens** L. Plentiful at upper elevations, but seen down to sea level in wet seasons. "Jumbie Pepper," "Bird Pepper." *624; Fishlock 155* (Experiment Station). Britt. & Wils.

Cestrum L.

**Cestrum diurnum** L. Cultivated and naturalized near villages in moist districts. "Lady of the Day." *129, 347.*

**C. laurifolium** L'Her. A very plentiful shrub or tree at upper elevations. "White Cinnamon." *128, 381, 617; Fishlock 55* (Great Mountain), *Fishlock 449* (Sage Mt.). Britt. & Wils.

**C. nocturnum** L. Cultivated and perhaps spontaneous. "Lady of the Night."

Datura L.

**Datura innoxia** Mill. *Datura metel* L. Common along the south coast. "Belladonna Bush." *94; Fishlock 215* (Experiment Station, as *D. metel*). Britt. & Wils.

**D. stramonium** L. At West End jetty and in the ghut, Long Look. In wet seasons it extends its range, but in dry years it persists in only these two locations, both of them very dry. "Belladonna Bush." *95; Fishlock 492* (Experiment Station). Britt. & Wils.

Physalis L.

**Physalis angulata** L. Plentiful in all parts of the island. *238; Fishlock 286* (Pasea Hall Estate). Britt. & Wils.

**P. pubescens** L. *Fishlock 5, 285,* and *286* (Experiment Station). Britt. & Wils.

**P. turbinata** Medic. Common in waste places near ghuts or dense thickets. *559, 560, 561, 562, 563; Fishlock 299* (Pasea Hall Estate). Britt. & Wils.

Solanum L.

**Solanum elaeagnifolium** Cav. Only one small patch east of the jetty, East End. *44*.

**S. erianthum** D. Don. *Solanum verbascifolium* L. Occasional plants, mostly in thickets, throughout the island. *54; Fishlock 415* (Pasea Hall). Little & Wads., Britt. & Wils.

**S. ficifolium** Ort. *Solanum torvum* Sw. Occasional plants throughout the island. Sometimes used medicinally. "Shoo Shoo Bush." *119; Fishlock 185* (Experiment Station). Britt. & Wils.

**S. lanceifolium Jacq.** Rather rare. Seen at Sage Mountain, Brewers Bay (sea level), and in Road Town. The berries of the Sage Mt. plants were hispid, the others were glabrous. *86*.

**S. melongena** L. Widely cultivated, and occasionally spontaneous. "Melongae," "Egg Plant."

**S. nodiflorum** Jacq. *Solanum nigrum* L. sensu Britt. & Wils. Occasional plants throughout the island. Some are believed to be poisonous, while others are eaten by children. The specific status of these plants needs further investigation. *543, 544, 545, 546, 547; Fishlock 8* (Experiment Station).

**S. persicaefolium** Dunal. Common throughout the island but especially common in dry eastern districts. *33; Fishlock 168* (Lower Estate). Britt. & Wils.

**S. polygamum Vahl.** Very common in coastal thickets. "Cakalaka Berry." *Fishlock 70* (Belleview), *Fishlock 101* (Harbours). Britt. & Wils.

*Nicotiana tabacum* L. (tobacco) was extensively planted 25 years ago, but there is no sign of it now. *Solanum tuberosum* L. (Irish potato) is planted from time to time with indifferent success. *Lycopersicum esculentum* (L.) Mill. is cultivated as a market vegetable (tomato).

Family 82. SCROPHULARIACEAE

Bacopa Aubl.

**Bacopa monnieri** (L.) Pennell. *Bramia monnieri* (L.) Drake. In freshwater ponds and marshy areas. Seen at Towers, Flamingo Pond, and Carrot Bay. *688, 689, 690, 691, 752, 753, 754, 755; Fishlock 311* (Purcells). Britt. & Wils.

Capraria L.

**Capraria biflora** L. Common almost everywhere. *327; Fishlock 211* (Experiment Station). Britt. & Wils.

Russellia Jacq.

**Russellia equisetiformis** Schlechtendal & Cham. Cultivated for ornament. *Fishlock 212* (Road Town).

Scoparia L.

**Scoparia dulcis** L. Very plentiful in Long Bay East, uncommon elsewhere. *165, 166, 399, 400, 401, 402, 403; Fishlock 113* (Huntums Ghut), *Fishlock 284* (Purcells). Britt. & Wils.

Family 83. BIGNONIACEAE

Crescentia L.

**Crescentia cujete** L. At lower elevations, especially along the south coast, and occasionally seen in the mountains. "Calabash Tree." *Fishlock 208* (Pasea Hall Estate). Little & Wads.

Doxantha Miers

**Doxantha unguis-cati** (L.) Rehder. *Batocydia unguis* (L.) Mart. Very plentiful in all moist districts. When it is in full bloom, the hillsides above Cane Garden Bay take on a glorious yellow color. "Cat's Claw." *114, 116; Fishlock 37* (thickets). Britt. & Wils.

Jacaranda Juss.

**Jacaranda mimosifolia** D. Don. *Jacaranda acutifolia* H. & B. Rarely cultivated. The continuous salt spray in most parts of the island limits its expansion.

Pandorea Spach

**Pandorea ricasoliana** (Tanfani) Baill. Commonly cultivated.

Phyrganocydia Mart.

**Phryganocydia corymbosa** (Vent.) Bur. & Schum. Rarely cultivated, but large masses at Fonseca's Corner and Government House grounds attract attention. *432, 433, 434, 435, 436.*

Spathodea Beauv.

**Spathodea campanulata** Beauv. Only three trees known, two in front of the Cottage Hospital, Road Town, and one in Huntum's Ghut. "African Tulip Tree."

Tabebuia DC.

**Tabebuia pallida** (Lindl.) Miers. *Tabebuia heterophylla* (DC.) Britton. One of the most plentiful tree species, occurring mostly at lower elevations. Several of the large leaved, large flowered form are on Government House grounds. "White Cedar." *Fishlock 334* (hillsides). Britt. & Wils.

**T. rufescens** J. R. Johnston. Only known from Government House grounds and Kingstown Hill. A very large tree was accidentally destroyed at the Road Town Experiment Station about five years ago. *11,*

Tecoma Juss.

**Tecoma stans** (L.) H. B. K. Very common along the south coast, but sometimes ascending to ca. 300 m. "Ginger Thomas." *261; Fishlock 201* (Pasea Hall Estate). Little & Wads.

Tecomaria Spach

**Tecomaria capensis** (Thunb.) Spach. Commonly cultivated for ornament.

Family 84. MARTYNIACEAE

Martynia L.

**Martynia annua** L. Seen only in the vicinity of the Road Town Experiment Station. "Wild Okra." *106; Fishlock 482* (waste grounds).

Family 85. GESNERIACEAE

Episcia Mart.

**Episcia fulgida** Hook. Commonly cultivated and rarely escapes. "Strawberry Plant."

Family 86. ACANTHACEAE

Anthacanthus Nees.

**Anthacanthus spinosus** (Jacq.) Nees. In coastal rocks; spiny and spineless forms are seen growing side by side. *808* (Camanoe), *837; Fishlock 105* (Harbours). Britt. & Wils.

Asystasia Blume

**Asystasia gangetica** (L.) T. Anders. Commonly cultivated and escaped, perhaps naturalized. *307, 308, 309, 310.*

Blechum P. Browne

**Blechum pyramidatum** (Lam.) Urban. *Blechum blechum* (L). Millsp. A common and troublesome weed. *135; Fishlock 353* (Experiment Station).

Crossandra Salisb.

**Crossandra infundibuliformis** (L.) Nees. Commonly cultivated.

Dicliptera Juss.

**Dicliptera assurgens** (L.) Juss. *Diapedium assurgens* (L.) Kuntze. On walls and waste places, Pasea Hall Estate. *742, 743, 744, 745, 746.*

Justicia L.

**Justicia carthaginensis** Jacq. *Fishlock 225* (Road Town). Britt. & Wils.

**J. periplocifolia** Jacq. One plant seen, not collected, at Slaney Point. It is very plentiful on Peter Island. *464* (Peter Island).

**J. sessilis** Jacq. Plentiful in moist districts. "Rock Balsam." *137, 138; Fishlock 362* (Huntum's Ghut). Britt. & Wils.

Pachystachys Nees

**Pachystachys coccinea** (Aubl.) Nees. Cultivated for ornament, Government House grounds.

Pseuderanthemum Radlk.

**Pseuderanthemum atropurpureum** Radlk. Commonly cultivated.

Ruellia L.

**Ruellia coccinea** (L.) Vahl. *Fishlock 54* (Great Mountain). Britt. & Wils.

**R. tuberosa** L. An extremely troublesome weed. "Many Roots." White forms occur with the blue forms at Kingstown Hill. *110, 242, 243, 244, 245; Fishlock 128* (Experiment Station).

**R. tweediana** Griseb. Occasionally cultivated. Not seen to escape.

Thunbergia Retz.

**Thunbergia alata** Bojer. *Fishlock 180* (Road Town). Britt. & Wils.

**T. erecta** T. Anders. *Meyenia erecta* (T. Anders.) Benth. Cultivated for ornament.

**T. fragrans** Roxb. Occasional plants, moist districts. Not seen in cultivation. *576, 577, 578, 579, 580; Fishlock 182* (Road Town). Britt. & Wils.

Family 86. MYOPORACEAE

Bontia L.

**Bontia daphnoides** L. Seen only in a large stand in the salt marsh at The Towers. "Alling." *131; Fishlock 100* (Harbours). Britt. & Wils.

Family 87. PLANTAGINACEAE

Plantago L.

**Plantago major** L. Seen only in a small patch at Meyers. *127, 187, 188; Fishlock 63* (Great Mountain). Britt. & Wils.

Family 88. RUBIACEAE

Borreria G. F. W. Mey

**Borreria laevis** (Lam.) Griseb. A troublesome weed almost everywhere. *Fishlock 57* (Experiment Station), *Fishlock 280* (Joe's Hill). Britt. & Wils.

**B. ocimoides** (Burm. f.) DC. Mountain pastures, not very plentiful. *428.* Britt & Wils.

Chiococca P. Browne

**Chiococca alba** (L.) Hitchc. Occasional plants in ghuts and thickets throughout the island. Sometimes used to make a beverage. "Snakeroot." *65, 66.* Britt. & Wils.

Chione DC.

**Chione venosa** (Sw.) Urban. Britt. & Wils.

Coffea L.

**Coffea arabica** L. Several cultivated bushes in the Agricultural Station, Road Town, but not seen in fruit or flower. The same species is locally reported as naturalized in the Sage Mountain forest. Little & Wads.

Diodia L.

**Diodia apiculata** (Willd.) Schum. Seen only in large patches behind Trellis Bay, Beef Island. *789, 790, 798.*

Erithalis P. Browne

**Erithalis fruticosa** L. Common along the sea coasts, especially in western parts of the island. "Black Torch." *258; Fishlock 429* (Belmont). Britt. & Wils.

Ernodea Sw.

**Ernodea littoralis** Sw. Seen only on Belmont Beach and in Trellis Bay, Beef Island. *593, 594, 595.* Britt. & Wils.

Exostema L. C. Rich.

**Exostema caribaeum** (Jacq.) R. & S. Common along the seacoast. Conspicuous when in flower and fruit. Used medicinally. "Torch." *92; Fishlock 486* (Kingstown). Little & Wads., Britt. & Wils.

Faramea Aubl.

**Faramea occidentalis** (L.) A. Rich. Fairly common in Sage Mountain forests. *717; Fishlock 86* (Sage Mt.). Little & Wads., Britt. & Wils.

Gardenia Ellis

**Gardenia jasminoides** Ellis. Very commonly cultivated and long persistent, appearing spontaneous although probably not so. Rarely or never fruiting.

Geophila D. Don

**Geophila repens** (L.) J. M. Johnst. *Geophila herbacea* (Jacq.) Schum. *Eggers 3236.*

Gonzalagunia Ruiz & Pav.

**Gonzalagunia spicata** (Lam.) *Duggena hirsuta* (Jacq.) Britt. Plentiful in forests and pastures at upper elevations. Sometimes a shrub to 2 m., and rarely a high climbing vine. *140; Fishlock 327* (Joe's Hill), *Fishlock 786* (Great Mountain). Britt. & Wils.

Guettarda L.

**Guettarda parviflora** Vahl. Britt. & Wils. Little & Wils.

**G. scabra** (L.) Vent. *Guettarda scabra* (L.) Lam. Britt. & Wils. Little & Wads.

Ixora L.

**Ixora ferrea** (Jacq.) Benth. *Eggers 3195.* Little & Wads., Britt. & Wils.

Several species of *Ixora* are planted for ornament. Most common are: *I. chinensis* (salmon), *I. coccinea* (red), *I. finlaysonia* (white).

Morinda L.

**Morinda citrifolia** L. Common along sea coasts, especially in the Road Harbour and Sea Cow Bay areas. Used medicinally. "Painkiller Tree." *794; Fishlock 488* (Road Town). Little & Wads., Britt. & Wils.

Palicourea Aubl.

**Palicourea crocea** (Sw.) R. & S. *Palicourea riparia* Benth. Common in wet mountain forests. Its showy red and orange flowers strongly recommend its use as an ornamental. "Yellow Cedar." *139, 369, 370, 371; Fishlock 94* and *363* (Sage Mt.); *Eggers 3193* (High Bush, 1200'). Britt. & Wils.

**P. domingensis (Jacq.)** DC. Rather rare in Sage Mountain forests. Its white flowers and wand-like aspect suggest suitability as an ornamental. *98; Fishlock 148* (Experiment Station). Britt. & Wils.

Psychotria L.

**Psychotria brownei** Spreng. *Eggers 3233.* Britt. & Wils.

**P. ligustrifolia** (Northrop) Millsp. Plentiful between Joe's Hill and Meyers. *280; Eggers 3232.*

**P. microdon** (DC.) Urban. *Psychotria pinularis* Sesse & Moçiño. Occasional in thickets throughout the island. *60, 820* (Camanoe); *Fishlock 296* (Pasea Hall Estate). Britt. & Wils.

**P. undata** Jacq. Britt. & Wils.

Randia L.

**Randia aculeata** L. *Randia mitis* L. Plentiful, especially on lower hillsides and ghuts, sometimes troublesome as a weed. This is the traditional Christmas Tree on Tortola. "Fishing Rod." *47, Fishlock 210* (Pasea Hall Estate). Little & Wads., Britt. & Wils.

Rondeletia L.

**Rondeletia pilosa** Sw. Roadsides and thickets, moist districts. Plentiful at Hope and on Joe's Hill. *350; Fishlock 434* (Zion Hill). Little & Wads., Britt. &. Wils.

Spermacoce L.

**Spermacoce confusa** Rendle. *Spermacoce tenuior* L. *sensu* Britt. & Wils. *Fishlock 11* (Experiment Station). Britt. & Wils.

*Portlandia grandiflora* L. and *Mussaënda luteola* Delile are rarely cultivated for ornament.

Family 89. CAPRIFOLIACEAE

Sambucus L.

**Sambucus simpsonii** Rehder. Occasionally cultivated and long persistent, appearing as if naturalized. Fruits not seen.

Family 90. CUCURBITACEAE

Cayaponia Manso

**Cayaponia americana** (Lam.) Cogn. Widespread in moist districts, forming large masses on Joe's Hill and Brewers Bay. *123, 351; Fishlock 4* (Experiment Station). Britt. & Wils.

**C. racemosa** (Mill.) Cogn. *Cayaponia racemosa* (Sw.) Cogn. Britt. & Wils.

Citrullus Forst.

**Citrullus lanatus** (Thunb.) Mansfeld. *Citrullus citrullus* (L.) Karst. Occasionally cultivated. A fine crop comes to Tortola each year from Peter Island. "Watermelon."

Cucumis L.

**Cucumis anguria** L. Common, especially in dry districts. "Wild Cucumber." Used for food. *324; Fishlock 154* (Experiment Station). Britt. & Wils.

**C. sativa** L. Cultivated as a market vegetable.

Lagenaria Ser.

**Lagenaria siceraria** (Molina) Standl. *Cucurbita lagenaria* L. Widely cultivated, and escaping in wet seasons. "Sweet Gourd." "Gourdie." *Fishlock 295* (Pasea Hall Estate). Britt. & Wils.

Melothria L.

**Melothria guadalupensis** (Spreng.) Cogn. Common in wet mountain districts, rare elsewhere. *334; Fishlock 21* (Experiment Station). Britt. & Wils.

Momordica L.

**Momordica charantia** L. A widespread and very troublesome vine. A decoction of the leaves is used medicinally as "Bitter Bark." "Maiden Apple." *Fishlock 23* (Experiment Station). Britt. & Wils.

Sechium P. Browne

**Sechium edule** (Jacq.) Sw. Cultivated on the north side of the island. "Christophene."

Family 91. CAMPANULACEAE

Hippobroma G. Don

**Hippobroma longiflora** (L.) G. Don. *Isotoma longiflora* (L.) Presl. Common in pastures wet mountain areas, *82*. Britt. & Wils.

Family 92. GOODENIACEAE

Scaevola L.

**Scaevola plumierii** (L.) Vahl. Although all beaches were searched for this species, it was found only at Long Bay West. It is plentiful on the north side of Peter Island. *321; Fishlock 424* (West End). Britt. & Wils.

Family 93. COMPOSITAE

Acanthospermum Schrank

**Acanthospermum hispidum** DC. A very plentiful and widespread weed, covering several acres in Free Bottom. *173, 174, 175; Fishlock 186* (Experiment Station). Britt. & Wils.

Ageratum L.

**Ageratum conyzoides** L. Common on hillsides, upper elevations. Dwarf forms, 4 cm. tall, are to be found in windswept pastures, Sage Mountain. *185, 681, 682, 683; Fishlock 281* (Leonards); *Eggers 3222*. Britt. & Wils.

Ambrosia L.

**Ambrosia hispida** Pursh. Seen in a large patch on Great Mountain (ca. 300 m.) *189*. Britt. & Wils.

Bidens L.

**Bidens cynapiifolia** H. B. K. A common weed. *634, 635, 636; Fishlock 29* (Experiment Station). Britt. & Wils.

**B. pilosa** L. A common weed. *625, 626, 627.*

Borrichia Adans.

**Borrichia arborescens** (L.) DC. Seen only at Trellis Bay, Beef Island. *773.*

Brachyrampus DC.

**Brachyrampus intybaceus** (Jacq.) DC. *Fishlock 273* (Brandywine Bay). Britt. & Wils.

Chaptalia Vent.

**Chaptalia nutans** (L.) Polak. *Fishlock 346* (Joe's Hill).

Conyza Less.

**Conyza bonariensis** (L.) Cron. *Leptilon bonariense* (L.) Small. Britt. & Wils.

**C. canadensis** (L.) Cron. *Erigeron canadensis* L. *Leptilon pusillum* (Nutt.) Britt. Widespread. Plentiful in Sage Mountain pastures, and in abandoned cultivation, Josia's Bay. *200, 201, 202.*

Cosmos Cav.

**Cosmos caudatus** H. B. K. Common in wet mountain pastures, and coming down to lower elevations in wet seasons. *348; Fishlock 48* (Great Mountain); *Eggers 3226.* Britt. & Wils.

**C. sulphureus** Cav. Cultivated and sometimes spontaneous.

Eclipta L.

**Eclipta prostrata** (L.) L. Beside the Freshwater Pond, Towers. *674, 675, 676; Fishlock 439* (Zion Hill). Britt. & Wils.

Elephantopus L.

**Elephantopus scaber** L. *Elephantopus mollis* H. B. K. Common in pastures and roadsides, upper elevations. *420, 421, 422, 423, 424; Fishlock 309* (Purcells); *Eggers 3224.* Britt. & Wils.

Emilia Cass.

**Emilia coccinea** (Sims) Sweet. Common at upper elevations. *270, 271, 272.*

**E. sonchifolia** (L.) DC. *Fishlock 238* and *356* (Experiment Station). Britt. & Wils.

Erechtites Raf.

**Erechtites hieracifolia** (L.) Raf. *Fishlock 19* (Experiment Station). Britt. & Wils.

Erigeron L.

**Erigeron cuneifolius** DC. Britt. & Wils.

Eupatorium L.

**Eupatorium corymbosum** L. *Osmia corymbosa* (Aubl.) Britt. & Wils. Common at upper elevations. "Christmas Bush." *356,* Britt. & Wils.

**E. odoratum** L. *Osmia odorata* (L.) Schultz. Common in moist districts, at all elevations. "Christmas Bush." *410; Fishlock 319* (Experiment Station). Britt. & Wils.

**E. sinuata** Lam. *Osmia sinuata* (Lam.) Britt. & Wils. Seen at sea level, Jackass Ghut. *731, 732, 733, 734.*

Lactuca L.

**Lactuca sativa** L. Cultivated for market. "Lettuce."

Melanthera Rohr

**Melanthera nivea** (L.) Small. *Melanthera confusa* Britt. Wet mountain districts. *684, 685, 686; Fishlock 440* (Zion Hill), *Fishlock 484* (Jost Van Dyke). Britton used Fishlock 440 as the type for *M. confusa.* Britt. & Wils.

Mikania Willd.

**Mikania cordifolia** (L. f.) Willd. Common in thickets and old ruins, upper elevations. *426; Fishlock 112* (New Bush). Britt. & Wils.

Neurolaena R. Br.

**Neurolaena lobata** (L.) R. Br. *Fishlock 87* (Sage Mountain). Britt. & Wils.

Parthenium L.

**Parthenium hysterophorus** L. A very common and extremely troublesome weed. "Bitter Weed." *38, 39, 40; Fishlock 255.* Britt. & Wils.

Pectis L.

**Pectis linifolia** L. Seen only by the main road, Pasea Hall Estate. *652, 653, 654, 655.*

Piptocoma Cass.

**Piptocoma antillana** Urban. *Piptocoma rufescens* Cass. Common at sea level, north side of Peter Island, but not seen on Tortola. Probably of ornamental value. *373, 374* (Virgin Gorda), *375, 376, 377.*

Pluchea Cass.

**Pluchea carolinensis** (Jacq.) D. Don. *Pluchea odorata* (L.) Cass. Forming large shrubby masses at Hannah, Paraquita Bay and Fat Hog Bay. *130; Fishlock 17* (Pasea Hall Estate). Britt. & Wils.

**P. purpurascens** (Sw.) DC. Seen only in the Freshwater Pond, Towers. *677, 678, 700; Fishlock 438* (Zion Hill). Britt. & Wils.

Pseudo-elephantopus Rohr

**Pseudo-elephantopus spicatus** (B. Juss. ex Aubl.) Gleason. *Pseudo-elephantopus spicatus* (Juss.) Rohr. Common at upper elevations and coming down to sea level in moist ghuts. *133; Fishlock 337* (Joe's Hill); *Eggers 3230.* Britt. & Wils.

Pterocaulon Ell.

**Pterocaulon virgatum** (L.) DC. *Fishlock 13* (Pasea Hall Estate). Britt. & Wils.

Solidago (Vaill.) L.

**Solidago microglossa** DC. Common at Meyers and widespread in mountain districts. Occasionally taken to sea level for cultivation. *132, 628, 629, 630.*

Sonchus L.

**Sonchus oleraceus** L. *Fishlock 343* (Joe's Hill). Britt. & Wils.

Synedrella Gaertn.

**Synedrella nodiflora** (L.) Gaertn. *Fishlock 22* (Experiment Station). Britt. & Wils.

Tithonia Desf.

**Tithonia diversifolia** (Helmsl.) A. Gray. In large patches at upper elevations; Great Mountain to Meyers. *134, 490.*

Tridax L.

**Tridax procumbens** L. A common weed in the Road Town area. *170, 171, 172, 649, 650, 651.*

Verbesina L.

**Verbesina alata** L. *Tepion alatum* (L.) Britton. Common although scattered, moist districts. Used medicinally. "Information (Inflammation?) Bush." *335, 337, 338.*

Vernonia L.

**Vernonia albicaulis** Pers. Common at upper elevations. *799.*

**V. cinerea** (L.) Less. A very common and troublesome weed. *35, 36, 37; Fishlock 3, 28* (Experiment Station). Britt. & Wils.

**V. sericea** L. C. Rich. Common at upper elevations. *275, 276, 277, 600, 601, 602.*

Wedelia Jacq.

**Wedelia calycina** L. C. Rich. Seen only beside the airport, Beef Island. *813, 814, 815.*

**W. parviflora** L. C. Rich. Britt. & Wils.

**W. trilobata** (L.) Hitchc. Common in wet fields and ditches, lower elevations. *822, 823, 824; Fishlock 445* (Purcells). Britt. & Wils.

Xanthium L.

**Xanthium strumarium** L. *Xanthium chinense* Mill. Very plentiful at Long Look. *341; Fishlock 300* (Pasea Hall Estate). Britt. & Wils.

# CONNECTING VOWELS IN EPITHETS OF LATIN ORIGIN[1]

BERNARD BOIVIN

Latin compound words are commonly formed with the letter *i* as a connecting vowel. Certain other methods of forming compound words also occur in Latin, but are of rather limited application or usage.

Article 73 note 2 of the International Code of Botanical Nomenclature calls for uniformity in the formation of names by stating that:

"The use of a wrong connecting vowel or vowels (or the omission of a connecting vowel) in a name or an epithet is treated as an orthographic error".

And the two examples given are *opuntiaeflora* corrected to *opuntiiflora*, and *napeaefolia* corrected to *napaeifolia*.

Some exceptions are given under Recommendation 73G. Before a vowel, a final vowel is normally elided: *multangulus*, not *multi-angulus*. The ablative ending may be retained as in *atropurpureus* and *fuscovenetus*. Forms revealing etymological distinctions may also be retained, such as *caricaeformis* from *Carica* versus *cariciformis* from *Carex*.

Other examples of the intent of the Rules can be culled from various parts of the text of the Code. These are:
*acutiflorus, angustifolius, biflorum, brevifolia, brevipedunculata, cruciformis, fragiferum, gossipiifolia, grandiflora, hieraciifolium, latifolia, longisiliquum, menthifolius, multicaulis, multicolor, multiflorum, napifolius, neriifolia, rumicifolia, salicifolia, salviifolius, soredïiformis, tricolor, tricuspis, trinervis.*

Two epithets used in the Rules appear to be in need of correction. *Fimbricalyx*, Art. 42, should read: *fimbriicalyx*, compare: *sorediiformis*. *Contortuplicatus*, Rec. 21A, is not only contrary to Art. 73, it is also a very old word, the classical form of which is *contortiplicatus*.

---

[1]Contribution No. 20, Faculty of Agriculture, Laval University, Quebec, Canada.

Contribution No. 580, Plant Research Institute, Department of Agriculture, Ottawa, Canada.

The full implication of Art. 73 may have escaped the attention of most botanists. A rapid sampling of the Kew Index, the Gray Index or the indices of various floras from a shelf at hand reveals that they all contain a fair number of epithets contrary to Art. 73. There is no intention on my part to carry out a full survey of all such names that need to be corrected under Art. 73; the task would be stupendous. However in skimming through M. L. Fernald, Gray's Manual of Botany, ed. 8, 1950, I have noticed that the following corrections are needed therein:

| NAME | CORRECTION |
|---|---|
| *Acalypha ostryaefolia* | *A. ostryifolia* |
| *Agastache scrophulariaefolia* | *A. scrophulariifolia* |
| *Aristida longespica* | *A. longispica* |
| *Aster dumosus* | |
| var. *subulaefolius* | var. *subulifolius* |
| *Athyrium thelypterioides* | *A. thelypteridoides* |
| *Beckmannia erucaeformis* | *B. eruciformis* |
| *Betula caerulea-grandis* | *B. caeruleigrandis* |
| *Bidens heterodoxa* | |
| var. *monardaefolia* | var. *monardifolia* |
| *Botrychium matricariaefolium* | *B. matricariifolium* |
| *Botrychium ternatum* | |
| var. *rutaefolium* | var. *rutifolium* |
| *Bromus brizaeformis* | *B. briziformis* |
| *Carex livida* | |
| var. *rufinaeformis* | var. *rufiniformis* |
| *Cerastium longepedunculatum* | *C. longipedunculatum* |
| *Comptonia peregrina* | |
| var. *asplenifolia* | var. *aspleniifolia* |
| *Coreopsis delphinifolia* | *C. delphiniifolia* |
| *Cyperus flavescens* | |
| var. *poaeformis* | var. *poiformis* |
| *Erectites hieracifolia* | *E. hieraciifolia* |
| *Eupatorium urticaefolium* | *E. urticifolium* |
| *Eupatorium verbenaefolium* | *E. verbenifolium* |
| *Gentiana Catesbaei* | |
| var. *nummulariaefolia* | var. *nummulariifolia* |
| *Helianthus grosseserratus* | *H. grossiserratus* |
| *Helianthus trachelifolius* | *H. tracheliifolius* |
| *Iva xanthifolia* | *Iva xanthiifolia* |
| *Kalmia polifolia* | *K. poliifolia* |
| *Kosteletzkya virginica* | |
| var. *altheaefolia* | var. *altheifolia* |

| | |
|---|---|
| *Lindera melissaefolium* | *L. melissifolium* |
| *Liparis lilifolia* | *L. liliifolia* |
| *Lycopodium sabinaefolium* | *L. sabinifolium* |
| *Lyonia ligustrina* | |
| var. *capreaefolia* | var. *capreifolia* |
| *Monarda fistulosa* | |
| var. *menthaefolia* | var. *menthifolia* |
| *Monarda menthaefolia* | *M. menthifolia* |
| *Myrica asplenifolia* | *M. aspleniifolia* |
| *Osmunda cinnamomea* | |
| f. *cornucopiaefolia* | f. *cornucopiifolia* |
| *Paspalum longepedunculatum* | *P. longipedunculatum* |
| *Paspalum setaceum* | |
| var. *longepedunculatum* | var. *longipedunculatum* |
| *Penstemon tubaeflorus* | *P. tubiflorus* |
| *Polygonum pensylvanicum* | |
| var. *rosaeflorum* | var. *rosiflorum* |
| *Potamogeton spathulaeformis* | *P. spathuliformis* |
| *Quercus falcata* | |
| var. *pagodaefolia* | var. *pagodifolia* |
| *Quercus macrocarpa* | |
| f. *olivaeformis* | f. *oliviformis* |
| *Quercus pagodaefolia* | *Q. pagodifolia* |
| *Ranunculus bulbosus* | |
| var. *valdepubens* | var. *valdipubens* |
| *Ranunculus sicaeformis* | *R. siciformis* |
| *Salvia lanceaefolia* | *S. lanceifolia* |
| *Sambucus pubens* | |
| f. *rosaeflora* | f. *rosiflora* |
| *Smilax Bona-Nox* | |
| var. *hederaefolia* | var. *hederifolia* |
| *Sium cicutaefolium* | *S. cicutifolium* |
| *Tragia nepetaefolia* | *T. nepetifolia* |
| *Valerianella chenopodifolia* | *V. chenopodiifolia* |
| *Veronica hederaefolia* | *V. hederifolia* |
| *Viola melissaefolia* | *V. melissifolia* |
| *Zenobia cassinefolia* | *Z. cassinifolia* |

Corrections of connecting vowels cannot be done indiscriminately and I hope I have not made too many unjustified corrections. A few examples of special cases may help the reader recognize some of the unusual compounds that should be allowed to stand.

*Millefolium*: this is an old classical word already in use by the third century A.D. and should be allowed to stand undisturbed. In compounds the forms *mille-* and *milli-* are equally acceptable. E.g., *milli-formis, millepeda, millegrana.* Similarly, with *pedemontanus, Vincetoxicum, Cerefolium, graveolens, suaveolens,* etc.

*Noveboracus:* the latin form of York is *Eboracus,* hence the elision of a final vowel and the omission of a connecting vowel.

*Anethiodora:* a better form would be *anethodora,* but the paragraph on the elision of a final vowel before an initial vowel is only a recommendation (73G), hence a correction is not compulsory. Note also: *asplenioides, brevi-aristatus.*

*Antecedens:* the preposition *ante* may either be used unmodified or it may be changed to *anti.* There is ample classical usage to justify both forms. Other prepositions and adverbs are also commonly used in compounds either unmodified or without connecting vowels; e.g.: *sempervirens, interruptus, retroflexus, praematurus.* Similarly with numerals: *quinquefolius.*

*Spica-venti:* this and other similar epithets are termed "pseudo-compounds" in the Rules (73G), and are exempt from the provisions of Art. 73 note 2. They are also exempt from the provisions for the elimination of hyphens in compound words. Otherwise, hyphens should be eliminated in compounds.

*Muscaetoxicum:* appears to fall in the category of "pseudo-compounds" and should be allowed to stand unchanged.

While reading Gray's Manual for the purpose of this survey, I paid attention only to connecting vowels in latin compounds. Yet I could not help noticing that a great many more orthographic errors should be eliminated. The most frequently needed correction is the lack of an additional *i* in certain genitives: *Helianthus Maximiliani* (for *Maximilianii*). Here is a sampling of certain other types of correction also needed: *Habenaria blephariglottis (blepharidiglottis); Panicum calliphyllum (callophyllum); Acer Pseudo-Platanus (pseudoplatanus); Franseria acanthicarpa* *(acanthocarpa); Veronica Anagallis-aquatica* f. *anagalliformis (anagallidiformis).*

As it presently stands, Art. 73 is a rather mild attempt at spelling-standardization. Yet botanists seem pretty lackadaisical about its observance. Under the circumstances it hardly seems worth while to propose still further spelling-standardizations. Yet I would strongly support an Article 73 that would eliminate such variants as *caeruleus, ceruleus* and *coeruleus; littoralis* and *litoralis; allegheniensis* and *alleghaniensis; pensylvanicus, pennsylvanicus* and *pensilvanicus,* and most of all, the multitude of alternate forms of *kamtschaticus* and *alaschkensis.* The latter are especially vexing.

LOUIS-MARIE HERBARIUM,
LAVAL UNIVERSITY, QUEBEC AND
DEPARTMENT OF AGRICULTURE, OTTAWA, CANADA

## ANOTHER TRIBULUS ADVENTIVE IN THE NEW WORLD

*Tribulus* L. (Zygophyllaceae) is an Old World genus of perhaps several dozen species, two of which are well-known adventives in the Americas. *Tribulus cistoides* L. is a common weed in tropical Mexico and the Carribbean region, and *T. terrestris* L. a ubiquitous pest in the warm temperate areas of both North and South America. While examining specimens of this genus from South America, I discovered a third adventive, *T. alatus* Del., represented by the following collections from western Peru:

DEPT. PIURA: Pariñas Valley, *Haught F-143* (F), *206* (GH); Talara, *Johnston 3513* (F, GH); 1 km W Talara, *Beetle 26201* (UC). DEPT. ICA: between Cocharcas and Quilque, *Ferreyra 580* (US). Information on the labels of the Beetle and Johnston collections indicate that the plant was not common where found, but *Haught F-143* states that the plant was "abundant after rains, especially north of Pariñas Valley."

This desert-dwelling annual from North Africa and the Middle East to India is easily recognized by its winged mericarps. Vegetatively, *Tribulus alatus* is similar to more pubescent examples of *T. terrestris*, which also is found in Peru. The three New World adventives may be separated readily by the following key:

1. Perennial; flowers 2-4 cm in diameter; intrastaminal glands connate, forming a 5-lobed ring around ovary base ........ *T. cistoides.*
1. Annual; flowers 5-15 mm in diameter; intrastaminal glands free:
   2. Flowers 5-10 mm in diameter; mericarps dorsally 2-4-spined .................................................................................... *T. terrestris.*
   2. Flowers 10-15 mm in diameter; mericarps winged on margin of dorsum ............................................................................ *T. alatus.*

In addition to the adventives, a number of species of *Tribulus* have been described from the New World as indigenes. Of these, *T. alacranensis* Millsp., from the Arrecife Alacrán, Yucatán, Mexico, and *T. sericeus* Anderss., from the Galápagos Islands, Ecuador, are synonyms of *T. cistoides.* All others prove to be members of the closely related *Kallstroemia* Scop.

DUNCAN M. PORTER
DUDLEY HERBARIUM, STANFORD UNIVERSITY
STANFORD, CALIFORNIA 94305

## THE FLORA OF EASTERN HIMALAYA[1]

This handsome volume is a report of the botanical expeditions of the University of Tokyo to the eastern Himalayas in 1960 and 1963. It is a contribution to the flora of that area of high significance, not only because of the care with which it has been prepared but also because of its broad scope and biological orientation. The volume is based on some sixty thousand specimens representing about three

[1]The Flora of Eastern Himalaya — Results of the Botanical Expeditions to Eastern Himalaya — Organized by the University of Tokyo 1960 and 1963. Compiled by Hiroshi Hara. i-x, pp. 1-744, pl. 1-40, figs. 1-68, route maps. University of Tokyo Press. 1966. ($32.00 from the University of Tokyo Press, 7-3-1 Hongo, Bunkyo-ku, Tokyo, Japan.)

thousand species of seed plants, ferns, bryophytes, lichens and fungi. The geographic records of the species are an important contribution but the catalogue of the collections is much more than that. The nomenclature and bibliography have received careful attention and the taxonomic work has been critical. Several new species are described and comments on old ones are frequent.

There is a chapter on cytology which deals with sixty species and illustrates the somatic chromosomes of nineteen of them. The chapter on phytogeography presents an excellent account of the vegetation and a detailed comparison of the floristic relations between the eastern Himalaya and Japan. This latter study involves over two hundred and fifty Himalayan species and their Japanese counterparts.

A series of photographs, twenty-one of them in color, illustrate the principal vegetational features, selected species and floral details.

This book will not only be widely used by botanists concerned with the Himalayan flora directly but will be of special interest to those interested in the eastern North American flora and its relationship to eastern Asia.

Dr. Hara and his thirty-seven colleagues who contributed to the book are to be congratulated for this fine publication.

ROLLA TRYON,
GRAY HERBARIUM, HARVARD UNIVERSITY

A NEW STATION FOR HAMAMELIS VIRGINIANA L. IN MINNESOTA. — Common witch-hazel (*Hamamelis virginiana* L.) is widely distributed in eastern North America reaching the northwest limit of its range in Minnesota. Until recently it has been known only from Winona and Houston counties in the extreme southeast corner of the state.

In 1960 Mr. Richard Brand, county agent of Todd County in central Minnesota requested verification of the identification of a witch-hazel plant found on a farm of Mr. Leon

Robideau in Gray Eagle Township in that county (SW 1/4 of the NW 1/4, Sec. 24, T. 127N, R 32W). Information from Mr. Robideau, confirmed by Mr. Brand, indicated that this was a wild shrub growing in a wooded area never subjected to cultivation. Mr. Robideau further commented that this was the only known specimen on his farm and that no others were known to exist in the vicinity. This occurrence is a range extension of approximately 200 miles northwest of the nearest previously known station in Minnesota at Quinn's Bluff, Winona County, and about 100 miles west of the nearest approach of witch-hazel in Polk County, Wisconsin.

To obtain propagating material for the perpetuation of this unusual witch-hazel plant the site was visited on October 19, 1963. Accompanied by Mr. Robideau we found the plant along a trail on his farm. Associated trees consisted in part of Ironwood (*Ostrya virginiana* (Mill.) K. Koch), Blue-Beech (*Carpinus caroliniana* Walt.), Quaking-Aspen (*Populus tremuloides* Michx.), Paper-Birch (*Betula papyrifera* Marsh.), Red Oak (*Quercus rubra* L.), Bur-Oak (*Q. macrocarpa* Michx.). American Hazel (*Corylus americana* Walt.), Prickly-Ash (*Zanthoxylum americanum* Mill.), Wolfberry (*Symphoricarpos occidentalis* Hook.), and Leatherwood (*Dirca palustris* L.) were common associated shrubs.

The witch-hazel plant was about 12 feet high, apparently quite old, as evidenced by the much thickened base and rotten stubs of former stems. The shrub was composed of several stems up to 4″ in diameter and of a number of sprouts of moderate vigor. The plant was in flower at the time of observation but no fruit was present. The flowers of *Hamamelis* are perfect and self-incompatibility may be the factor involved in the failure to produce seed.

Although fruit was absent, a number of fruit-like spiny galls was noted on the sterile fruit pedicels. These are produced by the spiny witch-hazel gall aphid, *Hamamelistes spinosus* Shimer, an insect with a complex life cycle alternating between birch (in this case *Betula papyrifera*) and witch-hazel. The presence of this insect on an isolated plant suggests that until comparatively recent times there may have existed a more or less continuous population of witch-hazel between the Grey Eagle station and the present general northwest limit of the species along the St. Croix and Mississippi Rivers.

Although no seed was obtained from this outlier specimen of witch-hazel, the plant had been propagated in a modest way by Mr. Robideau through the removal of rooted basal sprouts. Two small plants thus obtained had been planted near the farm house on the property. One of these Mr. Robideau presented to the University of Minnesota Landscape Arboretum. Cuttings obtained at the time of this visit rooted satisfactorily in a sand propagating bench but failed to become established when transferred to soil under greenhouse conditions.

Albert G. Johnson and Margaret H. Smithberg
DEPARTMENT OF HORTICULTURAL SCIENCE
UNIVERSITY OF MINNESOTA, ST. PAUL

# THLASPI TUBEROSUM NUTT., A TAXONOMIC SYNONYM OF CARDAMINE DOUGLASSII BRITT. (CRUCIFERAE)[1]

RONALD L. STUCKEY

When Thomas Nuttall undertook his journey of scientific exploration into the "Old Northwest" (the Great Lakes Region) in the year 1810, he discovered several new species of plants, twenty of which he described as new in his now classic book, *The Genera of North American Plants, and a Catalogue of the Species, to the Year 1817*, published in 1818. In the course of preparing an account of Nuttall's plant collections of this trip, I learned that his *Thlaspi tuberosum*, described from western Pennsylvania, has not been adequately understood by plant taxonomists. It would be an easy matter to make the proper determination of the plant and state the taxonomic position of this species if Nuttall's original specimen were available for study today. As pointed out by Ewan (1952) a mystery surrounds the whereabouts and existence of certain of Nuttall's plants believed to have been obtained on this trip. My own study of Nuttall's writings and his plant specimens in the herbarium of the Academy of Natural Sciences of Philadelphia gives evidence that Nuttall may have lost many of his plants of this trip and then replaced some of these with plants obtained later on the same trip, or on another trip, or from another botanist (Stuckey, 1967). The specimen of *Thlaspi tuberosum* evidently was one of those which was not replaced. No specimen labeled as *T. tuberosum* has been located in the herbaria of the British Museum (London), the Royal Botanical Gardens (Kew), the City of Liverpool Museums, or the Academy of Natural Sciences, all of which have Nuttall's plants collected previous to the publication of his *Genera*.

Nuttall's description of *T. tuberosum* in the *Genera* is quite brief and, as is shown below, even inaccurate at one

[1]Paper No. 731 from the Department of Botany, The Ohio State University, Columbus 43210.

point; consequently later writers have not been able to determine properly to what plant the description refers. DeCandolle (Syst. Nat. 2: 382. 1821 and Prodr. 1: 177. 1824) included *T. tuberosum* as a valid species, but placed it in a category of *Species non satis notae* because he did not have sufficient information to determine its relationship to other species. Eaton (Man. 3rd. ed. 486. 1822) wrote a description of *T. tuberosum* nearly identical to that given by Nuttall, and he continued this species and its description in all the succeeding editions of his *Manual.* Torrey and Gray (Fl. N. Am. 1: 114. 1838) also included *T. tuberosum,* but Gray did not mention or give a description of it in the first edition of his *Manual* (Gray, 1848), nor in the following four editions. Neither did Britton and Brown (1897, 1913) discuss this species. Payson (1926), who revised the genus *Thlaspi* for North America, stated that the genus was entirely lacking in northeastern America, and therefore he made no mention of Nuttall's *T. tuberosum.* Recent floristic works of northeastern North America, such as Fernald (1950), Gleason (1952), and Gleason and Cronquist (1963) also do not record this species. It therefore appears that the proper status of *T. tuberosum* has been lost sight of through the years and has never adequately been determined.

In a situation where the original specimen is apparently not extant, it is often necessary to turn to other sources of supplementary data, if they are available, in order to gain a clearer understanding of the original description. These data may be found among the author's field notes, diaries, or letters. It is fortunate that Nuttall's diary of the early portion of his 1810 trip was discovered and subsequently published by Graustein (1951). In this diary Nuttall wrote descriptions of plants he saw and studied. Whether he referred to these descriptions when he wrote the diagnoses in his *Genera* is not known. Detailed comparisons of these accounts in these two works might be made to determine their similarities and differences which in turn might lead to a clearer understanding of certain species' diagnoses in

Nuttall's *Genera.* Upon making several comparisons, I discovered that Nuttall's diagnosis of *T. tuberosum* in the *Genera* appears to be a condensed version of a much more detailed account of a plant he observed near Butler, about 27 miles north of Pittsburgh, and subsequently described in his diary (Graustein, 1951, p. 29). Pertinent data from these two sources are compared in the following chart.

| | GENERA | DIARY |
|---|---|---|
| Name: | "Thlaspi tuberosum" | "a species of Cardamine?" |
| Root: | "tuberous and fibrous" | "an irregular tho' some what roundish tuber, (or rather bulb,) having several knobs or protuberances on its under surface" |
| Stem: | "pubescent; very short and simple" | "roundish" |
| Leaves: | "rhomboid-ovate, obsoletely toothed, smooth, and sessile, radical ones upon long petioles" | "radical leaves are from reniform-cordate to obcordate, mostly entire tho' sometimes slightly dentate stem leaves, subcordate-lanceolate, obtuse, distantly & bluntly toothed, the uppermost leaves sessile & somewhat cuneate" |
| Flowers: (petals) | "rather large, like those of an Arabis, rosaceous" | "rather large, . . . of a pale purplish tinge" |
| Fruit: | "Silicle suborbiculate, short and compressed" | "Silique, erect, compressed. obcordate" |
| Height: | "Not more than 4 or 5 inches" | "about ½ foot high" |
| Flowering: | "April and May" | seen 26 April 1810 |
| Habitat: | Data not given | "in moist shady woods generally nr. rivulets in a rich vegetable earth" |
| Locality: | "Western Pennsylvania" | Near Butler, about 27 miles north of Pittsburgh |

Although the data from these two sources do not completely agree, there is little question that the two descriptions refer to the same species. The notes on habitat, flowering time, and the diagosis of the plant's morphology, except the description of the fruit, all point to its being

*Cardamine douglassii* Britt. Greene (1896), Schulz (1903), and Stuckey (1962), who have previously treated the taxonomy and nomenclature of *Cardamine douglassii* or its synonyms, do not mention *T. tuberosum,* although Watson (A. Gray, Syn. Fl. N. Am. 1(1) : 156. 1895) had suggested that Nuttall's *T. tuberosum* was probably the same as *C. douglassii (C. rhomboidea* (Pers.) DC. var. *purpurea* Torrey) because of its tuberous root, rose-colored flowers, and pubescence. Watson also stated that Nuttall described the pod "as orbicular." The fruit of *C. douglassii* is long and somewhat tapered at the apex. To my knowledge there is no member of the Cruciferae of eastern North America which has an obcordate or suborbicular fruit with the vegetative and flower characters of *C. douglassii.* This discrepancy in the original diagnosis has doubtless been the major reason why botanists have not been able to properly classify Nuttall's species. Graustein (1951, p. 29, footnote 60) regarded Nuttall's description to be in error with respect to fruit shape. Was this an error Nuttall made when looking at the plant? Or did Nuttall, in writing his notes, confuse this species with some other species? Examination of the *Genera* reveals that Nuttall did not give any description or mention any species under *Cardamine* or *Arabis* that would include the present-day understood *C. douglassii.* By comparing the data in the *Genera* with the information in the diary, it is clear that Nuttall's note pertaining to *Thlaspi arvense* is the same species as the *T. arvense* of today. His reference to *T. alliaceum* is the *Lepidium campestre,* and his *T. bursa pastoris* is the *Capsella bursa-pastoris.* Thus, other possible species of *Thlaspi* or species in allied genera which might be considered to agree with Nuttall's description of *T. tuberosum* (at least with respect to the fruit shape he gave) were otherwise included in his *Genera.*

On the basis of publication date only, Nuttall's *Thlaspi tuberosum* (Gen. 2: 64. 1818) has priority over Britton's *Cardamine douglassii* (Trans. N. Y. Acad. Sci. 9: 8. 1889). If *T. tuberosum* were transferred to *Cardamine,* it would create a later homonym because there already exists a

*Cardamine tuberosa* described by DeCandolle (Syst. Nat. 2: 254. 1821) from Chile and illustrated by Delessert (Ic. Sel. Pl. 2: *t. 29.* 1823). A study of DeCandolle's diagnosis of *C. tuberosa,* the photograph of the type specimen on a microfiche card of the DeCandolle herbarium (Card No. 69), the drawing in Delessert, and the illustration in Schulz (1903, *t. 10, f. 1)* reveals that plants of *C. tuberosa* DC. are very similar to plants of *C. douglassii* Britt. with respect to size, tuberous base, basal leaves, pedicel position, and flower morphology. However, the cauline leaves are trifoliate in the former and simple in the latter. Schulz (1903) separated *C. douglassii* Britt. *(C. rhomboidea* (Pers.) DC.) from *C. tuberosa* DC. primarily on the basis of the difference in morphology of the cauline leaves. In addition, Schulz pointed out that the petals of *C. tuberosa* DC. are white. I conclude that *C. tuberosa* DC. and *C. douglassii* Britt. are indeed two different species based on different types, and therefore *T. tuberosum* Nutt. is properly placed in synonymy under *C. douglassii* Britt.

My thanks are extended to Dr. Alfred E. Schuyler (The Academy of Natural Sciences) who searched for Nuttall's specimen of *T. tuberosum* at the British Museum, to Dr. Edward G. Voss (The University of Michigan) who has read the manuscript, and to Sir George Taylor (Royal Botanical Gardens, Kew) and Dr. E. F. Greenwood (City of Liverpool Museums) who have answered my letters of inquiry regarding the possibility of Nuttall's specimen of *T. tuberosum* being in their herbaria.

DEPARTMENT OF BOTANY
THE OHIO STATE UNIVERSITY,
COLUMBUS 43210

REFERENCES

BRITTON, NATHANIEL LORD, and ADDISON BROWN. 1897. An Illustrated Flora of the Northern United States, Canada, and the British Possessions. 1st. ed. Vol. II. Charles Scribner's Sons, New York. 643 pp.

————————. 1913. An Illustrated Flora of the Northern United States, Canada, and the British Possessions. 2nd. ed. Vol. II. Charles Scribner's Sons, New York. 735 pp.

EWAN, JOSEPH. 1952. Nuttall's diary of 1810 and some inquirendae. Rhodora 54: 234-236.

FERNALD, MERRITT LYNDON. 1950. Gray's Manual of Botany. 8th. ed. American Book Co., New York. lxiv + 1632 pp.

GLEASON, HENRY ALLAN. 1952. The New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada. Vol. II. [New York Bot. Gard., New York]. 655 pp.

————, and ARTHUR CRONQUIST. 1963. Manual of Vascular Plants of Northeastern United States and Adjacent Canada. D. Van Nostrand Co., Inc., Princeton. 810 pp.

GRAUSTEIN, JEANNETTE E. 1951. Nuttall's travels into the Old Northwest. An unpublished 1810 diary. Chron. Bot. 14: 1-88.

GRAY, ASA. 1848. A Manual of the Botany of the Northern United States, from New England to Wisconsin and South to Ohio and Pennsylvania Inclusive, . . . , arranged according to the Natural System. James Munroe and Co., Boston and Cambridge. lxxii + 710 pp.

GREENE, EDWARD L. 1896. Studies in the Cruciferae — I. 1. Cardamine and Dentaria. Pittonia 3: 117-124.

NUTTALL, THOMAS. 1818. The Genera of North American Plants, and a Catalogue of the Species, to the Year 1817. 2 Vols. Printed for the author by D. Heartt, Philadephia. 312 pp. and 254 pp. + index, eratum [*sic*], and additions.

PAYSON, EDWIN BLAKE. 1926. *Thlaspi, Oreocarya,* and *Erigeron.* 1. The genus Thlaspi in North America. Univ. Wyo. Publ. Bot. 1: 145-163.

SCHULZ, O. E. 1903. Monographie der Gattung *Cardamine.* Bot. Jahrb. 32: 280-623.

STUCKEY, RONALD L. 1962. Characteristics and distribution of the spring cresses, *Cardamine bulbosa* and *C. douglassii,* in Michigan. Mich. Bot. 1: 27-34.

————. 1967. The "lost" plants of Thomas Nuttall's 1810 expedition into the Old Northwest. Mich. Bot. 6: 81-94.

# A NEW TALINUM (PORTULACACEAE) FROM THE CEDAR GLADES OF MIDDLE TENNESSEE

STEWART WARE

**Talinum calcaricum** Ware, *sp. nov.* — *Herba* perennis, glabra, 7.0-20.0 cm. alta; *rhizoma* tuberosum. *Caulis* inferior succulentus, abrupte decrescens ad longum sine foliis stipitem filo metallico similem. *Folia* linearia, ad 4.5 cm. longa, teretia, aggregata. *Inflorescentia* vulgo systema tricotomum cymarum scorpioidearum, raro cyma singula terminalis scorpioidea. *Flores* ephemeri, post meridiem aperti; *sepala* 2, ovata, 3-4 mm. longa, 2-3 mm. lata, arescentia sed persistentia; *petala* 5, elliptica usque obovata, 8-10 mm. longa, 3-5 mm. lata, purpureo-rosea; *stamina* 25-45; *stylus* staminibus longior; *stigma* breviter trilobatum. *Capsula* pinguis, ovoidea usque obovoidea (raro ellipsoidalis), 4-6 mm. longa; *semina* matura 10-25 in capsula, 0.75 mm. lata, laevia, plumbea.

Glabrous herb perennating by a tuberous rhizome in soil surface; roots fibrous; stems one to several, lower succulent part to 8 cm. high, simple or branched, crowded with leaves, narrowing abruptly above to a leafless wiry stalk, to 15 cm. long. Leaves many, terete, fleshy, to 4.5 cm. long. Inflorescense a system of scorpioid cymes, usually with three primary branches, one or more of these sometimes secondarily branched, or occasionally a single terminal scorpioid cyme. Flowers regular, ephemeral, open from 1:00 p.m. to 6:00 p.m. CST (3:30 p.m. to 6:00 p.m. in Franklin Co., Alabama); sepals drying but persisting about fruit; petals 5, 8-10 mm. long; stamens 25-45; style longer than stamens; stigma with 3 short lobes, papillose; capsule ovoid to obovoid, 4-6 mm. long, unilocular, dehiscing by three valves; placentation free central: mature seeds 10-25, smooth, gray, dull, 0.75 mm. long. Shallow soil at the edges of rock exposures in calcareous cedar glades of middle Tennessee and northern Alabama. Flowers in May through September.

TYPE: TENNESSEE. DAVIDSON CO: southeast of Nashville on U.S. 70S, across road from Mt. View School; cedar glade; in shallow soil on limestone outcrop. Aug. 21, 1966. *Ware 215* (US). Isotypes at SMS, UT, VDB.

OTHER SPECIMENS EXAMINED:

TENNESSEE. DAVIDSON CO: 8 mi. SE of Una, at jct. of Old Hickory Blvd. and Charlton Lane, across from Burnette's Chapel, *Franklin, Freeman,* and *Sullivan 163* (VDB), *Quarterman 1653* (VDB), *Waits 059* (VDB), *Woodruff,* 16 July 1937 (UT); one mile N. of Burnette's Chapel on Laverge-Couchville Pike, *Franklin, Freeman,* and *Sullivan 229* (VDB); at type locality, *Ware 118* (VDB). Giles Co: S of Pulaski on limestone between Cedar Grove Church and quarry, *Ware 117* (UT, VDB). MARSHALL CO: one mi. E. of jct. of Tenn. 99 and U.S. 431 on Tenn. 99, along roadside and in bare places in cedar glade, *Franklin, Freeman,* and *Sullivan 147* (VDB). RUTHERFORD CO: N. of Murfreesboro, limestone barren opposite Stones River Mil. Park, *A. J.* and *Evelyn Sharp 25905* (UT); 5.3 mi. E of Murfreesboro, in rocky dry creekbed, *DeSelm 692* (UT); 1.9 m. NE of Rockvale on country road off Tenn. 99, occasional in openings, cedar glade near Snail Sheel Cave, *Franklin, Freeman,* and *Sullivan 316* (VDB); just N. of Murfreesboro, U.S. 70S, in roadside cedar glades, *Ware 119* (VDB). WILSON CO: S. of Gladesville, west end of Cedars of Lebanon State Park, glades along dirt road, *Ware 217* (VDB).

ALABAMA. FRANKLIN CO: E. of Russellville, cedar glade at jct. of Alabama 24 and Franklin Co. 79, *Ware 216* (UT, VDB).

Six terete-leaved species of *Talinum* have previously been reported in North America east of the Mississippi River. Two of these, *T. parviflorum* Nutt. and *T. calycinum* Engelm. are widespread west of the Mississippi but have been found east of the river only in southern Illinois (Jones, 1950; Mohlenbrock, 1955). A third species, *T. rugospermum* Holz., ranges from northwestern Indiana through Illinois, Wisconsin and northeastern Iowa to eastern Minnesota (Fernald, 1950; Gleason, 1952). The other three species are found only east of the Mississippi, and all occur in the southeastern United States. *Talinum appalachianum* Wolf is known only from two counties in central Alabama, growing on granite outcrops along either side of the Coosa River (David Cotter, 1966, personal communication). Wolf (1939) reported *T. mengesii* Wolf to be confined to Alabama, but McVaugh (1943) expanded its range to include the granite outcrops of Georgia, and specimens examined in this study confirm its presence in Tennessee. The most widespread and best known of the eastern species of *Talinum* is *T. teretifolium* Pursh, which ranges from Pennsylvania serpentine barrens to the Altamaha grit of Georgia, but is best known from the granite outcrops of the Piedmont of the Carolinas and Georgia (Harper, 1926; McVaugh, 1943).

In the early stages of an ecological study of *Talinum* in the cedar glades of middle Tennessee, the question arose of the proper identity of these cedar glade plants. All floristic and ecological workers in the cedar glades, from Gattinger (1901) through Weiss (1959), identified the *Talinum* there as *T. teretifolium,* except Svenson (1941), who reported it to be *T. mengesii* on the basis of a specimen identified by Wolf. While the cedar glade plants key out to *T. teretifolium* in *Gray's Manual* (Fernald, 1950), they key out to *T. calycinum* in Gleason's (1952) *New Britton and Brown,* but do not fit his description of that species. They do not fall safely within the description of either *T. teretifolium* or *T. mengesii in* Small's (1933) Manual, though they are more like the latter species. The cedar glade plants also key down to *Talinum calycinum* in Wilson (1932) and Von Poellnitz (1933), but they do not fit the description of that species given by either of these two authors.

After herbarium specimens of cedar glade *Talinum* were examined and compared with specimens of *T. teretifolium, T. mengesii, T. rugospermum,* and *T. calycinum* from outside the Central Basin, it became apparent that the delicate flowers and fruits of this genus are so damaged by pressing and drying that critical specific characteristics may be lost, especially those relating to flower color and size, fruit shape and size, sepal persistence, and anther and style characteristics. Therefore, any meaningful study of the group would have to be based on living materials grown in the greenhouse, a situation first noted by Holzinger (1900).

Using the taxonomic works cited above, comparisons were made between the cedar glade *Talinum* and the characteristics of the six species of terete-leaved *Talinum* known to grow east of the Mississippi. A dichotomous key was prepared for the seven entities involved, and this key was used to identify living material from various locations. From greenhouse and field observations, a table was prepared comparing the cedar glade plants with the two common southeastern species, *T. teretifolium* and *T. mengesii*

*Talinum parviflorum* and *T. appalachianum* have only 5 stamens, and can be eliminated from further consideration, for the cedar glade plants have many stamens per flower. Living material of five entities was studied: *T. teretifolium* (DeKalb Co., Georgia); *T. mengesii* (Marion and DeKalb Cos., Alabama); *T. rugospermum* (Tazewell Co., Illinois); *T. calycinum* (Saline Co., Arkansas); and cedar glade populations (Davidson, Rutherford, Marshall, and Giles Cos., Tennessee, and Franklin Co., Alabama). These population samples were grown in the greenhouse during the summers of 1965 and 1966, and compared with the sets of characters listed in the literature for each species, as well as with each other. Comparisons were also made with herbarium specimens from Vanderbilt University (VDB), the University of Tennessee (UT), and Southwest Missouri State College (SMS).

On the basis of living material and herbarium specimens, the cedar glade plants appeared to be more like *T. mengesii* than any other species, so careful comparisons were made of qualitative and quantitative characteristics which differed in the two groups of populations. These studies revealed that the cedar glade populations constituted a new species, *Talinum calcaricum*, named and described above.

Most of the differences between *T. calcaricum* and *T. mengesii* are quantitative, and many of them overlap in field populations, but the general aspect differences hold up in greenhouse plants grown from seed. The qualitative differences are remarkably constant, and these plus the non-overlapping quantitative ones make separation of individuals of the two species easy. A key to these and the other two southeastern terete-leaved species of *Talinum* is provided below.

*Talinum calcaricum* has fewer stamens, fewer seeds per capsule, darker colored petals, and is smaller throughout, except that it has considerably larger seeds than does *T. mengesii*. *Talinum calcaricum* has persistent sepals, a three-lobed stigma, an obovoid to ovoid capsule, and gray seeds, as compared with deciduous sepals, a subcapitate stigma, a subglobose capsule, and shiny black seeds in *T. mengesii*

TABLE I. A comparison of *T. calcaricum* with the two common southeastern Talinums.

| | *T. teretifolium* | *T. calcaricum* | *T. mengesii* |
|---|---|---|---|
| Petal length | 5-8 mm. | 8-10 mm. | 9-12 mm. |
| Petal color | pink | purplish-pink | pink |
| Style length | equal to stamens | longer than stamens | longer than stamens |
| Stigma type | three short lobes | three short lobes | sub-capitate |
| Stamen number | 15-20 | 25-45 | 50-90 |
| Sepals | deciduous | persistent | deciduous |
| Seed size (see text) | small | large | small |
| Seed color | shiny black | dull gray | shiny black |
| Substrate | Granite, serpentine, etc. | limestone | sandstone, granite |

Quantitative data were gathered from three areas: a cedar glade just north of Murfreesboro, Rutherford Co., Tennessee, on U.S. 70S *(Ware 119)*; another cedar glade in

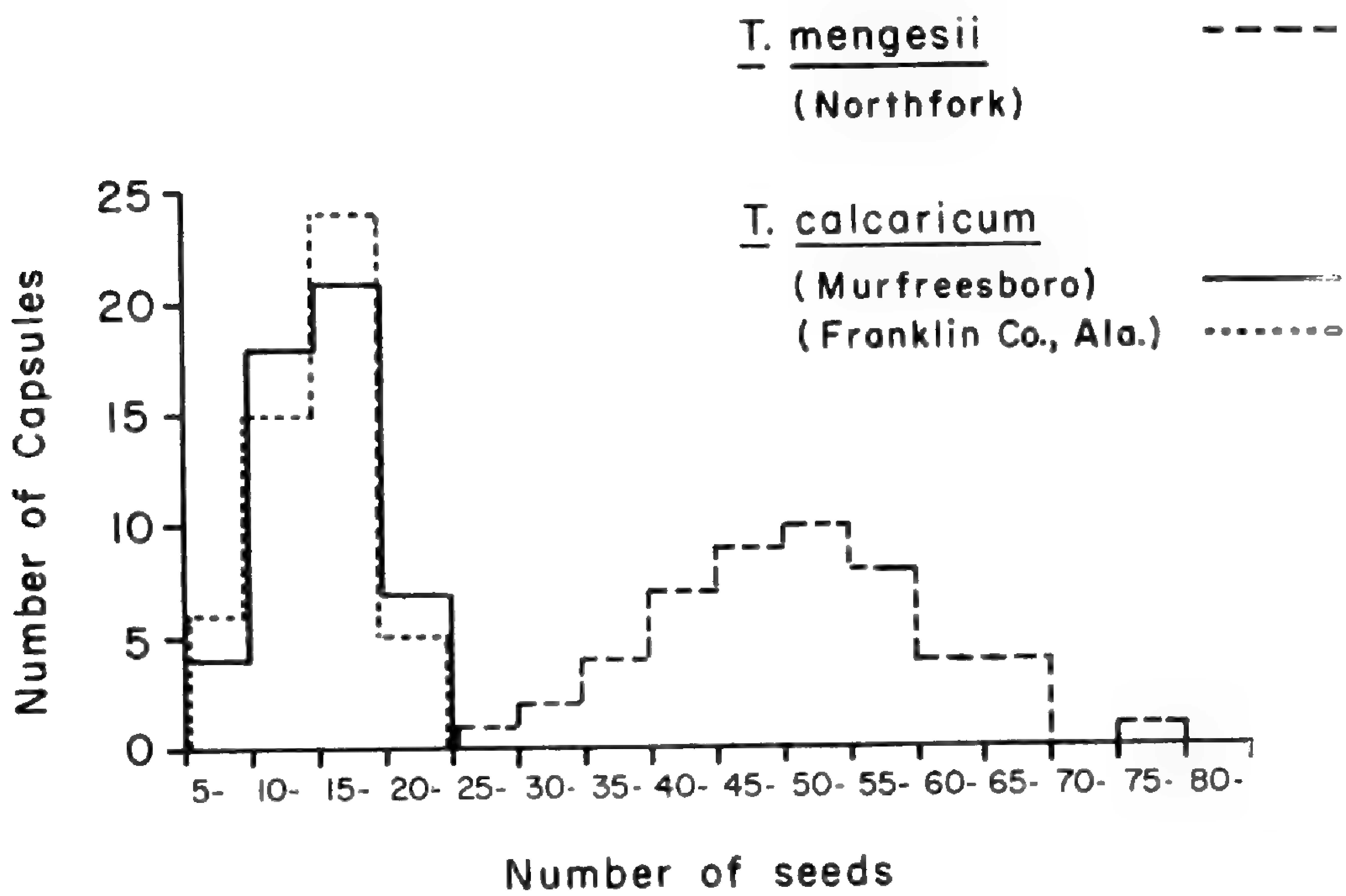



Fig. I. Comparison of two populations of *T. calcaricum* and a population of *T. mengesii* with respect to number of mature seeds per capsule.

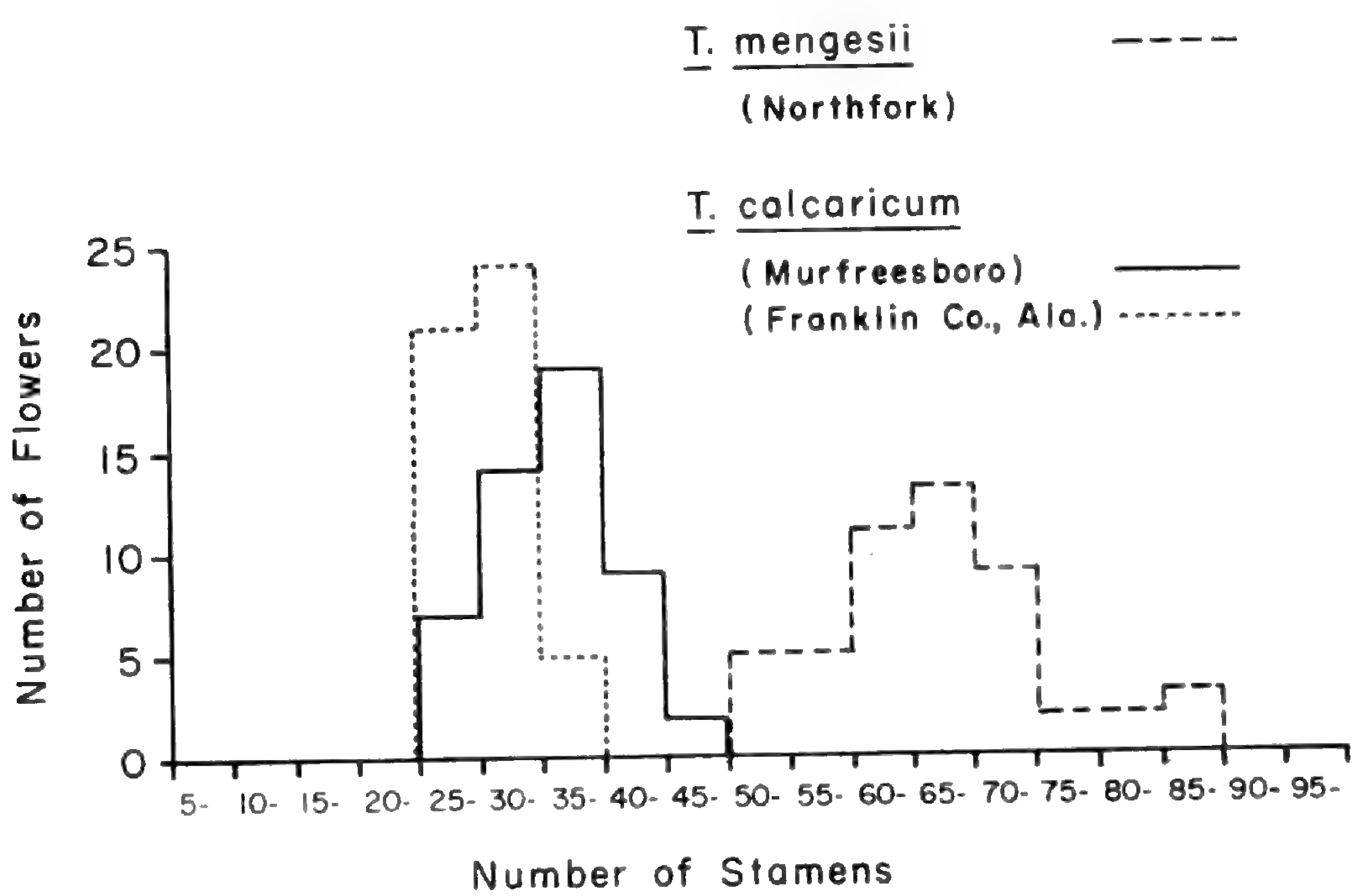



Fig. II. Comparison of two populations of *T. calcaricum* and a population of *T. mengesii* with respect to number of stamens per flower.

Franklin Co., Alabama, at the junction of Alabama 24 and Franklin Co. 79 *(Ware 216)*; and a population of *T. mengesii* from Marion Co., Alabama, on sandstone bluffs along Northfork Creek on U.S. 43 *(Ware 123)*. Fifty flowers and fifty capsules were collected from each population at one pace intervals along line transects across the population. At Northfork Creek and in Franklin Co., Alabama, flowers and capsules were preserved in 3:1 acetic alcohol and stamens and seeds were counted later; at Murfreesboro, counts were made in the field from fresh flowers and capsules. *Talinum calcaricum* consistently had fewer stamens and seeds per capsule than *T. mengesii* (Figs. 1 & 2), and there was no overlap in stamen or seed numbers between the two species.

To show a noticeable difference in size of seeds between *T. mengesii* and *T. calcaricum*, three replicates of 1500 seeds each were taken from the Northfork Creek *(T. mengesii)* and Murfreesboro *(T. calcaricum)* populations. The average weights per 1500 seeds were 264 mg. for *T. mengesii* and 628 mg. for *T. calcaricum*. Thus, the seeds of the cedar glade species are on the average more than twice as heavy as those of *T. mengesii*. This visible size difference and the gray *vs.* black color of the seeds are perhaps the best distinguishing characteristics on herbarium specimens.

## CROSSING RELATIONSHIPS

Because the pistil is considerably longer than the stamens in both *T. mengesii* and *T. calcaricum*, capsules are not formed in the greenhouse unless pollination is manually effected; thus, emasculation of the flowers was unnecessary in crossing experiments. Reciprocal crosses between the five populations of *T. calcaricum* gave 95% to 100% of the seed yield considered to be "normal" on the basis of field sampling. Crosses between the two populations of *T. mengesii* likewise produced yields comparable to those noted in the field.

Crosses between *T. calcaricum* and *T. mengesii* gave quite different results. When Murfreesboro plants were pollinated with *T. mengesii* pollen, not one of 18 pollinations yielded mature seed. When Franklin Co., Alabama *T. calcaricum* plants were pollinated with *T. mengesii* pollen, 4 of 9 pollinations yielded mature seed, but no capsule produced as many as the minimum of 9 seeds/capsule found in field studies of that population (Table II). In reciprocal crosses, with pollen from Murfreesboro *T. calcaricum* plants placed on *T. mengesii* styles, 17 of 20 pollinations yielded mature seed, but only one produced the minimum number of 25 seeds/capsule found in field studies of *T. mengesii,* and only three capsules produced more than ten seeds.

TABLE II. Results of crosses between *T. calcaricum* and two related species.

| Pistillate parent | Staminate parent | Number of polli-nations | Number setting seed | Number with normal yield |
|---|---|---|---|---|
| *T. calcaricum* × (Murfreesboro) | *T. mengesii* (Northfork) | 18 | 0 | 0 |
| *T. calcaricum* × (Franklin Co.) | *T. mengesii* (Northfork) | 8 | 4 | 0 |
| *T. mengesii* × (Northfork) | *T. calcaricum* (Murfreesboro) | 20 | 17 | 1 |
| *T. calcaricum* × (Murfreesboro) | *T. calycinum* (Arkansas) | 9 | 4 | 0 |

After *T. mengesii, T. calycinum* is the species most like *T. calcaricum.* When Murfreesboro *T. calcaricum* plants were pollinated with pollen from Saline Co., Arkansas plants *(Demaree 53659)* which keyed out to *T. calycinum,* 5 of 8 pollinations produced mature seed, but no capsule produced the minimum number of 9 seeds/capsule expected for the Murfreesboro population.

This demonstration of barriers to genetic exchange (one of 55 crosses produced normal seed yield) between the cedar glade *Talinum* and the two species most like it, *T. mengesii* and *T. calycinum,* strengthens the idea that *T.*

*calcaricum*, recognized as a new species on morphological grounds, is a valid biological species.

FIELD KEY TO THE SOUTHEASTERN TERETE-LEAVED TALINUMS

A. Stamens 5 .......... *T. appalachianum.*
A. Stamens 15-many.
  B. Style not longer than the 15-20 stamens .......... *T. teretifolium.*
  B. Style noticeably longer than the 25-many stamens.
    C. Mature seeds black, shiny, more than 25 per capsule; stigma subcapitate; sepals deciduous; capsule subglobose; stamens 45-90 .......... *T. mengesii.*
    C. Mature seeds gray, dull, 10-25 per capsule; stigma with three short lobes; sepals persistent; capsule ovoid to obovoid; stamens 25-45 .......... *T. calcaricum.*

## ACKNOWLEDGMENTS

Gratitude is expressed to fellow students at Vanderbilt University who aided in securing living materials for use in this study; to Miss Donna Marie Eggers, who aided in gathering of data; and to Professor Elsie Quarterman and other faculty members for help in preparing the manuscript.

VANDERBILT UNIVERSITY
NASHVILLE, TENNESSEE

PRESENT ADDRESS
COLLEGE OF WILLIAM AND MARY
WILLIAMSBURG, VIRGINIA

### LITERATURE CITED

FERNALD, M. L. 1950. Gray's Manual of Botany. 8th ed. American Book Co., New York. 1632 p.

GATTINGER, A. 1901. Flora of Tennessee and Philosophy of Botany. Gospel Advocate Press, Nashville, Tenn. 269 p.

GLEASON, H. A. 1952. Illustrated Flora of the Northeastern U. S. and Adjacent Canada, Vol. II. New York Bot. Gard. 3 v.

HARPER, R. M. 1926. The cedar glades of middle Tennessee. Ecol. 7: 48-54

HOLZINGER, J. M. 1900. The geographical distribution of the *Teretifolium* group of *Talinum*. Asa Gray Bull. 8: 36-39.

JONES, G. N. 1950. Flora of Illinois. 2nd ed. U. of Notre Dame Press, Notre Dame, Indiana. 368 p.

McVaugh, Rogers. 1943. The vegetation of the granitic flatrocks of the southeastern U. S. Ecol. Monog. **13:** 119-166.

Mohlenbrock, R. H. 1955. Contributions to the flora of southern Illinois. Rhodora **57:** 319-322.

Small, J. K. 1933. Manual of the Southeastern Flora. The author, New York. 1554 p.

Svenson, H. K. 1941. Notes on the Tennessee flora. Jour. Tenn. Acad. Sci. **16:** 1: 111-160.

Von Poellnitz, Karl. 1933. Zur Kenntnis der Gattung *Talinum* Adans. (Portulacaceae). Ber. Deut. Bot. Ges. **51:** 112-127.

Weiss, N. J. 1959. An Autecological Study of Three Mosses Important in Xerarch Succession in the Cedar Glades of Middle Tennessee. M. A. thesis, Vanderbilt Univ. 63 p.

Wilson, Percy. 1932. *Talinum,* in Portulacaceae, N. Amer. Flora **21:** 280-289.

Wolf, W. 1939. The status of *Talinum* in Alabama. Amer. Midl. Nat. **22:** 315-332.

# A NEW SPECIES OF MACHAERANTHERA SECTION PSILACTIS

R. C. JACKSON AND R. R. JOHNSON[1]

**Machaeranthera arizonica** Jackson & Johnson, sp. nov.

Herba perennis 15-30 dm alta, glandularo-puberulentis (pilis glandularibus saepe trichomatibus longioribus eglandularibus intermixtis); foliis sessilibus, laminis lanceolatis, inaequaliter incise dentatis crispatisque; involucris 4-9-7.1 mm altis; phyllariis 35-62, lanceolatis, 4.2-4.7 mm longis; radiis 19-34, 6.8-10.8 mm longis, 1.7-2.2 mm latis; disci corollis 41-111, 3.4-5.2 mm longis; pappis florium discorum 33-51, 2.8-3.3 mm longis; pappus eorum radiorum nullis.

Perennial herb from a strongly developed taproot, 15-30 dm tall, glandular-puberulent throughout with occasional intermixed non-glandular hairs; many branches from the somewhat woody base; leaves sessile, sometimes clasping at the base, alternate, crisped, irregularly incisely dentate, the lower ones more deeply so; heads on short peduncles with slightly reduced leaves; involucres 4.9-7.1 mm high; phyllaries in 4-5 series, lanceolate with green tips, the scarious margins of the outer series white, the inner ones purple; rays 19-34, 6.8-10.9 mm long, 1.7-2.2 mm wide; disc corollas 47-111, 3.4-5.2 mm long; pappus one series of 33-51 bristles, 2.8-3.3 mm long; achenes ca. 2 mm long. Chromosome number n=5.

TYPE. ARIZONA: PIMA COUNTY; Organ Pipe Cactus National Monument, low, rocky hillsides and sandy soil around Quitobaquito Springs, 31 March 1962, *R. C. Jackson* & *R. R. Johnson 3043-1*, KANU (Fig. 1); Isotype at ARIZ.

Additional specimens in the University of Arizona Herbarium from the type locality: 5 March 1940, *Benson 9934;* 5 March 1940, *Peebles 14560;* 17 April 1952, *Parker 7994;* 28 April 1939, *Nichols s.n.;* 27 November 1939, *Harbison 26176.*

The closest relatives of *M. arizonica* appear to be *M. crispa* (Brandegee) Turner & Horne and *M. arida* Turner & Horne.

---

[1]This study was supported in part by NSF Grant GB-3071

The second species is known from two localities in Baja California del Sur and the third occurs in the northwestern part of Sonora and the southern parts of California, Arizona, and Nevada.

The springs at Quitobaquito, the type locality of *M. arizonica,* are fed from water forced through rock fissures to

Plate 1370

Figure 1. Photograph of the holotype of *Machaeranthera (Psilactis) arizonica* Jackson & Johnson.

the surface. The desert pupfish lives in these waters and is found also in the Sonoyta River, about one mile south, and in the Lower Colorado River, an indication that at sometime in the past the springs flowed to the river and the river to the Gulf of California.[2] This could have provided a migration route from the general locality of *M. crispa,* perhaps the ancestral or a closely related stock of *M. arizonica,* to Quitobaquito along more a mesic habitat. *M. crispa* and *M. arida,* however, appear to occupy drier habitats than *M. arizonica* at the present time.

*Machaeranthera arizonica* is somewhat intermediate morphologically for characters of *M. crispa* and *M. arida* (Table 1) and may occupy the same position phylogenetically since it is still biennial or perennial and occupies a somewhat more mesic habitat than the annual *M. arida.* Artificial crosses between *arida* and *arizonica* yielded seed, but the $F_1$ hybrids have not been grown yet. Both species are self-sterile.

Turner and Horne (1964) combined *Psilactis* with *Machaeranthera,* proposing *Psilactis* as a series of the latter genus. This proposal was based on the break down of the diagnostic character of *Psilactis,* namely, the absence of pappus bristles on the ray achenes. One and possibly two species show variation for this character. In addition, a preliminary report on hybridization between *Psilactis* and *Machaeranthera* (Jackson, 1962) added weight to the proposed change. The presence or absence of a ray pappus as a diagnostic generic character does, indeed, seem a poor one for separating the two genera. The two taxa are genetically related as shown by the production of a hybrid which was, nonetheless, rather highly sterile. The degree of relationship and how this should weigh on the question of merging the taxa might be answered better when a detailed cytogenetic analysis of inter- and intrataxon hybrids has been completed. There are nevertheless some floral and leaf char-

[2]Information supplied in "A Guide to the 40-Mile Scenic Loop Drive [of] Organ Pipe Cactus National Monument" by U.S. National Park Service.

Table 1. Morphological comparisons of some floral characters of *Machaeranthera arida*, *M. arizonica*, and *M. crispa* *

| | *M. arida* | | *M. arizonica* | | *M. crispa* | |
|---|---|---|---|---|---|---|
| Characters | $\overline{X}$ | range | $\overline{X}$ | range | $\overline{X}$ | range |
| Disc Flower | | | | | | |
| a) no. per head | 52.3 | (41-62) | 80.4 | (41-111) | — | (75-100) |
| b) corolla length (mm) | 3.5 | (2.8-4.4) | 4.1 | (3.4-5.2) | — | (4-6) |
| c) no. pappus bristles | 28.6 | (21-34) | 41 | (33-51) | — | (c. 30) |
| d) pappus length (mm) | 2.6 | (2.2-3.3) | 3.0 | (2.8-3.3) | — | (2.8-3.4) |
| Ray Flower | | | | | | |
| a) no. per head | 23 | (18-29) | 29.4 | (19-34) | — | (30-40) |
| b) length (mm) | 7.9 | (6.6-9.2) | 9.0 | (6.8-10.8) | — | (6-8) |
| c) width (mm) | 1.6 | (1.3-1.9) | 2.0 | (1.7-2.2) | — | (0.8-1.0) |

* Data for ranges in *M. crispa* are from Turner & Horne (1964). Data for the other taxa were from plants grown in the greenhouse at the same time. Source of *M. arida* was seed collected at Aqua Caliente, Maricopa County, Arizona. Seed of *M. arizonica* was obtained from the type locality. Fourteen to 18 plants were used for the average and range data for *M. arida* and *M. arizonica*.

acters that effectively set off *Psilactis* from *Machaeranthera*, either as a distinct genus or as a subgeneric taxon.

On morphological grounds, *Machaeranthera parviflora* should be placed in series *Psilactis* also; it has the same chromosome number (n=5; *Jackson 5241*, KANU) as its other close relatives, *M. arida*, *M. coulteri*, *M. crispa*, and *M. arizonica*.

UNIVERSITY OF KANSAS, LAWRENCE
AND TEXAS WESTERN UNIVERSITY, EL PASO

LITERATURE CITED

TURNER, B. L. and D. HORNE. 1964. Taxonomy of *Machaeranthera* sect. *Psilactis* (Compositae-Astereae). Brittonia **16**:316-331.

JACKSON, R. C. 1962. Intergeneric hybridization between *Psilactis* and *Machaeranthera*. Amer. Jour. Bot. **49**:676. (Abstract).

## ADDITIONS TO THE VASCULAR FLORA OF OKLAHOMA — II

It is a tendency for some botanists to think of the vascular flora of our area as rather thoroughly collected until for some reason they attempt to delineate the distribution of some species. Often when the specimens housed in our herbaria are examined, two conditions are encountered. (1) Although the species is often a rather common one, only a few specimens are available. (2) Again, sometimes there may be several folders of specimens, but all from a few locations. The interest of more and more of our botanists today does not take them to the field, yet much general collecting is still to be done. I feel that the species discussed in this brief paper offer some support to these contentions. Although they are thought not to have been previously reported for the state, they occur in rather common habitats (old fields, rocky roadsides, sand dunes, etc.) and probably have been members of our flora for a long time. We wish to express our thanks to Betty Weisenhunt, who helped with the species of *Schrankia*. All specimens cited were collected by John and Constance Taylor unless otherwise indicated, and are presently located at the Bebb Herbarium, Norman.

*Ophioglossum crotalophoroides* Walt. The genus *Ophioglossum* has been known in our flora by the one species *O. engelmannii* Prantl for over 30 years. Now we have *O. cro-*

*talophoroides* as No. *3322*, collected March 15, 1966 from a sandy old field just west of Durant city limits. This species differs in that it fruits about two to three weeks earlier in this area, is much smaller, is found mainly in sandy soils, the rhizome is almost spherical or bulb shaped, and in the older specimens, the old leaf bases remain to form a cylindrical black collar on their top. It has been reported from a number of counties in Texas: Newton (Reverchon, 1903); Bastrop, Hardin, and Harris (Correll, 1956); and from Llano in the Edwards Plateau (Ridgway and Walne, 1965). One specimen of this species was located in the Bebb Herbarium from Faulkner Co., Arkansas by C. M. Moore, No. *5417*.

*Schrankia roemeriana* (Scheele) Blankenship. In Texas this species of sensitive briar is known from the Red River south through the south central part of the state. Turner (1959) listed it as occurring in Fannin, Grayson, and Clay counties just south of the Red River, thus its presence in Oklahoma might have been expected. This species may be differentiated from *S. uncinata* by the lack of raised veins on the lower surface of the leaflets and the flattened seed pod. It usually occurs on soils derived from limestone or clay, while *S. uncinata* is usually found growing in sandy soil. Our specimen, No. *3355*, is from along a county road from a limestone outcrop, collected 4 miles NE of Bennington in Bryan Co. on June 5, 1966. This species may occur over much of the southern half of the state where clay and limey soil are found and should be looked for in the Arbuckle Mountains.

*Zanthoxylum hirsutum* Buckley. This name is taken from Shinners (1958) who gives the following synonymy. *Z. carolinianum* var. *fruticosum* (Gray) S. Watson, *Fagara fruticosa* (Gray) Small, *F. clava-herculis* var. *fruticosa* (Gray) Sargent. The Texas distribution of *Z. hirsutum* is given as from the northcentral part of Texas south and westward to the Transpecos. We have this species from Oklahoma as No. *2095*, rocky limestone hill, 11 miles W of Marietta, Love County; No. *3427*, limestone bluff above the Red

River floodplain, 8 miles W of Waurika, Jefferson County; No. *3427B*, sand dune area 17 miles SE of Randlett, Cotton County; and No. *3442*, 1 mile S of Davidson, on sand dunes, Tillman County, which is our westernmost location. In our area it takes a low growth form with fruiting specimens 4-5 feet tall being common. Occasionally a height of 10 to 15 feet is attained, but these are usually branched at or near the ground. *Zanthoxylum hirsutum* differs from *Z. clava-herculis* (under which it is sometimes placed as a variety) by smaller general growth form, leaves, and leaflets, and a smaller axillary inflorescence. Texas authors seem to disagree as to the exact status of this species. Vines (1960) lists *Z. clava-herculis* L. var. *fruticosum* Gray and gives essentially the same range as that listed by Shinners (1958) for *Z. hirsutum*. Gould (1962) lists *Z. clava-herculis* var. *fruticosum* (Gray) Wats. based on *Fagara fruticosa* (Gray) Small and gives a distribution including most of Texas except the high plains portion of the panhandle. He also lists a *Z. hirsutum* Buckl. from the coastal prairie and south Texas plains.

*Epilobium glandulosum* Lehm. var. *adenocaulon* (Haussk) Fern. To the best of our knowledge, the genus *Epilobium* has been known in the Oklahoma flora by one species *(E. coloratum)* and one collection (E. L. Little, No. *3996*) for almost 30 years (Hopkins, 1938). We now have *E. glandulosum* var. *adenocaulon* as No. *2520* from a small spring in a branch of Tessequite Canyon, 6 miles S of Kenton, Cimarron Co., Oklahoma. This is a wide ranging species in North America, occurring from Alaska east to Newfoundland, south to West Virginia and westward to California. It was a mild surprise to find that similar material I had collected in the interior of Alaska in the summer of 1965 was considered to belong to the same species. Rogers (1953) lists this species (as *E. adenocaulon* Haussk.) as common in the Colorado portion of the Black Mesa, which suggested the possibility of its occurring in Oklahoma.

R. John Taylor and Constance Taylor
SOUTHEASTERN STATE COLLEGE
DURANT, OKLAHOMA

LITERATURE CITED

CORRELL, D. S. 1956. Ferns and Fern Allies of Texas. Renner, Texas: Texas Research Foundation.

GOULD, F. W. 1962. Texas Plants — A checklist and ecological summary. Texas Agr. Exp. Sta. MP-585.

HOPKINS, M. 1938. Notes from the Herbarium of the University of Oklahoma. Rhodora **40**:433.

REVERCHON, J. 1903. The Fern Flora of Texas. Fern Bull. **11**:33-38.

RIDGWAY, J. and P. WALNE. 1965. *Ophioglossum Crotalophoroides* Walt. on Enchanted Rock, Llano County, Texas. Southwestern Naturalist **10**(2):143.

ROGERS, C. M. 1953. The vegetation of the Mesa de Maya Region of Colorado, New Mexico, and Oklahoma. Lloydia **16**(4):257-290.

SHINNERS, L. H. 1958. Spring flora of the Dallas-Ft. Worth area, Texas. Publ. by Lloyd H. Shinners, Dallas.

TURNER, B. L. 1959. The Legumes of Texas. Austin: Univ. Texas Press.

VINES, R. A. 1960. Trees, Shrubs, and Woody Vines of the Southwest. Austin: Univ. Tex. Press.

## SAXIFRAGA AIZOÖN IN NEW HAMPSHIRE*

*Saxifraga Aizoön* Jacq. is an arctic-montane, amphi-Atlantic rock plant of Europe, Iceland, Greenland and North America[1]. In eastern North America the species, represented by var. *neogaea* Butters, ranges southward into cold localities of Nova Scotia, New Brunswick, Maine (Mt. Katahdin), Vermont, and northern New York[2]. The plant has not been reported previously from New Hampshire[3].

On 20 July 1939 I found a colony of *Saxifraga Aizoön*, numbering about 80 flowering plants, in a deep chasm cut by glacial action into the flank of Mt. Washington, Coös County, New Hampshire. Most of the plants grew in a nearly horizontal fissure in a vertical rock wall of impres-

---

[1]HULTEN, E. 1958. The amphi-Atlantic plants and their phytogeographic connections. Kungl. Svensk. Vetensk. Handl. IV. 7: 1-340.

[2]FERNALD, M. L. 1950. Gray's Manual of Botany, Ed. 8. American Book Co., New York. 1632 p.

[3]PEASE, A. S. 1964. A Flora of Northern New Hampshire. New England Botanical Club, Inc. v + 278 p.

*The author appreciated the help of John Beaman, Ph.D., Associate Professor and Curator of the Beal-Darlington Herbarium in the preparation of this article.

sive height. The precipice faced northward, and thus was shaded most of the day. The fissure collected moisture from films of water seeping down the rock from above. The locality, at an altitude of about 3,500 ft, is often shrouded in cloud.

*Saxifraga Aizoön* is generally a calciphile. Hence it is surprising that it should grow anywhere on the Presidential Range in New Hampshire where limestone is unknown[4]. In an area as well botanized as Mt. Washington it is remarkable that the species could have remained this long undiscovered.

I obtained five plants from crowded colonies, taking great care to prevent uprooting adjacent rosettes. The collection was donated recently to the Beal-Darlington Herbarium of Michigan State University, and one plant has been shared with the New England Botanical Club Herbarium.

[4]BILLINGS, M. P. et al. 1946. Geology of the Mt. Washington Quadrangle, New Hampshire. Bull. Geol. Soc. Amer. 57: 261-274, 1 pl.

JOHN A. CHURCHILL
LAFAYETTE CLINIC
DETROIT, MICHIGAN

## THE SAXIFRAGA AIZOÖN STATION REVISITED

The report by Dr. Churchill of *Saxifraga Aizoön* on Mt. Washington was so surprising that three of us decided to make an investigation. On July 29, 1967; A. R. Hodgdon, James Teeri, a graduate student at the University of New Hampshire, and I made a trip into Huntington Ravine. We were equipped with a good pair of field glasses but no rock-climbing gear. After some careful but fruitless searching we eventually located the *Saxifraga* well up on a cliff by means of field glasses. The plants were in full bloom and the colony appeared to be in the same condition as described by Churchill. After careful checking with a topographic map it appeared to us the elevation was close to 4500 ft.

Naturally we were eager to examine the colony at close range and with some effort were able to reach a point about

20 ft. below it. Even though two of us had some experience in rock-climbing, the last pitch was too much for us. It was steep and a rushing brook covered all the promising handholds. In a dry season, the ascent might have been easier, but it appeared to us that a rope would have been most desirable. We all felt considerable respect for Dr. Churchill's mountaineering ability.

From a vantage point across from a narrow shelf covered with vegetation, it was possible to study the surrounding area with care through the glasses and we felt that it was possible that there were other interesting plants in extremely hazardous or inaccessible sites in the gully. In any case we feel that Dr. Churchill's discovery was the most outstanding bit of botanizing on Mt. Washington in the past 50 years.

FREDERIC L. STEELE
ST. MARY'S-IN-THE-MOUNTAINS
LITTLETON, NEW HAMPSHIRE

## SAXIFRAGA CERNUA IN NEW ENGLAND*

In the United States east of the Rocky Mountains, *Saxifraga cernua* L. has been found only in northern Minnesota.[1] Although it grows in the Gaspé Peninsula of Quebec, this chiefly northwestern and Eurasian arctic plant was hitherto unexpected in the well explored mountains of New England. The unusual circumstance attending the discovery of *Saxifraga cernua* on Mount Washington in Cöos County, New Hampshire, is the subject of this report.

On July 20, 1939, one of the authors (Churchill) explored a deep ravine cut into the flank of Mount Washington and, while exploring a cliff face there, found *Saxifraga Aizoön*.[2] Near the *Saxifraga Aizoön* colony, Churchill also

[1]FERNALD, M. L. 1950. Gray's Manual of Botany, Ed. 8. American Book Co., New York. 1632 P.

[2]CHURCHILL, J. A. 1967. Saxifraga Aizoön in New Hampshire, Rhodora 69: 483-484.

*The authors appreciated the help of John Beaman, Ph.D., Associate Professor and Curator of the Beal-Darlington Herbarium in the preparation of this article.

explored a shelf situated high in a vertical rock trough down which a cataract poured. The shelf was covered with greenery, which was wet with spray. On the shelf grew plants, which the writer assumed were *Saxifraga rivularis*, a plant known from the Presidential Range. The story might easily have ended at this point, for the descent from the wet trough proved to be extremely treacherous.

The other author (Hodgdon) wanting to verify the *Saxifraga Aizoön* record, sought the plant on July 29, 1967 in company with F. L. Steele and James Teeri following directions that Churchill had forwarded to Richard Eaton.[3] They decided they could not reach the shelf without excessive risk. However, they did scale a buttress at one edge of the trough reaching the level of the shelf. With glasses, Hodgdon could see Saxifrage plants on the shelf, and much to his surprise made out the features of *Saxifraga cernua*.

When this news was related to Churchill at a meeting with Hodgdon at the Gray Herbarium, he had to admit that he had remembered seeing what he had thought was *Saxifragia rivularis* on the shelf, but that he feared he had made no collection of it. Fortunately, this fear proved to be unfounded and, when informed, Dr. John Beaman examined the collection, which he found was indeed *Saxifraga cernua*.

The collection is deposited in the Beal-Darlington Herbarium of Michigan State University.

JOHN A. CHURCHILL
NATIONAL INSTITUTE OF NEUROLOGICAL DISEASES
AND BLINDNESS
BETHESDA, MARYLAND

A. R. HODGDON
UNIVERSITY OF NEW HAMPSHIRE DURHAM

[3]STEELE, F. L. 1967. The Saxifraga Aizoön Station Revisited, Rhodora 69: 484-485.

## STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION

Date of Filing: October 1, 1967

Title of Publication: RHODORA

Frequency of Issue: Quarterly

Location of Known Office of Publication:
Botanical Museum, Oxford Street, Cambridge, Massachusetts 02138

Location of the Headquarters of the Publishers:
Botanical Museum, Oxford Street, Cambridge, Massachusetts 02138

Names and Addresses of Publisher, Editor and Business Manager:

Publisher:

New England Botanical Club, Inc., Botanical Museum, Oxford Street, Cambridge, Mass. 02138

Editor:

Albion R. Hodgdon, Dept. of Botany, Univ. of New Hampshire, Durham, N. H. 03824

Business Manager:

Herman R. Sweet, Botanical Museum, Oxford Street, Cambridge, Mass. 02138

Owner: New England Botanical Club, Inc., Botanical Museum, Oxford Street, Cambridge, Mass. 02138

No stockholders

Known Bondholders, Mortgagees and other Security Holders: None

| | Average No. Copies each issue during preceding 12 months | Single issue nearest to filing date |
|---|---|---|
| Total No. copies printed | 775 | 775 |
| Paid circulation | | |
| Sales through dealers, etc. | none | none |
| Mail subscriptions | 719 | 750 |
| Total paid circulation | 719 | 750 |
| Free distribution | 10 | 10 |
| Total distribution | 729 | 760 |
| Office use, left-over, etc. | 46 | 15 |
| Total | 775 | 775 |

I certify that the statements made by me above are correct and complete. Herman R. Sweet, Business Manager

# INDEX TO VOLUME 69

**New scientific names and combinations are printed in bold face type**