Rhodora

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The New England Botanical Club, Inc.
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A NEW SPECIES OF SAMOLUS (PRIMULACEAE) FROM MEXICO

R. B. CHANNELL[1]

The last comprehensive treatment of the genus *Samolus* L. (anomalous among the *Primulaceae* by the half-inferior position of the ovary) appeared in the monograph of the *Primulaceae* by Pax and Knuth (1905). According to this work only two species are characterized by ebracteate pedicels and by the absence of staminodia: *S. ebracteatus* HBK. (1818) [including *S. alyssoides* Heller (1895) and *S. cuneatus* Small (1897)] and *S. cinerascens* (Robinson) Pax & R. Knuth (l. c.; cf. Robinson, 1892). The presence of a group of small glandular hairs at the base of each corolla-lobe, rendering the corolla-throat more or less pubescent, is another feature common to both and unknown elsewhere in the genus. No other species of the genus so characterized has subsequently been described. The species here proposed as new is evidently related to the two above, inasmuch as it shares with them the characters thus far enumerated. One of these characters has served as the primary basis for establishing a separate genus. Thus, while specific affinities are clear, the assignment of the new species to genus deserves further comment.

Publication of the segregate genus *Samodia*, originally proposed but not validly published by Baudo (1843), was validated by Small (1933), who accorded generic significance almost solely to the absence of staminodia. Typified by *Samolus ebracteatus* HBK. and to date nomenclaturally monotypic, this genus has never enjoyed general acceptance. This is partly due to the fact that elsewhere in the *Primulaceae* conservative taxonomists have

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[1] Gray Herbarium and Arnold Arboretum. Present address: Department of Biology, Vanderbilt University.

not attributed generic importance to the presence of staminodia in an otherwise non-staminodial group (cf. *Lysimachia* [Tourn.] L. subgenus *Selencia* Bigelow; *Steironema* Raf.). As a character, moreover, the presence or absence of staminodia in *Samolus* cuts across a long-established line, perhaps demarcating groups equally as natural, between those species of herbaceous habit with smooth herbage, as exemplified by *Samolus ebracteatus,* and those of suffruticose habit with glandular-porous herbage, as exemplified by *Samolus cinerascens.* Generic segregation on the basis of differences in habit or general appearance alone, however, seems wholly unjustified. The other characters distinguishing *Samodia,* relative length of tube to lobes of the corolla and level of adnation of the stamens, are generally disregarded as representing merely matters of degree. Under the circumstances the single Linnaean genus *Samolus* is here recognized.

The new species is based upon two unicate collections in the Gray Herbarium found among undetermined *Samolus* specimens examined in a survey of the morphological variation and geographical distribution of *S. ebracteatus* for the southeastern United States. These specimens were collected in western Coahuila, Mexico, by Reynaldo Santos, under the direction of Robert M. Stewart, and bear the latter's collection numbers: *Stewart 2748,* 25 September 1942, holotype—"*Rancho del Coyote* (1 km. S.E.) gypsum slopes, scarce, ascending, 2 dm., fl. white. Base of mountains along the eastern margin of the Valle de Acatita." *Stewart 2805,* 2 October 1942, paratype—"*Cañon del Agua Grande* by water, common, fl. white. Canyons in the Sierra del Sobaco a few kilometers west of Las Delicias."

Samolus dichondrifolius Channell, sp. nov.[2] Herbae perennes, caulescentes (laeves, non glanduloso-porosae), 1–3 dm. altae, caules repentes vel decumbentes, apices foliati adscendentes, axillae foliorum superiorum racemos graciles nudos gerentes. Caulis glaber, 2.5 dm. longus, vel ultra, internodii 4–8 mm. longi, pars vestustior basibus petiolaribus foliorum disruptorum vestita, apices folia numerosa alterna vel approximata gerentes. Folia (2–)4–7(–9) cm. longa, simplicia, glabra, supra griseoviridia, subtus pallida vel glauca, laminae integrae reniformes apiculato-mucronatae, 1–3 cm. latae, 1–2(–3) cm. longae, basi in petiolis gracilibus linearibus complanatis (1–)2–5(–6) cm. longis abrupte contractae. Racemi, pedicelli calycesque minute glanduloso-pubescentes. Racemi

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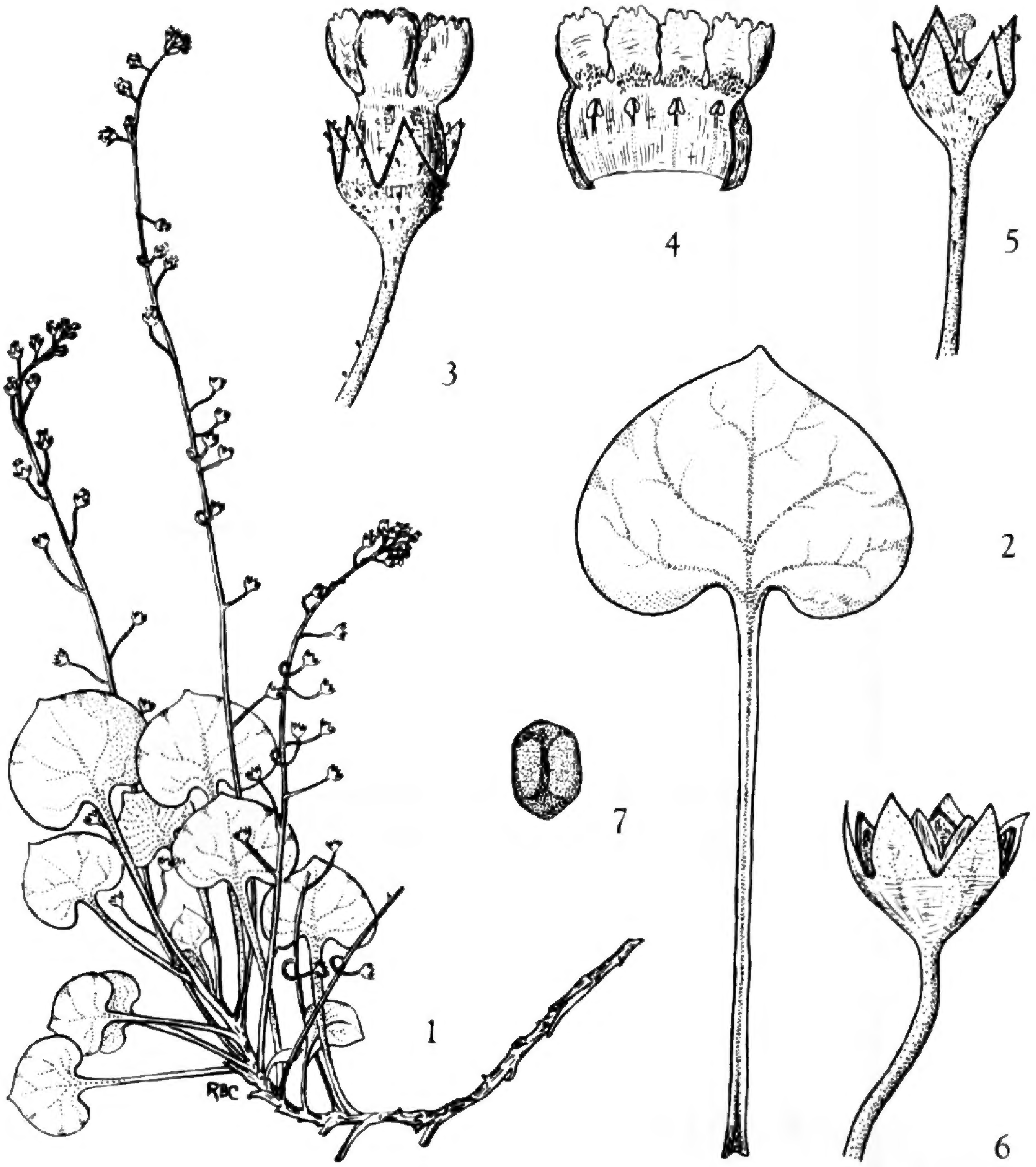
[2] The Latin description was kindly prepared by Dr. R. C. Foster, Gray Herbarium.



Samolus dichondrifolius: Fig. 1, habit (½ natural size); fig. 2, leaf (natural size); fig. 3, flower (× 5); fig. 4, opened corolla showing stamens and tufts of glandular hairs (× 5); fig. 5, flower with corolla removed to show pistil (× 5); fig. 6, fruit after dehiscence (× 5); fig. 7, seed (× 20). All drawings made from holotype: *Stewart 2748*, GH.

simplices, 0.5–2.5 dm. longi, pedicelli graciles ebracteati 5–10 mm. longi, divergenti-adscendentes. Calyx herbaceus, campanulatus, lobi triangulares vel triangulato-lanceolati, acuti, tubum aequantes. Corolla alba (vel pallide rubra in sicco), 3–4 mm. diametro, lobi late ovati vel oblongo-ovati, obtusi, eroso-denticulati vel retusi, tubum paene aequantes, faux paullo constricta interne pubescens. Stamina inclusa, in corollae tubum paene ad medium inserta, antherae ovatae, 0.3–0.5 mm. longae, filamenta brevia aequantes; staminodia nulla. Ovarium semiinferius, stylus ca. 0.5 mm. longus, stigma apicale, discoideo-capitatum.

Capsula semi-inferior, ca. 3 mm. diametro, muris crassis, in valvis triangularibus paullo recurvatis dehiscens. Semina numerosa, atrobrunnea vel nigra, complanata, ovoideo-angularia, axis longus 0.25–0.5 mm., integumenta polygonali-reticulata.

Caulescent perennial herbs (leaves smooth, not glandular-porous) 1–3 dm. in height, with repent or decumbent stems, the leafy tips ascending, bearing slender naked racemes from the upper leaf-axils. Stem glabrous, 2.5 dm. or more in length, the internodes 4–8 mm. long, the older portion bearing the petiolar bases of old or broken foliage, the tips bearing numerous alternate or approximate leaves. Leaves (2–)4–7(–9) cm. long, simple, glabrous, gray-green above, pale or glaucous below, the reniform entire blades apiculate-mucronate, 1–3 cm. wide, 1–2(–3) cm. long, abruptly contracted into slender, linear, flattened petioles (1–)2–5(–6) cm. long. Racemes, pedicels and calyces minutely glandular-pubescent. Racemes simple, 0.5–2.5 dm. long, the slender ebracteate pedicels 5–10 mm. long, spreading-ascending. Calyx herbaceous, campanulate, the lobes triangular or triangular-lanceolate, acute, equalling the tube. Corolla white (or when dry flesh-pink), 3–4 mm. in diameter, the lobes broadly ovate or oblong-obovate, obtuse, erose-denticulate or retuse, nearly equalling the tube, the slightly constricted throat pubescent within. Stamens included, inserted on the corolla-tube near the middle, the anthers ovate, 0.3–0.5 mm. long, equalling the short filaments; staminodia wanting. Ovary ½ inferior, the style about 0.5 mm. long, capped by the discoid-capitate stigma. Capsule ½ inferior, about 3 mm. in diameter, the free portion thick-walled and dehiscent by slightly recurving triangular valves. Seeds numerous, dark brown or black, flattened, ovoid-angular in outline, the long axis 0.25–05 mm., the testa polygonal-reticulate. (Figs. 1–7.)

Samolus dichondrifolius is more closely related to the widespread *S. ebracteatus* than to *S. cinerascens.* Known only from San Luis Potosí, Mexico, where it grows on alkaline plains, the latter species is distinguished by the suffruticose, subligneous habit, the conspicuously glandular-porous, linear or linear-lanceolate, acute leaves, the linear-lanceolate sepals, exceeding in length the valves of the mature capsule, by the entire corolla-lobes, anthers 1.5 mm. long, and by the non-dilated stigmas.

Samolus ebracteatus (sensu lato) is distributed in Cuba, Florida, Texas, Oklahoma, New Mexico and from Coahuila, Nuevo León and Tamaulipas southward into Oaxaca, as well as in Baja California, Mexico. Considerably variable in habit, this species apparently grows equally well in calcareous clay, sandy soils, sandy loam, humus and on almost bare, eroded limestone (cf. Small, 1934). According to herbarium data the habitats include pine woods, brackish flats and salt marshes, gypsum ravines, chalk bluffs, limestone rocks, edges of streams, ponds and springs, calcareous clay and granitic soils. It is not surprising, therefore, that practical difficulties have arisen in the interpretation of local variation, even though the species is typically riparian. This species is characterized by the herbaceous habit, glabrous herbage, broad spatulate to spatulate-rotund leaves with broad, gradually contracted, vaginate bases, often decurrent on the stem, the triangular-ovate sepals, merely equalling the valves of the mature capsule, by the erose-denticulate corolla-lobes, anthers only about 0.75–1.0 mm. long, and by the capitate stigmas.

The new species is distinguished from all other members of the genus by the distinctive leaves. The reniform-apiculate blades and the long, linear petioles give the foliage a striking resemblance to that of species of *Dichondra* (*Convolvulaceae*), whence the epithet. Although sharing the same fundamental floral structure, including the irregularly erose-denticulate corolla-lobes and capitate stigmas, *S. dichrondrifolius* may be distinguished from *S. ebracteatus* by the smaller size of the flowers and by the narrower, more slender inflorescences, as well as by obvious foliage differences. *Samolus ebracteatus* has corollas 4–9 mm. in diameter and pedicels 10–20 mm. long; *S. dichondrifolius* has corollas only 3–4 mm. or less in diameter and pedicels only 5–10 mm. long. In addition, the corollas of the latter species are white; those of *S. ebracteatus* are generally pigmented, varying in color from pink to purple or even red. The anthers of *S. dichondrifolius* are only about 0.3–0.5 mm. long.

Little is known, except in general terms, about the type locality and associates of the new species. The descriptive account by Muller (1947) of the vegetation and climate of Coahuila indicates that the plains and basins of the southern, western and northern three-fourths of the state are extremely arid and are occupied chiefly by a strictly desert vegetational type designated as Chihuahuan Desert Shrub. The vegetation is polymorphic, consisting of low, sparse perennials and ephemeral annuals. *Larrea tridentata* (DC.) Cov. is the most characteristic species and the variant vegetational types are described by Muller in terms of associates of that species and those which occasionally replace it. The only known stations for *Samolus dichondrifolius* are located within this vegetational type in western Coahuila, near the southeastern corner of Chihuahua. As already indicated, the holotype was collected from a gypsum slope; the paratype near water.

The studies of Johnston (1941) of extensive gypsum flats and gypseous ridges in the same vicinity have yielded a rather extensive list of gypsophiles, including species of *Dicranocarpus, Sartwellia, Nerisyrenia, Drymaria, Nama,* etc. Whether or not *Samolus dichondrifolius* may be classified as a strictly gypsophilous species, however, remains to be determined.

It is to be noted that *Samolus ebracteatus* also occurs in this area, near water, in relatively close proximity to the type locality of the new species (cf. *Stewart 2729, 2735* and *2942:* GH) and elsewhere in gypsum ravines (cf. *Johnston 3631* and *Waterfall 6142:* GH). According to the collection data the two species flower simultaneously, at least in western Coahuila. Insofar as present collections indicate, however, the two species retain their morphological identity and are probably isolated genetically.

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A CYTOTAXONOMIC STUDY OF THE GENUS ACHILLEA IN PENNSYLVANIA[1]

Elwood B. Ehrle

The problem of speciation in the genus *Achillea* has received attention from workers at the laboratory of the Carnegie Institution of Washington in California (Clausen, 1951; Hiesey & Nobs, 1952; Ehrendorfer, 1952). These studies have been directed chiefly toward deciphering evolutionary trends and ecological specialization within this genus. Major study has been concentrated on forms from the Western United States and Europe. Very little is known of relationships among Achilleas of the Eastern United States.

Herbarium specimens of eastern material, located at various institutions in Pennsylvania, all bear the name *Achillea millefolium* L. The western species, *Achillea lanulosa* Nutt., has not been recognized in this state since all material of the genus has been somewhat automatically referred to *A. millefolium* L. Cronquist, in the new Britton and Brown Flora (Gleason, 1952), treats *A. lanulosa* Nutt. as a subspecies of *A. millefolium* L. and describes its distribution as occurring "toward the western part of our range" and "occasionally introduced eastward." The two forms are differentiated by Cronquist on the basis of the degree of crowding of the leaf segments and the shape of the ultimate segments.

A. millefolium L. *sens. strict.* is a European hexaploid with 54 somatic chromosomes, whereas American *A. lanulosa* Nutt. is tetraploid with 36 somatic chromosomes (Ehrendorfer, 1952). In his review of the geographical distribution of *Achillea* in North America, Lawrence (1947) included the three eastern records (Vermont, Mass., & N. Y.) for tetraploid *A. lanulosa* Nutt. as reported by Turesson (1939). No cytologically proven records of the existence in the east of the European hexaploid, *A. millefolium* L. *sens. strict.*, occur in the literature.

Twenty-six specimens of Achillea were collected in Pennsylvania during the winter of 1956 and the spring of 1957 and were grown in a greenhouse at the Pennsylvania State University.

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[1] The aid of Dr. Paul Grun in the preparation of material and in the interpretation of cytological figures is gratefully acknowledged.

The leaves of these plants and those of herbarium specimens labeled *A. millefolium* or *A. lanulosa* from various parts of the United States were examined. It was not possible to separate the herbarium specimens or the growing plants into two categories on the basis of the shape of the ultimate segments or the degree of crowding, as the plants were highly variable with regard to these two characters.

When the plants were growing vigorously, root tips were collected, treated by the oxiquinoline method (Tijo and Levan, 1952), and stained with propio-orcein. The cells of all plants studied showed 36 somatic chromosomes. A list of these plants with their points of collection is shown in Table I. Many of the chromosomes (Fig. 1) were of equal length and had centrally located centromeres. Of those with sub-terminal centromeres, four satellite-bearing chromosomes were frequently discernible, indicating that this tetraploid species arose from satellite-bearing diploid precursors, either by auto- or allo-polyploidy.

The existence of tetraploid *Achillea* in Pennsylvania is thus demonstrated. These plants should, therefore, be referred to ecological races of the western tetraploid *A. lanulosa* Nutt. and not to European *A. millefolium* L. as is the current practice. It might be possible that the latter species will be found in the vicinity of seaports and other points of entry of European migrants.

TABLE I. Known distribution in Pennsylvania of tetraploid *A. lanulosa* Nutt.—verified by chromosome counts.

County	Locality	No. plants determined
Centre	State College	1
Clearfield	Caledonia Pike	1
"	Clearfield Bridge	3
"	Dimeling	4
"	Grampian	1
"	Kratzer Run	4
"	Lick Run	1
Clinton	Lamar	1
Huntingdon	Spruce Creek	2
Lycoming	Maple Hill	1
Perry	Mecks Corner	1
"	Millerstown	1
"	Shermandale	1
"	Waggoner Gap	1
Snyder	Kratzerville	1
"	Mt. Pleasant Mills	1
Union	Weikert	1

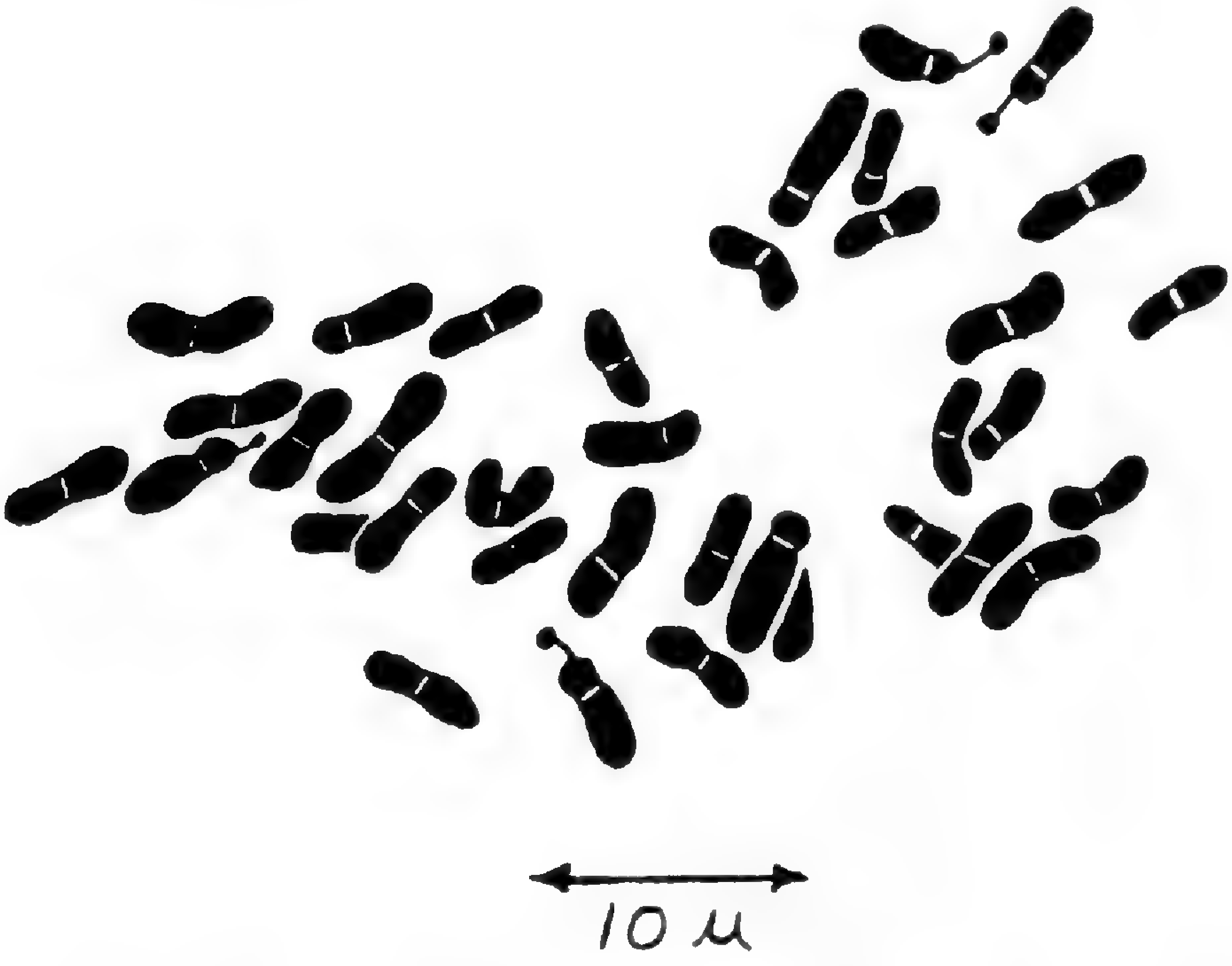

Fig. 1. Camera lucida diagram of the mitotic early metaphase chromosomes of tetraploid *Achillea lanulosa* Nutt., occurring at the side of Rt. 322 at Kratzer Run in Clearfield Co., Pennsylvania.

The presence of this species in such areas must, however, be proven before we can conclude that any *A. millefolium* L. *sens. strict.* exists in Pennsylvania.—DEP'T. OF BOTANY AND PLANT PATHOLOGY, PENNSYLVANIA STATE UNIVERSITY, UNIVERSITY PARK, PA.

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SPECIES NEW TO THE FLORA OF NORTH OR SOUTH CAROLINA[1]

Harry E. Ahles, C. Ritchie Bell and Albert E. Radford

Most of the distribution records included in this paper are from the collections of the authors during 1956. Others are from the many excellent specimens contributed by O. M. Freeman to the Flora of the Carolinas project. Still others were found in the herbaria of the University of North Carolina (NCU), North Carolina State College (NCSC), Duke University (DUKE) and the New York Botanical Garden (NY).

The determinations of the grasses included in this paper have been made or verified by H. L. Blomquist of Duke University. R. B. Channell, then of the Gray Herbarium and Arnold Arboretum, and Joseph Monachino, of the New York Botanical Garden, checked their respective herbaria for the presence of many of the species that appear in this report. In addition, Mr. Monachino also verified the identification of the following specimens: *Sesbania exaltata* (Raf.) Cory, *Bell 4822*; *Plantago hookeriana* var. *nuda* (Gray) Poe, *Ahles 12169, 12607* and *Bell 2712*; and *Hypochaeris glabra* L., *Ahles 12404*. H. N. Moldenke supplied current distribution information on the verbenas. We gratefully acknowledge the valuable technical aid rendered by these individuals, and the generous field assistance given us by Lionel Melvin, R. S. Leisner and J. H. Horton. The hospitality and help of the curators of the various herbaria were sincerely appreciated.

All but two of the plants included in the following enumeration of species we presume to be new records for one or both of the Carolinas. The family arrangement follows that used by Fernald (1950); genera and species are listed alphabetically. Specimens and collection data are cited by state (North Carolina first) and county, the latter being arranged alphabetically. All specimens are deposited in the University of North Carolina Herbarium (NCU) unless otherwise noted by an appropriate symbol.

Andropogon campyloracheus Nash—SOUTH CAROLINA. Allendale Co.:

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[1] It is a pleasure to acknowledge the generous financial assistance given in support of the project by Mrs. W. C. Coker; by the Alumni Annual Giving Fund and the Smith Fund of the University of North Carolina; and by the Highlands Biological Laboratory via a grant-in-aid from the National Science Foundation.

Sandhill by Co. Rt. 41 sw. of Barton and 2.1 mi. n. of jct. with Co. Rt. 91, *Bell 5124.*

Hitchcock (1933) and Chase (1950) report the range as Florida to Louisiana. This specimen represents a northern extension of range into South Carolina. A specimen of the cited collection was verified by Agnes Chase.

Brachiaria platyphylla (Griseb.) Nash—SOUTH CAROLINA. Beaufort Co.: Weed in vegetable garden, Dale, *Ahles 15584;* weed in corn field, 0.6 mi. n. of Lobeco on U. S. 21, *Ahles 20946.*

In Hitchcock (1933) this species is cited as *Brachiaria extensa* Chase. According to Chase (1950) this grass is found primarily in the Gulf States with an east coast extension into Georgia. These are the first records of this weed from South Carolina.

Digitaria filiformis (L.) Koel.—SOUTH CAROLINA. Hampton Co.: Sandy roadside, 3.1 mi. nw. of Yemassee on S. C. 28, *Ahles 15750.*

Hitchcock (1933) treats this species as *Syntherisma filiforme* (L.) Nash, giving its distribution as Florida to Texas and Massachusetts. Chase (1950) maps the species from all the states on the southeastern coast except South Carolina. No herbarium specimens have been found in NCU, DUKE or NCSC.

Digitaria texana Hitchc.—SOUTH CAROLINA. Colleton Co.: Sandy oak woods at jct. of Co. Rts. 172 & 28, w. of Hendersonville, *Ahles 17916.*

Hitchcock (1933) does not include this species. Chase (1950) reports it from southern Texas only. This is the first southeastern record for this taxon.

Eragrostis lugens Nees.—SOUTH CAROLINA. Hampton Co.: Pond and sandy margins, 0.8 mi. nnw. of Shirley on Co. Rt. 20, *Bell 5013.* Oconee Co.: Meadow near S. C. 59, 1 mi. n. of Fair Play, *Radford 17916.*

Hitchcock (1933) gives the distribution of *Eragrostis lugens* as Louisiana to California and naturalized in Georgia and Alabama. Chase (1950) has essentially the same distribution. This is the first report of a collection from South Carolina.

Heteropogon melanocarpus (Ell.) Benth.—SOUTH CAROLINA. Beaufort Co.: Sandy roadside, Hilton Head Island, *Ahles 18062.* Hampton Co.: Roadside, 1 mi. s. of Brighton, *Ahles 21008.* Jasper Co.: Field-savannah border, on S. C. 170, 1.6 mi. n. of jct. with S. C. 128, *Bell 5317.*

This grass has been known previously only as far north as Georgia, as reported by Hitchcock (1933) and Chase (1950).

Melica nitens Nutt.—NORTH CAROLINA. Madison Co.: Hardwood forest, 3 mi. nw. of Hot Springs on the French Broad River, *Radford 8053.*

Chase (1950) and Fernald (1950) report the range as Pennsylvania to Virginia. In Madison County the species was very infrequent on limestone.

Paspalum plicatulum Michx.—SOUTH CAROLINA. Colleton Co.: Cultivated field, Ritter, *Ahles 15489.*

According to the range given for this species by Hitchcock (1933) and Chase (1950), the Colleton County collection represents a northern extension from Georgia.

Phalaris canariensis L.—SOUTH CAROLINA. Anderson Co.: Waste places, mixed deciduous woods, 0.5 mi. wnw. of Seneca-Tugaloo River jct., *Radford 12087*.

This European adventive is widely scattered in waste places and is rarely persistent, according to Fernald (1950). Chase (1950) maps the species from all of the states east of the Mississippi River except North Carolina, South Carolina, Georgia and Alabama. The Anderson County collection is the first report from South Carolina.

Scirpus etuberculatus (Steud.) Kuntze—SOUTH CAROLINA. Marlboro Co.: Fresh-water marsh, 2.25 mi. e. of Wallace on S. C. 9, *Radford 15549*.

Small (1933), Beetle (1947), Fernald (1950) and Gleason (1952) indicate the range as from Delaware to Florida and Louisiana. The absence of specimens from South Carolina in the NCU, DUKE, NCSC and NY herbaria warrants the inclusion of this species in the list of South Carolina plants.

Scirpus koilolepis (Steud.) Gleason—NORTH CAROLINA. Union Co.: Meadow, 3 mi. s. of Rocky River, 4.5 mi. n. of Unionville, *Radford 10597;* wet corn field, 2.5 mi. w. of New Salem, *Ahles 12083*.

Small (1933) treats this taxon as *Scirpus carinatus* (H. & A.) Gray, ranging from Alabama to Texas and Tennessee. Beetle (1947), Fernald (1950) and Gleason (1952) give essentially the same range. The 1956 collections represent an eastward extension from Tennessee into North Carolina.

Commelina communis L. var **ludens** (Miquel) C. B. Clarke—NORTH CAROLINA. Cleveland Co.: Roadside ditch, 0.5 mi. n. of Lawndale on Maple Creek, *Ahles 15195*. Polk Co.: Roadside, Saluda, 6 mi. n. of Tryon, *Fosberg 18735*.

According to Fernald (1950) this naturalized variety of the Asiatic species is found from New Jersey and Pennsylvania to Virginia and Kentucky. It is not mentioned by Small (1933). The cited specimens represent a southern extension of range into North Carolina.

Allium ampeloprasum L.—NORTH CAROLINA. Davidson Co.: Roadside, 3 mi. nw. of Churchland near Yadkin River, *Radford 12864*. SOUTH CAROLINA. Oconee Co.: Roadside of Co. Rt. 68, w. of Madison, *Bell 3111*.

This Old World species is not treated by Small (1933), and Fernald (1950) includes it only because the var. *atroviolaceum* (Boiss.) Regel has been found in York County, Virginia (Fernald, 1941). Although Gleason (1952) includes the species, his treatment is apparently based on Fernald's collection of the variety in southeastern Virginia. James (1956) reports the species in an apparently undocumented list of plants introduced into northern Tennessee, but without comment as to whether or not it is the variety mentioned by Fernald. Without herbarium material it is not possible to know whether James had the first record for the species itself in the eastern United States, or another record for the variety.

Brodiaea uniflora (Lindl.) Engler—NORTH CAROLINA. Orange Co.: Field along railroad tracks at U.N.C. power plant at Chapel Hill, *Radford 8842.*

This South American horticultural introduction has become well established as a weed in Chapel Hill. Bailey (1950) lists the species as *Brodiaea uniflora* Baker and gives *Triteleia uniflora* Lindl. as a synonym; Hoover (1941) specifically excluded this taxon from the genus *Triteleia* with the comment that it may belong to either *Nothoscordum* or *Tristagma.*

Hymenocallis occidentalis (Le Conte) Kunth—SOUTH CAROLINA. Union Co.: Rocky shoals of Broad River, Lockhart, *Freeman 56401.*

Small (1933) states the range of this species as Georgia to Missouri and Indiana. Fernald (1950) gives it as Georgia to Alabama, and north to Kentucky, southern Indiana, southern Illinois and southeastern Missouri. Gleason (1952) says that it occurs from southern Indiana to southern Missouri and south to the Gulf. Apparently the Union County collection is the first record for South Carolina.

Pilea fontana (Lunell) Rydb.—NORTH CAROLINA. Halifax Co.: Swamp along the Roanoke River, just n. of Roanoke Rapids on N. C. 48, *Ahles 20713.* Jones Co.: Hardwood forest over marl on Trent River, ne. of Pollocksville, *Radford, Haesloop & Miller 7707.*

The two preceding specimens are recorded here because of the discrepancy in the ranges given by Fernald (1950), "w. N. Y. to N. D., s. to n. Fla., Ind., Ill. and Neb.," and Gleason (1952), "P. E. I. to Minn. & N. D. s. to Va., Ind., and Neb.; Fla." Small (1933) does not include this species at all. The placing of *Pilea opaca* (Lunell) Rydb. as a synonym of this species in Gleason (1952) rather than as a synonym of *P. pumila* (L.) Gray is apparently an error, as is the illustration for this species which is clearly *Boehmeria cylindrica* (L.) Sw. However, the achene to the left of the illustration is that of *P. fontana.*

Polygonum hirsutum Walt.—SOUTH CAROLINA. Allendale Co.: Low pine savannah, 1.5 mi. se. of jct. Co. Rts. 41 & 60 on Co. Rt. 26, sw. of Barton, *Ahles 15868;* pond banks, 7 mi. nw of. Allendale on S. C. 641, *Bell 4039;* field, 3.3 mi. sw. of Sycamore, 3 mi. e. of jct. U. S. 301 & S. C. 644, *Bell 5185.* Lexington Co.: Mucky margin of open shallow pond, Columbia, *Godfrey & Tryon 1220* (DUKE, NY).

All of the plants described by Walter in his *Flora Caroliniana* (1788) are presumably from South Carolina. Apparently Small (1895) overlooked this fact or had reason to ignore it, in giving the range of *Polygonum hirsutum* as Georgia and Florida. In his 1933 manual he repeats the same range under the name *Persicaria hirsuta* (Walt.) Small. Due to the uncertainty of the existence of an herbarium specimen from South Carolina, we are citing the above collections.

Rumex patientia L.—NORTH CAROLINA. Wake Co.: Waste ground, Rolesville, *Ahles 11428.*

Small (1933) does not include this species. Fernald (1950) reports it south to eastern Pennsylvania while Gleason (1952) gives no indication that it occurs outside of that manual's range. Therefore the preceding specimen is cited as the first record for North Carolina. Only two plants were observed at the Rolesville locality.

Cycloloma atriplicifolium (Spreng.) Coult.—NORTH CAROLINA. New Hanover Co.: Sandy waste place, N. C. 420 at causeway, Wrightsville Beach, *Radford & Radford 2079.* SOUTH CAROLINA. Darlington Co.: Common in a field on road from Darlington to Lauther's Lake, *B. E. Smith 1657;* sandy soil on Witherspoon Island, *B. E. Smith 916.* Sumter Co.: Roadside ditch 1 mi. n. of county line on U. S. 15A, *Bell 3607.*

These collections are recorded here because the Southeastern United States are excluded from the range of this taxon as given by Small (1933), Fernald (1950) and Gleason (1952). At the Sumter County locality the species was abundant in several fields.

Amaranthus graecizans L.—SOUTH CAROLINA. Anderson Co.: Field, S. C. 81, 3.5 mi. n. of Anderson, *Radford 14053.*

Although the ranges given by Small (1933), Fernald (1950) and Gleason (1952) indicate that this species occurs throughout the United States, intensive field work in both North and South Carolina during 1956 produced only one collection. No specimens from either state are present in the herbaria of NCU, DUKE, NCSC or NY. These facts seem to warrant the reporting of the Anderson County collection as a new record for South Carolina.

Froelichia gracilis (Hook.) Moq.—SOUTH CAROLINA. Allendale Co.: Sandy field sw. of Allendale on Co. Rt. 57, *Bell 4034.* Lee Co.: Sandy waste ground, 1 mi. sw. of Alcot on U. S. 15, *Ahles 15898.*

According to Fernald (1950) and Gleason (1952), this species is native to the central United States and is adventive eastward, ranging southward only as far as Virginia. Small (1933) makes no mention of it. *Froelichia gracilis* is probably more widely distributed throughout the Southeastern United States than present collections would indicate, as it is easily confused with *F. floridana* (Nutt.) Moq. and possibly has been mistaken for that species. However, the gray color, low stature and habit of branching freely at the base distinguish *F. gracilis* from *F. floridana. Froelichia gracilis* is to be expected along railroads or in sandy places.

Mirabilis jalapa L.—NORTH CAROLINA. Iredell Co.: Statesville *M. E. Hyams 4991.* Stanly Co.: Well established on road embankment, 4.1 mi. sw. of N. C. 73 on N. C. 27, *Ahles 19839.*

Small (1933) says of this species, "escaped, s. Fla.," while Fernald (1950) and Gleason (1952) give a very vague range. In 1956 it was found well established on a road embankment and for this reason is placed on record.

Tetragonia expansa Murr.—NORTH CAROLINA. Durham Co.: Escaped from gardens and fields, Engelwood Ave., Durham, *Blomquist 3584* (DUKE).

Small (1933) gives the range as Florida and California. Fernald (1950) says, "sometimes escapes from cultivation," and Gleason (1952) states, "occasionally persists in gardens or appears spontaneously near them." In North Carolina this species is probably no more than a waif, occurring sporadically after cultivation.

Holosteum umbellatum L.—SOUTH CAROLINA. Cherokee Co.: Roadside, 8.7 mi. nw. of Gaffney on S. C. 11, *Ahles 11291*. Spartanburg Co.: Anderson Bridge over the Enoree River, S. C. 417, *Freeman 6509*.

Maguire (1952) gives the range as eastern Massachusetts to Georgia in the Atlantic States. Even though South Carolina is in the general range of this species, no South Carolina specimens have been found in NCU, DUKE, NY or GH.

Spergula pentandra L.—NORTH CAROLINA. Warren Co.: Sandy roadside, 0.5 mi. e. of Warren Plains on U. S. 158, 200 yards e. of railroad crossing, s. side of highway, *Ahles 10966*.

According to Maguire (1952) this European species is an adventive at Cape May, New Jersey only. The Warren County collection is the first record for the southeast.

Ranunculus arvensis L. var. **tuberculatus** DC.—NORTH CAROLINA. Cabarrus Co.: Fields, Harrisburg, May 25, 1944, *W. H. Garmon* (NCSC); field by woodland, 3 mi. ne. of Harrisburg, along Wolf Meadow Branch, *Bell 2271*. Clay Co.: Roadside, 1.3 mi. sw. of Hayesville at jct. of Sweet Water Gap Road and U. S. 64, *Ahles 13801*. Mecklenburg Co.: Wheat field, 1.5 mi. w. of Mecklenburg-Cabarrus Co. line on N. C. 49, *Ahles 11324*.

Gleason (1952) describes the species as a European introduction occasionally found along the Atlantic coast. The variety is not described by Small (1933), Fernald (1950) or Gleason (1952). According to Hegi (1912) it is found in Central Europe. In North Carolina the variety seems to have been introduced with grain, and therefore may be established elsewhere in North America. At one of the localities the species grew mixed with the variety, and at two localities the variety occurred by itself. This variety of *R. arvensis* was very abundant at two of the localities.

Ranunculus sardous Crantz—NORTH CAROLINA. Iredell Co.: Roadside, 2.9 mi. w. of Elmwood and 1.5 mi. ne. of U. S. 70 near Fourth Creek, *Ahles 12982*. Union Co.: Roadside, 0.3 mi. s. of Stanly-Union Co. line (Rocky River) about 4.5 mi. n. of Unionville, *Ahles 11952*. SOUTH CAROLINA. Colleton Co.: Wet soil near railroad, Ritter, *Ahles 12177*.

Small (1933) gives the range of this species, under *Ranunculus parvulus* L., as "Cosatal Plain and New England Coast, Ga. to N. B."; Fernald (1950) says, "N. B. to Mo. and southw." According to Gleason (1952) this weed ranges from southeastern Virginia to Georgia. No specimens from either of the Carolinas have been found in the local herbaria.

Alliaria officinalis Andrs.—NORTH CAROLINA. Rockingham Co.:

Wooded river bottom, about 2 mi. e. of Thompsonville on N. C. 87, *Ahles 10746;* swamp forest, Dan River near N. C. 14, s. of Leaksville, *Radford 10769.*

Small (1933) does not include this species in his manual. Fernald (1950) and Gleason (1952) have it ranging only as far south as Virginia on the eastern portion of the range.

Hesperis matronalis L.—NORTH CAROLINA. Forsyth Co.: Escape, Winston-Salem, *Schallert 8765.*

Although the range of this species as given by Small (1933), Fernald (1950) and Gleason (1952) may be interpreted to include North Carolina, there are no specimens from the state at DUKE, NCSC or NY. This fact warrants the inclusion here of the Forsyth County record.

Raphanus raphanistrum L.—SOUTH CAROLINA. Beaufort Co.: Roadside and edge of cultivated field, Bluffton, *Ahles 12372.* Darlington Co.: Field s. of ferry at Lauther's Lake, *B. E. Smith 1492.* Hampton Co.: Sandy roadside, 2 mi. n. of Estill on U. S. 321, *Ahles 10588;* weed in cultivated field, 3.7 mi. nne. of Early Branch, *Ahles 12462.* Jasper Co.: Waste ground, Ridgeland, *Ahles 15607.* Marlboro Co.: Shrub bog, 2.5 mi. nw. of Blenheim, *Radford 12667.*

This species is not included in Small (1933), and is recorded only as far south as Virginia in the eastern part of the ranges as given by Fernald (1950) and Gleason (1952). Freeman (1955) reports it from North Carolina and Thorne (1951) from Georgia. The Jasper County specimen, *Ahles 15607,* is forma *albus* (Schuebler & Martens) Hayek.

Thlaspi perfoliatum L.—NORTH CAROLINA. Alexander Co.: Field, 4 mi. e. of Caldwell Co. line on N. C. 90, *Radford 9979.* Graham Co.: Roadside, about 2 mi. s. of the town of Yellow Creek on U. S. 129, *Ahles 13317.* Rockingham Co.: Meadow, 3 mi. n. of Reidsville near N. C. 14, *Radford 13612.* Stokes Co.: Roadside, 0.4 mi. w. of Stokes-Rockingham Co. line on U. S. 311, about 1 mi. n. of Pine Hall, *Ahles 10807.*

Thlaspi perfoliatum is not included by Small (1933), and is reported south only to Virginia by Fernald (1950) and Gleason (1952).

Warea cuneifolia (Muhl.) Nutt.—NORTH CAROLINA. Harnett Co.: From sandhills, about 3 mi. ne. of Spout Springs on Sprunt land, Sept. 1, 1940, *H. A. Rankin.*

Small (1933) gives the range as "Fla. to Ala. and S. C." The Harnett County collection is not a new record as it was cited in 1940 by Rankin in the Journal of the Gray Memorial Botanical Association. However, due to the omission of a complete citation of Rankin's specimen in 1940 in an obscure publication, it would seem worthwhile to repeat this state record here.

Chrysobalanus oblongifolius Michx.—SOUTH CAROLINA. Jasper Co.: Sand hill, 2 mi. nw. of Grays on S. C. 631, *Ahles 15794;* sand hills, 10.5 mi. nw. of Tillman, 0.6 mi. se. of Seaboard Air Line Railway, *Ahles 18217.*

Small (1933) gives the range of this species, under the name *Geobalanus oblongifolius* (Michx.) Small, as "Fla. to Miss. and Ga." The species was found to be fairly abundant in the sand hill country of northwestern Jasper County where it appears to be native.

Sesbania exaltata (Raf.) Cory— NORTH CAROLINA. Brunswick Co.: Abundant in extensive marsh, Brunswick River w. of Wilmington, *Godfrey 50162* (DUKE, NCSC). Granville Co.: Camp Butner, *Batson 118* (DUKE). SOUTH CAROLINA. Darlington Co.: Coker's Seed Farm, Hartsville, *B. E. Smith 1559*. Jasper Co.: Sandy roadside, edge of brackish marsh, 0.7 mi. n. of the Savannah River on U. S. 17A, *Ahles 18154*.

The range of this species as given by Small (1933) under *Sesban exaltata* (Raf.) Rydb. does not include the South Atlantic States. Thorne (1951) reports it for the first time from Georgia while the above earlier and unpublished collections from North and South Carolina were found during the checking of herbarium specimens in connection with the current collection from Jasper County.

Oxalis martiana Zucc.—NORTH CAROLINA. Wake Co.: Roadside near Cary, April 1, 1949, *Godfrey* (NCSC).

Small (1933) under *Ionoxalis martiana* (Zucc.) Small, gives the range of this species as "Fla. to Tex. and S. C." No specimen from North Carolina has been found in NCU, DUKE or NY. Therefore, the above collection is cited here as the first record for North Carolina.

Ruta graveolens L.—NORTH CAROLINA. Orange Co.: Roadside on edge of field by Morgan Creek, above bridge on Pittsboro Rd., Chapel Hill, April 8, 1945, *Costello & D. & A. Beers*.

Small (1933) gives the range for this species as various provinces in the eastern United States. Gleason (1952) cites no range, merely stating, "Native of Europe; cultivated in old-fashioned gardens and often escaped to waste ground and roadsides." Fernald (1950) gives it south only to Virginia on the Atlantic Seaboard. The Orange County collection is cited here as a first record for North Carolina.

Croton lindheimeri (Engelm. & Gray) Wood—SOUTH CAROLINA. Beaufort Co.: Sandy palm woods, Jenkins Island, *Bell 4807*. Richland Co.: Vacant lot near railroad, Columbia, *Freeman 56823*.

According to the range given by Small (1933) for this species under the binomial *Croton engelmannii* Ferguson, and that given by Fernald (1950), the Beaufort and Richland County collections represent a northern extension in the east coast states; both Small and Fernald report it north only to Georgia on the Atlantic Seaboard. Gleason (1952) treats this entity as *C. capitatus* var. *lindheimeri* Muell.-Arg., apparently ignoring the authority (Engelm. & Gray) for the basionym, and reports it only in Florida in the Atlantic coast states. At the Beaufort County locality it was very abundant, and conspicuous from a car.

Euphorbia dentata Michx.—NORTH CAROLINA. Graham Co.: Roadside, U. S. 129, near Cheoah Creek, 5 mi. se. of Tapoco, *Radford 15904*. Surry Co.: Ditch, Yadkin River near Elkin, *Radford 18380*.

Small (1933), under *Poinsettia dentata* (Michx.) Small, has this species as occurring throughout the southeastern United States, while

Gleason (1952) excludes this region, at least south of Virginia. In Fernald (1950) the range "N. Y. to Minn., S. D. and Wyo., s. to Va., La., Tex. and Mex.," can be interpreted as either including or excluding North Carolina. The absence of specimens in NCU, DUKE and NCSC is, therefore, the principal reason for including this species as new to North Carolina.

Euphorbia hirta L.—SOUTH CAROLINA. Jasper Co.: Lawn weed around gas station, Ridgeland, *Ahles 15812*.

Small (1933) under the name *Chamaesyce hirta* (L.) Millsp. gives the range of this species as "Fla. to Tex." Fernald (1950) does not mention it at all and Gleason (1952) says, "Widely distributed in tropical and subtropical lands, including the southern states." Since no mention is made of South Carolina, the specimen from Jasper County is worthy of note here as the species is well established at this locality.

Phyllanthus niruri L.—SOUTH CAROLINA. Sumter Co.: Weed in disturbed soil, Sumter, *Freeman 56801*.

The range given by Small (1933) for this southern species is Florida and the Keys. It spreads freely by seed as a weed in the greenhouse of the University of North Carolina. For this reason it is not too surprising to find it spreading, particularly in disturbed areas. More careful field work will doubtless reveal it in other places.

Phyllanthus pentaphyllus C. Wright—SOUTH CAROLINA. Darlington Co.: In sand hills beyond Camden Rd., 5 mi. n. of Hartsville, March 27, 1910 (without collector or number).

This species is known only from Florida, the lower Florida Keys and the West Indies, according to Small (1933). It is possibly only a sporadic introduction in South Carolina, or it may be an isolated native remnant.

Stillingia aquatica Chapm.—SOUTH CAROLINA. Hampton Co.: Associated with *Taxodium ascendens* Brongn. and *Ilex myrtifolia* Walt., 0.2 mi. n. of Luray on U. S. 321, *Ahles 18285*.

Small (1933) gives the range of this species from Florida to Mississippi and South Carolina. However, Rogers (1951) restricts its distribution to Florida, and Sumter County, Georgia. The fact that UNC, DUKE, NCSC and NY have no specimens other than those from Florida and Georgia is significant. The Hampton County specimen is considered a northward extension of the range.

Callitriche terrestris Raf.—NORTH CAROLINA. Union Co.: Meadow, 3 mi. s. of Rocky River, 4.5 mi. n. of Unionville, *Radford 10598*. Warren Co.: Wet border of cultivated field, about 4 mi. n. of Church X Roads on Jordans Creek, near the Roanoke River, *Ahles 12865*.

Small (1933) and Fassett (1951) give the range of this species as western Massachusetts south to Virginia, and in the midwest south to Louisiana and Alabama. The Union and Warren County collections are a southern extension of range into North Carolina.

Elaeagnus pungens Thunb.—NORTH CAROLINA. Forsyth Co.: Escape, *Schallert 613* (no locality). Orange Co.: Pine-oak woods, Chapel Hill, March 10, 1956, *Ahles 9995.* SOUTH CAROLINA. Union Co.: S. C. 9 at the Broad River, *Freeman 56880.*

This commonly cultivated species is not included by Small (1933), Fernald (1950) or Gleason (1952). James (1956) seems to be the first to have reported it as established in a southeastern state. It occurs abundantly in small colonies in each of the localities listed. It is quite frequent in the woods around Chapel Hill as an escape.

Cuphea carthagenensis (Jacq.) Macbr.—NORTH CAROLINA. Brunswick Co.: Swampy woods along creek, Orton, *Godfrey 10156.* Carteret Co.: Wet sandy soil, Beaufort, July 15, 1938, *R. Gray* (DUKE, NCSC); pineland at Sea Level, *Godfrey 6412.* Johnston Co.: Savannah along U. S. 70 near Pine Level, *Radford 4409.* Onslow Co.: Roadside at Folkstone, July 25, 1923, *E. J. Alexander.* Pitt Co.: Path near house site, 1 mi. e. of Fountain, *Radford, Haesloop & Miller 7357.* Wayne Co.: Marshy ground at edge of lake, about 5 mi. ne. of Mt. Olive, *Blomquist 14768* (DUKE). Wilson Co.: Pineland, 12 mi. e. of Wilson, *Blomquist 11214* (DUKE). SOUTH CAROLINA. Beaufort Co.: Swamp 0.2 mi. ne. of Neue River on S. C. 170, *Bell 5283.* Colleton Co.: Roadside swamp, 0.7 mi. sw. of Cottageville, on Co. Rt. 40, *Ahles 17949;* under highway bridge over Combahee River on U. S. 17A, *Ahles 21031.* Georgetown Co.: Sand wash along small stream 2 mi. ne. of Andrews, *Godfrey & Tryon 964* (DUKE). Jasper Co.: Swamp by S. C. 170, 2 mi. s. of jct. with S. C. 128, *Bell 4837.*

Small (1933) gives the range of this plant, under the name of *Parsonsia balsamona* (C. & S.) Standley, as "lake region, pen. Fla." Thorne (1951) reported the species from Georgia. It was found in both North and South Carolina during the 1956 collecting season. The earlier specimens cited above were found while checking the local herbaria; many were misidentified, or identified only to genus. Despite the relatively large number of these collections from the Coastal Plain, this species does not appear to have been published previously for North or South Carolina. Macbride (1930) pointed out that *Lythrum carthagenense* Jacq. and *Cuphea balsamona* Cham. & Schlecht. were names applied to the same species; therefore, he made the new combination now in use.

Gaura parviflora Dougl.—SOUTH CAROLINA. Aiken Co.: Near Savannah River on U. S. 1, *Radford 513.* Fairfield Co.: Railroad crossing at Dawkins, *Freeman 56395.*

Small (1933) reports the range of this taxon as Alabama and westward. Munz (1938) gives the range of the species and the varieties as mid-western and western. The Aiken and Fairfield County collections are the first records for South Carolina.

Jussiaea leptocarpa Nutt.—NORTH CAROLINA. Harnett Co.: Pond margin, 10.6 mi. e. of Harnett-Lee Co. line on U. S. 421, *H. Laing 625.* SOUTH CAROLINA. Beaufort Co.: Brackish marsh, 0.7 mi. sw. of Co. Rt. 33 on U. S. 17, *Ahles 18015.* Hampton Co.. Sandy shore of pond, 0.8 mi. nnw. of Shirley on Co. Rt. 20, *Ahles 18257.* Jasper Co.: Edge of cypress swamp, 2.4 mi. s. of jct. of U. S. 17 & 17A on U. S. 17A, *Ahles 18149.* Lee Co.: Near U. S. 15, about 1 mi n. of DuBose, *Freeman 56788.*

Small (1933), Fernald (1950) and Gleason (1952) give the range of this plant as Florida to Texas, and north to Georgia in the Atlantic States. The cited specimens extend the range northward to South and North Carolina.

Anthriscus scandicinus (Weber) Mansf.—NORTH CAROLINA. Madison Co.: Waste ground at Hot Springs, *Freeman 56330.*

This European weed is not mentioned by Small (1933) or Rodgers (1950). Fernald (1950) states that it is "as yet local" in southeast Virginia.

Chaerophyllum procumbens (L.) Crantz—NORTH CAROLINA. Alamance Co.: Wooded floodplain of Haw River, 11 mi. w. of Chapel Hill, *Radford 5572.* Lee Co.: Woods on floodplain of Cape Fear River near Hgih Hill, *Radford 5589.* Rockingham Co.: River bottom woods along Dan River, 1.5 mi. ese. of Leaksville, *Ahles 10780.* Warren Co.: Wooded slopes of river bottom by Jordan's Creek at Roanoke River, about 4 mi. n. of Church X Road, *Bell 2860.*

Although this species was listed by Curtis (1867) as growing in the "Mid. Dist." (Piedmont) of North Carolina, the manuals currently covering our area, as do Mathias and Constance (1944–45), give the range of this species as generally north and west of the Carolinas. Rodgers (1950) cites two nineteenth century collections from South Carolina, but speaking of North Carolina he says, "No collection is yet known from this state." Because the Curtis reference to *Chaerophyllum procumbens* has been either overlooked or, for lack of herbarium specimens, discounted by all contemporary workers, the species is here considered as new to the state, and the above collections are cited to show the plant to be growing at several points in the Piedmont of North Carolina. The determination of the Alamance County collection was verified by Dr. Lincoln Constance.

Hydrocotyle sibthorpioides Lam.—SOUTH CAROLINA. Darlington Co.: Lower lawn of Kalmia Gardens, Hartsville, *Bell 1574.*

Mathias and Constance (1944–45), Fernald (1950) and Gleason (1952) variously report the sporadic introduction of this small plant into the general area of Pennsylvania, Virginia, Kentucky and Indiana. This species is not mentioned by Small (1933), but specimens from North Carolina, Georgia and Louisiana are cited by Rodgers (1950), and an additional North Carolina station for the species is reported by Freeman (1955). No previous report of this plant from South Carolina is known.

Ptilimnium fluviatile (Rose) Mathias—NORTH CAROLINA. Chatham Co.: In gravelly, seeping soil; rocky bed of Deep River 1 mi. w. of Moncure below Lockville Dam, *Beard 1277.* Granville Co.: Wet sand, growing in sand bar in middle of Tar River 10 mi. s. of Oxford on N. C. 96, *Gillespie 397* (NCSC).

Small (1933) and Mathias and Constance (1944–45) treat this species as an Alabama endemic; Small uses the name *Harperella fluviatilis* Rose. Rodgers (1950) does not include the species for North Carolina. The first collection for this state was made by Beard while he was working on the flora of the Deep River basin.

Buddleia lindleyana Fort.—NORTH CAROLINA. Forsyth Co.: Escaped near Winston-Salem, *Schallert 508*.

Small (1933) under the name *Adenoplea lindleyana* (Fort.) Small gives "Fla. to Tex. and Ga." as the range for this species. In 1948 E. J. Alexander, H. E. Ahles and J. K. McGrath collected it as established in the vicinity of Jocassee, Oconee County, South Carolina. A specimen of this collection is in the personal herbarium of H. E. Ahles. Schallert's specimen appears to be the first collection for North Carolina. It is not known with any certainty that the plant is established in this state.

Centaurium umbellatum Gilib.—NORTH CAROLINA. Orange Co.: Lawn of President's Mansion, Chapel Hill, July 6, 1914, *W. C. Coker*.

Small (1933) does not include this species in his manual. Fernald (1950) says, "local, Que. to Mich., s. to Ga. and Ind.," and Gleason (1952), "N. S. to n. Ill." Because the limits of the range of this species are indefinite and because the Coker specimen is the only one from North Carolina found in any of the four herbaria, NCU, DUKE, NCSC or NY, the Orange County collection is considered to be the first record for North Carolina. It is probably only a sporadic waif in this state.

Ampelamus albidus (Nutt.) Britt.—NORTH CAROLINA. Halifax Co.: Climbing on other plants, roadside, Weldon, *Ahles 14831*; climbing in thickets along the Roanoke River just n. of Roanoke Rapids on N. C. 48, *Ahles 20732*. Warren Co.: Fence row and roadside at Eaton Ferry, Roanoke River, s. of Elams, *Bell 4363*.

Although Small (1933) under *Gonolobus laevis* Michx. states the range of this plant as "Fla. to Tex., Kans., and Pa.," Fernald (1950) and Gleason (1952) give the range in such a way as to exclude Florida and the Carolinas.

Phlox drummondii Hook.—SOUTH CAROLINA. Allendale Co.: Roadside about 2 mi. ese. of Ulmers on Co. Rt. 48, *Ahles 12578*. Beaufort Co.: Sand and shell dunes by U. S. 21, near Harbor River, *Bell 1723*. Colleton Co.: Roadside and low woods, Buckhead Creek along Co. Rt. 48, 3.4 mi. sw. of U. S. 21, *Bell 2286*. Hampton Co.: Roadside of U. S. 601 about 2 mi. nw. of Miley, *Bell 2564*. Jasper Co.: Roadside 2 mi. s. of Tillman on U. S. 321, *Bell 1663*.

This plant, native to the southwest, is considered by Small (1933) to be naturalized east to Florida and Georgia. It is now well established in some parts of South Carolina.

Heliotropium amplexicaule Vahl—NORTH CAROLINA. Anson Co.: Sandy pine-oak woods border, 1.6 mi. ese. of Cason Old Field, *Ahles 19471*.

Small (1933), under the name *Cochranea anchusaefolia* (Poir.) Guerke, gives the northernmost range of this plant as Georgia. It has been reported since for South Carolina by Smith (1946). Fernald (1950) gives the range of this species as "Fla. to Tex. and Calif. n. to N. J. and O." Gleason (1952) says, "S. C. to Fla. and Tex. occasionally n. to Va. and Mo." The lack of specimens from North Carolina in the local herbaria warrants the reporting of the Anson County collection.

Myosotis versicolor (Poir.) Sm.—NORTH CAROLINA. Granville Co.: Field at Creedmoor, *Radford 10449*.

Small (1933) does not mention this species, and Fernald (1950) cites it only as far south as Virginia where he collected it in Dinwiddie County (Fernald, 1938). It appears that there are no collections from North Carolina prior to 1956.

Verbena brasiliensis Vell.—SOUTH CAROLINA. Beaufort Co.: Railroad in Yemassee just s. of Co. line on U. S. 17A, *Bell 2520*. Cherokee Co.: Roadsides and fields, 3 mi. ne. of Chesnee, *Freeman 56425*. Chester Co.: Roadside, 0.25 mi. e. of Lockhart, *Freeman 56406*. Hampton Co.: Roadside, Yemassee, *Bell 2595*. Marlboro Co.: Roadside, Crooked Creek, 5 mi. sw. of Bennettsville, *Radford 15482*. Sumter Co.: U. S. 76 at the Wateree River, *Freeman 56809*. Union Co.: Waste places, Lockhart, *Freeman 56402*.

Small (1933) gives the range of this species as Louisiana. Since that time it has apparently become more widely spread. Fernald (1950) says, "Fla. to La. and n. to se. Va.," while Moldenke (1952) has a similar range, but extending it westward to Arkansas and also into southern California. Moldenke (1949) does not include this species for South Carolina.

Verbena × engelmannii Moldenke—NORTH CAROLINA. Ashe Co.: Banks of New River, Solitude P. O. (without date, collector or number).

This hybrid of *Verbena hastata* L. × *Verbena urticifolia* L. is not included by Small (1933) or Fernald (1950). Moldenke (1952) cites this hybrid from fourteen states; none, however, are southeastern except Tennessee and Kentucky. In his 1949 treatment he cites no records for North Carolina.

Verbena × hybrida Voss.—SOUTH CAROLINA. Darlington Co.: Low, sandy bottom lands, open woods, se. of Hartsville, April 8, 1921, *J. B. Norton*.

This common garden hybrid is not listed in Small (1933) or Fernald (1950). Moldenke (1952) says, "naturalized, Pa., O., Ia., Okla., occasionally found escaped elsewhere," and in his treatise of this family (1949) he does not cite any specimens of the hybrid from South Carolina.

Verbena rigida Spreng.—SOUTH CAROLINA. Allendale Co.: Sandy roadside, 2.6 mi. nnw. of Allendale on S. C. 28 and 3.8 mi. ene. on Co. Rt. 39, *Ahles 12581*. Beaufort Co.: Forming colonies on roadside, 1.6 mi. se. of Pocotaligo on U. S. 21, *Ahles 12368*. Colleton Co.: Road embankment, 1.4 mi. ne. of Ashepoo on U. S. 17, *Ahles 15505*. Dorchester Co.: Open sandy soil in and around Summerville, *Correll 5348* (DUKE).

Small (1933) gives the range of this introduced species as "W. Fla. to Tex. and N. C." Moldenke (1949) cites many specimens from Georgia, only a few from North Carolina, but none from South Carolina. Although South Carolina is well within the range of the species, the fact that Moldenke has not seen any specimens from that state warrants the inclusion of the collections cited above.

Perizoma rhomboidea (Hook.) Small—NORTH CAROLINA. Carteret Co.: By Beaufort Channel, Beaufort, *Rogers & Blomquist 3168* (DUKE). Orange Co.: Weed in arboretum of U. N. C., Chapel Hill, *Ahles 16310*. Rowan Co.: Abundant weed in cultivated field near Salisbury, Oct. 12, 1955 (sent in by County Agent), (NCSC); abundant garden weed, Spencer, *Ahles 14933*. SOUTH CAROLINA. Beaufort Co.: Along sidewalk, Hamar St., one block s. of Green St. (two blocks s. of National Cemetery), Beaufort, *Ahles 20926*. Newberry Co.: Near Wallace Home on Caldwell St., Newberry, *Freeman 56633*.

Small (1933) gives only Florida as the range of this plant which has been introduced into the southeast. It now appears to be well established at the North Carolina localities listed above, and also in the Piedmont and Coastal Plain of South Carolina. The two collections from Rowan County are from the same locality, where the plant has become an undesirable weed difficult to eradicate.

Ajuga reptans L.—NORTH CAROLINA. Orange Co.: Growing in bed of Siberian iris near bamboo colony in arboretum, Chapel Hill, *L. M. Radford & E. Wicker*; March 28, 1945, *W. Webb*; April 17, 1947, *B. Ivey 82;* May 3, 1949, *P. Titman*. Wake Co.: Campus, N. C. State College, Raleigh, April 13, 1943, *Wells* (NCSC); April 2, 1948, *Williamson* (NCSC).

Small (1933) makes no mention of this species. Fernald (1950) says, "Nfld., to Wisc. s. to Pa. & O.," and Gleason (1952) states, "rarely escaped near gardens." In Chapel Hill it has become fairly well established. The Orange and Wake County collections are being cited as the first report of this species for North Carolina.

Dicerandra densiflora Benth.—SOUTH CAROLINA. Jasper Co.: Sandy hills, lightly wooded, 7.9 mi. nw. of Tillman, 3.2 mi. se. of Seaboard Air Line Railway, *Ahles 18205;* also Oct. 11, 1956, *Ahles 20988*.

The range of this southern species is given by Small (1933) as "e. Fla. and Ga." In northwestern Jasper County this plant is very local on the same sand ridge as *Chrysobalanus oblongifolius*, and is probably also native here. The specimen was just coming into flower on September 9, and was in fruit on October 11.

Stachys sieboldii Miq.—NORTH CAROLINA. Cumberland Co.: Escaped weed in Butler's Nursery, July 2, 1951, *Butler & Totten*. SOUTH CAROLINA. Oconee Co.: Roadbank and upland woods by Co. Rt. 68, 2.4 mi. se. of Co. Rt. 17, w. of Madison, *Bell 3109*.

Small (1933) and Gleason (1952) do not include this species in their manuals, and Fernald (1950) does not give a range, merely stating that it spreads from cultivation but is hardly established. At the Oconee County locality this species is well established on a road bank.

Verbascum virgatum Stokes—NORTH CAROLINA. Moore County: Sandy roadside, 1 mi. s. of Aberdeen on U. S. 15–501, *Ahles 15377*.

Small (1933) gives South Carolina as the range for this species in the Atlantic States. Although Fernald (1950) says the range extends from Ontario to South Carolina, no specimens from North Carolina have been found in the local herbaria or in the Gray Herbarium prior to the Moore County collection.

Scoparia dulcis L.—SOUTH CAROLINA. Colleton Co.: Under highway bridge, along Combahee River on U. S. 17A, *Ahles 21030*.

This species has been reported by Pennell (1933) as far north as southern Georgia. It has not been reported previously for South Carolina.

Plantago hookeriana F. & M. var. **nuda** (Gray) Poe—NORTH CAROLINA. Moore Co.: Along railroad at U. S. 1 in Aberdeen, *Bell 2712*. Richmond Co.: Roadside 3 mi. ne. of Hamlet on N. C. 77, *Bell 2711*. SOUTH CAROLINA. Allendale Co.: Roadside of Co. Rt. 21 about 2.5 mi. sw. of Fairfax, *Bell 2648*. Bamberg Co.: Abundant on roadside with *Plantago aristata* Michx., 0.9 mi. ne. of Bamberg–Allendale Co. line (Salkehatchie River) on U. S. 301, *Ahles 12605*. Calhoun Co.: Roadside, 1.6 mi. s. of Calhoun-Richland Co. line (Congaree River) on U. S. 601, *Ahles 12608*. Chesterfield Co.: Roadside, 3.6 mi. ene. of Chesterfield-Kershaw Co. line (Lynches River) on U. S. 1, 1 mi. sw. of McBee, *Ahles 12612*. Colleton Co.: Cinder bed along railroad, Lodge, *Ahles 12146;* cinder bed along railroad, Green Pond, on S. C. 303, *Ahles 12169*. Hampton Co.: Associated with *Plantago aristata* Michx., roadside, 1.8 mi. nw. of Yemassee on S. C. 28, *Ahles 12412*. Kershaw Co.: Roadside, 0.5 mi. s. of jct. U. S. 601 and S. C. 12 on U. S. 601, *Ahles 12611*. Marlboro Co.: Roadside, 3.6 mi. ne. of Marlboro-Chesterfield Co. line (Pee Dee River) on S. C. 77, *Ahles 12613*. Oconee Co.: Common on roadside, 1.5 mi. ne. of Fair Play on S. C. 59, *Ahles 13360;* roadside, 1.5 mi. ne. of Tugaloo River on S. C. 59, *Bell 3085*. Orangeburg Co.: Roadside, 1.1 mi. ne. of Orangeburg-Bamberg Co. line (South Edisto River) on U. S. 301, *Ahles 12607*. Richland Co.: Roadside associated with *Plantago aristata* Michx., 2.1 mi. n. of Calhoun–Richland Co. line (Congaree River on U.S. 601, *Ahles 12609*.

In a revision of the *Plantago patagonica* complex Poe (1928) made the combination used here. These plants, now established locally along the roads of North and South Carolina, are described by Small (1913) under the name *Plantago Wrightiana* Decne. as native to Texas. Kearney and Peebles (1951) give the range of this western plant as "western Texas to central Arizona, Oregon and California." It has not been reported previously from the eastern United States.

Sphenoclea zeylandica Gaertn.—SOUTH CAROLINA. Jasper Co.: Weed in rice fields, Savannah River Wildlife Refuge, 1.3 mi. w. of jct. U. S. 17 & 17A, and n. on levee, *Ahles 18175*.

The range of this species is as yet too far south to be included by Fernald (1950) and Gleason (1952). Small (1933) gives the range as

"La. to Ark." Fox & Godfrey (1949) cite a specimen from Hyde County, North Carolina. In Jasper County it was found in only one rice field, but there fairly abundantly.

Wahlenbergia gracilis Schrad.—SOUTH CAROLINA. Aiken Co.: Weedy yard, about 2 mi. n. of North Augusta, *H. Laing 174.* Chesterfield Co.: Roadside, Cheraw St. Pk. near U. S. 52, *Radford 15890.* Colleton Co.: Weedy area along Seaboard Railroad on Co. Rt. 26, 8 mi. se. of U. S. 17, *Ahles 12226.* Darlington Co.: Damp soil back of Carnes farm about 5 mi. s. of Hartsville, *B. E. Smith 414;* damp soil along highway between Hartsville and Darlington, *B. E. Smith 415;* damp flats near Lauther's Lake, *B. E. Smith 416;* damp soil on Witherspoon Island, *B. E. Smith 1730.* Hampton Co.: Sandy field, 2.4 mi. ne. of Hampton on U. S. 601, *Bell 3935.* Lee Co.: Sandy roadside, 1 mi. sw. of Alcot on U. S. 15, *Ahles 15897.* Marlboro Co.: Field, 2.5 mi. w. of Blenheim, *Radford 12516;* roadside, 1.5 mi. e. of Wallace near N. C. 90, *Radford 15612;* roadside Muddy Creek se. of Marlboro, *Radford 19070.*

This species which is not found in the manuals by Small (1933), Fernald (1950) or Gleason (1952), has become very well established in many places in South Carolina and northern Florida. The first collection from South Carolina in the herbaria is dated 1939, from Darlington County. Extensive collecting in 1956 has yielded records from six additional counties in this state. It is difficult to determine how long the species has been established in this region.

Artemisia vulgaris L.—SOUTH CAROLINA. Laurens Co.: U. S. 221 at the Enoree River, *Freeman 56920.*

Small (1933) in his range "Ga. to Ala., B. C., Ont. and Newf." would include this species as occurring in South Carolina, and Cronquist (1952) with the vague "established throughout most of eastern U. S. and adjacent Canada," might also include South Carolina. Fernald (1950) gives the range "Nfld. to Ont., s. to N. S., N. E., Del., Pa., casually to Ga., Mich., Wisc. and Minn." Since there were no South Carolina specimens at NCU, DUKE or NCSC, it seems that the Laurens County collection should be cited as the first record of the species for that state.

Bidens pilosa L. var. **radiata** Bip.—SOUTH CAROLINA. Georgetown Co.: Sandy bank, causeway across marshes at Georgetown, *Godfrey 50911.* Jasper Co.: Weed around Little City Motel, Ridgeland on U. S. 17, *Ahles 12397.*

Sherff (1937) in his monographic treatment of the genus restricts the range of *Bidens pilosa* L. to the extreme southwestern United States and southward through Mexico. The plant in the eastern United States he refers to as var. *radiata,* but cites no specimens from South Carolina. Fernald (1950) says for this plant, "casual weed n. to Mass.," and Cronquist (1952), "ballast waif at Philadelphia." Sherff (1937) cites specimens from Massachusetts and New Jersey, indicating that it is sporadic at least as far north as Massachusetts. Wiegand (1933) gives the range as Florida, southern Georgia and Alabama. Godfrey (1950) cites one specimen from North Carolina.

Chrysanthemum lacustre Brot.—NORTH CAROLINA. Chowan Co.: In ditch on N. C. 32, 1.9 mi. n. of Edenton, July 12, 1949, *E. T. Browne, Jr.* Stanly Co.: Low depression, 0.8 mi. nw. of Richfield, *Ahles 16174*.

This species, native to Portugal according to Bailey (1950), is not included as an introduced plant in North America by any of the works cited in this paper. A specimen at DUKE labeled "Beach of Lake Huron, Mackinaw Island, Michigan, July 28, 1935, H. A. Gleason," would seem to warrant its inclusion in the manuals of the northeastern United States. It is occasionally cultivated and apparently spreads from this source. The two specimens cited above constitute the first report for North Carolina.

Cirsium arvense (L.) Scop.—NORTH CAROLINA. Ashe Co.: Flat bottomlands along New River, Sept. 21, 1946 (collector not given, NCSC). Haywood Co.: Open grassy pasture, Crabtree Bald knoll, se. of summit. Plentiful in small area, *Quarterman 85* (DUKE). Jackson Co.: Pisgah Forest, July 25, 1940, *H. Myres*. Swain Co.: Edge of abandoned road, s. of Black Camp, *Blomquist 9757* (DUKE). Transylvania Co.: Open pasture in the Pink Beds, *Correll 3389* (DUKE).

Although Small (1933) gives the range as "N. C. to Kans., B. C. and Newf.," the preceding collections seem worthy of record, since Fernald (1950) gives the range south only to Virginia, while Cronquist (1952) says northern United States and southern Canada.

Coreopsis basalis (Dietr.) Blake—SOUTH CAROLINA. Beaufort Co.: Cinder bed along railroad, 0.4 mi. e. of Burton on U. S. 21, *Ahles 12347*. Colleton Co.: Railroad at Green Pond, on S. C. 303, *Bell 2326*. Hampton Co.: Very abundant along railroad, Early Branch on S. C. 28, *Ahles 12445*.

Watson (1933a), under *Coreopsis drummondii* (D. Don) T. & G., gives the range of this species as Texas, and states that it is an escape from cultivation eastward. Fernald (1950) says that it spreads to waste ground. Cronquist (1952) reports it as found occasionally as an escape from cultivation. Godfrey (1950) reports it as abundantly naturalized around Southport, Brunswick County, North Carolina. In the three stations cited above for South Carolina, plants of this species were well established in good-sized stands, always near or on railroad ballast.

Cosmos bipinnatus Cav.—SOUTH CAROLINA. Chesterfield Co.: Roadside, 2.5 mi. nw. of Jefferson, *Radford 18792*.

Alexander (1933) gives the range of this species as Florida, Fernald (1950) says that it is becoming established southward, and Cronquist (1952) gives the range as Arizona and Central Mexico, cultivated elsewhere and frequently escaped. Thorne (1951) cites it from Georgia as infrequent along roadsides. No record of the occurrence of this species in South Carolina prior to 1956 has been published.

Crepis pulchra L.—SOUTH CAROLINA. Chesterfield Co.: Waste place, Forked Creek, 1 mi. e. of Jefferson, *Radford 12385*. Oconee Co.: Once-cultivated field, about 7 mi. s. of Westminster on Co. Rt. 20 at jct. Co. Rt. 140, *Ahles 14047*. Pickens Co.: Field, 0.7 mi. nw. of Norris on S. C. 137, *Bell 3458*. Union Co.: U. S. 176, 4 mi. n. of Union, *Freeman 56147*.

This taxon is not in Small (1933). Fernald (1950) gives the range as Virginia and Indiana. Cronquist (1952) gives it as Virginia, Ohio and Indiana. Fox & Godfrey (1949) report it from three counties in North Carolina, and as abundant at each locality. Freeman (1955) reports it as occasional in Polk County, North Carolina. During 1956 many additional collections of it were made in North Carolina. The Oconee, Pickens and Union County collections in 1956 constitute the first report of this species from South Carolina.

Facelis retusa (Lam.) Sch.-Bip.—SOUTH CAROLINA. Allendale Co.: Sandy roadside, 0.1 mi. nne. of Co. Rt. 26 on Co. Rt. 49, *Ahles 12523*. Anderson Co.: Sandy roadside, 3 mi. ese. of Fair Play, *Ahles 13416*. Beaufort Co.: Cinder bed along railroad at station, Sheldon, *Ahles 10367*. Colleton Co.: Weed in once-cultivated field, Ritter, *Ahles 10538;* sandy roadside, near Ashepoo River, about 1 mi. s. of Ritter on Co. Rt. 41, *Ahles 12189*. Hampton Co.: Low woodland, 2.8 mi. se. of Furman on U. S. 621, *Bell 1800*. Jasper Co.: Lawn weed, Ridgeland, *Ahles 10358;* roadside, 5 mi. s. of S. C. 128 on S. C. 170, *Ahles 12392*. Newberry Co.: Indian Creek, 7 mi. sw. of Whitmire, *Freeman 56223*. Orangeburg Co.: Roadside near Bowman, common in waste places and meadows, *Freeman 56168*. Pickens Co.: Dry upland pasture, 1.4 mi. w. of Pumpkintown, on S. C. 11, *Ahles 14366*.

Under the binomial *Facelis apiculata* Cass., Small (1933) states the range as "coastal plain & piedmont, Fla., Ala. and Ga." Fernald (1950) and Cronquist (1952) do not include the species. Thorne (1954) reports it as common in Georgia, and Godfrey (1950) cites a specimen from Cleveland County, North Carolina. Apparently it has become more abundant in the last few years and there are now specimens from many more North Carolina counties. In 1956 collections were made in nine counties of South Carolina, a state from which the species had not been reported previously.

Helianthus maximiliani Schrad.—NORTH CAROLINA. Cleveland Co.: Open field along stream, 2 mi. ssw. of Mooresboro, *Ahles 19200*. Forsyth Co.: Open place (without further data), *Schallert 610* (det. C. B. Heiser, 1955). Rockingham Co.: Roadside, 1.75 mi. nw. of Lawsonville, *Radford 18569*.

Watson (1933), Fernald (1950) and Cronquist (1952) all give the range of this species as west of the Mississippi River, and state further that it is adventive, escaped or introduced eastward.

Helianthus radula (Pursh) T. & G.—SOUTH CAROLINA. Colleton Co.: Sandy roadside of Co. Rt. 24, by pine woods, 0.5 mi. nw. of jct. with Co. Rt. 34, frequent locally, *Bell 5382*. Hampton Co.: Sandy upland, 2.2 mi. s. of Brighton on dirt road, *Bell 4985;* pine savannah, 0.4 mi. n. of Jasper-Hampton Co. line on S. C. 128, *Ahles 18374;* pine savannah, 0.1 mi. w. of Hampton-Jasper Co. line on U. S. 321, 1 mi. e. of Garnett, *Ahles 21009;* pine savannah, 0.7 mi. ne. of Early Branch, *Ahles 21019.* Jasper Co.: Pine savannah, 2 mi. n. of Hardeeville on U. S. 321, *Ahles 18191;* sand hill by Co. Rt. 41, w. of Barton and 0.5 mi. s. of jct. with Co. Rt. 23, *Bell 5114;* pine savannah and roadside, 3.3 mi. n. of Hardeeville on U. S. 601, *Ahles 20972.*

It is very surprising to note that Watson (1933) does not include South Carolina in the range of this species ("Fla. to Ala. and Ga."). In South Carolina it appears to be a very definite part of the flat pine-savannah flora. At each locality cited it was conspicuous and at least frequent, if not common. It was observed in many more localities within the cited counties, but specimens were not collected from all of them.

Hypochaeris glabra L.—NORTH CAROLINA. Alexander Co.: Open stream bank, Middle Fork of Little River near jct. with Catawba River sw. of Taylorsville, *Radford 18167.*

No collections of this species were found from North Carolina at NCU, DUKE, NCSC or NY. Fernald (1950) does not include this species, while Cronquist (1952) says, "established in the Pacific states, and has been collected several times apparently as a waif in our range." Small (1933) gives a very ambiguous range, "n. Fla. to Ohio and Me." It is well established at the locality cited above and is here recorded as new for that state.

Iva ciliata Willd.—NORTH CAROLINA. Anson Co.: Abundant on roadside and field edges for a stretch of one mile, 1 mi. s. of Pee Dee River on N. C. 109 and 1 mi. e. on dirt road, vicinity of Cedar Creek, *Ahles 19498.* Franklin Co.: Weed in cultivated field, 0.4 mi. nw. of Sutton, *Ahles 20664.* Halifax Co.: Abundant on edge of cultivated field, 4.1 mi. se. of Weldon on U. S. 301, *Ahles 20820.*

The range of this species as a native plant is predominantly central United States and introduced eastward to Alabama according to Small (1933), and New England according to Fernald (1950). The three collections cited are all close to the fall line, two in the northern part, and one in the southern part of the state. Only at the Franklin County locality was this species scarce.

Lapsana communis L.—NORTH CAROLINA. Haywood Co.: Open moist hillside, Waynesville, lower part of trail to summit (of) Eaglenest, *Quarterman 74* (DUKE).

Fernald (1950) gives the range of this species as "Que. and Ont., s. to N. S., N. E., Va., W. Va. and Mo." Cronquist (1952) also has Virginia as the southernmost state on the Atlantic seaboard. Small (1933) does not include the genus. The above cited specimen is therefore taken as a southward extension of the known range.

Leontodon leysseri (Wallr.) G. Beck—NORTH CAROLINA. Clay Co.: Roadside, Buck Creek area near U. S. 64, w. of Black Gap, *Radford 16202.*

This species is not included by Small (1933). Fernald (1950) gives the range south to Ohio and New Jersey, while Cronquist (1952) has it south to the District of Columbia. The Clay County collection represents a southward extension of the range. Superficially this species very closely resembles *Hypochaeris glabra.*

Picris hieracioides L.—NORTH CAROLINA. Buncombe Co.: Habitat in vicinis Asheville, Maio, 1888, *Gerald McCarthy.* Haywood Co.: Junaluska Mt., *Blomquist 5291* (DUKE); moist open pasture, Waynesville, near summit of Eaglenest, *Quarterman 73* (DUKE).

Small (1933) does not include this species in his manual. Fernald (1950) says it occurs south to New Jersey and Pennsylvania, and Cronquist (1952) south to the District of Columbia.

Rudbeckia mollis Ell.—SOUTH CAROLINA. Jasper Co.: Open sand hills, 8.5 mi. nw. of Tillman, 2.6 mi. se. of Seaboard Air Line Railway (this is presumably the town of Myres), *Ahles 18216.*

This species has been reported by Boynton (1933) from Florida and eastern Georgia. The Jasper County specimen is therefore a northward extension of range. It is very probable that this is a native plant here, occurring as it does on the same sand ridge with *Chrysobalanus oblongifolius* and *Dicerandra densiflora.*

Soliva sessilis R. & P.—NORTH CAROLINA. Carteret Co.: Lawn from Beaufort, May 1, 1953, *A. H. Newsome* (NCSC). SOUTH CAROLINA. Orangeburg Co.: Weed in lawn, Edisto Gardens along Edisto River, *Ahles 10695;* same locality, *Freeman 56165.*

Small (1933) gives the range of this species as "n. Fla. to La." Thorne (1951) supplements this by reporting it from Georgia. The three above collections extend the range northward into South and North Carolina.

Tragopogon dubius Scop.—NORTH CAROLINA. Catawba Co.: Weed along railroad, 2.6 mi. e. of Conover, *Ahles 12984.*

Small (1933) does not include this species in his manual. Fernald (1950) gives it south only to Virginia, while Cronquist (1952) says, "established over most of the U. S., more common westward." The absence of North Carolina specimens at NCU, DUKE, NCSC and NY seems to justify recording the species as new to North Carolina.

Verbesina encelioides (Cav.) B. & H.—NORTH CAROLINA. Robeson Co.: Scattered in pasture on upland, 20 mi. w. of Lumberton, Sept. 4, 1953, *B. W. Wells* (NCSC). SOUTH CAROLINA. Sumter Co.: Sandy waste ground, abundant, southern city limits of Sumter, *Ahles 15896;* Wedgefield at the jct. of S. C. 763 & 261, *Freeman 56804.*

Small (1933), under the name *Ximenesia encelioides* Cav., places this species as indigenous west of the Mississippi, and cites it as introduced in Alabama and Key West, Florida. Fernald (1950) has it adventive in Missouri and occurring casually to New England. Cronquist (1952) says it is occasionally introduced eastward. In the vicinity of Sumter, in Sumter County, South Carolina, this species is so abundant as to create large yellow masses in almost every vacant lot.

Summary

One hundred state records are reported: fifty taxa are reported for the first time from North Carolina, and fifty taxa from South Carolina. Two hybrids and only four subspecific taxa are included in the records, and of these latter, two varieties, *Plantago hookeriana* var. *nuda* and *Bidens pilosa* var. *radiata,* also represent species new to the respective states for which they are reported. Of the total of eighty-eight taxa treated as new to one or both of the Carolinas, fourteen taxa represent native plants, sixty-seven taxa represent introduced plants, and seven taxa (*Digitaria filiformia, D. texana, Paspalum plicatulum, Scirpus koilolepis, Phyllanthus pentaphyllus, Callitriche terrestris* and *Ampelamus albidus*) represent plants of questionable origin in the Carolinas. Vouchers for all records are deposited in the Herbarium of the University of North Carolina unless otherwise indicated.

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Bartholomew's Cobble.[1]—This unpaged pamphlet briefly describing the geological and botanical features of a rocky 30 acre reservation near Ashley Falls, Massachusetts, is noteworthy because of the accurate list of plants of the area provided. The pamphlet is made attractive with six full-page photographs of a few of the interesting plants found at the Cobble and of the Cobble itself. The plant list is mostly based upon studies made by the late C. A. Weatherby, who was extremely interested in having the natural features of the area preserved for the enjoyment of present and future generations. It is fortunate that the Cobble is in the hands of the Trustees of Reservations so that preservation is now assured. The Trustees of Reservations is a non profit corporation composed of public-spirited citizens in Massachusetts who have an interest in preserving distinctive parts of our heritage from threatened destruction or irreparable alteration. The organization has been in existence for over 65 years and has by acquisition and management done much to make places of beauty and of historical interest within the Commonwealth available to the public.—R. C. Rollins.

[1] Bartholomew's Cobble, by Herbert J. Arnold and S. Waldo Bailey. Published by, and available from the Trustees of Reservations, 50 Beacon Street, Boston 8, Mass., $0.50.

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Rhodora

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DISTRIBUTION OF LITTORELLA AMERICANA IN THE MID-ARROWHEAD REGION OF MINNESOTA

Olga Lakela

Professor Fernald in separating *L. americana* from *L. uniflora* (L.) Asch.[1] refers to the plant as one of the rarest in North America, known only from a few localities throughout its range from Newfoundland to Minnesota. Until recently the collection of L. H. Bailey, no. 437, Basswood Lake, July 28, 1886 appears to have been the only record from the state.

L. americana first came to my attention while I was collecting in the "Roadless Area" of St. Louis County. Plants without flowers or fruit (no. 16743, August 9, 1953) were collected from a submersed colony with *Lobelia Dortmanna,* growing on a sandy bottom in shallow shorewaters of Iron Lake on the Ontario border. On the following day it was found again in Lac La Croix, at Beatty portage from Loon Lake. Plants in vegetative condition, no. 16756, were collected from a colony submersed in shallow water, again associated with *L. Dortmanna.* In each site the bottom soil was mostly a mixture of gray sand with black organic soil, peaty or mucky. Identification of the species in vegetative condition remained doubtful until 1957. In dealing with the known flora from Lake County for the manuscript of a *Flora of the Mid-Arrowhead Region,* Bailey's early collection of flowering plants was studied. This decisively cleared the identity of the sterile specimens.

In the ensuing search for additional flowering material in late season Basswood Lake seemed most accessible. Working from

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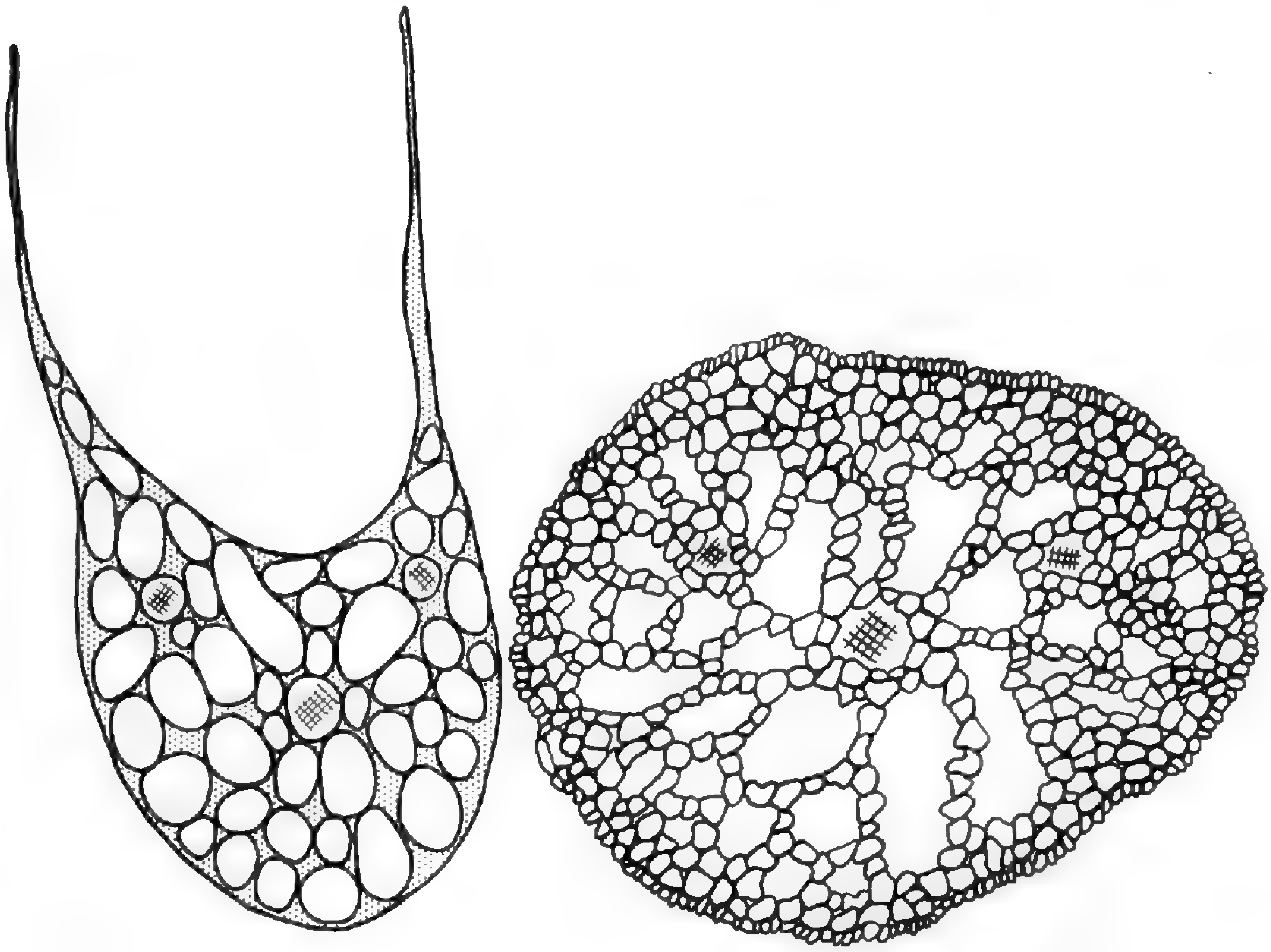
[1] Rhodora **20:** 61–62. 1918. *The North American Littorella.*

the Quetico-Superior Wilderness Research Center at Basswood Lake, after an extensive fruitless search of the more distant shores, *Littorella* was sighted without effort in the "home harbor" shore of the Center bay near the boat docks. The compact colony growing in silty sand was stranded above the water level. The associate species was *Ranunculus repens*. Coll. no. 22417, Sept. 10, 1957, consists of plants in late anthesis, with some mature fruits.

The label data of Bailey's collection lacks a specific location on Basswood Lake. The finding of the species there again temptingly invites one to visualize Dr. Bailey towering over the spot preferred by a persistent colony of *Littorella.* However, in reality, the occurrence of a solitary colony on a lake with several hundreds of miles shoreline is presumptuous.

L. americana was encountered again in Snow Bank Lake, located in the north central part of Lake County, about three miles south of the Canadian border. Here, in peaty sand of shallow waters of the bay south of the Resort, *Subularia aquatica,* in late flower and fruit, occurred in abundance with *Isoetes muricata.* Farther south in an adjoining bay some dozen plants of *Nymphaea tuberosa* were in full flower. Not far from the latter site on the sandy shore was an emersed colony of sterile *Littorella*, no. 22492 Sept. 14, 1957. Perhaps it was the stranded part of a much larger submersed colony 5–10 feet from the beach at a water-depth of 2–3 feet which covered square yards of the sandy, cobblestone strewn bottom. The plants were clearly visible in the early morning sun, but almost beyond the reach of the collecting tool. Only a few plants dislodged from the seemingly hardened sediment floated to the surface with fragments of *Myriophyllum tenellum.*

It may be permissible to state here that botanizing is catching. On finding *Littorella* at the Quetico-Superior Research Center, the plants were shown to Mr. Otto Oltman, foreman, with a request that he try to find and collect the species during an anticipated canoe trip through the wilderness canoe country. His collection of *Littorella*, from the shore of an island in Malberg Lake about 4 miles west of Cook County, Sec. 8, T. 63, R. 6 W, September 19, 1957, was a welcome contribution to knowledge of this little known species. Thus within a space of a week, three new localities were discovered. The Ontario site in the accompanying map is based on a sight record made September 2, 1956; circumstances prevented collecting at the time. The colony may be found on the shore of a small bay connected with Crooked Lake by a narrow channel, opposite Curtain Falls Resort Area.



Littorella americana. Fig. 1, at left, sheathing leaf-base, × 30; tissues stippled, clear areas air-chambers or lacunae, vascular traces cross-hatched.
Fig. 2, at right, cross section of leaf near the middle, × 50; cells in outline only; epidermis without chlorophyll; (elongate cells with straight walls in face view not shown); stomata numerous throughout; mesophyll spongy with radial lacunae; traces cross-hatched.

In studying living plants of *Littorella* discrepancies in descriptions of leaves by different authors came to my attention. According to N. C. Fassett,[2] the leaves are "rather stiff dark thread-like." H. A. Gleason[3] notes their shape as "linear." In his illustration of the plant as a whole, they are depicted as being flat and thin. Professor Fernald features leaf morphology as one of the diagnostic differences between the American and European

[2] Manual of Aquatic Plants p. 313–314, 1940.

[3] The New Britton and Brown Illustrated Flora of the United States and Canada Vol. 3, p. 273, 1952.

species. In describing *L. americana,* he observed the leaves as "flattish, falcate-arcuate or straightish"; in *L. uniflora,* as "subterete or semi-cylindric."

It may not be amiss to place on record another description based on the study of living plants from five different localities. Mature fully turgid leaves are subulate, falcate-arcuate, lustrous, bright green to yellowish green above the white bases. The blade distally above the shallow groove of the sheathing leaf-base, feels and looks terete, firm and pliable. The rich green tips of young leaves, two in alternate succession, embraced within the scarious-margined bases of opposing mature leaves are somewhat compressed but soon become subulate. Microscopically the mature leaves are nearly terete or at least more than semi-circular with concentric mesophyll centered about the median trace. The large air chambers appear to be radial; the two smaller traces are elevated above the median plane, cf. fig. 1 & 2.

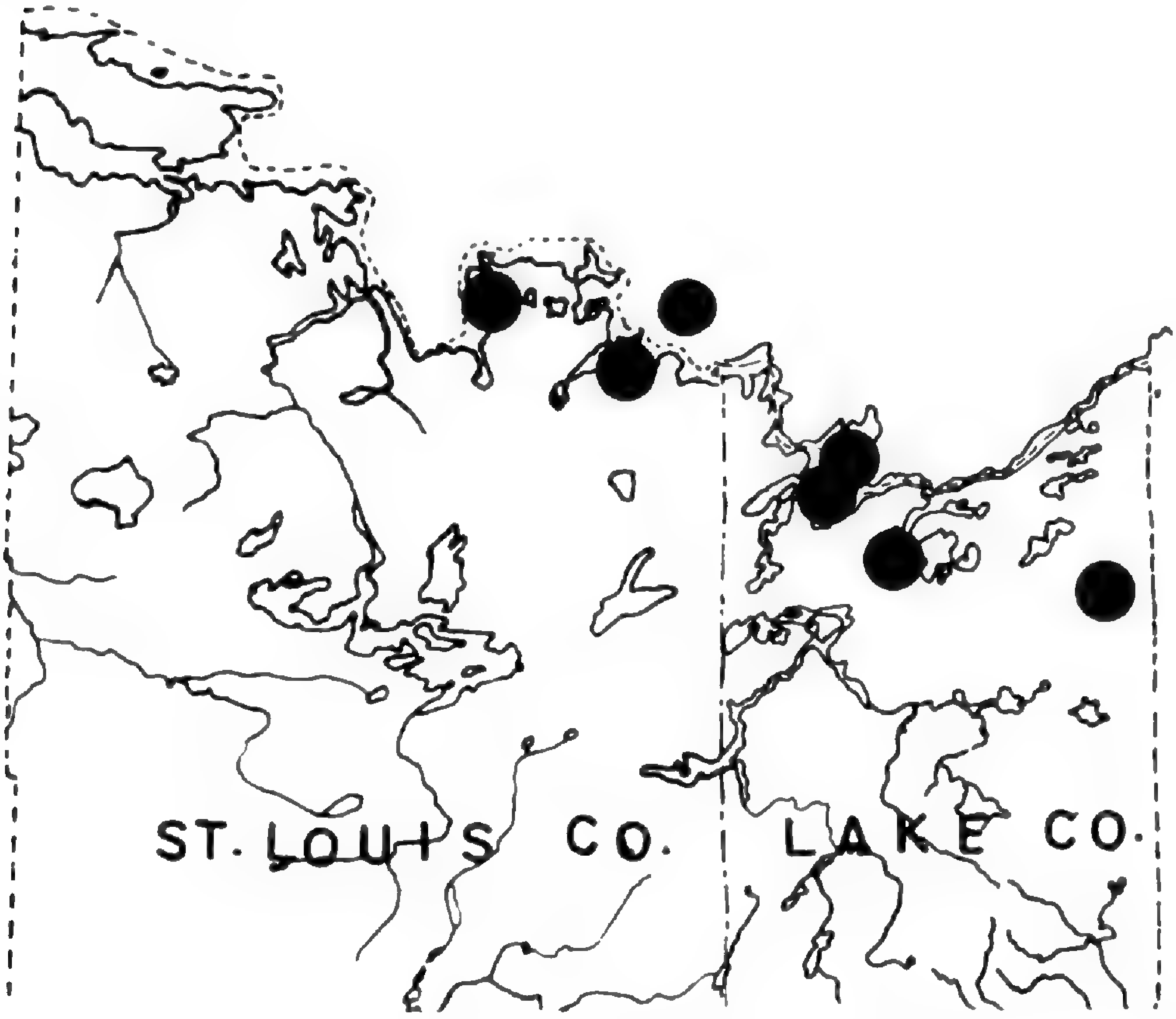


Fig. 3. The known sites of *Littorella americana,* in the upper portions of St. Louis and Lake Counties, mid-Arrowhead Region, Northeastern Minnesota.

Although *Littorella uniflora*, the European species has not been studied, descriptions of its leaves as, "subterete or semi-cylindric" indicates a similarity to those of *L. americana.* Otherwise, in floral structures and size Minesota plants well agree with Fernald's descriptions. The purplish-black fruit in maturity appears terete, apiculate with a short stipe and a minutely rugose pericarp.

Plants collected in late October show yellowing and gradual decay of the older leaves. Under greenhouse conditions the young leaves continue growth. The renewed overwintering rhizome of the season is 2–3 mm. thick and about as long; rhizomes of the previous years are persistent, subject to gradual decay. Whether the plants are stranded or submersed, they are readily recognized in field studies. The terete-appearing leaves, 1–2.2 mm. thick near the midpoint cannot be confused with *Ranunculus repens.*[2] Their outwardly-arching habit sets them apart from the linear-compressed obtuse leaves of *Lobelia Dortmanna,* which are broadly elliptic in cross-section, with two lacunae flanking the median trace.

The author is indebted to the Quetico-Superior Wilderness Research Center for courtesies pertinent to facilities for field studies, the Graduate School of University of Minnesota for defraying the cost of collecting and Dr. J. B. Carlson and Donald W. Davidson, Duluth Branch, for preparing the illustrations.—
UNIVERSITY OF MINNESOTA, DULUTH BRANCH.

EXPERIMENTS AND OBSERVATIONS BEARING ON EVOLUTION IN OENOTHERA

R. RUGGLES GATES[1]

I

During an examination of the collections of *Oenothera* in the Gray Herbarium, Harvard University (Gates, 1957), a new species *Oe. perangusta* (Gates, 1950) was described from the North shore of Lake Superior. One specimen in the collection from Jackfish Station differed from the rest in having deep red stems and buds. It was recognized as a mutation parallel to the red-budded mutation from *Oe. Lamarckiana* (Gates, 1911)

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[1] Cambridge, Mass.

and was therefore called *Oe. perangusta* var. *rubricalyx.* While in Vancouver, B. C., in 1953 I found in the herbarium of the University of British Columbia, through the courtesy of Professor Hutchinson, specimens of the same species and its red-budded variety originally collected from the same locality. On my way East I was able to stop at Jackfish, and had the good fortune to find the original locality from which the red-budded mutation was derived.

About 1400 feet east of Jackfish Station on August 28, 1953 near the railway, a colony of *Oenothera* was found in which were counted 7 plants with red stalks in fruit and many young rosettes also evidently of the red variety (as shown by the red colour ventrally of the midribs), as well as one plant of the ordinary type with green stems. A specimen was collected for the Gray Herbarium. The red plants in this clump must all have been descended from the original mutation. How old this colony is can only be conjectured, but Mr. Peter Leschuk, who managed the local hotel and afterwards sent me seeds on Sept. 28 when they were ripe, thought he remembered seeing the red form here as a boy. The clump might easily be destroyed by railway operations. Search of the area failed to reveal more than the one group of red plants.

In June, 1954, returning from Japan over the same route, many observations of *Oe. perangusta* were made. The species was very uniform all along the north coast of Lake Superior from Schreiber Station, where there were large colonies, to Terrance Bay, near Angler Station, at Marathon and along the C.P.R. line to Heron Bay. At the last locality were large numbers of plants in their favorite habitat, loose sand and gravel on the steep railway embankment some 400 yards west of the station. Nowhere were red plants seen except in the clump near Jackfish Station. The same species was afterwards seen growing by the railway near Hamilton, Ont. It thus evidently occupies a wide area in Ontario, from the north shore of Lake Superior to Hamilton on Lake Ontario and the Bruce Peninsula (Gates, 1950) of Lake Huron.

II

All the small-flowered Oenotheras, including nearly all the species in Canada, are self-pollinating. There is clear evidence, however, that cross pollination occasionally occurs between different forms occupying the same area. Such crosses are an important factor in the evolution of the genus, and it is therefore desirable to obtain some evidence of the frequency with which cross pollination takes place in nature. For this purpose the ideal would be to use *Oe. perangusta* and its dominant red mutation, planting them in alternate rows and collecting open-pollinated seeds from the green form. Any plant with red buds derived from these seeds would then be the result of cross-pollination.

Before seeds of *Oe. perangusta* and its red form were available, this experiment was tried with *Oe. Victorini*, a species with somewhat larger flowers which may be somewhat less strictly self-pollinating. Seeds of *Oe. Victorini* were obtained from the Montreal Botanical Garden through the Director, Professor Jacques Rousseau, and of a strain of *Oe. blandina* containing the gene (*rubricalyx*) for red buds from Professor D. G. Catcheside. These were grown at the Bussey Institution, Jamaica Plain, Mass., the facilities being kindly provided by Professor Karl Sax of Harvard University. The two species were planted in four alternate rows, ten plants to each row. When the seeds were collected on September 15, 1953, only nine plants of *Oe. blandina rubricalyx* had flowered, mostly from side branches. They also came into flower later than *Oe. Victorini*. The 20 plants of this latter species all flowered and were full of seeds, many of the capsules having already shed some of their seeds. Since the species with red buds began flowering later, only the later seed capsules of *Oe. Victorini* were collected, four capsules from each of 12 plants.

As a partial control of the frequency of crossing, the number of capsules on 12 plants of *Oe. Victorini* was roughly estimated. They totalled 2305, with a range from 100 to 385 per plant. Estimating 300 seeds per capsule, a total of 691,500 seeds could have been exposed to "red" pollen in time to ripen before the frosts. It was judged that 10 lower capsules per *Victorini* plant or 36,000 seeds, were fertilized before the *blandina* pollen began to be produced. Subtracting this number leaves 555,500 seeds probably exposed to "red" pollen.

About four capsules each from eleven exposed *Victorini* plants were sown on vermiculite in the greenhouses of the Bussey Institution on Ooctober 2, 1953. On January 16, 1954, they had produced 3395 young rosettes, two of which had ventrally red midribs and would therefore have red buds. This gives a very tentative crossing frequency of 1:1698. Later attempts to get results on a large scale, using *Oe. perangusta* and its red variety, have not succeeded because the plants remained rosettes which failed to survive the winter season.

III

One incidental observation is worth recording. *Oenothera* flowers are generally visited by nocturnal moths after the flowers open in the evening. Their long proboscis enables them to suck up the nectar which is secreted in the hypanthium and fills the lower part of this tube. Bees may also be seen visiting *Oenothera* flowers. One bee which was carefully observed visited flower after flower in a routine way. Being unable to obtain the nectar at the base of the hypanthium in the normal way by sucking it up from the inside, it lighted on a petal, then walked down the slender hypanthium, punctured it at the base just above the ovary, and lapped up the nectar, leaving an ooze of nectar where its short proboscis had been withdrawn. The pollination mechanism was thus entirely bypassed, the bee obtaining the nectar without entering the flower. This was done with flower after flower on different plants as a regular routine. Whether this bee was exceptional in having discovered a way to circumvent the floral mechanism, or whether this is a general custom of bees in the New England area or elsewhere is unknown. It shows at any rate that some bees have developed an efficient method of their own for extracting the nectar from *Oenothera* flowers. The fact that each flower is punctured in the position to obtain the maximum amount of nectar from the nearly erect hypanthium, seems to show a mental activity closely akin to intelligence.

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PLANT NOTES FROM ILLINOIS

Glen S. Winterringer

Several plant species of western United States have made their way into Illinois and have apparently become established, e.g., *Froelichia gracilis* (Hook.) Moq., *Callirhoe involucrata* (T. & G.) A. Gray, *Salvia pitcheri* Torr., *Salvia reflexa* Hornem. and several others. The newest arrival is *Phlox gracilis* (Hook.) Greene which according to William A. Weber is, "a common but inconspicuous weedy annual of the mesas and foothills". Such a habitat sounds strange when applied to plants collected in Illinois for this little weed was found in mid-May growing along the shoulder of a main highway west of Niantic in Macon County. It seems likely to the writer that this small weedy annual may have grown in the area for some time and has been overlooked. It would be interesting to know how the plant actually arrived in the Illinois area. In these days of superhighways and transcontinental travel it is not surprising that seeds or even plants are transported from one corner of the continent to another. What may be more important is the ability of a species, even a weed, to adapt itself in this new locality. Continued observations of this weedy Phlox will be made during subsequent growing seasons. Collection data. Macon Co.: May 12, 1957, shoulder of Highway No. 36, 2½ mi. W. of Niantic, *G. S. Winterringer 14003.* Another collection same locality May 16, 1957, *G. S. Winterringer 14001, 14002.* Specimens are in herbaria of the following: Illinois State Museum, Illinois Natural History Survey, and the University of Colorado.

The following items are listed either (a) they are new for the state or (b) they are very infrequently collected plants in Illinois. The writer expresses thanks to R. T. Rexroat of Virginia, Illinois, for his contribution of excellent botanical specimens.

Species New to the State

Scleria reticularis Michx. Cass Co.: east of Beardstown, Sept. 14, 1956, in sand at edge of peaty sand hole, *R. T. Rexroat 3438.* Specimen verified by Earl T. Core. In August, 1957, Rexroat reported an abundance of this species in the same area.

Falcaria sioides (Wibel) Aschers. Schuyler Co.: 2 mi. W. of Frederick, June 28, 1955, moist soil, *R. T. Rexroat 1800.* Verified by

Mildred E. Mathias. This species was not recently observed in the same area.

Infrequently Collected Plants

Aristida desmantha Trin. & Rupr. Morgan Co.: Oct. 12, 1956, E. of Meredosia; dry and sandy, *R. T. Rexroat 3516, 3517*. Cass Co.: Sept. 14, 1956, E. of Beardstown; sand, *R. T. Rexroat 3434, 3435*. Mason Co.: Oct. 9, 1955, W. of Saidora, sand, *R. T. Rexroat, 2426, 2403, 2427, 2428*. Oct. 18, 1954, with no definite county locality, dry sand, not common, *R. T. Rexroat 1294*. The Mason Co. specimens verified by Jason R. Swallen. Originally collected in Illinois by M. S. Bebb in 1861. Since that time it was collected by V. H. Chase in 1929 and by H. E. Ahles in 1950. The Morgan and Cass County locations are new.

Echinodorus parvulus Engelm. Cass Co.: Aug. 13, 1957, E. of Beardstown, moist peaty sand, *R. T. Rexroat 4150, 4151, 4152*. The collector reported numerous plants of this species in the area. Previous Cass and Mason County records are indefinite. A collection was made in St. Clair County in 1892.

Zizania aquatica L. Mason Co.: Aug. 19, 1956, S. of Havana; in shallow spring water, *R. T. Rexroat 3225, 3226*. The reason for reporting these collections is the apparently unusual length of the culms which, according to the collector, were from 11 to 13 ft. in length. Leaves, near the upper part of the culm, 2 in. wide and wider on the lower part.

Tradescantia bracteata Small. Mason Co.: May 31, 1953, SW. part of the county, in sand and sun, fls. blue, *R. T. Rexroat 182*, and same date, fls. rose, *R. T. Rexroat 763*.

Trillium recurvatum, forma **shayi** Palmer & Steyerm. Cass Co.: May 14, 1953, NE. of Virginia in woods, *R. T. Rexroat 85*.

Iris brevicaulis Raf. Morgan Co.: June 15, 1955, 10 mi. NW. of Jacksonville, wooded clay hillside, *R. T. Rexroat, 2008*. Cass Co.: June 6, 1955, NE. of Virginia, clayey woods, *R. T. Rexroat 2001*. Same locality June 8, 1955, *R. T. Rexroat 2002, 2003, 2004*. Same locality July 22, 1955, *R. T. Rexroat 2005, 2006, 2007* (with capsules).

Rubus laciniatus Willd. Mason Co.: July 14, 1957, E. of Bath, on a small sand dune with wild plum, *R. T. Rexroat 3981, 3982*.

Rubus phoenicolasius Maxim. Morgan Co.: May 31, 1956, 5 mi. SE. of Meredosia, *R. T. Rexroat 2735*. June 14, 1955, W. of Arenzville, *R. T. Rexroat 1776, 1777*. This introduced Rubus has been regarded previously as not established in Illinois. At the Arenzville locality the plants were abundant and thoroughly established over a considerable area.

Lotus corniculatus L. Cass Co.: June 4, 1953, sand, *R. T. Rexroat 201*. July 17, 1953, fence row in full sun, *R. T. Rexroat 383*. Mason Co.: July 8, 1956, 5 mi. S. of Havana, dry, peaty sand, *R. T. Rexroat 2988*. Brown Co.: August 30, 1956, N. of Cooperstown, clay hillside, *R. T. Rexroat 3344*.

Callirhoe involucrata (T. & G.) A. Gray. Schuyler Co.: July 25, 1956, N. of Browning, clay; roadside, stems trailing 2–3 ft., *R. T. Rexroat 3099, 3100.*

Echium vulgare L. Schuyler Co.: June 28, 1955, 3 mi. S.W. of Frederick, clay hillside in pasture, *R. T. Rexroat 1807, 1808, 1809.* A few plants were observed in July 1957.

Trichostema dichotomum L. Cass Co.: Sept. 17, 1953, no definite locality, moist sand, *R. T. Rexroat 684.* Aug. 19, 1954, peaty sand, dry or moist, *R. T. Rexroat 1358, 1102.* Sept. 8, 1955, 4 mi. E. of Beardstown, in peaty sand, *R. T. Rexroat 2285, 2286.* In these Cass County localities this species was abundant.

Salvia pitcheri Torr. Cass Co.: Sept. 11, 1954, near Virginia, dry soil, full sun, *R. T. Rexroat 1359.* Sept. 11, 1954, along R. R. tracks in full sun, perennial with several stems, *R. T. Rexroat 1188.* Sept. 10, 1954, R. R. tracks in full sun, *R. T. Rexroat 1189.* Sept. 23, 1955, near Virginia, dry clay soil, *R. T. Rexroat 2372, 2371, 2370.* Plants of the areas cited above have been destroyed but specimens transplanted to Rexroat's garden were in good condition in July 1957.

Salvia reflexa Hornem. Woodford Co.: Aug. 6, 1957, 4 mi. S. of El Paso in an old pastured area, *G. S. Winterringer 13818, 13819.* The abundance of this adventive western sage in this locality was surprising. It was the dominant species over approximately an acre.

Mentha alopecuroides Hull. Schuyler Co.: July 25, 1956, N. of Browning, clay soil, spreads by stolons, *R. T. Rexroat 3102, 3103.* Specimens transplanted to Rexroat's garden in 1956 are now thriving.

Mimulus geyeri Torr. Mason Co.: May 13, 1956, 5 mi. S. of Havana, growing in a spring-fed creek in an inch of water, forming a dense mat, *R. T. Rexroat 2612.*

All specimens cited in this paper are deposited in the Illinois State Museum Herbarium.—illinois state museum, springfield, illinois.

ARENARIA ROSSII AND SOME OF ITS RELATIVES IN AMERICA

Bassett Maguire

Recently, my colleague, Arthur Cronquist, collected a series of an interesting *Arenaria* of the *rossii*-complex in Montana that seemed to require special study. About the same time, William A. Weber sent to me collections from Colorado which bore on a related problem and required further consideration of the status of *Arenaria macrantha* (Rydb.) Nels. (also of the *A. rossii*-complex). Further, a recently published paper by Nannfeldt[1] raised questions as to taxonomic interpretation and status, and the typification and nomenclature of *Arenaria rossii.* All of these circumstances made necessary a review of the matter and require the present statement.

In his discursive paper, Nannfeldt has presented arguments purporting to establish the name (*Minuartia*) *rolfii* to supplant the long-used epithet *rossii.* Examination of historical materials at the British Museum (BM), Kew (K), Fielding Herbarium, Oxford (OXF), Gray Herbarium (GH), and The New York Botanical Garden (NY), and a large body of newly collected specimens on deposit at the National Herbarium (CAN) and the herbarium of the Department of Agriculture (DAO), both at Ottawa, the Gray Herbarium, and The New York Botanical Garden, has convinced us that there is but one polymorphic arctic American species involved, and that all of the Richardson specimens and those of the Parry Voyage belong to it. Accordingly, there is no necessity, or indeed permissibility, for nomenclatural change or substitution, since it is clear that Richardson did in fact effectively and validly publish the epithet *Rossii* (Franklin Journ. p. 738. 1823), and that neither the epithet nor the authorship by Richardson may be displaced.[2]

Arenaria rossii in the broad sense extends in the American Arctic from the Eastern Arctic Archipelago and northeast Greenland (also in Spitzbergen, acc. to Nannfeldt) westward to the Bering Straits and the Aleutian Archipelago, and in the moun-

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[1] Nannfeldt, J. A. Some Notes on *Minuartia stricta* (Sw.) Hiern. and Allied Species. Nytt. Mag. Bot. **3**: 159–170. 1954.

[2] This position was substantially taken by Porsild in Vasc. Pl. West Cana. Arctic Archipelago Bull. 135, Nat. Mus. Cana. p. 110. 1955.

tains in Alaska and Yukon south to Wyoming and Oregon. Clinal modifications take place westerly by which the sepals become acute, the petals narrower and shorter, and the leaves less fleshy. The occidental population has been known as *A. elegans.* The line of phytogeographic division between the two races seems to lie just west of the delta of the Mackenzie River, perhaps to the north of the Richardson Mountains.

In the Mackenzie Range and southward in the Rocky Mountain System, where the species is common, sepals become smaller and broader, petals inconspicuous or lacking, and the leaves remain more or less fleshy. This austral population, the ssp. *columbiana,* extends into Wyoming and Oregon. *Arenaria rossii* seems to be absent from the Middle Rocky Mountains and the Wyoming Basin (both as defined by Fenneman), i.e., from the Uinta and Wasatch Ranges in Utah, and possibly all of Wyoming, except the northernmost portion.

A taxonomic arrangement of the races of *A. rossii,* and a brief consideration of *A. macrantha* and its relatives, the southern complement of *A. rossii,* is provided herewith, and appended is a further provisional key[3] to the species of the *Arenaria rossii—A. stricta* complexes of America.

ARENARIA ROSSII Robert Brown apud Richardson.

A. rossii ssp. **rossii.**—*A. Rossii* R. Br. apud Richards. Append. Franklin Journ. p. 738. 1823, as to Richardson Arctic specimens; *A. Rossii* R. Br., in Chloris Melvilliana p. 14. 1823, as to the Parry Voyage Plants of Melville Island, and "*A. Rossii,* Richardson in Franklin's Journ. p. 738, paulo diversa est statura majore, . . . "; idem, R. Br. in Suppl. Parry's 1st Voyage p. 272 (cclxxii), 1824; "*A rossii,* Brown, Supp. Parry's Voy. cclxxii. No. 20. α Brown, l.c. nobis non visa.," and "β *A. Rossii* Frankl. App. 1 ed. p. 738, No. 170," Richardson, Append, Franklin Journ. ed. 2 p. 745. 1823; Hooker Fl. Bor.—Am. **1:** 100. 1831; *Alsine rossii* Fenzl, Verbreit. Alsin. 18. 1833; *Minuartia rossii* (R. Br.) Graebn. Syn. Mitteleurop. Fl. 51: 772. 1918; *Arenaria Rossii* R. Br. apud Richards. var. *Daethiana* Polunin, Bot. Can. East. Arctic Bull. Nat. Mus. Can. **92:** 201. 1940; *Minuartia rolfii* Nannfeldt, Nytt. Mag. Bot. **3:** 161. 1954.

In the northernmost part of its range, the subsp. *rossii* is characteristically a densely and closely pulvinate plant, infrequently flowering, and probably often reproducing vegetatively by means

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[3] For a key to the genus see: Maguire, B., Arenaria in America North of Mexico. A Conspectus. Am. Mid. Nat. **46:** 494–498. 1951.

of easily detached short shoots borne in the axils of the primary leaves (discussed at length by Nannfeldt, l.c.). The type specimens of *Minuartia rolfii* Nannf. (*Simmons 2390*) are of this form.

More westerly, and perhaps generally in more protected places, particularly on the mainland, the plant tends to become more loosely tufted and, as observed by Porsild (in correspondence) flowers abundantly, and presumably matures seed. The specimens of Richardson represent both forms.

The specimens of Richardson (No. *170*, the types of *A. rossii*) collected on "Barren Grounds from Point Lake to the Arctic Sea," of which we have seen the material at Kew, the British Museum, the Gray Herbarium, the Oxford Fielding Herbarium, and The New York Botanical Garden, consist both of densely pulvinate and more loosely tufted specimens. Melville Island plants of the Parry Voyage, seen at the British Museum and Fielding Herbarium, are of the pulvinate form.

TYPE or arctic exploration specimens seen: coast, British North America, Dr. Richardson [*170*] 1819–22, *"Arenaria Rossii* Br.," (holotype, BM, photo CAN, the holotype sheet consisting of six specimens all of the more compact form); second sheet with three specimens (BM); "Arctic America, Frankl. Exp. (GH 2 sheets, K), the tufted form; [Franklin Journ.] No. *170*. Richardson (GH, NY), the tufted form; Melville Island, "Parry's 1 Voy. No. 20. Chloris Melvilliana p. 14. 1823." (BM, OXF), the pulvinate form. Ad Barren Vallies (lat. 76° 37′, long. 84° 25′) sinus Harbour Fjord, Ellesmerelandiae meridionalis in campis argillosis, July 28, 1900, *H. G. Simmons 2390* (GH, NY, isotypes of *M. rolfii* Nannf.).

DISTRIBUTION. Barren lands at low altitude, West Greenland, the Arctic Archipelago and the arctic coastal mainland to the Mackenzie River.

REPRESENTATIVE SPECIMENS. **Greenland:** Jacobsen Bay, Ymer Island, Aug. 11, 1932, *T. Sørensen 3312* (CAN); Dragon Point (82° 15′ N.), July 19, 1917, *Th. Wulff s.n.* (GH). CANADA. ARCTIC ARCHIPELAGO. **Baffin Island:** Arctic Bay, Sept. 8–11, 1936, *Polunin 2587* (GH); ? Cape Dorset, July 29, 1938, *Manning & Manning 19* (CAN); Hantzsch River, Sept. 3, 1938, *Manning & Manning 182* (CAN); Silliman Mt., July 11, 1948, *Senn & Calder 3924* (DAO), with characters of ssp. *elegans*. **Ellesmere Island:** Harbour Fjord, July 28, 1900, *Simmons 2390* (GH, NY, isotypes *Minuartia Rolfii* Nannf.); Craig Harbour, Sept. 16–17, 1934, *Polunin 872* (CAN); Eggerton Lake, Aug. 17, 1951, *MacDonald 18* (CAN); Hawkins Lake, July 17, 1951, *Bruggemann 202* (DAO); Parr Inlet, Aug. 8, 1951, *Bruggemann 252* (DAO); Wood Creek, Aug. 13, 1951, *Bruggemann 262* (DAO); Ward Hunt Island off n. coast Ellesmere I., 83° N., July 14, 1954, *Christie 50* (CAN). **Devon Island:** Dundas Harbour, Sept. 7, 1936, *Polunin 2554* (CAN). **Prince Charles Island:** Foxe

Basin, Aug. 15–18, 1949, *Baldwin 1939* (CAN). **King William Island:** 68° 47′ N., 97° 40′ W., Aug. 10, 1949, *Woodruff 144* (DAO); Victory Point, Aug. 8, 1954, *Cooper 112* (CAN); Aug. 17, 1955, *Cooper 151* (CAN). **Grinnell Land:** Lady Franklin Bay, *Greely 50* (GH). **Victoria Island:** Wollaston Pen., July 27, 1949, *Porsild 17216* (CAN); Holman Island trading post, Aug. 8, 1949, *Porsild 12278* (CAN); Albert Sound, Aug. 4, 1949, *Porsild 17384* (CAN). **Banks Island:** Cape Lambton, July 30, 1949, *Porsild 17554* (CAN); n.e. corner of island, Aug. 13–20, 1949, *Porsild 17667* (CAN); Bernard Island, Aug. 22, 1949, *Porsild 17749* (CAN); De Salis Bay, July 17, 1952, *Manning & Macpherson 16* (CAN). **Cornwallis Island:** Resolute Bay, July 31, 1949, *Collins 192* (CAN); 75° 15′ N., 96° 20′ W., in 1952, *Mackay 8* (CAN); Resolute Bay, July 30, 1949, *Schofield 446* (DAO). Melville Peninsula, Repulse Bay, July 25, 1950, *Bruggemann 69* (DAO). Spruce Bay, July 23, 1951, *Chillcott 56* (DAO). Keewatin District. **Southampton Island:** South Bay, Aug. 22, 1936, *Polunin 2280* (GH), *2282* (GH); July 9, 1948, *Cody 1231B* (DAO); July 25, 1948, *Cody 1558* (DAO); July 28, 1948, *Cody 1637* (DAO); July 29, 1948, *Cody 1653* (DAO); Aug. 5, 1948; *Cody 1855* (DAO); Aug. 11, 1948, *Cody 2016* (DAO); July 15, 1948, *Cody & Senn 1338* (DAO); Ford River, Aug. 15, 1950, *Brown 213* (DAO). Mackenzie District. Bernard Harbour, Aug. 1915, *Johansen 367* (CAN); Great Bear Lake, Aug. 2, 1928, *Porsild & Porsild 5140* (CAN); Tree River, July 11, 1955, *Miller 94* (CAN); Coppermine, Aug. 4, 1951, *Findley 252* (DAO).

A. rossii subsp. **elegans** (Cham. & Schlecht.) Maguire, comb. nov. *Arenaria elegans* Cham. & Schlecht. Linnaea **1:** 57. 1826.

TYPE. Ad sinum St. Laurentii inter muscos et Dryadem crescens, *Chamisso no. 13*, p. 57, l.c.

DISTRIBUTION. Coastal and montane Alaska and Yukon of the Yukon River drainage. Variable. Specimens with flat ascending leaves 8–10 mm long and small flowers (sepals ca. 2.5 mm long), represented by *A. & R. A. Nelson 4080*, and *L. Viereck 1400* from Mt. McKinley National Park, and other like specimens, probably constitute a discrete well segregated variety.

REPRESENTATIVE SPECIMENS. Canada, Mackenzie District. Richardson Mts., Aug. 15–17, 1933, *Porsild 6792* (CAN), *6793A* (CAN); Mackenzie Range, Sept. 9, 1944, *Porsild & Breitung 11804* (CAN); Canol Rd., Mile 111 east, July 25, 1944, *Wynne-Edwards 8294* (CAN). **Yukon Terr.:** Canol Rd., Mile 132, June 15, 1944, *Porsild & Breitung 9609* (CAN); Canol Rd., Mile 105, July 21, 1944, *Porsild & Breitung 10891* (CAN). **Alaska.** Miller House, 115 miles n. Fairbanks, July 22–28, 1936, *Scamman 168* (GH); July 24, 1947, *Scamman 482* (GH); July 14, 1947, *Scamman 4695* (GH). Brooks Range, *Jordal 3605* (CAN). Eagle Summit: July 7–11, 1937, *Scamman 756* (GH); July 12–28, 1940, *Scamman 2074* (GH); Aug. 1–9, 1940, *Scamman 2247* (GH); June 23–30, 1945, *Scamman 3514* (GH); July 13–15, 22–23, 1949, *Scamman 5195* (GH); June 25, 1948, *Lepage 23277* (CAN, DAO). White Mts., July 7, 1953, *Gjaerevoll 456* (CAN). Alaska Range, June 19, 1926, *Porsild & Porsild 225* (CAN). Mt. McKinley Nat. Park: Aug. 8, 1939, *A. & R. A. Nelson 4080* (GH, NY); July 17, 1956, *Viereck 1400* (COLO, NY); July 10, 1956, *Viereck 1191* (COLO, NY). Seward Peninsula: Cape Nome, in 1900, *F. E. Blaisdell s. n.* (GH, NY); Upper Kougarok River, June–July, 1909, *C. B. Atwater s. n.* (GH); Nome, Aug. 6–10, 1926, *Porsild & Porsild 1336* (CAN, GH); Nome, Anvil Hill, Aug. 6–10, 1926, *Porsild & Porsild 1334* (CAN), *1335* (CAN, GH); Bluff, Aug. 5–6, 1926, *Porsild & Porsild 1222* (CAN); Nome, Anvil Hill, Aug. 9, 1948, *Lepage 23895* (CAN, DAO); Nome, June 20, 1951, *Whillans 52* (DAO). Norton Sound, July 16–29, 1926, *Porsild & Porsild 984* (CAN, GH). Port Clarence, Aug. 6–20, 1949, *Scamman 5481* (GH).

A. rossii subsp. **columbiana** (Raup) Maguire comb. nov. *A. rossii* var. *columbiana* Raup, Contr. Arnold Arboretum **6:** 157. 1934.

TYPE. Wet stones in sun at 5500 ft., Pass n. of Robb Lake, British Columbia, *Mrs. J. Norman Henry 262* (GH).

DISTRIBUTION. The petaliferous element, montane, the Stikine Mountains, Yukon, south in the Rocky Mountains to Colorado.

REPRESENTATIVE SPECIMENS. CANADA. **British Columbia.** N. Kootanie Pass: July 29, 1883, *Dawson 656A* (CAN); *Dawson 665* (CAN); Rainbow Mts., July 16, 1898, *Spreadborough 19291* (CAN, GH); Robb Lake, July 25, 1932, *Henry 262* (GH, holotype of *A. rossii* var. *columbiana* Raup); Mt. Selwyn, July 19, 1932, *Raup & Abbe 3951* (CAN, GH, NY); *Raup & Abbe 3761* (CAN, GH); Laurier Pass, July 22, 1935, *Henry 718* (GH); Alaska Highway, Mile 456, *Porsild 9010* (CAN). **Alberta.** Moose Mt., June 29, 1897, *Macoun 18266* (CAN, GH); July 1, 1897, *Macoun 18267* (CAN); Crow's Nest Pass, Aug. 2, 1897, *Macoun 18270* (CAN); June 30, 1897, *Macoun 268* (CAN); Saddle Mt., Banff Nat. Park, July 31, 1891, *Macoun 4868* (CAN); Waterton Lake, July 11, 1931, *A. S. Pease 22570* (GH); Banff Nat. Park, July 13–22, 1946, *Porsild & Breitung 15886* (CAN); *15977* (CAN).

A. rossii subsp. **columbiana** var. **apetala** Maguire, Am. Mid. Nat. **46:** 510. 1951.

TYPE. Alpine meadow, Preston Park, alt. 7520 feet, Glacier Park, Montana, July 20, 1932, *Maguire 732* (*holotype* NY).

DISTRIBUTION. The apetalous element, forming extensive local populations, British Columbia, Alberta, Montana, and possibly northwestern Wyoming. Commonly more compact, and more frequently collected than the preceding. A single collection is known from the Wallowa Mts., Oregon, and a diminutive specimen, *J. T. Howell 22773* from Mono Mesa, Inyo Co., Calif., has seed and flower characteristics of the var. *apetala*, and is tentatively assigned here.

REPRESENTATIVE SPECIMENS. CANADA. **Yukon Terr.,** Canol Rd., Mile 102, July 19, 1944, *Porsild & Breitung 10615* (CAN). **Alberta.** Crow's Nest Pass, Aug. 2, 1897, *Macoun 18271* (CAN), *18296* (CAN); July 31, 1897, *Macoun 18271* (CAN). Upper Red Deer River: July 12, 1951, *Porsild 18175* (CAN); July 12, 1951, *Porsild 18306* (CAN). Coleman, July 6, 1956, *Porsild & Lid 19351* (CAN). Mt. Inglismoldie, July 1, 1916, *Lewis 296* (CAN). Banff Nat. Park, *Porsild & Breitung* in 1945; Sulphur Mt., *12432* (CAN); Mt. Temple, *12554* (CAN); Sunshine Ski Lodge, *13161* (CAN); *13423* (CAN); *13469* (CAN); *31470* (CAN); *14102* (CAN); *15885* (CAN); Mt. Bourgeau and Mt. Brett, *13802* (CAN); Cascade River, *14950* (CAN); Upper North Saskatchewan River, *16056* (CAN); Brewster Hill, *19464* (CAN); Citadel Mt., *19555* (CAN); Sulphur Mt., June 14, 1906, *S. Brown 146* (GH, NY). Waterton Lake: Sheep Mt., July 28, *Macoun 10098* (CAN); Sept. 6, 1953, *Moss 10516* (CAN); Carthew Pass, July 26, 1953, *Breitung 16689* (NY). Jasper Nat.

Park, Medicine Lake, Aug. 7–9, 1941, *Scamman 2528* (GH). UNITED STATES: **Montana.** Glacier Nat. Park: Mt. Jackson, Aug. 24, 1920, *Somes 70* (NY); Piegan Pass, July 20, 1930, *Pease 22194* (GH); Preston Park, July 20, 1932, *Maguire 732* (NY, holotype *A. rossii* var. *apetala* Maguire); Logan Pass, July 16, 1934, *Jones 5523* (GH). Mt. Henry, Midvale, July 16, 1903, *Umbach 405, in part* (NY). Beaverhead Co.: Black Lion Mt., July 30, 1945, *Hitchcock & Muhlick 12908* (NY). Big Snowy Mts., July 6, 1945, *Hitchcock & Muhlick 12037* (NY); Pintlar Peak, July 27, 1945, *Hitchcock & Muhlick 12860* (NY). Bridger Mts., June 5, 1897, *Rydberg & Bessey 4050* (NY, 2 sheets). Big Horn Mts., July 1898, *Tweedy 162* (NY); Beartooth Mts., Carbon Co., July 29, 1955, *Cronquist 8003* (NY, GH, US, UC, WS, WTU, COLO, K, P). **Oregon.** Wallowa Mts. July 31, 1899, *Cusick 2299, in part* (GH). **Wyoming.** Northwestern Wyoming Expedition, in 1873, *Parry 40* (GH).

ARENARIA MACRANTHA AND ITS RELATIVES

As shown above, *Arenaria rossii*, occupying the American trans-Arctic region and northern Rocky Mountains, apparently does not extend into the Middle Rocky Mountain area of Wyoming and Utah (the Uinta and Wasatch Ranges), or the Wyoming Basin. Apparently the range of *A. macrantha*, which replaces *A. rossii* in the south, and its relatives are confined to the southern Rocky Mountains and Colorado Plateau region (as defined by Fenneman) and do not occur in the Middle Rocky Mountain area. Thus, the Middle Rockies form a broad spacial hiatus between the ranges of the two closely related complexes.

From the material of the complex now available, two elements stand out more strongly, viz., that represented by the specimens of the type collections of *A. macrantha* from Montezuma County, Colorado, and of *A. filiorum* from Iron County, Utah.

Arenaria macrantha (Rydb.) Nels. Man. Bot. Rocky Mts., p. 186. 1909. *Alsinopsis macrantha* Rydb. Bull. Torrey Club 31: 407. 1904.

TYPE. Common alpine form, Little Kate Basin, La Plata Mts., Montezuma Co., Colorado, July 14, 1898, *Baker, Earle & Tracy 678* (holotype NY, isotype NY).

The types, consisting of four plants on two sheets at The New York Botanical Garden, are luxuriant specimens, obviously perennial, with numerous procumbent stems to 10 cm long; conspicuous flowers borne in 3 (5)-flowered cymes; sepals broadly lanceolate, 4.5–5.0 mm long, 2 mm broad, acuminate, strongly 3-nerved; petals conspicuously exceeding the sepals, 7–8 mm long; and leaves more or less plane, strongly 1-nerved, blunt. No mature capsules had been formed, consequently seeds are lacking. Collections recently obtained show the species, as expected, to be somewhat variable in habit, leaf-form, and range of flower size. Two of them have formed mature capsules and seed.

Adequate circumscription is now possible: leaves may be more or less plane (as in the types) or triquetrous-subulate; sepals 4.0–5.5 mm long; petals ordinarily conspicuously surpassing the sepals; seed reniform ca. 1 mm broad, tesselate-tuberculate, blackish.

DISTRIBUTION. Alpine or similar habitats, mountains of the Southern Colorado Rockies.

Representative specimens, Colorado. Gray's Peak, *A. Eastwood s.n.*, in July 1888 (COLO); alpine, South Park, *Wolf & Rothrock 346* (GH). Park Co., Hoosier Ridge, *Weber, Rollins & Livingston 655* (COLO); tundra, North Star Mountain, Hoosier Pass, ca. 12,300 ft. alt., *Weber 8751* (COLO); Bald Mt., 11,500 ft., Aug. 1898, *E. A. Bessey s.n.* (NY); Bald Mt., Aug. 28, 1954, *Jean Langenheim 3968* (COLO). Clear Creek Co. *Weber & Dahl 8613*, depauperate specimens, (COLO). Gunnison Co. Travertine bog and cliffs, Cement Creek Canyon, ca. 8500 ft., *Weber & Langenheim 9520* (COLO); Horse Basin, 11600 ft., *Langenheim 70* (COLO); alpine, Comanche Creek at 12000 ft., *Langenheim 1361* (COLO). Pitkin Co. ridge east of Avalanche Creek, 12000 ft., *Langenheim 2106* (COLO, NY). Montezuma Co. Little Kate Basin, *Baker, Earle & Tracy 678* (holotype NY, isotype NY). San Juan Co. Near Irontown, July 21–31, 1899, *C. C. Curtis s.n.* (NY).

Hall & Harbour No. 69, Lat. 39°–41°, Colorado, in 1862 (GH), an apetalous form with 1–3-flowered cymes and reddish slightly sculptured seed, can hardly be assigned to *A. macrantha*. It is similar to a few scattered collections obtained from the Northern Rocky Mountains and Canadian Rocky Mountains (viz.: *Porsild & Breitung 10615* (CAN), an apetalous form from Mile 102, Canol Road, Yukon Terr.; and *Spreadborough 19290* (CAN), Rainbow Mt., Fraser River, B. C., petalous form), which are rare, sporadic and do not form populations, and have for the time being been assigned to *A. rossii* subsp. *columbiana*.

Arenaria filiorum Maguire, Bull. Torrey Club **73:** 326. 1946.

TYPE. Common, gravelly beach, Navajo Lake, Iron County, Utah, July 13, 1940, *Maguire 19472* (holotype NY, isotype GH, UTC, UC).

Small glabrous annual from a slender taproot, with cymes usually bearing 3–5 flowers; sepals are ovate-lanceolate, strongly 3-nerved, and are 3.5–4.8 mm long; petals more or less equaling or shorter than the sepals; seed abundantly produced 0.7–1.0 mm broad, reniform, very dark reddish brown or blackish, rather strongly sculptured (in contrast to the seed of *A. rossii*).

This highly distinctive form occurs intimately with *A. rubella*, where both hold dominance on the gravelly beach of the lake. Quite similar plants, *L. Ellison 4523* (NY), Island Lake, San Pete County, were collected also on gravelly lake beaches.

Elsewhere from the high Colorado Plateau of Utah, viz., *Maguire 19988* (NY), 10928 ft. alt., Mayfield Canyon, and *Maguire 20060* (NY), 12000 ft. alt., Horseshoe Mt., both in San Pete County, and *Maguire*

20097 (NY), East Brian Head Peak, 11000 ft. alt., Iron County, are somewhat similar plants but obviously perennials. They most closely resemble small-flowered members of the complex cited above from Colorado, but are distinguishable in minor ways from them.

A series of specimens obtained from the Charleston Mts., Clark Co., Nevada, *Clokey 5460* (NY), *7510* (NY), and *7923* (NY), collected in 1935, 1937 and 1938 respectively, are obviously perennial with commonly uniflorous cymes. They were initially assigned to *A. filiorum* but are easily recognizable as distinct from it. They are extremely uniform and certainly form a geographically restricted race, yet undoubtedly belong to the *A. macrantha-filiorum* complex.

A Key[4] to the Arenaria rossii-A. stricta[5] Complexes and Their Relatives in North America

1. Seed reniform (with respect to the hilum), hence broader than long; plants completely glabrous.
   2. Seed smooth or inconspicuously ornamented (under × 10 magnification), pale, reddish, 0.5–0.7 mm broad, cymes uniflorous, ebracteate. .... *A. rossii.*
      3. Sepals commonly 1.5–2.5 (3.0) mm long, oblong-ovate, obtusish, usually 1-nerved;[6] petals conspicuously surpassing the sepals; cymes uniflorous, ebracteate; pedicels 5–20 mm long; leaves fleshy, subulate, obtuse, 2–4 mm long; densely pulvinate or tufted plants of (Spitzbergen and) Arctic America; Greenland, Arctic Archipelago, and Arctic Coastal America to the Mackenzie River Region. .... *A. rossii* subsp. *rossii.*
      3. Sepals commonly 3.0–3.5 mm long, lanceolate, acute, commonly 3-nerved; pedicels 2–4 (5) cm long; leaves less fleshy, more or less plane, acutish, petals narrower, equaling or commonly somewhat shorter than the sepals; loosely tufted plants of Alaska, Yukon in the Yukon River drainage, and probably the Richardson Mountains. .... *A rossii* subsp. *elegans.*

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[4] This "key" is intended to supplement, by introducing some corrections and additions, the key offered by me in 1951 (l.c.). In no sense do I mean to imply that the species herein admitted are necessarily more strongly intra-related, than to or with other members of the Sect. *Alsine.*

[5] Dr. A. E. Porsild in correspondence of Aug. 6, 1957, wrote, "I wonder if you are not overlooking that *Minuartia stricta* (Sw.) Hiern. is not the same as *Arenaria uliginosa* Schleich and certainly not synonomous with *A. stricta* ssp. *dawsonensis* as suggested by you (1951)." Both from lack of material and opportunity to extend the present study, I cannot have a competent self-gained opinion on the point. In view of Dr. Porsild's broad knowledge of boreal American plants, and his careful study, I am quite content to accept his interpretation of plants so indicated by him. Obviously, this would require the addition of *A. uliginosa* to my "key" of 1951; and indeed also *A. macrantha* (Rydb.) Nels., there inadvertently omitted by me.

[6] Anatomically the sepals in the entire complex are 3-nerved. The lateral nerves may be prominent, or weakly developed. Or, the lateral nerves may be obscured, in more crassulous sepals, by relatively thicker mesophyll tissues, thus in appearance the sepal becoming "1-nerved." The terms "3-nerved" or "1-nerved" merely give expression for relative prominence of the lateral nerves.

3. Sepals 2.5–3.5 mm long, lanceolate or ovate-lanceolate, acutish, moderately or weakly 3-nerved, or often 1-nerved; petals inconspicuous, narrow, shorter than the sepals, often lacking; leaves more or less fleshy, triquetrous or subulate; Rocky Mountains from the Stikine Mountains south to Oregon and northern Wyoming. .... *A. rossii* subsp. *columbiana*.
    4. Petals present .... var. *columbiana*.
    4. Petals lacking .... var. *apetala*.

2. Seed obviously tesselate-tuberculate (under × 10 magnification), blackish, (0.8) 1.0–1.5 mm broad; cymes commonly 3-several-flowered, bracteate; sepals strongly 3-nerved.
    5. Stems mostly under 10 cm high (or long), the inflorescence shorter than the vegetative portion of the stem, cymes commonly 3–5-flowered.
        6. Plants glabrous.
            7. Obviously perennial; cymes 1–3-flowered, flowers large, showy; sepals 4.0–5.5 mm long, lanceolate, acute; petals commonly exceeding the sepals, to 8 mm long; plants rather densely tufted; mountains of central and southern Colorado and the type collection from the La Plata Mountains, Colorado. .... *Arenaria macrantha*.
            7. Annual or weakly perennial; flowers not showy; cymes 3–7-flowered; sepals 4.0–5.5 mm long; petals shorter than the sepals; apparently restricted to the high Colorado Plateau of southcentral Utah. .... *A. filiorum*.
        6. Plants conspicuously glandular; circumboreal. .... *A. rubella*.
    5. Stems 10–30 cm high; primary leaves 1–2 cm long; inflorescence characteristically exceeding the hyaline portion of the stem; sepals 3.5–5.0 (6.5) mm long, 3-nerved, rarely 1-nerved; petals 5–8 mm long; seed 0.8–1.5 mm broad. .... *A. stricta*.
        8. Plants totally glabrous, strongly perennial.
            9. Petals conspicuously surpassing the calyx; capsule equal to or shorter than the calyx.
                10. Stems leafy for more than half their length; primary leaves usually 1.5–3.0 cm long; plants mostly lax, frequently matted. .... *A. stricta* subsp. *stricta*.
                10. Stems leafy usually below the middle; primary leaves mostly 0.5–1.5 cm long; plants rigid, not matted. .... *A. stricta* subsp. *texana*.
            9. Petals equal to or mostly shorter than

the calyx; capsule exserted. .... *A. stricta* subsp. *dawsonensis*.

8. Plants glandular-pubescent, at least in the inflorescence, weakly perennial. .... *A. stricta* subsp. *macra*.

1. Seed oblong (with respect to the hilum), hence longer than broad.
  11. Primary leaves 3-nerved, non-glaucous; inflorescence stipitate-glandular, half or less than half the length of the glandular stem; sepals 3.5–6.5 mm long; ovules 9–15; seed several or solitary, oblong, 1.0–1.3 mm broad, 1.25–2.0 mm long; widespread in the Rocky Mountain, Intermontane, and Cascade-Sierra Nevada region of western America, in the mountains from British Columbia and Alberta to California, Nevada, Utah and Colorado. .... *A. nuttallii*.
    12. Leaves ascending or strict, neither arcuate nor squarrose.
      13. Leaves abruptly acute or apiculate, infrequently pungent; sepals acuminate, midrib not prominent.
        14. Petals shorter than the sepals; Cascade Range, Rocky Mountains. .. *A. nuttallii* subsp. *nuttallii*.
        14. Petals longer than the sepals; north California coast ranges, Siskiyou Mountains. .. .. *A. nuttallii* subsp. *gregaria*.
      13. Leaves strongly pungent; sepals narrow, pungently attenuate, midrib prominent; Sierra Nevada Range. .... *A. nuttallii* subsp. *gracilis*.
    12. Leaves arcuate or squarrose.
        15. Sepals 3.5–5.5 (6.0) mm long, lanceolate, sometimes broadly so, acuminate, 1-nerved (occasionally 3-nerved); petals shorter than the calyx; Cascade Range, Rocky Mountains. ...... *A. nuttallii* subsp. *nuttallii*.
        15. Sepals 5.5–6.6 mm long, narrowly lanceolate, pungently attenuate, 3-nerved; petals more or less equaling the calyx; central Great Basin. .... *A. nuttallii* subsp. *fragilis*.
  11. Primary leaves 1-nerved; glaucous; inflorescence diffuse, exceeding the length of the glabrous stem; sepals 3.0–4.5 mm long; ovules 6 (7); seed solitary, 1.4–1.5 mm broad, 2.3–2.8 mm long; plants of serpentine areas, Coast Ranges, Trinity County, California. .... *A. rosei*.

Rumex stenophyllus in North America.—Two specimens of *Rumex stenophyllus* Ledeb. have been discovered in a collection of plants from Manitoba. They were found growing in a roadside ditch not far from the village of Otterburne, about 30 miles SE of Winnipeg, and were collected by the junior author on Aug. 21, 1950.

Rumex stenophyllus Ledeb. is a continental Eurasiatic species, native to eastern and western Siberia, central Asia, eastern and middle Europe to lower Austria, Moravia and central Germany (Rechinger 1949). It is occasionally introduced into Scandinavia (cf. Hylander 1955), Holland (cf. Rechinger 1949), and England (cf. Clapham, Tutin & Warburg 1952). The most favorable habitats are roadside ditches and other places, where the soil is slightly saline and occasionally flooded. At times the plant spreads to road shoulders and wastelands, or may even become a field weed.

The Red River valley, where the plant was found, was originally settled by French-Canadian farmers, but early this century a great influx of immigrants came from the Ukrainian parts of central and eastern Europe. Like other immigrants, these Ukrainian farmers brought their own grain, which included an assortment of weeds. Although this alien flora still is not fully known, it includes some very well naturalized species, like e.g. *Sonchus uliginosus* M. B., which is now widespread all over the marshes of central Canada and the adjacent United States. *Rumex stenophyllus* apparently also belongs to this group of species, although its occurrence is not as evident as that of the conspicuous *Sonchus*. Only a single locality of *Rumex stenophyllus* is known so far from Manitoba, but the plant is undoubtedly more widespread. The valleys on the prairies with their slightly saline and repeatedly flooded soils certainly offer conditions very much like those of its original habitat.

According to Frankton (1955, and in litt.) the species is not uncommon in Saskatchewan, where it was first discovered a few miles north of Swift Current in 1954, when seed collections were sent in for identification by Mr. A. Budd. In the herbarium of the Dept. of Agriculture, Ottawa, specimens from the following states have also been uncovered: Colorado, Nebraska, Wyoming, N. Dakota, S. Dakota and Minnesota, under the following names: *R. obtusifolius, brittanica, pulcher, alluvius* and *odontocarpus. R. odontocarpus* (cf. Moore, 1957) and *R. alluvius* (cf. Gates & McGregor, 1950; Rechinger, 1952) are synonyms to *R. stenophyllus.*

Due to the fact, that the species has been the object of so much confusion, it seems appropriate to repeat in translation the detailed description given in latin by Rechinger (1949):

> "Root fusiform, vertical, perennial (occasionally the plant flowers during its first year?), stem stiffly erect, 20–60 (–120) cm. tall, brownish or reddish, sulcate-striate, leafy, often divided above the middle into several branches, but in depauperate specimens sometimes subsimple. Branches erect, or erect-divergent, very rarely arching; in sturdy specimens lower branches sometimes ± fasciculate and repeatedly branched, but usually all branches straight and simple, forming an open, but narrow panicle. Basal leaves lanceolate, acute, their bases broadly or narrowly cuneate, their tips gradually attenuate, their laminas flat or with slightly undulate margins, the leaf stalks ± equal to or rarely longer than the blades. Stem leaves lanceolate, narrowing towards both ends, most of them with flat margins but some slightly crenulate-crispate towards the tip, 4–6 (–7) times longer than broad, smooth and glabrous, with the lateral nerves leaving the midnerve at 40–60° angle. Upper leaves with increasingly shorter leaf stalks and topmost leaves ± linear. Flowers in many-flowered whorls, the lower ones ± remotely leafy, the uppermost almost continuous and perfectly aphyllous. Fruit pedicel narrowly filiform, of varying length, but often 1.5–2 times as long as the mature perigone, and in its lower 3rd or 4th part with a distinct ring-joint. Close to the perigone the pedicel widens to funnelshape, or becomes at least considerably thicker. Outer perigone leaves linear-lanceolate of about half the length or slightly shorter than the valves, to which their margins are pressed. Valves cordate triangular, the base slightly cordate or subtruncate, the tip acute, membranaceous, the surface subregularly reticulate with slightly raised veins, the areas between the nerves elongate towards the margins, which form more or less irregular, sharp and coarse teeth, ±0.5, rarely 1, mm. long, on both sides of the entire-margined tip. Valves (3.5–) 4 (–rarely 5) mm. long, about as broad or rarely somewhat narrower, all with about equally large grains. Grain golden-brown, almost smooth, ovate-ellipsoid, very prominent, the acute tip often running out into and continuing in the median nerve of the valve. The grain is about half the length of the valve and occupies ¼ to ⅓ of its width. Mature nut dark brown, about 2 mm. long and 1.5 mm. broad, apiculate at both ends, the tip somewhat sharper than the base."

Superficially, *Rumex stenophyllus* resembles *R. crispus,* but there are several significant differences. Rechinger (1949) points out, that *R. stenophyllus* possesses two characteristics which never occur in true *R. crispus,* namely valves with distinctly toothed margins and a valve-nervature which forms elongate, flat meshes (cf. fig. 1). The two species were placed in very different sections and sub-sections by Rechinger (1949) and Losina-Losinskaja (1935).

Although *Rumex stenophyllus* was described as a species from Altai by Ledebour in 1830, its occurrence in Europe was obscured for a long time by its casual resemblance to *R. crispus* and *R. obtusifolius*. It has thus been regarded as a variety of these two species, i.e. *R. crispus* var. *dentatus* Schur. or *R. obtusifolius* var. *cristatus* Neilr., or even as only a hybrid between them, *R. crispus* × *obtusifolius*. Other authors have regarded it as a separate species, *R. biformis* (Menyh.) Borbas, or *R. odontocarpus* Sandór (cf. Mansfeld 1940), thought to be endemic in central and eastern Europe. However, in all recent European manuals, the plant is identified with the Altaian taxon, since the type material of this species does not differ from European material (cf. Rechinger 1949).

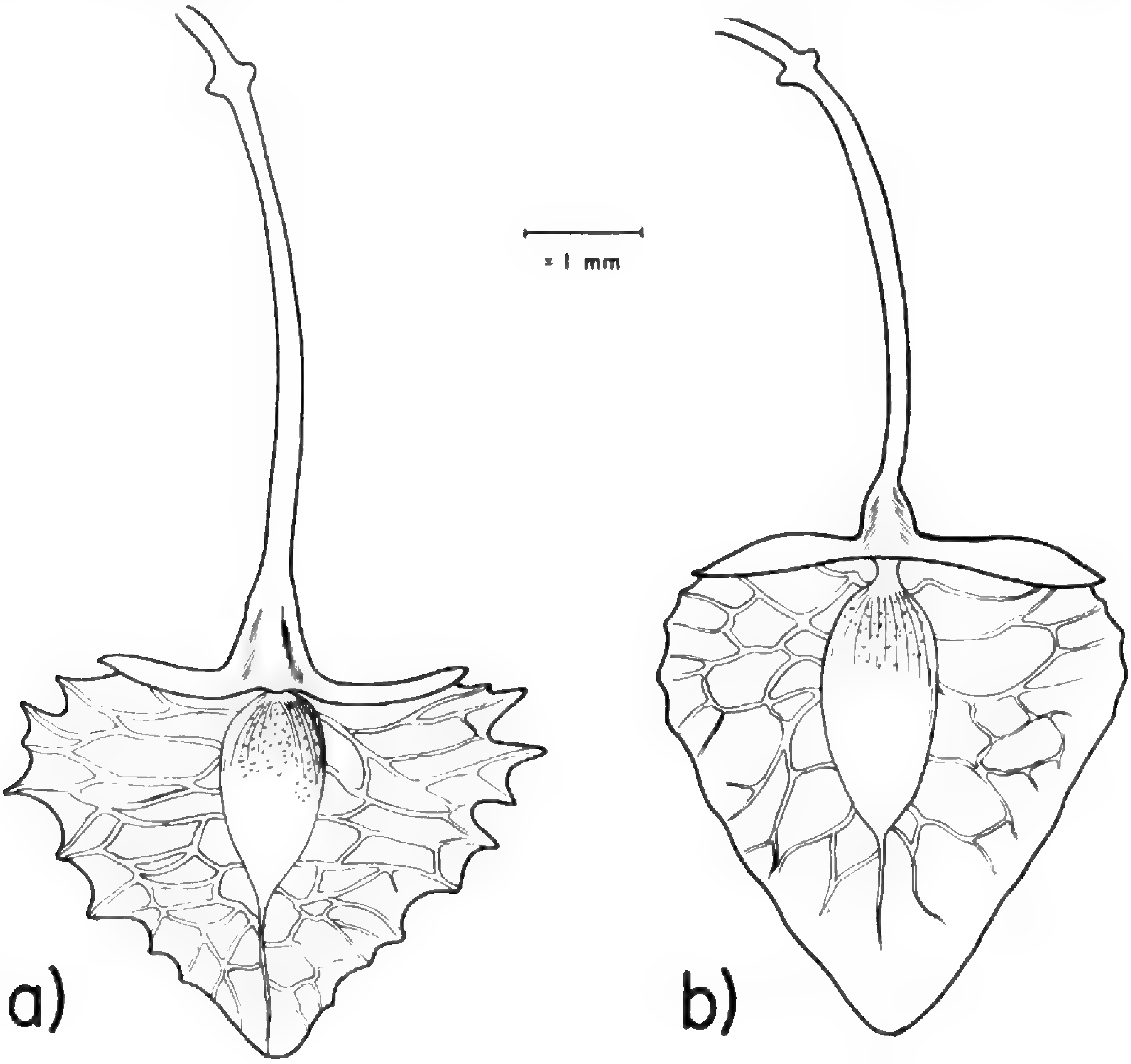

Fig. 1: a, *Rumex stenophyllus* Ledeb., b. *Rumex crispus* L.

Rumex stenophyllus differs from the real hybrid *R. crispus* ×

obtusifolius in several morphological characteristics, e.g. in the shape of leaves and valves. However, the hybrid is always sterile, and the species is fully fertile. The sterility is caused by the fact, that the hybrid has 2n = 50 chromosomes, its parents 2n = 60 and 40 chromosomes, respectively (Löve 1942). *R. stenophyllus*, however, has 2n = 60 chromosomes, as determined by Pólya (1950) on Hungarian material and confirmed on germinating seeds of the Manitoba plants by Mrs. N. Sarkar (unpubl.). There is no reason to suspect, that any of the *R. crispus* × *obtusifolius* hybrids reported from North American localities by Rechinger (1937) belong to *R. stenophyllus*.

A specimen of *Rumex stenophyllus* Ledeb. has been deposited in the herbarium of the Institut Botanique, Université de Montréal.—DORIS LÖVE AND FRÈRE JEAN-PAUL BERNARD, O.S.V., INSTITUT BOTANIQUE, UNIVERSITÉ DE MONTRÉAL AND INSTITUT DES SOURDS-MUETS, MONTRÉAL.

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Elatine triandra in New York.—*Elatine triandra* Schkuhr previously was found in the Manual Range in several localities in Wisconsin and in Skowhegan, Maine, (Fasset, Rhodora **41**: 370. 1939). I can now report the species (forma *submersa* Seubert) growing spontaneously in a swamp in Brooklyn, New York City (voucher deposited in The New York Botanical Garden, *Monachino 612*, Prospect Park, near the Music Grove, several dense mats in soft mudbank and shallow water of small over-grown swamp, Aug. 29, 1957; all submerged after rain, Sept. 14). It was confined to several patches in one small area, but thriving vigorously. The stems measured were up to 30 cm. long, the internodes 1 cm.; the opposite scarious-stipulate leaves oblong-lanceolate, up to about 1 cm. long, 3 mm. wide, lightly emarginate at apex; the inconspicuous flowers trimerous; the green tiny depressed-globular fruits plentiful though solitary in the leaf-axils, sessile, 1 mm. high, 1.4 mm. broad, the placenta extending half way up the capsule; the minute, numerous, slightly arcuate seeds (not fully matured) radiating from the central placenta, the upper ones erect, the lower spreading, about 0.5 mm. long, their angular pits about 24 in each row.

The swamp is fed by a brooklet and flows into Prospect Park Lake a short distance away. The yellow floating-heart, *Nymphoides peltatum*, and *Sagittaria latifolia* were the most conspicuous plants near the *Elatine*. Other aquatics nearby were *Chara*, *Hydrodictyon*, *Potamogeton*, *Lemna*. Further off were seen a few plants of *Mimulus guttatus*. The center of the swamp was choked with rice cut-grass. There were large tangles of *Solanum dulcamara*. With *Bidens frondosa* was growing the form of *B. connata* with leaves mostly simple to tripartite. Several other plants but sparsely represented were *Erechtites*, *Lythrum*, *Rumex*, *Polygonum*, *Glyceria*, *Echinochloa*, *Panicum*. The shrubs in the swamp were *Cephalanthus*, *Sambucus*, *Cornus*, *Salix*. It is reasonable to suppose that the *Elatine* is adventive, possibly introduced with the European floating-heart. Quite suggestive of this is the fact that the species (examined, but no complete specimen collected) also was growing in the lily pool in the Brooklyn Botanic Garden.

The discovery of a second eastern station for the waterwort (previously collected more than a quarter of a century ago in only one place in Maine) is not too surprising. There is a likelihood that this unobtrusive weed is more extensively distributed than records show. However, how frequent it is in our ponds and other fresh water sites remains to be demonstrated. The waterwort has much the aspect of the water starwort, until the details are examined closely. The habit, shade of green, and the leaves even as to their retuse tips are similar in the two aquatics. Of course there are vegetative differences: in *Callitriche* the leaves at the end of the branches are often crowded with the upper reduced to give a rosette or star-like appearance, they have characteristic punctation and are not stipulate; in *Elatine* the leaf-margins are obscurely and remotely punctiform-crenulate. Although it is generally essential in *Elatine* to study the seeds to determine the species (or variety, as understood by Fasset), the leaf-size of our plant is not described for any other species or form in America but *E. triandra* f. *submersa*.—JOSEPH MONACHINO, THE NEW YORK BOTANICAL GARDEN, N. Y.

SPECIES PLANTARUM—MORE THAN A FACSIMILE EDITION,[1]—This is a "curious" book—if we interpret "curious" to mean "interesting," following the usage of Gronovius in his reference to the famous Hortus Cliffortianus, interesting and also important to the systematic botanist, who, even today, must constantly refer to the works of Linnaeus. William T. Stearn of the British Museum has done an excellent job of bringing together in an extensive introduction the pertinent material to make not only the works of Linnaeus fully understandable but also the nature, use and limitations of the Linnaean herbarium in typification procedures. Furthermore, he has made clear the bearing and interdependence of contemporary books and other works of Linnaeus on the Species Plantarum. The introduction to Volume I is a treasure of vital information for the student and scholar alike. Perhaps some conception of the range of coverage may be seen from a mere listing of the chapter headings. These are as follows: The nomenclatural importance of the *Species Plantarum;* Principal events in the life of Linnaeus; Major botanical publications of Linnaeus; Linnaeus's sexual system of classification; The *Genera Plantarum* and the typification of Linnaean genera; *Hortus Cliffortianus;* The *Amoenitates academicae* and the authorship of Linnaean Dissertations; The preparation of the *Species Plantarum*

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[1] Species Plantarum by Carl Linnaeus. A Facsimile of the first edition, 1753. Volume I, with an introduction of 176 pages by W. T. Stearn. Publication No. 140 of The Ray Society, London, 1957. Sold by Bernard Quaritch Ltd., 11 Grafton St., London, W. 1, £2, S 10.

and the introduction of binomial nomenclature; The reception of the *Species Plantarum* in England and its influence on British botany; Sources, format, method and language of the *Species Plantarum;* Editions and variants of the *Species Plantarum;* Geographical names in the *Species Plantarum;* The species-concept of Linnaeus; Signs used by Linnaeus; General Bibliography. A facsimile of the 560 pages of Volume I of the Species Plantarum plus an added index to genera and classes completes the volume. The value of the index is increased by the inclusion of page references to the 5th edition of Genera Plantarum, with which the names of Species Plantarum are to be associated.

Many points concerning the herbarium materials used by Linnaeus are dealt with in a clear and concise way. Heretofore, much of this information could be learned by the student or young scientist most effectively from older persons through a kind of apprenticeship association with them. Although much information had been written down in scattered places, a great deal of it was essentially unavailable. Part of it got passed on from one generation of botanists to another by word of mouth. This situation resulted, in part at least, from the very complex history of the Linnaean herbarium itself, as well as the other collections that figured in 'the typification of species described by Linnaeus. This history has only gradually been pieced together. Now, this situation is well taken care of by the material at hand in the very fine volume under review. Assiduous study of the introductory material in this volume should be a must on the list of every young botanist, not to mention some of us who are not as young. Fortunately, the price of the volume is relatively modest and the workmanship on the book itself is of good quality. Many botanists will want to own personal copies I am sure.—R. C. Rollins.

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Rhodora

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THE SPONTANEOUS FLORA OF AN OLD HOUSE-LOT IN EASTERN MASSACHUSETTS

RICHARD J. EATON

For several years, and intensively during 1955–56, I have attempted to collect specimens of all the vascular plants to be found growing spontaneously on the three-acre plot of land surrounding our early eighteenth century farm house in Lincoln, Massachusetts. The census is reasonably complete as of November, 1957, although subsequent additions are to be expected either as species previously overlooked or as new arrivals. In this latter category several recent instances have come to notice, thus giving striking evidence of the dynamic status of local floras. For example, a seedling of the rapidly spreading *Rhamnus Frangula* appeared in my strawberry bed early in 1954 where evidently it had been "planted" by a bird. *Aster novae-angliae* arrived in my "meadow" as two inconspicuous seedlings in 1952. A third instance is particularly interesting. A vigorous fruiting specimen of *Vitis aestivalis* emerged from a dense shrubbery behind my tennis court in 1956, festooning the wire backstop. I am convinced that there was no grapevine in the shrubbery five years earlier when I last gave it a thorough pruning. The nearest known station for this locally rare grape (where it is unquestionably indigenous) is about three-quarters of a mile to the northeast on a trap outcropping in association with the locally rare *Aster infirmus*.

The analysis of the spontaneous vegetation of this particular piece of land may be of scientific interest for several reasons. The present house with attached small barn was built about 1720.

Presumably, the house lot was cleared before that time, possibly much earlier. Judging from the apparent age of a few surviving ancient apple trees and from pictures taken about 1880, the easterly half of the lot probably has been an unplowed orchard for at least one hundred years. Its surface soil is relatively poor and unattractive for tillage. Vertical sections show vague color stratifications above the depth reached by a plow, a condition which strengthens my guess that this portion of the lot never has been plowed. It may have been pastured in the early years, and when not pastured surely mowed annually for hay. There is hearsay evidence that the "meadow" (½ acre ±, described below) was used as a truck garden for an indeterminate number of years prior to 1925. Thus, ecologically speaking, one-half of the lot may have been partially shaded sod land continuously from the time it was originally cleared more than two hundred years ago, its superficial soils varying from thin sandy loam to moist deep clayey loam.

By making a reasonably convincing estimate of the composition of its original climax forest and by analyzing the present vegetation, it should be possible to make an educated guess as to what species in that forest may have survived *in situ* down to the present day. We can also indicate what native species may have invaded the area after it was cleared and still persist under existing ecological conditions. Of equal interest, perhaps, is the role played by the introduced and adventive old world species in competition with our native flora in a "civilized" habitat which has remained more or less stable for two centuries or more.

Other questions of interest emerge: What forest species indigenous to Lincoln tend to "seed in" regularly only to be destroyed by scythe or fire? (Controlled burning of the orchard grassland in December or early spring has been my usual practice since 1940.) What native species appear only in the artificial habitat of leaf mold and mulch under the shrubberies and border plantations? What weedy species conspicuously resist the severe conditions imposed on them, and what ones are conspicuous by their scarcity or absence? In this latter connection, I find that *Solidago* ssp. (notably *canadensis* and *rugosa* which were dominant in the "meadow" in 1940) survived two mowings annually but have nearly disappeared when a three-mowing schedule was inaugurated.

DESCRIPTION OF THE LOT

The three-acre lot, more accurately 2.75 acres, is a squarish trapezoid bounded on three sides by stone walls and on the east by the embankment of the town pressure reservoir. It is situated just under the crest of the highest land in Lincoln with a west-northwest exposure. High deciduous shade trees, young hemlocks, and shrubberies line the south and north boundary walls, with numerous trees of varying ages elsewhere, including a very large vigorous white pine adjacent to the barn on the north side. A very small area in the northeast corner has been allowed to grow up undisturbed for at least thirty years, as judged by the appearance of several hickory trees along the wall. The lawns, house site, garden, and tennis court occupy, roughly, the westerly half of the lot along the street. The easterly half is still primarily an orchard of mostly young fruit trees. From among the ten ancient apple trees standing in 1940 two survive. Thus, portions of the orchard are open sunny hillside. Its turf is dense and in many places interlaced with a close mesh of poison ivy runners.

The hill, except possibly its core, is of glacial origin, probably a modified drumlin, with the usual erratic boulders and underlying till. A moderate northwesterly slope dips into a shallow draw, with a gentle rise to the street. The drainage is northerly along this draw and includes effluent from a septic tank. Formerly, I am reliably informed, this draw was a narrow swamp extending to a tiny pond hole south of the property. It was drained many years ago by a covered ditch. Today part of this swampy area is the site of a "meadow". I have made a small plantation of spruce, hemlock, larch and native deciduous trees in moist rich soil on the northerly side of the meadow, thus providing a suitable habitat for several locally adventive species not present in 1940. Additions may be expected in future years when the aggressive species of sunny grassland completely fade out. Adjacent to it is a vegetable garden. The soil there is a deep clayey loam, usually moist even during very dry summers. Elsewhere on the hillside the surface soils vary from their somewhat sterile sandy loam to moderately deep clayey loam. In general, except where locally modified by applications of ground limestone, they are acid, varying slightly from pH 4.95 in the draw to pH 4.90 at the top of the orchard.

CULTURAL MANAGEMENT IN RECENT YEARS

Since 1940, the hillside orchard has been mowed once annually in June or July, and the meadow at least twice until 1950. Since then the lush growth of the latter plot has required three mowings each year. Excluding the war years, each area has been burned, generally in December or early spring, except under the fruit trees and narrow strips along the property lines. This latter practice tends to check ubiquitous poison ivy, and numerous herbaceous weeds, such as wild carrot, goldenrod, fleabane, yellow daisy, and dandelion. By burning on calm sunny days when the soil is cold and moist the slow fire seldom if ever reaches down to the crowns of the herbaceous plants and apparently has no adverse effect on seeds in the very top layer of the soil. Parenthetically, no burning was done in the springs of 1956 or 1957, nor was the orchard mowed until after the maturity of most of the grasses later in the season, in order to make collections in suitable condition for accurate determination. Weeding of the shrubberies and elsewhere was deferred for the same reason. The young fruit trees are heavily mulched with hay, and the shrubberies with leaves and compost. The garden is fertilized with spent compost from a mushroom farm and sparingly with chemicals, including ground limestone. It is cultivated regularly after each rain, thus accounting for the paucity of the usual garden weeds and for the complete absence of a few common species.

The vegetation in the meadow is now subject to considerable artificial control to improve the hay crop. Fifteen years ago the grasses were in severe competition chiefly with a large and rapidly expanding patch of *Helianthus tuberosa*, with *Solidago rugosa* and *S. canadensis*, *Asclepias syriaca*, *Equisetum arvense*, and other "weeds" in the descending order of abundance. Today, the grasses—chiefly a few lush species from the Old World—are dominant.

ANNOTATED CHECK LIST

The following lists of plants found on the house lot are based on collected specimens deposited in the Herbarium of the New England Botanical Club. I have excluded all species which have been deliberately introduced by myself or presumably so by my predecessors, including spontaneous seedlings from introduced shade trees on the place or in the neighborhood, such as *Juglans* *nigra, Betula alba, Acer platanoides, A. saccharum, A. saccharinum,* and *Catalpa bignonioides* (of which a single seedling appeared for the first time in 1956). The nomenclature and sequence of families and genera follow Gray's Manual, 8th Ed. Species within a genus are listed alphabetically for convenience, authors' names being omitted for the sake of brevity.

TABLE 1

SPECIES INTRODUCED AND NATURALIZED FROM THE OLD WORLD

Bromus commutatus. Scarce. First observed in 1956. Vineyard.
Festuca elatior. Common. Variable. Meadow and orchard.
F. ovina. Scarce. Rocky, sterile soil on retaining wall.
Poa compressa. Scarce. Dry, stony soil, edge orchard.
Dactylis glomerata. Common. Meadow and orchard.
Lolium perenne. Lush turf. Near edge of lawn.
Arrhenatherum elatius f. *biaristatum.* Scarce. Vineyard.
Agrostis alba. Abundant in moist ground.
A. canina f. *mutica.* Several large colonies. Sunny orchard.
A. tenuis. Rather scarce. Moist sunny orchard.
Phleum pratense. Scarce. Meadow and sunny orchard.
Anthoxanthum odoratum. Common. Moist soil. Banks, orchard, etc.
Digitaria Ischaemum. Common. Lawn, tennis court, etc.
D. sanguinalis. Abundant. Lawn, garden, shrubberies, etc.
Setaria glauca. Abundant. Meadow, garden weed.
Carex spicata. Rather scarce. Orchard.
Asparagus officinalis. Occasional. Dry upper orchard.
Ornithogalum umbellatum. Frequent. Meadow, shrubberies, etc.
Rumex Acetosa. Abundant. Rich soil in restricted area of orchard.
R. Acetosella. Abundant. Sterile, acid soils throughout.
R. crispus. Common. Meadow.
R. obtusifolius. Scarce. Meadow.
Polygonum aviculare. Abundant weed in thin lawn, sidewalks, etc.
P. Convolvulus. Scarce and transient. Sunny bank of meadow.
P. Persicaria. Common. Perennial beds, garden, meadow.
Chenopodium lanceolatum. Frequent in orchard.
Portulaca oleracea. Common garden and lawn weed.
Stellaria media. Abundant weed in disturbed moist soils.
Cerastium vulgatum. Abundant, chiefly as weed in lawn.
Ranunculus repens. Common. Meadow, moist lawn, shrubberies.
R. acris. Common. Drier portions of orchard.
Berberis vulgaris. Frequent as seedlings under trees, shrubberies.
Capsella Bursa-pastoris. Very scarce. Thin lawn.
Barbarea vulgaris var. *arcuata.* Very scarce.
Sedum purpureum. Abundant and aggressive.
Trifolium agrarium. Very scarce. Dry sandy soil. Orchard.
T. pratense. Scarce. Moist rich slope. Orchard.
T. repens. Abundant, moist sunny orchard. Lawn.
Vicia Cracca. Abundant in two areas of orchard.
Rhamnus Frangula. Sporadic as seedling in strawberry bed.
Daucus Carota. Abundant. Meadow, orchard, etc.

Lysimachia Nummularia. A single large patch near the White Pine.
Prunella vulgaris. Abundant. Moist lawn, meadow, etc.
Solanum Dulcamara. Common. Moist ground under shrubberies, trees, etc.
Verbascum Thapsus. Frequent as seedlings in light soil.
Veronica serpyllifolia. Abundant, moist lawn.
Plantago lanceolata. Common. Lawns, meadow, etc.
P. major. Abundant except in orchard.
× *Lonicera bella.* Sporadic as seedlings under apple trees.
Achillea Millefolium. Scarce. Dry, sunny orchard.
Chrysanthemum Leucanthemum var. *pinnatifidum.* Scarce. Edge of meadow.
Tanacetum vulgare. Sporadic. Nursery.
Arctium minus. Sporadic as seedlings.
Cirsium vulgare. Sporadic as seedlings.
Cichorium Intybus. Scarce. Meadow, moist orchard.
Leontodon autumnalis. Abundant. Meadow, orchard, lawn.
Taraxacum erythrospermum. Formerly abundant in drier parts of lawn.
T. officinale. Formerly abundant in meadow and richer portions of lawn.
Hieracium aurantiacum. Scarce. First noticed in 1955.
H. florentinum. Very scarce. Dryish ground in orchard.

This list totals 60 species in 45 genera from 21 families.

Those species of the foregoing genera which more or less resist an attempt to eradicate them appear to be assisted in their continued occurrence by the following agencies: *Daucus*, germination of long dormant seeds(?); *Solanum*, birds; *Arctium*, animals; *Cirsium*, wind; *Taraxacum*, wind; *Hieracium aurantiacum*, wind. Because of their customary appearance as seedlings under trees and food-yielding shrubs the following doubtless are also spread by birds: *Asparagus, Berberis, Lonicera.* I am at a loss to account for the prevalence of *Sedum purpureum* and of its constant appearance as a weed in the infrequently cultivated portions of the garden, such as the strawberry bed.

TABLE 2

SPECIES INTRODUCED OR ADVENTIVE AND NATURALIZED FROM THE NEW WORLD

Mollugo verticillata. Common weed.
Geranium Robertianum. Abundant. Weedy in shrubberies and elsewhere.
Cuscuta campestris. A single vigorous plant appeared in 1957, parasitic on garden carrot.
Solanum rostratum. A single plant, 1956. Garden.
Aster novae-angliae. Scarce. Meadow. First appeared about 1953, possibly locally native.
Galinsoga ciliata. Occasional. Garden and disturbed ground.
Helianthus tuberosa. Meadow. Resists eradication.
Rudbeckia serotina. Abundant. Orchard and dry banks.

This list totals 8 species in 8 genera from 5 families.

TABLE 3

NATIVE IN EASTERN MASSACHUSETTS BUT PRESENT POPULATIONS PROBABLY ORIGINATING FROM OUTSIDE THE LOT

Pinus Strobus. Occasional as seedlings along walls.
Festuca rubra. Common. Orchard.
F. rubra var. *commutata.* Apparently scarce. Unmowed bank.
Poa pratensis. Common. Meadow, orchard.
Eragrostis spectabilis. Frequent. Orchard.
Agropyron repens var. *subulatum.* Abundant. Meadow, orchard.
Agrostis perennans. Frequent. Orchard.
Muhlenbergia frondosa. Frequent. Shrubberies, disturbed ground.
M. mexicana. Scarce, several clumps. Orchard.
M. Schreberi. Frequent. Shrubberies, disturbed ground.
Paspalum ciliatifolium var. *Muhlenbergii.* Rather common. Orchard.
Panicum capillare var. *occidentale.* Not common. Orchard.
P. lanuginosum var. *fasciculatum.* Frequent. Orchard.
P. lanuginosum var. *implicatum.* Frequent. Orchard.
P. spretum. Scarce. Orchard.
Echinochloa pungens var. *Wiegandii.* Scarce. Orchard.
Andropogon scoparius var. *frequens.* Scarce. Orchard.
Cyperus strigosus. Frequent. Orchard, meadow, cultivated ground.
Carex annectens. Not common. Orchard.
Juncus tenuis. Abundant weed. Tennis court.
Maianthemum canadense. Abundant. Edge of meadow under white pine.
Sisyrinchium atlanticum. Scarce. Orchard.
S. montanum var. *crebrum.* Scarce. Orchard.
Habenaria lacera. Two plants. Orchard. First observed in 1957 as new arrival(?).
Spiranthes cernua. Sporadic. Orchard.
Carya glabra. Frequent as seedlings. Orchard. Several young fruiting trees.
C. tomentosa (?). A single sapling about 8 years old. Bank, edge of meadow.
Corylus americana. Scarce. Thicket around large boulder.
Betula populifolia. Strawberry bed, as occasional seedlings.
Quercus alba. Frequent as seedlings especially under apple trees. Orchard.
Q. rubra. Frequent as seedlings. Orchard.
Ulmus americana. Property line, 2 tall trees. Occasional as seedlings under shrubs.
Pilea pumila. Abundant weed in one location under shrubs.
Polygonum Hydropiper. Weed in vineyard, perennial bed.
P. pensylvanicum var. *laevigatum.* Weed in vineyard, perennial bed.
Phytolacca americana. Common weed in shrubberies, etc.
Sagina procumbens. Common weed along sandy flagstone path, shrubbery.
Spiraea latifolia. Very scarce but surviving repeated burns. Orchard.
Fragaria virginiana. Two large clones. Orchard.
Potentilla canadensis. Common. Orchard, thin lawn.
Geum laciniatum var. *trichocarpum.* Scarce. Plantation, shrubberies.
Rubus Enslenii. Very scarce. Orchard.
R. occidentalis. Frequent as seedlings under old trees, along walls, etc.
R. pensylvanicus. Encroaching from neighboring field.
Prunus serotina. One well grown tree. Frequent as young sprouts in orchard.
P. virginiana. Several mature specimens. Thicket.

Oxalis europaea forma *villicaulis.* Abundant. Orchard, lawn, shrubberies.
Geranium maculatum. Well established near plantation.
Acalypha rhomboidea. Common. Orchard, moist shrubberies, garden.
Euphorbia supina. Abundant weed. Driveway, thin lawn.
Celastrus scandens. A single old vine. Numerous root shoots in vicinity.
Impatiens capensis. Abundant. Edge of meadow.
Parthenocissus quinquefolia. Orchard, along southwall. Also as frequent seedlings.
Vitis aestivalis. A single specimen, recently established. Shrubbery.
Hypericum mutilum var. *parviflorum.* Frequent. Moist open shrubbery.
H. perforatum. Scarce. Orchard.
Viola cucullata forma *albiflora.* Scarce. Meadow, orchard.
Epilobium coloratum. Frequent. Moist open shrubbery.
Circaea quadrisulcata var. *canadensis.* Frequent. Moist open shrubbery.
Cornus alternifolia. Scarce. Orchard thicket.
Vaccinium angustifolium var. *laevifolium.* Scarce. Orchard, slope.
Lysimachia quadrifolia. Large clone, under white pine.
Fraxinus americana. Frequent. Shrubberies, etc., as seedlings.
Asclepias syriaca. Nearly eradicated. Formerly abundant.
Convolvulus sepium. Persistent in three locations.
Verbena urticifolia. Scarce. Plantation. Sporadic elsewhere.
Solanum americanum. Sporadic weed. Garden.
S. carolinense. Large clone. Orchard. Spreads rapidly unless checked.
Physalis heterophylla. Upper orchard. Thin sandy soil where under observation since 1940. Two or three stems first appeared in 1956 under old apple tree north side of house on disturbed sandy bank.
Linaria canadensis. Scarce. Shrubbery.
Orobanche uniflora. Very scarce and sporadic. Edge of meadow (1946). Orchard near south wall (1952).
Plantago Rugelii. Ubiquitous weed. Meadow, lawn, shrubberies, etc.
Solidago caesia. Persistent in a single location behind tennis court.
S. canadensis. Frequent, formerly abundant. Meadow, lower orchard.
S. juncea. Frequent. Orchard.
S. nemoralis. Frequent. Orchard.
S. rugosa. Common. Orchard, meadow.
Aster ericoides. Scarce. Orchard.
A. lateriflorus. Common. Orchard.
A. lateriflorus var. *pendulus.* Scarce. Orchard.
A. linariifolius. Scarce. Orchard.
A. undulatus. Abundant. Orchard.
Erigeron annuus. Abundant. Meadow, orchard, lawn.
E. canadensis. Common. Orchard.
E. pulchellus. Several large clones. Orchard.
Antennaria neglecta. Common. Orchard.
A. neodioica. Common. Orchard, lawn.
A. plantaginifolia. Scarce. Orchard.
Gnaphalium obtusifolium. Common. Orchard.
Ambrosia artemisiifolia var. *elatior.* Abundant. Orchard.
Bidens frondosa. Sporadic. Shrubbery.
Lactuca canadensis var. *latifolia.* Meadow where weedy. Orchard where frequent.
L. canadensis var. *longifolia.* Common. Orchard.

This list totals 88 species in 65 genera from 37 families.

Assignments to the category of Table 3 are the result chiefly of subjective judgment. One basic assumption which has influenced my opinion is that the lot had been mowed annually for many years right up to the property lines, except for a small thicket near a big boulder in the northeast corner. The reasons for this assumption, not stated here, seem to me to be convincing. Therefore, all the spontaneous trees and most of the shrubs are listed here. Those native herbaceous plants collected in the unplowed orchard, which appear to require the specialized habitat of dry, sunny sterile soils, presumably have invaded the lot after it was originally cleared. Furthermore, it is a fact that the plantation and most of the shrubberies were established by me after 1940. There seems to be little doubt about the recent invasion of those species found only in the artificial habitats of plantation, shrubberies, tennis court, lawns, driveways and other disturbed soils. It is conceivable, however, that *Corylus*, *Prunus virginiana* (both immediately adjacent to the boulder in the thicket), *Geranium maculatum*, *Cornus*, *Asclepias*, and *Solanum carolinense* have been present in the lot since pre-colonial times.

There are several species listed in Table 3 which appear to occur *only* in disturbed or artificial soils, in the leaf mold of shrubberies, or in mulched areas where there is little competiton from aggressive herbaceous vegetation. These, referred to by generic name only in cases where the identities are in no doubt, are as follows: *Muhlenbergia* (both species), *Juncus, Betula, Ulmus* (the seedlings), *Pilea, Polygonum* (both species), *Phytolacca, Sagina, Geum, Geranium, Euphorbia, Impatiens, Vitis, Hypericum, Epilobium, Circaea, Fraxinus, Verbena, Solanum americanum, Linaria, Bidens.*

TABLE 4

NATIVE IN EASTERN MASSACHUSETTS
AND VERY POSSIBLY PERSISTENT *in situ*, FROM PRE-COLONIAL TIMES

Equisetum arvense. Abundant. Meadow, borders, garden weed.
Osmunda cinnamomea. Scarce. Orchard, chiefly along south wall.
O. Claytoniana. Common. Orchard, chiefly along south wall.
O. regalis var. *spectabilis.* Very scarce. Orchard, in moist sod land.
Onoclea sensibilis. Abundant. Meadow, orchard.
Dryopteris Thelypteris var. *pubescens.* Abundant. Orchard.
Athyrium Filix-femina var. *Michauxii.* Frequent. Orchard, along south wall.
A. Filix-femina var. *Michauxii* f. *elatius.* Frequent. Orchard, along south wall.
A. Filix-femina var. *Michauxii* f. *laurentianum.* Very scarce. Orchard.
A. thelypterioides f. *acrostichoides.* Very scarce. Orchard.

Carex cephalophora. Frequent. Orchard.
C. normalis. Rather scarce. Orchard.
C. pallescens var. *neogaea.* Rather scarce. Orchard.
C. pensylvanica. Frequent. Orchard.
C. scoparia. Not common. Orchard.
C. Swanii. Very scarce. Orchard.
C. tenera. Common. Orchard.
Luzula multiflora. Rather common. Orchard.
Apios americana. Two colonies. Along north and south walls.
Rhus radicans. Abundant and ubiquitous. Orchard. Seedlings repeatedly appearing in shrubberies, under trees, nursery, etc.
Viola papilionacea. Abundant. Orchard. Also as weed in shrubberies.
Apocynum androsaemifolium. A single large clone. Orchard near thicket. Also one seedling found in raspberry bed in 1956.
Aster cordifolius. Common. Orchard. Along walls. Also abundant weed in shrubberies and disturbed ground.
A. novi-belgii. Scarce, nearly extirpated. Meadow.
A. puniceus var. *compactus.* Scarce, nearly extirpated. Meadow.
A. vimineus. Common. Orchard.

This list totals 24 species in 12 genera from 10 families.

Many of the species which I have assigned to Table 3 possibly were sparse or rare constituents of the original flora of the lot. However, I have excluded from Table 4 most of the forage plants (those grasses, sedges and other herbaceous species frequently disseminated directly or indirectly by grazing animals), and also aggressive species shedding wind-borne seeds or attractive to seed- and fruit-eating birds. The mere fact that with due diligence we can find most of them in our fourth-growth woodlands is no proof that they occurred normally in a virgin deciduous forest except as transients in naturally disturbed soils or habitats, such as blow-downs and "burns" started by Indians or rarely by lightning. These considerations lead to the inevitable reflections concerning the profound change in the composition and relative abundance of our local flora, which has occurred during the past three hundred years. The conversion of the wilderness to farm land with its multiplicity of wood lots, pastures, mowings, fence rows, stone walls, ditches, roadsides and thickets offers numerous suitable habitats for hundreds of species where few or none existed under primitive conditions. Hence, a large number of our native species, now common to abundant throughout the countryside, originally must have been uncommon, or local, or even rare, for the simple reason that favorable habitats were scarce.

In attempting to sort out the species which may have survived *in situ* as a relic of the primeval flora of the lot it is first necessary to reconstruct the probable nature of the forest growth before the land was cleared and to visualize the various ecological niches provided by it, with due reference to physical characteristics of the site as described earlier in this paper. It is then possible to consider whether the ecological requirement of each native species now growing on the lot is consistent with the ecological niches reasonably assumed to have been provided by its original forest cover. As a clue to this problem, there is a patch of rocky woods on the steeper north slope of our hill at a distance of about three hundred meters but at a somewhat lower elevation. Although badly mauled by the series of hurricanes during the past twenty years, it has every appearance of being a relatively undisturbed remnant of the original forest. It consists mainly of a mixed deciduous hardwood forest. A brief winter inspection reveals the following species (doubtless among others): *Pinus rigida, Juglans cinerea* (a single aged and dying specimen), *Carya* sp., *Betula lenta* (now the most abundant species and rapidly invading the openings made by windfalls), *Quercus alba, Q. rubra, Ulmus americana* and *Fraxinus americana.* There are also a few *large* stumps of *Castanea dentata.* At the lower edge of this wooded patch is a small water course which, in fact, is a continuation of the covered drainage ditch in my meadow. Its herbaceous vegetation is what one might expect in an area such as this: ferns, grasses, sedges, and the other elements of a flora to be found in dry to moist woods, glades, and along partially shaded runnels. Prior to the hurricanes there were several very large old white oaks on the southern flank of our hill, and, according to an old neighbor, a small grove of ancient chestnut trees in the vicinity, most of which were removed between 1875 and 1900.

It is probable, therefore, that mature deciduous trees grew originally on my portion of the hill, effectively suppressing sapling growth under them and offering a suitable habitat for a varied herbaceous flora in dry, moist and swampy open woods. I conclude that the foregoing list represents a remnant of the original flora—a remnant capable of persisting under the harsh ecological conditions imposed by mowing, burning and competition with introduced species.

It is of some interest, perhaps, to note that the following plants listed in Tables 3 and 4, although indigenous to the lot or in the neighboring region, behave in a weedy manner in one or more of the various "artificial" habitats on my place, viz., meadow, garden, shrubberies, plantation, lawn, tennis court, but occur sparingly if at all on undisturbed soils: *Equisetum*, *Onoclea*, *Agropyron*, *Muhlenbergia* sp., *Cyperus*, *Juncus*, *Pilea*, *Polygonum* sp., *Phytolacca*, *Sagina*, *Geum*, *Potentilla*, *Geranium*, *Oxalis*, *Acalypha*, *Hypericum mutilum*, *Epilobium*, *Circaea*, *Plantago* ssp., *Aster cordifolius*, *Erigeron annuus*, *Helianthus*, *Bidens*, *Lactuca*.

In certain instances there is indirect evidence of the means of dissemination, aside from those plants whose seeds are obviously windblown or have been introduced in manure and lawn grass seed. Seedlings of the following plants occur almost exclusively under apple trees used by nesting robins or under juicy fruited shrubs attractive to catbirds, starlings, and robins, and other fruit-eating birds: *Asparagus*, *Phytolacca*, *Berberis*, *Rhus*, *Parthenocissus*, *Rhamnus* (strawberry bed), *Physalis*, *Lonicera*. I have alluded to the surprising appearance of *Vitis aestivalis*. Mentioning the occurrence to an ornithological friend, he asked if I had ever seen Ruffed Grouse on my place. When I assured him that I had recorded Grouse on at least three widely separated occasions he said that Grouse were fond of ripe grapes and apparently ate them whole. I have never permitted *Arctium* or *Bidens* to reach maturity on my place, but having observed that my dog frequently comes home with an assortment of burs in his coat, it is reasonable to assume that long coated animals (dogs, cats, skunks or foxes) have transported the seeds in these two cases. The frequent occurrence of hickory and oak seedlings in the orchard is probably due to Gray or Red Squirrels, although Jays and Crows cannot be excluded as possibilities.

The Flora of the Boston District, published serially in Rhodora,

TABLE 5

AGGREGATE COUNT OF FAMILIES, GENERA AND SPECIES COMPARED WITH THE FLORAS OF THE BOSTON DISTRICT AND OF GRAY'S MANUAL RANGE

	Families	*Genera*	*Species*			
			Introd.	Native	Total	% Native
Lincoln House Lot	53	95	66[1]	110[2]	176	62.5
Boston District	133	697	789[1]	1312[2]	2101	62.5
Gray's Manual Range	168	1133	1098	4425	5523	80.1

[1] Introduced and naturalized or adventive from outside eastern Massachusetts.
[2] Native in eastern Massachusetts.

Vols. 9–26 incl., comprises a preliminary list of all Pteridophytes and Spermatophytes, including varieties and named forms, reliably reported to a committee of the New England Botanical Club as growing without cultivation in a precisely defined area which is here roughly described as within thirty miles of Boston. Lincoln is fifteen miles due west of Boston.

The Boston District figures are derived from an unverified count of the taxa involved. Accuracy, as of the present day, is impossible because the list has never been brought up to date either in respect to nomenclature or additions. However, it is unlikely (by the law of chances) that the ratio of native species to total species would be significantly different were an up-to-date list available. Incidentally, it is, of course, a sheer coincidence that this ratio of 62.5%, as stated above, is exactly the same as that for the Lincoln house lot! The significant point is that they are of the same order of magnitude and are in marked contrast to the ratio of 80.1% for Gray's Manual range. Here, it seems, is a bit of concrete evidence of the truth of the commonly accepted assumption that the exotic elements of the floras of long and densely settled areas of this country (e.g., along the eastern seaboard) are much larger than of the relatively youthful regions (e.g., Mississippi basin and prairie states). It takes time for introductions to spread, even when suitable habitats are available. Perhaps in this age of universal motor travel the tempo of the spread is being greatly accelerated.

The figures in Table 5 well illustrate the diversity of our local flora. My house lot of less than three acres contains nearly 8.5% of the species reported from the Boston District (approximately 1900 square miles of which a substantial fraction is salt marsh and sand dune). The Boston District, less than one-quarter of the area of Massachusetts, contains 38% of the species recorded from the entire Gray's Manual range. This diversity is even more striking in respect to genera and families.—LINCOLN, MASSACHUSETTS.

THELEPOGON ELEGANS ROTH IN THE DOMINICAN REPUBLIC.—Specimens of this tropical Old World grass recently came to hand for determination, with the information that it is becoming a pest in the rice fields of the Dominican Republic. In its immature stages it resembles rice plants rather closely, thus making more difficult the application of selective control measures.—O. E. JENNINGS, CARNEGIE MUSEUM.

THE FRUTICOSE AND FOLIOSE LICHENS OF WORCESTER COUNTY, MASSACHUSETTS.[1]

Vernon Ahmadjian

The study of lichens has undoubtedly been discouraging to many who have become interested in these forms, due to the lack of simple and readily available keys. It is hoped that this work will be useful in the identification of lichens and help to contribute to the fulfillment of this major need in the field of lichenology.

Although the present work is regional in its scope, the lichens described are by no means localized and can be readily found throughout the northeastern part of the United States. The keys, however, have been designed specifically from material collected within Worcester County. Anyone attempting to determine lichens from outside of this region should bear this in mind.

Only the fruticose and foliose lichens have been dealt with because the crustose forms are too difficult to be given a simple and yet adequate treatment suitable for beginners.

Worcester County, making up the central part of Massachusetts, is the largest county in the state, and consists of an area of approximately 1,522 square miles or 974,000 acres. It extends 35 miles from east to west and 50 miles, or the entire width of the state, from north to south. The county is characterized by ranges in elevation of from 800–1,200 feet, excluding the extremely low and high points, and shows a remarkable uniformity of the horizon line. The most notable of the remnants of elevations above the plateau surface still existing are Mt. Wachusett in Princeton, elevation 2018 ft., Little Wachusett, Princeton, elevation 1,559 ft. and Asnebumskit Hill, Paxton, elevation 1,395 ft. Throughout the county many rocks have been scattered as a result of the glaciation; contacts of schist and granite are most prevalent.

The climate of Worcester County is as variable as that in any temperate region. In general, the winter temperature averages about 26 degrees with a minimum recorded of −24 degrees and the average summer temperature is about 69 degrees, with a maximum recorded of 103 degrees. The average annual precipitation is 42.3 inches.

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[1] This contribution is part of a thesis submitted to Clark University, Worcester, Massachusetts, for the degree of Master of Arts, 1954–1956.

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LITERATURE USED IN THE IDENTIFICATION OF LICHENS

For an introduction to lichenology, the Lichen Book by G. G. Nearing has proved to be most satisfactory. It describes approximately 500 lichens, most of which are commonly found in the northeastern part of the United States, and its illustrations and descriptions are good. Unfortunately, the approach is rather unscientific and the keys are not too usable.

Lichens by Annie Lorrain Smith is an excellent book embracing virtually all aspects of lichenology, from the history of lichens to their physiology, ecology, morphology, etc. It also has an extensive bibliography and is an invaluable book for those who are interested in studying this group of plants.

The Lichen Flora of the United States by Bruce Fink gives a comprehensive survey of the lichens of the United States and serves as a good reference book. Its keys, however, are difficult and poorly constructed and on the whole the beginner would find the book rather cumbersome.

For those wishing to go on further in the study of lichens, Rabenhorst Kryptogamen Flora provides an excellent treatment, with keys and descriptions of the various lichen groups. Each group treatment is the work of an expert in that particular area. The section on lichens in Engler and Prantl, Die Natürlichen Pflanzenfamilien, is also worthy of notice here, containing good keys and descriptions.

The Catalogus Lichenum Universalis by A. Zahlbruckner is another indispensable piece of lichenological literature containing all known lichen taxa up to 1940, and giving nomenclature and references to literature pertaining to each lichen that is listed. Consisting of ten volumes, it contains over 17,000 lichen names, many of which, however, have now been outdated. Dr. I. Mackenzie Lamb is at present working on an extension of this treatment by Zahlbruckner which will bring this list of known lichens up to date.

The Lichen Handbook[2] by Mason E. Hale is an excellent up-to-date booklet on lichenology and includes sections on the chemistry, reproduction, phytogeography, and classification of lichens. Prepared from a series of lecture notes on the subject, it reviews all aspects of the field and would be of much value to beginners.

For recent lichenological works or studies, The Bryologist, a quarterly journal of the American Bryological Society, would be a likely source containing a section listing recent literature on lichens by William L. Culberson. Rhodora, a monthly journal of the New England Botanical Club, is another possible reference source.

Key to the Main Groups of Lichens

Thallus elongated, shrubby to band-like or thread-like, erect or pendulous, usually branched; arising either directly from the substratum by a basal holdfast, or from a primary thallus, in some instances dying off at the base .... Fruticose Lichens.

Thallus flattened, leaf-like, dorsiventral, with a visible difference between upper and under surfaces; partly free from the substratum, to which it is relatively loosely attached, usually by rhizoids .... Foliose Lichens.

Thallus crust-like, closely applied and wholly fused to the substratum by the underside; not detachable except by scraping off in small fragments; commonly areolate, divided by cracks into small island-like portions Crustose Lichens.

Key to the Genera of Fruticose Lichens

1. Thallus flattened; primary thallus absent 2
1. Thallus not flattened, cylindrical; primary thallus present or absent 4
2. Thallus soft and flaccid when dry, usually pendulous ... *Evernia mesomorpha* Nyl. On bark. Thallus greenish or yellowish-green, sorediose. Spores simple, one-celled.
2. Thallus rather stiff and rigid, erect 3
3. Thallus yellowish, almost always without marginal spinules ...... *Ramalina pollinaria* (Liljebl.) Ach. Branches short, tips bursting open, densely farinose sorediate. Spores two-celled.
3. Thallus brownish, with marginal spinules .... CETRARIA, p. 77
4. Stalks solid 5
4. Stalks hollow or loosely filled 7
5. Stalks with tough tensile cartilaginous central core 6
5. Stalks without tough tensile cartilaginous central core .... *Baeomyces roseus* Pers. On sandy banks along roadside. Very common. Primary thallus crustose, gray. Podetia simple, white or pinkish, bearing single mushroom-like pink apothecia. Thallus bearing scattered white or greenish globules.
6. Thallus greenish to silver-gray; assimilative branches squamulose, coralloid, or granulose .... STEREOCAULON, p. 81
6. Thallus greenish-gray; assimilative branches filamentous ..... USNEA, p. 81

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[2] Available from the author: Mason E. Hale, Division of Cryptogams, Smithsonian Institution, United States National Museum, Washington 25, D. C.

7. Thallus hair-like......*Alectoria nidulifera* Norrl. On rocks and rotting wood. Thallus sorediate. Apothecia rare.
7. Thallus cylindrical, shrubby or dendroid................CLADONIA, p. 77

KEY TO THE SPECIES OF FRUTICOSE LICHENS

CETRARIA

1. Thallus having scattered brown or black tubercles. Apothecia originating from under surface...................*Cetraria ciliaris* Ach. On bark.
1. Thallus having no tubercles. Apothecia, if present, originating from upper surface......*Cetraria islandica* (L.) Ach. On ground in pine woods. Stalks strap-shaped, forking, thin, curling when dry to form a trough-like structure.

CLADONIA

1. Primary thallus crustose, gray. Podetia simple or branched, brown tipped. Apothecia brown and clustered....*Cladonia papillaria* (Ehrh.) Hoffm. On ground.
1. Primary thallus squamulose or disappearing..........................2
2. Primary thallus disappearing, rarely present. Podetia branched, usually elongated and entangled, dying off at the base....................3
2. Primary thallus squamulose, persistent...........................12
3. Podetia squamulose, usually erect and sterile, showing openings in branch axils, grayish-green, rarely brownish. Apothecia, if present, brown...4
3. Podetia not squamulose...5
4. Podetia slender, entangled, warty in appearance. KOH−, Pd+ red *Cladonia furcata* (Huds.) Schrad. On ground. Var. *palamaea* (Ach.) Vainio. Podetia brownish. Var. *pinnata* (Flk.) Vainio. Podetia densely squamulose.
4. Podetia somewhat swollen, little entangled, covered sparingly with granular soredia. KOH−, Pd+ red....*Cladonia scabriuscula* (Del.) Vainio. On ground.
5. Podetia entangled, short, spinose at tips, usually forming sponge-shaped tufts. KOH−, Pd−..6
5. Podetia entangled, or little entangled. Extreme tips blunt to hair-like, drooping or erect...7
6. Extreme tips spinose, branch axils usually perforated...*Cladonia uncialis* (L.) Web. On ground in rocky hillside pastures. Very common.
6. Podetia much enlarged, contorted, flabby, showing lattice-like openings *Cladonia Boryi* Tuck. On ground.
7. Podetia abundantly farinose-sorediate, little entangled. KOH−, Pd+ red.................*Cladonia farinaceae* (Vainio) Evans. On ground.
7. Podetia esorediate..8
8. Podetia silver-gray and smooth or warty to granular in older specimens. Tips brownish, usually divided into whorl-like arrangements and then each tip subdivided into many drooping finger-like projections. KOH + yellow, Pd+ red......*Cladonia rangiferina* (L.) Web. On ground in rocky hillside pastures. Fairly common. f. *crispata* Coem. Podetia more densely branched and colonies more compact.
8. Podetia greenish or yellowish-gray...............................9
9. Podetia slender, tips forked, hair-like; branch axils usually closed. KOH + yellow, Pd + red.....*Cladonia tenuis* (Flk.) Harm. On ground in open fields and hilly pastures. Very common.

9. Podetia polytomously branched; branch axils usually perforated......10
10. Tips not usually darkened, tending to curve in one direction. KOH −, Pd + red......*Cladonia sylvatica* (L.) Hoffm. On ground in rocky hillside pastures.
10. KOH −, Pd −..11
11. Podetia forming rather loose branch-systems; extreme tips rather long, diverging in various directions....*Cladonia mitis* Sandst. On ground.
11. Podetia thickened, tips short and numerous....*Cladonia submitis* Evans. On ground.
12. Podetia usually lacking or very short. Apothecia, if present, brown, resting on or appearing immersed in the primary squamules........13
12. Podetia present, well-developed, simple or branched, cylindrical or cup-forming..14
13. Primary squamules small, margins serrated into fine tooth-like lobes. Usually sterile. Apothecia, if present, large, lumpy. KOH −, Pd + red......*Cladonia caespiticia* (Pers.) Flk. On ground, rotting wood, bark. Very common.
13. Primary squamules long, strap-shaped, notched at tips, blue-gray, curling upward when dry showing white under surface. KOH + yellow, Pd + red...........*Cladonia apodocarpa* Robbins. On ground. Common.
14. Podetia clustered to form more or less matted colonies; apothecia brown.15
14. Podetia separate, not forming mat-like colonies.....................18
15. Podetia cupless, having openings in branch axils; often squamulose. KOH −, Pd + red.....................*Cladonia furcata* (Huds.) Schrad.
15. Podetia usually covered in various degrees with large or minute squamules; usually forming open cups which broaden out gradually or abruptly; irregular dichotomous branching..............................16
16. Podetia forming cups with sieve-like openings....*Cladonia turgida* (Ehrh.) Hoffm., f. *squamulosa* (Rabenh.) Theobald. On ground. Podetia squamulose.
16. Podetia not forming cups with sieve-like openings...................17
17. Podetia densely covered with minute or large squamules. KOH −, Pd −....*Cladonia squamosa* (Scop.) Hoffm. f. *squamosissima* Flk. Podetia densely squamulose.
17. Podetia not densely covered with squamules; forming well developed cups 2–4 mm. in diameter. KOH +, Pd +....*Cladonia carassensis* Vainio, f. *regularis* Vainio. On ground. Podetia repeatedly proliferating with short stories (2–13 mm.) Cups small, regular, usually abruptly dilated. No squamules.
18. Podetia scyphous, forming cups.................................19
18. Podetia ascyphous, not cup-forming.............................34
19. Podetia cylindrical, except at the extreme tips where they expand abruptly to form small cups. Apothecia brown.........................20
19. Podetia expanding gradually to form rather large cups...............25
20. Cups funnel-shaped, usually opening into podetial cavity. Podetia never sorediose...21
20. Cups closed, shallow. Podetia sorediose.........................22
21. KOH −, Pd −....................*Cladonia squamosa* (Scop.) Hoffm.
21. KOH +, Pd +........................*Cladonia carassensis* Vainio.
22. Podetia farinose-sorediate throughout except for a small portion at base. Cups merely small depressions in slightly expanded tips, often lacking and the podetia pointed and horn-like at the tips. KOH −, Pd +

red....*Cladonia coniocraea* (Flk.) Spreng. On ground, rotting wood, bark. Very common. f. *phyllostrota* (Flk.) Vainio. Podetia squamulose. f. *stenoscypha* (Stuckenberg) Sandst. Podetia forming cups, narrow at the mouth, often abortive.

22. Podetia granular-sorediate, or if farinose, mixed with granules........23
23. Podetia usually over 15 mm. long, covered with finely granular soredia only on upper part; expanded at tips to form shallow star- or wand-shaped cups; or cupless and simple. KOH −, Pd + red.....*Cladonia nemoxyna* (Ach.) Nyl. On ground and rotting wood. Very common.
23. Podetia short, less than 15 mm. long. KOH −, Pd + red...........24
24. Podetia covered with farinose soredia, mixed with coarse granules.*Cladonia cylindrica* Evans. On ground. f. *scyphifera* Evans. Podetia stout, forming distinct cups at the tips.
24. Podetia covered with coarse granular soredia....*Cladonia pityrea* (L.) Hoffm. On rotting wood. Common.
25. Cups flat, shallow, saucer shaped, usually proliferating once or several times. Apothecia brown....................................26
25. Cups deep, goblet shaped, rarely proliferating, and then usually only once. Apothecia brown or red...............................27
26. Proliferations few, from margins of cups....*Cladonia gracilis* (L.) Willd. On ground.
26. Repeated proliferations from center and margins of cups, or from sides of podetia. KOH −, Pd +....*Cladonia verticillata* Hoffm. On rotting wood and ground. Very common. f. *aggregata* (Del.) Oliv. Proliferations central and numerous. f. *apoticta* (Ach.) Vainio. Podetia with proliferations along the sides as well as from the centers of the cups. f. *phyllocephala* (Flat.) Oliv. Podetia squamulose.
27. Apothecia, if present, red. Podetia pale bluish to yellowish-green....28
27. Apothecia, if present, brown. Podetia grayish-green to brownish.....29
28. Podetia usually covered with coarse granular soredia, rarely farinose. KOH −, Pd −....*Cladonia pleurota* (L.) Willd. On ground. Common. Var. *frondescens* (Nyl.) Oliv. Podetia squamulose.
28. Podetia dusted with fine soredia, farinose; long, usually contorted and stout. Proliferations, if present, from margin of cup. KOH −, Pd −..................*Cladonia deformis* (L.) Hoffm. On ground.
29. Podetia esorediose. KOH −, Pd + red....*Cladonia pyxidata* (L.) Hoffm. On ground and rotting wood. Very common.
29. Podetia sorediose...30
30. Soredia farinose..31
30. Soredia granular..33
31. Cups narrow, slender, sometimes lacking, KOH −, Pd + red....*Cladonia fimbriata* (L.) Fr. Soredia throughout length of stalks. On ground.
31. Cups rather well formed, rarely lacking..........................32
32. Podetia forming distinct cups with marginal proliferations. KOH −, Pd + red....*Cladonia cornutoradiata* Sandst. On ground. f. *radiata* (Schreb.) Sandst. Podetia forming distinct cups with marginal proliferations.
32. Podetia forming broad, funnel-shaped cups. KOH + brown, Pd + red......*Cladonia conista* (Ach.) Robbins. Soredia found only on cups. On ground.
33. KOH −, Pd + red....*Cladonia chlorophaea* (Flk.) Spreng. On ground and rotting wood. Very common. f. *carpophora* (Flk.) Anders.

Podetia fertile. Apothecia usually borne on proliferations from margins of cups.

33. KOH –, Pd – . . . . *Cladonia Grayi* Merrill. On ground and rotting wood. Very common. f. *carpophora* Evans. Podetia fertile. Apothecia usually borne on proliferations from margins of cups. f. *prolifera* Sandst. Cup-forming proliferations from margins of primary cups. f. *squamulosa* Sandst. Podetia squamulose.

34. Apothecia red 35

34. Apothecia brown 40

35. Podetia esorediose, simple or branched, with or without squamules. Apothecia almost always present . . . . *Cladonia cristatella* Tuck. On ground, rotting wood and bark. Very common. f. *ochrocarpia* Tuck. Apothecia yellow, to flesh colored. f. *simulata* Robbins. Bearing minute, clustered, pale apothecia on short lateral outgrowths of main podetial axes. f. *squamosissima* Robbins. Apothecia red. Podetia densely squamulose. f. *vestita* Tuck. Apothecia red. Podetia squamulose.

35. Podetia sorediose 36

36. Thallus yellowish-green. Primary squamules densely farinose-sorediose, often crust-like . . . . *Cladonia incrassata* Flk. On rotting wood. Fairly common.

36. Thallus greenish gray or whitish 37

37. Podetia densely covered with coarse granules and squamules, usually falling away at tips to expose whitish medulla. KOH –, Pd –, or Pd + pale yellow . . . . *Cladonia didyma* (Fée) Vainio. On rotting wood.

37. Podetia covered with farinose, rarely granular soredia 38

38. KOH + yellow, Pd + red . . . . *Cladonia macilenta* Hoffm. On rotting wood and ground. Common.

38. KOH –, Pd – 39

39. Podetia usually decorticate and farinose sorediate throughout length except small basal portion, slender . . . . *Cladonia bacillaris* (Ach.) Nyl. On rotting wood and ground. Very common. f. *clavata* (Ach.) Vainio. Forms with simple podetia which are blunt at tips; usually sterile. Apothecia, if present, always terminal. f. *reagens* Evans. Podetia with yellowish-brown spots. KOH +, purple red.

39. Podetia not decorticate throughout; farinose sorediate in upper parts . . . . *Cladonia Floerkeana* (Fr.) Flk. On rotting wood and ground. *f. trachypoda* (Nyl.) Vainio. Podetia large, well developed, bearing cups; partly decorticate.

40. Primary squamules containing large granules along the margins, forming a dense, granular crust. Podetia granulose sorediate. Thallus small, delicate . . . . *Cladonia delicata* (Ehrh.) Flk. On rotting wood. Fairly common.

40. Primary squamules not forming a granular crust 41

41. Primary squamules small, usually 1 mm. long or less 42

41. Primary squamules large 43

42. Podetia small, simple or branched sparingly at tips, usually contorted. Apothecia large, turban-like, dark brown. KOH + yellow, Pd + red . . . . *Cladonia capitata* (Michx.) Spreng. (Syn. C. *mitrula* Tuck.) On ground. Fairly common.

42. Podetia larger, often squamulose, producing short branches at tip. Apothecia large, buff or lavender . . . . *Cladonia piedmontensis* Merrill, f. *squamulosa* Robbins. On ground. Podetia squamulose.

43. KOH + red, Pd + yellow. Podetia grayish-green, peg or rod-shaped. Apothecia lumpy and irregular......*Cladonia subcariosa* Nyl. On ground. f. *squamulosa* Robbins. Podetia squamulose.
43. KOH −..44
44. Podetia esorediose, grayish-green, simple or sparingly branched. KOH −, Pd + red....*Cladonia clavulifera* Vainio, f. *nudicaulis* Evans. On ground. Podetia simple or little branched, lacking squamules except at base. Apothecia large, one or several.
44. Podetia sorediose..45
45. Soredia farinose...46
45. Soredia granular, or if farinose, mixed with granules.................47
46. Tips of podetia pointed, horn-like. KOH −, Pd + red....*Cladonia coniocraea* (Flk.) Spreng.
46. Tips of podetia blunt. KOH −, Pd + red....*Cladonia fimbriata* (L.) Fr.
47. Podetia covered with farinose soredia mixed with coarse granules..*Cladonia cylindrica* Evans.
47. Soredia granular...48
48. Podetia long, usually over 15 mm.; soredia occurring only in upper parts..............................*Cladonia nemoxyna* (Ach.) Nyl.
48. Podetia short, less than 15 mm.; podetia sorediate throughout...*Cladonia pityrea* (L.) Hoffm.

STEREOCAULON

1. Primary thallus persistent, crustose, well developed. Stalks small, usually less than 1 cm., simple or sparingly branched, tips densely sorediate *Stereocaulon pileatum* Ach. On rocks.
1. Primary thallus disappearing. Stalks rather long, well developed esorediose...2
2. Stalks densely covered with coralloid squamules and granules. Usually fruiting. Pd + orange red....*Stereocaulon dactylophyllum* Flk. (Syn. *S. coralloides* Fr.) On rocks.
2. Stalks not densely covered with coralloid squamules and granules. Rarely fruiting. Pd + faint sulfur yellow....*Stereocaulon evolutoides* (H. Magn.) Frey. On rocks. Common.

USNEA

1. Thallus short, erect, shrub-like, sorediose, abundantly fibrillose....*Usnea hirta* (L.) Wigg. On bark.
1. Thallus short, erect, shrub-like, esorediose, less abundantly fibrillose..*Usnea florida* (L.) Web. On bark. Fairly common.

Key to the Genera of Foliose Lichens

1. Thallus brightly colored, yellow or orange...............................2
1. Thallus not brightly colored..3
2. Thallus yellow; KOH −....*Candelaria concolor* (Dicks.) Arn. On bark. Thallus small, finely divided; lobes small, finely incised, sorediate or granulose. Apothecia very small, scattered, circular, yellow to orange. Var. *effusa* (Tuck.) Merrill & Burnh. Very common. Thallus reduced almost wholly to a powdery crust.
2. Thallus yellowish to orange; KOH +, red to purple....*Xanthoria candelaria* (L.) Kickx. Found on elm trees along roadsides. Thallus of rather deeply cut, branched and imbricated lobes the margins of which are densely granulose or powdery, sometimes forming a thick powdery crust.

3. Thallus fastened by a central point below 4
3. Thallus fastened by several or more points or rhizinae 5
4. Fruit bodies perithecia, immersed in thallus, globose, appearing outwardly as spots or small warts. Thallus pale on underside . . . Dermatocarpon, p. 82.
4. Fruit bodies apothecia, sessile on thallus, round or angular. Thallus blackish on underside . . . . Umbilicaria, p. 84
5. Lower surface reticulated with distinct veins . . . . *Peltigera canina* (L.) Willd. On ground. Apothecia large, margins rolled backward, borne on tips of extended lobes.
5. Lower surface not veined 6
6. Lobes elongated, narrow. Upper cortex compact, well developed . . *Anaptychia hypoleuca* (Muhlb.) Mass. On bark.
6. Lobes not greatly elongated. Upper cortex loose, not compact 7
7. Rhizinae usually quite numerous 8
7. Rhizinae scarce or absent 9
8. Spores two-celled, dark. Underside of thallus usually white, rarely brown or black . . . . Physcia and Pyxine, p. 83
8. Spores simple, uncolored. Underside of thallus most always brownish to blackish . . . . Parmelia, p. 82
9. Thallus hollow; tips usually bursting, densely sorediate; rhizinae absent . . . . *Hypogymnia physodes* (L.) Nyl. On bark, very common.
9. Thallus not hollow; rhizinae scarce . . . . Cetraria, p. 82

CETRARIA

1. Thallus brownish 2
1. Thallus greenish-gray 3
2. Thallus having scattered brown or black tubercles. Apothecia originating from under surface . . . . *Cetraria ciliaris* Ach. On bark.
2. Thallus having no tubercles. Apothecia, if present, originating from upper surface . . . . *Cetraria islandica* (L.) Ach. On ground in pine woods. Stalks strap-shaped, forking, thin, curling when dry to form a trough-like structure.
3. Thallus irregularly lobed; lobes usually curled away from substrate; margins undulate, somewhat crenulate, covered with dense pale green soredia; undersurface brown . . . . *Cetraria Oakesiana* Tuck. On bark.
3. Thallus lobes channeled and pitted, margins ascending, usually irregularly jagged and torn; undersurface pitted, white or brown near the tips, black at the base . . . . *Cetraria Tuckermanii* Oakes.

DERMATOCARPON

1. Growing on rocks submerged in water. Undersurface veined. Thallus lobes not pruinose when dry . . . . *Dermatocarpon aquaticum* (Weis.) Zahl. Found only in one location, on a rock in a stream which normally dries up in the summer months.
1. Growing on rocks in dry situations. Undersurface not veined. Thallus lobes much imbricated, pruinose when dry . . . . *Dermatocarpon miniatum* (L.) Mann, var. *complicatum* (Lightf.) Th. Fr.

PARMELIA

1. Thallus sorediose 2
1. Thallus esorediose 5

2. Soredia developing in rows, along cracks in the thallus or along the margins..............*Parmelia sulcata* Tayl. On bark. Very common.
2. Soredia not in rows..3
3. Thallus brown, with small warts breaking down into soredia.....*Parmelia subaurifera* Nyl. On bark. Very common.
3. Thallus not brown, without warts.....................................4
4. Thallus yellowish-green; undersurface brown or black....*Parmelia caperata* (L.) Ach. On bark and rocks. Very common.
4. Thallus greenish to bluish-gray; undersurface pale to drab......*Parmelia dubia* (Wulf.) Mass. (Syn. *P. Borreri* Turn.) On bark.
5. Thallus containing few blackish cilia along margins; rather broad-lobed.....................*Parmelia perforata* (Wulf.) Ach. On bark.
5. Thallus not ciliate, not broad-lobed.................................6
6. Thallus reticulate-rimose, having a network of chinks and cracks, greenish to bluish-gray..7
6. Thallus not reticulate-rimose, yellowish-green....*Parmelia conspersa* (Ehrh.) Ach. On rocks and bark. Very common. var. *stenophylla* Ach. Lobes rather narrow and imbricated. No isidia. f. *isidiata* (Anzi) Berry. Thallus densely covered with isidia.
7. Under surface pale......*Parmelia rudecta* Ach. On bark. Very common.
7. Under surface black....*Parmelia saxatilis* (L.) Ach. On rocks and bark. Common.

PHYSCIA and PYXINE

1. Thallus sorediose...2
1. Thallus lacking soredia, esorediose...................................8
2. Medulla yellow; apothecia lecideine...*Pyxine sorediata* (Ach.) Fries. On bark.
2. Medulla white or orange; apothecia lecanorine.......................3
3. Lobes ascending, free from substratum...............................4
3. Lobes adnate, flattened, not ascending..............................5
4. Lobes helmet or hood-shaped, with long cilia along margins; soredia within these hood-like pustules. KOH = ..*Physcia ascendens* Bitt. On bark.
4. Lobes finely incised, not hood-shaped, small, short. KOH ± yellow....*Physcia millegrana* Degel. (Syn. *P. tribacia* (Ach.) Nyl.) On bark. Very common.
5. Lobes very thin, adglutinated to the substratum....*Physcia elaeina* (Sm.) A. L. Sm. On bark.
5. Lobes rather thick, not adglutinated to the substratum...............6
6. Medulla orange....*Physcia orbicularis* (Neck.) Potsch., f. *rubropulchra* Degel. On bark. Very common.
6. Medulla white..7
7. Thallus gray or whitish, without brownish tinge....*Physcia leucoleiptes* (Tuck.) Lettau. On bark.
7. Thallus brownish or olive-gray....*Physcia orbicularis* (Neck.) Potsch. On bark.
8. Thallus pruinose, having powdery appearance....*Physcia pulverulenta* Hampe. On bark.
8. Thallus not pruinose. Cortex KOH + yellow...........................9
9. Lobes with marginal cilia........*Physcia leptalea* (Ach.) DC. On bark.
9. Lobes without marginal cilia..10
10. Thallus gray, with white spots. Medulla KOH + yellow.......*Physcia aipolia* (Ehrh.) Hampe. On bark.

10. Thallus gray, without white spots. Medulla KOH —. . . . *Physcia stellaris* (L.) Nyl. On bark. Very common. f. *tuberculata* Kernst. Lobes densely covered with tubercles, except at tips. var. *rosulata* (Ach.) Nyl. Lobes are wide, fan shaped at the tips.

UMBILICARIA

1. Thallus pustulate, blistered or pimpled; undersurface pitted. . . . *Umbilicaria papulosa* (Ach.) Nyl. On rocks.

1. Thallus not pustulate. 2

2. Undersurface having grilled or laced appearance. Thallus margins commonly curling under, inrolled. Apothecia common. . . . . *Umbilicaria Mühlenbergii* (Ach.) Tuck. On rocks.

2. Undersurface hairy. Thallus margins not curling under. Apothecia rare. . . . *Umbilicaria mammulata* (Ach.) Tuck. (Syn. *Gyrophora Dillenii*, *U. Dillenii*). On rocks.

Glossary

Adnate. Adhering or touching broadly to the substratum.

Apothecium. An open cup- or saucer-shaped fruiting body in which the cavity is lined with a palisade-like layer of microscopic asci which bear the spores.

Areolate. Marked out in little spaces or islands.

Ascus. (Asci). A sac-like cell in which the spores are developed.

Ascyphous. Podetia without cups.

Caespitose. Growing in low tufts or patches.

Ciliate. Having hairs or cilia.

Coralloid. Coral-like outgrowths usually on thallus.

Cortex. Outer layer of the thallus.

Corticate. Covered with a continuous cortex.

Cylindrical. Having the same diameter throughout the length.

Dorsiventral. With two unlike sides, the upper surface differing from the lower surface.

Farinose. Meal-like; mealy.

Fibrillose. Provided with fibers.

Flaccid. Soft and flabby; limp.

Granulose. Covered with minute granules. Almost powdery.

Gyrose. Convoluted; folded; wavy.

Imbricate. Overlapping like shingles.

Isidium. (Isidia). A coral-like outgrowth produced on the thallus.

KOH. Potassium hydroxide (aqueous solution—15–25%).

Lacunose. Covered with pits or depressions.

Lecanorine. Type of apothecium which has a rim consisting of and the same color as the thallus.

Lecideine. Type of apothecium which does not have a thallus rim.

Medulla. Made up of loosely interwoven strands or hyphae; can be observed when outer cortex is scraped off.

Pd. Paraphenylenediamine (fresh saturated alcohol solution).

Perithecium. A flask-shaped, rounded or oval fruit-body in which the spores are borne; lined with a palisade-like layer of asci, but with a small opening (ostiole) at the tip.

Podetium. A stalk-like elevation arising from the thallus; bears the fruit-body.

Primary thallus. Characterized by a horizontal and stratose thallus from which arises the secondary or radiate thallus termed the podetium.

Pruinose. A finely powdered surface.

Pustule. A blister or pimple-like structure.

Pycnidium. (*Pycnidia*). Small flask-shaped structures immersed in thallus.

Reticulate. Lines, veins, or ridges crossing each other to form or give the appearance of a net.

Reticulate-Rimose. A network of cracks or chinks.

Rhizoid. A single thread-like filament (hypha) or a bundle of hyphae extending from lower surface of the thallus and serving to attach the lichen to the substratum.

Scyphus. Cup-like dilation of the podetium.

Serrate. Saw-toothed margin.

Sessile. With no stalk.

Soredium. One or more algal cells surrounded or enveloped by fungal hyphae (threads). Masses of these when formed on the thallus give it a scattered or localized powdery or granular appearance.

Spore. The reproductive cell produced by the fungus.

Squamule. A small scale.

Squamulose. With minute scales.

Substrate. The substance or material to which the lichen is attached.

Thallus. The assimilative body consisting of algal and fungal components.

Tubercle. Any knob-like or wart-like elevation of the surface.

Umbilicus. The central point by which means the thallus is attached to the substratum.

Veined. Having raised lines or vein-like structures.

FARLOW HERBARIUM, HARVARD UNIVERSITY

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THREE CHANGED AUTHORITIES FOR COMBINATIONS.—Recently, I had occasion to examine, page by page, the first 111 volumes of Curtis's Botanical Magazine, in search of varietal names of American plants for inclusion in the Gray Herbarium Card Index. In the course of this examination, three instances were found in which the current attributions of authorities and places of publication are incorrect.

Aquilegia formosa, var. *flavescens* (S. Wats.) J. K. Henry, Fl. So. Brit. Columbia, 137 (1915) is antedated by **Aquilegia formosa,** var. **flavescens** (S. Wats.) Hook. f. in Curtis, Bot. Mag. **107:** tab. 6552 (1881).

Mimulus luteus, var. *cupreus* (Regel) Hoss. in Trab. Inst. Bot. Farm. Buenos Aires, no. 33: 71 (1915) is antedated by **Mimulus luteus,** var. **cupreus** (Regel) Hook. in Curtis, Bot. Mag. **90:** tab. 5478 (1864).

Vaccinium corymbosum, var. *fuscatum* (Ait.) A. Gray, Syn. Fl. 2, pt. 1: 23 (1878) is antedated by **Vaccinium corymbosum,** var. **fuscatum** (Ait.) Hook. in Curtis, Bot. Mag. **62:** tab. 3433 (1835).—ROBERT C. FOSTER, GRAY HERBARIUM.

SOME IDENTITIES IN HALESIA (STYRACACEAE)

R. K. GODFREY[1]

In western Florida, from the Tallahassee Red Hills area westward, the two-wing silverbell, *Halesia diptera* Ellis, comprises two populations: a larger flowered population which in general grows in mixed woodlands of upland slopes in the Tallahassee Red Hills, mixed woodlands of bluffs and ravine slopes along the Apalachi-

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Halesia tetraptera Ellis, fig. A. Halesia diptera Ellis, fig. B. After Ellis.

cola and Chipola Rivers, and mixed woodlands of the uplands having limestone outcrops in the vicinity of Marianna; a smaller flowered population which grows in the broad floodplain forests of the Choctawhatchee and Escambia Rivers and in lesser floodplains of smaller streams between. I have, as yet, no reason to believe that the larger flowered form is of more widespread distribution than from the Tallahassee to the Marianna area. Neither have I, to date, encountered any of the smaller flowered form within this limited range. The smaller flowered one, in western Florida occurring from about the Choctawhatchee River westward, is a part of a much more extensive population extending westward to Texas and northeastward to the Savannah River (or thereabouts).

Aside from habitat and distribution differences, the only morphological differences between these two-wing silverbells is that of flower size. This is conspicuous as one views the trees, those of the larger flowered form being nearly twice the size (the form and proportions being the same) of the smaller flowered one. However, when flowering material is carefully pressed, the size difference is less strikingly apparent in herbarium specimens. The flowers shrink considerably in drying.

Although in the non-flowering condition, the two-wing silverbells are not distinguishable, it seems advisable to give them varietal designations. This necessitates, of course, ascertaining what Ellis may have had when he described *Halesia diptera*. The species was described by Ellis in the Philosophical Transactions of the Royal Society, London, **51:** 931, t. 22, fig. B (1791). This is in the paper in which he also described (and figured much more fully) *H. tetraptera* the identity of which is considered below. At the conclusion of his discussion of *H. tetraptera*, Ellis wrote (of *H. diptera*) as follows:

> "About two years ago, I received from Governor Ellis of Georgia another species of this tree, which was sent him by Mr. De Brahme, from Augusta in Georgia, three hundred miles up the river Savannah.
> "The fruit of this kind has two wings, as described in the plate, at B."

There follows a diagnosis of *Halesia*, then the following species designations:

The species are,

TETRAPTERA. 1. HALESIA *fructibus membranaceo-quadrangulatis.*
DIPTERA. 2. HALESIA *fructibus alatis.*

From this, and in the light of my present knowledge of the distribution of the smaller and larger flowered forms of *Halesia diptera*, it may be inferred that the species is based on material of the smaller flowered one which thus becomes *Halesia diptera* Ellis var. *diptera*. Fresh flowers of this are 1.0–1.5 cm. long at anthesis. The width of the corolla varies because the petals spread variously. The individual petals are oval, oblong, or obovate, 1.0–1.5 cm. long and 0.8–1.0 cm. broad at their broadest places, the tips obtuse or rounded. The androecium length is equal to that of the petals, the filaments united at base.

The larger flowered form I designate as **Halesia diptera** var. **magniflora,** var. nov. *Var. diptera similis sed floribus maioribus. Floribus 2–3 cm. longis, 1.0–1.5 cm. latis. Petalis 2–3 cm. longis, 1.0–1.5 cm. latis, ovalibus, oblongis, ad obovatis.* Type specimen: deciduous woods, ravine slope, 1.5 miles east of Tallahassee, Florida, Godfrey no. 54434 (Herbarium of Florida State University).

Halesia tetraptera Ellis (l. c. 930–931, t. 22, fig. A) was described from material sent to England from along the banks of the Santee River in South Carolina. The plate (fig. A) accompanying the description, which is here reproduced, admirably portrays flowering material and a fruiting branch. This seems to me clearly and unequivocally identifiable with the little silverbell of the coastal plain, *Halesia parviflora* Michaux (Flora Boreali-Americana **2:** 40. 1803), and not with the much larger flowered silverbell of the uplands and interior, *Halesia carolina* L., with which it has long been identified.

Halesia tetraptera Ellis is the earlier name and the one which should be applied to the tree which we are currently calling *H. parviflora* Michx.—DEPARTMENT OF BIOLOGICAL SCIENCES, FLORIDA STATE UNIVERSITY, TALLAHASSEE, FLORIDA.

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DETERMINATION OF POLYPLOIDY FROM HERBARIUM SPECIMENS

Robert P. Celarier and K. L. Mehra

In the evolutionary history of the flowering plants there are several biological phenomena known to be of major consequence. Foremost among these, and perhaps the best understood, is polyploidy. A brief survey of any of the recent compilations of chromosome numbers of the Angiosperms (Löve and Löve, 1948, Delay, 1951; Darlington and Wylie, 1955) will suffice to show the frequency of this phenomenon. There are literally hundreds of examples of so called intraspecific polyploids reported, not to mention the even more frequent condition of interspecific polyploidy.

The importance of polyploidy in the critical evolutionary fields of taxonomy, geobotany, hybridization, mode of reproduction, etc. has been shown and discussed by many workers (Löve, 1951; Löve and Löve, 1949; Gustafsson, 1947; 1948; Muntzing, 1936; Stebbins, 1940; 1950; Darlington, 1956, etc.). Not only is the importance of polyploidy well known but much is understood concerning its biological mechanisms of operation.

Because of the obvious significance of polyploidy in both continuous and discontinuous variation of plants, it is a factor that cannot easily be dismissed in any detailed study involving the relationships of species or their modes of origin.

Determination of chromosome numbers is, however, a time consuming operation, and becomes virtually impossible for monographers who deal principally with non-living herbarium materials. Some effort has been made to overcome this handicap and recently Khoshoo (1955) has been able to study chromosomes from herbarium material in *Impatiens*. However the techniques are rather laborious, the results far from the best, and the extent to which the technique is applicable is not yet known.

Numerous studies have been conducted that attempt to correlate morphological conditions with degree of ploidy (see Stebbins, 1950 for review), and some workers believe that there is almost always some correlation (Löve, 1951). Although the general conclusion from these studies is that there are no universal criteria, nevertheless there are certain characters that have rather general application. Foremost among these is cell size.

From herbarium material there are usually easily available two types of cells (pollen grains and guard cells of the stomata). Since there is often some overlapping between cell size and degree of ploidy, it is desirable, and sometimes essential, to study the cell size of both before drawing conclusions.

In general, pollen grains are easily studied, but the conventional method for studying guard cells requires a pretreatment of the leaf, followed by scraping or stripping (deWet, 1954). In any event some portion of the specimen is mutilated or destroyed, a condition that is very undesirable especially with valuable specimens such as types.

In this report an impression method is described for the study of the guard cells of the stomata that is quick, reliable, and causes no damage to the specimen. This method is based on the principles of impression long used in paleontology, and with the use of some of the modern plastics gives very desirable results. Somewhat similar methods have been used by plant pathologists (Long & Clements, 1934; Husain, 1956) to detect the open or closed condition of the stomata.

The procedure is simply to mix cellulose nitrate[1] in acetone until a viscous solution is obtained. When the constancy of the solution is such that it spreads smoothly with a camels hair brush, paint the surface of the leaf to be studied with the solution. This will work better if the leaf surface has been previously cleaned with acetone. The solution is allowed to dry thoroughly and is then peeled off with tweezers. This plastic strip is then

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[1] Jacobo Ortega Castro of this department, in a study involving the relationship between the opening and closing of the stomata in wheat and leaf rust infection, has used cellulose acetate and collodion with equal success. His work shows that at different temperatures different plastics are preferable.

floated in a drop of water on a slide, covered with a cover slip, and is ready for study under the microscope.

Cell impressions prepared by this method are usually distinct (figs. 1–8) and measurements can be made with considerable confidence.

Results

In the present study several grass species complexes of the tribe *Andropogoneae* were analyzed. A rather detailed study was made of the *Dichanthium annulatum* complex, which included diploids ($2n = 20$), tetraploids ($2n = 40$), and hexaploids ($2n = 60$). Also studied, but in less detail, were tetraploids, pentaploids, and hexaploids of the *Bothriochloa ischaemum* complex, and tetraploids and hexaploids of the *B. intermedia* and *B. pertusa* complexes. The chromosome numbers of all accessions used in this study were previously determined (Celarier, 1957; Celarier and Harlan, 1955; Celarier, Mehra, and Wulf, in press, and unpublished).

Pollen grains and stomata guard cells were studied from both fresh material and herbarium specimens and the results are given in tables 1 and 2. Although most specimens were only three or four years old, it seems likely that, under proper storage conditions, only a negligible amount of change would be expected with the age of the specimen.

D. ANNULATUM COMPLEX

In the present report three diploid, eight tetraploid, and two hexaploid accessions were studied. The data are presented in table 1, and figures 1–8 show their general appearance.

Pollen grain size was quite variable in all accessions with a range of approximately 10μ. However the means were similar in all accessions of one ploidy level, and quite different between polyploids (figs. 1–3). The diploids means ranged from 32.0 to 33.0μ, the tetraploids from 36.2 to 39.9μ, and the hexaploids from 42.9 to 48.7μ. Pollen grains from herbarium specimens were almost always smaller than fresh material but usually the mean values were of less than one micron difference.

There was also variation in stomata guard cell size but it was much less than in pollen grains and was in general, less than five microns. Again the mean values were quite distinct at the different ploidy levels. In the fresh material the means in the diploids varied from 23.7 to 24.8μ, in the tetraploids from 30.0 to 32.0μ, and the hexaploids varied from 36.8 to 45.9μ. The same kind of variation was seen in the herbarium specimens but guard cells were in all cases considerably smaller than in fresh material (figs. 4–6).

TABLE 1. Comparison of pollen grains and guard cells with degree of ploidy in *Dichanthium annulatum*.

			Pollen Grain Size—μ				Guard Cell Size—μ			
A-No.	Location	2n	Fresh		Specimens		Fresh		Specimens	
			range	mean	range	mean	range	mean	range	mean
3242	Calcutta, India	20	26.5–37.1	32.4	26.5–37.1	32.2	22.8–25.2	24.3	10.8–16.8	13.6
3965b	Calcutta, India	20	29.1–37.1	32.9	29.1–37.1	32.8	22.8–26.4	24.8	13.2–15.6	14.0
5396	Belatal, India	20	26.5–37.1	33.0	26.5–37.1	33.2	21.6–25.2	23.7	12.0–16.8	14.6
5437	Lucknow, India	40	31.8–47.7	39.0	31.8–42.4	38.6	30.0–32.4	31.0	18.0–22.8	20.6
5797	Bombay, India	40	31.8–42.4	36.3	31.8–42.4	36.3	28.8–33.6	31.8	22.8–26.4	24.1
4600	Lucknow, India	40	31.8–42.4	36.2	31.8–42.4	36.3	27.6–32.4	30.0	19.2–24.0	20.9
3789	Giza, Egypt	40	31.8–42.4	37.9	31.8–42.4	37.2	28.8–33.6	30.7	18.0–24.0	21.0
4082	South Texas (Int.)	40	37.3–42.4	39.3	31.8–42.4	38.6	30.0–34.8	31.4	18.0–22.8	20.3
4099	Punjab, India	40	37.1–45.0	39.9	37.1–45.0	39.4	28.8–36.0	32.0	18.0–20.4	19.6
3182	N. Gallilea, Israel	40	31.8–42.4	37.1	31.8–42.4	36.4	30.0–33.6	31.7	20.4–27.6	22.4
5295	Coimbatore, India	40	31.8–42.4	37.1	31.8–42.4	36.4	28.8–32.4	30.4	16.8–20.4	18.8
3716	Southern Rhodesia	60	31.8–53.0	48.7	37.1–47.7	45.1	34.8–38.4	36.8	26.4–34.8	29.6
4080	South Africa	60	37.1–53.0	42.9	39.7–47.7	43.8	43.2–48.0	45.9	24.0–30.0	26.2

TABLE 2. Comparison of pollen grains and guard cells with degree of ploidy in *Bothriochloa* species.

			Pollen Grain Size—μ				Guard Cell Size—μ			
A-No.	Location	2n	Fresh		Specimens		Fresh		Specimens	
			range	mean	range	mean	range	mean	range	mean
	Bothriochloa ischaemum									
561	Mus, Turkey	40	31.8–42.4	37.1	31.8–39.7	35.4	24.0–26.4	25.0	15.6–20.4	19.0
5704	Peking, China	40	31.8–42.4	36.7	34.4–42.4	36.6	27.6–30.0	28.7	15.6–20.4	18.0
726	Amoy, China	50	34.4–47.7	38.2	31.8–45.0	39.3	28.8–31.2	30.2	19.2–22.8	21.3
6459	Hong Kong, China	50	31.8–45.0	37.8	31.8–39.7	35.5	27.6–32.4	29.0	18.0–21.6	20.6
2582	Formosa	60	37.1–47.7	43.9	37.1–47.7	43.9	28.8–32.4	30.7	19.2–24.0	21.8
1347	Triangle City, China	60	37.1–47.7	41.9	37.1–45.0	40.9	31.2–36.0	31.8	18.0–24.0	22.0
	Bothriochloa intermedia									
5409	Bareilly, India	40	31.8–39.7	34.7	31.8–37.1	34.4	24.0–27.6	25.8	14.4–16.8	15.2
5450	Delhi, India	40	31.8–42.4	36.9	31.8–39.7	35.0	22.8–28.8	25.5	13.2–15.6	14.7
4596	Gatton, Australia	60	34.4–47.7	42.0	34.4–47.7	41.9	25.2–31.2	29.1	18.0–21.6	19.6
4597	Gatton, Australia	60	31.8–47.7	39.7	31.8–42.4	39.7	30.0–36.0	32.8	18.0–21.6	20.1
	Bothriochloa pertusa									
4806	Hyderabad, India	40	31.8–39.7	35.8	31.8–37.1	35.0	24.0–27.6	25.8	12.0–15.6	13.9
3185	Cuba (Int.)	40	34.4–42.4	37.6	31.8–42.4	36.5	21.6–27.6	24.3	13 2–15.6	14.2
4905	South Africa	60	31.8–45.0	39.4	31.8–42.4	37.1	28.8–32.4	30.0	18.0–21.6	20.2
3704	South Africa	60	39.7–47.7	44.3	37.1–47.7	42.2	34.8–38.4	34.9	20.4–22.8	21 6

Although the diploids, tetraploids, and hexaploids could be easily distinguished from one another in the herbarium materials it is obvious that comparisons between herbarium and fresh materials cannot be made until a correction factor is established.

B. ISCHAEMUM COMPLEX

Two accessions each were studied in the tetraploids, pentaploids and hexaploids (table 2). As in *D. annulatum* there is considerable variation in pollen grain size (ca. 10–15μ) whereas the range in variation in the guard cells is small (less than 5μ). The means however were rather constant for both, but different in different ploidy levels.

In the tetraploids the means of pollen grain size ranged from 36.7 to 37.1μ for fresh materials and 35.4 to 36.6μ for specimens. The pentaploids ranged from 37.8 to 38.2μ for fresh materials and 35.5 to 39.3μ for specimens, and in the hexaploids the range was 41.9 to 43.9μ for fresh material and 40.9 to 43.9μ from specimens.

Stomata guard cells were also distinct but as in *D. annulatum* showed a big difference from fresh material to specimens.

In the tetraploids the means ranged from 25.0 to 28.7μ in fresh materials and 18.0 to 19.0μ in specimens. The pentaploids ranged from 29.0 to 30.2μ in fresh materials and 20.6 to 21.3μ in specimens, and the hexaploids ranged from 30.7 to 31.8μ in fresh material and 21.8 to 22.0μ in specimens.

In *B. ischaemum* it seems that pentaploids cannot be easily separated from hexaploids on guard cell size alone but by the use of both pollen grain and stomata guard cells the separation is fairly reliable.

B. INTERMEDIA COMPLEX

In this species only two tetraploids and two hexaploids were used. The tetraploids were readily distinguishable from the hexaploids with both pollen grain size and stomata guard cell size. Variation in both was rather similar to that seen in *D. annulatum* and *B. ischaemum*.

The tetraploids had a range in mean pollen grain size of 34.7 to 36.9μ in fresh materials and 34.4 to 35.0μ in specimens; whereas the hexaploids ranged from 39.7 to 42.0μ in fresh material and 39.7 to 41.9μ in specimens.

The range of the means in guard cell size were 25.5 to 25.8μ in fresh materials and 14.7 to 15.2μ in specimens for the tetraploids and for the hexaploids were from 29.1 to 32.8μ for fresh materials and 19.6 to 20.1μ for specimens.

B. PERTUSA COMPLEX

In this species complex two tetraploids and two hexaploids were used and the results were similar to those found in the other species.

The range in pollen grain means was 35.8 to 37.6μ for fresh material

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Figs. 1–8. Pollen grains and stomata guard cells in *Dichanthium annulatum*. Figs. 1–3. Pollen of the three ploidy levels. X300. Fig. 1 diploid. Fig. 2 tetraploid. Fig. 3 hexaploid. Figs. 4–6. Comparison of stomata guard cells from fresh mounts and plastic peels of herbarium specimens in the three ploidy levels. X1350. Fig. 4 diploid. a. fresh material. b. plastic peel of specimen. Fig. 5 tetraploid. a. fresh material. b. plastic peel of specimen. Fig. 6. hexaploid. a. fresh material. b. plastic peel of specimen. Figs. 7–8. Comparison of plastic peel of fresh material (Fig. 7) with plastic peel of specimen (Fig. 8) in the hexaploid. X300.

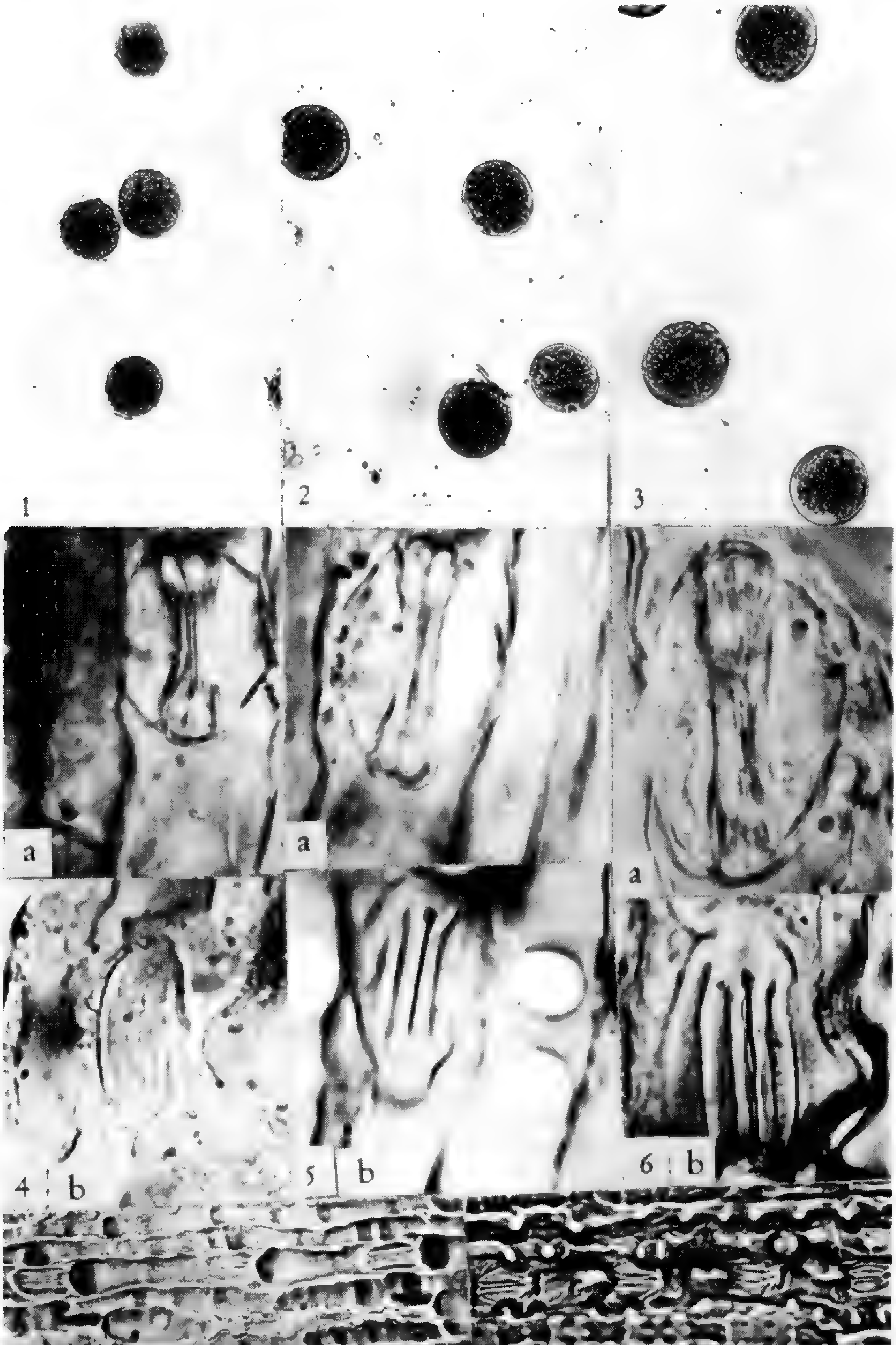

Fig. 1–8. For explanation see opposite page.

and 35.0 to 36.5μ for specimens in the tetraploids, and 39.4 to 44.3μ for fresh material and 37.1 to 42.2μ for specimens in the hexaploids.

The stomata guard cell size was also distinct with means ranging from 24.3 to 25.8μ in fresh material and 13.9 to 14.2μ in specimens for the tetraploids; whereas, the hexaploids ranged from 30.0 to 34.9μ in fresh material and 20.2 to 21.6μ in specimens.

DISCUSSION AND CONCLUSIONS

It has been shown that both pollen grain and stomata guard cell size are fairly reliable indicators of the degree of ploidy in several of the Old World species of the genera *Bothriochloa* and *Dichanthium*. It has also been shown by Gould (1957) that pollen grain size is useful in determining the degree of ploidy in several of the American species of *Bothriochloa*.

In the species studied there was no difficulty in distinguishing between diploids, tetraploids and hexaploids. However in *B. ischaemum* the differences between the pentaploids and hexaploids were not so distinct, but by the use of both pollen grain and guard cell sizes a fairly reliable conclusion could be drawn.

In general it was possible to place the materials studied in their proper ploidy levels by pollen grain and guard cell size regardless of the species involved. However there were exceptions to this, such as the tetraploid *D. annulatum* A-4099 with pollen grains 39.9μ and guard cells of 32.0μ and the hexaploid *B. intermedia* A-4597 with pollen grains of 39.7μ and guard cells of 32.8μ.

The impression technique for measuring guard cells is shown to be quite reliable but the actual measurements were in all cases much less than those made from fresh material. In order to determine what portion of this decrease in length was due to the technique and what portion was due to the drying of the specimens, measurements were also made from plastic strips taken from fresh material.

In the diploid *D. annulatum* A-3242 the mean guard cell measurements from fresh material was 24.3μ whereas the plastic strip measurements from specimens was 13.6μ. Plastic strip measurements of fresh material of this accession were found to be 20.4μ. From this it is seen that a considerable portion of this decrease in size is due to the technique itself but that most of it is probably due to the shrinkage in drying of the specimens. A similar condition was found in the hexaploid (figs. 7–8) but only a few measurements were made.

These studies seem to warrant certain recommendations in the procedures used in studies where it is desirable to determine chromosome numbers from herbarium specimens. The following appear to be significant:

1. Pollen grain and stomata guard cell size are usually reliable indicators of polyploidy, and the use of both would be expected to give much more dependable results than either alone.
2. Actual chromosome counts should be made from at least a few plants of several polyploid levels. Pollen grain and guard cell measurements from these plants can serve as a standard.
3. Data should be calculated in terms of ranges and means. This seems to be especially important in studies of pollen grains.
4. Guard cells from herbarium specimens can be reliably measured by the impression technique but when compared with fresh material a correction factor must be taken into account to offset the shrinkage.
5. Conclusions regarding chromosome number based on cell size should be transferred to a second species with extreme caution, unless some chromosome counts of the second species have been made so that a standard can be established.
6. Data concerning cell size would be a valuable addition to a monograph even if the chromosome numbers of the taxa involved are not known, in that they may offer a suggestion of polyploidy and will be available if cytological studies are made in the future.

Summary

Data are presented that demonstrate a correlation between the degree of polyploidy and size of pollen grains and stomata guard cells in four species complexes of the grass genera *Dichanthium* and *Bothriochloa.* These studies were made both from living material and dried herbarium specimens.

An impression technique using plastic strips is outlined for the study of stomata guard cells from herbarium specimens. This technique gives reliable measurements without damage to the specimens.

Some of the limitations to the use of cell size as a gauge of polyploidy are discussed and certain recommendations are offered based on present studies.—DEPARTMENT OF BOTANY AND PLANT PATHOLOGY, AGRIC. EXP. STA., OKLAHOMA STATE UNIVERSITY, STILLWATER.

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THE NAME LEPANTHES TURIALVAE: A SOURCE OF CONFUSION

RICHARD EVANS SCHULTES

One of the most puzzling concepts in the orchid genus *Lepanthes* has been *L. turialvae* Rchb. fil., described from material collected in Costa Rica. The binomial has been applied to a bewildering array of species which obviously represent different concepts and has, as a result, become a rather convenient, albeit an inexact, receptacle to which are referred many Middle American collections the identification of which might pose difficulties or doubts.

During my investigation of the species of *Lepanthes* known from Mexico, the name *Lepanthes turialvae*, with its present vague interpretation, continually confounded the study. Critical examination of what has been called *Lepanthes turialvae* in the literature and herbaria convinces me that, whichever of the several concepts is followed, it is not represented in Mexico. Nevertheless, it would seem advisable to present the following notes which have grown out of my study of *Lepanthes turialvae*, so that they may be made available to future workers in the genus.

Lepanthes turialvae Reichenbach fil. in Bonpl. 3 (1855) 225.

Original description: "*Lepanthes Turialvae* (*Effusae*): similis *L. cochleariformi* Sw. vaginis arctis, ostio tantum angusto microscopice muriculatis, folio ovato acuto bene limboso, racemi pectinati bracteis parvis muricatis, sepalo inferiori alte bifido, tepalis incisione triangula extrorsa acuta bilobis, labelli lobis obtuse triangulis. Stengel drei bis vier Zoll hoch mit Einschluss des zollangen Blatts. Blüthe nach Hrn. Dr. Oersted's zeichnung beschreiben. Sepalen dreieckig fleischroth. Tepala gelblich, obserseits mit Purpurroth auf Innenecke. Lippenlappen und Säule purpurroth. Turialva in Costarica, 3000′. Oersted."

In the same year, Reichenbach (Xen. Orch. 1 (1855) 151, 156, t. 50, fig. V, 15–16) published a second (Latin) and a third (German) description, differently worded but referring essentially to the same concept. In connection with these descriptions, he published drawings showing (V) a leaf (with its sheaths) and inflorescence (with one flower), (15) a flower and (16) a bract. Reichenbach intimated (loc. cit. 151) that the description was based upon Oersted's collection in the Copenhagen Herbarium ("Vid. sp. sicc. in herbario Hafniensi").

Through the kindness of Dr. O. Hagerup, director of this herbarium, we were able to borrow what is probably the type of *Lepanthes turialvae* and a water-color of the flower made by Oersted himself from the living plant in the field. The binomial "Lepanthes Turialvae Rchb." is written under the floral drawing in Reichenbach's own hand. There is no flower present on the specimen. Probably none was ever available to Reichenbach, for he stated clearly (Bonpl. 225) that his description of the flower was based on Oersted's drawing. Certainly, Reichenbach's rather inadequate sketches of the flower match very closely the Oersted water-color.

We have also, thanks to the cooperation of Dr. K. H. Rechinger, borrowed for study from the Reichenbach Herbarium in Vienna a sheet (No. 54553) on which there is a sterile specimen and a colored sketch of the flower. This sheet from Vienna is likewise labelled "Lepanthes Turialvae Rchb."

The sterile collection from Vienna is said to represent Oersted's collection made in Turrialba, Costa Rica, at 3,000 feet altitude. It is here, however, that confusion enters the picture. Neither the two detached leaves nor the sheaths covering the secondary stem represent, in my opinion, the same species as that which we have thought to be the type. But the colored sketch of the flower is identical with that in the Copenhagen material and, accordingly, corresponds to the floral diagram published by Reichenbach.

Reichenbach's original description of the sterile parts seems not to have been based on the suborbicular-ovate and apically tridentate leaf which is found in Copenhagen, but rather on the elliptic and very acute leaves attached to sheet No. 54553 from Vienna. His second description (Xen. Orch. 151) definitely refers to the Copenhagen material, for he stated that the leaf was "apice attenuato brevissimo tridentatum."

There is in the Reichenbach Herbarium a sheet (No. 54553) which Reichenbach himself labelled "*Lepanthes* Turialvae." The collection was made in Turrialba by Wendland: *Wendland 549.* This sheet has a habit sketch of the plant and a very careful drawing of the flower. Mr. Elmer W. Smith recently prepared a larger drawing from a flower taken from this collection, boiled and floated out in water; his drawing agrees in all essentials with Reichenbach's. In *Wendland 549*, the anterior lobe of the petals is triangular, the posterior obliquely subquadrate; whereas the petals shown in the type-drawing of the flower of *Lepanthes turialvae* have both lobes elliptic-lanceolate. The petal-lobes in the former are not spreading and, consequently, have no sinus between them; those of the latter are shown as very spreading with a conspicuous sinus.

Reichenbach not only annotated *Wendland 549* as *Lepanthes turialvae.* In an article treating of the orchids collected by Oersted, he (Beiträge zu einer Orchideenkunde Central Americas (1866) 57, 90, t. 10, figs. III, 16) illustrated as *Lepanthes turialvae* what is obviously the orchid represented in the collection *Wendland 549.* This illustration is wholly distinct from that published in *Xenia Orchidacea* eleven years earlier.

In view of 1) the apparent discrepancy in sterile parts between the Copenhagen and the Vienna material collected by Oersted, both of which Reichenbach considered to represent *Lepanthes turialvae* and 2) his identification of *Wendland 549* as *L. turialvae*, we must agree that Reichenbach himself had either an extremely vague or else a confused conception of the morphological characters on which *L. turialvae* was based.

An examination of the Middle American material labelled *Lepanthes turialvae* in the Orchid Herbarium of Oakes Ames indicates the extent of the confusion attendant upon the use of this binomial, for there are clearly several concepts involved which only a monographic study of the genus can clarify. Even in modern taxonomic and floristic treatments, one can sense this confusion and doubt. Schweinfurth (in Standley "Flora of Costa Rica" in Field Mus. Nat. Hist. Bot. Publ. 391 (1937) 245) followed what he thought to be Reichenbach's concept of the species as shown by his citation as basic material both the Oersted and the Wendland collections. Pertinent to this point, perhaps, is Schweinfurth's observation (loc. cit. 242) that he considered *Lepanthes Brenesii* Schltr. to be "very close to, if not the same as, *L. turialvae*." In 1946, L. O. Williams (in Woodson & Schery "Flora of Panama" in Ann. Mo. Bot. Gard. 33 (1946) 84) stated that "*Lepanthes turialvae*, as now delimited, is possibly an aggregate of several species." Extreme confusion marks the treatment of *Lepanthes turialvae* by Ames & Correll ("Orchids of Guatemala" in Fieldiana, Bot. 26 (1952) 196, 204). Their description is so very broad that it would embrace a number of species. Furthermore, there is a discrepancy between the characters used to key out *Lepanthes turialvae* (e.g. "Lip without a ciliate apicule or pubescent midlobe . . .") and the detailed description of the concept (e.g. lip "with a minute puberulent apicule in the sinus").

In view of this extreme confusion which, as we have seen, goes as far back as the original description, I suggest that the binomial *Lepanthes turialvae* Rchb. fil. be rejected as a *nomen confusum* in accordance with Articles 63 and 65 of the *International Code of*

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[1] There is here a discrepancy between the French and the English versions. The French version (as well as the Spanish) uses the word "confusion" where the English (and the German: "Irrtum") employs "error": "Un nom est a réjèter . . . s'il est une source de confusion." Lanjouw has stated in the preface of the *International Code* . . . that "it was decided [by the Nomenclature Section] that, should there be any inconsistency between the versions, the English one would be regarded arbitrarily as correct."

Botanical Nomenclature as adopted at Paris in 1954: (Article 63) "A name must be rejected . . . if it is a source of error"[1] and (Article 65) "A name must be rejected if it is used in different senses and so has become a long-persistent source of error." It seems to me that no purpose would be served by trying to retain a name which apparently can never be clarified with satisfaction. However, in view of the fact that monographic studies in *Lepanthes* will shortly be initiated, I merely offer this as a suggestion and leave formal action to the monographer.

CHROMOSOME NUMBERS IN THE GENUS KRAMERIA: EVIDENCE FOR FAMILIAL STATUS

B. L. Turner

The genus *Krameria* is composed of about 20 species of perennial herbs and shrubs, most of which occupy the warmer desert or semi-desert regions of North and South America (Britton, 1930). Since its initial description in 1762 the genus has been a taxonomic "problem", both as to rank and phyletic position. Some workers have recognized it as the single genus of the family *Krameriaceae* (Chodat, 1890; Small, 1903; Britton, 1930; Abrams, 1944; Cronquist, 1957; etc.); other workers have assigned the genus subfamilial rank within the *Leguminosae* (Benson and Darrow, 1954; Benson, 1957); while still others have relegated the group to merely tribal status within the subfamily *Caesalpinioideae* of the *Leguminosae* (Taubert, 1894; Capitaine, 1912; etc.).

Such differing taxonomic treatments are not particularly disturbing since most of the workers mentioned above are more or less in agreement that the relationship of *Krameria* lies within or close to the *Leguminosae* and in particular to the tribe *Caesalpinioideae*. However, there are serious doubts as to its phyletic position. It is interesting to note that while such an eminent worker as Taubert in Engler and Prantl's PFLANZENFAMILIEN treats the genus as a tribe within the subfamily *Caesalpinioideae* of the order Rosales, Hutchinson (1926) places the genus in the family *Polygalaceae* of the order *Polygalales*, quite removed from the *Leguminosae* proper. Indeed, Taubert had enough confidence in his treatment to relate *Krameria* specifically to the tribes *Cassieae* and *Eucaesalpinieae* and so placed *Krameria* as tribe 6 between these two taxa. Hutchinson does not give reasons for the inclusion of *Krameria* in the *Polygalaceae*, but precedence for such a treatment may be found in Bentham and Hooker (1862) who also placed it in the *Polygalaceae*. The latter authors, in treating this family, listed *Krameria* last among a group of "genera affinis aut exclusa, v. dubia." Hallier (1912) also viewed the relationship of *Krameria* as being with the *Polygalaceae* but assigned it familial status.

Kunz (1913) has given the most detailed study of the problem to date. After a review of the literature and as a result of his own observations on exomorphic and anatomical characteristics he concluded that *Krameria* did not belong within the *Caesalpinioideae* but rather should be treated as a distinct family. He did not attempt to show phyletic position, but he did indicate that *Krameria* was perhaps closer to the *Leguminosae* than the *Polygalaceae*.

Since Kunz's excellent study only a few published facts have been added. Heimsch (1942), using anatomical criteria, considered the position of *Krameria* with respect to the *Leguminosae* and *Polygalaceae*. He concluded that *Krameria*, on the basis of wood structure, was closer to the latter family. However, Erdtman (1944), on the basis of pollen morphology, briefly commented on the unnatural position of *Krameria* when placed in the *Polygalaceae* and stated that it belonged to the *Caesalpinioideae* of the *Leguminosae*. Dr. John Dwyer (personal communication), after a broad study of floral types within the *Caesalpinioideae*, has concluded that *Krameria* does not belong within this subfamily, though he has no set opinion of its phyletic position.

In the present paper chromosome evidence has been used to evaluate the position of *Krameria* with respect to the *Caesalpinioideae*. Unfortunately, chromosomal information is not adequate to permit comparisons with the supposed extra-leguminous relatives of *Krameria*, so little can be added to the controversy regarding phyletic position.

K. grayi and *K. ramosissima* are small shrubs of semi-desert and desert regions of North America, while *K. lanceolata* is a widespread, common perennial herb which occurs throughout the

Chromosome Numbers

Meiotic chromosome counts[1] were obtained for three species of *Krameria* as enumerated below:

Species	*Source*	*n*
Krameria grayi Rose & Painter	TEXAS, Terrell Co.: 10 mi. east Sanderson. *B.L.T. 3927*	6
Krameria lanceolata Torr.	TEXAS, Coryell Co.: 3 mi. north Cooperas Cove. *B.L.T. 3811*	6
" "	TEXAS, Kinney Co.: 12 mi. northeast Brackettville. *B.L.T. 3803*	6
" "	TEXAS, Leon Co.: Marquez Dome. *M. C. Johnston et al. 54994*	6
" "	TEXAS, Val Verde Co.: 10 mi. northwest Langtry. *B.L.T. 3771*	6
Krameria ramosissima (Gray) Wats.	TEXAS, Kinney Co.: 10 mi. southeast Brackettville. *B.L.T. 3874*	6

Southwestern United States and Mexico. All collections examined proved to be diploid with $n = 6$. Since the chromosomes in the first division of meiosis are exceptionally large, showing three or more chiasmata at metaphase (fig. 1), two-dimensional camera lucida drawings and photography become difficult.[2] Best counts are obtained from Division II of meiosis, when the chromosomes are less massive and thus flatten more easily. As indicated in figures 2 and 4, these chromosomes have nearly medium centromeres.

Discussion

Taubert in Engler and Prantl's PFLANZENFAMILIEN treated *Krameria* as the sole genus of the tribe *Kramerieae*, placing it after the tribe *Cassieae* of the *Caesalpinioideae*. By reference to floral morphology, Taubert (footnote, p. 166) explicitly reckoned its relationship to be with this latter tribe.

Since the inclusion of *Krameria* within the *Leguminosae* should depend upon the total similarities it shares with members of the *Caesalpinioideae*, it seems appropriate to examine the chromosomal evidence bearing on this presumed relationship. As indi-

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[1] Buds were killed and fixed in a mixture of 4 chloroform: 3 absolute alcohol: 1 glacial acetic acid. Anthers were squashed in acetocarmine 3–14 days after collection. Voucher specimens are deposited in The University of Texas Herbarium, Austin, Texas.

[2] The meiotic chromosomes of *Krameria* rank among the largest known within the dicots. Covas and Schnack (1946) and Baldwin and Speese (1957) have documented somewhat larger meiotic chromosomes for two parasitic species of the Loranthaceae (*Psittacanthus cuneifolius* and *Phoradendron flavescens*). Except possibly for those of the well known species of *Paeonia*, these species have the largest meiotic chromosomes of any dicot known to the present writer.

cated above, *Krameria* is, so far as known, unibasic with a number of $x = 6$, its meiotic chromosomes being especially noteworthy for their very large size and several chiasmata. A base number of $x = 6$ is not known for any of the tribes within the *Caesalpinioideae* (Darlington and Wylie, 1956).[3] However, since a base number of $x = 12$ is common for many genera of the *Caesalpinioideae* it might be conjectured that the number $x = 6$ for *Krameria* is but a lower base for the subfamily as a whole. Consideration of chromosome morphology proves more instructive. Meiotic chromosomes from a wide selection of *Cassia* species (Turner, 1956; H. S. Irwin, unpublished) are consistently small, usually showing only two terminalized chiasmata at metaphase. This is also true of the known meiotic chromosomes of species examined in the tribes *Bauhineae* and *Eucaesalpinieae*. By comparison, meiotic chromosomes of *Krameria* are 10–40 times as massive as those of the *Cassieae* thus far examined.

Unfortunately, *Krameria* can not be compared with the *Polygalaceae* since chromosomal information on the family is seanty. The only established base number for the family is $x = 7$ and this from a single *mitotic* count on *Bredemeyera colletioides* (Covas and Schnack, 1946).

Though the cytological evidence available at present does not permit one to judge phyletic alternatives, at least chromosomal comparisons of *Krameria* with members of the subfamily *Caesalpinioideae* seem to negate any close relationship with taxa of this group. In view of this negation, particularly as concerns its affinity with the *Cassieae*, the genus *Krameria*, even if related to the *Caesalpinioideae* on phyletic grounds, seems deserving of supra-tribal rank, if cytological evidence is considered along with that of wood anatomy, floral morphology, etc.

"Problem" taxa such as *Krameria* make present-day taxonomy the exciting field it is. One never knows how new evidence will affect the taxonomic scales. Indeed, it stimulates the taxonomist to look to other fields for additional weights that might affect the balance. Thus floral morphology, anatomy, palynology,

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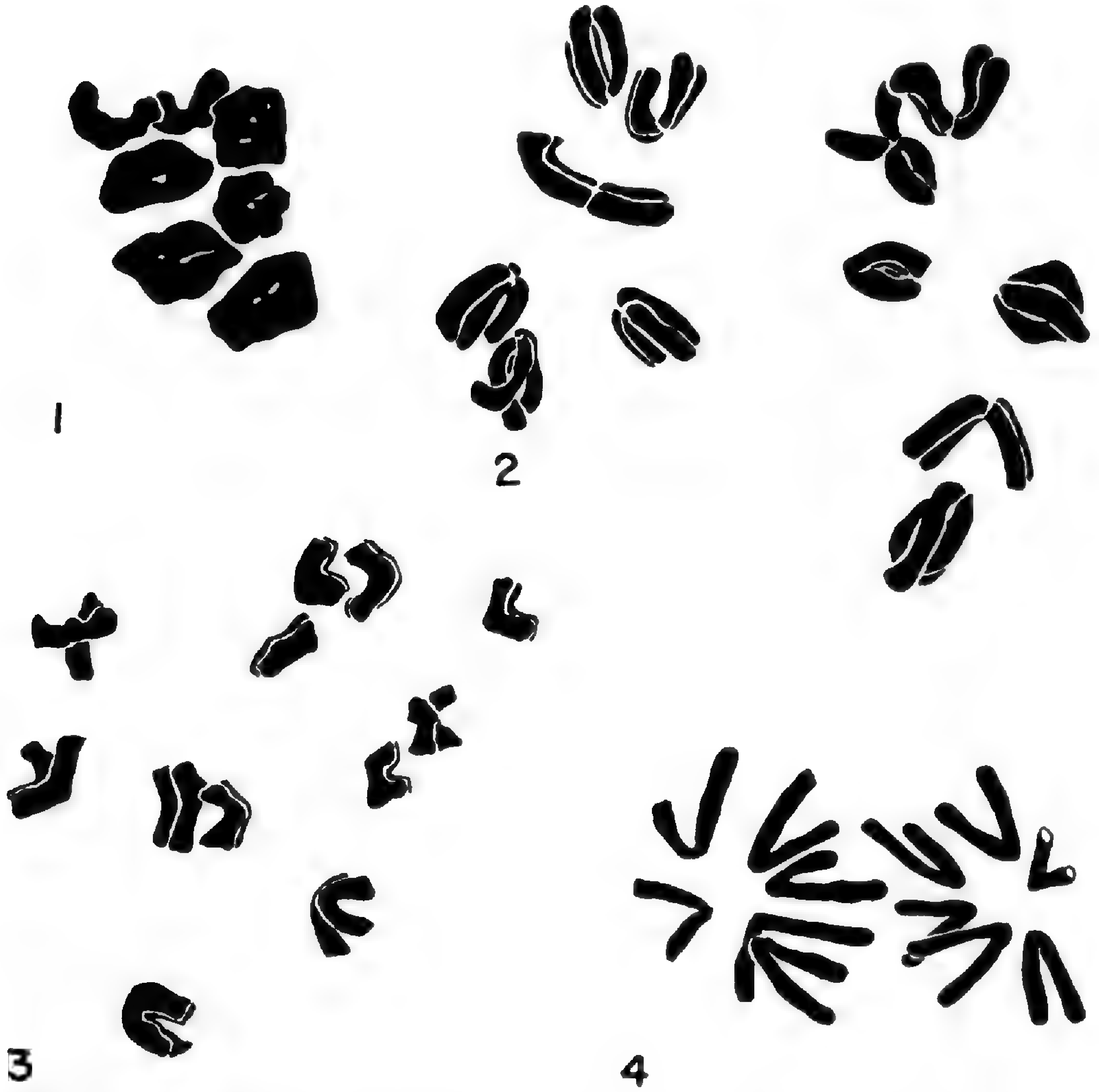
[3] These authors (p. 148) list 6 as one of several base numbers for *Cassia*, but this is not borne out by a reference to their listed counts. Senn (1938) gives a count of $n = 6$ for *Cercis canadensis*, but Baldwin (1939) reported counts of $2n = 14$ for several collections of the species. In view of the drawing accompanying Senn's report (p. 183), which appears to show two clumped chromosomes drawn as one, the report of $n = 6$ for this species should be considered erroneous.



Figures 1–4. Camera lucida drawings of the meiotic chromosomes in *Krameria* spp.—Fig. 1. *K. lanceolata*, chromosomes closely packed at metaphase I.—Fig. 2. *K. lanceolata*, metaphase of division II.—Fig. 3. *K. ramosissima*, metaphase of division II.—Fig. 4. *K. grayi*, anaphase of division II (only one half of quartet shown). (X ca 1400).

biochemistry, cytology, etc., must necessarily bring us closer to the truth, since the total attributes of a group of organisms will more nearly reflect their relationships than will the characters from any one field when considered alone.

If all taxonomic problems were obvious and merely resolved themselves to cataloguing always discreet, easily placed entities, then many of us would long since have lost interest in the tabulation and turned to other fields.

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A TAXONOMIC STUDY OF THE GENUS PHYSALIS IN NORTH AMERICA NORTH OF MEXICO[1]

U. T. Waterfall

Linnaeus founded the genus *Physalis* in 1753 with nine species, two of which are now usually referred to *Withania*. Five of the remaining seven are found within the area of the present study, although one, *P. Alkekengi*, is known only as a horticultural species, or as an escape from cultivation. In the second edition of Species Plantarum (1762) Linnaeus added two more species, *P. pensylvanica* and *P. peruviana*. The former does not occur in Pennsylvania and perhaps is not found in North America. In any event, it is considered to be a synonym of *P. viscosa*. *P. peruviana* is sometimes cultivated. Perhaps it escapes, but, if so, it is rarely collected. Pre-Linnean authors were familiar with the genus under the names *Physalis*, *Solanum* and *Alkekengi* as indicated in the Linnean references. Philip Miller (1768) described two species coming within the scope of this study. One of them, *P. virginiana*, is here interpreted as it has been for the last sixty years, although the application of the name is by no means certain.

Michaux (1803) described *P. lanceolata* and *P. obscura*, the latter consisting of var. *glabra* and var. *viscidopubescens*. Nees (1831) described *P. heterophylla*, *P. lanceifolia* and *P. Linkiana*.

P. crassifolia, the common species of southwestern desert regions, was described by Bentham (1844). Thomas Nuttall, in publications hereinafter enumerated under the species concerned,

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[1] This paper is based on a dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at the University of Oklahoma under the guidance of Dr. George Goodman, Professor of Plant Sciences. The author is grateful to him, and to the other members of his committee, for their valuable suggestions.

He is also thankful to the curators of several herbaria whose loans of all, or selected parts, of their valuable collections of *Physalis* made this study possible. They have loaned 8090 sheets of *Physalis* and related genera. Of this total, there are 5716 sheets of *Physalis* included in the present study. Many of the remainder were collections from other areas which materially aided in the formation of species concepts. These herbaria, listed by the standardized abbreviations published by Lanjouw and Stafleau (1954), are: ARIZ, COLO, DUKE, GH, KANU, LIL, MICH, MO, NY, OKL, OKLA, P, PH, RM, SMU, TEX, UARK, UC and WIS.

Thanks are also due the librarians of both the University of Oklahoma and Oklahoma State University (formerly Okla. A. & M. College) for securing photostats of publications unavailable locally, and the Arnold Arboretum of Harvard University for the loan of photographs of Linnean types, as well as to Dr. Albert Delisle formerly of the University of Notre Dame for photographing certain types of species described by Greene.

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described *P. angustifolia, P. longifolia, P. mollis, P. pumila* and *P. Walteri.* Dunal (1852) described *P. nyctaginea,* now generally referred to *P. heterophylla.*

In his study of the North American species, Asa Gray (1875) described *P. Fendleri, P. hederaefolia* and *P. Wrightii.* Rydberg (1896), in the last general study of the genus, described *P. ciliosa, P. comata, P. macrophysa, P. neomexicana, P. rotundata* and *P. versicolor.*

Following this, as a result of increased botanical activity, Mohr (1899) described *P. monticola*; *P. rigida* was described by Pollard and Ball (1900), and *P. polyphylla* by Greene (1900). *P. missouriensis* and *P. subglabrata* were proposed by Mackenzie and Bush (1902). Rydberg added *P. floridana, P. pendula* and *P. sinuata* in Small's Manual (1903). Aven Nelson (1909) proposed *Quincula lepidota* and *P. genucaulis. P. caudella,* described by Standley (1937) from Chihuahua has been found in southern Arizona, and these collections usually have been identified as *P. lanceolata.*

Margaret Y. Menzel (1951) has published an exploratory survey of the cytology and genetics of many of the species of our area, as they were interpreted by Rydberg, and various collectors who followed that author's treatment. Her work is valuable because it shows that the observed variation may indeed be correlated with cytologic and genetic differences.

TAXONOMIC CHARACTERISTICS

The stability of taxonomic characteristics apparently has been much disturbed by the long-continued distribution of various species by man as esculents. Some of the species, such as *P. ixocarpa* and *P. peruviana,* are still so used. No doubt many of the species have been used by aborigines of many parts of the world at one time or another. This introduces the possibility of gene interchange between taxa that would otherwise not be contiguous. Furthermore, man's activities in producing disclimaxes provide habitats in which individual plants, or populations, of narrow ecological amplitude may survive. Such ecological niches might not have existed otherwise. It may be significant that many collections of *Physalis* are made in such disturbed habitats. Somewhat similar situations are admirably discussed by Edgar Anderson (1949).

The following discussion concerns the principal morphological characteristics which have been used in the taxonomy of the genus.

ROOTS. Both annual and perennial species occur in the genus. The former have fibrous root systems, or sometimes taproots. The latter are usually woody-based or rhizomatous. The annual vs. perennial characteristic has been used much in the past, beginning with Linneaus, to divide the genus into two main divisions. Since most herbarium specimens do not show the underground parts, this system is not a particularly convenient one. More dependence has been placed on other structures in the following treatment.

STEMS. All of our species have herbaceous stems, although in Mexico and Central America shrubby ones may occur. They may perennate from a woody caudex in such species as *P. crassifolia* of the desert areas of southwestern United States. Several of them grow from rhizomes, which may be cord-like, near the surface, and are often present in herbarium collections, as *P. arenicola* of sandy areas of Georgia and Florida, or thick, deeply buried and seldom collected, as the wide-ranging *P. heterophylla* and *P. virginiana.* The stems may be erect to prostrate and simple to much branched. An extreme in branching is found in *P. crassifolia* which, as reported by Jepson (1925), forms plants "1–3 ft. broad and ½–1 ft. high."

LEAVES. The leaf blades are usually ovate to ovate-lanceolate, but they may be reniform, as are rarely some of the lower leaves of *P. hederaefolia,* or narrowly linear as in *P. angustifolia.* Petioles may be longer than the blade, or the blades may taper into short, winged petioles. The leaves are normally alternate, but sometimes appear to be opposite as in *P. viscosa* var. *Elliottii* which often has two leaves at a node, particularly in the upper part of the stem.

Leaf shape has often been used as a basis for establishing, or characterizing, taxa, as is indicated by such names as *latifolia, hederaefolia, angustifolia, heterophylla, lanceifolia, integrifolia, crassifolia, spathulaefolia* and *longifolia.* No doubt in some instances, as in *P. angustifolia* with its long linear leaves, the emphasis on leaf-form is justified. However, the size, shape and margins of leaves are extremely variable characteristics in groups that appear to be natural populations. One approach to the understanding of this variability is to study a species that is well-delimited otherwise. An excellent example is *P. lobata*, a species so distinct that it has been considered a separate genus by such taxonomists as Rafinesque and Rydberg. Here the leaf shape may vary from narrowly ovate to linear-oblong, and the margins from pinnatifid to entire. Although the variation in leaf margins appears to be at an extreme here, the variability of leaf shape can be duplicated, and the variability in margins approached, in several other natural populations.

Under such conditions it would seem hazardous to establish species or varieties based on these characteristics; such a procedure should be followed only when these features are correlated with other morphological characteristics, or with geographic distribution. The author has utilized these criteria in maintaining *P. viscosa* var. *spathulaefolia* of the Texas gulf, and *P. viscosa* var. *maritima* of the southeastern seacoast. Here the extremes are distinct, but variation makes some collections difficult to place. Measurements of many specimens show the leaves of the former to be narrower than the latter, as indicated later in the keys to the species. However, if these features are used with the idea of either matching specimens, or describing new species, only confusion can result.

VESTITURE. The indument varies from hairs that are stellate or variously branched, to long jointed hairs and short hairs, capitate or sessile glands, or small crystalline vesicles as in *P. lobata*. Even the seemingly glabrous species usually have a few trichomes of some kind, at least on the younger parts. Frequently two or more kinds of trichomes are intermixed.

Such names as *viscosa, mollis, comata, pubescens, hirsuta, cinerascens, ciliosa, villosa, pruinosa* and *subglabrata* indicate the consideration that authors have given to indument in the past. The procedure seems to be partly justified. Surely the "stellate" populations are related. But if one attempts to distinguish taxa on the basis of the density or the size of the stellate hairs, caution should be exercised. In this study *P. viscosa* var. *mollis* has been segregated from var. *cinerascens* partly by this characteristic, but the latter taxon is extremely variable within itself in this respect. In *P. heterophylla* many of the variations in vestiture seem to be so little correlated, either with other characteristics, or with geographic distribution, as to be unusable to distinguish even varieties. On the other hand, in *P. virginiana, sens. lat.*, the correlations are such that they are of value in helping to establish geographic varieties. In the *P. angulata-P. pubescens* series indument is also of taxonomic significance, the villous *P. pubescens* usually having abundant multi-cellular hairs, *P. angulata* having a few short ones.

COROLLAS. The shape, color and spotting of the corollas have been considered of taxonomic significance. The shape varies from funnel-form-campanulate to rotate with the limb reflexed. The corolla is plicate, and is truncate with the exception of *P. Alkekengi* in which the lobes are separated by short sinuses. The shape of the corollas may be of taxonomic significance. Since the characteristic shape is attained for only a short time in the full sun, the application of this criterion is of limited value. Several species such as *P. lobata, P. Wrightii, P. hederaefolia* and *P. crassifolia* have corollas that are either rotate, or have a reflexed limb when fully open. Since the corollas are seldom fully open, the author has usually used a linear measurement for comparative purposes where such usage seemed desirable.

Color of the corolla has been used to help characterize *P. lobata*, which is our only species with a bluish, or violet, corolla. Otherwise the presence, and sometimes the color, of five spots on the limb of the yellowish corolla near its base has been found useful. The majority of the species either have distinct, dark spots present, or they have none that are noticeable in herbarium specimens. A few taxa such as *P. hederaefolia* var. *Fendleri* and some of the maritime varieties of *P. viscosa* have spots which are only a little darker than the rest of the corolla.

STAMENS. Size and color of the anthers are of taxonomic value. With a few exceptions, large anther size (measurements given in the keys) and thick filaments are correlated with our perennials. Small anther size and slender filaments are usually found in our annual species. In some taxa anther color is of significance. So many of the annual species have blue anthers that the yellow anthers of *P. missouriensis* attract attention. In others, such as *P. heterophylla* and *P. virginiana* var. *virginiana*, yellow or bluish tinged anthers seem to occur without much significance. However, *P. virginiana* var. *subglabrata* and var. *sonorae* may be distinguished by the bluish anthers of the former and the yellow anthers of the latter even when their other characteristics overlap.

A peculiarity of *P. crassifolia* and its var. *versicolor* is the presence of a few long jointed hairs on the filaments.

FLOWERING CALYX. The relative depth to which the calyx lobes are divided may be of value, as it is in helping to separate *P. angulata* var. *angulata* from var. *pendula*.

PEDUNCLE. The length of the peduncle, both flowering and fruiting, may be of taxonomic significance. In fruiting material of *P. ixocarpa* and *P. virginiana* var. *subglabrata*, some specimens of which may resemble each other, the very short fruiting peduncle of the former will serve to separate the two. Among the southwestern desert species, *P. hederaefolia* and its relatives may be separated from *P. crassifolia* and its relatives by the short flowering peduncle of the former. Although of lesser significance in the *P. angulata* complex, it may be used, in conjunction with the size of the fruiting calyx, to help separate *P. angulata* var. *angulata* from var. *pendula* and var. *lanceifolia*.

FRUITING CALYX. The calyx greatly enlarges with the maturing fruit, usually being much inflated around it. In some populations the size and shape seem to be constant, and characteristic enough to be taxonomically usable. In *P. pubescens* and its relatives there is present a distinctly five-angled fruiting calyx. A population in southern Arizona is proposed as a new species, easily recognized by its unusually broad, sharply-angled fruiting calyx. In the *P. angulata* series, *P. angulata* var. *angulata* has a larger fruiting calyx than either var. *pendula* or var. *lanceifolia*.

In other populations the size and shape of the fruiting calyx seem to be either quite variable, or the extremes occur sporadically. The present author believes that the large-calyx form described as *P. macrophysa* is a more or less sporadically occurring form of *P. virginiana* var. *subglabrata*, although it also may be found in intergrades with var. *sonorae* (*P. longifolia*). Specimens with large fruiting calyces also appear in *P. virginiana* var. *virginiana* and in some phases of *P. viscosa*.

The length of the lobes of the fruiting calyx was considered characteristic enough by Standley (l.c.) to call a new species *P. caudella*.

The writer has not found the indentation at the base of the fruiting calyx to be of much taxonomic value. Considerable variation may occur on the same plant. Of course if the calyx is nearly filled by the berry, it will be little invaginated.

OTHER CHARACTERISTICS. The style has not been used to any extent. In *P. lobata* it is distinctively curved near the base and bent to one side. The more or less reniform, punctate to reticulate seeds are very similar in most of the species. Differences seen in preliminary study appear to be bridged by many intermediates when a large series is examined. The backs of the seed of *P. lobata* are rather crenate or rugose.

Generic Relationships

The genus *Physalis* is studied here in its more or less conventional conception, including those members of the *Solanaceae* having a funnelform or campanulate to rotate, or rotate-reflexed corolla, longitudinally dehiscing anthers, and a berry, or berry-like fruit, enclosed in an enlarged and usually inflated calyx. It excludes both *Margaranthus*, with its urceolate corollas and very *Physalis*-like fruiting calyces, and also *Chamaesaracha* with a corolla very similar to some species of *Physalis*, but with a fruit very closely invested by the enlarging calyx.

When not in flower, *Margaranthus* could hardly be distinguished from moderately small-fruited species of *Physalis*. The rather tightly investing fruiting calyx of *Chamaesaracha* can be matched, or is approached, in some specimens of certain species of *Physalis* such as *P. ixocarpa*. A peculiar situation is found in *Chamaesaracha* where *C. grandiflora*, originally described as *Physalis* by Hooker, and a related species, *C. nana*, have seeds very similar to the punctate or minutely reticulate seeds of *Physalis*, while the other species of the genus have rather strongly alveolate surfaces.

Possibly both genera should be included in *Physalis*. This would make *Physalis* an inclusive genus, similar in its concept to *Oenothera* as delimited by Munz and other conservative taxonomists. In that genus a number of subgenera, regarded as genera by some authors, are bound together by flower similarities despite their differently shaped fruits. In *Physalis*, under this broad concept, the distinctive fruiting calyx would hold together subgenera differing in corolla structure. In *Chamaesaracha* the distinctiveness of the fruiting calyx becomes progressively less evident. The difficulty here would be in finding a stopping place short of including the whole genus. The author prefers making a more intensive study of the problem before proceeding with such action.

Since there is the possibility of creating distinctive subgenera as outlined in the preceding paragraph, it seems preferable not to formally place the species here treated into subgenera or sections, but to defer this action until not only species of *Physalis* from other areas, but also related taxa can be studied.

Taxonomy

PHYSALIS L., Species Plantarum 1: 182. 1735; *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, some having woody caudices, others with short to elongated rhizomes; leaves usually broadly ovate to linear, alternate or sometimes two at a node; vestiture various in kind and quantity, including short hairs, long jointed hairs, stipitate or sessile glands, or with hairs variously branched to stellate; corollas plicate, campanulate to rotate with the limb reflexed; corolla color usually some shade of yellow with, or without, five darker spots near the base of its limb, sometimes blue; flowers usually solitary in the axils of the leaves, sometimes on foreshortened axillary branches causing them to appear to be in axillary fascicles; calyx united, its lobes distinct for a little over one-half to about one-fourth of its length; calyx lobes ovate-deltoid to narrowly lanceolate, sometimes acuminate; calyx enlarging with, and usually inflated around, the maturing fruit; fruit a two-carpellate many- to few-seeded berry, sometimes rather dry; style more or less filiform, usually expanding somewhat at its summit into a slightly capitate, but sometimes nearly truncate, stigma; stamens five, their filaments attached near the base of the corolla tube; anthers ovate-oblong to linear-oblong, dehiscing by lateral slits, yellow or bluish in color; filaments varying from nearly as wide as the anthers, and sometimes clavate, to slender and filiform.

(*To be continued*)

New Illinois Carex Records.[1]—Collections of the following species of Carex have been deposited, as indicated, in Illinois State Museum (sm), University of Illinois (iu), University of Wisconsin (wu), and Rockford College (rc), herbaria.

Carex stenophylla Wahl. var. *enervis* (C. H. May) Kükenth. (*C. eleocharis* Bailey) ranges normally west and northwest from Iowa. It has not been reported east of the Mississippi River. In the spring of 1957 it was found on a dry gravel bluff prairie in Greater Rockford Airport south of Rockford, Winnebago County, in an area that was a part of Camp Grant during World Wars I and II. Here it grows in nearly pure stands in several patches 10 to 20 feet in diameter, blooming at the same time as *C. pensylvanica* Lam. var. *digyna* Boeckl. with which it is associated. It ceases growth by the first of July at which time the slender rhizomes and stolons have reached a length of 2½ to 3 inches. Thus it seems likely that seeding took place during World War I. Collection numbers are: *57–9* (sm, iu, wu, rc); *57–68* (sm, iu, rc); *57–157* (sm, iu, wu, rc); *57–248* (sm, iu).

Carex praegracilis W. Boott, another western species, is credited in the manuals to northern Michigan. There are no other records of its occurrence east of the Mississippi River. In 1951, it was found at Greater Rockford Airport and since then in a number of places on the gravel bluff prairie in the area, on a roadside near Perryville six miles from the Airport and in DeKalb County near Kirkland on a railroad right-of-way, 15 miles distant. Neither of these places are on a direct line of travel from the Airport. All are in prairie situations. The strong rhizomes grow rapidly but definite patches are not formed so the probable length of time that it has been established cannot be determined. The World War I idea of introduction would not apply to the DeKalb County station. Station locations and collection numbers are: Winnebago County; (Rockford Airport) *51–114* (sm); *52–356* (sm); *55–420* (wu); *57–158* (iu); (Perryville) *55–440* (wu, rc); *56–73* (iu). DeKalb County (Kirkland) *53–371* (sm); *55–141* (wu); *56–91* (iu).

In this location these plants bear seed sparingly but *C. praegracilis* is well dispersed and seems to be well established. *C. stenophylla* has persisted for 40 years and has spread. It is in a favorable habitat which is of a type common in Winnebago County. The airport authorities have agreed that this gravel hill

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[1] A contribution from the Evelyn I. Fernald Memorial Herbarium of Rockford College.

prairie will not be disturbed unless it is needed for an essential operation of the airport, which is not likely. For these reasons it seems probable that these carices will become a part of our flora with *Paspalum stramineum*, *Ratibida columnifera*, *Froelichia gracilis*, *Artemisia dracunculoides*, and others from the west which are found in the same area.—Egbert W. Fell.

Nelumbo lutea in Essex County, Massachusetts.—The only known station for *Nelumbo lutea* (Willd.) Pers. in Essex County was the Devil's Dishfull in West Peabody where it was apparently introduced at some time between 1880 and 1913. It soon became so abundant that the pond became known as Lotus Pond and some well-intentioned but misinformed person erected a sign stating that the pond was the only place in the United States where the Sacred Lotus occurred. *Nelumbo* was still common there in the fall of 1953, when I collected a specimen. In August, 1957, I put my boat in the pond and covered the area thoroughly collecting aquatic plants. While *Nuphar variegatum* and *Nymphaea odorata* were as common as in the past there was no trace of *Nelumbo*. I can think of no valid cause to explain its disappearance.—Stuart K. Harris, dept. of biology, boston university.

Cabomba caroliniana in Essex County, Massachusetts.—When collecting aquatics in Fosters Pond, Andover, Massachusetts in June, 1957, I found that the most common plant there was *Cabomba caroliniana* Gray. This is the first station known in Essex County. Since Professor A. S. Pease, who has an uncanny ability to spot interesting plants, collected on the pond in 1903 and did not find *Cabomba*, it seems safe to assume that it must have been introduced there since that date. Probably *Cabomba* is more widely introduced in Massachusetts than collections indicate. There are only two sheets in the herbarium of the New England Botanical Club from this state other than my collection, 24 June 1957, *12997*. However, *Cabomba* is abundant in Muddy River in Boston's Fenway but no specimen appears in the Club herbarium.—Stuart K. Harris, dept. of biology, boston university.

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GENERIC CONSIDERATIONS CONCERNING CARPHEPHORUS, TRILISA AND LITRISA (COMPOSITAE)

Charles W. James

Carphephorus Cass. (4 species), and *Trilisa* (Cass.) Cass. (2 species) and the monotypic *Litrisa* Small (merged with *Trilisa* by Robinson, 1934), are closely related genera in the Eupatorieae. They are allied to *Liatris* Schreb. and *Garberia* Gray with which they form a seemingly natural segregate of the subtribe Kuhniinae. Primarily of the Coastal Plain, they are known only from the southeastern United States; southeastern Virginia to south Florida and westward into eastern Louisiana. All of the seven species appear distinctive and present relatively little variation. The present problem is one of generic limits, the basis of which is presented in the following historical account.

In describing *Carphephorus,* Cassini (1816) stated that it differed from *Liatris* in that the receptacle was provided with pales and the pappus bristles were non-plumose. Later (1818), he recognized *Trilisa* as a subgenus of *Liatris,* as typified by *Liatris odoratissima.* The rank of subgenus was considered sufficient for this taxon because there was observed in *Liatris* a short-plumose (barbellée) pappus which was intermediate between true *Liatris* whose pappus was long-plumose (barbée), and *Trilisa* whose pappus was barbed (barbellulée). He further stated that *Trilisa* had the greatest affinity with *Carphephorus,* from which it differed by the absence of pales. Although he directly proceeded to point out that a few pales were occasionally observed even in the subgenus *Trilisa.* In 1820, Cassini raised *Trilisa* to generic status without further discussion. Not until 1828, however, were any species actually transferred to it. At this time Cassini cited *Liatris odoratissima* and *Liatris paniculata* of Willdenow (1803)[1] as species of *Trilisa* and summarized his previous comments on these genera.

It is Cassini's remark (apparently overlooked, subsequently) of the occasional presence of some pales in *Trilisa odoratissima* that has prompted the question of the generic limits in *Carphephorus* and *Trilisa,* and also *Litrisa.* The last named "genus" has only one species, *Litrisa carnosa* Small, an endemic of east, central Florida. In describing it, Small (1924) wrote, "Technically it is most closely related on the one hand to *Trilisa,* by its involucre, and on the other, to *Carphephorus,* by its chaffy receptacle." It is implied here, as has been customary, that *Trilisa* has a naked receptacle. After the publication of Small's manual (1933), Robinson (1934) noticed that Small contradicted himself by keying out *Litrisa* as having "Receptacle naked." In a study of the type collection, as well as other material, Robinson made several sketches, one of which bears the annotation, "No scales on disk." Since he then proceeded to transfer *Litrisa carnosa* to the genus *Trilisa,* rather than *Carphephorus,* the implication is again that *Trilisa* lacks pales. Presumably, if Robinson had seen any pales in *Litrisa carnosa,* he would have transferred it to *Carphephorus,* for he was not impressed by the differences in the involucres.

Upon examination of all of the species of the genera under consideration, I conclude that pales may be borne in any one of the species. They are most abundant in *C. pseudo-liatris* and *C. corymbosus.* Their number also varies, as might be expected, with the size of the heads. Since the heads are typically smaller in the two *Trilisa* species and in *Litrisa* (involucres ca. 4–5 mm. high), than in *Carphephorus* (involucres ca. 6–10 mm. high), the number of pales per head as a primary generic character would

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[1] Willdenow took both epithets, "odoratissima" and "paniculata" from Walter (1788), who had employed them with "Anonymos." However, Michaux, also in 1803, transferred these "Anonymos" species of Walter to *Liatris.* According to Schubert (1942), Michaux's Flora preceded this particular volume of Willdenow's. Consequently, the citation of these binomials should be: *Trilisa odoratissima* (Michx.) Cass. and *Trilisa paniculata* (Michx.) Cass.

[2] The presence of pales in these genera is unique in the tribe Eupatorieae. Bentham (1873) says, "Receptaculum plus minus paleaceum in Decachaetae, Alomiae, et Agerati speciebus paucis et in Carphephorus." They are also present in *Hartwrightia* Gray ex S. Wats. Furthermore, they are little, if at all, specialized; the peripheral ones, particularly, are very similar to the phyllaries, with which they have been considered homologous.

seem questionable. The pales are also deciduous, a factor perhaps accounting for discrepancies in determining their presence[2] or absence.

The only other known morphological basis for these genera is found in the involucre. In *Carphephorus,* the phyllaries are well-imbricated in 3–6 series; the involucre 6–10 mm. high. In *Trilisa,* the phyllaries are in 1–2(–3) series, scarcely, if at all, imbricate, the involucre 4–5 mm. high. However, in *Litrisa,* the phyllaries are well-imbricated, but only in 2–3 series and the involucre is 4–5 mm. high.

Cytological studies (Gaiser, 1954) in these genera have yielded no evidence for the maintenance of *Trilisa* or *Litrisa* as distinct from *Carphephorus.* In all of the species $2n = 20$. "One karyotype is believed to be common to these two species [*Trilisa paniculata* and *Trilisa odoratissima*] and it has been found to be indistinguishable from that of *Carphephorus.*" Concerning *Litrisa carnosa,* "The number ($2n = 20$) and approximately the same kinds of chromosomes as found in the other two species [of *Trilisa*] were sketched from cells not adequate for photography. However, lacking sufficient material for careful studies, the karyotype of this species cannot be included at this time." The only other genera in the subtribe Kuhniinae in which $n = 10$[3] are *Garberia* and *Liatris,* both of which have long been suspected of being closely related to the genera in question by their morphological similarities. Neither of these genera has been reported to have pales. The monotypic *Garberia,* represented by *G. heterophylla* (Bartr.) Merrill & F. Harper (*G. fruticosa* (Nutt.) Gray), is endemic to the sand scrubs of central Florida and is the only woody member having $n = 10$. Also, its karyotype is distinctive. Although karyotypes have not been determined for all of the species of *Liatris,* some intra-generic variation in karyotype has been detected. Certainly there is as much variation, morphological as well as cytological, in the one genus *Liatris* (cf. Gaiser, 1946; 1949; 1950) as there is in the whole *Carphephorus-Trilisa-Litrisa* complex.

As it now stands, the primary basis for *Trilisa* (including *Litrisa,* as Robinson did) seems to rest entirely on the size of the

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[3] Other basic numbers in the subtribe are 9 and 11; only the South American genus, *Kanimia,* has not been examined cytologically.

involucres. If, however, *Litrisa carnosa* were transferred to *Carphephorus*, the primary generic distinction could then be based on whether or not the phyllaries were imbricate. The latter character would appear to segregate the species much more naturally. This apparently was R. M. Harper's view, also, for he collected *Trilisa carnosa* before it was described (St. Lucie Co.: flat pine woods about 2 mi. w. of Fort Pierce, Fla., 23 Aug. 1923, GH), and annotated it "*Carphephorus* (?) n. sp." This same character has been used as a primary basis for distinguishing *Brickellia* from *Kuhnia* (cf. Robinson 1913; 1917), also in the *Kuhniinae*, but having $n = 9$. Shinners (1946) considered this a very weak basis, but in this case was able to point out additional reasons to justify the continued recognition of those genera. In the present and somewhat comparable case, supplementary characters, if any, have not been found. But regardless of whether or not *Trilisa* is to be maintained as a genus, it appears best segregated at the present time on its non-imbricate phyllaries. Since the phyllaries of *Litrisa* are imbricate as in *Carphephorus*, it is proposed that *Litrisa carnosa* Small be transferred from *Trilisa* to *Carphephorus*. This action would be in agreement with McVaugh's (1945) recommendation six on the generic disposition of species having affinities with two or more genera. "Any segregate genus should be sharply delimited; that is, any species which is intermediate in one or more respects toward a more inclusive genus should be relegated to the latter. The retention of the anomalous species in the more inclusive genus will change its limits, if at all, but very slightly, and only in this way can the segregate genus be precisely defined." In this case, the "segregate genus" would be *Trilisa*, the "more inclusive genus"—*Carphephorus*, and the "anomalous species"—*Litrisa carnosa*.

Carphephorus carnosus (Small) James, comb. nov. based on *Litrisa carnosa* Small, Bull. Torr. Bot. Club **51:** 392. 1924. Type: *Small* **10658**, Istokpoga Prairie, east of Sebring, Florida, 31 Aug. 1922 (NY); photograph of type (GH). *Trilisa carnosa* (Small) Robinson, Contrib. Gray Herb. **104:** 49. 1934.

This species is endemic to the seasonally wet, low, sandy pine lands in east central to southern Florida. It is known from Brevard (GH), Charlotte (FLAS, GH), DeSoto (FLAS), Highlands (FLAS, GH), Martin (FLAS, GH), Okeechobee (FLAS, GH), Orange (FLAS, GH), Osceola (FLAS, GH), Polk (FLAS) and St. Lucie (GH) Counties.

Key to the Species

a. Phyllaries imbricate (in (2–)3–6 series), densely pubescent with eglandular trichomes or glabrous and erose-ciliate; involucre 4–10 mm. high .... *Carphephorus* Cass.
  b. Phyllaries (at least the inner) glabrous, the margins erose-ciliate, eglandular, obtuse.
    c. Stems pubescent .... 1. *C. corymbosus* (Nutt.) T. & G.
    c. Stems glabrous .... 2. *C. bellidifolius* (Michx.) T. & G.
  b. Phyllaries with eglandular trichomes and colorless resin atoms (sometimes few), acute or apiculate.
    d. Basal leaves long, needle-like .... 3. *C. pseudo-liatris* Cass.
    d. Basal leaves broad, linear or lanceolate.
      e. Basal leaves lanceolate, usually pubescent, not leathery, ascending .... 4. *C. tomentosus* (Michx.) T. & G.
      e. Basal leaves linear or linear-lanceolate, glabrous, leathery, forming a depressed rosette (endemic to Florida) .... 5. *C. carnosus* (Small) James.
a. Phyllaries scarcely, if at all imbricate (in 1–2(–3) series), glabrous or with few glandular trichomes or resinous atoms, the margins eciliate; involucre 4–5 mm. high .... *Trilisa* (Cass.) Cass.
    f. Stems glabrous .... 6. *T. odoratissima* (Michx.) Cass.
    f. Stems pubescent .... 7. *T. paniculata* (Michx.) Cass.

—DEPARTMENT OF BOTANY, UNIVERSITY OF GEORGIA.

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CHROMOSOME RACES IN THE CHRYSANTHEMUM LEUCANTHEMUM COMPLEX[1]

Gerald A. Mulligan[2]

In 1954, as the result of chromosome studies on Canadian weeds, the presence of two chromosome races in North American material of *Chrysanthemum leucanthemum* L. s.l., oxeye daisy, was detected. Subsequent study revealed that the abundant and widespread oxeye daisy of North America is diploid with 18 somatic chromosomes. Tetraploid plants do occur on this continent but the occurrences are not widespread.

I determined the number of chromosomes in 36 lots of material from different locations in Nfld., Lab., P.E.I., N.S., N.B., Que., Ont., B.C., and Me. A somatic number of 18 was determined on 32 lots of this material and the other 4 lots had 36 somatic chromosomes. The tetraploid plants were grown from seed collected at Batiscan, Lauzon and Lennoxville in the Province of Quebec and at Tidehead, New Brunswick. Cooper and Mahony (1935) counted 18 meiotic chromosomes on material from the campus of the University of Wisconsin and Martin and Smith (1955) counted 18 somatic chromosomes in material from Corvallis, Oregon. Three chromosome races of *C. leucanthemum* L. s.l., with somatic chromosome numbers of 18, 36 and 54, occur in Europe. I counted 36 chromosomes on material received from France and the U.S.S.R. and 54 mitotic chromosomes on two lots of material from Portugal. Other counts on European material were made by Polya (1950) on diploid plants and Negodi (1937), Ohrt in Tischler (1950) and Löve and Löve (1956) on tetraploid plants. Dowrick (1952) and Böcher and Larsen (1957) obtained somatic counts of 18, 36 and 54 on European material. Three tetraploid counts

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[1] Contribution No. 1607 from the Botany and Plant Pathology Division, Science Service, Canada Department of Agriculture, Ottawa, Ontario.

[2] Assistant Botanist (Weed Investigations).

were obtained on Japanese material by Tahara (1915), (1921) and Shimotomai (1937).

The maximal inner width of pollen grains of the diploid, tetraploid and hexaploid plants counted was measured[3] and a correlation was found to exist between size of pollen grains and chromosome numbers. The pollen grains of diploid plants ranged from 16.3μ to 19.5μ, tetraploids from 19.5μ to 22.8μ and hexaploids from 22.8μ to 24.4μ. Pollen grains from 191 Canadian and United States herbarium specimens were measured. None of these specimens had pollen grains in the hexaploid size range. A total of 162 herbarium specimens collected in Nfld., Lab., N.S., P.E.I., N.B., Que., Ont., Man., Sask., Alta., B.C., Mass., Vt., N.Y., Va., W.Va., Mich., Minn., Colo., Mont., Ida., Wash., Nev., and Calif. had pollen grains in the diploid size range. The remaining 29 sheets had pollen grains that fell within the tetraploid size range. A total of 17 of these "tetraploids" had been collected in the area between Quebec City and Gaspé or in the vicinity of Granville and Digby, Nova Scotia. The other 12 herbarium sheets with tetraploid-size pollen grains were collected from other locations in Lab., Que., Ont., Man., B.C., Minn., and Wash. The inner diameters of pollen grains from 15 European herbarium specimens were examined and 12 sheets had pollen grains in the tetraploid size range, 2 in the diploid range and 1 in the hexaploid range.

It appears, from chromosome counts and pollen data, that most of the North American plants of *C. leucanthemum* L. s.l. are diploid although a small amount of our material is tetraploid. In Europe, the common *C. leucanthemum* L. s.l. is not diploid but tetraploid. Diploid plants seem to be slightly less common than tetraploids in Europe and hexaploids are rare. Dowrick in personal correspondence, dated December 2nd 1955, wrote: "Of the European *C. leucanthemum* plants which I have counted $2n = 36$ is by far the most frequent number. The $2n = 54$ plants came from Switzerland and the *one* count of $2n = 18$ from plants obtained from Ireland." Böcher and Larsen (1957) counted 26 lots of plants from 10 European countries and 9 lots were diploid, 16 tetraploid and 1 lot hexaploid.

The morphological differences between my diploids and tetraploids are similar to those given by Fernald (1903) when he de-

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[3] Pollen was removed from open disk florets and stained with cotton blue in lacto-phenol. Only well stained pollen showing three open pores were measured.

scribed the characters differentiating his *Chrysanthemum leucanthemum* L. var. *subpinnatifidum* from what he considered the typical *C. leucanthemum* L. He recognized that the common ox-eye daisy of North America had in general a uniformly different type of foliage from the common plant of Europe and named the common North American plant var. *subpinnatifidum*. Fernald's variety has the characters of my diploid plants; the basal leaves generally coarsely and irregularly toothed and the middle and upper leaves usually narrowly oblong or oblanceolate, conspicuously subpinnatifid at the base. The characters he gave for the plant that is localized in North America and most common in Europe, the so called *C. leucanthemum* L., correspond to the morphological characters found in my tetraploids. The basal leaves are usually spatulate-obovate and closely and regularly crenate and the middle and upper leaves are usually oblong or oblanceolate, coarsely crenate or dentate above with larger spreading teeth at the base.

Böcher and Larsen (1957) examined the type specimen of *Chrysanthemum leucanthemum* L. in the British Museum. This plant although lacking stem leaves had diploid size pollen grains and was considered by the authors to be morphologically similar to their diploid plants. They include in their paper an excellent photograph of a diploid plant originally collected at Edenderry, Eire. This photograph and their description of the European diploids convince me that their diploids are morphologically indistinguishable from my diploids and the common oxeye daisy of North America. It can be concluded that our common oxeye daisy is *Chrysanthemum leucanthemum* L. s. str. Böcher and Larsen believe that European tetraploid plants should be placed in *Chrysanthemum ircutianum* Turcz. s.l. From the photographs and description in their paper it is evident that our North American tetraploids are very similar in morphology to their tetraploids. Unless the size of pollen grains is known, it is often impossible to positively identify tetraploids on anything but a complete herbarium specimen. Therefore, it appears premature to regard the tetraploids as a separate species.

In summary, the common oxeye daisy of North America has a somatic chromosome number of 18 and appears to be the typical *Chrysanthemum leucanthemum* L. s. str. Plants with a somatic number of 36 also occur on this continent but the stands are relatively few and localized. Plants with somatic numbers of 18, 36 and 54 occur in Europe; the tetraploid plants are somewhat commoner than the diploids and hexaploids are rare.

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NOTES ON THE DISTRIBUTION OF OHIO COMPOSITAE: I. HELIANTHEAE, ANTHEMIDEAE[1]

Robert W. Long

This series of observations was made during the preparation of "A Preliminary List of the Compositae of Ohio."[2] The plants named below are those whose occurrence in Ohio is poorly understood judging from the information given in Gray's Manual (1950) and The New Britton and Brown Illustrated Flora (1952). Most of these plants were introduced into Ohio as weeds either from Europe or from western states. This illustrates, however, the

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[1] This study was aided in part by a grant from the Ohio Academy of Science.

[2] Long, Robert W. (1957) A preliminary list of the Compositae of Ohio. The Ohio Flora Comm., Ohio State University, Columbus, Ohio.

changing composition of the state flora, especially with respect to the *Compositae*.

All specimens cited here are deposited in the Herbarium of the Ohio State University, and the identifications all have been verified by the writer.

Heliantheae

Ambrosia bidentata Michx. This western species of prairies and other dry places is apparently known only from the extreme southern portion of the state, in the Allegheny Plateau. It was undoubtedly introduced from regions west, but the evident delimitation to the unglaciated portion of Ohio cannot be explained at this time. collection data: Jackson Co. Madison Twp., in a cornfield four miles NE. Thurman, *Floyd Bartley and Lawrence Hicks*, Aug. 14, 1955. Also, specimens were examined from Adams, Gallia, and Lawrence counties.

Ambrosia psilostachya DC. var. **coronopifolia** (T. & G.) Farw. Another western ragweed, this plant appears to be limited to the extreme northern part of the state. It is no doubt adventive from the West, with collections being made chiefly from railroad yards, and other waste places. collection data: Lake Co., N. Y. Central R. R. at Perry, *Fred J. Tyler*, July 23, 1933. Also, Huron and Ottawa counties.

Coreopsis verticillata L. This is a plant of dry woods and is found in the southeastern states. Its occurrence in Ohio is considerably north of its center of distribution. Only one collection was seen and the species is probably very rare. collection data: Clark Co., Silver Lake near New Carlisle, *John H. Schaffner*, Aug. 30, 1929.

Helianthus angustifolius L. This species is known only from one county at the southeastern edge of the state. It is probably an escape from cultivation, or otherwise introduced. Typically, this plant grows in moist places in southeastern United States, but extends inland to Kentucky and Indiana. There are two separate collections from the same county in Ohio. collection data: Washington Co. in an old field, 3 mi. N. Marietta, *Floyd Bartley*, Oct. 20, 1951.

The genus *Helianthus* is well-represented in the state and a number of putative hybrids have been identified. They are *Helianthus* × *ambiguus* T. & G. pro. sp., *H.* × *luxurians* Watson pro. sp., *H. giganteus* × *mollis*, *H. occidentalis* × *grossesserratus*, and *H. petiolaris* × *annuus*. *Helianthus brevifolius* Watson was based on a collection from Lake county and the type has been examined. The status of this name is not clear at present, but it appears to refer to a hybrid of *Helianthus grosseserratus* and *H. divaricatus* (*H.* × *divariserratus* Long), judging from the size, shape, and arrangement of leaves. collection data: Lake Co., Richmond, *Otto Hacker*, 1894, (type).

Rudbeckia hirta L. var. **Brittonii** (Small) Fern. This variety is distinguished from the typical one by the presence of oblong phyllaries. Known from West Virginia, this record represents a westward extension for the variety. collection data: Coshocton Co. *Harold N. Moldenke 13293*, July 25, 1942.

Rudbeckia tenax Boynt. & Beadle. A single collection from southern Ohio, this would constitute an eastward range extension for the species, previously reported for Indiana and Illinois. COLLECTION DATA: Adams Co. SW. corner Oliver Twp., openings, post oak area, *E. Lucy Braun.*

Silphium laciniatum L. Schaffner has noted on a collection from Franklin Co. that this plant is probably not native to Ohio, but rather is adventive from the West. In his Revised Catalogue,[3] however, he lists it as apparently indigenous. Its chief distribution occurs in the prairies of Michigan and North Dakota, Oklahoma, and Texas. It is known from widely separated areas in Ohio. One of the collections is from the unglaciated, southern tip of the state. COLLECTION DATA: Lawrence Co., collected in an old field along route 141, 1.6 mi. S. Wilgus, 200 plants in one patch; *Floyd Bartley and Lawrence Hicks,* Aug. 3, 1952. Also, specimens from Franklin and Summit counties.

ANTHEMIDEAE

Achillea Ptarmica L. A single collection with "flowers not doubled," probably escaped from local cultivation. In general, this collection is south of the chief Midwestern area of distribution for this species. COLLECTION DATA: Franklin Co., *W. H. Camp,* June 1, 1934.

Anthemis arvensis var. **arvensis** L. A single collection, but at this location very abundant as a weed, evidently. According to the distribution given in Gray's Manual this would be a westward range extension. COLLECTION DATA: Highland Co., Hillsboro, B. & O. freight yards, *Katie M. Roads,* June 22, 1931.

Anthemis arvensis var. **agrestis** (Wallr.) DC. Differing from the typical variety by the presence of chaff shorter than disk flower; more common than the preceding, but from widely scattered localities in Ohio. COLLECTION DATA: Greene Co., in a yard near Fairborn, *Clara Weishaupt,* June 25, 1953. Other collections from Lorain and Auglaize counties.

Anthemis mixta L. The occurrence of this plant as a weed is a westward extension of the range given in the manuals; A single collection. COLLECTION DATA: Lake Co. Painesville, Ohio; *Otto Hacker,* July 28, 1901.

Anthemis tinctoria L. From four widely separated areas of Ohio, probably commoner than indicated here. COLLECTION DATA: Marion Co., *R. A. Dobbins,* August 24, 1937. Other collections from Fairfield, Guernsey, and Lake Counties.

Artemsia albula Woot. This species is not given in either manual and is definitely a plant of the western plains, specifically of Texas, Colorado, and New Mexico. It was collected, however, outside of cultivation, and the specimen is typical in every way according to its description. COLLECTION DATA: Coshocton Co. along fence row, Mill Creek watershed, *H. N. Moldenke 13320,* July 28, 1942.

Matricaria Chamomilla L. From the collections seen, this plant is

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[3] SCHAFFNER, JOHN H. (1932) Revised Catalogue of Ohio Vascular Plants. Ohio Biol. urvey 5: 89–215.

found in widely scattered portions of the state as an occasional weed. COLLECTION DATA: Pike Co., Jackson Twp., in an old field head of Toad Heaven Hollow; *Floyd Bartley,* May 17, 1947. Other collections from Greene, Lake, Lawrence, and Ottawa counties.—DEPARTMENT OF BOTANY, OHIO WESLEYAN UNIVERSITY, DELAWARE, OHIO

A TAXONOMIC STUDY OF THE GENUS PHYSALIS IN NORTH AMERICA NORTH OF MEXICO

U. T. Waterfall

(*Continued f om p. 114*)

KEY TO GROUPS OF SPECIES OR TO UNIQUE SPECIES

1. Corolla yellow, yellowish-green or white, with or without darker spots; plant surfaces without crystalline vesicles; enlarging ovules all of one kind.
  2. Corolla with broad shallow sinuses between the lobes; fruiting calyx reddish.................................1. *P. Alkekengi.*
  2. Corolla truncate; fruiting calyces not red.
    3. Plants covered with stellate or variously branched trichomes, or glabrous with a few stellate hairs on the sepals or sometimes on the leaf margins.....................GROUP I.
    3. Plants nearly glabrous, or variously hairy, but branched hairs, if present, very small and inconspicuous and usually much less numerous than the short unbranched hairs mixed with them.
      4. Anthers (2) 3–5 mm. long; perennials excepting *P. ixocarpa* and *P. Wrightii*.........................GROUP II.
      4. Anthers (.5) 1–2.3 (2.8) mm. long; annuals
        5. Plants nearly glabrous, usually with a few short curved or appressed hairs on the sepals or young parts. GROUP III.
        5. Plants long-hairy, sometimes with shorter hairs or glands intermixed...............................GROUP IV.
1. Corolla blue to purple (rarely white), or yellow and with plump seedlike corky bodies mixed with the reniform seeds.
  6. Corolla blue to purple (rarely white), rotate; no corky bodies mixed with the seeds; herbage with few to many crystalline vesicles, sometimes giving it a scurfy look............21. *P. lobata.*
  6. Corolla yellowish, funnelform; plump, rounded, corky seedlike bodies mixed with the reniform seeds..........22. *P. Carpenteri.*

GROUP I

1. Hairs stellate, each ray sometimes rebranched, the verticils sometimes in more than one series, and sometimes the branches irregularly arranged; or plant with a coat of short stellate hairs, plus either long-stiped branched hairs, or simple hairs.
  2. Leaves ovate to narrowly linear, their blades mostly 2.5–6 times longer than the petiole, sometimes decurrent on it; corolla usually not dark spotted, or with spots not very prominent in herbarium specimens (rarely with prominent dark spots and more or less spathulate leaves); maritime

plants extending from southeastern Va. to the Gulf Coast of Texas.

3. Leaf blades ovate, spathulate, lanceolate or linear-lanceolate (sometimes linear in intergrades with *P. angustifolia*); mostly stellate-vestite, but nearly glabrous in one form of var. *Elliottii*.
  4. Leaf blades ovate to spathulate.
    5. Leaves with definite petioles usually about one-third to one-fourth the length of the blade; whole leaf (1.7) 2–3 (3.4) times longer than wide; se. Va. to Fla.
      6. Leaf blades usually 2–4 (5) cm. wide. 2a. *P. viscosa*, var. *maritima*, f. *maritima*.
      6. Leaf blades usually 5–7 cm. wide. 2a. *P. viscosa*, var. *maritima*, f. *latifolia*.
    5. Leaves tapering to the base, or extending gradually into winged petioles; whole leaf (2) 2.5–4 (4.7) times longer than wide; Gulf Coast of Texas. 2c. *P. viscosa*, var. *spathulaefolia*.
  4. Leaf blades lanceolate to linear-lanceolate; leaves mostly 2.5–10 times longer than wide.
    7. Plants stellate-vestite .... 2b. *P. viscosa*, var. *Elliottii*, f. *Elliottii*.
    7. Plants glabrous except on the margins or the tips of the sepals, and sometimes on the leaf margins. 2b. *P. viscosa*, var. *Elliottii*, f. *glabra*.
3. Leaves linear, often ca. 8, but sometimes from 1–20 times longer than wide; plant glabrous except the tips or margins of the sepals .... 3. *P. angustifolia*.

2. Leaves mostly ovate, sometimes reniform, ovate-deltoid, or ovate-lanceolate, their blades mostly (1.2) 1.5–2 (3) times as long as their petioles; corolla dark-spotted; mostly plants of the south central plains, but extending to the Gulf Coast of Texas.
  8. Hairs 1–4 mm. long on at least the calyx or the base of the stem, in addition to stellate hairs covering herbage. . 4. *P. variovestita*.
  8. Plants without hairs 1–4 mm. long intermingled with shorter stellate ones.
    9. Flowering calyces (6) 7–10 mm. long; vestiture forming a dense mat, at least beneath the leaves; leaves dentate. 2d. *P. viscosa*, var. *mollis*.
    9. Flowering calyces mostly (3) 5–7 (9) mm. long; vestiture usually sparse; leaf margins dentate, undulate or entire. 2e. *P. viscosa*, var. *cinerascens*.

1. Hairs jointed, those of the stem mostly 1–2 mm. long and spreading at right angles to the stem giving it a bristly appearance; hairs 2- or 3-branched, not having a second coat of short stellate hairs .... 5. *P. pumila*.

GROUP II

1. Long cord-like rhizomes present near the surface of the soil; found in Fla. and adjacent areas.
  2. Plants with hairs short and antrorse, sometimes viscid. 6a. *P. arenicola*, var. *arenicola*.
  2. Plants ciliate with jointed hairs 1.5–2 mm. long. 6b. *P. arenicola*, var. *ciliosa*.

1. Plants with deeply buried, seldom-collected rhizomes, or possibly other perennating structures, or, in one species, annual.

3. Anthers blue, ca. 3 mm. long; corolla blue- or purple-spotted; leaves lanceolate; perennials of s. Ariz. and adjacent Mexico. 11. *P. caudella.*

3. Anthers often yellow; if anthers blue, then plants not lanceolate-leaved perennials with purple-spotted corollas native to s. Ariz. and adj. Mexico.

4. Corolla usually dark-spotted near the base of its limb; flowering peduncles 3–15 mm. long; if corolla not noticeably dark-spotted, then flowering peduncles ca. 3–8 mm. long.

5. Flowering peduncles usually 10–15 mm. long; corolla limb usually not reflexed when fully open; plants primarily of the eastern and northern U. S.

6. Vestiture villous; hairs jointed.

7. Filaments as wide as the anthers to about one-third as wide, sometimes clavate; leaves blunt to pointed; anthers yellow to light blue.

8. Anthers (3) 3.5–4.5 mm. long; filaments often clavate.

9. Bases of stems not thickened and subligneous.

10. Vestiture of stems various, but not of abundant hairs 2–4 mm. long. 7a. *P. heterophylla*, var. *heterophylla.*

10. Vestiture of abundant hairs 2–4 mm. long; Ala. and Fla. . . . . 7c. *P. heterophylla*, var. *villosa.*

9. Bases of stems thickened and subligneous; se. Va. . . . . 7b. *P. heterophylla*, var. *clavipes.*

8. Anthers (2) 2.5 (3) mm. long; filaments not clavate . . . . 9a. *P. virginiana*, var. *virginiana.*

7. Filaments slender; leaves acuminate; corolla spots and anthers deep blue-purple; introduced . . . . *P. peruviana.*

6. Vestiture not villous.

11. Flowering calyx campanulate, the lobes spreading, 4–5 mm. wide at base and 15–20 mm. wide at tips. 9g. *P. virginiana*, var. *campaniforma.*

11. Flowering calyx not as above.

12. Hairs of stem short, retrorse. 9a. *P. virginiana*, var. *virginiana.*

12. Hairs not short and retrorse, often antrorse.

13. Anthers light blue, or tinged with light blue.

14. Fruiting calyx 2.5–3.5 cm. long and 2–3 cm. wide. . 9b. *P. virginiana*, var. *subglabrata*, f. *subglabrata.*

14. Fruiting calyx 4–5 cm. long and 3–4 cm. wide. . 9b. *P. virginiana*, var. *subglabrata*, f. *macrophysa.*

13. Anthers yellow.

15. At least a few stiff spreading hairs about 1 mm. long on the flower buds, leaf margins or stems; thick-leaved plants of the prairie region westward, usually in sand. 9e. *P. virginiana*, var. *hispida.*

15. Plants without stiff spreading hairs.
    16. Principal leaves ovate; plants nearly glabrous usually several-branched from the base, and spreading; s. Tex. 9c. *P. virginiana*, var. *texana*.
    16. Principal leaves usually lanceolate to linear, if ovate then plant not with several spreading branches from near the base.
        17. Plants usually single-stemmed, erect; larger basal leaves usually 5–10 cm. long. . . . . 9d. *P. virginiana*, var. *sonorae*.
        17. Plants usually branched from the base; larger basal leaves usually 4–5 cm. long; s. Colo. . . . 9f. *P. virginiana*, var. *polyphylla*.

5. Flowering peduncles usually 3–8 mm. long; corolla limb often reflexed when fully open; plants primarily of the southern Rocky Mts. and westward.
    18. Plants with long jointed hairs mixed with shorter hairs, or with glandular ones, or with only long jointed hairs.
        19. Flowering calyx 8–11 mm. wide; anthers 1.5–3 mm. long; leaf blades frequently rotund; mostly in the north central prairies extending west into the Rockies. . . . . 10b. *P. hederaefolia*, var. *comata*.
        19. Flowering calyx 4–8 mm. wide; anthers 3–4 mm. long; sw. Tex. to Colo. and westward. 10a. *P. hederaefolia*, var. *hederaefolia*.
    18. Plants without long jointed hairs; short hairs, or glandular ones present.
        20. Anthers yellow, not prominently twisted after dehiscence; perennials.
            21. A few short stiff branched hairs with a spread of ca. 1 mm. present at least on the calyces, sometimes abundant; leaves ovate to lanceolate. 10c. *P. hederaefolia*, var. *cordifolia*.
            21. Small branched hairs not present; leaves mostly ovate. . . . . 10a. *P. hederaefolia*, var. *hederaefolia*.
        20. Anthers blue, 3 mm. long; strongly twisted after dehiscing; annuals. . . . . 13. *P. ixocarpa*.

4. Corolla not dark spotted, or with slightly darkened spots which hardly show when dry, sometimes turning blue when dry.
    22. Flowering peduncles 3–8 (10) mm. long, shorter than the flowers, or about equalling them.
        23. At least some of the hairs short, stiff and branched. 10c. *P. hederaefolia*, var. *cordifolia*.
        23. None of the hairs short, stiff and branched. 10a. *P. hederaefolia*, var. *hederaefolia*.
    22. Flowering peduncles (10) 12–20 (50) mm. long, somewhat longer than the flowers to several times their length.

24. Corolla rotate, with 5 hairy pads exposed on its limb near the short tube; anthers blue, usually 2.5–3 mm. long; annuals. . . . . 14. *P. Wrightii.*
24. Corolla not rotate with 5 hairy pads exposed on its limb; anthers not blue and 3 mm. long; perennials.
    25. Corolla remaining yellow when dried; leaves thick, often entire; flowering calyces usually 4–6 mm. long on peduncles from little longer than, to 6 or 7 times their length . . . . 12a. *P. crassifolia*, var. *crassifolia.*
    25. Corolla often drying with a blue tinge; leaves thin, often toothed; flowering calyces usually 3–4 mm. long on peduncles 5–10 times their length. 12b. *P. crassifolia*, var. *versicolor.*

GROUP III

1. Fruiting calyx rather rounded, or 10-ribbed, but not strongly 5-angled.
    2. Leaves ovate to ovate-lanceolate; corollas usually 6–10 mm. long.
        3. Flowering peduncles usually 5–15 mm. long (as much as 3 times the length of the calyx); fruiting peduncles usually 20–30 mm. long, shorter than, to equalling, the fruiting calyces which are 25–35 mm. long; flowering calyces usually 4–5 mm. long with teeth 2–2.5 mm. long; s. U.S. 15a. *P. angulata*, var. *angulata.*
        3. Flowering peduncles usually 15–40 mm. long (3–13 times the length of the calyces); fruiting peduncles usually 20–40 mm. long, equalling to 3 times as long as the shorter fruiting calyces which are 20–25 mm. long; flowering calyces usually ca. 3 (4) mm. long with teeth ca. 1 mm. long; s. cent. U. S. . . . . 15b. *P. angulata*, var. *pendula.*
    2. Leaves lanceolate to linear-lanceolate; corollas usually 4–5 mm. long; sw. U. S. . . . . 15c. *P. angulata*, var. *lanceifolia.*
1. Fruiting calyx sharply and strongly 5-angled; corolla with 5 evident dark spots. . . . . 16b. *P. pubescens*, var. *glabra.*

GROUP IV

1. Corolla dark spotted; anthers usually some shade of blue or purple.
    2. Fruiting calyces 1.5–2.5 (3) cm. wide.
        3. Anthers (1.2) 1.5–2 mm. long; plants without capitate-glandular hairs, but sometimes viscid-glandular or with sessile glands.
            4. Leaves having a greyish surface, often with "mealy" or sessile glands; leaf blades usually toothed nearly to the base; mostly northeastern U. S. . . 16d. *P. pubescens*, var. *grisea.*
            4. Leaves not greyish, not having sessile glands.
                5. Leaves usually toothed nearly to the base with 5–8 teeth on each side of the seldom translucent blade; widespread. . . . . 16a. *P. pubescens*, var. *pubescens.*
                5. Leaves with few teeth, 3–4 on each side, or entire; blades mostly flaccid and translucent. 16a. *P. pubescens*, var. *integrifolia.*

3. Anthers (.3) 1–1.5 mm. long; capitate-glandular hairs usually mixed with long jointed ones. 17. *P. foetens,* var. *neomexicana.*
2. Fruiting calyces (2.5) 3–4 cm. wide; s. Ariz. . . . . 18. *P. latiphysa.*
1. Corolla yellow, unspotted, or sometimes slightly dark-tinged.
6. Flowering peduncles 2–5 mm. long, about equalling to twice as long as the calyces . . . . 19. *P. missouriensis.*
6. Flowering peduncles mostly 15–20 (30) mm. long, 4–5 (7) times the length of the calyces . . . . 20. *P. Greenei.*

1. **Physalis Alkekengi** L., Species Plantarum 183. 1735; incl. *P. Francheti* Mast. in Gard. Chron. **2:** 434 and 441. 1894.

Plants perennial, erect, usually unbranched, 30–60 cm. tall, glabrous or with a few scattered long hairs; leaves broadly ovate, or ovate-rhombic, the blades usually 5–12 cm. long and 4–9 cm. wide on petioles 2–4 cm. long; margins of the leaf blades from entire to irregularly few-toothed or undulate-dentate; flowers white, slightly 5-lobed with broad shallow sinuses about 2 mm. deep between the apices of the lobes; corollas 10–15 mm. long and 15–25 mm. wide; anthers 2.5–3 mm. long on slender filaments; flowering calyces 4–7 mm. long and 4–5 mm. wide, densely hairy with jointed trichomes about 1–1.5 mm. long; fruiting calyces reddish, 3–5 cm. long and 2.5–4 cm. wide, pendent on peduncles 2–3 cm. long.

TYPE: Not seen; Linnaeus states, "Habitat in Italia."

This species is cultivated or escaped, in northeastern U. S.; flowering in June; 19 sheets examined.

2. **Physalis viscosa** L., Species Plantarum 183. 1753; other synonymy under the varieties to which the names are referred.

Perennials covered with stellate, or several-branched hairs, or nearly glabrous and having stellate hairs only on the calyces; leaves from ovate to linear-lanceolate, petiolate or with blade tapering to the stem; corolla yellowish, funnelform, with or without darker spots on the limb near its base, 8–20 mm. long; anthers yellow, about 3 mm. long; flowering calyx 3–10 mm. long on peduncles 10–20 mm. long; fruiting calyx 2–5 cm. long and 1.5–4 cm. wide on peduncles 1–4 cm. long.

P. viscosa L., ssp. **viscosa.** *P. viscosa* L., loc. cit., as limited to the South American plants. Linnaeus cited *P. viscosa* from "Virginia, Bonaria." Since (1) only one element of this species, the part described by Chapman as *P. maritima,* barely extends into southeastern Virginia, since (2) it hardly matches the photographs of the Linnean types, and since (3) previous authors have restricted the application of the specific name, in its strictest sense, to the plants of South America, the present author believes that it is best to so delimit it.

South American material is usually more sparsely vestite with finer stellate hairs than most of ours, and has corollas slightly spotted to unspotted.

Occasionally in our populations of *P. viscosa, sens. lat.,* there appears a specimen which can hardly be distinguished from South American collections. Whether these are introductions from that continent, or represent gene combinations from within our population which produce phenotypes similar to the South American plants, it is impossible for the author to determine.

Some examples are: ALABAMA: Alabama Co.: *Mohr 26* (NY); TEXAS: Brazoria Co.: *Young* Apr. 22, 1918 (TEX); Houston Co.: *Fisher* July 25, 1914 (UC); Walker Co.: *Warner* 29 (NY).

P. fuscomaculata de Rouville ex Dunal, at least as to the few collections seen, is included here.

P. viscosa ssp. **maritima** (M. A. Curtis) Waterfall, comb. et stat. nov., based on *P. maritima* M. A. Curtis, Am. Journ. Sci. ser 2. 1: 407. 1849. Under this subspecies are included the maritime varieties listed below.

2a. **P. viscosa** var. **maritima;** *P. Walteri* Nuttall, Journ. Acad. Nat. Sci. Phila. 7: 112. 1834; type from "South Carolina" (PH); *P. maritima* M. A. Curtis, loc. cit.; *P. viscosa* L., var. *maritima* (Curtis) Rydberg, Mem. Torr. Bot. Club 4: 357. 1896.

The varietal name is used above as a tautonym of ssp. *maritima*. However, since the author is utilizing the varietal concept for taxa with both morphological and distributional differences, taxa which he considers the principal subdivisions of complex species, and is using the subspecific catagory as an aggregation of similar varieties, he would prefer to transfer the specific name, in this case *maritima*, to the varietal status, letting the tautonym, without author citation, belong to the aggregate subspecies. This does not seem permissible under Article 15 of the International Rules.

Leaves ovate to spathulate, especially the upper ones; whole leaf (1.7) 2–3 (3.4) times longer than wide; from sparsely to usually densely vestite.

TYPE: *M. A. Curtis*, seacoast, North Carolina (GH); probable isotype, "sandy seacoasts" (NY).

This taxon grows on sandy seacoasts, southeastern Va. to Fla.; usually flowering in March, April and May, but sometimes in winter in the southern part of its range; 120 sheets of 93 collections seen.

Occasional is a large, broad-leaved form with leaf blades about 5–7 cm. wide as contrasted to the usual width of 2–4 (5) cm. in forma *maritima* (supra). It may be described as **P. viscosa** f. **latifolia** Waterfall, f. nov., laminis 5–7 cm. latis. The type is *Small, Mosier* and *DeWinkeler 10892* (NY); isotype (GH); north part of Jupiter Island, Florida. Also seen from Florida were: Dade Co.: *Moldenke 384* (DUKE), *Small 2116* (NY).

2b. **P. viscosa** var. **Elliottii** (Kunze) Waterfall, comb. et stat. nov., based on *P. Elliottii* Kunze, Linnaea **20**: 33. 1847.

Leaf blades lanceolate to linear-lanceolate; leaves mostly 2.5–10 times longer than wide; plants covered with stellate hairs, or nearly glabrous; corollas yellow, usually not dark-spotted, but sometimes prominently so.

TYPE: *Rugel* June 1843, "Ad ostium fluvii St. Marks in Florida" (NY). The type belongs to the vestite phase although it is only sparingly stellate on the leaf-surfaces and the stem.

This taxon grows in sands, Florida; apparently flowering throughout the year.

P. viscosa f. **Elliottii.** The following citations selected from 73 sheets of

58 collections: FLORIDA: Broward Co.: *Moldenke 479* (DUKE, NY); Clay Co.: *Williamson* Aug. 1893 (PH); Dade Co.: *Small* and *Mosier 5944* (DUKE, GH, NY); *Moldenke 715* (NY); Hernando Co.: *McFarlin 6079* (MICH); Highlands Co.: *Correll* and *McFarlin 6219* (DUKE); Hillsboro Co.: *Churchill* Mar. 21, 1923 (GH, PH); Indian River Co.: *Small 8894* (NY); Lee Co.: *Mosier* July 1928 (DUKE, NY); Manatee Co.: *Tracy 7577* (GH, NY); Monroe Co.: *Sargent 6417* (ARIZ); Pinellas Co.: *McFarlin 3653* (MICH); St. John Co.: *Meredith* Feb. 4, 1899 (PH); Sarasota Co.: *McFarlin* July 1931 (MICH).

P. viscosa var. **Elliottii.** f. **glabra** Waterfall, f. nov., foliis glabris, sepalis stellato-vestitis. Stellate hairs are found on the flowering sepals, or at least on their margins; a few are rarely present on the margins of the leaves. The TYPE is *Tracy 7608*, Sanibel Island, Lee County, Florida (NY), isotype (GH).

Selected from 42 sheets of 33 collections: FLORIDA: Collier Co.: *Deam 60785* (DUKE); Dade Co.: *Small 7410* (NY); Hillsborough Co.: *McFarlin 5525* (MICH); Lee Co.: *Hitchcock 237* (GH, NY); Monroe Co.: *Palmer 376* (GH); Pinellas Co.: *Deam 1948* (UC); Sarasota Co.: *McFarlin 6091* (MICH).

An unusual, compacted short-leaved phase is sometimes found. It is represented by the following: *Small, Britton* and *DeWinkeler 2328*, pineland-prairie, Tamiami trail west of Miami, Dade Co., Dec. 19, 1919; *Small 8894*, pinelands near Felsmere, Indian River Co., May 17, 1918; *Small* and *DeWinkler 9979*, Ancient sand dunes near Kuhiman, April 25, 1921, all in Florida. If there proves to be a population in this area, similar to the cited collections, it will probably justify nomenclatural recognition.

2c. **P. viscosa** var. **spathulaefolia** (Torr.) Gray, Proc. Amer. Acad. Arts and Sci. **10:** 67. 1875. *P. lanceolata* Michx., var. *spathulaefolia* Torr., Bot. Mex. Bound. 153. 1859.

Leaf blades ovate to lanceolate to spathulate, tapering at base, or extending gradually into winged petioles; whole leaf (2) 2.5–4 (4.7) times longer than wide; corolla varying from apparently unspotted to having prominent dark spots; Gulf Coast of Texas; flowering irregularly throughout the year.

TYPE: *Schott 30,* seabeaches, Rio Bravo (Rio Grande?), Texas (NY).

The following selected from 65 sheets of 54 collections: LOUISIANA: Calcasieu Parish: *Palmer 7707* (PH); TEXAS: Aransas Co.: *Tharp 1620* (OKLA, TEX); Austin Co.: *Pennell 10271* (NY, PH); Brazoria Co.: *Cory 51057* (GH); Cameron Co.: *Clover 1724* (MICH); Galveston Co.: *Nelson* Mar. 20, 1942 (TEX); Harris Co.: *Fisher* July 25, 1914 (NY); Jefferson Co.: *McVaugh 6880* (MICH); Kenedy Co.: *Tharp 48333* (OKLA, TEX); Matagorda Co.: *Wright* (GH); Nueces Co.: *Tharp, Johnson* and *Webster* Dec. 3, 1948 (TEX); San Patricio Co.: *Cory 51249* (GH, US); Victoria Co.: *Tharp 2512* (TEX, UC).

The following collections have prominently dark-spotted corollas: TEXAS: Austin Co.: *Tharp* Apr. 8, 1939 (TEX); Brazoria Co.: *Celerier 51–41* (OKLA); Cameron Co.: *Lundell 1073* (TEX); Kenedy Co.: *Lundell 8714* (GH, MICH, NY, UC); Willacy Co.: *Johnston 54169* (TEX).

P. viscosa ssp. **mollis** (Nuttall) Waterfall, comb. et stat. nov., based on *P. mollis* Nutt., Trans. Am. Phil. Soc. 5 (n.s.) 194. 1837. This is an inland population, here divided into two varieties, as compared with ssp. *maritima*, a maritime population divided above into three varieties.

2d. **P. viscosa var. mollis.** The varietal name is used here as a tautonym of ssp. *mollis*, hence it is listed without author-citation. However, the present author believes that the varietal category is best used as the principal division of a species, and that the subspecific category is most significantly used as a means of grouping varieties, just as a section may be utilized to group species within a genus.

TYPE: not seen; isotypes: *Nuttall*, Arkansas (NY, PH).

Leaves densely stellate-tomentose, at least beneath, dentate; plant usually erect; flowering calyces (6) 7–10 mm. long.

Growing in open woods, sandy areas and disturbed sites, western Arkansas, eastern Oklahoma and eastern Texas. There are many intermediates with var. *cinerascens*. Usually flowering in May and June, but specimens in flower have been collected in July and August.

Selected from 43 sheets of 34 collections; Arkansas: Franklin Co.: *Pennell 10621* (NY, PH); Pulaski Co.: *Merrill 1861* (UARK, OKLA): Sebastian Co.: *Bigelow* in 1853–54; Louisiana: Bossier Parish: *Correll 10058* (GH, DUKE, NY, PH); Jefferson Davis Parish: *Palmer 7629* (PH); Oklahoma: Choctaw Co.: *Houghton 4037* (GH, NY); Comanche Co.: *Clements 11767* (GH); Love Co.: *Hopkins 3429* (OKL); Marshall Co.: *Basler* Aug. 5, 1950 (OKL); Muskogee Co.: *Little 1515* (OKL); Texas: Callahan Co.: *Palmer 13811* (WIS); Denton Co.: *Whitehouse 15780* (MICH); Grayson Co.: *Gentry 51–392* (OKLA); Tarrant Co.: *Ruth 902* (WIS); Wilson Co.: *Rogers, Albers* and *Webster 6849* (TEX).

2e. **P. viscosa var. cinerascens** (Dunal) Waterfall, comb. nov., based on *P. pensylvanica* L. var. *cinerascens* Dunal, in De Candolle, Prodromus 13(1): 435. 1852; *P. mollis* Nutt., var. *cinerascens* (Dunal) Gray, Proc. Amer. Acad. Arts and Sci. **10:** 66. 1875; incl. *P. mollis* Nutt., var. *parvifolia* Rydb., Mem. Torr. Bot. Club **4:** 355. 1896.

Leaves dentate to entire, varying in size, probably due, at least in part, to seasonal heteromorphy; plants erect to spreading, or nearly procumbent; more or less densely covered with stellate hairs, but not tomentose; flowering calyx (3) 5–7 (9) mm. long; small-leaved forms have been segregated as var. *parvifolia*.

TYPE: Dunal cited "n. 83 et 2316 Berland. pl. exs. Mex." when he described var. *cinerascens*. Since he indicated no holotype, *Berlandier 2316*, circa Matamoros urbem, April 1831 (GH) is designated as Lectotype.

This taxon grows on prairies, plains and in disturbed habitats, primarily in Oklahoma and Texas, extending into Mexico; often flowering in May and June, but to some extent at any time during the growing season, which may be most of the year in southern Texas.

Four hundred twenty seven sheets of 365 collections of var. *cincerascens* (sens. lat.) have been examined. In addition to numerous Oklahoma and Texas collections, the following have been seen: ARKANSAS: Fulton Co.: *Bush 2518* (GH); Kansas: Barber Co.: *Rydberg* and *Imler 640* (NY); New Mexico: Chaves Co.: *Earle 283* (NY); Lea Co.: *Waterfall 7836* (GH, OKL).

P. pensylvanica L., Species Plantarum, ed 2, 1670, 1762, is not accounted for in the above synonymy. A tracing from the Linnean herbarium on a Canby sheet of *P. viscosa* in the Gray Herbarium bears the annotation "pubescence very short stellular—same as in *P. viscosa* Hb. Linn." No stellate species is known from Pennsylvania. No disposition of it can be made from the photograph of the species from the Linnean Herbarium, other than to say that if it is indeed from North America, it might be a small, rotund-leafed phase of *P. viscosa*, var. *maritima.*

3. **Physalis angustifolia** Nuttall, Journ. Acad.Nat. Sci. Phila. 7: 113. 1834.

Perennial from a thick woody taproot, often with many branches; leaves linear, (8) 10–20 times longer than wide; plants glabrous except on the tips or margins of the sepals; corolla yellow, unspotted to apparently spotted, but only lightly so, 8–20 mm. long; flowering calyx 5–10 mm. long, on peduncles 10–20 mm. long; fruiting calyx 2–3 cm. long on peduncles 1–3 cm. long.

TYPE: Not seen; Isotype: *N. A. Ware* "west Florida" (PH). Its larger leaves are 6–8 cm. long and about 2–3 mm. wide.

P. angustifolia grows in coastal sands, coral soil, or pine woods, Alabama to Mississippi with one collection from Louisiana; it usually flowers from May to August, but a number of collections, particularly from Florida have been taken in flower in December, January and February.

Selected from 87 sheets of 65 collections: ALABAMA: Baldwin Co.: *Mohr* March 20, 1883 (GH, UARK); Mobile Co.: *Mohr 1878* (NY, PH); FLORIDA: Bay Co.: *Banker 3670, 3679* (NY); Collier Co.: *Moldenke 1006* (DUKE, NY); Dade Co.: *Moldenke 852* (DUKE, NY); Gulf Co.: *Correll* and *Oosting 5630* (DUKE); Monroe Co.: *Curtiss 114* (GH, MICH, NY, PH, UARK); Oskaloosa Co.: *Menzel* and *Menzel 55-3* (WIS); Santa Rosa Co.: *Fassett 21141* (WIS); Wakulla Co.: *Griscom 21478* (GH); LOUISIANA: "seashore": *Carpenter,* July (PH); MISSISSIPPI: Jackson Co.: *Baker* July 25, 1897 (NY); Harrison Co.: *Demaree 21911* (OKL, OKLA, TEX); *Tracy* May 8, 1898 (NY, MICH).

4. **Physalis variovestita** Waterfall, sp. nov. Planta bivestita, pilis elongatis, 1–4 mm. longis, articulatis, simplicibus vel furcatis, et brevostellatis; caulibus erectis; foliis petiolatis; laminis ovatis dentatis vel subsinuato-dentatis; penduneulis petiolis longioribus; corollis luteis, fundomaculatis; antheris luteis ca. 3 mm. longis.

The presence of abundant jointed hairs, 1–4 mm. long, in addition to a covering of stellate hairs, is the most obvious characteristic of this species. The long hairs are sometimes branched, sometimes simple. The plant is a perennial, 12–25 cm. tall, from a rhizome. The leaf blades are ovate, dentate to more or less sinuate-dentate, 2.5–3.5 cm. long and 2–3 cm. wide on petioles 1.5–2.3 cm. long. The nodding flowers are on peduncles 2–3 cm. long. The corolla is 1.5–2 cm. long and 2–3 cm. wide, with large dark markings on its limb near its junction with the tube. The flowering calyx is about 1 cm. long divided about one-third to one-half of the way into ovate-lanceolate, or lanceolate lobes. The anthers are yellow, ovate to ovate-oblong, about 3 mm. long.

TYPE: *Eula Whitehouse 18179,* back of Rockport Tourist cottages in sandy soil, live-oak belt, Rockport, Aransas Co., Texas, April 21, 1947 (MICH).

A number of collections radiating northward from this area have long articulated hairs present to a greater or lesser extent. These are found in specimens resembling both var. *mollis* and var. *cinerascens*, with a degree of variability in leaf size, margins, and stellate vestiture similar to that found in these two taxa.

Sheets approaching the type in vestiture are: Kenedy Co.: *Cory 28408* (GH); Medina Co.: *Johnston, Tharp* and *Turner 3401* (OKLA, TEX).

Collections more widely diverging from *P. variovestita*, but with several to few long jointed trichomes present in addition to the short stellate hairs are: Austin Co.: *Pennell 10300* (NY, PH); Bexar Co.: *Metz 477* (UC); Caldwell Co.: Coll. unknown (J. B. McB.) 1931 (TEX); Cameron Co.: *Tharp 1206* (TEX); DeWitt Co.: *Reidel* Apr. 5, 1942 (GH, OKLA); Gillespie Co.: *Bray 293* (TEX); Gonzales Co.: *Bogusch 1868* (TEX); *Cory 8366* (GH); *Turner 3706* (TEX); Jim Hogg Co.: *Tharp* June 17, 1928 (TEX); Hidalgo Co.: *Cameron 269* (TEX); Kenedy Co.: *Johnston 53256.19* (TEX); *Lundell 8715* (GH); Upshur Co.: *Reverchon 3237* (NY); Victoria Co.: Coll. unknown Mar. 29, 1930 (TEX); Waller Co.: *Hall 500* (GH, NY); Wilson Co.: *Cory 7795* (GH); *Parks 29530* (GH); Wood Co.: *McMullen* June 10, 1927 (TEX).

It is postulated that a population such as described above, and exemplified by the type collection, must exist in the area indicated in southern Texas, and that gene interchange has diluted its characteristics with those of *P. viscosa* var. *mollis* and var. *cinerascens* in an area radiating northward. Probably Edgar Anderson's method of extrapolated correlates (1949) could have been used to predict the occurrence of *P. variovestita* on the basis of the intergrades found in approaching the area in which it grows.

5. **Physalis pumila** Nuttall, Trans. Am. Phil. Soc. 5 (n.s.); 193, 1836; *P. lanceolata* Michx., var. *hirta* Gray, Proc. Amer. Acad. Arts and Sci. **10:** 68. 1875.

Plants perennial, 15–45 cm. tall, often branched, usually covered with jointed hairs 1–2 mm. long, some of which are 1- to rarely 3-branched, and which spread at right angles from the stem. Leaf blades ovate to ovate-lanceolate, or rarely lanceolate, sometimes somewhat rhombic, tapering to a more or less winged petiole; larger blades (4) 6–9 cm. long and (2.5) 3–5 cm. broad, on petioles 1–3 cm. long; leaf margins usually entire, but sometimes lightly and irregularly sinuate-or repand-dentate; corolla 12–20 mm. long, and about 15–25 mm. wide at the top; anthers usually 2.5–3 mm. long, yellow; flowering calyx usually 10–15 mm. long with free lanceolate-deltoid sepal tips about one-third as long; flowering peduncles 15–30 mm. long; fruiting calyx usually 15–20 mm. wide and 3–4 cm. long, much inflated around the fruit, on reflexed peduncles 25–40 mm. long.

TYPE: Not seen; Isotype: *Nuttall*, Arkansas (PH). The isotype is representative of the extreme having few branched hairs. It was collected near the eastern limit of its range in this area.

P. pumila grows in prairies, open woods and disturbed habitats, primarily in western Missouri, eastern Kansas, eastern Oklahoma and adjacent Texas; it usually flowers in May, June, July and August, perhaps earlier in the southern part of its range, as fruiting specimens have been collected in May in Texas.

The 169 sheets of 146 collections examined include: Arkansas: Sebastian Co.: *Armstrong 186* (TEX, UARK); Carrol Co.: *Moore* and *Iltis 204* (WIS); Washington Co.: *Hill 23* (UARK); Illinois: Peoria Co.: *Chase 3570* (NY, UC).

6. **Physalis arenicola** Kearney, Bull. Torr. Bot. Club **21:** 485. 1894.

Plants perennial from cord-like rhizomes which are near the surface, usually 15–30 cm. tall, simple or branched; hairs short and antrorse, sometimes viscid, in var. *ciliosa* 1–2 mm. long, jointed, spreading and more or less abundant; leaf blades ovate to ovate-rhombic, the larger ones usually 2–6 cm. long and 2–4 cm. wide on petioles 1–3 cm. long; leaf margins irregularly dentate to sinuate or entire; corollas 10–20 mm. long, yellow with slightly darker spots on the limb near its base; flowering calyx 7–11 mm. long, its lobes 2–4 mm. long; flowering peduncle 10–25 mm. long; fruiting calyx 20–30 mm. long and 15–25 mm. wide, much inflated around the fruit.

TYPE: Kearney cited several collections of Nash's when he described *P. arenicola.* Since no holotype was designated, the author selects the following from among the cited collections: *George V. Nash 1170,* dry sandy soil, high pine land, vicinity of Eustis, Lake County, Florida, July 1–15, 1895 as the lectotype (GH); Isolectotypes: (NY, UC).

This species grows on sand dunes, ridges, sandy oak woods, pine woods and disturbed sandy areas, primarily in Florida, but also in adjacent Georgia and Mississippi; flowering March through August.

6a. **P. arenicola** var. **arenicola.** Selected from 28 sheets of collections: Florida: Alachua Co.: *Wiegand* and *Manning 2810* (GH); Brevard Co.: *Curtiss 5713* (GH, UC); Duval Co.: *Curtiss 6644* (GH, NY, UC); Lake Co.: *Nash 1170* (GH, UC); Levy Co.: *Garber* Nov. 1877 (GH); Marion Co.: *Moldenke 1090* (DUKE); Palm Beach Co.: *Small 8514* (DUKE, GH); Sumter Co.: *Curtiss 6634* (GH); Volusia Co.: *Small 8692* (DUKE, GH); Georgia: Lowndes Co.: *Harper 1594* (GH, NY).

6b. **P. arenicola** Kearney, var. **ciliosa** (Rydb.) Waterfall, comb. et stat. nov., based on *P. ciliosa* Rydb., Mem. Torr. Bot. Club **4:** 346. 1898.

TYPE: In describing *P. ciliosa*, Rydberg stated "Chapman (in Herb. J. Donnell Smith, Harvard University, Columbia College, and A. W. Chapman, type)." As Lectotype the author chooses a sheet (GH) showing both flowering and fruiting plants. Isolectotypes are: GH, a second sheet, NY and OKL.

Selected from 35 sheets of 33 collections: Florida: Alachua Co.: *Walker 1917* (OKLA); Brevard Co.: *Small* and *DeWinkeler 2468* (NY); Gadsden Co.: *Berg* (NY); Hendry Co.: *Moldenke 1018* (DUKE, NY); Highlands Co.: *Small, Mosier* and *DeWinkeler 10906* (NY); Lee Co.: *Moldenke 946* (DUKE, NY); Levy Co.: *Oosting 139* (DUKE); Osceola Co.: *Singletary* Apr. 28, 1938 (DUKE); Polk Co.: *McFarlane 5021* (MICH); Santa Rosa Co.: *McFarlane* and *Goertz* June 17, 1905 (DUKE); Sarasota Co.: *Rusby* April 1935 (NY); Sumter Co.: *Curtiss 6634* (UC); Georgia: Calhoun Co.: *Thorne 3321* (GH); Chatham Co.: *Gay* (GH); Charlton Co.: *Small* June 12–15, 1895; Mississippi: Jackson Co.: *Skehan* May 10, 1895 (GH).

The following specimens, all from Florida, seem to be intermediate between var. *arenicola* and var. *ciliosa:* Collier Co.: *Small 10477* (NY);

Dade Co.: *Small* and *Small 6825* (GH, NY); Volusia Co.: *Small 8692* (GH, DUKE).

7. **Physalis heterophylla** Nees, Linnaea **6**: 463. 1831; synonymy cited under the varieties.

Stems usually erect from a deeply buried rhizome, 15–90 cm. tall, simple or branched; herbage densely to sparsely covered with varying proportions of short usually viscid hairs and glandular hairs, together with long jointed hairs which are usually 1–2 mm. long; sometimes only a few long hairs are present; rarely, as in var. *villosa*, the stems are villous with long multicellular hairs; leaf blades usually broadly to narrowly ovate, or ovate-rhombic, the principal ones usually 5–10 cm. long and 3.5 to 6 cm. wide on petioles 3–6 cm. long; corollas 10–18 mm. long, yellow with brownish, sordid or blue-tinged spots on the limb near its base; flowering calyx 7–12 mm. long, its lobes 3–5 mm. long, lanceolate-triangular, sometimes acuminate; anthers usually 3–4.5 mm. long, yellow, sometimes tinged with blue; filaments thickened, often as wide as the anthers, frequently clavate; fruiting calyx usually 2.5–3 cm. long and 2–3 cm. wide, much inflated around the fruit, borne on peduncles 1.5–4 cm. long.

7a. **P. heterophylla** Nees, var. **heterophylla** *P. virginiana* Mill., var. *ambigua* Gray, Proc. Amer. Acad. Arts and Sciences **10:** 65. 1875; *P. nyctaginea* Dunal, DeCandolle, Prodromus **13**(1): 440–441. 1852; *P. ambigua* (Gray) Britton, Mem. Torr. Bot. Club **5:** 287. 1894; *P. heterophylla*, var. *umbrosa* Rydberg, Contr. U. S. Natl. Herb. **3:** 172. 1895; *P. heterophylla*, var. *ambigua* (Gray) Rydberg, Mem. Torr. Bot. Club **4:** 349. 1896; *P. sinuata* Rydb., in Small's Flora: 986. 1913.

This is an extremely variable assemblage as indicated in the preceding description, which, with stated exceptions, covers var. *heterophylla*, only two other localized varieties being recognized. Forms (the species or varieties of earlier authors) might be distinguished on the basis of dentation of leaves, or of vestiture, but many specimens would be assignable only on an arbitrary basis, even if some of the extremes seem quite striking. An example is the densely stiff-haired form often found on sands at various localities in the range of the species.

TYPE: Not seen; "In collibus argillosis Pennsylvanicae Poeppig legit."

Habitat, range and flowering time: Open woods, prairies, hillsides, fields and other disturbed habitats, principally in the eastern United States and adjacent Canada, the prairie and plain region westward into the central and northern Rockies and the Great Basin; flowering from June to August in Canada and from April to September in Texas.

In examining 730 sheets of 664 collections, material has been seen from: Ontario and Quebec, Canada and from Alabama (Jackson and Tuscaloosa Cos.), Georgia (Chatham and Clark Cos.), Idaho (*Allen 1873*), Illinois, Indiana, Massachusetts, Michigan, Minnesota, Mississippi (Harrison Co.), Missouri, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota (Richland Co.), North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina (Oconee Co.) South Dakota, Tennessee (Davidson, Frank and Rutherford Cos.), Texas, Utah (Salt Lake Co.), Vermont, Virginia, Washington, D. C., West Virginia, Wisconsin, Wyoming (Big Horn and Crook Cos.).

7b. **P. heterophylla** Nees, var. **clavipes** Fernald, RHODORA **49**: 178. 1947.

TYPE: *Fernald, Long* and *Clement 15347*, sandy woods near Darden's Pond, northeast of Courtland, Southampton Co., Virginia, (GH); isotype (NY). Known only from the type collection.

7c. **P. heterophylla** Nees, var. **villosa** Waterfall, var. nov., caulibus dense articulato-villosis, pilis 2–4 mm. longis.

The abundant, soft, long, jointed hairs, 2–4 mm. long, characterize this variety. The leaf size and margin vary in a manner comparable to var. *heterophylla.*

TYPE: *Earle* June 2, 1901, moist hillsides thick woods, Lee County, Alabama (NY).

Collections examined: ALABAMA: Lee Co.: *Earle* June 2, 1901 (NY); *F. S. Earle* May 10, 1896, Auburn (NY); FLORIDA: Gadsden Co.: *Berg* Summer (NY); Walton Co.: *A. H. Curtiss* June 1886, De Funiak Springs (NY); County undetermined: *W. E. Buswell* April 9, 1931, Pine Woods, East Fort Meyers (NY); TEXAS: doubtfully referred here is *Tharp* April 19, 1930, East Texas coast (TEX).

P. heterophylla appears to intergrade with *P. virginiana* in some areas, producing individuals with varying indument and leaf-shape, including lanceolate. Such specimens are found in South Carolina from which Michaux described his *P. lanceolata,* Flora Boreali-Americana 149. 1803. Examples are: *Gibbes,* in 1834, Columbia, S. Car. (NY); *Gibbes* Aug. 1835, South Carolina (NY); *Ravenel,* Aiken, South Carolina (NY). The photograph of the type of *P. lanceolata* in the Gray Herbarium appears to match these specimens fairly well. The author believes that it was on such a specimen that Michaux based his species. This leaves the population of the western prairies and plains, which has been passing under the name *P. lanceolata,* without a name. It will be treated under *P. virginiana.*

Other collections believed to be *P. heterophylla* intergrades are: CONNECTICUT: *Bishop* Sept. 1902, Norwich (GH); GEORGIA: *Harper 93,* Dry fields, Clarke Co., June 29, 1900 (NY); Coll. unknown (herb. Schw. sub nom. "P. obscura Baldw., Georgia") (PH); NORTH CAROLINA: *Williamson* Aug. 1900, Wilmington (PH); *Small,* July 1896, Summit of Paris Mt. (NY).

8. **Physalis peruviana** L., Species Plantarum, ed. 2, 1670. 1762. *P. peruviana,* var. *latifolia* (Lam.) Dunal, in DeCandolle, Prodromus **13**(1): 440. 1852, based on *P. latifolia* Lamarck, Tableau Encyclopédique et Méthodique . . . Bot. **2**: 29. 1793, is the only synonymy that has been applied in the area under consideration.

An erect branching perennial, densely villous but not glandular; leaf blades ovate, extending into an acuminate tip; corolla blue-spotted; anthers about 3 mm. long, blue, on slender filaments. This species resembles *P. heterophylla,* but may be distinguished by the narrow filaments and the rather strongly acuminate leaves, as well as by the blue anthers (sometimes the anthers are violet-tinged in *P. heterophylla*) and by the darker, bluish spots of the corolla.

TYPE: Not seen; Linnaeus says "Habitat Limae".

This species is sometimes introduced, and may rarely escape. Some examples are: *Kidder* Oct. 3, 1926, Norfolk Co., Mass. (NEBC); *Martindale* Sept. 1879 Camden, New Jersey (NY); *Brinkley 222*, Sevier Co., Arkansas (TEX) ?; *Earle* June 26, 1899, Lawrence Co., Alabama (NY) ?.

9. **Physalis virginiana** Miller, Gardener's Dictionary, ed. 8: No. 4. 1768. The synonymy is given under the varieties.

Stems from a deep rhizome, simple or branched; plants nearly glabrous, or with long hairs, or short curved trichomes; leaf blades from ovate to linear-lanceolate; corolla from 15–25 mm. long, yellow, dark-spotted; anthers 2–4 mm. long, yellow or blue- or violet-tinged; filaments from one-third as wide to nearly equalling the width of the anthers; calyx from one-half to two-thirds as long as the corolla; flowering peduncles about equalling the flower to 1½ times its length; fruiting calyx inflated, usually 25–35 mm. long and ovate to ovate-oblong, but sometimes much larger, particularly in one forma.

The varieties described below seem to intergrade more or less with each other, making the disposition of individual specimens sometimes difficult. However they seem to represent natural populations, in some instances covering large geographic areas, which are fairly distinct as groups.

9a. **P. virginiana** Miller, var. **virginiana.** *P. virginiana* Mill., var. *intermedia* Rydb., Mem. Torr. Bot. Club **4**: 345. 1895; *P. monticola* Mohr, Bull. Torr. Bot. Club **26**: 119–120. 1899.

Plants villous with long jointed hairs, or having only short retrorse ones; leaf blades ovate to lanceolate (rarely narrowly so), their margins irregularly dentate to sinuate-dentate; corolla usually 15–20 mm. long; anthers yellow, or sometimes with a blue or violet tinge.

TYPE: None cited by Miller. It is supposed to be present in the Sloane Herbarium of the British Museum.

Habitat, distribution and flowering time: Growing in open woods, prairies and disturbed areas in most of the eastern United States, and adjacent Canada, extending, generally, into the eastern part of the prairie region, with a few collections from the central Rockies; flowering in June and July in the northern part of its range, and usually from April to June in the southern part.

(*To be continued*)

FURTHER NOTES ON THE ILLINOIS FLORA.—Field trips to southern Illinois in late September and in October, 1957, yielded two plants not previously collected in Illinois, a new station for the filmy fern in the state and some additional information on the height of big bluestem.

The slender-fruited primrose willow, *Jussiaea leptocarpa* Nutt., ranges from Florida to Texas and Mexico, north to Georgia and southeastern Missouri, according to the range given by Fernald in Gray's Manual, ed. 8. While botanizing on September 25 in the narrow neck of land known as the Dogtooth Bend in Alexander County, I found a few plants of this species[1] growing on the banks of the Mississippi River. On October 24, Dr. M. W. Sanderson, an insect taxonomist on the staff of the Illinois Natural History Survey, and I visited this site and located numerous individuals and a sizable patch of this species. From these plants Dr. Sanderson collected specimens of a flea beetle of the genus *Altica*. Because of the local abundance of the *Jussiaea* in this site in the Dogtooth Bend, we were curious to learn whether or not it was growing farther upstream. Accordingly, we stopped at Fayville, a small village opposite Commerce, Missouri, at the mouth of the Thebes Gorge of the Mississippi River and approximately 10 miles upstream from the Dogtooth Bend location. Here on the banks of the river we located some plants. We did not, however, observe this species on the riverbank at Thebes, about 5 miles upstream from Fayville. The following is a list of specimens of *Jussiaea leptocarpa* Nutt. in the Herbarium of the Illinois Natural History Survey (ILLS):

Riverbank in Dogtooth Bend, south of Miller City, Alexander County, Illinois, September 25, 1957, *R. A. Evers 55513;* October 24, 1957, *R. A. Evers 55747;* riverbank at Fayville, Alexander County, Illinois, October 24, 1957, *R. A. Evers 55781.*

The narrow-leaved sunflower, *Helianthus angustifolius* L., ranges from Florida to Texas and northward to Long Island, New Jersey, eastern Pennsylvania, Kentucky, southern Indiana and southeastern Missouri, according to Gray's Manual. Southern Illinois can now be included in the known range. On the northern limits of the village of Brookport, Massac County, I located numerous individuals of this sunflower and made collections in September and October. It was growing in an old field and was associated with *Bidens* sp. and several asters, chiefly *Aster pilosus* Willd. Herbarium sheets were provided with the following data:

Old field north of Brookport, Massac County, Illinois, September 25, 1957, *R. A. Evers 55625;* October 23, 1957, *R. A. Evers 55728.*

The filmy fern, *Trichomanes boschianum* Sturm., which ranges from Alabama, north to West Virginia, southern Ohio and southern Illinois, is rare in the northern part of its range. Its known range

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[1] I wish to thank Professor G. Neville Jones, University of Illinois, for examining this and the following species and for verifying my identifications.

in southern Illinois has been restricted to Pope County and based upon collections made in only one locality, Jackson Hollow, by Mary M. Steagall in 1923, J. W. Swayne in 1950 and R. A. Evers in 1951. Plant collectors who botanize in Pope County have been seeking this fern elsewhere in the county and also in adjacent Johnson County. On October 23, Dr. M. W. Sanderson and I were collecting insects and plants in Hayes Creek Canyon, north of Eddyville, Pope County, and discovered several small patches of *T. boschianum* on an undercut in a sandstone cliff. Hayes Creek Canyon is approximately 5.5 miles east of the Jackson Hollow station of this fern. Perhaps a more intensive search in this section of Pope County will reveal other stands of *T. boschianum*. The herbarium specimen has the following label information:

Sandstone cliff, Hayes Creek Canyon, north of Eddyville, Pope County, Illinois, October 23, 1957, *R. A. Evers 55741*.

Thieret and Evers[2] reported on culms of big bluestem, *Andropogon gerardi* Vitman, that measured 3 meters tall. While examining a prairie slope on the James M. Nelson property northwest of Alton, Madison County, on October 17, Mr. Nelson and I observed some culms which we believed to be taller than 3 meters. We collected and measured one of the culms and found it to be 3.5 meters (about 11.5 feet) tall. This culm exceeded by 1.5 meters the maximum height for this species as it is described in Hitchcock-Chase, Manual of the Grasses of the United States, and by 2 meters as indicated by Fernald in Gray's Manual, ed. 8. Apparently the weather conditions in Illinois in 1957 favored the tall and luxuriant growth of big bluestem.—Robert A. Evers, ILLINOIS NATURAL HISTORY SURVEY, URBANA.

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[2] Rhodora **59** (701): 124.

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THE GENETIC EVALUATION OF A TAXONOMIC CHARACTER IN DITHYREA (CRUCIFERAE)

Reed C. Rollins

Developing accuracy in the evaluation of plant characters and characteristics for taxonomic purposes is a long-standing problem. When differences are found between groups of plants which otherwise appear to be related, the immediate question arises as to what these differences mean. Specifically, what do the differences mean in terms of the genetic make-up of the natural group to which such plants belong and how valuable are they as taxonomic criteria? In our efforts to interpret speciation in relation to a given species or a group of species, we wish to rely upon those characters as indicators of relationship (or lack of it) that are so deeply seated in the genetic constitution of the species that they cannot be easily obliterated or greatly modified by the direct effects of any given simply segregating factor or combination of segregating factors. In general, the kinds of characteristics that offer the greatest possibilities for taxonomic reliability are those that are dependent upon a multiplicity of genes and gene combinations for their ultimate expression—genes that are not in a single linear sequence of interdependency, but genes in many series whose interaction in a highly complex way results in the final structure or function. It may also be suggested that any given characteristic thus dependent upon a complex genetical system, which is deeply situated within the genotype, becomes protected from radical changes by the build-up of interdependencies between it and other characteristics, some of which may be vital to survival. Thus the species phenotype persists over many generations, little altered in basic pattern by the numerous minor segregations that account for the usual variation present.

At the other end of the scale, characteristics under the control of the simplest gene systems are expected to be least reliable as the basis for classification. Such characteristics would be easily modified or suppressed by repetitious mutations, gene rearrangements or by ordinary segregation. In consequence, it is probably accurate to say that the more simply a character-difference is inherited, the less reliable it is as a criterion of speciation. The converse of this proposition, that the greater the complexity of inheritance of a character-difference the more reliable it is as a criterion of speciation, seems equally tenable. In trying to evaluate a given genetically controlled characteristic, an important attack on the problem is to determine the relative complexity of its inheritance.

One reason that taxonomic characters *per se* have not been frequently subjected to genetic analyses is that this is very time consuming and relatively unrewarding. The results of such experimental work, though answering the specific question regarding the nature of the taxonomic character, often do not have broader implications. Generalizations can only rarely be made because the applicability is or may be restricted to the immediate group under investigation. However, it is important for the long term to have many more cases worked out than are now known. Ultimately these will provide safe guides to proper character-evaluations, which is one of the current needs of taxonomy.

In working with the *Cruciferae* over a period of years, I have often encountered situations where "presence" or "absence" of trichomes appeared to be of trivial significance (1940, 1952). However, without actually testing a given case, it was not possible to know whether the absence of an indument in a given population, in an otherwise pubescent species, was environmentally induced or whether it was under genetic control. An opportunity to experiment with the presence and absence of a dense covering of trichomes on the fruits of *Dithyrea Wislizenii* Engelm. came when a population of this species was found having both glabrous- and pubescent-fruited types growing together near Sacaton, Arizona. The fruits of individual plants of both the glabrous type and the pubescent type were collected

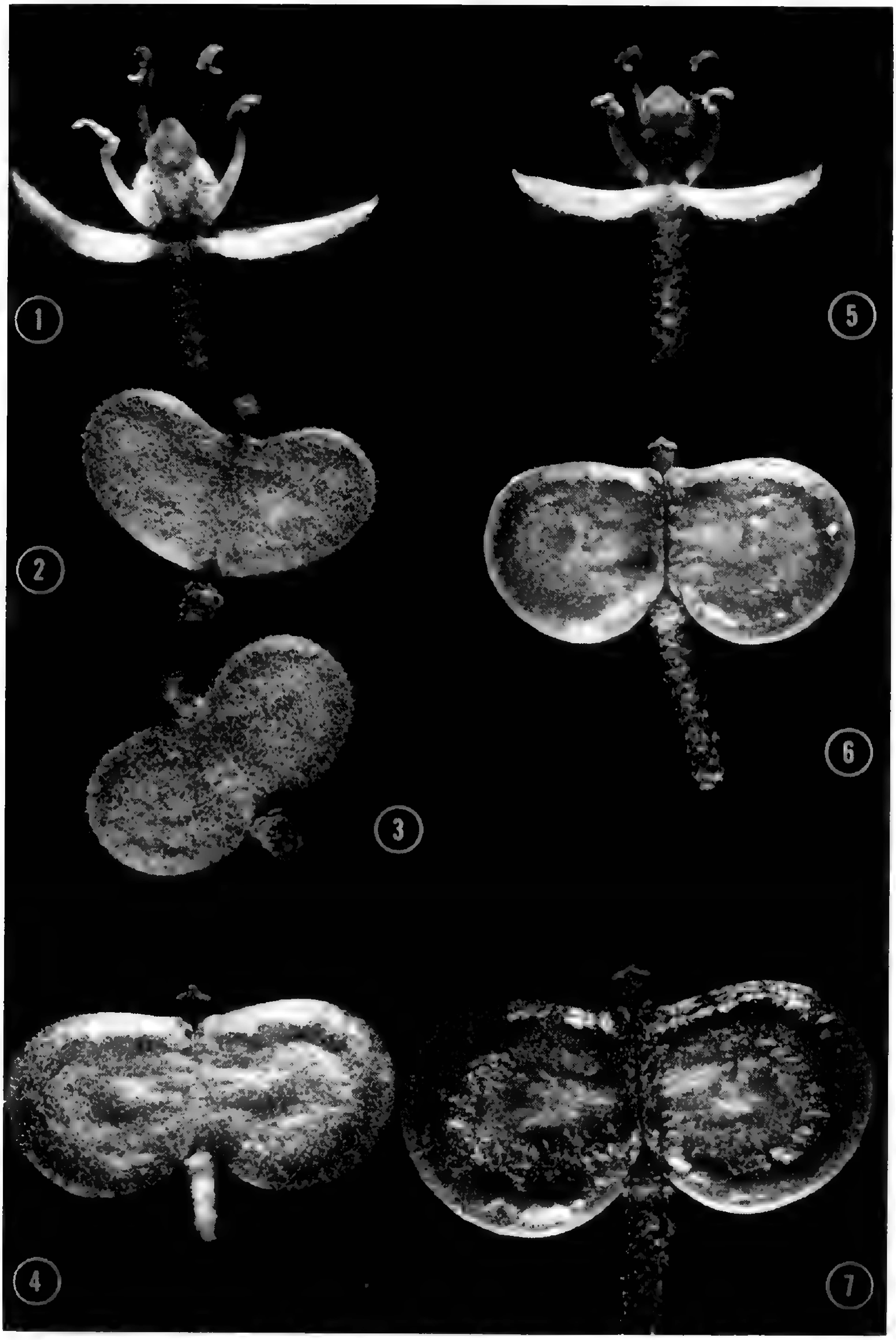

Plate 1233. Flowers and fruits of *Dithyrea Wislizenii* Engelm. Fig. 1–4, a developmental series from flower to mature fruit of a pubescent-fruited type. In fig. 1, the petals, 2 sepals and the 2 near stamens have been removed to make the ovary visible. The same applies to fig. 5. Fig. 5–7, a developmental series from flower to mature fruit of a glabrous-fruited type.

and kept separate for testing purposes. The difference between the glabrous siliques and pubescent siliques is very striking, as may be seen in Plate 1233. The objective of the following experiments was to determine the genetic nature of glabrous vs. pubescent siliques in this species.

THE WILD POPULATION

The species, *Dithyrea Wislizenii*, extends from western Oklahoma and Texas to southern Utah and Nevada, and to Arizona and northeastern Mexico. It is common in sandy and loose granitic soils and often forms large stands composed of several thousands of individuals. Up to the present, a single glabrous-fruited *Dithyrea*, presumably closely related to *D. Wislizenii*, has been recognized as being of some taxonomic worth. Wooton and Standley (1913) originally described it at the species level as *D. Griffithsii* and it was later reduced to varietal rank by Payson (1918) under *D. Wislizenii*. In the Sacaton population, which provided the material for the following experiments, most of the plants possessed pubescent fruits, but there was a goodly number of glabrous-fruited individuals. Circumstances did not permit a definite count of pubescent vs. glabrous plants in the wild population. However, a rough estimate was recorded suggesting that the pubescent type predominated at least three to one. There were no intergrades. The wild plants possessed either glabrous fruits or pubescent fruits and none showed a gradation from one condition to the other.

PROGENY TEST OF SEED PARENTS

Four lots of seeds from the wild population were grown to provide plants for crossing purposes. Each seed lot came from a single wild plant, which had been open pollinated under natural conditions. The plants of culture numbers C-1 and C-4 were produced from glabrous-fruited parents, C-2 and C-3 were from

TABLE I

WILD PLANTS		PROGENIES	
Plant No.	*Siliques*	*No. Glabrous*	*No. Pubescent*
C-1	glabrous	9	3
C-2	pubescent	0	15
C-3	pubescent	0	10
C-4	glabrous	5	9

pubescent-fruited parents. Table I gives the classification of the plants of each culture.

It is of some interest that the progenies of both pubescent plants turned out to be uniformly pubescent even though there had been no pollen control on the parent plants.

Pollen mother-cell smears were made to reveal the chromosome number of both glabrous and pubescent plants. In each case the number n = 5 was found.

Crosses and Results

Three types of crosses were made using various combinations from the four cultures originally grown from the wild plants listed in Table 1. These were glabrous × glabrous, glabrous × pubescent, and pubescent × pubescent. In addition, 14 pubescent plants were placed together in an isolated greenhouse where interpollination was permitted to be effected by the insects normally present. In each of the three types of controlled crosses, bagging with muslin, emasculation and hand pollination were practiced. Controls to check the procedures were carried along with the experiments. These showed that pollen control was effective. All crosses were carried out reciprocally. Essentially the same results were achieved regardless of the direction in which the pollen was carried except for the reciprocal of

Table 2. glabrous × glabrous

CROSS	PROGENY			3:1 RATIO	CHI-SQUARE
	No. plants	*No. glabrous*	*No. pubescent*		
C1-1 × C1-3	17	12	5		
reciprocal	7	5	2		
	—	—	—		
	24	17	7	18:6	.16
C1-4 × C4-9	20	15	5		
reciprocal	6	4	2		
	—	—	—		
	26	19	7	19.5:6.5	.05
C1-7 × C4-7	12	9	3		
reciprocal	8	7	1		
	—	—	—		
	20	16	4	15:5	.266
					—
Total	70	52	18		.287
					P = .98–.95

pubescent C1–5♀ × glabrous C1–7♂. In this case, the reciprocal did not produce any filled seeds. The significance of this failure was not determined.

In addition to the results shown in Tables 2, 3 and 4, fourteen progenies of pubescent plants open pollinated from pubescent plants were grown. These amounted to 159 plants, all of which possessed pubescent siliques.

Table 3. glabrous × pubescent

CROSS	PROGENY			1:1 RATIO	CHI-SQUARE
	No. plants	*No. glabrous*	*No. pubescent*		
C1–7 × C1–5	0	0	0		
reciprocal	10	3	7		
	10	3	7	5:5	1.60
C1–6 × C4–8	12	3	9		
reciprocal	11	4	7		
	23	7	16	11.5:11.5	3.52
C4–13 × C4–6	6	4	2		
reciprocal	14	5	9		
	20	9	11	10:10	.20
C4–10 × C4–14	17	6	11		
reciprocal	6	3	3		
	23	9	14	11.5:11.5	1.08
Total	76	28	48		6.40
					P = .2–.1
Pooled Chi-square (1 df)					5.26
					P = .05–.02
Heterogeneity Chi-square (3 df)					1.14
					P = .3–.7

The results are easily explainable if it is assumed that a single gene pair is operative in producing the glabrous or pubescent condition of the siliques. From the data, it is obvious that the pubescent plants are homozygous and recessive. Thus the genotype of the pubescent plants may be designated *gg*. When such a plant is crossed with a glabrous heterozygous individual (*Gg*), the resulting progeny should show a 1:1 ratio of glabrous to pubescent plants. In table 3, results from four different crosses between glabrous and pubescent plants are given and the Chi-square test for goodness of fit to a 1:1 ratio is provided. The

Table 4. pubescent × pubescent

CROSS	PROGENY	
	No. glabrous	*No. pubescent*
C2–7 × C2–8	0	11
reciprocal	0	1
	0	12
C3–2 × C3–9	0	10
reciprocal	0	8
	0	18
C3–6 × C3–7	0	13
reciprocal	0	28
	0	41
C4–11 × C4–12	0	17
reciprocal	0	30
	0	47
Total	0	118

numbers of plants in the various progenies are small and the possibility of results different from those shown should perhaps not be ruled out completely. However, the evidence strongly favors a 1:1 ratio and the assumption of a heterozygous (*Gg*) plant as the glabrous parent in each cross seems justified.

If heterozygotes are crossed, a 3:1 ratio of glabrous to pubescent is to be expected. Table 2 gives the data on three glabrous × glabrous crosses and the results show convincingly that a 3:1 ratio of glabrous to pubescent was obtained. It seems perfectly safe to assume that each of the six parents was of the constitution *Gg* with respect to the genes in control of the glabrous vs. pubescent condition. Evidently no homozygous dominant plants were used in the experiments. Such plants could not be distinguished from the heterozygotes phenotypically.

Discussion

The mechanism of genetic control of glabrous vs. pubescent siliques in *Dithyrea Wislizenii* is obviously a relatively simple one. For this reason, it is safe to reject the phenotypic characteristic of glabrous siliques as having no significance for taxonomic purposes. Plants with this characteristic are expected to occur without respect to phylogenetic relationship in the populations of the species. In fact, this is exactly what one finds.

Glabrous-fruited plants are found in *D. Wislizenii* proper and in *D. Wislizenii* var. *Palmeri*. Furthermore, glabrous-fruited plants are found more or less throughout the geographical range of the species. On the basis of collections in the Gray Herbarium, the pubescent type appears to be more common than the glabrous. Collectors evidently distinguish between the glabrous and pubescent plants in the field because there are but three mixed collections among 84 different ones available in the herbarium. Six of the collections have glabrous fruits and 75 have pubescent fruits.

In my own field experience, I have examined four different populations of *D. Wislizenii*, one in Texas, two in Arizona and one in New Mexico. In three of these populations, I was unable to locate any glabrous-fruited plants. The fourth population yielded the material reported on above. This evidence added to that from herbarium material makes it quite clear that pubescent-fruited plants predominate in the species. If pubescent siliques represent the homogygous recessive condition, as indicated by the analysis of the one population, a more prevalent occurrence of the glabrous type would be expected throughout the species as a whole unless there are positive factors operating to select against it. However, we have no way of knowing about this at the present time. One observation may be pertinent to any ultimate explanation for the prevalence of the pubescent-fruited type. It is that the plants of *D. Wislizenii* are self incompatible. The chances of the accidental establishment of predominantly glabrous-fruited populations through isolation are considerably reduced as compared with a self compatible species.

Conclusions

The glabrous-fruited condition in *Dithyrea Wislizenii*, which provided the chief basis for describing *D. Griffithsii* Wooton and Standley as a separate species, is a simply inherited characteristic under single gene control. Glabrous-fruited heterozygotes when crossed produce a simple mendelian 3:1 ratio of glabrous- to pubescent-fruited plants. Glabrous-fruited heterozygotes crossed with pubescent-fruited plants produce approximately a 1:1 ratio of glabrous to pubescent plants. Pubescent-fruited plants crossed with each other produce only pubescent-fruited offspring. The pubescent plants studied all proved to be

homozygous and recessive for the pubescent fruit character. The presence or absence of pubescence on the siliques of *D. Wislizenii* is of no taxonomic significance.
—GRAY HERBARIUM OF HARVARD UNIVERSITY.

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Wooton, E. O. and P. C. Standley. 1913. Contrib. U. S. Nat. Herb. **16:** 124.

A TAXONOMIC STUDY OF THE GENUS PHYSALIS IN NORTH AMERICA NORTH OF MEXICO

U. T. Waterfall

(Concluded from p. 142)

Among the 481 sheets of 450 collections studied, material has been seen from Manitoba, Ontario (*Macoun 54525*, ny) and Quebec (*Marie-Victorin* et al *46421*, gh) in Canada, and in the United States from: Alabama, Arkansas, Colorado (Boulder and El Paso Cos.), Connecticut, Delaware, Florida (Lafayette Co.), Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana (*Short*, ny), Maine (Cumberland Co.), Massachusetts, Michigan, Minnesota, Mississippi (University Campus), Missouri, Nebraska, New Hampshire (Coös and Merrimack Cos.), New Jersey (Middlesex Co.), New York (Staten Island), North Carolina, North Dakota, Ohio (Lorain Co.), Oklahoma, Pennsylvania (Chester Co.), Rhode Island, South Carolina (Aiken Co.), South Dakota, Tennessee, Texas, Utah (Washington Co.) Virginia, Washington D. C., West Virginia (Monroe Co.) and Wisconsin.

9b. **P. virginiana** Miller, var. **subglabrata** (Mackenzie and Bush) Waterfall, comb. et stat. nov., based on *P. subglabrata* Mackenzie and Bush, Trans. Acad. Sci. St. Louis **12:** 86–87. 1902.

Plants nearly glabrous, or with a few short antrorse hairs; leaf blades mostly ovate to ovate-lanceolate, their margins usually entire, sometimes slightly sinuate-dentate; anthers tinged or margined with blue or violet; fruiting calyces mostly 25–35 mm. long and 20–30 mm. wide.

type: *K. K. Mackenzie* collected at Sheffield, Jackson Co., Missouri, June 14, 1896 (ny).

This variety grows in woods, grassland, roadsides, fields, and other disturbed sites, primarily in the northeastern United States, but with scattered collections elsewhere; it flowers mostly from June to September.

Four hundred thirteen sheets of 267 collections have been studied. This taxon occurs in Ontario, Canada, and in Arkansas, Colorado (Gunnison and Routt Cos.), Connecticut, Delaware, Georgia (Wayne Co.), Idaho (Ada, Canyon and Payett Cos.), Illinois, Indiana, Iowa, Kansas (Douglas, Ellis and Shawnee Cos.), Kentucky, Louisiana (East Feliciana and Grant Parishes), Maryland, Massachusetts, Michigan, Mississippi (Coahoma Co.), Missouri, Nebraska (Kearney and Nemaha Cos.), New Jersey, New Mexico (Lincoln Co.), New York, North Carolina, Ohio, Oklahoma (Rogers and Tulsa Cos.), Oregon (Polk Co.), Pennsylvania, Rhode Island, South Carolina (Pickins Co.), Tennessee, Texas (Delta, Nueces and Potter Cos.), Utah (San Juan and Sanpete Cos.), Virginia, Washington D. C., West Virginia, Wisconsin.

Sometimes forms are found with larger fruiting calyces which are 4–5 cm. long and 3–4 cm. broad. These may be called **Physalis virginiana** f. **macrophysa** (Rydberg) Waterfall, comb. et stat. nov. based on *P. macrophysa* Rydberg, Bull. Torr. Bot. Club **22:** 308. 1895.

TYPE: Since Rydberg cited several number without choosing a type, the author selects as LECTOTYPE *A. A. Heller 1756* (NY); isolectotypes: (NY, UC).

Although the latter name antedates *subglabrata*, the author has chosen to transfer the name *subglabrata* to varietal status, since it is associated with a large, wide-spread population, primarily of the northeastern United States. According to Article 70 of the Rules no name has priority outside its own rank. Article 71, Recommendation 71A suggests that in changing rank it is preferable to retain the original epithet unless it must be rejected under the rules. This particular choice of names seems to be in accordance with both articles, and keeps available the names now in usage, instead of either changing their application, or supplanting them with new names which would be permissible under the rules.

Selected specimens: ARKANSAS Marion Co.: *Demaree 20645* (NY); ILLINOIS: Peoria Co.: *McDonald* Aug. 1903 (NY); Champaign Co.: *Gleason* Oct. 7, 1907 (DUKE); INDIANA: Lawrence Co.: *Kriebel 1348* (DUKE); IOWA: Story Co.: *Hayden 424* (GH); MISSOURI: Jackson Co.: *Bush 12483A* (NY) and *12483* (DUKE); NEBRASKA: Howard Co.: *Bates 4910* (GH); New Jersey: Somerset Co.: *Lighthipe* Aug. 1, 1916 (TEX); TEXAS: Comal Co.: *Lindheimer* May 1847 (GH); Kerr Co.: *Heller 1756* (NY, UC); Tarrant Co.: *Ruth 746* (NY, PH); Travis Co.: *Tharp* May 6, 1931 (TEX).

9c. **P. virginiana** Miller, var. **texana** (Rydberg) Waterfall, comb. et stat. nov., based on *P. texana* Rydberg, Mem. Torr. Bot. Club **4:** 339–340. 1896.

Plant usually several-branched from the base; herbage glabrous or nearly so; principal leaves ovate and usually entire; plant of the Gulf coast of Texas, apparently intergrading inland with contiguous varieties.

TYPE: The type is *A. A. Heller 1507* NY; isotypes: ARIZ, GH, PH, UC.

This is primarily a taxon of the coastal area, but it extends inward through chaparral and other habitats nearly to central Texas, becoming more atypical as it does so. It usually flowers from March to June, but flowering specimens have been seen that were collected in December and in August.

Selected from 35 sheets of 17 collections: TEXAS: Bexar Co.: *Metz 73* (MICH, NY); Cameron Co.: *Parks 17943* (GH); Gonzales Co.: *Tharp 51–556* (TEX); LaSalle Co.: *Tharp* and *Tyson 52–488* (OKLA, TEX); Nueces Co.: *Tharp, Johnston* and *Webster 48–58* (TEX, ARK, OKLA); San Saba Co.: *Palmer 11841* (TEX); Travis Co.: *Tharp* and *Scarbrough 51–399* (COLO, OKLA, TEX, UARK); Victoria Co.: *Tharp 2516* (TEX); Washington Co.: *Tharp* July 9, *1929* (OKLA, TEX); Wilson Co.: *Palmer 947* (GH, NY).

9d. **P. virginiana** Miller, var. **sonorae** (Torrey) Waterfall, comb. nov., based on *P. pumila* Nutt., var. *sonorae* Torr., Botany of the Mexican Boundary 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 and Sciences **10:** 68. 1875; *P. lanceolata* Michx., var. *longifolia* (Nutt.) Trelease, Rep. Ark. Geol. Surv. **4:** 207. 1891; *P. rigida* Pollard and Ball, Proc. Biol. Soc. Wash. **13:** 134–135. 1900.

Since, according to Article 70, "When the rank . . . of an infrageneric taxon is changed, the correct name or epithet is the earliest legitimate one available in the new rank," the well-known name *longifolia* must be replaced in the varietal status with the relatively unknown *sonorae*.

Plants usually single stemmed, often branching above; leaf blades usually lanceolate to lanceolate-linear, but rarely ovate, their margins entire to irregularly toothed; herbage sparsely covered with short antrorse hairs, which are more abundant on the younger parts, sometimes nearly glabrous; calyx often with ten lines of short antrorse hairs; anthers yellow. Sometimes this variety is difficult to separate from var. *subglabrata*. In such cases the bluish, or violet, anthers of the latter is considered a distinguishing characteristic since it occurs in a large population of the northeastern United States where the yellow-anthered var. *sonorae* is not found.

TYPE: *Geo. Thurber 418*, Fronteras, Sonora, Mexico, June 1851 in the Herbarium of the New York Botanical Garden. Two isotypes are in the Gray Herbarium.

Habitat, distribution and flowering time: This variety grows in prairies, plains, foothills, canyons, open woods, sandy areas and in various disturbed habitats. Its primary distribution is in the prairie region of central United States, but it extends into and west of the Rockies. It flowers in June, July and August in the northern part of its range, and from May through September in Texas and Arizona.

Four hundred sixty seven sheets of 385 collections have been studied. They were collected in Arizona, Arkansas, California (Trinity Co.), Colorado, Georgia (Whitfield Co.), Idaho, Illinois, Indiana, Iowa, Kansas, Nebraska, Nevada (Churchill and Storey Cos.), New Mexico, North Carolina, Oklahoma, Oregon (Malheur Co.), Pennsylvania (*Small*, 1889), South Dakota, Tennessee (Davidson Co.), Texas, Utah, Virginia (King George Co.), West Virginia (Mineral Co.), Wisconsin, and Wyoming (Park and Weston Cos.).

It is probable that the records from the far west represent introductions.

9e. **P. virginiana** Miller, var. **hispida** Waterfall, var. nov., foliis ovato-lanceolatis vel lanceolatis, vel spathulato-lanceolatis, crassis, plus minusve hispidis.

This perennial rhizomatous variety has thick leaf blades varying from ovate-lanceolate to linear-lanceolate in shape. The herbage is subglabrous, but it has a varying amount of stiff, more or less divergent trichomes about 1 mm. long, at least on the flower buds or the margins of the leaves. It is found in sandy areas of the prairie and plains region. It has been passing as *P. lanceolata*, but that name was given to seemingly aberrant plants of the eastern United States which may very well be intergrades between *P. heterophylla* and *P. virginiana*.

The TYPE is *Waterfall 7308*, sand dunes, 1 mile east of Mangum, Greer Co., Oklahoma, June 28, 1947, in the Herbarium of Oklahoma State University; isotypes (TEX, OKL).

It usually grows in sandy situations, but is found also on dry hilltops, edges of fields and other disturbed areas, primarily in Oklahoma, Kansas, Nebraska and eastern Colorado; flowering in May, June and July.

Selected from 212 sheets of 147 collectiors: Colorado: Baca Co.: *Rogers 6436* (COLO); Boulder Co.: *Ramaley 11624* (COLO); Denver Co.: *Eastwood 23* (COLO, GH, UC); El Paso Co.: *Williamson* July 10, 1901 (PH); Fremont Co.: *Brandegee 392* (NY, PH, UC); Jefferson Co.: *Greene 323* (GH); Larimer Co.: *Smith* July 15, 1944 (UC); Las Animas Co.: *Rogers 6003* (COLO); Lincoln Co.: *Ownbey 1318* (COLO, GH, NY, UC); Phillips Co.: *Weber 5040* (COLO); Weld Co.: *Ramaley 15138* (ARIZ, COLO, OKL, TEX, UC); Yuma Co.: *Harrington 5036* (COLO); Indiana: Lake Co.: *Bebb 499* (OKL); Tippecanoe Co.: *Ek* June 10, 1942 (GH, NY, TEX, UC); Kansas: Barton Co.: *Rydberg* and *Imler 1330* (KANU, NY); Cheyenne Co.: *McGregor 9433* (KANU); Clark Co.: *Rydberg* and *Imler 768* (KANU); Clay Co.: *Kellerman* July 2, 1888 (GH); Comanche Co.: *Rydberg* and *Imler 1109* (KANU, NY); Finney Co.: *Rydberg* and *Imler 996* (KANU, NY); Grove Co.: *Hitchcock 572* (GH); Hamilton Co.: *Wilson* and *Miller* (KANU); Meade Co.: *Horr* and *McGregor 3841* (KANU); Reno Co.: *Rydberg* and *Imler 563* (KANU, NY); Riley Co.: *Norton 368* (GH, NY); Rooks Co.: *Horr 5005* (KANU); Sedgwick Co.: *Coll. unknown* Aug. 20, 1933 (KANU); Wyandotte Co.: *Mackenzie 1159* (NY); Minnesota: Isanti Co.: *Rosendahl* and *Butters 5051* (GH); Missouri: Jackson Co.: *Bush 4970* (GH, NY, OKL); Johnson Co.: *Stevens 4166* (NY); Nebraska: Banner Co.: *Rydberg 473* (NY); Cherry Co.: *Tolstead 550* (GH); Custer Co.: *Bates* June 15, 1901 (GH); *Hapeman* June 7, 1928 (DUKE); Lincoln Co.: *Porter 2059* (GH, OKL); New Mexico: Santa Fe Co.: *Tracy* and *Evans 110* (NY); Oklahoma: Beckham Co.: *Pennell 10556* (NY, PH); Beaver Co.: *Goodman 5332* (OKL, TEX); Blaine Co.: *Waterfall 7070* (OKL, OKLA, TEX); Cleveland Co.: *Little 396* (OKL); Custer Co.: *Mericle 318, 328, 703, 1866* (OKL); Ellis Co.: *Waterfall 11891* (OKLA); Garvin Co.: *Andrews 97* (OKL); Grady Co.: *McFarland 15* (OKL); Greer Co.: *Bull 219* (OKL); Harper Co.: *Stevens 3322* (GH, NY, OKL); Jackson Co.: *Stevens 1176* (GH, OKL); Kay Co.: *Stevens 1919* (GH); Kingfisher Co.: *Byers 211* (OKLA); Logan Co.: *Goodman 2126* (GH, OKL); Oklahoma Co.: *Waterfall 2350* (GH, NY); Payne Co.: *Abernathy 32* (OKLA); Pushmataha Co.: *Waterfall 11397* (OKLA); Roger Mills Co.: *Smith 607* (OKLA); Texas Co.: *Waterfall 7961* (OKL, OKLA); Woods Co.: *Waterfall 7857* (OKL, OKLA); Woodward Co.: *Nelson* and *Goodman 5301* (OKL); South Dakota: Meyer Co.: *Wallace* (NY); Texas: Collingsworth Co.: *Cory 16151* (GH); Hall Co.: *Reverchon 4311* (GH); Hemphill Co.: *Cory 16236* (GH); Wichita Co.: *Tharp 535* (NY, TEX); Utah: Sanpete Co.: *Ward 676* (GH); Wyoming: Albany Co.: *Nelson 7358* (GH, NY);

Converse Co.: *Nelson 8366* (GH); Platte Co.: *Porter 4894* (COLO, GH, OKL, PH, TEX, UC).

9f. **P. virginiana** Miller, var. **polyphylla** (Greene) Waterfall, comb. et stat. nov., based on *Physalis polyphylla* Greene, Pittonia **4:** 150–151. 1900.

Plants simple or branched near the base, nearly glabrous, the few hairs short and antrorse; longer leaves mostly 3–5 cm. long, lanceolate or linear-lanceolate.

TYPE: *C. F. Baker 576* Piedra, southern Colorado, July 12, 1899 (isotypes: GH, NY, UC).

The only other collection seen is *Waterfall 11115*, collected on a shale hillside, opening in pine forest 12 miles west of Chama, Rio Arribo Co., New Mexico, Aug. 25, 1952. (OKLA).

9g. **P. virginiana** Miller, var. **campaniforma** Waterfall, var. nov., caulibus parvis, curtis retrorso-pilosis; foliis ovatis; corollis maculatis; calycis campaniformis, ad basin 4–5 mm. latis, ad apices 1.5–2 cm. latis.

This variety is characterized by the combination of ovate leaves, short retrorse hairs and campanulate calyx, 4–5 mm. wide at its base, and 1.5–2 cm. wide at the tips of its divergent lobes.

TYPE: *P. C. Standley 4556*. Mouth of Indian Creek, altitude 8000 ft.; in Pecos National Forest, New Mexico, July 25, 1908. Two sheets are in the Herbarium of the New York Botanical Garden. At present this distinctive variety is known only from the type collection.

10. **Physalis hederaefolia** Gray, Proc. Amer. Acad. Arts and Sciences **10:** 65. 1875.

Plants erect or spreading from a perennial base, simple or many-stemmed; herbage with a mixture of long jointed hairs and short trichomes, or with short hairs only, which may be viscid or not, glandular or not, antrorse or spreading; leaf blades subreniform to ovate, or rarely ovate-lanceolate; corollas 10–15 mm. long, yellow or yellowish green, usually darker on the base of the limb, but sometimes obscurely so; limb of the corolla often reflexed when fully open; anthers usually yellow, 1.5–4 mm. long; flowering calyx about one-half as long as the corolla, on peduncles usually 3–8 mm. long; fruiting calyx 2–3 cm. long and 1.5–2.5 cm. wide on peduncles 1–2 cm. long.

10a. **P. hederaefolia** Gray, var. **hederaefolia** *P. hederaefolia* Gray, var. *puberula* Gray, loc. cit. supra; *P. Palmeri* Gray, Synoptic Flora 2 (1): 235. 1888.

Herbage vestite with one or some combination of long jointed hairs, short divaricate or retrorse hairs, or glandular hairs; leaf blades subreniform to ovate; calyces at anthesis usually 3–4 mm. wide; anthers mostly 3–4 mm. long, yellow

TYPE: *Charles Wright* 528, in part, Turkey Creek, western Texas to El Paso, Oct. 1849 (GH). It has a few long hairs, a few short hairs and a few sessile, or subsessile spherical glands; the type of var. *puberula* has many short hairs on the stems, and short hairs and a few spherical sessile glands on the leaves.

Variety *hederaefolia* grows in desert plains, desert scrub, canyons, mountains and valleys, primarily in southwestern Texas, New Mexico and adjacent Arizona; it flowers in May, June and July, sometimes in August, September and October.

Selected from 243 sheets of 180 specimens: Arizona: Cochise Co.: *Harrison 8259* (ARIZ); Coconino Co.: *Hanson 133A* (COLO, TEX); Gila Co.: *Gould* and *Hudson 3742* (ARIZ, GH, UC); Pima Co.: *Gould 3952* (ARIZ); Pima Co.: *Toumey 404* (ARIZ); Yavapai Co.: *Wolf 2311* (GH); California: San Bernardino Co.: *Wolf 10772* (UC); San Diego Co.: *Abrams 3703* (GH); Nevada: Clark Co.: *Clokey 8107* (GH, NY); Lincoln Co.: *Ripley* and *Barneby 6405* (NY); New Mexico: Bernalillo Co.: *Koelz* June 28, 1926 (MICH); Dona Ana Co.: *Wooton 136* (NY); Grant Co.: *Greene* Sept. 31, 1880 (NY); Lincoln Co.: *Wooton 634* (NY); San Miguel Co.: *Rose* and *Fitch 17606* (NY); Texas: *Cory 16628* (GH); Bandera Co.: *Palmer 12253* (TEX); Brewster Co.: *Mueller 8154* (GH, MICH, NY, TEX, UC); *Warnock 341* (GH, NY, TEX); Burnet Co.: *Rogers, Albers* and *Barksdale 6864* (OKLA, TEX); Cameron Co.: *Chandler 7064* (GH, NY, UC); Culberson Co.: *Waterfall 4059* (GH, NY); Duval Co.: *Croft 11* (MICH, NY); El Paso Co.: *Warnock 4100* (TEX); Gonzales Co.: *Smith* and *LeSueur 42–42* (GH, TEX); Grimes Co.: *Tharp* April 11, 1936 (TEX); Hidalgo Co.: *LeSueur 442* (TEX); Hudspeth Co.: *Waterfall 4875* (GH, NY); Jeff Davis Co.: *Palmer 31935* (TEX); Kenedy Co.: *Cory 28408* (GH); Leon Co.: *Cory 21810* (GH); Mason Co.: *Whitehouse* Sept. 1, 1929 (TEX); McLennan Co.: *Smith 620* (TEX); Maverick Co.: *Pringle 8324* (GH, NY, UC); Pecos Co.: *Tharp 256* (OKL, UC); Presidio Co.: *Hinckley 2753* (GH); Real Co.: *Cory 42778* (GH); Reeves Co.: *Tracy* and *Earle 126* (GH, NY, TEX); Smith Co.: *Cory 25881* (GH); Taylor Co.: *Cory 7393* (MICH, UC); Terrell Co.: *Webster 190* (TEX); Tom Green Co.: *Reverchon 3922* (GH); Travis Co.: *Tharp* Aug. 18, 1941 (GH, TEX); Upton Co.: *Cory 53482* (GH); Webb Co.: *Mackenzie 86* (NY); Utah: Kane Co.: *Boyle* 208 (UC); Millard Co.: *Garrett* 2969 (NY).

10b. **P. hederaefolia** Gray, var. **comata** (Rydberg) Waterfall, Rhodora **52:** 171. 1950; *P. comata* Rydb., Bull. Torr. Bot. Club **22:** 306. 1895; including *P. rotundata* Rydb., Mem. Torr. Bot. Club **4:** 352. 1896.

Herbage with long jointed hairs more or less abundantly mixed with shorter hairs, which may, or may not, be viscid or glandular; flowering calyx 8–11 mm. wide; leaf blades ovate to rotund, toothed to nearly entire.

TYPE: *P. A. Rydberg 269*, under the cliffs, south side of Scott's Bluff, Nebraska, July 20, 1891, in the Herbarium of the New York Botanical Garden.

Variety *comata* is found on plains, mountains slopes, dry hills, gravel banks and sandhills, principally in western Nebraska, western Kansas and eastern Colorado; it usually flowers in June, July, August and September.

Selected from 80 sheets of 63 collections: Colorado: Bent Co.: *Osterhout 4118* (NY); Boulder Co.: *Ewan 12258* (UC); Cheyenne Co.: *Ownbey 1357* (COLO, GH, NY); Denver Co.: *Eastwood* Sept. 10, 1910 (GH, UC); El Paso Co.: *Ehlers 7764* (ARIZ, GH); Fremont Co.: *Ewan 14248* (COLO); Larimer Co.: *Nelson* Aug. 31, 1900 (NY); Las Animas Co.: *Rogers 4843* (COLO); Weld Co.: *Osterhout 2309* (NY); Kansas: Barber Co.: *Rydberg* and *Imler* July 5, 1929 (NY); Cheyenne Co.: *McGregor 9425* (KANU); Ellis Co.: *Rydberg* and *Imler 1228* (KANU, NY); Finney Co.: *Wilson* and *Miller* July 22, 1912 (KANU); Kiowa Co.: *Hitchcock 774* (GH, NY); Osborne Co.: *Shear 221* (GH, NY); Riley Co.: *Gates 14537* (MICH); Rooks Co.: *Bates 4563* (GH); Nebraska: Adams Co.: *Bates 4607* (GH); *Rydberg* Aug 8, 1891 (NY); Buffalo Co.: *Bates 4903* (GH); Custer Co.: *Bates 2403* (GH); Garfield Co.: *Bates 4634* (NY); Lincoln Co.: *Rydberg* Sept. 1895 (UC); Webster Co.: *Bates* July 3, 1907 (NY); New Mexico: Lincoln Co.: *Skehan* July 7, 1898 (GH, NY, UC); Oklahoma: Cimarron Co.: *Waterfall 7902, 9122, 9240* (OKL, OKLA); Texas Co.: *Waterfall 7867* (OKL, OKLA, TEX); Woods Co.: *Ward 54* (NY); South Dakota: Lawrence Co.: *Bennett 3259* (UARK).

10c. **P. hederaefolia** Gray, var. **cordifolia** (Gray) Waterfall, comb. nov., based on *P. Fendleri* Gray, var. *cordifolia* Gray, Synop. Flora N. Amer. 2(1): 395. 1878. *P. Fendleri* Gray, Proc. Amer. Acad. Arts and Sciences **10:** 66. 1875.

Indument of short reflexed hairs with many to few short, somewhat flattened branched hairs, which are sometimes present only on the calyx; leaf blades ovate to ovate-lanceolate (2) 3–6 cm. long and 1–3 cm. wide, from (1.2) 1.4–2.5 times longer than wide.

TYPE: The type of *P. Fendleri* is *Fendler 683*, New Mexico (GH). That of var. *cordifolia* is *Palmer 363*, St. George, southern Utah (GH).

This taxon grows in mountains, canyons, mesas, plains, in juniper-pinon pine areas, and in disturbed habitats, principally in southwestern Texas; it flowers mostly in July, August and September.

Selected from 196 sheets of 146 collections: Arizona: Apache Co.: *Goodman* and *Payson 3167* (GH, NY); Cochise Co.: *Blumer 2104* (ARIZ, GH, NY); Coconimo Co.: *Thornber 2088* (ARIZ); Gila Co.: *Parker, McClintock* and *Robbins 6125* (ARIZ); Maricopa Co.: *Rusby 775* (MICH, NY); Mohave Co.: *Kearney* and *Peebles 12761* (ARIZ); Navajo Co.: *Jones 1109* (ARIZ); Pima Co.: *Parker, McClintock* and *Haskell 5885* (ARIZ, UC); Santa Cruz Co.: *Peebles* and *Loomis 7019* (ARIZ); Yavapai Co.: *Kearney* and *Peebles 9719* (ARIZ); California: San Bernardino Co.: *Wolf 10722* (NY, UC); San Diego Co.: *Palmer 1875* (GH); Colorado: Archuleta Co.: *Weber* and *Livingston 6254* (COLO); El Paso Co.: *McCosh* and *Greene 1877* (NY); Fremont Co.: *Waterfall 11503* (OKLA, TEX); Huerfano Co.: *Ramaley 16236* (COLO); La Plata Co.: *Jones 503* (MICH); Las Animas Co.: *Rogers 5416* (COLO); Mesa Co.: *Rollins 1915* (GH, NY); Montezuma Co.: *Baker, Earle* and *Tracy 823* (NY); Montrose Co.: *Payson 3927* (GH); Otero Co.: *Paull 87* (COLO); Pueblo Co.: *Pammel* Aug. 24, 1913 (GH, TEX); Nevada: Clark Co.: *Train 2003* (ARIZ); *Clokey 8204* (ARIZ, DUKE, NY, OKL, OKLA, TEX); New Mexico: Colfax Co.: *Standley 14012* (NY); Dona Ana Co.: *Wooton* and *Standley 3157* (ARIZ, NY); Grant Co.: *Blumer 49* (GH, NY); Luna Co.: *Shreve 8343* (ARIZ); Otero Co.: *Schulz 297* (GH); San Miguel Co.: *Standley 4945* (GH, NY); Santa Fe Co.: *Robbins 8244* (COLO); Sierra Co.: *Metcalfe 945* (GH, NY); Taos Co.: *Wooton 2693* (NY); Torrance Co.: *Parker* and *McClintock 6526* (ARIZ); Valencia Co.: *Vogt 27* (ARIZ); Oklahoma: Cimarron Co.: *Waterfall 7915* (OKL, OKLA); Texas: Brewster Co.: *Marsh 261* (GH); El Paso Co.: *Lee, Berkman* and *Tharp 46192* (TEX); Hudspeth Co.: *Waterfall 6694* (GH); Jeff Davis Co.: *Hinckley 574* (NY); Utah: Piute Co.: *Tidestrom 2942* (MICH); San Juan Co.: *Rydberg* and *Garrett 9390* (NY); Washington Co.: *Gould 2028* (ARIZ, COLO, GH, NY).

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

Plants simple or branched, apparently from a deep rhizome which is not collected; indument usually villous, of long jointed hairs (1) 2–3 mm. long, dense or sparse, or of long and short hairs intermixed in varying proportions; leaf blades 4–7 cm. long and 1.5–4 cm. wide, usually lanceolate, rarely ovate-lanceolate or linear-lanceolate, on petioles 0.5–2 cm. long (this amount of variation in length of petioles may be found in the same plant, with the longer petioles below and the shorter ones above); margins of the leaf blades entire to irregularly undulate to saliently few-toothed; corollas 14–18 mm. long, yellow, with prominent deep reddish-blue or purplish spots on the limb; anthers blue or blue-green, about 3 mm. long, on slender filaments much narrower than the anthers; calyx 7–10 mm. long, its lobes 3–8 mm. long; flowering peduncles usually about 5 mm. long, sometimes as much as 8 mm. long; fruiting calyx (2.5) 3–5 cm. long and (2) 2.5–3 cm. wide, with calyx lobes (6) 10–15 (17) mm. long.

TYPE: *Howard Scott Gentry 2710*, on oak-pine slope, 2,160 meters elevation, Cajurichi, Rio Mayo, Chihuahua, Mexico, Sept. 13, 1936 (F). An isotype is at UC. The isotype has lobes of the flowering calyx 3–8 mm. long, and a calyx cup only about 2 mm. long; the fruiting calyx also has lobes at the extreme limit of length, being 14–17 mm. long. One of the Arizona specimens approaches the type, having a flowering calyx with lobes 7 mm. long and a calyx tube 3 mm. long. However most of them have calyx lobes somewhat shorter than the calyx tube; the lobes of the fruiting calyx in the Arizona material are usually 10–15 mm. long, rarely as short as 6 mm.

Habitat, range and flowering time: Growing in canyons, pine woods and oak woods in the mountains of southern Arizona (with one collection from southwestern New Mexico) and adjacent Sonora and Chihuahua; flowering in June, July and August.

Selected from 31 sheets of 19 collections: Arizona: Cochise Co.: *Benson 10448* (ARIZ, NY, UC); *Gooding 843* (ARIZ, GH, NY); Pima Co.: *Kearney* and *Peebles 10504* (ARIZ, UC); Santa Cruz Co.: *Parker 7683* (ARIZ, COLO, NY, UC); NEW MEXICO: Socorro Co.: *Wooton* Aug. 6, 1900 (NY).

12. **Physalis crassifolia** Bentham, Botany of the Voyage of the Sulphur 40. 1844.

Stems usually several from a ligneous base, each stem branched, sometimes several times; herbage minutely puberulent, sometimes slightly glandular; principal leaf blades (1.5) 2–3 (5) cm. long, and (1.5) 2–2.5 (3.5) cm. wide, usually broadly ovate; leaf margins entire to sinuately or repandly few-toothed to dentate; petioles two-thirds the length of the blade to equalling it; corolla yellow, sometimes becoming bluish in age, or when dried and pressed, 10–15 mm. long, its limb reflexed when fully open; anthers yellow, 2.5–3 mm. long; filaments having a few long hairs growing on them; calyx at anthesis usually 3–6 mm. long on peduncles 5–10 times their length; fruiting calyx usually 2–3 cm. long and 1.5–2 cm. wide.

12a. **P. crassifolia** Bentham, var. **crassifolia.** *P. cardiophylla* Torrey, Bot. Mex. Bound. 153. 1859; *P. crassifolia* var. *cardiophylla* (Torr.) Gray, Synoptic Flora 2(1): 235. 1878; *P. muriculata* Greene, Bull. Calif. Acad. **1:** 209. 1885.

Leaves thick, entire to sinuately or repandly few-toothed; flowering calyx usually 4–6 mm. long on peduncles 6–7 times their length; corollas yellow, sometimes with brownish centers.

TYPE: Bay of Magdalena, Lower California, Mexico; not seen.

Variety *crassifolia* grows on deserts, canyon floors, rocky hillsides, and mountains, principally in Arizona, and California; it flowers from March through October.

Selected from 185 sheets of 157 collections: ARIZONA: Cochise Co.: *Blumer 90* (ARIZ); Mohave Co.: *Harrison, Kearney* and *Fulton 7549* (ARIZ); Pima Co.: *Harrison* and *Kearney 7238* (NY); Pinal Co.: *Gillespie 8919* (NY, UC); Yavapai

Co.: *Peebles, Harrison* and *Kearney 7431* (NY); Yuma Co.: *Benson 10807* (ARIZ); CALIFORNIA: Imperial Co.: *Rose 36830* (OKL, MICH); Inyo Co.: *Clokey* and *Templeton 5776* (NY, UC); Kern Co.: *Munz, Johnston* and *Harwood 4034* (NY); Riverside Co.: *Clokey 6881* (NY, UC); *Mason 4185* (GH, UC), *Rose 36001* (GH, UC); San Bernardino Co.: *Munz 11720* (ARIZ, COLO, NY); San Diego Co.: *Abrams 3160* (GH, NY); NEVADA: Clark Co.: *Clokey 8577* (COLO, NY, UC); *Clover 8235* (MICH); Lincoln Co.: *Kennedy* and *Gooding 10* (ARIZ, NY, UC).

12b. **P. crassifolia** Bentham, var. **versicolor** (Rydberg) Waterfall, comb. et stat. nov., based on *P. versicolor* Rydb. Bull. Torr. Bot. Club **22:** 307. 1895; *P. genucaulis* Aven Nelson, Bot. Gaz. **47:** 430. 1909.

Leaves thinner, usually dentate, but sometimes nearly entire; calyx usually 3–4 mm. long on peduncles 5–10 times their length; corolla yellow, usually some, or all, of them turning bluish in drying.

TYPE: Rydberg selected no type, therefore *Edward Palmer 622*, collected at Guaymas, Mexico in 1887 is selected as the LECTOTYPE (NY); isolectotype (GH).

Its habitat, distribution and flowering time are apparently similar to the above, but it is not so widespread.

Selected from 71 sheets of 55 collections: ARIZONA: Gila Co.: *King* and *Belden 2439* (ARIZ); Mohave Co.: (?): *Clover 6009* (ARIZ); Pima Co.: *Toumey* June 1, 1896 (GH, NY), *Gould* and *Macbride 4128* (ARIZ, GH, NY, UC); Pinal Co.: *Thornber 5517* (ARIZ, NY); Yuma Co.: *Parker, Parker, Wright* and *Lowe 7816* (COLO, NY, UC); CALIFORNIA: Imperial Co.: *Wiggins 9606* (GH, UC); Riverside Co.: *Wiggins 9673* (GH, NY, UC); Nevada: Clarke Co.: *Train 1366* (NY, UC).

13. **Physalis ixocarpa** Brotero ex Hornemann, Hortus Regius Botanicus Hafniensis, Supplement 26. 1819; *P. aequata* Jacq. f. ex Nees, Linnaea **6**· 470. 1831.

Annual, 15–60 cm. tall, branched, glabrous to rather sparsely vestite with short appressed hairs; leaf blades 2–7 cm. long, ovate to ovate-lanceolate; margins of the leaves dentate to sinuate-dentate to entire, on petioles about one-half as long as the blade to equalling it in length; corolla 7–15 mm. long, with 5 bluish-tinged dark spots on its limb which is recurved when fully open; anthers blue, about 3 mm. long, strongly twisted after dehiscence; flowering peduncles 3–5 mm. long; fruiting calyx usually 2–2.5 (3) cm. long, nearly globose, often well-filled with the fruit; fruiting peduncles usually 3–8 mm. long.

Fruiting material may often resemble *P. virginiana* var. *subglabrata*. It can be distinguished by its shorter peduncles.

TYPE: None was selected by Hornemann, and no material was cited. Presumably a neotype should be selected, probably from Mexican collections since the species seems to be native there. However the author prefers to defer this action until a more detailed study of the species from that area may be accomplished. The concept of the species is based upon the material cited later, which seems to be conspecific with Mexican material seen.

This species is cultivated and escapes; it flowers through much of its growing season.

Selected from 95 sheets of 81 collections: CANADA: Ottawa, *Marie-Victorin*, et al. *43923* (GH); UNITED STATES: CALIFORNIA: Butte Co.: *Yates 6127* (uc); Fresno Co.: *Bacigalupi, Ferris* and *Wiggins 2491* (gh, ny, uc); Los Angeles Co.: *Fosberg 53036* (gh, ny); Riverside Co.: *Conger* Oct. 1909 (uc); San Bernardino Co.: *Parish* Sept. 1888 (uc); San Luis Obispo Co.: *Miossi* Aug. 5, 1840 (uc); Santa Barbara Co.: *Bingham 29* (ny); Ventura Co.: *Pollard* Oct. 27, 1945 (colo); Delaware: New Castle Co.: *Commons* Nov. 2, 1898 (gh); Sussex Co.: *Churchill* Sept. 11, 1908; Illinois: Adams Co.: *Seymour* Aug. 1878 (duke); DuPage Co.: *Moffett 3197* (gh, okla); Fulton Co.: *Vasey 1862* (gh); Maryland: *McVaugh 134543*, cult., originally from Mexico (mich); Massachusetts: Middlesex Co.: *Deane* Sept. 24, 1884 (nebc); Norfolk Co.: *Fernald* Sept. 26, 1908 (gh); Michigan: Emmet Co.: *Hoover 1943*, seeds from the Orange Free State (duke, tex, uc); Minnesota: Herb. *Canby* Sept. 1868 (ny); New Jersey: Hunterdon Co.: *Dodge* July 18, 1899 (mich); New Mexico: Rio Arriba Co.: *Wooton 2697* (ny); Santa Fe Co.: *Fendler 680* (gh); New York: Ontario Co.: *coll. unknown* Aug. 2, 1887, raised from seeds from Palmer from Mexico (gh); Tompkins Co.: *Hoisington 340*, cultivated (okla); Oregon: Multnomah Co.: *Nelson 3325* (gh); Pennsylvania: *Fretz 1881* (uc); Philadelphia Co.: *Parker* Sept. 9, 1874 (ny); Texas: Bexar Co.: *Jermy 1904* (ny); Brewster Co.: *Marsh 163* (gh); Crockett Co.: *Cory 29703* (gh); Refugio Co.: *Tharp* Sept. 7, 1929 (mich); Webb Co.: *Mackenzie 85* (ny); Vermont: Chittenden Co.: *Flynn 4* (gh); Virginia: Clarke Co.: *Young 485*, raised in experimental plots (tex); Washington: Klickitat Co.: *Suksdorf 2284* (gh, uc); Washington D. C.: *Steele* Sept. 20, 1899 (duke); West Virginia: Rawleigh Co.: *Tosh 650* (uc).

14. **Physalis Wrightii** Gray, Proc. Amer. Acad. Arts and Sciences **10:** 63. 1875.

Annual 30–90 cm. tall, nearly glabrous, the few hairs short, stiff and appressed; leaf blades ovate-lanceolate to linear-lanceolate, the principal ones usually 4–12 centimeters long on petioles 1.5–7 cm. long; leaf margins usually irregularly and often coarsely dentate, sometimes regularly and saliently dentate; corolla a light yellow color, sometimes with a greenish tinge, rotate with very little tube, 15–23 mm. wide when fully open, with five hairy pads on its limb near the base, alternating with the stamens; anthers (2.8)3 (3.8) mm. long, yellow with a blue or blue-green tinge; filaments slender, somewhat exceeding the anthers in length; flowering calyx usually 4–5 mm. long on peduncles 5–12 times its length; fruiting calyx usually 2–2.5 cm. long and 1.7–2 cm. wide, on peduncles usually 2.5–6 cm. long, sometimes nearly filled by the fruit.

type: *Charles Wright 1602*, prairies along the San Pedro River, southwestern Texas, 1851–52 (gh); isotype (ny); no other collections have been seen from Texas.

Habitat, distribution and flowering time: Growing in deserts and mountains, but particularly in fields and other disturbed habitats, primarily in Arizona and California; flowering from July to November.

Selected from 46 sheets of collections: Arizona: Cochise Co.: *Griffiths 1579* (ariz, ny); Gila Co.: *Collom* Sept. 15, 1934 (mich); Graham Co.: *Richardson 437* (ariz); Maricopa Co.: *Wiggins 3860* (mich); Navajo Co.: *Zuch 49* (ariz); Pima Co.: *Pringle* Aug. 1, 1894 (gh, ny); *Gould 3938* (ariz, tex, uc); Pinal Co.: *Arnold* and *Darrow* Sept. 13, 1936 (gh, uc); Yuma Co.: *Thornber* Sept. 24, 1912 (ariz); California: Imperial Co.: *Munz 11523* (ny); Kern Co.: *Yates 6839* (uc); Los Angeles Co.: *Wheeler 964* (uc); San Diego Co.: *Brandegee* July 1895 (uc); Texas: *Wright 1602.* (gh, ny).

15. **Physalis angulata** Linnaeus, Species Plantarum **1:** 183. 1753; other synonymy under the varieties.

Annual, 15–90 cm. tall, glabrous, or with a few short appressed hairs especially on the younger parts; blades of principal leaves usually 4–10 cm. long, ovate to lanceolate, or sometimes linear-lanceolate; margins of the leaves irregularly and sometimes coarsely or saliently toothed, or entire, on petioles 1–4 cm. long; corolla yellowish, not dark spotted, usually 4–10 mm. long; anthers usually 1–2.3 mm. long, bluish, on slender filaments; flowering calyx usually 3–5 mm. long with calyx lobes 1–2.5 mm. long; flowering peduncles 5–40 mm. long; fruiting calyx usually 2–3 cm. long and 1.5–2.5 cm. wide on peduncles 10–40 mm. long.

15a. **P. angulata** L., var. **angulata.** *P. Linkiana* Nees, Linnaea **6:** 471–472. 1831; *P. angulata* L., var. *Linkiana* (Nees) Gray, Proc. Amer. Acad. Arts and Sciences **10:** 64. 1875.

Leaves ovate to ovate-lanceolate; corolla usually 6–10 mm. long; flowering calyx usually 4–5 mm. long with calyx lobes 2–2.5 mm. long; flowering peduncles usually 5–15 mm. long; fruiting calyx on peduncles usually 20–30 mm. long, shorter than to equalling the length of the fruiting calyx.

Variety *angulata* grows in open woods, pastures, ditches, fields, and various disturbed habitats in the extreme eastern states, and in the southeastern states as far west as eastern Oklahoma and Texas; it flowers from May to September.

Selected from 104 sheets of 77 collections: Alabama: Coosa Co.: *Pollard* and *Ball 263* (GH, NY); Lee Co.: *Earle* and *Baker* Aug. 11, 1897 (NY); Tuscaloosa Co.: *Pollard* and *Maxon 330* (MICH, NY); Arkansas: Arkansas Co.: *Moore 32748* (OKLA, UARK); Ashley Co.: *Demaree 16362* (NY); Chicot Co.: *Demaree 18567* (ARIZ, NY); Hempstead Co.: *Buckholz 388* (UARK); Jefferson Co.: *Demaree 13987* (NY); Pulaski Co.: *Merrill 672* (UARK); Connecticut: Hartford Co.: *Bissell* Aug. 19, 1904 (GH); Delaware: *Commons* Aug. 15, 1877; Florida: Collier Co.: *Moldenke 5761* (NY); Columbia Co.: *Straub 36* (GH); Duval Co.: *Curtiss 5737* (GH, NY, UC); Gadsden Co.: *Berg* (NY); Gulf Co.: *Chapman 4345* (GH, NY); Hillsborough Co.: *Deam 2746* (GH); Lake Co.: *Nash 1052* (GH, MICH, UC); Lee Co.: *Hitchcock 238* (GH, NY); Leon Co.: *Godfrey 52385* (DUKE); Pinellas Co.: *Deam 2905* (GH); Polk Co.: *McFarlin 6569* (MICH); Volusia Co.: *Hood 9* (GH); Georgia: Decatur Co.: *Thorne 4629* (GH); De Kalb Co.: *Small* Sept. 11, 1894 (NY); McDuffie Co.: *Bartlett 1662* (MICH); Louisiana: Baton Rouge Parish: *Chamblis 17* (NY); *Correll 9567* (DUKE, GH, NY); Tangipahoa Parish: *Correll 9240* (DUKE); Mississippi: Harrison Co.: *Tracy 6476* (GH, NY); Jackson Co.: *Pollard 1123* (GH, NY); New Jersey: Brunswick Co.: *Godfrey 10083* (TEX); Camden Co.: *Beringer* Sept. 1891 (MICH); North Carolina: Moore Co.: *Oosting 34777* (DUKE, PH); New Hanover Co.: *Williamson* Sept. 1, 1900 (NY, PH); Wilson Co.: *Randolph* and *Randolph* July 7, 1922 (GH); Oklahoma: Delaware Co.: *Wallis 2728* (OKLA); Oklahoma Co.: *Waterfall 2349* (OKL); Pottawatomie Co.: *Barkley 395* (OKL); South Carolina: Charleston Co.: *Moldenke 5196* (NY); in cultis Curtis (GH); Texas: Angelina Co.: *Cory 10665* (GH); Brazos Co.: *Parks* Dec. 1, 1946 (TEX); Gonzales Co.: *Tharp* Nov. 23, 1935 (MICH); Harris Co.: *Boon 481* (TEX); Houston Co.: *Cory 26121* (GH); Jefferson Co.: *Tharp* Sept. 9, 1937 (TEX); Wood Co.: *Cory 57671* (COLO); Virginia: Princess Anne Co.: *Fernald* and *Long 10881* (GH); Southampton Co.: *Fernald* and *Long 13742* (GH).

15b. **P. angulata** L., var. **pendula** (Rydberg) Waterfall, comb. et stat. nov., based on *P. pendula* Rydb. in Small, Flora of the Southeastern United States 983. 1903.

Similar to var. *angulata*, but leaves sometimes narrower; flowering calyx usually 3 mm. long, sometimes 4 mm. long; with calyx lobes about 1 mm. long; flowering peduncles usually 15–40 mm. long; fruiting peduncles usually 20–40 mm. long, equalling the fruiting calyx (which is usually 20–25 mm. long) to three times its length.

TYPE: In describing this species, Rydberg did not select a type, stating that it was the taxon that he had originally called *P. lanceifolia*, or at least the part of it occurring from Illinois to Texas. He cited several collections in his treatment of the genus (1896), and from among these *F. L. Harvey 65* "central and southern Arkansas" (UARK) is selected as LECTOTYPE.

This variety grows in river valleys, bottom woods, fields and various disturbed sites, primarily in Oklahoma and Texas, but extending north to Illinois; it flowers from June through September.

Selected from 125 sheets of 104 collections: Arkansas: Conway Co.: *Moore 420449* (UARK); Garland Co.: *Demaree 20471* (NY, UC); *Harvey 65* (MICH); Little River Co.: *Moore 510682* (UARK); Prairie Co.: *Demaree 15498* (NY); Pulaski Co.: *Merill 725* (UARK); Illinois: Alexander Co.: *Palmer 16628* (PH); Cook Co.: *Umbach* Aug. 3, 1897 (MICH, NY, PH); St. Claire Co.: *Eggert* Sept. 16, 1893 (GH); Union Co.: *Vasey 1862* (GH); *Vasey* (NY); Kansas: Douglas Co.: *McGregor 607* (KANU); Geary Co.: *Hitchcock 775* (GH, NY); Linn Co.: *Rydberg* and *Imler 77* (NY); Miami Co.: *McGregor 11048* (KANU); Sedgwick Co.: *Horr 6191.1* (KANU); Louisiana: *Hale* (GH); Massachusetts: Middlesex Co.: *Perkins* Oct. 22, 1880 (NY); Missouri: Jackson Co.: *Mackenzie* May 10, 1896 (NY); Jasper Co.: *Palmer* 3093 (NY); St. Louis Co.: *Eggert* Sept. 7, 1887 (PH, UC); *Engelmann 324* (GH); Oklahoma: Alfalfa Co.: *Waterfall 9970* (OKLA); Blaine Co.: *Waterfall 2387* (OKL, UC); Cherokee Co.: *Wallis 1468, 1891* (OKLA); Creek Co.: *Bush 397* (GH); Custer Co.: *Palmer 12555* (TEX, UC); Garvin Co.: *Andrews 133* (OKL); Logan Co.: *Smith 889* (OKL); Murray Co.: *Robbins 2729* (OKL); Muskogee Co.: *Little 188* (OKL); Oklahoma Co.: *Waterfall 2091* (OKLA, GH); Osage Co.: *Stevens 2115* (GH, NY, OKL, OKLA); Payne Co.: *Coryell 388, 596* (OKLA); Pittsburg Co.: *McClary 66* (OKL); Pontotoc Co.: *McCoy 852, 1267, 1915* (OKLA); Pottawatomie Co.: *Van Vleet* July 12, 1905 (OKL); Texas: Bexar Co.: *Metz 64* (NY, UC); Bowie Co.: *Plank* May 9, 1891 (NY); Brazos Co.: *Reeves 62* (GH); Calhoun Co.: *Gentry 49* (TEX, LIL); Colorado Co.: *Bush 333* (GH, NY); Dallas Co.: *Hall 504* (GH, NY); DeWitt Co.: *Riedel* Aug. 3, 1941 (TEX); Harris Co.: *Boon* June 22, 1943 (TEX); Jackson Co.: *Tharp* Aug. 8, 1941 (TEX); Lamar Co.: *Strandtman 10* (TEX); McLennan Co.: *York 46232* (OKL, TEX); Refugio Co.: *Tharp* Dec. 4, 1928 (TEX); San Patricio Co.: *Cory 45389* (GH); Tarrant Co.: *Ruth 1242* (NY); Titus Co.: *Jones 10* (TEX); Travis Co.: *Tharp 1717* (TEX); Washington Co.: *Brackett* July 15, 1938 (GH, TEX).

15c. **P. angulata** L., var. **lanceifolia** (Nees) Waterfall, comb. et stat. nov., based on *P. lanceifolia* Nees, Linnaea **6**: 473. 1831.

Similar to var. *pendula*, but leaves lanceolate to linear-lanceolate, and corolla usually only 4–5 mm. long; anthers often only 1–1.5 mm. long.

TYPE: No collections were cited by Nees who said "Habitat in Peruvia

(Ruiz et Pavon); in Mexico (Herb. Hort. Reg. Ber.)". A Neotype should be selected, but preferably after a study of Peruvian and Mexican material. Specimens cited below appear to be similar to a number of Mexican collections seen by the author.

Variety *lanceifolia* grows in wet areas, river valleys, fields and other disturbed habitats in California, Arizona, New Mexico and to a lesser extent in Texas and southern Oklahoma, often being atypical in the latter two states, probably due to gene interchange with var. *pendula*; a few Florida collections are also referred here; it flowers usually in June to September, or as late as November in the warmer parts of its range.

Selected from 64 sheets of 41 collections: Arizona: Cochise Co.: *Thornber 2627* (GH), put here because the anthers are only about 1 mm. long, even though the leaves are broad; Pima Co.: *Pringle* Aug. 5, and Sept. 5, 1884 (NY, PH, UC); Pinal Co.: *Kearney 15067* (ARIZ); Yuma Co.: *Schott 2* (NY); California: Butte Co.: *Heller 13355* (GH); Fresno Co.: *Bacigalupi*, *Ferris* and *Wiggins 2488* (GH, NY, UC); Imperial Co.: *Parish 8337* (GH); Los Angeles Co.: *Wheeler 965* (UC); Merced Co.: *Hoover 1599* (UC); San Diego Co.: *Spencer 1014* (GH); Stanislaus Co.: *Hoover 2442* (UC); Tulare Co.: *Michener* and *Bioletti 1893* (NY); Florida: Dade Co.: *Small* and *Carter 649* (NY, PH); Kevy Co.: *Small*, *Small* and *DeWinkeler 10036* (NY); Monroe Co.: *Eyles 8213* (GH, OKL); New Mexico: Dona Ana Co.: *Archer 489* (MICH); *Kearney* and *Peebles 15073* (ARIZ); Oklahoma: McCurtain Co.: *Waterfall 7604* (OKL, OKLA); Oklahoma Co.: *Waterfall 2893*, near var. *pendula* (OKL); Payne Co.: *James 37* (OKLA); Texas: Brewster Co.: *Cory 31275* (GH); Cameron Co.: *Runyon 4243* (TEX); Llano Co.: *Bray 10* (NY); Presidio Co.: *Warnock T164* (GH, TEX); Refugio Co.: *Tharp* Sept. 7, 1929 (TEX); Travis Co.: *Tharp*, *Warnock* and *Barkley* Nov. 31, 1945, atypical material, perhaps intermediate with var. *pendula* (COLO, DUKE, GH, NY, OKL, OKLA, UARK, UC).

16. **Physalis pubescens** Linnaeus, Species Plantarum **1**: 183. 1753. Synonymy listed under the varieties.

Plants annual, 15–60 cm. tall, villous or viscid-villous vestite, sometimes with granular glands, sometimes glabrate; blades of principal leaves usually 3–10 cm. long, narrowly to broadly ovate, on petioles half as long to about equal them in length; margins of the leaves toothed to entire; corolla 6–10 mm. long, yellow with 5 prominent dark spots on the limb near its base; anthers 1.5–2 (2.4) mm. long, blue; flowering calyx 4–7 mm. long, its lobes 2–4 mm. long; flowering peduncles 3–12 mm. long; fruiting calyx 2–4 cm. long and 1.5–2.5 cm. wide, 5 angled, on peduncles 5–20 mm. long.

16a. **P. pubescens** L., var. **pubescens.** *P. turbinata* Medicus, Academia Theodora-palatina **4**: 188–192. 1780; *P. barbadensis* Jacquin, Miscellanea Austriaca Sive Plantarum Selectarum 360. 1781; *P. obscura*, var. *viscido-pubescens* Michx., Flora Boreali-Americana **1**: 149. 1803; *Alicabon barbadense* (Jacq.) Rafinesque, Sylva Telluriana 56–57. 1838; *P. viscido-pubescens* (Michx.) Dunal, in DeCandolle's Prodromus **13**(1): 442. 1852; *P. floridana* Rydberg, in Small, Flora of the Southeastern United States 983. 1903.

Plants more or less villous; leaf blades usually with 5–8 teeth on each side, usually not translucent; flowering peduncles 3–7 mm. long; fruiting calyces 2–3 cm. long on peduncles usually 5–9 mm. long.

TYPE: "In India utraque." A photograph of the type is in the Arnold Arboretum's collection of photographs of specimens in the Linnaean Herbarium, London.

Variety *pubescens* grows in swamps, margins of lakes, sand dunes, brush, fields and other disturbed habitats, primarily from Florida to Texas in our area; it flowers from May through November. It is a widespread pantropical taxon.

Selected from 81 sheets of collections: FLORIDA: Broward Co.: *Moldenke 480* (NY); Dade Co.: *Small* and *Small 4632* (DUKE, NY); Franklin Co.: *Chapman 3055b* (GH, NY); Highlands Co.: *Moldenke 5417* (NY); Hillsboro Co.: *Churchill* March 28, 1936 (GH); Lake Co.: *Nash* 1251 (GH, MICH, NY, UC, PH); Lee Co.: *Tracy 7612* (GH, NY); Monroe Co.: *Killip 41456* (NY, UC); Pinellas Co.: *Williams* Mar. 12, 1926 (DUKE); Polk Co.: *McFarlin 5924* (MICH); St. Lucie Co.: *Small 8507* (GH, NY); ILLINOIS: Jackson Co.: *Vasey* (GH); LOUISIANA: *Hale* (GH); TEXAS: Bexar Co.: *Metz 771* (MICH); Brazos Co.: *Moncreif 1476* (TEX); Gonzales Co.: *Tharp* Aug. 12, 1940 (TEX); Harris Co.: *Fisher* Oct. 9, 1917 (UC); Hidalgo Co.: *Walker 8* (GH, TEX); Jackson Co.: *Warnock 105* (TEX); Jefferson Co.: *Tharp* Sept. 10, 1937 (GH, TEX); McLennan Co.: *Smith 59* (TEX); Newton Co.: *Tharp 52141* (GH); Nueces Co.: *Tharp* and *Brown 48–165* (TEX); Travis Co.: *Tharp* Nov. 8, 1929 (GH, OKLA, TEX); Willacy Co.: *Johnston 542221* (TEX); Williamson Co.: *Wolcott 314* (TEX).

16b. **P. pubescens** L., var. **glabra** (Michx.) Waterfall, comb. nov., based on *P. obscura* Michx., var. *glabra* Michx. Flora Boreali-Americana **1:** 149. 1803. *P. obscura* Michx., *l.c. P. hirsuta* Dunal, var. *repando-dentata* Dunal, in DeCandolle's Prodromus **13**(1): 445. 1852; *P. barbadensis* Jacq., var. *obscura* (Michx.) Rydb., Mem. Torr. Bot. Club **4:** 327. 1896; *P. barbadensis* Jacq., var. *glabra* (Michx.) Fernald, RHODORA **51:** 82. 1949.

When Michaux described *P. obscura* he immediately divided it into two varieties, var. *glabra* and var. *viscido-pubescens*. The present author interprets var. *glabra* as being the "typical" variety.

This material has been referred recently, by some American authors, to *P. turbinata* Medicus, Academia Theodora-palatina **4:** 188–192. 1780. However, in describing this species Medicus says "Die Hauptstamme und nebenaste sind vierkandigt, haarich und rotlich violet-braun." One might dismiss the reddish violet-brown color, as either not necessarily being a characteristic of the whole taxon, or as possibly not being retained in herbarium specimens, but it seems dubious if the term "hairy" would be used to describe nearly glabrous, or slightly puberulent specimens. It seems that the taxon described by Medicus, at least as the name has been applied in our flora, is more likely referable to var. *pubescens*.

Plants glabrous or sparingly puberulent, but not villous as in the other varieties; blades of the principal leaves usually 2–7 cm. long, ovate, often rather broadly so, acuminate in many specimens; margins of the leaves irregularly toothed, sometimes saliently so; petioles about equalling the blades in length; anthers 1.8–2.4 mm. long, bluish; flowering calyx 5–7 mm. long with narrow lanceolate-acuminate lobes 2.5–4 mm. long; flowering peduncles 5–12 mm. long; fruiting calyx 3–4 cm. long, ovate or broader in outline, often acuminate at the apex, on peduncles 1–2 cm. long.

TYPE: In the Herbarium of Michaux, Mus. Hist. Nat., Paris; photograph in the Gray Herbarium.

Variety *glabra* grows in open woods, creek sides, valleys, yards and other disturbed habitats, mostly in southeastern coastal states from North Carolina to Texas, and inland in Arkansas and Missouri; it usually flowers from July through October.

Selected from 47 sheets of 34 collections: Alabama: Crenshaw Co.: *Reed 2103* (TEX); Mobile Co.: *Mohr* Aug. 1883 (MICH); Arkansas: Drew Co.: *Demaree 16498* (NY); Fulton Co.: *Bush 961* (NY); Hot Springs Co.: *Demaree 19471* (NY); Logan Co.: *Palmer 24209* (UARK); Saline Co.: *Moore 53–311* (UARK); Florida: Dade Co.: *Tatnell 620* (PH); Gadsden Co.: *Curtiss 5896* (GH, UC); Georgia: Calhoun Co.: *Thorne 7338* (GH); California: San Diego Co.: *Jones* March 1882 (PH); Louisiana: Calcasieu Parish: *Correll* and *Correll 9566* (DUKE, GH, NY, PH); Natchitoches Parish: *Palmer 8777* (PH); Vermilion Parish: *Tharp* July 27, 1929 (TEX); Mississippi: Oktibbeha Co.: *Pollard 1338* (GH); Missouri: Barry Co.: *Bush 547* (NY); Butler Co.: *Eggert* July 1893 (NY, UC); Madrid Co.: *Bush 189* (GH, NY); North Carolina: *Curtis* (GH); Pennsylvania: Bucks Co.: *Moyer* (PH); Texas: Bowie Co.: *Heller* and *Heller 4253* (GH, NY, PH); Harris Co.: *Hall 503* (GH, NY); Newton Co.: *Tharp 42–141* (GH, TEX); Orange Co.: *Tharp 2518* (TEX); Rusk Co.: *Reverchon 3239* (NY).

16c. **P. pubescens** L., var. **integrifolia** (Dunal) Waterfall, comb. nov., based on *P. hirsuta* Dunal, var. *integrifolia* Dunal, in DeCandolle, Prodromus 13(1): 445. 1852.

Plants more or less villous; leaf blades often entire, sometimes 3–4 (rarely more) more or less prominent teeth on each side, translucent or semitransparent; fruiting calyx 2–3 cm. long on peduncles 5–9 mm. long.

Included here are the plants, primarily of the northeastern United States, which have been referred to *P. pubescens* by recent American authors.

TYPE: "Physalis, n. 30, un. itin., Frank e sylvaticis agri Cincinnati civ. Ohio," presumably in the De Candolle collection in the Conservatoire et Jardin Botaniques, Genève, Switzerland.

Variety *integrifolia* grows on creek banks, lake shores, woods, hills and various disturbed habitats, mostly from Pennsylvania to Iowa and south to Florida and south central Texas, but also in southern New Mexico, Arizona and California; it is less frequent in southeastern United States than var. *pubescens*.

Selected from 166 sheets of 132 collections: Alabama: Jefferson Co.: *Karle* June 18, 1899 (NY); Tuscaloosa Co.: *Pollard* and *Maxon 331* (GH); Arizona: Pima Co.: *Toumey* Aug. 30, 1895 (UC); Arkansas: Baxter Co.: *Moore 510540* (OKLA, UARK); Clay Co.: *Demaree 20311* (OKLA, NY, UC); Crawford Co.: *Demaree 15300* (NY); Garland Co.: *Demaree 16190, 21841, 20422* (NY); Newton Co.: *Moore 430237* (OKLA, UARK); Perry Co.: *Demaree 20168* (NY); Polk Co.: *Moore* and *Williams* Aug. 15, 1951 (UARK); Pulaski Co.: *Demaree 16640* (NY); Sevier Co.: *Demaree 9913* (NY, UC); Union Co.: *French 500150* (UARK); Washington Co.: *Giles 429* (UARK); Yell Co.: *Demaree 20109* (NY); California: Colusa Co.: *Stinchfield 460* (NY); Imperial Co.: *Thomas* (GH, NY); Lake Co.: *Baker 11226* (UC); San Diego Co.: *Orcutt* Mar. 6, 1883 (MICH); Tulare Co.: *Congdon* Oct. 8, 1881 (UC); Florida: Dade Co.: *Small* and *Moiser 5902* (GH, NY); Leon Co.: *Godfrey 52473* (DUKE); ILLINOIS: Adams Co.: *Seymour* Sept. 26, 1876 (DUKE); Massac Co.: *Gleason 2630* (GH); INDIANA: Grant Co.: *Deam 15287* (NY); Lawrence Co.: *Kriebel 2564* (DUKE); Putman Co.: *Banker 1499* (NY); Tippecanoe Co.: *Boot* Oct. 6, 1895 (GH); Whitely Co.: *Friesener 16539* (GH, NY); KANSAS: Riley Co.: *Norton 366* (GH, NY); KENTUCKY: Bell Co.: *Lloyd* Aug. 10, 1888 (NY); Hickman Co.: *McFarland* and *Anderson 2223* (NY); MARYLAND: Montgomery Co.: *Blanchard* Aug. 12, 1892 (NY); Worcester Co.: *Canby* Sept. 1863 (NY); MASSACHUSETTS: Suffolk Co.: *Perkins* Sept. 6, 1881 (NEBC); MISSOURI: Butler Co.: *Eggert* July 1893 (UC) on sheet with var. *obscura*; Jackson Co.: *Bush 6423* (GH, NY); Jasper Co.: *Demaree 4424* (OKLA, UARK); Moniteau Co.: *Steyermark 70814* (UARK); Newton Co.: *Palmer 32492* (NY); Osage Co.: *Jeffrey 366* (GH); Phelps Co.: *Kellogg 196* (NY, TEX, UC); St. Louis Co.: *Eggert* Aug. 14, 1891 (TEX, UC); NEW MEXICO: *Rusby 310*, Burro Mts. (GH, NY); NORTH CAROLINA: Brunswick Co.: *Blomquist 4811* (DUKE); Carteret Co.: *Lewis 234* (NY); Washington Co.: *Correll 1921* (DUKE); OHIO: *Moldenke 13543* (OKLA); Franklin Co.: *Gleason* Sept. 5, 1904 (GH); Hamilton Co.: *Lloyd 2209* (MICH); Lake Co.: *Werner 141* (GH); OKLAHOMA: Cherokee Co.: *Waterfall 9661* (OKLA); Delaware Co.: *Wallis 2732* (OKLA); Johnston Co.: *Houghton 3572½* (NY); Murray Co.: *Hopkins* and *Cross 6429* (OKL); Muskogee Co.: *Waterfall 10139* (OKLA); Ottawa Co.: *Stevens 2530* (GH, NY); Payne Co.: *Thompson 82* (OKLA); PENNSYLVANIA: Allegheny Co.: *Porter* Aug. 28, 1896 (GH, NY); SOUTH CAROLINA: Berkeley Co.: *Godfrey* and *Tryon 622* (GH, NY); TENNESSEE: Cheatham Co.: *Svenson 10395* (UC); Davidson Co.: *Svenson 9494* (GH); Hamilton Co.: *Clalmgh 101* (DUKE); TEXAS: Cameron Co.: *Johnston 542210* (TEX); Dallas Co.: *Reverchon 382* (GH); Gonzales Co.: *Tharp 51–467* (OKLA, TEX); Jackson Co.: *Warnock 105* (NY); Travis Co.: *Armor 5508* (OKLA) approaching var. *pubescens*; Willacy Co.: *Davis* and *Johnston 53256.15* (TEX); VIRGINIA: Henrico Co.: *Fernald* and *Long 12794* (GH): Isle of Wight Co.: *Fernald* and *Long 13442* (GH); James City Co.: *Fernald* and *Long 13441* (GH); Loudon Co.: *Holms* Aug. 1888 (ARIZ, NY); Nansemond Co.: *Fernald* and *Long 10810* (GH); Northampton Co.: *Canby* Sept. 1878 (NY); Page Co : *Steele* and *Steele 197* (GH, NY); Princess Anne Co.: *Fernald* and *Long 4167, 4168, 10809* (GH); WEST VIRGINIA: *Mertz* Sept. 22, 1878 (*NY*).

16d. **P. pubescens** L., var. **grisea** Waterfall, var. nov., Planta grisea, nunc villosa nunc brevipilosa, nunc glandulari-farinacea; foliis ovatis sinuato-dentatis; calycibus fructu a penduneulis 5–9 mm. longis.

Stems densely covered with long, jointed hairs, or with long and short hairs mixed, or densely short viscid-hairy; leaves usually short hairy, sometimes with granular glands, the surfaces having a greyish appearance; leaf blades ovate, coarsely and irregularly 6–9 dentate, or sinuate dentate nearly to their bases; fruiting calyces on peduncles 5–9 mm. long.

This is the taxon, primarily of the northeastern United States, that has been passing as *P. pruinosa* L. However the photograph of the type of *P. pruinosa* in the Arnold Arboretum of Harvard University shows a plant with a more prominent acumination of the leaf blade, and a much longer flowering peduncle than is found in any of our material. The author has been unable to determine the application of the name, *P. pruinosa*. He has seen no material comparable with the photograph of the type.

TYPE: *Walter Deane* Sept. 24, 1884, Cambridge, Mass. (GH; isotype: NY).

Variety *grisea* grows on mountainsides, wooded slopes, roadsides, in gardens and various disturbed habitats, principally in northeastern United States; it usually flowers in August, September and October.

Selected from 114 sheets of 102 collections: CANADA—Ontario: *Macoun 54524* (NY); UNITED STATES—Alabama: Baldwin Co.: *Dukes 118* (NY); California: Inyo Co.: *Roos* and *Roos 6221* (UC); Connecticut: New Haven Co.: *Blewitt 1381* (NEBC); Delaware: New Castle Co.: *Latnall 1882* (GH); Florida: *Chapman* (NY); Georgia: DeKalb Co.: *Small* Aug. 1–6, 1895 (NY); Illinois: DuPage Co.: *Umbach 12484* (GH); Macon Co.: *Mills* Sept. 29, 1940; Indiana: Lawrence Co.: *Kriebel 2538* (DUKE, GH); Kansas: *Imler 68* (NY); Kentucky: *Short 1840* (NY); Maine: Cumberland Co.: *Chamberlain 1127* (NEBC); Massachusetts: Barnstable Co.: *Collins 950* (NEBC); Bristol Co.: *Hervey* (NEBC); Dukes Co.: *Bicknell 7704, 7706, 7693* (NY); Essex Co.: *Morong* Aug. 1, 1868 (NY); Hampshire Co.: *Torrey* and *S.J.E.* Sept. 16, 1943 (DUKE); Middlesex Co.: *Fernald* Sept. 26, 1908 (GH); Nantucket Co.: *Flynn* July 30, 1904 (NEBC); Norfolk Co.: *Kidder* Aug. 23, 1888 (NEBC); Plymouth Co.: *Williams* Aug. 21, 1898 (NEBC); Suffolk Co.: *Young* Sept. 1878 (GH, NEBC); Worcester Co.: *Woodward 2* (GH); Michigan: St. Claire Co.: *Dodge* Aug. 25, 1906; Missouri: Barry Co.: *Bush 564, 469* (NY); Christian Co.: *Blankenship* Aug. 1, 1895 (GH); Jackson Co.: *Mackenzie 7* (MICH); Jasper Co.: *Bush 10402* (GH, NY); Taney Co.: *Bush 170* (GH); New Jersey: *Hastings* Sept. 6, 1917 (NY) foot of Palisades; New York: Chemung Co.: *Lucy 7825, 11098* (NY); Oswego Co.: *Sheldon 6008* (UC); Tompkins Co.: *Hoisington 312* (OKL); Washington Co.: *Burnham* Sept. 25, 1896 (GH); North Carolina: Granville Co.: *Godfrey 2060* (GH); Jackson Co.: *Thaxter* June–July 1887 (GH); Swain Co.: *Beardslee* and *Kofoid* Aug. 15, 1891 (GH); Oregon: Tillamook Co.: *Lloyd* Sept. 10, 1894 (NY); Pennsylvania: Bucks Co.: *Fretz* Sept. 7, 1901 (GH); Lancaster Co.: *Small* Sept. 1889 (GH); Westmoreland Co.: *Shafer* and *Medayer 182* (UC); Rhode Island: Providence Co.: *Leland* Sept. 18, 1881 (NEBC); Tennessee: Knox Co.: *Ruth 3411* (NY); Texas: De Witt Co.: *Riedel* Aug. 3, 1941 (TEX); Vermont: Bennington Co.: *Ames* May 1885 (MICH); Chittenden Co.: *Flynn 3* (GH); Rutland Co.: *Eggleston 1510* (GH, NEBC); Virginia: Bedford Co.: *Curtiss* Oct. 3, 1871 (GH); Page Co.: *Steele* and *Steele* Aug. 28, 1901 (GH, NY); Washington: Klickitat Co.: *Suksdorf 2285* (NY); Yakima Co.: *Henderson 2496* (GH).

17. **P. foetens** Poiret, var. **neomexicana** (Rydb.) Waterfall, comb. et stat. nov., based on *P. neomexicana* Rydb., Mem. Torr. Bot. Club 4: 325–326. 1895.

Plants annual, 10–60 cm. tall, usually branched; indument short (0.5–1 mm. long) and usually dense, more or less yellowish or brownish capitate-glandular; leaf blades 3–6 cm. long, ovate to oblong-ovate or lanceolate-ovate, their margins toothed, or sometimes sinuate-toothed; petioles one-half to three-fourths as long as the blades; corollas 6–7 mm. long, bluish spotted; anthers (0.3) 1–1.5 (2) mm. long, bluish, on filiform filaments; flowering calyces 3–4.5 mm. long, on peduncles usually 1.5–3 mm. long; fruiting calyces 2–3 cm. long, more or less ovate in outline, sharply 5-angled, on peduncles mostly 4–7 mm. long.

This variety differs from var. *foetens* of Mexico primarily in its shorter anther-length (2–3 mm. in var. *foetens*), usually shorter corolla (as much as 1 cm. long in some Mexican material) and in having fewer yellowish or brownish capitate glands than var. *foetens*.

TYPE: In describing *P. neomexicana*, Rydberg cited several collections, but designated none of them as type. From among those cited, *Fendler* 678 (GH) is selected as the LECTOTYPE. A second sheet of the same collection, an isolectotype, is in the same herbarium.

Variety *neomexicana* grows in the mountains, often with junipers and pines, and in adjacent areas, including cultivated fields, in New Mexico and adjacent Colorado and Arizona; it flowers in June through October.

Selected from 48 sheets of 40 collections: ARIZONA: Graham Co.: *Bohrer 409* (ARIZ); Greenlee Co.: *Gould* and *Haskell 4080* (UC); Maricopa Co.: *Rusby 310* (MICH); Navajo Co.: *Wooton* September 13, 1913 (ARIZ); Pima Co.: *Toumey* Aug. 30, 1894 (NY); Yavapai Co.: *Wilcox* Sept. 1918 (ARIZ); COLORADO: *Porter* July 1872 (PH); El Paso Co.: *Livingston 497* (DUKE); NEW MEXICO: Colfax Co.: *Standley 13869* (NY); Bernalillo Co.: *Ellis 287* (NY); Grant Co.: *Rusby* Oct. 1881 (MICH); Lincoln Co.: *Skehan 60* (GH, NY); *Wooton 633, 635* (NY); Rio Arriba Co.: *Parker* and *McClintock 6449* (ARIZ, UC); San Miguel Co.: *Standley 4920* (GH, NY), *Nelson 11568* (UC); Santa Fe Co.: *Heller* and *Heller 3803* (GH, NY); Sierra Co.: *Metcalfe 1210* (GH, NY, UC); Socorro Co.: *Metcalfe 425* (NY); Torrance Co.: *Parker* and *McClintock 6529* (NY); Socorro or Grant Co.: *Rusby 309*, Mogollon Mts. (MICH).

18. **Physalis latiphysa** Waterfall, sp. nov. Planta annua, 15–45 cm. alta, ramosa, plus minusve villosa; foliorum laminis 5–7 cm. longis, ovatis vel ovatis-rotundis, integris vel paucidentatis, acuminatis; corollis maculatis, 4–6 mm. longis; antheris coeruleis, 1.5 2 mm. longis; calycibus fructu (2.5) 3–4 cm. latis; pedunculis 1–1.5 cm. longis.

Annual, 15–45 cm. high, branched, more or less villous; blades of the principal leaves 5–7 cm. long, ovate to ovate-rotund, thin and translucent, their margins from entire to having a few teeth, acuminate; petioles 1.5–7 cm. long; corollas yellow, dark-spotted, small, 4–6 mm. long; flowering calyces 3–4 mm. long with lobes about half that long, on peduncles 3–8 mm. long; fruiting calyces sparsely appressed-hairy, strongly 5-angled, 2.5–4 cm. long and (2.5) 3–4 cm. wide; fruiting peduncles 1–1.5 cm. long; linear-subulate calyx lobes 7–10 mm. long, extending 5–7 mm. beyond the body of the inflated fruiting calyx.

TYPE: *T. H. Kearney* and *R. H. Peebles 14425*, Rondstadt Ranch, plain east of Baboquivari Mts., Pima Co., Arizona, Sept. 23, 1939. It is deposited in the Herbarium of the University of Arizona.

In addition to the type, the following collections have been seen: ARIZONA: Pima Co.: *Bartram 237* Santa Catalina Mts., east of Pima Canyon, Jan. 16, 1920 (PH); *Kearney and Peebles 10427*, Toro Canyon, Baboquivari Mts., Sept. 30, 1934 (ARIZ, MICH); *Kearney* and *Peebles 14932*, South Canyon, Baboquivari Mts., Aug. 31, 1940 (ARIZ); Santa Cruz Co.: *Harrison* and *Hope 9058*, Forty miles south of Tucson on Sasabe Road, Sept. 11, 1932 (ARIZ); *Harrison* and *Fulton 8158*, Nogales, Aug. 30, 1931 (ARIZ); County undetermined; *Harrison 9058*, Robles to San Fernando, Sept. 10, 1932 (GH, MICH); *Harrison, Kearney* and *Hope 8950* half-way from Sasabe to Robles, Aug. 21, 1932 (ARIZ); *Kearney* and *Peebles 10576*, Florida Canyon, Santa Rita Mts., Oct. 7, 1934 (ARIZ).

19. **Physalis missouriensis** Mackenzie and Bush, Trans. Acad. Sci. St. Louis **12:** 84–85. 1902.

Annual, usually branched above, villous, sometimes with shorter hairs, often somewhat viscid; principal leaf blades 2–6 cm. long, ovate to narrowly ovate, dentate to sinuately dentate, or sometimes entire; petioles one-third the length of, to nearly as long as the blades; corolla yellow, not dark spotted, 7–10 mm. long; anthers (0.6) 1–1.2 mm. long, bluish, on slender filaments; flowering calyx 3–4 mm. long, its lobes 1–2 mm. long, on peduncles 3–6 mm. long; fruiting calyx 1.5–2.5 cm. long, ovoid, on peduncles 5–10 mm. long.

This species is easily distinguished from *P. pubescens* by its unspotted corollas and its smaller anthers.

TYPE: *K. K. Mackenzie 485*, Rocky soil, Red Bridge, Jackson Co., Missouri. The type was deposited in the "Herbarium of K. K. Mackenzie." Isotypes: GH, MICH, WIS.

P. missouriensis grows in rocky woods and limestone barrens, mostly in Missouri, northeastern Kansas, western Arkansas, with two collections from adjacent Oklahoma, and one collection, dubiously referred here, from southwestern Texas; it flowers from June through October.

Collections examined: ARKANSAS: Carroll Co.: *Palmer 29310* (UARK); Hempstead Co.: *Palmer 8955* (PH); Washington Co.: *Moore 3008* (UARK); *Moore* and *Iltis 430209* (OKLA, UARK); *Giles 404* (UARK); *J. T. B. 645* White River (UARK); KANSAS: Douglas Co.: *Snow 2210* (KANU); *McGregor 9703* (KANU); Marshall Co.: *Horr 4610* (KANU); Riley Co.: *Gates 18566* (GH, TEX, UC); *Hitchcock 402* (GH); Shawnee Co.: *Volle 737* (KANU); MISSOURI: Barry Co.: *Bush 162* (OKL); Jackson Co.: *Bush* June 27, 1887 (GH), Aug. 1888 (GH, NY); *772* (GH, NY), *4079* (GH), *7334* (GH), *7695* (GH, NY), *12298* (NY), *12298A* (NY); *Mackenzie 360* (NY), Aug. 23, 1896 (GH, NY); *485* (MICH); Jefferson Co.: *Prince* July 4, 1883 (GH); Phelps Co.: *Kellogg* Oct. 22, 1913 (TEX); Platte Co.: *Bush 11804* (NY); St. Louis Co.: *Eggert* July 20, 1887 (GH), Aug. 21, 1891 (NY); *Pennell 11701* (PH); Taney Co.: *Bush 173* (GH, NY); County undetermined; *Blankenship 1893* (NY); *Nelson 5* (NY); OKLAHOMA: Muskogee Co.: *Little 2568* (OKL); Ottawa Co.: *Stevens 2351* (GH, on sheet with *Stevens 2530, P. pubescens*); TEXAS: Brewster Co.: *Cory 35570*, five and three-quarter miles east of Alpine, Sept. 19, 1940 (GH) is somewhat doubtfully referred to this taxon.

20. **Physalis Greenei** Vasey and Rose, Contr. U. S. Natl. Herb. **1**: 18. 1890; *P. pedunculata* Greene, Pittonia **1**: 268–269. 1899, non Mart. and Gal., Bull. Acad. Brux. **12**: 132. 1842.

Annuals, villous or short pilose, glandular and viscid; principal leaf blades 2–4 cm. long, ovate; petioles one-half as long as to slightly longer than the blades; leaf margins dentate to sinuate-dentate, or rarely entire; corolla 8–10 mm. long, yellowish, or sometimes with a slightly darker tinge; anthers 1.5–2.5 mm. long, yellow, on slender filaments; flowering calyx 3–4 mm. long on peduncles 15–30 mm. long; fruiting calyx 2–2.5 cm. long, pointed-ovoid, on peduncles 15–40 cm. long.

The smaller anthers of this species will serve to distinguish it, and separate it from *P. crassifolia* in those instances in which they tend to resemble each other.

TYPE: *Charles F. Pond* Feb. 1889, Cedros Island, off the coast of Lower California; "southwest side of the island" according to Greene; type and isotype (US).

P. Greenei grows on hills and sea-cliffs, southern California; it flowers in February, March and April.

Collections examined: CALIFORNIA: Orange Co.: *Abrams* June 12, 1901 (NY); *Mason 2933* (GH, UC); Placer Co.: *Jones 88* (GH); San Diego Co.: *Abrams 3309* (GH, NY, PH, UC, US); *Allen 77* (GH); *Jones* March 1882 (GH, UC); *Wiggins 1821* (UC).

21. **Physalis lobata** Torrey, Ann. Lyc. Nat. Hist. New York **2**: 226–227. 1828; *Quincula lobata* (Torr.) Rafinesque, Atlantic Journal, **1**: 145. 1832; *P. sabeana* Buckley, Proc. Acad. Sci. Phil. **14**: 6. 1863; *Chamaesaracha physaloides* Greene, Bull. Torr. Bot. Club **9**: 122. 1882; *Quincula lepidota* Aven Nelson, Bot. Gaz. **47**: 430. 1909.

Chamaesaracha physaloides is included here on the basis of Greene's phrase "flat scale-like hairs," which seems to be a good description of the appearance of the characteristic crystalline vesicles of *P. lobata* after they are dried. These structures are not found on *P. Wrightii*, the other species to which this name has been referred.

Perennial, branching from the base, the branches spreading or procumbent; indument consisting of a varying amount of crystalline vesicles, flattening when dried, which may be abundant enough to give the plant a scurfy appearance, or may be very sparse; principal leaves usually 4–10 cm. long, with blades usually 0.5–3 cm. wide, ovate-lanceolate to linear-lanceolate, cuneate at the base to a winged petiole, usually pinnatifid, rarely sinuate-toothed or entire; corollas blue or violet (rarely white), rotate, 1.5–2 cm. broad, with five hairy pads on its base near the point of attachment of the filaments and alternating with them; anthers about 1.5–2 mm. long, yellow, on slender filaments; style twisted and bent to one side; flowering calyx 3–4 mm. long, its lobes 1.5–2 mm. long, deltoid; flowering peduncle 1–3 (5) cm. long; fruiting calyx 1.5–2 cm. long, pentagonal-ovoid, inflated, on peduncles 1–2.5 (3) cm. long; seeds usually somewhat crenate on their backs.

TYPE: *James* "On the Canadian"; not seen.

P. lobata grows on plains, prairies, mesas, canyons, juniper barrens, desert areas and various disturbed habitats principally in western Kansas, Oklahoma and Texas, and eastern Colorado and New Mexico, and southern Arizona.

Three hundred forty seven sheets of 275 collections have been seen from: Arizona, California (Fremont's Expedition in 1845), Colorado, Kansas, Nevada (Clark Co.), New Mexico, Oklahoma and Texas.

A white-flowered forma is rarely found. It may be described as **P. lobata** Torr., forma **albiflora** Waterfall, f. nov., corollis albis. TYPE: *J. J. Thornber* Aug. 11, 1901, Experiment Station Range Reserve, Pima County, Arizona (ARIZ). Another collection is *B. C. Tharp* and *C. Havard 49344*, 5–6 miles west of Del Rio, Valverde Co., Texas, April 16, 1949 (TEX).

22. **Physalis Carpenteri** Riddell ex Rydberg, Mem. Torr. Bot. Club **4**: 330–331. 1896; *P. Carpenteri* Riddell, N. Orl. Med. and Surg. Journ. 759. 1852, as a *nomen nudum*; Bot. Gaz. **3**: 11. 1847 in synonymy.

Plant over two-thirds of a meter tall, widely branched; herbage short-hairy, the leaf blades sometimes nearly glabrous and the calyces sometimes with a few long hairs; principal leaf blades (3) 7–11 cm. long, ovate to lanceolate-ovate, acuminate; petioles one-third to two-thirds as long as the blades; leaf margins usually entire, sometimes repand; flowers from single to 3–6 in the axils of the leaves; the fascicled flowers apparently due to the presence of a telescoped axillary branch, sometimes 2–4 cm. long and bearing reduced leaves (*Curtiss 6901*: UC, GH, NY) as well as flowers; corolla about 1 cm. long, yellow; anthers about 2 mm. long, yellow, on slender filaments; flowering calyx 4–5 mm. long on peduncles 5–8 mm. long; fruiting calyx about 1.5 cm. in diameter, nearly spherical, only slightly inflated; fruit having 1 to several plump, rounded, corky, seed-like bodies (possibly a peculiar development of unfertilized ovules) in addition to the normal, more or less reniform, flattened seeds.

The species may be annual, according to some collectors, or from a deep-seated "rootstock" according to others; all the specimens examined were branches only.

The author prefers to leave this species in *Physalis*, regardless of its peculiar characteristics, until a more thorough study of related genera, or possible subgenera, can be made.

Collections examined: ALABAMA: *S. B. Buckley*, April (NY); FLORIDA: Columbia Co.: *Geo. V. Nash 2503*, Aug. 29–31, 1895 (GH, MICH, NY); *Erdman West*, seeds from Fort White, raised by *Margaret Young Menzel* as her *508a* (TEX); Escambia Co.: *Curtiss, 1886*, Pensacola (GH); Suwanee Co.: *A. H. Curtiss 6901*, annual 2 ft. high and widely branched, growing in a cultivated field near Wellborn, Sept. 14, 1901 (GH, NY, UC); County undetermined: *M. A. Curtis*, Florida?; LOUISIANA: East Feliciana Parish: *Riddell*, March 1878 (GH, one fruiting calyx); Orleans Parish: *Drummond* New Orleans (GH); *Ingals* in 1835, New Orleans (NY); West Feliciana Parish: *R. S. Cocks, 3603*, common in rich woods (NY).—DEPT. OF BOTANY AND PLANT PATHOLOGY AND THE RESEARCH FOUNDATION, OKLAHOMA STATE UNIVERSITY, STILLWATER, OKLAHOMA.

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Waterfall, U. T. 1950. Some Results of a Third Summer's Botanizing in Oklahoma. Rhodora **52:** 171.

× Carex Deamii in Missouri.—This interesting sedge was described by Hermann (Rhodora **40:** 81. 1938) as a hybrid between *C. Shortiana* and *C. typhina* from Pike County, Indiana. The hybrid has thicker spikes (7–8 mm. wide) and longer beaks (1–1.5 mm. long) of the perigynia than are found in *C. Shortiana.*

It may now be recorded from Missouri on the basis of the following three collections, all in the herbarium of the Chicago Natural History Museum: Allenton, St. Louis Co., July 30, 1887, *G. W. Letterman* (specimen on right hand side of sheet); swaley margin of shallow sinkhole pond on wooded upland, T 23 N, R 8 W, west part of sect. 15, 4 mi. south of West Plains, Howell Co., June 25, 1955, *Steyermark 78724*; low wet woods in valley of Old Chariton River and bordering New Chariton River where swamp existed but is obliterated, T 62 N, R 16 W, SW 1/8 sect. 27, 2¼ mi. south of Youngstown, Adair Co., Sept. 19, 1955, *Steyermark 79705.* At the last locality both *C. squarrosa* and *C. typhina* were present, but at the Howell County locality only one of the putative parents, *C. Shortiana*, assigned by Hermann, was present, represented by *Steyermark 78725.* Instead of *C. typhina*, the other putative parent assigned by Hermann, there was present *C. squarrosa*, represented by *Steyermark 78723.* It is interesting, therefore, to record a different putative parent at the Missouri locality, i.e., *C. squarrosa*, rather than the one found by Hermann at the Indiana station for × *C. Deamii.*

As this hybrid eventually becomes collected elsewhere, it will be interesting to learn which of the putative parents predominate. The morphological distinctions effected by the hybridization of *C. typhina* and *C. Shortiana* apparently cannot be differentiated from those effected by the union of *C. squarrosa* and *C. Shortiana.* While admittedly *C. squarrosa* and *C. typhina* are related species, separated chiefly by the spreading-divaricate vs. ascending beaks of the perigynia, one would expect some marked differences between the hybrids resulting from crosses of each one of these species with *C. Shortiana.*—Julian A. Steyermark, chicago natural history museum and missouri botanical garden.

An Albino Form of Dipsacus sylvestris.—While botanizing an undeveloped section of Mt. Hope Cemetery in Chicago, Mr. Karl E. Bartel discovered a colony of over fifty plants of a white-flowered *Dipsacus sylvestris.* Over one hundred heads of flowers were counted. Only one stunted lavender-flowered plant was noted in the group.

Since most other white-flowered plants are recognized with a formal name, it is consistent to provide a name for the present white-flowered teasel.

Dipsacus sylvestris Huds., f. **albidus** Steyerm., forma nova. A forma *sylvestris* recedit corollis albidis.—Illinois: Mt. Hope Cemetery, 115th St., Chicago, Cook Co., Aug. 25, 1957, *Karl E. Bartel 1*, HOLOTYPE, in Herb. Chi. Nat. Hist. Mus.—JULIAN A. STEYERMARK, CHICAGO NATURAL HISTORY MUSEUM AND MISSOURI BOTANICAL GARDEN

TWO NEW STATIONS FOR CAREX PICTA. This rare sedge of anomalous structure was discovered more than a century ago near New Orleans by Drummond. Since then it has been detected in Winston County, Alabama, and in five adjacent counties in south-central Alabama. These are the only stations reported by Mackenzie in North American Flora (1935): if other stations in the southern states have been discovered in the last twenty years they are at present unknown to me. Few sedges have such a disjunct distribution, and these three widely separate areas suggest the possibility of its occurrence in suitable localities in Kentucky, Tennessee, and Mississippi.

Carex picta steud. was collected March 18, 1955, by a stream in woods near Meridian, Lauderdale County, Mississippi, by G. R. Cooley, A. S. Pease, and James D. Ray, Jr., number 3178. On March 29, 1956, Cooley and Ray collected it again in a wooded ravine opening into Tanyard Branch, north of Cross Road, Tishomingo County, Mississippi. These two stations are about 175 miles apart, while the second one is about 75 miles northwest of the known Alabama station. Specimens will be deposited at the Gray Herbarium, the New York Botanical Garden, and Mississippi State College.

The plant blooms early and must be very conspicuous at that time, due to its large clavate spikes with deep red scales. It is one of the few sedges which can be identified without perigynia. The plants are strictly dioecious and each flowering culm bears a single spike. The basal scale of the spike is somewhat elongate and almost completely surrounds the rachis.—H. A. GLEASON, GREENWICH, CONN.

A New Bryophyte Flora[1]. With this publication, A. LeRoy Andrews has filled a long existing lacuna in both bryology and plant geography. The work is to bryologists, what the FLORA OF THE CAYUGA LAKE BASIN, NEW YORK, by K. M. Wiegand and A. J. Eames is to students of the vascular plants.

Begun by the author in 1908, the publication under review represents a thorough survey of a relatively small, but botanically important area. Dr. Andrews has collected most of the species found in the region by such botanists as Atkinson, Brewer, Brown, Cipperly, Dudley, Durand, Graham, Jackson, Kellerman, Nanz, Pratt, Rowlee, Schuster, Whetzel, Wiegand, and Winne. Several species not previously reported from the area have been found by the author and are treated in this flora. Only specimens actually seen by Dr. Andrews are definitely cited; any others are listed as "reported."

Since Wiegand and Eames, in their previously mentioned work, described the geological and physiographical features of the region in considerable detail, these matters are given brief treatment.

The distribution and local site of each species is given as well as the names of collectors and dates of collection.

In the matter of nomenclature, Dr. Andrews begins with Linnaeus' SPECIES PLANTARUM of 1753 and observes the rule of priority "with some concessions in doubtful instances and no unfamiliar names."

The keys, which should be of considerable help to students of New England bryophytes, are of excellent quality—brief and concise. A list of references pertaining to the bryophytes of the region is given. This work, a valuable piece of research, should be in the library of all readers of Rhodora, bryologists, and students of plant geography.—Frank J. Hilferty, DEPARTMENT OF BIOLOGICAL SCIENCES, MASSACHUSETTS STATE TEACHERS COLLEGE, BRIDGEWATER, MASS.

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[1] THE BRYOPHYTE FLORA OF THE UPPER CAYUGA LAKE BASIN, NEW YORK by A. LeRoy Andrews, Professor Emeritus of German and Honorary Curator of the Bryological Collections of the Wiegand Herbarium, at Cornell University. Cornell University Experiment Station, Cornell University, Ithaca, New York, 1957; 87 pp.

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PERENNIAL RAGWEEDS (AMBROSIA) IN MICHIGAN, WITH THE DESCRIPTION OF A NEW, INTERMEDIATE TAXON

W. H. WAGNER, JR. AND T. F. BEALS[1]

Michigan is a key state for the study of the eastern spread of *Ambrosia coronopifolia* Torrey & Gray, the so-called "western ragweed." Present evidence indicates that what is generally called the "western ragweed," and usually identified as *A. psilostachya* DeCandolle in the literature of allergy and in many botanical manuals, comprises actually a series of closely related but more or less distinguishable types which, for the purposes of this report, will tentatively be treated as species, as was done by Rydberg in 1922. These taxa differ from each other in characters of hairiness, plant habit, distribution, shape of fruit, pollen size, and other characters, although the differences may be in statistical trends. The true or entirely typical *A. psilostachya* apparently does not grow in the central United States. The easternmost outlier of the complex, which is *A. coronopifolia*, is the sole species of ragweed in the central states known to be perennial, i.e., to have underground vegetative reproduction. The investigation to be reported here grew mostly out of our curiosity as to what importance the perennial ragweeds have in forming the ragweed populations in Michigan. We have succeeded in adding a large number of new records to the known range of perennial ragweeds in this state and have compiled considerable new information concerning them.

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[1] Publication No. 5 on *Atmospheric Pollution by Aeroallergens* under research grant No. E-1379 (C) from the National Institute of Allergy and Infectious Diseases, Public Health Service.

Ambrosia coronopifolia is the least abundant generally of the three ragweeds (*A. artemisiifolia, A. coronopifolia,* and *A. trifida*) heretofore known in Michigan (Lovell, Mathews, and Sheldon, 1953). It has been reported to be "rare or absent" in the Upper Peninsula of Michigan, and "found occasionally to frequently" in the Lower Peninsula (Buchholtz et al., 1954). There is a question whether the species is native to Michigan at all, and this problem will be considered in some detail below. One of the peculiarities of perennial ragweeds which has been reported earlier is that the period of pollen production differs from that of *A. artemisiifolia* (syn. *A. elatior*), the "common" or "low ragweed," and we attempted to determine whether this was true of the populations in Michigan. We also endeavored to determine in the field whether there were any circumstances indicating differences in ecological responses between the two species.

Quite early in the study it became apparent that the natural variation of *Ambrosia coronopifolia* is fairly extensive; but as more and more populations were examined it turned out that not all the perennial ragweeds in Michigan belong to this species. On the contrary, a perennial species was found to be present that resembled both *A. coronopifolia* and the annual *A. artemisiifolia.* Such a plant, so far as we can determine, has not been described previously. The new ragweed has proved to occur over a large area, with stations in a number of counties; and it has also proved to be able to spread and form extensive populations in a given locality. The discovery of this new form generated comparative field and laboratory studies on all three of these ragweeds, in terms of their vegetative characteristics, their chromosomes, pollen grains, and fruits.

This investigation was carried out by the senior author in the years 1956 and 1957. He was joined by the junior author in the summer of 1957, and the latter added a large number of chromosome and spore studies. We are indebted for assistance to various people, especially J. M. Sheldon and E. W. Hewson, directors of the Project on Atmospheric Pollution, for stimulating this study to be made; Mrs. D. A. Beals, for collecting California ragweeds for comparison; H. H. Bartlett, for the latin diagnosis; R. W. Hanlin, for help on measurements; E. G. Voss, for aid on historical matters; K. L. Jones, for his reading of the manuscript; and the curators of the following herbaria for lending specimens and looking up records: New York Botanical Garden, Michigan State University, University of Michigan, University of Minnesota, University of California (Berkeley), U. S. National Herbarium, and the Gray Herbarium. This report will deal with *Ambrosia coronopifolia* first, and will follow with a discussion of the new, intermediate species.

OCCURRENCE: *Ambrosia coronopifolia* is capable of forming very large populations locally. Because the reproduction takes place largely by vegetative means[2], a given area may be populated by the derivatives of only one or a few original mother plants. "Pure cultures" of a given variant may be distributed over hundreds of square yards, but they are clonal and represent offshoots of a single plant. Usually the spatial distribution of a given clone can be readily recognized because of subtle differences of color, hairiness, size, and shape between the individuals of different clones. Two or more different clones may intermingle more or less intimately but their members remain completely distinguishable. In Mecosta County, for example, numerous plants of a fruiting form with a bright-green color were found completely intermixed with a nearly sterile form with a dull-green color.

The environments in which perennial ragweeds thrive in Michigan are apparently always disturbed sites, the disturbance mostly of artificial nature. The annual species, *A. artemisiifolia*, also grows in such habitats; and where the perennial species occurs, the annual one is almost always near by. The latter is usually unable, however, to invade grassy fields. The annual ragweed is generally confined to open soil, but the perennial species will readily invade adjacent grassy fields and grow competitively with fairly dense field vegetation. In this connection, one of the most interesting occurrences of *A. coronopifolia* and *A. artemisiifolia* growing together was observed on the outskirts of Gaylord, Otsego County; here both species were scattered abundantly along the roadsides, but *A. coronopifolia*

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[2] The underground axes of the perennial ragweeds are commonly referred to as "rootstocks" or "rhizomes," but this does not seem to be accurate. The reproductive organs appear to be roots anatomically rather than stems (as was correctly given by Fernald, 1950), and it is hoped that a detailed report on the process of reproduction will be published in the future.

had spread over some sixty square yards of a large, mowed, private lawn, and its pale-green foliage was very conspicuous even though its shoots had been cut to the level of the grass. Only a few, scattered plants of *A. artemisiifolia* were seen in this lawn.

In behavior *A. coronopifolia* is decidedly "weedy" in Michigan, as noted by the earliest writers who mentioned the species in the state. Of the state's collections on which environmental data are recorded, about one-sixth specify that the habitat was along railroads, and one-third say "along roads" or "along highways." Over two-thirds of the collections came from about cities, villages, and settlements. The species can become a locally serious weed in yards and gardens (e.g., around the Interlochen R. R. Station area, and on the outskirts of Frederic and Gaylord). Because of its tendency to form large and dense clones it could provide a local hayfever problem, especially in the weeks before the annual species comes into flower, as will be discussed below.

The soil in which *A. coronopifolia* grows is ordinarily dry, very well drained, and commonly sandy or gravelly. Nearly one-third of the labels on Michigan herbarium specimens use the words "sandy" or "gravelly." The habitats that are found away from roadsides and railway lines are generally clearings, "deserts," open pastures, mowed fields, grass-covered hills, baseball diamonds, and waste ground and dumps. The species evidently can not withstand any great degree of shading; when in wooded areas it will always be discovered on the cleared ground —along open trails, or in more or less exposed, prairie-like spots such as the open sandy and grassy hillsides in jackpine (*Pinus banksiana*) regions.

Although *A. coronopifolia* may be extremely abundant locally, the species must be rated as only frequent to uncommon taking the state in its entirety. In the northern part of the state, i.e., the northern half of the lower peninsula and all of the upper peninsula, it may be found readily by driving along roads and highways, but this impression is misleading with respect to the state flora as a whole, because it is exactly those places where one is likely to drive where the species is most surely to be found. *Ambrosia artemisiifolia* is infinitely more common in the state as a whole. The giant ragweed, *A. trifida,* is locally frequent to common in the southern half of Michigan, but it becomes very rare in most of northern Michigan except around certain towns. Thus, where *A. coronopifolia* is the most common, *A. trifida* is usually rare or absent. In our field surveys, all three species of ragweeds were found growing together only at Cheboygan, Cheboygan Co., and Marquette, Marquette Co., in weedy city lots. *Ambrosia trifida* was considerably less common at these two places than the other ragweeds.

There seems to be a question whether *A. coronopifolia* was originally indigenous in Michigan or not. Fernald (1950) gave the range of this plant (as *A. psilostachya* var. *coronopifolia*) as "Mich. to Sask. and Mont., s. to La., Tex., and Mex.; adv. e. to Quebec, N.S. and N.E." On the contrary, Cronquist in Gleason (1952) circumscribed the range (of *A. psilostachya*) as "Ill. to La., w. to Sask., Ida., Cal., and n. Mexico; introduced eastward," and thus left Michigan out of its presumed original range.

Today *A. coronopifolia* is widespread in Michigan and it has been recorded from forty-three counties, as shown in Figure 1, A. The species extends across the Upper Peninsula down to the middle of the Lower Peninsula. Further southward, i.e., in the bottom half of the Lower Peninsula, the species is frequent only in the western or Lake Michigan side of the state. It is exceedingly rare in the southeastern quarter of the Lower Peninsula at the present time, and we have not succeeded in finding any populations; there is only one record from this part of Michigan.

The earliest definite record of this species in Michigan known to us was in the year 1900, and there are apparently no prior collections[3]. The first mention of perennial ragweeds in the state was in a list published by Daniels (1904) of plants found at Manistee, Manistee Co., that had not been included in Michigan

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[3] That it might have been collected as early as September, 1831, by Douglass Houghton, was suspected because of two herbarium sheets so dated and labelled "Fox River of L. Michigan" (MICH). The notion was dispelled, however, by consulting H. R. Schoolcraft's description (1834) of his expedition in 1831. Schoolcraft wrote that "At Galena [Illinois] the exploring party separated, part returning in canoes up the Wisconsin, and part crossing the mine country, over the branches of the Paktolika, and by way of the Blue Mounds, to Fort Winnebago. From this point, Fox River was descended to Green Bay, and the route of the lake coast pursued northward to the straits, and to the Sault of St. Mary." Thus the "Fox River" of Houghton's 1831 collections of *A. coronopifolia* came from the river of that name in Wisconsin, south of Green Bay. It is interesting that Houghton himself (*in* Schoolcraft, op. cit.) gave the locality for various plant species of his report as "Fox River, N.W. Terr.," but did not list this species.

by previous writers. He lists the species under "Weeds" as occurring in "Yard and roadside, Maple Street, near Catholic Cemetery," and a specimen from this collection is deposited in the Michigan State University Herbarium. For the two annual species of ragweeds, *A. artemisiifolia* and *A. trifida*, there are much earlier records: *A. trifida* was taken as early as 1838 by Houghton's survey at White Pigeon, St. Joseph Co. (and there are other collections as early as 1861 and 1869). *Ambrosia artemisiifolia* was obtained in the same year, by the same survey, but in Cass County (MICH).

That *A. coronopifolia* could have been overlooked during the entire nineteenth century seems quite unlikely unless the species was exceedingly rare. Its usually large clones with their characteristic pale foliage are readily noticed in the field. *Ambrosia coronopifolia* was collected considerably earlier in the states to the west (namely Wisconsin, Illinois, South Dakota, and Minnesota) as shown by specimens in the herbaria of the University of Michigan, Michigan State University, and other institutions. Many parts of Michigan, where *A. coronopifolia* now forms a conspicuous element of the vegetation were reasonably well collected by botanists prior to 1900. The region of Douglas Lake (Emmet and Cheboygan Cos.), for example, was examined by a number of botanists during the nineteenth century (Voss, 1956), but none of them found the perennial ragweed.

In 1899, C. K. Dodge completed a flora of St. Clair Co. based on nearly twenty-five years of collecting, but in a list of 1,112 species *A. coronopifolia* was lacking. Four years later he discovered it for the first time in this county. Dodge, who was a very active observer and collector of Michigan flora, and continued his work through the early decades of the present century, evidently concluded that this species was in the process of becoming naturalized. His statements, such as "a weed noted in waste places of Marquette, Negaunee, and Ishpeming . . . becoming frequent" (1918); and "becoming established in cities and villages as a perennial weed" (1921) clearly indicate that he considered the species to be behaving as an adventive.

Professor H. H. Bartlett, another botanist of long experience with the Michigan flora, expressed his opinion recently (1952) as follows: "This is a prairie species that seems to be taking ad-

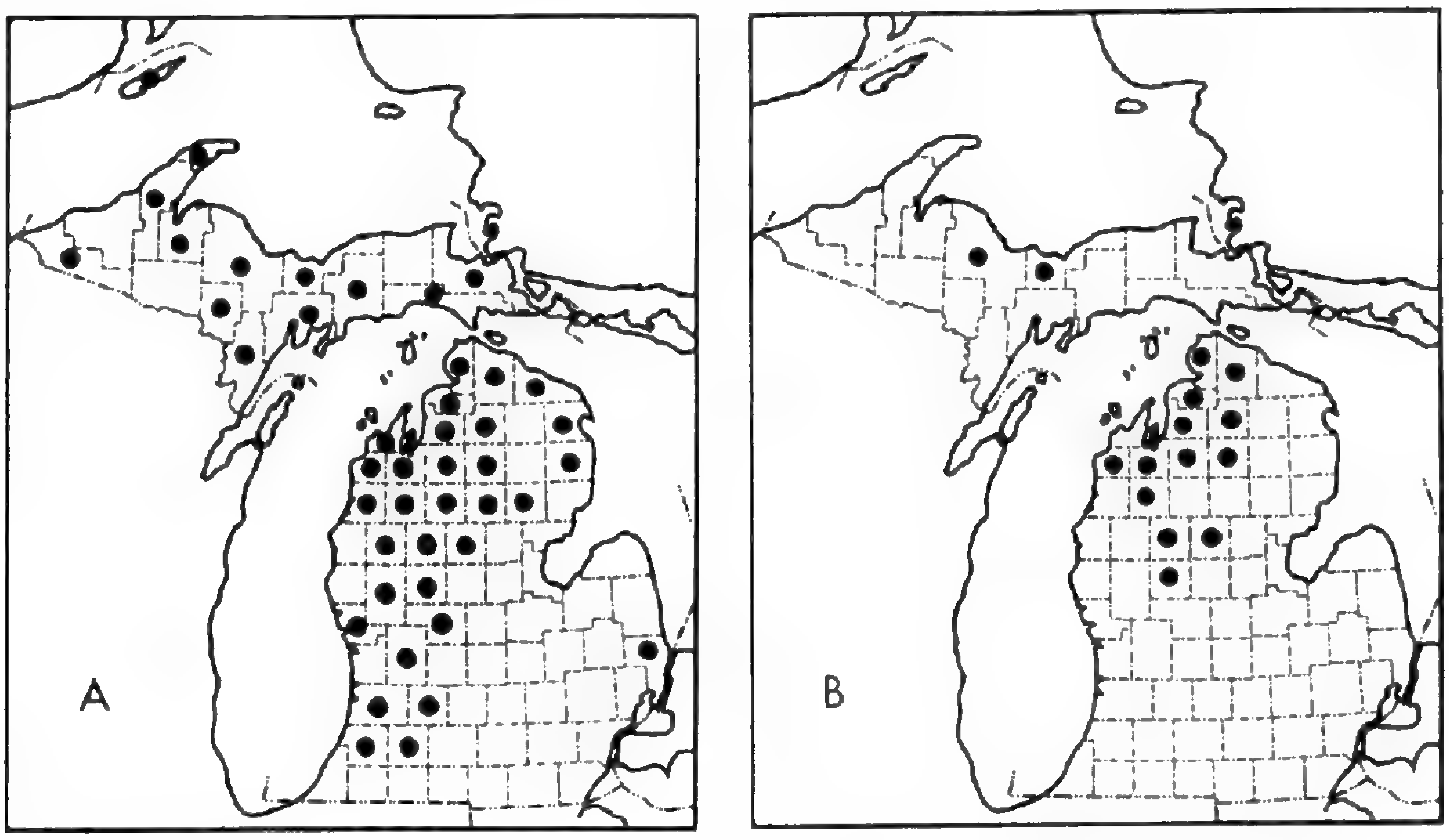

Fig. 1. County distribution maps of perennial ragweeds in Michigan: A. *Ambrosia coronopifolia*. B. *A.* × *intergradiens*. (Base maps courtesy of Cranbrook Institute of Science).

vantage of the clearing of forest and making headway in an eastern invasion fairly well to the north but not in southern Michigan." Observations by him and Dr. C. D. Richards (both botanists allergic to ragweed pollen) on a field trip to the north in 1951 indicated that "north of Gratiot County, Michigan, the amount of ordinary ragweed decreased appreciably, with resultant relief from allergic symptoms." When they reached Emmet Co., they observed that "although we had run beyond the region of greatest abundance of the ubiquitous common species, *Ambrosia artemisiifolia,* we had come into the newly extending range of another, namely *A. psilostachya* [i.e., *A. coronopifolia*]."

All that we can surmise, therefore, is that *A. coronopifolia* has spread since 1900 into a great number of localities in Michigan. It was either very rare and local, or non-existent, in the state prior to that time. It seems not unlikely that the bulk, if not all, of the present-day populations may have been introduced from further west—Minnesota, Wisconsin, and perhaps Illinois—where the species was in all likelihood native and well established. Deam (1940) considered this plant to be a rarity in nearby Indiana and to be introduced there. Moss (1956) has concluded on grounds similar to ours that another species, *A. artemisiifolia,* had been introduced into southeastern Alberta and adjacent

Saskatchewan, and he cites the fact that the earliest collection was in Saskatchewan in 1879.

Surely the development of great railroad lines and innumerable roads and villages and towns over the state of Michigan during the last century has opened the way for active invasion of *A. coronopifolia* into areas where it never before existed. In the course of its spread it has come repeatedly into contact with the abundant and weedy *A. artemisiifolia* which has itself also increased in numbers, and, where the two species have crossed, new types of perennial ragweeds have been generated which combine the characteristics of both, to be discussed below. An enumeration of present county distribution is given in the following list which contains the earliest records for *A. coronopifolia*, the years indicated in parentheses:

Alcona (1957), 1 mi. E. of Mikado, *Wagner 8482* (MICH); Alger (1957), Melstrand, *Wagner 8438* (MICH); Allegan (1950), Ely Lake, *Bazuin 8313* (MSC) also referred to by Kenoyer, 1934; Alpena (1957), Alpena, *Wagner 8483* (MICH); Antrim (1956), W. of Alba, *Wagner 8340* (MICH); Baraga (1950), N. of Baraga, *Richards 4342* (MICH); Barry (ca. 1930), reported by Bazuin, ms.; Benzie (1956), W. side of Co. 669, E. edge of Sect. 25, *Wagner 8334* (MICH); Charlevoix (1957), town of Walloon Lake, *Wagner 8434* (MICH); Cheboygan (1913), Indian Settlement, *Barnum* (UMBS); Chippewa (1935), Sugar Island, *Hermann 7235* (MSC, NY, US); Clare (1957), Meredith, R.3W, T.20N, Sect. 13, *Wagner 8513* (MICH); Crawford (1956), S. border of Frederic, *Wagner 8346* (MICH); Delta (1949), 2 mi. E. of Rapid River, *McVaugh 11170* (MICH, CRANBROOK); Dickinson (1951), 2.4 mi. W. of Norway, *Bartlett & Richards 793* (MICH); Emmet (1921), W. of Pellston, *Ehlers 1817* (MICH, UMBS); Gogebic (1919), 3 4 mi. N.E. Watersmeet, *B. & D. 2779* (MICH); Grand Traverse (1956), Interlochen, *Wagner 8336* (MICH); Houghton (1926), Calumet Water Works, *Wolff 795* (MICH); Kalamazoo (1937), 6 mi. W. of Schoolcraft, *Hanes 3827* (NY); Kalkaska (1956), M-72, just E. of Co. 597, *Wagner 8337* (MICH); Kent (ca. 1930), reported by Bazuin, ms.; Keweenaw (1910), *W. S. Cooper 274* (GH); Lake (1948), 7 mi. W. of Baldwin, *McVaugh 9797* (MICH); Leelanau (1956), E. of Empire, *Wagner 8332* (MICH); Mackinac (1913), Bois Blanc I., *C. K. Dodge* (MICH); Manistee (1900), *F. P. Daniels s. n.* (MSC); Marquette (1916–17), reported by Dodge, 1918, collected along M-28 at Marquette, *Wagner 8440*, in 1957 (MICH); Mecosta (1957), 0.3 mi. N. of Stanwood, *Wagner 8499* (MICH); Menominee (1933), *Grassl 2623* (MICH); Missaukee (1957), Lake City, *Wagner 8475* (MICH); Montcalm (1957), 2 mi. N. of junct. U.S. 131 and M-46, *Wagner 8506* (MICH); Muskegon (1949), Cedar Creek Twp., Sect. 18, *Bourdo 25* (MICH); Newaygo (1916), *Bessey & Darlington 1106* (MSC); Ogemaw (1957), West Branch, *Wagner 8480* (MICH); Osceola (1957), 3 mi. N.W. junction of M-61 and M-115, *Wagner 8500* (MICH); Otsego (1956), S. of Gaylord, *Wagner 8344*

(MICH); Presque Isle (1949), Bearinger Twp., *Marshall 857* (MSC); Roscommon (1919), N. end of Higgins Lake, *Bessey s.n.* (MSC); St. Clair (1903), Port Huron, *C. K. Dodge* (MICH); Schoolcraft (1915), reported by Dodge, 1921; Van Buren (1906), very rare, *Pepoon 944* (MSC); Wexford (1956), juncture M-115 and U.S. 131, *Wagner 8330* (MICH).

PERIODICITY: Wodehouse (1945, table iv) has already indicated that the pollen of "*Ambrosia psilostachya*" precedes that of *A. artemisiifolia* in the atmosphere by two weeks. It was therefore no surprise that field studies of the two species in Michigan revealed the same approximate relationship between *A. coronopifolia* and *A. artemisiifolia* in their morphological development. A total of 338 plants were collected during the period August 3–5, 1956, 234 of *A. coronopifolia* from eight localities in eight counties, and 104 of *A. artemisiifolia* from nine localities in nine counties. These specimens were then measured for length of the staminate spike primordia. In *A. coronopifolia,* 18% of the total branches bore staminate spikes which were over 3 cm. in length, many of these with mature flowers. In *A. artemisiifolia,* a mere 1% of the total bore spikes of such development during the first week of August. In *A. coronopifolia,* only 19% of the total number of branches lacked visible spike primordia, but in *A. artemisiifolia* 64% had no visible primordia. About one week earlier the same year, Professor K. L. Jones reported that on July 27–28, he developed a hay-fever reaction while visiting the city of Cheboygan. Along the estuary there, he discovered a large number of plants of *A. coronopifolia* in anthesis, while the *A. artemisiifolia* was not yet in bloom. The earliest herbarium specimen with flowers in *A. coronopifolia* in Michigan is July 12 (Menominee, C. O. Grassl 2623, 1933, MICH).

VARIATION: Of the three basic ragweed species in Michigan, *A. coronopifolia* seems to be the least variable. The uniformity of any given stand, however, may be misleading, since the individuals are clonal and tend to be derived from one or a few original plants as discussed earlier. The most conspicuous variations include those in leaf form, leaf arrangement, plant habit, and fruit characteristics.

The leaves have been described by Rydberg (1922) as "ovate in outline, pinnatifid, subsessile, or the lower with short winged petioles." The outline may vary, however, as shown in Figure 2

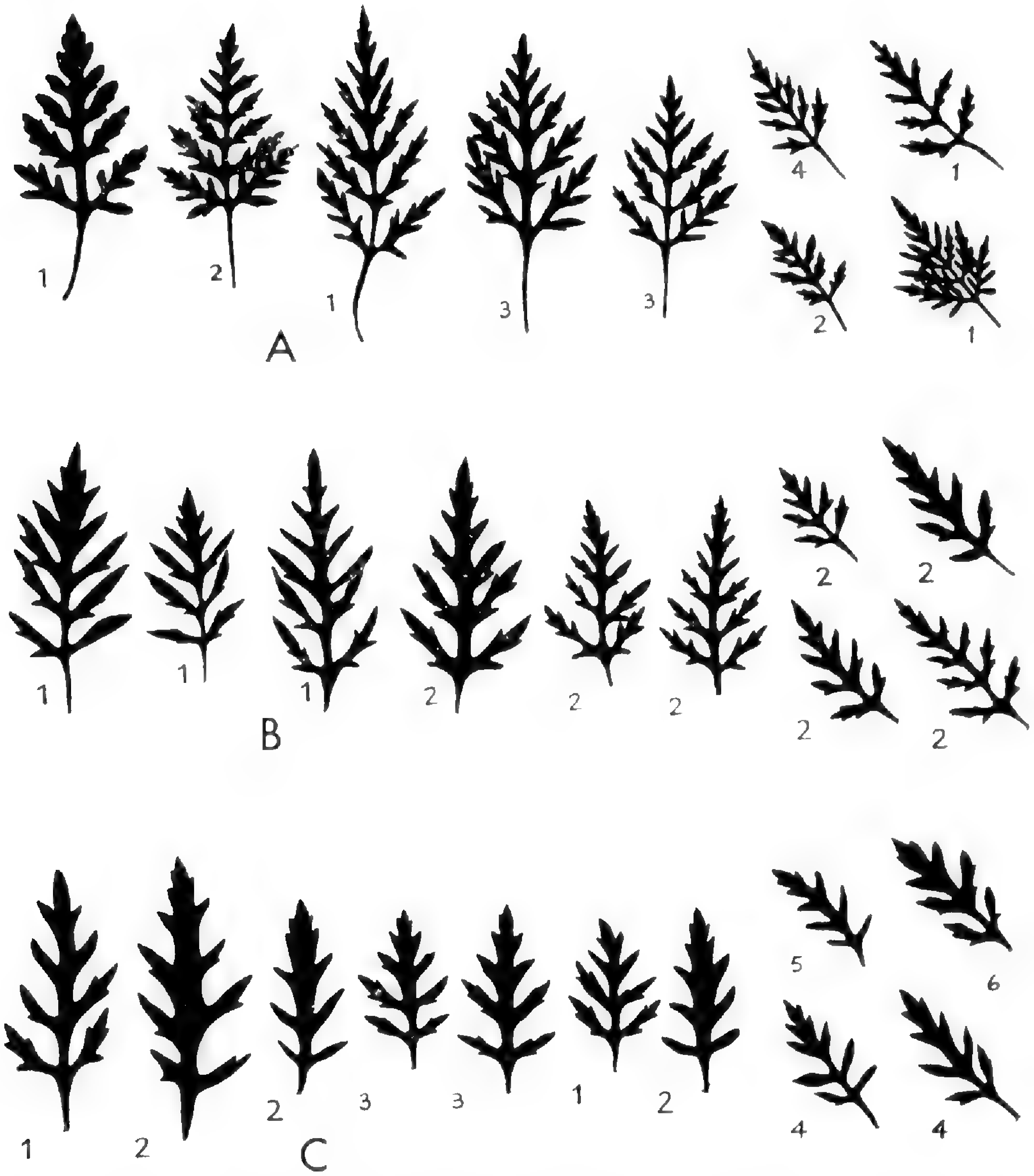

Fig. 2. Outlines of approximately median leaves of moderate-sized plants of ragweeds from Michigan (all petiole bases not complete): A. *Ambrosia artemisiifolia*: 1. Washtenaw Co.; 2 Otsego Co.; 3. Benzie Co.; 4. Crawford Co. B. *A.* × *intergradiens*: 1. Crawford Co.; 2. Benzie Co. C. *A. coronopifolia*: 1. Benzie Co.; 2. Grand Traverse Co.; 3. Leelanau Co.; 4. Antrim Co.; 5. Otsego Co.; 6. Kalkaska Co.

(e.g., 2 vs. 3) from approximately lanceolate to deltoid. Extremely large leaves (not figured) from plants growing under luxuriant conditions may approach in outline and cutting the much smaller, typical leaves of *A. artemisiifolia* growing under normal conditions. The length of the petiole diminishes from the basal to the median leaves, varying from obviously petiolate to sessile, making comparisons quite difficult from collection to collection unless leaf position is taken into consideration. The dissection of the leaves ranges from coarsely lobed to nearly bipinnatifid. In the least dissected extreme the leaf-blades are long-ovate and the sinuses so shallow that they extend only one-third to one-half of the way from the blade margin to the midrib. The other extreme is represented by triangular leaf-blades cut seven- to nine-tenths of the way to the rachis, resembling in leaf outline *A. artemisiifolia* forms except for the relative length of the petiole. The blade/petiole ratio of median leaves averages 4.2 but varies from 3.1 to 8.0.

Occasional specimens of *A. artemisiifolia* are collected, especially in southern Michigan, which resemble *A. coronopifolia* in foliar characters. Generally, however, the leaves of the latter may be distinguished by the following ensemble of differences, some of them subtle and not readily evident on the herbarium sheet: (a) thicker leaf texture; (b) harsher, more appressed hairs; (c) paler green color; (d) fewer lobes and segments; (e) broader midrib wing; (f) shorter petiole; and (g) narrower blade outline. All these characters tend to overlap individually to some extent between the two taxa, and they must, therefore, be considered together in making identifications.

Leaf arrangement in *Ambrosia coronopifolia* does not differ basically from that of the other ragweeds. Depending on size of plant, the lower four to nine leaf pairs are opposite, but the leaves above and especially those from the axils of which the staminate inflorescences arise tend to be subopposite to alternate. At Interlochen, Grand Traverse Co., however, there is at least one large clone, growing with clones of the ordinary opposite-leaved form, in which the leaves are all whorled, with three leaves per node. In this "leafy" form, the spacing of the nodes is like that in the typical form, and in the upper part of the plants the whorled condition gives way to the usual alternate-leaved state.

In habit the plant is usually a simple leafy axis. The vast majority of plants in typical exposed situations on sterile soil along roadsides and railways have simple axes with only a single terminal staminate spike or with one or a few laterals in the upper fourth of the plant. A few more lateral branches may tend to develop from axillary buds as the season progresses, thus spreading the potential flowering time. If the main stem of a plant is cut off or otherwise damaged during the first half of the summer, a short, "bushy" specimen will result, numerous branches arising from the base of the stem.

The only profusely branched forms that are not the result of injury are the giant plants found in unusually rich environments. This large form was found at the edge of a vacant lot in Alpena, Alpena Co. (*Wagner 8483*) and on a farm near the juncture of highways M-72 and Co. 597 in Kalkaska Co. (*8337*). At the latter site, the normal form with few branches occurred in fields and had spread into open soil in a cultivated truck garden where giant plants up to 70 cm. tall formed, bearing in some cases over 30 large and well developed staminate spikes with numerous coarse vegetative branches arising from near the base. These were very likely stimulated to grow and branch by the unusually rich soil conditions in the truck garden where they were free of competition. In growth habit they resembled the large, branching plants characteristic of true *Ambrosia psilostachya* as it grows in California, rather than the simpler forms typical of *A. coronopifolia* as it occurs in the Great Lakes area.

The morphology and maturation of fruits varies to some extent from clone to clone. It is not at all uncommon to find populations of *A. coronopifolia* in which only a small number of fruits have been produced. Such populations may co-exist side by side with others which have fully developed fruiting. Morphologically the fruits of *A. coronopifolia* usually have very short lateral processes or none at all so that they become, in the extreme form, entirely rounded at the top except for the beak. One striking population at Yuma, Wexford Co. (8497a), however, has fruits with rather conspicuous processes, suggesting the fruits of *A. artemisiifolia*.

POLLEN GRAINS: The pollen grains of *Ambrosia coronopifolia* were studied in terms of size, and presence or absence of protoplasts. To measure diameters, anthers were removed from herbarium specimens, placed in 75% aqueous ethyl alcohol on a microscope slide and glycerine jelly containing acid fuchsin was added. The measurements were made of the widest diameters of 20 grains for each collection. No broken or collapsed grains were measured. To estimate the number of inviable grains, the technique was to crush dried anthers in aceto-carmine and to

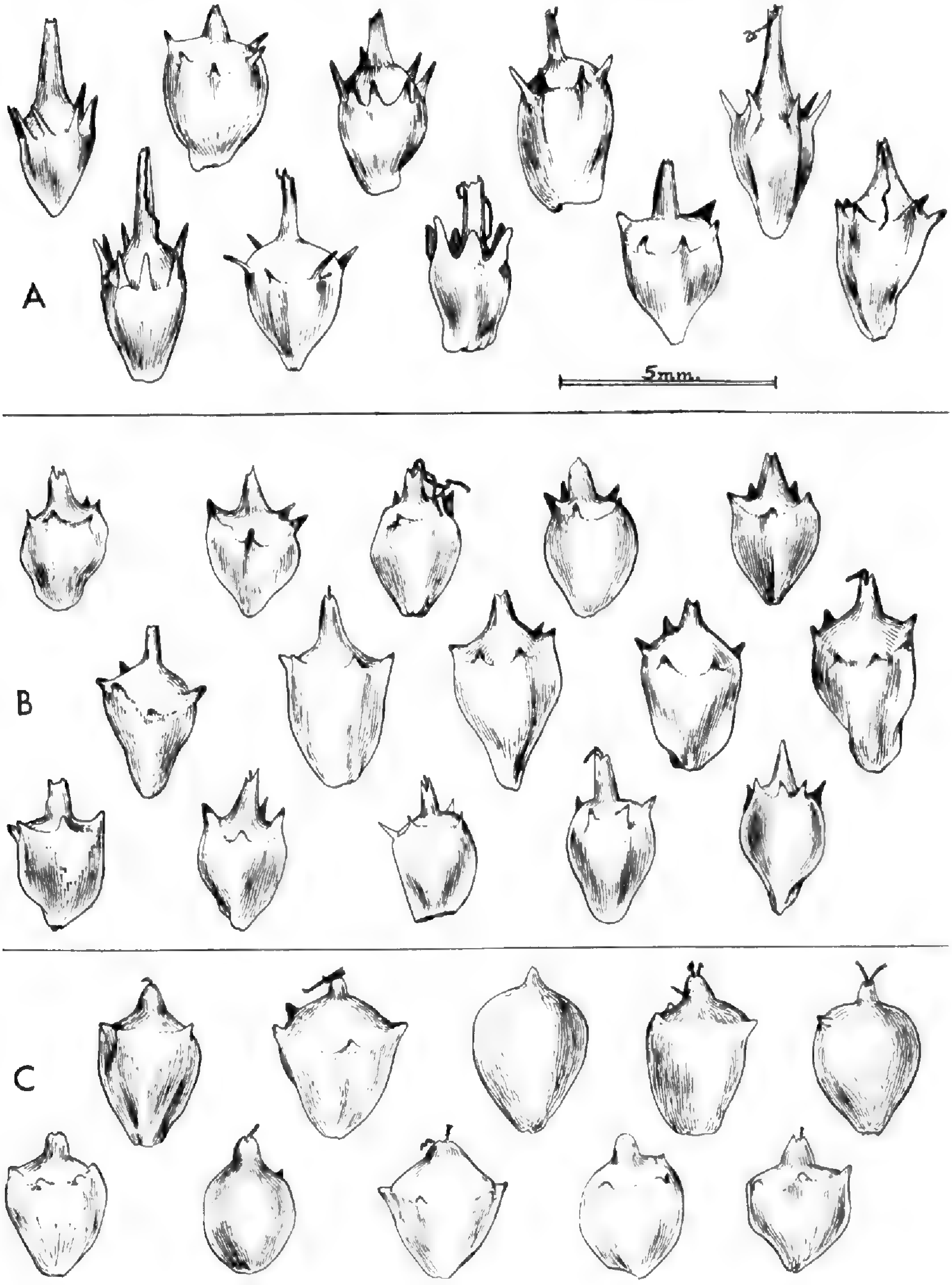

FIG. 3. Fruits of ragweeds collected near Stanwood, Mecosta Co., Mich., September 28, 1957 (specimens drawn without trichomes): A. *Ambrosia artemisiifolia* (from several plants). B. *A.* × *intergradiens* (each horizontal row from a different clone). C. *A. coronopifolia* (each row from a different clone).

heat the freed pollen grains until all the protoplasts became stained. Those grains in which no protoplasts were evident by staining were counted and compared with those in which the protoplasts did stain. Approximately 1000 grains were recorded

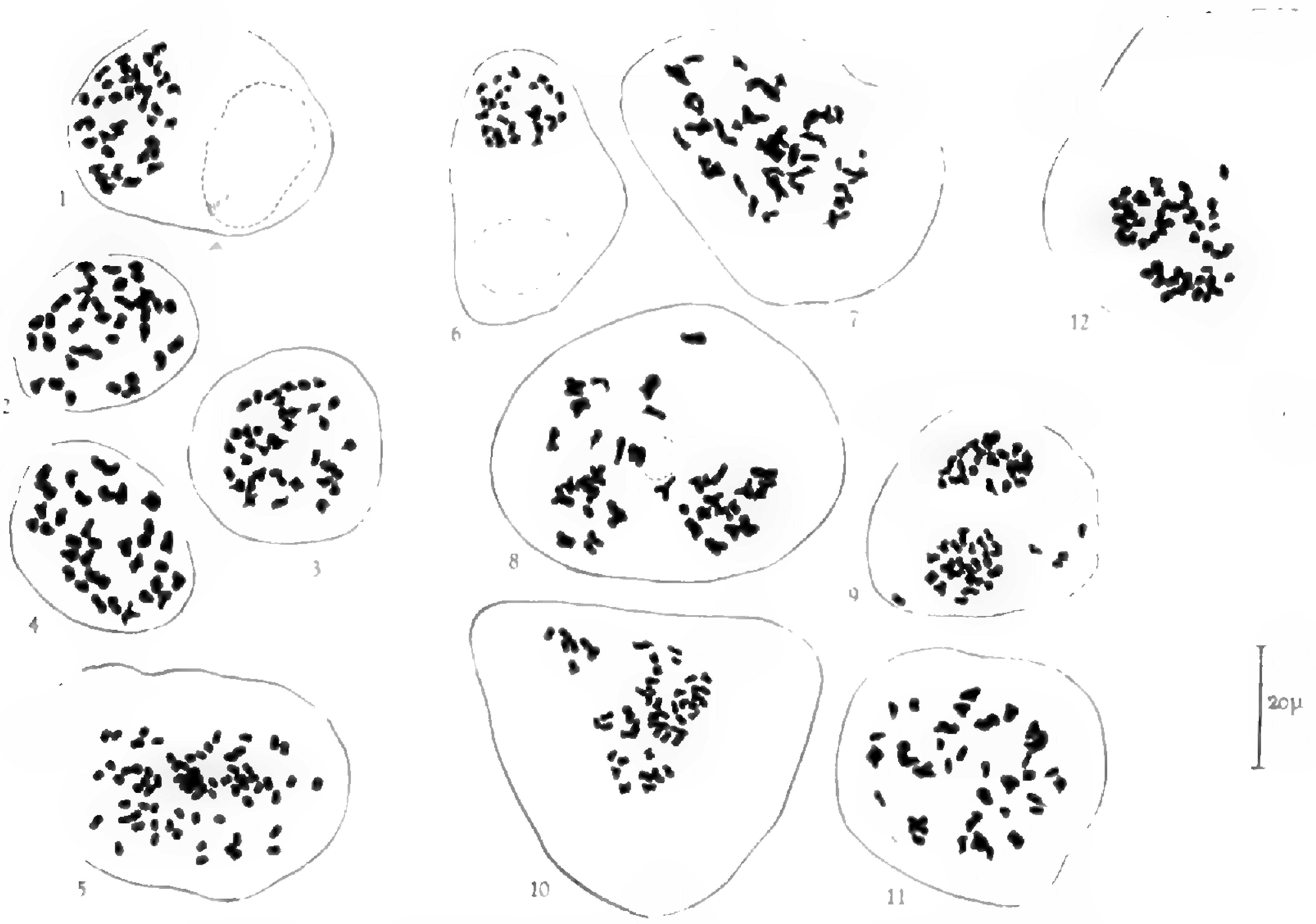

Fig. 4. Chromosomes of Michigan Ambrosia. 1–5. *A. coronopifolia*, $2n = 72$: 1, Antrim Co., metaphase II, 8340; 2, Emmet Co., metaphase I, 8446; 3, Benzie Co., metaphase I, 8334; 4, Mackinac Co., metaphase I, 8435; 5, Alger Co., mitotic metaphase, 8438-bl. 6–11. *A.* × *intergradiens*, $2n = 54$: 6, 9, Emmet Co., metaphase II, 8445; 7, 8, Emmet Co., late prophase, 8445; 10, Alger Co., mitotic metaphase, 8438–2; 11, Emmet Co., prophase I, 8445. 12. *A. psilostachya*, $2n$ = ca. 108, Los Angeles Co., California, metaphase II, D. A. Beals.

in this way with mechanical counters, and the results expressed as percentage abortive grains of the total.

The average pollen diameter of 11 collections of *Ambrosia coronopifolia* is 20.5 microns, with a range in individual grains of 17.6 to 25.0, and a standard deviation of 1.05. An average of 22.6% of the pollen grains from 11 collections appeared to lack protoplasts, with a range from 5 to 72%. Comparison of these values with those of the other ragweeds involved in this report is shown in Table 1, and will be discussed below.

CHROMOSOMES: To determine chromosome numbers, specimens were fixed in Newcomer's fluid (Newcomer, 1953). For meiotic observations, whole young staminate spikes were placed in the fixative after removal from plants grown in the University of Michigan Botanical Gardens (August, 1956), and from the wild (July, 1957). At the time of examination, individual involucres were removed, the florets dissected out, and the anthers carefully removed and crushed in aceto-carmine stain on a microscope slide. The pollen mother cells were thus extruded, and were then squashed in the ordinary way. For somatic observations, root tips were removed from greenhouse plants and pre-treated before fixation in a saturated cool solution of paradichlorobenzene and kept in a 40° cold-room for 3–5 hours to shorten the chromosomes. The roots were then fixed and squashed. Division figures were drawn using the camera lucida.

As stated in a preliminary report based on observations made during 1956 by the senior author (Wagner, 1957), there are 36 bivalents in meiotic metaphase, all of approximately the same size. This number has been confirmed by studies made in 1957 by the junior author, and also by the report, based presumably on the same species, of Mulligan (1957). Meiosis in *Ambrosia coronopifolia* is evidently regular, and the division figures of all stages appear to be normal (Figure 4, 1–5). Counts of $n = 36$ or approximately that number were made in meiosis of the following collections: Benzie Co., 8334; Antrim Co., 8340; Emmet Co., 8430; Mackinac Co., 8435; and 8444; and Marquette Co.; 8439. Counts of $2n = 72$ or near that number were made in mitosis in the following collections: Kalkaska Co., 8337; Grand Traverse Co., 8336; Benzie Co., 8334; Alger Co., 8438bl; and Emmet Co., 8444-1. Representative specimens of all these collections are on deposit in the University of Michigan Herbarium. The collections from which the majority of meiotic numbers were determined were collected mainly on July 19, 20, and 21, 1957.

INTERMEDIATE PERENNIAL RAGWEED: The second type of perennial ragweed in Michigan is easily overlooked by the collector because of its resemblances both to *Ambrosia coronopifolia* and the annual *A. artemisiifolia*. In all respects, this plant is an intermediate between these two species, and it will therefore be described as a hybrid taxon, *A.* × *intergradiens*[4]. The major characters of the new perennial ragweed are summarized in Table 1, in comparison with its relatives. In its habitat it is generally found with the two other ragweeds, but

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[4] ***Ambrosia*** × ***intergradiens*** Wagner, hybr. nov. Perennis, multiplicatione vegetative colonias uniformes formans sed inter se multiformes. *Ambrosiae coronopifoliae* similis sed differt plerumque pilis numerosis valde divergentibus in caule primario, foliis plus dissectis, tenuioribus, petiolis longioribus, chromosomatibus ($2n$) 54, divisione meiotica irregulari. Communis in locis dispersis ruderalibus michiganensibus borealibus cum *A. artemisiifolia* et *A. coronopifolia*.

Table I. A comparison of three ragweeds in Michigan.

	artemisiifolia	× *intergradiens*	*coronopifolia*
Duration	Annual	Perennial	Perennial
Petiole length (cm.) (ca. 30 median lvs.)	1.5 (0.3–3.0)	1.0 (0.5–1.7)	0.9 (0.5–1.4)
Number of projections on basal segment pair (ca. 30 median lvs.)	9.0 (0–22)	5.8 (2–10)	2.2 (0–10)
Narrowest rachis wing width between two basal segment pairs. (ca. 30 median lvs.)	1.4 (1.0–2.0)	2.4 (1.5–3.5)	3.1 (2.0–5.0)
Indument of main stem and petioles (subjective judgment)	Sparse and spreading (except f. *villosa*)	Mostly denser & spreading.	Denser and appressed.
No. pistillate fls./cluster	5.4 (2–15)	3.1 (1–8)	1.2 (1–3)
Per cent good fruits/cluster	77	16	55
Terminal beak length of fruit (mm.)	1.2 (0.8–2.0)	0.9 (0.8–1.0)	0.6 (0.5–0.8)
Length of "spines" (mm.)	0.5 (0.2–0.8)	0.4 (0.2–0.6)	0.2 (0.0–0.5)
Per cent abortive pollen per collection	16.0 (3–44) (9 collections)	54.9 (42–83) (12 collections)	22.6 (5–72) (11 collections)
Pollen grain diameter: over-all range (microns)	14.3–20.8	16.6–29.6	17.6–25.0
Pollen grain diameter: averages (microns)	17.6 (16.3–19.7)	21.8 (20.4–23.6)	20.5 (19.9–22.2)
Pollen grain diameter: standard deviation	0.79 (0.58–0.94)	2.30 (1.36–3.22)	1.05 (0.72–1.37)
Chromosome number ($2n$)	36	54	72
Meiotic metaphase	Regular	Irregular	Regular

this is not always so. For collectors in general it is probably most profitable to compare the new plant with the other perennial species, *A. coronopifolia*. *Ambrosia* × *intergradiens* may be distinguished from the latter by its more spreading, more delicate hairs on the stem axis, these usually more abundant. The whole plant of the intermediate is slightly greener (not glaucous). Corresponding leaves tend to be more divided and they have narrower wings between the pairs of lobes. Corresponding leaves (i.e., those in like position on plants of approximately equal size) will also tend to have slightly longer and narrower petioles. If the fruits have matured, the lateral processes and the beak will be more strongly developed than in *A. coronopifolia* so that the fruit is more suggestive of that in *A. artemisiifolia.*

The hybrid perennial ragweed has turned out to be surprisingly numerous in Michigan. In 1956 and 1957 it is estimated that between forty and fifty different populations, large and small, have been discovered. These were found in over twenty localities in fifteen counties. All collections in the following list were made by the senior author with the help of others, especially J. A. Churchill, R. F. Blasdell, and P. J. Neihaus. Unless otherwise indicated, both parental ragweeds were present at each station listed:

Alger, weedy edges of roads at Munising Falls, Munising, *8438–2*; Antrim, no parents within at least 100 yds., grassy plains along U.S. 131, 1.2 mi N. of county line, Sect. 31, R.6W, T.29N, *8491*; Benzie, on steep road-banks, W. side of Co. 669, E. edge of Sect. 25, R.14W, T.26N, *8335*; in overgrown vacant lot, Bendon, Sect. 23, T.26N, R.13W, *8493*; Charlevoix, vacant lot in town of Walloon Lake, *8485*; along R.R. tracks in Boyne City, *8487*; Cheboygan, vacant lots, Cheboygan, *8434*; Clare, Meredith, R.3W, T.20N, Sect. 13, *8513*; Crawford, lawns, gardens, fencerows, S. border of Frederic, *8348*; gardens and roadsides behind P.O., *8448*; Emmet, sandy vacant lot by Greyhound Bus Station, Mackinaw City, *8444–2*; open grassy places along R.R. tracks, Pellston, *8445*; Grand Traverse, one or both parents present, in 3 places—(#1) in sandy lot near Elementary School, an all-pistillate clone, (#2) just S. of bridge over Little Betsey Creek, and (#3) by the R.R. Station, Interlochen, *8473*; only *A. artemisiifolia* present, along railroad, 0.6 mi. W. of Grawn, Sect. 12, R.12W, T.26N, *8492*; Kalkaska, weedy fields at intersection of U.S. 131, 1.5 mi. S. of Co. line, Sect. 2, R.7W, T.28N, *8488X*; Marquette, both parents plus *A. trifida* present, vacant lot along M-28, Marquette, *8443a* and *8443b*; Mecosta, prairie-like fields, hybrids in sandy, more or less shaded, areas, 0.3 mi. N. of Stanwood on U.S. 131, *8498*; Osceola, only *A. artemisiifolia* seen, grassy fields near R.R. Station, Marion, *8429*; Otsego, 1.2 m. N.N.W. of Vanderbilt on M-27, *8515*; Wexford, grassy fields at junction of M-115 and U.S. 131, *8474*; along R.R. tracks, Yuma, Sect. 34, R.12W, T.23N, *8496a*.

The different intermediates are quite variable among themselves, and it is conceivable that there is some degree of introgression involved in the formation of *Ambrosia* × *intergradiens*. In general, however, we have assumed that we are dealing with F_1 hybrids which have become established and by means of their perennial habit and reproductive method have been able to form more or less large populations. It is interesting to note that *A.* × *intergradiens* is occasionally found with only one parent in the immediate neighborhood of the colony. At one place (Antrim Co.), in fact, we discovered a large population where careful searching failed to reveal either parent within at least 100 yards. The hybrid has been found to invade plowed fields (Otsego Co.), gardens (Crawford Co.), and plantations of pine trees (Benzie and Mecosta Cos.). The best localities for locating large populations are in grassy places along railroad tracks and sandy roads in and around towns and villages. Disturbed areas where both *A. coronopifolia* and *A. artemisiifolia* occur in a large mixture are almost sure to reveal at least one or a few populations of *A.* × *intergradiens*. Further field studies of Michigan weeds will unquestionably yield many more populations of the new ragweed (once its characteristics are recognized), judging from the readiness with which we have found it to date.

The major variations of *A.* × *intergradiens* include degree of hairiness and the size of the plant. The former is probably genetically controlled, and is perhaps determined more by inheritance from the annual ragweed, *A. artemisiifolia*, than the other parent. This is suggested by the fact that *A. artemisiifolia* is strongly variable in hairiness, and the form *villosa* Fern. & Grisc. is common throughout this area, contrasting by its dense, spreading-villous indument with the ordinary form. *Ambrosia coronopifolia* does not vary nearly so much in this respect. The size (i.e., height and number of branches) of the plant, on the other hand, is probably controlled mainly by the environment:

PLATE 1234. *Ambrosia* × *intergradiens* W. H. Wagner, type specimen.

those growing in completely exposed sites tend to be smaller and to have a simple form with only one terminal, staminate raceme (Pellston, R. R. tracks, Emmet Co., 8445); those growing in more or less shady and damper sites tend to be larger and more "bushy" and to have numerous staminate racemes branching out below the terminal one (from near Stanwood, at edges of pine plantation, Mecosta Co., 8509–5).

One of the most curious variants of *Ambrosia* × *intergradiens* was found at Interlochen, Grand Traverse Co. (8473–1). An entire clone was observed to comprise pistillate plants only. The pistillate flowers of these plants are borne in racemes in a manner similar to that of normal, staminate involucres in typical plants. The all-pistillate condition has been well known previously in a variant of *A. artemisiifolia*, which, like the foregoing, bears no staminate flowers at all (Jones, 1936, fig. 6), and which is found with the normal type and intermediates throughout Michigan. The all-pistillate condition is unknown, however, in *A. coronopifolia*, which, so far as is known, always comprises plants of the normal, bisexual type with axillary pistillate flowers and terminal racemes of staminate flower clusters. It seems entirely possible, therefore, that the pistillate intermediate population at Interlochen arose as hybrid in which the female parent was the pistillate form of *A. artemisiifolia*. Jones (1943) succeeded in crossing another ragweed, *A. trifida*, which is, like *A. coronopifolia*, a strictly monoecious species, with the pistillate form of *A. artemisiifolia* and showed that the progeny contained, in addition to monoecious and intergrading forms, the all-pistillate form as well.

In 1910, Rydberg described a plant, *Ambrosia media*, as resembling *A. coronopifolia* in leaf shape. He wrote that "Otherwise, the plant is more closely related to *A. elatior* and *A. artemisiifolia* [which he regarded as separate species], the root being annual and the fruit spiny." Our examination of the type specimen of *A. media*, which was lent to us through the courtesy of Dr. Keck of the New York Botanical Garden, shows that the plant in question is the coarsely lobed form of *A. artemisiifolia*, a form not uncommon as a variant in the populations of this species in southern Michigan. S. F. Blake reduced this plant to synonymy under *A. artemisiifolia* (1925). We further checked the pollen grains of the type specimen and found that the average pollen size is 19.0 microns, the total range from 14.7 to 21.0, and the standard deviation 0.95. The good grains in a sample of 1009 grains formed 79% of the total. Comparison with Table 1 will show that these figures are well within the ranges characteristic of *A. artemisiifolia* and not of *A.* × *intergradiens.*

FRUITS: For comparison of mature fruits of *Ambrosia* × *intergradiens* and its presumed parents, a field study was made on September 28, 1957, north of Stanwood, Mecosta County. In the prairie-like, rolling fields and roadsides there, all three taxa are common, and are readily compared as their fruits are fully developed at this season. In general, those of the parents may be immediately differentiated: those of *A. artemisiifolia* have terminal beaks twice as long on the average (1.2 mm.) as those of *A. coronopifolia* (av. 0.6 mm.). The lateral processes or "spines" of *A. artemisiifolia* average 0.5 mm. in length, while those of *A. coronopifolia* average 0.2 mm. and are commonly absent altogether in the latter as shown in Figure 3, C. There is, however, some variation and overlap as the specimens figured reveal. Any large collection of fruits of *A. artemisiifolia* in Michigan will show some individuals with very short lateral processes; and, as described earlier, a variant of *A. coronopifolia* exists (Yuma, Wexford Co., 8497a) in which the processes on the fruits are unusually well developed. *Ambrosia* × *intergradiens* is intermediate between the two other taxa in fruit morphology (see Table I) and the rather well developed beaks and spines provide a valuable additional character with which to distinguish the new taxon from *A. coronopifolia* in late summer and fall.

The pistillate flowers of *A. artemisiifolia* tend to occur in clusters of five or six in the axils of the upper leaves, but those of *A. coronopifolia* tend to be solitary (as determined from an average of 100 pistillate inflorescences for each species). The average number of flowers in inflorescences of *A.* × *intergradiens* is intermediate, i.e., averaging three flowers. The percentage of fruits which actually enlarge and mature differs considerably in the three taxa: In *A. artemisiifolia,* a total of 541 pistillate flowers counted yielded 415 approximately full-sized fruits, a proportion of 77%. In the plants identified as *A. coronopifolia,* a total of 118 flowers formed only 66 fruits, i.e., 55%[5]. In the hybrid taxon it was very low—of the 280 flowers counted, only 34 had expanded into normal-appearing fruits, only 16%. *Ambrosia* × *intergradiens* thus shows morphologically a high degree of sterility, a condition suggested also by the percentage of bad pollen grains and by the irregular meiotic process to be described below.

It is interesting to note that the clone of wholly pistillate plants of *A.* × *intergradiens* discovered at Interlochen, Grand Traverse Co., failed entirely to set fruits, and repeated collections made during September and October, 1957, of many pistillate spikes revealed not a single fully formed fruit.

POLLEN GRAINS: Following the same technique described above, the average pollen diameter of 12 collections of *A.* × *intergradiens* was determined as 21.8 microns, the total range of individual grains from 16.6 to 29.6. That the pollen grains of the intermediate ragweed turned out to average larger than those of *A. coronopifolia* was surprising, in view of their respective chromosome complements which would lead one to expect the reverse relationship. However, the variation in size of the pollen grains of the intermediate proved to be considerably greater than that of either of the parental ragweeds, including *A. coronopifolia*, and the standard deviation was 2.30 microns for the former and 1.05 for the latter.

Although two of the collections of *A. coronopifolia* revealed a high percentage of non-staining pollen grains (one with 33% and one with 72%), most showed a low percentage and the average of 11 collections was 22.6%. On the contrary, *all* of the collections of *A.* × *intergradiens* had high percentages of abortive grains. The mean of all the collections examined was 54.9% bad grains, the lowest single collection 42% and the highest 83%. These data on abortive pollen and pollen diameters are summarized in Table I, along with similar facts concerning *A. artemisiifolia* for comparison.

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[5] If our figures are at all representative for the species as a whole, then *A. artemisiifolia* with its much larger number of pistillate flowers and greater average production of fruit per head has well over six times the reproductive potential by seeds as *A. coronopifolia*. Actually the difference is probably even greater because of the tendency for more axils to form pistillate inflorescences in *A. artemisiifolia*. Thus the annual species which relies entirely on seeds for survival, (so far as we know) shows a striking difference in seed production from the perennial ragweed which relies on its ability to remain alive from year to year and its ability to propagate itself by underground roots.

CHROMOSOMES: Meiosis in the intermediate ragweed shows conspicuous irregularities. First metaphase is characterized by univalents, bivalents, and trivalents, and first anaphase commonly shows lagging of chromosomes. The determination of units from ten well-spread sporocytes from five collections averaged 14.5 univalents (range: 8–19), 15.1 bivalents (range: 11–20), and 2.5 trivalents (0–4). The average total number of units was 32.1 (range: 22–38). A rough explanation for the average pairing behavior might be suggested as follows: There are 54 chromosomes present, 18 from *A. artemisiifolia* and 36 from *A. coronopifolia*. Assuming a fairly high degree of homology between chromosomes of the parents, it then appears that 15 of the chromosomes of *A. artemisiifolia* and 15 of *A. coronopifolia* tend, on the average, to form pairs. The remaining three chromosomes of *A. artemisiifolia* would form trivalent configurations with six chromosomes of *A. coronopifolia*, leaving a residue of 15 univalents of the latter. The situation, however, is very much more variable from cell to cell than such an idealized "average" behavior would indicate.

The lagging that commonly occurs in the chromosomes of first anaphase result in the exclusion of up to as many as four chromosomes from the second metaphase division figures, so that they lie off the respective equatorial planes, as shown in figure 4, 9. At second anaphase, as many as ten chromosomes have been seen lying separate in the cytoplasm, and even after the nuclear membrane is formed, chromosomes may remain unassimilated. As the pollen grains mature, these chromosomes apparently disappear. In material of the intermediate plant from Pellston, Emmet Co., a sample of 171 division figures showing second anaphase had 55% of the figures with excluded chromosomes. The remaining 45% appeared to have normal second anaphase figures[6]. In contrast, in material of *A. coronopifolia* taken at the same time and place, a sample of 39 figures showed all normal second anaphases.

Root tip squashes from three localities of the intermediate ragweed confirm $2n = 54$ chromosomes, as would be expected

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[6] Avers, C. J. (Genetics **39**: 117–126, 1953) has suggested a mechanism in Aster whereby triploids produce fertile pollen by means of a double equational division of the univalents. No evidence of such a mechanism has been observed in the present study, but this is a possible explanation of the relatively high percentage of normal-appearing second anaphase figures.

from the known genomes of the putative parents, *A. artemisiifolia* with $2n = 36$ (Jones 1943; Yuasa 1956), and *A. coronopifolia* with $2n = 72$. These localities were in Benzie Co. (8335); Crawford Co. (8348); and Alger Co. (8438–2). Irregular meiotic behavior was observed in the Benzie Co. and Crawford Co. materials, as well as Osceola Co. (8429), Emmet Co. (8445), and other Crawford Co. collections (8448).

DISCUSSION: As botanists did not find *Ambrosia coronopifolia* in Michigan until 1900 we may assume that perennial ragweeds were probably introduced into the state sometime prior to the turn of the century. It should be pointed out, however, that the question of "introduced" vs. "indigenous" may be a vexing one when weeds are involved. Our concepts of these terms do not ordinarily admit of degrees (such as "introduced in part," or "mainly introduced"). With regard to our perennial ragweeds, it seems entirely plausible that from time to time, over thousands of years, small "extra-territorial" emigrations from the home range into Michigan took place. Many, if not all, of these probably died out. However, now—with railroad and highway systems, and myriad artificially disturbed habitats, the species can readily migrate into Michigan along definite pathways from the states further west. So even if the species *had* been present, though extremely rare, prior to 1900, the bulk of present populations may very well have immigrated from further west. Certainly over its present range in the state, the perennial ragweed will have to be interpreted as "mainly introduced." There is no positive evidence to date, in fact, to indicate that it was ever native at all.

When Michigan in its entirety is considered, *A. coronopifolia* must be treated as only frequent to uncommon; but its ability to "take over" large areas locally where the habitat is appropriate make it nevertheless a potential hayfever problem in its restricted territories. Its habit of congregating its populations around settlements make its hayfever significance out of proportion to its over-all abundance. The annual species, *A. artemisiifolia*, will in general much outweigh its allergic importance because of greater numbers. But in the two weeks prior to flowering in annual ragweed, the perennial species may become a local problem to allergic persons.

The hybrid perennial ragweed has turned out to be remarkably common in appropriate localities. If it had been found only once or several times in this investigation it would have been designated only by formula. The intermediate has been given a taxonomic binomial, *Ambrosia* × *intergradiens*, because of a belief that any natural hybrid which comes to form many individuals of importance in the community, whether by sexual means (e.g., as allopolyploids) or by asexual means (e.g., by underground reproductive axes, as in this instance) or both, should be so named. Perhaps other ragweed hybrids (e.g., *A.* × *helenae* Rouleau, an extremely rare plant in Michigan) are formed *de novo* in nature as frequently as *A.* × *intergradiens*, but none of the others, to our knowledge, compare in abundance to the present one which is self-perpetuating and builds up large local populations through the years.

Now that *A.* × *intergradiens* has been distinguished among the populations of perennial ragweeds in Michigan, collectors may be urged to look for it in other states (e.g., Illinois, Minnesota, and Wisconsin) where the two parental species intermingle. The characteristics of the new ragweed are subtle ones, it is true, and they are hard to perceive on casual inspection in the field; but the description and figures given above should suffice for its recognition.

The sizes of pollen grains reported here for the plant commonly referred to as "western ragweed" in the Great Lakes states differ from the previous reports. Wodehouse (1928, 1945) gave the diameter of pollen grains of "*A. psilostachya*" as 23.4 (22.0–27.4) microns. His measurements evidently refer not to our plant but to other taxa in the complex. Pollen grains in *A. coronopifolia* as defined here measure 20.5 microns in diameter on the average. Our own measurements of *A. psilostachya* from California (Solano Co., Heiser 1966; San Diego Co., Alderson s.n.; Colusa Co., Chandler s.n.; Stanislaus Co., Hoover 165; Los Angeles Co., Wolf 4241; and San Luis Obispo Co., Summers s.n.—MICH and UC) gave an average diameter of 23.0 microns, the range 20.0–25.6. There is a correlation of pollen grain diameter with chromosome numbers. Previous studies of chromosomes in the genus *Ambrosia* indicate that the *X* number is 12, 17, or 18 (Darlington & Wylie, 1955). Jones (1933, 1943) showed the chromosome number in *A. artemisiifolia* (as *A. elatior*) to be $n = 18$; in *A. bidentata*, $n = 17$; and in *A. trifida*, $n = 12$. Of these species the first is most obviously related to the perennial forms under discussion here, and the number of $n = 36$ determined by us (1957) and confirmed by Mulligan (1957) for *A. coronopifolia* supports this relationship. *Ambrosia coronopifolia* may therefore be considered a tetraploid species. *Ambrosia* × *intergradiens* would then be a triploid. Heiser and Whitaker's (1948) report of California material of *A. psilostachya* (Solano Co., Heiser 1966, UC) as having an estimated "$n =$ 50–52" suggested to us that the actual figure might be $n = 54$, i.e., the hexaploid number. Materials kindly collected for us by Mrs. D. A. Beals in Los Angeles Co., California (MICH) were observed in Metaphase I and Metaphase II: a total of 20 estimates ranged from 50 to 56, the average $n = 53$. The exact number may, accordingly, really be $n = 54$. It is worthy of mention at this point that smaller-spored forms also occur in the perennial ragweeds of California, suggesting that tetraploid taxa exist there as well as hexaploid. Three collections (San Diego Co., Palmer 161; Lathrop, Walker 889; and Yuba Co., Howell 28288—all UC) averaged 20.8 microns in diameter of pollen grains, with a range from 18.5–23.3, corresponding closely to the figures given above for *A. coronopifolia*.

On the basis of present knowledge, therefore, we may assume that there are probably at least four polyploid levels in the *A. artemisiifolia-coronopifolia* complex, viz. $2x$ (*artemisiifolia*), $3x$ (*intergradiens*), $4x$ (*coronopifolia* plus this or an additional taxon that grows in California), and $6x$ (*psilostachya*). Where it has been possible to compare them, the levels of polyploidy are matched by corresponding average pollen diameters, viz. 17.6 microns (*artemisiifolia*), 20.5 microns (*coronopifolia*), and 23.0 microns (*psilostachya*). *Ambrosia* × *intergradiens* does not conform with the sequence, but its irregular meiotic conditions and degree of spore abortion are such that the normal process of pollen ontogeny may be disturbed and thus produce the deviation.

It can be concluded that polyploidy has played an important role in the evolution of the *artemisiifolia-coronopifolia* complex of ragweeds. Further knowledge of the evolution of this assemblage will have to be enriched by a survey much broader in scope than the present one. In particular, areas of presumed geographical origin should be sought and investigated. Professor G. L. Stebbins has written (December 18, 1956) that in his opinion the understanding of the relationships of the taxa in this complex will require "a careful study of all the forms occurring in the southwest United States, Mexico, and elsewhere in the American tropics." We might suggest then that the forms that are found in California and in Michigan probably represent peripheral end-point populations derived from an evolutionary matrix that originated in the south. An interesting further possibility was recently indicated by Yuasa (1956) when he pointed out that "since the basic number of chromosomes in Compositae is nine, it is not surprising that the chromosome number of the ragweed [i.e., *A. artemisiifolia*] is $n = 18$." If the original number in these plants was $x = 9$, then the common annual ragweed is a tetraploid species itself; *A. coronopifolia* would have to be interpreted as $8x$; *A.* × *intergradiens* $6x$; and *A. psilostachya* $12x$.

SUMMARY

1. A study of perennial ragweed populations in the state of Michigan was made from standpoints of their distribution, periodicity, habitats, morphological variations, chromosome numbers, and pollen sizes.

2. The known Michigan range of *Ambrosia coronopifolia* was increased by 18 new counties in field studies, bringing the total to 43. The species was found to be frequent across the Upper Peninsula to the north half of the Lower Peninsula and the western part of the southern half. Historical evidence does not favor interpreting it as originally native; in fact, no collections are known prior to 1900.

3. It forms large clones by proliferation from underground parts in disturbed habitats such as roadsides and railways, especially around populated areas. Unlike the annual species (*A. artemisiifolia*) the perennial will invade grassy fields. The substrate is normally sterile, sandy or gravelly soil, in exposed places.

4. *Ambrosia coronopifolia* matures earlier than the annual species by two or three weeks as evidenced by gross morphology and pollen production.

5. Its variations include those of the leaves (lanceolate to deltoid in outline, from coarsely lobed to bipinnatifid, and sessile to short-petiolate), of leaf arrangement (opposite, whorled, and alternate), of plant habit (small and simple, to large and "bushy"), and of spines on the fruit (from unarmed to moderately spiny).

6. Its pollen grains are smaller (20.5 microns in diam.) than previously reported in perennial ragweeds, and an average of 23 per cent of those

tested lacked protoplasts. Its chromosomes number $2n = 72$, and meiosis appears to be normal.

7. An heretofore undescribed perennial ragweed, *A.* × *intergradiens*, hybr. nov., differs from *A. coronopifolia* in hairiness, color, leaf cutting, petiole length, and fruit structure. Its characteristics are intermediate between the latter and the annual *A. artemisiifolia* and it is interpreted as their natural hybrid.

8. The new ragweed is unexpectedly common and a large number of populations have been observed in 15 counties. It grows usually, though not always, in company with the parents.

9. The primary variation of *A.* × *intergradiens* includes characters of hairiness and plant size. One peculiar sterile population was found with wholly pistillate flowers.

10. The pistillate inflorescences average 3 flowers per axil and are thus intermediate between the parents. However, only 16 per cent of the flowers matured normal-appearing fruits, indicating low fertility.

11. Pollen grain diameter of *A.* × *intergradiens* is greater (21.8 microns) than either parent, but the variation is twice that of the parents. Over half of the grains appear to be inviable. The chromosomes number $2n = 54$, but meiosis is irregular with many univalents and a few trivalents at Metaphase I, and with a large number of figures showing lagging of chromosomes.

12. Pollen size of various ragweeds is discussed in relation to polyploid levels: there is a direct correlation. *Ambrosia artemisiifolia* is interpreted as a diploid, *A. coronopifolia* a tetraploid, and *A. psilostachya*, a hexaploid, based on $x = 18$. *Ambrosia* × *intergradiens* is a triploid, but its pollen size does not conform, probably because of irregularities due to its immediate hybrid origin.

13. A really comprehensive knowledge of this complex must entail studies in warmer regions in southern U. S. and Mexico. The primitive members of the complex may have $n = 9$ chromosomes.

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AN UNUSUAL BOTANICAL AREA IN MISSOURI

JULIAN A. STEYERMARK

Since the time of John Bradbury in 1809, and subsequently, through the efforts of Engelmann, Broadhead, Swallow, Trelease, Letterman, Eggert, Kellogg, and others of that period, Missouri has received its share of botanical exploration. The later and more detailed explorations of B. F. Bush and E. J. Palmer in the late nineteenth century and the first three decades of the twentieth century revealed the existence of additional significant plant regions in the state. Their work brought to light the coastal plain flora of the Mississippi Embayment of the southeastern Missouri lowlands, the elements of a Great Plains flora in the loess hills of northwestern Missouri, the edaphic and special flora of the Grand Falls chert barrens, the southwestern floral element of the limestone "bald knobs" and southern floral element of the White River region of southwestern Missouri, the northern element in the flora of northern Missouri, and such relict floras as that of Jam-up Bluff in Shannon County. Thus, after nearly a century and a quarter of botanical endeavor, the possibilities of discovering unknown and significantly interesting floristic areas in the state would have seemed negligible.

Nevertheless, during the past quarter century in a cycle of intensive exploration of areas, mostly remote and inaccessible to previous workers, the writer has revealed the presence within the state of such fascinating botanically rich areas as the sink-hole ponds and swampy meadows of the southeastern Ozarks, saline and brackish springs of central Missouri, and what represents a "driftless" area of northeastern and east-central Missouri. Each of these areas has uncovered many species new to the flora of the state, the results of which have, for the most part, appeared in various numbers of Rhodora.

Within the past four years, a new area, previously unbotanized, but occurring in a section of the state thought to have been adequately explored, has been visited by the writer. Since six species new to Missouri have turned up in this area, it has been thought appropriate to devote a special article to the locality concerned, rather than to scatter the information in a more general report.

The area concerned involves a series of sand hills and spring-fed streams emanating from Crowley Ridge in Stoddard County in extreme southeastern Missouri. These sands are of Tertiary age. Although they are also found in adjacent Scott, New Madrid, and Dunklin counties, the series developed in Stoddard County are larger and contain a more unusual flora than in the other sites. The particular area lies between three and one-half to three and three-quarter miles southeast of Bloomfield. The hills are generally forested with several species of oak (*Quercus velutina, Q. coccinea, Q. imbricaria, Q. falcata*), hickory (*Carya texana, C. ovalis, C. tomentosa*), *Sassafras albidum,* and *Cornus florida,* with an herbaceous forest floor cover of *Panicum laxiflorum, Comandra Richardsiana, Arabis missiouriensis, Ascyrum hypericoides* var. *oblongifolium, Phlox pilosa, Lithospermum caroliniense,* and *Linaria canadensis.* In the more open sandy areas such herbaceous plants as *Polygonella americana, Euphorbia corollata,* and *Asclepias verticillata* are common. In the small valleys along spring-fed streamlets between the sand hills occur stands of *Ilex opaca* of sizeable extent. Occurring with the holly are such shrubs as *Alnus serrulata, Lindera Benzoin,* and *Itea virginica.* Along the wet banks and swampy ground are found *Osmunda cinnamomea, O. regalis* var. *spectabilis, Onoclea sensibilis, Dryopteris Thelypteris* var. *pubescens,* rarely *Woodwardia areolata, Panicum microcarpon, P. polyanthes, P. commutatum, Cyperus flavescens* var. *poaeformis, Scirpus rubricosus, Fimbristylis autumnalis, Carex virescens* and *C. lurida, Juncus diffusissimus, Habenaria clavellata* and the rare *H. ciliaris, Boehmeria cylindrica, Hypericum tubulosum* var. *Walteri, Jussiaea decurrens, Rhexia virginica, Chelone glabra, Solidago patula, S. rugosa* var. *celtidifolia,* the rare *Eupatorium fistulosum, Pluchea petiolata,* and the rare *Polygonum arifolium.* On adjacent dry sandy slopes the very rarely collected *Aristida lanosa* is found.

Beginning the exploration of the area in August, 1954, the author found *Bartonia paniculata* at the head of a tiny spring branch and *Pyrus melanocarpa* along the bordering sandy banks in alder thickets and adjacent lower sandy slopes nearby. Both species were reported subsequently as new to the state (Rhodora 57: 314, 315. 1955). The same year *Paspalum setaceum* was added from the same area, and in April, 1955, along the same spring branch was found *Trisetum pensylvanicum,* also new. In June, 1955, *Typha latifolia* f. *ambigua,* was found as an addition along the same spring branch. Before having had an opportunity to report these latter discoveries, a visit to the area in October, 1955, yielded *Scleria nitida* and *Trichostema setaceum.*

The following is a summary of the data for the species from this unique area not previously reported for the state:

Typha latifolia L., forma **ambigua** (Sonder) Kronf. Swampy spring branch at base of Crowley Ridge near junction with floodplain, on property of Mr. Martin, T 25 N, R 11 E, sect. 6, near Pleasant Valley Church and Triplett Cemetery, 5 mi. northeast of Dexter, Stoddard Co., June 24, 1955, *Steyermark 78660.* This form was growing with typical *T. latifolia* (*Steyermark 78661*).

Trisetum pensylvanicum (L.) Beauv. Along spring-fed creek near junction of Crowley Ridge and lowland, bordered by sandy wooded ravine slopes, T 25 N, R 11 E, NW ¼ sect. 6, on property of Mr. Martin, 3½ mi. southeast of Bloomfield, Stoddard Co., April 25, 1955, *Ste ermark 78285.* The author first collected this species in April, 1955. Upon returning to the same locality two months later in June to show Drs. C. L. Kucera and Robert McDermott of the Botany Department of the University of Missouri the area concerned, no trace of this vernal-flowering species was evident. The plants had been growing half-submerged in the water of the spring branch among the thickets of *Alnus serrulata.* In the shallow water of the same stream and occurring with *Trisetum pensylvanicum* were numerous individuals of an unusual aquatic fungus with fleshy whitish stipe and dull orange sporangia. It was identified by Dr. Francis Drouet as *Mitrula phalloides.* The range of the *Trisetum,* according to Gray's Manual, is "Mass. to O., s. to Fla., Ala., and La." Apparently, this record represents the northwesterly limit of the species.

Paspalum setaceum Michx. (typical). Dry sandy wooded slopes bordering ravines along and tributary to spring-fed creek near junction of Crowley Ridge and lowland, on property of Mr. Martin, T 25 N, R 11 E, NW ¼ sect. 6, 3½ mi. southeast of Bloomfield, Stoddard Co., August 20, 1954, *Steyermark 76726.*

Previously known from "Fla. to Tex. n. to SE Mass., L. I., O. and Ky. and Mex.", according to Gray's Manual, this is another one of the coastal plain species which extends into this section of southeastern Missouri.

Scleria nitida Willd. Sandy and mossy slopes above and along spring branch in valley at junction of Crowley Ridge and bottomland, on property of Mr. Martin, T 25 N, R 11 E, sect. 6, 3¾ mi. southeast of Bloomfield, Stoddard Co., October 17, 1955, *Steyermark 80375*. Although this species is not recognized by Core in his revision of *Scleria* nor by Gleason in the New Illustrated Flora as distinct, and included by them under *S. triglomerata*, *S. nitida* appears amply distinct in having larger achenes and a close dense puberulence on the inner sheath of the leaf blades. The habitat of *S. nitida* in Missouri is also quite different from that of *S. triglomerata*. The latter occurs in the state on rocky limestone glades and prairies on soils of neutral to alkaline reaction, whereas *S. nitida* is found in the Stoddard County locality on sandy acid soil. It represents a remarkable extension of range of a predominantly southeastern species.

Trichostema setaceum Houtt. Sandy openings on slopes of blowout of sandy prairie and slopes on east side of road and eroded gully, Crowley Ridge, T 25 N, R 11 E, sect. 31, 3½ mi. southeast of Bloomfield, Stoddard Co., October 17, 1955, *Steyermark 80349*. Occurring in the same immediate area of the open sand slope as *Paspalum setaceum*, the discovery of this species adds another of the increasing numbers of coastal plain species to the flora of Missouri. Its previous known range was "Fla. to La., n. to sw. Ct., centr. Pa. and s. O.", according to Gray's manual. The new station represents its most northwesterly known occurrence. It was associated in the open sand area with *Aristida lanosa*, *Digitaria filiformis* var. *villosa*, and *Froelichia floridana* var. *campestris*.—MISSOURI BOTANICAL GARDEN.

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NOTES ON NEARCTIC HEPATICAE VI

PHYTOGEOGRAPHICAL RELATIONSHIPS OF CRITICAL SPECIES IN MINNESOTA AND ADJACENT AREAS OF THE GREAT LAKES

R. M. SCHUSTER[1]

A number of highly disjunct species of liverworts have recently been reported from the Great Lakes region by the writer in a manual on the Hepaticae of Minnesota, published in 1953. Limitations of space, and orientation of objective then prevented as full a discussion of the implications of some of the distribution patterns as would have been desirable. The present publication is intended to discuss the phytogeographical aspects which were not previously treated in detail. In utilizing the present paper, it may prove helpful to refer to the more generalized and abbreviated discussion of the floristic affinities of the Hepaticae of Minnesota (Schuster, 1958). In that paper are given a series of maps which, in part, supplement the maps included here.

The distribution patterns of the bryophytes have not received the attention that they deserve. This is partly due to the fact

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[1] The field work leading to the preparation of this paper was supported in part by two grants from the National Science Foundation (NSF Grants 669, 1369); during a portion of the writing of the paper the writer held a Fellowship from the Guggenheim Foundation. I would like to express my appreciation to Drs. W. D. Billings (Duke University), Warren H. Wagner Jr. and Edward Voss (University of Michigan) for critically reading portions of this paper. In the preparation of the original drafts I was assisted by my wife, Olga M. Schuster, who has also assisted in preparing the final draft for publication.

It should be pointed out that the original draft of this paper was written more than five years ago. The accumulation of additional phytogeographical data has been so rapid that the paper has been revised almost annually, greatly delaying its appearance. Several papers in this series (Nearctic Hepaticae, VIII–XI) have, in the meantime, appeared. The phytogeographical data is as complete as possible, up to, and usually including data published in 1956. I have omitted questionable reports, while localities that could not be accurately pin-pointed are indicated with a question mark on the maps. In a few cases stations are known for some species lying in the Aleutian chain of islands, beyond the margins of the map commonly used. An arrow is used to indicate a station (or stations) lying west of the area given on the map.

that an idea still persists that bryophytes do not show as rigidly defined ranges as the higher plants, and thus approach many algae in their distributional peculiarities, or lack thereof.[2] The rate of evolution of the bryophytes is probably much slower than that of many of the genera and families of the angiosperms, with the consequence that there is a slower, and less marked tendency for disintegration into geographical races or varieties. Such "conservatism" of the Bryophyta is, however, of marked advantage for the student of plant distribution, in that the bryophytes may often serve to show past phytogeographical links which otherwise have nearly been destroyed. An example, if one is needed, is the established connection between the flora of western England and Ireland, with that of the Southern Appalachians, that of the coastal portions of Alaska, and that of eastern Asia. The existing distribution of *Herberta sakuraii* serves to emphasize the floristic features these areas once had in common (Schuster, 1957a). The phytogeographical links thus established probably represent remnants of a former, more widespread range. That such connections remain is perhaps partly the consequence of a high "somatic plasticity," and correlated lower evolutionary potential, of many species of Hepaticae. This is especially the case with species which reproduce largely or exclusively by asexual methods. In such cases the chance for genetic recombination is proportionally infrequent or even lacking.

Linked with the inherent evolutionary "conservatism" of many bryophytes is their small size, and consequent ability to survive in limited niches, or microenvironments. The reduced size, as compared with that of seed plants, allows them to survive in small niches, even if they lack the ability to evolve to meet new environmental conditions. In a similar situation, the angiosperms in most cases must either evolve and adapt, or else die out. As a result, bryophytes, in many cases, perhaps have remained as

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[2] An equally significant factor in limiting the use of phytogeographical information derived from the Bryophyta is the difficulty of access to such data, and the relatively limited amount of such data available. The effect of recent collections on our concepts is illustrated, for example, by the ranges here plotted for *Diplophyllum obtusifolium* and *Anastrophyllum saxicola*. The writer has collected, in recent years, all of the material from eastern United States of both of these species, with the exception of only one collection. The recognition of these species as elements in the flora of the eastern United States thus is a very recent matter. Equally recent is our still very partial knowledge of the American range of *Scapania scandica*, which is not listed for the western hemisphere in the recent (1938) list of Buch, Evans & Verdoorn, and still listed as only known from Greenland in Frye & Clark (1946, in 1937–47).

relicts in sites where almost all disjunct angiosperms have disappeared and their study, therefore, is pertinent to the whole problem of the evolution of our present flora.

Within the more restricted framework of the phytogeographical affinities of the Great Lakes region, the pertinence of phytogeographical data, derived from bryophytes, has been shown in the pioneer paper of Steere (1937). He pointed out that the same phenomena of disjunction existed among the Great Lakes bryophytes as had been demonstrated by Fernald (1925, 1935) for the tracheophytes. In Steere's paper, the disjunct Bryophyta were treated as members of four floristic elements, as follows:

(1) Arctic species which reach their southernmost point in the Lake Superior region. *Asterella ludwigii* (Fig. 7) is cited as an example.

(2) Almost strictly Cordilleran species, "usually characteristic of high altitudes." *Jungermannia schiffneri* is cited as an example, and a map of its then-known distribution is given (Steere, Fig. 4).

(3) Pacific coast species, usually characteristic of lower altitudes. *Frullania bolanderi* is cited as an example, and its distribution given (Steere, Fig. 5; see Fig. 12).

(4) Cordilleran species, also found (at lower elevations) in the "Driftless Area" of Wisconsin, Iowa, Minnesota and Illinois. An example is cited, *Asterella saccata* (see Fig. 14).

To these distributional types the present writer would add, for the purposes of this discussion, several others:

(5) Arctic species, occurring in the "Driftless Area," but evidently not in the Lake Superior Region. *Athalamia hyalina* (Fig. 15) and *Mannia sibirica* (Fig. 16) have distribution patterns of this type.

(6) Arctic species, occurring southward to the Lake Superior Region, and also in the "Driftless Area." *Mannia pilosa* (Fig. 16) has a distribution pattern of this type.

(7) Appalachian species, with a scattered range into the Ozarks, in some cases to the "Driftless Area" and northward also to the Lake Superior region. *Mannia rupestris* and *Diplophyllum apiculatum* are examples (Figs. 17, 18).

The total effect of the introduction of these additional more or less clearly disjunct vegetational elements serves to attribute to the Great Lakes Area (including the nearby "Driftless Area"), and specifically the region peripheral to Lake Superior, an extremely synthetic and diversified flora, considering that the entire region appears to have been glaciated. In the following discussion, examples of each of the vegetational elements are treated, followed by a discussion in which these discordant distribution patterns will be briefly analyzed.[3]

(1) ARCTIC SPECIES, REACHING THEIR SOUTHERNMOST RANGE IN THE LAKE SUPERIOR REGIONS (Figs. 1–8)

In general, the species with this type of distribution occur southward (at high elevations) to New England, and (at much higher elevations) southward to varying degrees in the Cordilleran chain. Exceptions are specifically noted.

Odontoschisma macounii (Aust.) Underw. (Fig. 1). This species, of arctic and alpine distribution in Europe and North America, occurs in a transcontinental belt, lying largely between 55°–82°21′ Lat. N. Eastward it occurs to the south only on Cape Breton I., and on islands in Lake Mistassini; westward it occurs to St. Matthew I. south of Bering Strait. In the United States, it is found only in a restricted area along the North Shore of Lake Superior from Minnesota to Ontario (type), and in Wisconsin and Michigan along the southern shore of Lake Superior. The range is somewhat restricted by the weakly "calciphilous" nature of the species.

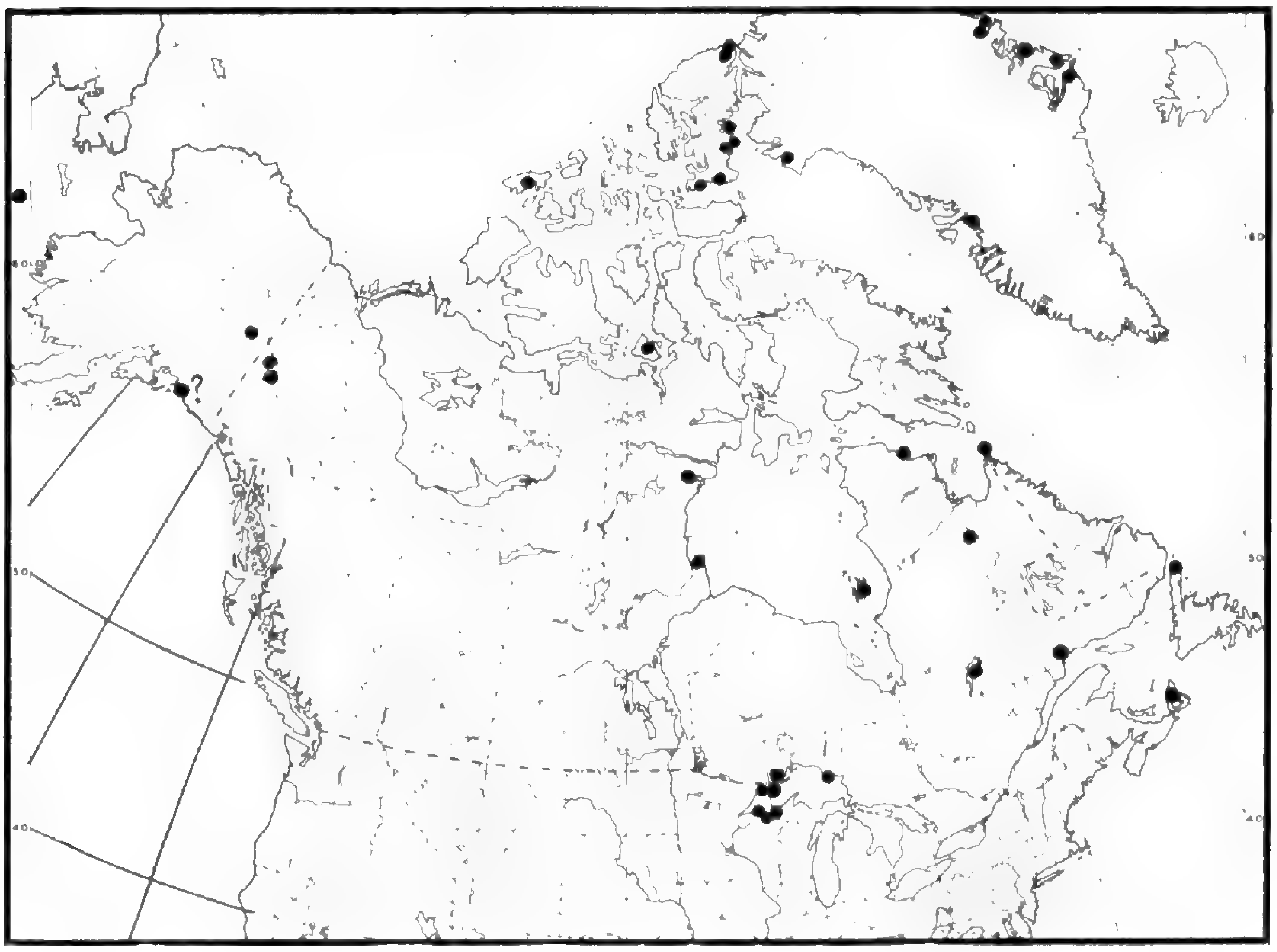

Fig. 1. North American range of *Odontoschisma macounii*.

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[3] Subsequent to the completion of the text and maps, the important paper by Buch & Tuomikoski (1955) on the Hepaticae of Newfoundland, has come to hand. Several of the species treated herein are there extended to Newfoundland.

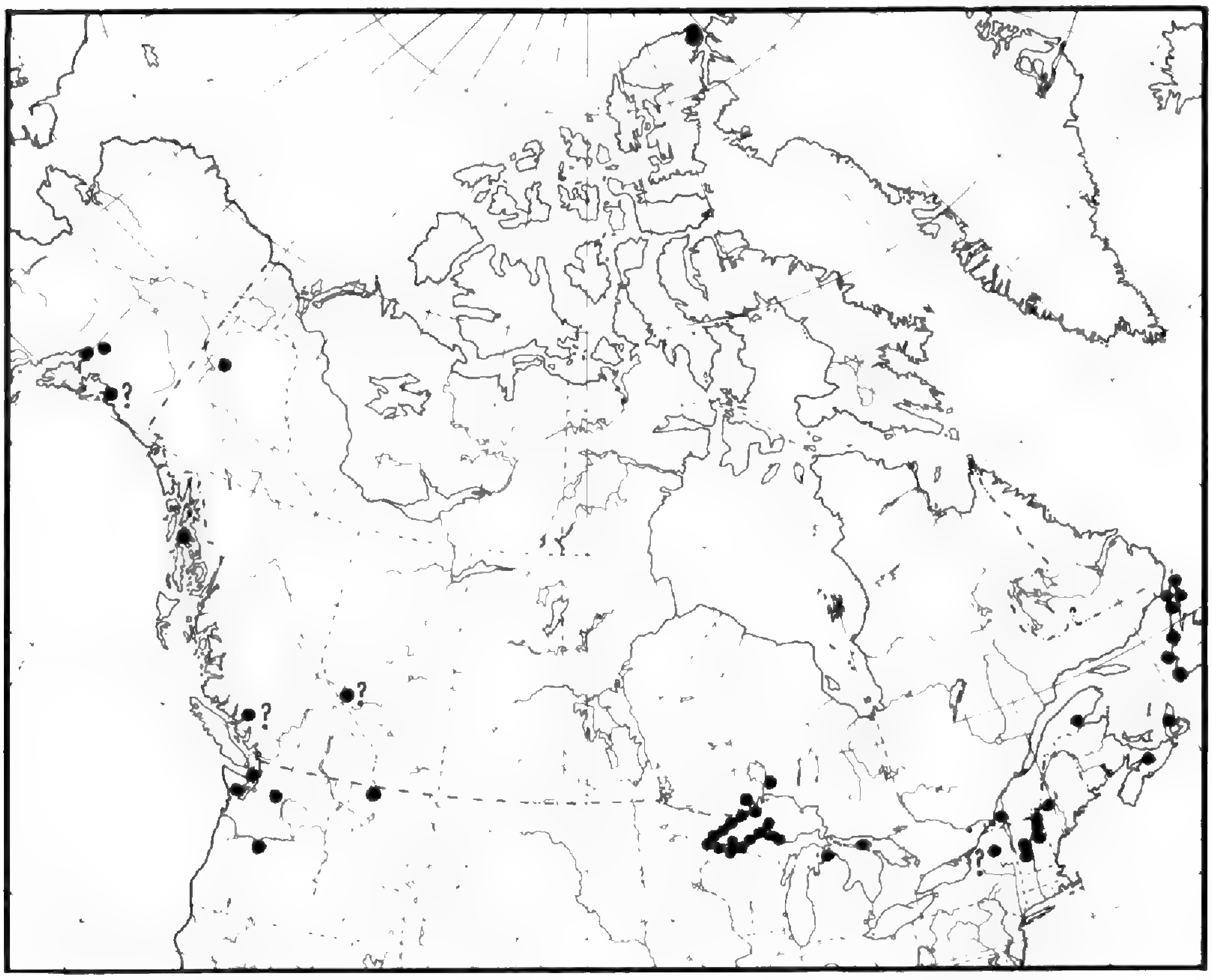

Fig. 2. North American range of *Lophozia (Leiocolea) gillmani.*

Lophozia gillmani (Aust.) Schuster (Fig. 2). A relatively widespread arctic-alpine species more strongly restricted than the last by pronounced Ca requirements. Found in isolated sites, from northeastern Ellesmere I. (*Schuster, 1955*) south to Quebec, Nova Scotia, Vermont and New Hampshire (to the south at medium and high elevations), as well as in the west from the Yukon to the south coast of Alaska, to northern Oregon and Montana. Abundant in the Great Lakes area from Manitoulin I. in Lake Huron to Lake Superior.

Scapania microphylla Wstf. (= *S. buchii* Müller) An arctic-alpine species known from northern Europe, westward to Iceland, reported from one station in Maine, and from Prince Edward I.; recently reported from the north shore of Lake Superior, Lake Region between Minnesota and Ontario, and from Isle Royale, Michigan (Schuster, 1953). An unpublished report extends the species to Wisconsin. This systematically difficult species probably will prove transcontinental when more fully understood.

Lophozia (*Orthocaulis*) **quadriloba** (Ldb.) Evs. (Fig. 3). Usually considered a high arctic species, with the range in North America almost totally north of the Arctic Circle, north to 83°6′ N. in Greenland and 82°32′ N. in Ellesmere I., only two reports from the high mountains of the Canadian Rockies lying far to the south. Recurring, totally as a disjunct, at Copper Harbor, and at the "Devil's Washtub," Keweenaw Co., Michigan (Schuster, 1953).

Lophozia (*Leiocolea*) schultzii (Nees) Schiffn. In Europe essentially arctic in distribution, but in North America with a peculiar range involving Alaska and the Yukon, the west coast of Hudson Bay (*Schuster, 1955*), the Gaspé, and the Lake Superior-Lake Michigan region. The totally anomalous report of the species from Bergen Swamp, N. Y. (Schuster, 1949) must be interpreted in the light of the occurrence at the latter locality of many western and Great Lakes species, i.e., *Solidago houghtonii*; the species there is certainly a late Pleistocene relict.

In the absence of reports from the eastern Arctic, the range of this species, in North America, approaches the next group to be treated, the Cordilleran species. However, it must be kept in mind that the species is an obligatory calciphyte.

Scapania scandica (Arnell et Buch) Macv. (Fig. 4). Until recently, the only reports of this species from North America were those of Buch (1928) from Greenland. Persson (1946) reported the species first for North America proper, the species occurring in four widely separated

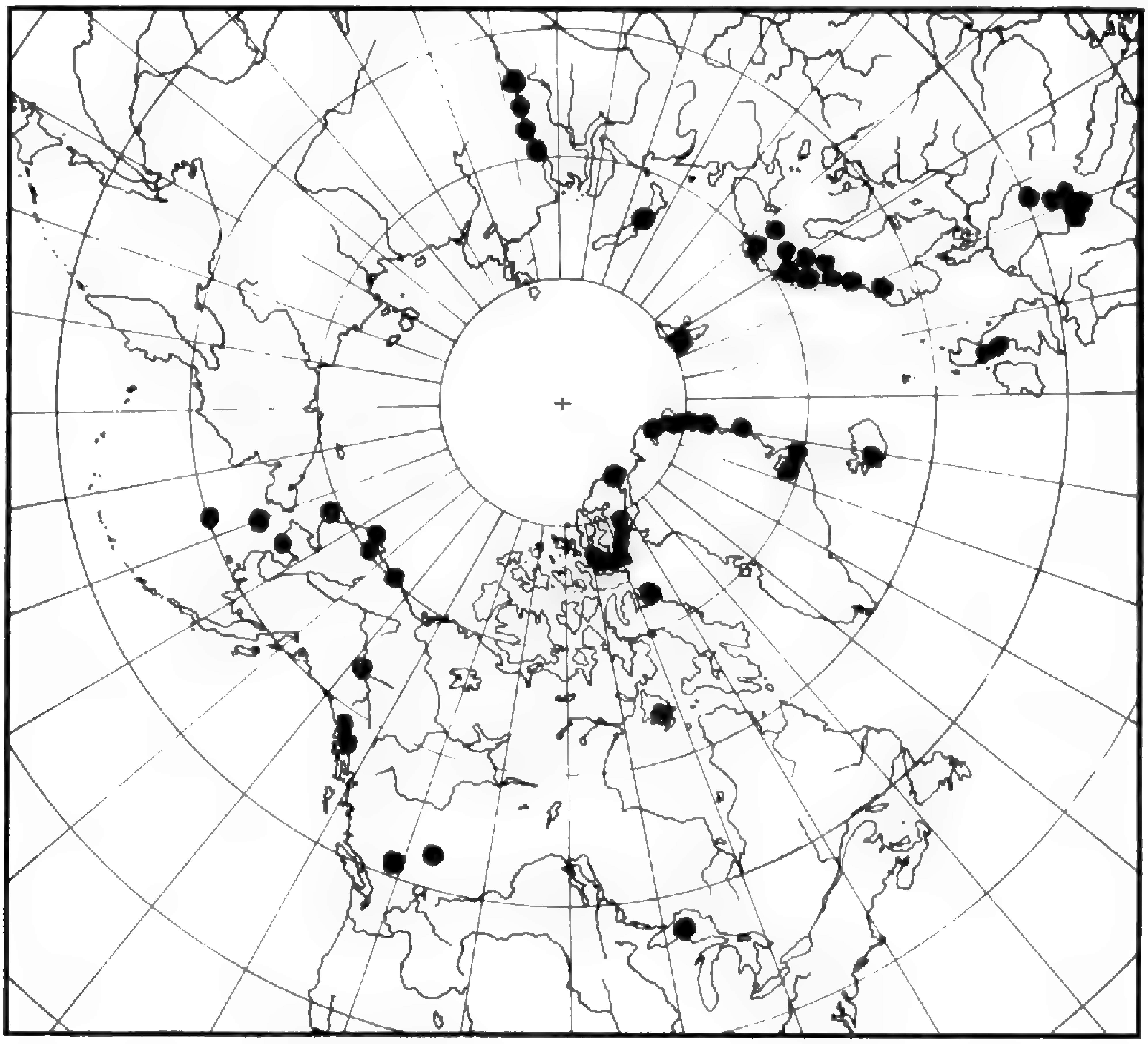

Fig. 3. World range of *Lophozia (Orthocaulis) quadriloba*. Not all stations could be indicated in cases where individual stations are situated less than 100 miles apart.

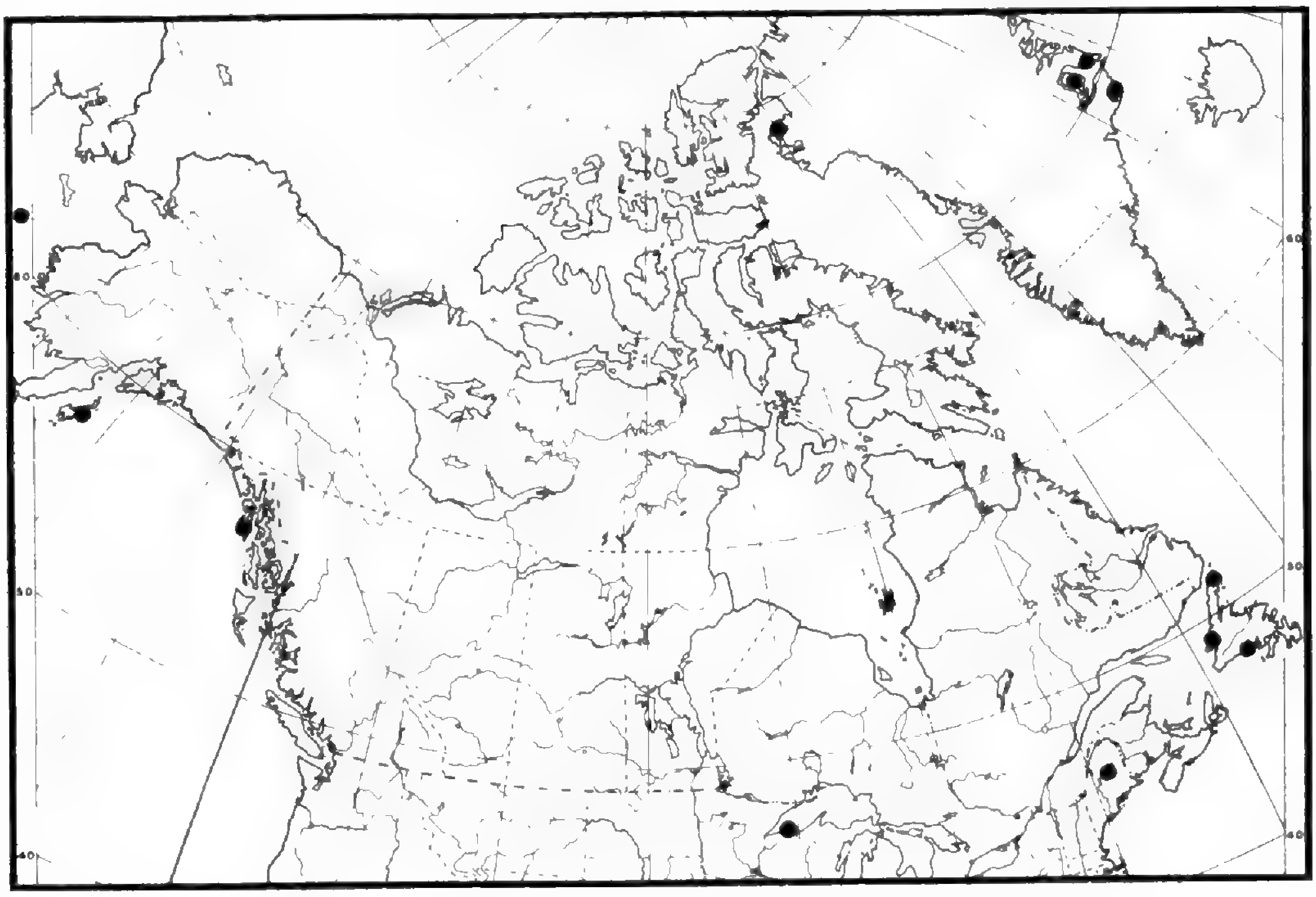

Fig. 4. North American range of *Scapania scandica*.

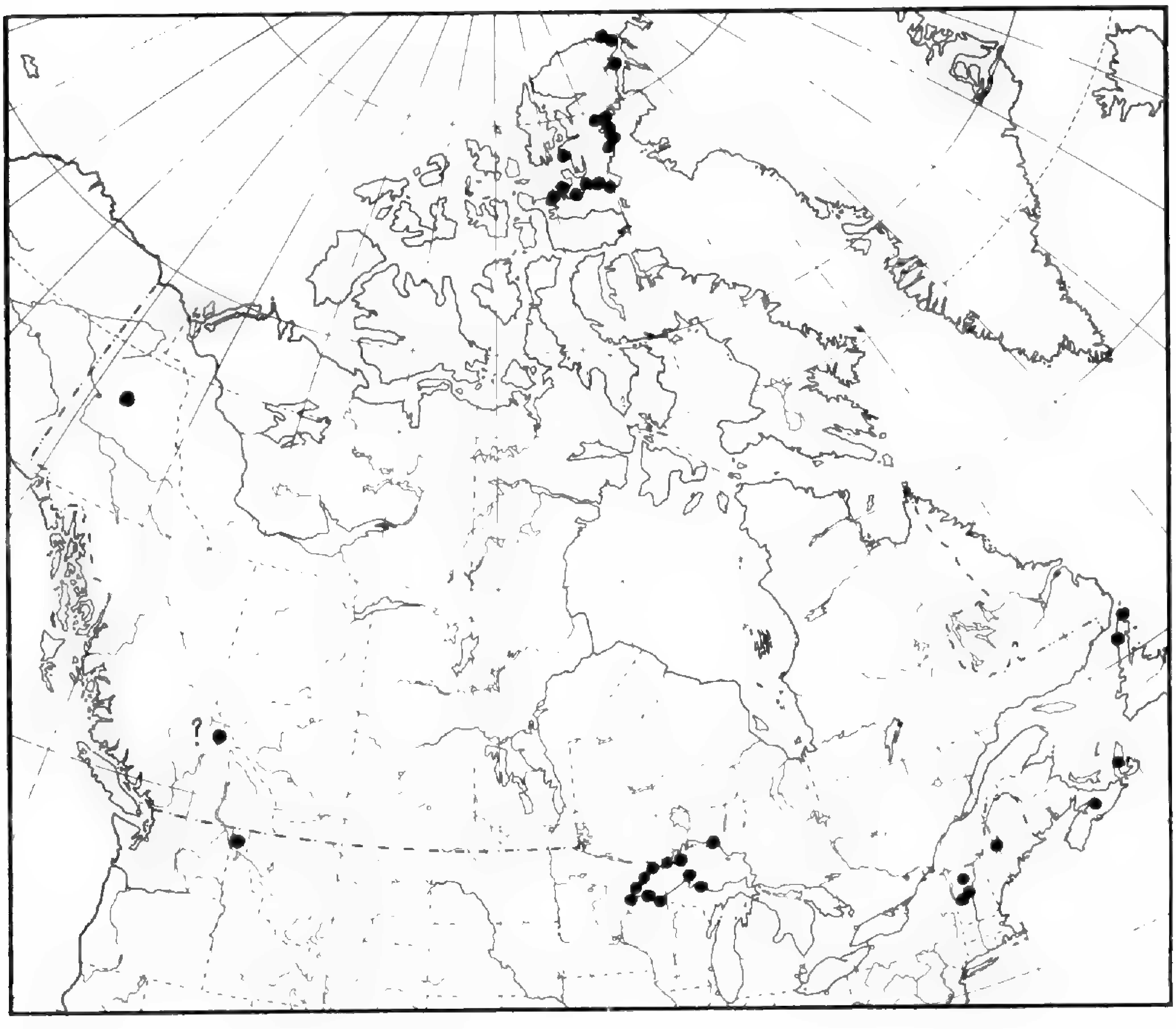

Fig. 5. North American range of *Scapania gymnostomophila* (including *S. incurva*); the British Columbia report uncertain.

localities from Sitka on the southern coast to Kodiak, to St. Matthew I., and to Unalaska (the latter station is not indicated on the map). Persson indicated a probable oceanic distribution for the species. From a study of the entire range of the species I postulated that it should be found southward to Labrador, Newfoundland and Nova Scotia, in the same general areas as *Diplophyllum albicans*. Shortly thereafter, two collections were made by the writer on Mt. Katahdin, Maine: one near the foot of Hamlin Ridge, at only 2800 ft.; the other near the top of the Saddle Slide, at *ca.* 4500–5000 ft. (*Schuster 32910, 32994a*, 1954). A year later the species was found in Newfoundland (Buch & Tuomikoski, 1955). Later during the same year, a specimen was studied from the Lake Superior region, Oak I., Wisconsin (*Cheney 6033*, 1896, as *Scapania curta*; NYBG) which exhibited many similarities to *S. scandica*, but some to the extremely closely allied *S. helvetica*, a species known only from the European Alps. It proved to be almost impossible to decide which of the two taxa was involved, so the material was submitted to the European specialist on the genus, the late Dr. K. Müller. He expressed the opinion that it was *S. scandica*. Although the occurrence of the high-arctic *Scapania spitzbergensis* on Mt. Katahdin (Schuster, 1951a) makes the occurrence there of *S. scandica* a matter of little surprise, the occurrence of *S. scandica* in the Great Lakes region is remarkable.

Scapania gymnostomophila (Kaal.) Kaal. (Fig. 5) (incl. *Diplophyllum incurvum* Kaal.). An arctic species in Europe, with isolated Alpine stations, and one or two in the intervening lowlands. In North America known from numerous stations on Ellesmere I., north to 82°32′ N. and recently established as occurring in the Yukon (Persson, 1952), with a somewhat dubious report from British Columbia (based on a Brinkman collection) and a dubious report from northern Idaho (Frye and Clark, 1946). Again found from Cape Breton I. and Nova Scotia to Maine and Vermont, and in a rather large number of stations in the Lake Superior area. The distribution strongly restricted by the presumably obligatory Ca requirement.

Scapania cuspiduligera (Nees) K. Müller (Fig. 6). A species with as rigid a restriction to calcareous rocks as *S. gymnostomophila*, but with a wider distribution in North America. In Europe, arctic-alpine. In North America widespread from Alaska to Ellesmere Island and Greenland, southward in the Cordilleras to Colorado and New Mexico, and probably to California (at high elevations only!); in the east south to the east shore of Hudson Bay (Schuster, 1951), and to the St. Lawrence Valley and the Gaspé. Recurring, not infrequently, along the Lake Superior shore in Minnesota, Michigan and Wisconsin.

I have also seen a single collection, of typical material, from the alpine portions of Japan (*Inoue*).

Asterella ludwigii (Schwägr.) Underw. (Fig. 7). Also a "calciphile" and consequently of restricted range. With the exception of a doubtful report from Alaska, restricted to the Cordilleran region of the west, (where frequent at high elevations), and recurring along both the east

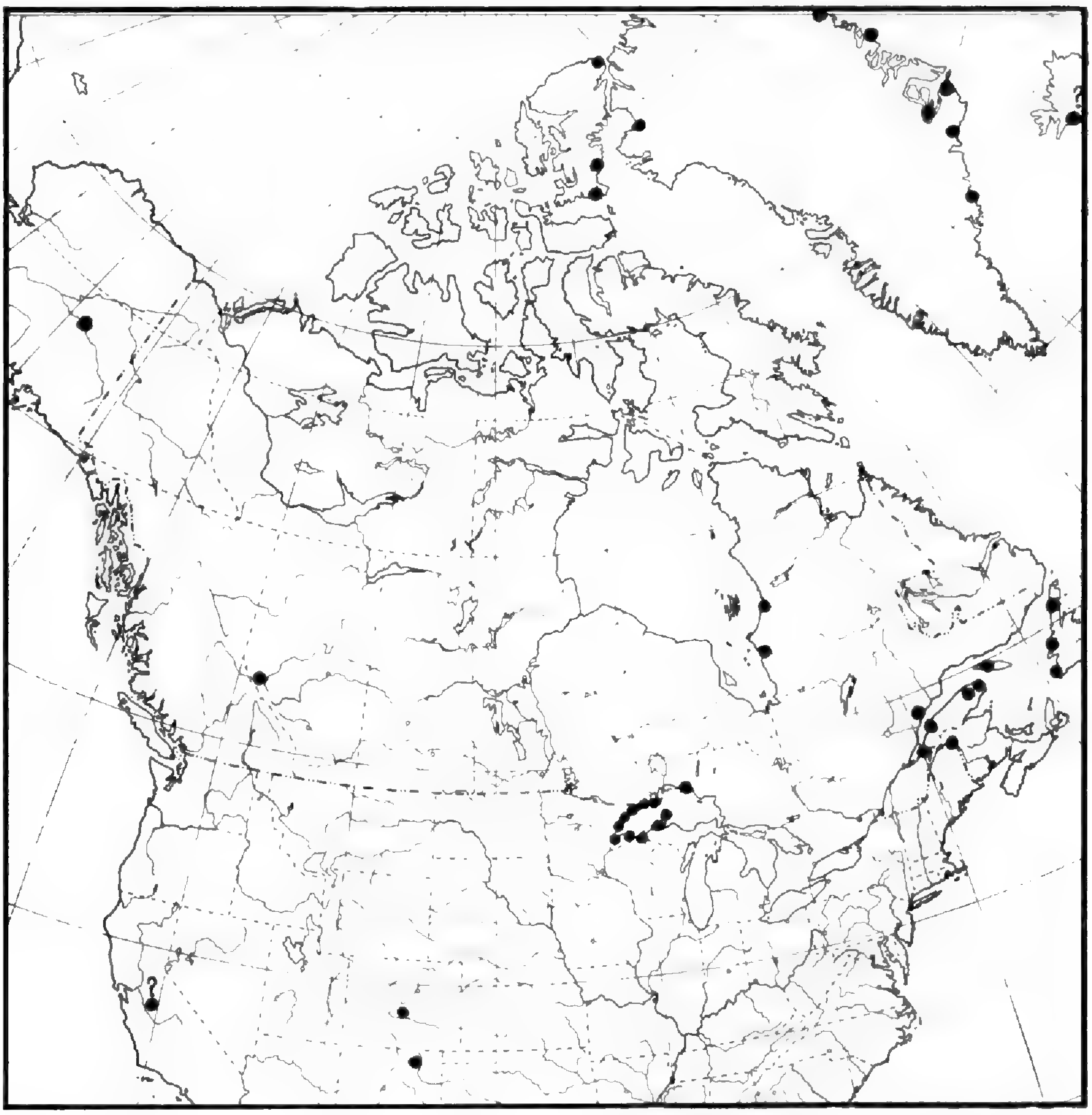

Fig. 6. North American range of *Scapania cuspiduligera*. The report of this species from western New York (*fide* W. C. Steere), cited in Schuster (1949) is regarded as questionable.

and west coasts of Greenland, in Baffin I., and at Ungava Bay; a doubtful report from the Gaspé. Known from four stations in the Lake Superior region (Ontario, Minnesota and Michigan). The rapidly increasing knowledge regarding the distribution of this species is clear if the map here given is compared with that in Steere (1937, Fig. 2). It is also illuminating to compare the distribution given for the species by Steere (1937) and by Frye and Clark (1937, in 1937–47). The latter, due to an inadvertent confusion of both the distribution data and the illustrations of the two species (see Schuster, 1953) gave the impression that *A. ludwigii* was a common lowland plant in eastern North America. They "extended" the range south to Missouri and Nebraska, and were followed in this by Whittlake (1954), who was able to "extend" the range of this species even as far south as Arkansas. All these reports are certainly erroneous, and must refer to *A. tenella*, the common lowland species.

Anthelia juratzkana (Limpr.) Trev. (Fig. 8). A non-calciphile, of

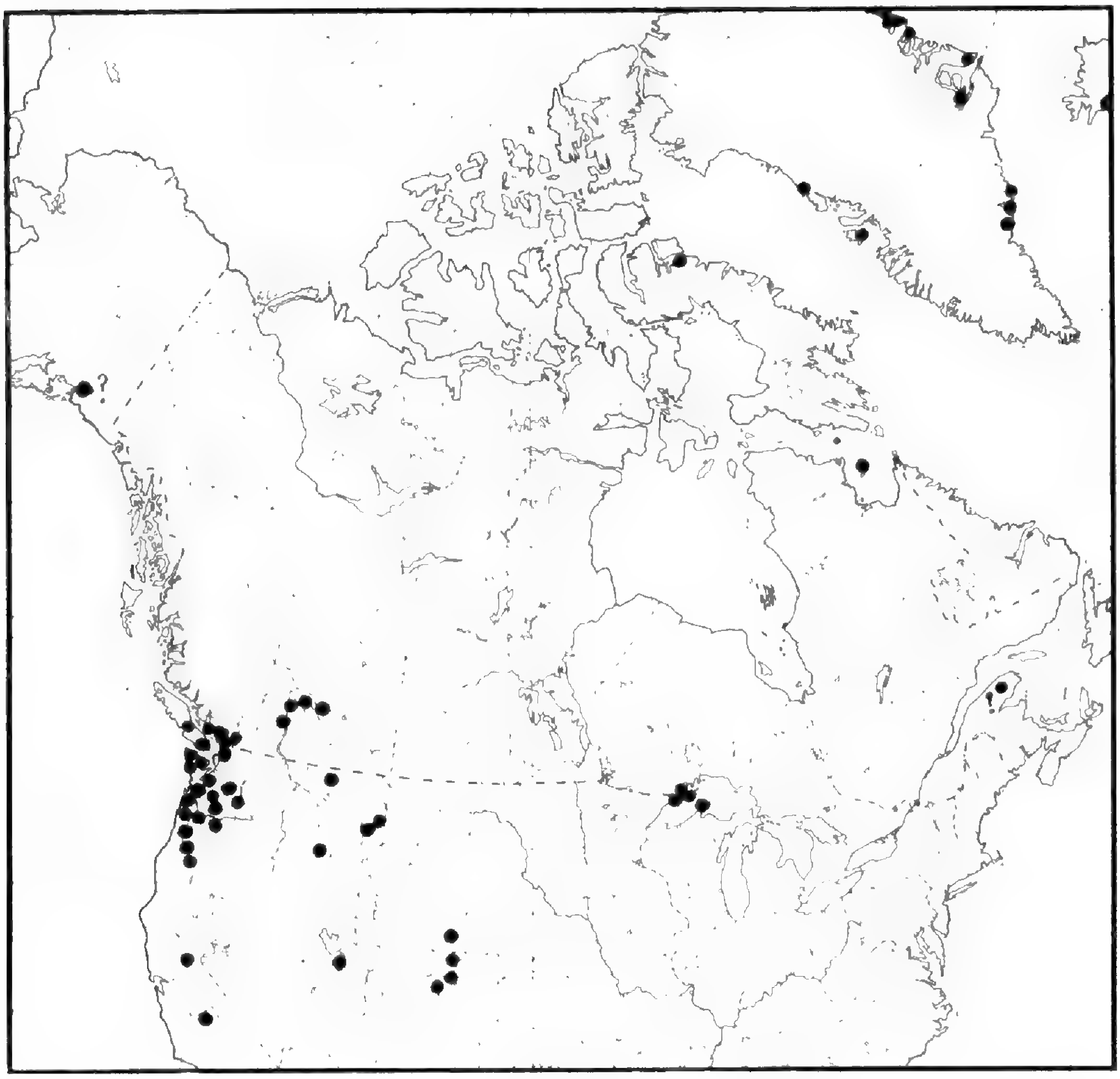

Fig. 7. North American range of *Asterella ludwigii.* The report from the Gaspé uncertain; all of the reports of this species from eastern United States in Frye & Clark (1937) are erroneous.

arctic-alpine distribution, known from the southern coast of Alaska to the Alberta-British Columbia boundary region, south to Washington, and California (locality uncertain), and in the east from Greenland and northernmost Ellesmere I., south to the east coast of Hudson Bay. With a somewhat isolated occurrence on the summit of Mt. Katahdin, Maine (Schuster, 1949), and in the White Mountains of New Hampshire. Totally disjunct at Pictured Rocks, Michigan, on the Lake Superior shore.

Cephalozia leucantha Spruce. A low-grade arctic and subarctic species, apparently lacking in Greenland and Ellesmere I., but with a widespread distribution in the southern portion of the Tundra, and the ecotone between Tundra and Taiga in Quebec, Labrador, and Newfoundland. In addition, a single report from Mt. Marcy, New York (Schuster, 1953), and one from Minnesota (Schuster, 1953). In the west apparently frequent from Alaska, as far west as Agattu I., southward to British Columbia and Washington.

Anastrophyllum saxicola (Schrad.) Schuster (Fig. 9). A rare arctic-alpine species, first reported from the United States from Pigeon Point, Minnesota (Schuster, 1953) but found recently on Mt. Katahdin, Maine (Schuster, August, 1954). The species occurs scattered from Alaska (as far west as Attu I.; station not on map) and the Yukon, and doubtfully to British Columbia, to east Greenland, Baffin I. (Stephani; a recent collection studied from Pangnirtung, *Wynne-Edwards*), Quebec, and the shore of James Bay in Ontario. The species is an oxylophyte.

Very recently a wholly disjunct station of *A. saxicola* has been discovered by the author on Roan Mt., both in Tennessee and North Carolina. The occurrence of this arctic-alpine species in the Southern Appalachians, although at first very surprising, is not without parallel. *Sedum rosea*, with the bulk of its range equally in the treeless regions from Labrador to Greenland, occurs as a disjunct on Roan Mt.

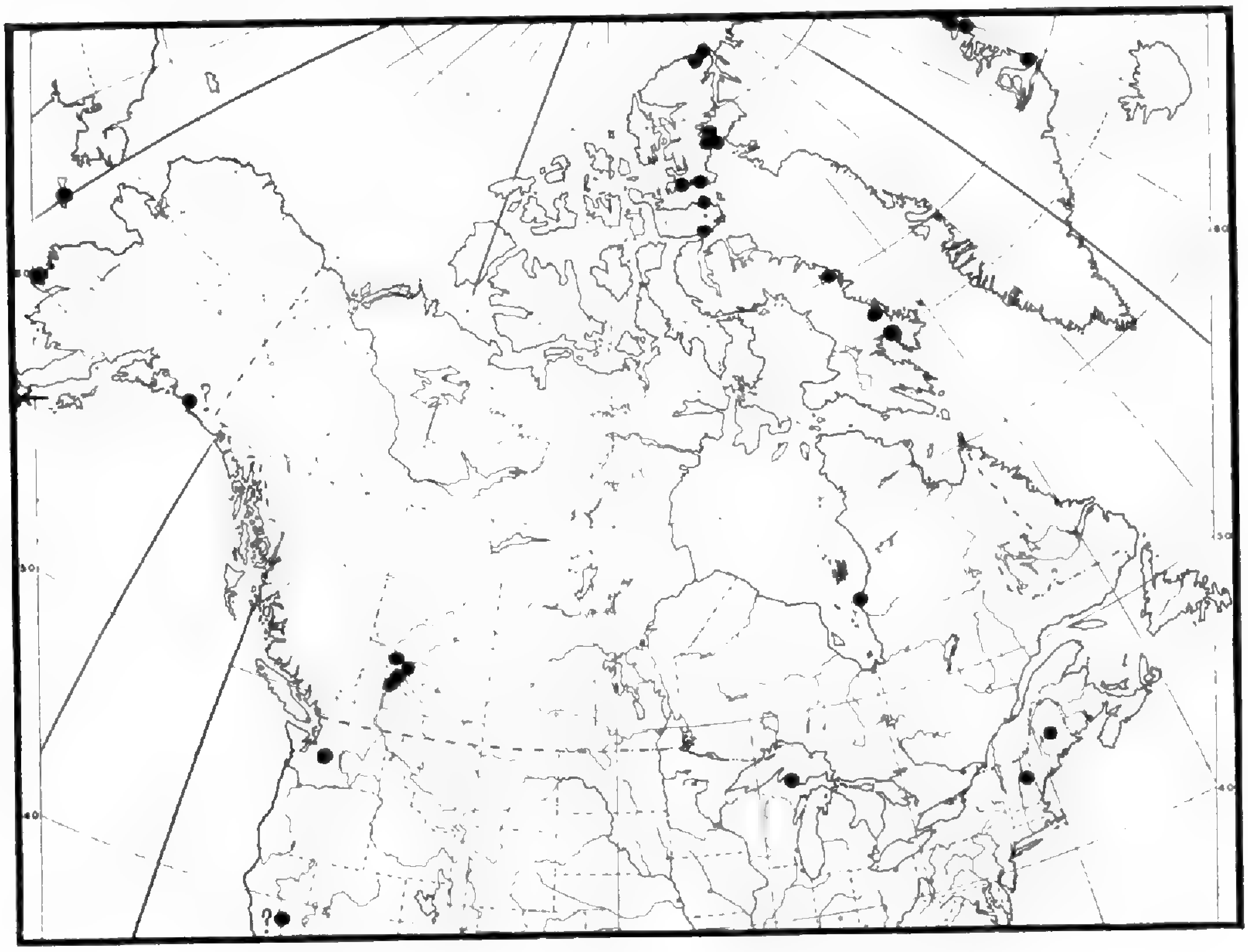

Fig. 8. North American range of *Anthelia juratzkana*.

Odontoschisma elongatum (Ldb.) Evs. An essentially arctic-alpine species, rare in the Taiga. Widespread in Alaska; recurring eastward on the Greenland coast, the coast of Hudson Bay (Schuster, 1951), southward to the high mountains of Maine and New Hampshire. Recurring as a disjunct, in the Lake Superior area, near Thunder Bay, Ontario, and at Deer Lake, west of Munising, Michigan (Schuster, 1953). Strongly oxylophytic.

Cephaloziella spinigera (Lindb.) comb. n. (based on *Cephalozia spinigera* Lindberg, Musci scand. 4, 1879; *C. subdentata* Wstf., Krypt. Fl.

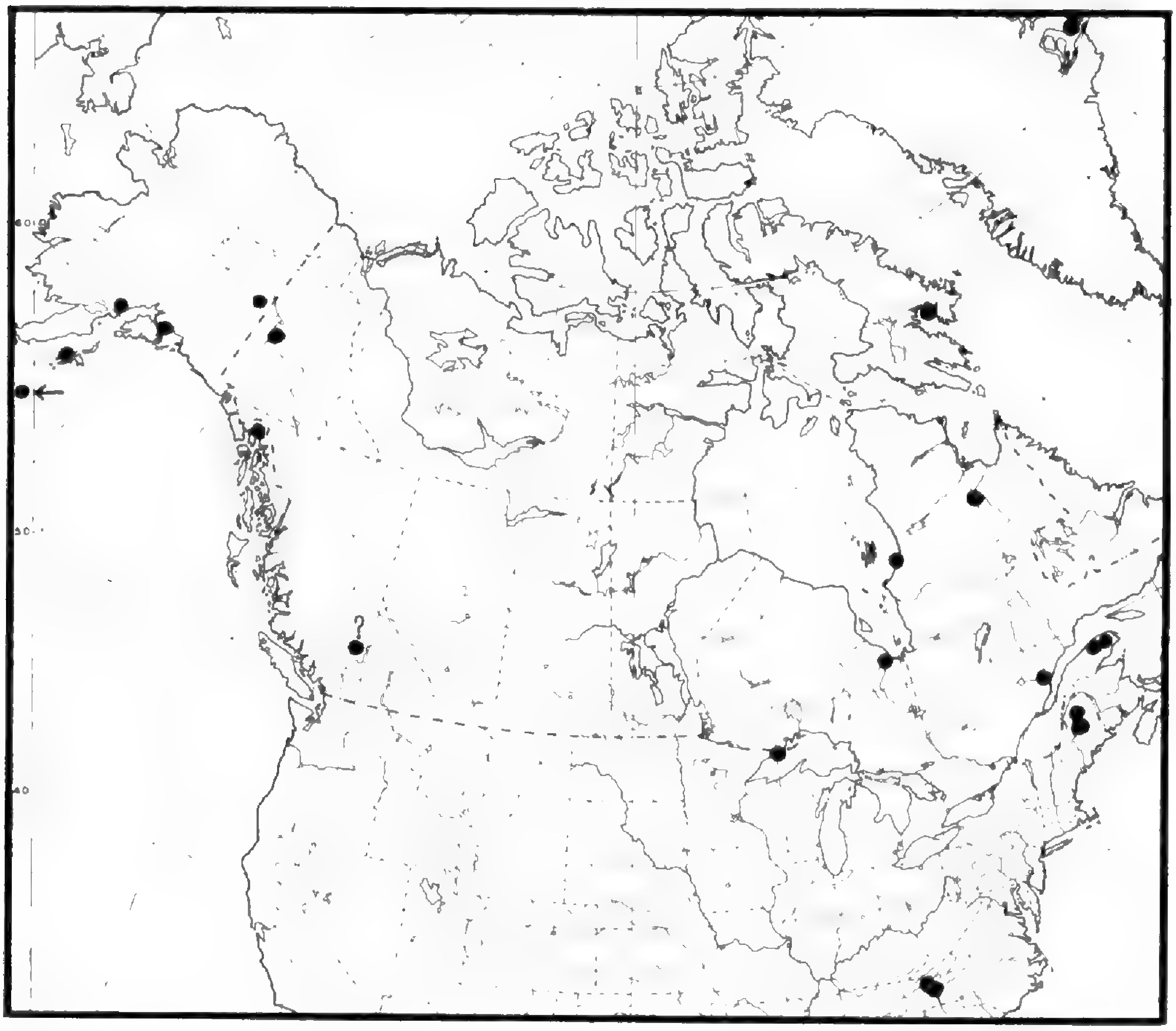

Fig. 9. North American range of *Anastrophyllum* (*Eurylobus*) *saxicola*.

Mark Brandenburg 1: 234, 1902). This helophytic species was first reported from continental North America by Schuster (1949), from western New York—the least likely place in which it would be expected to occur, because of the pronouncedly arctic and high subarctic character of the plant. The bulk of its range extends from St. Lawrence I. and continental Alaska to northern Quebec and Greenland. Collected several times in the high mountains of New England by the writer (Mt. Monadnock and Zealand, N.H.; Mt. Katahdin, Maine), and recently from northeastern Minnesota (Schuster, 1953). The plant is also present in a collection of *Microlepidozia setacea* made in a bog near Burt Lake, Michigan (*Patterson*). This species will probably prove transcontinental in peat bogs and on peat-covered ledges, with the bulk of its distribution in the Arctic.

Scapania degenii Schiffn., ex K. Müll. (Fig. 10) and *Scapania hyperborea*. These closely allied species (Schuster, 1953) are treated as a unit here because of the lack of agreement as to whether the Great Lakes p'ants are to be regarded as *S. hyperborea* or *S. degenii*. Because of their peculiarities, the Lake Superior plants have been regarded as a variety (var. *dubia*) of *S. degenii* (Schuster, 1953). *S. hyperborea* s. str. is frequent, apparently, on the Greenland coast, and occurs on the eastern shore of

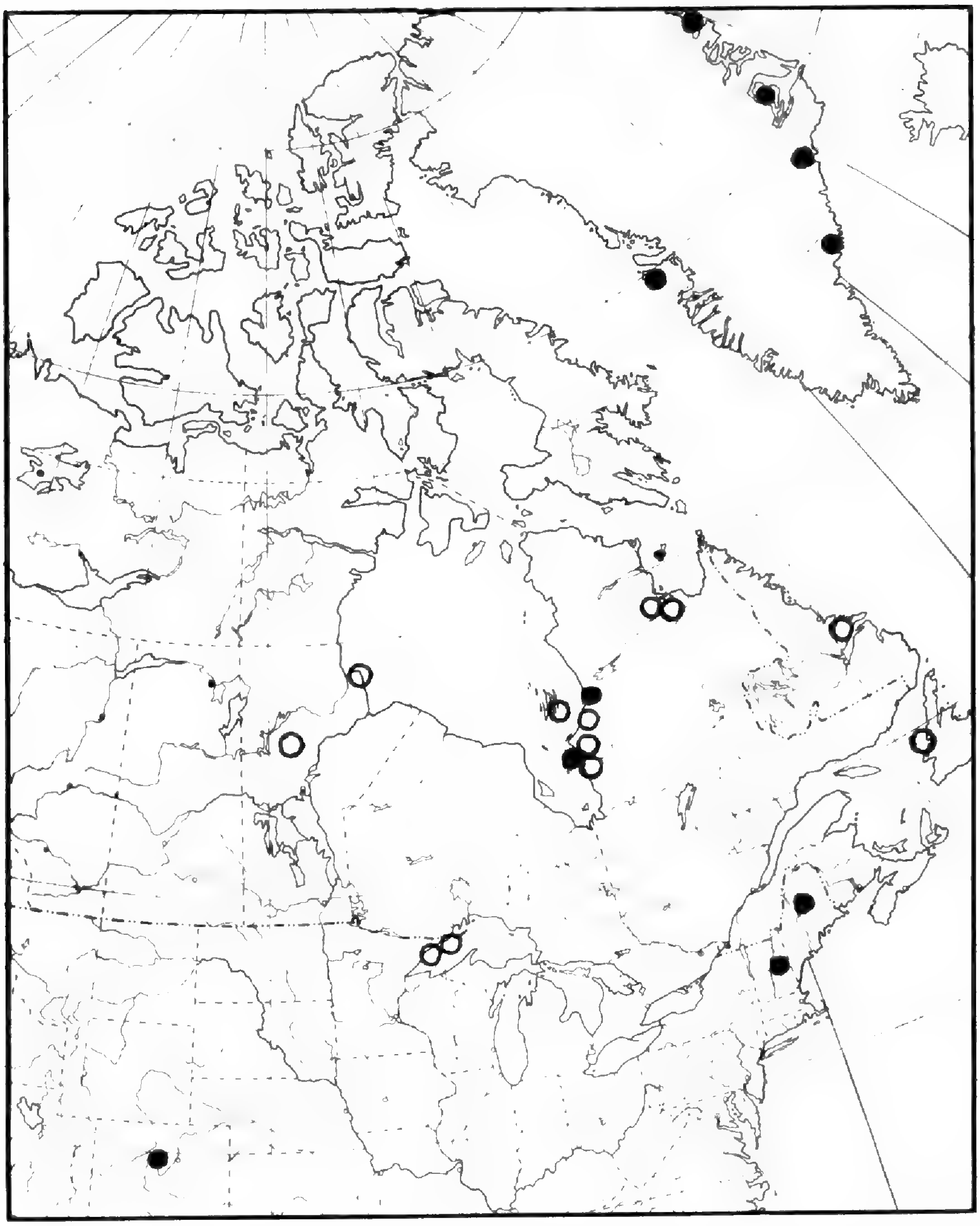

Fig. 10. North American ranges of *Scapania degenii*, including var. *dubia* (rings) and *S. hyperborea* (dots).

Hudson Bay (Lepage, 1953); it was earlier reported by Evans from Maine and New Hampshire, where it is limited to the alpine peaks of the higher mountains. The closely allied *S. degenii* occurs in northernmost Quebec, the Belcher Islands in Hudson Bay, the east coast of Hudson Bay, and near Churchill on the west coast of Hudson Bay, and then recurrs again on the north shore of Lake Superior in Minnesota (Schuster 1951, 1953); a specimen has recently been seen from the coast of Labrador. It was reported from North America only recently, almost simultaneously by Arnell (1950) and Schuster (1951), and does not appear in the work of Frye and Clark. In the opinion of the writer, two distinct species are involved, *S. hyperborea*, an oxylophyte; *S. degenii*, usually a "weak" calciphyte.

The preceding examples could be further supplemented, without too much point. The ranges of an additional series of species with a similar range are mapped, although not discussed, in Schuster (1958). They demonstrate the existence, in the Lake Superior area, of a well-developed element of arctic and arctic-alpine species, which extend further southward only in some instances (and then at high elevations in the mountains, in all but isolated cases). This, in the opinion of the writer, is clearly due to a microclimatic tundra zone, forming a narrow fringe around the coldest of the Great Lakes. The preceding species, therefore, are to be regarded as a sort of "rear guard" of a larger series of

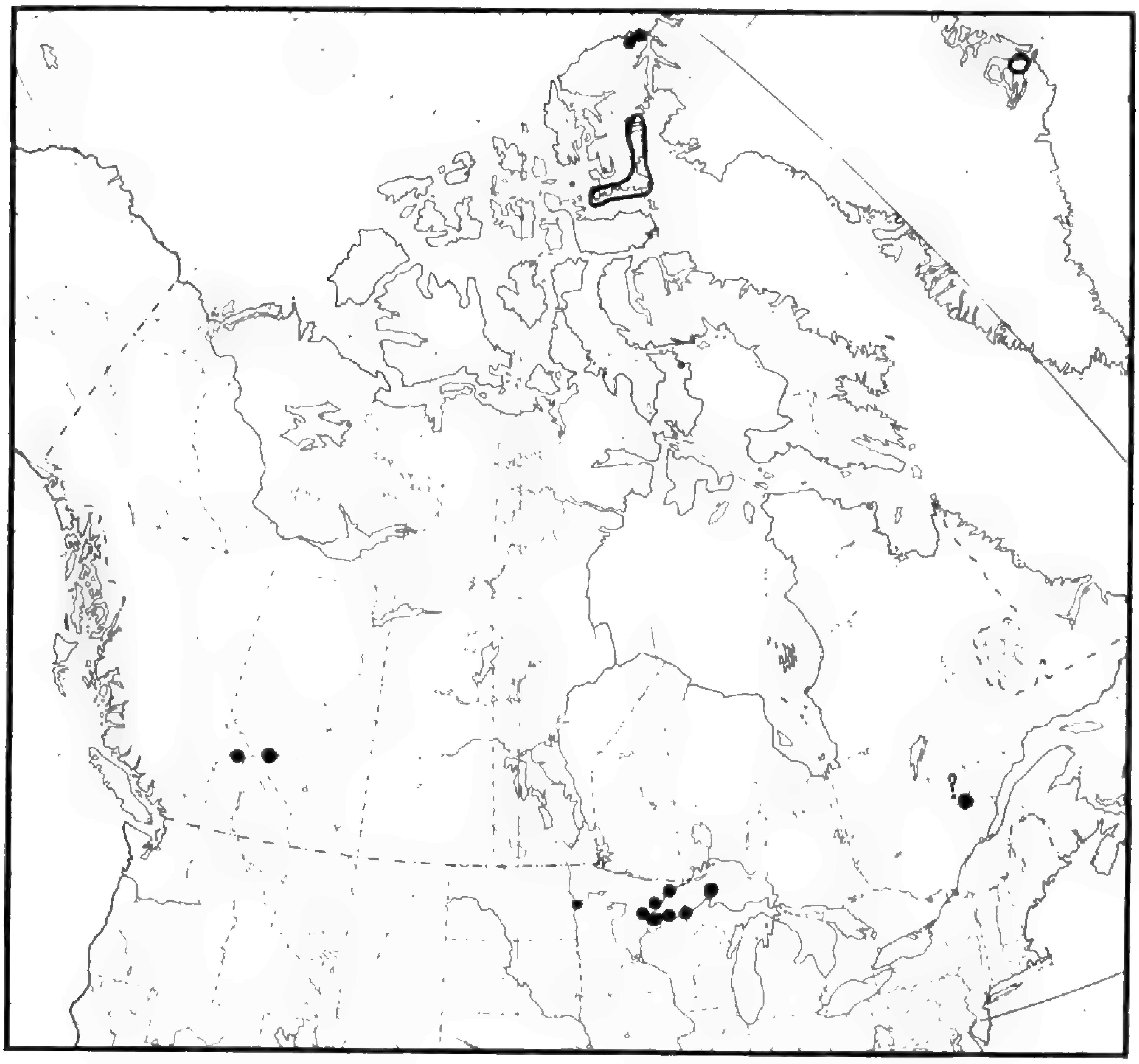

Fig. 11. North American range of *Jungermannia polaris* (open areas and rings) and of the presumed synonym, *J. schiffneri* (dots).

arctic species, at one time presumed to have characterized much of the raw, recently uncovered soil and rock, at the margin of the receding Pleistocene icesheet. The fact that of these 15 species (haphazardly selected), 8 are to be classified as "calciphiles" is clearly not contradictory to such an explanation. These species, then, are simply relicts, left behind during the northward march of the vegetation after the last glaciation. Their survival locally, in such large numbers, is clearly partially due to the influence of the cold waters of Lake Superior.

Subsequent to the completion of this paper, the writer had occasion to spend a summer in northeastern Ellesmere Island some 40 miles south of the northern tip and 80 miles south of the northern tip of Greenland (the northernmost land area in the world), collecting between Latitudes 82° 24′ and 82° 32′ N. Of these 15 species six (*Odontoschisma macounii, Lophozia gillmani, L. quadriloba, Scapania gymnostomophila, S. cuspiduligera, Anthelia juratzkana*) were found in this area; all of these are "calciphiles" or at least strongly Ca-tolerant. Of the many other largely arctic-alpine species reported for the Lake Superior area, several others were found, among them: *Cephaloziella arctica, Lophozia kunzeana, L. heterocolpa, Lophozia latifolia* and *Cryptocolea imbricata.* The latter two species, only recently described, very rare and restricted in the Lake Superior area, proved to be quite frequent on the north shore of Ellesmere I.!

(2) CORDILLERAN SPECIES OCCURRING AS DISJUNCTS IN THE LAKE SUPERIOR REGION

Steere cites *Jungermannia schiffneri* Loitlesb. (Fig. 11) as an example and gives a map which appears to support this viewpoint. However, this species has recently been reported from Quebec (Lepage, 1945) and is doubtfully known from Ellesmere I., while dubious material is reported as this species from western Pennsylvania. It is probable that a sporadically distributed, widespread arctic-alpine taxon is involved, rather than a *bona-fide* Cordilleran species. The rarity of the species makes it unwise to generalize as to its floristic affinities.[4]

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[4] A further complicating factor in interpreting the range of *Jungermannia schiffneri* is the status of the plant known as *J. polaris.* This last was described (as *J. pumila* var. *polaris*) from Spitzbergen material, distributed by Berggren, No. 176, in the Musci Spitzberg., in 1868. Two years later it was raised to a distinct species by Lindberg, and reported from Greenland. Bryhn (1906–1907) reported numerous stations of it from Ellesmere Is. Indeed, judging from the number of stations, this was, on the Second Thule Expedition, the most frequently collected member of the Jungermanniaceae. *J. polaris* was, however, placed as a synonym of the dioecious *Jungermannia atrovirens* by both Stephani and Müller. *(Con't. p. 224.)*

Perhaps no other good case of a species of Hepaticae with a restriction to the Cordilleran area, and an extension to the Lake Superior area is known. This, it should be emphasized, is most easily explained because of the essential lack of a Cordilleran series of species among the Hepaticae. With the greater age of the species, there has been, in virtually no case, divergent evolution of the widespread northern species with an east-west distribution in North America. If maps 1–11 are studied (of the arctic-alpine species), it will be seen that occasional species "approach" the Cordilleran-Great Lakes-St. Lawrence Valley pattern so often emphasized by Fernald. This is the case with *Lophozia gillmani* (Fig. 2) and also *Lophozia schultzii*. These species, however, are obligatory calciphiles, and the disjunction in distribution may be due largely to a disjunction of suitable habitats. As a consequence, the writer cannot at present recognize a Cordilleran element in the hepatic flora of the Lake Superior shore.

The absence of such a Cordilleran element is accompanied by another phenomenon: the frequent Cordilleran extension southward, at high elevations of species I would regard as arctic-alpine in nature. *Scapania cuspiduligera* (Fig. 6), *Asterella ludwigii* (Fig. 7) and *Scapania hyperborea* (Fig. 10) all show such a southward range in the Cordilleras. Any real east-west disjunction appears to be between an oceanic, Pacific element, restricted largely to the Coastal Ranges, and an Appalachian element. Among such examples may be cited *Bazzania denudata* and *Herberta sakuraii* (synonyms are *H. hutchinsiae* and *H. tenuis*; see Schuster, 1957a). East-west disjunction, in the Hepaticae, thus appears to be a phenomenon going back to the early Cretaceous, when the last great submergence of the North American continent took place. This explanation, if tenable, would go far to explain the restriction of a high incidence of "endemics" to the area peripheral to the mid-Cretaceous, Mesocordilleran geanticlinal of the westernmost portion of the continent, and to the Appalachian region to the east. This interpretation would involve, therefore, a pre-Tertiary and at least late Mesozoic origin of some extant species of Hepaticae.

In 1955 I found that the only frequent member of the Jungermanniaceae found on the northeastern coast of Ellesmere I. was the paroecious plant identical in all important respects with *Jungermannia schiffneri*. Subsequently, the collection of Berggren from Spitzbergen, described as *J. pumila* var. *polaris*, alluded to above, was examined. This collection must be considered as the type of var. *polaris*, although it is much less clear that it can serve as the type of the species *polaris*. Careful examination has revealed several pertinent features previously overlooked: (a) the plants are paroecious; (b) the capsules have the median epidermal cells of the valves with 2–4 strong, nodular thickenings on each face of alternating longitudinal walls while those longitudinal walls that alternate with the aforementioned walls lack thickenings or bear 1, rarely 2 thickenings. The cells average 13–15 μ wide. The paroecious inflorescence, as well as capsule-wall anatomy are clearly characteristic of *J. schiffneri*, not of *J. atrovirens* suggesting that *J. polaris* is identical with the later described *J. schiffneri*! Certainly the northern Ellesmere material that I collected in abundance in 1955 is an exact match for the type of var. *polaris*. As a consequence, *J. polaris* (= *J. schiffneri*) now acquires a high arctic range, with isolated stations in the Cordilleras and the Great Lakes region, southward in the east to the montane portions of Quebec (Fig. 11). The species thus clearly acquires a range similar to the arctic and arctic-alpine species previously considered.

Among such species, with a possible origin before the middle Cretaceous are the two following species, both of which are widespread at lower elevations on the Pacific Coast. These species are today found both east and west of the mid-Cretaceous Rocky Mountain geosynclinal, in which the great Cretaceous sea existed.

(3) PACIFIC COAST LOWLAND SPECIES RECURRING IN THE GREAT LAKES AREA

A disjunction of this type is, at first glance, extremely surprising. The classical case is that of *Frullania bolanderi* Aust. (Fig. 12), previously cited by Steere (1937). The considerable expansion in known range in recent years is evident on comparing the map in Steere (Fig. 5) with Fig. 12.

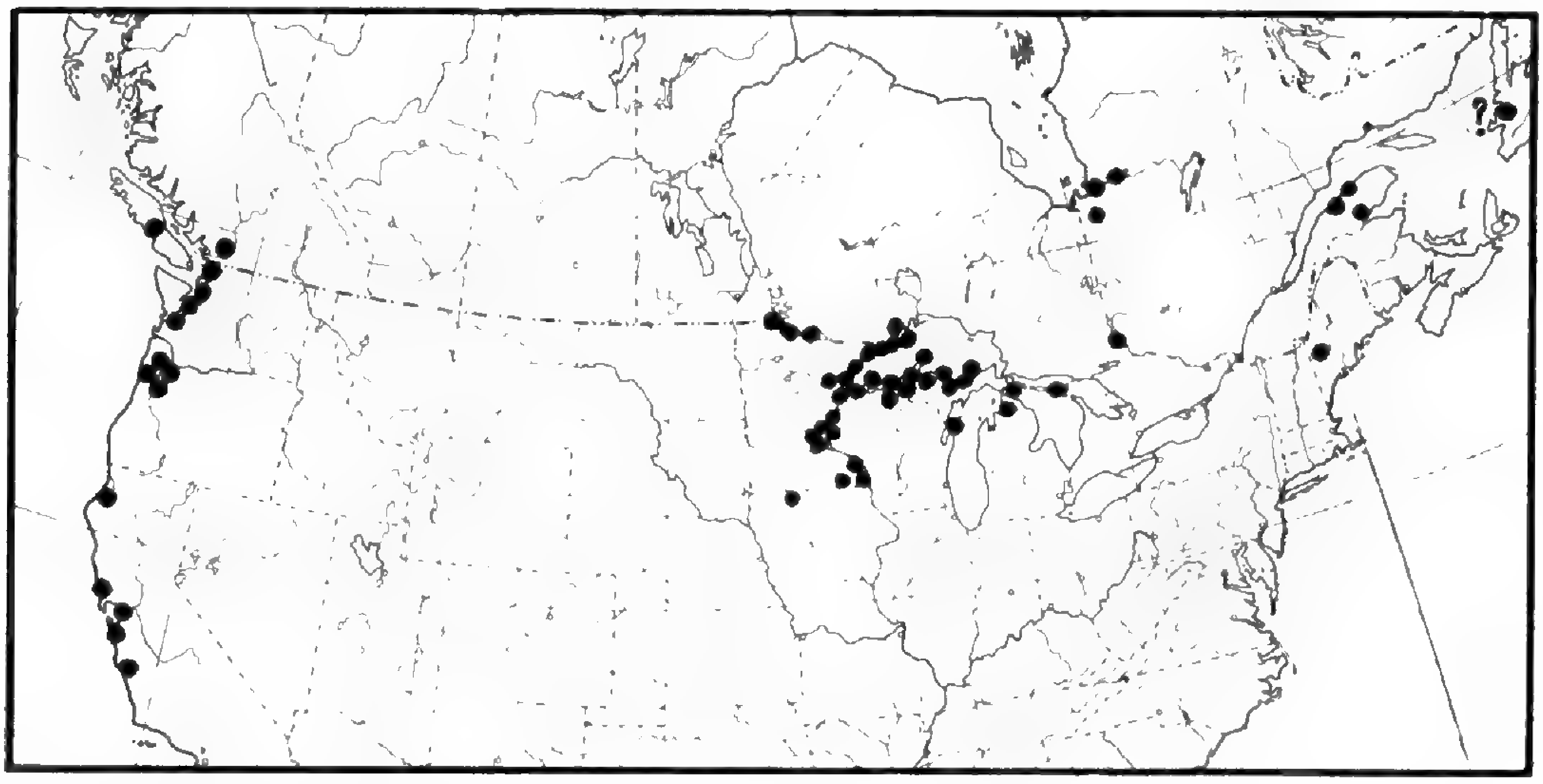

Fig. 12. North American range of *Frullania bolanderi*; the species is otherwise known only from the Pacific Coast of northern Asia.

F. bolanderi was described from near San Francisco, California. It extends from there northward to southern British Columbia, apparently always restricted to relatively low elevations. It then recurs in a disjunct area radiating out from the Great Lakes to the James Bay area, and to the Gaspé, with a single report from Maine. It is reputed to occur eastward to Newfoundland. The explanation of this distribution pattern is particularly difficult in view of the fact that *F. bolanderi* is almost exclusively corticolous, with rare (and probably never permanent) populations on rocks. It is furthermore "critical" in that it is clearly a non-arctic species, which could not have survived in treeless areas, by any stretch of the imagination; it is not known today from any area in immediate proximity to the Tundra. As a consequence, the statement by Abbe (in Butters & Abbe, 1953, p. 69) is of interest. Abbe suggests that the flora of the North Shore of Lake Superior (and specifically that of Cook Co., Minnesota) was not replenished, in late-glacial or post-glacial time from a "pool of 'Cordilleran' or 'arctic' rarities in the Driftless

Area." If this statement by Abbe is accepted as true, the existing range of *Frullania bolanderi* becomes incomprehensible. The simplest explanation for its existing distribution in western North America involves its migration into the Lake Superior area from a Pleistocene "refugium" in the Driftless Area. The suggestively similar case of *Mertensia paniculata* (Ait.) G. Don,[5] known from the periphery of the Driftless Area (n.e. Iowa), the western Great Lakes area, north to James Bay, Quebec; then again in the far West from Montana and Idaho to Washington, is equally impossible of a simple explanation, if Abbe's hypothesis of preglacial migration is uniformly applied. The *Mertensia*, like the *Frullania*, is a plant of forested areas, and not of the tundra. As a consequence, the suggestion that these species migrated into the Great Lakes area at the heels, so to speak, of the retreating glaciers, from a far western "home" is difficult to visualize. More probable, in such cases, is the assumption of "persistence," in the classical Fernaldian sense, with the Driftless Area a refugium in which these species were able to survive the Pleistocene glaciation (while their originally more widespread eastern range was otherwise destroyed).

Frullania bolanderi (and *Mertensia paniculata*) are significant species to consider, from the viewpoint of phytogeography, since they could scarcely have survived in the Great Lakes on any hypothetical nunatak, such as has been postulated by Fernald (1935) for the tip of the Keweenaw Peninsula. At least, the survival there of these species would appear to hinge on the survival of a well-developed forest, a viewpoint which does not deserve serious consideration.

In this connection, the repeated belief by Hultén (1937), in the lack of glaciation on "the islands in Lake Superior," or in nunatak "districts about the Great Lakes" is also pertinent. Hultén (loc. cit., Plate 43) shows such an "isolated" refugium in the Nipigon region of Ontario, north of the North Shore of Lake Superior. As has been repeatedly demonstrated by the geologists (see review in Butters & Abbe, 1953), no such ice-free refugia can be demonstrated. Indeed, the opposite is fairly well-established: all of these areas were glaciated during the Pleistocene. As a consequence of such evidence, the "persistence" theory, so vigorously propounded by Fernald (1925, 1935) has recently received almost no support. In any re-evaluation of the "persistence" theory, however, the evidence from such species as *Frullania bolanderi* must also be considered.

At the time Steere (1937) mapped the range of this species, it was known in the east only from obviously glaciated areas.[6]

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[5] The distribution of the various Tracheophyta cited largely derived from the Eighth Edition of Gray's Manual.

[6] Steere (1937) however assigns the eastern stations of the species to "the unglaciated part

Steere postulated that the distribution of the species was broken up into three "remote and isolated 'islands': (1) throughout the Pacific coast area . . . (2) around the southwest end of Lake Superior, and (3) in the unglaciated part of the Gaspé Peninsula of Quebec, with an extension into Maine. . . . This anomalous geographical distribution gains still more significance because of resemblance to that of many of the vascular plants reported from the Keweenaw Peninsula by Fernald." The distribution of these vascular plants, of course, moved Fernald to postulate the occurrence of a nunatak area at the head of the Keweenaw Peninsula (Fernald, 1935), which was believed to have served as a refugium during the late Pleistocene glaciation. Extensive collecting by the writer (1946–1950) in the Great Lakes area soon showed that *F. bolanderi* had a much wider range than had been suspected. The species occurred westward along the Minnesota border to Oak Island, Lake of the Woods; it occurred southward to the presumably partially unglaciated southeastern corner of Minnesota (Schuster, 1953), and it was also found at many points in Wisconsin, Michigan, and into Manitoulin I., Lake Huron, Ontario. Lepage (1945, 1953) extended the known range of the species northward to the southern corner of James Bay. With these extensions, there was a virtual confluence of two of the "islands" that Steere had postulated. More significantly, the known range of the species was extended southward into the edge of the "Driftless Area," an area about which there is no question as to the absence of Pleistocene glaciation. Furthermore, there is clear evidence of the existence, in the Driftless Area, of a well-developed forest, during the Pleistocene (i.e., from the "boreal" rather than arctic nature of the moss flora of the interglacial periods).

These facts prompt the writer to suggest that the eastern portion of the range of this species has radiated outward from the "Driftless Area." The latter, as a consequence, emerges as a possible refugium, postulated as long ago as 1925 by Fernald, who at the time was unable to adduce any concrete evidence in favor of such a viewpoint. In fact, Fernald (1935) fails to mention this earlier hypothesis.

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of the Gaspé Peninsula of Quebec, with an extension into Maine." Recent evidence suggests no such unglaciated area exists.

A final matter of interest is the clear demonstration of a connection between the existing flora of the "Driftless Area," and that of the Lake Superior shore. This will be commented on again later.

A second species with a distribution pattern of a nearly similar type is *Diplophyllum obtusifolium* (Hook.) Dumort. (Fig. 13). The range of this species approaches that of *F. bolanderi* in several respects: the wide distribution along the Pacific Coast, where it is abundant (several stations not drawn in owing to lack of knowledge of the exact localities!), with a much more restricted range in the Great Lakes area (Minnesota, Michigan, Ontario). However, *D. obtusifolium* differs in its range in several respects from *F. bolanderi.* Unlike the latter, it is considered an oceanic species, Persson (1952) describing it as a "coastbound species;" it is also a more widespread species, not endemic to North America, ranging from western Europe to Iceland, and recently reported from Honshu, Japan (Amakawa and Hattori, 1955). More significantly, it occurs as a rare disjunct not only in the Great Lakes area, but also in the old Appalachian Region where it has recently been found.

The Minnesota, Michigan, Ontario, North Carolina and Tennessee material, i.e., the eastern population, differs in being predominantly or wholly autoecious and in the almost constant production of gemmae; in these respects it closely approaches *D. apiculatum,* to which the Minnesota plants were referred by Schuster (1953), as var. *obtusatum.* It seems certain now, however, that the var. *obtusatum* is much closer to D. *obtusifolium.* The Ontario material was kindly forwarded by Mr. H. Williams; it was collected at Cache Lake Outlet in Algonquin Park. The Tennessee plants were collected by the author on Myrtle Point, Mt. Leconte; the North Carolina plants were collected by the author in Linville Gorge, Burke Co.

The Appalachian populations of *D. obtusifolium* are unquestionably ancient. Equally ancient is the series of western populations, which extend in an arc from northern California to Attu I., in the Aleutians, southward to Honshu Island, Japan. The arc-like, oceanic western range of *D. obtusifolium* is strikingly similar to that of *F. bolanderi,* which extends from California northward to British Columbia, and then reappears on the island of Sakhalin (Evans, 1915). As a consequence, the chief difference in the American range of *D. obtusifolium,* contrasted with that of *F. bolanderi,* lies in the retention of a disjunct Appalachian population in the former, vs. the evident lack of such a population in the latter. Also, the rarity of *D. obtusifolium* in the east makes it much more difficult to set up a plausible hypothesis as to the derivation of the Great Lakes population. The analogies in its range to that of *F. bolanderi* are at least suggestive.

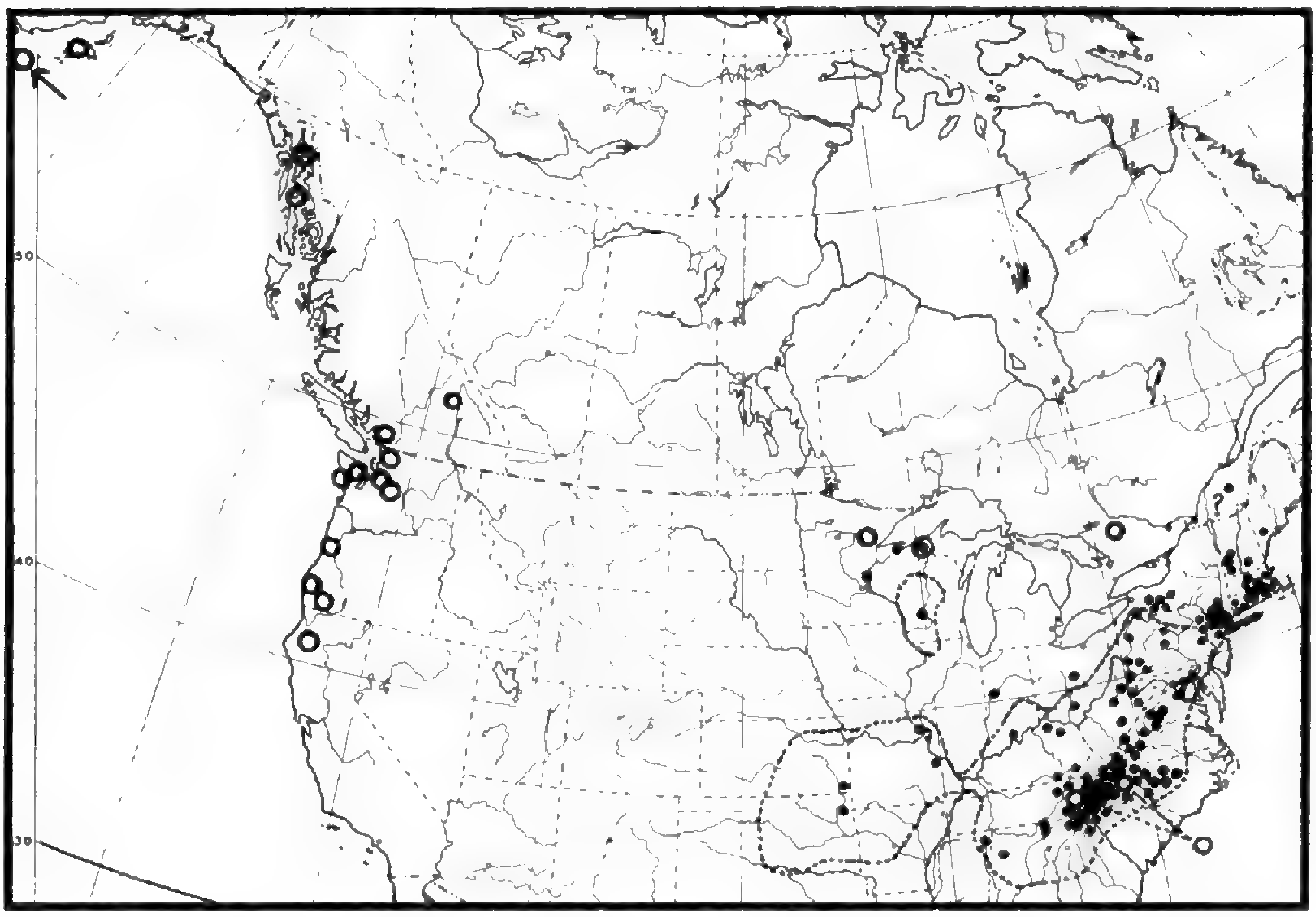

Fig. 13. Range of *Diplophyllum apiculatum* (dots) and North American range of *Diplophyllum obtusifolium* s. lat. (the eastern stations representing an undescribed subspecies). The Michigan station for *D. obtusifolium* was reported as *D. apiculatum* (Steere, 1947); it is based on plants collected at Bessemer (*M. S. Taylor, 1928*). Only two, juvenile, sterile plants have been seen with apiculate lobes; these, although hardly certainly determinable, could be referred to *D. apiculatum.* The single fertile plant, however, is not the same taxon; it bears a terminal perianth subtended by several cycles of sterile leaves; this perianth-bearing shoot bears innovations that are androecial (and, at least in one case, paroecious). In other words, the leading, gynoecial shoot bears male or bisexual innovations. This feature, together with the uniformly rounded ventral leaf lobes identifies these plants as the eastern race of *D. obtusifolium.*

If Fig. 12 and 13 are compared, a possible hypothesis for the origin of the easternmost stations of *Frullania bolanderi* can be derived by analogy to the existing range of *Diplophyllum obtusifolium.* Is it not possible that these eastern stations of *F. bolanderi,* the so-called "third center" of Steere (loc.cit.), were derived from an Appalachian refugium? Although *F. bolanderi* is currently unknown from the northern end of the unglaciated Appalachian plateau, it would not prove at all surprising to find relict stations for it in this area.

The interpretation of the existing range of these two species must involve recognition of the fact that both are lowland species of forested areas, *D. obtusifolium* occurring only rarely (in Europe) in the higher mountains. Neither species can be interpreted as a "nunatak species," however loosely we define this category.

(4) CORDILLERAN SPECIES EXTENDING EASTWARD AND FOUND AGAIN IN THE DRIFTLESS AREA, BUT NOT ALONG LAKE SUPERIOR

The classical case, previously cited by Steere (1937) is that of *Asterella saccata* (Fig. 14). This thallose, calciphilous species, occurs from the Yukon and Alaska southward to Oregon, Wyoming, New Mexico, and probably Mexico, at high elevations. The plant has been found, by the Europeans, to be amphizonal in distribution, i.e., with the bulk of its range in the arctic-alpine, but a limited and scattered range as an xerothermophyte (see Reimers, 1940). This species, in Europe, shows a similar distribution pattern to *Athalamia hyalina* (Fig. 15), which is treated subsequently. In both cases, there is a small area along the Mississippi River, in southeastern Minnesota, where a totally disjunct population occurs. The physical environment along the bluffs of the Mississippi River is so different (basswood-maple forest on the rich wooded slopes) that it seems difficult to reconcile such distributional anomalies.

At the present time, no other species of *Hepaticae* is known to have an exactly parallel pattern of distribution.

(5) ARCTIC SPECIES OCCURRING IN THE DRIFTLESS AREA BUT NOT IN THE LAKE SUPERIOR REGION

During the period 1946–1950, the writer carefully investigated the high bluffs on the Minnesota side of the Mississippi River, facing Wisconsin to the east. On ledges on these bluffs, usually in rather dense shade, but occasionally near the exposed summits of the bluffs, were found two species with a wholly anomalous distribution. These occurred here, in part, in the shade of basswood-maple forest, on rich mesic slopes, associated with such "southern" species as *Reboulia hemisphaerica.* The existing range of these two species may have considerable bearing on the problem of the origin of the post-Pleistocene flora of the Great Lakes region.

Athalamia hyalina (Sommerf.) Hattori (Fig. 15). On a number of bluffs facing the Mississippi River, from Waccouta southward, i.e., at the edge of the "Driftless Area," small to extensive colonies of this arctic-alpine species were discovered. The plant is strongly calciphile. In North America, it appears to have a western, Cordilleran "center," from British Columbia and Alberta southward to California and Colorado, at

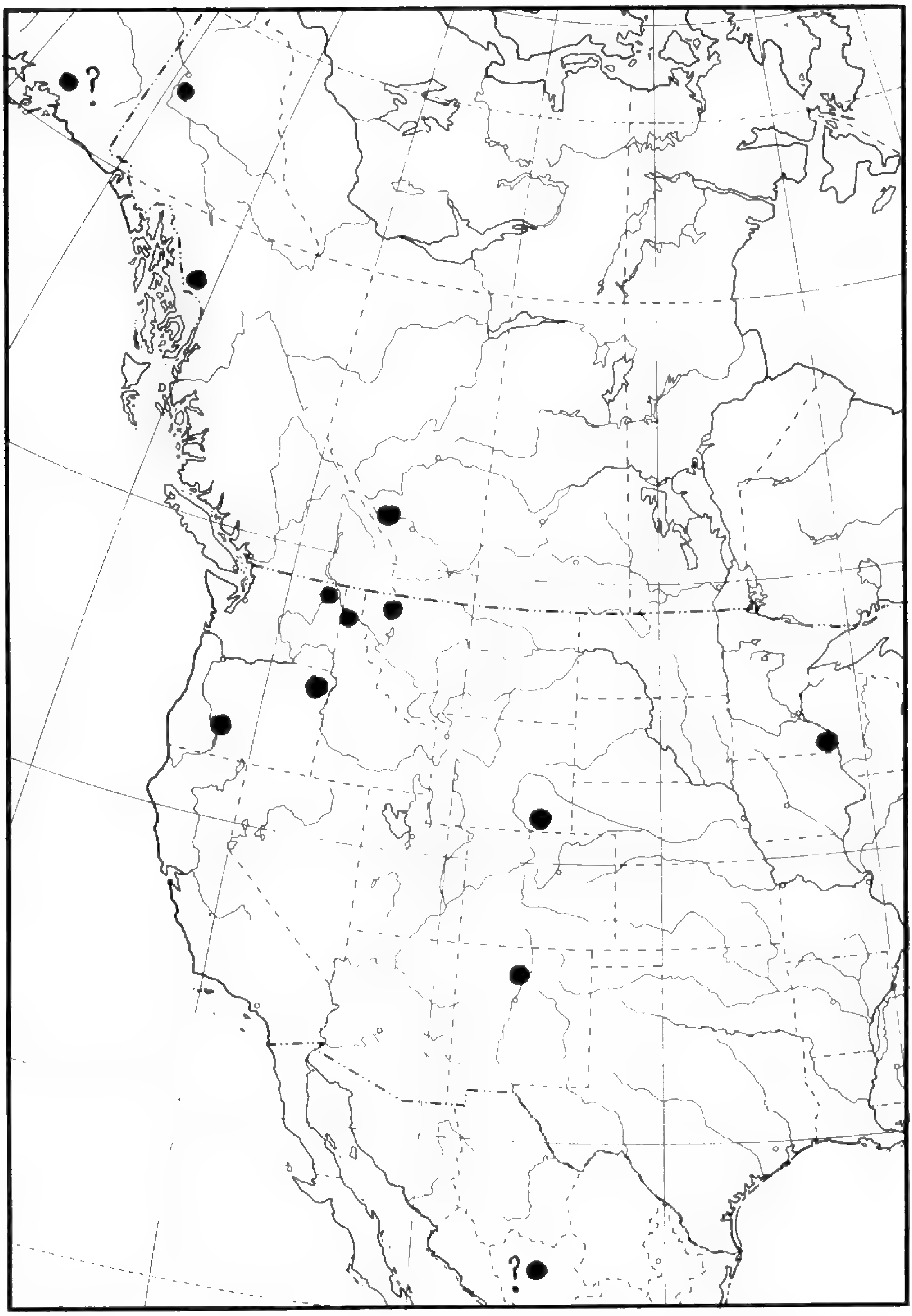

Fig. 14. North American range of *Asterella saccata*. The species is now evidently extinct at the Winona, Minn. station (see Schuster, 1953).

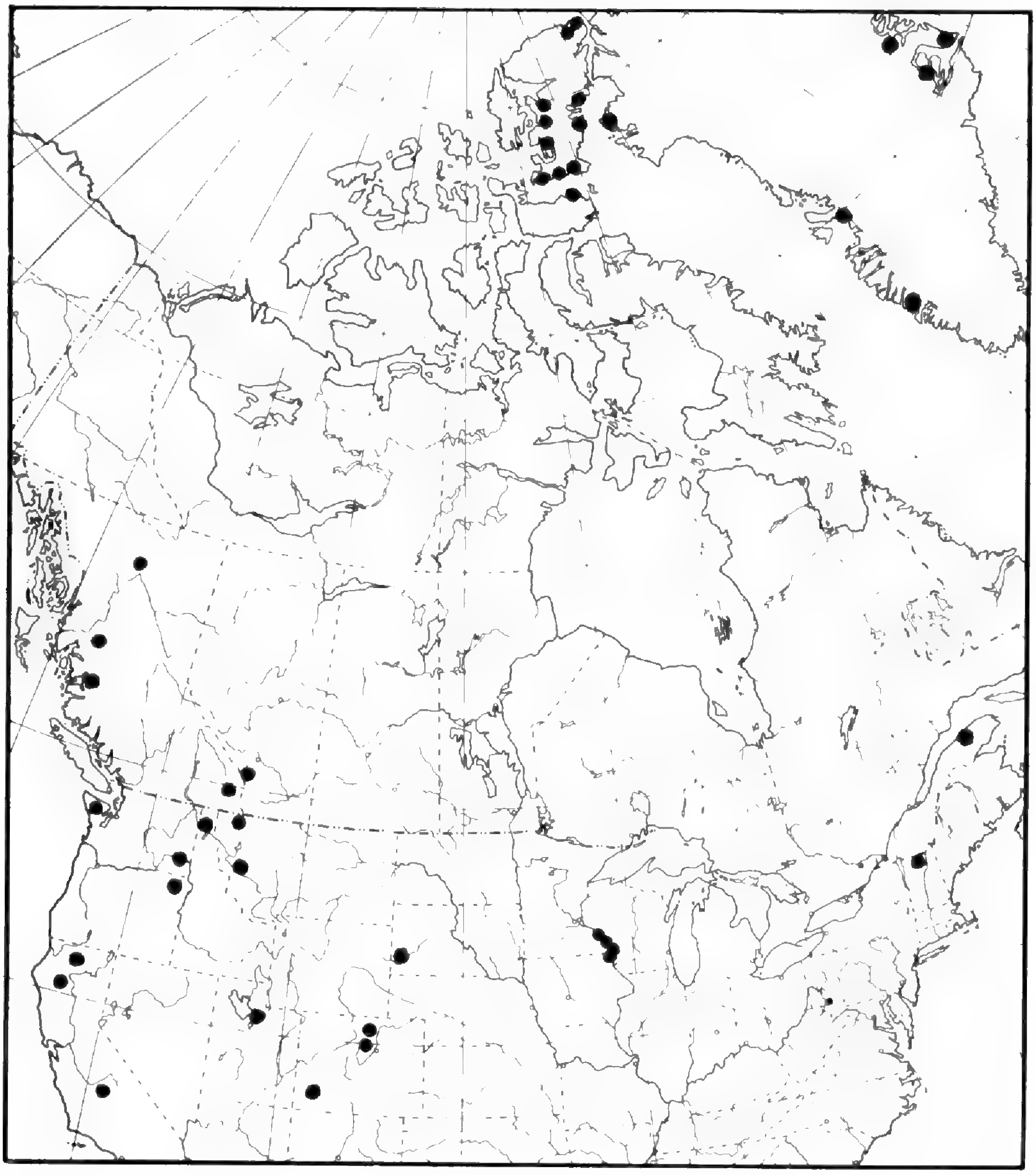

Fig. 15. North American range of *Athalamia hyalina* (= *Clevea hyalina*).

high elevations; a disjunct station is reported from the Black Hills area of South Dakota (Frye & Clark, 1937, in 1937–47; this report requiring verification). In the east, the plant is known from two collections, one from the Gaspé, the other from northern Vermont. However, the species appears to be much more frequent in the high Arctic, north of the Arctic Circle, on both coasts of Greenland, on Ellesmere Island to 82°32′ Lat. N., and south to Devon Island.[7]

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[7] Perhaps a nearly parallel case is that of the essentially arctic-alpine *Sedum rosea* known from s.e. Minnesota in the form of a local race (var. *leedyi* Rosend. and Moore). *S. rosea* probably includes, *fide* Fernald (1950) "several so-called but scarcely separable species of w. N. Am." This ancient species, however, again occurs as a disjunct in the Appalachian region, from central New York to Roan Mt., North Carolina, but is widespread in the eastern North American Arctic, from Greenland to the coast of Maine. Except for the few Appalachian stations, at

The occasional occurrence of the species in Minnesota with *Mannia fragrans*, a xerothermophyte, at the summits of bluffs (bordering the "goat prairies" at the summit and on the western slopes of the bluffs), is suggestive of the isolated stations in Europe where the plant occurs as an xerothermophyte (Suza, 1938; Reimers, 1940; Müller, 1951–54). It is possibly more than coincidental that the only xerothermophyte occurrence of *Asterella saccata* in North America is in the same area. It should be noted that the European students who have carefully investigated the occurrence of these two arctic-alpine species, also often occurring with the "southern" xerothermophytic *Mannia fragrans* in Europe, have concluded that these represent cases of physiological adaptation by Pleistocene relicts. The restriction of the two species to the "Driftless Area" thus acquires special significance.

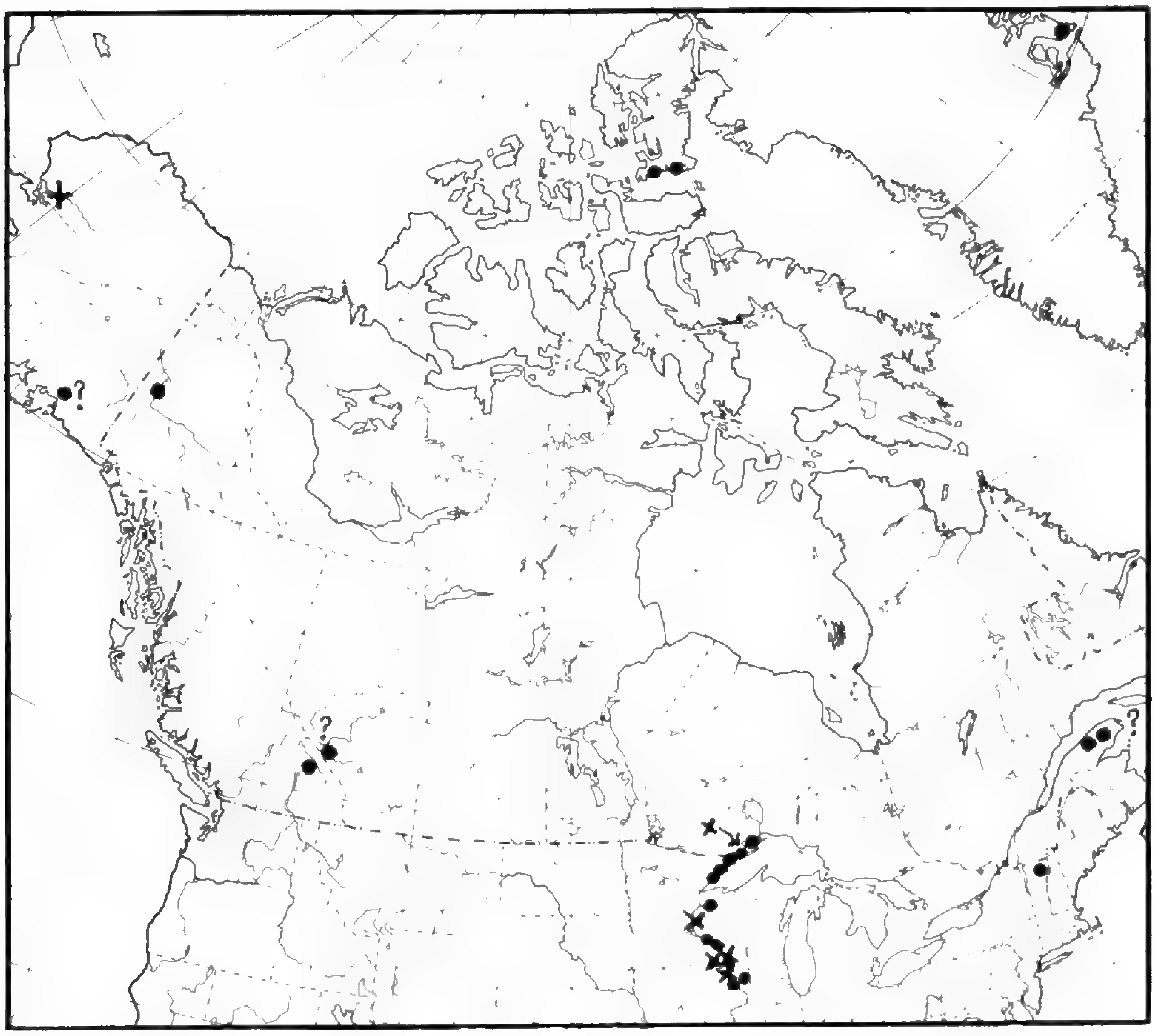

Fig. 16. North American range of *Mannia pilosa* (dots) and the doubtfully distinct *M. sibirica* (crosses).

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which the plant is a clear relict. *S. rosea* (L.) Scop., *sensu lato*, has a distribution pattern very closely paralleling that of the *Athalamia*, although not penetrating to as nearly as high a latitude as the latter.

Particularly striking, in this case, is also the connection established between the Driftless Area, and the Appalachian Region (in both of which the *Sedum* occurs as a relict!).

Mannia sibirica (K. Müll.) Frye and Clark. (Fig. 16, crosses). This species is reputed to be a high arctic type, although it has been collected so few times that any conclusion must be regarded as tentative. Virtually all of the few collections, from Norway and Siberia, are from the far north. The only previous report is of a single collection from Alaska (Clark & Frye, 1942). During the years 1947–1950 the writer found this species, in typical manifestations, a number of times at the edge of the "Driftless Area," and slightly to its north, in the St. Croix R. valley, i.e. in the same area as *Athalamia hyalina*, and usually associated with it. For exact locality data see Schuster (1953). These reports represent a major extension of the species southward.[8]

Unfortunately, as has been previously emphasized (Schuster, 1953), it is still uncertain whether *M. sibirica* is fully distinct from *M. pilosa* the latter having a wider but still arctic-alpine distribution (dots on map, Fig. 16). If the ranges of the *M. sibirica-pilosa* complex are combined, a nearly continuous series of collections is shown from the Driftless Area north to the Lake Superior shoreline (Fig. 16).

I have also seen several sterile fragments, mixed with spores, representing either this species, or the almost inseparable (when sterile) *Asterella ludwigii*; these plants were collected in lime sinks in Alpena Co., Michigan.

(6) ARCTIC SPECIES OCCURRING SOUTHWARD TO THE LAKE SUPERIOR AREA AND IN THE DRIFTLESS AREA

Although a number of *Hepaticae* of northern affinity occur in the Driftless Area, and again on the Lake Superior shore (*Scapania mucronata, Preissia quadrata, Tritomaria exsectiformis*, etc.), only two taxa with an essentially arctic-alpine distribution occur in both the Driftless Area and along the cold shores of Lake Superior. One species is *Mannia pilosa* (Hornem.) Frye and Clark, s. str. As will be noted below, it is not clear whether *M. sibirica* can be kept distinct from this. In either eventuality, the same basic pattern remains (Fig. 16). *Mannia pilosa* is known from a station in Greenland, from several in Ellesmere Island, and from the Alaska-Yukon region; it occurs south of the Arctic Circle only in the high Cordilleras along the Alberta-British Columbia boundary, in the Gaspé Mountains, and at a single station on Willoughby Mt. in Vermont. It then recurs, locally and usually in only small quantity, in western Wisconsin, and in eastern Minnesota and northeastern Iowa. The latter portion of its range extends from the Driftless Region northward to the north shore of Lake Superior. This distribution pattern, in some ways, serves to unite patterns 1 and 5 into a single unit. The implications of this are discussed in the final summation.

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[8] Dr. H. Crum of the Canadian National Museum has just submitted a specimen of this species to me for verification. This was collected at Ft. William, Ontario, near the Lake Superior shore (May, 1955).

(*To be concluded*)

Some New Floras for Parts of North America.—Although the total number of species of higher plants in the high arctic is not great, comparatively, the importance and complexity of the plant cover in connection with geomorphic processes is being increasingly recognized. This means that an ever larger number of investigators outside of botany concerned with research on arctic lands are becoming interested in the kinds of plants growing there. The excellent recently published ILLUSTRATED FLORA OF THE CANADIAN ARCHIPELAGO[1] by A. E. Porsild provides a sound coverage of the flora for most purposes. This work, with neat realistic drawings of each species by Mrs. Dagny Tande Lid, provides keys to the families, genera and species, brief descriptions and notes concerning each species and a map showing the total range in northern Canada.

Another book of outstanding quality concerned with the Canadian flora is: FLORA OF MANITOBA[2] by H. J. Scoggan. Here is a volume that ranks with the best state and provincial floras and is superior to most of them. The work covers all species and well marked varieties, native or introduced, known to occur within the provincial boundaries. There are keys to the families, genera, species and varieties and notes concerning the habitat and geographical distribution of each species or variety. Descriptions are omitted. The first 37 pages are devoted to the history and scope of the flora together with a discussion of the physical features of Manitoba, its climate and vegetation and the affinities of the flora. Scoggan has critically dealt with literature and specimen records for the Province, excluding many names shown to have been incorrectly applied or otherwise not authenticated as part of the present-day flora. In an analysis of Manitoba's flora, Scoggan finds 1,417 species and 124 subspecies or varieties of vascular plants present. This contrasts with 340 species, subspecies or varieties reported by Porsild for the Canadian Archipelago.

SPRING FLORA OF THE DALLAS-FORT WORTH AREA, TEXAS[3], by Lloyd H. Shinners, covers the ten counties immediately surrounding these two cities, but the book will have application to a considerably wider area. Plants blooming between January 1st and the first week of June are particularly included in the work, but many early summer blooming types are also mentioned. There are keys to the families, genera and species, and notes on outstanding characteristics, habitats, geographical distribution and blooming dates. Much of the originality in the book is found in the appendices where one finds a discussion of technical terms, the use of keys, scientific and common names, pronunciation, rules of nomenclature, collecting herbarium specimens, natural history of plants, conservation and notes on the background of the book. This book is definitely student

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[1] National Museum of Canada, Bulletin No. 146. pp. 1–209. 1957. Paperbound $2.00.

[2] National Museum of Canada, Bulletin No. 140. pp. 1–619. 1957. Buckram $5.00.

[3] Spring Flora of the Dallas-Forth Worth Area, Texas by Lloyd H. Shinners. 514 pp. 1958. Paperbound $5.50 ($5.75 by mail). Published by the author and available at S.M.U., Box 473, Dallas 5, Texas.

oriented. It is produced by photo-offset printing and the paper covers and pages are held together by a plastic spring binding.

This book, though both seasonally and geographically limited, is of considerable importance because it pertains to an area that has not been adequately covered by a flora.

SPRING FLORA OF CENTRAL OKLAHOMA[4] by George J. Goodman is similar in many ways to Shinner's book. It is produced by photo-offset printing, has a large page size and the flexible paper cover, together with the pages, are held by a plastic spring binding. The book has keys to the families, genera and species which bloom before June 1st in the central area of Oklahoma and is obviously designed for use by students at the University of Oklahoma. Nevertheless, it is a valuable addition to the floras covering portions of the United States. There are short notes on habitats and geographic ranges under each listed species. As pointed out by Dr. Goodman, the area covered is almost entirely in the Permian Red Beds and possesses a rich and varied flora. Some 716 species and infraspecific taxa are included in the work.—R. C. ROLLINS, GRAY HERBARIUM, HARVARD.

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[4] Spring Flora of Central Oklahoma by George J. Goodman. Published by the University of Oklahoma Duplicating Service, Norman, Oklahoma. 1958. 124 pp. Paperbound $3.35.

Volume 60, No. 715, including pages 177–208, was issued 6 August, 1958.

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MINOR FORMS OF NORTH AMERICAN SPECIES OF *ROSA*

Walter H. Lewis[1]

During the study of the North American rose species east of the Rocky Mountains, several unique and distinct forms have been observed. Variants include: individuals with more than five petals in each flower; those with white rather than pink petals; specimens having unarmed floral stems where armature is typical; and those with glandular-hispid hypanthia and pedicels when the expression for these characters is normally eglandular. Since their distinctiveness eliminates any possible confusion in naming them, since transplant studies have shown that the forms are not expressions of environmental modification, and since they may be of considerable importance to other biological disciplines (plant breeding, horticulture), it is felt that natural variations such as these should be given nomenclatural recognition at the rank of form. These several variations are doubtless the result of different types of genetic situations such as gene mutations, gene combinations controlling expression in certain cases (as probably with armature), and others.

With the new taxa are included new combinations that have been modified in view of the evidences obtained from a revision of the North American roses (Lewis, 1957a).

1. **R. nitida** Willdenow, f. **spinosa** f. nov.

R. carolina L., var. *setigera* Crépin. Rhodora **2:** 113 (1900) pro syn.
R. carolina x *R. nitida* Crépin. Rhodora **2:** 113 (1900).
R. nitida x *R. palustris* Rydberg. N. Am. Fl. **22:** 496 (1918).
? *R. nitida* x *R. virginiana* Rydberg. N. Am. Fl. **22:** 502 (1918).

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[1] The Blandy Experimental Farm, University of Virginia. Present address: Department of Biology, Stephen F. Austin State College, Nacogdoches, Texas.

Caulis floreus armatus setis tenuibus et amplificatis infrastipulatis spinis saepe inparem. Floral stems armed with fine bristles and enlarged infrastipular thorns, often in pairs. Very rarely these stems are without the bristles typical of *R. nitida* and have only infrastipular thorns. The kind of armature is the only certain way in which the form may be differentiated from *R. nitida*.

HOLOTYPE.—Wilton, Franklin County, Maine. *M. L. Fernald* 11 Aug. 1894 (GH).

Both Crépin (1900) and Rydberg (1918) believed f. *spinosa* to be a hybrid between *R. palustris* Marshall and *R. nitida*. Considering the success of many artificial hybrids between most diploid Cinnamomeae species (Erlanson 1934), such a cross could conceivably be possible in nature. The F_1 generation might even be male fertile as, for example, has been found in the progeny of *R. Woodsii* x *R. blanda* and *R. blanda* x *R. pisocarpa* crosses (Flory 1950). The small amount of abortive pollen (16%) found from a specimen of f. *spinosa* collected at Orono, Maine, would add evidence to this opinion. The difficulty with this approach arises, however, when it is realized that one of the parents, *R. palustris*, is not known from Newfoundland or central and northern Nova Scotia (some specimens from the latter province have been confused with *R. palustris*, but they are *R. virginiana* Miller). Since typical specimens of *R. nitida*, f. *spinosa* have been examined from Newfoundland at St. George Bay and at St. John's, it hardly seems possible that the form is a result of a cross between *R. palustris* and *R. nitida* when the variation is found in a region separated by hundreds of miles of water from one of the parents. It has been pointed out to the author, however, that a bird might transport the hybrid fruit from an area where such a hybrid is possible and deposit it in an area some distance from one of the parents. Although such an event would explain the occurrence of the form in Newfoundland, there is no evidence as yet to support this theory. Until *R. palustris* is definitely established as native to Newfoundland, experimental hybridization produces a phenotype similar to f. *spinosa*, or until bird migration is known to be a significant factor here, the form is considered a non-hybrid variation of *R. nitida*.

Rosa nitida x *R. virginiana* of Rydberg (1918) tentatively has been placed in synonymy under *R. nitida*, f. *spinosa*. Erlanson's

(1934) data showed that artificially produced F_1 plants from these species were highly sterile—a condition not apparent in the pollen of f. *spinosa* from Orono, Maine. This plant is morphologically similar to those cited by Rydberg as representative of the hybrid, *R. nitida* x *R. virginiana.*

Selected specimens examined:—CANADA. NEWFOUNDLAND: St. John's, *Robinson & Schrenk,* 3 Aug. 1894 (GH). QUEBEC: Stanstead Co.: Magog, *Pease 728* (GH). UNITED STATES. MAINE: Franklin Co.: Wilton, *M. L. Fernald,* 11 Aug. 1894 (as *R. carolina* x *nitida* ? by Crépin; as *R. nitida* x *palustris* by Rydberg; as *R. palustris* ? by Fernald) HOLOTYPE (GH). Kennebec Co: Pine Point, Scarboro, *Hyland 321* (MAINE). Penobscot Co.: Bangor bog, Orono, *Fernald 2958* (MAINE). Piscataquis Co.: Foxcroft, *G. B. Fernald 161* (GH), *Fernald 319* (GH). Washington Co.: West Sidney, *Hyland 115* (MAINE). NEW HAMPSHIRE: Coös Co.: Pike pond, Stark, *Pease 23778* (GH).

2. **R. palustris** Marshall, f. **inermis** (Regel) stat. nov.

R. hudsoniana Thory ex Red. Roses **1:** 95 (1817).
R. hudsoniana salicifolia Thory ex Red. Roses **1:** 95 (1817).
R. carolina salicifolia Seringe ex DC. Prod. **2:** 605 (1825).
R. carolina L., var. *inermis* Regel. Tent. Ros. Mon. 78 (1877).
R. carolina inermis Schuette. Am. Ass. Adv. Sci. **46:** 279 (1898).
R. palustris Marshall, var. *inermis* (Schuette) Erlanson. Pap. Mich. Ac. Sci. Arts & Let. **5:** 90 (1925).

Individuals typical of *R. palustris* except that the floral stems are without armature. The form occurs infrequently throughout the range of the species.

Selected specimens examined. CANADA. ONTARIO: Muskoka Co.: Dorset, *C. Huber 5854* (as *R. palustris* Marsh., var. *inermis* (Schuette) Erl.) (GH). UNITED STATES. CONNECTICUT: Windham Co.: Plainfield, Wauregan, *Sheldon 537* (as *R. carolina*) (GH). FLORIDA: Putnam Co.: Welaka, *Laessle,* 26 June 1940 (FLAS). MAINE: Hancock Co.: Seal Harbor, Mount Desert I., *Redfield,* 21 Aug. 1890 (as *R. carolina*) (GH). MASSACHUSETTS: Berkshire Co.: Lenox, *Hoffmann,* 11 Aug. 1911 (as *R. carolina*) (GH). Norfolk Co.: Milton, *Churchill,* 17 July 1898 (as *R. carolina*) (GH). MICHIGAN: Charlevoix Co.: Boyne City, *Erlanson 5789/B* (as *R. palustris* var. *inermis*) (MICH). Cheboygan Co.: Lancaster Lake, *Ehlers 613* (as *R. carolina*) (GH). NEW YORK: Monroe Co.: Manitou Beach, *Killip 7843* (as *R. carolina*) (GH). Tompkins Co.: near Spencer Lake, *Muenscher & Bechtel 520* (as *R. carolina*) (GH). TENNESSEE: Unicoi Co.: Unaka Springs, *Lyle 19415* (TENN). VERMONT: Rutland Co.: East Wallingford, *Kent,* June 1897 (as *R. carolina*) (GH). WISCONSIN: Brown Co.: Blesh's Farm, *Schuette,* 22 June 1890 (as *R. carolina inermis*) (GH).

3. **R. palustris** Marshall, f. **alba** (Rafinesque) stat. nov.

R. carolina L., var. *alba* Rafinesque Ann. Gen. Sci. Phys. **5:** 214 (1820).

This form established by Rafinesque (1820) as a variety of *R. carolina* L. (Sp. Pl. **1:** 703, 1762) non L. (Ibid: 492, 1753) is nomenclaturally corrected in combination with the binomial for the eastern swamp rose. No white petaled specimens have been observed in this study.

4. **R. palustris** Marshall, f. **plena** f. nov.

R. carolina L., var. *pimpinellifolia* Rafinesque. Ann. Gen. Sci. Phys. **5:** 214 (1820) pro parte.
R. hudsoniana flore multiplici Thory. Prod. Gen. *Rosa* 147 (1820).
R. hudsoniana subcorymbosa Thory ex Red. Roses **2:** 109 (1821).
R. carolina L., var. *scandens* (Thory) Seringe ex DC. Prod. **2:** 605 (1825).
R. carolina L., var. *hemisphoerica* Seringe ex DC. Prod. **2:** 605 (1825).

A form of *R. palustris* with more than five petals in each flower. No specimens have been observed.

5. **R. Woodsii** Lindley, f. **hispida** f. nov.

R. adenosepala Wooton & Standley. Contr. U. S. Nat. Herb. **16:** 131 (1913) pro parte.
R. MacDougali x *R. ultramontana* Rydberg. N. Am. Fl. **22:** 523 (1918).

Hypanthia sunt glandulari-hispida et plerumque cum pedicellis glandulari-hispidis. Hypanthia are glandular-hispid and usually with glandular-hispid pedicels. Accompanying the glandular-hispid hypanthia and pedicels in the type are glandular leaflets, gland-tipped double serrations, glandular stipules, and hispid petioles.

HOLOTYPE: Near Helena, Lewis & Clark County, Montana. *F. D. Kelsey,* June 1892 (as *R. Fendleri*). Herbarium of Montana State College.

Selected specimen examined. MONTANA: Missoula Co.: Missoula, *Sandberg,* Aug. 1892 (as *R. pisocarpa*) (MIN).

6. **R. blanda** Aiton, f. **carpohispida** (Schuette) stat. nov.

R. blanda carpohispida Schuette. Proc. Am. Ass. Adv. Sci. **46:** 279 (1898).
R. blanda Aiton, var. *hispida* Farwell. Pap. Mich. Ac. Sci. Arts & Let. **2:** 25 (1923).

Rosa blanda which has glandular-hispid hypanthia and pedicels. The floral stems may be somewhat bristly. Although this description approaches that for the individuals intermediate between *R. blanda* and *R. palustris,* the forma is known to occur north of the range of *R. palustris* on the Gaspé, Quebec (Erlanson 1934).

Selected specimens examined. MAINE: Penobscot Co.: Greenbush, near Cardville, *Hyland 816* (as *R. blanda*, var. *hispida*) (MAINE). MICHIGAN: Houghton Co.: Grand Traverse Bay, *Richards 3644* (as *R. blanda*, var. *hispida*) (MAINE). MINNESOTA: Houston Co.: near Bee, *Butters & Rosendahl 3827* (MIN). Rice Co.: 10 mi. w. Northfield, *Butters & Rosendahl 2897* (MIN). Saint Louis Co.: Duluth, *Lakela 1482* (as *R. suffulta*) (MIN). Yellow Medicine Co.: Granite Falls, *Moyer 358* (as *R. humilis*) (MIN). WISCONSIN: Ashland Co.: 3. Ashland, *Richards 3402* (as *R. blanda*, var. *hispida*) (MAINE). Door Co.: Little Sturgeon Bay, *Schuette*, 17 Aug. 1891 (as *R. humilis* x *R. blanda*) (US).

7. **R. arkansana** Porter, f. **alba** (Rehder) comb. nov.

R. pratincola Greene, f. *alba* Rehder. Mitt. Deutsch. Dendr. Ges. 1910 (19): 252 (1911).
R. arkansoides Schneider, f. *alba* Schneider. Ill. Hand. Laubh. **2:** 971 (1912).
R. heliophila Greene, f. *alba* Rehder. Mitt. Deutsch. Dendr. Ges. 1915 (24): 222. 1916.
R. suffulta Greene, f. *alba* Rehder. Journ. Arn. Arb. **3:** 17. 1921.

Since the pubescent leafed variation (= *R. suffulta* Greene) of this species is not considered specifically distinct, the white petaled form is combined with *R. arkansana.*

8. **R. arkansana** Porter, f. **plena** f. nov.

Forma ultra quinque petala in florem. A form typical of *R. arkansana* except that as many as twenty petals are found in a single flower.

HOLOTYPE. The form is known only from one locality, Woodrow, Saskatchewan and has been distributed by P. H. Wright. Individuals have been planted at The Blandy Experimental Farm, Acc. No. 12876–54 (*Lewis 2310*). Herbarium specimens are deposited in the U. S. National Herbarium (holotype) and the Bailey Hortorium.

9. **R. arkansana** Porter, f. **setulosa** (Cockerell) comb. nov.

R. pratincola setulosa Cockerell ex Daniels Fl. Bould. Colo., Univ. Mo. Stud. Sci. Ser. 11 (2): 148. 1911.
R. suffulta Greene, f. *setulosa* Cockerell. Torreya **18:** 179 (1918).

The form has glandular-hispid hypanthia and usually glandular pedicels. The isotype was collected by Cockerell at Boulder, Boulder County, Colorado.

Selected specimens examined. COLORADO: Boulder Co.: Boulder, *T. D. A. Cockerell* (as *R. suffulta setulosa*) ISOTYPE (US). El Paso Co.: 5 mi. from Colorado Springs, *Penfound*, 18 July 1924 (COLO). Larimer Co.: Fort Collins, *Harrington 3262* (COLO). MONTANA: Big Horn Co.: 6 mi. s. Pryor, *Charff*, 10 June 1953 (MONT).

10. **R. carolina** L., f. **plena** (Marshall) stat. nov.

R. pennsylvanica plena Marshall. Arb. Am. 136 (1785).
R. parviflora pleno Ehrhart. Beitr. Nat. **4:** 21 (1789).
R. pennsylvanica var. *flore pleno* Andrews. Roses **2:** No. 102 (1828).
R. caroliniana var. *flore pleno* Andrews. Roses **2:** No. 104 (1828).
R. carolina conglobata Trattinick. Rosac. Mon. **2:** 156 (1823).
R. parviflora (*flore multiplici*) Thory ex Red. Roses No. 11 (1824).
R. humilis Marshall, var. *plena* Best. Journ. Trent. Nat. Hist. Soc. **2:** 1 (1889).
R. carolina L., var. *plena* (Marshall) Lynes. Baileya **3:** 58 (1955).

First described in the eighteenth century, the double petaled form of *R. carolina* has recently been nomenclaturally revised by Lynes (1955). In this study the rare variation is reduced to forma status.

11. **R. acicularis** Lindley, subsp. **acicularis,** f. **alba** (Nakai) comb. nov.
R. acicularis Lindley, var. *Gmelini* (Bunge) Meyer, f. *alba* Nakai. Bot. Mag. Tokyo **30:** 241 (1916).

Among the many specimens of this subspecies examined from Europe and Asia, only one had entirely white petals rather than the typical pink. The material was collected in Tobolsk, Omsk R. S. F. S. R. (LE). Nakai (1916) cited the following localities: "Ham-gyöng austr.: Atok-ryöng (*Nakai 1825*) Cho-työng-ryöng (*Nakai 1569*)."

12. **R. acicularis** Lindley, subsp. **Sayi** (Schweinitz) Lewis, f. **plena** f. nov.

Forma ultra quinque petala in florem. A form typical of *R. acicularis* subsp. *Sayi* (Lewis 1957b) except that as many as fifteen petals occur in each flower.

HOLOTYPE. The form is known from only one locality, Moose Range, Saskatchewan. Herbarium specimens from plants growing at The Blandy Experimental Farm (Acc. No. 13386-56) are deposited in the U. S. National Herbarium (holotype) and the Bailey Hortorium.

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College Herbarium (MONT); University of Tennessee Herbarium (TENN); and the U. S. National Museum, Smithsonian Institution (US).

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NOTES ON NEARCTIC HEPATICAE VI. PHYTOGEOGRAPHICAL RELATIONSHIPS OF CRITICAL SPECIES IN MINNESOTA AND ADJACENT AREAS OF THE GREAT LAKES

R. M. SCHUSTER

(Concluded from p. 234)

(7) APPALACHIAN SPECIES OCCURRING NORTHWARD TO THE LAKE SUPERIOR REGION AND NEAR OR IN THE DRIFTLESS AREA

A number of species show this distribution pattern, *Diplophyllum apiculatum* (Fig. 13) and *Mannia rupestris* (Fig. 17) being perhaps typical. In both cases the population occurring near Lake Superior is somewhat disjunct, and represents the outlying population. A comparison of the distribution of the Appalachian endemic, *Diplophyllum apiculatum,* with that of another species of presumably Appalachian origin, *Tsuga canadensis,* is not without validity. The occurrence of such species of temperate occurrence around the shore of Lake Superior (and to the south in and near the Driftless Area), strongly suggests that the bulk of the distribution of these species is restricted to nonglaciated areas, with the restricted range around Lake Superior due to post-Pleistocene migration northward from a Pleistocene refugium in the Driftless Area. This thesis will be examined in more detail in the summation.

Diplophyllum apiculatum (Evs.) Steph. (Fig. 13). This common, essentially Appalachian species occurs from southern Maine to the southern edge of the Appalachian upland, south to northern Alabama and Mississippi (unpublished collections of the writer), and recurs westward sporadically to the Ozarks. It has evidently been able to push north from the glacial boundary to only a slight degree, and has been equally unable to invade the Atlantic Coastal Plain. The range is not unlike that of *Asplenium cryptolepis* (see Fernald, 1935, Map 5).

An old report from Quebec needs verification and seems unlikely. The report of the species from the coast of Hudson Bay (Wynne and Steere, 1943) is, in the light of our present knowledge, almost certainly erroneous.

The few stations in the Lake Superior area (one each in Wisconsin and Michigan), and that at Taylor's Falls, Minn., just north of the Driftless Area, are possibly derived from a population which originated in the Driftless Area. It is perhaps not entirely fortuitous that the northwestern range of *Tsuga canadensis* closely parallels the range of the *Diplophyllum*.[9]

Mannia rupestris (Balb.) Frye and Clark (Fig. 17). This species, unlike the preceding, is strongly restricted to calcareous rocks. It occurs in the unglaciated Appalachian Plateau and in the Ozarks, apparently in the few places where calcareous rocks occur, and from central New York (Schuster, 1949) and southern Ohio south to Tennessee, and to Linville Caverns, North Carolina. It is frequent in, and at the periphery of, the Driftless Area, in Illinois, Iowa, Wisconsin and Minnesota. Two stations occur on the Lake Superior margin in Michigan. Additional isolated stations occur in the Gaspé, in Vermont, and in Ontario. However, the only points at which the species occurs with any abundance are in and near the "Driftless Area," and north of the unglaciated plateau.

As is quite evident from map (Fig. 17), the post-Pleistocene range of this species must be regarded as derived, by limited northeastward dispersal, from Pleistocene and probably pre-Pleistocene centers in the Driftless Area, and in the unglaciated Appalachian Plateau. The rarity in the latter appears chiefly a result of the very localized occurrence of suitable, moist and calcareous sites in this region. This distribution pattern should be compared with that of *Frullania bolanderi* (Fig. 12) since it gives us a partial model for an explanation of the eastern post-Pleistocene range of that species. The same general northeastward, and never northwestward, post-Pleistocene "drift" is observable. This is easily understandable on the basis of the mesophytic nature of the

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[9] The preceding discussion of *Diplophyllum apiculatum* was written three years before the species was actually found in the Driftless Area. In June, 1957, the species was found to be abundant on damp, sandstone rocks, associated with *Lycopodium selago* var. *patens*, at Rocky Arbor Roadside Park, northwest of Wisconsin Dells, Juneau Co. To one who had never previously collected in the Driftless Area, the consociation of species there was very suggestive: the Hepaticae included only species with a wide range in medium to high elevations in the Southern Appalachian System, among them *Lophozia silvicola*, *L. incisa*, *Tritomaria exsecta* and *exsectiformis*, *Lepidozia reptans*, *Calypogeia neesiana* s. str., *Geocalyx graveolens*, and such mosses as *Diphyscium sessile*. The entire hepatic flora thus gave the distinct impression of species which are widespread at higher elevations in the Blue Ridge system, as well as northward.

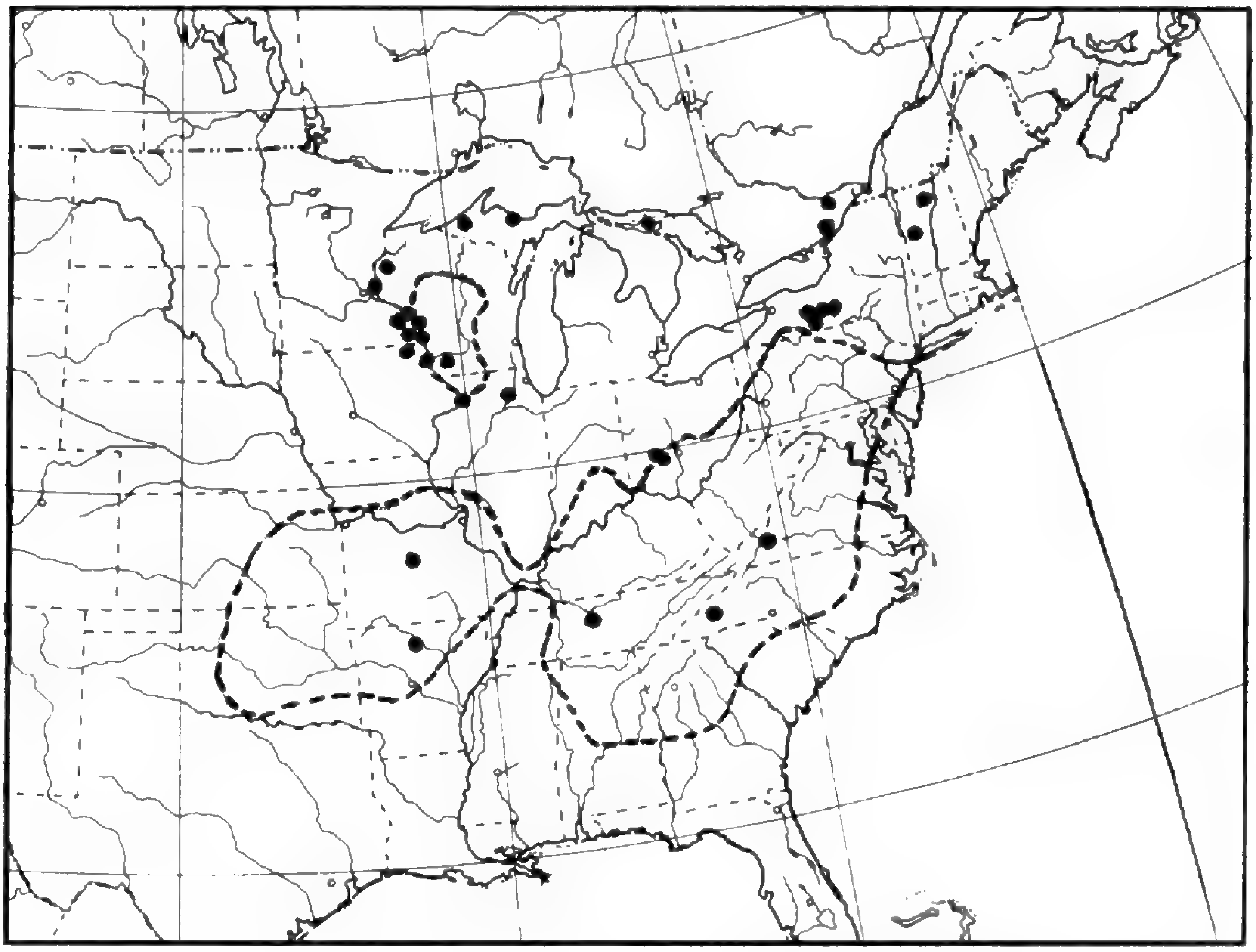

Fig. 17. North American range of *Mannia rupestris*. Within the dotted line the Ozarkian-Appalachian region that has not been submerged nor glaciated since the Paleozoic, and the Driftless Area.

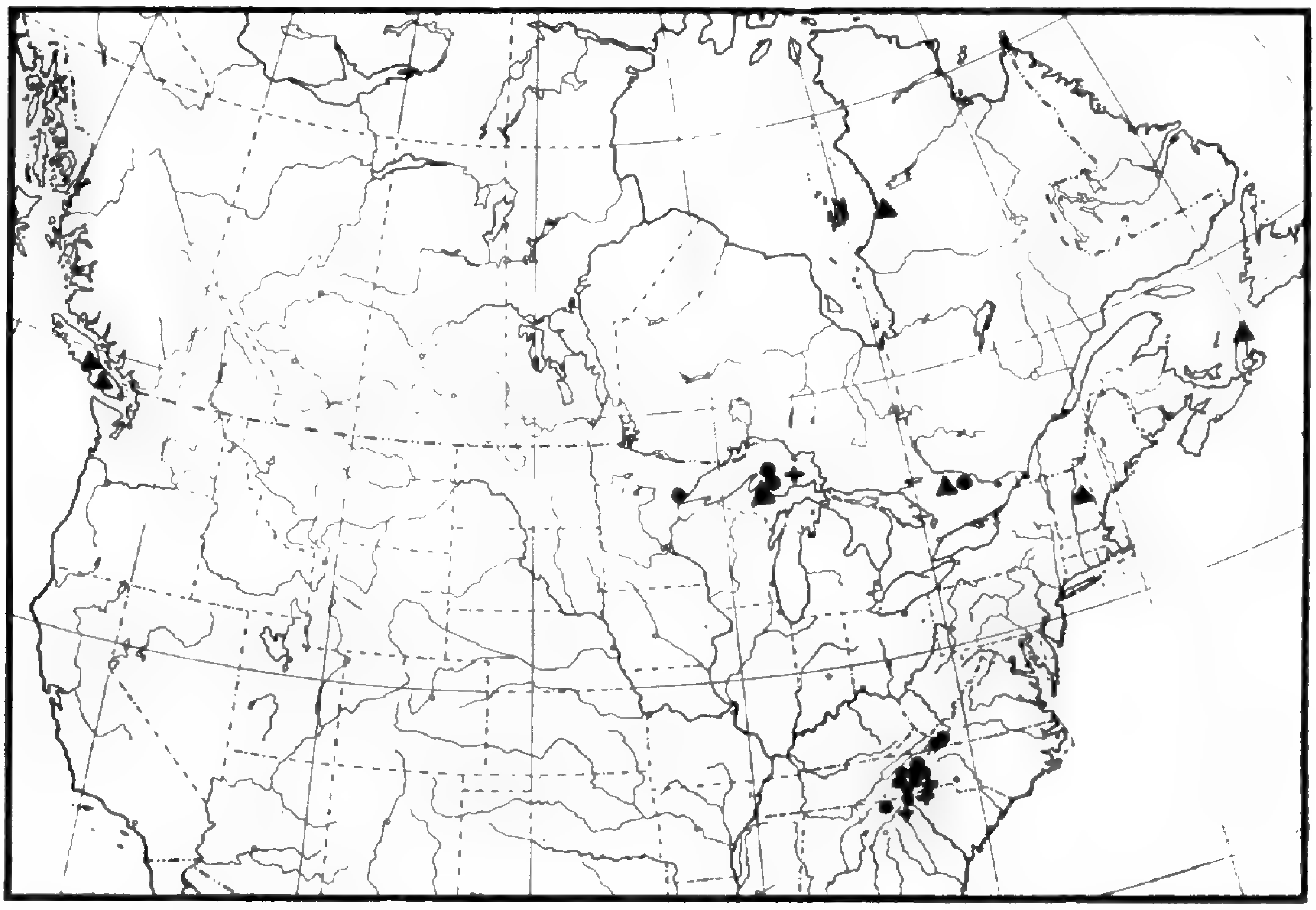

Fig. 18. Range of *Marsupella paroica* (dots), *M. sparsifolia* (triangles) and *Solenostoma appalachianum* (plus marks). Not all Appalachian stations of the latter drawn in; for its distribution see the text.

Hepaticae involved, and of the post-Pleistocene extension of the prairie, and prairie habitats, eastward.

Marsupella paroica Schuster (Fig. 18). This very recently distinguished species (Schuster, 1957) is locally common in a small area from Brasstown Bald, Georgia, northward to Mt. Rogers and Whitetop Mt., Virginia (see Schuster & Patterson, 1957). The plant had been confused with both *M. emarginata* and *M. sparsifolia* (see Schuster, 1953, where reasons are given why it cannot go into *M. emarginata*). Disjunct stations occur in Minnesota and in the Huron Mts. of Michigan; the former station has been previously reported as *M. sparsifolia*, an essentially arctic-alpine species (triangles on map, Fig. 18); the latter served as the basis of the report of *M. emarginata* from Michigan.

The Lake Superior stations of *M. paroica* are hardly explicable except on the basis of post-glacial dispersal northward from an unglaciated area. Since the species is evidently an old endemic of the unglaciated Appalachian plateau, the Lake Superior stations must be derived either from this latter center or from a Pleistocene refugium in the Driftless Area. The latter explanation appears more reasonable on the basis of the relative distances involved.

Solenostoma appalachianum Schuster (Fig. 18, crosses). This species appears to show a very definite affinity to *Solenostoma monticola* (Hattori) comb. n.[10] and is perhaps to be regarded as a vicariad of this Japanese species. Its relationships are discussed in Schuster (1958a). The original collections of *S. appalachianum* were made by the writer in 1953–54 in two localities: Neddie Creek, a small tributary of the Tuckaseegee R., Jackson Co., North Carolina, and near the Whitewater R., east of Jocassee, Oconee Co., South Carolina. In 1957 two further collections were made. In June the plant was collected, with capsules, at Pictured Rocks, Alger Co., Michigan, just above the shore of Lake Superior, and in July-August in the upper reaches of the Whitewater Gorge, in Jackson Co., near Beech Gap in Haywood Co., and in Cullasaja Gorge, Macon Co., North Carolina; subsequent collections were made in the Chattooga R., in both North and South Carolina, and in n.e. Georgia; the plant also was found in Big Creek, in n.e. Georgia. It is noteworthy that the Appalachian stations all lie in the "coves," where the old Mixed Mesophytic Forest, or derivatives of it occur.

The distribution of this species closely follows the same pattern as that of *Marsupella paroica*, except for a generally lower altitudinal range. It is perhaps significant that this species, like *M. paroica*, is a pioneer on non-calcareous rocks, therefore could have readily survived the Pleistocene glaciation on the damp, non-calcareous sandstone ledges and walls of the Driftless Area. Habitats very similar to those in which the species grows at Pictured Rocks have been found several times in the Wisconsin Dells area.

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[10] *Jungermannia monticola* Hattori, Bull. Tokyo Sci. Mus. 11: 33, 1944.

DISCUSSION AND SUMMARY

It is always tempting to generalize from distribution patterns which show unusual features. By a process of conscious or unconscious selection it is also often possible to misplace emphasis, or to derive unwarranted conclusions. Added to this are the additional dangers imposed by a fragmentary knowledge of the range of the species (the well-known "distribution of collectors" phenomenon), leading to erroneous conclusions, as, for example that of Steere (1937) with respect to some of the so-called "Cordilleran" relicts of the Lake Superior regions. In spite of these dangers, study of the present ranges of plants remains a fascinating, but somewhat hazardous occupation. Since practically all of the extant generalizations, valid and invalid, with respect to the distribution of temperate and boreal North American plants are derived from study of the ranges of the Tracheophytes, the present contribution may serve to add significantly to the available evidence. As has been pointed out, the small size of the *Hepaticae,* which is surely related to their ability to survive in microhabitats, together with their great genetic stability (partly a consequence of their high incidence of vegetative reproduction) makes them an ideal group from the point of view of phytogeographical studies.

Admitting the hazards involved in generalizing from a limited number of selected species, the following tentative conclusions appear warranted. (1) There is a distinct, if somewhat tenuous, connection between the "old" flora of the unglaciated Appalachians and that of the Driftless Area (Fig. 13, 17). Perhaps through the latter there is an even more tenuous connection with the flora of Lake Superior, presumably the consequence of recent migration from a Pleistocene refugium in the Driftless Area (Figs. 13, 18). (2) There is a definite floristic connection between the Driftless Area and Lake Superior. *Frullania bolanderi* (Fig. 12) and *Mannia pilosa* (Fig. 16) serve to demonstrate this connection, and the range of the latter appears to establish a connection between the Lake Superior flora and that of the Arctic. Parallelisms in the Angiosperms and Pteridophytes are not unknown. (3) There appears to be a striking, if tenuous, connection between the flora of the Driftless Area and the Arctic, as demonstrated by *Athalamia hyalina* (Fig. 15). A close parallel has been pointed out in the Angiosperms by Rosendahl (1947), in *Chrysosplenium iowense* Rydb., occurring peripheral to the Driftless Area in n.e. Iowa, again in Alberta, and in the high North American Arctic. (4) A pronounced connection between the Driftless Area, the Great Lakes region, and the far western flora is evidenced by the distribution of *Frullania bolanderi* (Fig. 12). The distribution of the herbaceous angiosperm, *Mertensia paniculata,* is suggestively similar.

The preceding cases, each involving the Driftless Area, are as a whole suggestive. Of these, the most meaningful perhaps is that of the corticolous species, *Frullania bolanderi* (Fig. 12). In this case, at least, the distribution in the east impinges only on one area where the species could have survived the Pleistocene glaciation, in other words, the Driftless Area. Thus there appears to be demonstrated a distinct connection between the flora bordering the Lake Superior region, and the much warmer Driftless Area. Among the Angiosperms, such cases, although rare, are also known (*Mertensia paniculata, Abies balsamea, Potentilla tridentata, Primula mistassinica, Populus balsamea, Thuja occidentalis,* etc.). Added to this is the fact that there are occasional species, of temperate and largely Appalachian, or Appalachian-Ozarkian range, which have attained the southern edge of the Lake Superior area, and occur in, or near, the Driftless area as well (Figs. 13, 17, 18). From this the conclusion can hardly be avoided that, in some fashion or another, the Driftless Area has served as a refugium for some of the plants, otherwise unknown from the Midwest, which have in post-Pleistocene times invaded the Great Lakes Area. In this connection, one must consider the range of the largely Cordilleran *Mertensia paniculata,* known from stations in northeastern Iowa, and southeastern Minnesota; the range of *Primula mistassinica,* known i.e., from a station in the unglaciated portion of Illinois; and the range of *Potentilla tridentata,* known i.e., from a station in southeastern Minnesota at the periphery of the Driftless Area, in Houston Co. All three species are common around Lake Superior. Additional examples appear unnecessary.[11] By this the writer would not try to deduce

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[11] There are also a host of "relicts" found in the glaciated Mississippi River-St. Croix River valley region, running northward from the Driftless Area towards the Lake Superior region. Among them are *Primula mistassinica* (near Stillwater, Minn.), *Streptopus roseus* var. *longipes* (Fern.) Fassett (Taylors Falls, Wisc.), *Dryopteris fragrans* var. *remotiuscula* Komarov (St.

a wholesale revegetation of the Great Lakes Area, from a hypothetical refugium in the Driftless region. However, it is probable, from the range of such arctic-alpine species as *Athalamia hyalina*, *Mannia sibirica* and *pilosa*, and of such Cordilleran species as *Asterella saccata*, that such "rigid" species, of relict distribution regionally, were forced this far southward during the time of the Pleistocene glaciation. That they were not, in all cases, able to migrate northward recently to the Lake Superior region (as, for instance, in the case of *Asterella saccata* and *Athalamia hyalina*) does not materially alter this fact. The only other explanation, that the ranges of these species in the "Driftless Area" are the result of chance post-Pleistocene migrations would imply too fortuitous a series of coincidences to warrant serious consideration. The writer would therefore suggest a serious re-appraisal of Fernald's (1925) hypothesis that the Driftless Area served as a possible refugium, from which some of the disjunct Great Lakes vegetation could have been derived. The argument against this by Fassett (1931) based in part on the fact that the Cordilleran-Lake Superior *Rubus parviflorus* does not occur in the Driftless Area is not insurmountable, especially in view of the fact that another of the Cordilleran-Lake Superior species (*Mertensia paniculata*) does still survive in n.e. Iowa at the borders of the Driftless Area. The absence of specific species from the "Driftless Area," which are, however, characteristic of the Lake Superior region, proves nothing.[12]

In the case of the larger herbs, or shrubs (such as the *Rubus*), and of trees, which are exposed to the macroenvironment, survival in the Driftless Area, especially during the thermal maximum, is scarcely to be expected. Smaller herbs (such as *Mertensia*) or even more likely, small cryptogamic plants (such as *Hepaticae*),

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Croix Falls, Wisc.), *Lycopodium selago* var. *patens* (Beauv.) Desv. (Minnesota R. near Mankato and near St. Paul, Minn.), *Scirpus caespitosus* var. *callosus* Bigel. (Scott Co. and Ramsey Co., Minn., in and near the Minnesota R. valley). The occurrence of these plants as relicts in the region between the Lake Superior shore (where they are common pioneer or near-pioneer plants), and the Driftless Area (where they are now unknown, except for the *Primula*), suggests that they may be the rear-guard of a considerably larger series of species which at one time may have migrated northward from the Driftless Area to the shores of Lake Superior. The inverse explanation: that they are recent migrants, southward from the Lake Superior shore region, appears highly improbable.

[12] Deevey (1949, p. 1391) warned specifically against this type of negative reasoning, stating: "There is probably no field of scholarly activity where it is so dangerous, and at the same time so tempting, to reason from negative evidence, as biogeography."

which can survive in restricted microenvironments appear more able to withstand major climatic changes, and appear to have survived in the Driftless Area in larger numbers. This concept receives some indirect support from the fact that the *Hepaticae* with arctic and/or Lake Superior affinity and/or Cordilleran affinity (*Mannia sibirica, M. pilosa, Athalamia hyalina, Asterella saccata*) are all members of the order *Marchantiales*, suborder *Marchantiinae*. The *Marchantiales*, of all the *Hepaticae*, are the only ones with a well-developed xeromorphic structure, adapted to long unbroken periods without available water. This is to be considered in the light of the fact that of the 175 species of Hepaticae found in Minnesota, less than 10% belong to the suborder *Marchantiinae*. Yet no arctic-alpine members of the Lake Superior flora, belonging to the other, less xeromorphic groups, occur today in the Driftless Area. Considering some of the above distributional anomalies, which have received far from satisfactory explanations, the earlier suggestion of Fernald (1925) becomes more plausible than his more recent (1935) hypothesis that a "nunatak" area at the head of Lake Superior served as a refugium during glacial times.

The above interpretation of the role of the Driftless Area in the vegetation of the western Great Lakes Area is also supported by other recent sources which have not been drawn on in the foregoing discussion. For example, Braun (1950, p. 522–523) states that "The development of the Beech-Maple Forest [of the "Glaciated North"] was not the result of uninterrupted migrations from south of the Wisconsin glacial border. The aspect of mixed forest communities of ravine slopes, and the nature of the soil of the Driftless Area and adjacent very old drifts to the west suggest that this hilly area may have been a Pleistocene refugium for an attenuated mixed mesophytic forest which was isolated hereabouts in late Tertiary time, or at latest, in pre-Wisconsin time. From this refugium, early post-Pleistocene migration took place. This is indicated by the early appearance of *Fagus* and *Tilia* in records of nearby bogs. . . ." Miss Braun concludes, therefore, that "Thus two migrations, one from the south and one from the Driftless Area, met to the north of the Prairie Peninsula," leading to the present distribution of the Beech-Maple forest. Implied in this is a much further westward occurrence of Beech during the "mid-postglacial humid, warm period" with subsequent curtailment of its range during the subsequent xerothermic period. During this period, also, a large variety of the larger shrubs that may have survived in the Driftless Area, such as *Rubus parviflorus*, may have suffered extinction in the Driftless. According to this interpretation of Braun, "The Maple-Basswood Forest is . . . at least in part postglacial in origin. It appears to have been derived by climatic modification of the late Tertiary or interglacial forest of the Driftless Area. . . ." Such an interpretation of postglacial migration outward of various vegetational elements has also been used to explain the existing range of various other species. Thus McLaughlin (1931, p. 286) has suggested that *Hypericum kalmianum*, a slender shrub up to 6 dm. high, endemic to the Great Lakes, survived the Pleistocene in the Driftless Area, migrating eastward during the early postglacial period along the margins of the glacial lakes. A similar explanation could also be advanced for the distribution of the very distinctive Great Lakes endemic, *Cirsium pitcheri*, which today is confined to the shores of Lakes Michigan, Huron and Superior.

The above conclusions, with respect to the role played by the Driftless Area in the revegetation of the Lake Superior region, stand directly opposed to those recently expressed by Abbe (in Butters & Abbe, 1953, p. 69). Abbe, indeed, goes so far as to consider the presumed migration of species from the Driftless Area northward to the North Shore of Lake Superior as requiring "far more in the way of botanical legerdemain" than the migration patterns he postulates. However, it must be emphasized that Abbe dealt with only the Tracheophytes, and largely with the Angiosperms. The presence in the Driftless Area of arctic and "Cordilleran" elements, as regards the Angiosperms, has been known for a long time (the case of *Rhododendron lapponicum*) and has been confirmed by recent work [Rosendahl (1947) *Chrysosplenium iowense* and *Sedum rosea;* Williams (1937) *Mertensia paniculata*]. This lends credence to the idea (Fernald, 1925) that the Driftless Area played some part as a source of some of the local populations of otherwise arctic and Cordilleran species now occurring around Lake Superior, and in the area to the north of it.

Abbe (loc.cit., p. 70), reviews the evidence against considering the north shore of Lake Superior, or the Keweenaw Peninsula, as "refugia." With this evidence, there is no valid basis for argument. However, Abbe also discards the idea of Fernald (1925) that some of the relict species (and specifically the "Cordilleran" ones) could have survived in the Driftless Area, and migrated in the post-glacial period to their disjunct stations in the Great Lakes. He states: "It becomes necessary, if a nunatak theory is to be maintained as a philosophical necessity, either to relegate such refugia to still unexplored areas or to retreat southward to the Driftless Area. Either procedure demands that the rarities of today migrate across a terrain already heavily mantled by vegetation. It is far more reasonable to recognize the limitations of these species which restrict them to migration under the more favorable conditions for dissemination found in a periglacial zone . . . or along the strand and shore rocks and cliffs of the glacial lakes." Such an explanation, undoubtedly, holds for the majority of widespread plants today found around the shores of the Great Lakes. However, a question remains as to whether it applies to the so-called "rigid" species (*sensu* Hultén), whose ability to compete and migrate actively appears to be exceptionally low or to such forest species as *Frullania bolanderi*. The majority of the so-called disjuncts, or "critical" species, are, to a greater or lesser extent, rigid species, as was emphasized by Fernald. It is in these cases, where it is difficult to visualize fluctuating and migrating populations rapidly extending their range in an east-west or west-east direction, where the closely adjacent Driftless Area may acquire some significance as a "refugium."

The preceding discussion leaves unanswered the question of why there is such a marked disjunct element of arctic species around the shores of Lake Superior. The first 15 examples cited (Figs. 1–10) can be materially supplemented, and represent only a portion of the arctic and arctic-alpine species of *Bryophyta* known from the Lake Superior region. The paper by Steere (1937) lists a series of equally interesting disjunct arctic mosses and that by Thomson (1954) an impressive list of arctic and "high arctic" lichens. This arctic flora can be very simply explained as a relict or "old" flora, left behind during the immediate post-glacial period, in a locally favorable area. The high incidence of arctic species around Lake Superior, and the much lower incidence of them in the rest of the Great Lakes Region supports this simple explanation. Lake Superior, the deepest of the lakes, is also by far the coldest, with the slightest winter-summer fluctuation in temperature. As a consequence, a narrow, permanently treeless, barren border exists, extending inward for only a few score yards (and often to a much lesser extent), and up for 10–50 feet in elevation above the Lake (rarely much higher), whose existence depends on the cooling effect of Lake Superior. This narrow strip has been presumed to represent a microclimatically (and, because of wave-action, in some cases a microedaphically) controlled Tundra strip (Schuster, 1953). The vegetation of this strip, involving the *Hepaticae* outlined (species 1–15), together with a series not discussed (*Lophozia kunzeana, L. hatcheri, L. groenlandica, L. grandiretis, L. alpestris, Tritomaria quinquedentata, Solenostoma sphaerocarpum, Tritomaria scitula, Lophozia lycopodioides, L. obtusa,* and others; for their regional distribution, see Schuster, 1953) compares favorably with that of the coastal portion of southern and central Greenland, as delineated by Böcher (1933) and of coastal Ellesmere Island (Bryhn, 1906–1907; Schuster, unpublished). The same rock-pool community, formed by *Scirpus caespitosus,* accompanied by *Polygonum viviparum, Potentilla tridentata, Pinguicula vulgaris,* characterizes some of the coastal portions of Greenland.[13]

It is therefore postulated that the disjunct species around the shore of Lake Superior may belong to two types (1) a series of "rigid" species, which may have survived the Pleistocene glaciation in the Driftless Area, and migrated northward the short distance involved to the Lake Superior shore, probably in the immediate postglacial period, and (2) a series of widespread arctic species, not found in the Driftless Area, which represent relicts of the immediate post-glacial period, when the Lake Superior area was invaded by a tundra-type of vegetation. The species of the first class persist in cool, moist microclimates, in many cases, in the Driftless Area, *in spite of the much warmer and*

[13] This affinity is even more strongly suggested by the fact that *Lophozia latifolia* Schuster (see Schuster 1953, 1954) known previously only from this arctic strip along the Lake Superior shore in Minnesota, has recently turned up in collections studied from Thule, Greenland, as well as in material from Swedish Lapland, from Alaska, and from northeastern Ellesmere Island.

drier general environmental conditions currently obtaining there. The species of the second class today persist around the Lake Superior shore because of the persistence there of localized tundra conditions in the vicinity of the spray zone of the lake.—DEPARTMENT OF BOTANY, UNIVERSITY OF MASSACHUSETTS, AMHERST, MASS.

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A NEW SPECIES OF VICIA (LEGUMINOSAE) IN FLORIDA[1]

R. K. Godfrey and Robert Kral

Vicia ocalensis Godfrey & Kral, sp. nov.—Perennis, caulibus ad 12 dm. altis, crebris et inter se multum innectentibus, prostratis vel suberectis. Caulibus ramisque insignite striatis, sparse pilosis. Foliis 4–6 foliolatis, plerumque 6. Foliolis 3–5 cm. longis 3–6 mm. latis, subtus sparse pilosis supra granularibus, linearibus vel anguste lineari-oblongis aut lineari-ellipticis, apicibus rotundo-mucronatis. Racemibus axillaribus, longi-pedunculatis, ferentibus ad 18 flores. Floribus 10–12 mm. longis. Pedicul is calycibusque pilosis, lobis late deltoidis brevi-acuminatis. Petalis albis, quorum cacumina suffundurtur colore pallido-caeruleo ipsa lamina plus minusve suffusa omnino colore pallido-caeruleo. Leguminibus sparse brevi-pilosis aut glabratis, 4–4.5 cm. longis 6–8 mm. latis, ferentibus ad 8–12 semina.

Specimens examined: **Florida.** Marion Co.: Juniper Creek bank, Ocala National Forest, May 18, 1949, *Mather m-270* (FLAS); prostrate to climbing, succulent-leaved, blue-flowered plants, common on moist sands along creek through sandhills, toward east-central boundary of Ocala National Forest, April 7, 1957, *Kral 4569* (FSU); forming a dense entangled mat in roadside ditch bordering hammock, along Juniper Springs Creek, northeast of Juniper Springs, May 3, 1957, *Godfrey 55537* (FSU—Type).

Vicia ocalensis is apparently closely related to two other native *Vicia* species of the southeastern United States, *V. acutifolia* Elliott and *V. floridana* S. Watson. It is readily distinguished from both of the latter by its much more robust stature, its

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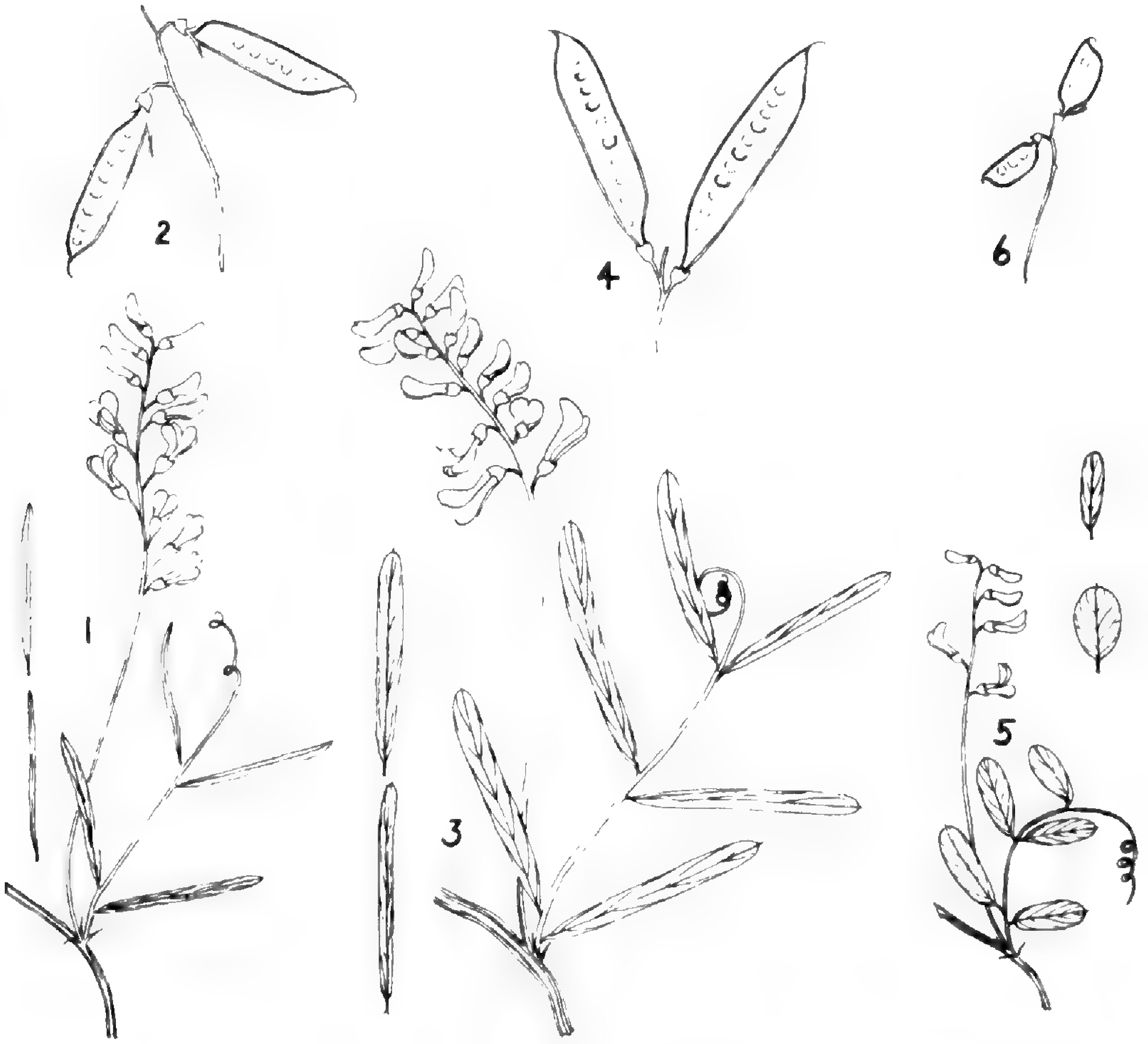

Fig. 1 and 2 Vicia acutifolia. Fig. 3 and 4 V. ocalensis. Fig. 5 and 6 V. floridana. All drawn to the same scale.

significantly larger leaflets, flowers, fruits, and seeds. Comparative distinguishing features are given in tabular form below. See also Figures 1–6.

	V. acutifolia	*V. floridana*	*V. ocalensis*
STEMS.	Usually not exceeding 8 dm. long.	Usually not exceeding 6 dm. long.	Mostly up to 12 dm. long.
LEAFLETS.	2–4, mostly 4, narrowly linear to linear, 1.5–3 cm. in length and 1–2 mm. in width.	4–6, mostly 4, linear-elliptic to suborbicular, mostly elliptic, 1.0–1.5 cm. in length and 3–5 (–8) mm. in width.	4–6, mostly 6, linear-oblong or linear-elliptic, 3–5 cm. in length and 3–4 (–6) mm. in width.
RACEMES.	2–12, mostly 8–10-flowered.	1–10, mostly 4–6-flowered.	12–18, mostly 15–18-flowered.

	V. acutifolia	*V. floridana*	*V. ocalensis*
FLOWERS.	8–9 mm. long.	5–7 mm. long.	10–12 mm. long.
LEGUMES.	2.5–3 cm. long and 5 mm. broad, 8–12-seeded.	1.0–1.5 cm. long and 5 mm. broad, 1–3-seeded.	4.0–4.5 cm. long and 7–8 mm. broad, 8–12-seeded.
SEEDS.	2.0–2.2 mm. in diameter.	2.0–2.5 mm. in diameter.	3.0–3.5 mm. in diameter.

The range of *Vicia acutifolia*, according to Small (1933), is coastal plain, Florida, Alabama, and Georgia.

Vicia floridana is restricted to Florida. Specimens in the herbaria of the University of Florida and F. S. U. are from the following counties: Alachua, Eustis, Hardee, Hillsboro, Lafayette, Levy, Marion, Taylor, and Volusia.

Vicia ocalensis is presently known only from the type locality in the Ocala National Forest, Marion County.

Our field experience and the limited data with herbarium specimen indicate that the habitats of the three species are closely similar, namely, moist to wet open areas. We have not yet encountered more than one species at a given site, however.

The authors are greatly indebted to Professor Francis R. Walton of the F. S. U. Classics Department for his assistance in preparing the Latin diagnosis.—DEPT. OF BIOLOGICAL SCIENCES, FLORIDA STATE UNIVERSITY.

ORANGE-YELLOW-FLOWERED CLAYTONIA VIRGINICA.—We are so accustomed to seeing the flowers of the Spring Beauty in various shades of rose, pink, or sometimes nearly white, that it comes as a shock to see plants of such a familiar species with orange-yellow flowers and reddish anthers. Yet ten to a dozen orange-yellow-flowered plants of *Claytonia virginica* have been found growing together with the usual color form, along the Susquehanna Canal in Maryland, by Mrs. George A. Elbert of New York City, and she has provided a specimen and photographs in color to prove it. The specimen was so carefully prepared that it retains the orange-yellow petal color, matching the 10 yr 8/10 moderate orange-yellow band on the Nickerson Color Fan. The veins of the petals are red, similar in color to the anthers.

In my own experience, I had not seen an orange-yellow-flowered

Claytonia and I wondered whether this find of Mrs. Elbert's was unique in the genus. A quick perusal of the literature shows that orange-yellow-flowered Claytonias are known. Nelson[1] described *C. aurea* [later[2] naming it *C. flava,* because *C. aurea* turned out to be a homonym] from Henry's Lake, Idaho, and Greene[3] named *Claytonia chrysantha* from Mount Baker in the state of Washington. I have not seen specimens of *C. flava* but isotypes of *C. chrysantha* do not show the yellow color attributed to it by Greene. Indeed, St. John[4] points this out and further states that there are no real differences between *C. chrysantha* and *C. lanceolata* Pursh. Nomenclaturally, this yellow-flowered plant has been regarded as a species, subspecies[5] and form.[4] However, not only are there known orange-yellow-flowered types in western North America but apparently *C. virginica* turns up with flowers of this color from time to time. In Bartonia,[6] Ball reported Spring Beauties with orange-colored flowers in abundance in a meadow near Quakertown, Pennsylvania. It would be interesting to know more about the geographical range of this color form.—R. C. ROLLINS.

BUCHLOË DACTYLOIDES IN ILLINOIS—Buffalo grass, one of the most famous and valuable native North American forage grasses, was an important constituent of the shortgrass prairies of the Great Plains over which vast numbers of bison formerly grazed. Its principal area of distribution extends from western Minnesota into western Canada and central Montana, and southward through eastern Colorado to Arizona, extending into western Louisiana, and northward to northwestern Iowa. It has recently been found in Peoria County, Illinois.

This plant is a stoloniferous perennial grass growing in characteristic colonies often forming a continuous turf of unusual toughness, the short stems rising to a height of a few inches and bearing curly leaves. In the fall it becomes dry and dull grayish green; in both the green and dry condition it is nutritious to

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[1] Bull. Torr. Bot. Club **27**: 260. 1900.

[2] Univ. Wyo. Pub. Bot. **1**: 142. 1926.

[3] Leafl. West. Bot. **2**: 45. 1910.

[4] Res. Stud. State Coll. Wash. **1**: 97. 1929.

[5] Ferris in Abrams, Ill. Fl. Pac. States **2**: 122. 1944.

[6] Bartonia **7**: 22. 1915. I am indebted to Dr. John M. Fogg for telling me of this reference.

grazing animals. The thick turf was cut into blocks to build the walls of the "sod houses" of early settlers on the western prairies.

The phytogeographical significance of the discovery of *Buchloë dactyloides* growing spontaneously in Illinois is that it establishes the fact that this grass ranged at least as far eastward as west-central Illinois, where it is clearly a relict from early post-Pleistocene times. Its discovery here by Dr. Chase in 1956 certainly does not represent a recent extension of range. Although it is now known to occur in Illinois in only a single locality where it occupies a small area in a relatively undisturbed part of a cemetery, it is probable that this colony was only one among several or many others that persisted in Illinois possibly down to the nineteenth century. The fact is nevertheless rather remarkable that during one hundred and fifty years of intermittent but extensive botanical collection and exploration in Illinois, this plant has remained undetected until now. Its recent discovery shows again how nearly impossible it is to discover all the species of a region even after long study. In this particular instance this grass had been completely overlooked, even by the several discriminating resident students of the flora of central Illinois, including, among others, Frederick Brendel, the distinguished author of *Flora Peoriana*, who studied the botany of the Peoria district from 1852 to 1912, and Francis Eugene McDonald, who collected extensively in the same area from about 1880 to 1920. It remained for the veteran Illinois botanist, Dr. V. H. Chase, to discover this species in Illinois at a station about 400 miles east of its nearest known occurrence in northwestern Iowa.

The collection data of *Buchloë dactyloides* in Illinois are as follows: in Springdale cemetery, Peoria, Peoria Co., August 8, 1956, *V. H. Chase 14304*, apparently a relic on soil never in cultivation. Specimens have been deposited in the herbaria of the Smithsonian Institution and the University of Illinois.—G. Neville Jones, university of illinois.

Rorippa sessiliflora in Essex County, Massachusetts.— When checking over the Cruciferae in the herbarium of the Peabody Museum of Salem I found a sheet of an unfamiliar species collected in Salem by the Rev. John Lewis Russell in

1859 bearing the notation, "A weed in garden and seen there for many years past." The specimen had been given various identifications, all obviously wrong. Taking it to the Gray Herbarium I narrowed it down to *Rorippa* and with the aid of Dr. Reed Rollins finally matched it with *R. sessiliflora* (Nutt.) Hitch., a plant of the South and West. While made nearly a century ago this still appears to be the only New England collection of the species.—STUART K. HARRIS,

DEPT. OF BIOLOGY, BOSTON UNIVERSITY.

A NEW COLOR FORM OF SOLIDAGO SEMPERVIRENS.—**Solidago sempervirens** L., forma **citrea** Harris, forma nov. Ad formam typicam similis, sed floribus pallide citrinis. Like the typical form but the florets pale lemon yellow.

Any botanist finding this conspicuous color form growing with normal plants near the parking lot of the Crane Beach Reservation in Ipswich, Essex County, Massachusetts, where it is now abundant, would have no reason to suspect that it was not native to the area. However, this is not the case, the original source was in a different county.

A single plant of the color form was noticed in a colony of normal plants growing on open ground in Winthrop, Suffolk County, Massachusetts by Mr. Francis Wade in 1942. He dug the plant and moved it to his garden in Stoneham, Middlesex County, where it prospered and Mr. Wade divided it annually. When he moved to Ipswich, he took the clones with him and continued to divide them until he now has a considerable number. Seedlings coming up resembled the parent plant. Mr. Wade then gathered seed in his garden and scattered it on various areas about Ipswich where the typical form was growing. In a number of these areas the new form seems to be well established and its pale yellow heads contrast sharply with the deep yellow heads of the normal plants. More recently Mr. Wade has scattered seeds of the color form along the sides of the highway between Newburyport and Plum Island but to date none of these plants have flowered.

Mr. Wade brought me material of the new form in September of 1954 and I showed it to Dr. Reed Rollins of the Gray Herbarium. Suspecting that the plants might be polyploids because of the head size and thickness of the leaves, he had Miss Ann Morrill make a cytological study of the material. The pollen proved to be normal and the chromosome number was normal for the species.

Material Studied: Massachusetts, Essex County: from clone of original plant, garden of Francis Wade, Ipswich, *S. K. Harris ,13982* 4 October 1957 (TYPE in GH; isotype in NEBC); garden, Ipswich, Francis Wade 20 September 1954 (NEBC); near parking lot of Crane Beach Reservation, Ipswich, *S. K. Harris 13872,* 27 September 1957 (NEBC). STUART K. HARRIS, BOSTON UNIVERSITY.

EVOLUTION OF FLOWERING PLANTS.—According to legend, the Ostrich, when frightened, buries its head in the sand, apparently reasoning that what cannot be seen or heard has no reality. In human affairs this is the sort of attitude that continually harks back to the "good old days," forgetting the open sewers, the tainted meat, and the little children choking with Diphtheria. Needless to say, there should be no tolerance, in Science, of Ostrich reasoning. In Biology, the increase of factual knowledge, in both the observational and experimental fields, of late years, has been truly remarkable. In many cases, however, theoretical considerations have not kept pace with the increase in factual data, with the unfortunate result that some biologists persist in trying to square the modern corpus of knowledge with theories that were none too happily contrived fifty or one hundred years ago. Indeed, perhaps the most serious deficiency in contemporary biology is the absence of a sober, impartial, encyclopedic, evaluation and correlation of the facts available in the fields of genetics, ecology, comparative morphology, and taxonomy.

A short time ago there was published a book entitled "Features of Evolution in the Flowering Plants."[1] The author is Ronald Good, a well known phytogeographer, and Professor of Botany at the University of Hull (England). On first glance, the book makes an extremely good impression, for it is simply and clearly written, and replete with examples and tastefully produced illustrations. A second look, however, shows that the book is fifty years out of date. The author has chosen to ignore most of the modern data of taxonomy, comparative morphology, and genetics. In doing so, he has not only denied himself the answers to many of his questions (or at least what answers may be available), but he has also denied himself the data necessary to frame his questions meaningfully.

As a plant geographer, the author seems to have picked up a nodding acquaintance with a great variety of species of flowering plants—and with a number of currently unpopular hypotheses about the mechanism of evolution. Unfortunately, it frequently appears that he does not have

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[1] Longmans, Green & Co., London and New York, 1956, 30 shillings.

intimate, first-hand acquaintance with the data which he uses. What is worse, however, he seems not to have used all of the available sources of information. No discussion of the relationships of the monocotyledons and dicotyledons, for example, can have much significance if it ignores our present knowledge of the vegetative anatomy of the two groups—based particularly on the recent work of I. W. Bailey and his collaborators at Harvard, V. I. Cheadle at the University of California, and C. R. Metcalfe at Kew. Neither can any discussion of the interrelationships of the higher dicots have much relevancy unless it takes into account the work of A. J. Eames and his students at Cornell. Finally, any discussion of the evolution of the Compositae or Gramineae should consider the genetic studies of Babcock and Stebbins, and their respective collaborators, at the University of California.

Good's main contention seems to be that evolutionary thought is too much dominated by the results of statistical analyses of animal populations, or by *a priori* axioms, and not by demonstrable facts. It is true that much of our knowledge of the behavior of structural characters in populations is derived from the study of laboratory cultures of the fruit fly, Drosophila. One of the values of these tiny, bisexual, insects is their extremely short life span, usually completed within two weeks. It is perhaps frequently forgotten by students of genetics and evolution that Drosophila is biologically comparable only with annual plants which are obligately cross-fertilized—types which are generally considered to have reached the acme of specialization. They tend to forget that woody plants, biennial and perennial herbs, and self-fertile annuals—which account for the vast majority of flowering plants—may behave very differently, both as individuals and as populations. Modern studies have shown that, in the north temperate zone, up to 80 per cent of the species in a given plant community may have some propensity for vegetative reproduction under natural conditions. Of the 1,500 species of plants studied so far, 46 per cent seem to have some faculty for producing seed without the need for cross pollination. Finally, of the 15,000 species investigated, about 33 per cent seem to be involved in polyploidy. These are phenomena unknown in populations of Drosophila.

Good had an excellent idea, but he didn't carry through. There remains a need for an impartial examination of current evolutionary hypotheses. There is a fair amount of botanical evidence, experimental and historical, which bears on the origin of species and genera. This evidence does not seem to support the neodarwinian concept of natural selection. The origin of species, or of any other taxonomic category—as distinct from the behavior of specific characters—is a matter of history and experiment, not speculation. In the literature of botany and horticulture, which has been built up over the past two hundred years, there is a wealth of historical and experimental data about individual plants and populations. It is time these data were used.—GORDON P. DEWOLF, JR., CAMBRIDGE UNIVERSITY.

GRASSES NEW TO ILLINOIS AND THE CHICAGO REGION.—Specimens cited are in the herbarium of the Chicago Natural History Museum (F); herbarium of the Illinois State Natural History Survey, Urbana (ILLS); herbarium of University of Illinois, Navy Pier, Chicago (NP); and United States National Herbarium, Washington, D. C. (US).

Puccinellia distans (L.) Parl. New to Illinois. Many plants of this alkali-grass were found in the Proviso railroad yards at Northlake, Cook County, Illinois, June 19, 1957, *Glassman 4088* (NP), *Thieret 3534* (F, ILLS, US).

Bromus marginatus Nees. New to the Chicago region. This brome-grass was collected in a waste place near Hickory Road and Kedzie Avenue, Homewood, Cook County, Illinois, June 17, 1957, *Thieret 3503* (F, ILLS). *B. marginatus* has been collected apparently only once before in Illinois. Dr. J. R. Swallen has kindly sent us the data for this collection: Fox River valley near Elgin, [Kane County], June 30, 1916, *Benke 1340* (US).—JOHN W. THIERET AND SIDNEY F. GLASSMAN, CHICAGO NATURAL HISTORY MUSEUM, AND UNIVERSITY OF ILLINOIS, NAVY PIER, CHICAGO.

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THE NEW ENGLAND BOTANICAL CLUB

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REDISCOVERY OF THE GENUS NEOPARRYA MATHIAS (UMBELLIFERAE)

WILLIAM A. WEBER[1]

Neoparrya Mathias[2] is a monotypic genus of Umbelliferae endemic in the southern Rocky Mountains. *N. lithophila* was described from a single collection of Parry from his 1867 expedition for the Pacific Railroads (Palmer 1869). Paradoxically, the species was never again found in nature until the spring of 1957, when the writer, having reconstructed Parry's itinerary from his diaries (Parry 1867), succeeded in discovering the actual type locality. This locality, given on the original label as "New Mexico. On rocks, Huefano Mts, Sept., 1867, *C. C. Parry* 83", is to be found in Colorado, rather than New Mexico as generally supposed.

The morphological affinities of *Neoparrya* are quite obviously with *Aletes*, a small genus of three species limited also to the southern Rocky Mountains. *A. humilis* is a very restricted endemic found at only one station, along Dale Creek in Larimer County in north-central Colorado; *A. macdougalii* occurs on talus slopes of the Colorado Plateaus Province in the Four Corners region; and the most widespread species, *A. acaulis*, occupies a narrow zone along the eastern base of the Rocky Mountains from northern Colorado south into New Mexico, West Texas, and northern Mexico.

Both *Aletes* and *Neoparrya* are strongly xeromorphic, with thick, glossy, leathery-textured leaves with a basic pinnate form but with the leaflets tending to be ternately divided. The leaves arise basally from numerous caudices, forming mats of several

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[1] University of Colorado Museum, Boulder.

[2] *Neoparrya lithophila* Mathias in Ann. Mo. Bot. Gard. **16**: 393. 1929.

decimeters diameter. The flowers are yellow in *Aletes* (in *Neoparrya* they were unknown) and the rays of the umbel in both genera tend to be reflexed at maturity. The only feature by which *Neoparrya* seems to differ markedly from *Aletes* is in the oil-tubes which are of various sizes and are scattered through the pericarp instead of lying in a uniform row. The ecological preference of *Aletes* is rock ledges and cliffs, usually at altitudes of from 6,000 to 8,000 feet, where it forms conspicuous mats on the canyon sides. In anthesis the masses of yellow umbels are quite showy.

Aletes acaulis is an abundant and conspicuous species in the canyons of the east face of the Front Range in Colorado and New Mexico, and *Neoparrya* is similar enough in its general appearance, judging from the herbarium material, to indicate similar ecological preferences. Nevertheless the plant has eluded collectors for nearly a hundred years although it must, according to Parry's route, occur in a region rather extensively botanized. Dr. Mathias, who described the species in 1929, had hunted it unsuccessfully for many seasons in what she felt must be the type region.

Although the writer was unaware of the following quotation until after *Neoparrya* was rediscovered, it is interesting to find that Standley (1910) suspected that Parry's New Mexico localities of 1867 were incorrectly interpreted, for he says (concerning the type locality of *Artemisia Parryi* Gray): " 'Huefano Mts., New Mexico, Dr. C. C. Parry in September 1867'. This must have been collected in Colorado, for there is a range of this name in that state and none, so far as the writer knows, in New Mexico. The name should certainly read Huerfano instead of Huefano."

That Dr. Mathias had independently come to the same conclusion is apparent from her letters to the writer (1956):

"At the time I published the genus, away back in 1929, I had a number of sheets, since the original collection by Dr. Parry was a large one and widely distributed; and from the information on these sheets and from other notes which I was able to get and which I no longer have, I indicated that it was apparently collected on Huerfano Peak near Servilleta in Taos County. I have looked in that area and, so far, without any success. However, it is highly possible that it was collected in the canyon of the Rio Grande, which is a little inaccessible in that area, as you know. . . . I have been on the plateau in New Mexico on both sides of the Rio Grande and I have also looked through large areas of the canyon of the Rio Grande and tributary canyons where I could get into them. The fruiting specimens were collected in September so that I do not believe I have been too late. I have gone into this area, now, in every month from June through late September without success. However, some of the perennial Umbelliferae manage to survive without maturing fruit over long periods of time and I may have been unfortunate in never hitting the area in a good year. It is one of those curious plants which I am certain will turn up sooner or later, and anything you can do in the way of looking will certainly be appreciated by us."

During this long search, Dr. Mathias' suspicion grew that the type locality was incorrectly understood.

"I had thought originally that it must have been collected in the Rio Grande Canyon, not far from Santa Fe or Taos, New Mexico. However, last summer when I was at the Missouri Botanical Garden library, I pulled out a number of the old reports on this expedition and it seems to me that it is just as likely that this plant may have been collected at the headwaters of Huerfano Creek somewhere in the neighborhood of La Veta Pass in southern Colorado. If so, it would be on the talus slopes, I suspect. I did look over the little Huerfano Peak near Walsenburg with a fine-toothed comb last summer, and I am certain it is not there. It probably was farther up the headwaters of the creek. This is a genus which you might watch for when you are in the southern part of the State. I would certainly be delighted to find it again."

In a study of the genus *Helianthella* (Weber, 1952), the writer had a similar experience in settling the type locality of *Helianthella parryi* Gray, and found evidence indicating that any plants which Parry collected in the 'Huefano Mts.' in 1867, were actually collected in Colorado rather than New Mexico, on the headwaters of Huerfano Creek.

Fortunately, several published documents concerning the 1867 expedition can be used effectively to plot the details of Parry's itinerary over the most critical part of the journey.

Probably the most important are the Parry notebooks, preserved in the Iowa State College Library, Ames, Iowa. A notebook for 1867, pp. 21–39, headed "Route from Fort Wallace to Fort Lyon on the Arkansas" records meteorological data taken along the course of the journey; dates and place names are linked and thus are of value in piecing together the exact route. Most of the localities mentioned may be found on the Huerfano Park Reconnaissance Map of 1892 (U. S. Geological Survey, 1892). The portion of this notebook pertaining to the plant collections made in the 'Huerfano Mountains' is abstracted below:

July, 13. Old Fort Lyon; 22. camp 10 mi. above Fort Lyon; 25. Timpas Creek near mouth; 26, 27. camp 5 mi. above mouth of Apishapa; 27. Apishapa Crossing. ranch 8 miles below mouth of Huerfano; 30. Wilton's Ranch on Huerfano 10 miles above mouth. Doyle's Ranch; 31. Craigs, bottom of Huerfano.

August, 1, 2. bottom of Huerfano; 2, 3. Corral de Toro; 4. camp at foot of Sierra Mojada [Wet Mountains]. Greenhorn Ridge, highest point reached; 5. two miles above mouth of Apache Creek. Patterson's Ranch, on Huerfano bottom; 6. two miles above Butte [presumably the Little Huerfano, a prominent volcanic plug in the plain at the mouth of the Huerfano]; Badito Ranch. foot of mountains; 7, 8. foot of mountains; camp 6 miles above Badito; 9. going to Sangre de Cristo Pass, 9 miles below; 10, 11. camp 6 miles above Badito; 11. camp 6 miles east of Pass; 12. oak grove 10 ft. above creek; 12–18. Sangre de Cristo Pass, on a bench below the crest; 19. survey station, Huerfano Valley; 27–29. Huerfano Valley below La Marsca [Mosca] Pass; 31. camp 1 mi. E. of Sangre de Cristo Pass; 31–Sept. 3. camp in Sangre de Cristo Valley 2 miles west of Pass.

Sept. 3–4. camp below Placer Creek; 4, 5. camp 3 miles above Fort Garland. (The journal ends here).

The mission of Parry's group along this route, as will be seen from some quotations to follow, was to investigate the feasibility of a railroad route through the Sangre de Cristo Pass. For this reason a great amount of time was spent in the Huerfano Creek drainage, and it was here that the bulk of the Parry plant collections were made. The available evidence implies that the rest of the journey, from Sangre de Cristo Pass to Fort Garland and on to Santa Fe, was a rapid one, which did not permit a leisurely study of the vegetation.

Other valuable tools for interpreting the 1867 collections are the narrative by Bell (1870) and the official report on the expedition by General Palmer (Palmer 1869). The Bell narrative contains, as an appendix, the list of plants collected by Parry, together with their general localities ('Colorado', 'Fort Garland', 'Valley of the Huerfano', 'Sangre de Cristo' [Pass], 'Purgatoire Valley', 'Sierra Blanca', 'Greenhorn Mountains', 'Upper Huerfano', and 'Upper Arkansas'), but Parry implies slight errors, for he claimed (Parry 1878) that the list was printed without his having opportunity to revise it. As might be expected, *'Cynomarathrum saxatile* Nutt. in herb. Durand', the specimen subsequently described as *Neoparrya lithophila,* is listed as having been collected near 'Sangre de Cristo' [Pass].

Despite the fact that Parry's plant list as published in Bell (1870) reports many specimens from Colorado, Porter and Coulter (1874) in their Synopsis of the Flora of Colorado, do not cite any of Parry's 1867 collections. Either they did not see these specimens or believed them to have been collected, as the labels may have indicated, in New Mexico.

General Palmer's official report (Palmer, 1869) described the 'Huerfano Route' as follows:

> "This was instrumentally examined by Mr. J. Imbrie Miller, Division Engineer, under direction of General Wright. It deflects from the Raton Mountain Line at Fort Lyon, and follows up the Valley of the Arkansas and its tributary—the Huerfano—to the summit of the 'Spanish Range' at the Sangre de Christo Pass, 141 miles from Fort Lyon—thence 50 miles southwestwardly to the Rio Grande, which it intersects near the mouth of the Culebro, at a point about 33 miles below Fort Garland, and thence down the Rio Grande to Albuquerque. The instrumental examination terminated on reaching the Rio Grande, where the elevation was found to be 7301 feet above tide—that at the summit of Sangre de Christo Pass being 9186 feet.
>
> The 'Mosca Pass' was also surveyed by Mr. Miller, but he reports both that and the Sangre de Christo to be impracticable within the Congressional limit of grade (116 ft. per mile), and there is the additional objection of heavy winter snows."

Bell mentions the Huerfano route, and Parry's part in the work, briefly in the following excerpt (Bell, 1870):

> "Early on the morning of the third day after our arrival in Santa Fe [Sept. 16], two of our friends came into the fonda—Calhoun and Imbrey Millar,—whom we parted with at Fort Lyon; and before evening all Millar's party arrived safe and sound, but much travel-stained and almost shoeless, from their mountain explorations. After leaving us at Fort Lyon, they had followed up the Arkansas and its tributary, the Huerfano, through the Sangre de Christo Pass to Fort Garland, a mili-

> tary post in the centre of the Rocky Mountains of Colorado; and after examining some of the most favorable passes which lead from the heads of the Huerfano to the sources of the Rio Grande [Mosca Pass], they followed the latter stream for 200 miles down to Santa Fé." (pp. 148–149). . . . "On the Huerfano Route, Dr. Parry reports that he met with no workable coal" (page 114).

Judging from these several complementary source materials, it was abundantly clear that the Huerfano Mountains of Parry were not in New Mexico at all, but in Colorado; all that remained, then, for a successful solution to the problem of the lost *Neoparrya,* was a visit to the Sangre de Cristo Pass and the valley of the Huerfano, which rises just east of the Pass.

The actual story of the rediscovery is anticlimactic, for the area was accessible, the habitat was indicated, the weather cooperative and the season right. Sangre de Cristo Pass was quickly eliminated from consideration, being an overgrazed saddle in the upper montane aspen zone with no promising rock outcrops. More promising was the eastern approach to the pass along a gravel road which follows the base of some huge rock walls and taluses in the form of dikes radiating out from a prominent hill southeast of Sangre de Cristo Pass. A five-minute reconnaissance on the slope of one such dike was sufficient; *Neoparrya* was there in great abundance.[3]

As expected, *Neoparrya lithophila* bears a strong resemblance to *Aletes acaulis* in its caespitose habit and masses of stiff basal leaves, yellow flowers and rounded inflorescence with reflexed outer rays. Like *Aletes,* it occurs in crevices of rock outcrops with little soil, but despite its north exposure, the slope on which the plants grow is more arid than those customarily inhabited by *Aletes acaulis,* rather more like that of *A. macdougalii.* Associates of *Neoparrya* include *Pinus edulis, Leptodactylon pungens Hymenoxys richardsonii* and *Gutierrezia sarothrae.* The yellow flowers, in late June, were already almost gone, an indication of how very late Parry's September collections were. Many mericarps were well developed, and thin sections verified the peculiar condition of the scattered oil tubes. Whether these

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[3] COLORADO. HUERFANO CO.: forming large clumps up to two feet in diameter among rocks on stabilized talus of a dike radiating from Dike Mountain, valley of South Oak Creek, between Badito and Sangre de Cristo Pass, 2 miles south and 4 miles west of Badito, ca. 7,000 ft. alt., 105°05′ W. Long., 37°41′ N. Lat. (Huerfano Park Sheet, Reconnaissance Map, U.S.G.S. ed. 1892), 29 June 1957, *W. A. Weber & Laurent Gaudreau 10,571.*

alone can maintain *Neoparrya* on the generic level, however, is a question which the writer does not feel ready at this time to resolve. Suffice it to say that the general morphology, phytogeography, phenology, and ecological preference suggest an extremely close relationship with the three species of *Aletes*.

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THREE NEW ANNUAL SUNFLOWERS (HELIANTHUS) FROM THE SOUTHWESTERN UNITED STATES

Charles B. Heiser, Jr.[1]

I. A NEW AND POSSIBLY EXTINCT SUNFLOWER FROM TEXAS

Helianthus paradoxus, sp. nov. Herba annua, 15 dm. alta, caule sparse scabra, foliis oppositis supra, alternis infra, laminiis inferioribus lanceolatis basi cuneatis, 10 cm. longis, 2.5 cm. latis, profunde 3-nervis, integris, scabris, petiolis 2 cm. longis, pedunculis 3 5, 12–18 cm. longis, phyllariis 16–20, ovato-lanceolatis vel lanceolatis, sparse hispidis, 10 mm. longis, 3 mm. latis, disco ca. 1.8 cm. diam., radiis ca. 15, 1.7 cm. longis, 0.7 cm. latis, corollis disci purpureis, paleis receptaculi ad apicem glabris. TEXAS: Pecos Co., 7 mi. west of Ft. Stockton, Sept. 11, 1947, *H. R. Reed* (type, US; isotypes, GH, SMU).

The new species appears to be most closely related to *H. petiolaris* and *H. annuus.* Its most distinctive feature is the strongly 3-nerved lanceolate leaves. The multicellular bases of the hairs on the upper surface of the leaf give it a distinct punctate appearance. In addition to the leaf shape, the new species is readily distinguished from *H. annuus* by the smaller heads, the nearly glabrous stem, and the narrower phyllaries, and from *H. petiolaris* by the glabrous chaff. The tap root is poorly developed and its similarity to that of *H. agrestis,* a species of low wet places, suggests that it may be a paludose species.

I have waited several years to describe this species in hopes of obtaining additional material. In 1955 an intensive search was made for this plant in the area around Ft. Stockton. Seven miles west of town presumably where the type was collected, there is a low marshy area which I visited in August. Although it may have been too early for the species to be in flower, I found nothing resembling this species in vegetative condition. The area was almost completely covered with the dead stalks of another *Helianthus,* however. A few seeds were secured from dried heads and all of them gave rise to plants of *H. annuus.* In 1957 Dr. Raymond Jackson visited this area and also found no sunflowers other than *H. annuus.*

Two other specimens (*Baker 2,* GH, TEX) have been seen from Fort Stockton which are rather puzzling. These plants

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[1] This study was aided by a grant from the National Science Foundation.

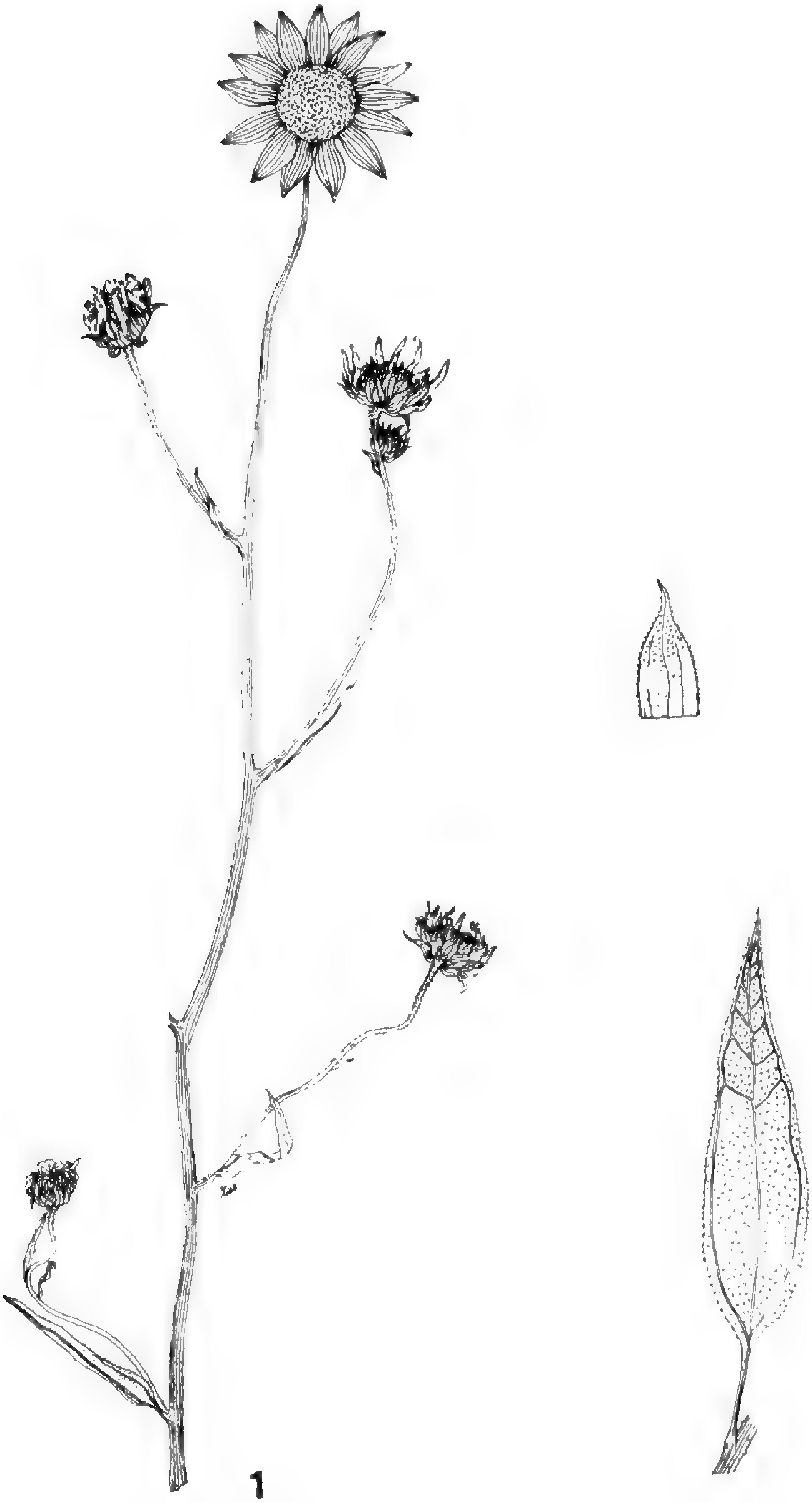

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Fig. 1. *Helianthus paradoxus.* Branch and leaf, x ½; phyllary, x 1½. Drawing by Ruth Smith.

are rather similar to *H. paradoxus* but are taller, much branched and have larger heads and leaves (blade 13 cm. x 5 cm.) Examination of the pollen in several flowers revealed the number of stainable grains to range from 2 to 37% in contrast to the 98% of *H. paradoxus*. In addition, over one half of the achenes in the head were unfilled. It seems likely that these plants are hybrids with *H. paradoxus* as one parent and probably *H. neglectus* as the other. The latter is not known to occur in this area, however, although it is known from Monahans, Texas, a short distance to the northwest. On morphological grounds it appears less likely that the second parent could be *H. annuus* which, however, is abundant in the Ft. Stockton area.

The specimen here designated as *H. paradoxus* was identified by me some years ago as *H. praetermissus* E. E. Wats., chiefly on the basis of a specimen which I at that time thought was an isotype of *H. praetermissus* (Heiser, 1952). Subsequent examination of the type of this species based on a collection from the Sitgreaves Expedition, "head of Rio Laguna" Sept. 27, 1851, and a collection labeled "Nay Camp, Rio Laguna, N. M., August 26, 1851" (Valencia Co.) convinced me that they belong to two different species. The latter material appears to be the same as *H. paradoxus*, differing from the type only in slightly narrower phyllaries and longer petioles. *Helianthus praetermissus* differs from *H. paradoxus* by its very narrow, sessile hirsute leaves. The type specimen of *H. praetermissus* is very fragmentary and no roots are present so it is not known whether it is an annual or perennial.

No specimens of either of these New Mexican sunflowers have been secured since the original collection in 1851. It may be that both are extinct. Río Laguna, now Río San José, and the pueblo of Laguna derived their names from a lake which now has disappeared. It is possible that these species were marsh plants which grew near the lake. I have made brief excursions into this region during two summers and have found only *H. annuus* and *H. petiolaris*, and Dr. Raymond Jackson of the University of New Mexico who has made special efforts to collect all of the species of *Helianthus* of New Mexico has so far not encountered either *H. paradoxus* or *H. praetermissus*.

II. DESCRIPTION AND CYTOGENETICS OF A SECOND NEW SUNFLOWER FROM TEXAS

In 1950 Theodore Odell in a search for *Helianthus paradoxus* for me brought back seeds of a sunflower from near Monahans, Texas. It was clearly evident that the plants grown from these seeds represented a new sunflower obviously closely related to *H. petiolaris* Nutt. In 1955 I was able to visit this area and I found these sunflowers growing in scattered colonies along Highway 80, ten miles east of Monahans to within two miles of the city.

Helianthus neglectus, sp. nov. Herba annua, 8–15 dm. alta, caule dense hispido infra, ramoso supra, foliis inferioribus ovatis, plerumque cordatis ad basim, subintegris vel serrulatis remote, sparse hispidis, pilis propiter appressis, laminis 7–14 cm. longis, 7.5–12.3 cm. latis, petiolis 9–11 mm. longis, pedunculis 10–40 cm. longis, phyllariis 25–35, lanceolatis, attenuatis 15–24 mm. longis, 2.5–4.0 cm. latis, disco ca. 2.3–2.8 cm. in diam., radiis 21–31, 3.0–3.9 cm. longis, 1.0–1.4 cm. latis, palei centrale receptaculi ad apicem albo-hirsutis. TEXAS: Ector Co., 10 miles east of Monahans, July 22, 1955, *Heiser 4123* (type, IND).

It seems somewhat arbitrary whether this sunflower is treated as a species or as a subspecies of *H. petiolaris.* It does not intergrade with the latter, but it is closely related as can be seen from the densely white pubescent chaff tips in the center of the head and most of the other characteristics. It differs from it, however, in the very long attenuate phyllaries, the larger heads, the broader, and frequently, cordate leaves, the densely hispid-hirsute lower stems, and the fact that the branches come off at a greater angle. The two species are allopatric, with *H. petiolaris* having a wide distribution over the western half of North America, and extending within 60 miles of *H. neglectus* in Martin Co., Texas. The new species grows in a more xerophytic area than does *H. petiolaris* in the Texas area.

The cordate leaf of *H. neglectus* is similar to that of certain races of *H. annuus* and *H. debilis. Helianthus debilis* occurs in eastern Texas and *H. annuus* is common throughout Texas, but no plants of these two species were seen growing in the area of *H. neglectus.* That *H. neglectus* owes its origin to past hybridization between *H. annuus* and *H. petiolaris* is a possibility, but it appears more probable that the new species differentiated from the same gene pool as *H. petiolaris.* The angle of branching in

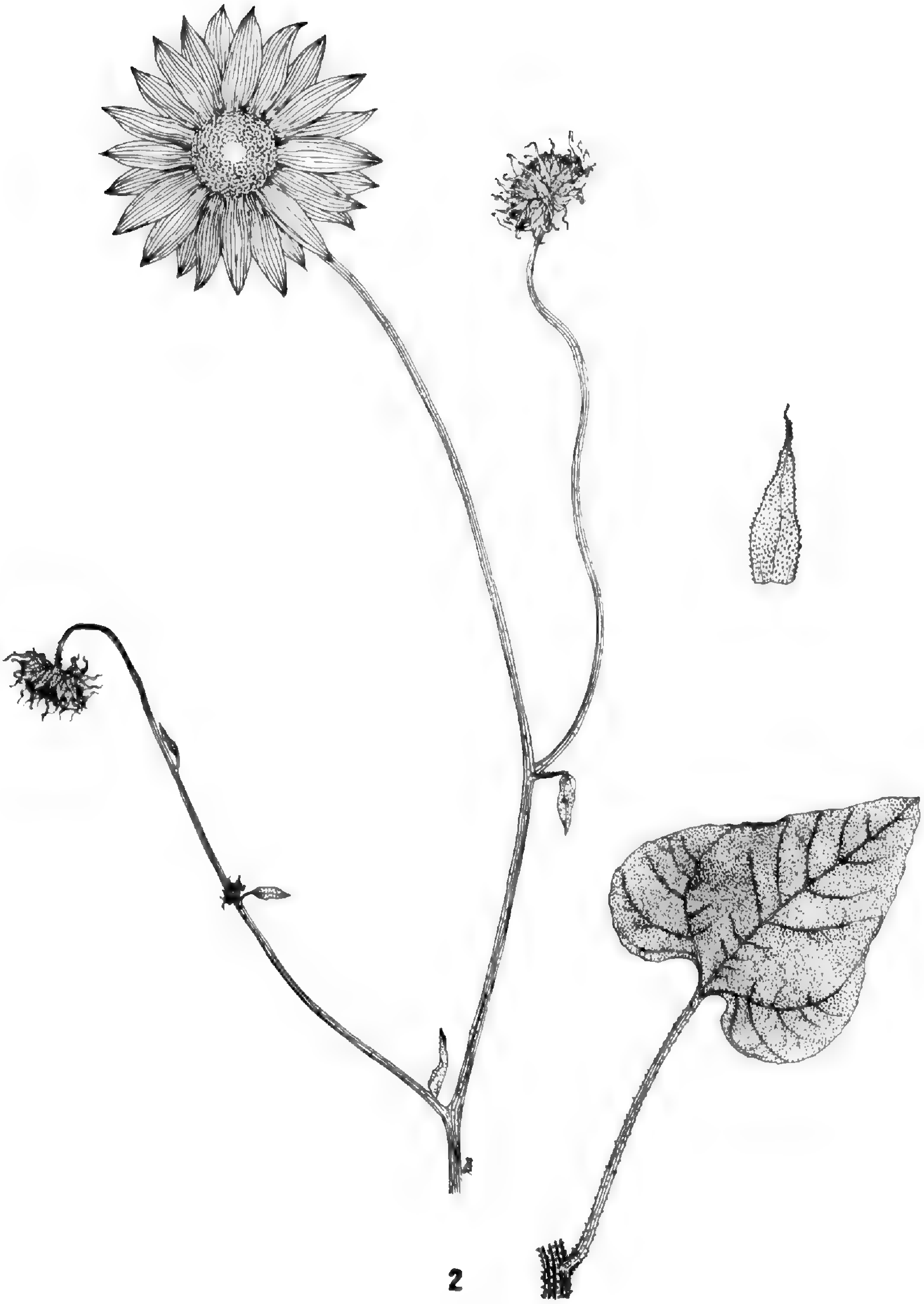

Fig. 2. *Helianthus neglectus.* Branch and leaf, x ½; phyllary, x 1½.

H. neglectus is unique and is most nearly approached by that of *H. paradoxus* of Pecos County, Texas.

The new species has been crossed with *H. annuus* and with two or more races of both *H. petiolaris* and *H. debilis.* The hybrids (Table 1), generally ten plants of each combination except in *5783b* where only one hybrid plant was secured, were grown in the experimental garden at Bloomington. Pollen grains for several plants in each culture were stained in cotton blue and those taking a deep stain were counted as "good". Seed set was estimated by examining the number of filled achenes in several heads in each plant and in general, the percentage of filled achenes was about of the same order as the percentage of "good" pollen. All of the species included in the hybridization program are diploid ($n = 17$). Aceto-carmine smears of the pollen mother cells from one plant of each of the hybrids were made and chromosome pairing was examined at diakenesis. Crosses of sister plants of all the species were made and were found to give fertile progeny with the expected 17 pairs of chromosomes. The results of the cytological survey are given in Table 1.

HYBRIDS WITH H. PETIOLARIS.—*Helianthus petiolaris* comprises two cytogenetic races: race A from the central and western United States and race B from the southwestern United States (Heiser, unpubl.). Crosses of *H. neglectus* with both races give F_1 hybrids with varying degrees of sterility and from the examination of meiosis it is clear that they both differ from *H. neglectus* by at least one translocation. The hybrids involving race B generally show higher pollen fertilities although a few cells in these hybrids showed the presence of two chains of four which would imply a difference of two translocations.

The single hybrid secured with *H. petiolaris* var. *canescens,* a taxon found from southwestern Texas through southern Arizona to northern Mexico, shows even greater sterility and indicates considerable structural differences in the chromosomes of the two parents.

HYBRIDS WITH H. ANNUUS.—Ten plants of the hybrid, *H. neglectus* x *annuus* were grown with *H. neglectus* as the female parent. The reciprocal cross failed. Pollen fertility was quite low and some heads failed to produce a single filled achene.

TABLE I. POLLEN FERTILITY AND CHROMOSOME PAIRING IN F_1 HYBRIDS OF *H. neglectus* WITH OTHER SPECIES

Culture Number	*H. neglectus* ×	Range of Stainable Pollen	No. of Plants Examined for Pollen	No. of Cells at Diakinesis with:						
				17 II	15 II ⊙4	15 II IV*	14 II VI	13 II IV IV	12 II IV VI	11 II VI VI
5781	*petiolaris* A Gary, Ind.	43, 44%	2	15		15				
5627a	*petiolaris* A St. Louis, Mo.	22–28%	3	1	17	2				
5627b	reciprocal	14–35%	5	4	3	16				
5247a	*petiolaris* B Amarillo, Tex.	28–39%	3	10	16	11		2?		
5782	*petiolaris* B Shamrock, Tex.	35, 37%	2	3		12		2?		
5626b	*petiolaris* B Acoma 1, N. M.	49–79%	4	3	3	12				
54–46:42	reciprocal	55–80%	6	1		7		2		
5561a	*petiolaris* B	24%	1							
	Acoma 2, N. M.	27–77%	6	4		6				
5783b	*petiolaris* var. *canescens* Dona Ana Co. N.M.	9%	1						1	5
5248a	*annuus* St. Louis, Mo.	2, 3%	2							
5420a	*debilis* ssp. *cucumerifolius* Gonzales, Tex.	12–21%	7			1	2	3	1	2
5420b	reciprocal	16–21%	8							
5526a	*debilis* ssp. *praecox* Galveston, Tex.	60–81%	3	4		10	9	2		
5526b	reciprocal	46–68%	3	4		10	9	2		

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* Occasional cells with 15 II III I have been lumped with the 15 II IV category for convenience.

Meiosis was examined in one plant but the configurations could not be determined with certainty although it was apparent that one or more chains were present. These hybrids, in general, are rather similar to those of *H. annuus* x *petiolaris.*

HYBRIDS WITH H. DEBILIS.—*Helianthus debilis* has been shown to comprise two cytogenetic races (Heiser, 1956). Representatives of one group of subspecies, including *H. debilis* subsp. *praecox*, when crossed with *H. neglectus* give F_1 hybrids with higher fertilities than does the second group, which includes *H. debilis* subsp. *cucumerifolius.* Similar results are secured in crosses of *H. petiolaris* with these subspecies.

III. A NEW SUBSPECIES OF H. PETIOLARIS

Recent field work combined with garden and herbarium studies has convinced me that the southwestern representatives of *H. petiolaris* are quite different from the typical element of the species. Crosses of the new subspecies have been made with several races of *H. petiolaris* subsp. *petiolaris* and it has been found that some of the resulting hybrids are fertile whereas others show some sterility. It seems desirable to put the subspecies on record at the present time, although a detailed discussion of the variation and cytogenetics will be deferred until later.

H. petiolaris subsp. **fallax,** subsp. nov. Herba annua, 0.5–2.0 m. alta, caule hispido vel glabro raro, rubro vel viride, ramoso supra; foliis inferioribus lanceolatis vel deltoideolanceolatis, serratis vel integris, 6–15 cm. longis, 1–6 cm. latis; pedunculis 5–40 cm. longis, phyllariis 12–20 mm. longis, 3–4 mm. latis, plerumque hispidis, glabris vel hirsutis raro, columnis antheris rubris vel purpureis.

Distribution:[2] western Colorado to Utah south to New Mexico and Arizona, 4000 to 8000'; June to Sept. ARIZONA: Apache Co., Painted Desert, July 25, 1955. *Heiser 4149* (Type, IND); Coconino Co., *Eastwood and Howell 6925* (US); Cochise Co., *Blumer 1488* (NY); Gila Co., *Harrison and Kearney 8294* (US); Pima Co., *Chondhri 60* (IND); Navajo Co., *Heiser 4164* (IND); Yavapai Co., *Peebles* et al *4291* (US). COLORADO: Moffat Co., *Heiser 4540* (IND); Montrose Co., *Walker 152* (GH, US). NEW MEXICO: Bernalillo Co., *Jackson 2101* (UNM); Chaves Co., *Griffiths 5685* (US); Colfax Co., *Heiser 4171a* (IND); Dona Ana Co., *Dunn 5350* (UNM); Eddy Co., *Whitehouse 16809* (US); Grant Co., *Metcalfe 763* (GH, NO, NY, US); Quay Co., *Fisher 35* (US); Rio Arriba Co., *Jackson 744* (UNM); San Juan Co., *Jackson 2485-2* (UNM); San Miguel Co., *Standley 5041* (MO, NY);

[2] One specimen from each county is cited. The herbarium abbreviations used are those recommended in *Index Herbariorum.* I would like to express my thanks to the curators of the herbaria cited for making the specimens available for study.

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Fig. 3. *Helianthus petiolaris* subsp. *fallax*. Branch and leaf, x ½; phyllary, x 1½.

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Fig 4. *Helianthus petiolaris* subsp. *petiolaris*. Branch and leaf, × ½; phyllary, × ½.

Sante Fe Co., *Heller 3785* (MO, NY, US); Socorro Co., *Dunn 5090* (UNM); Torrance Co., *Heiser 4509* (IND); Valencia Co., *Weatherwax* (IND). UTAH: Emory Co., *Stoutamire 2602* (IND); Garfield Co., *Piranian* (UTC); Grand Co., *Holmgren and Hansen 3288* (GH, NY); Kane Co., *Heiser 4512* (IND); San Juan Co., *Heiser 4154* (IND); Uintah Co., *Rollins 1725* (GH, MO, NY); Utah Co., *Jones 509* (GH); Washington Co., *Jones 5257* (MO, US); Wayne Co., *Stoutamire 2592* (IND).

Helianthus petiolaris subsp. *petiolaris*[3] which is found from Wisconsin to British Columbia, south to Texas, and occasionally adventive elsewhere, is from 0.5 to 1.4 mm. tall, more branched and spreading with stems usually green, rarely red, strigose, or somewhat hispid near base, lower leaves usually oblong lanceolate to deltoid-lanceolate, usually not over 12 cm. long by 6 cm. wide, peduncles shorter, phyllaries ovate-lanceolate to lanceolate, 10–14 cm. long, 3.5 5.5 mm. broad, strigose, and anthers usually purple, rarely red.

The new subspecies is extremely variable as can be seen from the description. From garden cultivation it is apparent that some of the variation in nature must be environmental modification of the phenotype although a great deal of genetic variability is also present. In the eastern part of its range it grades into *H. petiolaris* subsp. *petiolaris* and in the south into *H. petiolaris* var. *canescens* A. Gray. In its extreme form it is, however, very distinct and if it were not for the presence of intermediates I would consider it a distinct species. The generally longer, narrower phyllaries and the hirsute stem are perhaps the most reliable characters to separate it from *H. petiolaris* subsp. *petiolaris*; from *H. petiolaris* var. *canescens* it is most readily distinguished by a hispid rather than a canescent pubescence.

SUMMARY

Two new species and one new subspecies of *Helianthus* are described: *H. paradoxus* from Pecos Co., Texas and Valencia Co., N. M.; *H. neglectus* known only from Ector Co., Texas; and *H. petiolaris* subsp. *fallax* from Colorado, Utah, New Mexico and

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[3] Nuttall (p. 115, 1821) gives "on the sandy shores of the Arkansa" as the type locality. Watson (1929) cites a collection by Nuttall from the "Upper Missouri River" in the Academy of Natural Science at Philadelphia as the type. I have examined this specimen and also a photograph of a Nuttall specimen from the British Museum labeled "Arkansa" and the latter certainly must be regarded as the type. It is clear from Nuttall's account in his Journal, however, that the specimen was collected in what is now northeastern Oklahoma.

Arizona. Artificial hybrids of *H. neglectus* with several other species are discussed.—DEPARTMENT OF BOTANY, INDIANA UNIVERSITY, BLOOMINGTON, IND.

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DESCRIPTION, DISTRIBUTION AND ECOLOGY OF THREE SPECIES OF VAUCHERIA PREVIOUSLY UNKNOWN FROM NORTH AMERICA

JOHN L. BLUM AND ROBERT T. WILCE

During the period from June to November, 1955, a survey was made of the distribution and ecology of attached marine algae along the coast of the Labrador peninsula. Collections were made from the mouth of the Koksoak River, Quebec, northward along the western side of the Labrador peninsula to Port Harvey, Killinek Is., Quebec, and in a less extensive area in the regions of Hebron and Saglek, Labrador. Collected materials from the mouth of the Koksoak River and False River Bay, Quebec, show three species of Vaucheria previously unknown from North America.[1]

The writers express their gratitude to Dr. I. Mackenzie Lamb, Director of the Farlow Library and Herbarium, Harvard University, for the loan of the type material of *Vaucheria compacta* (Collins) Collins, and to Dr. David Irvine, who provided preserved material of *V. sphaerospora* Nordstedt collected in Scotland.

Intertidal areas of southeastern and southwestern Ungava Bay, especially at the heads of fjords and bays and near the mouths of larger rivers and streams, take the form of broad,

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[1] Specimens of the described species have been deposited in the New York Botanical Garden and the herbarium of the University of Michigan.

expansive, boulder-strewn mud flats as a result of enormously high tides, the low relief of the surrounding watershed, and the tremendous discharge of silt from rivers and other streams. In such habitats, uncommon in the area investigated, silty mud covers much of the shore between tides and, in regions of quiet water, extends well into the sublittoral. A dense, wide-spreading carpet or mat of Vaucheria filaments is common on these mud flats. Frequently, colonies of these plants are continuous for several square meters or more in extent, penetrating the silt and grit only slightly, but becoming strongly infiltrated with it so that the mat assumes considerable firmness. The overall appearance of the mat is dark green, becoming a glistening black when covered with water, and at that time, extremely slippery.

At the two stations[2] where these plants were seen the colonies were so located that at low water level, in most instances, all of the mat would be exposed for varying periods of time. In the most sheltered regions, where the water is continually quiet, small patches of the mat may extend into the upper sublittoral. The latter patches are subject to exposure only during low spring tides.

In addition to the Vaucheria species, a few other marine algae are present in this community, but are far less conspicuous. Among these are *Gloeocystis scopulorum* Hansgirg, *Urococcus foslieanus* Hansgirg and *Calothrix scopulorum* Drouet and Daily.

Vaucheria sphaerospora Nordstedt (fig. 1, 2). This well known European species, fruiting abundantly, was collected in quantity. It was apparently the dominant element of the mat. The measurements of the Quebec material correspond well with those given by Nordstedt (1878) in his description of this species. *V. sphaerospora* is distinctive in possessing a special fruiting branch which bears an oogonium and a single antheridium which curves toward the oogonium. This species is the only Piloboloidean Vaucheria possessing this combination of characters.

The oogonium is formed from the fruiting branch immediately below the suffultory cell which subtends the antheridium, much as in *V. intermedia* Nordstedt and *V. minuta* Blum and Conover. As the cylindrical oogonial filament becomes laterally distended

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[2] *Wilce 830*, September 1, 1955, near the mouth of the Koksoak River, eastern shore; *Wilce 844*, September 4, 1955, toward the head of False River Bay on the western side.

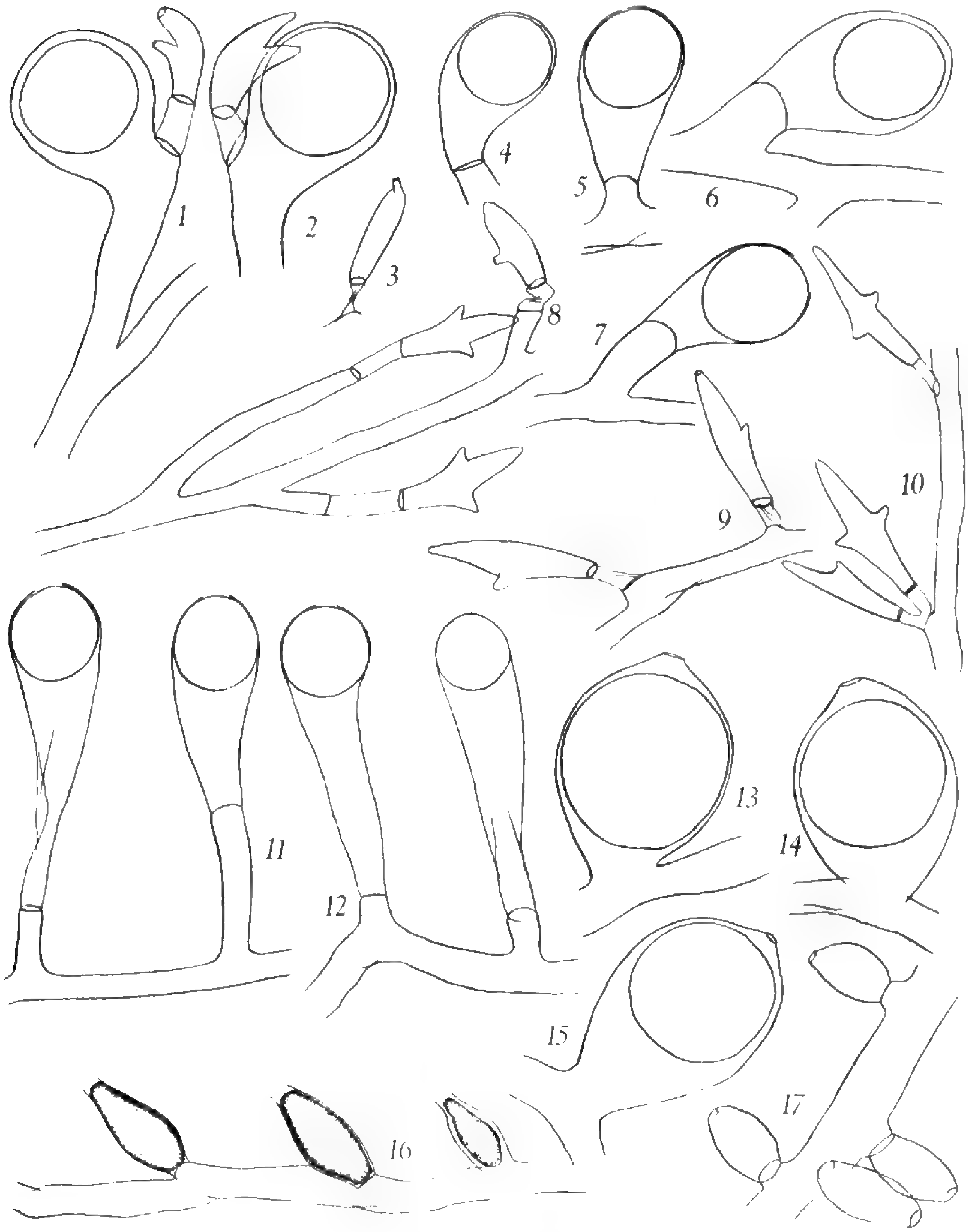

FIG. 1–17 VAUCHERIA. Fig. 1 & 2 *Vaucheria sphaerospora*. Fig. 3–8 *V. compacta*; fig. 3–5 drawn from type material in the Farlow Herbarium of Harvard University; Mystic River marshes, Malden, Mass., Sept. 1897 (*F. S. Collins 477*); fig. 3 Antheridium; fig. 4 & 5 Oogonia; fig. 6–8 drawn from material collected in Great Pond, Falmouth, Mass. (*J. T. Conover, 53–6*); fig. 6 & 7 Oogonia; fig. 8 Antheridium. Fig. 9–12 *V. compacta var. koksoakensis*; fig. 9 & 10 Antheridia; fig. 11–12 Oogonia. Fig. 13–17 *V. submarina*; fig. 13–15 Oogonia; fig. 16 & 17 Antheridia. All figures about 90X.

in the formation of the oogonium, the antheridium and the subtending suffultory cell lose their terminal position and thus appear to constitute a lateral offshoot of the mature oogonium (fig. 2). A wide terminal pore eventually forms at the upper end of the oogonium. The spherical oospore possesses at maturity a wall varying from 1–4μ in thickness and does not quite fill the oogonium. The antheridium is fusiform or conical at maturity, its upper end narrowing to its terminal pore. Other pores, numbering 1–4, are at the ends of the papillae, one or more of which may equal or exceed the terminal papilla or upper end of the antheridium in length. The entire antheridium lies parallel to and closely adjacent or appressed to the oogonium. The terminal papilla of the antheridium curves toward the upper end of the oogonium and the papillae other than the terminal one are mostly found on the side of the antheridium adjacent to the oogonial pore, and are more or less directed toward it.

Vegetative filaments 28–53μ in diameter; oogonium 87–178 × 214–386μ; oospore 86–144μ in diameter; antheridium 38–57 × 128–157μ; antheridial papillae 14–33 (–45)μ in length; antheridial suffultory cell 50–57μ in length.

Vaucheria compacta *var.* **koksoakensis** *var. nov.* (fig. 9–12). A typo differt in oogonia longiora. Differs from the type in the greater length of the oogonia.

V. compacta (Collins) Collins has been collected in eastern United States (Collins 1900, Blum and Conover 1953), and in western Europe (*vide* Christensen 1952). It is dioecious, with both oogonia and antheridia borne at the ends of short erect branches which occur in short series arising from the vegetative filaments. The oogonium is essentially cylindric but is greatly swollen at its upper end where the spherical oospore is present. Below the oospore the mature oogonium is empty. The stalk which bears the antheridium occasionally sends out a branch, in such a way that the antheridial branch bears two antheridia (fig. 10). Antheridia dehisce by two or three pores which terminate conical papillae, one of which is always terminal.

In the type material of *V. compacta* (fig. 3–5), and in the material of *V. compacta* from Massachusetts (*J. T. Conover 53–6*, east shore marsh, Great Pond, Falmouth, Barnstable Co., Jan. 31, 1953, fig. 6–8), the length of the oogonium averages 1.5–2.5

× the length of the oospore (fig. 4–7). In the material of *V. compacta var. koksoakensis* the oogonium is much longer, averaging from 3–4 × the length of the oospore (fig. 11–12); thus its appearance is significantly different from that of the type. Although this difference could be due to environmental factors, on the basis of the available data it seems nevertheless preferable not to regard this material as typical *V. compacta*.

Measurements of the Quebec material are as follows: Vegetative filaments 21–50μ in diameter; oogonium 87–128 × 235–357μ; oospore 92–100 (–114)μ; antheridium 24–48 × 128–186μ; papilla of antheridium 8–27μ in length; suffultory cell 28–65μ in length; total length of the oogonium with its subtending stalk 214–429μ.

Vaucheria submarina Berk. *sensu* De Wildeman 1899 (fig. 13–17). Adequate knowledge of the widespread *V. dichotoma.* Ag. and of its forms or varieties, if any, awaits further study. *V. submarina* is certainly closely related to *V. dichotoma* and may be referable to one of the described forms of the latter, such as Hauck's *V. dichotoma f. marina*, although the brief original description of the latter form renders the name essentially ambiguous. Berkeley, in an even less satisfactory description than Hauck's, raised *V. dichotoma f. marina* to specific rank, *V. submarina* Berk. De Wildeman, in his *Algues de la Flore de Buitenzorg* (1900) used the name *V. submarina* Berk. in a precise way, and from De Wildeman's description it is possible to identify *V. submarina* as one of the species from the Quebec collections. These plants seem to correspond in all essential respects with the material collected by De Wildeman in Java. Our material was found as a sparse admixture in the *V. sphaerospora* stratum.

This species, like *V. dichotoma*, is apparently dioecious, the subspherical oogonia being borne singly (in our material) on a short stalk directly upon the horizontal vegetative filaments, and the bottle-shaped, fusiform or cylindric antheridia being borne in uni- or multilateral series, on filaments separate from those which bear oogonia. Our material is strikingly smaller than *V. dichotoma* in the size of the vegetative filaments, and is further unlike that species in the spherical shape of the oospore, which fills a relatively smaller portion of the oogonium. In *V. dichotoma* the entire oogonium is usually filled by the oospore.

Vegetative filaments (35–) 50–84 (–100)μ in diameter; oogonium 185–228 × 186–314μ; oogonial pore about 12–40μ in diameter; oospore (130–) 171–186 × (150–) 171–200μ; antheridia 43–71 × 114–200μ.

SUMMARY

Collections of tidal Vaucheriae gathered in the Ungava Bay region of northern Quebec are described and brief notes on their habitat are given. *Vaucheria sphaerospora* and *V. submarina* are considered to be new to the North American flora. A collection of *V. compacta* characterized by unusually long oogonia is described as *V. compacta var. koksoakensis*.—CANISIUS COLLEGE, BUFFALO, N. Y. AND DEPARTMENT OF BOTANY, UNIVERSITY OF MICHIGAN, ANN ARBOR, MICHIGAN.

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STRIGA ASIATICA AND CHRYSOMA PAUCIFLOSCULOSA IN THE CAROLINAS

EDWARD E. TERRELL

Striga asiatica (L.) Kuntze, Witchweed, (*Scrophulariaceae*), is parasitic on the roots of corn, sorghum, sugar cane, and other grasses. It has long been a serious pest in tropical and subtropical areas of the Old World.

Garriss and Wells (Plant Disease Reporter 40(10):837–839. 1956) reported the occurrence of a species of *Striga* in Robeson County, southeastern North Carolina. Subsequently identified by Dr. S. F. Blake as *S. asiatica,* this was the first record of the species in the Western Hemisphere. Since this report intensive research was initiated by the Department of Agriculture and by agriculturalists and plant pathologists in North Carolina and South Carolina to find means of eradicating this pernicious weed. Studies of effects of soil types and soil temperatures on growth were made (Nelson, Plant Disease Reporter 42(1): 152–155. 1958). The same author (loc. cit. 42(3):376–382. 1958) stated that 45 species of cultivated and wild grasses may serve as hosts for *Striga.* General information, much of which came from earlier studies by South African researchers, was summarized by Nelson (loc. cit. 41(5):377–383. 1957), and in U. S. Department of Agriculture, Agricultural Research Service, Special Report 22–41, 17 pages, June 1957. The latter publication included drawings of *Striga.* Seeds of Witchweed may remain viable in the soil for twenty years; a single plant may produce 50,000 to 500,000 seeds, each about 0.2 mm. in length. Obviously, such seeds are readily disseminated by wind, and once present in the soil constitute a long-lasting source of new plants.

Witchweed causes stunting and withering of its host; if heavily infested, a field of corn may be a complete economic loss.

At present *Striga* is known only in the two Carolinas; it seems quite possible that it may spread in these two states and possibly to adjoining states, despite the efforts to eradicate it. Although nothing is known of the time and place of introduction, unconfirmed statements by farmers living in the area of infestation suggest that the species may have been present there since 1950, or even as early as 1946. As cited below, the present author collected the species in Robeson County in July, 1955, actually, as it turned out, antedating the collection reported by Garriss and Wells by about one year; therefore, this was the first collection in the Western Hemisphere. Immediately following the report by Garriss and Wells, surveys by practical botanists in the later summer and autumn of 1956 determined that Witchweed was then present in at least four counties in southeastern North Carolina and in four adjoining counties in northeastern South Carolina. This infestation was almost entirely in corn fields. A survey by the Plant Pest Control Division, U. S. D. A., revealed that *Striga* was by the end of 1957 present on 1277 farms in eleven counties of North Carolina, and on 416 farms in six counties of South Carolina (H. R. Garriss, letter dated April 29, 1958). These counties were Bladen, Columbus, Cumberland, Duplin, Harnett, Hoke, Pender, Richmond, Robeson, Sampson, and Scotland in North Carolina; in South Carolina Darlington, Dillon, Florence, Horry, Marion, and Marlboro.

The present author's collections of *Striga asiatica* may be cited as follows: dry, sandy soil at border of corn field, 3 miles east southeast of Pembroke, in Moss Neck community, Robeson County, North Carolina, July 28, 1955, *E. E.* and *Bessie Z. Terrell 2973(a)*. A subsequent collection, *2973(b)*, of the same population in fruiting condition was made on August 25, 1955. Duplicates of these collections are in the herbaria of the University of North Carolina (NCU) and Gray Herbarium (GH).

Chrysoma pauciflosculosa (Michx.) Greene is a shrubby composite closely related to or possibly congeneric with *Solidago*. It is here reported for the first time from North Carolina. Chapman (Fl. S. U. S., ed. 2, 1883) listed it under the name, *Solidago pauciflosculosa* Michx., as ranging from "Florida to South

Carolina". Small's Manual (1933) stated, "Coastal Plain, Fla. to Miss. and S. C." Despite these two listings, no specimens from South Carolina have been located; therefore, so far as known, the collections of Freeman and Radford, cited below, represent the first from South Carolina, also.

At its only North Carolina station *Chrysoma* grows in deep sand under and among turkey oak (*Quercus laevis* Walt.). It is very abundant over an area of several acres and is, in fact, the dominant shrub cover. Typical sand hill species associated with it include *Selaginella arenicola* Underw. subsp. *acanthonota* (Underw.) Tryon, *Aristida stricta* Michx., *Cnidoscolus stimulosus* (Michx.) Gray, and *Euphorbia Ipecacuanhae* L. Other sand hills near this one were visited, but *Chrysoma* was absent. Collections from North Carolina were as follows: dry sand hills, 1½ miles west of Pembroke, Robeson County, June 4, 1955, *E. E. Terrell 2953*(*a*), (NCSC); Sept. 4, 1955, *2953*(*b*), (NCSC, NCU, GH); July 17, 1956, *3109*, (NCU). The two collections (herb. NCU) from South Carolina were: near junction of state highways 6 and 602, turkey oak barrens, Lexington County, Oct. 10, 1956, *O. M. Freeman 56833*; sandhill, 4 miles northwest of Edmund, Lexington County, Oct. 5, 1957, *A. E. Radford 29849*. There is every indication that these two collections came from the same locality, which is in central South Carolina, about 125 miles southwest of the station in southeastern North Carolina.

It may be noted here that the usual flowering time for this species is in September and October. The writer's collections, *2953*(*a*) and *3109*, were made at times when a few plants were flowering much ahead of the remainder of the population.

Appreciation is hereby expressed to the following persons for data on distribution and for general assistance: Dr. R. L. Wilbur, Duke University; Mr. H. E. Ahles and Dr. A. E. Radford, University of North Carolina; Mr. O. M. Freeman, Tryon, North Carolina; Dr. H. R. Garriss, Plant Pathology Extension, North Carolina State College.—GUILFORD COLLEGE, NORTH CAROLINA.

FIELD AND HERBARIUM STUDIES IN SOUTHERN ILLINOIS

Robert H. Mohlenbrock, Jr.

Continued studies of the flora of southern Illinois have resulted in the discovery of a number of species not previously reported from the state and of some species previously unknown in southern Illinois.

Penstemon arkansanus Pennell. The discovery of the Ozarkian species in an area where other members of this province have been found furthers one's belief that southwestern Randolph County and northwestern Jackson County at one time harbored a considerable number of Ozark plants. *Ranunculus harveyi, Talinum calycinum, Solidago buckleyi,* and *Pinus echinata* are other southern species which occur in adjacent areas. In Missouri, *Penstemon arkansanus* is known from Madison, Ozark, Taney, Stone, Barry, Newton, and McDonald Counties (Palmer and Steyermark, 1935). It also occurs in Arkansas and eastern Texas. The Illinois station which is on a rocky wooded hillside southwest of Ava in Jackson County (May 21, 1956; *Mohlenbrock 8808*) extends the range of this species to the north and east. *Penstemon arkansanus* resembles *P. pallidus* in several respects, but the leaves of *P. arkansanus* are glabrous or nearly so and the flower parts are somewhat smaller.

Polygonatum. In recent years, the literature concerning the occurrence of species of the genus *Polygonatum* in Illinois has become confusing. Jones in 1945 recognized *P. biflorum* (Walt.) Ell. and *P. pubescens* (Willd.) Pursh as occurring in Illinois. However, in 1950, Jones listed *P. commutatum* (Schult.) Dietr. and *P. pubescens,* placing the specimens previously included by him under *P. biflorum* into either *P. commutatum* or *P. pubescens.* This was on the basis that the true *P. biflorum* of Elliott did not occur in Illinois. Fernald (1950) and Gleason (1952) substituted *P. canaliculatum* (Muhl.) Pursh for *P. commutatum* since Muhlenberg's epithet was recorded before that of Schultes. However, in a fairly recent monograph on *Polygonatum,* Ownbey (1944) states that since not a single character in the description of *Convallaria canaliculata* Muhl. corresponds with the characters of the present *Polygonatum commutatum,* it is best to consider *C. canaliculata* as a synonym for *P. biflorum.*

After collecting a specimen of what proved to be *P. biflorum* from Pope County, the author was led to study the problems concerning *Polygonatum* in Illinois. The following key serves to separate the three species that occur in Illinois.

a. Leaves pilose on the nerves beneath.....................1. *P. pubescens.*
a. Leaves glabrous beneath.....................................b
  b. Leaves more or less clasping or sheathing at the base, the largest ones with over 100 nerves; perianth 17–20 mm. long, the lobes 5–7 mm. long...................2. *P. commutatum.*
  b. Leaves sessile at the base, the largest ones with less than 100 nerves; perianth 10–17 mm. long, the lobes 3–4 mm. long.......................................3. *P. biflorum.*

1. POLYGONATUM PUBESCENS (Willd.) Pursh. In Illinois, this species grows in relatively moist, shaded woods in the northeast section of the state. It has been collected in Cook, DuPage, Kankakee, Lake, and Winnebago Counties, the collection from the latter county by Fell in 1945 being the only one since 1914.

2. POLYGONATUM COMMUTATUM (Schult.) Dietr. This is the common species of *Polygonatum*, found throughout the state in a wide variety of habitats.

3. POLYGONATUM BIFLORUM (Walt.) Ell. Only three collections for this species have been seen from Illinois where it grows in upland woods. All the stations are in the extreme southern part of the state. SPECIMENS EXAMINED: Pope Co.: atop sandstone bluff, Belle Smythe Springs, April 22, 1956, *Mohlenbrock 8015*; along Lusk Creek, May 21, 1952, *Bailey & Swayne 2359*. Hardin Co.: closed woods, Rock Creek valley, May 3, 1949, *Bailey & Swayne 673.*

THE NATIVE SPECIES OF PYRUS. E. J. Palmer in making his botanical reconaissance through southern Illinois in 1919 reported finding the narrow-leaved crab apple, *Pyrus angustifolia*, in Pope and Johnson Counties. These specimens, deposited in the Gray Herbarium and the herbarium of the Missouri Botanical Garden, have been considered merely as morphological variations of *Malus* (*Pyrus coronaria*) by Jones (1945, 1950) and Jones, *et al.* (1955), and do not represent the species which Aiton described. In the fall of 1957, the author found specimens which match Aiton's entity while collecting in a pin oak, overcup oak flat in Jackson County. Although *Pyrus angustifolia* is predominantly a plant of the southeast, it does extend into Kentucky and southern Illinois. *Pyrus lancifolia* Rehder, a plant which somewhat resembles *P. angustifolia* but differs principally in leaf shape and flower and fruit size, is best treated as a variation of the more widespread *P. coronaria* L. Another species, *P. ioensis* (Wood) Bailey, has characters which separate it more easily from the other taxa.

The native members of the genus *Pyrus*, subgenus *Malus* in Illinois may be separated as follows:

a. Calyx densely tomentose on the outside; leaves on vigorous shoots tomentose or villous at maturity. *P. ioensis.*
a. Calyx glabrous or nearly so on the outside; leaves glabrous or villous along the veins beneath at maturity. . . . . b
  b. Leaves on vigorous shoots more than half as broad as long, distinctly lobed. . . . . 2. *P. coronaria.*
  b. Leaves on vigorous shoots less than half as broad as long, serrate or shallowly lobed. c
c. Leaves of fertile branches acute or acuminate at the apex, more or less rounded at the base; pedicels 3.0–3.5 cm. long; petals 1.0–1.5 cm. broad. . . . . 2a. *P. coronaria* var. *lancifolia.*
c. Leaves of fertile branches obtuse to subacute at the apex, cuneate at the base; pedicels 2.0–2.5 cm. long; petals 0.5–1.0 cm. broad. . . . . 3. *P. angustifolia.*

1. Pyrus ioensis (Wood) Bailey. The Iowa Crab Apple is common in and along the edges of oak-hickory woods throughout Illinois. It is a frequent intruder in the hill prairies along the bluffs of the Mississippi River. Specimens from Richland (Ridgway in 1928) and Lawrence (Eaton in 1901) Counties determined as *Malus platycarpa* var. *hoopesii* (Rehder) Rehder may represent hydrids between *P. ioensis* and some other species, but with our present knowledge, this entity is best treated as a morphological variant of *P. ioensis.*

2. Pyrus coronaria L. The Wild Sweet Crab Apple is an occasional species of rather mesic woods in southern and eastern Illinois. Narrow-leaved forms may be segregated as: Pyrus coronaria L. var. lancifolia (Rehder) Fern. in Rhodora **49:** 232. 1947.

This variant is known through a few collections in southern Illinois now deposited in the Gray Herbarium from the counties of Jackson, Gallatin, and Pope.

3. Pyrus angustifolia Ait. This southern species has two known stations in Illinois where it grows in bottomland woods. The leaves remain green far into November. Jackson Co.: in pin oak-overcup oak flats, eight miles southwest of Murphysboro, *Mohlenbrock 8810.* Hardin Co.: near Rosiclair, October 10, 1919, *E. J. Palmer 17094.*

Helianthus hirsutus Raf. var. trachyphyllus T. & G. This variety which differs from var. *hirsutus* in having internodes short-hispid and scabrous and leaves 2–3 cm. broad can now be added to the flora of Illinois on the basis of its collection in Jackson County: dry open woods, Lake Murphysboro Recreation Area, August 31, 1957, *Mohlenbrock 8005.*

SMILAX GLAUCA Walt. var. LEUROPHYLLA Blake. This smooth-leaved variety of lowland areas has been found for the first time in Illinois growing along the edge of LaRue Swamp in southwestern Illinois (Union County): edge of water, LaRue Swamp, three miles north of Wolf Lake, June 22, 1956, *Mohlenbrock 7926.*

BOEHMERIA DRUMMONDIANA Wedd. This species of false nettle, often considered as a variety of *B. cylindrica* (L.) Sw., has been found in a boggy area in southern Illinois (1 mile north of Murphysboro, *Mohlenbrock 756*) where it is associated with *Dryopteris thelypteris, Solidago patula, Eupatorium perfoliatum,* and other moisture-loving plants. The narrower, harshly scabrous, short-petioled leaves distinguish this species from *B. cylindrica.*

PILEA IN ILLINOIS. In treating the species of *Adicea* Raf. (=*Pilea*) of northern and central United States, Lunell recognized five species, four of which he named for the first time in 1913. Of these, three species have now been found in Illinois. All Illinois specimens of *P. opaca* have been collected since the publication of "Flora of Illinois" (Jones, 1950), and Fernald (1950) did not include this species in his manual. The following key separates these three species.

a. Achenes green, averaging 1 mm. wide......................1. *P. pumila.*
a. Achenes black, averaging 1.5 mm. wide..............................b
  b. Plants leafy above the middle; seeds averaging 1.5 mm. long..2. *P. fontana.*
  b. Plants branching and leafy from near the base; seeds averaging 2.0 mm. long...................................3. *P. opaca.*

1. PILEA PUMILA (L.) Gray. The common clearweed is abundant in moist situations throughout Illinois. Variation in the leaf margins occurs, leading to the naming of scarcely separable taxa such as var. *deamii* (Lunell) Fern. The light-colored fruit easily separates this species from the following two.

2. PILEA FONTANA (Lunell) Rydb. This is the smallest species of *Pilea.* Lunell described it "4–8 cm. altus", but most specimens observed frequently become 20 cm. tall. Usually the teeth on the margin of the leaf are much lower than in either *P. pumila* or *P. opaca.* The two col-

lections in the University of Illinois herbarium are the only ones known from Illinois. SPECIMENS EXAMINED: Grundy Co.: on rotting post in Illinois River, September 28, 1951, *Ahles 5058*. Vermilion Co.: on top of fill from a ditch in swamp, Muncie, October 2, 1950, *Ahles 3395*.
3. PILEA OPACA (Lunell) Rydb. This species also grows to a size larger than that ascribed to it in the original description. Lunell states that the species grows "10–30 cm. altus". While most of our specimens fit this range, some attain a height of 60 cm. The previously known records of *P. opaca* from Illinois are from Champaign, Cook, Iroquois, Piatt, and Vermilion Counties (collection data can be obtained by consulting Jones, *et al.*, 1955). Now, Union County can be added: low ground at base of limestone bluff, Pine Hills north of Wolf Lake, June 15, 1956, *Mohlenbrock*.

LITHOSPERMUM CROCEUM Fern. This species is included by Jones, *et al.*, (1955) under *L. caroliniense* (Walt.) MacM. Regardless of which species one recognizes, the Jackson County collection is the first from southern Illinois. A summary of characters between *L. croceum* and *L. caroliniense* follows:

L. croceum	*L. caroliniense*
Leaves over 30 on the stem	Leaves 25 or less on the stem
Leaves with papillose-based hairs	Leaves without papillose-based hairs
Bracts closely overlapping	Bracts often remote
Calyx lobes keeled, papillose	Calyx lobes flat, not papillose
Veins of calyx anastomosing	Veins of calyx free

COLLECTION DATA: dry oak-hickory woods, Lake Murphysboro Recreation Area, May 15, 1957, *Mohlenbrock 8021*.

EUPHORBIA COMMUTATA Engelm. The wood spurge is a very attractive species in the early spring since the upper leaves and bracts are red while the lower leaves are green. In addition to its known range in seven of Illinois' northern counties, it has been found now in Williamson County in the Devil's Kitchen area: mesic woods, nine miles southeast of Carbondale, March 30, 1957, *Mohlenbrock 8010*.

BROMUS BRIZAEFORMIS Fisch. & Mey. In searching through the herbarium at Southern Illinois University, a specimen of the rattlesnake chess collected in Washington County by French in 1872 was found, making the second known collection for this species in Illinois. It was collected previously from Richland County by Ridgway in 1902.

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TWELFTH REPORT OF THE COMMITTEE ON PLANT DISTRIBUTION

The eleventh report included the Dicotyledoneae through Moraceae. The present report deals with the families from Cannabinaceae through Aizoaceae, taken in the order of the eighth edition of Gray's Manual. Although the Polygonaceae were treated by Mr. Wm. P. Rich in 1902 (Rhodora IV-203), they are discussed again at this time.

The data for these reports have been compiled from the herbarium of the New England Botanical Club and from the Gray Herbarium.

PRELIMINARY LISTS OF NEW ENGLAND PLANTS—XXXVII

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 our flora.

	Me.	N. H.	Vt.	Mass.	R. I.	Conn.
CANNABINACEAE						
***Cannabis sativa L.**	+	+	+	+	+	+
***Humulus japonicus Sieb. & Zucc.**	+		+	+	+	+
***Humulus Lupulus L.**	+	+	+	+	+	+
URTICACEAE						
Boehmeria cylindrica (L.) Sw.	+	+	+	+	+	+
Boehmeria cylindrica var. Drummondiana Wedd.			+	+	+	–
Laportea canadensis (L.) Wedd.	+	+	+	+	+	+
Parietaria floridana Nutt.		+				
Parietaria pensylvanica Muhl.	+	+		+		+
Pilea pumila (L.) Gray	+	+	+	+	+	+

	Me.	N. H.	Vt.	Mass.	R. I.	Conn.
Urtica chamaedryoides Pursh				—		
*Urtica dioica L.	+	+		+		+
Urtica gracilis Ait.	+	+	+	+	+	+
Urtica procera Muhl.	+	+	+	+	+	+
*Urtica urens L.	+		+	+		+
Urtica viridis Rydb.	+					
SANTALACEAE						
Comandra Richardsiana Fern.			+			
Comandra umbellata (L.) Nutt.	+	+	+	+	+	+
Geocaulon lividum (Richards.) Fern.	+	+	+			
LORANTHACEAE						
Arceuthobium pusillum Peck	+	+	+	+	+	+
ARISTOLOCHIACEAE						
*Aristolochia Clematitis L.				+		
*Aristolochia durior Hill			+			+
Aristolochia Serpentaria L.						+
Asarum canadense L.	+	+	+	+		+
Asarum canadense var. acuminatum Ashe			+	+		+
Asarum canadense var. reflexum (Bickn.) Robins.						+
POLYGONACEAE						
*Emex spinosa Campd.				+		
*Fagopyrum sagittatum Gilib.	+	+	+	+	+	+
*Fagopyrum tataricum (L.) Gaertn.	+	+	+	+		
Oxyria digyna (L.) Hill		+				
Polygonella articulata (L.) Meisn.	+	+	+	+	+	+
Polygonum achoreum Blake	+		+			
Polygonum allocarpum Blake	+					
*Polygonum amphibium L. f. terrestre (Leers) Fern.	+			+		+
Polygonum amphibium var. stipulaceum (Coleman) Fern.	+	+	+	+		+
Polygonum amphibium var. stipulaceum f. fluitans (Eat.) Fern.	+	+	+	+	+	+
Polygonum amphibium var. stipulaceum f. hirtuosum (Farw.) Fern.	+					
Polygonum amphibium var. stipulaceum f. simile Fern.	+		+			+
Polygonum arifolium L. var pubescens (Keller) Fern.	+	+	+	+	+	+
*Polygonum aviculare L.	+	+	+	+	+	+
Polygonum aviculare var. littorale (Link) W. D. J. Koch	+	+	—	+	+	+
*Polygonum aviculare var. vegetum Ledeb.	+	+	+	+	+	+
*Polygonum Bistorta L.				+		
Polygonum Careyi Olney	+	+	+	+	+	+
*Polygonum cespitosum Blume var. longisetum (DeBruyn) Stewart				+		+
Polygonum cilinode Michx. (including f. erectum (Peck) Fern.)	+	+	+	+	+	+
Polygonum coccineum Muhl.	+	+	+	+	+	+
Polygonum coccineum f. natans (Wieg.) Stanford	+		—	+		+
*Polygonum Convolvulus L.	+	+	+	+	+	+
*Polygonum Convolvulus var. subalatum Lej. & Court.	+	+		+	+	+
Polygonum cristatum Engelm. & Gray			+	+	+	+
*Polygonum cuspidatum Sieb. & Zucc.	+	+	+	+	+	+
Polygonum Douglasii Greene	+	+	+			
*Polygonum dubium Stein	+			+		
Polygonum erectum L.	+	+	+	+	+	+

	Me.	N. H.	Vt.	Mass.	R. I.	Conn.
Polygonum Fowleri Robins.	+					
Polygonum exsertum Small		+		+	+	+
Polygonum glaucum Nutt.				+	+	
Polygonum Hydropiper L. (including var. projectum Stanford)	+	+	+	+	+	+
Polygonum hydropiperoides Michx.	+	+	+	+	+	+
Polygonum hydropiperoides f. strigosum (Small) Stanford		+	–	+		+
Polygonum lapathifolium L.	+	+	+	+	+	+
*Polygonum lapathifolium var. prostratum Wimm.				+		
Polygonum lapathifolium var. salicifolium Sibth.	+	+	+	+		+
*Polygonum minus Huds. var. subcontinuum (Meisn.) Fern.				+		+
*Polygonum nepalense Meisn.						+
Polygonum opelousanum Riddell				+	+	
Polygonum opelousanum var. adenocalyx Stanford				+	+	+
*Polygonum orientale L.	+	+	+	+	+	+
Polygonum pensylvanicum L.				+	+	+
Polygonum pensylvanicum var. laevigatum Fern.	+	+	+	+	+	+
Polygonum pensylvanicum var. laevigatum f. albineum Farw.				+	+	+
Polygonum pensylvanicum var. nesophilum Fern.				+	+	
*Polygonum Persicaria L.	+	+	+	+	+	+
*Polygonum Persicaria var. ruderale (Salisb.) Meisn.	+	+		+		
*Polygonum polystachyum Wall.				+		
Polygonum prolificum (Small) Robins.	+	+	–	+	+	+
Polygonum punctatum Ell.	+	+	+	+	+	+
Polygonum punctatum var. leptostachyum (Meisn.) Small	+	+	–	+	+	+
Polygonum punctatum var. parvum Vict. & Rousseau	+			+		
Polygonum puritanorum Fern.	+			+	+	
Polygonum ramosissimum Michx.	+	+		+	+	+
Polygonum ramosissimum f. atlanticum Robins.	+			+	+	+
Polygonum robustius (Small) Fern.		+		+	–	–
*Polygonum sachalinense F. Schmidt	+			+	+	+
Polygonum sagittatum L.	+	+	+	+	+	+
Polygonum sagittatum f. chloranthum Fern.	+			+		+
*Polygonum scabrum Moench	+	+	+	+		
Polygonum scandens L.	+	+	+	+	+	+
Polygonum setaceum Baldw. var. interjectum Fern.				+	+	
Polygonum tenue Michx.	+			+	+	+
Polygonum viviparum L.	–	+	+			
*Rheum Rhaponticum L.	+	+	+	+	+	
*Rumex Acetosa L.	+		+	+		+
*Rumex Acetosella L.	+	+	+	+	+	+
*Rumex alpinus L.	+		+			
Rumex altissimus Wood	+	+		+	+	+
*Rumex crispus L.	+	+	+	+	+	+
Rumex crispus × obtusifolius	+	+		+	+	
Rumex crispus × orbiculatus					+	
*Rumex domesticus Hartm.	+	+	+	+		+
Rumex fenestratus Greene	+			+		
Rumex hastatulatus Baldw.				+		
*Rumex maritimus L.				+		

	Me.	N. H.	Vt.	Mass.	R. I.	Conn.
Rumex maritimus var. fueginus (Phil.) Dusén	+	+		+	+	+
*Rumex mexicanus Meisn. (including R. triangulivalvis (Danser) Rech. f.)	+	+	+	+	+	+
*Rumex obtusifolius L.	+	+	+	+	+	+
Rumex orbiculatus Gray	+	+	+	+	+	+
Rumex pallidus Bigel.	+	+	+	+		
Rumex persicarioides L.				+	+	
*Rumex Patientia L.	+	+	+	+	+	+
*Rumex pulcher L.				+		
Rumex verticillatus L.			+	+	+	+
Tovara virginiana (L.) Raf.		+	+	+	+	+
CHENOPODIACEAE						
Atriplex arenaria Nutt.		+		−	+	+
Atriplex glabriuscula Edmondston	+	+		+	+	+
*Atriplex hortensis L.				+		+
Atriplex patula L.	+	+	−	+	+	+
Atriplex patula var. hastata (L.) Gray	+	+	+	+	+	+
Atriplex patula var. littoralis (L.) Gray	+	+	−	+	+	+
*Atriplex rosea L.				+		
*Axyris amaranthoides L.	+	+		+		
*Bassia hirsuta (L.) Aschers.				+		
*Beta vulgaris L.	+	+		+		−
*Chenopodium album L.	+	+	+	+	+	+
*Chenopodium ambrosioides L.		+	−	+	+	+
*Chenopodium ambrosioides var. anthelminticum (L.) Gray				+		−
*Chenopodium Bonus-Henricus L.	+	+		+	+	
Chenopodium Boscianum Moq.	+	+	+	+	+	+
*Chenopodium Botrys L.	+	+	+	+	+	+
Chenopodium capitatum (L.) Aschers.	+	+	+	+		+
*Chenopodium carinatum R. Br.				+		
*Chenopodium foliosum (Moench) Aschers.				+		
*Chenopodium glaucum L.	−	+	+	+	+	+
*Chenopodium graveolens Lag. & Rodr.	+			+		
Chenopodium humile Hook.	+					
Chenopodium hybridum L. var. gigantospermum (Aellen) Rouleau	+	+	+	+	+	+
*Chenopodium incanum (S. Wats.) Heller	−					
*Chenopodium lanceolatum Muhl.	+	+	+	+	+	+
Chenopodium leptophyllum Nutt.	+	+		+	+	+
*Chenopodium murale L.	+		−	+	+	−
*Chenopodium paganum Reichenb.	+	+	+	+	+	
*Chenopodium polyspermum L.	+					
Chenopodium rubrum L.	+	+		+		+
*Chenopodium urbicum L.	+	+	−	+		+
*Corispermum hyssopifolium L.				+		
*Cycloloma atriplicifolium (Spreng.) Coult.				+		+
*Kochia Scoparia (L.) Roth	−	+	−	+		+
*Kochia Sieversiana (Pall.) C. A. Mey.				+		
*Monolepis Nuttalliana (R. & S.) Greene	+			+		
*Roubieva multifida (L.) Moq.				+		
Salicornia Bigelovii Torr.	+	+		+	+	+
Salicornia europaea L.	+	+		+	+	+
Salicornia europaea var. prostrata (Pall.) Fern.	+					

	Me.	N. H.	Vt.	Mass.	R. I.	Conn.
Salicornia europaea var. simplex (Pursh) Fern.	+	+			+	
Salicornia virginica L.	+	+		+	+	+
Salsola Kali L.	+	+	−	+	+	+
Salsola Kali var. caroliniana (Walt.) Nutt.			+	+	+	+
*Salsola Kali var. tenuifolia Tausch	+	+	+	+	+	+
*Spinacea glabra Mill.	+					
*Spinacea oleracea L.	+	+		+	+	
Suaeda americana (Pers.) Fern.	+			+		
Suaeda linearis (Ell.) Moq.	+	+		+	+	+
Suaeda maritima (L.) Dumort.	+	+		+	+	+
Suaeda Richii Fern.	+			+		
AMARANTHACEAE						
*Acnida altissima Riddell	+	+	+	+		+
*Acnida altissima var. prostrata (Uline & Bray) Fern.	−					−
*Acnida altissima var. subnuda (S. Wats.) Fern.			+			+
Acnida cannabina L.	+	+	−	+	+	+
*Acnida tamariscina (Nutt.) Wood	+		−	+		
Amaranthus albus L.	+	+	+	+	+	+
*Amaranthus ascendens Loisel.				+		
*Amaranthus caudatus L.			+	+		−
*Amaranthus cruentus L.				+		+
*Amaranthus deflexus L.				+		
*Amaranthus graecizans L.	+	+	+	+	+	+
*Amaranthus hybridus L. (including f. hypochondriacus (L.) Robins.)	+	+	−	+	+	+
*Amaranthus lividus L.				+		
*Amaranthus Palmeri S. Wats.				+		
*Amaranthus Powellii S. Wats.	−		−	+		
Amaranthus pumilus Raf.					+	
*Amaranthus retroflexus L.	+	+	+	+	+	+
*Amaranthus spinosus L.			−	+		+
*Amaranthus viridis L.				+		
*Celosia argentea L. var. cristata (L.) Ktze.						+
*Froelichia arizonica Thornber				+		
NYCTAGINACEAE						
*Mirabilis hirsuta (Pursh) MacM.	+			+		+
*Mirabilis Jalapa L.						+
*Mirabilis linearis (Pursh) Heimerl						+
*Mirabilis nyctaginea (Michx.) MacM.			+	+	+	+
PHYTOLACCACEAE						
Phytolacca americana L.	+	+	+	+	+	+
AIZOACEAE						
*Mollugo verticillata L.	+	+	+	+	+	+
*Tetragonia expansa Murr.				+		+

With the exception of the introduced species the geographical areas are the same as in previous reports. The groups represented are in marked contrast to those treated in the eleventh report. While the species in the latter were with one exception woody, in the present one there are no trees or shrubs. In the last report there were no strictly maritime species, while here there is a large representation of such plants. Another notable difference is that nearly fifty per cent of the forms here treated are not native to New England, but are introduced, naturalized or adventive. Several subgroups have consequently been adopted in this category. When only one, or at most five or six specimens representing a given form have been found, it has seemed best to designate such a plant as "local" even though in the area covered by Gray's Manual it may be distinctly northern or southern and in some regions common. In New England there are not enough stations to show any definite distributional patterns in such cases.

I. GENERALLY DISTRIBUTED.—*Urtica procera, Polygonum amphibium* var. *stipulaceum* f. *fluitans, P. coccineum, P. coccineum* f. *natans, P. Hydropiper* (including var. *projectum*), *P. sagittatum, Rumex orbiculatus.*

Ia. GENERAL, EXCEPT MAINE COAST EAST OF KENNEBEC RIVER.—*Pilea pumila, Polygonum pensylvanicum* var. *laevigatum.*

Ib. GENERAL, EXCEPT THE COAST OF WASHINGTON COUNTY, MAINE.—*Polygonum lapathifolium, P. punctatum* (including var. *leptostachyum*), *Amaranthus albus.*

Ic. GENERAL, EXCEPT CAPE COD.—*Polygonum cilinode* (including var. *erectum*).

Id. GENERAL, EXCEPT CAPE COD AND MAINE COAST EAST OF KENNEBEC RIVER.—*Urtica gracilis.* While *Urtica gracilis* seems to belong to this group, it does not occur on the coast north of Massachusetts and is very rare in New Hampshire.

Ie. GENERAL, EXCEPT CAPE COD AND WASHINGTON COUNTY, MAINE—*Laportea canadensis, Polygonum amphibium* var. *stipulaceum, Chenopodium hybridum* var. *gigantospermum.*

IIA. NORTHERN—NUMEROUS STATIONS SOUTH OF 43°.—*Arceuthobium pusillum, Polygonum lapathifolium* var. *salicifolium, Chenopodium capitatum.*

Polygonum lapathifolium var. *salicifolium* occurs infrequently and there are no stations on the coast north of Massachusetts. *Chenopodium capitatum* is absent from the coast and infrequent elsewhere.

IIB. NORTHERN—NOT OR NOT MUCH SOUTH OF 43°.—*Urtica viridis, Geocaulon lividum, Polygonum Douglasii, Rumex fenestratus.*

Urtica viridis is known only from the Maine coast east of the Kennebec River. *Polygonum Douglasii* is somewhat local and the stations for this species lie between 43° and 45° except on the coast. *Rumex fenestratus* is found in Washington County only.

III. ALPINE.—*Oxyria digyna* is found on the White Mountains only. *Polygonum viviparum* occurs also on Mt. Mansfield and Mt. Katahdin.

IV. CAPE COD BUT NOT NORTHERN MAINE—GENERAL IN MAINE SOUTH OF 45°.—*Boehmeria cylindrica, Comandra umbellata, Polygonum arifolium* var. *pubescens, P. Careyi, P. hydropiperoides, Chenopodium leptophyllum.*

Boehmeria cylindrica does not occur east of the Penobscot River. *Polygonum arifolium* var. *pubescens* is not found either in northern New Hampshire or northern Vermont. *Chenopodium leptophyllum* is infrequent and there are no stations for it in Vermont. It occurs in New Hampshire only in the Androscoggin Valley.

V. NEITHER CAPE COD NOR NORTHERN MAINE, NOT IN WASHINGTON COUNTY.—*Polygonum erectum, Chenopodium Boscianum.*

While *Chenopodium Boscianum* does not occur on Cape Cod, it is present on Nantucket and is not found north of southwestern Maine (S. Berwick).

VIA. CHIEFLY THE THREE SOUTHERN STATES, BOTH CAPE COD AND WESTERN MASSACHUSETTS.—*Polygonnm cristatum, P. tenue, Phytolacca americana.*

VIB. CHIEFLY THE THREE SOUTHERN STATES, CAPE COD BUT NOT WESTERN MASSACHUSETTS.—*Polygonella articulata, Polygonum scandens.*

Polygonella articulata seems to avoid the rich soils of western New England. It is found along the Maine coast to the Kennebec River. It is frequent along railroads and in sandy soil. *Polygonum scandens* also avoids the rich soils of western Vermont and Massachusetts.

VIC. CHIEFLY THE THREE SOUTHERN STATES, NEITHER CAPE COD NOR WESTERN MASSACHUSETTS.—*Polygonum robustius.*

VID. SOUTHWESTERN NEW ENGLAND ONLY.—*Aristolochia Serpentaria.*

VII. COASTAL PLAIN.—*Boehmeria cylindrica* var. *Drummondiana, Polygonum opelousanum, P. opelousanum* var. *adenocalyx, P. pensylvanicum, P. pensylvanicum* var. *nesophilum, P. puritanorum, P. setaceum* var. *interjectum, Rumex verticillatus.*

While *Boehmeria cylindrica* var. *Drummondiana* seems to fit this catagory it has two stations far outside the coastal plain, one at Beverly, Massachusetts, the other at Dorset, Vermont. *Polygonum puritanorum* has one isolated station at Waterford, Maine.

VIII. CALCICOLOUS—CHIEFLY WEST OF THE CONNECTICUT RIVER IN SOUTH; IN EAST MOSTLY NORTH OF 45°.—*Parietaria pensylvanica, Comandra Richardsiana, Asarum canadense, A. canadense* var. *acuminatum, A. canadense* var. *reflexum, Polygonum achoreum, Tovara virginiana.*

Parietaria pensylvanica occurs in western New England, on the Cranberry Islands, Maine and locally at three seemingly indigenous stations near Boston. *Comandra Richardsiana* is restricted to the northern Lake Champlain region. *Asarum canadense* also occurs on soils overlying basic rocks in eastern Massachusetts. *Asarum canadense* var. *reflexum* is restricted to southwestern Connecticut, while *Asarum canadense* var. *acuminatum* occurs west of the Connecticut River only. *Polygonum achoreum* is found at but four stations: Castle Hill and Caribou in Aroostook County, Maine, and Grand Isle and South Burlington in Vermont. *Tovara virginiana* is frequent in western New England and also occurs in seemingly indigenous locations near Boston and at two stations in Rhode Island.

IXA. MARITIME HALOPHYTES—IN VICINITY OF COAST, NO INLAND STATIONS.—This category is further divided into three subgroups—

a. GENERAL.—*Polygonum prolificum, P. ramosissimum* var. *atlanticum, Atriplex glabriuscula, A. patula* var. *littoralis, Salicornia europaea, Suaeda linearis, S. maritima.*

b. NORTHERN.—The southern limit is given for each species: *Polygonum allocarpum* extends to Cape Elizabeth, Maine, *Rumex pallidus* to Massachusetts Bay with one station at Nantucket, *R. persicarioides* from Cape Ann to Block Island only. *Chenopodium rubrum* occurs chiefly in New Hampshire and Massachusetts with one station each in Maine and Connecticut. *Salicornia europaea* var. *prostrata* extends to Penobscot Bay, *Suaeda americana* to Cape Ann and *S. Richii* to Massachusetts Bay.

c. SOUTHERN.—The northern limit of each species is stated: *Polygonum exsertum* extends to S. Berwick, Maine, *P. glaucum* to Massachusetts Bay, *Atriplex arenaria* to Hampton, New Hampshire, *Salicornia Bigelovii* to Cape Elizabeth, Maine, *S. europaea* var. *simplex* to Hampton, New Hampshire, *S. virginica* to Wells, Maine and *Acnida cannabina* to Casco Bay.

IXB. MARITIME (NOT NECESSARILY HALOPHYTIC) WITH INLAND STATIONS.—*Polygonum aviculare* var. *littorale, P. ramosissimum, Rumex maritimus* var. *fueginus, Atriplex patula, A. patula* var. *hastata, Salsola Kali, S. Kali* var. *caroliniana.*

Salsola Kali var. *caroliniana* is absent from Maine, New Hampshire and Vermont.

X. ESTUARINE.—*Polygonum punctatum* var. *parvum, P. sagittatum* var. *chloranthum.*

XI. INTRODUCED SPECIES—GENERAL.—*Humulus Lupulus, Fagopyrum sagittatum, Polygonum aviculare, P. aviculare* var. *vegetum, P. Convolvulus, P. Convolvulus* var. *subalatum, P. Persicaria, Rumex Acetosella, R. crispus, R. domesticus, R. mexicanus* (including *R. triangulivalvis*), *R. obtusifolius, Chenopodium album, C. lanceolatum, Salsola Kali* var. *tenuifolia, Amaranthus retroflexus, Mollugo verticillata.*

Polygonum Convolvulus is absent from northern Maine. Neither *Chenopodium lanceolatum* nor *Salsola Kali* var. *tenuifolia* occurs north of 45°.

XIa. INTRODUCED SPECIES—NEITHER CAPE COD NOR NORTHERN MAINE.—These species occur very sparingly in the three northern states as shown by the following table:

	Number of stations		
	Me.	N.H.	Vt.
Cannabis sativa	3	2	5
Humulus japonicus	3	0	1
Urtica dioica	3	1	1
Urtica urens	1	1	1
Polygonum orientale	2	2	1
Rumex Acetosa	5	0	5
Rumex altissimus	2	1	1
Chenopodium Botrys	3	4	10
Chenopodium urbicum	1	2	0
Acnida altissima	1	1	4

XIb. INTRODUCED SPECIES WITH NORTHERN TENDENCIES.—*Fagopyrum tataricum, Polygonum scabrum, Rumex alpinus.*

Rumex alpinus has been recorded at only two stations: Berwick in southern Maine and Wilmington in southern Vermont.

XIC. INTRODUCED SPECIES WITH SOUTHERN TENDENCIES—CHIEFLY SOUTH OF 43°.—*Polygonum cuspidatum, Chenopodium ambrosioides, C. ambrosioides* var. *anthelminticum, C. carinatum, C. graveolens, C. murale, Kochia Scoparia, Amaranthus caudatus, A. cruentus, A. graecizans, A. hybridus* (including f. *hypochondriacus*), *A. lividus, A. Palmeri, A. Powellii, A. spinosus, Celosia argentea* var. *cristata, Mirabilis hirsuta, M. nyctaginea.*

In 1902, no stations for *Polygonum cuspidatum* were known in either Vermont or Rhode Island. *Chenopodium carinatum* is confined to outer Cape Cod except for three inland stations on ballast or wool waste.

XId. INTRODUCED SPECIES—SPORADIC.—*Polygonum amphibium* f. *terrestre, P. Persicaria* var. *ruderale, P. sachalinense, Rumex Patientia, Bassia hirsuta, Chenopodium glaucum, C. paganum.*

Bassia hirsuta is chiefly maritime with one station at Westford, Massachusetts. *Chenopodium paganum* is absent from western Massachusetts and Connecticut.

XIe. INTRODUCED SPECIES—LOCAL.—*Aristolochia Clematitis, A. durior, Emex spinosa, Polygonum Bistorta, P. cespitosum* var. *longisetum, P. dubium, P. lapathifolium* var. *prostratum, P. minus* var. *subcontinuum, P. nepalense, P. polystachyum, Rheum Rhaponticum, Rumex maritimus, R. pulcher, Atriplex hortensis, A. rosea, Axyris amaranthoides, Beta vulgaris, Chenopodium Bonus-Henricus, C. foliosum, C. incanum, C. polyspermum, Corispermum hyssopifolium, Cycloloma atriplicifolium, Kochia Sieversiana, Monolepis Nuttalliana, Roubieva multifida, Spinacea glabra, S. oleracea, Acnida altissima* var. *subnuda, A. tamariscina, Amaranthus ascendens, A. caudatus, A. deflexus, A. viridis, Froelichia arizonica, Mirabilis Jalapa, M. linearis, Tetragonia expansa.*

XII. MISCELLANEOUS.—*Parietaria floridana, Urtica chamaedryoides, Polygonum Fowleri, Rumex hastatulatus, Chenopodium humile.*

Parietaria floridana is represented in New England by a single specimen from Pawtuckaway Mt., Rockingham County, N. H. *Urtica chamaedryoides* is reported in the eighth edition of Gray's Manual to be adventive north to Massachusetts, but there is no specimen from New England in the two herbaria consulted. *Polygonum Fowleri* is represented by a single specimen in the New England Club herbarium from Isle au Haut. Other collections originally identified as *P. Fowleri* are now segregated as *P. allocarpum. Rumex hastatulus* was credited by Mr. Wm. P. Rich in Rhodora IV-205 to a single station at Salisbury Beach, Massachusetts. This specimen is now in the Gray Herbarium. During the fifty-six years only one other specimen has been collected: at Melrose, Massachusetts. *Chenopodium humile* is known from one station only in New England at Brunswick, Maine.—R. C. BEAN, A. F. HILL AND R. J. EATON.

Note on the Distinction between the Broad- and Narrow-leaved Antennarias of Minnesota.—The broad-leaved and narrow-leaved Antennarias of the Gray's Manual range in the United States are customarily separated in keys on the basis of leaf size and nervation, with the size-ranges overlapping and the nerves varying in number from 3 to 7 in the broad-leaved plants to 1 or 3 in the narrow-leaved ones. Usually the nerves are said to be "prominent" in the former types and, when 3, "obscure" in the latter. Possibly this separation serves well enough for plants over most of the range, but for Minnesota plants it is unsatisfactory. Most of our narrow-leaved plants have 3 nerves, and these are often prominent. Close observation shows differences that make the separation more certain, particularly for the beginning student. The following dichotomy distinguishes reasonably well between our broad-leaved plants (*A. fallax*, *A. munda*, and *A. plantaginifolia* of the 8th edition of Gray's Manual) and our narrow-leaved ones (*A. aprica*, *A. campestris*, *A. canadensis*, *A. microphylla*, *A. neglecta*, *A. neodioica*, and *A. petaloidea* of the 8th edition):

Largest basal leaves 12–50 mm wide, 30–100 mm long, with 3–7 lengthwise nerves at base of blade that are prominent beneath, the two (main) laterals nearest the midrib each located nearly always from ⅓ to ½ of the way from the midrib to the margin where farthest from the margin, usually extending past the broadest point of the blade and converging toward and nearly reaching the leaf tip, additional nerves if any branching mostly from the outer sides of the two laterals mentioned; smaller leaves and those not fully expanded often with lateral nerves as described below; largest blades tending to be widest between ⅓ and ⅔ of the way to the tip; leaves of the flowering stem acute to bristle-tipped, without scarious appendages *broad-leaved plants.*

Largest basal leaves 3–21 mm wide, 5–55 mm long, with 1 or 3 prominent to obscure lengthwise nerves at base of blade, very rarely with a faint additional nerve next one or both margins, when 3- or more-nerved the two main laterals each located from nearly ⅔ to ¾ of the way from the midrib to the margin in the broader part of the blade, usually extending at most shortly beyond the broadest point, rarely converging toward and nearly reaching the leaf tip, additional nerves if any branching mostly from the midrib; largest blades tending to be widest between ⅔ and ⅘ of the way to the tip; leaves of the flowering stem as above or the upper third of them each with a thin flattened sometimes inrolled scarious appendage 1.5–2.5 mm. long by 0.4–0.9 mm wide. . . . . *narrow-leaved plants.*

—.Thomas Morley, university of minnesota.

Euphrasia micrantha New to North America.—Mount Greylock, a spur of the Taconic Range in Berkshire County, northwestern Massachusetts and the highest point (3491 ft. elevation) in the state, has already received considerable notice in the pages of this journal because of its botanical attractions. These have been revealed chiefly through the explorations of Dr. A. LeRoy Andrews, beginning with an account of the orchids of the region in 1900 and including a series of papers on the bryophytes extending up to 1957. Particularly noteworthy in the flora of the mountain is the subalpine element which, as might be expected, is markedly similar to that of the Green Mountains of Vermont.

Early in the evening of August 26, 1957 the writer, returning from the Adirondacks, made a hurried drive to the summit of Greylock via the excellent road leading from North Adams, on the chance of getting in some botanizing before dusk set in. The most striking plant on the exposed rocky summit at this date proved to be a Euphrasia (*F. J. Hermann 14075*, specimens in Gray Herbarium, U. S. National Herbarium, N. Y. Botanical Garden Herbarium and Cambridge University Herbarium, England) occurring in extensive beds, its violet corollas vividly coloring the sparsely grassy stretches surrounding the war memorial beacon which has become a popular tourist attraction.

Later attempts to identify the plant in current floras were unsuccessful. None of the ten species included in Gray's *Manual* would accommodate its combination of blunt bract-teeth and almost solid violet corolla, nor could it be matched with any of the American collections in the U. S. National Herbarium. A specimen sent to Kew was kindly referred by Dr. G. Taylor to Mr. P. F. Yeo, at Cambridge University Botanic Garden, who with Mr. P. D. Sell is at present engaged in a revision of the genus in North America. Mr. Yeo has referred the collection to the European *Euphrasia micrantha* Reichb., and very kindly sent European material of the species for comparison. As Mr. Yeo pointed out the plants from Mt. Greylock are not typical of the prevalent form of the species in Europe, differing chiefly in having very short floral internodes. In this respect it is very similar, however, to specimens collected by Mr. Yeo from cliff-top heaths in Brittany, so that it seems not unlikely that the shortening of the nodes is an ecological response.

The range of *Euphrasia micrantha,* which occurs throughout the British Isles according to Clapham, Tutin and Warburg in their *Flora of the British Isles* (1952), is given by H. W. Pugsley, in his *Revision of the British Euphrasias* (Journ. Linn. Soc. Bot. 48:488. 1930), as "northwest Europe, including Scandinavia, Germany, Bohemia, and a large part of France". The American species most nearly related to it is *E. disjuncta* Fern. & Wieg., of Labrador, Newfoundland and northern Maine (western plants formerly referred to *E. disjuncta* are really *E. subarctica* Raup, according to Hultén), which is also referred by Pugsley (Journ. Bot. 74:287. 1936) to the Series Latifoliae of the Subsect. Ciliatae, Sect. Semicalcaratae. Although characterized by blunt bract-teeth in common with *E. micrantha,* it is very unlike that plant in general aspect, the spikes being widely interrupted (lower bracts 2–5 cm. apart), and is readily distinguished from the European species by its larger, much broader and pubescent leaves and bracts.

Although the occurrence of this European species in well-established colonies on a New England mountain top was unexpected, it does not seem improbable that it was introduced there in view of the fact that the number of visitors at the locality must run into many thousands each year, and that not a few other exotic plants have turned up in much less frequented areas.—F. J. HERMANN, CROPS RESEARCH DIVISION, A.R.S., U.S. DEPARTMENT OF AGRICULTURE, BELTSVILLE, MARYLAND.

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THE HYBRID RAGWEED, AMBROSIA ARTEMISIIFOLIA × TRIFIDA

W. H. Wagner, Jr.[1]

One of the more striking of all weed hybrids is certainly the cross between the "common ragweed" and the "giant ragweed"—*Ambrosia artemisiifolia* × *trifida*. The parents differ strongly in habit, stature, leaf-form, and fruits, producing in their cross a distinctive plant. During recent studies of the parental species I have encountered occasional naturally occurring examples of this rare cross, and I wish to report here some observations not previously recorded.

The hybrid between our two most pernicious of hayfever weeds was first discovered and described by Wylie in 1915. Subsequent authors for the most part seem not to have noticed this early paper. A single plant was found during the summer of 1914 on a roadside about 2 miles north of Iowa City, Iowa. It produced flowers in abundance but no seeds were formed, although Wylie observed the plant closely until autumn. It is significant that none of the later writers has reported seeds (or fruits) either. The leaves of the new hybrid were described as "distinctly different from either of the supposed parents, though intermediate between them in a general way," and one of the leaves was figured (op. cit., pl. 21) together with comparable leaves of the parents.

Since Wylie's original description, various observations on *Ambrosia artemisiifolia* × *trifida*, both from North America and Europe, have been published. However, in his revision of

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[1] Publication No. 10 on *Atmospheric Pollution by Aeroallergens* under research grant No. E-1379(C) from the National Institute of Allergy and Infectious Diseases, Public Health Service.

Ambrosia in *North American Flora* Rydberg in 1922 did not mention Wylie's plant, including only another hybrid ragweed, *A. bidentata* × *trifida*. K. L. Jones (1943) did cite Wylie's original report and also recorded another example of the wild hybrid which was found in 1936 along the banks of the Huron River near Ann Arbor, Michigan. Jones, in genetic experiments, also created the hybrid under artificial conditions by growing the all-pistillate form of *A. artemisiifolia* together with pollinating plants of *A. trifida*. Of the seven hybrid plants that he secured, two inherited the all-pistillate condition of the *artemisiifolia* female parent, four were intergrades, and one was normally monoecious. In cytological studies of the cross, he determined that the 12 chromosomes in the haploid set of *A. trifida* are recognizably larger than the 18 from *A. artemisiifolia*. Chromosome pairing was found to be irregular and there were numerous univalents. Such pairing as occurred involved almost entirely chromosomes of similar size and therefore were assumed to have been contributed by the same parent. Stebbins (1945) called attention to this as a striking example of pairing between chromosomes contributed by the same parent in species hybrids involving polyploidy.

Rouleau in 1944 redescribed *Ambrosia artemisiifolia* × *trifida* on the basis of a collection made in Canada in 1935, and gave it the binomial "× *Ambrosia Helenae*," in honor of Hélène Boulé, for whom Ile Sainte-Hélène, where the hybrid was discovered near Montreal, was also named. In 1939, Ballais found the cross at Cauderan (Giroude), France, where the parent species have been introduced (Lawalrée, 1947). In 1950 the intermediate was taken at Urbana, Champaign Co., Illinois, by Marilyn L. Briggs (Jones and Fuller, 1955).

Although we now have records in our notes only from Iowa, Illinois, Oklahoma, Michigan, Quebec, and France, *Ambrosia artemisiifolia* × *trifida* will probably be detected from time to time wherever the two parents grow together in ruderal habitats. In Michigan, as mentioned previously (Wagner & Beals, 1958), this ragweed cross is extremely rare. Such few specimens as we have found during 1956, 1957, and 1958 have been in much disturbed habitats, along the sides of newly built roads and on construction sites in and around Ann Arbor.

Despite its somewhat unique appearance the hybrid may be passed unnoticed, or may even be confused with other species. There are probably unrecognized specimens in various herbaria. To illustrate, in the herbarium of Tulane University I found in 1958 an example of this ragweed cross from Pawnee, Oklahoma (August, 1933, *C. F. Coffman*) that was identified as *Ambrosia psilostachya*, the "perennial" or "western ragweed." Another specimen reported for the first time here was found in 1957 in the much-used herbarium of the University of Michigan Biological Station. The latter (East Cheboygan, Michigan, July 30, 1933, *J. H. Ehlers 5346*) bore the identification *A. artemisiifolia*, probably because on casual inspection it appeared like a very coarse individual of the common ragweed.

Part of the difficulty of recognizing *A. artemisiifolia* × *trifida* surely results from the rather extraordinary variation in the successive leaves produced from spring through fall. The earlier leaves of the season are roughly like over-sized leaves of *A. artemisiifolia*, but the later leaves formed on the main and lateral axes are not comparable directly to those of either parent, having rather large, but narrowly three-lobed or simple blades. By late summer and fall, all the spring leaves have normally fallen or completely dried up so that only the more simple leaf types of the distal parts of the plant remain. At this stage the plant looks something like a narrow-leaved form of *A. trifida*.

To attempt to show all the normal foliar variations of this hybrid I decided to make observations of a single, as nearly average as possible, plant - from cotyledons to highest bract. To accomplish this it was necessary to find a natural hybrid very early in its growth, so that all the first leaves would be present and intact. On May 18, 1958, a specimen was found growing with the parents on a construction site at the University Hospital, Ann Arbor. With the assistance of Dr. John M. Sheldon this plant was extracted from a difficult position in a crack along the sidewalk with as little injury as possible, and it was turned over for cultivation to Mr. Walter F. Kleinschmidt, Superintendent of the U. M. Botanical Gardens, who kept it under approximately normal conditions. A sample leaf was removed from each node just before it dried and fell off naturally. The plant grew to 50 inches in height and seemed to be of fairly average growth for this cross in Michigan, neither as small as Ehlers' specimen from Cheboygan, nor as large as the giant specimen grown under more luxuriant artificial conditions the previous year. The results from this "pruning" of the old leaves of successive nodes are shown in Figure 1.

The seedlings of the parent species have been described by Rowlee (1893) and Kummer (1951). In over-all stature the hybrid seedling is closer to *A. trifida* than *A. artemisiifolia.* The cotyledons and the first foliage leaves of the cross are readily distinguishable from the corresponding leaves of *A. trifida.* On the fourth to eighth nodes the leaves look somewhat like extremely gross leaves of *A. artemisiifolia* and their margins are lobed and toothed (fig. 1, especially the second row). This is the leaf type depicted by Wylie (op. cit., pl. 21). By the time the sixth pair of foliage leaves has appeared, there are already lateral branches growing from all except the lowermost nodes, a feature especially characteristic of *A. artemisiifolia* (Rowlee, op. cit.). At approximately the middle level of the plant, the opposite leaf arrangement gives way to alternate, in this respect also as in *A. artemisiifolia* rather than *A. trifida* which has opposite branching throughout. The leaves in the upper half of the plant tend to be progressively simpler in structure and finally, in the top five nodes, to become narrowly three-lobed to nearly simple, the margins now practically entire. The leaves illustrated by K. L. Jones (op. cit., figs. 2, 4, 5) are like the intermediate types found in the middle of the plant (fig. 1, third row).

The leaves produced on the lateral branches of this "average" hybrid are considerably smaller than those along the main axis. The three leaves (fig. 1, inset) from a branch at the sixth node (shown by the arrow) illustrate the most common types of leaves on the lateral branches. In extremely vigorous, large and much-branched specimens of *A. artemisiifolia* × *trifida*, however, the lateral branches become more like the top half of the main axis of our average plant. This unusually large form is shown by the specimen of Rouleau (op. cit., fig. 3), and is represented in our collections by *Wagner 8461* (MICH) from near Ann Arbor Airport which was grown to exceptionally large size in the U. M. Botanical Gardens in 1957.

Fruits have apparently not previously been found in *Ambrosia*

Fig. 1. Leaf variations of *Ambrosia artemisiifolia* × *trifida*. *Lower left:* Major branches of "average" plant 50 inches tall, showing successive nodes where leaves were removed. *Silhouettes* (to scale) of successive leaves arranged left to right—Bottom row, nodes 1–5; second row, nodes 6–8, third row, nodes 9–12, fourth row, nodes 13–16, top row, nodes 17–18 (18 at base of terminal spike). INSET: successive leaves from lateral branch shown by arrow in habit diagram. (Silhouettes photographed by T. F. Beals).

artemisiifolia × *trifida*, and it is possible that the production of any fruits at all is atypical. Nevertheless, our natural hybrid, cited above, that was cultured in 1957 under particularly luxuriant conditions in the greenhouse and permitted to develop into an unusually large specimen was grown side by side with numerous pollinating plants of *A. artemisiifolia*, and by the latter half of September the hybrid did produce approximately twenty fruits—these having been stimulated to form, perhaps, by the pollen from the parent species. The fruits, the outer walls of which are involucral in origin and appeared superficially to be normal, represent good intermediates between the rather different fruits of the parents as shown in the scale drawings in figure 2. The fruits of *A. artemisiifolia* average usually 4–5 mm. in total length, with a narrowly constricted beak that makes up one-third to one-half the length. Those of *A. trifida* are much larger, approximately double in over-all length, 7–10 mm., with a more broadly based beak that comprises one-fifth to one-fourth of the total length. The fruits of the hybrid are variable but all of those which did develop on the plant were intermediate both

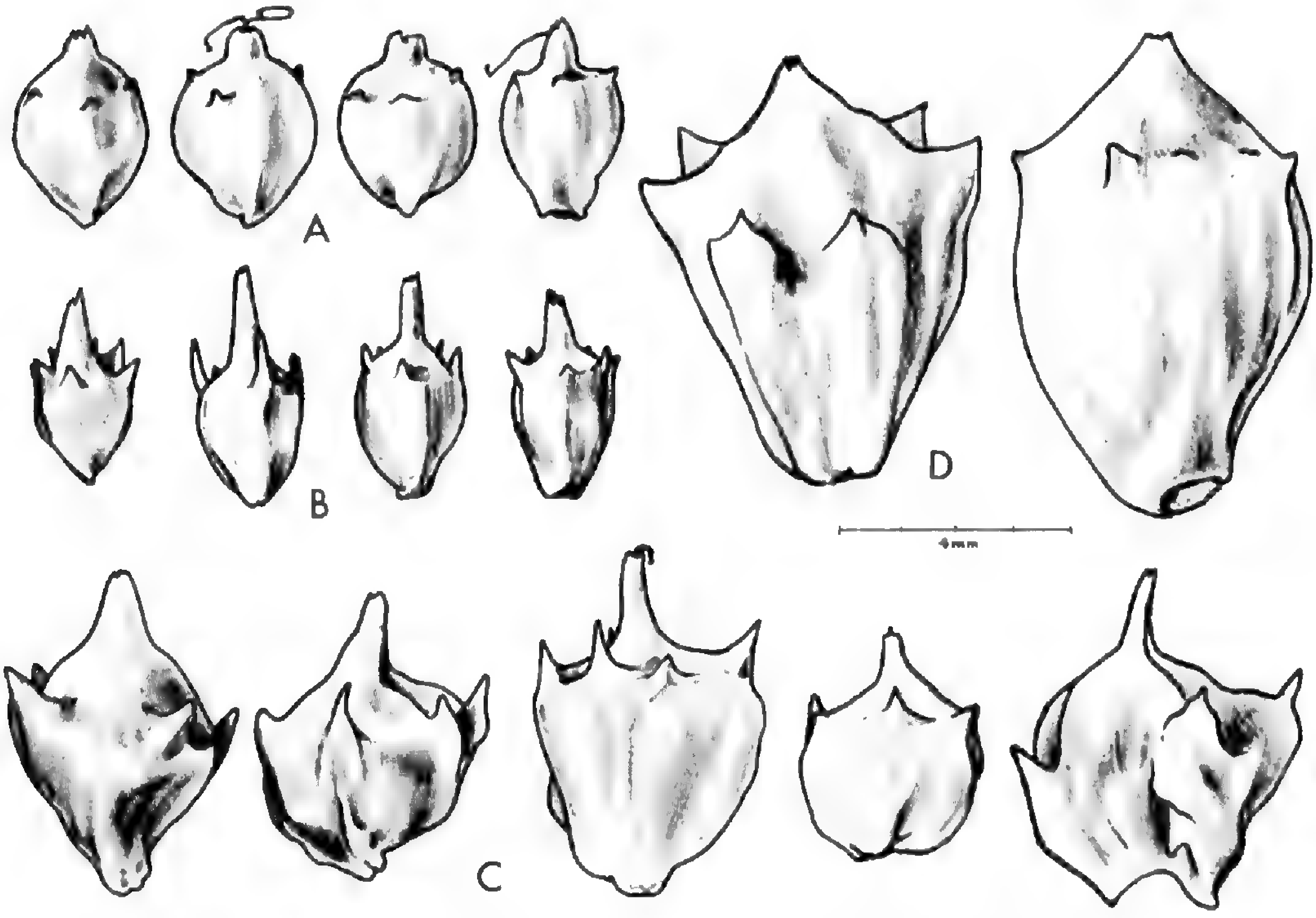

FIG. 2. Fruits of ragweeds. A. *Ambrosia coronopifolia*; B. *A. artemisiifolia*; C. *A. artemisiifolia* × *trifida*; D. *A. trifida*.

in size and shape between those of the parents. The only major deviation is that the hybrid fruits tend to be more deeply channelled, a feature no doubt related to the collapse or failure of development of the achene within. Following after-ripening during the winter of 1957–58, an attempt was made to germinate some of the hybrid fruits, but without success. Both the pollen and the fruits (when formed) of this hybrid are probably ineffective in its reproduction.

Because of the great rarity and sporadic occurrence of this hybrid ragweed, and because of its probable inability to reproduce or even survive more than one summer by any means, I am inclined to designate it by formula only, i.e., as *Ambrosia artemisiifolia* × *trifida*, rather than by formal binomial nomenclature, as *A.* × *helenae.* There is considerably more justification, perhaps, for designating the ragweed hybrid, *A. artemisiifolia* × *coronopifolia* with a taxonomic binomial as *A.* × *intergradiens* (Wagner & Beals, op. cit.), because the latter hybrid is found to be frequent in many counties of Michigan (and probably elsewhere) and has the ability to form very large, perennial populations through the years by way of root proliferations. The question, however, of when or why it is "useful or necessary" to designate an interspecific plant hybrid with a binomial is at present wholly arbitrary and personal. It would be desirable if there existed a generally acceptable and sound philosophy as a guide in this regard.

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SOME INTERESTING RECORDS FROM EASTERN MASSACHUSETTS

RICHARD J. EATON

Middlesex and Norfolk Counties in eastern Massachusetts, particularly within a radius of thirty miles from downtown Boston, have been intensively explored during the past century by several generations of energetic botanists. The flora of that area is, perhaps, as well represented by herbarium specimens, and the detailed distribution of its specific elements is as well known, as that of any comparable area in the New World. It is, therefore, a source of constant interest and surprise that novelties (from a local point of view) continue to crop up in some numbers. Despite the accelerating contraction of suitable habitats for our native vegetation and the rapid conversion of rural areas to industrial, highway, and housing uses with all that that process implies, it is still profitable to rework familiar ground intensively in search of previously overlooked plants or recent arrivals.

The specimens cited below were collected by the author unless otherwise stated, and have been placed in the herbarium of the New England Botanical Club.

ISOËTES RIPARIA Engelm. Walden Pond, Concord, Middlesex County, Massachusetts, Sept. 22, 1957. Neither it nor its more northerly and hardly separable var. *canadensis* has been reported previously from the county. Even if considered as an aggregate, this species appears to be somewhat local in eastern New England: one record each from Cumberland and York Counties, Maine; one from Suffolk, three from Norfolk, and two from Worcester Counties, Massachusetts; two from Providence County, Rhode Island; two from Windham County, Connecticut.

ISOËTES MACROSPORA Dur. Walden Pond, Concord, Massachusetts, *G. R. Proctor 3681-b*, Aug. 29, 1949; same station, Sept. 22, 1957. New to Middlesex County, Massachusetts. Aside from three other stations in Massachusetts (Plymouth and Hampden Counties) this species appears to be confined to northern New England. Unaware of the Proctor collection, I stumbled on it last fall while making a periodic "low-water" visit to Walden. It seems odd that the numerous keen botanists who have explored its shores and neighboring woods during the past hundred years should have previously overlooked two species of *Isoëtes.* The suspicion is inevitable that they are recent arrivals, particularly in view of the ever-increasing hordes of bait fishermen and others who infest the pond.

Cyperus erythrorhizos Muhl. Two recent collections from Concord: Great Meadows, *J. W. Brainerd 2569*, July, 1950; shore of Walden Pond, Sept. 22, 1957. Previously known in Middlesex County only from Winter Pond, Winchester. Until 1930 this species was considered rare in southern New England where it reaches its northeast limit of range at two stations in Massachusetts on the bank of the Merrimack River in Essex County. It was known elsewhere in our area at two stations each in Norfolk and Bristol Counties, all in Massachusetts, and at a scattering of seven stations in the Connecticut River valley from Hadley, Massachusetts, to its mouth at Lyme, Connecticut. Since 1930, in addition to the two Concord stations cited above, it has been discovered at five places in the Blackstone River valley from Auburn (near Worcester), Massachusetts, southward to Providence, Rhode Island; and at two places along the upper (southern) Nashua River in eastern Worcester County. It is difficult to accept the idea that this well-marked and easily recognizable sedge previously had been overlooked in such a thoroughly botanized town as Concord.[1]

More problematical is its status in Worcester County, Massachusetts, where active and competent botanists under the leadership of B. N. Gates and David Potter have been systematically collecting during the past twenty-five years. However, Joseph Jackson did intensive field work there (but without the benefit of motor transportation) in the 1890's while gathering material for his "Flora of Worcester County". During the next two decades, in addition to continued field work by local botanists, Messrs. Fernald, Knowlton, Hunnewell, and other members of the New England Botanical Club, either on formal field excursions or otherwise, visited the county more or less regularly. In short, its flora was reasonably well known to botanists of a preceding generation. Therefore, one must not dismiss the possibility, if not the probability, that *C. erythrorhizos* has invaded the Sudbury-Concord, Nashua, and Blackstone River valleys in recent years. If so, the reasons and agencies responsible for its possibly

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[1] The New England Botanical Club Herbarium contains specimens from Concord representing more than 1050 species plus an additional 124 named varieties and forms, collected by forty persons beginning with H. D. Thoreau and E. S. Hoar in the 1850's.

After these notes were sent to the printer an old undated specimen has been found in the recently acquired herbarium of Mary Rodman. The label is inadequately annotated "Bedford—C. W. J." Evidently she received it from Charles W. Jenks, a contemporary amateur botanist of Bedford who collected actively in central Middlesex County beginning about 1880. It is physically possible that Jenks could have collected the plant in the Bedford section of the Concord River meadows, but there are good reasons for disregarding this possibility. Internal evidence strongly suggests that the specimen did not originate with Jenks or from Bedford.

sudden dispersal must remain obscure. One is tempted to correlate the postulated phenomenon with the remarkable increase in eastern Massachusetts of migrant waterfowl, in particular surface-feeding fresh water ducks, such as Black Duck, Wood Duck, Pintail, Blue- and Green-winged Teal.[2] This correlation probably is coincidental. The recent increases, in fact, merely represent partial recoveries from the steady decline of waterfowl along the eastern flyway since early Colonial times when their abundance appears to have been fantastic. Obviously, the opportunities for dispersal of the sedge by avian means in post-glacial times were far greater prior to 1700, for instance, than during the years 1930–1957.

CAREX HIRSUTELLA Mackenz. Open deciduous woods, Concord, Massachusetts, June 16, 1957. First record from Middlesex County. I find only two herbarium specimens from eastern New England: one from Mt. Desert, Maine, and one from Bristol County, southeastern Massachusetts. Otherwise, it appears to be confined to localities west of the Connecticut River from Vermont to Connecticut. Dr. F. J. Hermann concurs with my determination of the Concord specimen.

CAREX LAXIFLORA Lam., var. SERRULATA F. J. Herm. Lincoln, Middlesex County, Massachusetts, June 22, 1955, wooded rocky slope over diorite outcropping. Obviously closely related to *C. laxiflora,* but unlike anything to be expected in eastern Massachusetts, I sent the specimen to Dr. Hermann for his opinion. He assigned it unhesitatingly to this apparently local and seldom collected variety. This appears to be its first recorded occurrence in New England. There are only five specimens in the Gray Herbarium: one each from New York, Michigan, and Washington, D. C., and two from Tennessee. Dr. Hermann writes that he has seen a recent collection from an additional station in Michigan. Like the typical form, var. *serrulata* seems to prefer rich hardwoods. Incidentally, the Lincoln station, according to the detailed geological map of the region, lies on the same formation as that for *Parietaria pensylvanica* in Concord mentioned below. The formation is mapped as a narrow, gradually expanding ribbon from Marlborough to Salem, Massachusetts. Except near the coast, it reaches the surface as outcrops at but a few places; otherwise it is buried chiefly by the acid soils of glacial origin. The outcropping in Concord is noteworthy for its rich flora. It is the site of a number of species not known to occur elsewhere in the town and which are relatively rare and local in eastern Massachusetts. To a much lesser extent, the same is true of the less extensive Lincoln exposure.

WOLFFIA PUNCTATA Griseb. Concord, Massachusetts, Oct. 16, 1957, on quiet water in an artificial wild-fowl impoundment adjacent to the Great Meadows impoundments of the United States Wild Life Refuge. The presence of this species was discovered by Carroll E. Wood, Jr., while searching for fruiting fronds of *W. columbiana* in a sample I had collected for him for that purpose. A collection subsequently taken from a detached colony of the now locally abundant *W. columbiana*[3] contained

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[2] See "Birds of Concord" by Ludlow Griscom (Cambridge, 1949), pp. 153–154, 181–188, etc.

[3] First discovered in eastern Massachusetts in 1938 and reported by the author in RHODORA, **41**: 42

roughly five per cent *W. punctata.* The latter species seems to float slightly higher in the water than the other and is somewhat boat-shaped. By running a cupful through a fine-meshed kitchen strainer to remove contaminating *Lemna,* etc., I was able to obtain a pure sample of the mixed *Wolffia* plants. Successive portions of the cleaned material were floated in a flat dish. By gently blowing across the surface, I found it possible to increase the percentage of *W. punctata* at the far edge to a marked degree, thus facilitating the preparation of a pure specimen of the latter species.[4]

This appears to be its first recorded occurrence in New England. Its range is stated by Fernald in Gray's Manual, 8th Ed., as "Fla. to Tex., n., very locally, to e. Md., n.w. N. Y., s. Ont., Mich . . .", etc. In connection with the possibility of the dissemination of aquatic vegetation by waterfowl, suitable ecological conditions at the place of deposition are essential for a successful introduction. In the case of the Lemnaceae, the sewage-polluted waters of the Sudbury-Concord River and particularly the Great Meadows impoundments adjacent to it are notoriously favorable for their luxuriant growth.[5] Seemingly, the chances are excellent that a single frond of *Wolffia,* released from entanglement in some portion of the external anatomy of a migrant duck, for instance, onto the surface of one of these impoundments, should soon proliferate abundantly. It is considered well-nigh impossible for any vegetal material, viable or otherwise, to remain in the digestive tract of a bird during the time required for a flight from Maryland to eastern Massachusetts. Also, it is questionable whether *Wolffia* ever can stick to a bird's feathers. It is conceivable that it can stick to a strand of weed fouled in a bird's foot or bill. Very rarely I have seen a land bird with a claw or bill apparently fouled by extraneous material. One or two of my ornithological friends have observed similar occurrences. *Wolffia* adheres strongly by capillary attraction to moist surfaces. Such a means of long-distance transport seems possible. On the whole, I think it rather likely that both species of *Wolffia* are recent arrivals in Concord.

SISYRINCHIUM ARENICOLA Bickn. Braintree, Norfolk County, Massachusetts, *R. B. Channell and R. J. Eaton,* July 5, 1957. The previously known occurrence of this southern species in northeastern North America is indicated by specimens in the Club and Gray Herbarium from Woodbury, Connecticut, Block Island, Rhode Island, Marthas Vineyard, Nantucket, and Provincetown in Massachusetts, and thence (disruptedly) from southwestern Nova Scotia. This familiar distributional pattern is characteristic of a number of southern plants which are assumed to have migrated in the late Pleistocene northeastward along the exposed continental shelf, and to have become isolated at scattered marginal stations by subsequent rise in the ocean level. Hence, the occurrence of *S.*

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[4] For methods of preserving herbarium specimens of Wolffia see "Wolffia in Canada" by W. G. Dore in The Canadian Field-Naturalist. **71**: 10–16.

[5] See author's paper "Lemna minor as an aggressive weed in the Sudbury River". RHODORA, **49**: 165–171.

arenicola on the mainland of Massachusetts in Norfolk County is somewhat surprising.

Parietaria pensylvanica Muhl. Deciduous woods, base of dioritic outcrop,[6] Concord, Massachusetts, Aug. 1, 1957. Previously unrecorded from Middlesex County. Except for three old records from the southerly outskirts of metropolitan Boston (one of which is definitely annotated "waste ground") its distribution in Massachusetts as reflected by the many specimens in the New England Botanical Club Herbarium is confined to the Connecticut River valley and westward, where rich woods species are notably numerous and abundant. The plant at Concord has every appearance of being indigenous. However, reference is made to Rhodora **1:** 168–172 wherein *P. pensylvanica* is listed as one of the species said to have been unsuccessfully introduced at Concord by Minot Pratt (who died in 1878). Pratt, contrary to his usual practice, made no mention of the introduction in his "List of Plants of Concord" (ms. in the Concord Public Library).

Bartonia paniculata (Michx.) Muhl. Shore of Bateman's Pond, Concord, Massachusetts, July 25, 1957. First record for Middlesex County. Previously known New England distribution: Cumberland and York Counties, Maine, one station each; Norfolk County, Massachusetts, three stations in the Blue Hills Reservation; thence westward near the coast in southeastern Massachusetts, Rhode Island and Connecticut.

Crataegus crus-galli L. Concord, Massachusetts, July 25, 1957. Second record for the county, the first being Middlesex Fells, *N. T. Kidder,* June 8, 1928; otherwise not known in eastern Massachusetts, north of Bristol County. This species is one of the very few New England members of the genus which can be readily identified in the field. At the Concord station were three large and apparently old individuals and several smaller ones at the edge of extensive rocky open woodland in a long abandoned pasture.

Vernonia missourica Raf. Clam Shell Bluff, Concord, Massachusetts, Aug. 21, 1957. Adventive from the West. Probably the first record for New England. It is included here as a previously overlooked addition to the long list of adventives at this station reported by the author in Rhodora **38:**64–67. It has presumably persisted for nearly thirty years, despite the fact that all but narrow edges of the field recently has been put back into cultivation.

Hieracium pilosella L. var. niveum Muell. Arg. Old sterile field, Concord, Massachusetts, July 30, 1957, where it occurs as a dense clone several meters in diameter. Naturalized from Europe. Its occurrence in the Gray's Manual range is stated by Fernald as "Fields, e. Maine". Var. *niveum* strikingly differs from the frequently collected and wide-ranging typical form in that its leaves are permanently and conspicuously white pannose beneath. Furthermore, it appears to be far less aggressive.
—LINCOLN, MASS.

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[6] The pH of a finely powdered mixed sample was determined as 6.2.

CABOMBA CAROLINIANA GROWS IN WORCESTER COUNTY, MASSACHUSETTS

Burton N. Gates

The distribution of *Cabomba caroliniana* A. Gray in Massachusetts is gradually unfolding. An important recent contribution is that of Stuart K. Harris[1] who collected it in Fosters Pond, Essex County, 1957. In the next County to the south, Suffolk, Dr. Harris also reported it in abundance in Muddy River, The Fenway, Boston. South of Boston, the present writer has seen a specimen from the sandy shore of Nippenicket Pond, Bridgewater, Plymouth County (*Frank C. Seymour, 4426,* 1935; a sterile specimen in the New England Botanical Club Herbarium).

The range of *Cabomba* extends westward into Worcester County. The specimens documenting this distribution are filed in the Hadwen Herbarium of Worcester County Plants, Clark University, Worcester. The earliest collection was from Uxbridge, in the Mumford River (*Walter H. Hodge, 2825,* 1933). Again in Uxbridge, it was found in great abundance; the long streamers,[2] having been washed up by a hurricane, were floating along the shore of Ironstone Reservoir. A random specimen measured 85+ inches long (*F. C. Seymour and B. N. Gates 32316,* 1954). Nine years previous, it had been collected as an occasional plant in Ironstone Brook at Ironstone Road, which is fed by Ironstone Reservoir (*B. N. Gates 23914,* 1946). In the southeast town in Worcester County, Blackstone, in the Blackstone River, two or three feet deep, Cabomba covered the bed of the river (*Malumphy 24893,* 1943).

Distribution in Worcester County extends west considerably beyond the geographical center of the State. On a field trip of the New England Botanical Club it was first collected floating along the north-east shore of Quaboag Pond near the inlet of Seven Mile River (*David Potter 24913,* 1946). At this station, it has been observed nearly every year since and was collected in May 1955 (*Winifred C. Gates 31976*). That there is no association by water-courses between this East Brookfield station and

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[1] Rhodora **60:** 116. 1958.

[2] A profusion of amazingly long streamers of Myriophyllum humile forma capillaceum tangled with Cabomba; the collected specimen measured in excess of 11.5 feet long (*F. C. Seymour and B. N. Gates 31995*).

the two towns, Uxbridge and Blackstone, is quite evident; East Brookfield is in the water-shed which empties into the Thames River in Connecticut, while the two other towns are in the Blackstone River water-shed, draining south through Rhode Island.

Westward from Worcester County, Fassett,[3] without a specific citation, lists an occurrence in "western Massachusetts, where perhaps introduced", is interpretable as most any locality west of the Connecticut River. It is quite probable, however, that his citation refers to the collection in 1930 by Wayne E. Manning[4] in Hatfield, Hampshire County. He found it very abundant in South Pond, once a very old ox-bow of the Connecticut River. A local florist and fisherman, Harold Keys, is quoted by Manning as having known it in profusion in this pond for at least a decade previous and as having suggested that it appeared to be indigenous.

To round out the statement of occurrence of Cabomba in southern New England, it may be helpful to cite briefly two collections in Connecticut, which have been seen by the writer. Ultimately, it might develop that they have some relationship to the Massachusetts station in the Connecticut River Valley water-shed. In Rogers Pond, Saybrook, Middlesex County, it was reported to be very abundant (*E. H. Eames 11854a*, 1937; a specimen in flower at the Gray Herbarium). In a pond at the south-west base of Chestnut Hill, Trumbull, Fairfax County, it has been long established, according to the property owner. (*E. H. Eames 11874*, 1937; a specimen in flower in the Gray Herbarium).

Sterile Cabomba has a reasonable resemblance to several other aquatics found in our New England waters. For this reason and because in the writer's experience it is seldom found in flower or fruit, at least in Massachusetts, it may be readily overlooked or mistaken for one of several plants of ponds and streams. Sterile specimens of Cabomba have the general appearance of *Ceratophyllum demersum* L., *Megalodonta Beckii* (Torr.) Greene, *Ranunculus flabellaris* Raf. and to some forms of *Myriophyllum*. Distinguishing characters of the stem and leaves of these are very helpfully pictured by W. C. Muenscher, in comparison with the

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[3] Manual of Aquatic Plants, 1940.

[4] Rhodora **39**: 187.

stem and leaves of Cabomba, on a plate in his "Aquatic Plants of United States".[5] Observe that *Cabomba* has a *well developed petiole without stipules.*

Conclusions are few, beyond the fact that *Cabomba* is locally widespread in Massachusetts. The earliest collection known in Massachusetts was in 1930, in Hatfield, Hampshire County, followed in Worcester County, in Uxbridge, in 1933. In the writer's experience, supported by the collections of others, it is locally plentiful and well established. Regrettably, the writer has yet to see it in flower or fruit in the area (although the two Connecticut collections were in flower). Occurrence in Massachusetts constitutes an extension considerably north of the normal range given in Gray's Manual, ed. 8, as Virginia, or, by Fassett, as New Jersey. Each of these authors would account for the New England extension as "naturalized" or "perhaps introduced" through some unexplained means. Its scattered but established distribution anticipates that further collections should show a more unified occurrence of *Cabomba* in southern New England.—BIOLOGY DEPARTMENT, CLARK UNIVERSITY, WORCESTER, MASS.

FURTHER NEW RECORDS OF MYRTACEAE FROM JAMAICA

GEORGE R. PROCTOR

Recent botanical exploration by the writer in Jamaica has revealed an interesting series of new plant records. A previous number of RHODORA (**50**:303–306. 1957) presented a few notes on *Eugenia* and proposed one new species. The present paper contributes more new Jamaican records in the Myrtaceae. The writer is grateful to Dr. Lily M. Perry for her assistance with the Latin descriptions.

Calyptranthes clarendonensis Proctor, sp. nov. Frutex circa 2.5 m. altus; ramulis novellis fere teretibus, dense brunneo-tomentosis. Folia sessilia, rigide coriacea, opaca, non pellucido-punctata, supra glabra, subtus decidue brunneo-tomentosa, 2.5–5 cm. longa, 1.5–4.5 cm. lata, late ovata, apice obtusa, basi valde cordato-subamplexicaule, nervo medio supra basin versus impresso, subtus prominente, venis secundariis prominulis. Inflorescentiae 2–4, subterminales, apice 2–3-florae, floribus sessilibus. Alabastra ovoidea, apiculata, 5–6 mm. longa, dense brunneo-

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[5] Ithaca, N. Y., 1944, plate 102a, page 232.

tomentosa. Flores aperti non visi. Baccae globosae (interdum irregulariter globosae), brunneo-tomentosae, 9–14 mm. diametro; seminibus 2–13, 6–9 mm. longis.

Shrub c. 2.5 m. tall; youngest branchlets nearly terete, densely brown-tomentose. Leaves sessile, rigidly coriaceous, opaque and without pellucid dots, glabrous above, deciduously brown-tomentose beneath, 2.5–5 cm. long, 1.5–4.5 cm. wide, broadly ovate, blunt at apex and rather deeply cordate-clasping at base, midrib impressed toward the base above, prominent beneath, secondary venation prominulous on both sides. Inflorescences 2–4, subterminal (i.e., accompanied and overtopped by a pair of leafy shoots which appear simultaneously from the same place); peduncles 2–5 cm. long, somewhat compressed or 2-edged, brown-tomentose, each bearing 2 or 3 sessile flowers at the apex. Buds ovoid-apiculate, 5–6 mm. long, densely brown-tomentose. Open flowers not seen. Berries globose (sometimes irregularly), brown-tomentose, 9–14 mm. in diameter, 2–13-seeded, the seeds 6–9 mm. long.

TYPE: Parish of Clarendon, Peckham Woods, elev. c. 2500 ft., on rocky limestone hilltop, *Proctor 11399*, collected Dec. 23, 1955. Holotype at the Institute of Jamaica; the type material is in fruit.

ADDITIONAL SPECIMENS: from the same locality, *Webster & Proctor 5392*, with young fruits (Herb. Arnold Arboretum); *Proctor 9760*, January 7, 1955, with buds and fruits.

The present new species was for a time doubtfully identified with *C. maxonii*, but clearly differs from that species in its terete, tomentose branchlets; larger and more deeply cordate leaves; longer peduncles bearing but 2 or 3 sessile flowers (instead of "3 heads of (to 12) sessile flowers, the 2 lateral heads more or less stalked"); and much larger buds. The fruits of *C. maxonii* evidently are not known; those of *C. clarendonensis* tend to have more seeds than is usual in this genus.

From *C. cardiophylla* Urb. of eastern Cuba, with which *C. clarendonensis* seems to show a near relationship, the latter differs by the leaves entirely lacking the "densely impressed-punctate" character of the upper surface and by differences in the nature of the pubescence. The flowers and fruits of *C. cardiophylla* were unknown to Urban, but more recently-collected material (*Alain 3352*), with buds, suggests that these structures are smaller in the Cuban species.

Calyptranthes ekmanii Urban, Ark. Bot. **22A** (10): 32. 1929. Sterile material apparently conspecific with this small tree of southwestern Haiti has been collected in moist elfin woodland on the east slope of the John Crow Mountains, Parish of Portland, *Proctor 9820*. This is a new record for Jamaica.

Myrcia skeldingi Proctor, sp. nov. Arbuscula circa 5 m. alta; ramulis, petiolis, nervo medio foliorum subtus, et inflorescentiae ramis superioribus sparsim strigillosis, deinde glabratis. Folia coriacea et sine punctis pellucidis, subsessilia (petiolis crassis, 1–2 mm. longis), 5.5–10 cm. longa, 3.5–6 cm. lata, late elliptica vel ovato-elliptica, apice plerumque rotundata vel obtusa, basi subcordata vel rotundata, nervo medio supra impresso, subtus prominente, venulis crebris et tenuibus reticulatis utrinque sed praecipue subtus prominulis. Paniculae terminales multiflorae, plerumque 7–14 cm. longae lataeque, pedunculo 0.5–1 cm. longo, ramis ultimis plerumque dichasiam 3–5-floram terminalem ferentibus. Tubus calycis 1.5 mm. longus, glaber, paulum supra ovarium productus, 4-lobatis, lobis circa 0.75 mm. longis; petalis albis, glabris, ca. 1 mm. longis; antheris bilocularibus; stylo ca. 3.5 mm. longo, stigmate peltato. Baccae globosae, glabrae, ca. 6 mm. diametro, maturae rubrae, seminibus 1–3, (3)–4 mm. longis.

Small tree c. 5 m. tall; youngest branchlets, petioles, midribs of leaves beneath, and upper inflorescence-branches sparsely strigillose, all parts becoming glabrate with age. Leaves coriaceous and without pellucid dots, subsessile (petioles thick, 1–2 mm. long) 5.5–10 cm. long, 3.5–6 cm. wide, broadly elliptic or ovate-elliptic, the blades mostly rounded or blunt at the apex, with base subcordate or rounded; midrib impressed above, prominent beneath, the finely-reticulate venation prominulous on both sides but especially beneath. Panicles terminal, many-flowered, mostly 7–14 cm. long and broad, the basal stalk (peduncle) 0.5–1 cm. long, the ultimate branches mostly ending in 3–5-flowered dichasia. Calyx with tube 1.5 mm. long, glabrous, slightly prolonged above the ovary, 4-lobed, the lobes c. 0.75 mm. long; petals white, glabrous, c. 1 mm. long; anthers 2-celled; style c. 3.5 mm. long, with peltate stigma. Berries globose, c. 6 mm. in diameter and deep red when ripe, with 1–3 seeds, these (3)–4 mm. long.

TYPE: Parish of Clarendon, Mason River Savanna, 2.75–3 miles northwest of Kellits, elev. c. 2300 ft., in thickets along stream, *Proctor 16478*, collected July 9, 1957. Holotype at the Institute of Jamaica; the type material has flowers and young fruits.

ADDITIONAL SPECIMEN: from the same locality, *Proctor 16734*, collected Oct. 14, 1957, with ripe fruits.

Myrcia skeldingi is easily distinguished from other Jamaican congeners (and most species elsewhere) by its subsessile, more or less subcordate, blunt-tipped leaves and 4-lobed calyx. In the latter character it is an anomalous member of its genus. This species shows a rather close resemblance to a group of Brazilian forms, especially *M. uberavensis* Berg (=*M. cardiophylla* Reicht. ?), but the latter clearly differ in having 5-parted flowers and in other individual details.

Named for Prof. A. D. Skelding of the Department of Botany, University College of the West Indies, who first pointed out to the writer the botanical richness of the Mason River Savanna area where this species is apparently endemic.

Eugenia jeremiensis Urb. & Ekm., Ark. Bot. **24A** (4): 29. 1931. JAMAICA: Parish of Hanover, interior summit slopes of Dolphin Head, on moist wooded limestone hillside, *Proctor 10032* and *10416*.

The specimens cited above were originally believed by the writer to represent an undescribed species, but subsequent comparison with type material of *E. jeremiensis* (from southwestern Haiti) strongly suggests that they are conspecific. Ekman's specimens of the latter species in the Institute of Jamaica herbarium are, however, sterile, and the Jamaican plants may yet prove to be different. In any case, this material represents a new record for Jamaica. It can be described as follows:

Shrub or small tree reaching at least 5 m. in height; branchlets terete or slightly compressed near the end, glabrous. Leaves coriaceous, glabrous, 10–12 cm. long by 7–9 cm. broad, ovate-orbicular with rounded apex, the base of the blade broadly cuneate, dark green above and paler beneath with numerous minute faintly pellucid punctate dots; midrib slightly impressed near the base on the upper side, but flat or slightly raised toward the apex, very prominent beneath, especially near the base, with side-veins and venules prominulous on both sides; petioles thick, furrowed above, 2–3 mm. long. Flowers paired in the upper leaf-axils; pedicels 2.5 cm. long, stout (1–1.5 mm. in diameter); bracteoles united at the base, broadly deltoid-ovate, obtuse, 1 mm. long; sepals apparently roundish, unequal, the longer 1.4 cm. long, the shorter 1 cm. long (seen in bud only). Expanded flowers and fruits not seen.

The flowers of this species, when open, must be larger than those of any other indigenous *Eugenia*.—INSTITUTE OF JAMAICA, KINGSTON, JAMAICA, W.I.

TYPIFICATION OF THE GENUS FORESTIERA (OLEACEAE)[1]

In preparing the treatment of the genera of the Oleaceae of the southeastern United States, I found it necessary to determine the type of the genus *Forestiera*. Two different species have already been chosen as the type, and the problem was to discover which one was correct. *Forestiera acuminata* (Michx.) Poir. was designated by Britton and Brown (Ill. Flora ed. 2. **2**: 278. 1913) and by A. Rehder (Bibl. Cult. Trees & Shrubs p. 576. 1949) as the type of the genus while M. C. Johnston (Synopsis of the United States species of *Forestiera* (Oleaceae). Southwestern Nat. **2**: 141. 1957 [1958]) maintained that the type species is *Adelia porulosa* Michx. After reviewing the literature, however, I have reached still another conclusion.

The genus *Adelia* was described by Patrick Browne in 1756 (Civ. Nat. Hist. Jamaica p. 361), but he listed only the polynomial "ADELIA I. *Foliis obovatis, oppositis; spicillis alaribus* [sic]; *cortica cinereo,*" and made no binomial combination. He did, however, include a short description and an illustration of the male plant (Tab. 36, fig. 3) which he said was "common in the low gravelly hills eastward of *Kingston.*"

Michaux (Flora Boreali-Americana **2**: 223. 1803) adopted the name *Adelia* ("ADELIA. Brown.") and described three species, making the proper binomial combinations. These species were *Adelia porulosa* ("HAB. in maritimus Floridae"), *A. ligustrina* ("HAB. in fruticetis Illinoensibus, Tennasée, &c"), and *A. acuminata* ("HAB. ad ripas fluviorum Carolinae et Georgiae). Browne's plant was not named by Michaux.

Willdenow (Sp. Pl. ed. 4. 4: 711. 1806) proposed the name *Borya* for the genus, and listed "*Adelia Mich.* amer. 2. *p.* 223" in synonymy. He included 4 species in his treatment: *Borya cassinoides* Willd., based on Browne's description and also a Richard specimen ("*Habitat in* Antillis"); *Borya porulosa* Willd., based on *Adelia porulosa* Michx. ("*Habitat in maritimis* Floridae"); *Borya ligustrina*, and *Borya acuminata.* Willdenow, therefore, included Michaux's three species in his treatment, but,

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[1] Continuing a series of miscellaneous notes and papers on the flora of the southeastern United States made possible through the interest and support of George R. Cooley and a grant from the National Science Foundation.

in addition, described and named Browne's plant upon which the genus *Adelia* was based. The name *Borya* Willd., however, was a later homonym of *Borya* Labill. (Liliaceae).

Forestiera was the name proposed for this genus in 1810 by Poiret (Encycl. Méth. Suppl. 1: 132. 1810) who cited both *Adelia* Michx. and *Borya* Willd. in the synonymy. Among the four species listed by Poiret (op. cit. 2: 663–665. 1811 [1812]) are *Forestiera cassinoides,* based on *Borya cassinoides* Willd. and Browne's description and figure ("Cette plante croît aux Antilles. (*Herb. Richard.*)") and *Forestiera porulosa,* based on *Borya porulosa* Willd. and *Adelia porulosa* Michx. ("Cette plante croît dans la Floride, sur les côtes de la mer.").

It is clear, then, that Patrick Browne's plant bears the specific epithet *cassinoides,* (not *porulosa*). Moreover, since this is the species upon which P. Browne's *Adelia* is based (and therefore also *Borya* Willd. and *Forestiera* Poir.) it should be considered as the type of the genus. Since *Adelia* L. (Euphorbiaceae) has been conserved over *Adelia* Browne, the correct name for the genus is *Forestiera* Poir., but the type remains the same.

The type species of the genus *Forestiera* is *Borya cassinoides* Willd. (=*Adelia cassinoides* (Willd.) O. Ktze. =*Forestiera cassinoides* (Willd.) Poir.).—Kenneth A. Wilson, GRAY HERBARIUM AND ARNOLD ARBORETUM.

A NEW RHODODENDRON STATION IN MAINE.—As a result of an intensive botanical and horticultural study of native *Rhododendron maximum* colonies in Maine and New Hampshire, one hitherto unreported stand has come to our attention. Professor Elwyn Meader of the Department of Horticulture, University of New Hampshire learned of it first and called it to the attention of the senior author.

A visit was made by the authors and notes taken on November 4, 1957. This is a very small colony consisting of rather uniform plants standing about 2½ feet high and covering an area about 10 feet long and 6 feet wide. It is situated a short distance in from the north shore of Horn Pond, Acton, York County, Maine, and is not more than ¼ mile from the Maine-New Hampshire boundary. The environment is a mixed forest on a gentle south-facing slope. Deciduous species predominate but some large trees of *Pinus*

Strobus and *Tsuga canadensis* occur not far away. The Rhododendrons are obviously young and it might be thought, therefore, that the colony is new and was established there recently either with the help of man or by means of natural migration. However, there is no information that the colony was planted nor is it likely that an attractive ornamental species would be planted in this kind of situation. The nearest known natural colony is the well known one in Sanford which is more than 11 miles away. It seems improbable that *R. maximum* with its particularly relic character in New England traversed this distance in recent years.

It may be more reasonable to conclude that there was formerly a larger colony in the area. Lumbering which is known to us as having been disastrous to other Rhododendron stands was formerly carried on at the Acton site and probably resulted in the almost complete destruction of the Rhododendrons. Fortunately, a few have survived. Now it will be interesting to see if it will regain its former abundance in future years.—RADCLIFFE PIKE AND A. R. HODGDON, DEPARTMENT OF HORTICULTURE AND DEPARTMENT OF BOTANY, UNIVERSITY OF NEW HAMPSHIRE, DURHAM.

THE TYPE OF VAUCHERIA COMPACTA var. KOKSOAKENSIS.—In describing this variety on page 286 of Rhodora, Volume 60, we inadvertently neglected to cite the type specimen. The following should have appeared on that page. TYPE: *R. C. Wilce 830,* collected on the eastern shore near the mouth of the Koksoak River, Québec, Canada, Sept. 1, 1955, in the herbarium of the New York Botanical Garden.—JOHN L. BLUM AND ROBERT T. WILCE.

Volume 60, No. 719, including pages 289–308, was published 15 December, 1958.

ERRATA

Cover, No. 710, line 3; for **Mid-arrowed,** read **Mid-arrowhead.**
Cover, No. 710, line 7; for **Glen J. Winterringer** read **Glen S. Winterringer.**
Page. 34, line 7; for *repens*, read *reptans.*
Page 37, line 15; for *repens,* read *reptans.*
Page 41, line 29; *for* listed either, *read* listed either because.
Page 48, line 12; *for* Colorado, *read* southern Alberta.
Page 58, line 4; *for* Fasset, *read* Fassett.
Cover, No. 711, line 9; *for* 76, *read* 86.
Page 90, line 32; *for* constancy, *read* consistency.
Page 272, line 7; *for* oppositis supra, alternis infra; *read* oppositis infra, alternis supra.
Page 282, line 11; *for* mm., *read* m.
Page 282, line 16; *for* 10–14 cm., *read* 10–14 mm.
Page 282, line 27; *for* hirsute, *read* hispid.

INDEX TO VOLUME 60

New scientific names and combinations are printed in bold face type