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CONTRIBUTIONS FROM THE GRAY HERBARIUM OF HARVARD UNIVERSITY—NO. CXXXI

I. STUDIES IN THE GENUS HEDYSARUM IN NORTH AMERICA

REED C. ROLLINS[1]

(PLATE 597)

SETACEOUS processes upon the reticulate lines or rib-like markings of the loments of *Hedysarum* are found in species which occur in northern Africa, certain parts of Europe and in Asia, but no species with this unusual characteristic has been recorded from America. It was, therefore, quite surprising when in 1937 plants of this genus with fruits bearing numerous setae were discovered growing in a decidedly undisturbed native habitat in the Uinta Basin of northeastern Utah. This discovery immediately raises the question as to whether these outgrowths upon the fruits are merely parallel developments in unrelated sections of *Hedysarum* or whether they indicate a close fundamental relationship between all species that possess them, despite wide geographic separation. If the latter is true, it will be agreed that a new interpretation of the geographical distribution of *Hedysarum* must be made, properly relating our new plant to those of the Old World. Since its discovery, the new plant has received intermittent attention with the view to determining its relationships and probable position in *Hedysarum* as a whole. To elucidate facts of relationship, distribution and speciation, and

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in order to present a coördinated picture of the genus as it occurs in North America south of the Yukon Territory and Alaska, a rather detailed consideration of *Hedysarum* has been necessary. The Yukon Territory and Alaska have been excluded from the present treatment because much of the material which ought to be studied is in the hands of Dr. Eric Hultén in Sweden and its return to America must await the termination of the present war. There are no questions involving name-priority which would be affected by specific names based on plants from this area.

De Candolle[1] in his monumental work upon the Leguminosae used, in part, muricate or glochidiate processes on the fruits to characterize section *Echinolobium* of *Hedysarum* and to separate it from the only other section recognized, *Leiolobium*. The two sections were clarified in his Prodromus[2] by the actual listing of the species belonging to each. That this classification was drawn along artificial lines apparently was first recognized by Basiner,[3] who reclassified the genus by using an entirely new set of characters. The essential features of Basiner's treatment have been accepted and used by Boissier[4] and more recently by Fedtschenko[5] in his world-wide monograph of the genus. The latter work[6] has been the most valuable single reference during the course of the present study, but the treatment of American plants is not satisfactory and reflects, perhaps, an inadequacy of material upon which the monographer based his decisions regarding our species. All the American plants were placed by Fedtschenko in "subtribe" *Gamotion*, which supposedly contained only those species with at least the lower stipules united. Actually, of the two separable groups of species found in America, one has the lower stipules frequently partially free and those above often entirely free, the other has the lower stipules always united and the upper somewhat united or in rare instances nearly free. On the basis of united or free stipules alone, some of our plants would fall into "subtribe" *Eleutherotion* where they obviously do not

[1] Mem. Legumin. 345 (1825).
[2] Prod. Syst. Nat. **2**: 340–44 (1825).
[3] Mem. Acad. Petrop. **6**: 45–97 (1846).
[4] Fl. Orientalis **2**: 511–25 (1872).
[5] Acta Hort. Petrop. **19**: 185–325 (1902).
[6] I am indebted to Mr. F. J. Whitefield, one of my colleagues in the Society of Fellows, for translating several passages from the Russian.

belong. In view of this fact, it appears that the use of this stipule-character, without others to support it, leads to a somewhat artificial division of *Hedysarum,* at least in so far as the American species are concerned.

Plants of *Hedysarum* in North America are divisable into two natural groups. One, which fits into section *Obscura* of Fedtschenko, has prominently veined leaflets; articles of the loment wing-margined, surface reticulations or areolae of the articles nearly as broad as long; unequal calyx-teeth which are much shorter than the tube, and linear wing-auricles which are united under the standard and equal or exceed the claw of the wings in length. In this group belong *H. alpinum, H. occidentale* and *H. sulphurescens.* In the other group, which does not fit clearly into any of the published subdivisions of the genus, the leaflet-veins are hidden; the articles of the loments are wingless, surface reticulations or areolae are transversely oblong to rectangular, hence much longer than broad; the nearly equal calyx-teeth are linear-subulate and longer than the tube; and the wing-auricles are free, short, broad and less than a third the length of the wing-claw. Here I place *H. boreale, H. Mackenzii* and *H. gremiale.* The characters which have been used to separate these two groups are surprisingly definite and have stood the test of dozens of flower-dissections in American material. It doubtless is true that this subdivision can be employed in classifying certain Asiatic species of *Hedysarum,* as a cursory examination of some of them has indicated, but it is not my purpose to so extend the present investigation.

As indicated above, *H. boreale, H. Mackenzii* and *H. gremiale* are not well-placed in any of the established subdivisions of *Hedysarum,* but according to the treatment of Fedtschenko they must be referred to section *Multicaulia.* Into this section both spiny-fruited and spineless-fruited species are admitted. That species with both types of fruit are sufficiently related to be placed in the same section of *Hedysarum* appears to be in accord with the facts, for my own studies indicate that *H. gremiale* is more nearly related to *H. boreale* var. *cinerascens* than to any spiny- or setose-fruited species from Africa, Europe or Asia. It must be concluded, therefore, that the discovery of a setose-fruited species of *Hedysarum* in America does not mean that there has been a recent genetical connection between this species and those of the Old World, but that this striking feature of the loment has probably arisen independently in America from forms without spiny fruits. Such a supposition is supported to some extent by the fact that occasional plants of *H. boreale* var. *cinerascens* tend to have muricate reticulations on the loment-segment over the seed, and, in at least one case (*Tweedy* no. 132 from the Tongue River in Wyoming), short but definite nubbin-like spines have been developed.

I am indebted to the curators of herbaria in the following institutions who have loaned material or made facilities available for my use: Gray Herbarium of Harvard University (G); Forest Service, U. S. Department of Agriculture (FS); North Dakota Agricultural College (NDA); New York Botanical Garden (NY); U. S. National Museum (US). Dr. Theodor Just of the University of Notre Dame has supplied pertinent information concerning some of Greene's types. Cited collections followed by the symbol (R) are in my own herbarium.

Synopsis of the genus Hedysarum L. in North America, excepting Alaska and the Yukon Territory

Herbaceous perennials; stems several to numerous from a ligneous root, decumbent to erect, terete, more or less longitudinally grooved, usually appressed-pubescent at least above, often densely so; leaves odd-pinnate, petiolate, leaflets nearly sessile, often apiculate, mostly puncticulate above; stipules united or sometimes free, chartaceous; inflorescence racemose, axillary, peduncled; flowers erect to reflexed, pink to purple, yellowish or white; calyx bracteolate, campanulate, five-toothed, pubscent; corolla glabrous, wings and standard shorter than the keel; stamens diadelphous (9 & 1), included; fruit a loment with elliptical to suborbicular articles; single-seeded articles pubescent or glabrous, areolate, wing-margined or the wings absent; loments usually stipitate.

Key to the Species

a. Auricles of the wings united, linear, equaling or nearly equaling the claw; calyx-teeth markedly unequal, upper nearly triangular; articles of loment wing-margined, areolae about as broad as long; leaflets conspicuously veined.

b. Articles of the loment 3.5–5 mm. broad, narrowly wing-margined, nearly orbicular to slightly oblong; flowers less than 18 mm. long; leaflets mostly oblong to narrowly oblong, 4–7 (–10) mm. wide 1. American varieties of *H. alpinum.*

b. Articles of the loment 6–13 mm. broad, conspicuously wing-margined, elliptical to broadly oblong; flowers at least 16 mm. long or if shorter then sulphur-yellow; leaflets mostly ovate to ovate-lanceolate, 6–14 (–20) mm. wide.

c. Flowers sulphur-yellow, 15–18 mm. long; leaflets glabrous above; loments glabrous; keel truncate ..... 2. *H. sulphurescens.*

c. Flowers reddish-purple, 16–20 mm. long; leaflets usually pubescent above; loments pubescent or very rarely glabrous; keel rounded .... 3. *H. occidentale.*

a. Auricles of the wings not united, blunt, much shorter than the claw; calyx-teeth nearly equal, linear-subulate; articles of the loment wingless, areolae transversely elongated; leaflet-veins hidden.

d. Articles of the loment covered with setae; loments divaricate; leaflets pubescent on both sides .... 4. *H. gremiale.*

d. Articles of the loment free of setae; loments divaricate to pendent; leaflets glabrous above or pubescent on both surfaces.

e. Inflorescence elongated; stems branched above, 2–6 dm. high; stipules dark brown; leaflets pubescent on both surfaces or glabrous above, usually dull slate-colored above; flowers 12–19 mm. long; nodes of the loment narrow, less than half as broad as the articles; articles 2–5 .... 5. *H. boreale.*

e. Inflorescence congested; stems usually unbranched above, 1–3.5 dm. high; stipules whitish-translucent, brown-streaked; leaflets green and glabrous above, rarely slightly pubescent; flowers 18–21 mm. long; nodes of the loment more than half as broad as the articles; articles 4–8 ....6. *H. Mackenzii.*

1. American Varieties of H. alpinum. Herbaceous perennial, stems numerous, terete, longitudinally grooved, branched above, sparsely appressed-pubescent, 2–7 dm. high; stipules connate, brown, 5–15 mm. long, lower large and obtuse, upper acute; leaves petiolate, 6–15 cm. long; leaflets 15–21, glabrous and obscurely puncticulate above, sparsely pubescent (particularly along mid-vein and margins) below, prominently veined, broadly lanceolate to oblong, usually obtuse, rarely nearly acute, apiculate, 10–25 mm. long, 5–10 mm. wide; inflorescence racemose, elongated, often somewhat secund; flowers deflexed, 12–18 mm. long, reddish-purple; calyx pubescent, teeth unequal, 1–2 mm. long, shorter than the tube, upper short and triangular, lower narrower and longer; standard broadly spatulate to obovate, emarginate, 11–14 mm. long; wings narrowly oblong to linear, blunt, 10–13 mm. long, about 2 mm. wide, claw 2–3 mm. long, wing-auricles linear, united beneath standard, equaling the claw;

loments mostly stipitate, glabrous to appressed-pubescent, pendent; articles 2–5, rarely one, 5–7 mm. long, 3.5–5 mm. wide, suborbicular to slightly longer than broad, wing-margined; areolae mostly polygonal, nearly as broad as long.

Key to the American Varieties of H. alpinum L.

Loments glabrous to very sparingly pubescent along the margins.
- Flowers 12–15 mm. long; inflorescence elongated; stems nearly erect, 3–5 dm. high .... 1a. var. *americanum*.
- Flowers 15–18 mm. long; inflorescence subcapitate to somewhat elongated; stems decumbent, 2–4 (–5) dm. high 1b. var. *grandiflorum*.

Loments pubescent on both surfaces, rarely glabrate .... 1c. var. *philoscia*.

1a. Var. americanum Michx. ex Pursh, Fl. Am. Sept. **2:** (1816); Fernald in Rhodora **28:** 216 (1926); Raup in Contrib. Arn. Arb. **6:** 181 (1934); Bull. Nat. Mus. Can. **74:** 148 (1935). *H. alpinum americanum* Michx., Fl. Bor.-Am. **2:** 74 (1803). *H. alpinum* sensu Marie-Victorin, Fl. Laurent. 352 (1935), non L. *H. alpinum* subsp. *americanum* Fedtsch. in Acta Hort. Petrop. **19:** 255 (1902) in part. *H. alpinum* var. *americanum* f. *albiflorum* Fernald in Rhodora **35:** 275 (1933). *H. americanum* Britt. in Mem. Torr. Bot. Club **5:** 201 (1894); Britt. and Brown, Ill. Fl. **2:** 311 (1897); Rydberg, Fl. Rky. Mts. adj. Plains 524 (1917); Fl. Pr. Pl. Cent. N. Am. 487 (1932). *H. boreale* sensu De Candolle, Prod. Syst. Nat. Veg. **2:** 343 (1825) in part; Hooker, Fl. Bor.-Am. **1:** 155 (1834); Torrey and Gray, Fl. N. Am. **1:** 356 (1838); Wood, Classbook Bot. ed. 2, 230 (1847); Gray, Man. ed. 2, 98 (1856); Provancher, Fl. Canad. **1:** 151 (1862); Stevens, Fl. Plants, 348 (1910); Henry, Fl. So. Brit. Columb. 192 (1915); non Nuttall.—Newfoundland to northern Maine and Vermont; Manitoba to British Columbia and probably Alaska. Newfoundland: Bard Harbor Hill, Highlands of St. John, Aug., 1925, *Fernald & Long 28627* (G); Bishop Falls, valley of Exploits River, July, 1911, *Fernald, Wiegand & Darlington 5800* (G); Grand Falls, valley of Exploits River, July, 1911, *Fernald, Wiegand & Darlington 5798* (G). Quebec: between Mont Louis and Rivière à Pierre, Aug., 1923, *Fernald & Smith 25875* (G); Gulf of St. Lawrence, east of Marten River, Gaspé Co., July, 1922, *Fernald & Pease 25171* (G); St. John River, Gaspé Co., Aug., 1904, *Collins, Fernald & Pease* s. n. (G); Tourelle, Gaspé Co., July, 1924, *Pierce & Hodge 7a* (G); Bic, Rimouski Co., July, 1904, *Collins & Fernald* s. n. (G); Aug., 1927, *Rousseau 26823* (G); Renard River, Anticosti Island, Aug., 1927, *Marie-Victorin & Rolland-Germain 27354* (G); Natiskotek River, Anticosti Island, Aug., 1927, *Marie-Victorin & Rolland-Germain 27356* (G); between Baldé and Baie des Chaleurs, Bonaventure Co., Aug., 1904, *Collins, Fernald*

& Pease s. n. (G); Lake St. Jean, July, 1921, *Marie-Victorin* s. n. (G). NEW BRUNSWICK: Gorge of the Aroostook River, Victoria Co., Aug., 1909, *Fernald 1962* (G); July, 1902, *Williams, Collins & Fernald* s. n. (G); Connors, St. John River, July, 1903, *Pease 2262* (G). MAINE: St. John River, St. Francis, July, 1932, *Pease & Goodale 67773* (G); Aug., 1893, *Fernald 26* (G); Fort Fairfield, July, 1902, *Williams, Collins & Fernald* s. n. (G); Fort Kent, July, 1908, *Mackenzie 3536* (NY). VERMONT: Willoughby, July, 1887, *E. & C. E. Faxon* s. n. (G); Aug., 1874, *Congdon* s. n. (G); Smuggler's Notch, Mt. Mansfield, July, 1894, *Eggleston* s. n. (G, NY); Aug., 1877, *E. & C. E. Faxon* s.n. (G); July & Aug., 1877, *Pringle* s. n. (G). MANITOBA: 6 miles east of Forest, June, 1906, *Macoun & Heriot 70783* (G). SASKATCHEWAN: 30 miles east of Touchwood, July, 1906, *Macoun & Heriot 70784* (G); Duck Lake, July, 1913, *Johnson 1375* (NY). ALBERTA: Kootenai Plains, North Branch Saskatchewan River, June, 1908, *Brown 946* (G, NY); Peace Point, Wood Buffalo Park, Aug., 1928, *Raup 2803* (G); Government Hay Camp district, Wood Buffalo Park, Aug., 1928, *Raup 2807* (G); Water Coulee, near Rosedale, June, 1915, *Moodie 948* (G.); Calgary, June, 1903, *Barber 240 & 262* (G.); near Banff, Aug., 1900, *Prince* s. n. (G.); July, 1897, *Van Brunt 20* (NY); Cypress Hills, June, 1894, *Macoun 4534* (G). BRITISH COLUMBIA: vicinity of Hudson Hope, June, 1932, *Raup & Abbe 3626* (G).

1b. Var. **grandiflorum,** var. nov. Herba perennis; caulibus decumbentibus, 2–4 (–5) dm. longis; floribus purpurascentibus, 15–18 (–19) mm. longis.—*H. alpinum* sensu Fernald in RHODORA **13:** 119 & 129 (1911); ibid. **28:** 216 (1926); ibid. **35:** 275 (1933); Raup in Contrib. Arn. Arb. **6:** 181 (1934); non L. *H. alpinum* var. *americanum* sensu Ostenfeld in Vidensk. Selsk. Skrift. I Klasse, no. 8, 55 (1909), non Michx. ex Pursh.—Labrador, Newfoundland, northern Alberta and British Columbia. LABRADOR: Forteau, 1870, *S. R. Butter* s. n. (G). NEWFOUNDLAND: Port à Port, July, 1921, *Mackenzie & Griscom 10332* (G, US); Table Mountain, region of Port à Port Bay, July, 1914, *Fernald & St. John 10849* (G); Cook Point, Pistolet Bay, July, 1925, *Fernald & Gilbert 28622* (G); Anse aux Sauvages, Pistolet Bay, Aug. 11, 1925, *M. L. Fernald, K. M. Wiegand & Bayard Long 28625* (G, TYPE); west of Big Brook, Straits of Belle Isle, *Long & Gilbert 28620* (G); Sandy Cove, Straits of Belle Isle, Aug., 1924, *Fernald, Long & Dunbar 26810* (G); Killdevil, Bonne Bay, Aug., 1929, *Fernald, Long & Fogg 1835* (G); Eastern Point, region of St. John Bay, July, 1929, *Fernald, Long & Fogg 1833* (G). ALBERTA: head of Malique Lake, July, 1908, *Brown 1218* (G, NY); Cataract Cr., headwaters of the Saskatchewan and Athabasca Rivers, Aug., 1908, *Brown 1452* (G); head of Smoky

River, Aug., 1911, *Riley 36* (G). British Columbia: Mt. Selwyn, July, 1932, *Raup & Abbe 3967 & 4091* (G).

1c. Var. **philoscia** (A. Nels.) comb. nov. *H. philoscia* A. Nelson in Proc. Biol. Soc. Wash. **15:** 185 (1902); Coulter and Nelson, Man. Bot. Cent. Rky. Mts. 300 (1909). *H. boreale* sensu Rydb., Fl. Rky. Mts. adj. Plains 524 (1917); Fl. Pr. Plains Cent. N. Am. 487 (1932); non Nuttall.—Saskatchewan and Alberta to South Dakota and Wyoming. Saskatchewan: without locality, 1858, *E. Bourgeau* s. n. (G, NY). Alberta: Fort Saskatchewan, July, 1938, *Turner 58 & 59* (G). South Dakota: Rochford, Black Hills, July, 1892, *Rydberg 640* (G); Black Hills, July, 1872, *Greene 13* (NY); near Custer Peak, Lawrence Co., June, 1929, *Palmer 37554* (G); Deerfield, Pennington Co., June, 1929, *Palmer 37509* (G). Wyoming: Boyd, Weston Co., July, 1910, *A. Nelson 9436* (G); Willow Creek, Albany Co., July, 1897, *A. Nelson 3367* (G); Crow Creek, Albany Co., Aug., 1903, *A. Nelson 8955* (G); Laramie Hills, Albany Co., July, 1901, *E. Nelson 622* (G, NY).

In eastern Asia, as in America, there are several phases and varieties of *H. alpinum.* The exact application of Linnaeus' name to Siberian material, except in the broad sense, has not been attempted in the present study. It is evident from a careful examination of Siberian specimens of *H. alpinum* in the Gray Herbarium and in the United States National Herbarium, that the plants heretofore passing as *H. boreale* in such works as Torrey and Gray's Flora[1] and Gray's Manual,[2] and as *H. americanum* in Britton and Brown's Flora[3] and Rydberg's Flora[4] are not specifically distinct from those of eastern Asia. However, the North American plants do differ in certain minor ways and should be considered as separate varieties of a wide-ranging species, *H. alpinum,* which extends from Asia across the north to Newfoundland, Gaspé and Maine and southward along the mountains of western America. Such a treatment indicates clearly the relationships of our plants with those of Asia, and at the same time shows that the American plants have certain special characteristics which are not possessed by those of the Old World. The differences separating the Old World plants from those of the New, particularly those emphasized by Hooker,[5] are at best

[1] Fl. N. Am. 1: 356 (1838).
[2] Robinson and Fernald in Gray's Manual 7th. ed. 518 (1908).
[3] Ill. Fl. 2: 311 (1897).
[4] Fl. Rky. Mts. adj. Plains 524 (1917).
[5] Fl. Bor.-Am. 1: 155 (1834).

only trivial. Certainly the actual differences are not of sufficient importance to justify specific segregation and, in my opinion, it is a mistake to obscure the natural relationships of our plants by giving them a separate specific epithet. The misapplication of the name *H. boreale* is dealt with under that species.

H. alpinum in America has three geographic varieties which are very closely related, but which have certain characteristics peculiar to themselves. Variety *philoscia* is very similar to var. *americanum* except for its densely pubescent instead of glabrous fruits. This difference is not absolute, for there are specimens with fruits pubescent along the margins or even with a very few trichomes along the edges of the flat surfaces of the loments which I have referred to var. *americanum*. Plants of the latter type are apparently of rare occurrence, but they indicate that intermediates between the two varieties actually exist and that attempts to establish either as a distinct species should be regarded with suspicion. Variety *grandiflorum* is a more dwarfed, larger-flowered plant than its nearly related var. *americanum*, and the two are usually quite easily distinguished, but here again, as far as herbarium material shows, there is a gradual transition from one to the other. Variety *grandiflorum* inhabits the headlands of Newfoundland and barrens of northern Canada, while var. *americanum* ranges southward in more favorable habitats. Their most distinctive characters have been set forth in the key above.

2. H. SULPHURESCENS Rydberg. Herbaceous perennial, stems several to numerous from a ligneous root, shallowly furrowed longitudinally, branched above, appressed-pubescent, 2–6 dm. high; stipules united, brown, chartaceous, lower obtuse, 1–1.5 cm. long, upper acute to acuminate, reduced; leaves petiolate, 8–12 cm. long; leaflets 9–17, elliptical to ovate-oblong, usually apiculate, conspicuously veined, sparsely pubescent below, glabrous and puncticulate above, 15–30 (–40) mm. long, 5–10 (–15) mm. wide; inflorescence axillary, racemose, elongated; flowers pendent, ochroleucous to yellow, 15–18 mm. long; calyx pubescent, teeth unequal, shorter than tube, 1–3 mm. long, upper shorter and broader than the lower; standard obovate-cuneate, emarginate, 12–14 mm. long, 6.5–8 mm. wide; wings obtuse, 12–14 mm. long, 2.5–3 mm. wide, wing-auricles linear, united under standard, equaling the claw, 3–3.5 mm. long; keel sharply truncate; loments pendent, stipitate, articles 1–4, conspicuously wing-margined,

glabrous, asymetrically elliptical, 8–12 (15) mm. long, 6–8 (9) mm. wide; reticulations not raised, polygonal.—Bull. Torr. Bot. Club **24:** 251 (1897); Mem. New York Bot. Gard. **1:** 257 (1900); Piper in Contrib. U. S. Nat. Herb. **11:** 367 (1906); Coulter and Nelson, Man. Bot. Cent. Rky. Mts. 300 (1909); Rydberg, Fl. Rky. Mts. adj. Plains 523 (1917). *H. flavescens* Coult. and Fisch., Bot. Gaz. **18:** 300 (1893), non *H. flavescens* Regel and Schmalh. ex Regel in Bull. Soc. Sci. Moscow **34:** 21 (1882). *H. boreale* Nutt. var. *flavescens* (Coult. and Fisch.) Fedtsch. in Bull. Herb. Boiss. **7:** 256 (1899). *H. boreale* Nutt. var. *albiflorum* Macoun, Cat. Canad. Pl. **1:** 510 (1884). *H. albiflorum* (Macoun) Fedtsch. in Acta Hort. Petrop. **19:** 252 (1902). *H. boreale* Nutt. var. *leucanthum* sensu M. E. Jones in Proc. Calif. Acad. Sci. **5:** 677 (1895), non *H. Mackenzii* Richards. var. *leucanthum* Greene, Pitt. **2:** 294 (1892).—Alberta and British Columbia to Washington, Idaho and Wyoming. Alberta: Pipestone Valley, July, 1906, *Brown 425* (G); Bow River Valley, June, 1906, *Brown 127* (G); Lake Louise, Aug., 1904, *Edith Farr* s. n. (G); between Lake Louise and Lake Louise Station, Sept., 1927, *Eggleston 21810* (US); Laggan, July, 1904, *J. Macoun* s. n. (G); vicinity of Banff, June–July, 1899, *McCalla 2140* (US). British Columbia: Burgess Trail near Field, July, 1906, *Brown 537* (G); Sept., 1904, *Shaw 591* (G); Crows' Nest Pass, July, 1883, *Dawsan 63* (G); Kananaskis, June, 1885, *J. Macoun* (G, isotype of *H. boreale* var. *albiflorum*). Montana: upper Marias Pass, Aug., 1883, *Canby 93* (G); McDonald's Peak, Mission Range, July, 1883, *Canby 90* (G); Cutbank Creek, Glacier Nat. Park, July, 1934, *G. N. Jones 5425, 5438* and *5513* (G); Mt. Haggin, near Anaconda, July, 1915, *M. E. Jones* s. n. (G); Bozeman, July, 1895, *Shear 5269* (US); Bridger Mts., Gallatin Co., Aug., 1902, *W. W. Jones* (G); Baldy Mountain, Park Co., June, 1912, *Eggleston 8079* (G); Pioneer, July, 1898, *J. K. Uhl* s. n. (G, NDA); Beartooth Mts., 17 miles southwest of Red Lodge, Carbon Co., July, 1939, *Rollins & Muñoz 2828* (G); West Fork of Sun River, Lewis and Clark Nat. For., Aug., 1912, *Saunders 174* (FS); north slope of Pryor Mt., Beartooth Nat. For., June, 1926, *Williamson 2* (FS). Wyoming: Little Tongue River Canyon, Big Horn Mts., Sheridan Co., June, 1936, *L. & R. Williams 3112* (G); 20 mi. west of Dayton, Sheridan Co., July, 1935, *L. Williams 2364* (G); Beartooth Butte, Park Co., Aug., 1937, *L. & R. Williams 3767* (G); near Cody, Yellowstone Nat. Park, July, 1930, *Churchill* s. n. (G); Wraith Falls, Yellowstone Nat. Park, July, 1899, *A. & E. Nelson 5706* (G). Idaho: south end of Lake Pend d'Oreille, July, 1892, *Sandberg, MacDougal & Heller 748* (G); Targhee Nat. For., Aug., 1911, *Willey 161* (FS). Washington: near Winthrop, Okanogan Co., July, 1934, *Thompson 10913* (G);

road to Salmon Meadows, Okanogan Co., June, 1931, *Thompson 7024* (G).

Fedtschenko[1] expressed doubt concerning the ultimate validity of *H. sulphurescens* (*H. albiflorum*) as a specific entity, stating that it was very close to *H. alpinum* var. *japonicum* and an undesignated variety of *H. obscurum.* Recently, Hara[2] named var. *japonicum,* in the sense of Fedtschenko, as a species, which seems to indicate that the relationship is not as close as originally supposed. A careful study of the Asiatic plants referred to, shows that they are in the same species-group, but that they are not conspecific with the American plants. Our plants belong to the "*alpinum*" group, but are actually most closely related to *H. occidentale* on account of the large, widely wing-margined loments. Besides having yellowish instead of reddish-purple flowers, *H. sulphurescens* differs from *H. occidentale* in having glabrous instead of pubescent fruits, smaller flowers and a more sharply angled truncate keel. These two species probably had a common origin, but in my opinion, they have now developed differentiating characters which are constant enough to merit for each the rank of a species. *H. sulphurescens* occupies a unified phytogeographical area in the northern Rocky Mountains and adjacent ranges.

3. H. OCCIDENTALE Greene. Herbaceous perennial, stems several to numerous from a ligneous root, longitudinally furrowed, pubescent, branched above, 3–7 dm. high; stipules brown, chartaceous, united, fragile, lower obtuse, upper acuminate; leaves petiolate to nearly sessile, 8–12 cm. long; leaflets 11–19, ovate, elliptical or broadly oblong, apiculate, sparsely pubescent on both surfaces or rarely glabrous above, puncticulate above, conspicuously veined, 12–25 (–30) mm. long, 7–14 mm. wide; inflorescence racemose, axillary, elongated, 6–13 cm. long; flowers pendent, reddish-purple, 16–20 mm. long; calyx pubescent, teeth unequal, 1–3.5 mm. long, upper short, triangular, lower nearly subulate, shorter than the tube; standard obovate-spatulate, emarginate, 13–15 mm. long, 6.5–7.5 mm. wide at widest point; wings 13–15 mm. long, 2–3 mm. wide, linear-oblong, wing-auricles united under the standard, linear, equaling the claw, 3–4 mm. long; loments pendent, stipitate; articles 1–4, elliptical, conspicuously wing-margined, pubescent or rarely glabrous, 9–14 mm. long, 7–13 mm. wide, reticulations polygonal.—Pitt. **3:** 19

[1] Fedtschenko, op. cit. p. 253.

[2] Journ. Jap. Bot. **15:** 52 (1939).

(1896); Piper in Contrib. U. S. Nat. Herb. **11:** 366 (1906); Piper and Beattie, Fl. Northw. Coast 225 (1915); G. N. Jones in Univ. Wash. Pub. Biol. **5:** 188 (1936). *H. marginatum* Greene, Pitt. **4:** 138 (1900); Rydberg, Fl. Colo. 215 (1906); Fl. Rky. Mts. adj. Plains 524 (1917); Coulter and Nelson, Man. Bot. Cent. Rky. Mts. 300 (1909). *H. uintahense* A. Nelson in Proc. Biol. Soc. Wash. **15:** 186 (1902); Coulter and Nelson, op. cit. p. 300. *H. lancifolium* Rydb. in Mem. New York Bot. Gard. **1:** 256 (1900); Fl. Rky. Mts. adj. Plains 524 (1917).—Washington to Montana, Colorado and Utah. Montana: Moser Mt., Flathead Nat. For., Aug., 1925, *Kirkwood 2187* (G, NY); Thompson Falls, Aug., 1909, *Butler 5058* (NY); Jocko Range, Aug., 1880, *S. Watson 95* (G); near Gunsight Lookout Station, Flathead Nat. For. July, 1928, *Liebig 303* (FS); West Fork Teton River, Lewis and Clark Nat. For., Aug., 1921, *Lane D2–3* (FS). Wyoming: headwaters of Clear Creek and Crazy Woman Creek, Big Horn Mts., July–Aug., 1900, *Tweedy 3193* (NY); Soldier's Park, Big Horn Mts., Aug., 1898, *T. A. Williams* s. n. (US); on the Red Grade near the top, eastern slope of the Big Horn Mts., June, 1934, *Rollins 503* (G, NY); Teton Pass, July, 1920, *E. B. & L. B. Payson 2096* (G, NY); July, 1901, *Merrill & Wilcox 977* (G, NY); Two-gwo-tee Pass, July, 1932, *L. Williams 955* (G); Mt. Wagner, southeast of Smoot, Aug., 1923, *Payson & Armstrong 3749* (G); Evanston, Uinta Co., June, 1900, *A. Nelson 7198* (G, NY, isotypes of *H. uintahense*); near Big Muddy Creek, between Fort Bridger and Evanston, June, 1938, *Rollins 2323* (G); Ashley Nat. For., Uinta Co., June, 1924, *Kane 6* (FS). Utah: near Mill Creek, Summit Co., July, 1926, *E. B. & L. B. Payson 4881* (G, NY). Colorado: White River Nat. For., June–July, 1910, *Reynoldson 81* (FS); 6 miles northwest of the Rio Grande Reservoir, Hinsdale Co., Aug., 1936, *Rollins 1503* (G, NY); Pagosa Springs, July, 1899, *Baker 429* (G, NY); near La Plata, July, 1898, *Baker, Earle & Tracy 464* (G, NY); Silverton, Aug., 1897, *Shear 5227* (NY); foot of Mt. Hesperus, La Plata Mts., Aug., 1892, *Eastwood* s. n. (NY); Rio Grande Nat. For., July, 1924, *Lister 75* (FS). Idaho: hills southeast of Victor, Teton Co., July, 1920, *E. B. & L. B. Payson 2167* (G, NY); Caribou Mt., Bonneville Co., July, 1923, *Payson & Armstrong 3538* (G); ridges south of Wiesner's Peak, July, 1895, *Leiberg 1366* (NY); divide between St. Joe and Clearwater River's, July, 1895, *Leiberg 1213* (G, NY); Waterfall Canyon, Targhee Nat. For., July, 1929, *Richwine 4* (FS); head of Georgetown Canyon, Caribou Nat. For., June, 1926, *Phinney 89* (FS). Washington: *Olympic Mts.:* without definite locality, July, 1890, *Henderson 1850* (G); 1889, *Grant 156* (G); Aug., 1895, *Piper 2227* (US); June, 1900, *Elmer 2529* (US); Mount Angeles, Aug., 1931, *Thompson 7831* (G); July, 1933, *Thompson 9471* (G, US); Hurricane Ridge, Sept., 1937, *Thompson 14176* (G, US); Blue Mountain, Deer Park Recreational Area, Aug., 1938, *Rollins & Chambers 2693* (G); Bogachiel Ridge, headwaters of the Hoh River, Aug., 1938, *Rollins & Chambers 2704* (G); Mt. Colonial Bob, July, 1931, *Thompson 9968* (G, US); Aug., 1933, *Thompson 9968* (G); Mt. Baldy, July, 1897, *Lamb 1318* (US).

H. occidentale is most nearly related to *H. sulphurescens,* from which it differs in having reddish-purple instead of light yellow flowers, usually pubescent instead of glabrous fruits and more leaflets on each compound leaf. There are 13 to 19 leaflets with pubescent upper surfaces in *H. occidentale,* whereas in *H. sulphurescens* the 9–15 leaflets are glabrous above. Also, the flowers and fruits of the former are uniformly larger than those of the latter. Both these species are related in a general way to the American varieties of *H. alpinum,* but the very much larger and more broadly winged loment-articles of *H. occidentale* and *H. sulphurescens* are not matched by any other American species of the genus.

The known geographical distribution of *H. occidentale* is of interest because of the total absence of this plant from the intervening area between the Olympic Mountains of western Washington and the mountains of northern Idaho. Many other plants of boreal dispersion have a similar distribution. Doubtless a continuous range once existed to the northward, but such a continuity could hardly have survived the glacial activity which is known to have taken place in the area. This explanation presupposes a preglacial migration of *H. occidentale* from the north to the Olympic Mountains on the one hand and to the Rocky Mountains on the other. Plants from the two areas are alike in all details, hence there is no question about their belonging to the same species. *H. marginatum,* described from Colorado, and *H. unitahense,* described from Wyoming, do not differ in any significant way from *H. occidentale.* Indeed, Nelson,[1] in his citation of specimens accompanying the original description of *H. uintahense,* mentioned a Henderson specimen from the Olympic Mountains of Washington as probably belonging to the species he was describing. *H. lancifolium* Rydberg appears to be a leaf-form of *H. occidentale.* The actual type was not found at the New York

[1] Proc. Biol. Soc. Wash. 15: 156 (1902).

Botanical Garden, but specimens annotated by Rydberg and plants coming from the type-locality have proved to be narrow-leaved forms of the latter species.

There are several minor variations in *H. occidentale,* but they are mostly quantitative and are not correlated with each other or with any phytogeographical area. For example, the length of the calyx-teeth varies a millimeter or more, the size and to some extent the shape of the leaflets vary, and the total height of the plants varies with habitat and altitude. The loments are nearly always pubescent, but an occasional collection from Montana or Washington may have glabrous fruits. There is a slight difference, in some cases, as to the way in which the trichomes are disposed upon the loment. Often they are appressed, but in a number of collections the hairs are spreading and may even be slightly crooked. These variations, in so far as I am able to discern, are not of any real significance as far as classification is concerned, but might easily have resulted from the differences in habitat and climatic conditions under which the plants grew.

4. H. **gremiale,** sp. nov. (Plate 597). Deep-rooted, perennial herb; stems numerous from a ligneous caudex, greenish, ascending, branched, densely pubescent with small simple appressed trichomes, terete, 3–6 dm. high; leaves odd-pinnate, densely appressed-pubescent; leaflets 5–13, oblong to elliptical, 1–2 cm. long, 5–10 mm. wide, often apiculate; stipules brownish, pubescent, chartaceous, very fragile, lower united, upper nearly free; inflorescence racemose, in fruit 1–1.5 dm. long; flowers numerous, erect, 1–1.5 cm. long; pedicels pubescent, 2–4 mm. long; calyx furnished with two small bracteoles, densely pubescent, calyx-teeth about equal, narrowly subulate, tipped with red, 4–5 mm. long; corolla pink to reddish-purple, drying purplish-pink; standard obovate, emarginate, 12–14 mm. long, about 1 cm. wide; wings about 1 cm. long, 3–3.5 mm. wide, auricles blunt, broad, not united, about 1 mm. long, claw broad, about 2 mm. long; keel blunt, 13–15 mm. long; loments stipitate, articles 1–5, either closely joined or with a connective of variable length, flattened, suborbicular to slightly longer than broad, prominently and loosely reticulate-nerved, rather densely appressed-pubescent, wingless, 6–8 mm. broad; nerves or costae of the articles supporting numerous spine-like or setaceous processes, these purple-tipped, 3–5 mm. long and usually with a few scattered trichomes upon them; articles one-seeded, mature seeds not seen.

Herba perennis multicaulis; caulibus erectis vel adscendentibus pubescentibus, 3–6 dm. altis; foliis imparipinnatis petiolatis; foliolis 5–13, oblongis vel ellipticis undique pubescentibus; stipulis fuscis connatis pubescentibus; inflorescentiis axillaribus racemosis; floribus erectis; calycis subcylindricis, lobis subulatis 4–5 mm. longis; corollis siccatis roseo-purpurascentibus 13–15 mm. longis; leguminibus articulatis stipitatis compressis; articulis suborbicularibus pubescentibus ciliatis reticulato-rugosis 6–8 mm. latis immarginatis in costis setosis vel subspinulosis.—*H. cinerascens* sensu Graham in Ann. Carn. Mus. **26:** 251 (1937) in part, non Rydberg. *H. utahense* sensu Graham, ibid. p. 252 in part, non Rydberg.—Known only from UTAH: *Uintah County:* heavy adobe soil in a narrow ravine, 14 miles west of Vernal, Uinta Basin, June 16, 1937, *Reed C. Rollins 1733* (G, TYPE, R, ISOTYPE); 18 miles north of Vernal, Uinta Basin, June, 1937, *Rollins 1757a* (G, R); bench west of the Green River, north of the mouth of Sand Wash, Uinta Basin, May, 1933, *Graham 7912* (G, US); Vernal-Manilla road north of Vernal, June 19, 1933, *Graham 8156* (US); Uinta Basin, June, 1912, *Peterson* s. n. (US).

Flowering plants of *H. gremiale* are difficult to distinguish from varieties of *H. boreale* which have both leaflet-surfaces pubescent, but with developing or mature fruits, there is no need for question as to which species one is observing. In the very young stage, fruits of *H. gremiale* do not show any signs of the very marked setae which later appear upon the flattened surfaces. As the fruit enlarges, small tubercles appear at various points along the surface reticulations. Soon these tubercles elongate into peculiar setae or spine-like processess which are sparsely covered with simple trichomes. *H. gremiale* is actually most closely related to *H. boreale* var. *cinerascens*, which it resembles in general habit. Both are pubescent throughout, though *H. gremiale* is much less densely covered with trichomes and less silvery in appearance than *H. boreale* var. *cinerascens*. A further clue to the relationship between these species is the occasional occurrence of very abbreviated tubercles on the loments of *H. boreale* var. *cinerascens*. This suggests a comparatively recent genetical connection between the two.

H. gremiale apparently occurs only locally in the Uinta Basin of northeastern Utah; however, the plants were very abundant in the two places where I observed them. The habitat is in the geologically young foothills of the Uinta Mountains, near the bottom of the Basin. This limited distribution in a geologically young area points to a recent origin for *H. gremiale.* I should suggest *H. boreale* var. *cinerascens* or some other phase or variety of *H. boreale* as the probable ancestor.

5. H. boreale Nuttall. Herbaceous perennial, stems several to numerous from a ligneous root, terete, longitudinally grooved, pubescent, 2.5–6 dm. high, branched above; stipules brown, chartaceous, triangular with a subulate tip, lower united, upper nearly free; leaves short-petioled, 4–8 cm. long; leaflets 9–13, linear-oblong to nearly elliptical or those of the lower leaves obovate, densely pubescent on both surfaces to glabrous above, puncticulate above, 3–8 mm. wide, 1–2.5 cm. long, obtuse; inflorescence racemose, elongated; bracts brown, subulate, equaling or exceeding the pedicels; flowers erect, numerous, carmine, 12–19 mm. long; calyx pubescent, teeth nearly equal, subulate, 3–5 mm. long, longer than the tube; standard obovate to broadly cuneate, emarginate, 12–17 mm. long, 7–12 mm. wide; wings 10–14 mm. long, 2.5–4 mm. wide; claw broad, 2–3 mm. long, wing-auricle blunt, free, about 1 mm. long; loments pendent to somewhat divaricate, usually stipitate; articles 2–5, orbicular to suborbicular, 5–7 mm. wide, 6–8 mm. long, appressed-pubescent, not wing-margined, flattened, rugose when mature, reticulations transversely elongated.

Key to the Varieties of H. boreale

Flowers 12–16 mm. long, erect or the lower tardily reflexed; inflorescence not interrupted; leaflets 10–15 (–20) mm. long.
- Leaflets glabrous to sparsely pubescent above, articles of the loment rugose, but not deeply wrinkled, short spines never present .... 5a. var. *typicum.*
- Leaflets and stems silvery-canescent throughout, articles of the loment deeply wrinkled over the seed, short tubercles often present.
  - Leaflets oblong to broadly linear; pubescence smooth, silvery hairs appressed, less than 1 mm. long .. 5b. var. *cinerascens.*
  - Leaflets obovate; pubescence shaggy, silvery hairs spreading, about 1.5 mm. long .... 5c. var. *obovatum.*

Flowers 16–19 mm. long, lower reflexed; inflorescence interrupted, leaflets 15–25 (–30) mm. long .... 5d. var. *utahense.*

5a. H. boreale Nuttall, var. **typicum.** *H. boreale* Nutt., Gen. N. Am. Pl. **2:** 110 (1818); Journ. Acad. Sci. Philad. **7:** 19 (1834). *H. Roezlianum* Prantl, Ind. Sem. Hort. Wirceb. 8 (1873) ? *H. carnosulum* Greene, Pitt. **3:** 212 (1897); Rydb., Fl. Colo. 216 (1906); Fl. Rky. Mts. adj Plains 524 (1917). *H. Mackenzii* sensu Rydb. in Mem. N. Y. Bot. Gard. **1:** 257 (1900); Fedtsch. in Acta Hort. Petrop. **19:** 273 (1902) in part, non Richardson. *H.*

pabulare A. Nels. in Proc. Biol. Soc. Wash. **15:** 185 (1902); Rydb., Fl. Colo. 215 (1906); Fl. Rky. Mts. adj. Plains 524 (1917); Coulter and Nelson, Man. Bot. Cent. Rky. Mts. 300 (1909); Wooton and Standley in Contrib. U. S. Nat. Herb. **19:** 373 (1915); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 333 (1925). *H. pabulare*, var. *rivulare* L. O. Williams in Ann. Mo. Bot. Gard. **21:** 344 (1934). *H. Mackenzii* Richards., var. *pabulare* Kearney and Peebles in Journ. Wash. Acad. Sci. **29:** 485 (1939). *H. cinerascens* sensu Tidestrom in Contrib. U. S. Nat. Herb. **25:** 333 (1925), non Rydberg. *H. utahense* sensu Graham in Ann. Carneg. Mus. **26:** 252 (1937) in part, non Rydberg.—Alberta to Oklahoma, Arizona and Idaho. ALBERTA: Rosedale Coulee, near Rosedale, July, 1915, *Moodie 1078* (G, NY); Rosedale Trail, near Rosedale, June, 1915, *Moodie 1020* (G); Red Deer Lakes, July, 1879, *Macoun 105* (G). NORTH DAKOTA: Donnybrook, July, 1935, *Stevens & Kluender 132* (G, US); Range 92, Township 149, Dunn Co., June, 1936, *Heidenreich* s. n. (NDA); Sanish, July, 1923, *Stevens* s. n. (NDA); Fort Buford, 1890, *Havard 2 & 3* (NY); Medora, Aug., 1923, *Stevens* s. n. (NDA); June, 1938, *Stevens & Brenkle 38–011* (G). OKLAHOMA: near Shattuck, Ellis Co., June, 1914, *Clifton 3200* (G). MONTANA: North Fork of Bear Cr., Gallatin Nat. For., Gallatin Co., *Whitham 1811* (FS); 1 mile west of Teal Lake, July, 1901, *Spragg 326* (G); Ear Mountain, Lewis and Clark Nat. For., July, 1921, *Butter D3–12* (FS); Jefferson Nat. For., Aug., 1927, *Park 65* (FS). WYOMING: Gilbert Creek, Park Co., July, 1937, *L. & R. Williams 3539* (G, NY, R); Undine Falls, Yellowstone Nat. Park, July, 1899, *A. & E. Nelson 5679* (G); along Snake River, Teton Co., July, 1932, *L. Williams 975* (G, ISOTYPE of *H. pabulare* var. *rivulare*); bars of Gros Ventre River, Teton Co., Aug., 1894, *Nelson 1087* (G); July, 1901, *Merrill & Wilcox 993* (G, NY, US); Bates Creek, Natrona Co., July, 1901, *Goodding 201* (G, US); 20 miles west of Big Piney, Sublette Co., July, 1922, *E. B. & L. B. Payson 2617* (G); 14 miles east of Evanston, Uinta Co., July, 1939, *Rollins & Muñoz 2875* (G, R). COLORADO: Canon City, Aug., 1896, *Shear 3768* (NY); June, 1917, *E. L. Johnston & Hedgecock 638* (G, NY); Trinidad, Aug., 1912, *Beckwith 91* (NY); June, 1917, *E. L. Johnston 617* (G); Trinchera Creek, about 20 miles northwest of Branson, July, 1937, *Rollins 1864* (G, R); Cimarron, Gunnison Co., June, 1901, *Baker 274* (G); mouth of Wolf Creek, White River, Rio Blanco Co., May, 1935, *Graham 9044* (G, US); Paradox, Montrose Co., June, 1912, *Walker 151* (G); Naturita, Montrose Co., May, 1914, *Payson 322* (G); Mancos, June, 1898, *Baker, Earle & Tracy 83* (G); Durango, May, 1916, *Eastwood 5311* (G). NEW MEXICO: near Cimarron, June, 1929, *Mathias 556* (G); Algodones, June, 1887, *Tracy & Evans 139* (NY); Canoncito, Santa Fe Co., June, 1897, *A. & E. Heller 3732* (G); between Gallup and Albuquerque, May, 1931, *McKelvey 2338* (G). Idaho: Clyde, Blaine Co., July, 1916, *Macbride & Payson 3124* (G, NY, US); Warm Springs Ranger Station, Lemhi Nat. For., June, 1928, *Schulze 71* (FS). Utah: Book Cliffs, Uinta Basin, July, 1935, *Graham 9842* (US); Soldier's Summit, 1894, *M. E. Jones 5592* (NY); Bryce Canyon, Garfield Co., July, 1938, *Rollins & Chambers 2453* (G, R); Pleasant Cr., Powell Nat. For., Garfield Co., July, 1915, *Hanks 6* (FS); Millard Co., June, 1938, *Jensen* s. n. (G); Juab, June, 1902, *Goodding 1076* (G); mesa east of Monticello, July, 1911, *Rydberg & Garrett 9203* (NY, US); Convulsion Canyon, Sevier Co., July, 1930, *Albertson 41* (FS); south of Mexican Hat, June, 1930, *Goodman & Hitchcock 1345* (G). Arizona: vicinity of Flagstaff, July, 1898, *MacDougal 214* (G, NDA, NY). Oregon: Hurricane Creek, Wallowa Co., July, 1897, *Sheldon 8628* (G, NY); Aug., 1898, *Cusick 2104* (G); head of North Fork of Imnaha River, Wallowa Co., July, 1928, *Reid 738* (FS).

5b. Var. **cinerascens** (Rydb.),[1] comb. nov. *H. cinerascens* Rydb. in Mem. N. Y. Bot. Gard. **1:** 257 (1900); Coulter and Nelson, Man. Bot. Cent. Rky. Mts. 299 (1909); Rydb., Fl. Rky. Mts. adj. Plains 524 (1917); Fl. Pr. and Plains Cent. N. Am. 487 (1932). *H. canescens* Nuttall in T. & G., Fl. N. Am. **1:** 357 (1838), non *H. canescens* L., Sp. Pl. **2:** 748 (1873). *H. Macquenzii* f. *canescens* Fedtsch. in Acta Hort. Petrop. **19:** 274 (1902). *H. Macquenzii* v. *canescens* Fedtsch., ibid. in index p. 362.—Saskatchewan and Alberta to Wyoming. Saskatchewan: Quappelle, June, 1879, *Macoun* s. n. (NY); Whiteshore Lake, Aug., 1906, *Macoun & Heriot 70786* (NY); Bare Hills, Aug., 1906, *Macoun & Heriot 70785* (G, NY); Moose Jaw, July, 1880, *Macoun* s. n. (G); without locality, 1858, *E. Bourgeau* s. n. (G, NY). Alberta: Cypress Hills, June, 1894, *Macoun 4532* (G); Medicine Hat, May, 1894, *Macoun 4531* (NY); Milk River Ridge, June, 1883, *Dawson* s. n. (G). Without definite locality: Lewis River, Rocky Mts., *Nuttall* (NY, isotype ?); Rocky Mts., *Nuttall* (G, isotype? possibly same as previous collection). Montana: Sec. 28, T. 10 N., R. 10 E., Jefferson Nat. For., June, 1925, *Bouham 25* (FS); Yellowstone River, 1878, *Havard* s. n. (G); Midvale, July, 1903, *Umbach 372* (NY, US); Lima, June, 1895, *Shear 3363* (NY, US); June 29, 1895, *Rydberg 2721* (NY);

[1] There is some question as to whether var. *canescens* Fedtschenko, though based on the illegitimate *H. canescens* Nuttall, should not take precedence over the combination I have made here, because of its possible priority in the varietal category. The fact that the combination *H. Macquenzii*, v. *canescens* was dubiously made only in the index of Fedtschenko's monograph, l. c., makes it almost imperative that the legitimate valid *H. cinerascens* be taken up in order to make the nomenclature of this variety definite and clear.

Livingston, 1901, *Scheuber 222* (NY, US); Sixteen Mile Creek, July, 1883, *Scribner 32* (G); Spanish Creek, Gallatin Co., June, 1901, *Vogel* s. n. (G); Park County, June, 1889, *Tweedy* s. n. (NY). WYOMING: Shirley Basin, Aug., 1908, *A. Nelson 9179* (G, NY); Red Bank, Big Horn Co., July, 1901, *Goodding 332* (G, NY, US); Headwaters of Tongue River, Big Horn Mts., July, 1898, *Tweedy 132* (NY); Dayton-Kane Road, Sheridan Co., June, 1932, *Dickson 250* (FS); Lower Blackrock, Teton Nat. For., *Rosencrans 39* (FS).

5c. Var. **obovatum,** var. nov. Herba perennis argentea pubescentia; foliolis obovatis; pilis ca. 1.5 mm. longis.—Northern NEVADA: Thorpe Creek, east of Lamoille, Elko Co., Humbolt National Forest, July 25, 1928, *Harold H. Price 168* (FS, TYPE).

5d. Var. **utahense** (Rydberg), comb. nov. *H. utahense* Rydberg in Bull. Torr. Bot. Club **34:** 424 (1907); Fl. Rky. Mts. adj. Plains 524 (1917); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 333 (1925). *H. boreale*? sensu Durand. in Journ. Acad. Nat. Sci. Philad. **11:** 162 (1859), non Nuttall. *H. Mackenzii* sensu Watson, Bot. Fortieth Parallel 78 (1871), non Richardson.—Northern UTAH: Wasatch Mts., July, 1869, *Watson 294* (G, NY); Fort Douglas, June, 1906, *Garrett 1798* (G); May, 1908, *Clemens* s. n. (G); vicinity of Salt Lake City, May, 1883, *Leonard 55* (NY, TYPE); Mt. Nebo, Aug., 1922, *Harris c22402* (G); Ogden Canyon, July, 1902, *Pammel & Blackwood 3705* (G); Rock Canyon, near Provo, June, 1925, *Garrett 3324* (G); Lehi, May, 1916, *W. W. Jones 170* (G); Salina Canyon, June, 1894, *M. E. Jones 5319g* (NY); Brigham, May, 1910, *Zundel 193* (NY); between Linder and Pleasant Grove, Utah Co., June, 1917, *Eggleston 13870* (US); South Sink, Garden City, Cache Nat. For., July, 1927, *Craddock 20* (FS).

H. boreale has been widely misunderstood, possibly because of Nuttall's[1] own suggestion that his plant was "H. alpinum ? Mich. Fl. Am. 2. p. 74." Apparently realizing his error, perhaps because he became familiar with the species of Michaux, Nuttall clarified his position by listing[2] one of Wyeth's specimens from the "sources of the Missouri" as "*Hedysarum boreale, H. Mackenzii* of Richardson, not *H. alpinum* of Michaux." Whatever led many authors, including Torrey and Gray,[3] Gray,[4] Britton and Brown[5] and Rydberg,[6] to apply the name *H. boreale* to one or

[1] Gen. N. Am. Pl. **2:** 110 (1818).
[2] Journ. Acad. Sci. Philad. **7:** 19 (1834).
[3] Fl. N. Am. **1:** 356 (1838).
[4] Man. Bot., ed. 2, 98 (1856).
[5] Ill. Fl. **2:** 392 (1913).
[6] Fl. Rky. Mts. adj. Plains 524 (1923).

another of the varieties of *H. alpinum* is not at present entirely clear. Several points brought out by Nuttall in his original description of *H. boreale* such as "stipules . . . subulate," "articulations of the loment . . . rugose," and "calix subulate" could hardly be applied to any of the American varieties of *H. alpinum.* Most suspicious of all, when one attempts to utilize the usual interpretation given in most floras and manuals, is Nuttall's statement of habitat "in arid and denudated soils around Fort Mandan, on the banks of the Missouri." Those familiar with the Fort Mandan region of North Dakota and the usual habitat for any of the varieties of *H. alpinum* are aware that no single species of *Hedysarum* is apt to be found in both habitats. Five collections of *Hedysarum* from North Dakota have been supplied by Dr. O. A. Stevens of the North Dakota Agricultural College for my study. All of these collections, one of which is from Dunn County in the Fort Mandan area, are the same species, *H. boreale.* In recent manuals plants comparable to these have been passing as *H. pabulare* and *H. cinerascens,* or in some instances as *H. Mackenzii.* Durand[1] long ago seems to have been on the right track as to the true identity of *H. boreale* when he noted that, "I cannot but consider *H. boreale* & *H. canescens* of Nuttall, and *H. Mackenzii* of Richardson, as forms of the same species, which it is impossible to separate."

H. boreale is one of those species with several recognizable varieties and numerous variants of less stable character. In several areas in its wide geographic range from Saskatchewan to Oklahoma and Arizona, trends of development are observable. Most prominent, perhaps, are those which have given rise to the large-flowered type found chiefly in northern Utah which Rydberg named *H. utahense* and the silvery-canescent type from northern Wyoming, Montana and adjacent southern Canada named *H. canescens* by Nuttall. Unfortunately, var. *obovatum* is not well enough known for its relationships with other varieties of *H. boreale* to be at all clear. Greene named another variant *H. carnosulum,* but the only points which are at all even measurably different from *H. boreale* var. *typicum* are the shorter stem-internodes and smaller leaves. These, it seems to me, are hardly sufficient to warrant keeping it up even in varietal rank.

[1] Journ. Acad. Sci. Philad. 11: 162 (1859).

Neither the original publication nor the type, if there be one, of *H. Roezlianum* have been available to me, but Fedtschenko[1] has reproduced Prantl's original diagnosis and notes in their entirety. The description is certainly that of a *Hedysarum* and, in my opinion, *H. boreale* or possibly one of its varieties. *H. Roezlianum* is based upon plants grown in the botanical garden of the University of Würzburg from seeds supplied by Rözl, who supposedly collected them in California. Since the genus *Hedysarum* is not known to occur in California and since Rözl is known to have traveled rather widely[2] in the Great Basin and Rocky Mountain regions, I think it is safe to assume that the seeds came from some locality in these areas.

6. H. Mackenzii Richardson. Perennial; stems several to numerous from a ligneous caudex, mostly simple above, terete, shallowly furrowed above, sparsely appressed-pubescent, 1–4 dm. high; stipules white-translucent with brown streaks, united, tips of the upper free; leaves petiolate, 4–8 cm. long; leaflets 4–6, oblong to broadly lanceolate or nearly elliptical, thick, glabrous to very sparsely pubescent and puncticulate above, appressed-pubescent below, 15–25 mm. long, 4–10 mm. wide, obtuse to acute, not apiculate; inflorescence racemose, subcapitate; flowers 5–12, purple, erect but soon pendent, 18–21 mm. long; bracts subulate, pubescent, broadly scarious-margined; bracteoles linear, 2–3 mm. long; calyx villose, teeth linear-subulate, nearly equal, longer than tube, 3.5–6 mm. long; standard cuneate to broadly spatulate or nearly obovate, emarginate, 15–17 mm. long, 9–11 mm. wide; wings oblong, 14–16 mm. long, 3–4 mm. wide, claw broad, about 3 mm. long, wing-auricles blunt, rounded, free, about 1 mm. long; loments pendent to divaricately ascending, stipitate, 3–8-articled; articles nearly orbicular, not wing-margined, appressed-pubescent, 4–6 mm. wide, 5–8 mm. long, reticulations prominent, transversely elongated.—App. Franklin's Journ. 745 (1823); Hooker, Fl. Bor.-Am. **1:** 155 (1834); Torrey and Gray, Fl. N. Am. **1:** 357 (1838); Basiner in Mem. Acad. Sci. Petrop. **6:** 58 (1846) in part; A. Nelson in Proc. Biol. Soc. Wash. **15:** 184 (1902); Fedtschenko in Acta Hort. Petrop. **19:** 273 (1902) in part; Henry, Fl. So. Brit. Columb. 192 (1915); Rydberg, Fl. Rky. Mts. adj. Plains 524 (1917); Fl. Pr. and Plains Cent. N. Am. 487 (1932) in part; Raup in Contrib. Arn. Arb. **6:** 181 (1934); Bull. Nat. Mus. Can. **74:** 148 (1935). *H. americanum Mackenzii* Britt. in Mem. Torr. Bot. Club. **5:** 202 (1894). Newfoundland and Quebec; Manitoba and northwestward; also

[1] Acta Hort. Petrop. 19: 324 (1902).

[2] Garten- und Blumenzeit. Hamb. 422 (1874).

eastern Siberia. Without definite locality, presumably the Canadian Arctic, *Richardson* s. n. (G, ISOTYPE?). NEWFOUNDLAND: Green Gardens, Cape St. George, July, 1922, *Mackenzie & Griscom 11005 and 11053* (G). QUEBEC: Vaureal River, Anticosti Island, July, 1925, *Marie-Victorin et al. 20871* (G). MANITOBA: Churchill, Hudson Bay, July–Aug., 1910, *J. M. Macoun* (G). NORTHWEST TERRITORY: Chesterfield, Aug., 1933, *Gardner 434* (G); Bernard Harbour, Aug., 1915, *Johansen 331* (G). ALBERTA: Calgary, July, 1903, *Barber 211* (G); near Fortress Pass, July, 1927, *Ostheimer 82* (G); Ptarmigan Lakes and vicinity, July, 1906, *Brown 401* (G); Bow River Valley near Banff, June, 1906, *Brown 75* (G); head of Malique Lake, July, 1908, *Brown 1219* (G); 40–60 miles southwest of Banff, July–Aug., 1905, *Clark* s. n. (G); Mt. Temple, Laggan, July, 1907, *Butters & Holway 121* (G); between Salt Mt. and Junction Lake, June, 1928, *Raup 2802* (G). BRITISH COLUMBIA: Mt. Selwyn, July, 1932, *Raup & Abbe 3757* (G); vicinity of Hudson Hope, June, 1932, *Raup & Abbe 3603* (G); vicinity of the mouth of Wicked River, July, 1932, *Raup & Abbe 3854* (G); Burgess Trail near Field, July, 1906, *Brown 538* (G); Telegraph Creek, June, 1918, *Walker 1203* (G). YUKON TERRITORY: Herschel Island, Aug., 1934, *Dutilly 235* (G).

H. Mackenzii is a close relative of *H. boreale* Nutt. and might with some propriety be considered a variety of it, but there are some good reasons for keeping the two as separate species. *H. Mackenzii* is an arctic-alpine species which extends, interruptedly, from eastern Siberia to Newfoundland, and southward along the Rocky Mountains in western Canada. On the other hand, *H. boreale* is not a high-mountain species at all, but rather inhabits the low hills of the plains region of southern Canada and the western plains states together with the intermontane basins and lower mountain slopes of the Rocky Mountain Region. *H. Mackenzii* has fewer, larger, more brilliantly colored flowers and a more globular inflorescence than *H. boreale*, in which the flowers are a dull reddish-purple and disposed in an elongated raceme. On the whole, the two species differ considerably in habit and general aspect as well as in a number of technical characters which have been emphasized in the key. Considering the fact that *H. Mackenzii* and *H. alpinum* var. *americanum* (*H. americanum* Britt.) belong to two entirely different sections of the genus, it is almost incredible that Britton should have considered the two to belong to the same species. His combination

H. americanum Mackenzii must have been the result of a very hasty judgment.

PLATE 597. HEDYSARUM GREMIALE Rollins, sp. nov.: FIG. 1, ISOTYPE, × 1/3, from 14 miles west of Vernal, Utah, *Rollins 1733;* FIG. 2, loments, × 3; FIG. 3, upper portion of inflorescence, × 3.

II. SOME SPERMATOPHYTES OF EASTERN NORTH AMERICA

M. L. FERNALD

(PLATES 598–625)

In an attempt to place the flora of the area covered by Gray's *Manual* upon a basis of greater precision it is found necessary to check the treatment of every genus and species. In the present paper notes which have accumulated during the past year are presented. In several cases nomenclatural transfers are necessitated by study of the actual types or of photographs of them purchased with aid of appropriations for research from the Department of Biology of Harvard University. The photographs of types of Linnean species have been received through the coöperation of Mr. Spencer Savage, Assistant Secretary of the Linnean Society of London, and of Dr. John Ramsbottom, Keeper of Botany at the British Museum of Natural History. For those of Lamarck, Desrousseaux and Michaux I am indebted to the always helpful Professor H. Humbert and M. R. Metman of the Muséum National d'Histoire Naturelle of Paris. To all these gentlemen I extend my grateful appreciation.

Some transfers are made from indefinite trinomials (published without clear statement of rank) or of plants originally described as subspecies. Most unfortunately, the term *subspecies*, clearly understood and correctly used by some of the most accurate of Old World systematists, has become debased and confused by a group of relatively inexperienced taxonomists (chiefly in this country) and its incorrect use is being urged by them, in the sense of the long-established term *varietas*. As correctly used the two are by no means of the same rank. The *subspecies* of the best taxonomists is a subdivision of an aggregate-species, *Gesamtart* or *species collectivus*, the subspecies often consisting of geographic varieties ("races") and by many of us often treated as true species. A clear and concise statement of the true relation of these categories is contained in the Preface (p. vi.) to Hayek's splendidly clear Prodromus Florae Peninsulae Balcanicae, i. in Fedde, Repert. Sp. Nov. Reg. Veg. xxx[1]. (1924). This I reproduce:

I. **Subspecies** . . . , i. e. formae valore systematico magno, quae plerumque facile distingui possunt, quarum origo communis autem formis intermediis vel alio modo patet.
  A. Varietates . . . , i. e. variationes valde distinctae distributione geographica propria.
    a) Subvarietates . . . , variationes similibus characteris ac priores sed aut constantia minore aut distributione geographica minus distincta
      a) formae
  . . . , variationes valoris systematici parvi, plerumque sine distributione geographica propria.

As an illustration we may look at Hayek's treatment of the cosmopolitan weed, *Stellaria media* (as it occurs in the Balkans). It is broken by him into three parallel subspecies: subsp. *eumedia, pallida* and *neglecta*. These differ in relatively fundamental characters, in which many systematists see true species: subsp. *eumedia* with outer sepals obtuse, petals about equaling calyx, stamens 3–5, styles recurved at apex, with forma *apetala* like it but apetalous; subsp. *pallida* with outer sepals lance-acuminate, petals minute or wanting, stamens 1–3, styles divaricate at base; and subsp. *neglecta,* a robust plant, with petals equaling or exceeding calyx, stamens 10. Subsp. *neglecta,* treated by many students as a good species, has two varieties: var. *macropetala* with stem pilose in lines, the petals longer than calyx; and var. *pubescens* with stem and peduncles densely viscid-puberulent, the petals equaling the densely pubescent sepals. Hayek correctly differentiated between subspecies and varieties. Another illustration of correct use of the terms is in Hackel's monograph of the *Andropogoneae* in DC. Mon. Phan. vi. (1889). Hackel (pp. 383–385) broke the familiar *Andropogon scoparius* Michx., which he considered an aggregate-species, into two subspecies: subsp. *a. genuinus* and subsp. *b. maritimus.* The former, including several subvarieties and forms, is the wide-ranging North American cespitose plant, with each fertile and sessile spikelet accompanied by a pair of plumose pedicels, the latter either with rudiments or without; the second subspecies, subsp. *maritimus,* has each sessile spikelet accompanied by a single hairy pedicel which terminates in a well developed staminate spikelet. Hackel's *A. scoparius,* subsp. *maritimus* consisted of var. α. *genuinus,* which is *A. maritimus* Chapm., a low and stout stoloniferous plant with solitary culms and reflexed or divergent short leaves, found on the sandy coast of the Gulf of Mexico; and var. β. *divergens* (Anderss.) Hackel, based on a previously unpublished species, *A. divergens* Anderss. in herb., the latter a very tall plant forming dense stools, with prolonged slender ascending leaves, known only in pinelands of Texas. Nash, Hitchcock and all American students of grasses who correctly know these two plants treat them as perfectly distinct species, *A. maritimus* Chapm. and *A. divergens* Anderss. In other words, the term *subspecies,* correctly used by Hayek and by Hackel, covers a taxonomic concept of far greater value than the term *varietas.* A quite similar interpretation will be found to underlie the subspecies and varieties of those masters who have long correctly used these categories in botany; the term *subspecies,* correctly used, is of higher rank than the term variety (*varietas*) as used by the overwhelming majority of outstanding leaders in taxonomy from Linnaeus down. The substitution of the term *subspecies* for *varietas* has no justification in sound taxonomy of plants; and those who so substitute it not only cheapen and obscure the categories but give concrete evidence of a lack of familiarity with the best work in taxonomy.

I am quite aware that, taking their cue from the statement in *Philosophia Botanica,* some like to argue that Linnaeus used the term *varietas,* the subdivisions of species designated in his *Species Plantarum* by greek letters, only for garden "creations" and abnormalities. A little experience with *Species Plantarum* shows, however, the error of such a claim; an extended experience with the works of Linnaeus and his illustrious and wise associates and later editors shows that in actual practice he generally designated as varieties indigenous plants which he considered to be natural (often geographic) variations within the broad limits of his specific concept. The misconception of those who interpret the Linnean use of the term *varietas* by stressing the statement in *Philosophia Botanica,* rather than the actual practice of Linnaeus, has been well discussed by Ramsbottom in his Presidential Address before the Linnean Society of London, delivered at the 150th Anniversary Celebration in May, 1938. No more wholesome document, in these days of many confused and superficial ideas, can be recommended for the careful consideration of all taxonomists. I venture to quote briefly from this masterly address, *Linnaeus and the Species Concept:*

To return to 'Philosophia Botanica' we find that varieties are defined as in the 'Fundamenta' [1736], where Linnaeus had in mind chiefly what are now known as variations. There are as many varieties as there are different plants, produced from the seed of the same species. (Varietates tot sunt, quot differentes plantae ex ejusdem speciei semine sunt productae.) He adds that a variety is a plant changed by an accidental cause due to the climate, soil, heat, winds, etc. It is consequently reduced to its original form by a change of soil. (Varietas est Planta mutata a causa accidentali: Climate, Solo, Calore, Ventis, &c., reducitur itaque in Solo mutato.) Further, the kinds of varieties are size, abundance, crispation, colour, taste, smell. (Species varietatum sunt Magnitudo, Plenitudo, Crispatio, Color, Sapor, Odor.) Species and genera are regarded as always the work of Nature, but varieties as more usually owing to culture. (Naturae opus semper est Species & Genus; culturae saepius Varietas.) For that reason he would have ignored them in the general discussion of his ideas "published for the sake of my pupils," but that they often have economic, artistic, and medicinal uses.

. . . .

But it is not reasonable to judge Linnaeus's ideas solely by his didactic 'Philosophia Botanica.' His greatest botanical work, his Golden Book, *maximum opus et aeternum*, is 'Species Plantarum,' published two years later. We know from his correspondence that he had been engaged upon the writing of this off and on for about nine years and consequently would not expect to find any departure from the definitions put forth in the 'Philosophia.' However, 'Philosophia Botanica' is precept, 'Species Plantarum' practice. . . . .

. . . .

Perhaps equally striking is the treatment of varieties in 'Species Plantarum' when we bear in mind the definitions repeated two years previously. Far from being merely variations in non-essential characters, they are treated in the same way as species, and as may be seen from some of the quotations already given it is sometimes queried whether what is described as a species is only a variety or vice versa. Constancy is now one of the characteristics: thus var. β. (*fulvus*) of *Hemerocallis Lilio-Asphodelus* is described as "hybrida & constans," and the vars. α. and β. of *Adonis annua* remain distinct. . . .

How are we to regard this apparent change of view between 1751 and 1753? I think by denying that there had been one. That this is so is shown by the fact that his earlier writings contain similar notes. 'Hortus Cliffortianus,' 1737, is remarkably fully annotated and contains much of interest in showing the development of Linnaeus's ideas. Even here varieties are treated for the most part as permanent forms and attached to their appropriate species (varietates ad species proprias reduxi). . . . .

'Flora Suecica' was published in 1745. Here again several species are regarded as related to others . . . or perhaps only varieties . . . ; an American *Pyrola* is regarded as a variety of a European species (ergo americana planta hujus varietas est.) Varieties may be inconstant . . . or constant as var. β. of *Alnus*.

. . . .

Though it is obvious, therefore, that there was no change of view, we are still left with the problem of explaining the categorical statements in 'Philosophia Botanica.' Is not the explanation the simple one that this was a text-book, and that too much stress has been placed upon it both by Linnaeus's contemporaries and by those who thought that therein they had an epitome of his botanical philosophy? The series of aphorisms of 1736 were copied practically verbatim into 'Philosophia Botanica' years afterwards. . . . 'Philosophia Botanica,' remarkable as it is, suffered like many more modern text-books in being an enlarged second edition and as a students' book was concerned more with giving them a general account of certain aspects of botany at a stage where it was probably considered better to receive categorical statements than to wander into the realms of real philosophy.[1]

The modern fad of certain botanists, to substitute the heretofore clear term *subspecies*, erroneously used and often misunderstood by them, for the long established *varietas*, as used correctly for more than two centuries, is, as stated, a practice which cheapens the status of true subspecies and makes for inaccuracy and misunderstanding. As shown so clearly by Ramsbottom's analysis of Linnaeus's more scientific writings, it glorifies a text-book precept of 1736 and completely ignores the actual practice in *Hortus Cliffortianus, Flora Suecica* and "his greatest botanical work, his Golden Book, *maximum opus et aeternum* . . . 'Species Plantarum'."

Naturally, in a work dealing with all known plants Linnaeus had to recognize the innumerable garden products, such as the great series in *Brassica* or *Lactuca*, but he did so under strong protest: "Botanists differ from florists in their conception of varieties in this respect: that the former bestow varietal names by way of defining and expressing in words some unique characteristic in the variety: but the latter do reverence to the objects of their worship with names showing their devotion. . . . The objects of Botanists and Florists in regard to varieties are the same, but with this difference, that the Florist begins to play his part where the Botanist leaves off. . . . Hence the species of

[1] Ramsbottom in Journ. Linn. Soc. Lond. 150th Sess., especially pp. 199–205 (1938).

Botanists become the Classes of Florists, the Varieties of Botanists the Orders of Florists."[1] In spite of his inclusion of some horticultural products as varieties, a large proportion of the varieties actually recognized by Linnaeus in *Species Plantarum* are, as Ramsbottom points out, wild plants in nature with strong morphological or geographic differences, the varieties as maintained by the great majority of taxonomists for two centuries. A few from very many illustrations from ed. 1 (1753) are here given, selected as plants familiar to those who are intimate with the North American flora. *Circaea lutetiana* (European) had a var. β. *canadensis* (p. 9), which is the eastern North American *C. quadrisulcata* (Maxim.) Franch. & Sav., var. *canadensis* (L.) Hara in Rhodora, xli. 287 (1939). *Alopecurus geniculatus* (p. 60) had a var. β., which is universally recognized as a distinct species, *A. aequalis* Sobol. *Juncus effusus* (p. 326) had a var. α, "floribus sessilibus," which is the very distinct *J. arcticus* Willd. *Phytolacca americana* (p. 441) from Virginia had a Mexican variety β.; but in the 2d edition Linnaeus himself separated them as two species, *P. decandra* (Virginian) and *P. octandra* (Mexican) and everyone who understands them keeps them apart. *Magnolia virginiana* had 5 varieties: α. *glauca*, β. *foetida*, γ. *grisea*, δ. *tripetala*, ε. *acuminata*; but in ed. 2 (1762) Linnaeus treated them, correctly, as species, *M. acuminata*, *tripetala*, etc. *Eupatorium purpureum* (p. 838) had a var. β., which in ed. 2 became the species *E. maculatum* L. These and scores of other cases (in *Myosotis*, *Erythronium*, *Arenaria*, *Prunella*, *Thlaspi*, *Sisymbrium*, *Arum*, etc.) sufficiently indicate that in actual scientific practice Linnaeus by no means confined the term varietas to garden products and sports, but used it for native plants with such strong morphological and geographic isolation that, in many cases, his own later studies showed them to be true species.

I have never found myself able to join this modern group who base their thesis upon lack of clear understanding. I prefer to be a follower of the practice (not merely the text-book precept) of Linnaeus and of the tremendous army who by their clear understanding and painstaking studies have won lasting honor in the field of taxonomy: such outstanding scholars, who have

[1] Linnaeus, Critica Botanica (1737), transl. of Sir Arthur Hort, 190, 191 (1938).

correctly used the honorable old term *varietas,* to enumerate a few, as N. J. Andersson, Arnott, Ascherson, Babington, Bentham, Bertoloni, Blume, Blytt, Boissier, Boott, Alexander Braun, Robert Brown, Briquet, Buchenau, Bunge, Chamisso, Cogniaux, Cosson, Crépin, Decaisne, A. P. DeCandolle, Alphonse DeCandolle, Desfontaines, Desvaux, Dunal, Eichler, Endlicher, Engelmann, Engler, Fée, Fenzl, Fischer, Franchet, Fries, Gaertner, Garcke, Gaudin, Gay, C. C. Gmelin, C. F. Gmelin, S. C. Gmelin, Godet, Godron, Gray, Greene, Grenier, Grisebach, Hackel, Hemsley, Hillebrand, Hoffmann, J. D. Hooker, W. J. Hooker, Hornemann, Jacquin, Koch, Kunth, Lamarck, Lange, Ledebour, Lehmann, Lindley, Link, Loudon, Martius, Maximowicz, Meisner, Mertens, C. A. Meyer, Michaux, Miller, Moquin-Tandon, Johann Mueller, Nees, Nuttall, Palisot de Beauvois, Persoon, Poiret, Presl, Regel, Reichenbach, Roemer, Ruprecht, Sargent, Schimper, Schlechtendal, Schrader, Schultes (several), Sprengel, Swartz, Torrey, Trattinick, Trinius, Turczaninow, Underwood, Urban, Ventenat, Warming, Watson, Wettstein and Willdenow.

The easy-going but often quite misleading practice of using trinomials without designation of rank, whether subspecies, variety, form or some other status, is an Americanism which does not reflect sound scholarship nor a desire to be quite clear to others. Those who thus avoid making their categories perfectly definite leave the burden of clarification to the unfortunate users of their work. It is not enough to say, like one author cited on a succeeding page, that "The trinomial in botany is usually referred to as a variety, although the designation subspecies would appear to be more reasonable." By thus "passing the buck," such authors automatically invite the outlawing of their names, for, as shown in the discussion of *Descurainia,* these names are not validly published by the International Rules of Botanical Nomenclature. Far from being definite the trinomial may be hopelessly indefinite. For instance, in his Working List of North American Pteridophyta (1901), the late B. D. Gilbert enumerated the variations of *Athyrium Filix-femina,* mostly on p. 15. He there had as no. 221 "f. rubellum f. nov. Gilbert," but in the Appendix where he described it (p. 35) it changed to *Athyrium filix-femina rubellum* Gilbert, with the statement three times made that it is a variety, and the objectionable "var." definitely finding place in the discussion: "In var. *rubellum*" etc. Gilbert, evidently, was not sure whether he wanted to call the plant a forma or a variety, though in the second effort he did settle on "var." put into the discussion. The trinomial alone told nothing. How much better to be absolutely definite. The time taken and the clarity of mind necessary correctly to write the abbreviation are slight; the confusion created by its omission or by an explanation of the category hidden somewhere in explanatory text, which no author with generous attitude toward readers of various linguistic stocks should expect them to dig out, is enormous and enduring. As stated, authors who do not clearly designate the category to which their names belong are likely to have their combinations ignored.

Potamogeton Berchtoldi Fieber, var. **tenuissimus** (Mert. & Koch), comb. nov. *P. pusillus* L., var. *tenuissimus* Mert. & Koch in Röhling, Deutschl. Fl. i. 857 (1823).

P. Berchtoldi, var. **lacunatus** (Hagström), comb. nov. *P. lacunatus* Hagström, Crit. Researches Pot. 120, fig. 53 (1916).

P. Berchtoldi, var. **polyphyllus** (Morong), comb. nov. *P. pusillus*, var. *polyphyllus* Morong in Bot. Gaz. v. 51 (1880) and Mem. Torr. Bot. Cl. iii². 46, excluding plant of Fresh Pond (1893).

P. Berchtoldi, var. **colpophilus** (Fernald), comb. nov. *P. pusillus*, var. *colpophilus* Fernald in Mem. Am. Acad. xvii. 90, t. 20. figs. *d* and *e*, and t. 35, fig. 5 (1932).

Ever since it was shown by Dandy & Taylor in Journ. Bot. lxxvi. 90–92 (1938), that the type of *Potamogeton pusillus* L. (1753) is really *P. panormitanus* Biv. (1838) and that the plant passing as *P. pusillus* must be called by the earliest available specific name, *P. Berchtoldi* Fieber (1838), American botanists, wishing to use the varietal names correctly, have awaited their transfer by the two English botanists. A letter to them sent long before the present war, inquiring if they proposed to make the transfers, having brought no reply and many students inquiring what they shall call the different varieties, there seems no discourtesy in getting them properly issued, that they may be available for use.

Fimbristylis **caroliniana** (Lam.), comb. nov. *Scirpus carolinianus* Lam. Illustr. i. 142 (1791). *S. puberulus* Michx. Fl., Bor.-

Am. i. 31 (1803). *Fimbristylis puberula* (Michx.) Vahl, Enum. ii. 289 (1806).

Scirpus carolinianus Lam. was collected in Carolina by Fraser. By *Index Kewensis* it is referred to the synonymy of *Fimbristylis castanea* (Michx.) Vahl, but the type, of which Professor Humbert and M. Metman send me a very clear photograph, shows that the Lamarck species was the usually smaller *F. puberula*, with relatively small ellipsoid-ovoid spikelets. It is very well matched by the photograph published by me of typical *F. puberula* in RHODORA, xxxvii. t. 388, fig. 4; also by the type of *S. puberulus* Michx. (photograph before me) and by material from Petty's Island, Delaware River, New Jersey, October 27, 1866, *C. F. Parker*, by the Virginian specimens of *Fernald & Long*, nos. 3751 and 3746, by *Wiegand & Manning*, no. 553 from Robeson Co., North Carolina and *Wiegand & Manning*, no. 554 from Tallahassee, Florida. The following transfers are necessitated.

F. CAROLINIANA, forma **pycnostachya** (Fernald), comb. nov. *F. puberula*, forma *pycnostachya* Fernald in RHODORA, xxxvii. 396, t. 388, fig. 3 (1935).

F. CAROLINIANA, forma **eucycla** (Fernald), comb. nov. *F. puberula*, forma *eucycla* Fernald, l. c. figs. 1 and 2 (1935).

WHAT IS ARISAEMA TRIPHYLLUM? PLATES 598–600. Linnaeus in 1753 (Sp. Pl. 965) recognized a single American *Arum* with ternate leaves. This species, *Arum triphyllum*, was, however, a composite one, with two designated but unnamed varieties based upon earlier descriptions and figures, while the only specimen seen by Linnaeus himself was supposed to be the same as *Dracunculus sive Serpentaria triphylla Brassiliana, in Prod. descripta* of Bauhin, Pinax, 195 (1671). What the latter may have been is a problem, for in his Prodromus Bauhin gave a full description of *Serpentaria triphylla Brassiliana* with a roundish and 3-lobed (subrotundum, trifidum) leaf; spathe 5 inches long, dark purple, with white stripes, the spadix blackish, oblong and 2-*cleft at tip* (flos . . . longitudine unciarum quinq; atrorubens, striatus, venis albicantibus per medium, . . . pistillo nigricente, oblongo, in summo bifido). Furthermore, it was stated unequivocally to come from Brazil: "Ex Tououpinambault Brassiliae anno 1614. allata."—Bauhin, Prodr. 101 (1671). In view of the subrotund leaf and the bifid spadix, in addition to the source of the plant in Brazil, the single synonym given by Linnaeus for the Virginian *Arum acaule, foliis ternatis* of Gronovius, must have been erroneously associated with the Gronovian species. Linnaeus cited under the Brazilian reference the treatment of Dodart, Memoires, 81 (1676), and others have cited Dodart's remarkably clear plate. The latter, said to be *Dracunculus sive Serpentaria triphylla Brasiliana*, was drawn from a specimen secured from Canada! It is an excellent representation of the commonest form of the wide-ranging species which has been erroneously passing as *A. triphyllum* (var. *zebrinum* Sims); and it represents nothing Brazilian. Blume treated the reputed plant of Brazil as a distinct species, *Arisaema brasilianum* Blume, Rumphia, i. 96 (1835), but he added nothing definitely clarifying its identity. In Flora Brasiliensis, iii^2. 47 (1878) Engler explicitly states that "Tribus V. AREAE Engl. cum subtribubus 1) Arisarinae Schott (gen. *Arisarum* . . . , *Arisaema* Mart., *Pinella* Ten.) . . . omnino extra-brasiliensis est"; and in 1879 (Araceae in DC. Mon. i. 534) Engler definitely reduced *Arisaema brasilianum* to the aggregate eastern North American species. In view of the confusion, however, as to *A. brasilianum*, based upon a reputed Brasilian plant, it is wisest not to consider *Dracunculus sive Serpentaria triphylla Brassiliana*, at least of Bauhin, as a primary basis of *Arum triphyllum* L. In order that the Linnean treatment may be clearly understood it is here reproduced.

4. ARUM acaule, foliis ternatis. *Gron. virg. 113.* *triphyllum.*
Dracunculus s. Serpentaria triphylla brasiliana. *Bauh. pin. 195. prodr. 101. Dod. mem. 81.*
β. Arum minus triphyllum s. Arisarum, pene viridi, virginianum. *Moris. hist. 3. p. 547. s. 13. t. 5. f. 43.*
γ. Arum s. Arisarum triphyllum minus, pene atrorubente, virginianum. *Pluk. alm. 52. t. 77. f. 5.*
Habitat in Virginia, Brasilia. ♃.
Plantae brasilianae *foliola lateralia extrorsum lobata,* virginiae *autem tantum, gibba, eandem tamen suadet* Floris *structura.*

It will be seen that the single unequivocal basis of true *Arum triphyllum* L. was the Gronovian *Arum acaule, foliis ternatis*. It is important, therefore, that a specimen of this plant, which Linnaeus had in his own herbarium prior to 1753 and which he marked "4. *triphyllum*," consequently the TYPE of the species, is the green-spathed form of *Arisaema pusillum* (Peck) Nash in Britton, Man. 229 (1901), based on *A. triphyllum*, var. *pusillum* Peck, N. Y. State Mus. Rep. li. 297 (1898). PLATE 598, FIG. 1, shows the leaf and one of the spathes of the TYPE of *Arum triphyllum*, × 1, from the sheet in the Linnean Herbarium, the original photograph sent by Mr. Savage. An exactly similar specimen is in the Gronovian Herbarium at the British Museum, a photograph of it supplied through Dr. Ramsbottom. Linnaeus gave no original description, merely citing the Gronovian account. Gronovious, however, described the spadix from the notes of Banister and of Clayton as green (pene viridi) and he cited as identical *Arum minus triphyllum s. Arisarum pene viridi Virginianum* of Morison's Plantarum Historiae Oxonensis, iii. sect. xiii. 547, no. 44, t. 5. fig. 43 (1715). This is the reference given by Linnaeus as the sole basis of his *Arum triphyllum*, β., and Morison's plate 5, fig. 43 shows a plant (our text-figure 1) readily referable to *Arisaema pusil-*

TEXT-FIG. 1. Morrison's figure of *Arum triphyllum*.

lum. It should be noted, however, that in the text (p. 547) Morison cites no figure under his no. 44, *Arum minus triphyllum sive Arisarum pene viridi Virginianum,* but the plate was cited by him under his no. 43, *Arum triphyllum Virginianum flore pallido, pistillo atrorubente,* although on the plate he called it *Arum triphyllum sive Dracunculus triphyllus Virginianus,* thus introducing a confusion which I do not attempt to clear. The main point is, that, regardless of early literary confusions, the actual TYPE of *Arum triphyllum* must be taken as the plant which Linnaeus had before him (our PLATE 598, FIG. 1).

Until 1901, when both *Arisaema pusillum* (Peck) Nash (our PLATE 598, FIG. 3) and *A. Stewardsonii* Britton (our PLATE 600, FIG. 4) were put forward as species, botanists generally supposed that we had in temperate eastern North America a single polymorphous species, to which several specific names had been needlessly given. So far as I can determine *A. Stewardsonii* has a clear title; the identity of *A. pusillum* as true *A. triphyllum* has been discussed. There remains the hope that one of the earlier names may clearly belong to the species (PLATE 599) which has generally passed as *A. triphyllum,* the plant with leaves glaucous and dull beneath (when fresh), the lateral leaflets strongly rounded on the lower side, the horizontally rounded summit of the spathe-tube with a flange 2–8 mm. broad, the broadly oblong-ovate abruptly acuminate hood 3–6 cm. broad, the fruiting head 3–6 cm. long, the depressed-globose or reniform seeds deeply invaginated at base. This is the common and often rather coarse species of rich woods and thickets from New Brunswick and adjacent Quebec to southeastern Manitoba, south to South Carolina, Tennessee, Missouri and eastern Texas. Its hood varies from purple to green, often with pale longitudinal stripes.

Contrasting with the wide-ranging and inland plant which erroneously passes as *Arisaema triphyllum,* true *A. triphyllum* (*A. pusillum*) is usually smaller (PLATE 598); its leaves are green and lustrous beneath, the lateral leaflets acute at base; the flange at the summit of the spathe-tube is narrow (0.5–2 mm. wide); the narrowly oblong to lance-ovate attenuate hood is only 2–3 cm. broad and solidly green or solidly purple on the inner face, without pale stripes above the base; the fruiting heads are only 1.5–2 cm. long; the obovoid seeds stipitate and not clearly invaginated at base. This is a plant of the southern Coastal Plain and Piedmont, occurring in wet woods and about spring-heads from Florida to Kentucky, northward to southeastern New York, Connecticut and southeastern Massachusetts.

Arisaema Stewardsonii (PLATE 600, FIG. 4) in the fresh material is strikingly different. Its tuber frequently sets off stolons or stalked plantlets; its foliage is similar to that of the preceding species, but its spathe has the inrolled tube sharply and deeply corrugated with white ridges (corrugations disappearing in drying), green or purple, the summit tapering gradually into the narrowly ovate (2–6 cm. broad) attenuate green to purple hood; fruiting head 2.5–3.5 cm. long; seeds as in *A. triphyllum* (*pusillum*). *A. Stewardsonii* is a plant of wet or swampy woods and thickets from Nova Scotia and Prince Edward Island to Minnesota, south to northern New Jersey and Pennsylvania.

Returning to the species with fresh foliage glaucous beneath, the lateral leaflets rounded at base, the spathe with smooth tube and horizontally rounded broad-flanged summit, several early names seem to belong to it. It was, probably, the *Arum s. Arisarum triphyllum minus, pene atrorubente, virginianum* of Plukenet, Almagestum, 52, t. 77, fig. 5; therefore, as the only cited plant, *Arum triphyllum*, γ. of L. Sp. Pl. 965 (1753). Plukenet's description is very brief and quite inconclusive and his figure is very far from satisfactory. It might have been conventionalized from a specimen of the glaucous-leaved plant. The first reasonably clear name for this species is *Arum atrorubens* Ait. Hort. Kew. iii. 315 (1789). Aiton recognized two North American species: *A. triphyllum*, described quite correctly (in the sense of the Linnean type) "foliis ternatis, lamina lanceolata acuminata"; and the new *A. atrorubens* "lamina ovata," cultivated from Virginia by Philip Miller in 1758. Aiton, to be sure, took his specific name from the not wholly definite *Arum s. Arisarum triphyllum minus, pene atrorubente virginianum* of Plukenet (see above); but since Aiton had fresh material with *ovate* (as contrasted with lance-acuminate) leaflets, his name may be accepted. Unfortunately, Mr. Weatherby, who sought, when in England, for Aiton's type, could find nothing to stand for his species. I am, however, adopting for the plant which has recently passed as *Arisaema triphyllum* the name *A. atrorubens*

(Ait.) Blume, Rumphia, i. 97 (1835). Its identity is reasonably certain.

Both *Arisaema triphyllum* and *A. atrorubens* vary greatly in the color of the spathes. These color-forms have mostly been named as varieties. In so far as I can identify the old names I have taken them up. The bibliography of the two long confused species follows.

Arisaema triphyllum (L.) Schott in Schott & Endlicher, Meletemata, i. 17 (1832). *Arum triphyllum* L. Sp. Pl. ii. 965 (1753) as to type. *Arum triphyllum, β. viride* Sims, Bot. Mag. sub. t. 950 (1806), based on Morison's plate. *Arisaema pusillum* (Peck) Nash, forma *pallidum* E. H. Eames in Rhodora, xxxiii. 168 (1931).—Hood of spathe and tip of spadix green. Plate 598, figs. 1 and 2.

Forma **pusillum** (Peck), comb. nov. *A. triphyllum,* var. *pusillum* Peck in N. Y. State Mus. Rep. li. 297 (1898). *A. pusillum* (Peck) Nash in Britton, Man. 229 (1901).—Hood full purple-brown on inner face. Plate 598, fig. 3.

A. atrorubens (Ait.) Blume, Rumphia, i. 97 (1835). *Arum atrorubens* Ait. Hort. Kew. iii. 315 (1789). *A. triphyllum, β. atropurpureum* Michx. Fl. Bor.-Am. ii. 188 (1803), probably (type not seen). *A. triphyllum* sensu recent Am. auth., not (L.) Schott.—Hood purple, without pale stripes. Plate 599, fig. 1.

Forma **zebrinum** (Sims), comb. nov. *Arum triphyllum, α. zebrina* Sims, Bot. Mag. t. 950 (1806). *Aris. hastatum* Blume, Rumphia, i. 96 (1835), plant with hastate-lobed leaflets.—Hood purple or bronze within, purple to greenish without, with long pale stripes on inner face. Plate 599, fig. 2.

Forma **viride** (Engler), comb. nov. *Arum triphyllum,* var. *β. virens* Michx. Fl. Bor.-Am. ii. 188 (1803), photograph of type in Gray Herb. *Arisaema atrorubens, β. viride* Engler in DC. Monogr. i. 536 (1879). *Aris. triphyllum,* var. *viride* (Engler) Engler, Pflanzenr. iv[23f]. 200 (1920). *Aris, triph.,* forma *viride* (Engler) Farwell (as *vivide*) in Am. Midl. Nat. xi. 50 (1928), xii. 53 (1930).—Spathe green, without or with only faint stripes. Plate 599, fig. 3.

In order to clarify the identities I am showing characteristic spathes of the different species and forms laid out to show the summit of the sheath and the flange at the junction of sheath and hood, in each case, × 1.

In plate 598, fig. 2 is the spathe of *A. triphyllum* from Great Neck, Princess Anne County, Virginia. *Fernald & Griscom,* no. 4351, plant identified by Mr. *C. A. Weatherby* with the original Clayton material; fig. 3. *A. triphyllum,* forma *pusillum* from Chestnut Neck, Mullica River, Port Republic, Atlantic County, New Jersey, *B. Long,* no. 12,064. Plate 599,

FIG. 1, is *A. atrorubens* from Hartford, Maine, *Parlin*, no. 2089; FIG. 2, *A. atrorubens*, forma *zebrinum* from southeast of Hopewell, Prince George County, Virginia, *Fernald & Long*, no. 9702; FIG. 3, *A. atrorubens*, forma *viride*, from Myrtle Beach, Horry County, South Carolina, *Weatherby & Griscom*, no. 16,469. PLATE 600, FIG. 4, is *A. Stewardsonii* Britton from Little Mud Pond, 4 miles northeast of Porter's Lake, Pike County, Pennsylvania, *Fogg*, no. 10,732. The seeds of *A. triphyllum*, × 5, are shown in PLATE 598, FIG 5, these from Little Neck, Princess Anne County, Virginia, *Fernald & Long*, no. 3822; characteristic seeds, × 5, of *A. atrorubens* from south of Milltown, Chester County, Pennsylvania, *Adams & Tash*, no. 558, are shown in PLATE 599, FIG. 4.

Two southern plants, *Arisaema quinatum* (Nutt.) Schott, with mostly quinate leaves and *A. acuminatum* Small, should be noted. The former is apparently only a frequent phase of *A. atrorubens* which often has the lateral leaflets lobed; while *A. acuminatum* (PLATE 598, FIG. 4) shows nothing but great size to separate it from typical *A. triphyllum*. The stalked obovoid seeds are too similar. I am leaving it as *A. triphyllum*, var. *acuminatum* (Small) Engler but gigantic plants of more northern *A. triphyllum* (rarely collected because of their great size) suggest that var. *acuminatum* is likely to prove of no taxonomic importance. The characteristic spathe, FIG. 4, is from Duval County, Florida, *A. H. Curtiss*, no. 2681.

Typically *Arisaema triphyllum* has the leaflets quite green on both sides, the relatively narrow leaflets attenuate or acuminate at both ends, the hood solidly colored (greenish or dark purple) and without clear striping. On the Cumberland Plateau of Tennessee and in western North Carolina there is an anomalous plant, with relatively broad and strongly rounded leaflets glaucous beneath, the spathe as in *A. triphyllum*, forma *pusillum*, except that it is clearly striped. In its extreme it is very definite, but one collection from Biltmore, North Carolina, with broadly rounded leaflets, has the solidly purple hood of forma *pusillum*. I am, therefore, treating the extreme plant as a variety because of its three characters. Further material may necessitate another disposition of it. I call it

ARISAEMA TRIPHYLLUM (L.) Schott, var. **montanum,** var. nov. (TAB. 600, FIG. 1–3), foliolis late obovatis vel ovatis apice subulato-aristatis subtus glaucis; spathe laminis intus purpurascentibus valde pallide striato-vittatis.—TENNESSEE: rocky slope at Caney Creek Falls, alt. 1200 feet, May 13, 1934, *E. B. Harger*, no. 7745 (TYPE in Herb. Gray.). NORTH CAROLINA: deep and rich woods, Biltmore, May 15, 1897, *Biltmore Herb.*, no. 1288[b].

In PLATE 600, FIG. 1 shows a characteristic leaf and FIG. 2, a spathe, × 1, of the TYPE; FIG. 3 a spathe opened out, × 1, of *Biltmore* no. 1288[b].

ZIGADENUS **densus** (Desr.), comb. nov. *Melanthium densum* Desr. in Lam. Encycl. iv. 26 (1796). *Helonias augustifolius* Michx. Fl. Bor.-Am. i. 212 (1803). *Amianthium angustifolium* (Michx.) Gray in Ann. Lyc. N. Y. iv. 121 (1848). *Z. angustifolius* (Michx.) Wats. in Proc. Am. Acad. xiv. 280 (1879). *Tracyanthus angustifolius* (Michx.) Small, Fl. Se. U. S. 251, 1328 (1903).

Desrousseaux thought that his new *Melanthium densum* might perhaps be the same as *Veratrum luteum* L. and gave the latter as a doubtful synonym. Consequently, later authors, including *Index Kewensis,* have assumed without examining Desrousseaux's material or detailed description that his *M. densum* is *Chamaelirium.* Desrousseaux's material, in Lamarck's herbarium, was collected in Carolina by Fraser. Its inflorescence, × ½, is shown in PLATE 601, FIG. 1. FIG. 2 is Michaux's type, also × ½, of *Helonias angustifolius.* That they are the same there can be no question.

STELLARIA CALYCANTHA (Ledeb.) Bongard, var. **laurentiana,** var. nov. (TAB. 602, FIG. 1 et 4), caulibus crassis 1–2 mm. diametro 3–5 dm. altis; foliis lanceolatis, primariis 3–7 cm. longis 5–11 mm. latis; pedunculis valde elongatis, imis 2–4 cm. longis, maturis adscendentibus; calycibus 4.5–5 mm. longis; capsulis maturis 5–6 mm. longis; stylis 1.3–1.6 mm. longis; seminibus 0.7–0.9 mm. longis.—QUEBEC: Anticosti Island, *Pursh;* Baie St. Claire, Anticosti, August 19, 1917, *Victorin,* no. 4219 (as *Moehringia macrophylla*); calcareous sea-cliffs and rock-slides by Gulf of St. Lawrence, Christie, Gaspé County, July 25, 1922, *Fernald & Pease,* no. 25,058 (TYPE in Herb. Gray); damp cold ledges, Baie Orignal, Bic, Rimouski County, June 27, 1905, *F. F. Forbes.*

Differing from the other eastern American variations of *Stellaria calycantha* (discussed below) in the great size of all its parts; our other eastern plants, true *S. calycantha* (*S. borealis* Bigel.) and its vars. *isophylla* and *floribunda,* having usually smaller leaves, mature calyx 2–3.5 (rarely –4) mm. long, mature capsules 3–5 mm. long, shorter styles and smaller seeds. Var. *laurentiana* was mistaken by me in RHODORA, xvi. 151 (1914) for the Pacific American *S. borealis* (or *calycantha*), var. *Bongardiana* Fernald, which has similarly long calyx, capsule, styles and seeds, but in maturity has the fruiting peduncles abruptly reflexed from the base.

The probable necessity to take up for the familiar *Stellaria borealis* the less known name *S. calycantha* makes it unfortunately necessary to transfer several varietal names and also to evaluate the characters recently emphasized in the group. In order that the situation may be clear it is important to illustrate the various points by photographs taken by Mr. Hodge. The transfers follow.

S. CALYCANTHA, var **Simcoei** (Howell), comb. nov. *Alsine Simcoei* Howell, Fl. Nw. Am. i. 83 (1897). *S. borealis,* var. *Simcoei* (Howell) Fernald in RHODORA, xvi. 150 (1914).

S. CALYCANTHA, var. **isophylla** (Fernald), comb. nov. *S. borealis,* var. *isophylla* Fernald, l. c. (1914). PLATE 602, FIG. 2; PL. 603, FIG. 4.

S. CALYCANTHA, var. **floribunda** (Fernald), comb. nov. *S. borealis,* var. *floribunda* Fernald, l. c. 151 (1914). PLATE 603, FIG. 2.

S. CALYCANTHA, var. **Bongardiana** (Fernald), comb. nov. *S. borealis,* var. *Bongardiana* Fernald, l. c. (1914). *S. sitchana* Steud., var. *Bongardiana* (as *Bongardia*) (Fernald) Hultén, Fl. Aleut. Isl. 165 (1937). PLATE 602, FIG. 3.

S. CALYCANTHA, var. **sitchana** (Steud.), comb. nov. *S. sitchana* Steud. Nom. ed. 2, ii. 637 (1841). *S. borealis,* var. *sitchana* (Steud.) Fernald, l. c. (1914). PLATE 602, FIG. 5; PL. 603, FIGS. 1 and 3.

Fenzl,[1] to whose judgment in the *Caryophyllaceae* everyone defers, had reduced *Stellaria borealis* Bigel. to *S. calycantha* (Ledeb.) Bongard, based upon *Arenaria calycantha* Ledeb. (1812) and, therefore, with a specific name older than *S. borealis* Bigel. (1824); and there was special significance in the fact that Ledebour's species was thus disposed of by Fenzl in Ledebour's Flora Rossica. When, however, in 1914 I doubted this identity and stood by the clearly described *S. borealis* Bigel., I based my skepticism upon the original diagnosis of *Arenaria calycantha* Ledeb. in Mém. de l'Acad. Sci. St. Pétersb. v. 534 (1812). Ledebour, along with Boissier, Schlechtendal, Bigelow and Torrey, stands out as one of the most accurate phytographers of his time. I, therefore, disliked to take up for *S. borealis,* with erect flowers on naked peduncles, the name given by Ledebour, for his

[1] Fenzl in Ledebour, Fl. Ross. i. 382 (1841).

Arenaria calycantha from Siberia was described with "pedunculis . . . diphyllis" or again "Pedunculi supra medium diphylli . . . Flores nutantes, interdum bractea ovata." Dr. Eric Hultén, however, in his Flora of Kamtchatka, ii. 64 (1928) unequivocally states that "the type-specimen in Hb. Hort. Petrop. of *Arenaria calycantha* Ledeb. which I have seen is identical with our plant [*S. borealis*], and it must therefore bear the name *Stellaria calycantha*." There is, consequently, no course, assuming that the plant Hultén examined was the actual type and that he correctly understood the characters of *S. borealis,* but to take up the very imperfectly described *S. calycantha.*

To this extent I am following him (and before him, Fenzl and Ledebour), with the reservation that a good photograph of the type, when it can be secured, may change the interpretation; but I cannot follow him when he says: "Fernald . . . includes as varieties under *S. borealis* Bigel. several forms which in my opinion represent distinct species" (p. 61). In his Flora of the Aleutian Islands, 164, 165 (1937), Hultén treats *S. sitchana* (*S. calycantha,* var. *sitchana*), with *S. sitchana,* var. *Bongardiana* (Fernald) Hultén, but misspelled *Bongardia* (*S. calycantha,* var. *Bongardiana*), as a species quite distinct from *S. calycantha* (*S. borealis*), quoting the characters I had used for them as varieties (merely the overlapping differences in length of calyx and capsule), to which he added "other characteristics"—"the styles are about twice as long (often broken on herbarium specimens), the stem is distinctly quadrangular and scabrous, especially on the edges, and, in many cases at least, short petals are developed. *S. calycantha* has a smooth, not quadrangular stem and no petals. As, furthermore, Fernald's varieties have a geographical area of their own and in general appearance differ considerably from typical *S. calycantha,* I think they together form a separate species."

As to the general appearance which Hultén finds to "differ considerably," plate 602, fig. 2, shows the upper part of one of the type specimens, × 1, of *S. calycantha,* var. *isophylla* (from New Hampshire), with sepals 2–3.5 mm. long; fig. 3 is from the upper half of a specimen, × 1, of var. *Bongardiana* from Atka Island (Dall), cited by Hultén and labelel by him as *S. sitchana,* var. *Bongardiana.* The difference in appearance does not seem to me specific. PLATE 603, FIG. 1, is a specimen, × 1, of the reputed species, *S. sitchana,* from Oregon (*Sheldon,* no. 8241); FIG. 2 a specimen, × 1, of *S. calycantha,* var. *floribunda* from near Lake Superior (John Macoun). I fail to get the specific dissimilarity in appearance, except that the mature fruiting peduncles of the former are more generally (but not always) reflexed than in the latter. PLATE 602, FIG. 4, shows a mature calyx and capsule, × 5, from an Anticasti (*Victorin*) specimen of the eastern *S. calycantha,* var. *laurentiana;* PLATE 602, FIG. 5, is a mature calyx and capsule, also × 5, from Alaskan var. *sitchana* (Wrangel, July 22, 1891, *Cooley*). The differences are not striking. Nor do the calyx and capsule, × 5 (FIG. 6), of *S. calycantha* from the White Mountains (type area of *S. borealis*) show any appreciable difference except in size, FIG. 6 from Ice Gulch, Randolph, New Hampshire, September 2, 1890 (*Churchill*).

If, as Hultén asserts, the type of *Stellaria calycantha* "is identical with our plant [*S. borealis*]" and if, as he also states, the wide-ranging *S. calycantha,* with relatively short calyx, capsule and styles, differs from the more localized and larger-flowered *S. sitchana* by having a "smooth, not quadrangular stem and no petals," it is most remarkable that that master of accurate observation and description, Jacob Bigelow, should, in his original description of *S. borealis* from the White Mts. of New Hampshire, have defined his new species as having "Stem . . . angular . . . Petals white, deeply cloven" (Bigelow, Fl. Bost. ed. 2; 182); that, still earlier, André Michaux, getting one of the narrow-leaved varieties (*S. calycantha,* var. *floribunda*) of the small-flowered series "in borealibus Americae septentrionalis" (which, as shown in his herbarium at Paris, meant Lake Mistassini and the Saguenay River), should have described it, as his *Spergulastrum lanceolatum,* "floribus petaliferis . . . Petala brevissima, ovalia" (Michx. Fl. Bor.-Am. i. 275); that Hooker, with material from "Throughout Canada" which, as shown by his detailed and critical discussion (his p. 99), he clearly understood, should have described *S. borealis* unequivocally "petalis bipartitis calyce aucto trinervia vix longioribus" (Hook. Fl. Bor.-Am. i. 94); that Torrey & Gray, both familiar with the common eastern plant, should have characterized *S. borealis* with "petals (sometimes none) 2-parted, nearly the length of the . . . sepals" (T. & G. Fl.

N. Am. i. 185). Michaux, Bigelow, Hooker, Torrey and Gray all knew their plants; and their uniform characterization of *S. borealis* (or *calycantha*) as having petals (sometimes not) is supported by the experience of others who have long known (some of us for more than half-a-century) the wide-ranging and highly variable plant with relatively short sepals, capsules, styles and seeds.

As to Hultén's other point, that the larger-flowered western series which he calls a distinct species, *Stellaria sitchana,* has "the stem . . . scabrous," while the small-flowered *S. calycantha* (*S. borealis*) "has a smooth . . . stem," I can only regret that he did not study a very full series of the North American plants. Had he examined with a medium-power binocular a good series of such plants as *S. calycantha* and vars. *isophylla* and *floribunda,* he would have found the stems of some plants glabrous, of others fully as scabrous (and that only remotely) as in much of the material of *S. sitchana.* Plate 603, fig. 3, shows a portion of stem, × 10, of *S. calycantha,* var. *sitchana* from Wrangel, Alaska, July 22, 1891 (*Cooley*); while fig. 4 is a similar piece, also × 10, of stem of var. *isophylla* from Madison County, New York (*House,* no. 17,651). The reputed "specific" difference, that the stem of the former is scabrous, that of the latter smooth, obviously is an unstable one.

The one usually decisive character which distinguishes vars. *sitchana* and *Bongardiana,* with mature calyx 4–5.5 mm. long and mature capsule 5–8 mm. long, from the series of *Stellaria calycantha,* with mature calyx 2–3.5 (–4) mm. long and capsules 3–5 mm. long, is the strong reflexing of the fruiting peduncles in the former series (this one often apparently constant, though only tardily developed, distinctive character not mentioned by Hultén), for the local var. *laurentiana,* of shores of the Gulf of St. Lawrence in Quebec, with ascending fruiting peduncles, is otherwise inseparable from the western var. *Bongardiana.* This character, however, loses its virtue when the fruiting peduncles of the small-flowered eastern plant become reflexed (see pl. 603, fig. 2).

Typical *Stellaria calycantha* has glabrous or only remotely scabrous stems. On the mountains from Washington to Montana and northern California var. *Simcoei* closely resembles it in its short and broad leaves, but the upper branches are definitely pilose. It is, therefore, noteworthy that Dr. G. N. Jones, unquestioningly accepting (Fl. Pl. and Ferns of Mt. Rainier, 76) Hultén's verdict, that *S. sitchana* is a distinct species, reduces without comment the local and uniquely pilose-stemmed var. *Simcoei* to the synonymy of the wide-ranging glabrous *S. calycantha*. Right here is a key-note to the whole situation. The series is one of the hundreds of plastic boreal species, growing extensively across or near the areas in which Pleistocene activity was extensive. Such species appear in different areas in somewhat different phases. To me these are geographic varieties, so confluent in their different characters that the sorting of specimens into piles with more than a single character semi-constant is seemingly impossible. Until some stable character besides the tardy reflexing of the peduncles is demonstrated for the western *Stellaria sitchana* I must continue to retain it within the plastic and wide-ranging *S. calycantha*.

Lychnis alpina L., var. **americana,** var. nov., omnibus partibus majoribus quam in planta Europaea; foliis radicalibus subcoriaceis 1.5–6.5 cm. longis 2–8 mm. latis; foliis caulinis 3–7-jugis, imis 1.5–5.5 cm. longis 2.5–10 mm. latis; calycibus 5–7 mm. longis; petalis roseis 8.5–14.5 mm. longis 3–6 mm. latis.—Greenland, Labrador, Newfoundland and eastern Quebec, southward confined to magnesian soils. Type: serpentine and magnesian limestone barrens, northeastern bases and slopes of Blomidon ("Blow-me-down") Mountains, Bay of Islands, Newfoundland, July 24, 1910, *Fernald & Wiegand*, no. 3395 (Herb. Gray).

Forma **albiflora** (Lange), comb. nov. *Viscaria alpina* (L.) Fenzl, forma β. *albiflora* Lange, Consp. Fl. Groenl. 19 (1880).

The albino form of var. *americana* is rare in comparison with the ordinary rosy-flowered plant.

The North American plants are usually coarser throughout than *Lychnis alpina*, var. *typica*[1] of Europe. Occasional collections from Iceland and Italy are as stout as ours and some from Iceland and Norway have flowers approaching ours in size. Furthermore, dwarfed American plants (especially from Greenland) may be as small as in some European specimens; but the average and ranges of size of the different organs shows a marked

[1] Lychnis alpina L., var. **typica**. *L. alpina* Sp. Pl. i. 436 (1753).

geographic segregation. 36 series of the European plant (typical *L. alpina*), including 130 plants, and 64 series, including 175 plants, of var. *americana* give the following results.

Var. typica	Var. americana
Radical leaves 1–3.5 cm. long, 2–5 mm. broad; cauline leaves 2–4 pairs, the larger leaves 1–3 cm. long and 2–5 mm. broad; calyx during anthesis 3–5 mm. long; petals (including claw) 6–8 (rarely –9) mm. long, 3–3.5 (–4) mm. broad.	Radical leaves thicker and firmer, 1.5–6.5 cm. long, 2–8 mm. broad; cauline leaves 3–7 pairs, the larger leaves 1.5–5.5 cm. long and 2.5–10 mm. broad; calyx during anthesis 5–7 mm. long; petals (including claw) 8.5–14.5 mm. long, 3–6 mm. broad.

The stature is variable but the following comparison is illuminating. Of var. *typica* 38% of the plants are less than 1 dm. high, of var. *americana* only 13%. Of var. *typica* 39% are from 1–1.5 dm. high, of var. *americana* 29%. Of var. *typica* only 14% are from 1.5–2 dm. high, of var. *americana* 29%. Of var. *typica* only 7% of the plants are 2–3 dm. high, of var. *americana* 27%, while no plants seen by me of var. *typica* are more than 3 dm. high, but 2% of var. *americana* are 3–4 dm. high.

Similarly, all but a few of the plants of var. *typica* have the stem (dried) at most 2 mm. in diameter at the first cauline node; but most plants of var. *americana* have the stems 2–4 mm. in diameter.

Silene caroliniana Walt., var. **pensylvanica** (Michx.), comb. nov. *S. pensylvanica* Michx. Fl. Bor.-Am. i. 272 (1803). *S. caroliniana,* subsp. *pensylvanica* (Michx.) Clausen in Rhodora, xli. 580 (1939).

S. caroliniana Walt., var. **Wherryi** (Small) comb. nov. *S. Wherryi* Small in Torreya, xxvi. 66 (1926). *S. caroliniana,* subsp. *Wherryi* (Small) Clausen, l. c. 582 (1939).

What is Actaea alba? (Plate 604). Two clearly defined species of *Actaea* occur in the northeastern states and southern Canada. They are distinguished as follows.

1. A. alba Bigel. in Eaton, Man. ed. 2: 123 (1818) and Fl. Bost. ed. 2: 211 (1824); Hook. Fl. Bor.-Am. i. 27 (1829); Torr. & Gray, Fl. N. Am. i. 35 (1838); and Gray, Britton, Robinson & Fernald and most subsequent authors; not *A. alba* Mill. Dict. ed. 8, no. 2 (1768) nor *A. spicata,* β. *alba* L. Sp. Pl. 504 (1753) nor, nomenclaturally at least, the following, resting upon the latter names: *A. americana* Pursh, α. *alba* Pursh, Fl. Am. Sept. ii. 366

(1814) and *A. brachypetala* DC., α. *alba* DC. Syst. i. 385 (1817). *A. pachypoda* Ell. Sk. ii. 15 (1821); Mackenzie in Torreya, xxviii. 53 (1928). *A. brachypoda* Rydb. Fl. Pr. Pl. 345 (1932), ascribed to Elliott and obviously an error for *A. pachypoda* Ell. —Pedicels in fruit becoming relatively thick, red or reddish; petals slender, mostly truncate; stigma during anthesis broadly sessile; fruits white, capped by the broad sessile purple stigma (whence the colloquial name DOLL'S EYES); seeds (3–) 5–10, 4–5 mm. long. PLATE 604, FIG. 1.

A form of *A. "alba,"* as above defined, has dark-red fruits. This is

A. ALBA, forma RUBROCARPA Killip in House, N. Y. State Mus. Bull. 243–244: 40 (1923).

It seems to be an extreme with darker fruits than in *A. brachypetala* DC., δ *microcarpa* DC. Syst. i. 385 (1817), described from near Boston with "baccis parvis albis subrubellis, pediculis incrassatis."

2. A. RUBRA (Ait.) Willd. Enum. 561 (1809) and most subsequent authors. *A. spicata*, γ. *rubra* Ait. Hort. Kew. ii. 221 (1789) and many later authors. *A. americana* Pursh and β. *rubra* Pursh, Fl. Am. Sept. ii. 366, 367 (1814). *A. brachypetala* DC., β. *rubra* DC. Syst. i. 385 (1817). *A. longipes* Spach, Hist. Veg. vii. 388 (1839).—Pedicels filiform; petals rhombic-spatulate, tapering to tip; stigma during anthesis slightly elevated above summit of ovary, in fruit contracted and relatively inconspicuous; fruit cherry-red; seeds 10–16, 3–4 mm. long.

The form with white fruits is

A. RUBRA, forma NEGLECTA (Gillman) Robinson in RHODORA, x. 66 (1908). *A. neglecta* Gillman in Lloyd, Drugs and Medicines, 235 (1884–5). *A. eburnea* Rydb. Mem. N. Y. Bot. Gard. i. 153 (1900). *A. alba* sensu Mackenzie in Torreya, xxviii. 53 (1928) and sensu Rydb. Fl. Pr. Pl. 345 (1932); not Miller nor Bigelow. PLATE 604, FIG. 2.

That species nos. 1 and 2 are wholly distinct everyone agrees. No. 1, our *Actaea "alba"* (PLATE 604, FIG. 1), is essentially southern, reaching Georgia, Louisiana and Oklahoma at the south and merely entering the southernmost borders of Canada; no. 2, our *A. rubra*, is northern, extending from Labrador to interior Alaska, becoming rare so far south as southern New England, northern New Jersey, southern New York, and westward into the Rocky Mountains. Until Mackenzie positively asserted that the Cornut plate (which started the name *A. alba* as used unequivocally for a century and three-fourths) was based upon the white-fruited form (forma *neglecta*) of *A. rubra* (PLATE 604, FIG. 2), everything was clear. Now, however, since Mackenzie's assertion (his pp. 52 and 53) that Cornut "very accurately figured" "our baneberry with slender pedicels," our *A. rubra*, forma *neglecta*, and that the latter "should be known by that name [*A. alba*], and . . . the ordinary red-fruited plant should be known as a form," the clarity of the past has suddenly been clouded. Rydberg promptly accepted Mackenzie's unqualified verdict; but, had he taken pains to look up the "very accurate" plate of Cornut, he would have found the fruiting raceme very far from convincing for any form of *A. rubra*, for the latter has the divergent filiform fruiting pedicels (FIG. 2) 1–2.5 cm. long. It is at least diverting that Mackenzie, apparently alarmed at the changes he was proposing, seems not to have been so uncompromisingly literal as in some of his other interpretations, when he proposed and chose a second alternative. Dismissing the plant with thick pedicels (PL. 604, FIG. 1) to which the name *A. alba* had previously been most applied and asserting without qualification that the Cornut plate (our p. 265, FIG. 1) is a "very accurate figure" of the white-fruited plant with slender divergent pedicels, *A. rubra* forma *neglecta* PL. 604, FIG. 2), he forthwith said:

"On the other hand, one can follow nature [as if the abundant white fruits are not natural!] and say that the red-fruited plant is undoubtedly the specific type, and that the first name applied to it (*Actaea rubra*) should be adopted, although published after *Actaea alba*. In this case one would treat the plant of Linnaeus [*A. spicata*, β. *alba* L., based on the Cornut plate] and of Miller [*A. alba* Mill. (1768)] as a form of *Actaea rubra* [*A. rubra* (Ait.) Willd. (1809)]." And he concluded: "My own preference is for the second course here indicated"!

Rydberg, although accepting the name *Actaea alba* for the plant with white fruits on slender pedicels, did not follow Mackenzie's preference to treat it as a form of the later-published *A. rubra*. He maintained them both as species, one with the white fruit "9–12 mm. long" and with seeds "about 4 mm. long," the other with red fruit "10–12 mm. long" and seeds "about 3 mm. long." Measurement of many seeds of each series shows them all the way from 3 to 4 mm. in length.

The whole difficulty arose from misunderstanding from the first of Cornut's plate, Cornut, Can. Pl. t. 77 (our p. 265, FIG. 1), which, as emphasized, Mackenzie considered as a "very accurate" figure of *Actaea rubra,* forma *neglecta* (PL. 604, FIG. 2). In publishing *A. spicata,* β. *alba* in 1753 Linnaeus rested the variety, without new description, wholly on the plate of Cornut (our p. 265, FIG. 1) and upon the figure in Morison's Historia, ii. fol. 1, t. 2, fig. 7 (our p. 265, FIG. 2), which was obviously copied directly from Cornut. In publishing *A. alba* in 1768 Miller gave the briefest of diagnoses and cited Morison (therefore by inference Cornut). Linnaeus had no material and Mackenzie states that there is nothing preserved to stand for Miller's plant. We, therefore, get back, automatically, to the Cornut plant (our p. 265, FIG. 1) as the only clear basis for *A. alba;* and that that is *not* a clear basis for any American species is apparent. The first definite differentiation of our two species was by Jacob Bigelow, first in Eaton's Manual (1818), later and very completely in Florula Bostoniensis, ed. 2 (1824). That *A. alba* sensu Bigelow and later authors was also *A. pachypoda* Ell. everyone has recognized; but the interpretation by Mackenzie and, following him, by Rydberg, that *A. alba,* as typified by the Cornut plate, is the slender-pedicelled *A. rubra,* forma *neglecta* (PL. 604, FIG. 2) is unique.

Cornut's *Canadensium Plantarum Historia* (1635) had an unfortunately misleading title, for, as repeatedly pointed out, it contains many plants which, at that date, had surely never seen Canada. Some, as indicated in the text, were admittedly not Canadian (*Bugula odorata lusitanica, Cyclamen orientale, Arundo indica,* etc.); others were wrongly supposed to be Canadian. To the latter group belongs, I think, the illustration of *Aconitum baccis niveis* [*et rubris*] which was the basis of *Actaea spicata,* β. *alba* L. and the only identifiable basis of *Actaea alba* Mill. Mackenzie (l. c. 53) had no doubt of the identity of Cornut's fruiting raceme with the American *A. rubra,* forma *neglecta,* saying: "Both the illustration by Cornut and the illustration by Morison represent a plant with slender pedicels and having an ovoid raceme and ovoid or ellipsoid berries. The only definite points to go on with Miller are his phrase 'racemo ovato' and his reference to Morison's figure. In other words, Cornut, Morison, Linnaeus and Miller all seem to have been dealing solely with *Actaea rubra*, f. *neglecta*." Had Mackenzie read Cornut's latin text he would have found some contradiction to the ellipsoid fruits of the plate in Cornut's statement that upon maturing the ovary becomes orbicular in outline. There is also food for thought in the statement by Cornut that the fruits may be red ("Baccae plerumque variant: vidimus enim etiam rubellas"). Incidentally, if one examines good material and illustrations of the European *Actaea spicata* L., described (by Moss, for instance, in the Cambridge British Flora, iii. 152) with "*Pedicels* about as long as the flowers" and with "*Fruit* . . . elliptical," he will have before him the species which was illustrated by Cornut! In order to show all the species which have been called *Actaea alba*, I have asked Mr. Hodge to reproduce the figures of Cornut (p. 265, FIG. 1) and of Morison (FIG. 2); a representative fruiting raceme (PL. 604, FIG. 1) of *A. alba* Bigel. and most later authors (*A. pachypoda* Ell.), from Granville, Nova Scotia (*Bartram & Long*, no. 23,862); a typical fruiting raceme (PL. 604, FIG. 2) of *A. rubra*, forma *neglecta*, from Willoughby, Vermont, July 11, 1898 (*Kennedy*); and reproductions from European plates of *A. spicata*: p. 265, FIG. 3 showing a flowering raceme from Moss, Cambr. Brit. Fl. iii. pl. 163; FIG. 4, a fruiting inflorescence from Schlechtendal, Langethal & Schenk, Fl. Deutschl. ed. 7, xi. t. 1087; FIG. 5, a fruiting raceme from Sturm, Fl. Deutschl. ed. 2, v. t. 39. That these figures of *A. spicata* are much closer to the plate of Cornut than are the two American species which have long been identified with it is apparent. To me it seems clear that Cornut had mixed material; his plate was obviously made from the European *A. spicata*, but his phrase "baccis niveis" and possibly some others came from American material he had received. At best the basis of *A. alba* Mill. was confused and I am taking up for *A. alba* sensu Bigel. and most later authors the unequivocal *A. pachypoda* Ell. This necessitates the following transfer.

Actaea pachypoda Ell., forma **rubrocarpa** (Killip), comb. nov. *A. alba*, forma *rubrocarpa* Killip in House, N. Y. State Mus. Bull. 243–244; 40 (1923).

ACTAEA SPICATA: FIG. 1, portion of the Cornut plate of ACONITUM BACCIS NIVEIS [ET RUBRIS], basis of A. SPICATA, β. ALBA L. and of A. ALBA Mill.; FIG. 2, portion of Morison's figure of CHRISTOPHORIANA AMERICANA, cited by Linnaeus under A. SPICATA, β. ALBA; FIG. 3, flowering raceme, × 1, after *Moss;* FIG. 4, fruiting raceme, × 1, after *Schlechtendal, Langethal & Schenk;* FIG. 5, fruiting raceme, × 1, after *Sturm.*

CIMICIFUGA RACEMOSA (L.) Nutt., forma **dissecta** (Gray), comb. nov. *C. racemosa*, var. *dissecta* Gray, Man. ed. 6: 47 (1890).

DESCURAINIA PINNATA (Walt.) Britton, var. **brachycarpa** (Richardson), comb. nov. *Sisymbrium brachycarpum* Richardson in Frankl. 1st Journ. App. 744 (repr. 16) (1823). *S. canescens* Nutt., var. *brachycarpum* (Richardson) Wats. Bibl. Index, 69 (1878). *S. pinnatum*, var. *brachycarpum* (Richardson) Jepson, Fl. Calif. ii. 46 (1936). *D. pinnata*, subsp. *brachycarpa* (Richardson) Detling in Am. Midl. Nat. xxii. 509 (1939). *D. pinnata brachycarpa* (Richardson) F. C. Gates in Trans. Kansas Acad. Sci. xlii. 137 (1940), the rank not definitely stated but the indecisive statement made on p. 135: "The trinomial in botany is usually referred to as a variety, although the designation subspecies would appear to be more reasonable."

The International Rules of Botanical Nomenclature quite reasonably recommend "not to publish a new name without clearly indicating whether it is the name of a family or a tribe, a genus or a section, a species or a variety; briefly, without expressing an opinion as to the rank of the group to which the name is given" (Recommendation xxi.). Furthermore, names or combinations put forward without clear statement of rank but with a suggestion that they belong in one or the other of two ranks (others besides the publishing author to make the decision), are invalid under the generally accepted International Rules. At the Amsterdam Congress (1935) the rule was accepted that "A name of a taxonomic group is not validly published unless it is *definitely accepted* by the author who publishes it. A name proposed provisionally (*nomen provisorium*) in anticipation of the eventual acceptance of a group, or of a particular circumscription, position or rank of a given group . . . is not validly published."—See Sprague in Journ. Bot. lxxiv. 75 (1936). This rule was adopted to guard against names put out in such indefinite status that the author leaves alternatives open in interpreting his real meaning.[1]

[1] The paper, *New Forms and Nomenclatorial Combinations in the Kansas Flora*, in Trans. Kansas Acad. Sci. xlii. 135–138 (1939, perhaps really 1940, the volume received at the Gray Herbarium March 4, 1940, the reprint March 19, 1940) contains several combinations which certainly are not new.

Descurainia intermedia (Rydberg) F. C. Gates (late 1939 or early 1940) is antedated by *D. intermedia* (Rydb.) Daniels in Univ. Mo. Studies, Sci. ser. i. 289 (repr. 147) (1907). *D. Richardsoniana* ("Sweet") F. C. Gates, said to be based on *Sisymbrium "Richardsoniana"* Sweet, Hort. Brit. ed. 2: 30 (1830), error for *S. Richardsoni* Sweet, is *D. Richardsonii* (Sweet) O. E. Schultz in Engler, Pflanzenreich, iv^{105}. 318 (1924). *Fraxinus pennsylvanica campestris* (Britton) F. C. Gates (1939 or 1940) was published as new by the same author also in 1938; *Apocynum cannabinum album* (Greene) F. C. Gates would have been a new

THE EASTERN AMERICAN VARIETIES OF RORIPPA ISLANDICA (PLATE 605). In 1928 I pointed out[1] that the plants then passing as *Rorippa* (or *Nasturtium* or *Radicula*) *palustris* should take an older specific epithet and should be called *Rorippa islandica* (Oeder) Schinz & Thellung. At that time I showed that the two common plants of North America are very different from the true Old World *R. islandica.* Subsequently[2] I suggested that the basic name, *Sisymbrium islandicum* Oeder, Fl. Dan. tab. 409 (1768), was invalid because published with a mark of interrogation and in a work partly polynomial in nomenclature; and, quoting European correspondents, I pointed out that the combination *Rorippa islandica* is carried back to Borbás. Later authors have, however, shown that *Sisymbrium islandicum* was validated, before any other specific epithet was published, by Murray in Nov. Com. Gott. iii. 81 (1773).

In the Journal of Botany, lxxvii. (Dec., 1939), Dr. T. A. Sprague made the characteristically British argument that the binomials of Oeder in Flora Danica, iii. are not invalidated by the rule adopted at Cambridge in 1930, as proposed by Sprague and his British associates: "Art. 68. Specific epithets are illegitimate in the following cases and MUST BE REJECTED [emphasis mine] . . . (4) When they were published in works in which the Linnean system of binary nomenclature WAS NOT CONSISTENTLY EMPLOYED." I am reproducing from Flora Danica, iii. a few treatments of species (p. 269). To him who runs it is sufficiently clear that "binary nomenclature was not consistently employed." If it had been, on the sophisticated basis argued by Sprague (that Oeder gave somewhere amidst the polynomial descriptive phrases emphasis to a Linnean binomial by use of roman type), why did Oeder not use roman type somewhere under the text of tab. DXXIII? The polynomial phrases wholly in italics are exactly

combination only if the trinomials meant subspecies, for as a variety it is *A. cannabinum*, β *album* (Greene) Béguinot & Belosersky, Rev. Monogr. del Gen. Apocynum, 105 (1913). *Astragalus longifolius* (Pursh) F. C. Gates has the same basinym as *A. longifolius* (Pursh) Rydberg, Fl. Neb. pt. 21: 47 (1895). *Gaura coccinea parviflora* (Torr.) F. C. Gates might have been a new combination if the author had unequivocally announced it as a subspecies. As a varietal name it is identical with *G. coccinea*, var. *parviflora* (Torr.) Rickett in Kew Bull. 1934: 57 (1934). *Rhus Toxicodendron Negundo* (Greene) F. C. Gates (1939 or 1940) was also published by the same author in 1938.

[1] RHODORA, xxx. 132 (1928).

[2] RHODORA, xxxi. 17 (1929).

those used by Linnaeus in 1753 as his bases for the binomial Lamium purpureum. Again, by Sprague's interprepation, binomial nomenclature was consistently employed by Oeder when, under tab. CCCLXXVI, he buried as effectively as possible the Linnean binomial Ranunculus aquatilis as a synonym under his third polynomial citation. In fact, a large proportion of the Linnean binomials cited by Oeder in this volume are given only in synonymy or in the 2nd or 3d string of polynomials. How, furthermore, can it be maintained that, in the explanation of the beautiful illustrations of the four wholly different mosses in tab. DXXXVIII, "the Linnean system of binary nomenclature was . . . consistently employed"? Three of the four species (75%) are under completely italicized polynomials, only the fourth having roman type employed for the "trivial" name.

Article 68 (4) of the International Rules was Art. 72 (3) of the Proposals of the Sub-Committee on Nomenclature of the British Botanical Conference (1929), presented to the International Botanical Congress of 1930 in "An attempt to remove various sources of ambiguity in the Rules" (p. 5). By many of those who supported the British proposal it was inferred that the rule was essentially clear; by Sprague's latest interpretation it is evident that to him, at least, its meaning is essentially *ambiguous*. Many of us who have long fought for international agreement in plant nomenclature and who still believe in such an ideal can see only disagreement if those in positions of authority in this technical and to most of us tedious, though unescapable evil, allow themselves to become advocates of violation of both the spirit and the letter of the rules. The difficulties are sufficient without seeking to increase them.

In a recent number of Rhodora (xlii. 25–32) Butters & Abbe correctly take up *Rorippa islandica* (Oeder ex Murr.) Borbás for the inclusive species and they there honor me by describing as *R. islandica*, var. *Fernaldiana* the plant which I had mistakenly called *Rorippa hispida* (Desf.) Britton, var. *glabrata* Lunell, and which Victorin, following my misidentification of Lunell's plant, had called *R. palustris*, var. *glabrata* (Lunell) Victorin. Butters & Abbe publish a photograph (their plate 588) of Lunell's type, showing it to be very close to *R. islandica*, var. *hispida* (Desv.) Butters & Abbe. They thus have cleared the identity

Tab. CCCLXXVI.

Ranunculo sive Polyanthemo aquatili albo affine millefolium maratriphyllum fluitans. J. B. II. 774.
Ranunculus aquatilis, albus, fluitans, Peucedani foliis. Herm. Lugdb. 516.
Ranunculus caule fluitante, petiolis unifloris, foliis capillaceis, longissimis, laciniis parallelis. Hall. 1161. Rupp. Jen. Hall. 104. *Ranunculus* aquatilis d. Linn. Sp. pl. 782.
Locus. In fluentis rapidioribus, e. g. fluvio *Hunte* prope *Dödlingen.*

Tab. CCCXC.

Saxifraga foliis caulinis palmatis petiolatis, caule bulbifero subramoso & multifloro. an S. *bulbifera?*
Locus. Ex Islandia attulit Clar. J. G. Kœnig, lectam prope *Adner See, Saide Fiell, Hraffntinna Fiel* prope *Kraffle.*

Tab. CCCCIX.

Sisymbrium, (islandicum?) *siliquis brevibus declinatis, foliis lyratopinnatis, foliolis ovalibus dentatis.*
Locus. In horto nobis luxuriat natum e seminibus a Dno *Kœnig* ex Islandia allatis, ubi crescit prope scaturigines calidæ, & alibi locis udis. Vereor autem ut a *S. sylvestri* satis differat.

Tab. DXXIII.

Lamium purpureum fœtidum folio subrotundo. C. B. P. 230. Kyll. Vir.
Lamium, purpureum, foliis cordatis obtusis petiolatis. Linn. S. N. 393. Hall. 272.
Locus. Vulgatissum in cultis & fimetis.

Tab. DXXXVIII.

1. *Bryum, foliis capillaribus, capsulis ovalibus erectis in pedunculis brevibus.*
   In Saxis Norvegiæ.
2. *Bryum, foliis setaceis curvatis, capsulis erectis obtuse ovatis, capitello oblique rostrato, apophysi capitulo subjecta.*
   In huma irrigua atra schisti montis *Eckeberg* prope Christiania, agnoscitur calyptra nigra in capsula viridi, diversum a *B. viridulo.*
3. *Bryum, foliis subulatis, capsulis sphæricis striatis in pedunculis brevibus lateralibus.*
   In alpibus Norvegiæ.
   cf. *Bryum foliis mollibus subulatis, setis brevissimis alaribus, capsulis ovatis.* Hall. 1802. t. 46. f. 8. Enum. 1128.
4. *Mnium*, cirrhatum, *foliis arefactione revolutis.* Linn. S. N. 700. Dill. t. 48. f. 42. Enum. 995. cf. Hall. 1786.
   In sylvis & ad sepes.

Some Treatments of Species by Oeder in Flora Danica, vol. iii, showing that "binary nomenclature was not consistently employed" in that Volume.

of Lunell's variety, but in doing so they seem inadvertently to have overlooked some points which would have greatly changed some of the varietal combinations they published.

Taking advantage of the printing of their study of the American varieties of *Rorippa islandica* and their clarification of the identity of the Lunell plant, *R. islandica,* var. *glabrata* (Lunell) Butters & Abbe, I undertook the needed revision of the genus for the Gray's Manual area; but, unfortunately, I am unable to maintain either var. *glabrata* or the very gratifying name var. *Fernaldiana.* My reasons follow.

Rorippa islandica, var. *Fernaldiana* is well represented in the Gray Herbarium by many sheets from Japan, Amur and Manchuria. They are so very unlike typical *R. islandica* (with very thin deeply pinnate cauline leaves and ellipsoid arcuate siliques) that it seemed most improbable that the acute students of the eastern Asiatic floras should not have detected the difference. They did detect it as early as 1861, when Regel beautifully described the plant in his Tentamen Florae Ussuriensis, Mém. Acad. Imp. Sci. St.-Pétersb., sér. 7, iv. no. 4: 20 (1861), as *Nasturtium palustre,* var. *microcarpum.* To be sure, N. Busch, Fl. Sib. et Orient. Extr. xxv. Crucif. 203 (1915), took up *N. palustre,* var. *microcarpum* in the sense of his *N. palustre,* var. *brevisiliquum* N. Busch, Rhoead. 326 (1909) and illustrated as var. *microcarpum* siliques of the latter, which to me are very characteristic fruits of var. *hispida* (Desv.) Butters & Abbe, and the latter authors specially comment that "Some of the fruits of Siberian plants figured by Busch under the name '*Nasturtium palustre* var. *microcarpum* Rgl.' are very similar to those of var. *glabrata*. . . . This combination, published, according to Busch in 1861, of course greatly antedates Lunell's, but from the very meager information available it is impossible to say whether the plants are in all respects identical. It seems best therefore for the present to retain Lunell's varietal name."

It is too bad that Butters & Abbe accepted Busch's misidentification of *Nasturtium palustre,* var. *microcarpum.*[1] The original description could easily have been secured and a probable isotype

[1] Busch also erred (his p. 207) in treating as *N. hispidum* (Desv.) DC. the very large-fruited *Camelina barbareaefolia* DC. or *Rorippa barbareaefolia* (DC.) Kitagawa, which he correctly describes as having fruits up to 9 mm. long and 5 mm. broad—measurements never met by *N. hispidum* or *R. islandica,* var. *hispida.*

of Regel's variety was quickly available for the asking. Here is Regel's original account:

58. **Nasturtium palustre** D. C. **var. microcarpum:** caule tenui deinde ramosissimo; fol. lyratis v. pinnatifidis v. subintegris; floribus luteis; siliquis parvis linearibus v. oblongo-ellipticis, nec turgidis.

Am obern Ussuri bei Damgu und der Mürenmündung, auch am Sungatschi.

Siliquae parvae, pedicello plerumque breviores, saepissime in paniculam ramosissimam densam congestae, in pedicello patentissimo adscendentes.

Liegt uns auch nebst der vorhergehenden Form in Examplaren vor, die Maximowicz am Amur sammelte.

Fortunately a sheet of the Maximowicz collection from Amur, which Regel said was representative of his *Nasturtium palustre*, var. *microcarpum*, is in the Gray Herbarium. It is a relatively small plant, but other eastern Asiatic specimens quite like it in foliage and fruit are several times as tall. PLATE 605, FIG. 1, is this authentic specimen, × 1, of *N. palustre*, var. *microcarpum* Regel; FIG. 2 is a small portion of fruiting inflorescence, × 1, from an isotype of *Rorippa islandica*, var. *Fernaldiana*. I do not see the difference. I am, consequently, forced into the seemingly ungracious necessity to reduce var. *Fernaldiana* to

RORIPPA ISLANDICA (Oeder ex Murr.) Borbás, var. **microcarpa** (Regel), comb. nov. *Nasturtium palustre*, var. *microcarpum* Regel in Mém. Acad. Imp. Sci. St.-Pétersb. sér. 7, iv. no. 4 (Tent. Fl. Ussur.), 20 (1861). *R. islandica*, var. *Fernaldiana* Butters & Abbe in RHODORA, xlii. 28 (1940).

The only possibility which may make it allowable to retain the name *Rorippa islandica*, var. *Fernaldiana* is the doubtful one, that some very recent European student has made the combination *R. islandica*, var. *microcarpa* for a wholly different plant. In 1892 Beck von Mannagetta, apparently not cognizant of the earlier variety of Regel (under *Nasturtium*) published a form of the pinnate-leaved European *R. palustris*, with more ellipsoid siliques at most 4 mm. long, as *R. palustris*, β. *microcarpa* G. Beck, Fl. Nied.-Österr. ii[1]. 466 (1892). This has later become *Radicula palustris*, var. *microcarpa* (G. Beck) C. E. Britton in Bot. Exch. Cl. Brit. I. Rep. for 1919: 806 (1920); also *Rorippa islandica*, forma *microcarpa* ascribed (erroneously) to Beck by Thellung in Hegi, Ill. Fl. Mitt.-Eu. iv[1]. 317 (1919). I have not found Beck's varietal name for the short-fruited typical *Rorippa islandica* used in that rank under *R. islandica;* if it has been properly transferred, with Beck's plant as the type, then var. *Fernaldiana* will automatically have to be taken up.

Even the varietal names here used, var. *microcarpa,* starting in 1861, and var. *hispida,* first used in varietal rank in 1856, are liable to upset. Dr. Hara calls my attention to *Nasturtium palustre,* vars. *majus* and *minus* Ledeb. Fl. Alt. iii. 8 (1831). The characterizations of Ledebour do not make clear whether his plants belong to one or both of the common varieties which occur in Asia and cross North America. When Ledebour's types (at Leningrad) can be properly studied a shifting of varietal combinations may necessarily result.

In their paper Butters and Abbe discuss at great length the type of *R. islandica* (Oeder ex Murr.) Borbás, var. *glabrata* (Lunell) Butters & Abbe, and set off under this name a selected series of five specimens from a somewhat unnatural area, North Dakota, Idaho and New Mexico, because, among other characters, "Most of the specimens of this entity have a large number of tricarpellate and tetracarpellate siliques." They had earlier (p. 26) stated that var. *glabrata* was originally thought by Lunell, when he published it as *R. hispida,* var. *glabrata,* to be "a glabrous form of the latter [*R. hispida,* i. e. *R. islandica,* var. *hispida*], which is evidently very close to its true status." It seems to me that they might, happily, have rested the case there. They based their deductions regarding the semi-cosmopolitan *R. islandica* and its many varieties upon measurements of only 93 specimens of the whole series. Had they seen a much greater representation from the whole range it is probable that they would have found their western var. *glabrata* not separable from great numbers of eastern specimens of var. *hispida* (Desv.) Butters & Abbe. I have before me 204 sheets of this single variety. The type of var. *glabrata* is closely matched or approached by material from Newfoundland (*Fernald & Wiegand,* no. 5486), Maine (Foxcroft, *Fernald,* type of *R. palustris,* var. *hispida,* forma *inundata* Victorin; East Machias, August 7, 1935, *Knowlton*), Ontario (Bruce Co., *Krotkov,* no. 7481) and Ohio (Oberlin, July 13, 1894, *W. M. Dick*). I have before me both numbers from Idaho cited by Butters & Abbe under their var. *glabrata.*

One, the type number of *R. terrestris globosa* Nelson, is too young for proper study but the other, *Nelson & Macbride*, no. 1318, was also distributed as *R. terrestris globosa* Nelson. In foliage this is matched or closely approached by so many plants (for instance *Abbe*, no. 1206 from Fog Island, Saguenay Co., Quebec) from Newfoundland, Quebec, Nova Scotia, New England, New York, Michigan and Indiana that their enumeration would be cumbersome. Similarly the small (2.5–4 mm. long, 1.7–2.2 mm. thick) ellipsoid to rounded-obovoid siliques of no. 1318 (FIG. 3) are so closely matched by fruits of specimens from Quebec, Maine, New Hampshire, Vermont, Massachusetts, Connecticut, New York (FIG. 4), Pennsylvania, Virginia and Florida, that I can merely offer the loan of these sheets to any who are skeptical. The New Mexican material picked out by Butters and Abbe as their var. *glabrata* is *Heller & Heller*, no. 3743. The very full sheet in the Gray Herbarium shows nothing unusual in foliage. It differs from the type of the variety and from *Nelson & Macbride*, no. 1318 in having much larger siliques (FIG. 5), up to 5 mm. long and 4 mm. thick. But plenty of eastern specimens of var. *hispida* have fruits meeting or closely approximating these dimensions (Newfoundland: *Fernald & Wiegand*, no. 5487. Quebec: *St. John*, no. 90,493, with tri- or tetra-carpellate siliques (FIG. 6); *W. F. Wight*, no. 269 (FIG. 7). Maine: Houlton, August 26, 1897, *Fernald;* and Massachusetts, Rhode Island and Connecticut, several specimens, including one from Rhode Island, *Thurber* (FIG. 8), upon which Asa Gray made the note "3–4-carpellary!", this forming the basis of the comment by Watson in Gray, Syn. Fl. i[1]. 148 (1895), under *Nasturtium terrestre*, var. *hispidum*, "*Tetrapoma pyriforme*, Seem.[1] . . . is a very closely allied form with globose or pyriform pods, which are often abnormal in the number of carpels (2 to 6) and cells, as occasionally occurs also in var. *hispidum*").

In view of the ready matching of the specimens cited as representing *Rorippa islandica*, var. *glabrata* by foliage and siliques of plants of var. *hispida* from the eastern border of the continent and in view of the occasional occurrence of 3 or 4 carpels in the eastern plant, I find myself unable to subscribe to var. *glabrata* as a well defined variety of the interior.

[1] *Rorippa barbareaefolia* (DC.) Kitagawa in Journ. Jap. Bot. xiii. 137 (1937); A. E. Porsild in RHODORA, xli. 232 (1939).

As already noted N. Busch confused the small-fruited *Rorippa islandica,* var. *hispida* (*R. hispida* (Desf.) Britton), the fruits measuring, according to the table of Butters & Abbe, only 2.2–5.5 mm. long and 1.7–3.7 mm. broad, with the large-fruited *R. barbareaefolia,* with fruits, as correctly stated by Busch, up to 9 mm. long and 5 mm. broad. This species of northeastern Asia and Pacific North America, east to Yukon and south to western Oregon, not only has the very large fruits commonly 3–4-carpellary, but its short and thick style without dilated stigma is characteristic. In well developed plants the fruiting racemes are so like those of *Camelina* that it is easy to see why DeCandolle originally placed the plant in that genus, as *Camelina barbareaefolia.* Fig. 9 is a fruiting inflorescence, × 1, of a typical Asiatic plant from Amur, *Maximowicz.* This species, which eventually may have to be considered a very extreme variety of *R. islandica,* with *R. islandica,* var. *occidentalis* (Watson) Butters & Abbe forming the transition, is here noted because two sheets from the northeastern shore of the Gulf of St. Lawrence in Quebec apparently belong to it. These are from grassy shore, Ile Bayfield (Sandy Island), Archipel de St. Augustin, July 21, 1915, *St. John* in Herb. Geol. Surv. Can. no. 90,492; rivages calcaires, luxuriant, Ile Tête-à-la-Baleine, Archipel de Mingan, 12 août, 1925, *Victorin & Rolland,* no. 21,439. These are particularly interesting as adding another to the identities in the flora of the Gulf of St. Lawrence and of the northern Pacific region.

In plate 605, fig. 1 is a representative (isotypic?) collection, × 1, of *Rorippa islandica,* var. *microcarpa* (Regel) Fernald, from Amur, *Maximowicz,* cited by Regel as characteristic; fig. 2, fruiting branch, × 1, from isotype of var. *Fernaldiana* Butters & Abbe, from Fort Fairfield, Maine, July 6, 1893, *Fernald*; fig. 3, siliques, × 5, of small-fruited extreme of var. *glabrata* (Lunell) Butters & Abbe (cited by them), from Twin Falls and Shoshone Falls, Idaho, *Nelson & Macbride,* no. 1318; fig. 4, *siliques,* × 5, of small-fruited extreme of var. *hispida* (Desv.) Butters & Abbe, from DeKalb, New York, *Phelps,* no. 514; fig. 5, silique, × 5, from large-fruited extreme of var. *glabrata* (cited by Butters & Abbe), from Santa Fé, New Mexico, *Heller & Heller,* no. 3743; fig. 6, tri- or tetracarpellate silique, × 5, large-fruited extreme of var. *hispida,* from Romaine, Lagorgendière, Saguenay Co., Quebec, *St. John* in Herb. Geol. Surv. Can., no. 90,493; fig. 7, silique, × 5, of large-fruited extreme of var. *hispida,* from Lake St. John, Quebec, *W. F. Wight,* no. 269; fig. 8, young tri- or tetracarpellate silique, × 5, of var. *hispida,* from Rhode Island, 1846, *Thurber;* fig. 9, raceme, × 1, of authentic *R. barbareaefolia* (DC.) Kitagawa, from Amur, *Maximowicz,* identified by Bunge.

VARIETIES OF RUBUS NUTKANUS. In 1935 I fell into the nomenclatural trap of taking up for *Rubus nutkanus* Moçino ex Seringe in DC. Prodr. ii. 566 (1825) the earlier name *R. parviflorus* Nutt. Gen. i. 308 (1818), overlooking the very simple fact that the latter is a later homonym of *R. parviflorus* L. Sp. Pl. 1197 (1753). Nuttall's later epithet had been perpetuated by Rydberg in *Rubacer parviflorum* (Nutt.) Rydb. in Bull. Torr. Bot. Cl. xxx. 274 (1903) and in N. Am. Fl. xxii. 426 (1913) and by Greene in *Bossekia parviflora* (Nutt.) Greene, Leaflets, i. 211 (1906), neither of them noting that the basic binomial was a later homonym. I have been informed that the varieties are merely trivial forms which may be found anywhere within the range of the species. This may sometime prove to be the case, but until var. *velutinus* is found more generally than along the Pacific slope in California, var. *Nuttallii* somewhere besides the region of the upper Great Lakes, var. *scopulorum* more generally outside the Rocky Mountain area, var *bifarius* more generally within the Rocky Mountain area, and var. *parvifolius* north or northwest of Utah and New Mexico, I am constrained to retain them as geographic varieties. Under *Rubus nutkanus* the varieties have the following names.

R. NUTKANUS Moçino ex Seringe in DC. Prodr. ii. 566 (1825). *R. parviflorus*, var. *grandiflorus* (as *grandiflora*) Farwell in Am. Midl. Nat. xi. 263 (1929); Fernald in RHODORA, xxxvi. 281, pl. 265, fig. 4 and map 20 (1935).

Var. **bifarius** (Fern.), comb. nov. *R. parviflorus*, var. *bifarius* Fernald, ibid. 280 and map 19 (1935).

Var. **hypomalacus** (Fern.), comb. nov. *R. parviflorus*, var. *hypomalacus* Fernald, ibid. 277, pl. 364, fig. 5 and map 17 (1935).

Var. **heteradenius** (Fern.), comb. nov. *R. parviflorus*, var. *heteradenius* Fernald, ibid. 279, pl. 364, figs. 6 and 7 and map 279 (1935).

Var. NUTTALLII Torr. & Gray, Fl. N. Am. i. 450 (1840). *R. parviflorus* Nutt. Gen. i. 308 (1818), not L. (1753). *R. nutkanus*, var. *parviflorus* (Nutt.) Focke in Bibl. Bot. xvii^{72}. 124 (1911). *R. parviflorus*, var. *genuinus* Fernald, ibid. 277, pl. 364, figs. 1 and 2 and map 15 (1935).

Var. VELUTINUS (Hook. & Arn.) Brewer, Bot. Calif. i. 172 (1876). *R. velutinus* Hook. & Arn. Bot. Beech. Voy. 140 (1832), not Vest (1823). *R. parviflorus*, var. *velutinus* (Hook. & Arn.) Greene in Bull. Torr. Bot. Cl. xvii. 14 (1890); Fernald, ibid. 277, pl. 364, figs. 3 and 4 and map 16 (1935). *Rubacer tomentosum* Rydb. in Bull. Torr. Bot. Cl. xxx. 274 (1903).

Var. SCOPULORUM Greene ex Focke in Bibl. Bot. xvii[72]. 124 (1911); Fernald, ibid. 283, pl. 365, fig. 5 and map 21 (1935).

Var. PARVIFOLIUS Gray, in Mem. Amer. Acad. ser. 2, iv. (Pl. Fendl.), 42 (1849). *R. parviflorus*, var. *parvifolius* (Gray) Fernald, ibid. 284, pl. 365, figs. 1–3 and map 22 (1935).

RUBUS, subg. EUBATUS, § **Persistentes,** nom. nov. § *Triviales* Rydb. in N. Am. Fl. xxii. 430 and 435 (1913), non P. J. Muell. in Flora (1858), 176.

The sectional name *Triviales* of P. J. Mueller (1858) for the trailing and pruinose brambles (*R. caesius* L., and others) of Europe, necessitates a new name for our non-pruinose southern dewberries with evergreen or persistent firm glabrous leaves and variously glandular but otherwise glabrous canes.

(*To be continued*)

SOME SPERMATOPHYTES OF EASTERN NORTH AMERICA

M. L. Fernald

(*Continued from page 276*)

Rubus parviflorus Nutt.—a Confession.

Professor Bailey calls my attention to a humiliating error. On p. 275 I rejected *R. parviflorus* Nutt., stating that I had overlooked "the very simple fact that the latter is a later homonym of *R. parviflorus* L. Sp. Pl. 1197 (1753)." The actual fact, most unfortunately, is that the Linnean species was *R. parvi*FOLIUS. *R. parviflorus* Nutt. is the valid name for the North American species.

Rubus hispidus L., var. **obovalis** (Michx.), comb. nov. *R. obovalis* Michx. Fl. Bor.-Am. i. 298 (1803).

True *Rubus hispidus* L., as shown by Bailey in Gentes Herbarum, i. 174, fig. 77 (1923), is the coarse extreme of the species, with copiously setose primocanes and petioles. It is in part *R. hispidus,* var. *major* Blanchard in Rhodora, viii. 213 (1906), Blanchard taking the less bristly and more slender *R. obovalis* as his *R. hispidus.* I distinguish the two as follows:

R. hispidus L. (typical). Canes woody, the stronger portions 2–5 mm. in diameter; primocanes with 300–2000 bristles and glands on a dm. of the median and terminal growth; petioles of principal new primocane-foliage with 100–500 bristles; terminal leaflet of primocanes 2.5–7 cm. long, 2–5.5 cm. broad.

Var. obovalis. More slender; canes weaker, mostly 1–2 mm. in diameter, quite smooth or with only 1–100 bristles per dm.; petioles of primocane-foliage smooth or with 1– rarely 100 bristles; terminal leaflet 1.5–4.5 cm. long, 1–3.5 cm. broad.

The slender var. *obovalis* is wider-ranging and extends farther south than the coarser and more bristly typical *R. hispidus.* I have studied the material in the Gray Herbarium and the herbaria of the New England Botanical Club and of the National Museum of Canada. These collections give the following results.

	Typical HISPIDUS	Transition	Var. OBOVALIS
So. Quebec and so. Ontario	14	0	5
Prince Edward Island and New Brunswick	8	0	0
Nova Scotia	6	2	12
Maine, New Hampshire and Vermont	50	4	55
Massachusetts	13	2	72
Rhode Island and Connecticut	3	1	17

	Typical HISPIDUS	Transition	Var. OBOVALIS
New York	4	5	4
New Jersey	2		7
Virginia	1		5
North Carolina	0		2
Ohio	0		1
West Virginia	0		1
Indiana	0		2
Michigan	1		0

Rubus, subg. Eubatus, § **Tholiformes,** nom. nov. § *Hispidi*. ser. *Jacentes* Bailey, Gentes Herbarum, i. 248 (1925). § *Jacentes* Bailey, ibid. ii. 300, 346 (1932).

True *Rubus jacens* Blanchard in Torreya, vi. 147 (1906), is, as originally stated by Blanchard, a small member of the *Hispidi*, with slender canes trailing, and elongating to about 1 m. It is a local plant of dry clearings and pastures from the warm Connecticut Valley of southwestern New Hampshire (tobacco country) to southeastern New York and eastern Pennsylvania. The coarse arching or doming plant, so abundant in Nova Scotia and in the White Mountain region, thence extending northward into Quebec and west across northern New York, not only makes complex domes, with arching to ascending primocanes, but its long curving branches, reaching the ground, trail for 2–3 meters and then root. This coarse plant, misidentified by Brainerd and Peiterson (Blackberries of New England, Vt. Agric. Expt. Sta. Bull. 217: 77 (1920)) and later by Bailey (in including the Nova Scotian plant) is very unlike true *R. jacens*. It is the species I am calling *R. adjacens*. Since I can hardly place *R. jacens* in a section apart from the equally depressed *R. hispidus* Michx., *R. vigil* Bailey and *R. cubitans* Blanchard, and since *R. adjacens* has the coarser and doming habit of *R. permixtus* Blanchard, *R. arcuans* Fern. & St. John, *R. tardatus* Blanchard, *R. severus* Brainerd, and *R. novanglicus* Bailey (members of § *Jacentes*, as treated by Bailey) this doming and arching section can hardly be called § *Jacentes* (based on *R. jacens*). On account of the arching or doming habit of growth, the chief diagnostic character of the section, which separates it, on the one hand, from the prostrate § *Hispidi* Rydb., on the other from § *Setosi* Bailey, erect plants without long-arching and tip-rooting canes, I am renaming § *Jacentes* as defined by Bailey, l. c., and basing the name on the characteristic doming *R. tholiformis,* which admirably displays the habit of the section.

RUBUS (EUBATUS, § THOLIFORMES) **tholiformis,** sp. nov. (TAB. 606 et 607), valde arcuans cannis tholos formantibus, cannis vel ramis ad 1 m. longis apice saepe radicantibus; primocannis 3–7 mm. diametro densissime griseo- vel fusco-glandulosis setosisque, setis divergentibus 1–2 mm. longis aculeiformibus subrigidis; primocannae foliis quinatis ternatisve chartaceis pallidis opacis glabris, costis subtus prominulis pilosis; foliolis elliptico-ovalibus plerumque basi apiceque acuminatis duplicato-serratis; foliolo terminali 7–11 cm. longo 3.5–6.5 cm. lato basi subrotundato petiolulo glandulifero setosoque 1.2–2.4 cm. longo; floricannae foliis ternatis, foliolis obovatis vel late ovatis acutis anguste serrato-dentatis; inflorescentiis corymbosis vel corymboso-racemosis rhachis pedicellis calycibusque griseo-villosis; bracteis saepe trifidis; pedicellis subadscendentibus 1–2 cm. longis glandulosis plus minusve setosis; calycis glanduloso-setosis, lobis brevibus deinde reflexis; petalis 0.5–1 cm. longis, 3–4 mm. latis; fructibus subglobosis 1–1.3 cm. diametro.—Abundant in Coös County, NEW HAMPSHIRE: sandy terraces of Connecticut River, Stewartstown, September 4, 1917, *Fernald & Pease,* no. 15,600; damp or springy thickets, Colebrook, July 18 and 19, 1917, *Fernald & Pease,* no. 15,723, September 3, 1917, *Fernald & Pease,* nos. 15,604 and 15,605; dry bushy hillside, Colebrook, September 3, 1917, *Fernald & Pease,* no. 15,661; sandy plains, thickets and roadsides, Stratford, July 18, 1917, *Fernald & Pease,* nos. 15,724, 15,728 and 15,729, September 3, 1917, *Fernald & Pease,* no. 15,666; damp alluvial thicket (by Connecticut River), Northumberland, July 18, 1917, *Fernald & Pease,* no. 15,722, September 3, 1917, *Fernald & Pease,* no. 15,784; boggy thickets and clearings, Lancaster, July 18, 1917, *Fernald & Pease,* no. 15,817; sandy roadside, Millsfield, September, 5, 1917, *Fernald & Pease,* no. 15,658; alluvial thicket by Androscoggin River, Errol, September 5, 1917, *Fernald & Pease,* no. 15,783; bushy swales and borders of woods, Randolph, July 18, 1917, *Fernald & Pease,* no. 15,733 (TYPE in Herb. Gray), August 8, 1917, *Fernald & Pease,* no. 15,666. All distributed erroneously as *R. frondisentis* Blanchard.

Rubus tholiformis, identified by the late Ezra Brainerd as *R. frondisentis* Blanchard, is really very unlike that species in many characters. *R. frondisentis,* of southeastern Vermont and adjacent southwestern New Hampshire, is a stiffly erect species, with hard prickles, and leaves velvety beneath. *R. tholiformis,* separated from it by three-fifths the length of New Hampshire and by the White Mountain system, has doming canes with tip-rooting branches, the primocanes densely covered with fine setae, the leaves quite glabrous except for the pilose nerves beneath. Superficially *R. tholiformis* suggests *R. aculiferus* of northern New Hampshire, *R. adenocaulis* of Nova Scotia and the following species of northern New Hampshire. *R. aculiferus* and *R. adenocaulis* have the leaves velvety-pilose beneath, the flowers large, with petals mostly 1.3–1.5 cm. long and 5–10 mm. broad. The primocanes of *R. aculiferus* have hard conic-subulate prickles and very few glands, and the petioles and petiolules are strongly prickly and essentially glandless; *R. tholiformis,* with glabrous foliage with heavily glandular and finely setose petioles and petiolules, and with small petals, really has little relationship to it. *R. adenocaulis* shares with *R. tholiformis* the densely glandular and short-setose primocanes but, as noted, its foliage is velvety-pilose beneath, its terminal primocane-leaflets are subcordate and on petiolules 2–4 cm. long (in *R. tholiformis* narrowed to slightly rounded to base and on petiolules only 1.2–2.4 cm. long), its raceme elongate instead of corymbiform, with strongly armed rachis, entire upper bracts, much larger petals and larger fruits. The many characters separating *R. tholiformis* from the following species will be considered in the discussion of that plant.

Rubus tholiformis is so abundant and characteristic in sandy or alluvial thickets, on sand plains or in sandy swamps of the upper Connecticut and upper Androscoggin systems north of and among the northern White Mountains that it should confidently be sought in Essex County, Vermont, Compton County, Quebec and Oxford County, Maine.

Plate 606, fig. 1, is a characteristic leaf of a primocane, × 1, from Stratford, Coös County, New Hampshire, *Fernald & Pease,* no. 15,728; fig. 2, junction of primocane-leaflets, × 5, from Stewartstown, New Hampshire, *Fernald & Pease,* no. 15,600; fig. 3, lower surface of primocane-foliage, × 10, from no. 15,728. In plate 607, fig. 1 is a flowering branch, × 1, from Stratford, *Fernald & Pease,* no. 15,729; fig. 2, flowers and pedicels, × 5, from no. 15,729; fig. 3, piece of primocane, × 3, from no. 15,728.

Rubus (Eubatus, § Tholiformes) **spiculosus,** sp. nov. (tab. 608 et 609), valde arcuans deinde depressis, cannis vel ramibus ad 2 m. longis apicibus prostratis rarissime radicantibus; primocannis 3–6 mm. diametro retrorso-setosis, setis ad 3 mm. longis discretis (100–500 per dm.), glandulis sparsis; primocannae foliis quinatis firmis pallidis glabris petiolo 6–12 cm. longo sparse setoso vix glandulifero; foliolis elliptico- vel rhomboideo-ovatis longe acuminatis acute serratis costis subtus prominulis glabris vel glabrescentibus; foliolo terminali 7–14 cm. longo 3.5–8 cm. lato saepe subcordato petiolulo sparse setoso 1–3 cm. longo; floricannae foliis ternatis, foliolis anguste ovatis vel rhomboideo-obovatis acuminatis argute serratis; racemis laxis saepe subcorymbiformibus rhachi pilosi 3–8 cm. longi; bracteis lanceolatis saepe incisis; pedicellis laxe patentibus plerumque 2.5–5 cm. longis griseo-pilosis glanduliferis vix setosis; calycis pilosis saepe glandulosis lobis 6–7 mm. longis deinde reflexis; petalis anguste obovatis 1.2–1.5 cm. longis, 5–9 mm. latis; fructibus subglobosis 1.3 cm. diametro.—Northern and central NEW HAMPSHIRE: Coös County: wooded bank of Magalloway River, Errol, September 5, 1917, *Fernald & Pease*, no. 15,678; borders of dry woods near Mascot Pond, Gorham, *Fernald & Pease*, no. 15,659; borders of woods by the carriage road, Mount Washington, at 760 m., August 7, 1917, *Fernald & Pease*, no. 15,774. Grafton County: dry thickets and borders of woods, Lincoln, July 28, 1917, *Fernald*, nos. 15,707, 15,708, 15,795, 15,801, 15,802, 15,815 and 15,816, September 23, 1917, *Fernald*, no. 15,602; sandy roadsides and clearings, Johnson, Lincoln, August 25, 1917, *Fernald*, no. 15,676; borders of dry or wet woods or in alluvial thickets, North Woodstock, Woodstock, July 11, 1915, *Fernald*, no. 11,761; August 7, 1915, *Fernald*, no. 11,745, July 14, 1917, *Fernald*, no. 15,790 (also in Pl. Exsicc. Gray., no. 361), July 31, 1917, *Fernald*, no. 15,718; August 3, 1917, *Fernald*, no. 15,598, August 20, 1917, *Fernald*, no. 15,664, September 12, 1917, *Fernald*, no. 15,791, mature of no. 15,790 (also in Pl. Exsicc. Gray., nos. 362 and 363, primocane and fruit of no. 361); damp thickets, clearings and roadsides, Thornton Gore, Thornton, July 28, 1917, *Fernald*, no. 15,814, August 27, 1917, *Fernald*, no. 15,766 (TYPE in Herb. Gray); dry thickets, clearings, swampy woods and roadsides, Plymouth, August 1, 1917, *Fernald*, nos. 15,595, 15,809 and 15,828. Belknap County: moist sandy thickets and borders of woods, Laconia, August 30, 1917, *Fernald*, no. 15,689; swampy thickets and damp borders of sandy woods, Gilford, no. 15,653. Specimens erroneously distributed as *R. multiformis* Blanchard or as "*R. canadensis* × *setosus*, fide Brainerd."

Just as *Rubus tholiformis* is the abundant pale-leaved and short-bristly doming or arching and finally tip-trailing species in the alluvial thickets and on terraces and sandy roadsides and sand plains of northernmost New Hampshire, so *R. spiculosus* is the superabundant species of similar habit in north-central New Hampshire, overlapping *R. tholiformis* only in eastern Coös

County, but dominating the sandy thickets of the Pemigewasset Valley. *R. tholiformis* has the grayish primocanes densely glandular and with almost innumerable horizontally divergent fine bristles only 1–2 mm. long; *R. spiculosus* has the primocanes greener and glabrous, with few or negligible glands and with scattered reflexed bristles mostly 3 mm. long. In *R. tholiformis* the foliage is chartaceous, with the prominent costae of the lower side strongly pilose; in *R. spiculosus* firmer, with the glabrous or glabrescent costae not specially prominent. In *R. tholiformis* the petioles and petiolules are heavily glandular, in *R. spiculosus* not. In *R. tholiformis* the subascending pedicels are 1–2 cm. long and more or less setose; in *R. spiculosus* the loosely divergent pedicels are mostly 2.5–5 cm. long and scarcely if ever setose. The petals of *R. tholiformis* are narrow, 3–4 mm. wide, and only 5–10 mm. long; in *R. spiculosus* they are showy, 5–9 mm. broad and 1.2–1.5 cm. long. In the silts and gravels of the Upper Connecticut where *R. tholiformis* abounds, lime is relatively abundant; in those of the Pemigewasset it is relatively deficient. These two superficially similar but really very distinct species well illustrate the localization of many species in the genus, many scores or hundreds of them yet to be worked out.

The identification of *Rubus spiculosus* with *R. multiformis* was unfortunate, for the latter species, although with a too catholic specific name, is quite glandless and its racemes are very prolonged. Brainerd's disposition of the many numbers of *R. spiculosus* as "*R. canadensis* × *setosus*" was an easy and ill considered verdict. The most accurate accounts of *R. canadensis* and *R. setosus* (in Bailey, Gent. Herb. ii. fasc. vi) correctly characterize the former as a "Tall upright smooth more or less glossy plant . . . Primocanes erect or upright-arching"; and *R. setosus* as an "erect or strongly ascending blackberry of low stature, . . . not tip-rooting." How, by crossing two species with erect habit constant offspring with long-arching and tip-rooting primocanes could be produced Brainerd did not attempt to explain; he was satisfied to assert that such was the source of *R. spiculosus*. Unfortunately, tentatively accepting his verdict, I long ago distributed all the duplicate material under the patently impossible identification supplied by him. In view of the extensive ranges of both *R. canadensis* (Newfoundland to

Ontario, south to New England and New York and along the mountains to Georgia) and *R. setosus* (Newfoundland and Quebec to Wisconsin, south to Nova Scotia, New England and Pennsylvania) it would be most singular if they were, to use Bailey's phrase, "to spawn into mongrels" (and mongrels so unlike either parent), that this phenomenon should transpire only in north-central New Hampshire and that there the "mongrel" should be so constant and ubiquitous a species.

In PLATE 608, FIG. 1 is a portion of a typical leaf of a primocane, × 1, from Thornton, Grafton County, New Hampshire, *Fernald*, no. 15,814; FIG. 2, junction of primocane-leaflets, × 5, from 15,814; FIG. 3, portion of primocane, × 3, from no. 15,814. In PLATE 609, FIG. 1 is an inflorescence, × 1, from Woodstock, New Hampshire, *Fernald*, no. 11,761; FIG. 2 a flower-bud and pedicel, × 5, from no. 11,761.

RUBUS (EUBATUS, § THOLIFORMES) **aculiferus,** sp. nov. (TAB. 610 et 611), arcuans deinde depressus valde ramosus, cannis vel ramis ad 3 m. longis apice saepe radicantibus; primocannis 5–10 mm. diametro aculeatis glanduliferisque, aculeis conico-subulatis rectis numerosissimis; primocannae foliis quinatis submembranaceis subtus pilosis petiolo longo aculeato glanduliferoque, foliolis ovatis longe acuminatis anguste duplicato-serratis, foliolo terminali cordato 8–12 cm. longo 5–8 cm. lato petiolulo setoso 1.5–3.5 cm. longo; floricannae foliis ternatis, foliolis ovalibus vel obovatis grosse serratis; inflorescentiis corymbosis corymboso-racemosis vel cymosis rhachi pedicellis calycibusque villoso-tomentosis, rhachi sparse setoso nec aculeato; bracteis superioribus plerumque divisis; pedicellis plerumque 2–8 cm. longis divergentibus; calycibus villosis lobis 7 mm. longis; petalis elliptico-obovatis 1.5 cm. longis 6–10 mm. latis; fructibus subglobosis 1 cm. diametro.—Abundant in northern NEW HAMPSHIRE: Coös County: sandy roadsides and thickets, Stratford, July 18, 1917, *Fernald & Pease*, no. 15,715; damp alluvial thicket, Northumberland, July 18, 1917, *Fernald & Pease*, no. 15,716; dry fields, clearings and thickets, Shelburne, September 6, 1917, *Fernald & Pease*, no. 15,765. Grafton County: abundant in woods and thickets along Eastman Brook, Thornton Gore, Thornton, July 28, 1917, *Fernald*, no. 15,710 (TYPE in Herb. Gray), August 27, 1917, *Fernald*, no. 15,810 (fruit of no. 15,710); damp thicket, borders of woods and roadsides, 1/2 mile west of Russell Pond trail, Thornton Gore, Thornton, August 27, 1917, *Fernald*, no. 15,606; borders of dry woods and recent clearings, North Woodstock, Woodstock, July 8, 1917, *Fernald*, no. 15,786, also *Fernald* in Pl. Exsicc. Gray., no. 364, August 15, 1917, *Fernald*, no. 15,837 (fruit of no. 15,786), also *Fernald* in Pl. Exsicc. Gray., no. 366 (fruit of no. 364), August 20, 1917, *Fernald*, no. 15,617. All distributed incorrectly as *R. abbrevians* Blanchard.

Rubus aculiferus, like *R. adenocaulis,* has most singularly been called *R. abbrevians.* The latter, as explained in the discussion of *R. adenocaulis,* is a very low and stiffly erect plant, with no inclination to tip-rooting. *R. aculiferus,* however, is one of the most extreme of tip-rooting species. The young and simple primocanes are at first ascending and up to nearly 2 m. in height. They then branch and rebranch, quickly making an intricate dome of fiercely prickly stems. These arching canes and branches soon reach the ground and extensively trail, often reaching a length of 2 or 3 m. From the abundant *R. adenocaulis* of Nova Scotia, the equally abundant *R. aculiferus* of the White Mountain country differs in the very sparse glandularity of its primocanes, in the essentially glandless petiolules of the primocane-leaflets, in its more corymbose or loosely cymose inflorescence with merely setose rachis and with the upper bracts mostly deeply cleft, and in the very long and loosely spreading pedicels. Its fruit is of superior quality. Extending generally north to the international boundary, *R. aculiferus* is confidently to be sought in the Eastern Townships of Quebec and also in northeastern Vermont.

In plate 610, fig. 1 is a portion of a typical primocane-leaf, × 1, from Woodstock, New Hampshire, *Fernald,* no. 15,837; fig. 2, lower surface of leaf, × 10, from no. 15,837. In plate 611, fig. 1 is a raceme, × 1, from Northumberland, New Hampshire, *Fernald & Pease,* no. 15,716; fig. 2, a flower-bud and pedicel, × 5, from Woodstock, *Fernald,* no. 15,786; fig. 3, portion of cane, × 3, from no. 15,837.

Rubus (Eubatus, § Tholiformes) **adenocaulis,** sp. nov. (tab. 612–615), arcuans vel deinde procumbens valde ramosus, cannis vel ramis 1–2 m. longis saepe radicantibus; primocannis 5–8 mm. diametro densissime glanduliferis plus minusve aculeatis, aculeis rectis basi latis, glandulis saepe fasciculatis numerosissimis; primocannae foliis quinatis firmis subtus pilosis petiolo 4–12 cm. longo aculeato glanduliferoque, foliolis ovalibus vel ovatis vel ovali-obovatis acuminatis anguste duplicato-serratis, foliolo terminali cordato vel subcordato 5–9 cm. longo 3.5–8.5 cm. lato petiolulo glandulifero aculeatoque plerumque 2–4 cm. longo; floricannae foliis ternatis, foliolis anguste ovalibus acuminatis; racemis elongatis rhachi pedicellis calycibusque dense villoso-tomentosis, rachi valde armato; bracteis superioribus integris vel subintegris; pedicellis subadscendentibus 1–2 (–3) cm. longis; calycis lobis villosis 4–6 mm. longis; petalis elliptico-obovatis 1–1.4 cm. longis 5–10 mm. latis; fructibus globoso-ovoideis 1.5–2 cm. longis.—Southwestern Nova Scotia: Yarmouth

Co.: damp to dryish roadside thickets, Yarmouth, July 24, 1920, *Fernald, Bean & White*, no. 21,545; September 7, 1920, *Fernald, Long & Linder*, no. 21,557 (fruit of no. 21,545); rocky roadsides and borders of woods, Yarmouth, July 4, 1920, *Pease & Long*, no. 21,585 (TYPE in Herb. Gray); gravelly railroad bank, Tusket, July 21, 1921, *Fernald, Bartram, Long & Fassett*, no. 23,996; open rocky thicket near Vaughan (Tusket) Lake, Gavelton, August 13, 1921, *Fernald & Long*, no. 24,016; sphagnous thicket, Markland (Cape Forchu), July 13, 1921, *Fernald, Bartram, Long & Fassett*, no. 23,982; border of spruce swamp, Markland (Cape Forchu), August 22, 1921, *Fernald & Long*, no. 24,025 (fruit of no. 23,982); Glenwood, September 13, 1924, *J. G. Jack*, no. 3416. Shelburne County: rocky railroad bank, Wood Harbor, July 9, 1920, *Fernald, Bissell & Linder*, no. 21,616; gravelly railroad bank, Atwood Brook, July 14, 1921, *Bartram & Long*, no. 23,987; rocky thicket bordering Welchtown (Birchtown) Lake, August 2, 1921, *Fernald & Long*, no. 24,003; sandy railroad ballast, Shelburne, August 3, 1921, *Fernald & Long*, no. 24,008 (as *R. arcuans* Fern.); sandy railroad bank, Sable River, August 4, 1921, *Fernald & Long*, no. 24,011 (as *R. arcuans*). Most specimens erroneously distributed as *R. abbrevians* Blanchard.

Rubus adenocaulis is very different from *R. abbrevians;* only a desperate wish to place it somewhere accounts for its original identification (coupled with the fact that it superficially resembles the characteristic doming, arching and tip-rooting shrub of the White Mountains which Brainerd had erroneously referred to *R. abbrevians*). *R. abbrevians*, however, as its name signified, is a stiffly erect shrub only 3–6 dm. high, the canes slenderly bristly. It is the type of the very definite section *Abbreviantes* Bailey. In its doming and finally long-trailing canes *R. adenocaulis* belongs in the § *Tholiformes.* Its only close ally is the common White Mountain species which has also erroneously passed as *R. abbrevians.* In its more prostrate extreme *R. adenocaulis* might be mistaken for *R. biformispinus* Blanchard, a wide-ranging species, from Quebec to New York, south to Nova Scotia, southern New England and eastern Pennsylvania, but that species has the leaves glabrous on the lower face, leaflets of the floricanes blunt or merely acutish, the rachis of the raceme unarmed, the petals only 4–6 mm. broad.[1] The misidentification

[1] In view of the prolonged canes and the collection of the type by *Long & Pease*, it has been suggested that an appropriate specific name could be made by uniting their names by the conventional connective, *i*. The necessary distortion of spelling and the question of capital initials leads me to forego this intriguing possibility.

with *R. arcuans* was quite inexcusable, for that species has glabrous foliage with obovate primocane-leaflets, the terminal one abruptly short-tipped and with only 12–35 coarse teeth on each side; the ovate long-acuminate terminal leaflet of *R. adenocaulis* being soft-pubescent beneath and with 40–50 fine serrations on each margin.

In PLATE 612, FIG. 1 is a portion of primocane and a leaf, × 1, from the TYPE, Yarmouth, Nova Scotia, *Pease & Long*, no. 21,585; FIG. 2, lower leaf-surface, × 10, from TYPE; FIG. 3, portion of cane, × 3, from Shelburne, Nova Scotia, *Fernald & Long*, no. 24,008. In PLATE 613, FIG. 1 is a medium-sized inflorescence, × 1, from the TYPE; FIG. 2, flower-buds and pedicels, × 5, from the TYPE. PLATE 614 is a larger inflorescence, × 1, borne on sprout-growth, from Sable River, Nova Scotia, *Fernald & Long*, no. 24,011. PLATE 615 is a fruiting branch, × 1, from Gavelton, Nova Scotia, *Fernald & Long*, no. 24,016.

RUBUS (EUBATUS, § THOLIFORMES) **adjacens,** sp. nov. (TAB. 616–618) arcuans vel deinde procumbens, cannis ad 2.5 m. longis, 3–8 mm. crassis; primocannis tholos formantibus apice liberis vel radicantibus densissime retroso-setosis plus minusve glandulosis, setis purpurascentibus vel coloratis valde imbricatis (3000–5000 per dm.); primocannae foliis coriaceis atroviridibus lucidis glabris quinatis vel ternatis petiolo 6–12 cm. longo setoso glanduliferoque, foliolis obovatis vel rhomboideis abrupte breviterque acuminatis serrato-dentatis, foliolo terminali rhomboideo-obovatis basi rotundo-subcuneato 4–8 cm. longo 2.5–5 cm. lato petiolulo piloso setifero glanduloque 0.5–1.8 cm. longo; floricannae foliis ternatis; foliolis anguste cuneato-obovatis subcoriaceis acutis vel subacutis, acute serratis; inflorescentiis corymbiformis corymbiformi-racemosis vel cymosis rhachi pedicellis calycibusque pilosis plus minusve armatis glanduliferisque; bracteis mediis lanceolatis simplicibus vel incisis; pedicellis arcuato-adscendentibus plerumque 1.5–2.5 cm. longis; calycis lobis plus minusve glanduloso-setosis 2.7–5 (–6) mm. longis; petalis anguste oblanceolatis 7–12 mm. longis 2–5 mm. latis; fructibus subglobosis ca. 1 cm. diametro.—Quebec to Nova Scotia, Maine and Massachusetts. QUEBEC: woods, vicinity of St. Jerome, Laurentide Mountains, July 8, 1920, *Victorin*, no 11,233. NEW BRUNSWICK: low land, Shediac Cape, July 27, 1914, *F. T. Hubbard;* railroad embankment, Ingleside, Westfield, Kings County, August 8, 1909, *Fernald & Wiegand*. NOVA SCOTIA: Lunenburg County: rocky thickets and woods, bordering Big Mushamush Lake, August 17, 1921, *Fernald & Long*, no. 24,024. Digby County: boggy thickets, Sandy Cove, August 28, 1921, *Fernald & Long*, no. 24,030; sandy roadsides, Weymouth, August 8, 1921, *Fernald & Long*, no. 24,012; moist thickets, Meteghan, July 7, 1920, *Fernald & Long*, no. 21,551. Shelburne County: gravelly railroad bank, Atwood

Brook, July 14, 1921, *Bartram & Long*, no. 23,988; dry rocky and gravelly slopes, Shag Harbor, July 9, 1920, *Fernald, Bissell & Linder*, no. 21,630. Yarmouth County: dry gravelly railroad embankment, Arcadia, July 12, 1920, *Pease & Long*, no. 21,542; damp to dryish roadside thickets, Yarmouth, July 24, 1920, *Fernald, Bean & White*, no. 21,546; gravelly railroad embankment, Yarmouth, September 7, 1920, *Fernald, Long & Linder*, no. 21,558; rocky and gravelly woods and thickets bordering Cedar Lake, July 11, 1920, *Fernald, Bissell, Pease, Long & Linder*, no. 21,599; gravelly thicket, Lower Argyle, August 11, 1920, *Fernald, Bissell, Graves, Long & Linder*, no. 21,619; sphagnous thicket, Markland (Cape Forchu), July 13, 1921, *Fernald, Bartram, Long & Fassett*, no. 23,983; rocky and cobbly border of Lake George, July 16, 1921, *Fernald & Fassett*, no. 23,992. MAINE: dry soil, Pembroke, July 24, 1909, *Fernald & Wiegand;* border of moist woods and thickets, Lyman, August 10, 1916, *Fernald & Long*, no. 13,902; west road to West Kennebunk, Kennebunk, July 12, 1905, *Blanchard* (as *R. hispidus*, var. *major*). NEW HAMPSHIRE: Coös County: boggy thickets and woods near Gorham, August 9, 1917, *Fernald & Pease*, no. 15,805. Grafton County: thickets, clearings and borders of woods, Lincoln, August 13, 1917, *Fernald*, no. 15,601, July 28, 1917, *Fernald*, nos. 15,706 and 15,719, August 23, 1917, *Fernald*, no. 15,838; dry or moist thickets or clearings, North Woodstock, Woodstock, August 7, 1915, *Fernald*, nos. 11,762, 11,764 and 11,767, July 6, 1915, *Fernald*, no. 11,779, August 20, 1917, *Fernald*, no. 15,614 (TYPE in Herb. Gray), July 14, 1917, *Fernald*, no. 15,750 (also in Pl. Exsicc. Gray., no. 367), August 22, 1917, *Fernald*, no. 15,751, fruit of no. 15,752 (also in Pl. Exsicc. Gray., nos. 368 and 369, primocane and fruit of no. 367), August 20, 1917, *Fernald*, no. 15,811; damp thickets and borders of woods, Thornton Gore, Thornton, August 27, 1917, *Fernald*, no. 15,609, 15,772 and 15,773. Belknap County: swampy thicket and damp border of sandy woods, Gilford, August 30, 1917, *Fernald*, no. 15,775. VERMONT: Ripton, August 19–21, 1903, *Eggleston*, no. 3241, as *R. hispidus* × *setosus*. MASSACHUSETTS: gravelly railroad bank, Concord, October 24, 1897, *W. P. Rich*. Mostly distributed erroneously as *R. jacens* Blanchard.

Rubus adjacens has passed generally as *R. jacens* Blanchard; some specimens have been identified as *R. hispidus* Michx. (var. *major* Blanchard). True *R. jacens*, however, is a relatively slender trailer with thin and pale green chartaceous primocane-foliage with lateral ribs impressed above and prominent beneath, the leaflets oblong-ovate and long-acuminate, and calyx mostly without glands. It occurs in relatively warm areas, the type-region, Alstead, New Hampshire, along the Connecticut River, being an area with many southern trees and shrubs (*Carya spp.*, *Castanea dentata*, *Quercus ilicifolia* and *prinoides*, *Sassafras albidum*, *Xanthoxylum americanum*, *Acer nigrum*, *Ceanothus americanus*, *Rhododendron roseum* and *Lonicera dioica*). It is clearly of the § *Hispidi*. *R. adjacens* is a relatively coarse species, the heavy primocanes doming, but finally becoming depressed. The material from northern New Hampshire was cited by Brainerd & Peiterson under *R. jacens* (as *R. hispidus* × *setosus*) and the error has been continued by others. It is one of the northernmost species, having its great development in western Nova Scotia, in the area of spruce forest, and in the White Mountain region, quite outside the limits of *Carya* and *Sassafras*. *R. adjacens* has coriaceous and lustrous primocane-foliage somewhat suggesting that of typical *R. hispidus* Michaux, but that has more truly evergreen leaves, with round-tipped or obtuse blunt-toothed leaflets, the floricane-leaflets firmer and obtuse, the pedicels only minutely (instead of strongly) pilose, the calyx mostly glandless, and the soon completely trailing primocanes bear only 200–2000 (in var. *obovalis* only 0–200) bristles and glands per decimeter (against 3000–5000 in the thinner-leaved, more arching *R. adjacens*, which has acute leaflets with sharp teeth, the calyx strongly glandular). In the very copious and overlapping bristles *R. adjacens* suggests *R. permixtus* Blanchard, but the indument of the primocane in *R. permixtus* is soft and plush-like (not stiffish), the leaflets pale and velvety to the touch beneath (not dark green, coriaceous and glabrous). *R. adjacens* likewise suggests some forms of *R. trifrons*, but its much coarser and more doming canes with 3000–5000 coarse and overlapping bristles (against a more slender habit and fewer—100–500—setae) per dm., its more coriaceous foliage and its later flowering and fruiting in the same areas, set it apart. It is as late as *R. tardatus* Blanchard but that poorly understood species has the slender canes with strong prickles and few if any setae and the primocane-foliage paler and more membranaceous, with longer-tapering strong-ribbed leaflets.

In PLATE 616, FIG. 1 is a portion of primocane with foliage, × 1, from the TYPE, Woodstock, New Hampshire, *Fernald,* no. 15,614; FIG. 2, junction of primocane-leaflets, × 5, from Woodstock, *Fernald,* no. 11,767; FIG. 3, portion of cane, × 3, from no. 11,767. In PLATE 617, FIG. 1 is a flowering branch, × 1, from Woodstock, *Fernald* in Pl. Exsicc. Gray., no. 367; FIG. 2, a calyx and pedicels, × 5, from no. 367. PLATE 618 shows fruiting racemes, × 1, from Thornton, New Hampshire, *Fernald,* no. 15,772.

RUBUS (EUBATUS, § THOLIFORMES) **bracteoliferus,** sp. nov. (TAB. 619 et 620), valde arcuans cannis tholos altos formantibus; primocannis valde elongatis 6–10 mm. diametro, apice radicantibus dense armatis, aculeis conico-subulatis setis glandulisque numerosissimis; primocannae foliis quinatis subtus subvelutinis, petiolo 1–1.3 dm. longo aculeato glanduliferoque, foliolis ovatis longe acuminatis duplicato-serratis, foliolo terminali cordato 1.2 dm. longo 7–8 cm. lato petiolulo glandulifero aculeatoque 3.5–4.3 cm. longo; floricanne foliis ternatis vel subquinatis, foliolis late ovatis acuminatis; racemis laxis rhachi 4–11 cm. longo sparse piloso plus minusve armato glanduliferoque; bracteis imis foliaceis ovatis acuminatis, superioribus valde reductis lanceolatis; pedicellis 7–12 arcuato-adscendentibus 2–4 cm. longis, glanduliferis aculeatisque, imis 3–6 bracteolas imbricatas gerentibus; calycis dorso breviter pilosis vel glabrescentibus glanduloso-setosis, lobis 7–10 mm. longis; fructibus subglobosis 1.5 cm. diametro.—NEW YORK: abundant in damp thicket back of dry sand dunes (overlying Silurian limestone) by Lake Ontario, northwest corner of Sandy Creek Township, Oswego County, August 25, 1922, *Fernald, Wiegand & Eames,* no. 14,337, distributed as *R. glandicaulis* Blanchard (TYPE in Herb. Gray).

Rubus bracteoliferus apparently belongs in the group of northern species constituting § *Tholiformes.* Its doming canes and tip-rooting habit place it there. In foliage it is very close to *R. Boyntoni* Ashe of the southern Appalachians, but its very copious armature of prickles, bristles and glands (many hundreds to a decimeter of typical primocane) and the elongate and more open racemes with much larger and acuminate lower bracts quickly distinguish it. It is really not very close to *R. glandicaulis,* that species having the upright canes of § *Alleghenienses.*

In PLATE 619, FIG. 1 is a portion of primocane, with leaf, × 1/2; FIG. 2, portion of primocane, × 3. PLATE 620 shows two fruiting racemes, × 1. All from the TYPE, from Stony Creek Township, Oswego County, New York, *Fernald, Wiegand & Eames,* no. 14,337.

RUBUS (EUBATUS, § THOLIFORMES) **paludivagus,** sp. nov. (TAB. 621 et 622), arcuans valde ramosus, cannis tholos formantibus, cannis ramisque apicibus saepe radicantibus; primocannis simplicibus deinde intricate ramosis 3–6 mm. diametro juvenilibus puberulis deinde glabratis armatis; aculeis rectis subulatis 5 mm. longis basi 2–3 mm. latis; primocannae foliis quinatis firmis vel submembranaceis supra strigoso-pilosis, subtus subvelutinis griseis; foliolis oblongis vel anguste lanceolato-ovatis duplicato serratis acuminatis basi angustis vel subrotundatis, foliolo terminali 7–8 cm. longis 2.5–3.7 cm. latis petiolulo armato 1–1.7 cm. longo; floricannae foliis ternatis membranaceis foliolis elliptico-lanceolatis, -oblanceolatis vel anguste ovatis acuminatis; racemis laxis rhachi plerumque 4–11 cm. longo sparse piloso; bracteis plerumque trifidis 4–8 mm. longis; pedicellis laxe adscendentibus pilosis plus minusve aculeatis plerumque 1.5–3 (–5) cm. longis ebracteolatis; calycis pilosis inarmatis lobis 3–5 mm. longis vix reflexis; petalis elliptico-obovatis 1–1.5 cm. longis, 6–7 mm. latis; fructibus pergratis 1.5 cm. diametro.—Barnstable County, Massachusetts: damp thickets bordering cranberry bogs, Harwich, June 26, 1918, *Fernald*, nos. 16,909 and 16,923; moist thicket along Doane Creek, Harwichport, Harwich, August 13, 1918, *Fernald & Long*, no. 16,910; damp thickets on dikes by cranberry bogs, east of Slough Road, Harwich, August 18, 1918, *Fernald & Long*, no. 16,924 (type in Herb. Gray.) ; all erroneously distributed as *R. argutus* Link.

Rubus paludivagus, characteristic of the wet margins of cranberry bogs on Cape Cod, really has little to do with *R. argutus*, although its leaves are quite similar to those of *R. argutus* as shown by Bailey, Gent. Herb. i. fasc. iv. fig. 84, p. 187 (1923). Bailey there and in Gent. Herb. ii. fasc. iv. 388, figs. 168 and 169 (1932)[1] identifies *R. argutus* as a southern erect or high-climbing species, with which I am very familiar in eastern Virginia. Its short corymbiform raceme is very leafy, the rachis, short pedicels and large calyx densely villous, the calyx-lobes promptly reflexed. It belongs in § *Arguti*, whereas *R. paludivagus* is a low-arching and tip-rooting species.

In plate 621, fig. 1 is a portion of primocane, with leaf, × 1, from the type, Harwich, Massachusetts, *Fernald & Long*, no. 16,924; fig. 2, lower leaf-surface, × 10, from the type; fig. 3, fruiting raceme, × 1, from the type. In plate 622, fig. 1 is a flowering raceme, × 1, from Harwich, *Fernald*, no. 16,909; fig. 2, portion of flowering cane, × 1, from Harwich, *Fernald*, no. 16,923; fig. 3, calyx and pedicel, × 5, from no. 16,923.

[1] I have elsewhere commented on the advantages of receiving credit for absent-treatment performances.—See Science, lxxxix. 329 (1939). Bailey, op. cit. 391, states that, "In 1897 I photographed these sheets in Berlin, and pictures have been taken by Fernald (see figs. 84, 127, Gent. Herb. i)". Unfortunately, to the best of my recollection, I have never visited Berlin nor have I examined Link's type. A tracing of it, made by Dr. J. M. Greenman, December 19, 1899, is in the Gray Herbarium. It is presumably this which Bailey had in mind.

RUBUS **laevior** (Bailey), stat. nov. *R. permixtus,* var. *laevior* Bailey, Gentes Herbarium, ii. 348 (1932).

Rubus laevior, occurring at the base of Cape Cod, differs in so many characters from *R. permixtus* Blanchard, found from southwestern Maine across New Hampshire and Vermont to central New York and originally described from the Connecticut Valley, that I find them quite as different as the other local species of the genus. The contrasts follow:

R. PERMIXTUS. Primocanes with 1000–5000 soft purple hairs and gland-tipped bristles with few prickles intermixed on a dm. of young growth; leaflets of primocane-foliage rhombic-ovate to obovate, abruptly short-pointed, the terminal ones 2.5–6.5 cm. long, and on heavily glandular petiolules only 0.7–2 cm. long; inflorescence an elongate raceme, the rachis, pedicels and calices villous-tomentose; bladeless bracts mostly lobed or cleft, lanceolate, elliptic or oval.

R. LAEVIOR. Primocanes with fewer and paler prickles and glands; leaflets of primocanes more gradually acuminate, the terminal ones 6–9 cm. long and on glandless or very sparsely glandular petiolules 2.3–3.5 cm. long; inflorescence a short corymbiform raceme or open cyme, the rachis, pedicels and calices minutely pilose to glabrescent; bladeless bracts linear-lanceolate, entire.

CENTELLA **erecta** (L. f.), comb. nov. *Hydrocotyle erecta* L. f. Suppl. 177 (1781). *H. reniformis* Walt. Fl. Carol. 113 (1788). *H. ficarioides* Michx. Fl. Bor.-Am. i. 161 (1803), not Lam. (1789). *H. repanda* Pers. Syn. i. 202 (1805). *Glyceria repanda* (Pers.) Nutt. Gen. i. 177 (1818). *Chondrocarpus repandus* (Pers.) by implication only, though ascribed by later authors as a binomial to Nutt. Gen. ii. Errata (1818). *Chondrocarpus erectus* (L. f.) Nutt. ex Wats. Bibl. Index, 425 (1878), as error for Nuttall's merely implied *C. repandus. H. asiatica* sensu Coult. & Rose, Revis. N. Am. Umb. 136 (1888), not L. (1753). *H. asiatica,* var. *Floridana* Coult. & Rose, l. c. (1888). *Centella asiatica* sensu Coult. & Rose in Contrib. U. S. Nat. Herb. vii. 30 (1900), not (L.) Urban (1879). *Cent. asiatica floridana* (Coult. & Rose) Coult. & Rose, l. c. (1900). *Cent. repanda* (Pers.) Small, Fl. Se. U. S. 859, 1336 (1903). *Cent. repanda floridana* (Coult. & Rose) Small, Fl. Se. U. S. l. c. (1903). *C. floridana* (Coult. & Rose) Nannfeldt in Svensk Bot. Tidskrift, xviii. 411 (1924).

Centella erecta, recently generally known as *C. repanda,* was clearly described by Linnaeus filius from Jamaica. It is the only member of the genus known from that and adjacent West Indian Islands, Fawcett & Rendle citing only the one species, as *Hydrocotyle asiatica.* The younger Linnaeus had dwarf plants "foliis cordatis crenatis, scapis paucifloris longitudine petiolorum", but plenty of West Indian specimens also show prolonged petioles, Jamaican material, coll. by *March* in 1858, showing them 2 dm. long and many times overtopping the scapes. Walter's *Hydrocotyle reniformis* (1788) was beautifully described, with the generic and specific characters emphasized: "foliis reniformibus, dentatis, erectis. Scapis, 2, 3ve 1, 2, 3ve floris, involucro diphyllo", and by Watson's Bibliographic Index and by Index Kewensis it is clearly made synonymous with the later *H. repanda* Pers. (1805). Walter's trivial name was quite available, though seven years later than that of Linnaeus filius, when the Persoon name was perpetuated and finally placed under *Centella.*

The plant varies greatly in stature in response to the simplest of edaphic factors. When it grows on open mud, without shade, its creeping stems hug the ground and the clusters of leaves will be crowded, with petioles down to 2.5–0.5 cm. long, with blades, naturally, reduced in area (down to 2.5–1.5 cm. long) and increased in thickness. When it grows among tall vegetation the loosely ascending petioles extend up to 1–3 dm. in length and the blades increase in size (up to 4–8 cm. long) and become relatively thin (as in most herbs under parallel conditions). Upon this difference and an implied difference in the size of fruit Coulter & Rose attempted to differentiate *C. "asiatica,"* including *Hydrocotyle repanda* Pers., with petioles "7.5–10 cm. or even 30 cm. long" and growing from "Maryland to Florida and west to Texas"; and *C. asiatica,* var. *floridana,* "Petioles 2.5 cm. long or less, making the leaves appear in rather close clusters along the rootstock, more or less pubescent; fruit somewhat larger and more or less pubscent," this short-petioled series occurring in "Florida; also in the West Indies and Central America"; the TYPE being *A. H. Curtiss,* no. 988, from near Jacksonville, Florida (in herb. Coulter). Fortunately or unfortunately, the sheet of *Curtiss,* no. 988 which came to the Gray Herbarium contains both developments of the plant; a tuft with petioles up to 2 dm. high and blades up to 5.5 cm. long, and a repent strand with short petioles and small blades. Similarly in the West Indies both extremes and all kinds of transitions occur, a Jamaican sheet showing, as already noted, petioles 2 dm. long. In our experiences in Virginia the largest and smallest extremes prove to be mere responses to light and moisture. Small, who was not averse to habit-species, went no farther than Coulter & Rose, but Nannfeldt, finding what seemed to him differences in size and proportions of fruits, treated these plants as two species, *C. repanda* and *C. floridana*. Unfortunately he rather reversed the ranges given by Coulter & Rose, citing *C. repanda* only from the West Indies to Texas, and north to South Carolina; while "**C. floridana** (C. et R.) Nannf. n. sp.", with "Spec. orig.: Purpus Nr. 5237 [from San Luis Potosí, Mexico]" was described "Planta robusta . . . Petioli . . . usque ad 15 cm. longa" and specimens were cited from north through eastern Virginia into Maryland. In other words, Nannfeldt, although deriving his specific epithet from Coulter & Rose, applied it largely to the plant which they excluded from their *C. asiatica* var. *floridana*. This difference arose through Nannfeldt's feeling that the Maryland and Virginia material had fruits somewhat broader, "4.5–5.0 mm." broad, while his *C. repanda* should have them "3.5–4.0 mm." broad. I have tried this character and get no satisfaction from it. Nannfeldt states that his description of the fruit of *C. repanda* was made from a Lindheimer specimen from Texas, from at least 800 miles away from the TYPE region in eastern South Carolina. His description of the fruit of his *C. floridana* was made, not from the Jacksonville TYPE, but from a specimen from San Luis Potosí, more than 1100 miles from Jacksonville and in a very different vegetational area. The Purpus plant, as represented in the Gray Herbarium, does have some fruits nearly 5 mm. broad; the TYPE number of *C. floridana* (*Curtiss*, no. 988) shows, in the Gray Herbarium sheet, fruits down to 3.5 mm. broad. The futility of struggling to recognize two species here is evident.

A word should be said regarding *Hydrocotyle cordata* Walt. Fl. Carol. 113 (1788). This name occasionally appears, with indication of doubt, in synonymy of *Centella erecta*. Walter had four species under *Hydrocotyle* and I am under obligation to my friend Ramsbottom for a very clear photograph of the four as represented in the Walter herbarium at the British

Museum. *H. umbellata* L. and *H. americana* L. were correctly described and are represented by characteristic specimens. *H. reniformis* Walt. was clearly described, with the generic characters of *Centella* and the tuft of long-petioled leaves was annotated (apparently by the late Keeper, James Britten) "*H. asiatica* (*repanda*)". Returning to *H. cordata*, described merely "foliis cordatis integris erectis", the specimen is a single characteristic leaf, correctly identified in the same hand as the last, "*Limnanthemum trachyspermum.*" Walter's *Hydrocotyle cordata* long antedated *Villarsia cordata* Ell., basis of *Nymphoides cordatum* (Ell.) Fernald in Rhodora, xl. 338 (1938). The latter name, under *Nymphoides*, cannot now be changed. *Hydrocotyle cordata* Walt., being of the same date and published in the identical volume with *Anonymus aquatica* Walt., cannot disturb the name *Nymphoides aquatica* (Walt.) Ktze. for the coarse southern species.

Zizia **trifoliata** (Michx.), comb. nov. *Sison trifoliatum* Michx. Fl. Bor.-Am. i. 168 (1803). *Z. aurea*, var. *Bebbii* Coult. & Rose in Bot. Gaz. xii. 138 (1887). *Z. Bebbii* (Coult. & Rose) Britton in Mem. Torr. Bot. Cl. ii. 35 (1890).

In view of the similarity of various species of *Zizia* and of *Thaspium* in the flowering condition it is most regrettable that the rule of priority of specific epithets forces upon a species of *Zizia* the specific epithet *trifoliata* when there is also a *Thaspium trifoliatum* (L.) Gray. Fortunately, however, the two species are quite dissimilar in appearance in the flowering condition. They will not be confused in fruit and foliage. *Sison trifoliatum* Michx. was from the high mountains of Carolina. That it is the plant generally known as *Z. Bebbii* will be clear from the photograph of the type, × ½ (our plate 623, fig. 1). Fig. 2 is a portion, × ½, of characteristic *Z. Bebbii* from Warm Springs, Georgia, *Tracy*, no. 8917.

Breweria **patens** (Desr.), comb. nov. *Convolvulus patens* Desr. in Lam. Encycl. iii. 547 (1789).

Breweria patens has been generally confused with *B. trichosanthes* (Michx.) Small. The latter species, resting nomenclaturally on *Convolvulus trichosanthes* Michx. Fl. Bor.-Am. i. 137 (1803), was described as having fascicles of 1–5 flowers, but the type shows all the peduncles with 3–5 flowers and is a good match for extremely large specimens of *B. aquatica* (Walt.) Gray. Desrousseaux beautifully described the very slender plant of sandy pine barrens and openings from North Carolina to northwestern Florida (our PLATE 624), with widely divergent 1-flowered peduncles and linear leaves. His material, sent by Fraser from Carolina, was characterized: "*Convolvulus filiformis suberectis foliis linearibus, mucronatis; pedunculis patentissimis folio longioribus*" and his fuller account emphasized the obtuse leaves about 1 inch long and 2 lines broad, solitary flowers on horizontally divergent peduncles with 2 oval to lanceolate bracts at summit, the sepals oval and pointed. That it is not the *Convolvulus trichosanthes* Michx. (= *Breweria aquatica*) is clear from PLATE 624, FIG. 1, showing a portion, × ½, of Desrousseaux's type. FIG. 2 is from a plant, × 1, from Liberty County, Georgia, *Wiegand & Manning*, no. 2632.

The following specimens are referred to *B. patens*. NORTH CAROLINA: dry open pine woods, 2 miles south of Pinebluff, Moore Co., *Wiegand & Manning*, no. 2631; sandhill, 12 miles north of Laurinburg, Scotland Co., *Godfrey*, no. 5047; sand-ridge at Carolina Beach, New Hanover Co., *Godfrey*, no. 4705; sand-ridge, 5 miles west of Clinton, Sampson Co., *Godfrey*, no. 4495. CAROLINA: without designation of locality, **FRAZER**, TYPE (see PLATE 624). GEORGIA: sandy roadside, 4 miles southwest of Hinesville, Liberty Co., *Wiegand & Manning*, no. 2632; sandy soil near Augusta, *Biltmore Herb.* no. 14953[d]. FLORIDA: dry pine barrens, De Funiak Springs, *A. H. Curtiss*, no. 5903 (distrib. as *Evolvulus sericeus* Sw.); De Funiak, *Tracy*, no. 9198.

HOUSTONIA **nigricans** (Lam.), comb. nov. *Gentiana nigricans* Lam. Encycl. ii. 645 (1786). *Houstonia angustifolia* Michx. Fl. Bor.-Am. i. 85 (1803).

The heretofore problematic *Gentiana nigricans* was described with "fleurs . . petites, purpurines ou bleuâtre, nombreuses, & disposée au sommet de la plante en cîme corymbiforme. Leur limbe est quadrifide & un peu pubescent à l'interieur." Lamarck had his doubts about it and really suspected the true generic affinity, commenting, "Il faudra peut-être la ranger parmi les *Houstonia*, avec lesquelles il paroît qu'elle a des rapports." PLATE 625, FIGS. 1 and 2 are the two plants, × 1, of the TYPE of *Gentiana nigricans;* FIG. 3 is a similar portion of *Houstonia* *angustifolia* from Georgia, *Boykin*, near the type region of Michaux's species. That they are the same no one is likely to question.

Lactuca **biennis** (Moench), comb. nov. *Sonchus biennis* Moench, Meth. 545 (1794). *S. racemosus* Lam. Encycl. iii. 400 (1789), not *L. racemosa* Willd. Sp. Pl. iii. 1524 (1804). *Sonchus leucophaeus* Willd. Sp. Pl. iii. 1520 (1804) as to plant described but excluding synonyms *S. spicatus* Lam. and *Prenanthes autumnalis* Walt. *Mulgedium leucophaeum* Willd. DC. Prodr. vii². 250 (1838). *L. leucophaea* (Willd.) Gray in Proc. Am. Acad. xix. 73 (1883), not Sibth. (1833). *L. spicata* sensu Hitchc. ex Britt. & Brown, Ill. Fl. iii. 276 (1898), not *Sonchus spicatus* Lam. Encycl. iii. 401 (1789), basinym.

It is most difficult to understand how *Lactuca biennis*, the erect large-leaved plant with thyrsoid-paniculate inflorescence of erect heads with pale- or dirty-bluish to whitish ligules should have been confused with the beautifully described *Sonchus spicatus* Lam., with the diagnosis "*Sonchus pedunculatis squamatis nutantibus, spica longissima virgata, foliis runcinatis*" and with the full account of this "Nouvelle espèce très-distinguée de toutes les autres par la disposition de ses fleurs. Sa tige est haute de deux à trois pieds, très-simple . . . feuilles . . roncinées . . les supérieures sont fort étroites, linéaires-lancéolées, entières, plus petites que les autres. Les fleurs sont purpurines, penchées ou même pendantes . . & disposées en un épi effilé, très-long, & terminal . . . Cette espèce a été trouvée dans la Caroline méridionale par M. Fraser, qui nous l'a communiquée". Lamarck clearly described *Prenanthes autumnalis* Walt.; in fact he cited Walter's species as a probable synonym! Incidentally, Fraser could not have missed *Prenanthes autumnalis* in South Carolina; he could hardly have found *Lactuca biennis* there. Small gives the southern limit as in North Carolina, and the only specimens from that state are from the Blue Ridge counties. Lamarck was familiar with our plant. He clearly described it, with pyramidal panicle and with the sessile pappus russet, as *Sonchus racemosus*. The photograph of his type is perfectly characteristic; but unfortunately there is already a *Lactuca racemosa*! The identity of *Sonchus spicatus* is so apparent from Lamarck's lucid account that, since noting the error of identifying the coarse *Lactuca* with it, I have merely waited until I could get a photograph of Lamarck's type before attempting to clarify the situation. The photograph of the type of *Sonchus spicatus*, received through the coöperation of Professor Humbert and Messrs. Metman and Cintract,[1] is conclusive; the clarification is only tentative.

The identity of the many North American plants described in the 18th and early years of the 19th centuries by European authors under *Lactuca*, *Sonchus* and *Mulgedium* are quite impossible to decipher from the meager descriptions alone. Yet, until they can be painstakingly studied, with fully representative American specimens for comparison, we can only take the statements of others regarding them. In modern would-be exact taxonomy no saying is more true than "you can trust nobody". In the present instance the untrustworthiness of past identifications is patent. The confusion seems to have started with the great and almost unexcelled scholar, A. P. DeCandolle, who, correctly describing *Mulgedium leucophaeum* (Willd.) DC. Prodr. vii^2. 250 (1838), "caule erecto glabro apice paniculato, . . . paniculae ramis racemosis . . . Capitula . . juniores albi demùm coerulescentes", cited *Sonchus spicatus* as a synonym but with the comment: "Nomen Lamarckii etiamsi vetustius sed falsum omisi". Starting with DeCandolle, the misidentification of *S. spicatus* has stood uncorrected for more than a century. Asa Gray, calling the coarse species of *Lactuca*, *L. leucophaea*, wrote in 1883, "The large synonymy of this species may be still further extended; for it must be the *S. racemosus* as well as *S. spicatus* of Lamarck, *S. biennis* of Moench, and it may also be *S. multiflorus* Desf."—Gray, Proc. Am. Acad. xix. 73 (1883). These with other synonyms and "*sensu*" names appeared under *L. leucophaea* (Willd.) Gray in the Synoptical Flora. As indicated in the opening paragraph of this note, the latter name is a later homonym. Some other names are similarly disbarred. Other names treated by Gray as synonyms, such as *S. pallidus* Torr., seem very doubtfully identified. Torrey's brief account called for a *yellow*-flowered plant of *fields*, with lanceolate-ensiform leaves and flowering in July. That sounds like some

[1] A package of photographs of types, arranged for two years ago, was mailed in Paris on September 1 and was delivered in Cambridge on December 6, 1939, more than 3 months en route!

form of *Lactuca canadensis.* The identity of *Sonchus biennis* Moench is not absolutely established but Gray had no doubt about it; and Moench's comparison of it with *S. alpinus* L., a European species with which our plant was much confused by early European authors (including Linnaeus) makes the identification reasonable. I, therefore, take up *L. biennis,* at least until Moench's type at Marburg can be examined. At any rate, we can use for our plant neither of the familiar names, *L. leucophaea* nor *L. spicata.*

The following forms should be noted.

L. BIENNIS, forma **integrifolia** (T. & G.), comb. nov. *Mulgedium leucophaeum,* β. *integrifolia* T. & G. Fl. ii. 499 (1843). *L. spicata,* var. *integrifolia* (T. & G.) Britton in Mem. Torr. Bot. Cl. v. 350 (1894). *L. spicata,* var. *aurea,* forma *integrifolia* Jennings in Ann. Carnegie Mus. xiii. 443, pl. 33 (1922).

L. BIENNIS, forma **aurea** (Jennings), comb. nov. *L. spicata,* var. *aurea* Jennings, l. c. 440 (1922).

III. ON TWO WEEDY CRUCIFERS

Reed C. Rollins[1]

During the last few years, weed specialists and agronomic botanists in America have become aware that two species of pernicious crucifers were passing in weed-surveys and bulletins as the same plant. Weed-manuals have usually given the common name of these plants as "hoary cress" or in some cases as "white-top". From the striking similarity of the two species, which have frequently been found growing in the same field, it is no wonder that they have been confused. Yet, taxonomically, the two have usually been known in separate genera under the names of *Lepidium Draba* L. and *Hymenophysa pubescens* C. A. Meyer. Both are introductions from the Old World and are apparently spreading rapidly, particularly in western North America. Repeated queries regarding the systematic position of these species have prompted a detailed examination of each with a view to determining their generic relationships.

Historically, *Lepidium Draba,* so-called, has often been thought of as an aberrant species in the genus *Lepidium.* Lin-

[1] Society of Fellows of Harvard University.

naeus himself in the tenth edition of his Systema and second edition of Species Plantarum shifted it from *Lepidium* to *Cochlearia*. Since that time, "*L. Draba*" or one of its numerous subspecies, varieties or forms has been placed, by different authors, in no less than five genera[1] other than *Lepidium*. Almost without exception, treatments of *Lepidium* have either excluded "*L. Draba*" or placed it by itself in a separate section or subsection of the genus. Thus, nearly everyone who has dealt with the plant has been impressed by its singular peculiarities and was not satisfied to give it equality with the general run of species in *Lepidium*. Some of the salient points of difference between "*L. Draba*" and the other species of *Lepidium* may be summarized as follows: 1, the fruits of "*L. Draba*" are indehiscent, those of *Lepidium* are dehiscent; 2, the siliques of "*L. Draba*" are neither strongly flattened nor carinate-margined, while in the rest of *Lepidium* the siliques are strongly flattened contrary to the narrow septum and the margins are either carinate or at least strongly compressed; 3, the siliques of "*L. Draba*" are somewhat inflated (markedly so in var. *repens*), whereas the siliques of *Lepidium* proper are uninflated; 4, the nectar-glands in "*L. Draba*" are comparatively large and well developed, completely surrounding the base of the single stamens and subtending the paired stamens but in the rest of *Lepidium* the nectar-glands are small, poorly developed, merely subtending the single stamens and only weakly developed below the paired stamens, or are absent entirely. According to Schulz,[2] myrosin-cells are found in the vascular bundles of "*L. Draba*", but none have been found in the vascular bundles of those species of *Lepidium* proper which have been investigated. Although the latter point does not have any practical taxonomic importance, it adds weight to the evidence against a presumed close direct relationship between "*L. Draba*" and other species of *Lepidium*. Taking all available evidence into consideration, it appears to be a mistake to continue "*L. Draba*" as a species in the genus *Lepidium*. The earliest generic name to which this species may

[1] *Nasturtium*, Crantz, Crucif. 91 (1769); *Cardaria*, Desvaux, Journ. de Bot. **3**: 163 (1814); *Draba*, Baumg., Enum. Stirp. Transilv. **2**: 232 (1916); *Cardiolepis*, Wallr., Sched. Crit. 340 (1822); *Physolepidion*, Schrenk, Enum. Pl. Nov. 97 (1841).

[2] Engler's Pflanzenf. **17b**: 416 and 476 (1936).

be referred is *Cardaria* of Desvaux l. c., hence the plant in question should be known as *Cardaria Draba* (L.) Desv.

The striking habital resemblance between *Cardaria Draba* and *Hymenophysa pubescens* suggests a closer relationship between the two than has usually been admitted. A detailed study of *H. pubescens* has not revealed a single valid reason for its not being considered congeneric with *C. Draba*. The siliques of *H. pubescens* are inflated and indehiscent; the seeds are large and have incumbent cotyledons; there is only one seed in each loculus of the ovary; the petals are broad-limbed and narrow-clawed as in *C. Draba;* and the style is of the same type as that found in the latter species. Most authors have separated *Hymenophysa* from *Lepidium* on the basis of its subglobose inflated silique and broad septum, but these characteristics are shared also by *C. Draba* var. *repens,* and to a lesser extent by typical *C. Draba*. The most important character which *Cardaria Draba* and *Hymenophysa pubescens* have in common is an indehiscent silique. In the species of *Lepidium* with which I am familiar, the siliques are definitely dehiscent. The extent of development and disposition of the nectaries of *C. Draba* and *H. pubescens* are similar, and both species possess myrosin-cells in their vascular bundles which seemingly further indicates close relationship. The available evidence indicates that *H. pubescens* should be placed in the genus *Cardaria*, which I should constitute as follows:

1. Cardaria Draba (L.) Desv.; based on *Lepidium Draba* L., Sp. Pl. **2:** 645 (1753). Type species of the genus.

The oldest American specimen of *C. Draba* in the Gray Herbarium, is *E. L. Greene no. 783,* collected near Yreka, California, in 1876. The species is now widely distributed in North America as a noxious weed. It is particularly troublesome in the slightly alkaline soils of many irrigated districts in western America, though it is by no means restricted to this type of habitat. Specimens of *C. Draba* have been seen from Nova Scotia, Massachusetts, Connecticut, New York, New Jersey, District of Columbia, Illinois, Nebraska, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, California, Oregon and Washington.

1a. C. DRABA (L.) Desv., var. REPENS (Schrenk) O. E. Schulz; based on *Physolepidion repens* Schrenk, Enum. Pl. Nov. 97 (1841).

Specimens of the variety have been seen from Alberta, South Dakota, California, Oregon and Washington. O. E. Schulz, l. c., has named these plants forma *macrocarpa*, but the additional epithet is not necessary for a clear understanding of variety *repens*.

2. C. **pubescens** (Meyer), comb. nov.; based on *Hymenophysa pubescens* C. A. Meyer in Ledeb. Ic. Pl. **2:** 20 (1830) tab. 165, and Fl. Alt. **3:** 181 (1831).

The plants of this species which have been introduced into North America are not typical of the species as originally described or of specimens coming from Central Asia. Our weeds have a much more elongated fruiting raceme and smaller siliques than those described and figured by Meyer, l. c., and by Busch.[1] There are four specimens of *C. pubescens* from the Altai region in the Gray Herbarium, all of which have a short dense raceme, compact subcorymbose inflorescence and larger siliques than specimens from North America. On the other hand, a specimen collected in 1939 in the territory of Neuquen, Argentina by A. Chicchi, is typical of the Altai plants. The Argentina collection, so far as I am aware, is the first collection of this weedy crucifer from South America. It should be pointed out that Schulz's illustration in Die Pflanzenfamilien[2] is of the plant which we now have as a weed in the United States and Canada. His figures so nearly match specimens collected in Idaho by Mrs. Soth, which were known to have been sent to him at the Berlin Herbarium,[3] that it is not improbable that these drawings were actually taken from Idaho-grown material. As near as I have been able to learn, the weedy *Cardaria pubescens* as found in North America is an undescribed variety which perhaps originally came from some area south and west of the Altai district of central Asia. Import-records indicate that the seeds of these plants were brought to America as impurities in Alfalfa seed.[4] The variety which is extant in North America is named as follows:

[1] Fl. Sib. et Orient. Extr. 107 (1913).

[2] Engler's Pflanzenf. 2 Aufl. **17b:** 477 (1936).

[3] Science **62:** 509 (1925).

[4] Mr. Herbert Groh of Ottawa is actively interested, and has a forthcoming paper on this subject.

2b. C. PUBESCENS (Meyer) Rollins, var. **elongata** var. nov. Herba perennis; inflorescentiis 4–10 cm. longis; siliquis 2.5–3.5 mm. latis. MICHIGAN: Ypsilanti, June, 1919, *C. Billington* s. n. (G); Aug., 1919, *B. A. Walpole* s. n. (G). IDAHO: Pocatello, July & Aug., 1925, *Mrs. M. E. Soth* s. n. (G, NY, US). WYOMING: near Powell, Park Co., June, 1933, *Rollins 324* (R). COLORADO: Fort Collins, *B. Thornton 1* (US); near La Jara, Aug., 1926, *M. W. Talbot* s. n. (US). CALIFORNIA: edge of an alfalfa field, near Sacramento, June, 1932, *Bellue* s. n. (US). OREGON: near Redmond, Sept., 1922, *Whited 499* (G); near Burns, Harney Co., July 9, 1933, *J. W. Thompson 11960* (G, TYPE; NY, US, *isotypes*); Klamath Falls, June, 1923, *Applegate 3603* (G). WASHINGTON: roadside south of Ellensburg, June, 1933, *Thompson 9047* (G, US); May, 1935, *Thompson 11539* (G, NY, US); near Tonasket, June, 1931, *Thompson 7107* (G, US); wheat field, Pullman, July, 1925, *R. F. Haxton* s. n. (G). Presumably the same plant has been reported from Pennsylvania by J. M. Fogg, Jr.,[1] but I have not seen specimens of the collections cited. Our plants are neither of the following species which have not turned up as weeds in North America.

Although I have not seen specimens of *Hymenophysa fenestrata* and *H. macrocarpa*, judging by their descriptions and notes concerning them, they are also to be included in *Cardaria*.

3. C. **fenestrata** (Boiss.), comb. nov.; based on *Hymenophysa fenestrata* Boiss. in Ann. Sci. Natur. Bot. **17**^{2}**:** 197 (1842). Turkestan.

4. C. **macrocarpa** (Franch.), comb. nov.; based on *Hymenophysa macrocarpa* Franch. in Ann. Sci. Natur. Bot. **15**^{6}**:** 233 (1883). Persia.

[1] RHODORA **39**: 190 (1937).

HEDYSARUM GREMIALE: FIG. 1, ISOTYPE, × 1/3; FIG. 2, loments, × 3; FIG. 3, summit of flowering raceme, × 3.

Photo. H. G. Fernald.

Arisaema triphyllum: fig. 1. type (leaf and smaller spathe), × 1, of Arum triphyllum L.; fig. 2. spathe, laid open, × 1, from type-region, Virginia; fig. 5 seeds. × 5. from Virginia.

A. triphyllum, forma pusillum: fig. 3. spathe. laid open. × 1, from New Jersey.
A. triphyllum, var. acuminatum: fig. 4. spathe. laid open. × 1. from Florida.

Photo. H. G. Fernald.

ARISAEMA ATRORUBENS: FIG. 1, spathe, laid open, × 1, from Maine; FIG. 4, seeds. × 5, from Pennsylvania.
A. ATRORUBENS, forma ZEBRINUM: FIG. 2. spathe, laid open, × 1, from Virginia.
A. ATRORUBENS, forma VIRIDE: FIG. 3. spathe, laid open, × 1, from South Carolina.

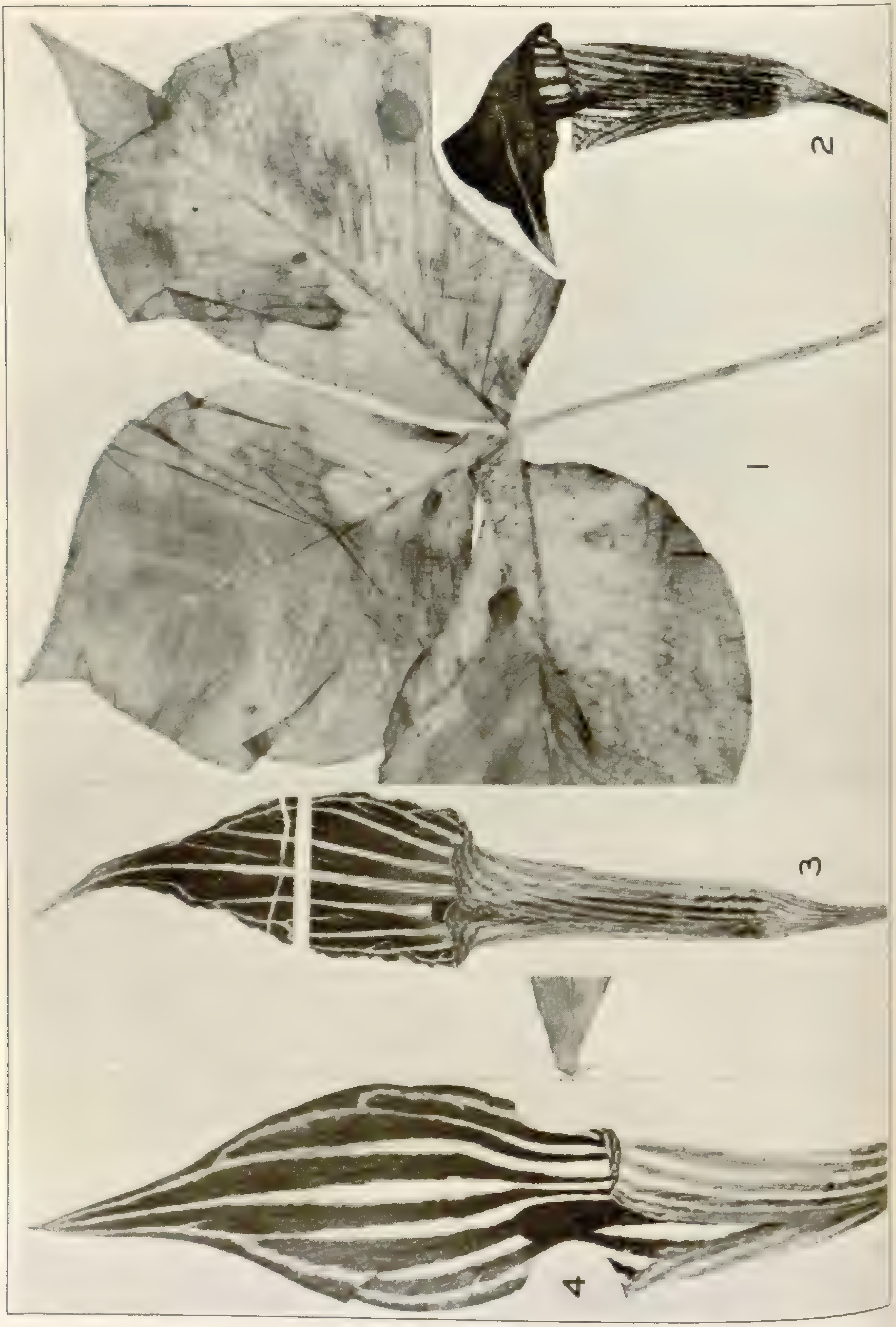

Photo. H. G. Fernald.

Arisaema triphyllum, var. montanum: figs. 1 and 2, leaf and spathe, × 1, from the type; fig. 3, spathe, laid open, × 1, from North Carolina.
A. Stewardsonii: fig. 4, spathe, laid open, × 1, from Pennsylvania.

FIG. 1. Type of MELANTHIUM DENSUM Desv., × ½.
FIG. 2. Type of HELONIAS ANGUSTIFOLIUS Michx., × ½.

Photo. W. H. Hodge.

Stellaria calycantha (*S. borealis*): fig. 6, fruiting calyx, × 5, from White Mountains, New Hampshire (type-region of *S. borealis*).

Var. laurentiana: fig. 1, portion of type, × 1; fig. 4, fruiting calyx, × 5, from Anticosti.

Var. isophylla: fig. 2, portion of type, × 1.

Var. Bongardiana: fig. 3, portion of plant, × 1, from Atka Island, Alaska.

Var. sitchana: fig. 5, fruiting calyx, × 5, from Wrangel, Alaska.

Photo. W. H. Hodge.

STELLARIA CALYCANTHA, var. SITCHANA: FIG. 1, portions of plant, × 1, from Oregon; FIG. 3, portion of stem, × 10, from Wrangel, Alaska.
Var. FLORIBUNDA: FIG. 2, portion of plant, × 1, from Ontario.
Var. ISOPHYLLA: FIG. 4, portion of stem, × 10, from New York.

Photo. W. H. Hodge.

ACTAEA PACHYPODA: FIG. 1, fruiting raceme (dried), × 1, from Nova Scotia.
A. RUBRA, forma NEGLECTA: FIG. 2, fruiting raceme (dried), × 1, from Vermont.

Photo. W. H. Hodge.

Rorippa islandica, var. microcarpa: fig. 1, isotype of Nasturtium palustre, var. microcarpum, × 1, from Amur (2 plants); fig. 2, fruiting raceme of isotype of *R. islandica*, var. *Fernaldiana*, × 1, from Maine.

Var. hispida: fig. 3, siliques, × 5, from Idaho, of *Nelson & Macbride*, no. 1318, distributed as *R. terrestris globosa* Nelson and cited by Butters & Abbe as *R. islandica*, var. *glabrata*; fig. 4, siliques, × 5, from New York; fig. 5, silique, × 5, from New Mexico, of *Heller & Heller*, no. 3743, cited by Butters & Abbe as *R. islandica*, var. *glabrata*; fig. 6, tetracarpellate silique, × 5, from Saguenay Co., Quebec; fig. 7, silique, × 5, from Lake St. John, Quebec; fig. 8, young tri- or tetracarpellate silique, × 5, from Rhode Island.

R. barbareaefolia: fig. 9, raceme, × 1, of authentic specimen from Amur.

Photo. H. G. Fernald.

RUBUS THOLIFORMIS: FIG. 1, characteristic primocane-leaf, × 1; FIG. 2, summit of petiole and bases of leaflets, × 5; FIG. 3, lower surface of leaflet, × 10.

Photo. H. G. Fernald.

Rubus tholiformis: fig. 1, portions of floricane and inflorescences, × 1; fig. 2, flowers and pedicels, × 5; fig. 3, portion of primocane, × 3.

Photo. H. G. Fernald.

Rubus spiculosus: fig 1, characteristic primocane-leaflets, × 1; fig. 2, summit of petiole and bases of leaflets, × 5; fig. 3, portion of primocane, × 3.

Photo. H. G. Fernald.

RUBUS SPICULOSUS: FIG. 1. tip of flowering shoot. × 1; FIG. 2. calyx and pedicel. × 5.

Photo. H. G. Fernald.

Rubus aculiferus: fig. 1, characteristic primocane-leaflets, × 1; fig. 2, lower surface of leaflet, × 10.

Photo. H. G. Fernald.

RUBUS ACULIFERUS: FIG. 1, portion of raceme, × 1; FIG. 2, calyx and pedicel, × 5; FIG. 3, portion of primocane, × 3.

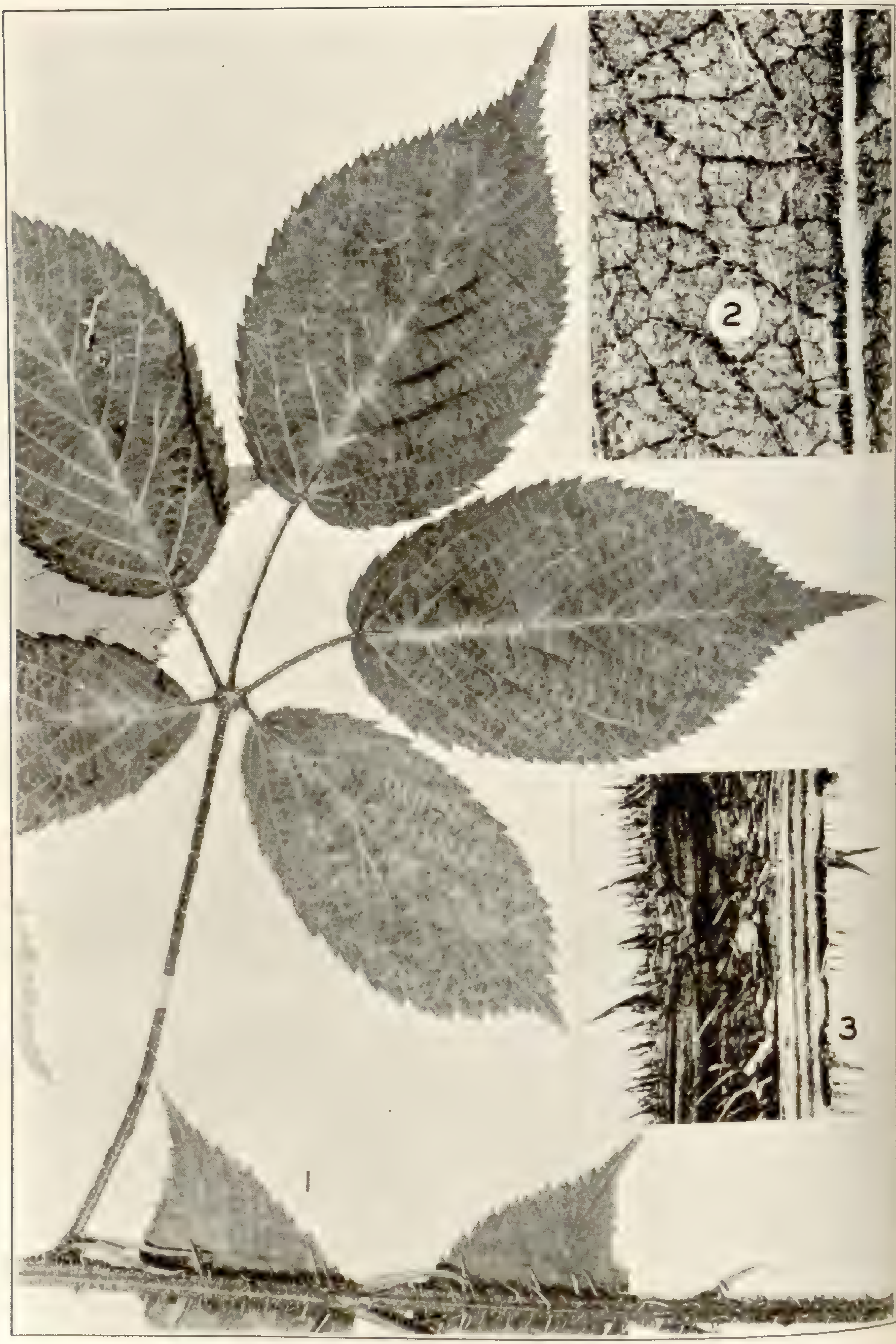

Photo. H. G. Fernald.

Rubus adenocaulis: fig. 1, portion of primocane and typical leaf, × 1; fig. 2, lower surface of leaflet, × 10; fig. 3, portion of primocane, × 3.

Photo. H. G. Fernald.

RUBUS ADENOCAULIS: FIG. 1, medium-sized inflorescence, × 1; FIG. 2, flower-buds and pedicels, × 5.

Photo. H. G. Fernald.

RUBUS ADENOCAULIS: tip of vigorous flowering sprout, × 1.

Photo. H. G. Fernald.

RUBUS ADENOCAULIS: fruiting racemes, × 1.

Photo. H. G. Fernald.

RUBUS ADJACENS: FIG. 1. portion of primocane, with characteristic foliage, × 1
FIG. 2. summit of petiole and bases of leaflets. × 5; FIG. 3. portion of primocane. × 3

Photo. H. G. Fernald.

RUBUS ADJACENS: FIG. 1. flowering branches. × 1; FIG. 2. calyx and pedicels. × 5.

Photo. H. G. Fernald.

RUBUS ADJACENS: fruiting racemes. × 1.

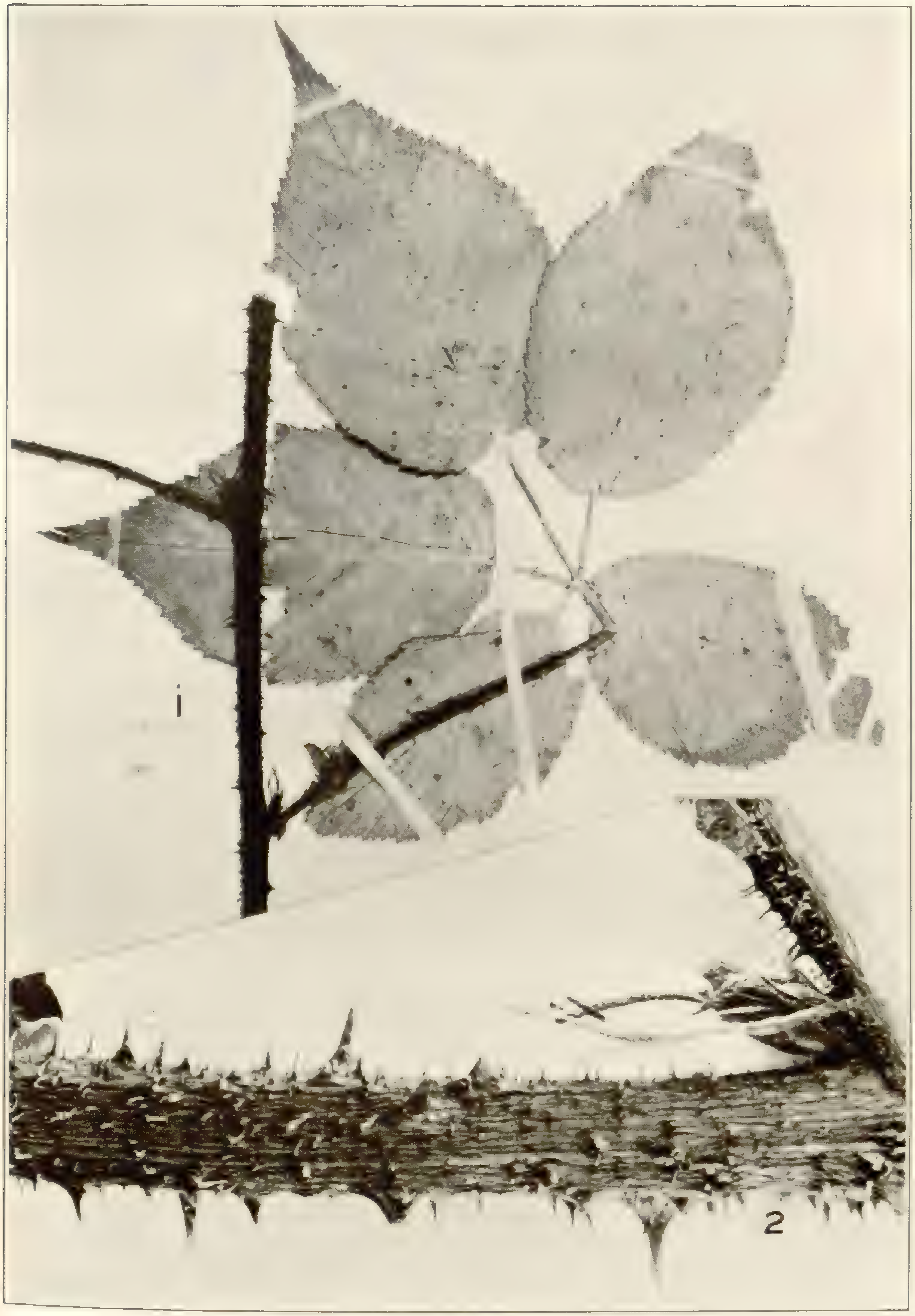

Photo. H. G. Fernald.

RUBUS BRACTEOLIFERUS: FIG. 1, portion of primocane and a primocane-leaf. × ½; FIG. 2, portion of primocane, × 3.

Photo. H. G. Fernald.

RUBUS BRACTEOLIFERUS: FIGS. 1 and 2, fruiting racemes, × 1.

Photo. H. G. Fernald.

Rubus paludivagus: fig. 1. portion of primocane and characteristic primocane-leaf. × 1; fig. 2. lower surface of leaflet. × 10; fig. 3. fruiting raceme, × 1.

Photo. H. G. Fernald.

RUBUS PALUDIVAGUS: FIG. 1, branches of vigorous floricane, × 1; FIG. 2, portion of typical floricane, × 1; FIG. 3, calyx and pedicel, × 5.

Photo. H. G. Fernald.

ZIZIA TRIFOLIATA: FIG. 1, TYPE, × ½, of *Sison trifoliatum* Michx.; FIG. 2, characteristic plant, × ½, of *Zizia Bebbii* (Coult. & Rose) Britton.

Photo. H. G. Fernald.

BREWERIA PATENS: FIG. 1, TYPE, × ½, of *Convolvulus patens* Desr.; FIG. 2, flowering plant, × 1, of *Breweria trichosanthes* sensu Small, not *Convolvulus trichosanthes* Michx.

Photo. H. G. Fernald.

HOUSTONIA NIGRICANS: FIGS. 1 and 2, TYPE of *Gentiana nigricans* Lam., × ½; FIG. 3, characteristic branch of *Houstonia angustifolia* Michx, × ½, from Georgia.

INDEX

New scientific names are printed in full-face type

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CONTRIBUTIONS FROM THE GRAY HERBARIUM
OF HARVARD UNIVERSITY

CXXXII

A LIST OF PLANTS FROM INTERIOR ALASKA

EDITH SCAMMAN

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CONTRIBUTIONS FROM THE GRAY HERBARIUM OF HARVARD UNIVERSITY—NO. CXXXII

A LIST OF PLANTS FROM INTERIOR ALASKA[1]

Edith Scamman

Of the great territory of Alaska—in extent equal to one-fifth the size of the United States—the Interior has received little attention from botanists. In Southeastern Alaska, the Aleutian Islands, and the Bering Sea region, many collections have been made and reports published, since the earlier years of Russian occupancy. Ledebour's "Flora Rossica" remains today a most valuable work for all students of Alaskan plant life.

But the vast Interior, cut through by the Yukon River—a natural highway for the gold seekers and adventurers of early days—and its drainage system, including the valleys of the Tanana and the Koyukuk Rivers, with Mt. McKinley Park as the southern boundary, contains a great wealth and variety of plants. Much of the region is unglaciated, except locally, and has, therefore, afforded a safe and secure home in which plant species have lived undisturbed for countless ages. On the mountains of this old region may be found growing in close proximity arctic-alpine plants, many circumpolar, cordilleran species of the Rocky Mts. and British Columbia, and Asiatic types, "transgressing" seven or eight hundred miles inland from the coast of Bering Sea. The distribution of plants in the Interior is, therefore, of considerable interest, and this list includes new localities and extensions of range for many species.

[1] Cost of publication defrayed by the author.

The summers of 1936 and 1937 were spent by the writer in Alaska for the purpose of collecting specimens for the Gray Herbarium. Small collections were made in Juneau and Seward, but are excluded here, as this list covers only vascular plants of the Interior, obtained from a number of different localities: Mt. McKinley National Park; Black Rapids, on the Richardson Highway, extending from the coast to Fairbanks; Fairbanks; Miller House, Eagle Summit, and Circle Hot Springs, all three near the Steese Highway, the only road from Fairbanks, the metropolis of the Interior, to Circle City on the Yukon; and Wiseman, the "Arctic Village" on the Middle Fork of the Koyukuk. The stations in this area extend from McKinley Park, 63° 43′ no. lat., to Wiseman, about 67° 30′ no. lat.

Mt. McKinley Park

Two visits were made to the Park, one of three days only, July 5–7, 1936, and a longer period, June 13–22, in 1937. Spring was late in Alaska in 1937, and when I reached Savage River Camp, twelve miles from the railroad entrance to the Park, on June 13th, practically nothing was in bloom. From a collector's point of view it looked quite hopeless. But several days of warm weather with sunshine much of the night, causing underground ice to thaw and surface snow to melt, resulted in an almost unbelievable transformation. The stony banks of the Savage River, with swamp sand beyond, and open, parklike woods behind the Camp, were masses of brilliant color—Silene, Anemones (four species), Delphinium, Aconite, Papaver, Parrya, Drabas, Saxifragas, Dryases, Potentillas, Rhododendron, Lupine, Dodecatheon, Mertensia, and Polemonium. As I was eager to get farther north, I remained in the Park only long enough to collect 115 species. The majority of these were obtained within two or three miles of the Camp. A day's trip to the Rangers' cabin at Igloo, Sable Pass and Polychrome Pass yielded a few less common finds—*Viola biflora, Draba alpina, Potentilla nivea* and, on a rock pile near Sable Pass, *Astragalus falciferus* and several critical species of *Oxytropis*. A clump of pinkish-purple *Douglasia* in bloom at Polychrome Pass was the chief reward for the days spent at the Park.

Rapids

An impressive demonstration of the forces of nature was staged at Rapids on the Richardson Highway between my two visits there, August 7–10, 1936, and August 25–28, 1937. The Hunting Lodge is situated on the Big Delta River, 138 miles south of Fairbanks, on the northeastern slopes of the Alaska Range, elevation 2130 feet. In 1936 a small glacier could be seen from the Lodge, merely as a glittering spot of ice high up in the mountains. A year later it had become a "runaway" glacier, had moved downward five miles, taking shrubs and all other vegetation with it, and stopped, a great wall of ice 300 feet high, on the opposite bank of the Big Delta.

On a dry, rocky bluff near the river a new variety of *Lesquerella arctica* grew in abundance. Tiny, low-growing *Saxifraga Eschscholtzii*, and *Woodsia alpina* and *Crepis nana* were also collected at Rapids, with other plants one would expect to find in the two habitats—spruce and birch woods bordering the swift-flowing glacial streams, and the mountain-sheep "pastures" at higher altitudes above the tree line.

Miller House

A brief acquaintance with the plants of Eagle Summit, seven miles from Miller House, in 1936, made me realize the fine possibilities for collecting arctic-alpine plants there. So I returned the following year, happy to be back with my kind, hospitable friends, Mr. and Mrs. Frank Miller. There in a tiny log cabin next door to the roadhouse, post-office, and general store—all three in one—I remained from July 2 to 26. In the center of the "Circle diggings," 116 miles north of Fairbanks, this roadhouse is located in a valley, through which flow several mining creeks, Mammoth, Mastodon, and Miller.

Plants typical of the Interior valleys of an elevation of about 2000 feet were found here. Large clumps of the rusty-backed swords of *Dryopteris fragrans* shared the dry hillsides above the creeks with *Arctostaphylos Uva-ursi* and *A. rubra*, *Vaccinium Vitis-Idaea*, var. *minus* (Mountain Cranberry), *Empetrum nigrum*, *Pedicularis labradorica*, *Geocaulon lividum*, *Silene repens*, *Arnica attenuata*, *Saxifraga tricuspidata* and *Arenaria obtusiloba*. In the open tundra below were white pools of *Eriophorum* with *Carices*, *Andromeda polifolia*, *Vaccinium uliginosum*, *Rubus Chamaemorus*, *Polygonum viviparum*, and the straight pink plumes of *P. Bistorta*. *Parnassia Kotzebuei* and *P. palustris*, var. *neogaea*, *Linnaea borealis*, and tangled *Hedysarum alpinum*, var. *americanum* were sheltered by willows and alders in moist shady spots. Flat patches of *Arenaria physodes* were abundant, and delicate *Crepis elegans*, with long tap-root, penetrated the spaces between the piles of round stones thrown up by mining operations. Along the lower part of the trail from Miller House to Eagle Summit shrubs and tall, weed-like plants of the familiar roadside association flourished luxuriantly—*Rubus idaeus*, var. *canadensis*, *Potentilla fruticosa*, *Rosa acicularis*, *Senecio lugens*, *Aster sibiricus*, *Solidago multiradiata*, *S. decumbens*, *Polygonum alpinum*, var. *lapathifolium* and *Epilobium angustifolium.* The latter is the most striking and conspicuous plant in the Interior, covering the low hills around Fairbanks with masses of brilliant color, visible for miles.

Eagle Summit

An Alaskan "travelogue" describes Eagle Summit, elevation 3880 feet, as a barren summit, the highest point on the road between Valdez on the southwestern coast to Circle City on the Yukon. The extreme top is level, with disintegrated rock fragments, dry and barren, indeed. In winter it is bleak, wind-swept, and bitterly cold, and is considered one of the most difficult places to cross by dog team. But in July all the cave-like hollows and wet slopes form an alpine rock garden of great beauty. Large snow patches remain nearly all summer between the slopes—a favorite place for caribou to seek refuge from mosquitos and flies, as well as from the heat. The borders of wet, springy ground where water trickles down from the snow afford a perfect home for *Ranunculus nivalis*, also *Claytonia sarmentosa* and *C. tuberosa*, *Senecio Kjellmanii*, *Saxafraga Hirculus*, *S. foliolosa*, *Dodecatheon frigidum*, *Parrya nudicaulis*, *Cardamine purpurea*, and numerous others.

Slightly higher in the rocky crannies grow different species—two dwarf *Salices*, *Oxyria digyna*, *Arenaria arctica* and *Arenaria macrocarpa*, *Silene acaulis*, var. *exscapa*, *Ranunculus pygmaeus*, *Anemone narcissiflora*, *Cardamine bellidifolia*, *Saxifraga rivularis*, *S. punctata*, *S. bronchialis*, subsp. *Funstonii*, *Dryas octopetala*, *Cassiope tetragona*, *Gentiana glauca*, *Arnica Lessingii*, *Saussurea densa*, and *Antennaria alaskana*. Five species of *Pedicularis* were close neighbors in spongy ground near the base.

It was a delight to discover several rarer plants—*Campanula uniflora*, inconspicuous and easily missed; fragrant and charming *Eritrichium aretioides;* a pink and white *Papaver*, *Oxytropis Mertensiana*, the first record for the Interior and third for Alaska; and *Eutrema Edwardsii*, known usually from the northern coast. Here on the slopes of Eagle Summit circumpolar, Asiatic or North Pacific, and cordilleran species lived side by side.

Porcupine Dome

The red letter day of my two Alaskan summers came on July 12, 1937, when Mr. Miller and I climbed Porcupine Dome, the highest peak, elevation 4810 feet, of the whole region between Fairbanks and the Yukon. Wearing high rubber boots, our faces hidden by mosquito netting, and armed with a gun, for protection against unfriendly bears, we made slow progress across the "niggerheads." Our hike ended with a climb almost on hands and knees over the massive rock-pile to the flat plateau which formed the top of the Dome. There growing beside *Salix phlebophylla* and *Antennaria alaskana*, was a delicate little *Potentilla*, glabrous, with three-foliolate leaves. It proved to be *Potentilla elegans*, a rare plant of the mountains of Siberia, reported but once before on the North American continent, on the coast. Here it was more than 600 miles inland. It bears a close resemblance to a rare endemic of the White Mountains.

Potentilla biflora, found occasionally on the northwest coast, but rare in the Interior, had been collected on the way up. At a lower altitude in wet, springy ground below a snow patch were a few plants only of a single-flowered, purplish-magenta *Claytonia*—very characteristic and unlike any *Claytonia* I had seen either in the field or in the herbarium. This new species—recently described by Dr. Eric Hultén—and *Potentilla elegans* were enough thrills for one day, even though we missed meeting a grizzly.

Circle Hot Springs

This is the chief resort of Interior Alaska, 9 miles southeast of the Steese Highway and about 138 miles north of Fairbanks. The hot baths of healthful mineral water are very popular, as are also the fine vegetables grown in the neighborhood of the springs in the hotel garden. Plants with a more southern range are found here, growing luxuriantly around the springs, in spite of the nearness to the Arctic Circle. I spent only several days at the Hot Springs in 1936 (July 17–22), but was repaid by finding *Juncus filiformis*, not previously reported from Alaska, and northern extensions of range for several plants. *Caltha natans*, of rare and local distribution, grew in ditches with *Ranunculus Purshii*, subsp. *yukonensis*.

Wiseman

Wiseman is a small village of Eskimos and gold miners, on the Middle Fork of the Koyukuk, about 75 miles north of the Arctic

Circle. It is reached by a plane trip of 200 miles from Fairbanks. One night in 1936, July 12, I flew there and back to view the midnight sun, picking up a few common plants in the town. But most of my specimens, the first collected or recorded from Wiseman, were obtained from August 2–12, 1937. It was late in the season for the best collecting, however.

The river valley and ravines are well wooded with *Picea, Populus tacamahacca* and *Betula papyrifera,* with *Populus tremuloides* on higher altitudes in the hills. *Juniperus communis,* var. *montana* is occasional and *Betula glandulosa* very common, as it is everywhere throughout the Interior. Three Orchids grew abundantly in the woods about the town—*Cypripedium passerinum, Habenaria obtusata* and *Habenaria hyperborea. Spiranthes Romanzoffiana* was occasionally found, probably the most northern station on record. *Boschniakia rossica,* called "corn pipes" by the Eskimo children, is very plentiful. Masses of *Dryas Drummondii,* with beautiful feathery styles, lined "Main Street," and *Epilobium latifolium* gave color to the river bars. Three unusual "finds" were true *Oxytropis deflexa,* the second station in Alaska; the rare *Antennaria pulcherrima,* and *Artemisia alaskana.* This is the only report of the latter, with the exception of the type specimen from the lower Yukon. Most of the Wiseman plants are noticeable for their unusually tall growth, due probably to the rapid forcing by so many hours of sunlight.

A few specimens, labelled "Along the Yukon River," were collected when the steamer stopped to load at various wood-piles between Tanana and Eagle, August 20–27, 1936. *Astragalus yukonis* from Tanana is the most noteworthy.

The material from Fairbanks is scanty and not representative, as I gathered plants there only while waiting to go on to other places, so missed some, well-known and common. I have also included several from Curry, on the Alaska R. R. between Anchorage and the Park, too far south to be classed as truly in the Interior.

While in Alaska I appreciated the courtesy shown me by Professor Gasser of the University at Fairbanks, Mrs. Ada Sharples of Juneau, author of a popular Flora of Alaska, and Mr. J. B. Anderson, who kindly offered me while in Juneau, the use of his private herbarium, containing the largest and finest collection of Alaskan plants in the Territory.

My deepest appreciation is expressed to Professor Fernald for his generous encouragement, kindly interest and helpful guidance, without which this study of flora of the Alaskan Interior could not have been undertaken.

On a visit to the Gray Herbarium in 1938, Dr. Eric Hultén of Lund looked over many of my specimens, giving me valuable aid in their identification and record of distribution. He also took several critical species back to Sweden for later study, and has since kindly described and named the new Claytonia.

"Contributions to the Flora of Alaska," by A. E. Porsild, of Ottawa, in Rhodora, 1939,[1] has been a constant guide and inspiration. To him I am greatly indebted for identifying and annotating a number of my puzzling specimens, and for his generous and helpful advice in regard to this list.

It is a pleasure to express my gratitude to Mr. C. A. Weatherby for his assistance in the classification of the *Pteridophyta;* to Dr. Hugh M. Raup, the *Salices;* to Mr. Reed Rollins, the *Cruciferae;* and to Dr. G. Haglund, the *Taraxaca.*

List of Vascular Plants Collected in Interior Alaska
(407 species and varieties, 847 numbers)

I. Pteridophyta

Botrychium Lunaria (L.) Swartz. Not common and seen only once. It may easily have been overlooked, however. Rapids, no. 28.

Woodsia ilvensis (L.) R. Br. On exposed dry cliffs above the Susitna River. Curry, nos. 2 and 565.

W. alpina (Bolton) S. F. Gray. Crevices in rocks overhanging Gunnysack Creek. Rapids, no. 1.

Plants in this collection have straw-colored stipes, as is often the case in typical *W. alpina* of the Old World, which in all other characters they resemble.

W. glabella R. Br. Frequent around Wiseman on moist rocks and in damp, mossy hollows shaded by overturned tree roots, no. 871.

Cystopteris fragilis (L.) Bernh. Abundant in shaded ravines. This semicosmopolitan fern grows luxuriantly in many places. Park, no. 575; Rapids, no. 4; Circle Springs, nos. 3 and 6.

Pteretis nodulosa (Michx.) Nieuwl. *Onoclea nodulosa* Michx. In alder thickets along the Susitna River, sometimes reaching the height of six feet. Curry, no. 564; Fairbanks, no. 7.

Dryopteris fragrans (L.) Schott. *Thelypteris fragrans* (L.) Nieuwl. Apparently the most common fern of the north-central In-

[1] Porsild, A. E., Rhodora **41**: 141–183, 199–254, 262–301 (1939).

terior. At Miller House hundreds of plants grow on dry, stony hillsides, nos. 15 and 700; Park, no. 574; Circle Springs, no. 14; Wiseman, no. 872.

D. spinulosa (O. F. Müll.) Watt, var. dilatata (Hoffm.) Watt. See Fernald, Contrib. Gray Herb. **76**: 147 (1926), for discussion of *D. spinulosa* and *D. austriaca*. Common in southern Alaska along the coast, but rare in the central Interior. Circle Springs, no. 17.

D. spinulosa (O. F. Müll.) Watt, var. americana (Fisch.) Fernald, in Rhodora **17**: 48 (1915). Rare. Circle Springs, no. 16. Scales on stipe and a few on rachis, pale brown, concolorous.

D. Phegopteris (L.) C. Chr. *Phegopteris polypodioides* Fée; *Thelypteris Phegopteris* (L.) Slosson. Common in southern Alaska, but rare in the Interior. Rich woods by the river. Curry, no. 12.

D. Linnaeana C. Chr. *Phegopteris Dryopteris* (L.) Fée; *Thelypteris Dryopteris* (L.) Slosson. Rare in cool, moist woods. Circle Springs, no. 10; Wiseman, no. 913. These specimens have a few glands on the rachis, and belong with forma glandulosa Tryon in Fern Jour. **29**: 4 (1939).

Athyrium Filix-femina (L.) Roth ex Mertens, var. sitchense Rupr. ex Moore. Abundant and of tall, luxuriant growth near the hot springs. Circle Springs, no. 19. Forma strictum (Gilbert) Butters, no. 20.

Equisetum arvense L. Common and widely distributed. Fairbanks, no. 34; Miller House, no. 30; along Yukon River, no. 31; Wiseman, no. 29.

E. pratense Ehrh. In willow and poplar thickets along banks of sloughs. Fairbanks, no. 1082.

E. sylvaticum L. See Fernald in Rhodora **20**: 129 (1918). Often in woodland. Park, no. 576; Fairbanks, no. 33; Circle Springs, no. 32.

E. palustre L. Abundant on mud bars and in shallow water. Fairbanks, no. 860; Wiseman, no. 873.

E. fluviatile L. In sloughs and ponds. Fairbanks, nos. 34-a, 860-a; Miller House, no. 702.

E. variegatum Schleich. Occasional along borders of creeks. Miller House, no. 701; Wiseman, no. 874.

Lycopodium Selago L. Frequent on mossy ledges in alpine situations. Park, no. 577; Rapids, no. 1044; Eagle Summit, nos. 35, 703.

L. annotinum L. Damp, rich woods. Rapids, no. 1043.

L. annotinum L., var. pungens (La Pylaie) Desv. In drier places. Eagle Summit, nos. 37, 704; Circle Springs, no. 36; Wiseman, no. 876.

L. clavatum L. Park, no. 578. Var. monostachyon Grev. & Hook. On dry ledges in hillside graveyard. Wiseman, nos. 40, 877.

L. complanatum L. Circle Springs, no. 41; in open woods on higher slopes, Wiseman, no. 875.

Selaginella sibirica (Milde) Hieron. See Hultén, Fl. Aleut. Isl. 62 (1937). On dry, bare cliffs. Wiseman, no. 878.

II. Spermatophyta

Gymnospermae

Picea glauca (Moench) Voss, and Picea mariana (Mill.) B.S.P. constitute the coniferous forests of the Interior.

Larix laricina (DuRoi) Koch. Occasional in swamps. Fairbanks, no. 43.

Juniperus communis L., var. montana Ait. *J. sibirica* Burgsd. On dry, gravelly slopes, not common. Park, no. 579; Wiseman, no. 879.

Angiospermae

Monocotyledonae

Triglochin palustris L. Common in marshes and along the rivers. Fairbanks, no. 46; Wiseman, no. 880.

Phalaris canariensis L. Introduced. Fairbanks, no. 1087.

Hierochloë odorata (L.) Wahlenb. Park, no. 580.

H. alpina (Sw.) Roem. & Schult. On alpine summits. Park, no. 581; Eagle Summit, no. 706.

Arctagrostis arundinacea (Trin.) Beal. In the hills above Wiseman, no. 881.

A. latifolia (R. Br.) Griseb. Miller House, no. 709.

Agrostis scabra Willd. Circle Springs, no. 48.

Calamagrostis canadensis (Michx.) Nutt., var. Langsdorfi (Link) Inman. *C. Langsdorffii* Trin. See Rhodora **24**: 143 (1922), and **32**: 43–44 (1930). Very common. Rapids, nos. 49, 1049; Miller House, no. 710; Wiseman, no. 882.

Deschampsia caespitosa (L.) Beauv. Fairbanks, no. 50.

Trisetum spicatum (L.) Richter. Miller House, no. 53.

Beckmannia Syzigachne (Steud.) Fernald in Rhodora **30**: 27 (1928). Widespread and common. Miller House, no. 707; Circle Springs, no. 54; Wiseman, no. 883.

Poa alpina L. Stony soil. Park, no. 604.

P. arctica R. Br. *P. rigens* Hartm. In alpine situations. Eagle Summit, nos. 55, 710-a.

P. alpigena (Fries) Lindm. Miller House, no. 708.

Glyceria grandis Wats. In sloughs about the Chena. Fairbanks, no. 56.

Festuca rubra L. Varies greatly. Rapids, no. 1050.

F. altaica Trin. Miller House, no. 705.

Bromus Pumpellianus Scribn. In dry ground around cabins. Fairbanks, no. 1086.

Agropyron latiglume (Scribn. & Sm.) Rydb. Rapids, no. 1053.

Hordeum jubatum L. Abundant around towns. A nuisance in Fairbanks where it grows everywhere along the sidewalks and in vacant lots. Tanana, no. 58; Wiseman, no. 885.

Elymus innovatus Beal. Common in dry fields and on the edges of woods. Rapids, nos. 60, 1052; Wiseman, no. 884.

Eriophorum opacum (Björnstr.) Fernald in Rhodora **7**: 85 (1905); **27**: 203–10 (1925). Very common in swampy ground. This and the following species form large "niggerheads" in the tundra. Park, no. 587; Circle Springs, no. 65; Wiseman, no. 888.

E. vaginatum L. Miller House, no. 713.

E. callitrix Cham. Occasional in bogs and along the edges of small ponds. Miller House, no. 712; Circle Springs, no. 63.

E. Scheuchzeri Hoppe. Miller House, no. 711; Wiseman, no. 887.

E. medium Anders. *E. Chamissonis* C. A. Meyer, var. *albidum* sensu Fernald. Rapids, no. 1048.

E. angustifolium Roth. Widespread and abundant in wet places. Miller House, no. 714; a larger form, no. 715; Circle Springs, no. 64; Wiseman, no. 889.

Scirpus americanus Pers. Circle Springs, no. 61.

Carex capitata L. Rare. In swamp near Fairbanks, no. 692.

C. disperma Dewey. *C. tenella* Schkuhr. Beside creek at Miller House, no. 718.

C. brunnescens Poir. Fairbanks, no. 693.

C. supina Wahlenb. Rare. Rapids, no. 1045.

C. scirpoidea Michx. Common. Park, no. 585; Rapids, no. 1046; Circle Springs, no. 69; Wiseman, no. 991.

C. scirpoidea Michx., var. convoluta Kükenth. Miller House, no. 719.

C. concinna R. Br. Park, no. 583.

C. capillaris L. Occasional on mossy banks. Rapids, no. 72; Wiseman, no. 886.

C. angarae Steud. Synops. Cyper. 190 (1855). *C. Vahlii* Schkuhr, var. *inferalpina* sensu Fernald in Rhodora **35**: 220–223 (1933), non Wahlenb. Very common. Rapids, no. 1047; Miller House, no. 717; Circle Springs, no. 75.

C. stylosa C. A. Meyer. Wiseman, no. 992. Probably first record for the Interior.

C. podocarpa R. Br. Park, no. 582; Eagle Summit, no. 720-A.

C. Tolmiei Boott. Park, no. 586; Miller House, no. 722.

C. atrosquama Mackenzie. Miller House, no. 725.

C. aquatilis Wahlenb. Common in swamps and along creeks and rivers. Miller House, no. 716; Circle Springs, no. 80; Wiseman, no. 993.

C. physocarpa Presl. Miller House, no. 724.

C. membranacea Hook. *C. membranopacta* Bailey. Common. Park, nos. 84, 584; Rapids, no. 85; Miller House, no. 723; Circle Springs, no. 83; Wiseman, no. 995.

C. rotundata Wahlenb. In low, marshy ground. Wiseman, no. 996.

C. rostrata Stokes. In a ditch in Fairbanks, no. 87.

Juncus bufonius L. Frequent along paths or roadsides. Fairbanks, nos. 89, 1085; Circle Springs, no. 88.

J. BALTICUS Willd., var. HAENKII (E. Mey.) Buch. Common in wet places. Park, no. 591; Fairbanks, no. 90; Wiseman, no. 998.

J. FILIFORMIS L. Rare. The first station for this slender *Juncus* reported in Alaska. Circle Springs, no. 93.

J. ALPINUS Vill. Fairbanks, no. 94.

J. CASTANEUS Smith. Abundant and widespread in the Interior. The most common Juncus in the places I visited. In marshy ground. Fairbanks, no. 96; Miller House, no. 726; Circle Springs, no. 95; Wiseman, no. 999.

LUZULA PARVIFLORA (Ehrh.) Desv. Alpine slopes. Park, no. 589.

L. CONFUSA Lindeb. Also an alpine species. Miller House, no. 729.

L. MULTIFLORA (Retz.) Lej. *L. campestris* (L.) DC., var. *multiflora* (Ehrh.) Čelak. Park, no. 588. Var. FRIGIDA (Buch.) G. Sam. *L. campestris*, var. *frigida* Buch. See Hultén, Fl. Aleut. Isl. 125 (1937). Miller House, no. 728.

L. JAPONICA Buch. Park, no. 590.

TOFIELDIA PALUSTRIS Huds. *T. minima* (Hill) Druce. Very common all through the central and northern Interior. Miller House, no. 102; Eagle Summit, no. 730; Circle Springs, no. 101; Wiseman, no. 890.

T. COCCINEA Richards. Found occasionally in higher, more alpine situations. Rapids, no. 103; Eagle Summit, no. 731.

ZYGADENUS ELEGANS Pursh. Abundant in grassy plains and thin, open woods. Rapids, no. 106 (in fruit), no. 1005 (in flower); Wiseman, nos. 105, 891.

ALLIUM SCHOENOPRASUM L., var. SIBIRICUM (L.) Hartm. *A. sibiricum* L. Occasional on sandy shores. On banks of the Yukon, Rampart, no. 107.

LLOYDIA SEROTINA (L.) Reichenb. This delicate little "Alp Lily" is rare in the mountains. A good-sized colony along the rocky shore of Savage River, Park, no. 592. A single plant was seen in a crevice at Eagle Summit.

IRIS SETOSA Pall. A tall, beautiful purplish-blue *Iris*, abundant along roadside ditches and on marshy ground in Fairbanks, no. 110 (in fruit), no. 688 (in flower).

CYPRIPEDIUM PASSERINUM Richards. Abundant in spruce woods along the Koyukuk River, Wiseman, no. 892.

As I was there in August my specimens were all in fruit, but the following year Tom Brady, a miner of Wiseman, sent me several in flower, no. 892-A.

C. GUTTATUM Swartz grows in Fairbanks. I saw mounted specimens there, but did not collect it myself.

? HABENARIA SP.

These plants, growing in marshland in Wiseman, no. 894, seem to belong to the *Habenaria hyperborea* or *H. dilatata* group, as the lip is entire, about 5 mm. long, broader at the base and slightly dilated. Basal leaves are rather wide and obtuse, and the flowers greenish-white.

H. obtusata (Pursh) Richards. Occasional in rich woods. Rapids, nos. 112, 1006; Wiseman, no. 893.

Spiranthes Romanzoffiana Cham. & Schlecht. Rather rare and local. Circle Springs, no. 113; Wiseman, no. 895.

Several plants were found in moist ground on hills above the town. This is probably the most northerly station ever recorded for *S. Romanzoffiana.*

Calypso bulbosa (L.) Oakes. A mounted specimen, collected along the Steese Highway, was seen at the Tanana Valley Fair in Fairbanks.

Dicotyledoneae

Populus tremuloides Michx. The aspen is common in dry soils throughout the Interior. Here and there in the hills above Wiseman, no. 897.

P. tacamahacca Miller. *P. balsamifera* DuRoi, not L. See Jour. Arn. Arb. **10**: 55 (1929). Common on flood plains along creeks and rivers. Miller House, no. 114; on the banks of the Koyukuk, Wiseman, no. 896.

Salix reticulata L. One of the most common prostrate willows in the hills of the Interior. Park, nos. 115, 595; Rapids, no. 116; Wiseman, no. 903. The two latter belong to var. orbicularis (Anders.) Floderus.

S. arctica Pallas. *S. crassijulis* Trautv. Common in alpine regions. Park, nos. 118, 594 (Savage River Camp), 600; Paxson, no. 119.

S. rotundifolia Trautv. Eagle Summit, no. 735.

This small willow with bright green, round leaves and short pistillate catkins is rare in the mountains.

S. phlebophylla Anders. Growing in mats on bleak, bare mountain summits. Porcupine Dome, no. 736.

The stems of this species are crowded with skeletonized leaves.

S. pseudopolaris Floderus. Rare. Eagle Summit, no. 117.

S. stolonifera Coville. Eagle Summit, nos. 120, 737.

A low-growing willow of alpine regions, characterized by many stolons.

S. niphoclada Rydb. Frequent along the Richardson Highway on the banks of glacial streams. Paxson, no. 121; Rapids, no. 1039; Fairbanks, no. 1084; Wiseman, no. 904.

These specimens seem to belong to the general complex of *S. brachycarpa* Nutt. and *S. niphoclada* Rydb. The leaves tend to become gray or spotted when dry, are rounded at the base, on short petioles.

S. GLAUCA L. A circumpolar willow which varies widely. The Alaskan-Yukon Valley representative was named *S. Seemanii* by Rydberg. Miller House, nos. 123, 733.

S. GLAUCA L., var. ACUTIFOLIA Schn. See Bot. Gaz. **66**: 327 (1918), and **67**: 60 (1919); RHODORA **33**: 241–4 (1931). Very common along streams. Paxson, no. 124; Rapids, no. 1038; Circle Springs, no. 125; Miller House, no. 126; Ft. Yukon, no. 128; Wiseman, no. 899.

S. BARCLAYI Anders. Paxson, no. 129.

S. ALAXENSIS (Anders.) Cov., var. LONGISTYLIS (Rydb.) Schn. The felt-leaf willow is a characteristic common tree of valleys of the Interior. Park, no. 597; Miller House, nos. 130, 732; Wiseman, no. 901.

S. BEBBIANA Sarg. *S. rostrata* Richards. A shrub or small tree common in woods and along the banks of creeks and sloughs. Park, no. 593; Circle Springs, no. 131; Fairbanks, no. 1083.

S. ARBUSCULOIDES Anders. Occasional. Park, no. 599; Miller House, no. 734.

S. PULCHRA Cham. Apparently rather rare in the Interior. Park, no. 598.

MYRICA GALE L. Rare in this region. Along the Yukon River, no. 133.

BETULA PAPYRIFERA Marsh. The common white birch of the Interior forests. Abundant and widespread. Miller House, no. 738; along the Yukon River, no. 134; Wiseman, no. 905.

B. GLANDULOSA Michx. A vast portion of the tundra is covered by this dwarf birch. Miller House, nos. 135, 739; Wiseman, no. 906.

B. GLANDULOSA Michx., var. SIBIRICA (Ledeb.) Blake. Park, no. 136; Wiseman, no. 907.

B. ERMANI × GLANDULOSA. Park, no. 601.

ALNUS CRISPA (Ait.) Pursh. *A. fruticosa* Rupr. Abundant along the edges of creeks and streams. Rapids, no. 1037; Wiseman, no. 908.

A. SINUATA Rydb. Along river banks, near Fort Yukon, no. 137.

GEOCAULON LIVIDUM (Richards.) Fernald in RHODORA **30**: 21–24 (1928). *Comandra livida* Richards. Common in sterile soil on hillsides, often associated with *Pedicularis labradorica*. Rapids, nos. 141, 1015; Circle Springs, no. 140; Wiseman, no. 909.

The leaves are frequently variegated.

RUMEX MEXICANUS Meisn. Along Yukon River, no. 142; Miller House, no. 740.

R. ARCTICUS Trautv. In bogs, Wiseman, no. 910.

R. ACETOSA L. On stony slopes, near Savage Camp, Park, no. 602.

OXYRIA DIGYNA (L.) Hill. Common in damp rocky crevices in the mountains. Rapids, nos. 144, 1042; Park, no. 603; Eagle Summit, nos. 143, 741.

Polygonum aviculare L. Wiseman, no. 911.

P. viviparum L. Abundant throughout the alpine tundra. Park, no. 149; Eagle Summit, nos. 150, 744; Wiseman, no. 912.

P. Bistorta L. *P. plumosum* Small. Scattered over the tundra, this plant from Asia with plumy rose-pink spikes, occurs less frequently than the preceding circumpolar, bulb-bearing species. Park, no. 147; Miller House, no. 743; Eagle Summit, no. 148, 745.

P. alpinum All., var. lapathifolium Cham. & Schlecht. A tall, conspicuous plant, very common in thickets along roadsides and in gravelly places. Miller House, no. 746; Circle Springs, no. 151.

It is called "Wild Rhubarb," and, when young and tender, is sometimes used for greens.

P. hydropiperoides Michx. Circle Springs, no. 152.

P. Convolvulus L. Occasional. Fairbanks, no. 1074; Circle Springs, no. 153.

Chenopodium capitatum (L.) Asch. *Blitum capitatum* L. Common around cabins and in vacant lots. Fairbanks, nos. 154, 1076.

C. album L. A common weed. Fairbanks, no. 1077.

Claytonia sarmentosa C. A. Meyer. *Montia sarmentosa* Robinson. Large clumps of this delicate, pink *Claytonia* grew in wet, springy spots at the base of Eagle Summit, nos. 156, 747. A small specimen (in bloom) was brought to me by an Eskimo in Wiseman, no. 914.

C. tuberosa Pall. Occasional with the preceding at the base of the Summit, no. 748.

The large tubers of this white-flowered plant are eaten by Eskimos and Indians. Both these Claytonias have been considered endemic to the North Pacific or to the Bering Sea region.

C. Scammaniana Hultén in Botaniska Notiser **4**: 826–827, fig. 1 (1939). Porcupine Dome, July 12, 1937, no. 749.

A few plants of this brilliant purplish-magenta Claytonia made a vivid patch of color at the base of a melting snowbank on the lower slopes of the Dome. I saw it only in this one spot throughout the region. It is very characteristic in appearance, low in growth, single-flowered, with long, narrow basal leaves.

Stellaria calycantha (Ledeb.) Bong., var. isophylla Fernald. Not common. Miller House, no. 750-A.

S. calycantha (Ledeb.) Bong., var. floribunda Fernald. Miller House, no. 752.

S. crassifolia Ehrh. *Alsine crassifolia* (Ehrh.) Britton. Occasional in sloughs. Fairbanks, no. 862.

S. LONGIPES Goldie. *Alsine longipes* (Goldie) Cov. Common throughout the region. Very variable. Park, no. 611; Eagle Summit, no. 750; Circle Springs, no. 159. A glaucous form with stiffer leaves described as var. LAETA (Richards.) Wats. Rapids, nos. 160, 1008; Miller House, no. 751.

S. LONGIFOLIA Muhl. *Alsine longifolia* (Muhl.) Britton. Miller House, no. 752-a.

S. MEDIA (L.) Cyrill. Introduced. Fairbanks, no. 158; Wiseman, no. 920.

CERASTIUM VISCOSUM L. Introduced. Wiseman, no. 919.

C. BEERINGIANUM Cham. & Schlecht. Very common throughout the region. Park, no. 607; Fairbanks, no. 1055; Miller House, no. 753; Eagle Summit, no. 163.

C. BEERINGIANUM Cham. & Schlecht., var. GRANDIFLORUM (Fenzl) Hult. Fl. Aleut. Isl. 165 (1937). This larger variety, with petals much longer than the green sepals and acute leaves, is not as common. In wet places. Rapids, nos. 162, 1009; Eagle Camp, no. 698.

SPERGULARIA RUBRA (L.) J. & C. Presl. Probably introduced. Fairbanks, no. 1067.

ARENARIA LATERIFLORA L. *Moehringia lateriflora* (L.) Fenzl. Not very common, but widely distributed in woods and thickets. Curry, no. 571; Miller House, no. 760; Circle Springs, no. 164.

A. PHYSODES DC. *Merckia physodes* Fisch. This North Pacific species seems to be very plentiful wherever it is found in this region. In gravel and mining debris at Miller House, no. 755; Circle Springs, no. 166; Wiseman, no. 915.

A. DAWSONENSIS Britton. Rare. Along road at the base of Eagle Summit, no. 167; Wiseman, no. 918.

A. RUBELLA (Wahlenb.) Sm. On stony ground. Park, no. 610; Rapids, nos. 169, 1007.

A. ROSSII R. Br. On damp slopes. Conspicuous for its reddish-purple sepals. Miller House, no. 168; Eagle Summit, no. 756.

A. OBTUSILOBA (Rydb.) Fernald in RHODORA **21**: 12–15 (1919). Park, no. 609; Rapids, no. 170; in great clumps on dry cliffs and ledges back of Miller House, no. 759.

A. ARCTICA Steven. *Minuartia arctica* (Steven) Aschers. & Graebn. Park, no. 173; Eagle Summit, nos. 174, 758.

A. MACROCARPA Pursh. *Minuartia macrocarpa* (Pursh) Ostenf. Park, no. 171; Eagle Camp, no. 697; Eagle Summit, nos. 172, 757.

Both this species and the preceding were very abundant on the mountains in the Park and the Eagle Summit region. They are sometimes confused, if not found in fruit. See Hultén, Fl. Kamtch. **2**: 79–81 (1928) for descriptions of the two species. The stems of *A. macrocarpa* are matted-cespitose instead of tufted; the lower leaves are denticulate and falcate; the stem-leaves are connate-clasping and very glandular; the sepals and petals are longer than and of different shape from those of *A. arctica;* the flat filaments widen more gradually to the dilated base.

Silene acaulis L., var. exscapa (All.) DC. This arctic species forms large cushions in the mountains of the Interior. Abundant in gravelly places along the Savage River. Park, no. 605; Eagle Summit, nos. 175, 761.

S. acaulis L., var. subacaulescens (F. N. Williams) Fern. & St. John in Rhodora **23**: 119–120 (1921). This western cordilleran variety is rare in the Interior of Alaska. It was found only in the Park, nos. 176, 606.

S. repens Patrin. Occasional on exposed slopes at altitudes of about 2000 feet in places where one finds *Pedicularis labradorica, Arnica attenuata* and often *Dryopteris fragrans.* Miller House, nos. 177, 762; on road between Miller House and Eagle Summit, no. 178.

S. Williamsii Britt. in Bull. N. Y. Bot. Gard. **2**: 168 (1901); see Porsild in Rhodora **40**: 212 (1938). In dry places on the banks of the Chena River, Fairbanks, nos. 179, 1056.

Lychnis Tayloriae Robinson in Proc. Amer. Acad. **28**: 150 (1893). See Rhodora **34**: 22–25 (1932). Occasional in alpine regions. Eagle Camp, nos. 699, 764.

L. apetala L. *Melandrium apetalum* (L.) Fenzl. Seen only at the base of the higher summits. Eagle Summit, no. 180; Porcupine Dome, no. 763.

Nuphar variegatum Engelm. *Nymphozanthus variegatus* (Engelm.) Fernald. Observed commonly in ponds and small lakes in the lower regions of the Interior.

Caltha natans Pall. This small white-flowered *Caltha* is probably rare in the Interior. Collected only once in a wet, boggy area with *Ranunculus Purshii*, subsp. *yukonensis*, Circle Springs, no. 181.

It has an interesting distribution from northern Mongolia and Kamtchatka, in the Bering Sea region, with isolated stations in Alberta, Athabasca, and northern Minnesota.

C. palustris L., var. asarifolia (DC.) Huth. Very common in southwestern Alaska and observed in ditches along the R. R. tracks from McKinley Park to Fairbanks. Collected it at Seward, but neglected to get specimens from the Interior. Probably common in the lowlands.

Actaea rubra (Ait.) Willd. *A. spicata* L., var. *rubra* Ait. Apparently very rare in the central and northern Interior. Circle Springs, no. 183. Plants with white berries (forma neglecta (Gillman) Robinson = *A. eburnea* Rydb.) as well as red grew tall and luxuriantly in thickets and thin woods in the neighborhood of the Hot Springs. Both specimens in fruit. Circle Springs, no. 184.

Delphinium Menziesii DC. Frequent in the mountains of the Interior. Eagle Summit, nos. 186, 765; on the way to Porcupine Dome, no. 766.

D. scopulorum Gray, var. glaucum Gray. *D. Brownii* Rydb. A tall plant often four or five feet high. Collected in two places only, but it appeared to be common in thin woods in lower regions. Rapids, no. 1014; Fairbanks, no. 185.

Aconitum delphinifolium DC. Widespread and common throughout the Interior, in thickets on hills and slopes of mountains. Rapids, nos. 188, 1013; Circle Springs, no. 187; Eagle Summit, no. 771; Wiseman, no. 922.

Anemone patens L., var. Wolfgangiana (Bess.) Koch. *Pulsatilla ludoviciana* (Nutt.) Heller. My specimen from the Park, no. 613, was in fruit, but a beautifully pressed flower was given me by a young girl in Fairbanks.

A well-known and beloved wild flower of the Interior, called generally "Wild Crocus." The very large purple blossom comes very early in the spring as soon as the snow melts.

A. parviflora Michx. One of the earliest flowers to bloom at Savage River Camp, in the Park, about the middle of June, no. 616. In Wiseman, no. 923, I collected both flowers and fruit the first week in August. Other collections were made at Rapids, no. 191, and on the road below Eagle Summit, no. 190.

A very common *Anemone* of wide-spread distribution. The backs of the sepals are usually tinged pink or blue.

A. parviflora, var. grandiflora Ulbr. in Engl. Bot. Jahrb. **37**: 251 (1905). Park, nos. 189, 617.

This variety, with the large flowers nearly two inches in diameter, was the most abundant at Savage River Camp. It seemed quite distinct, the sepals in my specimens lacking the bluish tinge.

A. multifida Poir., var. hudsoniana DC. *A. globosa* Nutt. See Rhodora **19**: 141 (1917). Occasional in gravelly places. Rapids, no. 192.

A. narcissiflora L. *A. zephyra* A. Nels. One of the most beautiful of the Alaskan wild flowers, growing sometimes in large masses, in dry, rocky soil in the mountains of the Interior. General throughout the territory. Park, nos. 614, 615; Eagle Summit, nos. 195, 767. Often the plants of higher altitudes where there is little soil are single-flowered, described by Eastwood as var. uniflora.

A. Richardsonii Hook. This low-growing bright yellow Anemone prefers moist, springy ground. Common along the southwestern coast, and also in the Bering Sea region, but occasional in the Yukon Valley. Park, no. 612.

Ranunculus Purshii Richards., ssp. yukonensis (Britt.) Porsild. *R. yukonensis* Britt. in Bull. N. Y. Bot. Gard. **2**: 168 (1901). Occasional along edges of ponds. On the mud of a dried-out swamp. Both flowers and leaves very small. Circle Springs, no. 198.

R. hyperboreus Rottb. In wet places. Paxson, no. 199.

R. nivalis L. Park, no. 618; Eagle Summit, nos. 200, 769.

True to its name this bright yellow buttercup is found often abundantly just below melting ice or snow patches in the mountains. A characteristic field mark is the brown- or black-hairy calyx.

R. pygmaeus Wahlenb. A small arctic-alpine plant, very rare in the mountains of the central Interior. Seen only on Eagle Summit, nos. 201, 770.

R. sceleratus L. In ditches near Ester Creek, Fairbanks, no. 202.

Thalictrum sparsiflorum Turcz. In ditches along wooden sidewalks in Fairbanks, no. 210.

Papaver alaskanum Hultén, Fl. Aleut. Isl. 190, tab. 10 (1937). Park, no. 619.

In bloom the middle of June on a sunny exposed spot where the snow had just melted. These were low-growing plants with many old petioles, deeply dissected grayish-green leaves, well covered with stiff hairs, and pale yellow flowers with the central projection of the stigma absent.

P. microcarpum DC. A tall, slender, large-flowered, deep yellow poppy, frequent in the hills. Eagle Summit, no. 772; Wiseman, no. 968.

One plant only, very unusual and distinctive, with white petals, bordered by a wide pink band, and with dark green leaves, was collected at Eagle Summit, no. 212.

Corydalis pauciflora (Steph.) Pers. A low plant with several large pinkish-lavender spurred flowers, apparently common in the alpine meadows of the Park, no. 620, but rather rare elsewhere in the Interior. It grew also at Eagle Summit (field notes).

C. sempervirens (L.) Pers. Apparently rare. On a rocky slope behind the R. R. station. Park, no. 213.

Eutrema Edwardsii R. Br. Collected only near top of Eagle Summit, no. 774.

This circumpolar, arctic species, known usually from the northern coast and the Bering Sea region is rare in the higher mountains of the Interior. See Fernald in Mem. Gray Herb. **2**: 337 (1925), for map of general distribution.

Brassica campestris L. Introduced. Miller House, no. 218.

Rorippa barbareaefolia (DC.) Kitagawa in Journ. Jap. Bot. **13**: 137 (1937). In damp places near the mines. Miller House, no. 777.

R. curvisiliqua (Hook.) Bess. Occasional. Park, no. 223; Rapids, no. 224.

Barbarea ? planisiliqua C. A. Meyer. Not well developed. Curry, no. 569.

Cardamine pratensis L. Not common in the Interior. In damp thicket beside the Savage River, Park, no. 629; Wiseman, no. 1188.

C. pratensis, var. angustifolia Hook. Park, no. 628.

C. purpurea Cham. & Schlecht. This beautiful little arctic plant of Siberia and Alaska grows in masses in moist alpine situations in the mountains of the Interior. Park, no. 627, (white-flowered form) no. 626; Eagle Summit, nos. 226, 779.

C. bellidifolia L. Rare in the mountains. Eagle Summit, nos. 227, 780.

C. bellidifolia L., var. beringensis A. E. Porsild in Trans. Royal Soc. of Can. ser. 3, sect. 5, **32**: 31 (1938). This sturdy, vigorous variety with broader and shorter siliques was collected in damp ground on lower slopes of Eagle Summit, no. 781 (listed by Porsild in Rhodora **41**: 234 (1939).

All previous collections are from the islands and nearby shores of Bering Sea. New to the Interior of Alaska.

Lesquerella arctica (Wormskj.) Wats., var. Scammanae Rollins in Am. Journ. Bot. **26**: 421 (1939). A new variety of *L. arctica*, taller in growth, with long slender pedicels and leaves, grew abundantly on a dry, gravelly bank near Gunnysack Creek. It was collected both years in the same place, but not seen elsewhere. *L. arctica* is rare in Alaska, as, with the exception of specimens from the Bering Sea region, it has been reported only from the head of the Chitina River. The type of the new variety is no. 216, Rapids, Aug. 7–10, 1936. The second collection, Rapids, no. 1000.

Thlaspi arvense L. In waste grounds around roadhouses and cabins. Introduced. Rapids, nos. 217, 1002; Fairbanks, no. 863.

Lepidium apetalum Willd. Fairbanks, no. 864.

Neslia paniculata (L.) Desv. Introduced. Fairbanks, no. 1069.

Capsella Bursa-pastoris (L.) Medic. Observed in several places about settlements, but failed to collect it.

Draba alpina L. Seen only once. Park, no. 625. Rare.

Dr. nivalis Lilj. Delicate, tufted, in dry gravels near Savage River. Park, no. 621.

Dr. praealta Greene. A Rocky Mountain species. Park, nos. 214-B and 622.

Dr. glabella Pursh. See Fernald in Rhodora **36**: 333 (1934). Common in alpine situations in Interior. Park, no. 214-A; Rapids, no. 215.

Dr. borealis DC. An Asiatic-Northern Pacific species. Park, no. 623-A.

Descurainia sophioides (Fisch.) O. E. Schulz in Engler, Pflanzenr. 4: 105: 316 (1924). Common and abundant in settlements and mining districts. Park, no. 632; Miller House, no. 776; Wiseman, no. 926.

Arabis lyrata L., var. kamchatica Fisch. Very common at Seward and along the coast where it was one of the first plants to bloom in the spring, but not seen as often in the Interior. Rapids, nos. 229, 1001.

A. lyrata L., var. glabra (DC.) Hopkins in Rhodora 39: 93–94 (1937). In dry stony places. Park, no. 630; Rapids, no. 228.

A. divaricarpa A. Nelson. Probably rare in Alaska in dry sandy places. Along R. R. track from Anchorage to Curry, no. 568; Park, no. 633.

Erysimum cheiranthoides L. Very common and of widespread distribution in the central Interior. Probably introduced. Fairbanks, no. 221; Miller House, no. 775; Circle Springs, no. 220; along Yukon River, no. 222; Wiseman, no. 925.

Parrya nudicaulis (L.) Regel. *P. macrocarpa* R. Br. In open woods in the Park, no. 631; Eagle Summit, nos. 225, 778.

A showy plant with large flowers varying from white and pink to lavender and purple. It is popularly called "Wild Stock" in Alaska and is fairly common in Alpine regions in moist tundra. There is considerable variation in the leaves and in the degree of glandular pubescence.

Sedum roseum (L.) Scop., var. integrifolium (Raf.) Hultén, Fl. Aleut. Isl. 205 (1937). *Rhodiola integrifolia* Raf. See also Porsild in Rhodora 41: 239–240 (1939). Common throughout the Territory in moist mossy crevices. Park, no. 230; Circle Springs, no. 231. Also seen at Eagle Summit, no. 783.

Boykinia Richardsonii (Hook.) Gray. This tall conspicuous plant is seen occasionally in damp open ground in subalpine regions. Park, no. 233; Wiseman (in fruit), no. 928.

Saxifraga rivularis L. In wet mossy crevices in the mountains. Rapids, no. 235 (in fruit); Eagle Summit, nos. 234-A, 784.

S. adscendens L. One specimen resembles closely this cordilleran species. Very rare in Alaska. Eagle Summit, no. 234-B.

S. foliolosa R. Br. *S. stellaris* L., var. *comosa* Retz. Most of the flowers on the delicate stem are replaced by tiny tufts of green leaves. In wet ground beside a small ditch. Eagle Summit, no. 791.

Probably new to the flora of the Interior.

S. hieracifolia Waldst. & Kit. Occasional in alpine tundra. Park, no. 638; Circle Springs, no. 236; Eagle Summit, no. 785.

S. reflexa Hook. Fl. Bor.-Am. 1: 249, tab. 85 (1840). *S. yukonensis* Small. On a gravelly bank, Park, no. 637.

Apparently rare, as it has been recorded in two other stations only in the Interior.

S. PUNCTATA L. sens. lat. Common on moist ledges in the Eagle Summit region, nos. 237, 238, 786; almost at the very top of Porcupine Dome, no. 787.

This group is very variable. See Hultén, Fl. Aleut. Isl. 213–214 (1937) and Sv. Bot. Tidskr. 30, 3: 324, fig. 5 (1936). Most of my specimens have the inflorescence more open, dark purple capsules and purplish-tinged leaves and scape, as in ssp. *insularis* Hultén.

S. TRICUSPIDATA Rottb. Common on dry ledges in all the subalpine regions where I collected. Sometimes forming large mats over rocks, and readily separated from the next species by the rigid leaves with three sharp teeth. Park, nos. 239, 636; Rapids, no. 1003; Miller House, no. 788; Wiseman, no. 929.

S. BRONCHIALIS L. ssp. FUNSTONII (Small) Hult. Fl. Kamtch. **3**: 12–17 (1929). Fairly common also in stony places. Park, no. 636-A; Eagle Summit, nos. 240, 789; Wiseman, no. 930.

S. ESCHSCHOLTZII Sternb. Rapids, no. 1041.

This dwarf cespitose *Saxifraga* of Asiatic-Western American distribution is rarely found. Probably the second record for the Interior.

S. FLAGELLARIS Willd. Occasional in the mountains of the Interior. In a swampy meadow in Park, nos. 241, 635; Wiseman, no. 931.

The specimens in the two collections differ considerably. No. 931 has a much larger single flower with very long flagella.

S. HIRCULUS L. Park, no. 242; Eagle Summit, nos. 243, 790.

A common and beautiful Saxifrage, with large bright yellow flowers, the petals usually red-spotted, growing in wet boggy places in the mountains.

S. OPPOSITIFOLIA L. This well-known circumpolar species seemed to be surprisingly rare in the central Interior. Park, no. 634.

PARNASSIA PALUSTRIS L., var. NEOGAEA Fernald in RHODORA **39**: 310–312 (1937). Common and abundant throughout the region, except in the higher altitudes. Park, no. 247; Rapids, no. 1004; Big Delta, no. 250; Fairbanks, no. 1070 (a freak form); Miller House, no. 793; Circle Springs, no. 249; Wiseman, nos. 248, 932.

Prof. Fernald has described in detail, with plates, the differences between the American plant and the head form. Several of my specimens, especially those from Wiseman, seem to show transitional forms between the variety and the typical form of the species.

P. KOTZEBUEI Cham. & Schlecht. Found often in damp thickets in sub-alpine regions. Miller House, no. 792; Eagle Mining Camp, no. 695; Circle Springs, no. 251; Wiseman, no. 1189.

RIBES TRISTE Pall. Occasional. Wiseman, no. 927.

Spiraea Beauverdiana Schneid. See Hultén, Fl. Kamtch. **3**: 38–41 (1929). *S. betulifolia* Am. auth., non Pall.; *S. Stevenii* (Schneid.) Rydb. Very common along roadsides, in thickets, and dry tundra throughout. Miller House, no. 794; Circle Springs, no. 253; Wiseman, no. 933.

Rubus idaeus L., var. canadensis Richardson. A delicious wild raspberry common in thickets of the Interior. Miller House, no. 796; Circle Springs, no. 254.

R. Chamaemorus L. The Cloudberry or Baked-apple Berry is abundant in moist tundra and peat bogs throughout. Park, no. 640; Miller House, no. 795; Circle Springs, no. 255; Wiseman, no. 934.

R. acaulis Michx. In moist ground near Savage River. Park, no. 639.

R. arcticus L. Wiseman, nos. 935, 935-A.

The specimens from Wiseman seem to belong here, although *R. arcticus* and *R. acaulis* are confusing and critical in Alaska. Stems leafy, calyx-lobes densely pubescent, petals obovate and less clawed.

Fragaria yukonensis Rydb. A small-fruited strawberry with long runners, common on banks of sloughs. Fairbanks, no. 1072.

Potentilla norvegica L. Common in low ground. Miller House, no. 798; Fairbanks, no. 260; Wiseman, no. 937.

P. nivea L. See Hultén, Fl. Kamtch. **3**: 68–69 (1929) for discussion of this and *P. uniflora*. Occasional. Park, no. 642; Rapids, no. 261.

P. uniflora Ledeb. On bare rocky places in the mountains. Not common. Park, no. 641; Wiseman, no. 936.

P. pensylvanica L. Sandy banks of rivers. Rapids, nos. 262, 1010; Eagle on the Yukon, no. 263.

P. Nuttallii Lehm. Eagle, no. 264; Along Yukon River, no. 265.

P. gracilis Dougl. New to interior of Alaska. Wiseman, no. 938.

P. biflora Willd. On the slopes of Porcupine Dome, no. 800.

A tufted alpine Potentilla, very characteristic, with thick woody caudex, leaves with linear divisions, calyx-lobes and bractlets of a reddish tinge, as is also the stem, and pale yellow petals. According to Wolf it has a wide range from the Himalayas and mountains of Central Asia to arctic regions of eastern Asia and Western N. A., but is nowhere common. It has been collected at Cape Thompson, and several places on the Seward Peninsula, but this, a far inland station, is the first record for the Interior.

P. elegans Cham. & Schlecht. in Linnaea **2**: 22 (1827); Ledeb. Fl. Ross. **2**: 56; Lehmann, Rev. Potentill. 53, fig. 1 (1856); Wolf, Monogr. Gatt. Potentilla, 532 (1908). Amid rock fragments on the bare, wind-swept top of Porcupine Dome, no. 801 (flowers and fruit). The first record for Interior Alaska, and the second for the North American continent.

The finding of this dainty, low, tufted Asiatic Potentilla, with caudex crowded with persisting brown stipules, three-foliolate leaves, hairy calyx, and pale yellow petals, a little longer than the sepals, was a happy experience of the summer. At home in the mountains of Siberia and north-western Mongolia, it was collected once before by Thornton, in the Sawtooth Range on Seward Peninsula, and reported by Porsild, RHODORA **41**: 246 (1939). Its closest relative is *P. Robbinsiana* Oakes, a rare endemic of the White Mountains, N. H.

P. EGEDII Wormsk., var. GROENLANDICA (Tratt.) Polunin in RHODORA **41**: 40 (1939). *P. pacifica* Howell. Very common along the Yukon River, nos. 270, 271 (very silvery hairy); Rampart, no. 269.

P. PALUSTRIS (L.) Scop. *Comarum palustre* L. In wet places, Paxson, no. 267.

P. FRUTICOSA L. This shrubby Potentilla, known in the Interior as "Tundra Rose," is one of the most abundant and characteristic plants in the region. In lowlands, beside roads, in dry tundra, and in subalpine locations. Fairbanks, no. 1071; Miller House, no. 799; Wiseman, no. 268. Also common in Park (field notes).

GEUM MACROPHYLLUM Willd., var. PERINCISUM (Rydb.) Raup in RHODORA **33**: 172–176 (1931). Common around settlements. Fairbanks, no. 275; Circle Springs, no. 274.

G. ROSSII (R. Br.) Sér. *Sieversia Rossii* R. Br. A beautiful plant, abundant in wet, springy ground, in the higher mountains; often below snow patches. Eastern Asiatic-Western American. Park, no. 643; Eagle Summit, no. 802-A; slopes of Porcupine Dome, no. 802.

SANGUISORBA OFFICINALIS L. *S. microcephala* Presl, according to Rydb. in N. Am. Fl. **22**[4]: 387 (1908). Along the banks of rivers. Tanana, no. 285.

Both Hultén and Porsild think the American plant should not be separated.

S. SITCHENSIS C. A. Meyer. Not seen north of the Alaska Range. Beside a brook in the woods above Rapids, nos. 284, 1011.

S. ? MENZIESII Rydb. Form with oblong spikes and purple calyx. In same places as above. Rapids, nos. 286 and 1011-A.

DRYAS DRUMMONDII Richards. Occasional in gravel bars along rivers. Park, no. 277. Abundant in large mats along the paths of the village, mostly with the striking feathery akenes, as it was in August, but several with the low-stemmed nodding yellow flowers. Wiseman, nos. 278, 941.

DR. OCTOPETALA L. Very common in dry, stony places in the mountains. Growing so closely in thick mats that the ground looks as though covered by snow patches. Park, no. 645; Rapids, nos. 282, 1012; Eagle Summit, nos. 281, 803.

DR. INTEGRIFOLIA M. Vahl. Not as frequent as the preceding species. In gravels in the mountains. Park, nos. 279, 644.

Dr. integrifolia M. Vahl, var. sylvatica Hultén in Sv. Bot. Tidskr. **30**, 3: 527, fig. 2a (1936). Below Ft. Yukon on wooded bank, no. 280; Wiseman, in woods, no. 940.

Rosa acicularis Lindl. Very common everywhere except in the high mountains. Fairbanks, nos. 287, 1057; along Yukon River, no. 288; Wiseman, no. 942. Also at Miller House, but did not collect it there.

The beautiful wild rose of Alaska, with very prickly stems, pyriform fruit, and large fragrant flowers.

Trifolium pratense L. Introduced. Fairbanks, no. 1079.

T. hybridum L. Introduced. Fairbanks, no. 1078.

Medicago lupulina L. Miller House, no. 811.

Lupinus arcticus Wats. Common on dry sandy slopes throughout the region. In open woods in the Park, nos. 289, 646; Circle Springs, no. 290.

Astragalus frigidus (L.) Gray, var. littoralis (Hook.) Wats. Occasional in subalpine locations. Park, no. 649; Miller House, nos. 293, 804.

A. alpinus L. Generally common. Park, no. 648; Rapids, no. 292; Fairbanks, no. 690; Wiseman, no. 943.

A. yukonis Jones, Revision of N. A. Astragalus, p. 89 (1923). Tanana, along the Yukon River, no. 294. Possibly the first record for Alaska.

This weak-stemmed, much branched *Astragalus*, with flowers capitate in bloom and pods ascending, is very rare in herbaria. It was described from specimens found by Gorman near Ft. Selkirk, Yukon Territory. Later collected by Eastwood at Whitehorse, and recently by Raup on the Athabaska.

A. falciferus Hult. *Gynophoraria falcata* Rydb. See Hultén in Sv. Bot. Tidskr. **30**, 3: 526. Rare. On rock pile near Sable Pass, Park, no. 647.

Second report for Alaska.

Oxytropis Maydelliana Trautv. *O. campestris* DC., var. *melanocephala* Hook. Rare in the high mountains of the Interior. Eagle Summit, no. 805; on way down from Porcupine Dome, no. 805-A.

Characterized by chestnut-colored stipules.

O. Mertensiana Turcz. Porcupine Dome, no. 809.

A distinctive eastern Asiatic species, very rare in the Interior, probably the first station, but reported previously twice from Seward Peninsula. The third record for Alaska.

O. arctica R. Br. Eagle Summit, no. 806; Porcupine Dome, no. 807.

O. PYGMAEA (Pall.) Fernald in RHODORA **30**: 153 (1928). Occasional in the mountains. Park, no. 650; Eagle Summit, no. 808.

O. HUDSONICA (Greene) Fernald. Near Polychrome Pass, Park, no. 651.

A plant with a strong tap-root, leaflets 18 or more, usually attenuate, and very glandular calyx.

O. GRACILIS (A. Nels.) K. Schum. Fairly common. Park, no. 295; Rapids, no. 296; Wiseman (in fruit), no. 945.

O. DEFLEXA (Pall.) DC. Wiseman, no. 944.

This specimen has truncate calyx-tubes, with broad, rectangular sinuses between short teeth. It is, therefore, the true Siberian *O. deflexa*, not *O. retrorsa* Fernald, the American plant which formerly passed in America as *O. deflexa*. See RHODORA **30**: 140 (1928). *O. retrorsa* has lanceolate, approximate calyx-lobes and acute sinuses. Second record for Alaska.

HEDYSARUM ALPINUM L., var. AMERICANUM Michx. A variable species, very common along sloughs and creeks throughout the Interior. Park, nos. 304, 653; Rapids, nos. 302, 1018; Fairbanks, nos. 301, 689; Miller House, no. 810; Circle Springs, no. 300; along Yukon River, no. 303; Wiseman, no. 947.

H. MACKENZII Richards. Occasional in thickets along rivers and streams. Rapids, no. 1017; Wiseman, nos. 306, 946.

GERANIUM ERIANTHUM DC. Not seen north of the Alaska Range. Curry, no. 566.

LINUM LEWISII Pursh. Fairbanks, no. 865.

EMPETRUM NIGRUM L. The Crowberry is abundant in heaths and bogs, especially in subalpine regions. Park, no. 308; Rapids, no. 1022; Miller House, no. 812; Circle Springs, no. 309; Wiseman, nos. 310, 948.

VIOLA BIFLORA L. The Violas are among the rarest plants of the Interior. This yellow-flowered species was collected but once, in a willow thicket on a slope back of the ranger cabin at Igloo, Park, no. 654.

V. ? PALUSTRIS L. In swamps, Circle Springs, no. 312; Fox near Fairbanks, no. 313.

Not sufficient material to be sure of this. Collected *V. epipsila* Ledeb. in Seward on the southwestern coast, but did not see it in the Interior.

SHEPHERDIA CANADENSIS (L.) Nutt. The "Soap berry" is common in open woods and thickets along streams. Park (in bloom), no. 655; Fairbanks, no. 315; Circle Springs, no. 314; Wiseman, no. 949.

CIRCAEA ALPINA L. Circle Hot Springs, no. 327.

Apparently the second record from the Interior. Porsild reports it from Tanana Hot Springs, in RHODORA **41**: 263 (1939).

Epilobium angustifolium L. *Chamaenerion angustifolium* (L.) Scop. The Fire-weed is, doubtless, the most spectacular plant in Alaska, covering entire hills and meadows with a rose-magenta blanket. It also fringes both the Richardson and Steese Highways. Paxson, no. 316; Fairbanks, no. 1060; Wiseman, no. 950.

E. angustifolium, forma albiflorum (Dumort.) Haussk. Occasional. Wiseman, no. 318.

E. angustifolium, forma spectabile (Simmons) Fern. Miller House, no. 813.

E. latifolium L. *Chamaenerion latifolium* (L.) Sweet. The large-flowered "River Beauty," as it is sometimes called in Alaska, is often found on gravel bars in rivers and creeks in subalpine regions. For map of general distribution see Fernald in Mem. Gray Herb. **2**: 337 (1925). Park, no. 320; Miller House, no. 814; Wiseman, nos. 321, 951, (a pale pink form) no. 952.

E. latifolium L., var. kamtschaticum Haussk. Park, no. 323; Wiseman, no. 953.

E. palustre L. In wet ground by a creek. Miller House, no. 815.

E. glandulosum Lehm. A northern station for this species. Circle Hot Springs, no. 324.

Bupleurum americanum Coult. & Rose. Common in dry gravels. Park, no. 329; along Yukon River, no. 330; Wiseman, no. 954.

Conioselinum cnidiifolium (Turcz.) Porsild in Rhodora **41**: 267–268 (1939). *C. dawsoni* Coult. & Rose. On the bank of the Chena Slough, Fairbanks, no. 1081; along Yukon River, no. 333.

Heracleum lanatum Michx. This very tall, large plant grew in a woody thicket back of Gunnysack Creek, Rapids, no. 332.

Did not see it farther north.

Cornus canadensis L. Common in wooded areas, also in damp open places. Rapids, no. 1021; Fairbanks, nos. 337 and 691; Miller House, no. 335; Circle Springs, no. 334.

C. canadensis L., var. intermedia Farr. *C. unalaschkensis* Ledeb.; *C. canadensis* × *suecica* Hult. Fl. Aleut. 253–254 (1937). See also Porsild in Rhodora, **41**: 270 (1939). Occasional. Park, no. 656; near Donnelly Dome on Richardson Highway, no. 339; Circle Springs, no. 338.

C. stolonifera Michx., var. Baileyi (Coulter & Evans) Drescher. A common shrub in the Yukon Valley and central interior region. Fairbanks, no. 342; Circle Springs, no. 341.

Moneses uniflora (L.) Gray. In moist woods. Park, no. 344.

M. uniflora, var. reticulata (Nutt.) Blake. Rapids, nos. 345, 1020.

Pyrola secunda L. A wooded ravine, Wiseman, no. 956.

P. secunda L., var. obtusata Turcz. Rich woods, Rapids, no. 1019; Paxson, no. 349; Circle Springs, no. 348.

P. grandiflora Radius. Circle Springs, no. 351.

P. GRANDIFLORA, var. CANADENSIS (Andres) A. E. Porsild. Wiseman, no. 955-B.

P. GRANDIFLORA, var. GORMANII (Rydb.) A. E. Porsild. Common in open spruce woods near Savage River, Park, no. 657; Eagle Summit, no. 817. See Porsild, RHODORA, **41**: 271–273 (1939), for discussion of this species and varieties.

P. ASARIFOLIA Michx., var. INCARNATA (DC.) Fern. in RHODORA **6**: 178 (1904). Wiseman, no. 955–A.

LEDUM GROENLANDICUM Oeder. The Labrador Tea is very common in muskegs in the central Interior. Fairbanks, no. 355; Circle Springs, no. 354; Wiseman, no. 957.

L. PALUSTRE L., var. DECUMBENS Ait. *L. decumbens* (Ait.) Small. A dwarf, more northern species, with narrowly linear leaves, growing in the mountains. Park, no. 658; Eagle Summit, nos. 356, 820.

RHODODENDRON LAPPONICUM (L.) Wahlenb. Occasional on alpine slopes and also on the banks of the Savage River in the Park, no. 664.

LOISELEURIA PROCUMBENS (L.) Desv. The little "Alpine Azalea" is found occasionally on bare mountain slopes. Park, no. 659; Eagle Summit, no. 818; Circle Springs, no. 357.

CASSIOPE TETRAGONA (L.) D. Don. Very common and widespread on mossy ledges and alpine summits. Park, nos. 361, 660; Eagle Summit, no. 362; Wiseman, no. 958.

ANDROMEDA POLIFOLIA L. Common in peat bogs and tundra throughout. Fairbanks, no. 363; Eagle Summit, no. 819; Wiseman, no. 959.

CHAMAEDAPHNE CALYCULATA (L.) Moench. In low bogs. Fairbanks, no. 365; Circle Springs, no. 364; Wiseman, no. 960.

ARCTOSTAPHYLOS UVA-URSI (L.) Spreng. Bearberry or Kinnikinick is found now and then on dry bare slopes. Park, no. 661; Circle Springs, no. 366; Wiseman, no. 961.

A. RUBRA (Rehder & Wilson) Fernald. *A. alpina* (red-fruited form) of Richards. Very common in this region. Circle Springs, no. 367; Wiseman, no. 962.

The thin, deciduous leaves turn scarlet in the fall, causing the hills and lower mountain slopes of central Alaska to become masses of brilliant color.

VACCINIUM ULIGINOSUM L. The highly-prized blueberry of the Interior. Common in heaths and tundra. Fairbanks, no. 368; Wiseman, no. 963.

V. ULIGINOSUM L., var. ALPINUM Bigel. In alpine situations. Park, no. 662; Wiseman, no. 963-a.

V. VITIS-IDAEA L., var. MINUS Lodd. Common on dry slopes. Park, no. 663 (in flower); Circle Springs, no. 369; Wiseman, no. 964 (in fruit).

DIAPENSIA OBOVATA (Fr. Schmidt) Nakai in Nakai and Koidzumi, Trees and Shrubs of Japan proper, 194 (1922). *D. lapponica* L., var.

obovata Fr. Schmidt. Rather rare on mountain ledges. Top of Polychrome Pass, in Park, no. 665; rocky cliff above the Lodge, Rapids, no. 371; Eagle Summit, no. 821.

See Porsild in Trans. Royal Soc. of Can., ser. 3, sect. 5, **32**: 35 (1938), for discussion of *D. obovata* and *D. lapponica*. *D. obovata*, loosely caespitose with trailing branches, and of a reddish-green tinge, with short, thick styles is of Eastern Asiatic-Western American distribution, and all records west of the Mackenzie should be referred to it according to Porsild.

Douglasia Gormanii Constance in Am. Midland Naturalist, **19**: 257 (1938). A tiny caespitose plant with several rose-purplish flowers was found on a bare summit near Polychrome Pass in the Park, on June 20th, no. 675.

This very rare little plant I put with some hesitation here. The backs of the leaves are pubescent with forked hairs and the margins not definitely ciliolate, which corresponds to Constance's description. But specimens of this and *D. arctica* Hook. are so rare in herbaria that it is difficult to make determinations without more material. *D. arctica*, a rare arctic plant of the region west of the Mackenzie, is known in Alaska only by a sheet from Bering Strait. The type of *D. Gormanii*, and one other collection mentioned by Constance, are from Yukon River Valley and Lake Kluane in Yukon Territory respectively, so this is the first record for Alaska.

Androsace Chamaejasme Host, var. arctica R. Knuth. ?*A. Lehmanniana* Spreng. Occasional in sandy places. Near Savage River Camp, Park, no. 667.

A. septentrionalis L. *A. Gormanii* Greene. Rare. Dry cliff back of R.R. station in Park, no. 687.

Dodecatheon frigidum Cham. & Schlecht. A beautiful western-arctic "Shooting Star," common in wet, springy ground in high alpine regions of the Interior. Park, nos. 372, 666; Eagle Summit, nos. 373, 822.

Trientalis europaea L., var. arctica (Fisch.) Ledeb. Along the wooded bank of the river at Curry, nos. 572, 573.

No. 573 has narrow, acute leaves instead of broad and obtuse, and lanceolate petals. Also seen in a willow thicket in Fairbanks.

Gentiana propinqua Richards. See Hooker, Fl. Bor.-Am. **2**: 62, tab. 150 (1840). Twelve Mile, on Steese Highway, no. 377; Wiseman, nos. 376, 965.

These two collections are true *G. propinqua*, tall, but delicate stems, purplish, many branched, with a slender corolla, 10–15 mm. long, and generally short, very unequal calyx-lobes.

Other collections—Park, no. 375; Rapids, no. 1024; Miller House, no. 379; Circle Springs, no. 378—show much stouter plants with stem and leaves yellowish-green, cauline leaves more connate-clasping and calyx-lobes longer and united in a tube. Although they are different from typical *G. propinqua*, they can not be satisfactorily placed in any other species.

G. PROSTRATA Haenke. This low-growing, often almost prostrate Gentian with small blue flowers is found only occasionally in damp ground in the mountains. Park, no. 380; Rapids, no. 381.

G. GLAUCA Pall. A rare alpine plant with corolla of a strange shade of greenish-blue, growing in moist places on high mountains. Park, no. 382; Eagle Summit, nos. 383, 823.

SWERTIA PERENNIS L., var. OBTUSA (Ledeb.) Griseb. Collected only once, in the Alaska Range, beside a brook at Paxson, no. 384.

LOMATAGONIUM ROTATUM (L.) Fries, forma TENUIFOLIUM (Griseb.) Fernald in RHODORA **21**: 197 (1919). *Pleurogyne rotata* (L.) Griseb. β. *tenuifolia* Griseb. Occasional in marshy ground in the Interior. Fairbanks, no. 385; Wiseman, no. 966.

POLEMONIUM ACUTIFLORUM Willd. Very common in damp meadows throughout the region. Park, no. 668; lower slope of Eagle Summit, nos. 386, 825; Tanana, no. 387.

P. PULCHERRIMUM Hook. Circle Springs, no. 388.

PLAGIOBOTHRYS CUSICKII (Greene) Johnston. Introduced, Fairbanks, no. 1080-a.

P. COGNATUS Johnston. Dry ground, Fairbanks, no. 1080.

AMSINCKIA MENZIESII (Lehm.) Nels. & Macbride. Probably introduced. Rapids, nos. 395, 1023.

ERITRICHIUM ARETIOIDES (Cham. & Schlecht.) DC. Eagle Summit, no. 826-A; Porcupine Dome, no. 826.

A charming little fuzzy plant of the high mountains, with a rosette of hairy leaves at the base, rising from a woody root covered with brown leaves; the flowers in a capitate head, blue with a yellow eye, and very fragrant.

MYOSOTIS ALPESTRIS Schmidt, ssp. ASIATICA Vestergr. Twelve Mile Summit on the Steese Highway, no. 392; Wiseman, no. 967.

The "Forget-me-not" is the Territorial flower, found in alpine meadows, and moist ledges of the mountains.

MERTENSIA PANICULATA (Ait.) G. Don. One of the most conspicuous and graceful plants of open woods, common throughout the Interior. Curry, no. 567; Park, no. 669; Paxson, no. 397; Miller House, no. 827; Eagle, on the Yukon, no. 399.

STACHYS SCOPULORUM Greene. *S. palustris* L., subsp. *pilosa* (Nutt.) Epling. Fairbanks, no. 866.

Scutellaria epilobiifolia Hamilton. See Fernald in Rhodora **23**: 86 (1921). Fairbanks, no. 401.

Mentha canadensis L., var. glabrata Benth. In swampy land, beside the hot springs, Circle Springs, no. 404.

Prunella vulgaris L., var. lanceolata (Barton) Fernald, forma iodocalyx Fern. in Rhodora **15**: 179–186 (1913). Fairbanks, no. 403.

Linaria vulgaris Hill. In waste land, probably a garden escape. Fairbanks, nos. 405, 1058.

Veronica alpina L., var. unalaschcensis Cham. & Schlecht. *V. Wormskjoldii* Roem. & Schult. Rare. A mossy slope at Twelve Mile Summit, on Steese Highway, no. 408. See Fernald in Rhodora **41**: 450 (1939).

V. peregrina L. Waste land. Fairbanks, no. 1068.

Lagotis glauca Gaertn., var. lanceolata Hult. Fl. Kamtch. **4**: 105 (1930). Rare. Near snow patch on Eagle Summit, no. 836.

Castilleja hyperborea Pennell in Proc. Acad. Nat. Sci. Phil. **86**: 532 (1934). Eagle Summit, nos. 411 and 828.

C. pallida (L.) Spreng., subsp. caudata Pennell. Rapids, no. 1025. One specimen of this collection is yellow-villous and very glandular. Circle Springs, no. 413; Wiseman, no. 412.

C. sp. Other col.ections of *Castilleja* await further study.

Euphrasia mollis (Ledeb.) Wettst. In a low thicket on a hill behind the Lodge, Rapids, nos. 416, 1026.

E. subarctica Raup in Rhodora **36**: 87–88 (1934). Fairbanks, no. 868.

Pedicularis verticillata L. Occasional in subalpine regions. Park, no. 417; Rapids, no. 418; Wiseman, no. 972.

P. labradorica Wirsing. Common on dry hillsides, not usually in high altitudes. Park, nos. 419, 672; Miller House, no. 831; Circle Springs, no. 420; Wiseman, no. 971.

P. sudetica Willd. Fairly common in tundra. Miller House, no. 829; along road to Eagle Summit, no. 422.

P. Oederi Vahl. Abundant in wet ground below snow banks at base of Eagle Summit, but not seen elsewhere, nos. 421, 833.

P. Langsdorffii Fisch. Park, no. 670; Eagle Summit, nos. 423, 834.

A striking alpine Pedicularis with tall thick pink spikes. Rarely reported from the Interior.

P. lanata Cham. & Schlecht. Rare. Eagle Summit, nos. 424, 832.

Reported by Porsild in Rhodora **41**: 287 (1939), from the Alaska Range. Probably second record for the Interior.

P. capitata Adams. On dry stony slopes, occasional in alpine regions. Park, no. 671; Eagle Summit, nos. 425, 830.

Boschniakia rossica (Cham. & Schlecht.) B. Fedtsch. Rapids, no. 427; Wiseman, no. 973, where it was very abundant.

A strange looking plant, parasitic on roots of alder and spruce, growing in woods and thickets. It has a wide distribution in Alaska, as I saw it also in Seward. The Eskimo children called the plants "corn pipes."

PINGUICULA VULGARIS L. Many of the leaf rosettes were seen in a marsh in Wiseman, but I failed to collect them.

PLANTAGO MAJOR L., var. ASIATICA (L.) Decaisne. Circle Springs, no. 428.

GALIUM BOREALE L. Very common in dry soil on banks of streams and rivers in low areas. Fairbanks, no. 867; Circle Springs, no. 431.

A tall, showy Galium with many white flowers in compact panicles.

G. TRIFIDUM L. In moist places near Circle Hot Springs, no. 434.

VIBURNUM PAUCIFLORUM Raf. Very common in thickets along rivers. Rapids, no. 1016; Circle Springs, no. 439.

The red fruit of this tall straggling shrub, often called "High-bush Cranberry," is much prized for jellies and pies.

LINNAEA BOREALIS L. Specimens from Wiseman, nos. 437 and 974, belong to the typical form. See Fernald in RHODORA **24**: 210 (1922).

L. BOREALIS L., var. AMERICANA (Forbes) Rehder. Plants from Miller House, no. 837, have the funnel-shaped corollas. Common in rich woods and shaded thickets.

VALERIANA CAPITATA Pall. A common characteristic plant of moist meadows and subalpine tundra. Park, nos. 441, 674; Wiseman, no. 975.

CAMPANULA LASIOCARPA Cham. A handsome alpine species, called familiarly "Bluebells," growing in large clumps in gravelly soil. Common in the Interior. Park, no. 442; Rapids, no. 444; Eagle Summit, nos. 443, 839; Wiseman, no. 976.

C. UNIFLORA L. Rare in the mountains, but no doubt easily overlooked. My only collection was from Eagle Summit, no. 840.

SOLIDAGO MULTIRADIATA Ait. The most common and abundant Solidago with wide-spread distribution in dry soil. Park, no. 445· Rapids, no. 448, 1033; Circle Springs, no. 447; Wiseman, nos. 446, 977.

S. DECUMBENS Greene, var. OREOPHILA (Rydb.) Fernald in RHODORA **38**: 201–204 (1936). Occasional on sandy banks. Miller House, no. 841; Eagle, on Yukon River, no. 449.

S. LEPIDA DC., var. ELONGATA (Nutt.) Fernald in RHODORA **17**: 8–10 (1915). Along the Chena River, Fairbanks, nos. 451, 870.

Apparently the second record for the Interior.

ASTER JUNCEUS Ait. Circle Springs, no. 455.

Reported but twice previously from Alaska.

A. SIBIRICUS L. Very common throughout the region, especially on sandy banks of streams. Park, no. 453; Rapids, no. 1027; Fairbanks, no. 1059; along Yukon River, no. 454; Wiseman, nos. 456, 978.

ERIGERON ELATUS Greene. *E. acris* L., var. *arcuans* Fernald. See RHODORA **40**: 347 (1938). Wiseman, no. 980.

E. ANGULOSUS Gaudin, var. KAMTSCHATICUS (DC.) Hara in RHODORA **41**: 389. *E. elongatus* Ledeb. *E. acris* L., var. *asteroides* of Am. Auth. Very common in subalpine regions. Rapids, nos. 458, 1028; Miller House, no. 843; Wiseman, nos. 457, 979.

E. LONCHOPHYLLUS Hook. In a sandy location not far from the Chena River, no. 1064.

Apparently rare, as only other reports are from Fairbanks.

E. COMPOSITUS Pursh, var. TRIFIDUS (Hook.) Gray. Probably occasional in high mountains. On a rock pile near Sable Pass in Park, no. 676-a.

Tufted with finely cut leaves and white flowers.

E. SALSUGINOSUS (Richards.) Gray. Along the Yukon River in thickets, Tanana, no. 460.

E. CAESPITOSUS Nutt. Along the Yukon River, no. 461.

E. RADICATUS Hook. Park, no. 676; Eagle Camp, nos. 459, 696.

Low, caespitose, with strong tap-root, growing in rocks. Similar in appearance, but in the Park specimen the leaves are less linear and inclined to be slightly lobed and base of heads more villous.

ANTENNARIA PHILONIPHA A. E. Porsild in RHODORA **41**: 294, pl. 554 (1939). Park, no. 678.

This alpine species, recently named and described, differs from *A. monocephala*, its nearest relative, according to Porsild l. c. "by the thinner tomentum of leaves, the elongated offsets, tall and slender stems and by the larger pistillate heads." It has a wide range from the Bering Sea, the mountains of interior Alaska and Yukon Territory to the Arctic coast east of Mackenzie.

A. ALASKANA Malte in RHODORA **36**: 107 (1934). Rare in bleak, exposed gravelly places on high mountains. Eagle Summit, no. 464; on the very top of Porcupine Dome, no. 845.

A. LAINGII A. E. Porsild in RHODORA **41**: 293 with pl. 554 (1939). Dry gravelly location near the Savage River, Park, no. 677 (mentioned by Porsild).

"By its densely matted growth, the very leafy stems and compact glomerulate ivory-white heads, it differs strikingly from all other boreal Antennarias" Porsild l. c. The TYPE was collected by *H. M. Laing* at the head of the Chitina River. My specimens constitute the second record for this species.

A. PULCHERRIMA (Hook.) Greene. This attractive Antennaria, often 15 inches high, grew abundantly in low open woods near the Koyukuk River, Wiseman, nos. 463, 982.

Rarely reported from Alaska. This is probably the second record.

ACHILLEA BOREALIS Bong. Very common throughout the Interior, especially along rivers. Rapids, nos. 468, 1036; Fairbanks, no. 1063; Rampart, on the Yukon, no. 469.

A. OCCIDENTALIS Raf. Fairbanks, no. 1061.

A. SIBIRICA Ledeb. *A. multiflora* Hook. Occasional on river banks. Fairbanks, no. 1062.

Leaves only pinnately divided.

MATRICARIA MATRICARIOIDES (Less.) Porter. *M. suaveolens* (Pursh) Buch. Common around settlements. Fairbanks, no. 475; Wiseman, no. 987.

ARTEMISIA BOREALIS Pall. Found growing plentifully on a steep, rocky hill near Gunnysack Creek, Rapids, nos. 447, 1034. A rare species in interior Alaska.

A. ARCTICA Less. Common on damp, mossy ledges of high mountains. An Asiatic-Western American species. Eagle Summit, nos. 478, 846; Porcupine Dome, no. 847.

A. FRIGIDA Willd. Occasional on dry hillsides. Fairbanks, no. 1066.

A. ALASKANA Rydb. in N. A. Flora **34**: 281 (1916). Gravel bars of a creek in Wiseman, no. 984.

These match the photograph of Rydberg's TYPE SPECIMEN in Gray Herbarium, collected by I. C. Russell on Yukon River between Nulato and Nowikakat, July 23–27, 1889. The second report for this species.

A. TILESII Ledeb. sens. lat. Very variable. Several specimens resemble var. UNALASCHCENSIS Besser (var. *elatior* Torr. & Gray). Common around roadhouses and towns. Park, no. 480; Rapids, nos. 482, 1035; Miller House, no. 848; Wiseman, nos. 481, 983.

PETASITES FRIGIDUS (L.) Fries. Common in alpine meadows and tundra. Park (in flower), no. 685; Wiseman (basal leaves only), no. 988.

ARNICA ATTENUATA Greene. A tall plant with strongly attenuated leaves, common in thickets and on dry hillsides in subalpine regions. Park, no. 681; Miller House, no. 849; along Yukon River, no. 483.

A. LOUISEANA Farr. Park, no. 679; on slopes of Eagle Summit. no. 850.

A Cordilleran species found at Lake Louise and other locations in the Canadian Rockies, in the mountains of interior Alaska, and the Gaspé Peninsula and western Newfoundland. See Fernald in RHODORA **35**: 368, pl. 270 (1933).

A. LESSINGII Greene. See Hultén, Fl. Kamtch. **4**: 193, pl. 6 (1930). Close beside the preceding species on Eagle Summit, nos. 486, 851. Also in the Park, no. 485.

An Asiatic-Western American Arnica, with pale yellow ligules, brownish pappus and nodding heads.

A. sp.? Resembles *A. Louiseana*, but the rays unusually long for that species. Miller House, no. 850-a.

Senecio vulgaris L. Probably introduced. Rapids, no. 1030.

S. palustris (L.) Hook. In wet places in the mining dumps after the ground has been thawed by water pipes. Fox and Ester Creeks near Fairbanks, no. 488.

Conspicuous and tall, often 3 to 4 feet high.

S. lugens Richards. Abundant in thickets, along roadsides in lowlands and subalpine regions. Park, no. 492; Rapids, nos. 493, 1032; Fairbanks, no. 494; Miller House, no. 853; Wiseman, no. 985.

Tall and weedy, characterized by the black-tipped bracts of the involucre.

S. pauperculus Michx. Fairbanks, no. 491.

S. frigidus (Richards.) Less. *Cineraria frigida* Richards. Occasional in the mountains. Park, nos. 682, 683.

S. Kjellmanii A. E. Porsild in Rhodora **41**: 299 (1939). *Cineraria frigida* Richards., f. *tomentosa* Kjellm. Growing in moist places beneath snow patches on Eagle Summit, nos. 854, 855.

The heads are larger in this species, rootstock stouter, and whole plant woolly and tomentose. Rare in high mountains.

S. atropurpureus (Ledeb.) Fedtsch. in Fedtsch. & Fler. Fl. Eur. Russ. 992 (1910). *Cineraria atropurpurea* Ledeb.; *S. integrifolius* Kjellm. Eagle Summit, nos. 496, 856; Porcupine Dome, 856-a.

A striking plant with orange rays and stem and leaves gray with lanate wool, found commonly on the mountain slopes and dry alpine tundra in the Eagle Summit region. Usually a number of heads in a cluster, but several plants were collected at higher altitudes with a larger single head.

There is a resemblance between this species and specimens in the Gray Herbarium of *S. pyroglossus* Kar. & Kir. from the mountains of the northwestern part of Mongolia.

S. resedifolius Less. See Fernald in Rhodora **26**: 113–116 (1924), and Mem. Gray Herb. **2**: 259 (1925), for map of general distribution. Rare in the mountains. Eagle Summit, no. 852.

S. conterminus Greenm. On stony ground near the Big Delta River at Rapids, nos. 490, 1031.

Saussurea angustifolia DC. Fairly common in dry gravelly places and subalpine tundra of interior valleys. Park, no. 498; Miller House, no. 858; Circle Springs, no. 499.

S. ? monticola Richards. Wiseman, no. 986.

A tall plant, with the heads longer-peduncled. Similar to *S. remotiflora* Rydb. These three have been grouped under *S. alpina*, and more recently under *S. angustifolia* sens. lat., but at least *S. densa* seems distinct in the field.

S. DENSA (Hook.) Rydb. Eagle Summit, nos. 497, 857.

Low alpine plant with heads in a close cluster.

CREPIS NANA Richards. *Youngia nana* (Richards.) Rydb. Occasional in dry soil on alpine slopes. Park, nos. 505, 684; Rapids, nos. 506, 1029; Wiseman, no. 989.

Low and tufted, often stemless.

C. ELEGANS Hook. Apparently rare, but abundant at Miller House, in the piles of stones thrown out by placer mining, nos. 507, 859.

A taller plant, many-stemmed with a long tap-root.

TARAXACUM MUTILUM Greene. (Group *Ceratophora* Dahlst.) (determinavit G. Haglund 1938). Wiseman, no. 990.

T. KJELLMANII Dahlst. ("verosimiliter") (Group *Vulgaria* Dahlst.). Fairbanks, no. 1065.

T. KAMTCHATICUM Dahlst. (Group *Glabra* Dahlst.). Park, no. 686.

LACTUCA SCARIOLA L. Introduced. Miller House, no. 508.

L. PULCHELLA (Pursh) DC. Along Yukon River, no. 509.

INDEX

New scientific names are printed in full-face type

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A CENTURY OF ADDITIONS TO THE FLORA OF VIRGINIA[1]

M. L. FERNALD

(Plates 626–649)

PART I. ITINERARY OF FIVE FIELD-TRIPS

Aided by a generous and greatly appreciated grant from the Penrose Fund of the American Philosophical Society, I was able to continue botanical exploration on the Coastal Plain of southeastern Virginia at intervals from June to October, 1939. Half the grant was used to cover the expenses of an all-summer botanical reconnaissance of the lower Santee valley in South Carolina (the home of Thomas Walter and a collecting ground of Stephen Elliott) by my students, Messrs. Robert K. Godfrey and Rolla M. Tryon, Jr., their results to be published in a separate paper. With the portion of the grant retained for the Virginia work I employed our already proved and efficient helper, Mr. Leonard Birdsall, maintained the established headquarters at Mrs. Bowman's at Century House, south of Petersburg, and met the expenses of equipment and a portion of those of travel.

Mr. Bayard Long, most happily, was able to join me for all five trips, most happily because the eastern Virginia work has

[1] Exploration done with the support of a grant from the AMERICAN PHILOSOPHICAL SOCIETY.

now become intensive and wholly eclectic, with little or no attention devoted to the ubiquitous and well known species, our eyes being always on the alert for something which "does not register." Occasionally the failure of a plant to "register" proves humiliating but in two out of three cases the plant we do not at once recognize from the car or in walking through the unspoiled areas justifies a special stop; most often it is quite new to the known flora of the region and it frequently leads to the discovery of a new and productive habitat. Without Long's keen knowledge of Coastal Plain plants and his persistence in following clues to successful discoveries too many rare and excessively localized species would be overlooked. As it is, we are often amazed to find in supposedly familiar areas plants of great significance which, diverted by some other species, we must previously have overlooked. For instance, in June, 1939, attracted by an unusual composite, we slowed down near Applewhite's Church—to collect for the first time the remarkably distinct *Tetragonotheca helianthoides*,[2] a southern monotype (MAP 1), based by Linnaeus partly upon a Virginian specimen of Clayton's, but certainly rare in eastern Virginia. That discovery soon led us to a rich strip of undisturbed woodland along the Nottoway near Carey Bridge, on the plantation of Mr. S. R. Westbrook, who readily granted us permission to botanize over the area. Our interest absorbed by many unusual species, we perhaps had blind spots for others. At any rate, returning in June, 1940, we found on the springy wooded slopes which we had canvassed during three days at the same season the year before such extraordinarily conspicuous species as an *Aconitum*, leaning and twining on the neighboring shrubs, a plant not yet in flower but presumably *A. uncinatum* of the interior; the true and famously rare *Sphenopholis pallens*

[2] In this, as in preceding papers of this series, the authors of species are omitted in the narrative if they are in Gray's Manual. The preceding papers on the work in Virginia are as follows: Fernald & Griscom, *Three Days of Botanizing in Southeastern Virginia*, RHODORA, xxxvii. 129–157 and 167–189, 20 plates (1935)—Contrib. Gray Herb. CVII; Fernald, *Midsummer Vascular Plants of Southeastern Virginia*, RHODORA, xxxvii. 378–413 and 423–554, 22 plates (1935)—Contrib. Gray Herb. no. CIX; Fernald, *Plants from the Outer Coastal Plain of Virginia*, RHODORA, xxxviii. 376–404 and 414–452, 13 plates (1936)—Contrib. Gray Herb. no. CXV; *Local Plants of the Inner Coastal Plain of Southeastern Virginia*, RHODORA, xxxix. 321–366, 379–415, 433–459 and 465–491, 14 plates (1937)—Contrib. Gray Herb. no. CXX; *Noteworthy Plants of Southeastern Virginia*, RHODORA, xl. 364–424, 434–459 and 467–485, 27 plates (1938)—Contrib. Gray Herb. no. CXXIII; *Last Survivors in the Flora of Tidewater Virginia*, RHODORA, xli. 465–502, 529–559 and 564–577, with 14 plates (1939)—Contrib. Gray. Herb. no. CXXVIII.

(Spreng.) Scribn.,[3] of which, as stated by Hitchcock (*Man.*), "The only other specimen [besides the original of more than a century ago, sent by Muhlenberg to Sprengel, supposedly from Pennsylvania] known is the type of *Eatonia aristata* collected [somewhere] in South Carolina by Curtiss"; and, beneath them, carpets of a reclining rhizomatous *Cardamine*, with showy petals deeply cleft like those of some species of *Silene*. A few miles away, in another area north of Applewhite's Church, where we had extensively botanized one year earlier, there was a very definite and apparently heretofore unrecognized *Carex*, although it exists, misidentified, in some of our herbaria from Georgia and Florida. In these cases, each species is so highly localized that, passing a rod or two on either side of their small colonies, we might easily have missed them all the second year. They again illustrate the truism, that no area is ever fully worked out. Needless to state, it was Long who first detected three of the four.

Our first field-work of the summer of 1939 was from June 11–24. We had some problems left over from previous years which demanded immediate attention. On our first trip on the inner Coastal Plain, in June, 1936, we were amazed to find in open woods and clearings a species of *Andropogon* in the prime of flowering and early fruiting. Dreading the complexity of the genus, we tentatively set it aside as an aberrant colony of *A. scoparius*, a variable species normally flowering in September and October. But the plant could not be thus disposed of. Every June it abounds in open woods, clearings and fields as a regular element in the late-spring and earliest-summer vegetation, from Dinwiddie County at the west, York County at the east, thence south nearly to the North Carolina line; and Godfrey & Tryon got it, over-ripe and shattered in July, in southeastern South Carolina. Best of all, it has strong morphological characters separating it from *A. scoparius*. It is a vernal species, nearest related to an autumn-flowering endemic of Texas. It will be described and illustrated (PLATE 626) in Part II.

Another characteristic plant of the region, also found by us in June, 1936, and subsequently much collected, from May into July, on the rich wooded bottomlands, is a gigantic quillwort,

[3] *S. pallens* true, not that of most treatments, which is the transcontinental *S. intermedia* Rydb.

Isoëtes. Flaccid and sprawling in the richest woods, with bulbs up to 3 cm. in diameter and loose rosettes up to 9 dm. across, it always fascinates us, for it is decidedly not an aquatic; and on many bottomlands, from Dinwiddie County to Greensville and western Nansemond, it is impossible to walk in June without trampling upon it. It proves to be the little known *I. Engelmanni* var. *caroliniana* A. A. Eaton, described from along creeks tributary to the Tennessee River in westernmost North Carolina but subsequently found in Georgia (MAP 2), another of the upland and inland types reappearing on the Coastal Plain of Virginia.

These were a good start and on our first full day in the field (the 12th) we began brand new discoveries. On one of the earlier trips we had hoped for good things about Taylor's Millpond in southeastern Greensville County but, alas, it is a conventional millpond, formed by damming a stream, with water lapping the drowned marginal forest and without a natural beach, such as we are constantly seeking. Taylor's Millpond was promptly given a black mark. On June 12th, however, the region came into botanical favor. After making brief visits to old areas near Skipper's and Dahlia, we took the dirt road east from Skipper's (that from Dahlia has become impassable), planning to explore via any side road which looked tempting. Suddenly, beyond an open pine wood, we saw a swale. That meant moisture and perhaps a sphagnous bog. Sphagnum was there in abundance but we were on a ruined remnant of several acres of what was once a good habitat. The plow had been there, although, as is so often the case, the heavy and soggy clay land is unfit for agriculture. Only a few of the original bog plants remained, *Panicum strigosum* and some Droseras; but here was the greatest assemblage imaginable of the bog species of *Lycopodium*, which seemed to have profited by cultivation of the land. *L. alopecuroides* and *L. inundatum* vars. *adpressum* and *Bigelovii* formed a nearly continuous carpet, and at one end of the swale there was the rare *L. carolinianum.* It is sometimes listed as a Virginian, but in their monograph of the genus (1900) Lloyd & Underwood were unable to cite any specimens from between southeastern North Carolina and southern New Jersey, although it has long been known at a single station in Prince George

County, Maryland. In June *L. carolinianum* was very immature but we made regular monthly calls, to watch its development. On our September visit the swale was under two feet of rain-water. We then wallowed and tumbled about the submerged furrows, well above our knees in muddy water, and, reaching arm's-length below, pulled up strobiles of *L. carolinianum* 7½ cm. long, of *L. alopecuroides* 1 dm. long and of *L. inundatum* var. *Bigelovii* 1.1 dm. long, of var. *adpressum* 1.2 dm. long. After this hydropodic and most novel adventure among the *Lycopodia* we gladly replaced Taylor's Millpond upon the botanical map.

Taylor's Millpond further justifies its existence as a focal point of botanical note because slightly to the southeast a dirt road leads across and along the wooded bottomland of Fontaine Creek into North Carolina. The bottomland, where not too heavily wooded, is a tangle of southern sedges, *Carex louisianica* Bailey up to 7.5 dm. high (Mackenzie says 2–6 dm.), *C. crus-corvi* var. *virginiana* Fernald, *Scirpus atrovirens* var. *flaccidifolius* Fernald, and several others. At the upper border of the bottomland there is a fine clump of *Amsonia Tabernaemontana*, the typical variety, not recorded by Woodson in his monograph of the genus as native north of South Carolina. Farther out, at the margin of the Creek, *Sagittaria Weatherbiana* Fernald mingles with an orchid with oblanceolate leaves 3–3.5 cm. broad. In June the latter was not yet flowering, and the colony was deep under water until the end of September, when, from among the clay-crusted leaves, the characteristic long raceme showed it to be *Spiranthes cernua* var. *odorata* (Nutt.) Correll (*S. odorata* Nutt.), a giant plant for its group, though in September and October we found it on tidal marshes farther north reaching a greater stature (up to 7.5 dm. high).

On the 14th, Godfrey, on his way to South Carolina, joined us for half-a-day. After showing him some of the specialties between Petersburg and Emporia, we drove east to look at the bottomland of Three Creek, between James River Junction and Grizzard. In what was once a sphagnous bog along the Southern Railway *Sarracenia flava* and a few other bog species still held their own (though apparently completely obliterated by ditching operations later in the summer). Here was a new inland limit for *Erigeron vernus,* and the second station in Virginia and east of the Mississippi valley of *Eleocharia tenuis* var. *verrucosa* Svenson. On the bottomland, where we went to show Godfrey *Glyceria arkansana* Fernald and other species not recorded from neighboring North Carolina, we were greatly impressed by *Peltandra virginica.* In New England, New Jersey and Pennsylvania the plant we know by that name has a tightly rolled green spathe with closely appressed pale margins which loosen without spreading more than just enough to allow the entrance of insects and snails to the closely surrounded whitish spadix. Here on Three Creek, however, the spathe loosely opens, its creamy-white margin spreading and fully exposing the deep orange-yellow spadix. At the summit of the enclosed ovary the spathe is circumscissile, a deliquescent band soon developing at this point, so that the limb of the spathe very soon drops off, leaving a truncated young fruit. This prompt circumscission of the limb of the spathe I have not seen in Massachusetts. Furthermore, the pale spadix of the northern plant is covered with flowers essentially to its tip; the orange-yellow spadix of the eastern Virginian has the upper inch or so often sterile. On all the streams we have yet visited in southeastern Virginia *Peltandra* is uniform; and Dr. Lily M. Perry informs me that this plant with open spathe and yellow spadix is what she knew in Georgia. *P. virginica* was based on the brief description by Gronovius of the Virginian plant of Clayton. It is probable that the northern plant is not *P. virginica.* The spathe and spadix of each will be shown in PLATES 627 and 628.

Attending the meeting of the Botanical Society of America at Mountain Lake and Blacksburg, where we were the guests of Professor and Mrs. Massey, we got back into our special fieldwork on the 18th. Wishing to check on *Peltandra,* we took a side road, leading from near the Prince George-Sussex County line from the Jerusalem Plank Road across to Stony Creek. On the first bottomland, that of Jones Hole Swamp, we were collecting the calla-like spathes when a passing fisherman, looking down from the bridge, remarked: "Oh! getting water lilies?" That seems to be a general name for *Peltandra virginica* in the region, more appropriate to it than to the northern plant. On the wooded bottomland of Jones Hole Swamp *Rhododendron* *canescens* was frequent, the first we had met in Virginia, though we afterward got it in woods along other portions of the Nottoway system. This is true *R. canescens,* as restricted by Rehder, who, in his monograph of the group, gives its range as extending "from southwestern Tennessee and southern central North Carolina" southward and southwestward. Somewhat northeast of Stony Creek and again both north and south of that botanically productive center swampy woods were characterized by pin oak, *Quercus palustris,* which we also found along Three Creek, farther south. We had never before met it on the Coastal Plain of the state and Sargent (*Man.*) cites it as occurring in Virginia south of the Potomac only in the mountains (Wythe County). It has, however, been reported from several counties, including Amelia, which approaches the Coastal Plain, and Charles City County which is upon it. As it turned out, the day was primarily devoted to trees and shrubs. Driving eastward to Sussex Courthouse, then to Homeville and Waverly, we stopped on the west side of the Nottoway, where the ash-keys attracted us by their extreme smallness. They were on *Fraxinus americana,* var. *microcarpa* Gray, a southern extreme which we had not previously met. On the east side of the river, nearer Homeville, the forest was so rich that we returned next morning for further collecting. *Carya ovata* var. *pubescens* Sargent, recorded from Alabama and Mississippi northward into South Carolina and Tennessee, abounded, and with it the southern *C. pallida* Ashe. At one point in the drier forest above the bottomland *Arabis canadensis* abounds, our first Coastal Plain station; and near it was a carpet of *Paronychia fastigiata,* var. *paleacea* Fernald, heretofore known only from Delaware and Pennsylvania to Illinois and Tennessee. Another extension southward to Virginia was noted when we stopped, as we usually do, at the border of Assamoosick Swamp, northeast of Homeville. A bramble there was one of the arching or doming but tip-rooting series midway between dewberries and high blackberries. I cannot separate the material from that of *Rubus Janssonii* Bailey, of southern New England.

Exploring, still unsuccessfully because of the clearing of land and the turning in of hogs on most boggy areas, with the hope of rediscovering Pursh's stations of 137 years ago, some of them on "boggy meadows near Dr. Gray's,[4] Southampton", others simply from "swamps, Southampton", we covered much of the county. Pursh's material, at the Philadelphia Academy, shows familiar Southampton County plants, such as *Stillingia sylvatica, Asimina parviflora, Quercus laevis, Sarracenia flava, Amianthium Muscaetoxicum, Lobelia glandulifera, Carphephorus bellidifolius* and *tomentosus,* and others which are now very local. But we wanted to find in the county *Gentiana Stoneana* Fernald (*G. linearis* in Pursh's herbarium), from "swamps, Southampton" and *Asclepias paupercula,* "wet swampy woods, Southampton". We already have them from farther east, so that their rediscovery is of secondary importance. But of the very first importance is the fact that Pursh got in "swamp, Southampton" the very rare *Litsea geniculata,* probably not subsequently collected in the state; and "in rich hedge-rows, Dr. Gray's", *Baptisia villosa,* a species also collected by Canby near Franklin in 1867. As yet these two are unknown as living species in the state. During these searches we found on the old road from Sebrell to Courtland an area of white sand, with the remnant of a forest of Catesby's oak, *Quercus laevis,* and with *Q. cinerea* Michx. at a new northern limit. *Stillingia* is abundant, perhaps where Pursh got it, but at its northernmost known station; *Bulbostylis ciliatifolius* (Ell.) Fern. also is there at its northern limit, and at the margin of Assamoosick Swamp *Nyssa sylvatica* var. *dilatata* Fernald abounds. The area was so promising that we registered it for later visits.

I have referred in the opening paragraphs to the region of Applewhite's Church and of Carey Bridge. Here is an area of alternating rich loamy (often calcareous) woodland, more sterile sandy woods and wooded bottomland. The unique *Tetragonatheca* (MAP 1), with four big foliaceous bracts subtending the sunflowerlike heads, the distinctive achenes becoming conspicuous, was found in two spots. In the woods were *Onosmodium virginianum* and a complex series of *Houstonia,* from typical *H. lanceolata* to extreme *H. tenuifolia.* It begins to look as if Gray's old treatment, of combining several of these as variations of one species, were sound. *Polygala polygama* abounds and is

[4] Edwin Gray, proprietor of much of Southampton County in the late 18th and early 19th centuries, buried between Sebrell and Wakefield.

strikingly unlike the more northern plant in its very lax raceme with distant and relatively large flowers. It is true *P. polygama* of Walter at its northern limit, the plant of the North, with more crowded and mostly smaller flowers being var. *obtusata* Chodat. *Viola triloba* var. *dilatata* (Ell.) Brainerd ("southwestern Louisiana northward to northern Oklahoma, southern Missouri, and southern Illinois; thence eastward to northern Georgia and western North Carolina") was there, with scattered *Chamaelirium luteum* and *Carex striatula*. *Viburnum rufidulum*, rarely flowering, was here heavily in bloom, some of the trees 20 feet high, with trunks 4 inches in diameter, the blackish bark broken into rectangular blocks suggestive of the bark of *Diospyros*. Small trees of *Vaccinium arboreum* (up to 20 feet high, with trunks a foot in diameter, the main branches 6 inches through) were also very beautiful, with their loads of milk-white drooping flowers.

At the point where Mr. Westbrook's bridge crosses Three Creek an old woodroad leads up the latter stream to pits from which the shell-marl was long ago dug out. Here, as exclusively in lime as elsewhere in eastern Virginia, *Equisetum arvense* and *E. hyemale* var. *affine* abound; and the thousands of plants of *Ponthieva racemosa* (Walt.) Mohr give encouragement that this southern orchid may hold its own in Virginia. In deep woods along the bottomland *Ampelopsis arborea* occurs and near it sterile plants which could be only the rare *Chelone obliqua;* and later in the year we here established a new southern limit on the Coastal Plain for the Canadian and Alleghenian *Prenanthes altissima*.

At a crossing of Three Creek slightly farther up-stream, on the road north from Applewhite's Church, *Rhododendron canescens* abounds; and on the steep slopes with *Antennaria solitaria* we got our first Coastal Plain material of the upland *Cunila origanoides*.

The last full day in the field in June (23rd) we went to some of the old ferry-landings on the Nottoway and the Blackwater. The tidal shore at Knight's Seine Beach (Battle Beach of the contour-sheet) on the lower Nottoway was showy with masses of flowering *Zizaniopsis*, with great swales of *Rhynchospora caduca* Ell. and other nice species farther back, but our great prize here was the first collection of the season (by no means the last) of the estuarine *Isoëtes saccharata,* not seen by Pfeiffer from south of the Potomac at Alexandria. Later in the summer and autumn it proved to be a regular inhabitant of tidal shores. Since Battle Beach is almost in North Carolina, just above the junction of the Nottoway and the Blackwater which form the tidal Chowan River, the *Isoëtes* will certainly be found in North Carolina. At Cobb's Wharf,[5] on the west bank of the lower Blackwater, there are good swales. *Panicum albomarginatum,* not too common in Virginia, was in fine condition and *Lysimachia producta,* which we had not previously collected in the state, abounded, quite by itself, with no *L. quadrifolia* nor *L. stricta* (sometimes thought to be its parents) seen. Best of all, there were splendid great clumps in perfect vernal flowering of one of the very rarest of grasses, *Panicum cryptanthum* Ashe, which had been unknown between southeastern North Carolina and its local stations in New Jersey.

These old landings, long ago cleared of heavy timber, thus offering sunshine, as compared to the darkness of the neighboring cypress and gum forests, were so full of local species that we at once conceived the idea that the old landings on the east side of the Blackwater would yield their quota of novelties. The contour-sheet showed below South Quay bridge a tempting series, George's Bend, Milk Landing, Cox Landing, Sandy Landing and Cherry Grove; and Wyanoke at a point which, if it were west of the Blackwater, would be in Virginia. At this area along the Blackwater, the boundary between Virginia and North Carolina suffers what the geologist would call a nonconformity or perhaps a fault. From below False Cape, on the Atlantic coast, westward to the Blackwater the boundary line is at latitude approximately 36° 48′, but from the Alleghenies eastward to the Blackwater it is nearer 36° 46′. We were told that when the early boundary surveyors came from the west and from the east in two parties they failed by more than half-a-mile to meet at the Blackwater and their miscalculation is still sacred.

When, in 1936, I first approached western Nansemond I had left Long at home to make up sleep and with Carroll Williams

[5] On some of our earlier labels we mistook Smith's Ferry on the Nottoway for Cobb's Wharf on the Blackwater. No plants of critical importance are involved, since most of them share the two adjacent localities.

crossed the bridge at South Quay from Southampton County. I hoped, somewhat blindly, to find a continuation southward of the white-sandy pine barrens which occur south of Zuni (farther up the Blackwater). As I then wrote, "Expressing my hopes to the drawtender, I received the reassuring reply, accompanied by a general sweep of his arm toward Nansemond County: 'Thar's a powerful lot of right smart sand over thar'."[6] We consequently took the firm road southeastward to Factory Hill, thence to Somerton, and on many subsequent days this route and its arteries have led us through southwestern Nansemond. It would not serve, however, if we were to get to the old landings on the Blackwater. We had formerly let the wheels of the car make our decision for us and they had automatically followed the hard road. Now, putting our own minds to the task, it was clear from the contour-sheet that between the Factory Hill road and the river there are no good roads; the area has a loose mesh of dotted lines indicating only "poor roads" and paths, and much of the region is uncleared. Following the first "poor road" southward from east of the bridge, we soon found ourselves in loose white sand, the road crossing deeply drowned and loosened or floating corduroys over the rain-swollen branches, so that Long and I had to get out and, standing in deep water, hold floating logs at each end of the submerged bridge while Leonard "bucked" the bridge, the water often flooding the body of the car. Only a driver with Leonard's skill would attempt such a road, but through two years now he has not balked, except when, trying a swollen branch and finding the water nearly up to our hips, we have concurred in his decision not to cross.

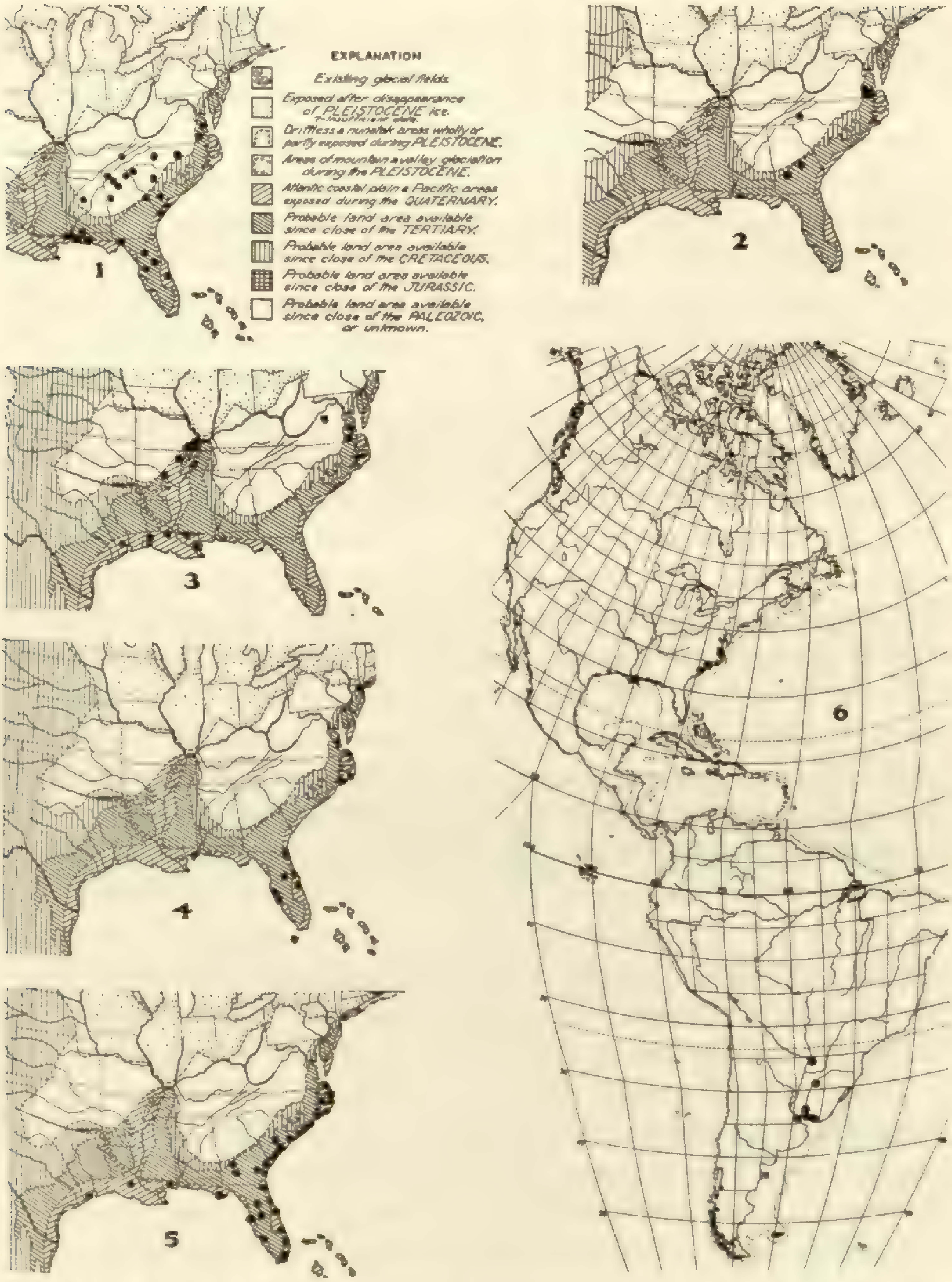
We did not reach any of the landings on the Blackwater that afternoon. The familiar black clouds were assembling in the north and west, ominous thunder was increasing and we, obviously, must get out of this "poor road" before the next cloudburst. But the continuous white sand, with forest dominated by Catesby's oak, *Quercus laevis*, and by *Q. cinerea*, with long-leaf pine (*Pinus palustris*) quite evident, with *Carphephorus bellidifolius*, *Scleria nitida* Willd. and other pine-barren specialties everywhere, it was obvious that at last and at the last moment of our last day of the June trip we had unwittingly

[6] Rhodora, xxxix. 360 (1937).

stumbled upon the "powerful lot of right smart sand" which we had been missing for four years. The pine barrens of southwestern Nansemond occupy more than 12 square miles and they could not be investigated until the July trip.

On our July trip (12–28) old problems also had to be looked into. In 1936, on the bottomland of the Nottoway at Cypress Bridge, we got two small individuals which were not quite typical of *Lysimachia radicans* Hook., primarily of the Mississippi basin. We needed material collected through the season and showing all variations. So, on July 17 we went to Cypress Bridge to start a series of monthly inspections of the plant. At the original station freshets had apparently wiped it out, but at the western end of the bridge the plant, in flower, was abundant about cold spring-heads, thence extending far out into the submerged borders of the bottomland. Collections then made, with others up to late autumn, show it to be good *L. radicans* (MAP 3), with considerable leaf-variation, but the plant, which fruits in the Mississippi basin, was here all sterile, whether because too thoroughly drowned or because of its efficient vegetative reproduction we cannot say. Another year, if flowering freely above high-water mark, it may produce fruit. Although *L. radicans* (*Steironema radicans*) occurs in Virginia, I am unable to locate any specimens from other Atlantic states. Its chief development is along the lower Mississippi Valley. This characteristic isolation in Virginia is one which no longer surprises us. With it was a *Galium* which puzzled us. Its fruit and foliage-form were those of *G. obtusum* Bigel., a species ordinarily with whorls of 4 leaves. The Cypress Bridge plant was producing 5 and 6 leaves at the primary and some secondary nodes. This was hardly regular, but flowering material, collected in June, 1940, shows the corollas of *G. obtusum;* we will leave it at that.

For some years we had looked suspiciously at the group of *Rhynchospora cephalantha* Gray and *R. microcephala* Britton. The latter is common in peaty soils of southeastern Virginia, the former rare and confined to sphagnous bogs. But that is not all. A third plant, also rare, somewhat like *R. microcephala* but clearly different, had been found; and in drowned peaty hollows and margins of pools there is a fourth, very much coarser than any of the others. It was now blooming and we made a point



MAP 1, Range of TETRAGONOTHECA HELIANTHOIDES; 2, of ISOËTES ENGELMANNI var. CAROLINIANA; 3, of LYSIMACHIA RADICANS; 4, of AMMANNIA KOEHNEI; 5, of JUNCUS MEGACEPHALUS; 6, bicentric Range of LILAEOPSIS CAROLINENSIS.

of securing it, with the hope that its anthers might give good characters. Since my student, Miss Shirley Gale, had for two years been closely studying and monographing *Rhynchospora* in North America, I asked her help on this problem. Our results will be included in Part II.

One rainy and dreary morning (the 19th), disliking to spend the day, when identities of plants are so disguised by mist and loads of rain-drops, upon an open habitat, we reasoned: since we are bound to get soaking wet and it is a dismal day, why not tackle the Great Dismal Swamp? Accordingly, in the afternoon, at the lumber camp of the Camp Lumber Co., southeast of Suffolk, we followed the lumber-road into the Swamp. As we already knew, the forest and its flora are essentially those of many large flooded swamps and pocosins or dismals in southern Virginia. However, *Ilex coriacea* (Pursh) Chapm., which we had met nowhere else, is there, and we were particularly pleased to make its acquaintance and to see how really different it is from *I. glabra.* In October the contrast became emphasized, for, whereas *I. glabra* retains its hard drupes through the winter and is used as a Christmas green, the drupes of *I. coriacea* in October were soft and pulpy and most of them had dropped. Only by long search could we find any branchlets with drupes still intact. A smooth-leaved *Persea* interested us and I had a vain hope that we had at last found *P. Borbonia,* but it is not that; in outline the leaf is similar to that of the pubescent *P. palustris* (Raf.) Sarg. Later in the season we secured it also in wet depressions of the pine barrens of western Nansemond. Its identification must await further study, for the material of the group from most American herbaria is now buried in Holland, where, long before the war, it was sent on loan.

On our second trip to the region of Taylor's Millpond we returned to Fontaine Creek, where the bottomland woods are near the northern limits of some species. We were quite unprepared to find them the extreme southern limit of any range but in one recently cut area there was a good colony of the northern *Lactuca canadensis* var. *longifolia* (Michx.) Farwell,[7] heretofore known only farther north or inland, from Quebec to Saskatchewan, south to New England, New York, the upland of North Carolina, Ohio, Indiana, Missouri, etc.

We had found, when we had only a fragment of the day free for botanizing, that the waste places, dumps, neglected road-

[7] See Fernald, Rhodora, xl. 481 (1938).

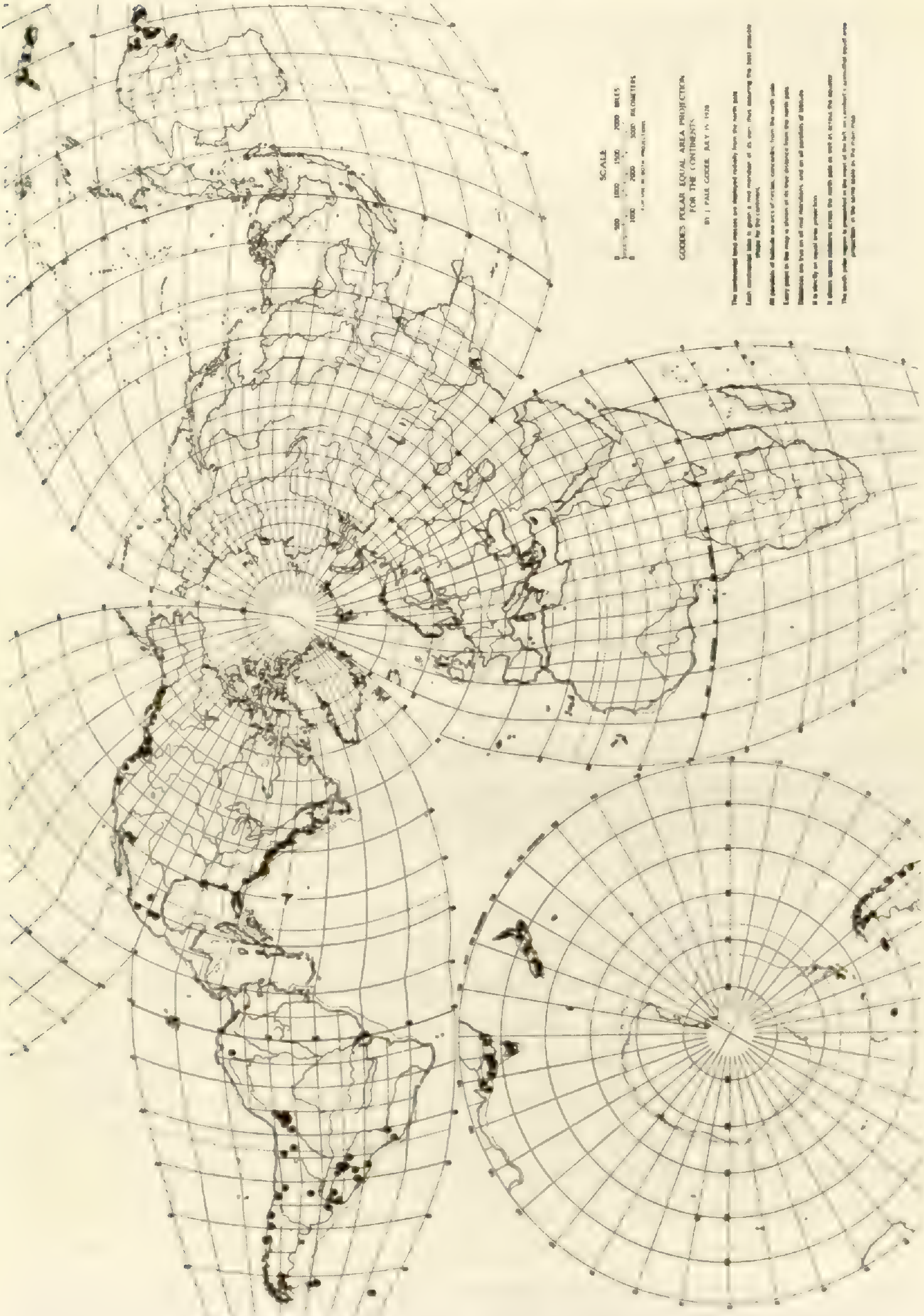
sides and the railroad yards (especially that of the Norfolk and Western at the eastern margin of Petersburg) supplied some novel weeds; furthermore some weeds, rare or scanty in 1938 or 1939, like *Potentilla recta* and *Chondrilla juncea,* have in 1940 become very abundant and aggressive. So, on the 21st, having only the forenoon clear, we set out to weed the town. Botanically, if not economically, the operation was successful and we brought back a large series of weedy Euphorbias, including the southern *Euphorbia prostrata* Ait., which had been known in the state only through collections of Grimes's. *Acalypha ostryaefolia,* very distinct and almost handsome, abounds on steep weedy slopes near the Appomattox but along the Norfolk and Western, where it might have been indigenous, but too doubtfully so, since, except for a somewhat shaky record for New Jersey, it is otherwise known in the Atlantic States, from South Carolina southward, primarily as a weed. On one open and weedy patch there was a tall amaranth, with prolonged but much interrupted spiciform inflorescences. This proves to be *Amaranthus Torreyi* (Gray) Benth., a western prairie type, a species which may soon abound about Petersburg.

Our earliest Virginia work, from 1933 to 1935, centered on Virginia Beach. We then became very cognizant of the strong contrast between the flora of the open shore and marshes from Cape Henry to Sand Bridge and the western side of Back Bay and that of the eastern shore of Back Bay and the islands (Knott's Island and Cedar Island, the only ones formerly visited). Along the mainland shore or on the west side of Back Bay several species occur which we did not see on the islands and the eastern shore of the Bay. Conversely, there are many species on the islands or at False Cape which we have never found on the west side of the Bay. Thus, along the shore or on the sands between Cape Henry and the inner shore near Munden the following, among others, are characteristic, yet we have never got them from the outer shore of the Bay or from the islands: *Aristida lanosa, Cyperus retrorsus* var. *Nashii* (Britton) Fern. & Grisc., *C. erythrorhizos, Fuirena pumila* Torr., *Xyris difformis, Tillandsia usneoides* (on trees), *Sesuvium maritimum, Nelumbo* and *Heliotropium curassavicum.* On False Cape or Cedar Island the following, unknown on the mainland side of the Bay, we knew to be characteristic: the austral *Phalaris caroliniana* Walt. and *Eleocharis albida;* the boreal *E. halophila* Fern. & Brackett; and *E. Lindheimeri* (Clarke) Svenson at the only known coastal area east of Texas; the southern *Dichromena colorata* and *Juncus megacephalus;* and the remarkable *Iresine rhizomatosa* of the Mississippi basin and southwestward but with another isolated area on the Potomac; and *Ampelopsis arborea* and *Lippia nodiflora.* These contrasts indicated that the islands of Back Bay need much more exploration by competent botanists. Consequently, when that energetic and successful champion of conservation of the flora of Cape Henry, Miss Sally Ryan, invited us to her home at Virginia Beach and asked me to suggest some area where we could do worth-while botanizing, I suggested securing a motor-boat and getting out to the islands.

On the 22nd, therefore, with Miss Ryan's co-worker on conservation, Miss Mary Leigh, my correspondent for some years, and with Mr. George Mason, Director of the Mariners' Museum at Newport News, we drove to the headquarters (C. C. C. camp) of the National Wildlife Refuge at Pungo. The friendly Manager of the Refuge, Mr. Harry A. Bailey, with his associate, Mr. Ewell, a native of the region, drove us down the beach to the developing headquarters of the Refuge, back of and below Little Island Life Saving Station. Thence we were taken in one of the splendid launches of the Biological Survey by Mr. Ewell to the southeastern corner of Long Island, and he waited patiently among the mosquitoes and flies for some hours while we waded along the marshy margin of the Island. Before we had left the plank-walk leading from the landing at the outer border of the marsh we wanted to jump in, to get the rare plants which were in sight. *Najas guadalupensis* and *Anacharis occidentalis,* flecked with *Lemna perpusilla,* filled the water; *Ammannia Koehnei,* MAP 4 (represented in our larger herbaria from only a few stations between Florida and the Hackensack Marshes), was in solid phalanx, and the white and lilac-tinged flowers of the sub-tropical *Bacopa Monnieria* and the panicles of the local marsh grass, *Diplachne maritima* Bicknell, were conspicuous. We waded at the inner margin of the marsh (in fresh water, we were assured, but with a remarkable number of halophytes, like *Scirpus robustus, Spartina cynosuroides* and *Lythrum lineare*) through shoulder-high and taller vegetation. Progress was slow and difficult but we wanted to go slowly in order to see the plants. Amidst the commoner marsh species there were limited colonies of *Dichromena colorata* and of *Juncus megacephalus* (MAP 5) which we had known in Virginia only at False Cape, the latter following the coastal marshes northward, but in the southern half of its range venturing inland, and unmistakable *Verbena scabra* Vahl, a tropical species which we already knew as an excessively local plant in eastern Virginia. At the border of the marsh, beneath the bushes, *Carex Frankii,* an inland species, had reached the coast, although we had never before met it in Princess Anne County; and farther back, just as on Cedar Island, the Mississippi basin *Iresine rhizomatosa* abounded, and *Physalis angulata,* the first we have had in the Gray Herbarium from north of North Carolina, was occasional. We were approaching the small pond back of the marsh and south of the landing, and Mr. Ewell was in sight, coming to say that it was time to leave, for it was important to get back to Little Island in order to take advantage of low tide in driving up the beach. It was necessary, however, to see what was in the pond. It is fortunate that we did so, for this pool contains a continuous carpet of closely interlocked plants of *Lilaeopsis carolinensis* Coult. & Rose (MAP 6). *Lilaeopsis,* a very primitive genus of the *Umbelliferae,* without true leaves but with clavate or broadened and jointed stems functioning as leaves, has one species on tidal shores of Atlantic North America from Florida to Nova Scotia, another on the Pacific coast from California to British Columbia, others (very local) in Arizona and Mexico and the others (except *L. carolinensis*) local species of various parts of South America (tidal shores to more than 4000 m. in the Andes), Tasmania, New Zealand and Australia. The antiquity of the genus (MAP 7) is evident; and at the last moment on Long Island we were pulling in mats of *L. carolinensis.* Described in 1897 from a single collection from eastern North Carolina (presumably near Wilmington), it is now known from three other stations in North America: Myrtle Beach, South Carolina; New Orleans; and our new station on Long Island. But along La Plata River in Argentina, Uruguay and Paraguay it is evidently frequent. *L. carolinensis* is clearly a bicentric species, with one area in warm-temperate eastern South America, there reaching its southern limit near lat. 35°, the other area in warm-temperate eastern North America, with the northern limit near lat. 36°. Such ranges will find amplification when we consider other plants of fresh tidal waters and marshes collected in the late summer and autumn of 1939.

We were deeply grateful to Miss Ryan for having arranged so successful an expedition and to all our new friends who had helped her carry it through; but she and Miss Leigh, with the remarkable enthusiasm which they share, were not through for the day. When we reached headquarters near Pungo, although we had already had a long day and were soaking-wet, they offered to show us some of the specialties; but, since none of the party had ever seen *Asarum arifolium,* which Griscom and I had found in May, 1935, in woods near Creeds, we went in search of that. The station seems to have gone with its protecting forest. After that the ladies introduced us to their station for *Stewartia Malachodendron* and took us to other interesting plants. When, after dark, we brought up at a fashionable restaurant for late dinner, the well-groomed official haughtily looked us over and shook his head. After demonstration that we were more respectable than our bedraggled clothes, we were ushered into a secluded room and allowed to eat where the sporting fraternity of Virginia Beach would not be shocked. Long and I were dead-tired when we reached the Ryan home; the ladies could have stayed up all night, going over the specimens!

Next morning we drove, not too far away, in the vicinity of the Beach, for Long and I had to catch a noon train at Norfolk. Having heard that the area of sphagnous peat south of the Rifle Range was greatly altered and that deep ditching had obliterated the only known station in the world for the unique cleistogamous *Hypoxis Longii* Fernald in Rhodora, xxxvii. 410, pl. 393 (1935), both Long and I, as responsible for its original recognition, were anxious to know its fate. Since the discovery of the plant the Rifle Range has been greatly altered and, whereas we used to go and come at will in the region to the south, the area is now fenced off and with military guard, for not only rifle-practice but mortar-firing and other military training have greatly increased. The Commandant, as soon as I explained my errand,



Map 7, Range of Genus Lilaeopsis.

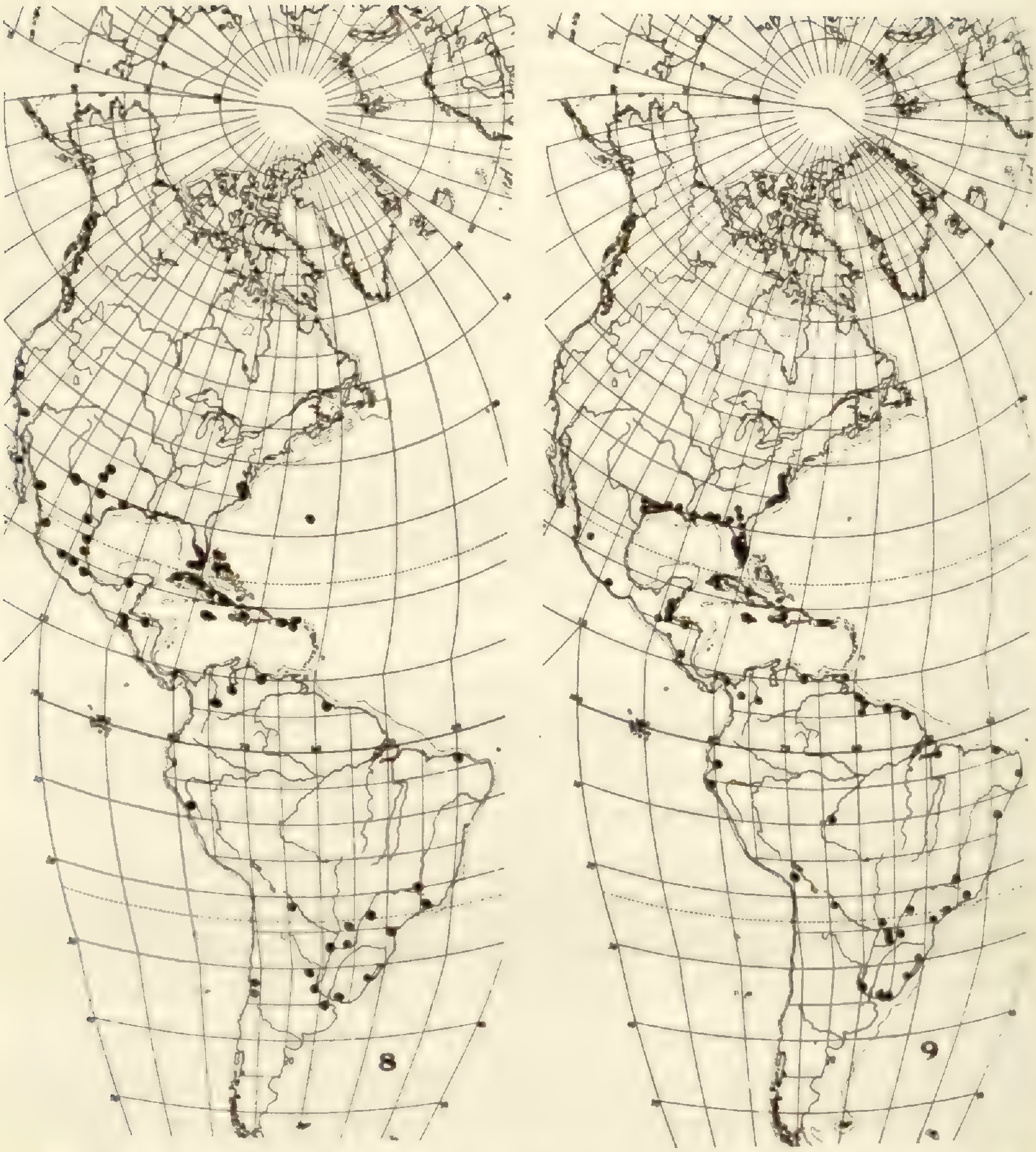
most kindly let us pass, with the precaution to be back before mortar-firing; and in five minutes we were standing in the original station, with *Hypoxis Longii* seemingly as prosperous as ever.

This species, descended from the ancient stock (of subgenus *Ianthe*) which left representatives in New Zealand, Australia, Tasmania and South Africa and *H. Longii* and *H. sessilis* L. or their progenitors in eastern America, has not given up merely because of temporary change. It is, however, too near the military developments which are rapidly moving toward it and it is fortunate that it was discovered and collected when it was.

We then went to Dam Neck, where in May, 1935, Griscom and I had found a single plant of the other American member of *Hypoxis*, subg. *Ianthe* (*H. sessilis*), hoping that the cattle, which then infested its habitat, had moved on. The cattle were not there but, so far as we could determine after an hour of back-breaking search, neither is *Hypoxis sessilis*. As a last episode, Miss Ryan took us to her station for *Osmanthus americanus* (L.) B. & H., a southern tree isolated at northern stations back of Cape Henry. It was a joy to see it with our own eyes, but there was hardly time to drive to another station for it, discovered by Miss Leigh.

On the way to and from Norfolk on the through train we had caught flashes which we took for *Sarracenia flava* and for *Zigadenus glaberrimus*. These meant possible good bogs. So, on the 24th we drove down the line (parallel with the Norfolk and Western) to investigate them. For the most part they are meagre remnants with nothing notable; but 2 to 2½ miles west of Waverly there is a rather nice and very typical patch of swampy woods, with *Zigadenus glaberrimus* in such profusion as we had never imagined. Returning to the car, which was parked at a minor cross-road, we were surprised to find the ditch full of *Typha truxillensis* HBK. (MAP 8), the tropical species reaching the shores of Back Bay and discussed by me in 1935. The Back Bay stations were the first known north of Florida, and the *Typha* there extends north to latitude 36° 40′. The station in Sussex County is 65 miles inland and in latitude 37° 2′. Another plant at this crossing was new to us. Occupying the railroad embankment, so suspiciously close to a farm-gate as to suggest that it had started from seed brought in freight delivered there, it has become an extensive colony. It proves to be *Froelichia gracilis* (Hook.) Moq., native from Iowa to Arkansas and southwestward. We were quite excited over it, but next day we found it also in the Norfolk and Western yard at Petersburg, and in 1940 in similar places at Richmond.

The sphagnum bogs along the Norfolk and Western mostly proving of no interest and we being much overheated after some miles of tramping along the tracks, we decided to start home and, if opportunity presented itself, to do a little exploring. We had many times noticed a road leading north from Disputanta to Newville and since exploration and relatively cool riding were in order we took that. Yellow-rayed composites were becoming frequent and we had more than once chided each other for calling a halt at colony after colony of familiar species of *Coreopsis* or *Rudbeckia.* At the border of pine and oak woods, however, something failed to "register", so I risked being laughed at and called to Leonard to stop; there was a strange yellow composite in the woods. Although we had passed the original spot, there was no need to go back; the border of the woods for a mile or two was full of the strange plant. Only a few heads were expanded and we were not sure of the genus; in August the woods-border was brilliant with the fully developed heads and then we enjoyed the real beauty and distinction of the plant. We even guessed it to be a strange *Heliopsis,* but it proves to be *Rudbeckia Heliopsidis* Torr. & Gray (MAP 10), described, with two varieties, "α. almost glabrous" etc., and "β. . . . pubescent", from "Pine woods, &c. α. Columbus, Georgia, *Dr. Boykin!* β. Cherokee country of Alabama, in wet places, *Mr. Buckley!*" It has not been found in other regions and most of our herbaria lack the species. They will now be well supplied, and roots of the species wintered successfully in the Harvard Botanic Garden, whence seed can later be sent out. Furthermore, the Disputanta area has both the glabrous and the pubescent forms. Carl Mohr in his *Plant Life of Alabama* says of it "Local and rare" and found only in the "Mountain region" of Cherokee, Lee and Dekalb Counties. This disruption of range inevitably calls to mind the Cherokee Gentian, *Gentiana cherokeensis* (W. P. Lemmon) Fernald in Rhodora, xli. 487 and 552, map 14 (1939), which is known only from northwestern Georgia and from wet pineland of Sussex County, Virginia. These ranges are also suggested by *Isoëtes Engelmanii* var. *caroliniana* (MAP 2), already discussed, and by one of the very rarest of Trilliums, *Trillium lanceolatum*



Map 8, Range of Typha truxillensis; 9, of Cyperus haspan var. americanus.

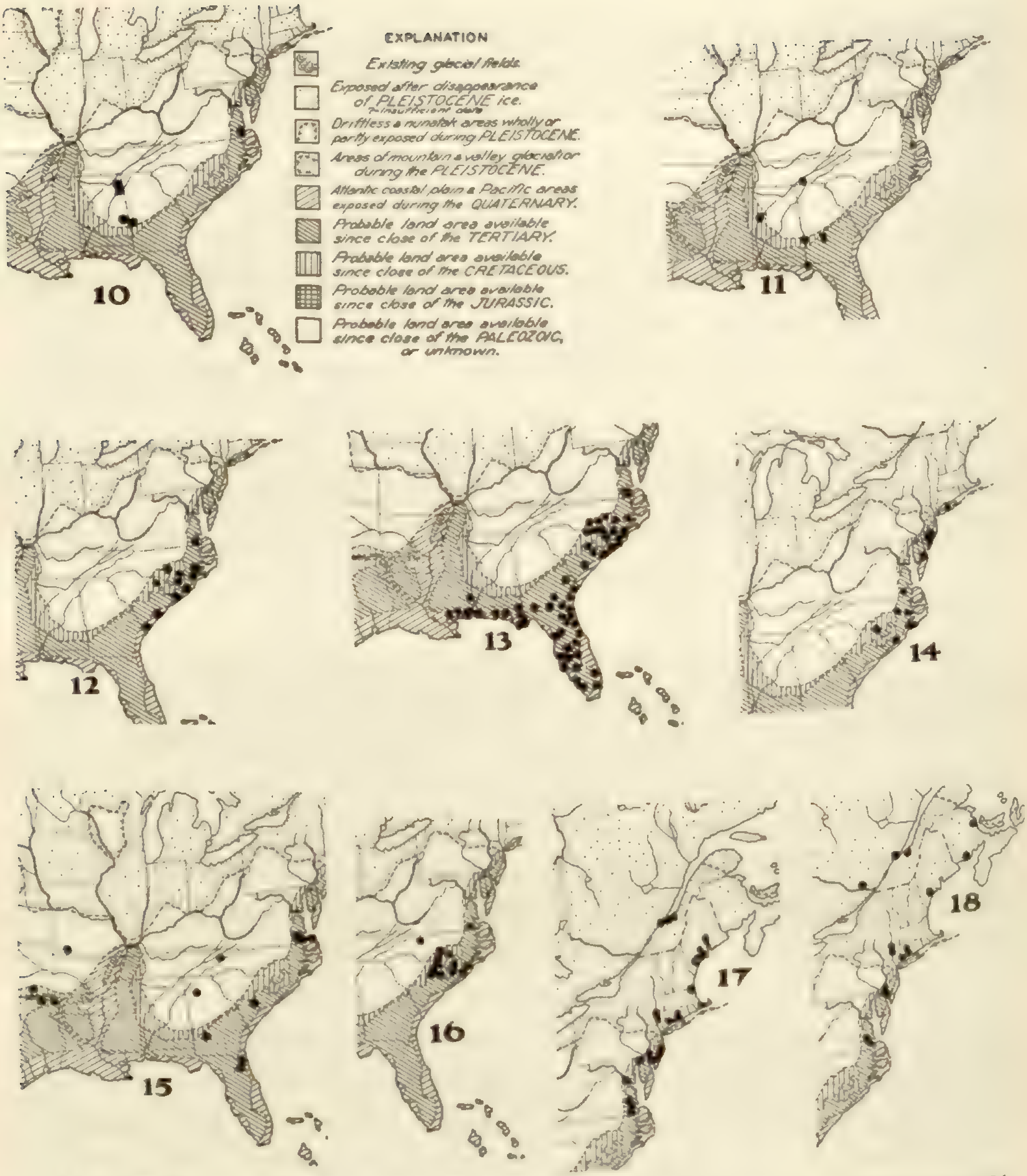
Boykin (map 11), which was collected in late April, 1926, by Professor Paul A. Warren, in the Great Dismal Swamp, when a party from the College of William and Mary went from Wal-laceton to Lake Drummond. Up to 4 P. M. we had considered the day a "flop"; at bed-time we regarded it with complete satis-faction!

The next day was really a "flop". Aiming to cross the James from Scotland to Jamestown and to investigate back roads in that region, we got to a point between Surry Courthouse and the Scotland Ferry; then the car stalled. Towed back to Surry

Courthouse for repairs, we spent the day there. After lunch there was little to do except to wait patiently for the repairs and to look over the weeds of back yards and roadsides. Two weeds, *Potentilla intermedia* and *Rumex Acetosella* var. *integrifolia* Wallr., we had never met in the state, but on the whole the pickings were few. Naturally the people of the county-seat were curious about two strangers who constantly looked down and suddenly stooped at roadsides or in waste lots and grabbed at something; and when Long ventured to clean the mosses off trees and basements in the court-house precincts, the admiration and wonder increased. Upon his explaining the interest of such studies he received the judicial reply: "Well, a grass is a grass, a moss is a moss; that's all we know about it". Forty-eight hours later, in a more humble locality, we stimulated a quite different comment.

Next day, reasoning that the pine barrens of western Nansemond County must by this time have warmed up and come well into bloom, we went there. Taking the first sandy road toward the Blackwater River, below South Quay bridge, we reached George's Bend. Wishing to park our car in the yard of the isolated house above the river, we at first met some dissent from the owner; but, as soon as he knew our errand and that we were not after his fish, he and his alert wife proved most cordial and valuable new friends, for he was Mr. T. S. Jones, long employed in surveying, and it was he who had located the colonial landings and worked out their history in the preparation of the contour-sheet of 1918. Mr. and Mrs. Jones were so hospitable and so full of lore about the Blackwater valley and its history that we almost forgot that we came to botanize. However, going down to the river and following south toward the old (or original) South Quay, we found ourselves in such a forest of *Styrax americana* as we had never imagined. Along the Nottoway, below Point Beach, we had been amazed at the profusion and size of the small trees, but the colony between George's Bend and old South Quay is scarcely to be excelled; and *Asimina parviflora* (Michx.) Dunal, elsewhere scattered, was here really abundant.

Returning to the main "poor road" southeastward, we next left it to go down to Milk Landing, but we did not stay long, for



Map 10, Range of Rudbeckia Heliopsidis; 11, of Trillium lanceolatum; 12, of Vaccinium crassifolium; 13, of Calopogon pallidus; 14, of Rhynchospora pallida; 15, of Triodia Chapmani; 16, of Zenobia pulverulenta; 17, of Eriocaulon Parkeri; 18, of Elatine americana (omitting far-inland records).

my two companions promptly got into a nest of "seed ticks", literally thousands and thousands of the tiny vermin. In a few seconds they were peppered, resembling old-fashioned pictures of the worst eczema-cases, with the minute irritating specks. An hour off was necessary for them partially to clean up; and Milk Landing was carefully avoided for two months and became the object of uncomplimentary remarks whenever we drove by the road. So, leaving that infested area, we went on and took the partially overgrown road leading southward, parallel with the river. We soon came to an overflowed branch, too much swollen to cross, and parking the car off the narrow road, we went on afoot. In five minutes we were in such a pine barren as we had not imagined. In fact, we did not get to the road leading down to Cox Landing that afternoon. The daily thunder-storm was upon us, with vivid lightning and claps of thunder which could mean only that lightning had struck near-by. Finally, returning to the car, we saw a tall pine shattered within ten feet of the parked car; that meant that it was time to start home. For three days we explored this area and I shall make no effort to follow exact chronology in enumerating the specialties. Sharing the damp sands and peats with *Pyxidanthera* were solid carpets of a trailing evergreen *Vaccinium,* somewhat suggesting cranberries but with axillary young fruits. This could be nothing but *Vaccinium crassifolium* Andr. (MAP 12), a very local Carolina species heretofore unknown north of central-eastern North Carolina. There are many square miles of it here; we found it to the east, nearly over to Marsh Hill School; and in May, 1940, stretched its range northward into Isle of Wight County. That was a good start! Practically all open and damp areas were full of *Juncus abortivus* Chapm. and *Rhynchospora distans* (Michx.) Vahl, both found by us in 1936, growing together in one small patch in the Isle of Wight barrens south of Zuni; the sands were a seemingly continuous carpet of *Xyris flexuosa* (*arenicola*); and *Bulbostylis ciliatifolius* and *Tradescantia rosea* Vent. var. *graminea* (Small) Anders. & Woodson, along with *Panicum mutabile* Scribn. & Sm., were in the drier sands. At one point Long detected tiny seedlings of a plant which resembled *Polygonella articulata;* but, since we had never found that species (common farther north) in Virginia, we fondly hoped that in October it would prove to be some rare southern species. *Seymeria cassioides* (Walt.) Blake, also of the Isle of Wight barrens, was there, as were the two Sarracenias, along with *Rhexia ciliosa.* In the bushy hollows, among the common but always beautiful *Lyonia lucida, Leucothoe axillaris, Smilax laurifolia, Cyrilla racemiflora* and other characteristic austral shrubs, there was one colony of a tall *Amelanchier* with most of the leaves entire. Unfortunately, it was too late for fruit and in April, May and June of 1940 we could find neither flowers nor fruit. Here, too, was the glabrous-leaved *Persea* which we had seen in the Great Dismal Swamp. *Chamaecyparis thyoides* often filled the hollows and in many depressions there was a characteristic *Hamamelis*, with twigs quite pubescent, the relatively small leaves heavily felted and mostly with a silvery tone beneath. This greatly interested us and we followed up the colonies until, in October, we had the newly expanding flowers. It is *H. virginiana* var. *parvifolia* Nutt., originally described from the mountains of Pennsylvania and from Louisiana. Long and I used to get it in Nova Scotia, but south of New England it is apparently highly localized. *Cleistes divaricata* (L.) Ames is scattered in the thickets, but the great prize in the orchids was *Calopogon pallidus* Chapm. (MAP 13), a beautiful little species new to the "Manual range"; but already known within 90 miles of Virginia. The map, generously supplied me by Dr. Donovan S. Correll, clearly brings out the gap between the northeastern stations in North Carolina and the isolated area in southeastern Virginia. So many southern Coastal Plain species extend northward to the Neuse or occasionally to Pamlico Sound and then vanish, to reappear again in southeastern Virginia, that we can only conclude that northeastern North Carolina really lacks them or that its assumed sterility has prevented proper search for them. My North Carolina friends tell me that the former is the right interpretation. So much for the general area of pine barrens.

Wishing to get to Sandy Landing, Cherry Grove and Wyanoke, but hoping to find a road with fewer overflowed branches, we drove one day down the Factory Hill road and took a side road southwestward below Marsh Hill School. Two years earlier, with a driver whose bent was not exploration, we had started out this route but had soon turned back because the road was so bad. Now it seemed almost a boulevard. Passing the clearings and farms, we soon came into pineland and, reaching Big Branch, we saw that it was the deepest one yet. I tested the crossing until the water was nearly up to my hips, so this route to Sandy Landing would not do in the rainy season. Backing up from Big Branch to turn, we suddenly realized that, intent upon map and road, we had just passed a wonderful sphagnous savannah-like swale, such as we had never before seen in Virginia. Parking near the house of the colored farmer, Tom Hunter, who, with his brother on the clearing beyond, has the satisfaction of being without neighbors for some miles to the north or south, and for more than a mile to the west, east and northeast, we proceeded to explore. Much of the original bog had been cleared and turned into corn, beans and peanuts, but there were remnants which showed what a wonderful spot it originally was and, to a slight extent, still is. Melanthaceous and more typically liliaceous species vied with orchids and unusual sedges for possession. The place was brilliant with the purple racemes of fruiting *Tofieldia racemosa.* Dozens of leaf-green fruiting racemes of *Amianthium Muscaetoxicum* could easily be counted; and a regular army of creamy-white panicles of *Zigadenus glaberrimus,* with purple panicles of *Melanthium virginicum,* was at the upper border of the area. Orange-flowered *Habenaria cristata* and white *H. blephariglottis,* by thousands and larger than we usually see, were splendidly flowering; and with them there was a single ×*H. Canbyi,* their hybrid, heretofore unknown from Virginia. Beyond the *Zigadenus* patch we suddenly halted, each of us excitedly calling to the other to look, for there were great erect orange-red flowers of a lily. Obviously related to the more southern *Lilium Catesbaei,* it is larger in all parts, with broader and less recurving petals, broader and blunter leaves and other characters which set it apart, and in October, when we collected ripe fruit, we found that it has distinctive capsules and seeds. It is undescribed but will be fully discussed and illustrated (PLATE 632) in Part II. Seeds have been given to several growers of lilies and the seedlings at the Harvard Botanic Garden are prospering. In the wetter areas among nice associates, *Lachnocaulon anceps* was thriving; and, scattered over the bog, there were many choice sedges. Space will be taken to mention only two. *Scleria minor* (Britton) W. Stone, always a very satisfying species of wet sphagnum, abounded; and there were gigantic clumps (up to a foot in diameter and 3½ feet high) of *Rhynchospora pallida* (MAP 14), the tallest specimens ever collected and the first evidence of this truly rare species with bulbous-based culms between Beaufort County, North Carolina, and its local station in Delaware. We had, indeed, been having several "peppy" half-hours.

Before we quit, Tom Hunter, the colored owner, returned from Franklin. Already informed by his flock of children as to our visit, he greeted us: "I'm glad that someone who knows plants has come in here; there are lots of them here that I don't know about". So I opened my box, which happened to have fruiting *Persea* at the top. "Ah! Red Bay!" was the immediate response, followed by the question, "Have you found the Polypody that grows up in the trees?" Two days before, at Surry Courthouse the best we could draw from the rulers of the land was, "Well, a grass is a grass, a moss is a moss; that's all we know about it"!

In August (17–30) we first went to the wet pineland at Colliers' Siding, south of Petersburg, where one of the new Rhynchosporas abounds, along with *Rhynchospora perplexa* Britton, hoping to find *Manisuris* which *ought* to be there. It certainly is not there! But in crossing the tracks of the Atlantic Coast Line we got one tiny individual of a rubiaceous plant new to us. Eye-straining search among the weeds for half-an-hour showed no more. We, accordingly, accurately divided the tiny plant, scattered the ripe seeds and recorded the tropical weed, *Richardia scabra* L., as having barely reached Virginia. We then went to Disputanta to get fully flowering material of *Rudbeckia Heliopsidis.* While doing so we found the northernmost and really quite extensive station for *Lilium Michauxii* Poir. Then, having an hour left before dark, we went exploring, this time to Indian Point on the James. There we found very rich slopes which, in spring, must be full of interest; and one species in old fruit, *Viola striata,* was definitely an addition to the Coastal Plain flora. It belongs primarily in the richer interior.

Next day, exploring and somewhat lost on back roads between Stony Creek and Emporia, we were approaching Double Bridge on the Nottoway when *Helianthus decapetalus,* which we had not had on the Coastal Plain, caught our attention. Stopping to collect it we found, just below the fall-line, a rich assemblage of upland types. I had long been worried because in the Gray Herbarium there is an old specimen, called *Sida Elliottii,* without further data than "Petersburg, Va., *Tuomey*". In our four seasons of botanizing, with Petersburg often a center, we had never seen it, but, in pine woods slightly below the fall-line there was a large colony of the plant in fine flower. Later in the season, above Carey's Bridge, we found the plant very abundant, also in pine woods. Now that we have a full series in flower and in mature fruit, it shows many characters, including conspicuous ones in the carpels. It is an undescribed species (PLATES 638 and 639) and not at all *S. Elliottii.* Slightly above the bridge the "fall-line" is here conspicuous because of the ledges displayed, with a steep cliff at the fall of the river. On these ledges, the common plants both of the Piedmont and of the Coastal Plain, *Woodsia obtusa, Panicum laxiflorum,* etc. were abundant, but it was a real surprise to find, within a few rods of the inner margin of the Coastal Plain, the upland *Cheilanthes lanosa.* We have not yet succeeded in coaxing it over the fall-line. While waiting for the party to assemble I crossed the bridge from Sussex into Greensville County. There, at the end of the bridge (north of Purdy), was a large oak with heavily fruiting branches. In October, when the fruit was ripe, the profusion of acorns upon it was most striking. Yet it proves to be *Quercus Bushii* Sargent, a reputed hybrid of *Q. marilandica* and *Q. velutina,* heretofore recorded only from Georgia and Florida to Oklahoma and Mississippi.

When we returned to Cobb's Wharf for the later stage of *Panicum cryptanthum,* also getting at the tidal shore *Echinochloa Walteri,* forma *laevigata* (*E. longearistata* Nash), new to Virginia, we passed by an extensive and very weedy peanut field. In joke I said, "Let's get some fancy weed out of this field". Leonard stopped the car, and pronto! there was an acre or more of gigantic *Richardia scabra* overtopping the peanut plants, the tropical weed of which we had scrupulously divided a single starved plant a few days earlier! Another day, in Nansemond County, stopping at the border of the road, the first plant we saw was *Richardia.* It has more than "barely" reached Virginia; but something had spoiled the charm. Repeatedly thereafter I tried the formula, "Let's get some fancy weed out of this field", but it never worked again.

Returning to the white sands south of Sebrell we found the clearings and open woods full of critical species of grasses and sedges, but our chief interest centered on *Triodia Chapmani*

(Small) Bush (map 15). Ever since Griscom and I found it back of Cape Henry, we had been watching it. We never have any question about its identity and now we noticed that this plant of pine barren and dry sands has conspicuous pulvini as compared with those of *T. flava.* Our experiences lead us to the conclusion that it is a distinct species, which comes north into southeastern Virginia.

Returning to Tom Hunter's, via the road south of Marsh Hill School, where, in the pineland, fruiting plants of *Cleistes divaricata* were scattered, we found the sphagnous swale much changed in appearance. The brilliant display of color was gone, but the large purple flowers of *Chelone Cuthbertii* were very handsome. Still prettier, from our prejudiced viewpoint, was tiny blue-flowered *Burmannia biflora,* its local range now extended eastward into Nansemond County. The open springy spots had carpets of *Utricularia,* especially *U. juncea* and its tiny imitator, *U. virgatula.* I think I do him no injustice when I state that Long is inclined to look upon them as possible phases of one species, comparable with *U. subulata* and its forma *cleistogama* (*U. cleistogama*). Other such oozy openings were the home of *Psilocarya scirpoides,* var. *Grimesii* Fernald & Griscom in Rhodora, xxxvii. 154, pl. 344, figs. 1 and 2 (1935). The plants were of all sizes, from starved individuals with few spikelets up to relative giants, 6 dm. high.

In the more typical pine-barren area we were delighted with several plants which in July had been unrecognizable. *Eupatorium tortifolium* Chapm. had not been recorded from north of South Carolina, and the range of *Andropogon virginicus* var. *glaucus* Hackel (*A. capillipes* Nash) was extended north from North Carolina. With it was *A. virginicus* var. *tetrastachyus* (Ell.) Hackel (*A. tetrastachyus* Ell.) which Griscom and I had found at Cape Henry. East of Sandy Landing there were many plants, resembling *Carphephorus tomentosus* (Michx.) Torr. & Gray but much smoother and with glabrous rosette-leaves. These could be only the plant described by Elliott from South Carolina as *Liatris Walteri* but not recently recognized, although Ravenel correctly identified material from Santee Canal and M. A. Curtis so named specimens from Wilmington, North Carolina. It is a fine addition to the "Manual range" and will be further considered in Part II. Another addition to the flora of Virginia, one which tremendously pleased us, is *Zenobia pulverulenta*, a very local species heretofore known only in the Carolinas (MAP 16).[8] In many wet thickets and *Chamaecyparis* swamps, particularly from northeast of Cox Landing to below Sandy Landing, it is conspicuous. In 1939, when it was in fruit, we got only the green-leaved shrub, but in June, 1940, when the beautiful milk-white and delicately fragrant large bells were expanded, we found all shades of foliage, from the deepest green to the bluest white, and great diversity in outline and toothing of leaves. These will be discussed in Part II. It is futile, perhaps, to attempt to discriminate among the handsome members of the tribe *Andromedeae*, but at the moment *Zenobia*, when loaded with flowers, ranks about first in our minds.

At last (on the 22nd) we made the crossing to Jamestown Island and the surrounding area. As soon as we reached Back River, opposite Jamestown, our duty became plain. The tidal marshes were becoming rich botanical ground. Close to the landing there *Aeschynomene virginica* was maturing. A year before we had been thrilled by it and now it was a bit exciting; but from now on through October it was seen on practically every tidal shore of the river-systems from the James northward. *Echinochloa colonum* (L.) Link, which we had never before met, was there, and some other species to be noted in Part II. Doing the obvious, we sought out the fresh tidal marshes of Powhatan Creek and, luckily, we arrived before the tide had too much drowned them, though we finally got driven out before we had completed our survey. That, however, is the disadvantage of work on estuaries, and, strangely enough, low tide on rivers a few miles apart may be at quite different hours. This is especially the case on creeks entering rivers with long distances to the open ocean and with sinuous channels, like the James. In September and October, when we specialized on estuaries, it was necessary to learn the hours of low tide on different rivers and at different points upon them; otherwise we should have failed. We got the impression that the favorite

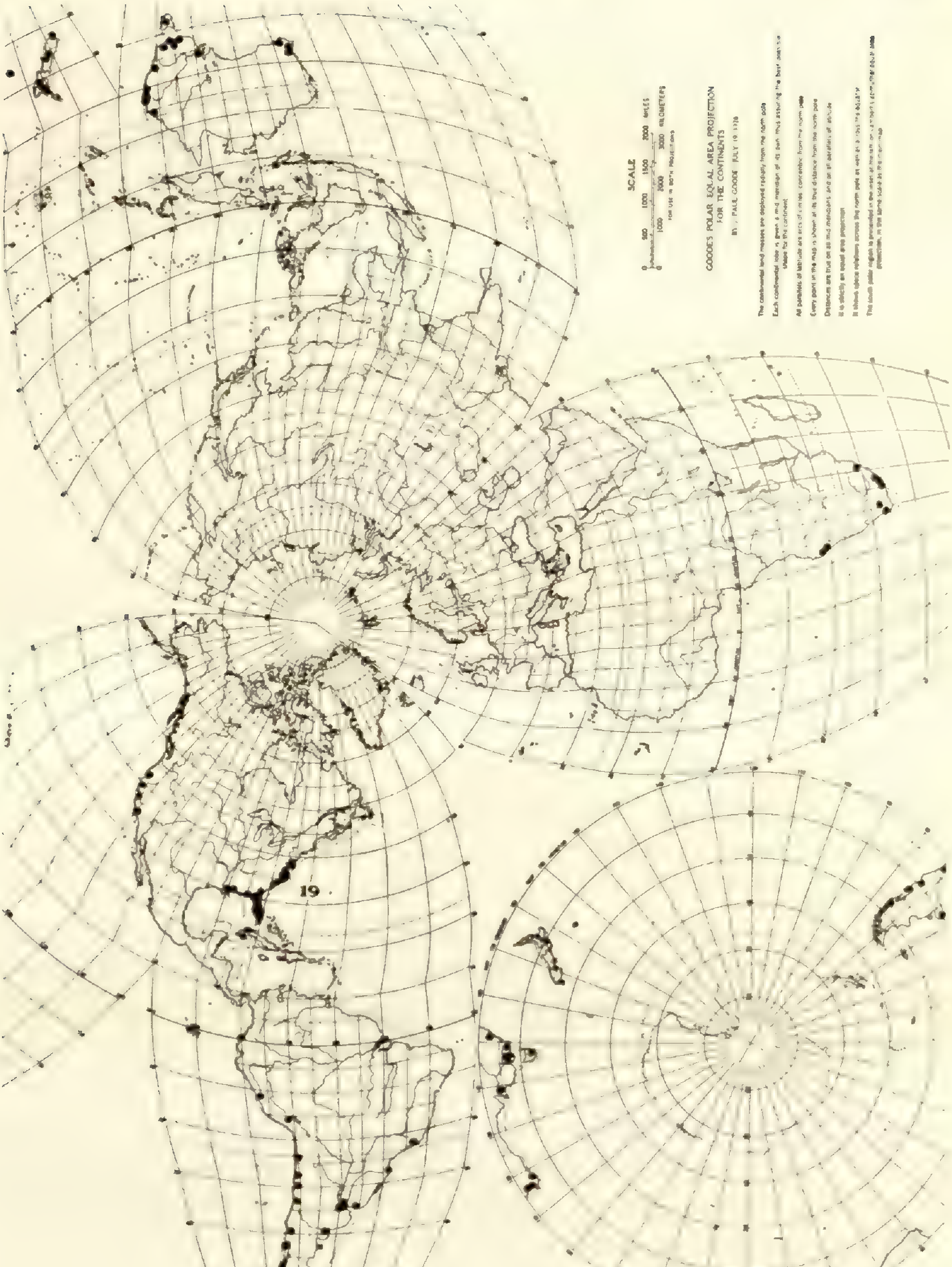
[8] In the Herbarium of the New York Botanical Garden there is a specimen marked on a copied (not original) label: "High mountains of North Carolina, June, 1868, *Wm. M. Canby*". This specimen is too doubtful for inclusion in the map.

hours for low tide were between 7 and 10 in the evening and 5 and 8 in the morning! But to return to Powhatan Creek, northwest of Jamestown. The most obvious plant as we came to the tidal marsh was *Eryngium aquaticum* and we soon learned to expect it on every tidal marsh. *Cyperus haspan,* var. *americanus* Boeckel. (map 9), likewise, tropical and warm-temperate American representative of a pantropical species, was there and on most other such marshes, and so was the giant flaccid-leaved variety of *Rhynchospora macrostachya.* In Rhodora, xli. 533 (1939), I noted the occurrence of the species on the tidal mud of the James and the Chickahominy, whereas in the Great Dismal Swamp and in most regions it is a species of acid peat. The plant of many river-estuaries of Virginia is uniform in its thin and flaccid, greatly elongate leaves and its great stature (up to 1.75 m. high), and Miss Gale finds distinctive characters in the achenes. It will be further discussed in Part II. On the mud at extreme low tide were *Eriocaulon Parkeri* (map 17), whose Virginia citizenship has rested only on a collection of Grimes's on the Chickahominy, *Sagittaria subulata* (typical) and *Elatine americana* (map 18), the first from south of the estuary of the Delaware. When the incoming tide finally drove us back into the woods, there was *Scirpus fontinalis* Harper, var. *virginiana* Fernald in Rhodora, xli. 532 (1939), which we had known only *south* of the James.

Forced out by high tide at Powhatan Creek, we drove westward and finally tried the shore at Wilcox Wharf on the James. The water was pretty high but we were there particularly impressed by a demonstration (discussed in Part II) of the transition from *Panicum agrostoides* to *P. condensum.* But the great prize was a repent plant of the *Commelinaceae,* quite strange to us. It was still very young, not beginning to flower. We were completely puzzled by it, for it did not belong either to *Commelina* or to *Tradescantia.* The spot was, consequently, carefully noted for a visit in September.

Long Island in Back Bay had supplied so many novelties that we wanted to return there. Miss Ryan and Miss Leigh had gone to the mountains; but we arranged with Mr. Bailey at the Pungo camp to get us out to the Island or the islands for the 24th and 25th. We did not then know that the conservation of wild life involved so much plowing up and planting of the land to foreign crops as we soon discovered that it does—grain for the migrating geese, etc. When we reached headquarters at the appointed time the Manager had gone, expecting to return for us at once. But, as we learned that evening when we dined with Mr. Bailey, something had gone wrong with a tractor and it was impossible to come back for us. So, after deciding that we could not reach Long Island on the 24th, we drove to Munden in the afternoon and, taking roads and lanes out to the west side of Back Bay at every opportunity from there to Nowney Creek, when it was time to quit, accomplished some worthwhile exploration. Open muddy shores were often carpeted by two plants so alike in superficial aspect that we had to look twice to separate them: *Sesuvium maritimum* and *Heliotropium curassavicum.* Water-holes and pools were generally bordered by *Diplachne maritima.* Open flats were carpeted with *Eleocharis parvula;* and occasional colonies of *Triglochin striata* (MAP 19) exceeded in size of plant any we had ever met. This species, in its disrupted range (warm-temperate North and South America, South Africa, Australia and New Zealand), is fairly typical of many species which inhabit the fresh to merely brackish tidal shores in southern Virginia. They will be specially considered in Part III. Shallow pools at the inner border of the marsh were filled by a *Sagittaria* in full flower, often with oblong floating leaf-blades. This was *S. subulata* var. *natans* (Michx.) J. G. Smith, the first from so far north as Virginia, and with it was *Utricularia biflora,* also new to the state. At the inner border of one marsh *Asclepias lanceolata* (typical), also the first known in Virginia, was fruiting. When we were forced to stop collecting we felt that the afternoon had been well spent.

Next morning at the appointed time, 8 o'clock, Messrs. Bailey and Ewell drove us down the beach and the latter soon landed us at the old point on Long Island. From there we worked northward to the tip of the island, then back by a slightly different route to the landing. The water of shallow Back Bay was so very clear that we could see the white sandy bottom only a few feet below, except where *Potamogeton bupleuroides, Vallisneria americana* and the other aquatics made solid growth. Immediately upon landing we saw the sky-blue flowers of *Com-*



Map 19, Range of Triglochin striata.

melina diffusa Burm. f., the creeping species which we had got the year before on the bottomlands of Meherrin River. This began the season, for from late July to October the *Commelina*, usually along with its mysterious ally of Wilcox Wharf, was found to characterize many tidal marshes and shores. Paths and borders of clearings on Long Island were often fringed by *Erigeron bonariensis* L., a tropical weedy species which Griscom, Long and I had once collected as a "casual" in Norfolk County; and one of the sandy fields supported *Diodia teres* var. *hirsutior* Fern. & Grisc., which had not been known north of North Carolina.

The marshy flat at the northern end of the Island was most interesting, for it is so characteristically what elsewhere would be called a subsaline marsh (See p. 370). *Polygonum prolificum*, usually of saline soils, and *Spergularia marina*, of seashores and saline or brackish soils, are there; *Sabatia amoena* (Raf.) G. Don (*S. stellaris* Pursh) of "salt marshes" was frequent; and the coastal *Lippia nodiflora*, the previous northern limit of which was on Knott's Island, abounded. Best of all, the *Pluchea* was a narrow-leaved and relatively small-headed plant, the tropical and sub-tropical *P. purpurascens* (Sw.) DC., heretofore unknown from north of southeastern Georgia and on the labels from there and from Florida frequently designated as growing on "salt marshes" or "brackish shores". In view of the assertion so definitely made to us by many who know Back Bay that it is "strictly fresh", it would be interesting to have analyses of the lowest films of water.

The material brought back to Petersburg from Back Bay was so extensive that we could get out on the 26th only for a short local trip. Having been told of a springy and mossy swale east of Burgess, where trumpets (*Sarracenia flava*) abound, we went to investigate. The swale, one of the best areas of the *Sarracenia* we know, was a gem, in spite of cattle and hogs. They had left the extensive colony of *Juncus caesariensis* Coville (*J. asper*), a species formerly supposed to be a New Jersey endemic, but subsequently found by Grimes near Williamsburg and by us in eastern Henrico County, in a spring-fed sphagnous bog greatly resembling this one, and recently discovered at an intermediate station (in Anne Arundel County, Maryland[9]). Now we had it in Dinwiddie County, and, just as in Henrico County it is associated with a group of singularly localized plants, so here its associates were among the rarities. For, at last, we were

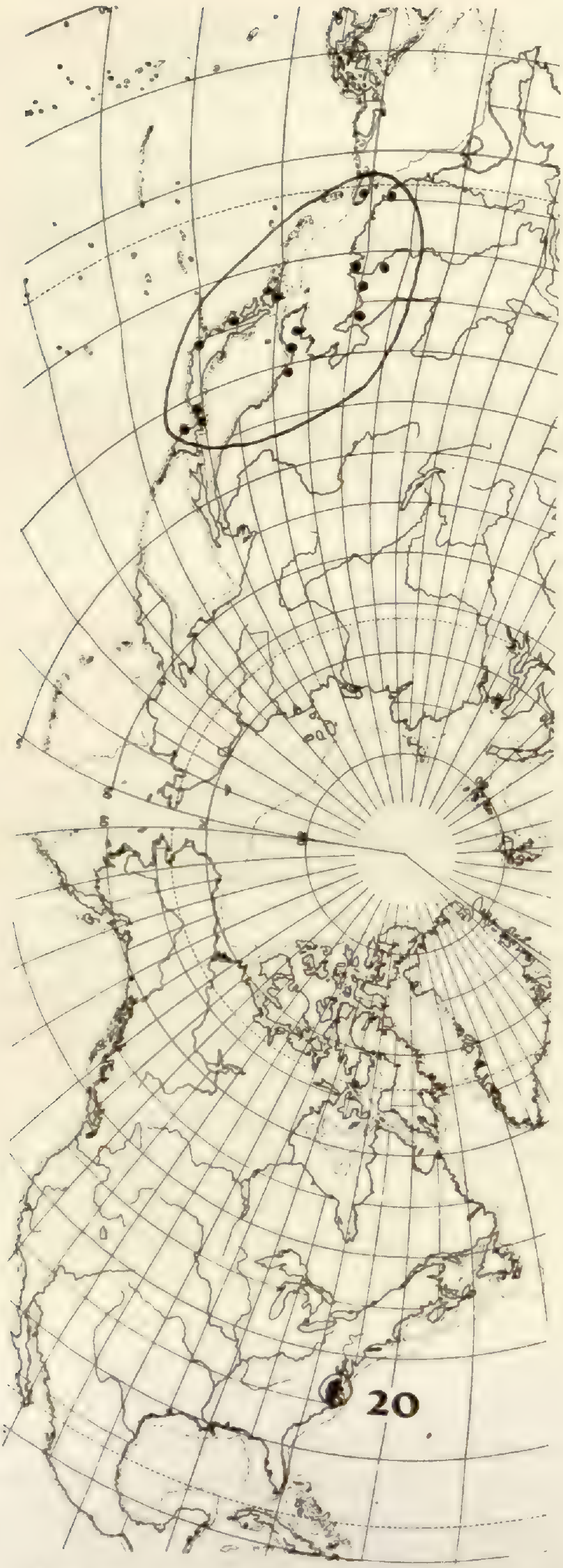
[9] A. V. Smith, RHODORA, xli. 111 (1939).

getting *Fuirena breviseta* Coville, which, known northward into North Carolina, we had vainly watched for in many Virginian swales. Here, too, was *Eriophorum virginicum,* a species very rare on the Coastal Plain of the state but frequent among the mountains; and mingled with them were tufts of *Scirpus debilis,* which we had never met in the state, though it is known in the Piedmont and upland area to the west. The *Pycnanthemum* of this bog puzzled us. Miss Elizabeth Boomhour of Duke University, who is closely studying the genus, tells me that it is *P. verticillatum,* heretofore known in the state only from the western counties. For a spot almost at our headquarters this one had too long been neglected. As we came up from the bog to the house of the owner, Mr. Blaha, a highly intelligent gentleman, we walked on rosettes of *Sanguisorba minor* which, we were told, colors areas of the farm when in flower. Young Mr. Blaha telling us of another swale which, however, had been plowed and, therefore, might not yield much, we went with him to look it over. But we were quickly diverted by the great abundance of dead-ripe and dropping fruit on *Vitis Labrusca.* Here in eastern Virginia it had been dropping for several days; in fact, on the 22nd of August we had found the fruit all on the ground in Charles City County. In New England we gather it a month later. In 1934 Long and I had first noted that the Fox Grape of the Coastal Plain of Virginia has less shouldered and smaller-toothed leaves than farther north and inland and that there is a somewhat evasive difference in the pubescence of the lower side of the blade, this frequently leaving a varnish-like print on the pressing-paper. Now, at last, we had good fruiting material. In Part II I shall illustrate true *V. Labrusca* (PLATE 636) and this Coastal Plain variety (PLATE 639) of it.

The brief half-day at the end of the August trip spent in weeding Petersburg, was, as usual, productive. *Humulus scandens* (Lour.) Merr. (*H. japonicus*) is there rapidly spreading, as it does farther north; *Leptochloa fascicularis* is coming in as a weed; and *Euphorbia heterophylla,* which we had never seen in Virginia, is appearing in waste spots. In the Norfolk and Western yard great clumps of true hirsute-sheathed *Eragrostis hirsuta* (Michx.) Nees have become established. In Rhodora, xli. 500 (1939), I pointed out that this typical extreme of the species is essentially southern, the common var. *laevivaginata* Fernald of eastern Virginia having glabrous sheaths.

In September (14–24) we inevitably turned to the tidal marshes and tidal shores of the rivers. In view of the difference of 8 hours for low tide at the mouth of the James and at head of tide at Richmond and similar differences between Yorktown and head of tide on its two chief tributaries, the Pamunkey and the Mattaponi, I had asked my mathematically addicted son to prepare tables showing when we could expect low tide at different points, especially on the James and the Chickahominy. Armed with this invaluable document, Long and I were enabled to use our daylight to the best advantage for, if the tide was low at the mouth of the Pamunkey at 8:20 in the morning it would not be low at Windsor Shades, about 13 miles to the southwest, on the Chickahominy, until 12:40 noon. Thus, by careful planning we could collect at low-tide level on one river, then in a few minutes reach an adjacent river while the tide was just ebbing.

Our first adventure on tidal shores for the month was at the margin of the James at "Four Oaks", just below the ferry-landing near Harrison Point. Tide, as we expected, was going out, gradually exposing a broader and broader belt of estuarine plants. Here were the usual species of tidal shores, *Panicum agrostoides* var. *condensum* (Nash) Fernald, *Sagittaria falcata* Pursh, *Aeschynomene virginica, Lilaeopsis chinensis* (L.) Ktze., etc.; and, nestled among them, unmistakable *Eriocaulon Parkeri*, which we had found along Powhatan Creek, and *Isoëtes saccharata*, which, when we got it on the lower Nottoway, was the first from south of the Potomac. *Commelina diffusa* was finely flowering and, since it is necessary to catch the expanding corollas early in the day if one wants good material, we proceeded to lay the sky-blue flowers between folds of waxed paper (to prevent adhesion to the pressing paper), when we suddenly espied its relative of Wilcox Wharf now in full bloom. We were greatly excited, for the plant, which we soon found to be a characteristic element in the fresh tidal marshes of the James, Chickahominy, Pamunkey and Mattaponi and their tributary creeks and for want of a name called "Pinky Posy," proves to be *Aneilema Keisak* Hassk. (MAP 20), an addition to the more



Map 20, bicentric Range of Aneilema Keisak.

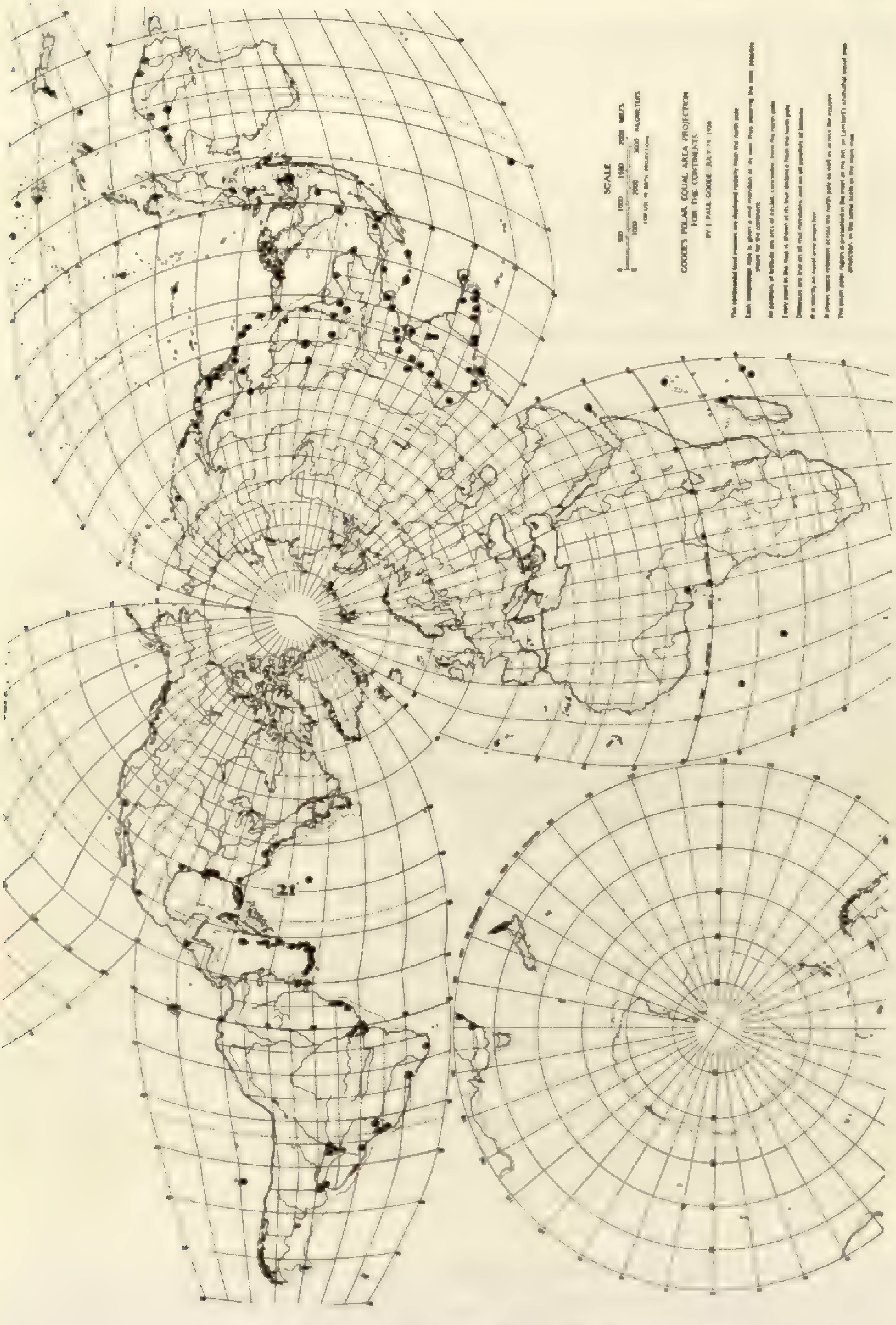
than 350 identical species sharing eastern Asia and eastern North America. In view of the recognition of this striking relationship for nearly a century and of our supposed familiarity with the flora of the Atlantic states, it was certainly very thrilling to be adding another to this ancient series of species, now with a strikingly bicentric range. While we were enthusiastically collecting *Aneilema* and laying its freshly expanded flowers between waxed papers, the owner of "Four Oaks", Mrs. Fox, came to the shore and, after learning the cause of our excitement, most hospitably invited us to her porch for refreshment and for shelter from the extreme heat. Mrs. Fox's hospitality is what we unfailingly meet from the owners of estates along the James, as soon as they learn what the pair of wet and muddy naturalists are really doing. But to return to the tidal margin of the James. Seeing a gigantic *Cassia fasciculata* Michx. (*C. Chamaecrista* of our manuals not of L.), nearly 5 feet high, I pulled the plant because of its exceptional size, planning to trim it down and fold it back and forth in press, as a record specimen. But merely casual examination caused us to keep the segments, for the pubescence seemed to us unfamiliar and the legumes and seeds enormous—legumes up to 8.5 cm. long and 1 cm. broad, the immature seeds 7 mm. across. We were frankly puzzled by it, for its habitat (inundated tidal mud) was all wrong for *C. fasciculata* and its details were just as atypical. I had unwittingly pulled up the only individual and there were no ripe seeds to scatter!

We had spent several hours on the shore at "Four Oaks" and when we left the tide was turning. Incidentally, when we had left home in the morning we had started out to visit one of the marshes near the head of tide on the Chickahominy; and now it would soon be too late. Quite at random we drove down to "Shady Rest", the place of Mr. W. T. Walls at Windsor Shades. Mr. Walls, keenly interested in the flora of his marsh, told us that from April to October there is something bright flowering there. The season evidently starts with golden club (*Orontium*) and in September the inevitable *Aeschynomene virginica* with creamy-yellow and purplish papilionaceous flowers towered above golden masses of *Bidens laevis* and forms of *B. coronata*. *Aneilema Keisak* leaned on the other vegetation and ascended to a length of 6 feet, its roseate flowers borne in elongate but interrupted leafy racemes. *Eleocharis quadrangulata*, which in Virginia is usually, if not always, confined to tidal marshes and shores, abounded, along with unusually tall *Sacciolepis striata* (with panicles up to 3 dm. long), and towering high were the great inflorescences (up to 1 m. long) of the estuarine variety of *Rhynchospora macrostachya*. The tide was rapidly making but outside the dense swale we were able to get the inevitable *Isoëtes saccharata* and, best of all, a few quite characteristic fragments of *Potamogeton Spirillus* Tuckerm. In the northern part of its range ubiquitous in fresh ponds and streams, it there shows no aversion to tidal waters. Southward, however, its southeastern known extension has been in tidal waters of the

Delaware system. New to Virginia, still farther south, it is here in the tidal margin of the Chickahominy.

Aiming another day for the great tidal marshes of the Chickahominy, we crossed the James from Jordan Point to Harrison Point and were starting down-stream when, crossing the somewhat uninspiring Kimmages Creek, we saw that it too was tidal. *Aneilema* and its regular companions were here, but nothing novel. Then, driving out toward Weyanoke, we came to the upper stretch of marsh along Kittewan Creek. The brilliant display of *Bidens* with high-towering *Aeschynomene* lured us in. Here was the big *Cassia*, nearly 6 feet high, in greatest profusion, holding its characters and obviously completely drowned at high tide—a most unusual habitat for any *Cassia*, but on the fresh tidal reaches of at least the James and the York and their many tributaries the conventional one for this conspicuous plant. In Part II I shall describe and illustrate it (PLATE 635). *Aneilema Keisak*, of course, was here, the creeping, leaning or ascending stems freely forking, and in marginal thickets beginning to mature the seeds which have enabled Dr. Hiroshi Hara and me to conclude that it is inseparable from the Japanese plant, except that in eastern Asia the petals may often have a more violet or bluish coloring. Emulating in stature its still thrilling associates, *Spiranthes cernua* var. *odorata*, which we had earlier found on the inundated bottomland of Fontaine Creek, was here abundant and in full bloom, the splendid racemes less fragrant than in the relatively small typical *S. cernua*.

Crossing the mouth of the Chickahominy, we went to its tributary, Gordon Creek. The broad tidal marshes there were splendid but the deep submerged paste-like clay was so vigorous in its suction that we soon quit. All the specialties of the fresh marshes were there and we also got the pale-scaled estuarine form of *Cyperus rivularis*: forma *elutus* (C. B. Clarke) Kükenthal, a pale form characteristic of such shores northward to southern Maine and strikingly unlike typical dark-scaled and relatively low *C. rivularis*. Along Gordon Creek the pale form was 6 dm. high and with an inclination to thickened bases. Quitting Gordon Creek, which would yield good returns if one could explore it by boat, we stopped just above the entrance of



Map 21, Range of Cyperus brevifolius.

the Chickahominy into the James, below Barrat's Bridge (formerly Barrat's Ferry, the bridge opened during the summer of

1939). The still pretty nice series of species abounds there; but under water, completely submersed when we found it, was the tidal-shore form of *Xyris caroliniana* with floating ribbon-like leaves, which Long had been sending me from the lower Delaware. Here, again, was another identity, though this only of minor taxonomic importance, between the flora of the lower Delaware and of these southeastern Virginian tidal shores. The great prize of these marshes, however, was the stoloniferous and extensively creeping pantropical *Cyperus brevifolius* (Rottb.) Haussk. (*Kyllinga brevifolia* Rottb.), widely dispersed in tropical and subtropical regions (MAP 21) but heretofore unknown in eastern North America between its stations in Florida and adjacent Georgia and the isolated colony on the lower Delaware. This was pretty fine but, after helping dig a good series of plants and leaving Long on dry land to lay them into paper, I pushed farther out into deep water and found myself in a colony of a purple-rayed *Boltonia.* This was the third species of the genus we had found in eastern Virginia and quite like one which Griscom and I had collected on our late-September trip in 1933 on the tidal marshes of North Landing River. By current treatments all three go into the too inclusive *B. asteroides,* but the plant of tidal marshes is freely stoloniferous, the other two species of southeastern Virginia not at all or but slightly so, and one of them has tiny white heads. The discovery of the plant of North Landing River had led Griscom and me to attempt a revision of the group. Our tentative results were held back pending receipt of photographs of types from abroad; but this discovery of a new colony was the signal to revamp and strengthen the unpublished treatment of seven years ago. This, with illustrations, will be found in Part II.

Forced out by high tide, we drove west, hoping to beat the incoming tide up-river. We took a chance on the shore near Tettington, but there we found sand-beach, with vigorous weedy colonies of soy bean and peanuts and other signs of man's invasion. The native flora, however, was interesting, for here, far up the James and mingled with typical plants of fresh sands, there were colonies of *Spartina patens* var. *juncea, Panicum amarum* and other maritime species. Best of all, the upper border of the beach was covered with characteristic *Apocynum* *sibiricum* Jacq., the northern white-flowered species which Woodson, in monographing the genus, recorded southward in the Atlantic coastal region only to Delaware and the District of Columbia.

Still having a remnant of daylight when we reached Charles City Courthouse, we drove northward for a ten-minute glimpse of the Chickahominy at Long Bridge. The ten minutes were well rewarded. On the wooded bottomland in New Kent County we might have been in Southampton County, 50 miles to the south. Here were *Leersia lenticularis,* which we had never seen north of Sussex County, *Hypoxis leptocarpa* Engelm. & Gray, a southern species which was new to Virginia when we found it in Southampton, and *Lysimachia radicans,* with which we had been keeping regular appointments at Cypress Bridge in southern Southampton. The bottomlands of the Chickahominy evidently need close study; but we had been out since an early breakfast, had explored six remote localities and, with darkness coming on, were willing to leave the Chickahominy bottoms and "call it a day".

Our September work had led us to the region north of the James, but we had not wholly forgotten the allurements of the pine-barren regions of western Nansemond and southeastern Southampton. The sandy pine barrens and pinelands several miles south of Franklin, where "Long's Flannel-weed", *Chrysopsis Longii* Fernald in Rhodora, xl. 467, pl. 531 (1938) and *Tradescantia rosea* Vent. var. *graminea* (Small) Anders. & Woodson abound, are always fascinating. On most of our visits heavy rains had made the wood-roads too full of water-holes for comfortable driving. On September 20th, however, the roads being well dried out, we made a circuit out to Point Beach on the Nottoway (where *Styrax americana* is very fine), thence northwestward to Round Gut on the same river and eastward via Wiggins School to the automobile road. Fine material of many rare species was collected and we were delighted to find *Zenobia pulverulenta* in Southampton County, much taller than in Nansemond (even if Pursh, nearly 140 years ago, "beat us to it" by collecting in Southampton the very rare *Litsea geniculata*, which has not subsequently been found, he did not discover *Zenobia!*). The local *Trichostema setaceum* Houtt. (*T. lineare*) abounded and was very large, and in a patch of hickory and oak woods (usually relatively rich) *Kuhnia eupatorioides* was at its easternmost station. In the sandy woods at Round Gut the *Tephrosia spicata* looked unusual. This was because the plants are nearly glabrous, instead of densely pilose-villous. I have been tempted to glorify the type-locality of this plant by applying to the latter the name splanchnodita, but the glabrous or glabrescent plant occurs at other stations; I am, consequently, giving it a less suggestive name in Part II.

Chinquapin, *Castanea pumila,* was heavily fruiting in the barrens and very puzzling. Some shrubs had the burs densely covered with erect long-rayed scales, others had the rays or bristles short and erect, while in others the remote scales had depressed and horizontally divergent rays, their tips often not touching and thus leaving broad naked areas. Such differences in the cups of acorns would be strongly specific, but in *Castanea pumila* the different variations all have essentially uniform foliage and nuts. We ate the nuts inordinately and filled all receptacles we could find with more nuts to take home. Tragically, however, when we opened the containers at home, we found them squirming with the fattest of grubs. We could merely take comfort by remembering the ancient conundrum about the half-worm in the partly eaten apple! I have carefully compared our material with the extensive series at the Arnold Arboretum. The shrub or small tree with broad naked spaces on the involucre is *C. pumila* var. *Ashei* Sudworth, heretofore known from southeastern Texas, Arkansas, and Louisiana to Georgia and northeastern North Carolina. The one with very long erect bristles is a close match for *C. pumila* var. *Margaretta* Ashe, which Ashe (for years familiar with the Carolinas) knew chiefly from "the upper edge of the longleaf pine lands of Texas and Louisiana". Ashe did not know it from the Atlantic States (only from western Alabama, Mississippi, Louisiana, Arkansas, Oklahoma and Texas). This isolation in southeastern Virginia is like that of scores of other plants; the next step is to find var. *Margaretta* and the other plants in the Carolinas and Georgia.

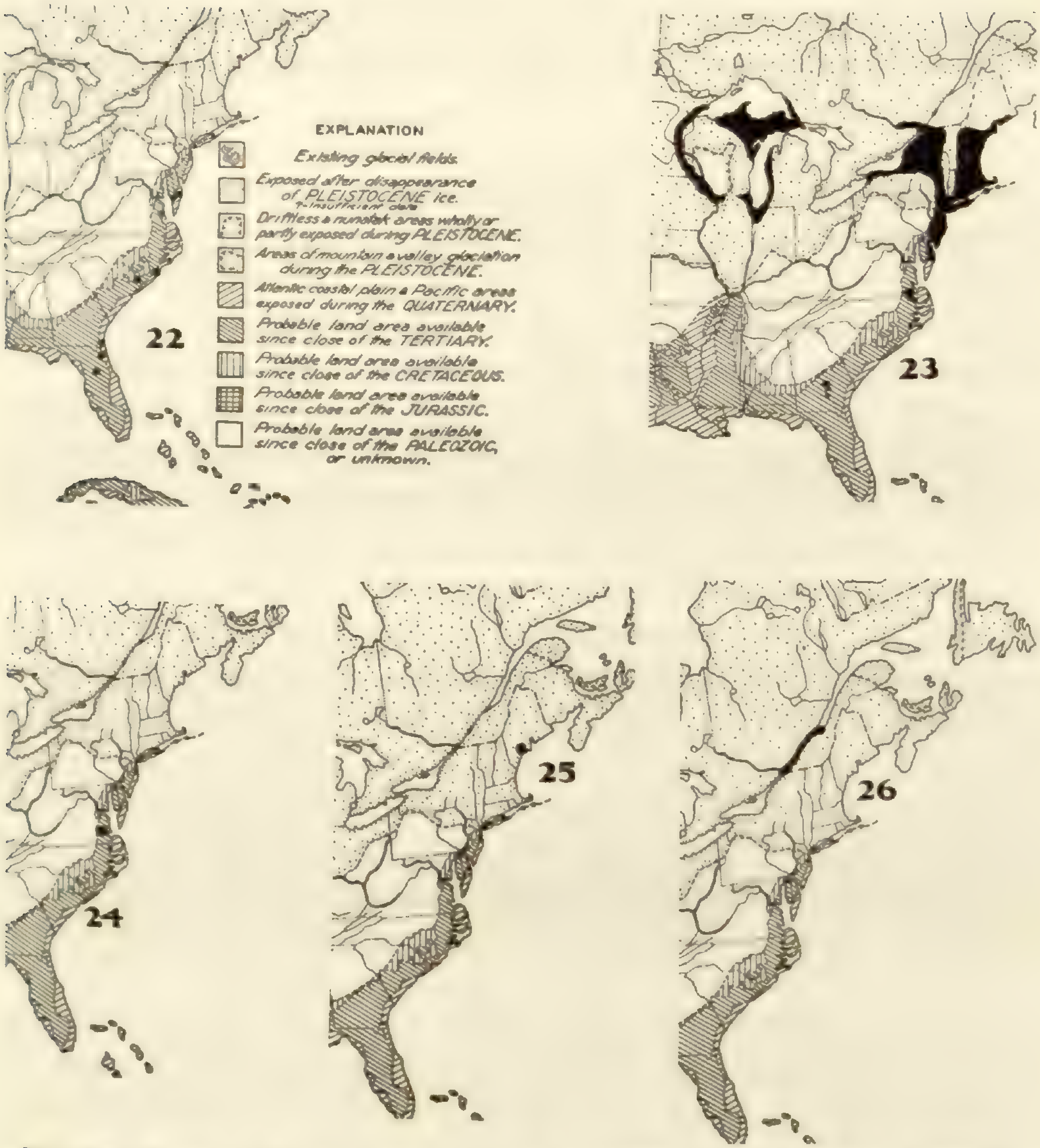
Returning on the 22nd to the pine barrens of western Nansemond County, I asked Leonard to stop the car at the woodroad leading to Milk Landing, where in July he and Long had been unmercifully peppered with seed ticks. I knew that I must start alone, for the memories of the place were still too sad for me to hope for Long's company. But he soon caught up with me, fearing that I might discover something interesting and correctly reasoning that the seed ticks of two months before were no longer waiting for him. And when we got to Milk Landing the Blackwater was at low tide. The little ribbon of tidal vegetation under the overhanging shrubs was tiny and interrupted but in five minutes we had *Sagittaria subulata,* the submersed form of *Xyris caroliniana* and, near the head of tide which runs up from Albemarle Sound in North Carolina, *Aneilema Keisak.* It surely must grow in North Carolina as well as in Virginia! Slightly farther down-river, at Cox Landing, we got *Eriocaulon Parkeri* only 3½ miles north of North Carolina.

The sphagnous savannah-like bog at Tom Hunter's was gorgeous with the orange and brown heads of *Coreopsis oniscicarpa* Fernald in Rhodora, xl. 472, pl. 533 and 534 (1938). The plants were up to 9 dm. high, often with 30 to 60 heads. This is the greatest station we know, but the species continues abundant eastward to the region of Cleopus. South of this area, not far from Cathole Landing, the white sands support, among superabundant *Carphephorus bellidifolius,* fine colonies of *Phlox Hentzii* Nutt. (discussed in Part II) at its easternmost known station, *Eupatorium tortifolium* Chapm., which we had already got near Sandy Landing, a northern extension; and, the great prize of the day, extensive carpets of a prostrate *Desmodium,* now over-ripe but quite strange to us. It proves to be true *D. glabellum* (Michx.) DC., quite unlike the rare plant which passes in our manuals under that name, the latter being *D. humifusum* Beck. Michaux's South Carolina type is represented in the Gray Herbarium by a fragment (leaf) and by a very clear photograph. Otherwise, so far as I can find, the species is unknown. In late August, 1940, we secured a representative series of specimens. These will be discussed in a later report. The discovery of *Desmodium glabellum* at dusk closed our exploration of the native flora for the month, except that on the 23d we went to Carey Bridge to get flowering material of *Chelone obliqua* (found too young earlier in the season).

The regular 2-hour weeding of Petersburg, after the presses were finally emptied and we awaited the afternoon train, brought us, among other unusual adventives, a labiate which greatly puzzled us. It proves to be *Hyptis mutabilis* (A. Richard) Briq. var. *spicata* (Poit.) Briq., the West Indian and Floridan representative of a tropical American species. At Petersburg, growing on a weedy bank, it is far from home. The weed which makes the fortunes of many residents of Petersburg and of Richmond is *Nicotiana Tabacum.* We were more interested in *Hyptis mutabilis!*

In October (12–17) our limited time was mostly devoted to the fresh tidal shores, although we started off by returning to the Great Dismal Swamp, near the Camp Lumber Company's plant southeast of Whitemarsh School. We were primarily after mature fruit of *Ilex coriacea,* already noted; but we found the wonderfully developed phyllodia of *Sagittaria Weatherbiana* Fernald which will be specially noted in Part II, extended eastward the ranges of *Leersia lenticularis* and *Scirpus divaricatus,* and, in the clearings, found unusually strong and heavily fruiting plants of *Viola esculenta* Ell.

On the 13th we returned to "Shady Rest" for mature fruit of *Aneilema Keisak.* On this trip we noticed that the deep channel which runs through the marsh was full of *Potamogeton epihydrus* var. *Nuttallii* (C. & S.) Fern., here found for the first time south of the Potomac, a fitting companion for the northern *P. Spirillus* which we got here in September. High tide forcing us from the Chickahominy, we then went north to the York, where we could still have four hours of low water. We spent some time on the sandy beach north of Holly Forks, this region of the upper York being essentially sea-shore, with carpets of *Euphorbia polygonifolia* and other maritime plants. On a steep sandy slope there was an abundance of *Sporobolus asper,* which we had never met in Virginia. Upon referring to Hitchcock's Manual it becomes evident that the species is new to the state. It was obvious that for fresh tidal marshes we must go up the Pamunkey and the Mattaponi which unite to form the broad salty York. So we drove up the former river and tried the marshes east of White House. *Aneilema,* the new *Cassia* and *Aeschynomene* were there and we at once set ourselves the task



Map 22, Range of Bacopa cyclophylla (derived largely from *Pennell*); 23, of Polygonella articulata; 24, of Bacopa obovata; 25, of Cardamine Longii; 26, of Gentiana Victorinii.

of following these three index-species to the northern limits of their range (a task not yet finished).

Next day, after some exploration in other areas, we reached the Mattaponi at Horse Landing, near King William Courthouse. The shores were so fine and the tide so unaccommodating that we returned for a second day, at low tide. All the standard species, including the variety of *Rhynchospora macrostachya*, were there, as were the less common *Eriocaulon Parkeri* and *Elatine americana*. *Spiranthes cernua* var. *odorata* was there producing young plants (rosettes) at the tips of the prolonged roots;[10] and in the outer mud, exposed at extreme low tide, *Hypericum mutilum* var. *latisepalum* Fernald, heretofore known only from Florida to Texas, was mixed with scattered individuals of the excessively rare and little collected *Bacopa cyclophylla* Fernald (*Herpestis rotundifolia* Gaertn. f., not *B. rotundifolia* (Michx.) Wettst.), this being the eighth known station and the first between Wilmington, North Carolina and the two colonies on the Eastern Shore of Maryland (MAP 22). In southeastern Virginia *Bidens coronata* (L.) Britton is chiefly represented by var. *trichosperma* (Michx.) Fernald in Rhodora, xl. 350, t. 506, figs. 8 and 9 (1938); but along the Mattaponi some plants had coarse and often simple leaves and very large broad-based awns. They can be referred only to typical *B. coronata,* which in the Atlantic States had been unknown south of the lower Delaware.

Farther up river, opposite Walkerton, the marsh was bordered by a towering thicket of *Aeschynomene,* so dense and so high above our heads that we finally abandoned the last lingering pretense that it is rare! And slightly below Walkerton, on the King and Queen side of the river, the index-plants were all seen, and with them *Bidens coronata.* Having trailed the quarry to King and Queen, the obvious step was to hunt for the group on the next river to the north, the Rappahannock. We made a tactical error, however, in going toward Tappahannock, for there the marshes are salt and it was obvious that we must go much farther up river for fresh tidal shores. Consequently, the hour being late, we went to the nearest open shore, at Richmond Beach, on the Rappahannock in Essex County. The maritime character of the area was evident from the abundance on the sands of *Diodia teres* var. *hystricina* Fern. & Griscom of the sands of Cape Henry and of Yorktown. In the thicket back of the beach the giant *Arundo Donax,* up to 15 feet high, was thoroughly naturalized. We selected small panicles and by folding them back and forth and tying their tips to the bases of the inflorescences secured specimens which can be kept within the limits of the herbarium-sheet.

One trip was made to the pine barrens south of South Quay.

[10] Correll says: "often in dense clumps because of its stoloniferous habit"—D. S. Correll, Bot. Mus. Lfts. Harvard Univ. viii. 81 (1940).

At Tom Hunter's we were happy to find the new *Lilium* with mature fruit and abundant seeds; and in one seeping or springy spot *Utricularia fibrosa,* rare in Virginia, was flowering. *Quercus cinerea* Michx., abundant in all the pine barrens of southeastern Virginia, is sometimes well-behaved, but it often mixes with the other oaks. One of the most striking hybrids, of which we found a characteristic tree, is × *Q. subintegra* Trelease (*Q. cinerea* × *falcata*). In **1940**, at the northern limit of *Q. cinerea,* in Sussex County, we felt that its hybrids with various species were almost as abundant as typical *Q. cinerea.* One of our chief errands at this time was to collect, at last, flowering material of the *Polygonella,* of which we had found seedlings in July. The plant was very abundant, and we traced it across the state-line, nearly to Wyanoke in Gates County, North Carolina. The larger plants, heavily loaded with flowers and fruit, were 8 dm. high, but, alas, they are only the northern *P. articulata* (MAP 23). Alas!—nevertheless the species is really a most interesting one to find in southeastern Virginia and northeastern North Carolina. There is an old specimen of Thomas Nuttall's at the Philadelphia Academy, marked simply as from "Georgia". Otherwise, there are no specimens of this essentially northern species in the herbaria of the Philadelphia Academy and the New York Botanical Garden nor in the Gray Herbarium from south of the Eastern Shore of Maryland. Our disappointment in not having a typically more southern species was, consequently, tempered.

Thus our season of botanical exploration came to a close. It had been one of unusual discoveries in view of all the previous work in the same area and, even if the record shows less than one hundred maintained species and geographic varieties, which by some would be treated as species (for instance *Andropogon virginicus,* var. *glaucus,* maintained by Nash, Small and Hitchcock as a species, *A. capillipes* Nash), the inclusion of several well marked forms which deserve designation (some of them usually called species, as in case of *Commelina crispa* Wooton or the green-leaved form of *Zenobia,* maintained by Small as a species, *Z. cassinefolia*) fully justifies the title I have given to this report of progress. The records in abbreviated form constitute Part II; for the convenience of users some of the data diffusely stated in the Narrative is repeated. In Part III brief consideration will be given the phytogeographic problems raised by some of the discoveries, especially those of the fresh tidal shores.

Part II. Enumeration and Consideration of the More Noteworthy Plants

As in previous reports species, varieties and forms of significance in reaching an understanding of the flora of the Coastal Plain of southeastern Virginia are enumerated. Some records are from collections of earlier years; a few are of plants in the Gray Herbarium, collected by others; and in a few cases specimens collected in 1940 are included in order to complete the record to the date of going to print. In most cases, where the plants were collected by Long and me, it has seemed unnecessary to repeat the names of the collectors. In course of identifying the material many genera or groups of species have been critically studied. In so far as these revisional studies have grown out of the Virginia work they are here included. The photographs and material for the plates have been prepared by my assistant, Walter H. Hodge, or by my son, Henry G. Fernald. The maps showing world-ranges are on base-maps of the Goode series, copyrighted by the University of Chicago. The initial cost of photography and preparation of blocks has been partly met through appropriations for personal research from the Department of Biology of Harvard University; the cost of their reproduction through the generous support of Mr. Long. The names of plants thought to be reported for the first time from Virginia are preceded by an asterisk (*).

Cheilanthes lanosa (Michx.) Watt. Sussex County: ledges in rich woods at the "fall-line" along Nottoway River, above Double Bridge, about 6 miles northwest of Jarratt, no. 10,862.

Close to the inner border of the Coastal Plain. See p. 383.

Equisetum arvense L. Southampton County: in lime-marl, wooded bottomland of Three Creek, northwest of Carey Bridge. no. 10,071.

Equisetum arvense, so common in all damp habitats in the North, is rare in southeastern Virginia, and always, so far as we have observed, in calcareous pockets. See p. 363.

Lycopodium inundatum L., var. adpressum Chapm., forma **polyclavatum** (McDonald), comb. nov. *L. adpressum*, f. *polyclavatum* McDonald in Fern Bull. ix. 9 (1901). *L. alopecuroides*, var. *adpressum*, f. *polyclavatum* (McDonald) Clute in Fern Bull. xvii. 45 (1909). Sussex County: argillaceous swale southwest of Grizzard, no. 10,866.

In originally describing the variety, Chapman used the spelling *Lycopodium inundatum*, var. *appressum* Chapm. in Bot. Gaz. iii. 20 (1878). Subsequently, however, he took up the alternative spelling, var. *adpressum* Chapman, Fl. So. U. S. ed. 2: 671 (1883), holding to this altered spelling in the 3rd edition (1897). Most authors have used the second (and by Chapman obviously preferred) spelling. If it be maintained by some that an author has a right to correct his own error (assuming that Chapman so considered his first spelling), then, immediately, an equally strong group will argue that the original spelling must stand. As one who has been forced through typographic, orthographic or stenographic errors into misspellings, I have claimed the right to correct them. This is quite different from alterations made by others. In the latter cases, unless an evident error is corrected they are not justified. In the case of Chapman's name, of course, the original spelling was etymologically as correct as the substitute.

*L. carolinianum L. Greensville County: argillaceous and sphagnous meadow northwest of Taylor's Millpond, nos. 10,075, 10,867.

Certainly a very rare plant in Virginia. We have met it only at this station, a much burned peaty meadow or swale, where the *Lycopodia* of bogs have a remarkable and perplexing development. I have been unable to trace the source of the record for Virginia, sometimes given. Lloyd & Underwood in Bull. Torr. Bot. Cl. xxvii. 158, 159 (1900), cited no material from between southeastern North Carolina and southern New Jersey, although there is a single station in Maryland. In August, 1934 (Claytonia, i. 3) Massey, in his account of the genus in the state, said: "No reports of its having been collected in Virginia are at hand." See p. 358.

Isoëtes saccharata Engelm. Fresh tidal shores. King William County: Mattaponi River, at Horse Landing, near King William Courthouse, no. 11,508. New Kent County:

Chickahomimy River at "Shady Rest", southeast of Windsor Shades (Boulevard Postoffice), no. 11,507. Charles City County: James River at "Four Oaks", below Harrison Point, no. 11,216. Nansemond County: Blackwater River, Milk Landing, south of South Quay, no. 11,217. Southampton County: Nottoway River, Knight's Seine Beach (Battle Beach), no. 10,082.

Pfeiffer, in her *Monograph,* cites no material from south of tributaries of the Potomac near Alexandria. Knight's Seine Beach is barely *not* in North Carolina; *I. saccharata* will doubtless be found in that state farther down the Nottoway or on the Chowan. See pp. 364, 391 and 393.

*I. Engelmanni A. Br., var. caroliniana A. A. Eaton. Greensville, Southampton, Nansemond, Sussex and Dinwiddie Counties, frequent and often abundant on the wooded bottomlands of the larger rivers and creeks (Meherrin and Nottoway Rivers, Fontaine Creek, Three Creek, Somerton Creek, Rowanta Creek) and even along small runs in the woods, fruiting from mid-May to August, usually in June, most colonies being over-ripe and nearly unrecognizable by mid-summer (many nos.).

Extension north from Georgia and mountains of North Carolina. See pp. 358, 367 and 375 and map 2.

Taxodium distichum (L.) L. C. Richard, var. imbricarium (Nutt.) Sudw. (*T. ascendens* Brogn.). Common on wooded bottomlands and even on tidal shores of rivers, many collections from James City, Sussex, Southampton and Greensville Counties.

Influenced by the persuasions of those who see two species of *Taxodium* in the South, we called our collections made in June *T. ascendens.* Finally, however, noting that the characters separating the two were very fickle, we reached the conclusion of Sudworth and of the late Carl Mohr. The latter's statement is one with which we have full sympathy:

> Of smaller size than the species, with the leaves reduced in size and closely appressed to the deciduous branchlets, thus imparting to the tree a strikingly peculiar aspect. This character, however, is not constant, and the variety can scarcely be maintained, the same individual producing during the earliest stages of growth and on vigorous adventitous shoots leaves of the ordinary form.
>
> This form passes freely into the species where the soil conditions are more favorable.—Mohr, Pl. Life of Alab., Contrib. U. S. Nat. Herb. vi. 325 (1901).

After a strong wind in early summer, many of the deciduous branchlets bearing only the small leaves of the variety will be found on the floors of bottomlands. In Virginia, at least, this form is not confined to pond-margins, as it is sometimes said to be farther south. Probably var. *imbricarium* is not a true variety, but merely a state of development or a seasonal stage.

TYPHA TRUXILLENSIS HBK. PRINCESS ANNE COUNTY: brackish to fresh marsh along Back Bay, at eastern margin of Long Island, no. 10,476. SUSSEX COUNTY: argillaceous ditch by Norfolk and Western Railroad, about 2 miles west of Waverly, no. 10,477. See pp. 374, 376 and MAP 8.

Recorded in 1935 (RHODORA, xxxvii. 385) from shores of Back Bay, the first area known north of Florida. The station in Sussex County is 65 miles inland and extends the range northward to lat. 37° 2′, from the former northern limit at 36° 40′.

*POTAMOGETON SPIRILLUS Tuckerm. NEW KENT COUNTY: Floating at outer border of fresh tidal marsh by Chickahominy River, at "Shady Rest", southeast of Windsor Shades (Boulevard Postoffice), no. 11,219.

Extension south from the lower Delaware River and adjacent waters of southwestern New Jersey and of Delaware. See p. 374.

P. EPIHYDRUS Raf., var. NUTTALLII (C. & S.) Fernald. NEW KENT COUNTY: in open water, fresh tidal marsh by Chickahominy River, at "Shady Rest", southeast of Windsor Shades (Boulevard Postoffice), no. 11,541.

Extension south from the Potomac. See p. 400.

TRIGLOCHIN STRIATA R. & P. To the station on North Landing River, recorded in 1936, add the following, also in PRINCESS ANNE COUNTY: inner border of brackish to fresh marsh along Back Bay, at eastern margin of Long Island, no. 10,479; turfy knolls in shallow pools in brackish to fresh marsh along Back Bay, east of Creeds, no. 10,876, very fine development, plants nearly 3 dm. high, with spikes more than 1 dm. long. See pp. 387, 388 and MAP 19.

SAGITTARIA SUBULATA (L.) Buchenau. To the few recorded stations add one in JAMES CITY COUNTY: tidal mud along Powhatan Creek, north of Jamestown Island, no. 10,877. KING WILLIAM COUNTY: fresh tidal shore of Mattaponi River at Horse Landing, near King William Courthouse, no. 11,512. NANSEMOND COUNTY: muddy tidal margin of Blackwater River, Milk Landing, south of South Quay, no. 11,220. See pp. 386 and 399.

*S. SUBULATA, var. NATANS (Michx.) J. G. Sm. PRINCESS ANNE COUNTY: shallow pools in fresh to brackish marshes along Back Bay, east of Munden, no. 10,878; east of Creeds, no. 10,879;

along Nowney Creek, southeast of Back Bay Postoffice, no. 10,880. See p. 387.

I am keeping as var. *natans* the narrower-leaved plant which was included by Chapman, along with the coarser Florida plant, under his *Sagittaria natans,* var. *lorata.* As I interpret *S. subulata* it consists of four fairly marked varieties as follows.

S. subulata (L.) Buchenau, var. **typica.** *Alisma subulatum* L. Sp. Pl. 343 (1753). *S. pusilla* Nutt. Gen. ii. 213 (1818). *Echinodorus subulatus* (L.) Engelm. in Gray, Man. 460 (1848). *S. subulata* (L.) Buchenau in Abh. Nat. Ver. Bremen, ii. 490 (1871).—Dwarf; leaves linear, strap-shaped, obtuse to acutish, 2–12 cm. long, 1–3 mm. broad, exceeding to shorter than scape, rarely with a narrow blade up to 2 cm. long and 4 mm. broad; inflorescence 1–4 cm. long; pedicels in 1–3 whorls, the 1 or 2 fruiting ones stouter and shorter than the others, recurved, 0.5–2 cm. long; bracts scarious, connate or spathe-like and oblique, obtuse or with prolonged tips, 3–5 mm. long; filaments 6–8, glabrous; fruiting heads nodding, 4–6 mm. in diameter; achenes obovate, 1.6–2.3 mm. long, 0.7–1.4 mm. broad, wing-margined, with slenderly keeled faces, the lateral to subterminal subulate beak 0.3–0.4 mm. long.—Fresh to brackish tidal mud, Florida and Alabama, north to Massachusetts.

Var. natans (Michx.) J. G. Smith, N. Am. Sp. Sagittaria and Lophotocarpus, 18 (1894), at least as to type. S. natans Michx. Fl. Bor.-Am. ii. 190 (1803)—photograph of type in Gray Herb. *S. natans,* var. *lorata* Chapm. Fl. So. U. S. 449 (1860), in part only.—Leaves ribbon-like or with dilated lanceolate to ovate blades up to 4 cm. long and 2 cm. broad, the obtuse phyllodia 1–3 dm. long and 3–6 mm. broad, often overtopped by the scape (1–4 dm. long); inflorescence 3–10 cm. long, the 1–3 recurving pistillate pedicels 0.5–3.5 cm. long.—Shallow pools along the coast, Florida to southeastern Virginia.

Var. gracillima (Wats.) J. G. Smith in Mem. Torr. Bot. Cl. v. 26 (1894) and N. Am. Sp. Sagittaria and Lophotocarpus, 19, pl. 14 (1894). *S. natans* Michx., var. (?) *gracillima* Wats. in Gray, Man. ed. 6: 556 (1890).—Very elongate, up to 1 m. or more long, and submerged; leaves (phyllodia) prolonged, 1–3 mm. wide; scape prolonged; inflorescence 1–3 dm. long, with 2–4 very remote whorls; bracts (at least of the upper whorl) subherbaceous, elongate, mostly caudate-tipped, nearly distinct, 6–10 mm. long; pedicels all elongate, the lower with pistillate flowers, arched or spreading, 0.3–2 dm. long, not much thickened; fruit unknown.—Deep water of streams, eastern Massachusetts to southeastern Pennsylvania.

Var. **lorata** (Chapm.), comb. nov. *S. natans* Michx., var. *lorata* Chapman, Fl. So. U. S. 499 (1860) in great part. *S. lorata* (Chapm.) Small in No. Am. Fl. xvii[1]. 52 (1909), as to type.—The coarsest extreme; phyllodia 0.8–1.5 cm. broad, 2–9 dm. long; inflorescence with 3–6 whorls; sepals relatively large; fruiting head up to 1 cm. in diameter; achenes 2–2.5 mm. long, with 5–7 crests.—Brackish waters, Florida.

The somewhat mystifying bibliography in the treatment in the North American Flora gives the type locality of *Sagittaria lorata* (Chapm.) Small as "Carolina". Chapman, in originally publishing *S. natans,* var. *lorata,* upon which *S. lorata* rests, said "Brackish water, along the west coast of Florida". On the same page in the North American Flora, in the synonymy of typical *S. subulata,* we get the following entry: *"Sagittaria natans lorata* A. Gray, Man. ed. 5. 494. 1867". Search for the latter combination fails to reveal it; but the combination, *S. subulata natans* (Michx.) J. G. Smith, properly published by Smith in his monograph of the genus (1894), failed to win citation in the North American Flora.

S. Weatherbiana Fernald in Rhodora, xxxvii. 387, pl. 385 and 386, fig. 1 (1935).

In summer the broad phyllodia are mostly shriveled, though conspicuous in early spring. On October 12, we found the plants of pools in the Great Dismal Swamp with completely shriveled mature foliage but with newly developing phyllodia of extraordinary beauty, with the whole breadth or a wide central band filled by large lacunae, in this suggesting the foliage of *Potamogeton epihydrus.* It is evident that *S. Weatherbiana* makes its principal growth from autumn to spring, as do *Hottonia inflata* and some other aquatics. See pp. 359 and 400.

Vallisneria americana Michx. To the station recorded in 1936 add another, also in Princess Anne County: abundant on sandy bottom of Back Bay (depth slightly more than 1 m.), Long Island, no. 10,881. See p. 387.

Anacharis densa (Planch.) Victorin. To the station in Dinwiddie County reported in 1938 add one in James City County: pool in cypress swamp back of Chickahominy River, below Barrat's Bridge (or Ferry), no. 11,221.

Diplachne maritima Bicknell. Princess Anne County: inner border of brackish to fresh marsh along Back Bay, at eastern margin of Long Island, no. 10,522; shallow pools in brackish to fresh marsh along Back Bay, east of Munden, no. 10,833; similar habitat east of Creeds, no. 10,884. See pp. 370 and 387.

Glyceria arkansana Fern. To the stations in Greensville and Surry Counties recorded in 1938 add the following. Sussex County: wooded bottomland, Three Creek, southwest of Grizzard, no. 10,128; bottomland swamp, Nottoway River, southwest of Homeville, no. 10,129. Greensville County: wooded bottomland of Fontaine Creek, southeast of Taylor's Millpond, no. 10,127. See p. 360.

Eragrostis hypnoides (Lam.) BSP. Local range extended eastward to the Blackwater valley. Nansemond County: sandy border of rill in swampy woods east of Milk Landing, south of South Quay, no. 11,223.

E. peregrina Wiegand. Range extended southward to Princess Anne County: roadside, open muddy and sandy shore of Back Bay, east of Creeds, no. 10,891. Southampton County: railroad yards and waste places, Franklin, no. 10,886.

E. hirsuta (Michx.) Nees. To the station in Arlington County (see Rhodora, xli. 500) add one in Dinwiddie County: large clumps in cinders of freight-yard of Norfolk and Western Railroad, Petersburg, no. 10,892.

The typical southern plant with strongly hirsute sheaths. See p. 390.

Arundo Donax L. To the station in Sussex County reported in 1938 add one in Essex County: woods bordering sandy beach of Rappahannock River at Richmond Beach, southeast of Tappahannock, no. 11,527, plants 10–15 feet high. See p. 402.

Triodia Chapmani (Small) Bush. Southampton County: dry white sand of clearings in oak and pine woods bordering Assamoosick Swamp, south of Sebrell, no. 10,894; border of sandy woods near Three Creek, northwest of Carey Bridge, no. 11,222. See pp. 378, 383 and map 15.

Extension inland from Nansemond County. Experience in the field, now extending over several years, indicates that *T. Chapmani* is abundantly distinct from *T. flava.* Hitchcock treated it as inseparable, but in 1934, Griscom and I, finding it in the sandy woods back of Cape Henry, recognized it as at least varietally separable, *T. flava,* var. *Chapmani* (Small) Fernald & Griscom, in Rhodora, xxxvii. 133 (1935). Subsequent observations show that, whereas the wide-ranging *T. flava* (L.) Hitchc. prefers relatively good soil and is inclined to follow roadsides, *T. Chapmani* is restricted to sandy pinelands and oak-scrub. It not only has the spikelets long-stalked; its very narrow leaves are bluish-green, 5–7 mm. broad, and strongly inclined to become inrolled. Its open and skeleton-like panicle has the bases of the principal branches surrounded by ring-like pulvini with very long hairs, whereas the denser panicle of *T. flava* has the shorter hairs confined to the upper sides of the axils of the branches. *T. Chapmani* reaches its northernmost limit, apparently, in the sands of southeastern Virginia.

*SPOROBOLUS ASPER (Michx.) Kunth. NEW KENT COUNTY: steep sandy bank of York River, near mouth of Fillbate's Creek, north of Holly Forks, no. 11,525. See p. 400.

Hitchcock (*Manual*) indicates no station in the Atlantic States south of northern Maryland.

SPARTINA CYNOSUROIDES (L.) Roth. JAMES CITY COUNTY: fresh tidal marsh of Chickahominy River, below Barrat's Bridge (or Ferry), no. 11,236.

Noteworthy as an extension inland beyond the saline shores. See the two following.

S. ALTERNIFLORA Loisel., var. PILOSA (Merr.) Fern. Inland to CHARLES CITY COUNTY: sandy tidal margin of Chickahominy River, Ferry Point, no. 10,911.

S. PATENS (Ait.) Muhl., var. JUNCEA (Michx.) Hitchc. Inland to CHARLES CITY COUNTY: sandy beach of James River southeast of Tettington, no. 11,235. See p. 396.

In dry fresh sand, associated with plants of strictly fresh habitats.

LEERSIA LENTICULARIS Michx. CHARLES CITY COUNTY: bottomland woods by Chickahominy River, north of Roxbury, no. 11,238. NEW KENT COUNTY: similar habitat, north of Long Bridge, southeast of Quinton, no. 11,239. NANSEMOND COUNTY: border of gum swamp at margin of Great Dismal Swamp, southeast of Whitemarsh School, no. 11,521. See pp. 397 and 400.

In view of Hitchcock's map, indicating no station in the Atlantic States north of South Carolina, and our records of it from Greensville and Southampton Counties (RHODORA, xxxix. 348, 353, 382 and map 22 (1937)), the stations in New Kent and in Nansemond Counties constitute notable local extensions of range.

PASPALUM URVILLEI Steud. To the stations in Warwick and Nansemond Counties reported in 1939 add the following. NANSEMOND COUNTY: roadside ditch east of Suffolk, no. 10,917. SUSSEX COUNTY: roadside ditch southeast of Wakefield, no. 10,918.

It is evident that this species is rapidly spreading northward.

Panicum caerulescens Hackel. Range extended inland to Southampton County: sphagnous swampy woods southwest of Applewhite Church, no. 10,104.

*P. cryptanthum Ashe. Southampton County: bushy swales and borders of swampy woods near Blackwater River, Cobb's Wharf, no. 10,931. See pp. 364 and 383.

One of the rarest members of the genus, heretofore unknown between the region of Wilmington, North Carolina, and southern New Jersey. Near Cobb's Wharf (just north of the North Carolina line, on the west bank of the Blackwater River) there are several very large clumps. One-half of such a plant, broken into fragments, made 30 full sheets of representative material. The station, unfortunately, is within a rod or two of a plowed field.

P. capillare L. New Kent County: ditch at border of damp woods, near Fillbate's Creek, north of Holly Forks, no. 11,519.

The first time we have met this elsewhere usually common species on the Coastal Plain of Virginia.

P. agrostoides Spreng., var. condensum (Nash) Fernald. Tidal shores of James River, forming dense clumps up to 1.8 m. tall, with wide-branching panicles up to 3 dm. long and 1–1.5 dm. broad (several nos.). See pp. 286 and 391.

Just such plants from tidal shores all the way to Texas are referred in the Gray Herbarium by Hitchcock & Chase to *P. agrostoides.* I can get no satisfaction in separating them from *P. condensum* Nash. They have the longer spikelet of that plant, also the firmer foliage with broader midrib. Along the James these very tall clumps with panicles much exceeding the "rarely more than 5 cm. wide" of Hitchcock's *Manual* form thickets at high-tide limit. Farther out, they pass into an outer band (as at Wilcox Wharf, for instance) with plants down to 6 dm. high and with dense lance-ellipsoid panicles only 3–4 cm. thick. These are *P. condensum* as defined by the above authors, but they are clearly small individuals of the coarser plants which form part of the series of specimens listed by Hitchcock & Chase as "intermediate between *P. agrostoides* and *P. condensum*". Unfortunately some of the specimens cited by them as intermediate do have the coarse habit of the tall plants of the James and short spikelets which I cannot distinguish from those of *P. agrostoides.* If *P. agrostoides* and *P. condensum* are distinct species, I shall welcome having their morphological distinctions pointed out.

ECHINOCHLOA COLONUM (L.) Link. JAMES CITY COUNTY: tidal shore of Back River, opposite Jamestown Island, no. 10,939.

The only time we have met this species, although Hitchcock (*Man.*) gives Virginia as its northeastern limit. Wiegand in his study of *The Genus Echinochloa in North America*, RHODORA, xxiii. 49–65 (1921), cited it from South Carolina southward and westward. See p. 385.

*E. PUNGENS (Poir.) Rydb. (*E. muricata* (Michx.) Fern.). NANSEMOND COUNTY: roadside bordering sandy and sphagnous margins of thickets in pineland southwest of Marsh Hill School, south of South Quay, no. 11,242.

Not seen from Virginia by Wiegand, l. c.

*E. WALTERI (Pursh) Nutt., forma LAEVIGATA Wiegand. (*E. longearistata* Nash). PRINCESS ANNE COUNTY: open muddy and sandy shore of Back Bay, east of Creeds, no. 10,940. SOUTHAMPTON COUNTY: swaley tidal shore of Nottoway River, Knight's Seine Beach (Battle Beach), no. 10,938. See p. 383.

Wiegand cites no material from Virginia; Nash gave the range, "South Carolina to Louisiana."

*SETARIA VIRIDIS (L.) Beauv., var. WEINMANNI (R. & S.) Beauv. PRINCE GEORGE COUNTY: cinders of freight-yard of Norfolk and Western Railroad, east of Petersburg, no. 11,240.

F. T. Hubbard, in his *Taxonomic Study of Setaria italica and its immediate Allies*, Am. Journ. Bot. ii. 169–198 (1915), cited no material from south of New England.

*ANDROPOGON (§ SCHIZACHYRIUM) **praematurus,** sp. nov. (TAB. 626, FIG. 1–3), ab *A. scopario* recedit planta dense cespitosa 3–9 dm. alta; racemis 1–3 cm. longis 3–7-articulatis longe pedunculatis pedunculis filiformibus valde exsertis; rhachi undulato internodiis 3–5 mm. longis superne barbatis; spiculis sessilibus 5–7 mm. longis; spiculis pedicellatis saepe bene evolutis solitariis plerumque masculis 3.5–7 mm. longis.—Dry open woods, clearings and fields, southeastern VIRGINIA: dry gravelly soil northwest of Grove, York County, June 21, 1922, *L. F. & Fannie R. Randolph*, no. 353, as *A. scoparius* (in anthesis); dry sandy pine woods about 3 miles southeast of Petersburg, on headwaters of Blackwater River, Prince George County, June 25, 1936, *Fernald, Long & Smart*, no. 5593, as *A. scoparius*, var. *divergens* (in anthesis); dry fields and roadsides south of Petersburg, Dinwiddie County, June 8, 1938, *Fernald & Long*, no. 8094 (in anthesis); argillaceous field near Century House, northeast of Burgess, Dinwiddie County, September 13, 1937 (shattered), *Fernald & Long*, no. 7310; June 17, 1938 (in anthesis) *Fernald & Long*, nos. 8095 (foliage green) and 8096 (glaucous); border of dry woods near Assamoosick Swamp, about 2 miles northeast of Homeville, Sussex County, August 24, 1938, *Fernald & Long*, no. 8922 (fruit scattered); hickory and oak woods and clearings east of Skipper's, Greensville County, June 12, 1939 (in anthesis), *Fernald & Long*, no. 10,092 (TYPE in Herb. Gray.). SOUTH CAROLINA: grass-sedge bog or savannah, 1 mile west of Chicora, July 24, 1939 (shattered), *R. K. Godfrey & R. M. Tryon, Jr.*, no. 844.

Andropogon praematurus (see p. 357), when first found by us in June, 1936, at once challenged interest because of its extraordinary flowering season. Subsequently we have seen much of it, the plant consistently flowering from early June through the month (presumably into early July) but the inflorescences become quite shattered and the fruit scattered by August. *A. scoparius* and its varieties are autumn-flowering plants, in eastern Virginia very immature in September and in their prime through October. In *A. scoparius* the culms are mostly 0.5–1.5 m. high, the leaves 3–6 mm. wide, the racemes 3–7 cm. long, and the pedicels at each node are paired and truncate or terminated by a sterile rudiment. The early-summer *A. praematurus* is usually only 3–6 dm. high, though exceptional woodland colonies may reach a height of 9 dm.; its leaves are mostly 2–4 mm. broad; the racemes only 1–3 cm. long, with internodes only 3–5 mm. long. Most remarkable, the sessile perfect spikelets, instead of being accompanied by a pair of truncate bearded pedicels or these terminated by mere rudiments, usually are accompanied by a single well developed staminate pedicelled spikelet (FIGS. 2 and 3), though the terminal group may have 2 pedicelled spikelets. In well developed plants these characters are conspicuous; in some, however, only a few well formed staminate spikelets develop. All specimens display some of them and no second pedicel (except the terminal group).

Andropogon praematurus thus belongs in the remarkable group of species which retain well developed pedicelled staminate spikelets, these species being presumable ancestral types in which the pedicelled spikelets have not become reduced to mere rudiments or to truncate bearded pedicels, but in the three American species with this character the pedicelled spikelets are mostly solitary, instead of paired. The new species can not, however, be placed with either of the other North American species with the solitary pedicelled spikelets staminate. *A. divergens* Anderss.[11] is a coarser endemic of Texas, 0.8–1.5 m. high, with scarcely or barely exserted racemes (our FIG. 4) 3–4 cm. long, the internodes of the rachis 4.5–7 mm. long, the sessile spikelets and the pedicelled staminate ones 6–8 mm. long. The three sheets of it before me (*Cory*, nos. 25,510, 25,840 and 26,064) were all collected in October. *A. praematurus* is certainly very closely related to it, but it differs in its much lower stature, its long-exserted racemes with internodes only 3–5 mm. long, the spikelets mostly smaller. These differences, associated with the pronounced difference in flowering season and the geographic isolation, sufficiently distinguish *A. praematurus.*

From *Andropogon maritimus* Chapm., of the coast of the Gulf of Mexico, *A. praematurus* is abundantly distinct. *A. maritimus* is a stout and stoloniferous non-cespitose species with conspicuously distichous divergent leaves, racemes (FIG. 5) partly included and 4–6 cm. long, the spikelets 8–10 mm. long.

Whether the break in the range of *A. praematurus* (Southeastern Virginia, reappearing in southeastern South Carolina) is an actual one may be doubted. It is probable that the species occurs also in southeastern North Carolina, a region sharing many of the peculiar plants of Southeastern Virginia.

In PLATE 626, FIG. 1 is the type of *Andropogon praematurus*, × ½; FIG. 2, a raceme, × 1, from the TYPE; FIG. 3, upper half of raceme, × 5, from TYPE; FIG. 4, raceme, × 1, of *A. divergens* Anderss., from near Alba, Texas, *Cory*, no. 25,510; FIG. 5, raceme, × 1, of *A. maritimus* Chapm., from Horn Island, Mississippi, *Tracy*, no. 3786.

*A. VIRGINICUS L., var. GLAUCUS (Muhl.) Hack. (*A. capillipes* Nash). NANSEMOND COUNTY: dry white sand of pine barrens, east of Cox Landing, south of South Quay, no. 10,943. See pp.

[11] *Andropogon maritimus* and *A. divergens* were treated by Hackel as *A. scoparius* Michx., subsp. *maritimus*, α. *genuinus* and β. *divergens*, Hackel, Androp. (in DC. Mon. Phan. vi.), 385 (1889), the subspecies distinguished by the staminate pedicelled spikelets. Var. *divergens* was based upon a specimen from Texas which bore the herbarium name *A. divergens* Anderss., published in synonymy by Hackel. Taken up as a species its author is Andersson ex Hackel in syn., not *A. divergens* (Hackel) Anderss., the authorship ascribed to it by Hitchcock. Andersson died nine years before his manuscript name was published by Hackel. In RHODORA, xxxvii. 143, 144 (1935), Griscom and I wholly misinterpreted *A. divergens*. The plant there called by us *A. scoparius*, var. *divergens* is var. *polycladus* Scrib. & Ball.

First from north of southern North Carolina.

A. virginicus, var. tetrastachyus (Ell.) Hack. To the single recorded Virginian station (at Cape Henry; see Fernald & Griscom in Rhodora, xxxvii. 142) add two in Nansemond County: seeping bank of ditch at margin of woods, about 2 miles southeast of Cleopus, no. 9513; dry white sand of pine barrens, east of Cox Landing, south of South Quay, no. 10,944.

Andropogon virginicus L., var. hirsutior (Hackel) Hitchc., forma **tenuispatheus** (Nash), comb. nov. *A. glomeratus tenuispatheus* Nash in Small, Fl. Se. U. S. 61 (1903). *A. tenuispatheus* (Nash) Nash in N. Am. Fl. xvii. 113 (1912). *A. virginicus* var. *tenuispatheus* (Nash) Fernald & Griscom in Rhodora, xxxvii. 142 (1935).

Forma *tenuispatheus* seems to be only a glabrous form of the hirsute-sheathed var. *hirsutior.* In making the transfer of the name *tenuispatheus* as a variety to *A. virginicus,* with var. *hirsutior* as a hirsute form, *A. virginicus,* var. *tenuispatheus,* forma *hirsutior* (Hackel) Fern. & Grisc. l. c. (1935), Griscom and I overlooked the fact that as a varietal name *A. macrourus,* γ. *hirsutior* Hackel (1889) has priority over *A. glomeratus tenuispatheus* Nash (1903).

(To be continued)

A CENTURY OF ADDITIONS TO THE FLORA OF VIRGINIA

M. L. Fernald

(*Continued from page 416*)

*Cyperus rivularis Kunth, forma elutus (C. B. Clarke) Kükenth. James City County: tidal marsh along Powhatan Creek, north of Jamestown Island, no. 10,946; similar habitat, Gordon Creek, east of Barrat's Bridge (or Ferry), no. 11,260.

Apparently all the plants of tidal estuaries from southern Maine southward belong to forma *elutus*, with nearly colorless scales. The type of var. *elutus* C. B. Clarke, was from Pennsylvania, without designation of locality. In the tidal marshes the form becomes very tall (up to 6 dm. high). See p. 394.

C. haspan L., var. americanus Boeckeler. Tidal estuaries of the James and the Chickahominy and tributary creeks inland to Charles City and New Kent Counties, also tidal marshes of Back Bay (many nos.). See pp. 376 and 386 and map 9.

American variety of a pantropical type, reaching essentially equivalent latitudes north and south of the Equator in North and South America.

C. globulosus Aublet.

This adventive species, rapidly spreading as a weed, often forms dense carpets in dooryards, where, mowed at frequent intervals, it maintains a good, green carpet through the midsummer heat. It thus becomes an uninvited "lawn grass" of some value.

*C. brevifolius (Rottb.) Haussk. (*Kyllinga brevifolia* Rottb.). James City County: fresh tidal marsh of Chickahominy River, below Barrat's Bridge (or Ferry), no. 11,266. See p. 395 and map 21.

First known area north of Georgia, except that on the lower Delaware. Like *Cyperus haspan* (see above), *C. brevifolius* is a pantropical type, with dispersal which suggests great antiquity, although in some areas it is evidently a recent adventive; and, like *C. haspan* var. *americanus*, its eastern American limits north and south of the Equator are in equivalent latitudes.

Eleocharis tenuis (Willd.) Schultes, var. verrucosa Svenson. To the station in Dinwiddie County, recorded in 1938, add one in Greensville County: peaty swale by Southern Railway, northeast of Emporia, no. 10,137. See p. 360.

Dichromena colorata (L.) Hitchc. To the station recorded in Rhodora, xxxix. 396, add another, also in Princess Anne County: inner border of brackish to fresh marsh along Back Bay, at eastern margin of Long Island, no. 10,539. See pp. 370 and 371.

Psilocarya scirpoides Torr., var. Grimesii Fern. & Grisc. in Rhodora, xxxvii. 154, pl. 344 (1935). To the two original stations add a fine one in Nansemond County: seepy sandy and peaty open spots in sphagnous savannah-like swale east of Cherry Grove, south of South Quay, no. 11,530. See p. 384.

Bulbostylis ciliatifolius (Ell.) Fernald in Rhodora, xl. 391 (1938). Local range extended northward in Southampton County and eastward into Nansemond County (many nos.). See pp. 362 and 379.

Scirpus debilis Pursh. Dinwiddie County: springy sphagnous swale about 5 miles east of Burgess Station, no. 10,970.

South of the Potomac chiefly a plant of the interior of the State. We have met it nowhere else on the Coastal Plain. See p. 390.

S. atrovirens Muhl., var. flaccidifolius Fern. in Rhodora, xl. 396 (1938). Range extended into Greensville County: wooded bottomland of Fontaine Creek southeast of Taylor's Millpond, nos. 10,140, 10,544. Sussex County: bottomland swamp, Nottoway River, southwest of Homeville, no. 10,141. See p. 359.

By mid-July the over-lopping and drowned inflorescences freely proliferate in the manner of the two following.

S. divaricatus Ell. Local range extended eastward into Nansemond County: border of gum swamp at margin of Great Dismal Swamp, southeast of Whitemarsh School, no. 11,532, old culms prostrate, freely proliferating and rooting at nodes. See p. 400.

S. FONTINALIS Harper, var. VIRGINIANA Fern. in RHODORA, xli. 532 (1939). Range extended northward across the James to JAMES CITY COUNTY: swampy woods along Powhatan Creek, north of Jamestown Island, no. 10,974, old culms arching and trailing, the inflorescences producing many rooting young plants. See p. 386.

ERIOPHORUM VIRGINICUM L. DINWIDDIE COUNTY: springy sphagnous swale about 5 miles east of Burgess Station, no. 10,975. PRINCESS ANNE COUNTY: swampy and inundated woods, north of Blackwater River, no. 3779.

It is not known where Clayton got his material, cited by Gronovius and by Linnaeus, nor the exact geographic source of the plant said to be from Virginia, described and illustrated by Plukenet. The species is frequent along the Blue Ridge and the Appalachian Upland but we have only twice met it on the Coastal Plain, although Britton & Hollick collected it in late September, 1890, in the Great Dismal Swamp in Nansemond County, along "the old canal" from Suffolk, where "masses of *Eriophorum Virginicum* were frequent."—Hollick in Mem. Torr. Bot. Cl. ii. 56 (1890). See p. 390.

*FUIRENA BREVISETA Coville. DINWIDDIE COUNTY: springy sphagnous swale about 5 miles east of Burgess Station, no. 10,976.

Extension north from North Carolina. See p. 390.

*RHYNCHOSPORA MACROSTACHYA Torr., var. **colpophila** Fernald & Gale, var. nov., planta 0.8–1.75 m. alta; foliis valde elongatis subflaccidis; achaeniis 3–3.8 mm. latis 5–5.8 mm. longis; tuberculis 1.8–2.3 mm. longis basi 1.8–2.4 mm. latis.—Tidal marshes of the Chesapeake Bay drainage, Maryland and Virginia. MARYLAND: very rare, swamps near Marshall Hall, September 28, 1898, *Th. Holm;* Chesapeake Beach Railroad at Patuxent River, August 27, 1902, *Geo. H. Shull,* no. 283. VIRGINIA: Fairfax County: low wet woods, near Accotink Bay, Camp Humphreys, October 12, 1924, *S. F. Blake,* no. 8915. King William County: fresh tidal shore of Mattaponi River, at Horse Landing, near King William Courthouse, October 14 and 16, 1939, *Fernald & Long,* no. 11,536. New Kent County: fresh tidal marsh by Chickahominy River, at "Shady Rest", southeast of Windsor Shades (Boulevard Postoffice), September 16, 1939, *Fernald & Long,* no. 11,273; open marsh of Chickahominy River, Lanexa, July 30, 1921, *Grimes,* no. 4155. Charles City County: fresh tidal marsh along Kittewan Creek, Weyanoke, September 18, 1939, *Fernald & Long,* no. 11,274. James City County: muddy tidal marsh along Gordon Creek, east of Barrat's Bridge (or Ferry), September 19, 1939, *Fernald & Long,* no. 11,275; tidal marsh along Powhatan Creek, north of Jamestown Island, August 22, 1939, *Fernald & Long*, no. 10,977. Prince George County: muddy tidal shore of James River, Jordan Point, August 16, 1938, *Fernald & Long*, no. 8983 (TYPE in Herb. Gray). See pp. 386, 393 and 401.

As noted by me in RHODORA, xli. 533 (1939), *Rhynchospora macrostachya* is known on the Coastal Plain of Virginia only from the acid Great Dismal Swamp and from the tidal estuaries entering Chesapeake Bay. The plant of the tidal shores is extraordinarily large, with prolonged and almost flaccid leaves. Miss Shirley Gale, engaged in an intensive study of the genus, has made measurements which give the following contrasts.

Typical RHYNCHOSPORA MACROSTACHYA: plant 4.5 (in dwarf specimens down to 1)–11.3 dm. high, in the Southeast becoming taller; leaves firm, 0.35–1.2 cm. broad; achene 5–5.4 mm. long, 2.6–3.1 mm. broad; tubercle 1.7–2 (rarely –2.2) cm. long, 1–1.8 mm. broad at base.

Var. COLPOPHILA: plant 0.8–1.75 m. high; leaves very long, subflaccid, 0.9–1.5 cm. broad; achene 5–5.8 mm. long, 3–3.8 mm. broad; tubercle 1.8–2.3 cm. long, 1.8–2.4 mm. broad at base.

Var. *colpophila* is a member of the remarkable flora which characterizes the tidal reaches of the Chesapeake, a group of endemic and isolated species specially discussed in Part III.

THE VARIETIES OF RHYNCHOSPORA CEPHALANTHA.—In 1935 I pointed out[12] that the type of *Schoenus axillaris* Lam. (1791), which is the nomenclatural basis of *Rhynchospora axillaris* (Lam.) Britton (1888), can have nothing to do with the plant with subspherical glomerules to which Britton had applied it. I then showed that the first clearly identifiable binomial in this series is *R. cephalantha* Gray in Ann. Lyc. N. Y. iii. 218 (1835); and I took up *R. cephalantha* in the inclusive sense of Gray and recognized *R. microcephala* Britton as a species on account of more numerous and more remote and smaller glomerules of smaller spikelets with smaller achenes with more slender tubercle.

During the summer and autumn of 1938 and again in 1939 Mr. Long and I were much perplexed by the series, for it was noted that in bogs where deep sphagnum prevails plants very close to typical New Jersey *R. cephalantha* occur, but that in inundated pinelands and shallow pools there is a much coarser plant, with achenes and spikelets of *R. cephalantha*, the glomer-

[12] Fernald in RHODORA, xxxvii. 403–405, plate 391 (1935).

ules tending to be very numerous and remote and the broad leaves remaining flat, whereas typical *R. cephalantha* has the narrow leaves soon becoming involute and the few glomerules less scattered. Miss Shirley Gale has joined me in a detailed study of the series and we are recognizing two well defined varieties of *R. cephalantha.* See p. 366.

*R. CEPHALANTHA Gray, var. **typica** Fernald & Gale. *R. cephalantha* Gray in Ann. Lyc. N. Y. iii. 218, as to plant of Torrey from New Jersey and Long Island (1835); Torrey, Fl. N. Y. ii. 365 (1843); Gray, Man. 533 (1848); Fernald in RHODORA, xxxvii. 404, pl. 391, figs. 2 and 3 (1935). *R. axillaris* Britton in Bull. Torr. Bot. Cl. xv. 104 (1888) as to plant, in part, not as to name-bringing synonym, *Schoenus axillaris* Lam.—Culms 5.7–9 dm. high; leaves 1.5–2.5 (–3) mm. broad, tending to become strongly inrolled in drying; glomerules chiefly confined to the summit or the upper fifth of the culm, terminal or in 1 or 2 (rarely 3) upper axils, the lowest then 2–10 (–15) cm. apart; mature glomerules 1.5–2 cm. in diameter; spikelets castaneous to blackish-fuscous, 5–6 mm. long; achenes 2–2.4 mm. long, 1.4–1.6 mm. broad; tubercle 1.8–2.4 mm. long; bristles 3.8–4.8 mm. long.—Wet pine barrens and bogs, Long Island, New Jersey and Delaware; southeastern Virginia, eastern North Carolina and southeastern South Carolina. The following are the more southern specimens. VIRGINIA: argillaceous and siliceous boggy depression southeast of Petersburg, at head of Poo Run, Prince George County, June 19, 1936, *Fernald, Long & Smart,* no. 5661, with scattered glomerules (as *R. microcephala*), July 18, 1936, *Fernald & Long,* no. 6090 (distributed as *R. microcephala*); sphagnous argillaceous boggy depression just northwest of Wakefield, Sussex County. September 11, 1937, *Fernald & Long,* no. 7352 (as *R. microcephala*); sphagnous bog about 1 mile northeast of Dahlia, Greensville County, July 15, 1938, *Fernald & Long,* no. 8610. August 20, 1938, *Fernald & Long,* no. 8993. NORTH CAROLINA: sphagnous bog at Method, Wake County, July 13, 1938, *R. K. Godfrey,* no. 4985 (transition to var. *pleiocephala* in its distant glomerules); drainage ditch at Carolina Beach, New Hanover County, June 24, 1938, *Godfrey,* no. 4719 (broad leaves of var. *pleiocephala*); savannah 12 miles north of Jacksonville, Onslow County, August 6, 1938, *Godfrey,* no. 5756: savannah 5 miles east of Jacksonville, Onslow County, August 6, 1938, *Godfrey,* no. 5808. SOUTH CAROLINA: grass-sedge bog or savannah, 12 miles north of Georgetown, Georgetown County, August 2, 1939, *Godfrey & Tryon,* nos. 752a, 1061; drainage ditch, 3 miles north of McClellanville, Charleston County, July 19, 1939, *Godfrey & Tryon,* no. 677.

Much of the material from southeastern Virginia has 3 or 4 remote glomerules, whereas 2 glomerules are more general in New Jersey. Plants with only 2 glomerules occur, however, in Virginia and exceptional New Jersey specimens show 1, 3 or 4.

*Var. **pleiocephala** Fernald & Gale, var. nov., culmis crassis 0.6–1.2 m. altis; foliis planis 2.5–4.5 mm. latis; inflorescentiis 1.4–5 dm. longis, glomerulis axillaribus 4–7 remotis 1.2–2 cm. diametro, imis 0.6–1.8 dm. distantibus; spiculis fulvis vel castaneis 5 mm. longis; achaeniis 2.1–2.5 mm. longis 1.4–1.6 mm. latis; tuberculis 1.4–2.2 mm. longis; setis 3–4.4 mm. longis.—Swamps, pond-holes, wet pinelands and ditches, southeastern Virginia to Florida and Louisiana. VIRGINIA: abundant and dominating an exsiccated argillaceous pond-hole in woods, about 1 mile south of Mercy Seat Church, Surry County, August 23, 1938, *Fernald & Long,* no. 8994 (TYPE in Herb. Gray), October 15, 1938, *Fernald & Long,* no. 9549: dominant in flat sphagnous pineland, Collier's Yard, 3–4 miles southwest of Petersburg, Dinwiddie County, July 16, 1939, *Fernald & Long,* no. 10,548; same station, August 17, 1939, *Smith & Hodgdon* in Pl. Exsic. Gray.; pond-hole in pine and oak woods near Three Creek, north of Emporia, Greensville County, September 9, 1938, *Fernald & Long,* no. 9283. NORTH CAROLINA: pineland at Nakina, Columbus County, August 29, 1938, *R. K. Godfrey,* no. 6347; low pineland at Dunn, Harnett County, August 25, 1938, *Godfrey,* no. 6122; without stated locality (presumably near Wilmington), *M. A. Curtis;* ditches near Wilmington, July 2, 1897, *Biltmore Herb.,* no. 279[a]. SOUTH CAROLINA: Santee Canal, August, ——, *Ravenel* (as *R. cymosa*); sandy drainage ditch, 2 miles west of Salters, Williamsburg County, July 14, 1939, *Godfrey & Tryon,* no. 504; gum-swamp depression in savannah, 15 miles north of Georgetown, Georgetown County, June 24, 1939, *Godfrey & Tryon,* no. 62; grass-sedge bog or savannah, 12 miles north of Georgetown, August 2, 1939, *Godfrey & Tryon,* no. 752; shallow peaty pond in pine barren, 9 miles north of Georgetown, July 21, 1939, *Godfrey & Tryon,* no. 759; boggy ditch in pine barrens, 2 miles east of Meggett, Charleston County, July 16, 1927, *Wiegand & Manning,* no. 582 (as *R. axillaris*); drainage ditch, 3 miles north of McClellanville, Charleston County, July 19, 1939, *Godfrey & Tryon,* no. 675. GEORGIA: Waycross, August 18, 1909, *H. A. Lang* (Phil. Acad.); wet meadow, Leslie, Sumter County, August 17, 1900, *Harper,* no. 413 (as *R. axillaris*). FLORIDA: low "rich" places, near Jacksonville, August ——, *Curtiss,* no. 3144; swampy places in pine barrens near Jacksonville, June 18, 1894. *Curtiss,* no. 5016 (as *R. axillaris*); cypress swamp, vicinity of Eustis, Lake County, May 16–31, 1894, *Nash,* no. 845 (as *R.*

axillaris); swamp, Okeechobee region, Brevard County, May 14, 1903, *Fredholm*, no. 5821 (as *R. fascicularis*); swamp on prairie, Okeechobee region, October 29, 1903, *Fredholm*, no. 6175 (as *R. axillaris*); bogs and shady swamps, Apalachicola, July–August, ——, Chapman in *Biltmore Herb.* no. 279[b]. MISSISSIPPI: tidal marsh on Bilox Bayou, Harrison County, September 17, 1885, *Donnell Smith;* Wisdom, June 14, 1897, *Tracy*, no. 3418 (as *R. axillaris*); moist open pine woods, 2 miles west of Bay St. Louis, Hancock County, June 25, 1938, *D. S. & H. B. Correll*, no. 9103. LOUISIANA: low moist grassy soil of open prairie, 3 miles east of Robert, Tangipahoa Parish, July 2, 1938, *D. S. & H. B. Correll*, no. 9317; open pine-land, north of Abita Springs, St. Tammany Parish, August 12, 1912, *Pennell*, no. 4137 (Phil. Acad.).

A single collection from New Jersey (Quaker Bridge, October 12, 1859, *Wm. Boott*) is as coarse as *R. cephalantha*, var. *pleiocephala* but its few glomerules place it nearer var. *typica*. *Godfrey*, no. 4985, from Wake County, and his no. 4719 from New Hanover County, North Carolina (see var. *typica*) are also transitional.

The coarse southeastern plant which we are calling *Rhynchospora cephalantha*, var. *pleiocephala* was recognized by Gray when he originally described *R. cephalantha;* and he gave the latter name rather than the original manuscript *R. biceps* of Torrey because of the southern specimens (from Wilmington, North Carolina, to Florida and Louisiana). The original material which Torrey had designated *R. biceps* and which formed the primary basis of *R. cephalantha* was the plant of the Pine Barrens of New Jersey (and of Babylon, Long Island); the coarser several-headed plant of the South was appended to it by Gray and caused his rejection of Torrey's name. Gray's comment was as follows:

> OBS. This interesting species was discovered by Prof. Torrey several years since, in the pine barrens of New Jersey and on Long Island; and as in these localities it occurs, for the most part, with only two heads, it received the name of *R. biceps*. Our specimens from the southern states, however, have uniformly more than two heads, and often six or seven. I have therefore ventured to substitute for the manuscript name of Prof. Torrey, one which is in a good degree characteristic of the species.

Later, however, in 1848, Gray (Man. 533) restricted the range of *R. cephalantha* to "Long Island and New Jersey." We are, therefore, maintaining this more slender extreme of the species as var. *typica*.

*Rhynchospora **chalarocephala** Fernald & Gale, sp. nov. (fig. 1 et 2), planta cespitosa, culmis gracilibus 1.8–8.3 dm. altis; foliis lineari-involutis 1– rare 2 mm. latis imis confertis; glomerulis 3–7 remotis turbinatis vel laxe subhemisphaericis plerumque 2–5-lobatis 0.9–1.8 cm. diametro; spiculis laxe adscendentibus vel explanatis; floribus solitariis; achaenio lenticulari-obovoideo laevi lucido 1.4–1.7 mm. longo 0.9–1 mm. lato marginato basi angustissime attenuato, tuberculo angusto subulato basi quam achaenii apicem valde angustiore 1–1.6 mm. longo; setis 6 retrorse barbellatis tuberculo aequalibus vel id leviter superantibus 2.8–3.8 mm. longis.—New Jersey to South Carolina. New Jersey: wet pine barrens, Sims Place, Burlington County, September 10, 1935, *J. A. Drushel & H. K. Svenson,* no. 6860 (as *R. glomerata,* var. *minor*); Atsion, Burlington County, September 21, 1895, *B. Heritage* (Phil. Acad.); Pleasant Mills, Burlington County, September 24, 1887, *C. A. Gross* (Phil. Acad.); peaty, sandy bank along West Branch of Wading R., Harrisville, Burlington County, July 21, 1932, *Fogg,* no. 4545 (Phil. Acad.); peaty bog, near Beaver Branch of Wading R., southwest of Calico, Burlington County, July 28, 1937, *Long,* no. 50,935 (Phil. Acad.); Parkdale, Camden County, August 17, 1905, *S. Brown,* no. 56 (Phil. Acad.), September 1, 1911, *Pennell,* no. 3570 (Phil. Acad.); peaty and sphagnous pond-hole depression near Hardingville, Gloucester County, August 8, 1935, *Long,* no. 47,134 (Phil. Acad.); Weymouth, Atlantic County, August 15, 1883, *C. A. Gross* (Phil. Acad.); Atlantic Cranberry Meadows, Weymouth, August 26, 1922, *G. W. Bassett* (Phil. Acad.); moist pine barrens, Egg Harbor City, Atlantic County, August 10, 1913, *Mackenzie,* no. 5558 (herb. N. Y. Bot. Gard.); Maurice River flats, east of Vineland, Cumberland County, August 12, 1923, *Bassett & Long* (Phil. Acad.); wet peaty margin of East Creek Pond, East Creek, Cape May County, September 25, 1920, *Long,* no. 23,461 (Phil. Acad.); wet peaty pond-hole about 1 mile west

Rynchospora chalarocephala: fig. 1, achene, × 10; fig. 2, summit of inflorescence, × 1.

R. microcephala: fig. 3, achene, × 10; fig. 4, summit of inflorescence, × 1.

of Bennett, Cape May County, September 26, 1920, *Long*, no. 23,488 (Phil. Acad.); moist sandy and peaty margin of pond-hole northwest of Ocean View, Cape May County, *Long*, no. 25,007 (Phil. Acad.); swamp 1 mile west of Dennisville, Cape May County, August 16, 1925, *R. R. Driesbach*, no. 3869 (Phil. Acad.); swamp, "Head of River", Tuckahoe River, Cape May County, August 23, 1925, *Driesbach*, no. 3982 (Phil. Acad.). DELAWARE: moist soil, Lewes, August 15, 1895, *Commons* (Phil. Acad.). VIRGINIA: without definite locality, *John Ball* (as *R. glomerata*, var.); sandy and peaty border of Cat Pond, south of Benns Church, Isle of Wight County, September 18, 1937, *Fernald & Long*, no. 7357 (distrib. as *R. microcephala*), TYPE in Herb. Gray. NORTH CAROLINA: sandy soil, Beaufort (Cartaret County), August, 1903, *Ruth*, no. 9 (with memorandum, "Seems to be *R. glomerata* but I am not sure of it; the leaves are too setaceous for that"); drainage ditch near Hubert, Cartaret County, August 6, 1938, *Godfrey*, no. 5844 (as *R. glomerata*, exceptionally large plant with several glomerules borne in branching axillary cymes); pineland at Atlantic, Cartaret County, September 1, 1938, *Godfrey*, no. 6427 (as *R. glomerata*, var. *minor*); savannah 8 miles southwest of Jacksonville, Onslow County, September 1, 1938, *Godfrey*, no. 6469 (as *R. glomerata*, var. *minor*); savannah 12 miles north of Jacksonville, August 6, 1938, *Godfrey*, no. 5753 (as *R. glomerata*, var. *minor*); Pender County, September, 1880, *Hyams*, no. 4979 (herb. N. Y. Bot. Gard.); dried-out road-making sand-pit, 4 miles east of Bolton, Columbus County, July 5, 1927, *Wiegand & Manning*, no. 581 (as *R. axillaris*); Southport, Brunswick County, August 13, 1930, *Blomquist* (as *R. microcephala*). SOUTH CAROLINA: shrub-bog, 3 miles east of Georgetown, Georgetown County, July 21, 1939, *Godfrey & Tryon*, no. 774; grass-sedge bog or savannah, 12 miles north of Georgetown, August 2, 1939, *Godfrey & Tryon*, no. 1060; sandy drainage ditch, west of Salters, Williamsburg County, July 14, 1939, *Godfrey & Tryon*, no. 514; marshy border of lake, 8 miles southeast of Columbia, Lexington County, August 8, 1939, *Godfrey & Tryon*, no. 1339; damp soil, Aiken, July 28, 1866, *H. W. Ravenel* (as *R. cephalantha*?). FLORIDA: swamps, Sanford, November 3, 1927, *S. Rapp* (herb. N. Y. Bot. Gard.).

Rhynchospora chalarocephala (from the loose heads) belongs to § *Eurhynchospora*, series *Glomeratae*, having the characteristic "wire-edged" smooth and lustrous umbonate obovoid achene drawn out at base into a pronounced slender stipe. As shown by the original identifications, it has been (often with doubt) placed in *R. glomerata*, *R. capitellata* (*R. glomerata*, var. *minor*), *R. "axillaris"*, *R. cephalantha* and *R. microcephala.* Its closest affinity is with *R. microcephala,* since it has the spikelets 1-flowered, *R. glomerata* and *R. capitellata* having two or more florets to each spikelet, or, if with only one true floret, then with one or more terminal rudiments. Its tightly inrolled scales and small achenes also place it with *R. microcephala.* From that species (FIGS. 3 and 4) it is distinguished in gross aspect by the character of the inflorescence. This is composed of 3–7 remote glomerules which are turbinate or subhemispherical at full development. Never tightly compacted, they are often subdivided into a cluster of as many as 5 smaller secondary and mostly approximate fascicles, thus suggesting the inflorescences of *R. glomerata* and *R. capitellata.* As may be deduced from the shape of the fascicles, the spikelets are mainly ascending to loosely spreading, more rarely divergent.

R. microcephala, on the other hand, as shown by the type, kindly placed at our disposal by Dr. A. C. Smith and Mr. Wittrock, and as illustrated in Rhodora, xxxvii. t. 391, figs. 1 and 5 (1935), has the inflorescence normally composed of 4–6 remote globose heads, the spikelets of which are closely compacted, ascending to reflexed, thus presenting a solid aspect. Specimens of *R. microcephala* collected in shaded or unfavorable habitats may simulate *R. chalarocephala,* but in no case do they have the lateral glomerules lobed or forked. The basal leaves also afford a diagnostic character of secondary importance. Those of *R. microcephala* are commonly 1.5–3 mm. broad, and flat. In *R. chalarocephala,* however, they are rarely 2 mm. wide, being usually narrower, even to subfiliform, and usually involute in age. In borderline cases, where the gross appearance of the two species is similar, the identity can be determined by study of the mature achenes. Those of *R. chalarocephala* (FIG. 1), although of the same length and breadth as in *R. microcephala* (FIG. 3) usually have the longer and narrower stipe passing more abruptly to the main body of the achene, which is, therefore, proportionally shorter.

The ranges of *R. microcephala* and *R. chalarocephala* overlap, but their relative distribution varies. The former species, ranging from New Jersey southward along the Coastal Plain, is local in New Jersey but attains a maximum development in southeastern Virginia and eastern North Carolina, dwindling, though locally present, in South Carolina, Georgia, Florida, Alabama and Mississippi. *R. chalarocephala* is relatively common at its northern limit in New Jersey and, although we have seen only two collections (one without stated locality) from Virginia, it is apparently common in eastern North and South Carolina. We have found only one collection from Florida.

[RHYNCHOSPORA DODECANDRA Baldw. In RHODORA, xxxix. 328 and 389 (1937), I recorded this species as occurring near the Crater in Prince George County (no. 5652). The material is too young and repeated search has failed to reveal *R. dodecandra* there. Suspecting its identity Miss Gale and I have restudied it. It proves to be very young *Juncus biflorus* Ell., the flower-buds being those of *Juncus*. *Rhynchospora dodecandra* thus drops from the Virginia flora. This misidentification is inexcusable, more absurd than the once reported occurrence of *R. macrostachya* in Vermont, based upon insect-galls on *Juncus canadensis!*]

*R. PALLIDA M. A. Curtis. NANSEMOND COUNTY: sphagnous savannah-like swale east of Cherry Grove, south of South Quay, no. 10,550, forming large stools 1.1 m. high.

The first station between southeastern North Carolina and southern Delaware. See p. 381 and MAP 14.

R. PERPLEXA Britton. Local range extended to DINWIDDIE COUNTY: flat pineland, Collier's Yard, 3–4 miles southwest of Petersburg, no. 10,981. SURRY COUNTY: exsiccated argillaceous pond-hole in woods, about 1 mile south of Mercy Seat Church, no. 8989. See p. 382.

R. DISTANS (Michx.) Vahl. To the single small station in Isle of Wight County, reported in RHODORA, xxxix. 391 (1937), add from NANSEMOND COUNTY: wet peaty pine barrens, east of Cox Landing, south of South Quay, nos. 10,551–10,554, ranging in height from 2 dm. to 1 m.; similar habitat, southeast of Sandy Landing, south of South Quay, no. 10,980. See p. 379.

CAREX CRUS-CORVI Shuttlew., var. VIRGINIANA Fern. Local range extended into GREENSVILLE COUNTY: wooded bottomland of Fontaine Creek southeast of Taylor's Millpond, no. 10,154. SOUTHAMPTON COUNTY: wooded bottomland of Meherrin River, south of Hugo, no. 10,155.

Both stations within a mile of North Carolina!

C. FRANKII Kunth. Local range extended to the coast. PRINCESS ANNE COUNTY: in low woods along Back Bay, Long Island, no. 10,557. See p. 371.

*C. INTUMESCENS Rudge × LOUISIANICA Bailey. Plants clearly of this origin, cespitose like *C. intumescens* but with elongate pistillate spikes suggestive of those of *C. louisianica,* local in Sussex County: wooded bottomland, Jones Hole Swamp, west of Coddyshore, June 18, 1939, no. 10,174.

Arisaema. In view of the revision in Rhodora, xlii. 247–254, plates 598–600, the following are recognized on the Coastal Plain of Virginia.

A. triphyllum (L.) Schott. (*A. pusillum,* forma *pallidum* E. H. Eames). Princess Anne County: rich woods, Great Neck, *Fernald & Griscom,* no. 4351; Little Neck, no. 3822. Prince George County: rich deciduous woods, Coggins Point, no. 9703. Henrico County: dark shady places, University of Richmond, Westhampton, May, 1933, *Harriet M. Walton.* Southampton County: sphagnous pocket in rich deciduous woods northeast of Statesville, no. 8176; rich wooded slopes and spring-heads along Nottoway River, above Carey Bridge, no. 11,799. Type a Clayton specimen from Virginia.

A. triphyllum, forma pusillum (Peck) Fern. Princess Anne County: rich woods, Great Neck, *Fernald & Griscom,* no. 4350. Henrico County: damp woods, Westhampton, April 25, 1935, *Alice Ryland.* Southampton County: rich wooded slopes and spring-heads along Nottoway River, above Carey Bridge, no. 11,800.

[A. atrorubens (Ait.) Blume. Fruiting plants, not showing the fresh spathes, but referable to the species, common. We have seen no typical *A. atrorubens,* with unstriped full-purple hood.]

A. atrorubens, forma zebrinum (Sims) Fern. Prince George County: rich wooded ravine southeast of Hopewell, no. 9702; sandy alluvial woods, bottomland of Powell Creek, Garysville, no. 7785.

*A. atrorubens, forma viride (Engler) Fern. Princess Anne County: damp woods, Virginia Beach, *Fernald & Griscom,* no. 4349. Prince George County: rich deciduous woods, Coggins Point, no. 9704; sandy alluvial woods, bottomland of Powell Creek, Garysville, no. 7784. Sussex County: wooded bottomlands and swampy woods near Nottoway River, east of Stony Creek, no. 8175.

Are two Species passing as Peltandra virginica? On p. 360 I emphasized the marked differences in the freshly flowering material of the more northern and more southern plants which pass as *Peltandra virginica.* The two extremes are striking in fresh condition but, as in most aroids, the herbarium specimens are almost hopeless to make out. I am, therefore, merely showing photographs of characteristic fresh and passing spathes and a flowering spadix of each, × 1.

PLATE 627 is of the southern plant, common in southeastern Virginia, thence to Georgia. It is characterized by the loosely opening white-margined spathe (FIG. 1) which, at the base of the limb soon becomes deliquescent (FIG. 3), the limb coming squarely off by circumscission. The summit of the orange-yellow spadix (FIGS. 2 and 4) is sterile or only weakly floriferous. The photographs were made from fresh material collected by the Appomattox River at Petersburg, Virginia, in June, 1940.

PLATE 628 is of the northern plant, occurring at least from southern Maine to New Jersey and Pennsylvania. Its greener, though pale-margined spathe (FIGS. 1 and 2) barely opens or is tightly rolled. The limb decays away, leaving a stub at the summit of the fruit (FIG. 3); and the whitish spadix (FIG. 4) flowers to the tip. The photographs are from fresh material collected in June, 1939, by Dr. Lyman B. Smith in Aberjona River, Winchester, Massachusetts.

As stated, I am unable from herbarium material to reach a decision as to the importance of these characters. I merely present the problem, with the hope that many others will carefully watch and most carefully collect the plants from New England southward and westward, recording their observations on the degree of opening of spathe, circumscission or gradual rotting off of the limb, color of spadix and whether it flowers to the tip. If someone will volunteer to collate the material and reach a decision I shall be greatly relieved.

When it is clearly settled whether we have two species or two well defined geographic varieties, the names must be carefully weighed. The Linnean type is now underground and not available and those of Rafinesque are, if preserved, presumably also in European herbaria. Whether they would show more than most existing material in modern herbaria is questionable; but, until they are all traced and carefully considered and it is determined whether the contrasts evident in Virginia and from Pennsylvania to Maine are constant, it is, I feel, premature to make a decision which, at best, would be only tentative and too liable to upset. In 1890 Sereno Watson,[13] stating that

[13] Watson, Proc. Amer. Acad. xxv. 187 (1890).

"Extreme forms received from Mr. A. Commons of Wilmington, Del., seemed to indicate that two species might perhaps be distinguished", went extensively into the matter. He studied the flowers, staminodia, ovaries and their number, and other technical characters from variable fresh material. Besides the Commons material (with both open and tightly rolled spathes) and the Cambridge material, Watson had several lots of specimens (now showing little) sent by J. N. Rose from near Washington. His conclusion was that "a study of the forms growing near Cambridge shows that no division can be safely made". With relatively little experience in the group and a profound ignorance of the more technical characters, I hesitate, as stated, to make a hasty decision.

As to the names, the following must be carefully considered: *Arum virginicum* L. and at least 9 proposed for species by Rafinesque; it must also be determined to which species or variety the formal names proposed by Blake apply. The final solution, I feel, should be deferred until the applications of the 10 specific names and the several formal ones can be satisfactorily determined.

Eriocaulon Parkeri Robinson. To Grimes's station at Lanexa, add the following. King William County: fresh tidal shore of Mattaponi River, at Horse Landing, near King William Courthouse, no. 11,539. New Kent County: fresh tidal marsh by Chickahominy River, at "Shady Rest", southeast of Windsor Shades (Boulevard Postoffice), no. 11,538. Charles City County: sandy tidal shore of James River at "Four Oaks", below Harrison Point, no. 11,282. James City County: tidal mud along Powhatan Creek, north of Jamestown Island, no. 10,988. Nansemond County: muddy tidal margin of Blackwater River, Cox Landing, south of South Quay, no. 11,283. See pp. 386, 391, 399 and 401 and map 17.

The last station is near the head of tide on a river tributary to the Chowan in North Carolina. The plant should confidently be sought in the latter state.

Lachnocaulon anceps (Walt.) Morong. Local range extended eastward into Nansemond County: sphagnous savannah-like swale east of Cherry Grove, south of South Quay, no. 10,563. See p. 381.

Xyris ambigua Beyrich. Local range extended eastward to Nansemond County: sphagnous savannah-like swale east of

Cherry Grove, south of South Quay, no. 10,567, gigantic stools up to 3 dm. in diameter at base.

*XYRIS CAROLINIANA Walt., forma **flaccida,** f. nov., foliis submersis flaccidis 5–8 mm. latis plerumque 2–4.5 dm. longis translucentibus vel opacis 11–23-nerviis.—Tidal and perhaps other submersed areas, southeastern Pennsylvania, southern New Jersey, eastern Delaware and southeastern Virginia. PENNSYLVANIA: sandy-muddy tidal shore of Delaware River, southeast of Tullytown, Bucks County, September 6, 1927, *Long*, no. 33,786 (Herb. Phil. Acad.). NEW JERSEY: Mullica River, below "the Forks", Atlantic County, August 21, 1910, *Long*, no. 4727; tidal marsh, within 1 mile south of Catawba, along Great Egg Harbor River, August 6, 1937, *Long*, no. 51,208 (TYPE in Herb. Gray, ISOTYPE in Herb. Phil. Acad.). DELAWARE: 2nd mill pond west of Railroad Station, Milford, Sussex County, July 21, 1908, *Long* (Phil. Acad.); shore of Red Mill Pond, near Lewes, Sussex County, August 17, 1923, *J. P. Otis* (Phil. Acad.); sandy ditches near Georgetown, Sussex County, August 26, 1897, *A. Commons* (Phil. Acad.); Millsboro, Sussex County, September 21, 1907, *S. Brown* (Phil. Acad.). VIRGINIA: fresh tidal shore of Mattaponi River, at Horse Landing, near King William Courthouse, King William County, October 14 and 16, 1939, *Fernald & Long*, no. 11,540; completely submerged at high tide, fresh tidal marsh of Chickahominy River, below Barrat's Bridge (or Ferry), James City County, September 19, 1939, *Fernald & Long*, no. 11,284; muddy tidal margin of Blackwater River, Milk Landing, south of South Quay, Nansemond County, September 22, 1939, *Fernald & Long*, no. 11,285; muddy tidal margin of Blackwater River, Cox Landing, south of South Quay, Nansemond County, September 22, 1939, *Fernald & Long*, no. 11,286. See pp. 396 and 399.

Forma *flaccida*, in its very thin, often translucent, and mostly broad leaves is readily confused with *X. difformis* Chapm. It has, however, the small heads and flowers of *X. caroliniana* and the relatively few nerves in the leaves. *X. difformis* is usually coarser, with the very thin and translucent leaves (emersed) 6–14 mm. broad and 20–40-nerved, often falcate, half as long as to longer than the scapes, the latter when fresh conspicuously winged; the mature heads are 1–2 cm. long, and the seeds about 25-ribbed. It is locally abundant in the extreme South, coming north to eastern Maryland, with a station near Laurel, Delaware (sandy swamps, Pepper's Mill, *A. Commons* in Herb. Phil. Acad.).

Typical *X. caroliniana*, occurring from Florida to Louisiana, north to Nova Scotia, southeastern and central Maine, north-central New Hampshire, southeastern Vermont, eastern New York, thence west to Parry Sound, Ontario, Michigan and northern Indiana, is smaller, its opaque or subopaque leaves 0.5–6 mm. wide, mostly ⅓–½ as long as the mature scapes, and only 3–18-nerved (nerves vaguely seen by transmitted light). The scapes are less winged than in *X. difformis,* the mature spike 0.5–1.4 cm. long, the seeds about 13-ribbed.

In its thinner and mostly broader (5–8 mm. wide) elongate leaves (½ as long to nearly as long as scapes) *X. caroliniana* forma *flaccida* might be mistaken for *X. difformis,* especially when the leaves are translucent or not too encrusted with silt, but they have only 11–19 (rarely –23) nerves as in *X. caroliniana,* mature heads only 0.8–1.3 cm. long, and the seeds of *X. caroliniana.*

X. FLEXUOSA Muhl. (*X. arenicola* Small). Local range extended into NANSEMOND COUNTY: wet sandy and peaty depressions in pineland southwest of Marsh Hill School, south of South Quay, no. 10,992; very abundant in sandy and peaty pine barrens, east of Cox Landing, south of South Quay, no. 10,566, this area covering many square miles. ISLE OF WIGHT COUNTY: sandy and peaty pine barrens south of Lee's Mill, no. 12,283. See p. 379.

*COMMELINA DIFFUSA Burm. f. (*C. nudiflora* of Am. auth., not L.). KING WILLIAM COUNTY: fresh tidal shore of Mattaponi River, northwest of King William Courthouse, no. 11,550. CHARLES CITY COUNTY: sandy tidal shore of James River at "Four Oaks", below Harrison Point, no. 11,298. PRINCESS ANNE COUNTY: low woods and clearings along Back Bay, Long Island, no. 10,995. NORFOLK COUNTY: Dismal Swamp, Wallaceton, July 17, 1891, *A. B. Seymour,* no. 39. SOUTHAMPTON COUNTY: wooded alluvial bottomland of Meherrin River, near Haley's Bridge, no. 9290. GREENSVILLE COUNTY: weed in fencerow, Emporia, nos. 9291 and 10,996. See pp. 388 and 391.

In his enumeration of stations for *C. diffusa* (as *C. longicaulis*) Pennell, Bull. Torr. Bot. Cl. xliii. 100 (1916), cited no specimens from north of Georgia except on ballast at Philadelphia. Although sometimes a weed in southeastern Virginia, *C. diffusa* is a constituent element of the flora of bottomlands and in tidal marshes. It has this dual behavior in many regions. If an adventive, it has frequently sought out very natural habitats.

Its pantropical distribution indicates its plasticity at least in recent times.

The Varieties of Commelina erecta (Plates 629–631).—One of the most bafflingly intricate series in *Commelina* is the group of plants which broadly constitute *C. erecta* L. In southeastern Virginia we get four variations of it, which by the treatment in Small's *Flora of the Southeastern United States* could be sorted into seven so-called species. Varying from plants 1 dm. high, with linear leaves at most 3 mm. broad and with fruiting spathes barely 1 cm. long to colonies 1.2 m. high, with lance-ovate leaves 4 cm. broad and spathes 3.6 cm. long, ranging from southeastern New York to Nebraska, thence south to the West Indies, Gulf States and Mexico, sometimes in the driest of sands, again in rich alluvium, these plants have naturally offered a fertile field for the "splitter". But in his treatment of the group in 1916 Pennell[14] sounded the call for retreat from further specific segregation; for, although he then maintained three species in the series (*C. erecta* L., *C. angustifolia* Michx. and *C. crispa* Wooton), he hesitated about recognizing more than one, *C. erecta*, saying (p. 105): "*Commelina angustifolia* Michx. and *C. crispa* Wooton, until more fully compared living, are continued as of specific rank. Both are probably better considered as geographic varieties of *C. erecta*." Pennell forthwith reduced to *C. erecta* the recently proposed *C. saxicola* Small, and to *C. angustifolia* both *C. Swingleana* Nash and *C. Nashii* Small. With these reductions I am heartily in accord. But, even the recognition of three varieties, typical *C. erecta* and vars. *angustifolia* (Michx.) and *crispa* (Wooton) Palmer & Steyermark, does not satisfactorily settle the problems in the species. In order to see how in the most conservative treatment we have, Pennell's, the three elements are defined we may quote his key:

Leaves lanceolate. Posterior petals usually larger, 12–25 mm. long. Seeds mostly more or less oblong .... 6. *C. erecta*
Leaves linear-lanceolate. Posterior petals usually smaller, 10–15(–20) mm. long. Seeds mostly circular ....
Spathes 1.5–3 cm. long, with mostly long white hairs near the base. Posterior petals 12–18(–20) mm. long .... 7. *C. crispa*
Spathes 1–2 cm. long, rarely with long white hairs near the base. Posterior petals mostly 10–15(–18) mm. long 8. *C. angustifolia*

[14] Pennell: *The Genus Commelina (Plumier) L. in the United States*, Bull. Torr. Bot. Cl. xliii. 96–111 (1916).

In 1938 Pennell wrote "I would now consider that this species includes as narrow-leaved subspecies the southern *C. angustifolia* Michx. and the southwestern *C. crispa* Wooton."[15] With this decision I entirely agree, except that the free intergradation of the three compel me to treat them as two geographic varieties and a minor form, rather than to dignify them as subspecies.

There is practically no doubt about the identity of *Commelina erecta* L., although there has long been needless confusion of it with *C. virginica* L. (the coarse species with extensively creeping rhizome and stolons, the sheath of the leaf with erect summit fringed with long erect reddish bristles, whereas *C. erecta* has a fascicle of fleshy root-fibers and the sheath has a spreading flange-like summit short-ciliate with white hairs). It was long cultivated in Europe as *C. erecta* and Linnaeus described it "foliis ovato-lanceolatis" (rendered by Pennell simply "lanceolate", and by Small, Fl. Se. U. S. 242, "linear to linear-lanceolate"). The plant of European gardens, "*Habitat in* Virginia", was well shown by Dillenius in *Hortus Elthamensis,* his plate cited by Linnaeus and, in view of the confusion evident in the Linnean Herbarium, selected by the late C. B. Clarke in DC. Mon. iii. 181, to stand for *C. erecta.* Dillenius showed broadly lanceolate leaves nearly 3 cm. broad, the spathes about 3 cm. long. Just such a plant, tall (up to 1.2 m. high), with broad leaves on the primary axis, and with large spathes, occurs in relatively rich soil from southeastern New York to Kansas, south to Florida, Louisiana and eastern Texas. Much of the material of this largest extreme of the species has the spathes (PL. 629, FIG. 1) subglabrous to only minutely hirtellous but, creating confusion, a considerable series (PL. 629, FIG. 3), differing in no other notable character, has the base of the spathe as shaggily villous with long white trichomes as in the western plants called var. *crispa* (low and with linear or linear-lanceolate leaves and small spathes). This large plant, with white-villous spathe-bases (PL. 629, FIGS. 2 and 3), is regularly dispersed through much of the range of typical *C. erecta* and, although it differs from it as var. *crispa* does from var. *angustifolia,* it can be called only a form, not a geographic variety.

The type of var. *angustifolia, C. angustifolia* Michx., as shown

[15] Pennell in Bartonia, no. 19: 21 (1938).

by a photograph of Michaux's plant (our PLATE 630, FIGS. 1 and 2) has merely narrowly lanceolate leaves (6–8 cm. long, 4–9 mm. broad) and spathes 1.6–2 cm. long. Just such a plant, low, with narrowly linear to narrowly lanceolate leaves mostly less than 1 dm. long and 0.4–2 cm. broad and mature spathes mostly 1–2 (rarely –2.5) cm. long, occurs in dry sands or rocky soils from Florida to Texas and northern Mexico, north to Delaware, West Virginia, southern Illinois, Missouri and Kansas. In this typical var. *angustifolia,* from which the types of *C. Swingleana* Nash ("leaves . . . 4–6 cm. long, 5–7 mm. wide . . .; spathe . . . 2 cm. long") and of *C. Nashii* Small ("leaf-blades 4–8 cm. long . . .; spathes 1 cm. long") are inseparable, the spathe (PL. 630, FIG. 3) is rather densely short-hirtellous; but the reputed var. *crispa* ("leaves . . . 3–7 cm. long, 4–6 mm. wide . . .; spathe . . . 1.5–2 cm. long, 1 cm. broad") seems to differ from it only in having the base of the spathe villous with long white trichomes. Var. *crispa* (PL. 629, FIG. 4) is supposed to occur from northern Mexico to Missouri and Nebraska and about the head of Lake Michigan. In the material from southern Michigan and northern Indiana I find no such long hairs, but specimens from Nebraska southward and southwestward often display them (PL. 629, FIG. 4). Except for this single character I find nothing by which var. *crispa* differs from var. *angustifolia.* The situation is nearly parallel with that in the broad-leaved typical *C. erecta;* in fact, it is quite parallel, for some of the low and narrow-leaved plants with relatively small spathes, in the sands of eastern Virginia, (PL. 629, FIG. 5) have the long trichomes which place them with *C. crispa,* supposedly restricted to the Southwest. I can, therefore, see in the latter only a barely recognizable form of var. *angustifolia.* The fact that, upon geographic grounds alone, highly competent students have been placing the plants of northern Mexico impartially in *C. crispa,* though most of them are typical var. *angustifolia,* is eloquent.

The plant of northern Indiana, often referred to *C. crispa,* lacks the long white pubescence of the spathes of true but relatively unimportant var. *crispa.* In the latter the longer leaves are mostly 4–10 cm. long, the mature spathes usually 1–2 (rarely –2.5) cm. long. The plant of northern Indiana and adjacent Michigan (PL. 631), thence locally to Texas, has the longer (but narrow) leaves 7–15 cm. long, the mature spathes mostly 2.5–3 cm. long. It seems to be a well defined geographic variety, with which it is a pleasure to associate the name of its chief collector, the always alert Charles C. Deam.

In peninsular Florida, extending down to the Keys, there is another extreme (pl. 629, fig. 6), placed by Small and others in *C. angustifolia.* In the latter and in var. *Deamiana,* however, the mature spathes are more than half as high as long, with the lower margin straightish or only slightly curved, and the larger leaves are 4–20 mm. broad. The plant of the Florida Keys and southern and central Florida is very low and slender, the leaves only 3–5 mm. broad, the strongly falcate spathes long-beaked, 1.8–2.8 cm. long and less than half as high as long. It is a close match for the isotype in the Gray Herbarium of *C. hamipila* Wright, of Cuba. Clarke kept *C. hamipila* apart as a species, though stating that it was scarcely separate from *C. erecta.* The meagre material before him suggested that the spathes were solitary and axillary, never clustered. That they may be either solitary or grouped is now apparent from the several collections at hand. No difference in seed is evident and I am treating *C. hamipila* as a characteristic variety of southern Florida and Cuba.

As I see *Commelina erecta* it is a polymorphous species with pronounced but freely confluent varieties, as follows:

a. Stems (0.45–)0.6–1.2 m. high; larger leaves of primary axes lanceolate to lance-ovate, (0.9–)1–1.5 dm. long, (1.5–)2–4 cm. broad; mature spathes (2.2–)2.5–3.6 cm. long .... Var. *typica.*

a. Stems 1–4.5(–7) dm. high; larger leaves of primary axes narrowly linear to linear-lanceolate, 3–12(–20) mm. broad; mature spathes 1–2.7(–3) cm. long.

Mature spathe more than half as high as long, the lower margin only slightly curved; larger leaves 4–20 mm. broad.

Longer leaves 4–10 cm. long; mature spathes 1–2(–2.5) cm. long .... Var. *angustifolia.*

Longer leaves 7–15 cm. long; mature spathes mostly 2.5–3 cm. long .... Var. *Deamiana.*

Mature spathe less than half as high as long, strongly falcate to the prolonged beak, 1.8–2.8 cm. long; larger leaves 3–5 mm. broad .... Var. *hamipila.*

C. erecta L., var. **typica.** *C. erecta* L. Sp. Pl. 41 (1753). "*Habitat in* Virginia"; Clarke in DC. Mon. iii. 181 (1881); Pennell in Bull. Torr. Bot. Cl. xliii. 104 (1916).—Loamy or sandy soil, more rarely in rocky places, southeastern New York to Kansas, south to Florida, Louisiana and Texas. Plate 629, fig. 1.

On the Coastal Plain of southeastern Virginia we have it only from SOUTHAMPTON COUNTY: dry woods, thickets and clearings along Three Creek, Drewryville, no. 5701.

*Forma **intercursa,** f. nov. (TAB. 629, FIG. 2 et 3), caulibus 0.45–1.2 m. altis; foliis majoribus primariis late lanceolatis 1–1.5 dm. longis 1.5–4 cm. latis; spathis maturis 2.3–3.6 cm. longis basi longe albido-villosis.—DELAWARE: Laurel, September 21, 1880, *A. Commons.* VIRGINIA: sandy thicket by James River, Jordan Point, Prince George County, July 23, 1938, *Fernald & Long,* nos. 8642, 8643 (TYPE in Herb. Gray, ISOTYPE in Herb. Phil. Acad.); sandy pine and oak woods south of Zuni, Isle of Wight County, July 20, 1938, *Fernald & Long,* no. 8644 (transition to var. *angustifolia*); dry sandy open pine and oak woods, 6 to 7 miles south of Franklin, Southampton County, June 19, 1938, *Fernald & Long,* no. 8183. SOUTH CAROLINA: Congaree River, June 19, 1855, *Hexamer & Maier;* Santee Canal, June, —, *H. W. Ravenel.* GEORGIA: dry rocky woods on southwest slope of Kennesaw Mountain, Cobb County, July 12, 1900, *Harper,* no. 219; northwest slope of Stone Mountain, DeKalb County, July 10, 1900, *Harper,* no. 11. TENNESSEE: cult. Harvard Bot. Gard. 1847, from French Broad River, *Gray.* MISSOURI: woods, Eagle Rock. August 12, 1905, *Bush,* no. 3222; dry soil, Prosperity, June 17, 1909, *Bush,* no. 2242.

Var. **angustifolia** (Michx.), comb. nov. *C. angustifolia* Michx. Fl. Bor.-Am. i. 24 (1803); Pennell in Bull. Torr. Bot. Cl. xliii. 108 (1916). *C. virginica, β angustifolia* (Michx.) C. B. Clarke in DC. Mon. iii. 183 (1881). *C. Swingleana* Nash in Bull. Torr. Bot. Cl. xxii. 160 (1895); Small, Fl. Se. U. S. 242 (1903). *C. Nashii* Small, l. c. (1903).—Dry sandy soil, Florida to New Mexico and Mexico, north to Delaware, West Virginia, southern Illinois, Missouri and Nebraska. PLATE 630.

*Var. ANGUSTIFOLIA is known in Virginia from the following stations. YORK COUNTY: sandy clearings near Capital Landing, Queen's Creek, *Grimes,* no. 4081. WARWICK COUNTY: Old Point Comfort, September 15, 1885, *N. L. Britton.* PRINCESS ANNE COUNTY: dry pine and oak woods, Cape Henry, *Fernald & Griscom,* no. 2805. ISLE OF WIGHT COUNTY: dry sandy pine barrens, south of Zuni, *Fernald, Griscom & Long,* no. 6565. SOUTHAMPTON COUNTY: dry sand, pine barren about 7 miles south of Franklin, no. 7373. NANSEMOND COUNTY: dry sandy woods along Pitch Kettle Creek, north of Lake Kilby, *Fernald, Long & Fogg,* no. 4840 (unusually tall, but with small spathes).

*Forma **albina,** f. nov., petalis albis.—Dry sandy barrens, Cape Henry, September 24, 1933, *Fernald & Griscom,* no. 2804 (TYPE in Herb. Gray).

Forma **crispa** (Wooton), comb. nov. *C. crispa* Wooton in Bull. Torr. Bot. Cl. xxv. 451 (1898); Pennell, ibid. xliii. 107 (1916). *C. erecta*, var. *crispa* (Wooton) Palmer & Steyermark in Ann. Mo. Bot. Gard. xxii. 417 (1935), without bibliographic reference, and in Rhodora, xl. 131 (1938), validation.—Through much of the range of the var. Plate 629, figs. 4 and 5.

*Forma crispa is known in Virginia at the following stations. Fauquier County: by railroad, Beverly Mill, *H. A. Allard*, no. 1013. New Kent County: dry sandy field by Chickahominy River, Lanexa, *Grimes*, no. 4172. Sussex County: dry sandy hickory and oak woods, Burt, no. 6133. Nansemond County: white sand of pine and oak woods and clearings near Cathole Landing, west of Factory Hill, no. 12,285.

Var. **Deamiana,** var. nov. (tab. 631), caulibus gracilibus 2–6 dm. altis; foliis lineari-lanceolatis vel linearibus majoribus 7–15 cm. longis 5–15(–20) mm. latis; spathis maturis plerumque 2.5–3 cm. longis.—Michigan: "State Collection". Indiana: sand hills on west or southwest side of Lake Maxinkuckee, Marshall County, August 19, 1915 and July 15, 1920, *Deam*, nos. 17,944 and 31,900; sand hill north of Ora, Starke County, July 14, 1920, *Deam*, no. 31,852; sandy cut along roadside 6 miles south of Vincennes, Knox County, July 8, 1915, *Deam*, no. 17,087; very sandy soil along railroad at Duncan Siding, about 4 miles southeast of Vincennes, August 18, 1931, *Deam*, no. 50,986; sand dunes, Dune Park, Porter County, July 30, 1897, *Umbach*; wooded sand hill, Dune Park, August 16, 1897, *Agnes Chase*; inner faces of frontal dunes, Mineral Spring, Porter County, August 13, 1920, *D. C. Peattie*; bog, Chesterton, Porter County, August 9, 1925, *J. R. Churchill*; very sandy roadside cut, 4½ miles north and 1½ miles west of Morocco, Newton County, August 30, 1916, *Deam*, no. 21,511; roadside sand-hill, 4½ miles northwest of Morocco, July 13, 1920, *Deam*, no. 31,662 (type in Herb. Gray). Illinois: Oquawka, July 7, 1908, *Gleason*. Kansas: shady places, Riley County, July 20, 1895, *J. B. Norton*, no. 524. Oklahoma: sandy hillside near Page, Leflore County, June 20, 1914, *O. W. Blakley*, no. 1456; Arbuckle Mountains, near Davis, June 25, 1917, *W. H. Emig*, no. 736. Texas: 3½ miles north of Jasper, Jasper County, May 18, 1937, *Cory*, no. 22,629.

Var. **hamipila** (Wright), comb. nov. *C. hamipila* Wright in Sauvalle, Fl. Cubana, 157 (1873).—Stems 1–4.5 dm. high; leaves linear, the larger 6–10 cm. long and 3–5 mm. broad; spathes 1.8–2.8 cm. long, less than half as high, strongly falcate, with prolonged beak.—Cuba and Florida. The following are from Florida: cleared hammock, New Smyrna, Volusia County, April

19, 1910, *S. C. Hood;* high pineland, vicinity of Eustis, Lake County, *Nash,* no. 387; dry sandy soil, open woodland, Kelsey City, Palm Beach County, *F. R. Randolph,* no. 105; riverside, East Fort Myers, Lee County, *A. A. Eaton,* no. 1416; pineland, vicinity of Fort Myers, *J. P. Standley,* no. 137; pineland, Mullock Creek District, southeast of Fort Myers, *J. P. Standley,* no. 430; Pine Key, *Blodgett:* Key West, *Blodgett.* PLATE 629, FIG. 6.

In PLATE 629, FIG. 1 shows a mature spathe (essentially glabrous), × 2, of *Commelina erecta* from Safe Harbor, Pennsylvania, *Heller & Heller,* no. 686; FIG. 2, a flowering tip, × 1 of forma *intercursa* from the type-station; FIG. 3, a spathe, × 2, from the TYPE of forma *intercursa,* showing the characteristic long hairs; FIG. 4, a mature spathe, × 2, of *C. erecta,* var. *angustifolia,* forma *crispa* (*C. crispa*) from western Texas, *Chas. Wright,* no. 700, in part; FIG. 5, spathes, × 2, of forma *crispa* from Burt, Sussex County, Virginia, *Fernald & Long,* no. 6133; FIG. 6, spathe, × 1, of var. *hamipila* from Florida, *J. G. Cooper.*

PLATE 630, FIGS. 1 and 2, portions of type, × 1, of *C. angustifolia* Michx., FIG. 3, spathes, × 2, of *C. erecta,* var. *angustifolia* from Stone Mountain, Georgia, *Wiegand & Manning,* no. 711.

PLATE 631, *C. erecta* var. *Deamiana:* FIGS. 1, 2 and 3, portions of TYPE, × 1; FIG. 4, inflorescence, × 1, from Mineral Springs, Porter County, Indiana, *D. C. Peattie.*

*ANEILEMA KEISAK Hassk. Thoroughly typical of fresh tidal marshes and shores from King and Queen to Nansemond County, and, doubtless, into North Carolina, flowering from September to frost. The following are the actual specimens collected. KING AND QUEEN COUNTY: Mattaponi River, Walkerton, no. 11,549. KING WILLIAM COUNTY: Mattaponi River, northwest of King William Courthouse, no. 11,548, and at Horse Landing, near King William Courthouse, no. 11,547. NEW KENT COUNTY: Pamunkey River, southeast of White House, no. 11,546; Chickahominy River at "Shady Rest", southeast of Windsor Shades (Boulevard Postoffice), nos. 11,290, 11,542; Chickahominy River, Lanexa, no. 11,543. CHARLES CITY COUNTY: James River at "Four Oaks", below Harrison Point, no. 11,282; Kimage's Creek, Kimage's, no. 11,291; Kittewan Creek, Weyanoke, nos. 11,292, 11,545; James River, Wilcox Wharf, no. 10,994; Morris Creek below Adams Bridge, no. 11,544. JAMES CITY COUNTY: Gordon Creek, east of Barrat's Bridge (or Ferry), no. 11,293. NANSEMOND COUNTY: Blackwater River at Milk Landing (no. 11,294) and at Cox Landing (no. 11,295), south of South Quay. See pp. 386, 391–394, 399 and 400 and MAP 20.

A characteristic plant, here recorded for the first time outside eastern Asia. It is a regular constituent of the estuarine flora, along with *Cyperus haspan* L., var. *americanus, Eryngium aquaticum, Rhynchospora macrostachya,* var. *colpophila* (see above) and the several other species which inhabit these peculiar habitats. I have studied the material most carefully with Dr. Hiroshi Hara, who has been able to supply finely fruiting Asiatic specimens. In all characters, including the seeds, our plant seems quite inseparable from that of eastern Asia.

Tradescantia rosea Vent., var. graminea (Small) Anders. & Woodson. Local range extended eastward to Nansemond County: white sands of pine barrens south of South Quay (several nos.). See p. 379.

Juncus caesariensis Coville. Range in the state extended southward to Dinwiddie County: springy sphagnous swale about 5 miles east of Burgess Station, no. 11,000.

At our Henrico County station *J. caesariensis* was associated with an extraordinary series of species with disrupted ranges (see Rhodora, xli. 470, 473). So at the Dinwiddie County station it shares the honors with *Fuirena breviseta,* range extended north from North Carolina, *Scirpus debilis,* at our only station on the Virginian Coastal Plain, and other plants of great rarity in the region. See p. 389.

J. abortivus Chapm. To the single station recorded north of South Carolina (in Isle of Wight County) add from Nansemond County: very abundant in wet or moist sandy and peaty depressions of pinelands and pine barrens south of South Quay (many nos. from different stations). See p. 379.

J. megacephalus M. A. Curtis. To the previously recorded stations (False Cape and vicinity) add another, farther north in Princess Anne County: inner border of brackish to fresh marsh along Back Bay, at eastern margin of Long Island, no. 10,574. See pp. 370 and 371 and map 5.

J. diffusissimus Buckley. To the two stations previously recorded add the following, in Southampton County: wet clearing slightly west of Branchville, no. 10,190; along woodroad in wooded bottomland, Meherrin River, southeast of Branchville, no. 10,192; wet sandy roadside ditch south of Shiloh, no. 10,191; sandy roadside ditch southeast of Windman's Mill, no. 12,038. Greensville County: argillaceous clearing in swampy woods near Readjuster Bridge over Nottoway River, northeast of Orion, no. 12,039.

Tofieldia racemosa (Walt.) BSP. Local range extended eastward to Nansemond County: sphagnous savannah-like swale east of Cherry Grove, south of South Quay, no. 10,577. See p. 381.

Zigadenus glaberrimus Michx. Local range extended eastward to Nansemond County: wet peaty pine barrens, east of

Cox Landing, south of South Quay, no. 10,579. ISLE OF WIGHT COUNTY: sandy and peaty pine barrens, south of Lee's Mill, no. 12,294. See pp. 374 and 381.

MELANTHIUM VIRGINICUM L. Local range extended eastward to NANSEMOND COUNTY: wet bushy swale east of Cherry Grove, south of South Quay, no. 11,003. See p. 381.

*LILIUM CATESBAEI Walt., var. **Longii,** var. nov. (TAB. 632, FIG. 1–4), a var. typico recedit bulbi squamis ovoideis efoliosis; foliis oblongis, imis mediisque obtusis 6–13 mm. latis; tepalis laxe adscendentibus apice vix recurvatis ad 3.5 cm. latis; capsulis subtruncatis 2.5–4.5 cm. longis; seminibus 5–6 mm. longis ala 1.4–1.6 mm. lata.—Local, from southeastern Virginia to Georgia and Alabama. The following are placed here. VIRGINIA: sphagnous savannah-like swale east of Cherry Grove, south of South Quay, Nansemond County, July 21, 1939, *Fernald & Long,* no. 10,582 (TYPE in Herb. Gray, ISOTYPE in Herb. Phil. Acad.), October 15, 1939, *Fernald & Long,* no. 11,553. NORTH CAROLINA: pineland at Delway, Sampson County, August 25, 1938, *R. K. Godfrey,* no. 6176; pineland, White Lake, Bladen County, August 14, 1938, *Godfrey,* no. 5988; peaty grass-sedge savannah at Carolina Beach, New Hanover County, August 7, 1938, *Godfrey,* no. 5903. GEORGIA: Columbus, *Boykin.* ALABAMA: low, grassy pine barrens near Bolling, Butler County, August 28, 1885, *J. Donnell Smith.* See pp. 381 and 403.

Typical *Lilium Catesbaei* (our PLATE 632, FIGS. 5–10) has the slender bulb-scales often, or usually, terminated by long erect linear leaf-blades; its cauline leaves are acutish to long-attenuate, the broader ones (in a large series of specimens) 2–12 mm. broad. Its tepals have typically long slender claws and prolonged recurving tips, the claw being usually 0.25–0.36 as long as the blade, measurements of flowers of 32 collections showing the claw averaging 0.26 as long as the limb or, in other words, the limb about three times the length of the claw. Measurements of the limb of the broadest tepal show a range from 4.5–9.5 cm. long, with an average length (from 60 specimens) of 7 cm., the breadth ranging from 1–2.6 cm. (average 1.8 cm.). The capsule narrows gradually to a beak and the seeds are 4–5 mm. long, with wing (at broadest point) 0.6–1.2 mm. wide.

Var. *Longii* (PLATE 632, FIGS. 1–4) on the other hand, has the plumper bulb-scales without the leafy tips; the middle and lower cauline leaves are blunt and oblong, 6–13 mm. broad; the tepals are loosely ascending, without prolonged and recurving tips, consequently the proportion of claw and blade is very different, measurements of all the collections at hand showing the claw to be 0.3–0.42 (average 0.37) as long as the blade, in other words the blade about twice the length of the claw. In actual size the largest blades show a range from 4.5–6.5 (av. 5.5) cm. long, and 1.8–3.4 (av. 2.6) cm. broad. The capsule is subtruncate at summit, not narrowed to a beak, and the seeds are larger, 5–6 mm. long, with wing 1.4–1.6 mm. wide.

In their extremes the two plants are quite unlike. Unfortunately, however, transitions occur and several collections are as near one as the other. I am, therefore, constrained to treat the blunt-leaved plant with broad tepals scarcely recurving as a marked variety. It is noteworthy that at the northern limit of the variety it was in full flower on July 21. At its next known area to the south it is in full flower from August 7–14 (the collection of August 25 showing the flowers fading), while the Alabama material was collected in prime flower on August 28.

Lilium Catesbaei, according to English writers and also growers of lilies about Boston, is almost impossible to cultivate, in part because it stands no freezing. Now that we have a variety of it, sturdier and perhaps handsomer than typical *L. Catesbaei*, with a natural northern station in Virginia, where ice frequently forms and the children look forward to out-door skating, there is hope that var. *Longii* may prove to be a successful plant in northern gardens. Fully ripe seed collected in October has been supplied to the Harvard Botanic Garden and to several private growers of lilies.

In this study I have had the great advantage of having before me the material from the herbarium of the New York Botanical Garden. With its special concentration upon the Southeastern States, it was expected that this collection would add materially to the known stations of var. *Longii*. Very strikingly, however, it contains only typical or nearly typical *L. Catesbaei*.

In PLATE 632, FIG. 1 is one of the TYPE specimens, × ½, of var. *Longii* from Nansemond County, Virginia; FIGS. 2 and 3, capsules, × 1, from the same station, *Fernald & Long*, no. 11,553; FIG. 4, seeds, × 5, from no. 11,553. The figures of typical *L. Catesbaei* are from the following specimens: FIGS. 5 and 6, base and flower, × ½, from Baldwin, Duval County, Florida, *Nash*, no. 2321; FIG. 7, capsule, × 1, from Bluffton, South Carolina, 1871, *Mellichamp*; FIG. 8, seeds, × 5, from Eutawville, South Carolina, *Eggleston*, no. 5018 (N. Y. Bot. Gard.); FIG. 9, seed, × 5, from Bluffton, South Carolina, *Mellichamp*; FIG. 10, seed, × 5, from Florida, *Chapman* (N. Y. Bot. Gard.).

ALETRIS AUREA Walt. Local range extended eastward to NANSEMOND COUNTY: sandy and sphagnous margins of thickets in pineland southwest of Marsh Hill School, south of South Quay, no. 11,006.

*TRILLIUM LANCEOLATUM Boykin. ?NORFOLK COUNTY: Great Dismal Swamp, west of Wallaceton, April 24, 1926, *Paul A. Warren*, no. 413.

Specimen (unidentified) received in exchange from the College of William and Mary. Professor Warren tells me that it could have come only from west of Wallaceton, but whether in Norfolk or southeastern Nansemond County he does not know. First record from north of Georgia. See p. 375 and MAP 11.

SMILAX PULVERULENTA Michx. To the very few recorded stations add the following. SUSSEX COUNTY: rich woods and bushy clearing just east of the "fall-line" along Nottoway River, Double Bridge, about 6 miles northwest of Jarratt, no. 11,302. SOUTHAMPTON COUNTY: rich sandy and loamy woods along Three Creek, northwest of Carey Bridge, no. 10,210.

*HYPOXIS HIRSUTA (L.) Coville, forma **villosissima,** forma nov., scapis pedicellis perianthiis fructibusque persistenter denseque albido-villosis, villis ad 3–4 mm. longis.—VIRGINIA: sandy thickets and clearings near Coppahaunk Swamp, south of Waverly, very scarce, June 19, 1939, *Fernald & Long*, no. 10,214 (TYPE in Herb. Gray). NORTH CAROLINA: open woods, Winston-Salem, June 30, 1921, *P. O. Schallert*.

Typical *Hypoxis hirsuta,* with a very inappropriate name, has the scapes and pedicels sparsely pilose, the expanding perianth loosely short-pilose but soon glabrate and the fruit sparsely pilose. Forma *villosissima* is conspicuous on account of the permanent and very dense long white villosity of scape, pedicels, perianth and fruit. At the type-station it is very scarce but there associated with *Seymeria cassioides* and other species of dry pinelands.

H. LEPTOCARPA Engelm. & Gray. Range extended northward to NEW KENT COUNTY: bottomland woods by Chickahominy River north of Long Bridge, southeast of Quinton, no. 11,304.

A considerable northward extension, from Greensville, Southampton and Nansemond Counties. See p. 397.

SISYRINCHIUM MUCRONATUM Michx. Local range extended southward into GREENSVILLE COUNTY: rich woods near Three Creek, north of Emporia, no. 10,217.

*×Gladiolus gandavensis Van Houtte. Dinwiddie County: old field, south of Petersburg, no. 10,593. Seen persisting in other old fields.

Canna flaccida Salisb. Prince George County: roadside fill bordering wooded swamp, northwest of Disputanta, no. 10,008.

Burmannia biflora L. Local range extended eastward into Nansemond County: sphagnous savannah-like swale east of Cherry Grove, south of South Quay, no. 11,009. See p. 384.

*×Habenaria Canbyi Ames. A single plant flowering with abundant *H. blephariglottis* and *H. cristata,* sphagnous savannah-like swale east of Cherry Grove, south of South Quay, no. 10,601. See p. 381.

Cleistes divaricata (L.) Ames. Nansemond County: scattered and scarce at two stations south of South Quay, nos. 11,010 and 11,011. See pp. 380 and 384.

*Calopogon pallidus Chapm. Nansemond County: sandy and peaty pine barrens east of Cox Landing, south of South Quay, no. 10,603; moist peaty depressions in white sand of pine barrens 1–1½ miles south of Cherry Grove, south of South Quay, no. 12,054. See p. 380 and map 13.

Extension north from North Carolina. Identified by Dr. D. S. Correll.

Spiranthes cernua (L.) L. C. Richard, var. odorata (Nutt.) Correll in Bot. Mus. Lfts. Harvard Univ. viii. 79 (1940). (*S. odorata* (Nutt.) Lindl.). King William County: fresh tidal shore of Mattaponi River, at Horse Landing, near King William Courthouse, no. 11,557 (some root-tips budding into new rosettes). Charles City County: fresh tidal marsh along Kittewan Creek, Weyanoke, no. 11,307 (plants up to 7.5 dm. high, completely submerged at high tide). Greensville County: wooded bottomland of Fontaine Creek, southeast of Taylor's Millpond, nos. 10,224 and 11,308 (completely drowned during much of the summer). See pp. 359, 394 and 401.

Ponthieva racemosa (Walt.) Mohr. Local range extended into Southampton County: rich marly woods along Three Creek, northwest of Cary Bridge, no. 11,487. See p. 363.

Hexalectris aphylla (Nutt.) Raf. Local new stations of very limited extent in Dinwiddie County, no. 10,605, and in Southampton County, no. 10,606.

*Carya ovata K. Koch, var. pubescens Sargent. Sussex County: rich deciduous woods along Nottaway River, southwest of Homeville, no. 10,226.

Described by Sargent from South Carolina and Tennessee southward. See p. 361.

*Castanea pumila (L.) Mill., var. Margaretta Ashe. Nansemond County: Dry white sand of pine barrens east of Sandy

Landing, south of South Quay, no. 11,313; similar habitat, southwest of Marsh Hill School, south of South Quay, no. 11,014. SOUTHAMPTON COUNTY: white sand of pine and oak woods north of Point Beach, south of Franklin, no. 11,315.

First records from northeast of western Alabama. Our specimens, having a well developed pale tomentum on the lower leaf-surfaces, belong to the form later called *C. Margaretta* var. *arcuata* Ashe (from Texas). See p. 398.

*CASTANEA PUMILA (L.) Mill., var. ASHEI Sudworth. NANSEMOND COUNTY: sandy and peaty pine barrens east of Cox Landing, south of South Quay, no. 11,310. SOUTHAMPTON COUNTY: sandy woods, southeast of Round Gut, southwest of Franklin, no. 11,309.

Extension north from eastern North Carolina. See p. 398.

QUERCUS PALUSTRIS Muench. SUSSEX COUNTY: by woodland brook northeast of Stony Creek, no. 10,617; border of wooded swamp north of Stony Creek, no. 10,618; wooded bottomland, Three Creek, southwest of Grizzard, no. 10,237.

Although Sargent (Man.) cites the Pin Oak as occurring in Virginia south of the Potomac only in the extreme west (Wythe County), it is characteristic of river-swamps over a considerable area of southern Sussex County. It was reported in Claytonia, i. 44 (1934) from Amelia and Charles City Counties as well as from counties farther in the interior. See p. 361.

Q. LAEVIS Walt. (*Q. Catesbaei* Michx.). NANSEMOND COUNTY: very abundant in the sandy area south of South Quay, many nos. See pp. 362 and 365.

*×Q. BUSHII Sargent (*Q. marilandica* × *velutina*). GREENSVILLE COUNTY: large tree on wooded bottomland by Nottoway River, northeast of Purdy, no. 11,015.

Sargent (Man.) cites × *Q. Bushii* only from Georgia, Florida, Alabama, Mississippi and Oklahoma. The tree near Purdy fruits heavily. See p. 383.

*×Q. SUBINTEGRA Trel. (*Q. cinerea* × *falcata*). NANSEMOND COUNTY: a single large shrub, sandy and peaty barrens, east of Cox Landing, south of South Quay, no. 11,322. SUSSEX COUNTY: dry sandy woods by Nottoway River, below Peters Bridge, southeast of Lumberton, no. 12,320, several individuals. See p. 403.

*HUMULUS SCANDENS (Lour.) Merrill (*H. japonicus* Sieb. & Zucc.). DINWIDDDIE COUNTY: becoming abundant by roadsides and in waste places, Petersburg, no. 11,018. See p. 390.

*Rumex Acetosella L., var. integrifolia Wallr. Surry County: roadsides and waste places, Surry Courthouse, no. 10,626. See p. 377.

Very striking, with most of its rosette-leaves slenderly tapering to base and exauriculate. Infrequent in North America.

*Polygonum hydropiperoides Michx., var. **breviciliatum,** var. nov., planta subrobusta; foliis primariis lanceolatis acuminatis subtus scabris 9–13 cm. longis 1.5–3.2 cm. latis; ochreae ciliis perbrevibus 0.8–1.2 mm. longis; ochreolis eciliatis vel ciliis ad 0.4 mm. longis; floribus valde exsertis; achaenio trigono.—Dinwiddie County, Virginia: deep ditch in swale south of Burgess Station, July 16, 1938, *Fernald & Long*, no. 8698, August 15, 1938, no. 9044 (type in Herb. Gray; isotype in Herb. Phil. Acad.).

When he defined the eight geographic varieties of *Polygonum hydropiperoides* in Rhodora, xxviii. 22–28 (1926), Stanford said: "It is highly improbable that varieties recognized in this paper exhaust the list of admissable geographic varieties. Among possible fields for future geographic research, the southern seaboard states below Virginia and those of the lower Mississippi basin, which are not particularly well represented in the material at hand, suggest attractive possibilities." Var. *breviciliatum* is presumably in North Carolina, though as yet we have only the material from Dinwiddie County. It is at once separated from the other eastern American varieties as follows. From typical *P. hydropiperoides* by its coarser habit, broader leaves (1.5–3.2 cm. wide as against 1–1.5 cm.), cilia of the ochreae only 0.8–1.2 (as against 2–4) mm. long, and of the ochreolae wanting or barely 0.4 (as against 0.5–1) mm. long. Var. *psilostachyum* St. John, type from Sable Island, Nova Scotia, has glabrous leaves barely acuminate and only 4.8 cm. broad, eciliate and glabrous ochreae and ochreolae, the latter with broadly open summit; var. *macerum* Stanford, a very slender plant of Florida (only 5–6 dm. high) has leaves barely 6 cm. long and 1 cm. broad, cilia of the ochreae 2–4 mm. long, of the ochreolae 2 mm.; var. *sanibalense* Stanford, also from Florida, is stout, but with elliptic obtuse short leaves, long cilia of ochreae, and ochreolae broadly turbinate. Superficially var. *breviciliatum* closely resembles var. *Bushianum* Stanford of Oklahoma, and var. *asperifolium* Stanford of California. Both those varieties, however, have the ochreae and ochreolae long-ciliate, the cilia of the ochreae in var. *Bushianum* about 1 cm. long, in var. *asperifolium* 5–6 mm. long. Var. *breviciliatum* can scarcely be forced into any of these recognized varieties.

*Polygonella articulata (L.) Meisn. Nansemond County: dry white sand of pine barrens east and southeast of Cox Landing and east of Sandy Landing, south of South Quay, nos. 10,632, 11,025, 11,562 and 11,563. Isle of Wight County: dry sandy pine barrens and open woods, south of Lee's Mill, no. 12,068.[16] See pp. 379 and 403 and map 23.

A very extensive area, the plants, flowering in mid-October, often reaching a height of 8 dm. Although given a range south to Georgia ("or Fla.") by Small, *Polygonella articulata* is represented in the herbaria of the Academy of Natural Sciences of Philadelphia and the New York Botanical Garden and in the Gray Herbarium by no previous collections from south of northern Worcester County, Maryland, except for an old specimen bearing in Nuttall's hand the indefinite data: "Georgia. Dr. B[aldwin]". Whether it was actually collected in Georgia or whether there was confusion of data is an open question. Baldwin was born in Chester County, Pennsylvania; studied at the University of Pennsylvania; practiced medicine at Wilmington, Delaware, where he married; and, after moving to Georgia, made visits at Wilmington. The specimen which Nuttall had might have been picked in the North, the label being Nuttall's, not Baldwin's. In a letter dated "*Jefferson, November* 27, 1816", Baldwin wrote a friend:

The distance from our lodgings on the Sand Hills to Fort Barrington, where we crossed the Altamaha, is about seven miles; and from thence to this place, forty one. I have frequently mentioned *Fort Barrington;* but it would puzzle a stranger to find any *Fort*, here. The remains are alone visible, in the midst of a luxuriant vegetation, a short way below the Ferry.

Among the more rare productions of the Sand Hills, we find the *Eriogonum tomentosum, Polygonum articulatum,* and *Stipulicida setacea*, of Michaux;—all of which are found on the middle districts of Georgia, and not on the sea-coast. . . . I suspect, with Pursh, that the *Polygonum articulatum*, and *polygamum,* are merely *varieties*. The one found here, however, has always *flores albi,*—and is frequently more than two feet in height. That the northern plant should be *annual,* and the southern one *perennial,* is by no means extraordinary.[17]

[16] Also in white sand of pine barrens, Wyanoke, Gates County, North Carolina, no. 11,564.
[17] William Baldwin as quoted by Darlington, Reliquiae Baldwinianae, 334 (1843).

The last sentence quoted clearly shows that Baldwin knew as *Polygonum articulatum* (=*Polygonella*) in the Sand Hills of Georgia a white-flowered perennial, not the usually pink-flowered annual, but that he knew the northern plant as an annual (apparently *not* white-flowered). The Georgian source of the Nuttall specimen is not verified by its reputed collector.

*Amaranthus Torreyi (Gray) Benth. Dinwiddie County: roadsides and waste places, Petersburg, no. 10,633.

Native from Iowa to Texas and westward. A colony of vigorous plants, likely to spread. See p. 369.

Iresine rhizomatosa Standley. Range extended farther north in Princess Anne County: low woods and clearings along Back Bay, Long Island, nos. 10,636, 10,637 and 11,028. See pp. 370 and 371.

For discussion see Rhodora, xxxviii. 379 and 416 (1936); and xxxix. 483, map 58 (1937).

*Froelichia gracilis (Hook.) Moq. Dinwiddie County: cinders of freight-yard of Norfolk & Western Railroad, Petersburg, no. 10,639. Sussex County: similar habitat about 2 miles west of Waverly, no. 10,638. Henrico County: waste places and railroad ballast, Richmond, no. 12,338.

A western species (Iowa to Arkansas and southwestward), likely to become more established. See p. 374.

*Paronychia fastigiata (Raf.) Fern., var. paleacea Fern. in Rhodora, xxxviii. 421, pl. 447, figs. 6 and 7 (1936). Sussex County: border of rich deciduous woods along Nottoway River, southwest of Homeville, no. 10,251; white sand of dry woods near Nottoway River, south of Chub, no. 12,340; exsiccated brookbed in alluvial woods, Nottoway River, southeast of Owen's Store, no. 12,341; moist sandy roadside ditch, near Nottoway River, at Green Church Bridge, northwest of Owen's Store, no. 12,342.

First from south of Delaware and Pennsylvania. See p. 361.

*P. riparia Chapm. Dry sands and sandy woods of Isle of Wight, Sussex and Southampton Counties (many numbers).

This is the plant erroneously reported in 1937 as *P. Baldwinii*. I am indebted to Dr. Core for clarifying the identification.

Sesuvium maritimum (Walt.) BSP. To the station (Dam Neck) formerly reported add the following, also in Princess Anne County: open muddy and sandy shores of Back Bay, east of Munden, no. 11,029; east of Creeds, nos. 11,030 and 11,031. See pp. 369 and 387.

*Stellaria media (L.) Cyrill., var. glaberrima G. Beck. Lawns of Greensville and Southampton Counties.

This is the pernicious weed most erroneously reported in Rhodora, xli. 489 and 540 (1939) as the native southern *Stellaria prostrata* Baldwin. The latter is still unknown in Virginia. My apology for the erroneous identification is the lame one, that I accepted the verdict of a student who was making an intensive study of the genus. As I have elsewhere pointed out, the motto of the true scientist unfortunately has to be: "you can trust no one." We sometimes weaken and do so!

Silene noctiflora L. Prince George County: cinders of freight-yard, Norfolk & Western Railroad, east of Petersburg, no. 11,335.

Nuphar fluviatile (Harper) Standley. Range in the state extended eastward to Nansemond County: muddy margin of Blackwater River, Milk Landing, south of South Quay, no. 10,643; seen, forming a definite band of vegetation near the eastern margin of the river, northward to the draw-bridge at South Quay.

Ranunculus flabellaris Raf., forma riparius Fernald in Rhodora, xxxviii. 171 (1936). New Kent County: bottomland woods by Chickahominy River north of Long Bridge, southeast of Quinton, no. 11,336. Sussex County: gum and cypress swamp bordering pond, east of Littleton, no. 12,348. Southampton County: dried-out pools, wooded bottomland, Meherrin River, southeast of Branchville, no. 10,259.

Certainly local in southeastern Virginia.

Our Varieties of Ranunculus bulbosus. In the Northeastern States *Ranunculus bulbosus* L. is a tolerably uniform plant, with the three leaflets of the radical leaves cleft into 2 or 3 divisions, these again with short segments, the petioles and stems silky-villous to glabrate. In southeastern Virginia, however, the species there abundantly naturalized, is much more variable, three fairly definite varieties being recognizable in the field. These were worked out with me several years ago by Mr. Ludlow Griscom but our notes never published. They are here included. Besides the typical form, *R. bulbosus*, var. *typicus* Erdner, we there find var. valdepubens (Jordan) Briq., Fl. Corse, i. 619 (1910), with foliage as in var. *typicus*, but the whole plant strongly spreading-villous, often giving a hoary effect; and var. dissectus Babey, Fl. Jurassienne, i. 39 (1845), with the leaves finely dissected into elongate linear segments.

*Var. valdepubens in the United States is chiefly in the Southeast and only occasional northward into New York and Rhode Island. We have examined the following specimens. Rhode Island: Cumberland, May 30, 1911, *C. H. Knowlton.* New York: bank of Mohawk River, east of Crescent, Saratoga Co., May 30, 1906, *S. H. Burnham.* Virginia: Buckroe, May 18, 1912, *Robinson,* no. 302; near Norfolk, April 23, 1911, *Tidestrom,* no. 4495: roadside east of Little Creek, Princess Anne Co., *Fernald & Griscom,* no. 4402; cinders of freight-yard of Atlantic Coast Line Railroad, Petersburg, no. 12,076.

*Var. dissectus is more generally dispersed, but apparently local: Maine: Somesville, Mt. Desert Isl., June 15, 1928, *G. L. Stebbins, Jr.* Massachusetts: near Spring Pond, Peabody, June 11, 1896, *J. H. Sears;* Beaver Hill, Middlesex Fells Reserv., June 9, 1920, *N. T. Kidder;* Blue Hills Reserv., June 10, 1920, *N. T. Kidder.* Rhode Island: Nayatt, Barrington, May 30, 1911, *M. L. Fernald;* Middletown, May 31, 1908, *E. F. Williams.* New York: Inwood, New York City, May 14, 1887, *Mrs. L. M. Parker;* Ledyard, Cayuga Co., *Wiegand,* no. 6449. Virginia: Campbell, Bedford Co., May 14, 1871, *A. H. Curtiss;* near Blackwater River, Princess Anne Co., *Fernald & Griscom,* no. 4401. Michigan: Agricultural College, May 23, 1894, *C. F. Wheeler.*

Sassafras albidum (Nutt.) Nees. Greensville, Southampton, Sussex and Nansemond Counties (many nos.).

The typical form of the species, with glabrous branchlets and leaves; often more abundant than the pubescent extreme.

*Rorippa sessiliflora (Nutt.) Hitch. Henrico County: James River, Richmond, May 11, 1894, *J. R. Churchill.*

A characteristic species of the Mississippi Valley.

Arabis canadensis L. Sussex County: rich deciduous woods along Nottoway River, southwest of Homeville, no. 10,272.

Our first station on the Coastal Plain. See p. 361.

Drosera rotundifolia L. Nansemond County: swampy depressions in pine barrens south of Cox Landing, south of South Quay, no. 10,663; sphagnous savannah-like swale east of Cherry Grove, south of South Quay, no. 10,662. Seen some years ago in Isle of Wight County: in sphagnum near Joyner's Bridge.

It is a striking fact that the only stations we know on the Coastal Plain (south of the James) for *Drosera rotundifolia* are near the eastern border of the Blackwater River.

D. intermedia Hayne. Nansemond County: sphagnous savannah-like swale east of Cherry Grove, south of South Quay, no. 10,664.

Very local in southeastern Virginia: frequent in Princess Anne County but rare on the Coastal Plain farther west.

*SEDUM ALBOROSEUM Baker. GREENSVILLE COUNTY: naturalized in roadside thicket near Dahlia, no. 9575.

*HAMAMELIS VIRGINIANA L., var. PARVIFOLIA Nutt. See Fernald in RHODORA, xxiii. 265 (1921). NANSEMOND COUNTY: depressions in the pine barrens south of South Quay, several stations, nos. 10,666, 10,667, 11,339 and 11,570. ISLE OF WIGHT COUNTY: peaty and sandy thicket in pine barrens south of Lee's Mill, nos. 12,358 and 12,359. SUFFOLK COUNTY: dry woods of a "hammock", Great Dismal Swamp, west of Yadkin, no. 11,041 (transitional). SOUTHAMPTON COUNTY: sandy woods southeast of Round Gut, southwest of Franklin, no. 11,340; swampy woods west of Wiggins School, south of Franklin, no. 11,341.

Much of the material has the lower surfaces of the leaves strongly whitened but I am unable to separate it on any character (including seeds) from the thick-leaved shrub of Nova Scotia and New England with densely pubescent lower leaf-surfaces. Torrey & Gray, taking up Nuttall's variety, cited it from the mountains of Pennsylvania and from Louisiana. There has been no material in the Gray Herbarium from south of Nova Scotia, Maine and Massachusetts, where the lower surfaces are often, but not always, rufescent; but Mr. Long sends me for study the Pennsylvania material at the Philadelphia Academy. This consists of Nuttall's type from "mts., Penn", and characteristic specimens from Pocono (*Wolle*) and from Sand Patch, alt. 2500 feet, "summit of Allegheny Mts.", Somerset County (*C. F. Saunders*). See p. 380.

GILLENIA TRIFOLIATA (L.) Moench. SUSSEX COUNTY: dry sandy hickory and oak woods, Burt, no. 11,042.

Our only Coastal Plain station.

*POTENTILLA INTERMEDIA L. SURRY COUNTY: roadsides and waste places, Surry Courthouse, no. 10,676. See p. 377.

*RUBUS GENICULATUS Kalt. PRINCESS ANNE COUNTY: extensively trailing, waste ground at old railroad terminal, Munden, no. 10,674. DINWIDDIE COUNTY: roadsides and waste places, Petersburg, no. 10,673.

One of the sprawling and climbing European species.

R. GRIMESII Bailey. Local range extended southward. SUSSEX COUNTY: rich deciduous woods along Nottoway River, southwest of Homeville, no. 10,287. GREENSVILLE COUNTY: open thickets, clearings and borders of woods east of Emporia, no. 10,291.

*R. Janssonii Bailey. Sussex County: wet woods, Assamoosick Swamp, about 2 miles northeast of Homeville, no. 10,286.

I am unable to find any points to separate this from the trailer of southern New England. See p. 361.

*Rubus (Eubatus, § Tholiformes) **pernagaeus,** sp. nov. (tab. 633 et 634), arcuans, cannis simplicibus 6–7 dm. longis apice radicantibus; primocannis 2–3.5 mm. diametro subteretibus viridibus glabris sparse setosis setis aculiformibus, deinde uncinatis; primocannae foliis ternatis subquinatis, immaturis supra strigoso-pilosis subtus subvelutinis; foliolis terminalibus cuneato-obovatis 2.7–3.2 cm. longis argute duplicato-serratis sublobatis; floricannae foliis ternatis foliolis anguste cuneato-obovatis, ramorum sterilium foliolis 1.5–3.5 cm. longis; ramorum floriferum foliolis terminalibus vel foliis simplicibus 1.5–2.5 cm. longis; corymbis 1–3-floris; pedicellis laxe adscendentibus 1–2 cm. longis valde glandulosis plerumque bracteolatis; calycibus glandulosis lobis late ovatis 4 mm. longis deinde reflexis; petalis roseotinctis 6–8 mm. longis 4 mm. latis; fructibus ignotis.—Isle of Wight County, Virginia: roadside thicket near Smithfield, April 5, 1938, *Fernald & Long*, no. 7879, distributed erroneously as *R. pauxillus* Bailey.

Rubus pernagaeus (of the land of ham, Smithfield hams, from peanut-fattened hogs, having a reputation which has extended far from Virginia) was placed under *R. pauxillus* as a simple but quite unsatisfactory means of getting the specimens roughly identified. *R. pauxillus*, characterized by Bailey as "Littlest of the upright blackberries in the United States", is stiff and erect (instead of arching and tip-rooting) and belongs in § *Arguti* Rydb. It has the primocane-leaflets ovate (instead of narrowly cuneate-obovate); its floricane-leaflets, likewise, broadly ovate (instead of narrowly cuneate-obovate); "pedicels pubescent and sometimes with a few glandular hairs" (in *R. pernagaeus* copiously glandular); calyx apparently glandless, and petals much longer. *R. pernagaeus* in some ways resembles members of § *Procumbentes*, though the canes are more arching and less prostrate than in theoretically characteristic members of the *Procumbentes*. Its tiny corymb of 1–3 flowers is suggestive of that section, but I am unable to place it with any described member of that group. *R. Enslenii* Tratt. sometimes has glandular pedicels and calyx, but the very short pedicels and small pink flowers and the cuneate primocane-leaflets of *R. pernagaeus* keep it apart from *R. Enslenii*. *R. centralis* Bailey (type from southern Indiana) has glandular pedicels, but the plant is trailing, the primocanes branching, the terminal primocane-leaflets "broadly subcordate-ovate", the floricane-foliage similar, and the calyx-lobes ascend in fruit.

*SANGUISORBA MINOR Scop. DINWIDDIE COUNTY: dry field about 5 miles east of Burgess Station, no. 11,043. See p. 390.

*CASSIA FASCICULATA Michx., forma JENSENI Palmer & Steyermark. SUSSEX COUNTY: sandy pine and oak woods south of Stony Creek, no. 11,348.

An albino.

*CASSIA FASCICULATA Michx., var. **macrosperma,** var. nov. (TAB. 635, FIG. 1 et 2), planta 1–1.7 m. alta; caule ramisque piloso-hirsutis vel glabratis; pedicellis hirsutis; leguminibus plerumque 4–8.5 cm. longis 5–10 mm. latis strigosis vel glabratis, suturis hirsutis, segmentis 5.5–7 mm. latis; seminibus 4–10, oblique rhomboideo-ovatis valde rostratis plerumque 5.5–7.5 mm. longis 4–6 mm. latis.—Fresh tidal marshes and shores, southeastern VIRGINIA: sandy tidal shore of James River, at "Four Oaks", below Harrison Point, Charles City County, September 16, 1939, *Fernald & Long,* no. 11,349; fresh tidal marsh along Kittewan Creek, Weyanoke, Charles City County, September 18, 1939, *Fernald & Long,* no. 11,350 (TYPE in Gray Herb.; ISOTYPE in Herb. Phil. Acad.), October 14, 1939, no. 11,573 (fully ripe legumes); fresh tidal marsh of Chickahominy River, below Barrat's Bridge (or Ferry), James City County, September 19, 1939, no. 11,351 (flowering material); fresh tidal marsh of Pamunkey River, southeast of White House, New Kent County, October 14, 1939, no. 11,574 (fully ripe); fresh tidal shore of Mattaponi River at Horse Landing, near King William Courthouse, King William County, October 14, 1939, no. 11,575 (legumes rather small); fresh tidal shore of Mattaponi River, Walkerton, King and Queen County, October 16, 1939, no. 11,576 (ripe). See pp. 393, 394 and 400.

Cassia fasciculata, var. *macrosperma* is remarkable for its great stature and large legumes and seeds; it is also noteworthy for its apparent restriction to the tidal reaches of the rivers and creeks, partially or wholly submersed at high tide, partially emersed at low tide. It thus forms a characteristic element in the estuarine flora of the region.

Typical *C. fasciculata* (*C. Chamaecrista* of authors, not L.) is mostly much lower (1.5–9 dm. high), with minute appressed pubescence, the legumes (fig. 3) 2.5–5 cm. long and 4–5.5 mm. broad, with segments 3–4.5 mm. broad, the 4–13 seeds (fig. 4) 3.5–5 mm. long and 2.5–4 mm. broad. Var. *robusta* (Pollard) Macbride, chiefly of the Mississippi drainage, differs from typical *C. fasciculata* primarily in being more spreading-pubescent; its legumes (fig. 5) and seeds are not conspicuously larger.

Plate 635, fig. 1, shows portions of the type, × 1, of *Cassia fasciculata*, var. *macrosperma;* fig. 2, seeds, × 3, from the type. Fig. 3 is ripe fruits, × 1, of typical *C. fasciculata* from west of White Bluffs, Dickson County, Tennessee, *Svenson,* no. 4403; fig. 4, seeds, × 3, of *C. fasciculata* from New Castle, Delaware, *Benner,* no. 8584; fig. 5, fruits, × 1, of var. *robusta* from Auburn, Alabama, *Earle & Earle,* no. 30.

*Trifolium pratense L., forma pilosum (Griseb.) Hayek. Greensville County: open thickets, clearings and borders of woods east of Emporia, no. 11,051.

An extremely long-pilose form.

*Medicago lupulina L., var. glandulosa Neilr. Prince George County: cinders of freight-yard, Norfolk & Western Railroad, east of Petersburg, no. 11,352.

*Tephrosia spicata (Walt.) T. & G., var. **semitonsa,** var. nov., caulibus sparse piloso-hirsutis; rhachibus subglabris, foliolis supra glabris vel glabratis; leguminibus sparse strigoso-pilosis. Virginia: Southampton County: white sand of pine and oak woods at Round Gut, southwest of Franklin, September 20, 1939, *Fernald & Long,* no. 11,353, plants stiffly erect (type in Herb. Gray; isotype in Herb. Phil. Acad.). Nansemond County: dry sandy woods and adjacent clearings, Kilby, September 11, 1935, *Fernald, Long & Fogg,* no. 4892; dry sandy woods, Factory Hill, August 26, 1936, *Fernald & Long,* no. 6612. Isle of Wight County: dry sandy yellow pine and oak woods near Walters, July 28, 1936, *Fernald & Long,* no. 6235; dry sandy pine woods south of Zuni, August 24, 1936, *Fernald & Long,* no. 6611; white sand of dry woods and clearings east of Joyner's Bridge, July 17, 1940, *Fernald & Long,* no. 12,379. See p. 398.

There are two strongly marked varieties of *Tephrosia spicata* in southeastern Virginia. Assuming that the identification by Torrey & Gray of Walter's *Galega spicata* was correct and that the subsequent identifications of Small, Rydberg and others (as *Tephrosia* or as *Cracca*) are correct, typical *T. spicata* is the densely villous extreme extending from Florida to Louisiana and north to Tennessee and Delaware. It is common in southeastern

Virginia, extending northward at least to Princess Anne and York Counties. In view of the fact that many segregates have been made from the traditional *T. spicata*, it is highly important carefully to check the type of *Galega spicata* Walt. Fl. Carol. 188 (1788) which had the wholly inconclusive diagnosis "Spicis longis terminalibus." That simple character belongs to several southern species.

From its sparse pubescence extreme plants of *Tephrosia spicata*, var. *semitonsa* might be mistaken for *T. hispidula* (Michx). Pers., which is known from Virginia only through very old specimens without definite data. Although Small (Man.) separates *T. hispidula* (as *Cracca hispidula*) by "Pubescence of the stem of appressed hairs" and Rydberg (in N. Am. Fl.) says "stem . . . sparingly strigose or glabrate", the type of *Galega hispidula* Michx. (as shown by a photograph) has some spreading hairs; so has the specimen from Virginia (old specimen of Torrey & Gray; Michaux said "in Virginia, Carolina et Georgia") and some from South Carolina, Georgia and Florida. The clearest distinctions between *T. hispidula* and *T. spicata*, var. *semitonsa* are as follows:

T. HISPIDULA. Stem, rachis and petiolules strigose-hispid; principal leaflets lanceolate, lance-oblong or oblanceolate, strigose-sericeous beneath; pedicels filiform; upper calyx-lobes deltoid-lanceolate, 1.5–3 mm. long.

T. SPICATA, var. SEMITONSA. Stem, rachis and petiolules spreading-pilose or -villous; principal leaflets oblong-obovate, appressed-pilose beneath; pedicels stout; upper calyx-lobes lance-subulate, 2.5–3.5 mm. long.

AESCHYNOMENE VIRGINICA (L.) BSP. To the stations recorded in 1939 add others (often very extensive) on fresh tidal shores in KING WILLIAM, NEW KENT, CHARLES CITY and JAMES CITY Counties (many nos.). See pp. 385, 391, 393, 394, 400 and 402.

*DESMODIUM GLABELLUM (Michx.) DC. NANSEMOND COUNTY: white sand of pine and oak woods and clearings near Cathole Landing, west of Factory Hill, no. 11,356.

A close match for the type of Michaux from South Carolina, our material and a fragment and photograph of Michaux's type being the only representatives of the species I have seen. The more northern and larger-leaved plant passing as *Desmodium glabellum* is *D. humifusum* Beck. See p. 399.

*LESPEDEZA ANGUSTIFOLIA (Pursh) Ell., forma **subvelutina**, f. nov., caulibus calycibusque densissime subvelutino-pilosis, pilis subpatentibus; foliolis subtus dense subadpresso-pilosis.—

With typical *L. angustifolia* or by itself, southern New Jersey to North Carolina. New Jersey: sand, Cold Spring, Cape May County, August 30, 1917, *Gershoy*, no. 386, distrib. as *L. angustifolia* × *capitata;* dry soil, Bennett, Cape May County, August 8, 1925, *H. E. Stone*, distrib. as *L. oblongifolia.* Virginia: sphagnous bog about 1 mile northwest of Dahlia, Greensville County, August 20, 1938, *Fernald & Long*, no. 9077 (type in Herb. Gray; isotype in Herb. Phil. Acad.), growing mixed with typical *L. angustifolia;* sphagnous swale at head of north fork of Mill Swamp, south of Emporia, August 18, 1939, *Fernald & Long*, no. 11,060. North Carolina: Bladensboro, September 3, 1908, *Eggleston*, no. 4043, in part (mixed with typical *L. angustifolia*).

*Strophostyles umbellata (Muhl.) Britton, forma **ochroleuca,** forma nov., floribus ochroleucis. Greensville County, Virginia: open thickets, clearings and borders of woods east of Emporia, August 18, 1939, *Fernald & Long*, no. 11,065 (type in Herb. Gray, isotype in Herb. Phil. Acad.)

*Geranium dissectum L. James City County: cultivated field, 1 mile south of Williamsburg, *Grimes*, no. 3469 (reported as *G. carolinianum*). Southampton County: roadside, Boykins, no. 10,310.

Decidedly unusual in the Atlantic States. The only other material from the East in the Gray Herbarium is from Athens, Georgia, but it is included in the *Flora of the District of Columbia* from College Park, Maryland. The species is widely dispersed on the Pacific slope from southern British Columbia to California.

*Polygala polygama Walt. Southampton County: dry sandy pine woods near Nottoway River, above Carey Bridge, no. 10,311; border of dry mixed woods by Applewhite's Church, no. 10,312; rich wooded slopes and clearings by Three Creek, north of Applewhite's Church, no. 12,122. See p. 362.

We have never before met *Polygala polygama* on the Coastal Plain of Virginia, nor is it represented in the Gray Herbarium from between Montgomery County, Maryland (Great Falls and vicinity) and South Carolina. Wheelock in his monograph (Mem. Tor. Bot. Cl. ii. 140) cited nothing from Virginia and North Carolina. Our material is the true southern *Polygala polygama* of Walter, with very loose racemes, the flowers 4–6 mm. apart, 5–6 mm. long, on pedicels 1.5–3.5 mm. long, with the obovate wings much exceeding the capsule. The plant of Great Falls belongs to the wider-ranging and mostly northern var.

obtusata Chodat, with closer-flowered raceme, the flowers 1–4 mm. apart, 3–5(–6) mm. long, on pedicels 0.5–2 mm. apart, the wings strongly rounded above and shorter than to exceeding the capsule. The latter extends northward to Nova Scotia, central Maine, central New Hampshire, Vermont, New York, southern Ontario, Michigan, Wisconsin and Minnesota. I have seen typical *P. polygama* only from Florida, Georgia, South Carolina and southeastern Virginia.

POLYGALA VERTICILLATA L. To the station in Greensville County, noted in 1938, add one in SOUTHAMPTON COUNTY: argillaceous clearing near Blackwater River, southeast of Ivor, no. 10,700.

In RHODORA, xl. 337, pl. 501 (1938), I held as true *Polygala verticillata* the plant which Linnaeus actually had in his own herbarium prior to 1753 and which closely matches his diagnosis and notes; but Pennell still urges[18] (if I understand his long argument) that the species could as well rest on earlier specimens and concepts not so clearly identifiable as familiar to Linnaeus. If our identifications of the vague and mostly too inclusive American species of Linnaeus are to be determined by psychoanalysis of what one supposes Linnaeus to have thought, or by the specimens less known to him and least matching his mature notes, rather than by the specimens actually before him in preparing *Species Plantarum* and which better match his original diagnoses and notes, we might as well give up. Different psychoanalysts and interpreters of the vague past rarely draw identical conclusions from identical data. Similarly, no two modern botanists are likely to agree as to just what passed in the brain of Linnaeus a couple of centuries ago. Interpretation of his species is difficult enough even when the inadequate specimens before him are studied. Whenever possible we should rest our conclusions on the clearest, rather than the vaguest evidence.

P. VERTICILLATA, var. ISOCYCLA Fern. To the few recorded stations add the following. SUSSEX COUNTY: rich woods and bushy clearing just east of the "fall-line" along Nottoway River, Double Bridge, about 6 miles northwest of Jarratt, no. 11,070; dry old field and border of woods, near Nottoway River, southeast of Stony Creek, no. 12,392. SOUTHAMPTON COUNTY: wooded bottomland, Meherrin River, southeast of Branchville, no. 10,313.

[18] Pennell in RHODORA, xli. 378–384 (1939).

P. verticillata, var. ambigua (Nutt.) Wood. To the stations recorded in 1938 add the following. Sussex County: border of wooded swamp north of Stony Creek, no. 10,701.

In the article above cited I referred to *Polygala verticillata* as a polymorphous species. Experience with it in the field for more than 50 years makes this polymorphism quite evident to me; and Mr. Long's and my experiences in the field in eastern Virginia and elsewhere show that the separation of adjacent colonies into varieties (to say nothing of "species") is somewhat arbitrary. Plants referable to var. *ambigua* can often be separated from others called true *P. verticillata* only by a careful consideration of the degree to which intergradation can be discounted. It is, therefore, surprising to find Pennell, in his discussion of 1939, saying "These three species in constancy of characters, lack of intergradation, and differing areas of occurrence seem to me amply distinct specifically. After a long probation *Polygala ambigua* is now generally so recognized" (p. 378). The surprise is not that Pennell considers them three species; it is at the statement that "*Polygala ambigua* is now generally so recognized" [as "amply distinct specifically"] for this implies a universality of judgment which is hardly consistent with recent practice. It is true that authors immediately following Nuttall and with inadequate material so treated it. It is also, as would be expected, true that it is maintained by Britton and Small, as well as by Pennell. But it will be admitted that all of these authors have viewed the genus from a somewhat local standpoint. It may be equally said that, in his Manual, Asa Gray was viewing the genus locally, but by his 3d edition (1862) he had become skeptical, saying of *P. ambigua* "nearly as in No. 9 [*P. verticillata*] (of which it is probably a mere variety)" and later on he flatly so treated it. Chodat's *Monographia Polygalacearum* (1891) can hardly be called a provincial treatment. Chodat viewed all the known species of the world; yet he saw nothing specific about the characters of *P. ambigua*. He treated it as *P. verticillata*, var. *ambigua*. Similarly Blake's monograph of all the species of *Polygala* in North America is broad-gauge in its specific concept and area; yet here (N. Am. Fl. xxv^5. 348) *P. ambigua* is treated only as a variety of *P. verticillata*. The counting up of specialists to make a total by whom *P. ambigua* is generally recognized as a species is subject to the factors which affect many other statistics. Since my own experiences have abundantly shown me that *P. ambigua* and *P. verticillata* frequently intergrade, I do not find myself in the "general" group referred to by Pennell, which excluded Asa Gray (in his more mature years), Chodat and Blake.

*ACALYPHA OSTRYAEFOLIA Riddell. DINWIDDIE COUNTY: steep weedy bank by freight-yard of Norfolk & Western Railroad, Petersburg, no. 10,703.

Although stated to occur from New Jersey to Florida and westward, there is no other material in the Gray Herbarium from the Atlantic states north of South Carolina. *Acalypha caroliniana* Ell., not Walt., is referred to *A. ostryaefolia*. Elliott knew it only from Paris (or Parris) Island in Beaufort County, South Carolina "in cultivated land . . . very rare". Messrs. Godfrey and Tryon found it as a weed about Georgetown, South Carolina, in 1939. See p. 369.

EUPHORBIA POLYGONIFOLIA L. NEW KENT COUNTY: sandy beach of York River, near mouth of Fillbate's Creek, north of Holly Forks, no. 11,584.

Inland extension from the sandy coast. See p. 400.

E. PROSTRATA Ait. DINWIDDIE COUNTY: cinders of freight-yard of Norfolk & Western Railroad, Petersburg, no. 10,704; roadsides and waste places, Petersburg, no. 11,367.

Previously found, as a street-weed in Williamsburg, by Grimes. See p. 369.

E. DENTATA Michx. PRINCE GEORGE COUNTY: cinders of freight-yard, Norfolk & Western R. R., east of Petersburg, no. 11,366. HENRICO COUNTY: waste places and railroad ballast, Richmond, no. 12,393.

*E. HETEROPHYLLA L. DINWIDDIE COUNTY: roadsides and waste places, Petersburg, no. 11,072.

Not previously represented in the Gray Herbarium from north of South Carolina. See p. 390.

ILEX CORIACEA (Pursh) Chapm. NANSEMOND COUNTY: wet woods near lumber camp of Camp Lumber Co., Great Dismal Swamp, southeast of Whitemarsh School, nos. 10,718 and 11,587.

Shrubs up to 3 m. high. The black drupes become pulpy and juicy when ripe and promptly drop. Branches heavily loaded with young drupes in July had lost all but a few lingering ripe ones in October—an unusual character in the genus and one which has not been emphasized. See pp. 368 and 400.

*Ceanothus americanus L., var. intermedius (Pursh) Trel. Southampton County: dry sand, pine barrens about 7 miles south of Franklin, no. 7527. Nansemond County: white sand of pine and oak woods and clearings near Cathole Landing, west of Factory Hill, nos. 11,370 and 12,130.

Characteristic of these dry white sands. Trelease, in Gray's Synoptical Flora, gave the range: "Tennessee . . . and S. Carolina . . . to Louisiana . . . and Florida". Small (Man.) gives it, as *C. intermedius,* the range, "Fla. to La., Tenn. and Ga." Although extending northward into the pinelands of southeastern Virginia and well known on the sands of Middle Cape Cod,[19] var. *intermedius* seems to be lacking between Virginia and southeastern Massachusetts.

Ampelopsis arborea (L.) Koehne. To the very few known stations in eastern Virginia add the following. Southampton County: rich sandy and loamy woods along Three Creek, northwest of Carey Bridge, no. 10,327. Isle of Wight County: waste ground, near Lee's Mill, no. 12,407. Princess Anne County: damp sandy woods, Cedar Island, no. 12,406.

*Vitis Labrusca L., var. **subedentata,** var. nov. (tab. 637), foliis subtus densissime pannosis vix sublanatis, marginibus subedentatis humeris plerumque latis vix elongatis.—Coastal Plain, southeastern New York to Virginia. New York: Fisher's Island, August 10–15, 1920, *St. John,* no. 2811. New Jersey: roadside along creek, Turnersville, Gloucester Co., June 24, 1922, *R. R. Dreisbach,* no. 2,105; moist places, Pleasantville, October 7, 1923, *Tidestrom,* no. 11,398. Maryland: along canal, Chesapeake City, August 2, 1923, *Tidestrom,* no. 11,548. Virginia: swampy thicket southeast of Charles City, Charles City County, August 22, 1939, *Fernald & Long,* no. 11,074 (type in Herb. Gray); border of gum swamp, west of Pungo, Princess Anne County, May 6, 1935, *Fernald & Griscom,* no. 4454; wet peaty clearings in woods of *Pinus serotina,* south of Grassfield, Norfolk County, August 4 and 5, 1934, *Fernald & Long,* no. 4027; border of swampy thicket near Cornland, Norfolk County, June 18, 1935, *Fernald, Griscom & Long,* no. 4669; moist thicket about 5 miles east of Burgess Station, Dinwiddie County, August 26, 1939, *Fernald & Long,* no. 11,075; roadside bordering swampy woods, north of Whitemarsh School, Nansemond County, August 20, 1939, *Fernald & Long,* no. 11,073. See p. 390.

[19] Fernald, *The Cape Cod Ceanothus,* Rhodora, xxxii. 161 (1930).

Typical *Vitis Labrusca,* as shown by the Linnean type (PLATE 636, FIG. 1) is the wide-ranging vine with leaf-margin coarsely dentate and with more or less porrect lobes or shoulders on the fruiting portions of the branches. This is the common form from Maine to southern Michigan, south (southward chiefly in the Piedmont and mountains, though reaching the Coastal Plain in South Carolina) to Georgia and Tennessee. The dense blanket of pubescence is relatively loose, the tangled hairs often distinctly showing under slight magnification (PLATE 636, FIG. 5). The Coastal Plain var. *subedentata* has the margins of leaves accompanying inflorescences with only obsolescent teeth, the subuli at the ends of the stronger veins relatively short, the shoulders usually poorly developed and rounded or broad and subhorizontal, and the dense felt of the lower surface very close and fine, its component hairs scarcely discernible under slight magnification (PLATE 637, FIG. 3). In fact the lower surface glistens as if varnished and in pressing it leaves a heavy brown varnish-like stain on the specimen-sheets. In Virginia var. *subedentata* matures and drops its fruit by late August.

PLATE 636 shows, as FIG. 1, a portion of the TYPE, × 1, of *Vitis Labrusca,* from a photograph received from Mr. Savage. FIGS. 2–4 are leaf-margins, × 1, from different specimens: FIG. 2 from Bedford County, Virginia, May 20, 1871, *A. H. Curtiss;* FIG. 3 from Chilmark, Martha's Vineyard, Massachusetts, *Inez P. Mayhew;* FIG. 4, from Granville, Massachusetts, *F. C. Seymour,* no. 303. FIG. 5 shows the pubescence of the lower surface, × 10, of a mature leaf from Milton, Massachusetts, *C. E. Faxon.*

In PLATE 637, FIG. 1 is a portion of the TYPE, × 1, of var. *subedentata.* FIG. 2 is a leaf, × 1, from Chesapeake City, Maryland, *Tidestrom,* no. 11,548; FIG. 3, pubescence of lower surface, × 10, from the TYPE.

*SIDA **inflexa,** sp. nov. (TAB. 638, et TAB. 639, FIG. 1–3), perennis; caule minute stellato-puberulo 0.6–1.2 m. alto, ramis laxe adscendentibus; foliis lanceolato- vel lineari-oblongis breviter petiolatis, primariis 2.5–6 cm. longis, 0.4–2 cm. latis pagina superiore viridi sparsissime stellato-strigosa vel glabrata pagina inferiore pallida remote stellato-puberula, margine adpresso-serratis vel porrecto-dentatis; floribus plerumque corymbosis terminalibus et ad ramorum apices vel rare axillaribus pedunculis ad 1.7 cm. longis; calycibus 6–10 mm. longis basi plus minusve villoso-hirsutis, lobis deltoideo-acuminatis; petalis late obovatis inaequaliter obcordatis 1.5 cm. longis flavescentibus basin versus valde striatis; carpellis ca. 10, apice valde inflexis, maturis 3–3.5 mm. altis horizontaliter costato-reticulatis dorso viridibus hispidisque apice valde incurvatis plus minusve bidentatis, dentibus brevibus adscendentibus.—Southeastern Virginia, west-central Tennessee, Alabama and southeastern Missouri. Virginia: Petersburg, Dinwiddie County, *Tuomey;* dry pine woods just east of the "fall-line", along Nottoway River, Double Bridge, about 6 miles northwest of Jarratt, Sussex County, August 18 and September 21, 1939, *Fernald & Long,* nos. 11,076 and 11,372; border of sandy woods near Three Creek, northwest of Carey Bridge, Southampton County, August 19, 1939, *Fernald & Long,* no. 11,077, September 23, 1939, *Fernald & Long,* no. 11,373 (type in Gray Herb.; isotype in Herb. Phil. Acad.). Tennessee: cedar barrens, Lavergne, Rutherford County, May and September, 1882, *Gattinger.* Alabama: locality not stated, *Buckley.* Missouri: Stoddard County, September 12, 1893, *Bush,* no. 5; sands, Campbell (Stoddard County), September 9, 1910, *Bush,* nos. 6293 and 6293A.

Sida inflexa has been passing as *S. Elliottii* Torr. & Gray (see p. 382). That species rests primarily upon *S. gracilis* Ell. Sk. i. 159 (1816), not Richard. It was beautifully described by Elliott, from "the Sea Islands. Common about Beaufort" with "Stem . . . glabrous; leaves linear . . .; peduncles solitary, axillary . . .; capsules (10) two horned, glabrous." It is the very narrow-leaved plant occurring from southeastern South Carolina to southern Florida and Alabama, with nearly glabrous (often bushy-branched) stems 1.5–8 dm. high; linear cauline leaves mostly 1.5–5 cm. long and 1.5–7 mm. broad; flowers mostly solitary in the axils and on peduncles up to 2.5 cm. long; calyx at most strigose on the ribs at base; carpels (plate 639, fig. 4) with prominent erect teeth, glabrous or nearly so on the back and with relatively weak cross-ribs on the sides.

Sida inflexa is also related to the nearly glabrous *S. rubro-marginata* Nash in Bull. Torr. Bot. Cl. xxiii. 102 (1896) of Florida. In foliage the two are similar, but with quite different toothing. *S. inflexa* has the flowers chiefly in terminal corymbs, *S. rubro-marginata* axillary. *S. inflexa* has the calyx (pl. 638, fig. 4) villous-hirsute on the ribs at base, *S. rubro-marginata* (pl. 639, fig. 5) not; and the long erect teeth and quite different reticulation of the carpels (pl. 639, fig. 6) of the latter species show that *S. inflexa* can hardly be forced into it, even by those most modern of young taxonomists who are so frequently maintaining that characters of the carpels, achenes and spores are unimportant as compared with shape of the foliage.

Sida inflexa is also somewhat related to *S. neo-mexicana* Gray and to *S. Lindheimeri* Engelm. & Gray, especially in its stellate-puberulent stems. *S. neo-mexicana,* however, is a lower plant, with cinereous lower leaf-surfaces and calyx, the latter much lower than in *S. inflexa,* the petals short, and the muticous carpels (PL. 639, FIG. 7) without the transverse ribs which are so prominent in *S. inflexa. S. Lindheimeri* has the flowers chiefly on long axillary peduncles, the very large calyx cinereous, the carpels (PL. 639, FIG. 8) with erect cinereous teeth and with obliquely ascending elongate reticulation. *S. inflexa* in its less cinereous pubescence, its terminal corymbs, villous-hirsute base of calyx, and horizontally costate carpels with short (or no) hispid teeth is quite distinct from either *S. neo-mexicana* or *S. Lindheimeri.*

It is noteworthy that all these species have at one time or another been included under *Sida Elliottii.* The old specimen of *S. inflexa* from Petersburg, Virginia, and Bush's plants of it from southern Missouri are the bases for the inclusion of *S. Elliottii* in Gray's Manual, ed. 7; the Missouri and Tennessee material of *S. inflexa* was cited in the Synoptical Flora as *S. Elliottii. S. neo-mexicana* was placed in *S. Elliottii* in Gray's Plantae Wrightianae and in Torrey's Botany of the Mexican Boundary; *S. Lindheimeri* was first treated as *S. Elliottii, β texana* Torr. & Gray; and *S. rubro-marginata* of Florida was dismissed by Robinson in the Synoptical Flora, with the comment: "*S. rubro-marginata* . . . appears to be merely a broad-leaved form of *S. Elliottii.*" Abundant material now at hand indicates its specific distinction from the latter. See p. 382.

PLATE 638, FIG. 1, shows the TYPE of *Sida inflexa,* × 2/5; FIG. 2, portion of stem, × 10, covered with puberulence; FIG. 3, lower surface of leaf, × 10; FIG. 4, calyx, × 4, from the side; FIG. 5, ring of carpels, × 4, from above; all from TYPE or topotype. In PLATE 639, FIGS. 1–3 are details of *S. inflexa:* FIG. 1, a pressed flower, × 2 (margins reinforced by pencil), from Nottoway River, Double Bridge, Virginia, *Fernald & Long,* no. 11,076; FIGS. 2 and 3, carpels, × 10, from the TYPE. In PLATE 639 the remaining figures are details of related species: FIG. 4, carpel, × 10, of *S. Elliottii* Torr. & Gray from Miami, Florida, *A. H. Curtiss,* no. 5853; FIG. 5, calyx and ring of carpels, × 4, from ISOTYPE of *S. rubro-marginata* Nash, Tampa, Florida, *Nash,* no. 2472; FIG. 6, ripe carpel, × 10, of *S. rubro-marginata* from Punta Rossa, Florida, 1878, *Garber;* FIG. 7, ripe carpel, × 10, of *S. neo-mexicana* Gray, from the TYPE, eastern New Mexico, *Wright;* FIG. 8, ripe carpel, × 10, of *S. Lindheimeri* Engelm. & Gray, from the TYPE, Texas, 1843, *Lindheimer,* no. 24.

Hibiscus militaris Cav. Local range extended to New Kent County: bottomland woods by Chickahominy River, north of Long Bridge, southeast of Quinton, no. 11,371.

Stewartia Malachodendron L. To the few known Virginian stations add one in Norfolk County: dry woods of a "hammock", Great Dismal Swamp, west of Yadkin, nos. 11,078 and 12,131, many tree-like shrubs up to 6 m. high.

*Hypericum mutilum L., var. latisepalum Fernald. King William County: fresh tidal shore of Mattaponi River, at Horse Landing, near King William Courthouse, no. 11,590.

Heretofore known only from Florida to Texas. See p. 402.

H. Drummondii (Grev. & Hook.) T. & G. Greensville County: border of cultivated argillaceous field, northwest of Taylor's Millpond, no. 11,080; open argillaceous border of wood-road northeast of Gaskins, no. 11,081.

The plump capsules burst under slight pressure, pushing out their masses of ripe and unripe seeds. The colored children, knowing the plant as "Nits and Lice", demonstrated this feature to us. They repudiated the very common and slender-fruited *H. gentianoides* as a member of the same group because it had "no lice", the capsules being soft and unresponsive. The fact that they so sharply differentiated *H. Drummondii* indicates that it is less uncommon than we had supposed.

*Elatine americana (Pursh) Arn. King William County: fresh tidal shore of Mattaponi River, at Horse Landing, near King William Courthouse, no. 11,588. James City County: tidal mud along Powhatan Creek, north of Jamestown Island, no. 11,083. See pp. 386 and 401 and map 18.

Extension south from the estuary of the Delaware.

*Viola triloba Schwein., var. dilatata (Ell.) Brainerd. Southampton County: rich sandy loam of woods by Blackwater River, northeast of Ivor, no. 10,735; rich mixed and deciduous woods near Nottoway River, above Carey Bridge, no. 10,336.

First northeast of western North Carolina. See p. 363.

V. esculenta Ell. To the two stations recorded add one in Nansemond County: abundant and very large, along a ditch bordering wet woods and clearings near lumber camp of Camp Lumber Co., Great Dismal Swamp, southeast of Whitemarsh School, no. 11,591. See p. 400.

V. emarginata (Nutt.) LeConte, var. acutiloba Brainerd. To the few recorded stations add one in Southampton County: border of dry mixed woods by Applewhite's Church, no. 10,337.

V. STRIATA Ait. PRINCE GEORGE COUNTY: rich wooded slope by James River, Indian Point, nos. 11,087 and 11,874.

Our first station on the Coastal Plain of a characteristically inland species. See p. 382.

AMMANNIA KOEHNEI Britton. To the single recorded Virginian station (on York River) add the following in PRINCESS ANNE COUNTY: brackish to fresh marsh along Back Bay, at eastern margin of Long Island, nos. 10,741 and 11,088; similar habitat, Cedar Island, no. 12,416. See p. 370 and MAP 4.

GAURA BIENNIS L. PRINCE GEORGE COUNTY: sandy shore of James River, City Point, no. 11,094.

Our first Coastal Plain station.

ERYNGIUM AQUATICUM L. Very characteristic of fresh tidal shores and marshes at least from the James River to the Mattaponi (many nos.). See p. 386.

SANICULA CANADENSIS L., var. **grandis,** var. nov., a var. genuina recedit foliis amplioribus et fructibus crassioribus; folii petiolati imi foliolis longioribus 5.5–13 cm. longis, folii subsessilis, imi foliolis longioribus 4.5–12 cm. longis; fructuum triadibus 1–1.5 cm. latis.—Rich woodlands, western Vermont to Nebraska, south to North Carolina, Tennessee, Missouri, Oklahoma and Texas. TYPE from Bristol, Vermont, July 25, 1898, *Ezra Brainerd* (in Herb. Gray.).

Sanicula canadensis consists of three strongly marked varieties, as follows.

S. CANADENSIS L., var. **genuina.** *S. canadensis* L. Sp. Pl. 235 (1753) in part, as interpreted by Gray, Bicknell and later authors. Larger leaflets of the well developed petioled leaves 3.5–8 cm. long, 1.5–4(–5) cm. broad; larger leaflets of lower subsessile leaves (at lower fork of stem) 3–7 cm. long; triads of fruits (including tips of bristles) 7–9 mm. broad.—Open woods, Florida to Texas, north to Rockingham County, New Hampshire, Plymouth, Bristol and Dukes Cos., Massachusetts, central and southern Connecticut, Long Island, New Jersey, Pennsylvania, West Virginia, Ohio, Kentucky, Missouri and Oklahoma.

This is the common plant of eastern Virginia.

*Var. GRANDIS Fernald (supra). Var. *typica* H. Wolff in Engler, Pflanzenr. iv^{228}. 67 (1913), not *S. canadensis* L., as shown by the plants known to and cited by Linnaeus. Larger leaflets of well developed petioled leaves 5.5–13 cm. long, 2.5–6(–8) cm. broad; larger leaflets of lower subsessile leaves (at lower fork of stem) 4.5–12 cm. long; triads of fruits 1–1.5 cm. broad.—Of broad inland range (see above).

Our only Coastal Plain stations in Virginia are along the James. Prince George County: wooded bank of James River, City Point, no. 10,343 (plants up to 1.7 m. high). Surry County: rich calcareous wooded slopes along James River, Claremont Wharf, no. 10,344.

Var. floridana (Bickn.) H. Wolff, l. c. 67 (1913). *S. floridana* Bickn. in Bull. Torr. Bot. Cl. xxiv. 581 (1897). Smaller throughout; the abruptly cuneate small leaflets with firm spinulose teeth; larger leaflets of petioled leaves 2–5 (rarely –8) cm. long; triads of fruit 5–7 mm. broad.—Dry sandy woods, Florida to Mississippi, north to southeastern Virginia.

It would be perfectly possible to make a rational argument that the species known as *Sanicula canadensis* L., a southern species unknown in Canada, should be called *S. marilandica* L.; and that we should further reverse the established usage and take up for the more boreal and transcontinental *S. marilandica* of all recent authors the name *S. canadensis.* Such a complete reversal has more than the geographic argument in its favor. On the other hand, it is so evident that Linnaeus was utterly at sea regarding the real characters of the two and so confused the two elements in his writings and memoranda that it cannot be said that his own herbarium and the specimens he saw give unequivocal support to such a reversal. The situation, under the two names, is as follows.

S. canadensis L. The pre-Linnean references are to a Clayton plant of eastern Virginia described by Gronovius and supposed by him to be *Sanicula canadensis, amplissimo laciniato folio* of Tournefort. Tournefort gave no further information; consequently the only pre-Linnean reference of value is that of Gronovius. This account says "Pedunculi infra bifurcaturam caulis longi", thus emphasizing the usual 2 long rays or branches so characteristic of the plant with divaricate and bifurcate inflorescence, the *S. canadensis* of Bicknell, Britton and Robinson & Fernald. But in his own herbarium Linnaeus had a Clayton specimen from Virginia (part of Clayton's much confused no. 28—see below) which Linnaeus definitely marked *S. canadensis.* This is the northern large species, the *S. marilandica* sensu Bicknell et al., and it was presumably what Linnaeus had in mind when he gave the simple comparative phrase of original diagnoses: "Structura *ita praecedentis* [*S. europaea*] . . . *sed planta decuplo saepe omnibus partibus major.*" Asa Gray, in his manuscript notes on the Linnean Herbarium, specifically stated that the Linnean specimen of *S. canadensis* has long-exserted styles; and this observation was verified by Mr. Long and me in 1930. At that time, however, another Gronovian (Clayton) plant in the Clayton (Gronovian) herbarium was found to be short-styled *S. canadensis* sensu Bicknell et al. On the portion of the long-styled Clayton material of no. 28 (*S. marilandica* of recent authors) retained in the Gronovian herbarium occurs the original label:

Sanicle. D. Clayton An. 1734. Num. 28. Claython ex Virginia an 1734. Num. 28. Lappula fere umbellata Astrantiae foliis virginiana. Plukn. Mant. 114.

This was subsequently marked in a second (perhaps clerical) hand: "Sanicula flosculis masculinis pedunculatis, hermaphroditis sessilibus flor. Virg. p. 31", this phrase being the diagnosis given by Gronovius, Fl. Virg. 31, for no. 28, which Linnaeus cited as his basis of *S. marilandica.* This Clayton material with long styles was marked by Asa Gray: "The type of *Marilandica.* A. G." "The greater part of this was given to Linnaeus & he has wrongly named it : *Canadensis.* A. G."

However, there is another sheet of Clayton's no. 28 in the Gronovian herbarium. Mr. Long and I studied it in 1930 and Professor Alfred Rehder then kindly photographed it. This specimen is appropriately discussed under

S. MARILANDICA L. Linnaeus referred to 3 sources and gave no new diagnoses: (1) to Gronovius, p. 31 (*i. e.* Clayton's no. 28, in part at least); (2) to Hortus Upsaliensis; (3) to Ray. Hortus Upsaliensis referred back to the same accounts by Gronovius and by Ray, with 2 other references which were not cited by Linnaeus in Species Plantarum. Gronovius gave the brief diagnosis, "Sanicula *flosculis masculinis pedunculatis; hermaphroditis sessilibus*" and the citation, "*Sanicula sylvatica floribus albis, foliis triscuspidatis. Clayt. n.* 28"; also the reference to Ray which was later cited by Linnaeus.

Ray's account was detailed. It emphasized the *small* (minimis) fruit, the *divaricate* and *dichotomous* branching, the short (pollicares), simple peduncle in the forks, and the pair of leaves at the forks; all very striking characters of *S. canadensis* sensu Bicknell et al., not of *S. marilandica* of Bicknell et al. One sheet of Clayton's no. 28 has already been discussed. The other bears in the hand of Solander, apparently, the full text from Gronovius, p. 31, which referred to no. 28. This second sheet is perfectly characteristic of the bifurcate, divaricate-branched, small-leaved and small-fruited, short-styled plant (*S. canadensis* sensu Bicknell) which abounds in eastern Virginia. It is, thus, quite unlike the other sheet of no. 28, which bears the original annotation by Gronovius.

Since the names *Sanicula canadensis* and *S. marilandica*, as used by Linnaeus, were hopelessly confused, as were the two species as treated by all authors up to Bicknell (1895), we should not lay too much stress upon attempts to retrace the vague mental processes underlying the confusion. Gray decided that the long-styled specimen of no. 28 should stand as *S. marilandica*, the short-styled specimen as *S. canadensis*. Bicknell, the first monographer to clarify the formerly tangled group, followed Gray; and Wolff has followed their interpretations. These decisions should stand. Nothing would be gained by retypifying the species on the basis of early misconceptions.

*Torilis japonicus (Houtt.) DC. Prince George County: waste ground near wharf, City Point, no. 10,354.

Cited by Coulter & Rose from Baltimore and Washington.

*Lilaeopsis carolinensis Coult. & Rose. Princess Anne County: forming an extensive mat in shallow pool in brackish to fresh marsh along Back Bay, at eastern margin of Long Island, no. 10,758.

The fourth known station in North America and the first north of southeastern North Carolina; species bicentric, its second area on the drainage-system of La Plata River in eastern South America. See p. 371 and map 6.

L. chinensis (L.) Ktze. To the few recorded stations add the following. Charles City County: sandy tidal shore of James River, at "Four Oaks", below Harrison Point, no. 11,388. New Kent County: sandy tidal shore of York River, near mouth of Fillbate's Creek, north of Holly Forks, no. 11,597. See p. 391.

*Rhododendron canescens (Michx.) G. Don. King William County: steep wooded bank of Mattaponi River, at Horse

Landing, near King William Courthouse, no. 11,602 (shrubs up to 3 m. high). SUSSEX COUNTY: wooded bottomland, Jones Hole Swamp, west of Coddyshore, no. 10,363 (shrubs 3 m. high); rich woods and bushy clearing just east of the "fall-line", along Nottoway River, Double Bridge, about 6 miles northwest of Jarratt, no. 11,099. SOUTHAMPTON COUNTY: steep wooded slopes by Three Creek, northwest of Applewhite's Church, no. 10,364 (straggling, 0.5 m. high), 10,365 and 11,882 (erect, 1.5 m. high); on steep slope at Round Gut, southwest of Franklin, no. 11,391; rich woods near Raccoon Creek, north of Mill Neck Church, no. 12,427. NANSEMOND COUNTY: damp thicket, steep bank of branch entering Blackwater River, northwest of Duck's Store, no. 12,428. See pp. 361 and 363.

Rehder in Wilson & Rehder, Mon. Azaleas, 144 (1921) gave the range: "from southwestern Tennessee and southern central North Carolina to eastern South Carolina and northeastern Florida to extreme southeastern Texas", etc.

*KALMIA LATIFOLIA L., var. LAEVIPES Fernald in RHODORA, 53 (1940).

With or apart from typical *K. latifolia* in the southeastern counties.

*ZENOBIA PULVERULENTA (Bartram) Pollard. NANSEMOND COUNTY: *Chamaecyparis* swamp in sandy and peaty pine barrens northeast of Sandy Landing, south of South Quay, nos. 12,149 and 12,150. Passing through transitional shrubs (such as no. 12,151) into the green-leaved and commoner

*Z. PULVERULENTA, forma **nitida** (Michx.), comb. nov. *Andromeda speciosa*, var. *a. nitida* Michx. Fl. Bor.-Am. i. 256 (1803); Rehder in Bailey Cycl. Am. Hort. iv. 2007 (1902).—Leaves of fertile branches oval or elliptic-oblong, obtuse, shallowly crenate, green both sides.—In Virginia known from two southern counties. NANSEMOND COUNTY: swampy depressions and *Chamaecyparis* swamps in pine barrens, from northeast of Cox Landing to east of Sandy Landing, south of South Quay, nos. 11,102–11,104, distributed as var. *nuda*, no. 12,152. SOUTHAMPTON COUNTY: swampy woods southeast of Round Gut, southeast of Franklin, no. 11,395 (shrubs up to 3 m. high). Passing into

*Z. PULVERULENTA, forma **nuda** (Ventenat), comb. nov. *Andromeda cassinefolia* Ventenat, Descr. Jard. Cels, 60, t. 60 (1800). *A. cassinefolia*, var. *nuda* Ventenat, Jard. Malmais. ii. 79 (1804). *Z. cassinefolia* (Vent.) Pollard in Bull. Torr. Bot. Cl. xxii. 231 (1895). *Andromeda pulverulenta*, var. *nuda* (Vent.) Schneider, Ill. Handb. Laubholzk. ii. 526 (1911). *Z. pulverulenta*, var. *nuda* (Vent.) Rehder in Mitteil. Deutsch. Dendrol. Gesells.

for 1915: 226 (1915).—Leaves lance-oblong to narrowly ovate, acute at both ends, prominently toothed, green both sides.—In Virginia known only from Nansemond County: with the other forms, *Chamaecyparis* swamp in sandy and peaty pine barrens northeast of Sandy Landing, south of South Quay, no. 12,154.

In western Nansemond County the three forms of *Zenobia* are clearly confluent. Furthermore, among the very few sheets in the Gray Herbarium there are two sent from South Carolina by M. A. Curtis, one the green-leaved with elliptic-oval round-tipped blades, as *Andromeda speciosa* Michx., *α. nitida*, the other of the similar shrub with strongly whitened blunt leaves, as *A. speciosa, β. pulverulenta* and marked, "Mixed helter-skelter with the other". Curtis's experience in South Carolina was obviously like ours in Virginia. As forms they are strikingly different, but they certainly are not geographic varieties, much less two species—the disposition of them by Small. See pp. 385 and 397 and map 16.

The application of the names needs clarification.

The first name in the species was apparently *Andromeda pulverulenta* Bartram, Travels, pl. 8, opp. p. 476 (1791), accompanying a crude but recognizable drawing of a flowering branch (crude as to outline and toothing of leaf), with an evident attempt to indicate pulverulence on foliage and branches. There was no word of diagnosis and the name cannot be taken up as adequately published by Bartram. Willdenow, however, Sp. Pl. ii[1]. 610 (1799) properly described the species under Bartram's name, citing the plate, so that the species *Andromeda pulverulenta* properly dates from Willdenow's adequate publication (Bartram ex Willd.); but, whereas Bartram's original plate accompanied the description of "The North West of Cape Fear, here at Ashwood [the old estate of Colonel William Bartram] . . . near three hundred yards over . . . and . . . eighty or ninety miles above the capes", therefore near the inner border of the Coastal Plain of southeastern North Carolina, Willdenow rendered its geographic source as "*Habitat* in Florida."

In 1800, Ventenat, Descr. Jard. Cels, 60, t. 60, described and illustrated *Andromeda cassinefolia*, "Feuilles . . . ovales, dentées et munie d'une glande au sommet de chaque dent, souvent aiguës, quelquefois obtuses, glabres, . . . d'un verd foncé", etc.

The plate shows narrow leaves mostly acute at each end and coarsely toothed, a relatively infrequent extreme, like our no. 12,154. But Ventenat, like Willdenow in case of Bartram's shrub, took the easiest course and said "Arbrisseau découvert par Michaux dans la Florida", although Michaux himself (Fl. Bor.-Am.) cited his own collections as discovered "in Carolina septentrionali, circa *Fayette-Ville* et *Wilmington.*"

Andromeda speciosa Michx. Fl. Bor.-Am. i. 256, clearly described "A. foliis ovalibus, subrotundis, obtusis, crenatis serratisve", is the least rare form of the species, with green, obtuse or round-tipped relatively broad and low-crenate leaves (except on vigorous leaders). Michaux divided his *A. speciosa* into two varieties: var. *a. nitida* (the typical variety) from "circa *Fayette-Ville* et *Wilmington*" and var. "*β. pulverulenta:* Bart. ramis, foliis floribusque pulvere albo inspersis; qui candor certo morbus est . . . in Carolinae utriusque stagnosis." The name *pulverulenta* has been sufficiently considered, except that Ventenat, Jard. Malmais. ii. 79 (1804) treated it as *A. cassinefolia* Vent. (1800), var. *pulverulenta*.

Michaux's *A. speciosa, a. nitida* is the shrub with round-tipped or obtuse green leaves. Although the name var. *nitida* was without diagnosis, Michaux obviously meant it for his typical *Andromeda speciosa*. It was taken in this sense by Rehder in 1902 and I am so considering it.

Small and others, following Willdenow and Ventenat, who respectively ascribed Bartram's locality on Cape Fear River, North Carolina, and Michaux's stations, "in Carolina septentrionali, circa *Fayette-Ville* et *Wilmington*", to "Florida", state the range of *Zenobia cassinefolia* as "Pinelands, Coastal Plain, NE Fla. to N. C." and of typical *Z. pulverulenta* as "Ga. (or Fla.?) to N. C." In the herbarium of the New York Botanical Garden, where one would expect specimens from Florida (Small for many years collecting there), and in the Gray Herbarium the only material (until our Virginia collections) is from North and South Carolina, and at the former institution there is a letter to Dr. Small, stating that in the National Herbarium there is no material from south of South Carolina. "Florida" may safely be dropped from the range. See map 16.

*Vaccinium crassifolium Andr. (*Herpothamnus* Small). Nansemond County: forming extensive carpets in the sandy or peaty pine lands and pine barrens south of South Quay: southwest of Marsh Hill School (less common than at other stations), no. 11,105; east of Cox Landing, nos. 10,774 and 12,160; southeast of Cox Landing, no. 11,604 (fruit, ripe October 15, purple-black, lustrous, soft, juicy, sweet and bland); southeast of Sandy Landing, no. 11,106; 1–1½ miles south of Cherry Grove, no. 11,398. Isle of Wight County: dry sandy pine barrens south of Lee's Mill, no. 11,889.

Extension north from southeastern North Carolina. See p. 379 and map 12.

Pyxidanthera barbulata Michx. To the single station recorded add another, also in Isle of Wight County: dry sandy pine barrens south of Lee's Mill, no. 11,893. Nansemond County: very abundant, with *Vaccinium crassifolium*, in pine barrens south of South Quay, nos. 10,775, 10,776, and 11,716; rare in pineland southwest of Marsh Hill School, no. 11,107. See p. 379.

*Lysimachia producta (Gray) Fernald. Southampton County: bushy swales and borders of swampy woods near Blackwater River, Cobb's Wharf, no. 10,382.

Our first material from south of the District of Columbia, except from western North Carolina. See p. 364.

L. (§ Steironema) radicans Hook. New Kent County: bottomland woods by Chickahominy River north of Long Bridge, southeast of Quinton, no. 11,402. Southampton County: about spring-heads bordering alluvial wooded bottomland of Nottoway River, Cypress Bridge, nos. 10,778, 10,779, 11,109 and 11,401.

In Rhodora, xxxix. 438 (1937), I recorded the Cypress Bridge station and expressed some doubt as to the exact identity. We watched the plant from anthesis through prolonged drowning to maturity, when it set no fruit; there is now no doubt of its identity with the plant of the Mississippi and Gulf drainage. See pp. 366 and 397 and map 3.

*Sabatia angularis (L.) Pursh, forma **cleistantha,** f. nov., corollis minutis tubulosis clausis pallidis.—Greensville County, Virginia: argillaceous and sphagnous meadow northwest of Taylor's Millpond, August 29, 1939, *Fernald & Long*, no. 11,112 (type in Herb. Gray).

S. amoena (Raf.) G. Don. To the few recorded stations add another in Princess Anne County: brackish to fresh marsh along Back Bay, at eastern margin of Long Island, no. 11,113. See p. 389.

*NYMPHOIDES AQUATICUM (Walt.) Ktze. PRINCESS ANNE COUNTY: shallow water near margin of Salt Pond, no. 10,788, station shown us by the Misses Sally Ryan and Mary Leigh.

FRAXINUS AMERICANA L., var. MICROCARPA Gray. SUSSEX COUNTY: wooded bottomland, Nottoway River, southwest of Homeville, no. 10,389. See p. 361.

Although Small speaks of the small-fruited extreme as having no seeds, our material seems normal. Its fruits are not so small as in the original material from Alabama nor as in Small's collection from Smyth County, Virginia, but decidedly smaller than in the regular run of *F. americana*.

F. PENNSYLVANICA Marsh., var. AUSTINI Fernald in RHODORA, xl. 452, pl. 529, figs. 1 and 2 (1939). CHARLES CITY COUNTY: wooded sandy margin of James River, Wilcox Wharf, no. 11,110.

Our first station on the Coastal Plain of Virginia.

F. PENNSYLVANICA, var. LANCEOLATA (Borkh.) Sarg. GREENSVILLE COUNTY: alluvial woods along Meherrin River, Emporia, no. 11,111.

Our first station on the Coastal Plain of Virginia.

*APOCYNUM SIBIRICUM Jacq. *A. hypericifolium* Ait. See Fernald in RHODORA, xxxvii. 327, 328 (1935). CHARLES CITY COUNTY: sandy beach of James River, southeast of Tettington, no. 11,405. See p. 396.

Woodson in his monograph of the genus, Ann. Mo. Bot. Gard. xvii. 137 (1930), cited nothing from south of Delaware and the District of Columbia.

*AMSONIA TABERNAEMONTANA Walt. SOUTHAMPTON COUNTY: rich mixed and deciduous woods near Nottoway River, above Carey Bridge, nos. 10,790 and 11,895. GREENSVILLE COUNTY: wooded bottomland of Fontaine Creek southeast of Taylor's Millpond, no. 10,394. See p. 359.

Woodson, in his monograph of *Amsonia*, Ann. Mo. Bot. Gard. xv. 405–407 (1928), cited *A. Tabernaemontana* as only escaped from cultivation northeast of South Carolina. Along the Nottoway and Fontaine Creek it is a part of the strictly indigenous flora. The only Virginian material seen by Woodson was from Petersburg "data lacking" and referred by him to var. *salicifolia* (Pursh) Woodson. The variety abounds in rich woods and clearings along Appomattox River, slightly above the "fall-line" about 2 miles west of Petersburg, no. 11,896.

Acerates floridana (Lam.) Hitchc. To the single known station in Sussex County (now under the plow) add one (now also under the plow!) in Greensville County: very scarce (now deeply buried by clay thrown over it in ditching), peaty swale by Southern Railway northeast of Emporia, no. 11,119.

*Asclepias lanceolata Walt. Princess Anne County: brackish to fresh marsh along Back Bay, Pellitory Point, northeast of Munden, no. 11,117.

As pointed out by me in Rhodora, xxxvii. 438 (1935), the plant of Princess Anne and Norfolk Counties is mostly var. *paupercula* (Michx.) Fernald, with linear leaves. The Pellitory Point station (rather extensive) is the first known to us between northeastern North Carolina and Delaware. See p. 387.

A. purpurascens L. To the single station in Nansemond County add one in Dinwiddie County: rich deciduous woods about old marl-pits east of Burgess Station, no. 10,398.

Breweria humistrata (Walt.) Gray. Local range extended northward and eastward. New Kent County: dry clearing south of Providence Forge, no. 11,407. Surry County: dry thicket north of Surry Courthouse, no. 10,794. Nansemond County: dry sandy woods at Cox Landing, south of South Quay, no. 11,408.

Ipomoea hederacea Jacq., var. integriuscula Gray. To the station in Princess Anne County recorded in 1935 add one in Southampton County: roadside fencerow west of Franklin, no. 11,409.

Phlox Hentzii Nutt. in Journ. Acad. Nat. Sci. Phila. vii. 110 (1834). *P. nivalis* sensu Wherry in Bartonia, no. 11: 8 (1929); probably not of Loddiges, Bot. Cab. viii. no. 780 (1823), without description. Local range extended eastward into Nansemond County: white sand of pine and oak woods and clearings near Cathole Landing, west of Factory Hill, nos. 11,414 and 11,897. See p. 399.

In my earlier papers, without looking carefully into the matter, I erroneously took up the name *Phlox nivalis* Loddiges, in deference to the usage of Dr. Wherry, l. c., and in later papers. When the original source is consulted, however, no adequate description is found. Loddiges showed a branch with a mass of white corollas, the tubes barely exserted from the calyx, and his text was as follows:

No. 780

PHLOX NIVALIS.

Class.	Order.
PENTANDRIA	*MONOGYNIA.*

. . . .

This is a native of Carolina and Georgia. It was sent to us by our excellent friend Dr. Wray, of Augusta, and flowered beautifully the last spring. We think it so different from both subulata and setacea, that it may well form another species.

It is probably not quite hardy: we preserved it very well in a cold frame, and have increased it by cuttings. The soil should be light loam, with a little peat mixed. Like the setacea, it appears to be partly shrubby.

That, of course, is not a diagnosis and, unfortunately, the Loddiges plate (which shows no analyses of the flowers, which would admit it under the International Rules) shows corolla-tubes barely exserted from the calyx, one of the few flowers (at the left) which show the corolla-tube with it exceeding the calyx by only 2 mm. The many sheets in the Gray Herbarium checked by Dr. Wherry as "*Phlox nivalis*" have the long-exserted corolla-tube exceeding the calyx by 7–10 mm. Nuttall's account of *P. Hentzii* had the required diagnosis and a clear discussion of the plant. Its exact geographic source was not given, merely "Sent to the herbarium of the Academy by my friend Mr. Hentz", the plant said to be a "common species in the southern pine barrens." One of Nuttall's original specimens (part of the TYPE) in the Gray Herbarium bears in Nuttall's hand the clarifying data: "Chapel Hill, N. Carolina. *N. M. Hentz*". Material of the magenta-colored form (the only one known in southeastern Virginia) was collected near Chapel Hill on April 4, 1939, by *A. S. Pease* (no. 27,007).

HYDROLEA QUADRIVALVIS Walt. Local range extended eastward to PRINCESS ANNE COUNTY: margin of Stubby Lake, no. 10,797.

HELIOTROPIUM CURASSAVICUM L. To the two stations already recorded add from PRINCESS ANNE COUNTY: open mud and sand along Back Bay, Pellitory Point, northeast of Munden, no. 11,124; similar habitat east of Creeds, no. 11,125. See pp. 369 and 387.

ONOSMODIUM VIRGINIANUM (L.) A. DC. To the few recorded stations add one in SOUTHAMPTON COUNTY: dry sandy pine woods near Nottoway River, above Carey Bridge, no. 10,404. SUSSEX

County: dry open sandy woods and thickets between Littleton and Peters Bridge, no. 12,179; sandy woods near Chub, no. 12,448. See p. 362.

Verbena officinalis L. Dinwiddie County: roadsides and waste places, Petersburg, no. 10,798. Henrico County: waste places and railroad ballast, Richmond, no. 12,451. Princess Anne County: sandy clearing, Ragged Island, no. 12,452.

Our first stations on the Coastal Plain of Virginia; apparently very local.

V. scabra Vahl. To the two stations already recorded add two in Princess Anne County: inner border of brackish to fresh marsh along Back Bay, at eastern margin of Long Island, no. 10,799; sandy clearing, Ragged Island, no. 12,453. See p. 371.

Lippia nodiflora (L.) Michx. To the station (Knott's Island) recorded in 1935 add others, also in Princess Anne County: brackish to fresh marsh along Back Bay, at eastern margin of Long Island, no. 11,126; marsh along Back Bay, eastern margin of Ragged Island, no. 12,454. See pp. 370 and 389.

Trichostema setaceum Houtt. (*T. lineare* Walt.). To the stations in Isle of Wight County recorded in 1937 add from Southampton County: white sand of pine and oak woods north of Point Beach, south of Franklin, no. 11,416; similar habitat, southeast of Wiggins School, no. 11,417. See p. 397.

Pycnanthemum verticillatum (Michx.) Pers. Dinwiddie County: springy sphagnous swale about 5 miles east of Burgess Station, no. 11,131.

Heretofore known in the state only from the western counties. Associated in the swale with other localized species. See p. 390.

Cunila origanoides (L.) Britton. Entering the Coastal Plain in Sussex County: rich woods and bushy clearing just east of the "fall-line" along Nottoway River, Double Bridge, about 6 miles northwest of Jarratt, nos. 11,132 and 11,420. Southampton County: steep wooded slopes by Three Creek, northwest of Applewhite's Church, no. 10,409. See p. 363.

*Hyptis mutabilis (A. Richard) Briq., var. spicata (Poit.) Briq. Dinwiddie County: roadsides and waste places, Petersburg, no. 11,418.

A tropical American species (variety chiefly West Indian) not previously reported from north of Florida. See p. 400.

*Physalis angulata L. Princess Anne County: borders of low woods and clearings along Back Bay, Long Island, nos. 10,811 and 11,137.

Although given a broad range, "Pa. to Minn. and southw." by Robinson & Fernald in Gray, Man. ed. 7, there is no other indigenous material in the Gray Herbarium from north of North Carolina and southern Illinois. In his monograph of the group, Mem. Torr. Bot. Cl. iv. 334 (1896), Rydberg was unable to cite specimens from north of North Carolina. See p. 371.

P. PUBESCENS L. Range extended westward into NANSEMOND COUNTY: wood-road in swampy woods east of Milk Landing, south of South Quay, no. 10,810.

*LYCIUM CHINENSE Mill. DINWIDDIE COUNTY: roadsides and waste places, abundant and rapidly spreading, Petersburg, no. 11,609.

*CYMBALARIA MURALIS Gaertn., Mey. & Scherb. DINWIDDIE COUNTY: abundant on bank by railroad, Petersburg, no. 11,610.

Pennell (Scroph. E. Temp. N. Am. 317) cites no material seen from Virginia.

KICKSIA ELATINE (L.) Dumort. NEW KENT COUNTY: ditch at border of damp woods, near Fillbate's Creek, north of Holly Forks, no. 11,611. HENRICO COUNTY: waste places and railroad ballast, Richmond, no. 12,470. SOUTHAMPTON COUNTY: cinders of freight-siding, Branchville, no. 10,414.

CHELONE GLABRA L., var. ELATIOR Raf. SOUTHAMPTON COUNTY: with *C. Cuthbertii* Small, border of low woods southwest of Cypress Bridge, no. 11,488.

A plant chiefly of the upland, here definitely on the Coastal Plain.

C. OBLIQUA L. SOUTHAMPTON COUNTY: seeping wooded slope bordering bottomland of Three Creek, northwest of Carey Bridge, nos. 11,419 and 11,424.

The only Virginian station (probably the original of Clayton) known to Pennell, l. c., is in Gloucester County. See pp. 363 and 399.

C. CUTHBERTII Small. Local range extended eastward into NANSEMOND COUNTY: wet bushy swale east of Cherry Grove, south of South Quay, nos. 11,138 and 11,614; wet peaty thicket in pine barrens, east of Cox Landing, south of South Quay, no. 11,423. See p. 384.

*BACOPA CYCLOPHYLLA Fernald in RHODORA, xli. 446 (1939) (*Herpestis rotundifolia* Gaertn. fil.). KING WILLIAM COUNTY: very scarce, fresh tidal shore of Mattaponi River, at Horse Landing, near King William Courthouse, no. 11,613.

The eighth known station, connecting that at Wilmington, North Carolina, with the two in eastern Maryland. See p. 402. and map 22.

*Gerardia racemulosa Pennell. Nansemond County: sandy and peaty pine barrens, east of Cox Landing, south of South Quay, nos. 11,145 and 11,433.

Pennell, Scroph. E. Temp. N. A., map 115 (p. 434), indicates no station between the Eastern Shore of Maryland and southeastern North Carolina. *G. racemulosa* seems like a pine-barren extreme of *G. purpurea* L.

*Utricularia biflora Lam. King William County: fresh tidal shore of Mattaponi River, at Horse Landing, near King William Courthouse, no. 11,620. Charles City County: tidal water of Kimage's Creek, Kimage's, no. 11,438. Princess Anne County: shallow pools in brackish to fresh marsh along Back Bay, east of Munden, no. 11,147; similar habitat, east of Creeds, no. 11,148. Sussex County: small sandy pond in woods north of Double Bridge, about 6 miles northwest of Jarratt, no. 11,439.

There is no previous material in the herbarium of the New York Botanical Garden and in the Gray Herbarium from between South Carolina and southern New England. See p. 387.

U. fibrosa Walt. Nansemond County: seepy sandy and peaty open spots in sphagnous savannah-like swale east of Cherry Grove, south of South Quay, nos. 11,618 and 12,186. See p. 403.

There is no previous material in the herbaria of the New York Botanical Garden and of the Philadelphia Academy nor in the Gray Herbarium from between southeastern North Carolina and southern Delaware and New Jersey. Mr. Lloyd G. Carr has reported it (Claytonia, iv. 23) from Augusta County.

U. juncea Vahl. Local range extended to Nansemond County: seepy sandy and peaty open spots in sphagnous savannah-like swale east of Cherry Grove, south of South Quay, no. 11,149. See p. 384.

U. virgatula Barnhart. Local range extended to Nansemond County: with the last, no. 11,150. See p. 384.

*Ruellia strepens L., forma cleistantha (Gray) S. McCoy. Prince George County: wooded swamp by James River south of Indian Point, no. 11,152.

*Diodia teres Walt., var. hirsutior Fern. & Grisc. Princess Anne County: sandy fields, Long Island, no. 11,153. Nansemond County: dry white sand of pine barrens, east of Cox Landing, south of South Quay, no. 11,156. Southampton

County: border of sandy woods southeast of Round Gut, southwest of Franklin, no. 11,442. See p. 389.

D. teres, var. hystricina Fern. & Grisc. Essex County: sandy beach of Rappahannock River at Richmond Beach, southeast of Tappahannock, no. 11,621.

Extension inland from coastal sands. See p. 402.

*Richardia scabra L. Dinwiddie County: railroad cinders, scarce, Collier's Yard, 3–4 miles southwest of Petersburg, no. 11,159. Southampton County: weed in sandy field near Blackwater River, Cobb's Wharf, no. 11,160. Nansemond County: roadside bordering swampy woods north of Whitemarsh School, no. 11,161.

A tropical American species, formerly known northward into North Carolina. See pp. 382 and 383.

*Eupatorium tortifolium Chapm. Nansemond County: dry white sand of pine barrens northeast of Sandy Landing, south of South Quay, no. 11,108; similar habitat, near Cathole Landing, west of Factory Hill, no. 11,448.

Extension north from South Carolina. See pp. 384 and 399.

Kuhnia eupatorioides L. To the few recorded Coastal Plain stations add one in Southampton County: dry hickory and oak woods north of Point Beach, south of Franklin, no. 11,453. See p. 398.

*Carphephorus tomentosus (Michx.) T. & G., var. **Walteri** (Ell.), comb. nov. *Liatris Walteri* Ell. Sk. ii. 285 (1822), at least as to plant described. Isle of Wight County: dry sandy pine barrens south of Lee's Mill, no. 12,486. Nansemond County: sandy and peaty pine barrens northeast of Sandy Landing, south of South Quay, no. 11,173.

With typical pilose-leaved *C. tomentosus* and very distinct from it in its glabrous rosettes and only sparsely pubescent stems. Our plant is definitely what Elliott described from eastern South Carolina as *Liatris Walteri* with "leaves lanceolate, acute, glabrous, dotted, attenuate at base", etc., though Elliott made the error of including *Anonymos uniflorus* Walt. Elliott's note that "This plant appears to form an intermediate species between *L. Bellidifolia* and *Tomentosa*" is significant, but I find little to place it near *Carphephorus bellidifolius;* its characters, except for the glabrous lower leaves, place it with *C. tomentosus*. The late Henry W. Ravenel sent it to Gray as *Liatris Walteri* from Santee Canal and the late M. A. Curtis thus correctly identified his material from the region of Wilmington, North Carolina. See p. 384.

Solidago fistulosa Mill. Our most inland station is in Southampton County: low woods, very scarce, near the pond, Windman's Mill, south of Sunbeam, no. 11,464. From here eastward it becomes progressively more abundant.

S. Elliottii T. & G. (typical). To the single Virginian station, in Henrico County, recorded in 1939, add the following, in Nansemond County: clearings and borders of wet woods north of Whitemarsh School, nos. 10,831 and 11,625; swampy depressions in pine barrens east of Cox Landing, south of South Quay, no. 10,832; sphagnous savannah-like swale east of Cherry Grove, south of South Quay, nos. 11,463 and 11,626.

S. ulmifolia Muhl. Extending into the Coastal Plain in Charles City County: dry wooded bank of James River at "Four Oaks", below Harrison Point, no. 11,461.

A Synopsis of Boltonia (Plates 640–646).—In September, 1933, on my first trip to Virginia, Mr. Ludlow Griscom and I collected on the tidal marshes of North Landing River a *Boltonia* which did not readily work out by existing treatments of the group. In studying it we found other difficulties in the genus and then prepared a tentative outline of the more significant characters. The completion and publication of this study was delayed until the identity of some types, including those of *Matricaria asteroides* L., basinym of *B. asteroides* (L.) L'Hér., and of *Chrysanthemum carolinianum* Walt., referred by Gray to the synonymy of *B. asteroides*, could be established. The Walter type has not been found; but a sheet compared by Mr. C. A. Weatherby in October, 1935, and a photograph (our pl. 640, figs. 1 and 2) received from Mr. Savage in November of that year clearly settle that *Matricaria asteroides* L. is, as Mr. Griscom and I inferred from the Linnean diagnosis and the source of the type, "Pensylvania", not the wide-ranging series with broad leafy corymbs, extending westward to Illinois and beyond, as Gray inferred, but a local plant chiefly of the Atlantic States, with its chief concentration along the Susquehanna River in Pennsylvania and Maryland, though perhaps extending to northern Ohio, and known from western North Carolina; also with a geographic variety, the true *B. glastifolia* (Hill) L'Hér. (our pl. 641), extending from southern New Jersey along the coastal areas to Louisiana. Some other conclusions reached by Griscom and me in the winter of 1933–34 are supported by additional collections; other conclusions are altered through new evidence. For instance, the commoner species of southeastern Virginia (PL. 642), tall (up to 2.3 m. high), with small mostly white-rayed heads on the loosely paniculate branches, then not known to us, closely matches Walter's account of his *Chrysanthemum carolinianum* from the region of Charleston; and, fortunately, a collection made by Mr. Robert K. Godfrey in Berkeley County, South Carolina, in September, 1939, is quite like the plant of southeastern Virginia. We are, therefore, safe in considering it Walter's species, the type of which is presumably lost. In many points the outline prepared seven years ago is here adopted, with real regret that his other duties prevent my associate in the original study from continuing it at this time. The two coastwise species (*B. asteroides* and an undescribed one of southeastern Virginia and South Carolina, PL. 643), with broad disks and long lilac ligules, often produce, even at flowering time, well defined subterranean stolons; the tall southeastern species with small usually white-rayed heads (*Chrysanthemum carolinianum* Walt.) has a mass of fibrous roots, with no elongate stolons, at most producing sessile or subsessile superficial basal offsets in late autumn. Similar differences of habit apparently exist in the species of the interior but, most unfortunately, only one or two out of many sheets of specimens of them exhibit carefully dug and washed subterranean parts. Nine-tenths of all the specimens I have seen are hastily broken or snatched fragments without bases. Until properly collected and intelligently laid-out specimens of these plants are available their treatment must be necessarily tentative.

In this study I have been greatly aided by the use of the local material of the Academy of Natural Sciences of Philadelphia, most kindly sent me for examination by Mr. Long.[1]

[1] The following key, like many others published in recent years in my revisionary papers, was made primarily for use in a new edition of Gray's Manual. In some instances such keys published in the past have subsequently appeared (without serious alteration of even minor details) in books COPYRIGHTED by others. If compilers of such books like my keys, the product of weeks or months of concentrated study and of tedious measurements, it is hoped that they will not attempt to place me in the eventual position of having to acknowledge my own work as taken from their copyrighted books.

a. Phyllaries (involucral bracts) linear to linear-attenuate or subulate, 0.2–0.75 (rarely –1) mm. broad; disk 3–8 mm. broad; awns wanting or up to ⅔ as long as achene, shorter than disk-corolla .... *b*.

b. Phyllaries 0.5–1 mm. broad, not long-attenuate nor subulate; ligules 0.8–1.5 cm. long, lilac or purplish; heads few, on strongly ascending to erect naked or few-bracted peduncles; plant often spreading by elongate stolons 1. *B. asteroides*.

b. Phyllaries 0.2–0.4 (rarely –0.5) mm. broad, long-attenuate to linear-subulate; ligules 5–8 mm. long, white or lilac; heads numerous, more or less diffusely paniculate or corymbose .... *c*.

c. Involucre of 2–3 closely imbricated often subequal series of phyllaries, not often extending down the peduncles as bracts; peduncles 0.5–5.5 cm. long; achenes wingless or only narrowly margined .... *d*.

d. Diffusely panicled, the flowering branches and elongate (mostly 1.5–5.5 cm. long) peduncles spreading to loosely ascending; awns wanting or minute (about 0.1 mm. long); achenes narrowly cuneate-obovate.

Base without elongate stoloniferous offshoots; leaves subtending flowering branches narrowly lanceolate to linear-oblanceolate, attenuate to both ends; ligules 5–7 mm. long, white (rarely lilac); disks 3–5 mm. broad; anthers included; awns about 0.1 mm. long .... 2. *B. caroliniana*.

Base bearing elongate stolons; leaves subtending flowering branches narrowly obovate to broadly oblanceolate; ligules 7–8 mm. long, lilac; disks 5–8 mm. broad; anthers soon exserted; awns wanting or nearly so .... 3. *B. Ravenelii*.

d. Strongly corymbose, the leafy corymb with very many erect branches and short peduncles (0.5–2.5 cm. long); awns 0.7–1 mm. long, ½–⅔ as long as the broadly obovate achene .... 5. *B. latisquama*, var. *microcephala*.

c. Involucre of 3–5 unequal series, the lower commonly merging down the peduncle with the numerous small bracts; peduncles stiff and straight, many of them 2.5–15 cm. long; disks 3–5 mm. broad; achenes mostly broadly winged .... 4. *B. diffusa*.

a. Phyllaries (at least the larger) oblong to rhombic or cuneate-obovate, 0.5–2 mm. broad; disk 7–15 mm. broad; awns nearly or quite as long as the obovate achenes, about equaling disk-corollas, mostly 1–2 mm. long; coarse plant with leafy corymb; ligules lilac or white, 1–1.8 cm. long 5. *B. latisquama*.

1. B. asteroides (L.) L'Hér. (Plate 640). Slender, simple or with loosely ascending branches, 2–7 dm. high, with basal offsets and stolons developed in autumn; leaves submembranaceous, linear to oblong-lanceolate or oblanceolate, broad-based, scarcely petioled, the principal ones 2.5–12 cm. long and 3–13 mm. broad; heads 1–23, usually few, on loosely ascending to erect naked or few-bracted peduncles 2.5–11 cm. long; involucre of 2–3 series of subequal linear phyllaries 0.5–1 mm. broad; ligules lilac or pur-

plish, 0.8–1.5 cm. long; disk 6–8 mm. broad; achenes obovate, thick-rimmed, about 2 mm. long, the awns wanting or up to 0.7 mm. long.—Sert. Angl. 27 (1788). *Matricaria Asteroides* L. Mant. 116 (1767).—Northwestern New Jersey, eastern Pennsylvania and northern Maryland; western North Carolina; perhaps also northern Ohio. NEW JERSEY: low woods, Brighton, Sussex County, September 4, 1910, *Mackenzie,* no. 4778; border of pond east of Swartswood Lake, Sussex County, August, 1911, *Mackenzie,* no. 4922; muddy calcareous shores and flats, Shyster Pond, Warren County, July 24, 1920, *Mackenzie.* PENNSYLVANIA: TYPE (photograph in Gray Herb., our PLATE 640, FIG. 1) of *Matricaria Asteroides* L., cult. at Upsala from material sent by Bartram from Pennsylvania (*"Habitat* in Pennsylvania. *Barthram"*); banks of Susquehanna, Harrisburg, August, 1858, *Porter;* same locality, without date, *Martindale;* banks of Susquehanna, Lancaster County, August 20, 1862, *Porter* (with memorandum: "quite frequent on the rocky banks and islands of the Susquehanna from Harrisburg southward")—the preceding specimens distributed as *B. glastifolia;* Foster's Island, Harrisburg, August 10, 1888, *Porter;* river-bank, Harrisburg, July 9, 1888, *Small;* islands, York Furnace, September, 1892, *Jos. Crawford;* rocky pools on Bair's Island, York Furnace, June 18–23, 1896, *MacElwee;* mouth of Tucquan, Lancaster County, September, 1892, *A. A. & E. G. Heller,* no. 595; McCall's Ferry, September 5, 1892, *S. Brown,* July 17, 1903, *S. Brown & B. H. Smith.* MARYLAND: rocky islands of Susquehanna River, Conowingo, Cecil County, July 29–31, 1924, *Jos. Crawford;* Havre de Grâce, September 1, 1906, *Long;* ¼ mile south of Havre de Grâce, July 19, 1902, *G. H. Shull,* no. 75. NORTH CAROLINA: sandy roadside, near summit of divide, south of Tuxedo, Henderson County, August 22, 1927, *Wiegand & Manning,* no. 3232.

Two collections from northern OHIO (bay shore, Sandusky, September 28, 1898, *E. L. Moseley,* and Continental, Putnam County, October 1, 1883, *H. A. Young*) seem like the Susquehanna plant but the material is inadequate.

That true *Boltonia asteroides,* as shown by the TYPE, the specimen in the Linnean Herbarium described in Species Plantarum (our PLATE 640, FIGS. 1 and 2), is the slender species of the Susquehanna Valley, eastward into northwestern New Jersey, is apparent, although the name has erroneously been made to cover an assemblage of broadly corymbose and very leafy plants extending westward into the Prairie States. Details of the local eastern species are shown in PLATE 640.

In PLATE 640, FIGS. 1 and 2 are portions, × 1, of the Linnean TYPE of *Matricaria Asteroides*, enlarged from a photograph received from Mr. S. SAVAGE; FIG. 3, two heads, × 2, from Harrisburg, Pennsylvania, August, 1858, *Porter;* FIG. 4, partly denuded receptacle (split), with mature fruit, × 2, from same specimen as FIG. 3; FIG. 5, achene, × 10, from mouth of Tucquan, Lancaster County, Pennsylvania, *Heller & Heller,* no. 575.

Typical *Boltonia asteroides* was early in European botanic gardens, probably derived from the Pennsylvania material sent by Bartram to Linnaeus. A beautiful sheet of it (somewhat overgrown in cultivation) is in the Gray Herbarium, collected by Jacques Gay from plants cultivated in Paris in 1822; and old specimens from other European gardens are there represented.

Near the coast, on muddy shores or in tidal marshes (see p. 396) from southern New Jersey to Louisiana, *Boltonia asteroides* becomes stiffer, with firmer leaves and taller stems, and with more promptly stoloniferous habit. In this plant the principal leaves are narrowed into petiolar bases and the stiffer and straighter peduncles are often more bracteolate. Some specimens of this coastwise plant are a good match (taking into account the fact that it had been in cultivation) for the original plate of *Matricaria glastifolia* Hill, basinym of *B. glastifolia* (Hill) L'Hér. This wider-spread variety becomes

*B. ASTEROIDES (L.) L'Hér., var. **glastifolia** (Hill), comb. nov. (PLATE 641). Freely stoloniferous, the stems up to 1.2 m. high, slender, with erect or ascending branches; leaves coriaceous, the lower narrowly lanceolate or oblanceolate, acuminate or acutish, narrowed to subpetiolar bases; peduncles often more bracteate; awns of achenes well developed.—*Matricaria glastifolia* Hill, Hort. Kew, 19, t. 3 (1769). *B. glastifolia* (Hill) L'Hér. Sert. Angl. 27 (1788).—Southern New Jersey to Louisiana, local. NEW JERSEY: Bennett, Cape May County, September 4, 1907, *Van Pelt;* bog north of creek, Green Creek, Cape May County, August 15, 1909, *Van Pelt;* low ground along railroad, Rio Grande, Cape May County, September, 1911, *O. H. Brown;* clay-bottomed bog, Cold Spring, Cape May County, August 30, 1917, *Gershoy*, no. 701, June 23, 1939, *F. C. Schmid, Jr.* DELAWARE: bogs, Felton, September 25, 1873, *A. Commons;* bogs, Ellendale, August 16, 1877, *A. Commons;* moist open sandy depression east of Ellendale, September 5, 1925, *Pennell*, no. 12,872. VIRGINIA: tidal marsh along Chickahominy River about 5 miles west of Toano, James City County, August 13, 1939, *R. W. Menzel*, no. 311; fresh tidal marsh of Chickahominy River, below Barrat's Bridge (or Ferry), James City County, September 19, 1939, *Fernald & Long*, no. 11,466; brackish marsh of North Landing

River, Pungo Ferry, Princess Anne County, September 22, 1933, *Fernald & Griscom*, no. 2914; Northwest, Norfolk County, September 6, 1893, *Heller*, no. 1248. North Carolina: ditch near Old Dock, Columbus County, August 29, 1938, *Godfrey*, no. 6337. South Carolina: Santee Canal, September, —, *H. W. Ravenel*. Georgia: edge of nearly fresh marshes of Altamaha River, just below Darien, McIntosh County, September 17, 1903, *Harper*, no. 2003. Louisiana: without stated locality, *E. Hall*.

In plate 641, fig. 1 is a plant, × 2/5 from below Barrat's Bridge, James City County, Virginia, *Fernald & Long*, no. 11,466; figs. 2 and 3, heads, × 2, from no. 11,466; fig. 4, achene, × 10, from Pungo Ferry, Princess Anne County, Virginia, *Fernald & Griscom*, no. 2914.

2. *B. **caroliniana** (Walt.), comb. nov. (Plate 642). Very tall, up to 2.3 m. high, from fibrous roots, without elongate stolons, freely branched with wide-spreading to subascending long paniculate branches; early (soon dropping) lower leaves broadly oblanceolate, membranaceous and blunt; principal cauline leaves at flowering time submembranaceous, lanceolate to linear-oblanceolate, tapering to apex and petiolar base; paniculate branches up to 7 dm. long, leafy, diffusely forking; peduncles filiform, 1.5–4.5 cm. long; involucre of 2–3 close series, the linear-subulate phyllaries only 0.2–0.3 mm. broad; ligules white (rarely lilac), 5–7 mm. long; disks 3–5 mm. broad; achenes narrowly cuneate-obovate, narrow-rimmed; awns minute, about 0.1 mm. long.—*Chrysanthemum Carolinianum* Walt. Fl. Carol. 204 (1788).—Rich and damp soil, southeastern Virginia and eastern South Carolina. Virginia: thicket at margin of exsiccated old mill-pond in Swift Creek, Lakeview, Chesterfield County, September 16, 1938, *Fernald & Long*, no. 9470; alluvial woods, upper terrace of Nottoway River, southwest of Burt, Sussex County, September 20, 1937, *Fernald & Long*, no. 7678; alluvial woods, Nottoway River, southwest of Lambs, Sussex County, September 20, 1937, *Fernald & Long*, no. 7679; bushy swale 1½ miles east of Stony Creek, Sussex County, August 24, 1938, *Fernald & Long*, no. 9187; swale at border of woods, 4 miles south of Stony Creek, August 19, 1936, *Fernald, Griscom & Long*, no. 6716; same station, October 18, 1936, *Fernald & Long*, no. 6716*a* (fruiting branchlets); swampy woodroad northeast of Gaskins, Greensville County, August 29, 1939, *Fernald & Long*, no. 11,180; argillaceous and siliceous alluvium, bottomland of Nottoway River near Courtland, Southampton County, June 23, 1936, *Fernald, Long & Smart*, no. 5936 (young foliage); sandy wooded bottomland of Nottoway River, Courtland, August 25, 1936, *Fernald & Long*, no. 6717; wooded bottomland of Meherrin River, near Haley's Bridge, Southampton County, August 19, 1938, *Fernald & Long*, no. 9186. South Carolina:

Cooper River, Berkeley County, October, 1847, *Cranmore Wallace;* clearing along logging railroad, floodplain forest, along Santee River, 3 miles northeast of Pineville, Berkeley County, September 11, 1939, *Godfrey,* no. 8155.

This tall and paniculately branched species, with usually white ligules, the lanceolate leaves attenuate to base and commonly to apex, agrees far better than other Atlantic-slope species with Walter's description of his *Chrysanthemum carolinianum.* Walter's account was as follows:

> *Carolinianum* 1. foliis lanceolatis integris utrinque acuminatis laevibus, caule 5 ad 6-pedali ramosissimo, floribus radio albis disco luteo.

Walter lived on Santee River. We now have two collections of the tall much branched plant with leaves "utrinque acuminatis" and with white rays from that region. Even if the Walter type is never found the identification seems quite safe.

In PLATE 642, FIG. 1 is a plant, × 2/5, from east of Stony Creek, Sussex County, Virginia, *Fernald & Long,* no. 9187; FIG. 2, flowering head (white ligules scarcely showing), × 2, from no. 9187; FIG. 3, fruiting heads, × 2 from south of Stony Creek, *Fernald & Long,* no. 6716[a]; FIG. 4, achene, × 10, from no. 6716a.

3. *B. **Ravenelii** Fernald & Griscom, sp. nov. (TAB. 643), planta 2–8 dm. alta paniculato-ramosa basi stolonifera; foliis primariis membranaceis anguste obovatis vel late oblanceolatis obtusis vel subacutis basi subpetiolatis 6–10 cm. longis 1–3 cm. latis; paniculis elongatis subcylindricis 1.5–5.5 dm. longis 1–1.8 dm. diametro, ramis patento-adscendentibus foliosis paucifloris; pedunculis sparse bracteolatis rectis 2–5 cm. longis; phyllaribus lineari-subulatis 0.2–0.4 mm. latis 2–3-seriatis; ligulis lilacinis 7–8 mm. longis; disco 5–8 mm. lato; antheris deinde exsertis; achaeniis vix aristatis.—Rich bottomland woods, very local, southeastern Virginia and eastern South Carolina. VIRGINIA: wooded bottomland of Fontaine Creek, southwest of Haley's Bridge, Greensville County, October 11, 1938, *Fernald & Long,* no. 9642. SOUTH CAROLINA: Santee Canal, September, 1846, *H. W. Ravenel;* rich swamps, Santee Canal, October, —, *Ravenel* (TYPE in Herb. Gray).

A very little known species. The two Ravenel specimens, sent to Asa Gray more than 90 years ago, and the single collection from southeastern Virginia are consistent in their thin and broad leaves, stiffly ascending peduncles, very small involucres, lilac ligules and awnless achenes. The Virginia material, collected very late in the season, has most of the anthers exserted, and this unusual character shows in the older heads of the Ravenel material.

In PLATE 643, FIG. 1 is the original Ravenel material, × 2/5, the TYPE of *B. Ravenelii* at the left; FIGS. 2 and 3, heads, × 2, from the TYPE; FIG. 4, achene, × 10, from the TYPE; FIG. 5, heads, showing exserted anthers, × 2, from Fontaine Creek, southwest of Haley's Bridge, Greensville County, Virginia, *Fernald & Long*, no. 9642.

4. B. DIFFUSA Ell. Very slender, from subterranean rhizomes and stolons, 0.5–1 m. high, the stem 1.5–3 mm. thick at base, diffusely open-paniculate; leaves coriaceous, linear-subulate to broadly linear, only the few lowest dilated, the upper and those of the prolonged simple or only remotely forking ascending branches greatly reduced; peduncles filiform, many-bracteolate, straightish, 2.5–15 cm. long; heads small, remote; involucre of 3–5 unequal series, the lower phyllaries commonly merging down the peduncle into the numerous small bracts; phyllaries linear-subulate, 0.2–0.5 mm. broad; ligules white or lilac, 5–8 mm. long; disk 3–5 mm. broad; achenes cuneate-obovate, broadly winged, the awns about ¼ as long.—Sk. ii. 400 (1823).—Florida and southwestern Georgia to Arkansas, Oklahoma and eastern Texas. FLORIDA: hammock, Okeechobee Region, Brevard Co., October 26, 1903, *Fredholm*, no. 6151; cypress-head, Kelsey City, Palm Beach County, December 16, 1920, *Small, DeWinkeler & Rane*, no. 9814; moist rich soil, swamp, Juno, Palm Beach County, March 7, 1921, *F. R. Randolph*, no. 78; cypress swamp, vicinity of Fort Myers, Lee County, May 22, 1916, *J. P. Standley*, no. 199; river-swamps, Apalachicola, *Biltmore Herb.*, no. 142*b*. GEORGIA: wet pine barrens, Sumter County, September 8, 1900, *Harper*, no. 616; damp pine barrens near Leesburg, August 30, 1901, *A. H. Curtiss*, no. 6893. MISSISSIPPI: Mendenhall, August 20, 1903, *Tracy*, no. 8538; Deer Island, August 25, 1891, *Seymour & Earle*, no. 191; Deer Island, October 12, 1895, *Tracy*, no. 4778. ARKANSAS: roadside ditch near Hot Springs, August 3, 1935, *F. J. Scully*, no. 66. LOUISIANA: Covington, *T. Drummond*, no. 67; open dry soil, south edge of Hammond, Tangipahoa Parish, June 30, 1938, *D. S. & H. B. Correll*, no. 9256; damp soils, western Louisiana, *Josiah Hale;* moist soil along canal, near Holmwood, Calcasieu Parish, July 18, 1938, *Correll & Correll*, no. 9577. OKLAHOMA: along small streams, San Bois Mts., 1891, *C. S. Sheldon*, no. 280. TEXAS: Dallas, 1873, *Reverchon*, no. 233; Houston, September 14, 1913, *G. L. Fisher;* neglected field, Montgomery Co., July 18–21, 1909, *R. A. Dixon*, no. 492; ponds, Hempstead, June 6, 1872, *E. Hall*, no. 308.

Boltonia diffusa is here taken up in its traditional sense, although Elliott's type has not been studied. The range is usually stated as extending northward into South Carolina. I have seen no material, however, from north of northern Florida and southwestern Georgia, and I am inclined to the interpretation that authors have merely assumed that Elliott's species was described from South Carolina. Elliott's very detailed account states, fortunately, that his species "Grows in damp rich soils between the Chatahouchie and Alabama", *i. e.* somewhere between southwestern Georgia and northwestern Florida and western Alabama. Characteristic material is known from Sumter and Lee Counties, Georgia, in the drainage area of Flint River, which, at the extreme southwest corner of the state, joins the Chattahoochie to form Appalachicola River, whence *B. diffusa* is also known. Until authentic material from South Carolina is known, that state may well be omitted from the range.

Much of the material from the Mississippi valley differs from typical *Boltonia diffusa* in its coarser habit, much more branching stems and rather shorter and stiffer peduncles. Its bases are rarely collected, but the few seen usually show no stolons. This is

B. DIFFUSA Ell., var. **interior** Fernald & Griscom, var. nov. (TAB. 644), plerumque estolonifera; caulibus 0.6–1.2 m. altis basi 4–7 mm. crassis paniculato-ramosis, ramibus plerumque valde ramuliferis; pedunculis crassis; phyllaribus lineari-oblongis apice vix subulatis. KENTUCKY: weed in field, northeast of Murray, Calloway County, July 19, 1937, *Smith & Hodgdon*, no. 4078. TENNESSEE: dry oak barrens, alt. 1100 feet, Tullahoma, Coffee County, August 24, 1930, *Svenson*, no. 4257 (transition in phyllaries to typical *B. diffusa*, branching and fibrous roots of the var.). MISSISSIPPI: old field near Jackson, September 6, 1885, *John Donnell Smith:* Cat Island, August, 1900, *Tracy*, no. 485. ILLINOIS: Odin, 1860, *Geo. Vasey;* De Soto, August, 1862, *Vasey* (TYPE in Herb. Gray). MISSOURI: Springfield, August 31, 1888, *Blankinship.* ARKANSAS: waste, level cotton-land, Brinkley, Monroe County, August 28, 1934, *Delzie Demaree*, no. 10,858; bottoms, Arkansas River, Pine Bluff, October 24, 1931, *Demaree*, no. 8786; Texarkana, Miller County, September 8, 1898, *A. A. & E. G. Heller*, no. 4229 (transitional). OKLAHOMA: near edge of pond in woods, near Copan, Washington County, August 15, 1913, *G. W. Stevens*, no. 2094, as *B. latisquama*.

Var. *interior* is a perplexing plant, in its less extreme development clearly belonging near if not with *Boltonia diffusa*, but in extreme forms approaching small-headed extremes of *B. latisquama.* Fuller material, especially with carefully collected root-systems, is important to clarify the relationship here.

In PLATE 644, FIG. 1 is the TYPE, × 2/5, of *Boltonia diffusa*, var. *interior;* FIG. 2, heads, × 2, from TYPE; FIG. 3, mature head, × 2, from Tullahoma, Tennessee, *Svenson*, no. 4257; FIG. 4, achene, × 10, from no. 4257.

5. B. LATISQUAMA Gray (PLATE 645). Coarse, 0.7–1.5 m. or more high, the base apparently not stoloniferous; stem strongly corymbose-paniculate and leafy, conspicuously corrugated; leaves firm, the primary ones lanceolate, those of the corymbose branches linear-attenuate and much smaller; peduncles leafy-bracted, 1.5–5 cm. long; involucre of about 3 series of firm narrowly cuneate- to spatulate-obovate short-tipped phyllaries 1–2 mm. broad; ligules white or lilac, 1–1.8 cm. long; disk 7–14 mm. broad; achenes obovate, 2.5–3 mm. long, broad-winged; awns 1.5–2 mm. long.—Am. Journ. Sci., ser. 2, xxxiii. 238 (1862).—Prairies and banks of streams, Missouri, Kansas and Oklahoma, probably Texas; escape from cultivation eastward to New England.

In PLATE 645, FIGS. 1 and 2 are portions of the TYPE, × 1, from near the mouth of the Kansas River, *Parry;* FIG. 3 is a characteristic head, × 2, from Baker, Lincoln County, Oklahoma, August 25, 1895, *Blankinship;* FIG. 4, a fruiting head, × 2, from material cultivated by Gray in the Harvard Botanic Garden, October, 1865; FIG. 5, an achene, × 10, from the latter.

Var. OCCIDENTALIS Gray. Clearly stoloniferous; leaves larger and blunter; peduncles mostly naked; phyllaries more pointed. —Syn. Fl. i^2. 166 (1884). *B. occidentalis* (Gray) Howell, Fl. Nw. Am. i. 305 (1897).—Bottomlands, Union County, Oregon.

When better known, var. *occidentalis* may prove to be a distinct species. Howell in elevating it to specific rank added no new characters and gave no reason for separating it.

Var. **recognita** Fernald & Griscom, var. nov. (TAB. 646), foliis caulinis valde evolutis oblanceolatis vel lanceolatis; corymbis ad 4 dm. latis foliosis; phyllaribus anguste oblongis 0.5–1.3 mm. latis; disco 0.7–1.5 cm. latis; ligulis 1–1.8 cm. longis.—*B. asteroides* sensu Am. auth., non (L.) L'Hér.—Michigan to Manitoba and North Dakota, south to Kentucky, Missouri and Kansas; naturalized in New England and New Jersey. TYPE: Fort Snelling, Minnesota, August 20, 1891, *E. A. Mearns* (Herb. Gray).

Boltonia latisquama, var. *recognita* is the tall plant of woods and prairies, with broad corymbs of large heads, which has been passing erroneously as *B. asteroides*. It seems, phylogenetically, to be the main variety of *B. latisquama,* of which typical *B. latisquama* is an extreme development in the drier prairies and plains. Var. *decurrens* seems to differ from the wide-ranging var. *recognita* only in its decurrent leaves, while var. *microcephala* is a small-headed extreme somewhat approaching *B. diffusa*, var. *interior* and perhaps mixing with it.

In PLATE 646, FIGS. 1 and 2 are portions of the TYPE of var. *recognita,* × 1; FIG. 3, a head, × 2, from the TYPE.

Var. **decurrens** (Torr. & Gray) Fernald & Griscom, comb. nov. *B. glastifolia β. ? decurrens* Torr. & Gray, Fl. N. Am. ii². 188 (1842). *B. decurrens* (Torr. & Gray) Wood, Bot. and Florist, 166 (1870). *B. asteroides,* var. *decurrens* (Torr. & Gray) Engelm. in Gray, Syn. Fl. i². 166 (1884).—Bottomlands of Illinois and Missouri.

Var. **microcephala** Fernald & Griscom, var. nov. (TAB. 646), var. recognitae simillima; foliis primariis oblongis vel oblanceolatis 0.6–1.5 dm. longis; pedunculis 0.5–2.5 cm. longis; phyllaribus lineari-subulatis vel -lanceolatis 0.3–0.4 mm. latis; ligulis 5–8 mm. longis albidis; disco 5–8 mm. lato; achaeniis 1.5–2 mm. longis; aristis ca. 1 mm. longis.—Wisconsin, Illinois, Minnesota and Iowa. WISCONSIN: St. Croix Falls, August 1, 1900, *C. F. Baker.* ILLINOIS: along Illinois Central Railroad, south of Harvey, Cook County, August 30, 1893, *S. H. Burnham* (TYPE in Herb. Gray); wet bottoms, Urbana, *Gleason,* no. 1961; low wet soil near Creek, Vienna, August 9, 1902, *Gleason,* no. 2741; Fox Bottom, near Mud River, August 18, 1914, *Robert Ridgway.* MINNESOTA: Lake City, August 15, 1883, *W. H. Manning;* beach, Shakopee Lake, Louriston Township, Chippewa County, August 5, 1930, *Hotchkiss & Jones,* no. 362. IOWA: wet places, Johnson County, August, 1895, *T. J. Fitzpatrick.*

In PLATE 646, FIG. 4 is a group of mature heads, × 2, from the TYPE of var. *microcephala;* FIG. 5, an expanded head, × 2, from TYPE; FIG. 6, an achene, × 10, from TYPE.

ASTER GRANDIFLORUS L. Our northernmost station is in KING WILLIAM COUNTY: argillaceous roadside thicket northwest of King William Courthouse, no. 11,630.

*A. TATARICUS L. f. CHARLES CITY COUNTY: escaped to dry roadside thicket, Holdcroft, no. 11,631.

*A. UMBELLATUS Mill., var. **brevisquamus,** var. nov. (TAB. 647, FIGS. 1–4), caulibus ad 1.4 dm. altis; foliis lanceolato-ellipticis vel anguste ovatis glabris; involucris 2.5–4 mm. altis, phyllaribus 4–5-seriatis valde inaequalibus mediis lineari-oblongis obtusis ca. 0.5 mm. latis; ligulis 4–7 mm. longis.—Bogs and swamps, District of Columbia and eastern Virginia. DISTRICT OF COLUMBIA: swamp, Terra Cotta, September 29, 1897 and September 3, 1915, *Th. Holm.* VIRGINIA: sphagnous springy swales bordering Whiteoak Swamp, west of Elko Station, Henrico County, August 17, 1938, *Fernald & Long*, no. 9192; argillaceous and siliceous boggy depressions, about 3 miles southeast of Petersburg, at head of Poo Run, Prince George County, October 18, 1936, *Fernald, Long & Smart*, no. 6894 (TYPE in Herb. Gray; ISOTYPE in Herb. Phil. Acad.).

Typical *Aster umbellatus* Mill., ranging from Newfoundland to northern Ontario, south to western North Carolina, Ohio, Indiana and Illinois, has the involucre (FIGS. 5–7, all × 4) 4–5 mm. high, of gradually lengthening narrow linear-lanceolate acute or obtuse phyllaries, those of the median series nearly equaling the inner ones. Commonly with lanceolate or lance-oblong leaves, it may have them relatively short and broad (elliptic to lance-ovate). The latter individuals are *A. humilis* Willd., small plants sent to Berlin from Pennsylvania but (as shown by Muhlenberg's material and other eastern Pennsylvania broad-leaved plants) scarcely worth even formal designation, although some authors maintain them as a species or as a variety. The most extreme departure from typical *A. umbellatus* in the series with essentially glabrous but often scabrous leaves and gradually lengthening series of narrow phyllaries is the plant of wet cliffs described as *Doellingeria umbellata*, var. *flexicaulis* House. As an extreme departure from the usually stiffly erect plant it is noteworthy but its involucre is not strikingly different and it seems to me a forma rather than a true geographic variety.[20]

Var. *pubens* Gray, chiefly of the region from Upper Michigan to Saskatchewan, south to Iowa and Nebraska, is harsh with scabrous puberulence but otherwise resembles typical *Aster umbellatus*. Its involucres (FIGS. 8 and 9, both × 4) are inclined (in dried material) to be more turbinate and the relatively few phyllaries are very narrow.

On the Coastal Plain, from Florida to Texas, north to North Carolina and Arkansas, occurs *A. umbellatus*, var. *latifolius* Gray, Syn. Fl. N. Am. i^2. 197 (1884). Gray, and most later

[20] ASTER UMBELLATUS Mill., forma **flexicaulis** (House), comb. nov. *Doellingeria umbellata* (Mill.) Nees, var. *flexicaulis* House in N. Y. State Mus. Bull. no. 254: 712 (1924).

authors, confused the really definite plant of the South by citing a synonymy of *sensu* names. Gray's differentiation was based solely on breadth of leaf ("leaves from ovate-lanceolate to ovate, comparatively short, less narrowed or sometimes even rounded at base"; with the significant statement: "Extreme forms seem very different from *A. umbellatus,* having leaves even 2 inches wide by 3 in length"). It is thus clear that Gray had a broad-leaved southern plant primarily in mind, but he failed to note the distinctive involucre and consequently included any plants with "ovate-lanceolate leaves" and extended the range north to Pennsylvania and New Jersey. The first synonym was *A. humilis* Willd. Sp. iii. 2038, which, as already noted, is only a low and broad-leaved phase of typical *A. umbellatus,* although Willdenow so little understood his own *A. humilis* as to publish in 1806 in Hort. Berol. t. 67, a beautiful plate of *A. infirmus* Michx. as *A. humilis!* Gray's next synonyms under *A. umbellatus,* var. *latifolius* were *A. amygdalinus* sensu Bertoloni (1847) and *Doellingeria amygdalina* Nees (1833), "chiefly, excl. syn.", which is a misleading reference since the basinym, *Aster amygdalinus* Lam. Encycl. i. 305, no. 24 (1782) was founded (as shown by a photograph sent from Paris) on very characteristic *A. umbellatus* cultivated at Paris. The other synonym given by Gray under *A. umbellatus,* var. *latifolius* was *Diplopappus cornifolius* sensu Lindl. (1835), not *A. cornifolius* Muhl. ex. Willd. (1804). The synonymy given by Gray, consequently, is too vague to stand as the basis of his new var. *latifolius,* and only *A. humilis* could have been the nomenclatural basis for anything, the others being misapplications of older names by later authors. I am, therefore, taking Gray's name for the plant of the southern Coastal Plain which, alone, was so marked by him in preparing the Synoptical Flora; and, since he specially commented on "Extreme forms . . . very different from *A. umbellatus,* having leaves even 2 inches wide by 3 in length", I am designating as TYPE of var. *latifolius* the specimen he thus signified. This was collected by *Hale* in Louisiana in 1844. Photographs of portions of it, $\times$ 1, are shown in Plate 648, with the characteristic long involucres (5–7 mm. high), with phyllaries 0.8–1.5 mm. broad of it and other specimens shown, $\times$ 4. That

A. umbellatus, var. *latifolius*, as thus cleared of its encumberances, is a very distinct variety of the South will be apparent.

In PLATE 647, FIG. 1 is a portion of the TYPE, × 1, of *Aster umbellatus*, var. *brevisquamus*; FIG. 2, a head, to show involucre, × 4, from the TYPE; FIG. 3, head, × 4, from Elko Station, Virginia, *Fernald & Long*, no. 9192; FIG. 4, involucre, × 4, from Terra Cotta, District of Columbia, *Holm*. FIG. 5 is a head, × 4, of typical *A. umbellatus* from Ithaca, New York, *C. C. Thomas*, no. 5226; FIG. 6, involucre, × 4, from Randolph, New Hampshire, *A. H. Moore*, no. 348; FIG. 7, involucre, × 4, from Kennebunkport, Maine, September, 1894, *Grace Gilbert*. FIG. 8 is an involucre, × 4, of var. *pubens*, from the TYPE, Saskatchewan, *Bourgeau*; FIG. 9, involucre, × 4, from Madison, Wisconsin, August 30, 1893, *Churchill*.

In PLATE 648, FIGS. 1 and 2 are portions of the TYPE, × 1, of *A. umbellatus*, var. *latifolius*; FIG. 3, involucre, × 4, from TYPE; FIG. 4, involucre, × 4, from Alabama, *Gates*; FIG. 5, involucre, × 4, from Gateswood, Alabama, *Tracy*, no. 8587; FIG. 6, involucre, × 4, from Georgia, September 30, 1903, *Mrs. Taylor*.

ERIGERON VERNUS (L.) T. & G. Local range extended inland to GREENSVILLE COUNTY: peaty swale by Southern Railway northeast of Emporia, no. 10,441. See p. 360.

E. BONARIENSIS L. To the single station in Norfolk County already reported add from PRINCESS ANNE COUNTY: borders of low woods and clearings along Back Bay, Long Island, no. 11,188; open sandy flats about the Wild Fowl Refuge, near Little Island Life Saving Station, no. 11,189; clearing near old house, Cedar Island, no. 12,489. See p. 389.

*PLUCHEA PURPURASCENS (Sw.) DC. PRINCESS ANNE COUNTY: brackish to fresh marsh along Back Bay, at eastern margin of Long Island, no. 11,190; moist sandy shore, Ragged Island, no. 12,490. See p. 389.

A tropical American species heretofore recorded northward only to the coast of Georgia. The Long Island plant is extreme, with lanceolate leaves cinereous-pilose beneath, the involucre heavily pubescent, its outer phyllaries ovate. Some other collections, from near Hampton, and from tidal shores of the Chickahominy, have narrow leaves but the larger heads and oblong or elliptical outer phyllaries of the common northern *P. marilandica* (Michx.) Cass. Further observation may show that the latter usually broad-leaved and smoother plant may have to be treated as an essentially northern variety of the former. Until I have more field-experience with them in the transition-belt I am not ready so to treat them.

TETRAGONOTHECA HELIANTHOIDES L. To the station in Gloucester County add two in SOUTHAMPTON COUNTY: border of sandy woods southwest of Applewhite's Church, no. 10,447; rich sandy and loamy woods along Three Creek, northwest of Carey Bridge, no. 10,448. See pp. 356 and 362 and MAP 1.

*Rudbeckia Heliopsidis T. & G. Prince George County: borders of dry pine and oak woods 2–3 miles north of Disputanta, nos. 10,837, 11,196 and 11,468.

Very extensive station, the first known outside eastern Alabama and western Georgia. See pp. 375 and 382 and MAP 10.

*R. Heliopsidis T. & G., forma **villipes,** f. nov., petiolis imis villosis.—Prince George County, Virginia: border of dry pine and oak woods 2–3 miles north of Disputanta, July 24, 1939, *Fernald & Long*, no. 10,838, August 17, 1939, no. 11,197 (TYPE in Herb. Gray., ISOTYPE in Herb. Phil. Acad.).

Most of the plants in the large colony belong to *Rudbeckia Heliopsidis* α. of Torrey & Gray, "almost glabrous", originally from Columbus, Georgia. Forma *villipes* is relatively scarce. It was described from Cherokee County, Alabama, by Torrey & Gray as var. β., "stem stouter, pubescent below with spreading, above with appressed hairs." In Prince George County it is at best a minor form.

Coreopsis oniscicarpa Fern. The greatest area in Virginia of this species is in southwestern Nansemond County.

There in sphagnous swales and springy, peaty slopes it is often 9 dm. high, single plants bearing 30–60 heads. See p. 399.

Dr. Sherff, in Field Mus. Nat. Hist. Bot. Ser. xvii. 609 (1939), states that "A careful comparison of each specimen [of *C. oniscicarpa* lent him from the Gray Herbarium] with Floridan and other specimens of *C. Linifolia* [capitalization Sherff's] Nutt. showed no constant differences in foliar or capitular characters to warrant separating *C. Oniscicarpa* [capitalization Sherff's] even varietally from *C. Linifolia.*" The involucre with lanceolate outer phyllaries and a series of achenes of *C. oniscicarpa* were shown, from photographs, in Rhodora, xl. pl. 534, figs. 1 and 8, the habit of the plant, × ½, in plate 533.

Coreopsis linifolia Nutt. Journ. Acad. Phila. vii. 75 (1834) was one of several species described *"from the dried specimens in the herbarium of the Academy of Natural Sciences in Philadelphia."* It came from Alabama; and since other Alabama specimens cited in the same paper were collected by Dr. Gates (*Liatris pauciflosculosa* and *L. squamosa*) it is reasonable to take the series of Alabama sheets from Gates labeled by Nuttall as his own *C. linifolia* and preserved at the Philadelphia Academy as the TYPE series. Other Nuttall types described *"from the dried specimens in the herbarium of the Academy"* are there preserved and it is not probable that the Philadelphia Academy would have transferred them to the British Museum. Sherff, in Field Mus. Nat. Hist. Bot. Ser. xi. 436 (1936), gave for *C. linifolia* "Type specimen: Collected in Alabama (Brit.?)," the queried "Brit." standing for British Museum. On the seemingly safe assumption that the TYPE series is the one at Philadelphia labeled by Nuttall, but with similar specimens of the Gates material also in the Gray Herbarium and in the herbarium of the New York Botanical Garden, I am showing details of the TYPE series, as represented by the Gates specimen in the Gray Herbarium. Since Sherff cites none of the Gates material (except through his note on *C. callosa*), I have felt it justifiable to include some details from other specimens actually cited by him as *C. linifolia.*

In PLATE 649, FIG. 1 is an ISOTYPE (*Gates*), × ½, of *C. linifolia,* labeled by Sherff; FIG. 2, a flowering head, × 2, from the ISOTYPE, showing the broad and blunt outer and inner phyllaries, these conspicuously white-margined; FIG. 3, two plants, × ½, from Gateswood, Alabama, *Tracy,* no. 8565, labeled and cited by Sherff as *C. linifolia;* FIGS. 4, 5 and 6, achenes × 10, from tidal marshes on Biloxi Bayou, Mississippi, September 16, 1885, *John Donnell Smith* (labeled and cited by Sherff as *C. linifolia*).

In *C. linifolia* the relatively large involucre has the ovate white-margined outer phyllaries, to use Sherff's phrase, "ovatae . . . lateribus scariosae, apice subacutae vel rotundatae". The much smaller involucre of the more northern *C. oniscicarpa* (shown, also × 2, in RHODORA, xl. pl. 534, fig. 1) has the outer phyllaries lanceolate, the inner more oblong and not conspicuously white-margined. In the more southern *C. linifolia* the bodies of the achenes are 2.5–3.2 mm. long and 1–1.2 mm. broad; in *C. oniscicarpa* the bodies of the achenes are 1.8–2.2 mm. long and 0.6–0.9 mm. broad. These details of *C. linifolia,* shown in PLATE 649, and the photographic illustrations of *C. oniscicarpa,* already referred to, clearly speak for themselves.

The photographic reproductions of other species, in *Coreopsis* and *Bidens,* all reduced by Sherff in the above cited paper, also speak with complete definiteness.

*Bidens polylepis Blake. Charles City County: clearing in woods and roadside gutter, southeast of Sturgeon Point School, no. 11,203.

Sherff cites no coastwise material from south of Maryland.

*B. coronata (L.) Britton, var. typica Fernald in Rhodora, xl. 349, pl. 506, figs. 4 and 5 (1938). King William County: fresh tidal shore of Mattaponi River, Horse Landing, near King William Courthouse, no. 11,637; similar habitat, northwest of King William, no. 11,638. King and Queen County: similar habitat, Walkerton, no. 11,639. See p. 402.

First from south of lower Delaware; leaves simple to compound; awns of achenes very broad.

*Gaillardia pulchella Foug. Greensville County: sandy roadside south of Emporia, no. 11,205. Henrico County: waste ground and railroad ballast, Richmond, no. 2498. Spread from original cultivation.

*Lapsana communis L. Southampton County: cinders of freight siding, Branchville, no. 10,454. Henrico County: waste ground, Richmond, no. 12,206; embankments and cinders of Chesapeake and Ohio Railroad west of Elko Station, no. 12,207.

Serinia oppositifolia (Raf.) Ktze. Add a station in Greensville County: fallow clay field west of Vincent School, no. 10,455. Also in Southampton County: sandy roadside ditch, southeast of Windman's Mill, no. 12,208.

*Lactuca canadensis L., var. longifolia (Michx.) Farwell. Greensville County: clearing on wooded bottomland of Fontaine Creek, southeast of Taylor's Millpond, no. 10,850.

One of the more northern varieties, not represented in the Gray Herbarium from Atlantic States south of New York and singularly out of place with *Taxodium, Crataegus Marshallii, Sagittaria Weatherbiana, Spiranthes cernua* var. *odorata* and *Amsonia Tabernaemontana*. See p. 368.

*L. floridana (L.) Gaertn., forma **leucantha,** f. nov., corollis albidis.—Sussex County, Virginia: wooded bottomland, Jones Hole Swamp, west of Coddyshore, September 17, 1939, *Fernald & Long*, no. 11,484 (type in Herb. Gray; isotype in Herb. Phil. Acad.).

Prenanthes altissima L. Local range extended southward into Southampton County: rich marly woods along Three Creek, northwest of Carey Bridge, no. 11,486. See p. 363.

(*To be continued*)

A CENTURY OF ADDITIONS TO THE FLORA OF VIRGINIA

M. L. FERNALD

(*Continued from page 498*)

PART III. PHYTOGEOGRAPHIC CONSIDERATIONS

In 1937 I published[21] a brief analysis of the diverse geographic affinities of the flora of the Coastal Plain of Virginia. At that time I suggested seven primary types of relationship there displayed; these should perhaps be reduced to six. The main groupings, however, seem to hold. During the succeeding years considerable additions have been made to most of the groups; and during the five trips from June to October, 1939 (excluding obviously introduced weeds), we were able to extend into Virginia a great number of ranges: 11 plants of the upland (chiefly Blue Ridge, Appalachian Valley and Alleghenies) new to the Coastal Plain; 20 heretofore unrecorded from north of North Carolina; 9 unknown north of South Carolina; 6 unknown north of Georgia; and 1 heretofore known only in Alabama. Giving us a station or stations to fill in the previous broad gap between North Carolina and isolated areas in Delaware, Maryland or New Jersey are 6 species; while 2 supply an intermediate area between South Carolina and the North, and 4 species were found which had heretofore been known only from the Mississippi Basin or the Gulf States. New southern limits were established for 14 species: 13 the first from south of New Jersey, Delaware,

[21] RHODORA, xxxix. 465–489 (1937).

Maryland or the Potomac near Alexandria, 1 the first from south of southern New England. The Asiatic *Aneilema Keisak* is new to the American flora. *Desmodium glabellum* has apparently been unknown since its original collection in the 18th century in South Carolina. One species, erroneously identified, drops from the Virginia list; and 22 plants new to science, 7 of them endemic in Virginia, were discovered or worked out from earlier collections. Still others await fuller study.

It is needless here to discuss in detail most of the geographic relationships of these plants. They fit, for the most part, into the groupings already discussed. It is gratifying, however, to see regular increase in the group of species which apparently radiated out from the Appalachian Upland as it became elevated from its coastal plain status of Cretaceous time; and to see the gradual reduction in number of the species isolated from North or South Carolina in Delaware or New Jersey. One group of species, those of the fresh or but slightly brackish tidal shores and marshes has not previously been considered in this series of papers. It may, therefore, be specially discussed.

The Flora of Fresh Tidal Estuaries and Shores.—The peculiarity of the fresh or barely brackish tidal estuary[22] is the regular action of tide, alternately flooding and leaving bare the inner shores of streams and inlets twice a day with essentially fresh water. The plants which can tolerate such daily changes are a limited number. Besides the regular and somewhat indifferent species of reed-marsh they consist of a remarkable group of species of a few paludal genera, the species or the genera usually exhibiting as a regular feature of their geographic distribution extreme localization. Although a few plants found in our more brackish estuaries, like *Spartina cynosuroides* and *Scirpus robustus*, tolerate considerable salinity and usually follow the outer coast, the more typical estuarine species are intolerant of much salinity in the waters and confine themselves to the fresh to but slightly brackish reaches of streams, pools and inlets. This group is, then, of peculiar interest, since the plants have apparently mostly attained their present habitats and extreme isolation in the past, at periods when they could

[22] See Fassett, N. C.: *The Vegetation of the Estuaries of Northeastern North America.* Proc. Bost. Soc. Nat. Hist. xxxix. no. 3 (1928).

migrate from river to river along fresh or brackish (not strongly saline) shores.

Such conditions today prevail in a region like Back Bay in southeastern Virginia, where the off-shore bars and continuous dunes of the outer shore shut in a shallow body of tidal waters, perpetually renewed by fresh streams or seepage, and with the nearest inlet from the open sea far below the Virginia-North Carolina line. Rarely, during wild storms, sea-water dashes from the outside Atlantic into sheltered Back Bay; and sufficient salinity has been preserved in some of the marshes to maintain a few specially tolerant halophytes. The shores of Back Bay and the fresh pools and ponds on its margins or on Long Island are, however, the homes of such notable plants of the fresher marshes and waters as *Cyperus haspan* var. *americanus* (MAP 9), the American representative of a pantropical species (tropical and warm-temperate North and South America, Africa and warmer regions of Asia and Australia). The world-range of the species is suggestive of that of *Cyperus brevifolius* (MAP 21). Other typical plants of the freshish marshes of Back Bay are endemics of the two Americas; such, for instance, as *Typha truxillensis* (MAP 8), with details of distribution somewhat different from those of the two species of *Cyperus* and an ability, through its coma of perianth-bristles, to spread, locally, away from the slightly brackish marshes (where it rarely persists). Others are endemics of the southeastern United States. A good example is *Juncus megacephalus* (MAP 5), a very distinct species which occurs in the fresh to brackish marshes from Texas to the shores of Back Bay. Its habitats, as given on such labels as clearly indicate them, are as follows: ditch (La.), wet sandy shores (Fla.), mucky ground (Fla.), flatwood ponds (Fla.), prairie (Fla.), pineland (Fla.), low pinelands (Fla.), moist pine barrens (Ga.), low ground back of sand-dunes (Ga.), lime-sinks (Ga.), savannah (S. C.), dune-hollows (S. C.), river-marsh (S. C.), salt meadow (N. C.), marsh (N. C.), dune-hollow (Va.), swale back of dunes (Va.), inner border of brackish to fresh marsh (Va.). In brief, *Juncus megacephalus*, like its associates, is not a pronounced halophyte; we do not find it, like *J. Roemerianus*, for instance, following the salt marshes. It is not a plant of the saline outer coast but rather of the fresh to barely brackish inner margin of the coast, sometimes in fresh inland habitats. With great stretches of fresh to slightly brackish inner shore, now extending from below Cape Henry to Cape Fear and, formerly, doubtless more continuously to Florida, it has been able to follow more or less without interruption its most favorable habitats; but it does not follow north along the saline outer coast.

Not all the American plants of Back Bay shores have so continuous a range on the inner coast as do *Cyperus haspan* var. *americanus* and *Juncus megacephalus.* As pointed out on p. 371, the remarkable little genus *Lilaeopsis* (formerly called *Crantzia*) is a living relic of a very ancient dispersal (MAP 7), with its species variously scattered in New Zealand, southeastern Australia, Tasmania, temperate and subtropical South America, the Andes, Mexico and southern Arizona, and Pacific and Atlantic temperate North America. Apparently this disruption of the genus is the result of breaking down of old connections, with Eurasia and Africa omitted. It is difficult not to consider it a remnant of an old spread northward from ancient Antarctica. A frequent species of the Atlantic margin of North America is *L. chinensis* (name reflecting a geographic misconception by Linnaeus), with dispersal in fresh to brackish estuaries from Florida to western Nova Scotia. It is in many estuaries of Virginia. The specialty of Back Bay, however, is a much larger species with matted creeping and floating stems, *L. carolinensis* (MAP 6). On the southeastern side of Long Island in Back Bay a small pond at the head of fresh marsh is filled by this species, a very distinct member of the genus, with its chief center on the lower reaches of La Plata River in temperate eastern South America, but with four remote stations known in North America: near New Orleans; shallow water near Myrtle Beach, South Carolina; an unidentified station (presumably near Wilmington), North Carolina; and this pond on Long Island. *Lilaeopsis carolinensis* doubtless occurs in other shallow waters along or near the inner coast, back of the outer rim of sand dunes, but its two areas, one in latitudes 30°–36° 35′ north, the other between latitudes 25° and 35° south, were presumably derived from a former more continuous large area. In this connection the range of *Triglochin striata* (map 19), with a subantarctic dispersal, on Chatham Island and in New Zealand, Australia, South Africa, temperate South America and warm-temperate North America (in eastern South America found between lat. 22° and 40° south, in eastern North America between lat. 22° and 38° north), comes to mind, for *Triglochin striata* is known in Virginia only from the tidal marshes of Back Bay. It here accompanies *Ammannia Koehnei* (MAP 4). This is one of the most localized of estuarine plants. Discovered prior to 1840 on the marshes of Hackensack River in northern New Jersey, the species is now known on the estuary of York River and on Back Bay (an endemic variety on one river-estuary), with two known stations (doubtless many more) on the off-shore bar of North Carolina, the other known stations in Florida and locally along the Gulf of Mexico. Like so many estuarine species its range is interrupted. It is, therefore, significant that it belongs to another genus of somewhat general pantropical and warm-temperate range. As stated by Koehne in his treatment of the *Lythraceae* (in Engler's *Pflanzenreich*), *Ammannia* has 20 species, occurring in Australia, the Malayan region, Polynesia, southeastern and southern Asia (extending thence into southeastern Europe and the Mediterranean), Africa, sub-antarctic Sandwich Islands, South America and the warmer regions of North America. *Ammania* is not a holarctic genus. Like so many others which stretch northward into warm-temperate North America the genus today is primarily tropical and it also shows an austral disruption suggesting an old Antarctic dispersal.

In brief, the species which characterize the fresh to but slightly brackish shores and pools about Back Bay are largely plants of highly restricted and localized occurrence, and they belong for the most part to genera or species with the characteristically severed geographic occurrence of all pantropical and subantarctic groups. Their primary dispersal, considering the fact that they are incapable of succeeding in highly saline habitats, such as prevail on most coasts, has been a phenomenon of the past. Only on landlocked coastal shores can it now go on, except when the plants are transported by man or by the rarest of natural agencies. Of course, when a plant like "Wild Celery", *Vallisneria americana*, intentionally transplanted as a food for waterfowl, is placed in so favorable a habitat as Back

Bay it will prosper. But the plants which give significance to the flora of the region, *Cyperus haspan* var. *americanus, Juncus megacephalus, Lilaeopsis carolinensis, Triglochin striata* and *Ammannia Koehnei,* are largely unnoticed by those who look upon conservation of the wild life of such an area primarily as the attraction and maintenance of waterfowl. There is no probability that the typical estuarine species have been recently introduced by man.

The peculiarly significant indigenous plants of the fresh to but slightly brackish shores of Back Bay are not alone species of tropical and austral groups. Some plants of boreal dispersal are also isolated there. On the seeping, springy sands bordering Back Bay west of False Cape there is a remarkable turf, occupying the fresh springheads and saturated sands. It consists of a close mat of a few species: *Eleocharis albida* (tropical American, here near its northern limit), *E. halophila* Fern. & Brackett (Newfoundland and Gulf of St. Lawrence southward, here at its isolated southern limit), *E. Lindheimeri* (Clarke) Svenson (northern Mexico and San Bernardino Mountains, with distant stations eastward and northeastward to Texas and Michigan, here remotely isolated) and other local plants Among them is the very definite *Ranunculus hederaceus,* a matted herb of springy ground. *R. hederaceus* occurs in western Europe, and its American stations[23] are remote. By early authors, with no field experience with the plant, it was assumed to be an introduction from Europe. This may sometimes be the case. In Newfoundland[24], however, it occurs with the regular indigenous species of wet sands; and, surely, on the shores back of False Cape, where it forms part of the mat, it seems as indigenous as the endemic American species of *Eleocharis* with which it grows or as the highly localized and endemic *Ludwigia brevipes* (New Jersey and southeastern Virginia) which abounds, along with the subtropical *Bacopa Monnieria,* on the neighboring flat. In the Great Dismal Swamp, likewise, it is not in an area where man would presumably carry it. The significance of *Ranunculus hederaceus* in the problem will later be discussed.

[23] See Drew, W. B.: *The North American Representatives of Ranunculus, § Batrachium,* Rhodora, xxxviii., especially pp. 12–14 (1936).

[24] See Fernald, *Some Relationships of the Floras of the Northern Hemisphere,* Proc. Internat. Congr. Plant Sci. ii., especially p. 1506 (1929).

Back Bay, which today presents ideal conditions for the local spread of species of fresh to brackish shores, is not like the typical fresh river-estuary. The fresh estuaries are found far up-stream from the mouths of the eastern Virginian rivers. Those which have been explored by us are on the James and the Chickahominy and their tributaries, on the Pamunkey, the Mattaponi, and, to a lesser extent, on the Nottoway and the Blackwater. They are highly developed but only slightly explored (and that some years ago) on North Landing River. On the main River James the best of the fresh tidal marshes begin about 50 miles from its mouth and thence extend 25 miles up-river, but the smaller tributary creeks and the Chickahominy have good tidal marshes from near their mouths well up-stream, on the Chickahominy at least to Windsor Shades. The York is salt for more than 30 miles, up to Westpoint, at the confluence of the Pamunkey and the Mattaponi. The fresh tidal marshes on the Mattaponi follow that stream (often with broad tidal-marsh islands) about 30 miles, to the region of Walkerton. On the Pamunkey they are finely developed but we have not determined their extent. The Nottoway and the Blackwater unite at the North Carolina line to form the Chowan in North Carolina, reaching the sea via Albemarle Sound, which itself merges into Pamlico Sound, these sounds mostly cut off from the open Atlantic by a wonderful development of off-shore bars, sometimes 4 miles broad. Tidal conditions extend slightly into Virginia on the Nottoway; on the Blackwater they extend above Franklin. North Landing River, a sluggish tributary of Currituck Sound, thence to the sea through Albemarle and Pamlico Sounds, is bordered nearly its whole length by broad and fresh tidal marshes. Its mouth is more than 60 miles from the first opening to the Atlantic, at Oregon Inlet, on the outer coast of Dare County, North Carolina. The fresh tidal estuaries to which I am referring, are, then, anywhere from 30 miles (York River system) to 125 miles (Blackwater River) from the open Atlantic. They illustrate, very typically, the estuaries of Atlantic North America north to the St. Lawrence. On several or all of the Virginian estuaries examined a few of the species of Back Bay are found: *Sagittaria falcata* Pursh (Guatemala to Delaware and Maryland); *Cyperus haspan* var. *americanus* (MAP 9, already discussed); *Eleocharis albida* (see p. 508) and *Lippia nodiflora* (tropical America, north to Texas, Oklahoma, southeastern Missouri and southeastern Virginia). The river-marshes, however, have a considerable restricted flora, which we do not know on Back Bay. This includes

ISOËTES SACCHARATA (tidal mud of Delaware, Maryland, District of Columbia, and Potomac waters to Alexandria and vicinity.—*Pfeiffer*, Mon. Isoëtaceae; southeastern Virginia, closely approaching North Carolina. See p. 406).
SAGITTARIA SUBULATA (tidal mud, Alabama and Florida to southeastern Massachusetts).
ZIZANIOPSIS MILIACEA (Tropical America, north to Maryland and southeastern Missouri).
ECHINOCHLOA PUNGENS, var. COARCTATA Fern. & Grisc. (tidal marsh, North Landing River, endemic).
CLADIUM JAMAICENSE (tropical America, north to marshes of North Landing River).
CYPERUS BREVIFOLIUS (pantropical, north to Florida and southern Georgia; Chickahominy and Delaware Rivers. See pp. 395 and 419 and MAP 21).
RHYNCHOSPORA MACROSTACHYA var. COLPOPHILA (tidal marshes of Maryland and Virginia).
ERIOCAULON PARKERI (tidal mud, St. Lawrence River; Penobscot River, Maine, to Blackwater River, Virginia. See p. 432 and MAP 17).
ANEILEMA KEISAK (eastern Asia; southeastern Virginia, closely approaching North Carolina. See p. 441 and MAP 20).
CASSIA FASCICULATA var. MACROSPERMA (fresh tidal marshes and shores, southeastern Virginia, endemic. See p. 455 and PLATE 635).
AESCHYNOMENE VIRGINICA (fresh to brackish tidal marshes and shores, southern New Jersey, southeastern Pennsylvania and eastern Maryland to the valley of the James. See RHODORA, xli. 466 and map 1).
HYPERICUM MUTILUM var. LATISEPALUM (Florida to Texas; fresh tidal marshes of Mattaponi River. See pp. 402 and 466).
ELATINE AMERICANA (chiefly on tidal mud, St. Lawrence River and interruptedly to Virginia. See p. 466 and MAP 18).
AMMANNIA KOEHNEI var. EXAURICULATA Fern. (marshes of North Landing River, endemic).
LUDWIGIA ALATA Ell. (tidal marshes, Louisiana to Florida, thence very locally to North Landing River).
ERYNGIUM AQUATICUM (Texas to Florida, north to New Jersey. See pp. 386 and 467).
LILAEOPSIS CHINENSIS (tidal marshes, Florida to Nova Scotia. See pp. 391 and 470).

BACOPA CYCLOPHYLLA (tidal mud, Florida to Maryland, with apparent gaps of hundreds of miles. See p. 402 and MAP 22).
B. OBOVATA Fern. (tidal mud, Chickahominy river, very rare. See MAP 24).
LOBELIA ELONGATA Small (tidal marshes, very localized, Georgia to Delaware and Maryland. North Landing River and tributaries).
BOLTONIA ASTEROIDES var. GLASTIFOLIA (fresh tidal marshes and shores, southern New Jersey to Louisiana. See pp. 396 and 486 and PLATE 641).
BIDENS MITIS (Michx.) Sherff (tidal marshes, Louisiana to Florida, thence, very interruptedly, to Maryland. North Landing River).

These 22 plants, which, in Virginia at least, are strictly estuarine, are for the most part members of wide-ranging genera; but, whereas some of the more notable plants of the fresh to brackish shores of Back Bay have relatively continuous ranges northward, though others are with strikingly isolated stations, practically all the truly estuarine plants are highly localized. Two of them perhaps persist as relics from former semi-cosmopolitan ranges. *Cyperus brevifolius* (MAP 21) has as wide a range as *C. haspan* (see p. 419), occurring rather generally in the warmer parts of Asia (even north to southern Kamtchatka), the Malayan region, islands of the Indian Ocean, eastern Australia, New Zealand, Oceanica, locally in Africa, on islands of the South Atlantic, and from La Plata River in eastern South America northward to Bermuda and southern Georgia, with isolated stations on the Chickahominy and the Delaware and, westward, in Central America, Mexico and southern California. The world-range is definitely of the pantropical order, with the suggestion of radiation out of ancient Antarctica. Those who know the plant in eastern Asia and the Malayan region, however, state that it is there inclined to become a weed. On the Delaware it has not long been recognized and we have only a single station as yet on the Chickahominy. That is below an old ferry-landing, where it is not impossible that the plant started from oriental packing or straw thrown away. It needs further watching before we can surely assert that it is indigenous on the Chickahominy and the Delaware.

The other species of remote geographic relationship is *Aneilema Keisak* (MAP 20). It is so definitely a part of the regular vegetation of river-shores and fresh tidal marshes throughout the area from the Mattaponi to the Blackwater, always with the endemic and highly conservative eastern American estuarine species, that it is most difficult to think of it as a possible introduction. It seems as indigenous as the local *Cassia, Aeschynomene* and *Rhynchospora* with which it associates and as *Phryma, Liriodendron, Carya* and the other woodland genera which occur only in eastern North America and eastern Asia. When MAP 20, showing the range of *Aneilema Keisak*, is compared with MAP 21, giving the range of *Cyperus brevifolius*, one can not fail to recognize that it is like two small segments of MAP 21, with the rest of the world eliminated. It must be noted, however, that the very recent discovery of *Aneilema Keisak* in America at first seems like an argument against its being indigenous. When, however, we consider that such an abundant and very conspicuous plant of drier (therefore more accessible) areas of southeastern Virginia as the gigantic sunflower-like herb, *Silphium compositum* (up to 10 feet high and with leaves often a foot broad) was long overlooked as a Virginian, until within the past decade[25], that the regular estuarine companion of *Aneilema Keisak, Aeschynomene virginica* (up to 8 feet high, with ornamental pea-like flowers), was not known as a living Virginian from the time of its discovery by Clayton two centuries ago until Long and I found it in 1938, or that the very conspicuous and usual companion of these, the abundant endemic large-fruited *Cassia* (up to 6 feet high and with showy orange-yellow flowers) was undetected until 1939, the fact that the Aneilema has only recently been discovered in America becomes a very unimpressive point. Most of the phytogeographically significant plants of tidewater Virginia were unknown there a decade ago. It is most interesting, therefore, that *A. Keisak* occurs exclusively with conservative and endemic American estuarine species in southeastern Virginia and not in rubbish, waste spots, roadsides or man-made ditches. If it is not a native it has assumed a remarkable resemblance to one. It should not be overlooked, on the other hand, that another Asiatic species of *Aneilema* is found on the Coastal Plain from Florida to South Carolina. This is *A. nudiflorum* (L.) Wallich[26] of southern Asia, which

[25] See Fernald, RHODORA, xxxix. 329 (1937).
[26] For statement of nomenclatural situation see Merrill, Journ. Arn. Arb. xviii. 65 (1937).

Small (*Manual*) cites from "Roadsides, woods, and orange-groves, Coastal Plain, Fla. to Ga. Nat. of E. Indies." Not only is *A. nudiflorum* native of the East Indies; Clarke, in his monograph, says "India Orientalis, Malaya, China; ab Himalaya ad Zeylaniam, Borneo, ins. Philippine et Loo-Choo; alt. 0–2000 met., vulgatissima". I do not know its status in Florida and Georgia, except from the statement of Small; but the only Floridan label in the Gray Herbarium with statement of habitat reads "low flat woods", while Neil Hotchkiss, writing of its occurrence on Minim Island, Santee Delta, Georgetown County, South Carolina, said "the plant appeared to be at home along the margin of a marsh"[27]. That suggests the behavior of *A. Keisak* in southeastern Virginia. Both plants must be watched. Tidal marshes are scrupulously avoided by all except the most hardened of botanists; and even though *A. nudiflorum* may be a recent adventive from Asia which is rapidly spreading, *A. Keisak* may prove to be, as its behavior suggests, a conservative and ancient member of our flora.

There is no question that the remaining 20 species which in Virginia are restricted to fresh river-estuaries are indigenous. They include many phytogeographic types: some are tropical American species, like *Cladium jamaicense* ("Saw-grass"), reaching their northern limit on streams entering Currituck Sound, or *Zizaniopsis,* which comes farther north; others, like *Ludwigia alata,* are strictly North American but unknown in Virginia except along North Landing River; others, like *Eryngium aquaticum* or *Lobelia elongata,* are primarily southern but reach New Jersey, Delaware or Maryland; while some, such as *Sagittaria subulata* and *Lilaeopsis chinensis,* are scattered from the southeastern states to southern New England or Nova Scotia. Another series is prevailingly northern. *Eriocaulon Parkeri,* MAP 17 (member of a pantropical group of probably ancient dispersal from Antarctica), is on the fresh tidal mud of the St. Lawrence from above to far below Quebec, on tidal marshes of New England, New York, New Jersey, Delaware, Maryland and Virginia; while *Elatine americana* (MAP 18, excluding reported stations in the interior of the continent) is on the tidal reaches of the St. Lawrence, and on remote tidal muds from

[27] Hotchkiss, RHODORA, xlii. 21 (1940).

Northumberland Strait, New Brunswick, to the James, the known areas often 100 to 200 miles or more apart. Others, like *Isoëtes saccharata* and *Aeschynomene virginica* are chiefly on tidal marshes of the Delaware system and those confluent with Chesapeake Bay; *Rhynchospora macrostachya* var. *colpophila* belongs in the tidal marshes of the Chesapeake area in Maryland and Virginia; *Cassia fasciculata* var. *macrosperma* is endemic in tidal marshes from the Mattaponi to the James; and three others are known only from a single series of tidal marshes each: *Echinochloa pungens* var. *coarctata* and *Ammannia Koehnei* var. *exauriculata* on North Landing River and *Bacopa obovata* Fernald (MAP 24) on the Chickahominy.

If we were to follow northward, investigating the specialized floras of the different fresh tidal estuaries, we should find these conditions repeated: *Bidens bidentoides* on the Hudson, Delaware and Maurice (New Jersey) Rivers; *B. mariana* Blake on Northeast River and the lower Susquehanna in Maryland; *B. Eatoni* (with many localized and recognizable varieties along separate rivers) in the marshes of far-distant rivers from the St. Lawrence to the Hudson; *B. infirma* Fernald endemic on the St. Lawrence; *Micranthemum* (or *Hemianthus*) *micranthemoides* from the lower Hudson to the Potomac; *Cardamine Longii* Fernald (MAP 24) on tidal mud of Cathance River, Maine; *Gentiana Victorinii* Fernald (map 20) and *Cicuta Victorinii* Fernald on the St. Lawrence; and so on with several others. Whether primarily southern and failing to reach north to Virginia, or barely entering the state, or known northward to the Potomac, the Susquehanna or the Delaware; or more northern and known from the James or the Blackwater to the Penobscot or the St. Lawrence, the estuarine flora shows undoubted localization within the narrow ecological limits in which it thrives. Furthermore, specific or varietal endemism is a regular feature of this flora. Restricted endemics, known from no other area, are found in the marshes of more than a dozen rivers from southern Virginia to the St. Lawrence; and from Maine to Virginia they show a marked preference for the smaller rivers and creeks with extensive swales, rather than the larger. In Virginia, so far as we yet know, the endemics of a single (rarely also on an adjacent one) river are on the North Landing River, the Chickahominy and the Mattaponi, not on the James, the Rappahannock and the Potomac. This is evidently due to the much greater development of marsh along the small streams (the larger rivers, like the James, having more open wave-washed and unstable shores) and to their naturally more circumscribed areas (the larger rivers tending to have a more generalized flora).

When we consider the genera to which the species belong it will be seen that they are all wide-ranging or subtropical or tropical groups. The strictly holarctic genera are not represented. This fact, that the estuarine species belong in genera of semi-cosmopolitan, subtropical, tropical or extreme austral occurrence (*Eriocaulon* and *Lilaeopsis*, for instance) is of importance, for we do not get estuarine floras well developed on the more northern areas of eastern North America. The St. Lawrence and the streams entering the Gulf of St. Lawrence are, apparently, the northernmost rivers with well developed estuarine floras, but from there to North Carolina and beyond the estuarine floras become significant to the student of the flora.

I have sufficiently emphasized the extreme isolation of these plants and their very limited tolerance of other conditions than those in which they grow. By some their dispersal, whether they be pantropical types or endemic American species, is satisfactorily explained by saying "the birds did it", just as by a geologist of some renown I am told that the famous isolation of Coastal Plain plants about the head of Lake Michigan is wholly explained by the presence there of a bustling commercial center, Gary, freight-cars and railroad-engines, to his mind, having transported the seed. Not having the imagination to visualize railroad-trains dipping down into the Coastal Plain bogs and pools to secure the seeds of rare species of *Psilocarya* and other highly localized paludal and aquatic conservatives, in order to plant them (many milleniums before Gary was ever thought of) in the bogs and pools of northwestern Indiana, I can hardly be satisfied by so simple an explanation. So, cognizant of the many studies showing that migrating birds fly clean and that they are such expert aviators as not to carry on their long flights adhering chunks of mud to unbalance them, and that they eat most plants as food, not as altruistic spreaders of remote epibiotics, I can accept the superficial and too easy explanation that birds are the chief agents which have brought about the present ranges of many plants, only in case of their very short flights and flutterings from one spot to another in close proximity. If birds have been the primary agents in dispersing our most conservative estuarine species, it seems very strange that we should have so many limited endemics, known only from the shores of single or of few rivers. As has been repeatedly shown, the overworked bird is scarcely to be taken seriously in this problem.

So, likewise with winds. The plants which characterize the estuary-flora are those of wet mud, inundated shores and drowned marshes. They are not plants of dry habitats. If seed-bearing portions get stranded and sufficiently dry to be picked up by wind, this must be a rare exception and not enough to account for the regular occurrence in so many fresh estuaries of the same species. The seeds of estuarine species rarely, if ever, have modifications to favor wind-dispersal.

I have shown how, along such an extensive landlocked area as Back Bay, spread of the shore- and marsh-plants is a simple mechanical process, and that such a species as *Juncus megacephalus*, intolerant of much salinity, occurs back of the off-shore bars, islands and dunes, very regularly from Pamlico Sound to Back Bay. Although its two nearest relatives, *J. scirpoides* and *J. brachycarpus*, plants of stable sands, peats and clays and of more inland occurrence, follow north, in the former case to southern New York, in the latter to the local Tertiary beds of Massachusetts, *J. megacephalus* of fresh to but slightly brackish marsh stops its northern spread abruptly at Back Bay, beyond which the coast becomes open and exposed to the full saline influence of the Atlantic[28]. Right here, I believe, is the explanation of the great isolation in our fresh tidal river-estuaries of the distinctive plants of warm-temperate, subtropical, tropical and subantarctic relationships. These plants are intolerant of the extreme salinity of outer coasts; they thrive in the area between high and low tide where the waters are at most only slightly brackish. They are an extremely conservative and fastidious element in our flora. The wide latitudinal range of this special-

[28] Extensive landlocked bays farther north, like Chincoteague, Sinepuxent and Assawoman Bays, extending from Accomac County, Virginia, to Sussex County, Delaware, may, when properly explored, yield many of these southern species. Who knows?

ized flora along the margin of the northeastern United States and Canada, from southeastern Virginia (some of the species from Florida and the Tropics) to New Jersey, southern New York, the tidal rivers of Maine or even of eastern New Brunswick and, in some cases, the St. Lawrence from Lake St. Peter to below Quebec, calls for a condition comparable with that of Pamlico, Albemarle and Currituck Sounds and Back Bay today. Most geologists are agreed, I believe, that such a condition existed, all the way from Florida to the Gulf of St. Lawrence, when the continental shelf, now submerged off our Atlantic coast, was elevated as a nearly continuous outside ridge. That would make a tremendous southwest to northeast landlocked sound along the borders of which plants of fresh to merely brackish tidal shores could freely travel, just as today they are swashing and spreading on the changeable marshes and shores of Back Bay. The shores need have been no more stable than are those of Back Bay today; the exact stations of the plants need not have been fixed. The quality of the shore, tidal and fresh to brackish, not strongly saline, was the essential to success. To me this seems the obvious explanation. With the depression of the continental shelf the coast, especially northward, lost its outer fringe, the shores were bathed directly by seawater and the long stretches of country between the fresh tidal reaches of the rivers and creeks lost the estuarine flora. It today exists as a relic of the period before the continental shelf became depressed.

In considering when this migration northward along the landlocked sounds which extended to the Gulf of St. Lawrence, took place it is pertinent to quote from the thoughtful study of our coast by Professor Douglas Johnson. From his New England-Acadian Shoreline[29] I quote:

In Georgia and Alabama, exclusive of the Florida projection, that part of the Atlantic coastal plain exposed above sealevel has a breadth of 150 to 175 miles; in the Carolinas and Virginia it narrows to 125 miles or less; in New Jersey it declines from 65 to 25 miles; in Long Island, Marthas Vineyard, and Nantucket it appears as narrow fragments only; and off the coast of Maine is wholly lost to view. At the same time the submerged portion of the coastal plain, forming the continental shelf, which off southern Florida is only a few miles wide,

[29] Johnson, Douglas, The New England-Acadian Shoreline. New York, John Wiley & Sons. 1925. See especially pp. 296–302.

broadens off the Carolinas and Virginia to 50–80 miles, reaches a breadth of 100 miles off northern New Jersey, and where wholly submerged off the coast of Maine has a width of 150 miles or more. The increase is not uniform, however, for the submerged part of the plain is unusually broad opposite the bight where Florida and Georgia meet, and unusually narrow in the Cape Hatteras region. At the southwest the inner lowland, where well developed as in Alabama, is far from the sea. In the Virginia-New Jersey sector it dips under the water in places, is slightly but continuously submerged in Long Island Sound, and deeply so in the Gulf of Maine. Could we have a more striking picture of a single great topographic belt 150–200 miles broad, submerged progressively deeper and deeper toward the northeast, one of its elements after another disappearing from view, until all are completely buried under the ocean?.

. . . .

It will appear from this table [not here included] that the margin of the Atlantic continental shelf (excluding the Bahama banks) is only a few fathoms below sealevel off Florida, is from 25 to 35 fathoms deep off Georgia and the Carolinas, 40 to 48 fathoms opposite Maryland, 48 to 55 off the New Jersey and Long Island coasts, and 60 to 70 fathoms deep at the outer edge of the Banks. There are some local departures from the gradual deepening toward the northeast; but the progressively greater submergence in this direction, indicated so clearly by the progressive drowning of the cuesta and lowland topography and by the narrowing of the exposed coastal plain toward the northeast, is strikingly confirmed by the attitude of the edge of the continental shelf.

. . . .

It would seem that the depth of the Gulf of Maine inner lowland offers us the most reliable measure of the amount of submergence of this coast that we thus far possess. The unreliable character of estimates based on depths of submarine channels, especially when the subaërial origin of those channels is still open to question, has been commented on in another connection. But in the broad inner lowland of a coastal plain, preserving on its floor features characteristic of subaërial denudation operating on coastal plain deposits of unequal resistance, we apparently have a safe basis for calculation. Unless tidal scour has been strongly operative,—and both the form of the bottom and other considerations would seem to dispose of the possibility of effective tidal erosion on the broad open floor of the inner basin,—we have in the maximum depth of the drowned lowland a minimum measure of submergence since the lowland was carved. Several soundings between 180 and 200 fathoms are found along the deep channel at the northern base of the main cuesta. That these particular depths cannot be ascribed to tidal scour is indicated by the fact that the outlet channel farther east, between Georges Bank and Brown Bank, is much shallower. We must rather infer partial filling of the former valleys in cuesta and lowland, due possibly to slumping from the Banks and to material removed from their summits by waves and currents. Streams doubtless flowed from the deep areas in question through the outlet channel to the former sea margin many miles to the southeast; hence the apparent submergence calculated from the soundings must be increased by an allowance for the fall of the stream. It seems safe to say that since the inner lowland now forming the Gulf of Maine was carved, the land has been submerged to a depth of more than 1200 feet. If the land recently stood several thousand feet higher than now, as some have believed, it must have been for a very short period only; else the inner lowland, drained by a stream trenching comparatively weak coastal plain deposits, would have been graded to a much lower level. Farther to the southwest, as already noted, the submergence was progressively less than in the Gulf of Maine region, although there is evidence that the decrease was irregular, with local areas of increasing submergence,—facts which show that a subsidence of the land rather than a rise of sealevel was primarily responsible for the submergence.

. . . .

The interpretation of the Banks as a coastal plain cuesta receives support from the fact that in the course of their operations on the Banks fishermen bring to the surface fragments of fossiliferous sandstone and limestone. A series of these collected and described by Upham, and determined by Verrill to be of Tertiary age, (probably Miocene or even Pliocene) shows that the submergence must have occurred at the end of the Tertiary or still later in post-Tertiary time; for after the deposition of the late Tertiary sediments we must allow time for the erosion of the lowland prior to its submergence. If the bevelled top of the cuesta is the remnant of a peneplane developed on the coastal plain beds (and perhaps also on the crystallines of the oldland), then since the deposition of the late Tertiary formations the land was uplifted, one cycle of erosion completed, another uplift occurred, and in the new cycle maturity was attained before subsidence drowned the resultant topography. Thus we should expect the subsidence to be at least post-Miocene, and more probably post-Pliocene.

With this picture, so graphically presented by Douglas Johnson, of the northward depression of the Coastal Plain until, from Massachusetts eastward, it was completely submerged (except for the relatively slender and rapidly disintegrating Sable Island at the outer rim, more than 100 miles south of Cape Breton Island), it is easy to see what happened to the flora of fresh to but slightly brackish shores which, as I view the problem, freely spread along the margin of the landlocked sound which, by the final submergence of the Banks Cuesta in "post-Miocene, and more probably post-Pliocene" was finally severed into scattered remnants.

The interpretation that the conservative plants of the estuaries of New York, New England, New Brunswick and the St. Lawrence from Lake St. Peter to below Quebec can have persisted somewhere in those regions through the Wisconsin glaciation is distasteful to many who still hold to the archaic idea that

Wisconsin glaciation eliminated all life from these areas. So many evidences exist indicating that with us the Wisconsin was a relatively weak phase of Pleistocene activity as compared with earlier ice-accumulations, and so many conservative animals and plants are now found in regions where it is most improbable that they have arrived, without leaving traces of their migrations, since the Wisconsin, that I find myself not at all disturbed. My views and much of the evidence on this question and the phenomenal bulk of parallel evidence accumulated by Nordhagen, Hultén and others in Scandinavia and elsewhere in Eurasia and in Alaska are presumably well known. They need no expansion here. The evidence added by the isolated colonies of estuarine plants lingering in New York, New England, New Brunswick and Quebec is a slight but important addition to the whole story.

I have referred to *Ranunculus hederaceus* of wet sands of western Europe acting like a native on wet sands, tidal shores and about spring-heads in southeastern Newfoundland and on scattered points southward to Back Bay. It is simply one of many species which share western Europe and eastern America, especially Newfoundland. That considerable flora includes plants of mossy woodlands, acid bogs and other strictly natural habitats, plants which do not tolerate and can not spread by means of salt water. In addition to these plants numerous freshwater and land snails of native and undisturbed habitats show similar ranges. These and other cases, including some higher animals, are so numerous that it is absurd to imagine that they have been swimming the Atlantic in post-Wisconsin time, to find the natural habitats of Newfoundland, Gaspé and other areas within the latitude of Wisconsin glaciation. Their occurrence and their pre-Wisconsin spread has elsewhere been discussed and need not now divert us. *Ranunculus hederaceus* as well as *Carex arenaria* on the sands of Cape Charles may well be members of this illuminating group.

With this discussion of the disrupted floras of fresh tidal shores I close the paper. Their study is only begun. Thousands and thousands of miles of shores of fresh to merely brackish sounds and bays and hundreds and hundreds of fresh tidal river-estuaries from Florida to Delaware are botanically unknown. They will yield many new endemics. As I have repeatedly said, there is plenty to do; there are few botanically equipped and with energy or initiative to do it.

Photo. H. G. Fernald.

Andropogon praematurus: fig. 1, type, × ½; fig. 2, raceme, × 1, from type; fig. 3, upper half of raceme, × 5, from type.
A. divergens: fig. 4, raceme, × 1.
A. maritimus: fig. 5, raceme, × 1.

Photo. W. H. Hodge.

Peltandra virginica, southern representative (from Virginia). × 1: fig. 1, fresh spathe; figs. 2 and 4, fresh spadices; fig. 3, old spathe, showing deliquescence of base of limb.

Photo. W. H. Hodge.

PELTANDRA VIRGINICA, northern representative (from Massachusetts), × 1: FIGS. 1 and 2, fresh spathes; FIG. 3, old spathe, with limb rotted away; FIG. 4, fresh spadix.

Photo. H. G. Fernald.

COMMELINA ERECTA: FIG. 1, mature spathe, × 2.
Forma INTERCURSA: FIG. 2. flowering tip. × 1; FIG. 3. spathe, × 2.
C. ERECTA, var. ANGUSTIFOLIA, forma CRISPA (*C. crispa*): FIG. 4. spathe. × 2. from western Texas; FIG. 5. spathes. × 2. from Virginia.
C. ERECTA, var. HAMIPILA: FIG. 6. spathe. × 1.

Photo. H. G. Fernald.

Commelina erecta, var. angustifolia: figs. 1 and 2, portions of Michaux's type of *C. angustifolia*, $\times$ 1; fig. 3, spathes, $\times$ 2, from Georgia.

Photo. H. G. Fernald.

COMMELINA ERECTA, var. DEAMIANA: FIGS. 1–3, portions of TYPE, × 1; FIG. 4, an inflorescence, × 1.

Photo. W. H. Hodge.

Lilium Catesbaei: fig. 5, base, and fig. 6, flower, × ½, from Duval County, Florida; fig. 7, capsule, × 1, from South Carolina; fig. 8, seeds, × 5, from South Carolina; fig. 9, seed, × 5, from South Carolina; fig. 10, seed, × 5, from Florida.

Var. Longii: fig. 1, plant folded (with bulb in lower left-hand corner), × ½, from type-series; figs. 2 and 3, capsules, × 1, from topotype; fig. 4, seeds, × 5, from same collection.

Photo. H. G. Fernald.

RUBUS PERNAGAEUS: FIG. 1, floricane and tip of primocane, × 1; FIG. 2, bud and reflexed calyx-lobes, × 5.

Photo. H. G. Fernald.

RUBUS PERNAGAEUS: FIG. 1, floricane, × 1; FIG. 2, tip of primocane, × 1.

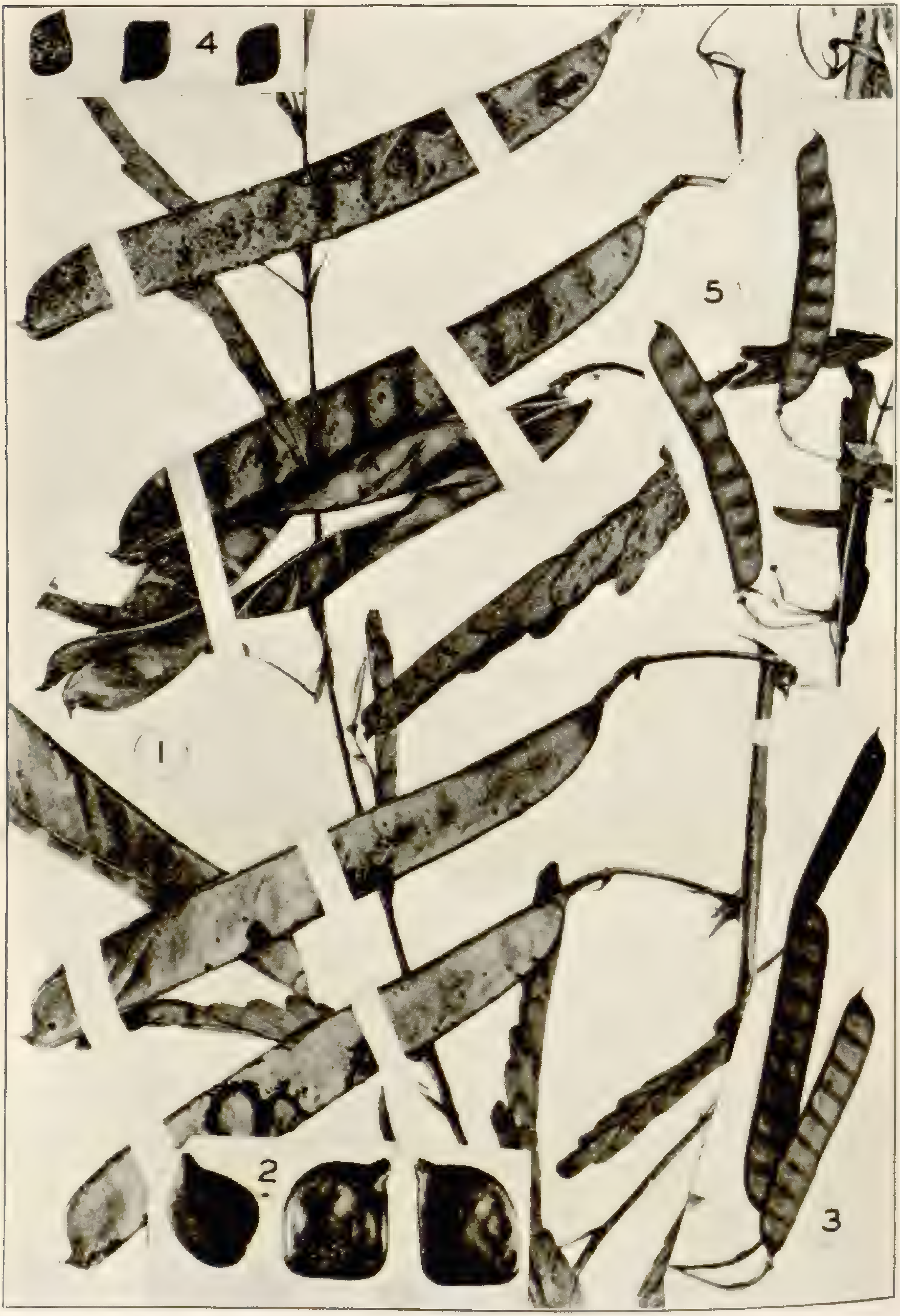


Photo. W. H. Hodge.

CASSIA FASCICULATA: FIG. 3. fruits, × 1, from Tennessee; FIG. 4. seeds, × 3, from Delaware.
Var. MACROSPERMA: FIG. 1. portions of TYPE, × 1; FIG. 2. seeds, × 3, of TYPE.
Var. ROBUSTA: FIG. 5. fruits, × 1, from Alabama.

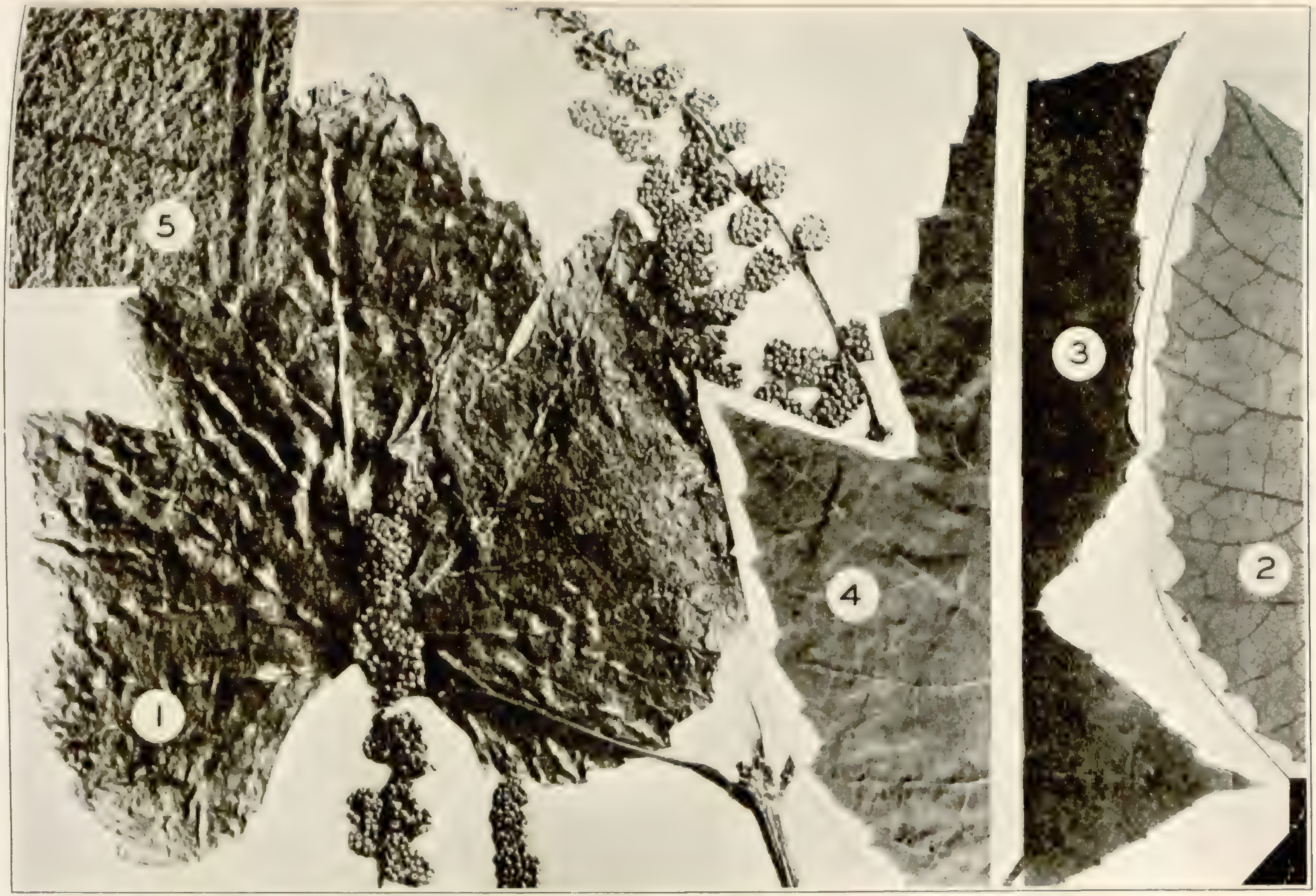


Photo. H. G. Fernald.

Vitis Labrusca: fig. 1, portion of type, × 1, in Linnean Herbarium; figs. 2–4, leaf-margin, × 1; fig. 5, pubescence of lower leaf-surface, × 10.

Photo. H. G. Fernald.

Vitis Labrusca, var. subedentata: fig. 1, portion of type, × 1; fig. 2, leaf from Maryland; fig. 3, lower surface of leaf, × 10, from type.

Photo. W. H. Hodge.

Sida inflexa: fig. 1. type. × 2/5; fig. 2, portion of stem, × 10, from type; fig. 3, lower surface of leaf. × 10. from type; fig. 4, calyx, × 4, from the side, from type; fig. 5, ring of carpels, × 4, from above, from type.

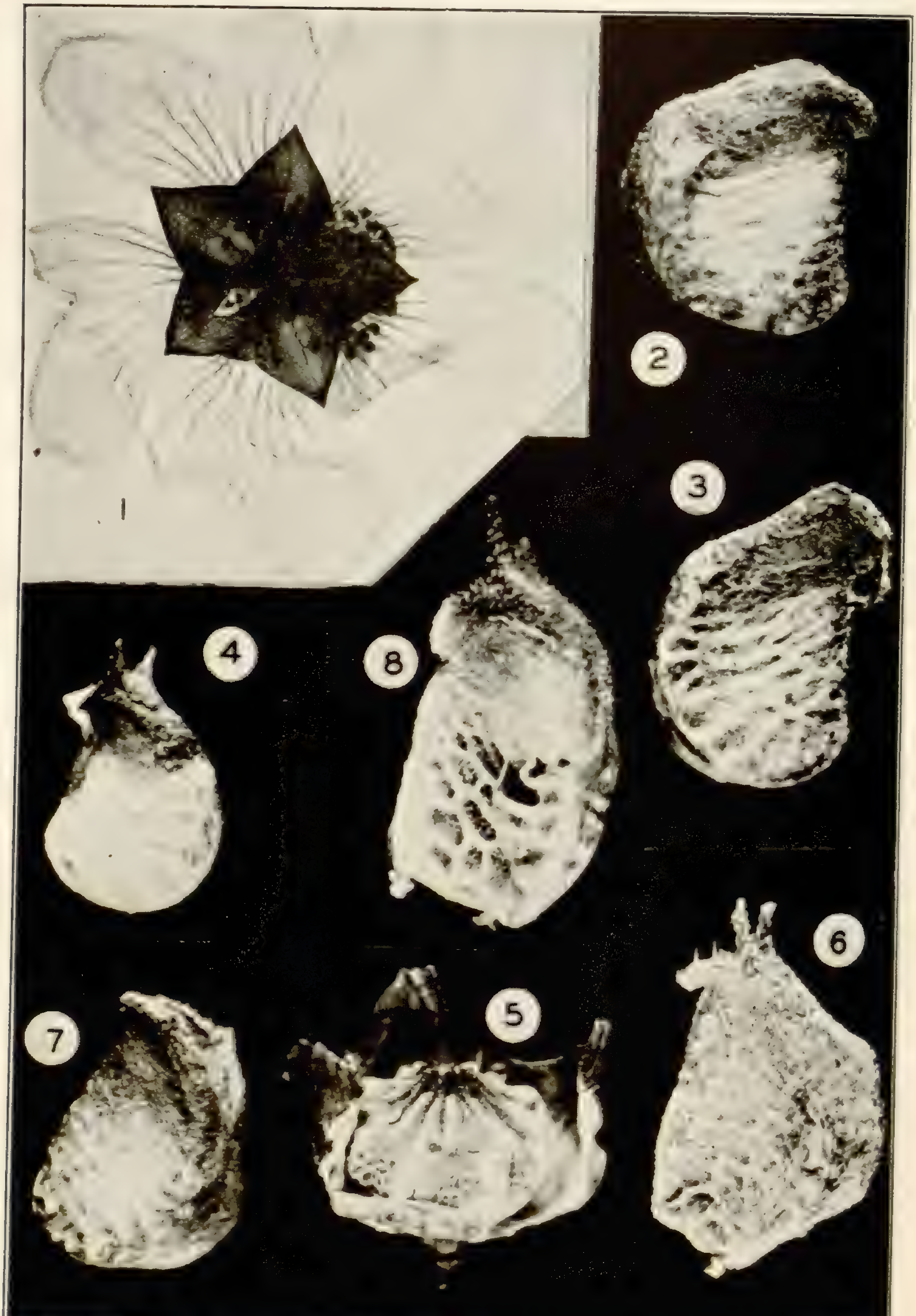


Photo. W. H. Hodge.

Sida inflexa: pressed flower, × 2, from Double Bridge, Virginia; figs. 2 and 3, ripe carpels, × 10, from type.

S. Elliottii: fig. 4, ripe carpel, × 10, from Florida.

S. rubro-marginata: fig. 5, calyx and ring of carpels, × 4, from isotype; fig. 6, ripe carpel, × 10, from Florida.

S. neo-mexicana: fig. 7, ripe carpel, × 10, from type.

S. Lindheimeri: fig. 8, ripe carpel, × 10, from type.

Photo. H. G. Fernald.

BOLTONIA ASTEROIDES: FIGS. 1 and 2, portions of TYPE, × 1; FIG. 3, two heads, × 2, from Susquehanna River; FIG. 4, old head, × 2, to show split receptacle and mature fruit; FIG. 5, ripe achene, × 10.

Photo. H. G. Fernald.

BOLTONIA ASTEROIDES, var. GLASTIFOLIA: FIG. 1, plant, × 2/5, from Chickahominy River; FIGS. 2 and 3, heads, × 2; FIG. 4, mature achene, × 10.

Photo. H. G. Fernald.

Boltonia caroliniana: fig. 1, plant, × 2/5; fig. 2, flowering head, × 2; fig. 3, fruiting heads, × 2; fig. 4, mature achene, × 10.

Photo. H. G. Fernald.

Boltonia Ravenelii: fig. 1, original *Ravenel* material, × 2/5, type at left; figs. 2, 3 and 5, heads, × 2; fig. 4, mature achene, × 10.

Photo. H. G. Fernald.

BOLTONIA DIFFUSA, var. INTERIOR: FIG. 1. TYPE. × 2/5; FIGS. 2 and 3, heads, × 2; FIG. 4, mature achene. × 10.

Photo. H. G. Fernald.

Boltonia latisquama: figs. 1 and 2, portions of type, × 1; fig. 3, flowering head, × 2; fig. 4, fruiting head. × 2; fig. 5. mature achene. × 10.

Photo. H. G. Fernald.

BOLTONIA LATISQUAMA, var. RECOGNITA: FIGS. 1 and 2, portions of TYPE, × 1; FIG. 3, head, × 2.

Var. MICROCEPHALA: FIG. 4, group of mature heads, × 2; FIG. 5, expanded head, × 2; FIG. 6, mature achene, × 10.

Photo. H. G. Fernald.

ASTER UMBELLATUS: FIGS. 5–7, head and involucres, × 4.
Var. BREVISQUAMUS: FIG. 1, portion of TYPE, × 1; FIGS. 2–4, heads and involucre, × 4.
Var. PUBENS: FIGS. 8 and 9, involucres, × 4.

Photo. H. G. Fernald.

ASTER UMBELLATUS, var. LATIFOLIUS: FIGS. 1 and 2, portions of TYPE, × 1; FIGS. 3–6, involucres, × 4.

Photo. H. G. Fernald.

Coreopsis linifolia: fig. 1, isotype, × ½; fig. 2, head, × 2, from isotype; fig. 3, portions of two plants (perhaps topotypes), × ½, from Alabama; figs. 4–6, achenes, × 10.

INDEX

New scientific names are printed in full-face type

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CONTRIBUTIONS FROM THE GRAY HERBARIUM
OF HARVARD UNIVERSITY

No. CXXXIV

REVISION OF THE GENUS PTERIDIUM

R. M. TRYON, JR.

DATES OF ISSUE
Pages 1–31 and Plates 650–652 . . . . 15 January, 1941
" 37–67 and Plate 653 . . . . 8 February, 1941

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A REVISION OF THE GENUS PTERIDIUM

R. M. Tryon, Jr.

(Plates 650–653)

INTRODUCTION

The only species of the monotypic genus *Pteridium, P. aquilinum,* is one of the most familiar plants in the world. Its distribution is world-wide in temperate and tropical regions and it is common to the point of becoming a weed in most of the regions in which it grows. Many authors complain of its weedy character in the British Isles, northwestern United States and New Zealand. In these regions and probably in others it invades fields and most especially pastures and it is probably the most obnoxious native weed with which the farmers have to deal. Apparently, it immediately assumes the role of a weed as soon as man tries to turn to his own uses any land that it finds suitable for its growth. However, the weedy character seems to vary with the variety, or region, for var. *latiusculum* and var. *pseudocaudatum* in eastern North America only rarely, if ever, become a serious menace to farmers.

Among the many species of ferns that spread by means of rhizomes or runners, the Bracken is particularly well adapted to the role of a weed. In favorable soil conditions there is a widely creeping, deep, main rhizome from which lateral, ascending branches arise. These branches usually rebranch and produce the fronds fairly near the surface. A dormant bud is produced at the base of each frond so that each year the plant has a potential second set of fronds. If, through burning or plowing, the lateral branches are destroyed, the main deep-seated rhizome can continue the life of the plant.

A few excerpts from a recent article on the Bracken in Britain[1] will illustrate its economic importance as a weed and some of the methods taken to control it. "Bracken ranks as the most plentiful and widespread of British ferns. It is generally distributed in most rough grazings and in many old permanent pastures in almost every part of Britain. It is plentiful in most open woodlands and on the sites of formerly wooded areas. . . . Many of the older writers have dealt with the loss of grazing due to Bracken. . . . 'I have seen the Roots of it in some Grounds, eight Foot deep. The best cure is often mowing of it while in grass. If you plow it up, plentiful dunging of it and Ashes are very good: but the certainest cure for it is Urine.' *J. Mortimer*, The Whole Art of Husbandry, 2nd Ed., 1708." At the present time, the authors recommend cutting the fronds when they are fully mature and following this with heavy grazing; and also the use of phosphate and lime fertilizers to build up the ground and make it unsuitable for the growth of the Bracken. Sodium chlorate and sulphuric acid are recommended as killing sprays. "In closing this paper, however, the writers desire very definitely to record their view that the bracken menace has grown so rapidly, and has now attained such proportions, that it is of real national importance: at the International Grassland Congress of 1937 one speaker referred to it as 'the ghost stalking silently at our side, which nobody dares to discuss.' . . . A million pounds sterling devoted to the reduction of the area infested by bracken would be well spent."

Many species of fungi are parasitic upon *Pteridium aquilinum*[2] and attempts have been made to use them in its control. *Fusarium* sp. and *Corticium anceps* (Bres. and Syd.) Gregor have been tried[3] but due to the fact that the host seems to be

[1] Long and Fenton, The Story of the Bracken Fern. Journ. Royal Ag. Soc. Eng. **99**: 15–36 (1938).

[2] See Seymour, Host Ind. Fungi N. Am. (1929) and Faull, Gen. Urediniopsis. Contrib. Arn. Arb. **11** (1938).

[3] See Gregor in Verdoorn, Man. Pterid. 146 (1938).

more durable under varying environmental conditions than the fungus, they have not met with success.

To compensate for its economic liabilities, the Bracken has made itself available for many uses, though at the present time none are of real importance. The fronds have been used for stock-food, when mixed with grass; as silage; for packing fruits; in the place of hops in brewing; medicinally; in glass making and as litter for both man and stock. The fronds and rhizomes have been used in thatching and the green fronds burned as a source of potash. Nakai[4] says that in Java the fronds are laid on racks over the *Cinchona* beds to protect the young plants from the sun and that: "This shelter is not liable to rotten and decays harmoniously with the growth of the *Cinchona.* When *Cinchona* reaches to the height of the roof, it want the shelter no more, and the fronds are so good and perfect as they then become bones only, dropping all of the leaves." The rhizomes have been used in brewing a beer and also as swine-food. It is reported that the swine prefer the rhizome plus soil. The hairs from the base of the petiole of var. *caudatum* are used for stuffing pillows and the fronds are used as packing in the tops of charcoal bags. A solution of the boiled fronds has been used effectively as a rose spray. Bracken is often accused of being poisonous to stock but apparently this is true only when it is eaten exclusively and in large amounts. The rhizomes, which contain a considerable amount of starch, have been used as food, at one time or another, in Switzerland, France, Canary Islands, western North America, Society Islands, New Zealand, Tasmania, New South Wales and China. It is said that formerly it was an important food-item of the Maoris of New Zealand. One doctor is reported as using the starch in place of arrowroot. However, the ordinary rhizome would undoubtedly be poor fare and probably was usually eaten only to stave off actual starvation. Forster[5] says that: "Radices ab incolis inopibus et famelicis exsuguntur, insipidae, parum nutrientes lignoso-fibrosae." The croziers have been used as "asparagus" in Japan and western North America. A number of botanists have reported eating the broiled croziers and say the flavor is quite agreeable. I can

[4] Nakai, Critical Notes on Japanese Ferns. Bot. Mag. Tokyo **39**: 110 (1925).
[5] Forster, Pl. Escul. 74 (1786).

attest this myself but must add that the dense pubescence is rather troublesome.

In the Canary Islands, *Orobanche trichocalyx* (Webb & Berth.) G. Beck and *O. Schultzii* Mut. are parasitic upon *Pteridium aquilinum.*

Reproduction

Vegetative propagation by means of the creeping rhizome is the predominate method of reproduction of the Bracken, although in favorable localities ordinary sexual reproduction is quite as effective. Although the Bracken habitually grows in rather dry places these are apparently not suitable for its normal reproduction, the prothallial stage developing only in relatively damp situations. Long and Fenton[6] say that in the eastern side of Britain, the prothallial stage is rare or unknown, while in the western side, where there is considerably more rainfall, young plants are not uncommon. In eastern North America young plants are only rarely seen. The young stages are not common as herbarium specimens. It is an indication of their relative rarity that at least two species and one variety have been described on the basis of young plants, although their authors no doubt little suspected they were redescribing the familiar Bracken. If, in the past, the Bracken has reproduced largely by vegetative means, this might well explain its present vigor and the lack of specific segregation within the genus. Judging biological age by the number of generations, it would still be a relatively young species.

Nectaries

Nectaries are present at the base of the lower pinnae. These were apparently first noticed by Charles and Francis Darwin[7] but they have been mentioned by few authors[8] since then. I had an opportunity to observe them on var. *latiusculum* in the Harvard University Botanic Garden in the spring of 1940. On the sixth of May, the basal pinnae were just starting to unroll and

[6] *Op. cit.*

[7] Francis Darwin, Journ. Linn. Soc. **15**: 407, Tab. 6, Fig. 6 (1876).

[8] The only other original observation I have seen is that of Victorin, Les Filicinées du Québec. Contrib. Lab. Bot. Univ. Montréal No. 2, 71 (1923), who says: "Au printemps les nectaires basilaires des segments sont presque toujours visités par une grosse fourmi noire."

the nectaries were clearly visible at the base of the pinnae as dark brown, smooth, somewhat swollen areas on the dorsal side of the then densely pubescent rachis. As the fronds continued to unroll proportionately smaller nectaries could be seen at the base of the second and third pair of pinnae. These nectaries were functional in that they exuded a liquid in the form of droplets from small pores. The nectaries at the base of the second pair of pinnae were not as active as those below and those at the base of the third pair of pinnae seemed to be entirely inactive. Large red and black ants were attracted by the exudation and observed in considerable numbers feeding upon it. Although an analysis was not made, the fact that ants feed upon the liquid undoubtedly indicates that it contains sugar. A free-hand section of the nectary area showed parenchymatous tissue but there was no evidence of glands. For these reasons I think it is likely that the exudation is neither a guttation of nearly-solute-free water nor a modified secretion but rather an excretion of the stipe-sap. The nectaries are active in the sun and also in the shade. They were quite active on a cloudy humid day. They were observed to remain active until the fronds were almost completely unrolled and may be active for a longer period of time. By midsummer they have become quite insignificant and entirely inactive. I believe this phenomenon is physiological, perhaps related to root pressure.

Primitive and Advanced Characters

Phylogenetically considered, *Pteridium* has a curious combination of relatively primitive external characters and relatively advanced internal characters. In the *Pteridoideae* it is considered to be a primitive genus[9] on the basis of the following characters: presence of a more or less vestigial inner indusium; initial basipetal succession of sporangia; hairs, but no scales, present on the rhizome; equal dichotomy of the axis in its early development; and open venation. On the other hand, the highly developed vascular structure of the stem and petiole and the presence of true vessels[10] indicate an advanced condition. The highly developed internal structure, however, is undoubtedly, at least in part, related to the relatively large size of the plant.

[9] See Bower, The Ferns. **3**: 41–45 (1928).
[10] Bliss, The Tracheal Elements in the Ferns. Am. Journ. Bot. **26**: 620–624 (1939).

Historical Account

Most of the taxonomic work on the Bracken has been done by authors working in a limited area or on a limited number of forms. There have been only a few comprehensive treatments. This has resulted in a general tendency to treat the various groups as species and to recognize, in one rank or another, trivial variations, a condition which naturally has led to a multiplicity of names. Not only has it been unnecessary to describe any new varieties in the present treatment, but in 1839 Agardh likewise found all of the groups he recognized already named. Most of the critical work has been done by local authors.

As in the case of so many groups, Linnaeus, Sp. Pl. **2** (1753), laid the foundations for the present treatment. He recognized, in the genus *Pteris,* two species, *P. aquilina* and *P. caudata,* which represent the ssp. *typicum* and *caudatum* of this treatment. Willdenow, Sp. Pl. **5** (1810) recognized, besides *Pteris aquilina* and *P. caudata,* some additional species described since 1753: *P. capensis, P. esculenta* and *P. lanuginosa.* Under *P. aquilina* he recognized, in var. β, a combination of var. *latiusculum* and var. *pseudocaudatum* of this treatment, but most later authors did not take up this segregate.

Agardh, Rec. Pterid. (1839) was the first author really to study material from most of the regions of the world and his treatment is in close agreement with the present one although he regarded most of the groups as species. He followed Linnaeus in treating the Brackens under the genus *Pteris,* but set them apart from the other species as the section *Ornithopteris.* He recognized *P. esculenta, P. arachnoidea, P. caudata* and *P. decomposita* and applied the names in essentially the same sense as in the present treatment. In *P. semihastata* and *P. recurvata* he recognized, respectively, var. *yarrabense* and var. *Wightianum.* Under *P. aquilina* he mentioned, but did not describe, var. *pseudocaudatum.* In the main his treatment differs from the present one only in the recognition of *P. lanuginosa* and in uniting var. *latiusculum* with *P. aquilina.* Later authors would have done well to follow Agardh's treatment more closely.

Hooker, Sp. Fil. **2** (1858) presented the next, and really the last, comprehensive treatment of the genus. He followed Agardh in treating the species under section *Ornithopteris* of *Pteris,* but except for *P. coriifolia* and *P. psittacina,* which he says he did not understand, having seen no specimens, he reduced all names under *P. aquilina* and recognized only varieties. The present treatment agrees with his in this respect, but his varietal lines were rather poorly drawn. All varieties in the present ssp. *typicum* he treats under var. *glabra,* fronds glabrous or nearly so beneath, and var. *lanuginosa,* fronds quite pubescent beneath. In the present ssp. *caudatum* he recognized var. *caudata,* applying it in the present sense, and var. *esculenta,* including the present var. *esculentum,* var. *arachnoideum* and var. *yarrabense.* This treatment was long followed and led especially to a confusion of var. *esculentum* of Polynesia, Australia and New Zealand and var. *arachnoideum* of South America.

Diels, Nat. Pfl. **1**[4] (1899) and Christensen, Ind. Fil. (1905) recognized the single species *Pteridium aquilinum.* Nakai, *op. cit.* (1925) in a rather rambling and non-critical discussion, made several new combinations under *Pteridium,* reviewed much of the literature and discussed the status of various species and varieties.

Under various names, Scopoli, Fl. Carn. (1760), Gleditsch, Syst. Pl. (1764), Newman, Phytol. **2** (1845) and John Smith, Hist. Fil. (1875) separated the present genus *Pteridium* from *Pteris,* but it was not until Kuhn in v. d. Decken, Reis. Ost.-Af. **3**[3] (1879) took up and defined *Pteridium* that the Brackens were widely treated as a distinct genus.

Terminology

Certain terms have been used in the descriptions in a strictly limited sense and certain unusual terms and characters have been used. These are explained below:

The *vernation* of the frond *equal,* all of the pinnae becoming unrolled at essentially the same time; *subgleichenioid,* the tips of the upper pinnae still inrolled while the lower pinnae are completely unrolled; or *gleichenioid,* the basal pinnae being completely unrolled while the third or fourth pair of pinnae are completely inrolled.

A *costa* is the midnerve of a pinna.

A *costule* is the midnerve of any segment of lesser order than a pinna, with the exception of the midnerve of the ultimate segments, which is called the *midnerve.*

In some varieties there are lunate or sublunate, entire lobes along part of the rachis, costae and costules, between the divisions of the blade. These are called *free lobes.* Plate 650, fig. 10.

The *ultimate segments* are *adnate,* broadest, but not dilated, at the base (pl. 650, fig. 7); *decurrent,* dilated at the base toward the base of the midnerve (pl. 650, fig. 16); *surcurrent,* dilated at the base toward the tip of the midnerve (pl. 650, fig. 3); or *narrowed* at the base (pl. 650, fig. 6).

The *upper surface* of the ultimate segments includes the midnerve but excludes the margin.

The *margin,* although morphologically on the upper surface of the segment, is described separately. It is the chlorophyll-bearing tissue closest to the base of the outer indusium.

Peculiar, irregular, wing-like epidermal outgrowths occur on the veins and midnerve on the lower surface of the ultimate segment in some varieties. These are called *membranous wings.* Plate 650, fig. 14.

Some varieties have a *farinaceous appearance* on the lower surface of the ultimate segments. This is a minute epidermal outgrowth, occurring between the veins, which, under high magnification, resembles a sparsely branched coral fungus. It may be an excretion but it is not affected by alcohol or dilute acid. Plate 650, fig. 13.

The term indusium is applied to the outer, functional indusium, the modified margin of the segment. The outer indusium is present in both fertile and sterile fronds and throughout partially fertile fronds. If it covers sporangia it is spoken of as the *fertile indusium,* if not, as the *sterile indusium.* The inner indusium is non-functional and usually nearly obsolete. When the inner indusium is meant it is called such.

The costules and lower side of the midnerves in ssp. *caudatum* are described as pubescent with white, dark or bicolorous hairs. The *white hairs* are long, thin, terete, whitish, multicellular hairs with oblique cross-walls. These are essentially of the same type that occur on the tissue on the lower surface of the segments. The *dark hairs* are rather large, stout, dark or reddish brown, usually terete, multicellular hairs with straight cross-walls, which are similar to those that occur on the rhizome. As these mature they often become moniliform, with whitish walls, only the septae remaining brown. These are called *bicolorous hairs.* When one of these dark or bicolorous hairs breaks off, it often leaves a swollen base that is dark reddish brown and has the appearance of a sessile gland.

Systematic Treatment

Although *Pteridium* is world-wide in distribution and the various populations show very strong phytogeographic affinities, and although it is undoubtedly a rather old genus, three lines of evidence lead me to believe that specific segregation has not taken place. First, in all areas where two varieties of the same subspecies overlap in range intermediate specimens are found (with the exception of var. *africanum* in ssp. *typicum*). Such intermediates are not common but they are of such frequency that, assuming indiscriminate rather than critical collecting, they must form a percentage of the *Pteridium* population of the area that cannot be overlooked. Second, in areas occupied exclusively by one variety, individuals, perhaps representing local populations, occur that have one or more characters of some other variety. That is, characters of one variety crop up occasionally in other varieties. In some cases a specimen will resemble another variety so closely that it would certainly be identified with it except by using the geographic "character." In other words, the critical characters of the varieties are not thoroughly stable. Third, the critical characters show little constancy within the group as a whole. That is, ciliation of the indusium in var. *Feei,* or nonciliation in var. *africanum,* are critical characters but both conditions are commonly found in var. *caudatum;* pubescence on the undersurface of the blade in var. *pubescens* and the lack of it in var. *latiusculum* are critical characters, but var. *Wightianum,* while most commonly pubescent, is not infrequently nearly glabrous; pubescence on the margin of the segments in var. *Feei* and the lack of it in var. *typicum* are important characters, but var. *Wightianum* frequently exhibits both conditions; and the free lobes in var. *arachnoideum* and their absence in var. *caudatum* are diagnostic characters but both conditions are found in var. *yarrabense.* It seems to me that, when the critical characters of a group show such inconstancy, they are materially weakened for use in specific segregation.

The treatment of each variety follows a fixed order somewhat different from the conventional one. First, the accepted name and its synonymy and then any necessary discussion of the nomenclature. Second, the description of the variety followed by a discussion of taxonomic problems and a comparison with closely related varieties. Third, a short phytogeographic discussion, if desirable, a statement of habitat preference and a general statement of range. Last, a citation of specimens. In this arrangement, the critical discussion of nomenclature and taxonomic problems follows the synonymy and description, respectively; and the usually long citation of specimens comes at the end.

This study is based on the 2,500 sheets of *Pteridium* in the Gray Herbarium, the Herbarium of the New York Botanical Garden, the United States National Herbarium and the Herbarium of the Field Museum of Natural History.

Descriptions

The critical characters in the descriptions have been italicised. The descriptions are based on mature specimens and do not take into account juvenile forms. The cutting of the blade is the same in the juvenile state of all varieties. The margins of the segments are flat, not revolute, and there is no sterile indusium. None of the various epidermal outgrowths are present except pubescence, and that is only weakly developed and not distinctive.

Maps

The maps of the varieties have been compiled primarily from the cited specimens. These localities have been augmented by localities taken from other specimens examined and in a few cases by localities taken from the literature. These are used only when a specific locality was mentioned and where there was no doubt as to the identity of the variety. Localities based on specimens are indicated by a dot and those based on a printed record by a cross. The map of the species includes all of the localities on the varietal maps and in addition several localities taken from the literature where the identity of the variety was in doubt. On this map no distinction is made between localities based on specimens and those based on the literature. No attempt has been made to make the maps absolutely complete.

The series of specimens studied has in most cases been sufficient to plot the general range of each variety. The maps used have been selected from Goode's Series of Base Maps, Henry M. Leppard, Editor, Copyright by the University of Chicago, published by the University of Chicago Press.

Citations of Specimens

The citations of specimens have been limited, when necessary, to two or three from each minor political division, i. e. state, province or department. The most widely distributed collections are cited in preference to the more locally distributed ones. Full citations are given in the discussions only for specimens that are not listed in the formal citations. Herbarium-sheet numbers, such as, Herb. Field Mus. no. 47805, are used in cases where the data on the label is insufficient to identify the specimen accurately. The usual abbreviations for the herbaria are used: F, for the Herbarium of the Field Museum of Natural History, Chicago, Ill.; G, for the Gray Herbarium, Harvard University, Cambridge, Mass.; NY, for the Herbarium of the New York Botanical Garden, Bronx Park, N. Y.; and US, for the United States National Herbarium, Smithsonian Institution, Washington, D. C. In the few cases where other herbaria are cited, abbreviations are not used.

Acknowledgements

I wish to thank Dr. P. C. Standley, Dr. H. A. Gleason and Dr. W. R. Maxon for the generous loan of material and for privileges extended at the herbaria under their care; and especially to express appreciation to Mr. C. A. Weatherby, without whose constant help and encouragement this study could scarcely have been completed.

SYSTEMATIC TREATMENT

PTERIDIUM Gled. ex. Scop. Fl. Carn. Ed. 1, 169 (1760), nomen abortivum(?); Kuhn in v. d. Decken, Reisen in Ost-Afrika **3**[3]**:** 11 (1879).

Pteris L. Sp. Pl. **2:** 1073 (1753), in part. *Filix* Ludwig, Instit. Hist. Ed. 2, 149 (1757), nomen dubium; sensu Woynar, Hedwigia **56:** 383 (1915). *Cincinalis* Gled. Syst. Pl. 290 (1764), emend Trevis. Atti Soc. Ital. sc. nat. **17:** 239 (1875). *Asplenium* Bernh. Schrader's Journ. **1799**[1]**:** 309 (1799), in part. *Allosorus* Bernh.

Schrader's neues Journ. **1**[2]**:** 36 (1806), sensu Pr. Tent. Pterid. 151 (1836), in part. *Paesia* St.-Hil. Voy. Brésil **1:** 381 (1833), sensu Moore, Gard. Chron. 878 (1858), in part. *Eupteris* Newm. Phytologist **2:** 278 (1845). *Ornithopteris* (Ag.) J. Sm. Hist. Fil. 297 (1875). *Aquilina* Pr. ex Diels in Engl. & Prantl, Nat. Pfl. **1**[4]**:** 296 (1899), in synonymy. *Filix-foemina* Farwell, Am. Mid. Nat. **12:** 290 (1931).

Although it is generally considered that Scopoli took up *Pteridium* Gled. for the Bracken, as a segregate genus from *Pteris* L., and it would therefore be the earliest valid generic name under the International Rules, some have argued that he proposed it as a substitute name for *Pteris* L. In order to meet this argument, *Pteridium* has been conserved (International Rules of Botanical Nomenclature, 131 (1935)).

Rhizome subterranean, extensively creeping, repeatedly branched, *invested with hairs but not scales,* the stele a perforated solenostele, true vessels present; *fronds alternate, large;* stipe relatively long, the *vascular bundles numerous; blade coarse,* pinnately divided, usually tripinnate, the lower pinnae with nectaries at the base; the segments very numerous, ovate to linear, the margin revolute; *veins free; sori marginal, mostly continuous; sporangia borne between the outer indusium, the modified margin of the segment, and the inner indusium;*[11] receptacle a vascular strand connecting the vein-ends, the inner indusium arising at its inner side; spores brown, very finely spinulose, tetrahedral-globose.—Represented by a single world-wide species, found in all temperate and tropical regions.

Pteridium aquilinum (L.) Kuhn in v. d. Decken, Reisen in Ost-Afrika **3**[3]**:** 11 (1879). Map 1. Bracken.
Characters of the genus.

Key to the Subspecies and Varieties[12]

a. Ultimate segments adnate, or equally decurrent and surcurrent, or surcurrent, or narrowed at the base, not having a farinaceous appearance beneath; pubescence of the lower surface lanuginose or absent. (ssp. *typicum*) *b.*
b. Fertile and sterile indusium ciliate, or pubescent on the outer surface, or both; ultimate segments densely or sparsely pubescent beneath between the margin and the midnerve; pinnules nearly at right angles to the costae. *c.*

[11] The inner indusium is quite variable in its structure. In some specimens it is a continuous membrane, as figured by Luerss. in Rabenh. Krypt. Fl. Ed. 2, **3:** 101, fig. 81 and Bower (after Luerss.), The Ferns, **3:** 43, in others it is an irregularly broken membrane and in some it consists only of a few hairs.

[12] The user can expect that a considerable number of intermediate and non-typical specimens, especially shade-forms, will not run down satisfactorily.

c. Pinnae and pinnules long-acuminate; ultimate segments falcate or subfalcate; fertile indusium 0.3 mm. or less wide, the sterile 0.2 mm. or less wide (India to Java, New Guinea and Formosa)...2. var. *Wightianum,* p. 22

c. Pinnae and pinnules short-acuminate to obtuse; ultimate segments straight; fertile indusium 0.3 mm. or more wide, the sterile 0.2 mm. or more wide. *d.*

d. Upper surface of the ultimate segments glabrous or subglabrous, or if pubescent, the margin glabrous. *e.*

e. Rachis more or less pubescent; blade lanuginose beneath (Europe, Africa and adjacent islands). 1. var. *typicum,* p. 15

e. Rachis glabrous; blade subappressed-lanuginose beneath (Hawaiian Islands) .... 5. var. *decompositum,* p. 40

d. Upper surface of the ultimate segments pubescent, at least near the margin, and the margin pubescent. *f.*

f. Sterile indusium 0.4 mm. or more wide; the fertile portion of the indusium no broader than the sterile on the same segment (Mexico, Guatemala and Honduras) .... 4. var. *Feei,* p. 37

f. Sterile indusium 0.25 mm. or less wide; the fertile portion of the indusium broader than the sterile on the same segment (western North America and northern Mexico)...3. var. *pubescens,* p. 26

b. Fertile and sterile indusium glabrous; ultimate segments glabrous beneath between the margin and the midnerve, or slightly pubescent on part of the segment; pinnules at an oblique angle to the costae. *g.*

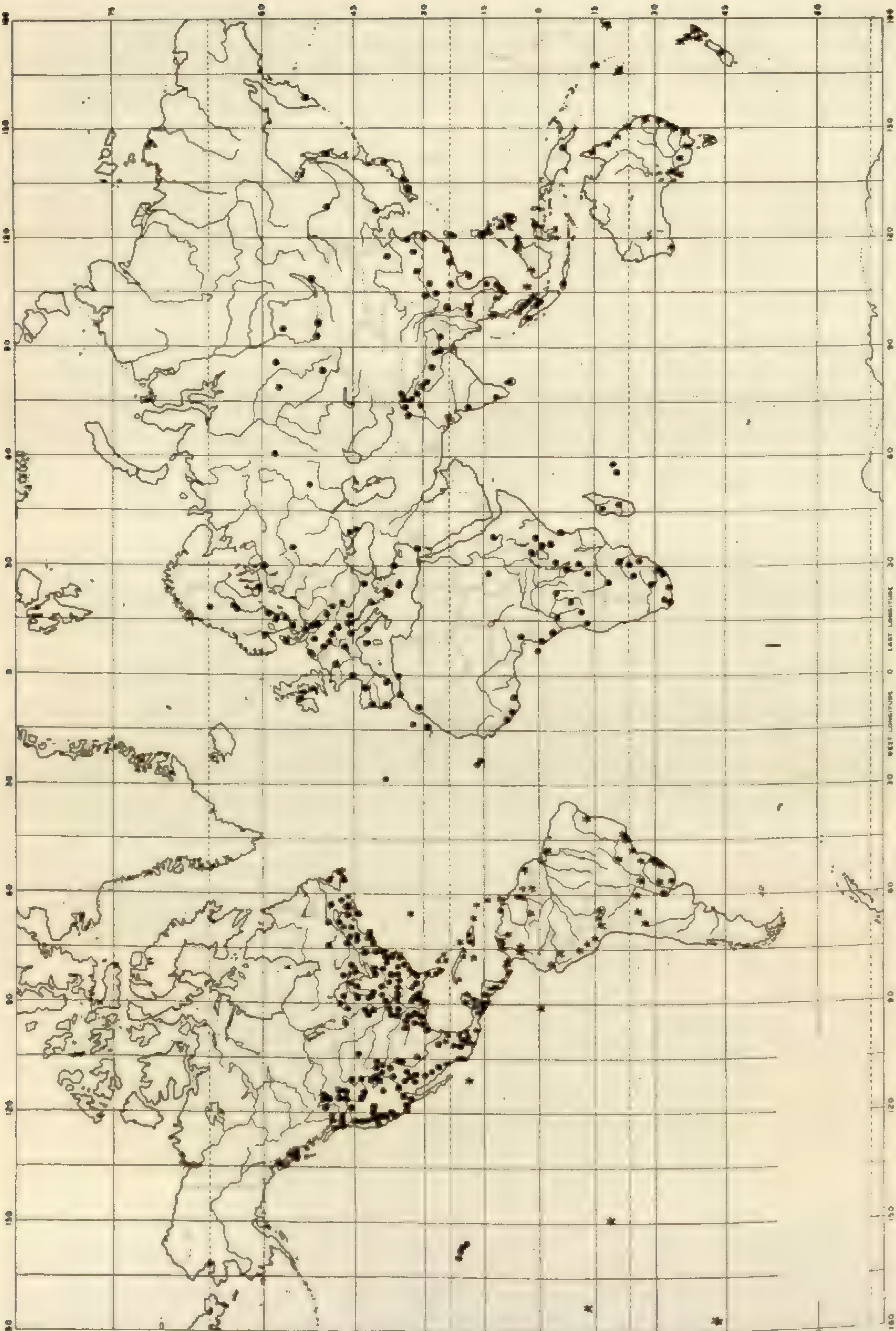
g. Blade usually quadripinnate, ovate; most of the ultimate segments narrowed at the base, the midnerve beneath glabrous or subglabrous (Africa) .... 8. var. *africanum,* p. 51

g. Blade usually bipinnate-pinnatifid or tripinnate, rarely tripinnate-pinnatifid, broadly triangular; the ultimate segments adnate or more often broadest at the base, the midnerve beneath moderately pubescent, sometimes glabrous. *h.*

h. Margin of the ultimate segments moderately pubescent; longest entire segment or entire part of a segment about four times as long as broad; the terminal segments mostly 5–8 mm. wide (North America, northern Europe and eastern Asia). 6. var. *latiusculum,* p. 41

h. Margin of the ultimate segments glabrous or subglabrous; longest entire segment or part of a segment about nine times as long as broad; the terminal segments mostly 2–4.5 mm. wide (southern and eastern United States)..7. var. *pseudocaudatum,* p. 48

a. Some of the ultimate segments decurrent only, or more strongly decurrent than surcurrent, usually having a farinaceous appearance beneath; pubescence of the lower surface straight, appressed or arachnoid, rarely sublanuginose or absent (ssp. *caudatum*). *i.*



Map 1. Range of Pteridium aquilinum, ssp. typicum (●) and caudatum (*).

i. Ultimate segments having a farinaceous appearance beneath, except in some glabrous forms; pubescence straight, appressed or arachnoid beneath. *j*.

j. No free lobes present on the rachis, costae and costules; the midnerve on the lower surface of the ultimate segments usually glabrous; fertile portion of the indusium broader than the sterile on the same segment; cells of the sterile indusium in rather definite rows, large, averaging 31 per mm. on the margin, the indusium not more than 5 cells wide (southernmost United States, West Indies, Mexico, Central America and northern South America) .... 9. var. *caudatum*, p. 54

j. Free lobes present on the rachis, costae and costules; the midnerve on the lower surface of the ultimate segments usually dark-pubescent; fertile portion of the indusium usually not broader than the sterile on the same segment; cells of the sterile indusium irregularly arranged, small, averaging 48 per mm. on the margin, the indusium at least 6, usually 8 cells wide. *k*.

k. Undersurface of the segments with membranous wings on the veins and midnerve, arachnoid-pubescent; margin of the segments often pubescent (West Indies, Mexico, Central America and South America) .... 10. var. *arachnoideum*, p. 57

k. Undersurface of the segments without membranous wings on the veins and midnerve, appressed-pubescent with straight hairs; margin of the segments glabrous (Australia, New Zealand and Polynesia). 11. var. *esculentum*, p. 61

i. Ultimate segments not having a farinaceous appearance beneath, sublanuginose-pubescent beneath (India to Sumatra, Philippine Islands and northeastern Australia) .... 12. var. *yarrabense*, p. 63

Pteridium aquilinum ssp. **typicum**

Growing tip of the rhizome usually with a tuft of dark hairs, sometimes naked; rachis glabrous to densely pubescent; pinnules at right angles or at an oblique angle to the costae; *ultimate segments* broadly ovate to oblong, sometimes linear, *adnate or surcurrent, or equally surcurrent and decurrent, or narrowed at the base*, the upper surface glabrous to quite pubescent, the *lower surface lanuginose-pubescent or glabrous, not having a farinaceous appearance;* cells of the sterile indusium of medium size, usually irregularly arranged. Map 1 (dots).

1. Pteridium aquilinum var. **typicum**,[13] Plate 650, fig. 2,

[13] Only the more important, the more obscure and scattered, and the more widely used subspecific names and combinations are cited. About one hundred new subspecific names and combinations in Lowe, *Our Native Ferns*, Druery, *British Ferns and their Varieties*, Junge, *Die Pteridophyten Schleswig-Holsteins*, Kaulfuss, *Die Pteridophyten* and Gandoger, *Flora Europae terrarumque adjacentium* are omitted from the synonomy. Some names from other well known but less detailed works are also omitted. All of these names apparently represent trivial variations. Gandoger's treatment (*op. cit.* **27**: 180 (1891)), the opening portion of which is here quoted, amounts almost to a naming of individuals:

PLATE 651, FIG. 4, MAP 4. Illustrations: Fl. Dan. **13:** t. 2303 (1840); Waldner, Deutschl. Farne t. 17 (1883); Schk. Krypt. Gew. t. 95 (1809); Lowe, Native Ferns **2:** 407, t. 61 (1867); Marloth, Fl. S. Africa **4:** pl. 37 (1915), *habitat.*

Pteris aquilina L. Sp. Pl. 1075 (1753). *Cincinalis aquilina* (L.) Gled. Verm. Abh. **1:** 24 (1765), reference taken from Woynar, Hedwigia **56:** 381 (1915). *Pteris nudicaulis* Güld. Reisen Russ. **1:** 421 (1787), according to C. Chr. Ind. Fil. 603 (1906). *Pteris borealis* Salisb. Prod. 402 (1796). *Asplenium aquilinum* (L.) Bernh. Schrader's Journ. **1799**[1]**:** 310 (1799). *Pteris capensis* Thunb. Prod. **2:** 172 (1800); fragment of type at NY. *Pteris lanuginosa* Bory ex Willd. Sp. Pl. **5:** 403 (1810); fragment of type at NY. *Pteris aquilina* L. var. *ciliata* Opiz, Kratos **2**[1]**:** 19 (1820).[14] *Pteris aquilina* L. var. *sinuata* Opiz, Kratos **2**[1]**:** 19 (1820). *Pteris foemina* Gray, Nat. Arr. Brit. Pl. **2:** 16 (1821). *Allosorus aquilinus* (L.) Pr. Tent. Pterid. 153 (1836). *Allosorus lanuginosus* (Bory ex Willd.) Pr. Tent. Pterid. 154 (1836). *Allosorus hottentottus* Pr. Tent. Pterid. 154 (1836). *Allosorus acutifolius* Pr. Tent. Pterid. 154 (1836), nomen nudum. *Allosorus villosus* Pr. Tent. Pterid. 154 (1836), nomen nudum. *Allosorus tauricus* Pr. Tent. Pterid. 154 (1836), nomen nudum. *Pteris brevipes* Tausch, Flora **19**[2]**:** 427 (1836). *Pteris lanuginosa* Bory ex Willd. var. *capensis* (Thunb.) Ag. Rec. Pterid. 51 (1839). *Pteris plebia* R. Br. ex Ag. Rec. Pterid. 52 (1839), in synonymy. *Pteris coriifolia* Kze. Linnaea **18**[2]**:** 120 (1844). *Pteris aquilina* L. var. *vera* Moore, Handb. Brit. Ferns, Ed. 1, 134 (1848), reference taken from Moore, Pop. Hist. Brit. Ferns, 167 (1851). *Pteris aquilina* L. var. *integerrima* Moore, Handb. Brit. Ferns, Ed. 1, 134 (1848), reference taken from Moore, Pop. Hist. Brit.

"20. Pteris L.

1. PTERIS AQUILINA L.

Hab. Europa tota.

1	Lobi sup. integri 4 mm. longi		2
	Lobi sup. integri 5 mm. longi		5
	Lobi sup. integri 6 mm. longi		8
	Lobi sup. integri 7 mm. longi		17
	Lobi sup. integri 8 mm. longi		28
	Lobi sup. integri 9 mm. longi		34
	Lobi sup. integri 10 mm. longi		40
	Lobi sup. integri 11 mm. longi		45
	Lobi sup. integri 12 mm. longi		47
	Lobi sup. integri 14 mm. longi - - *Dordogne, Payzac* (Gdgr.)		*Pteris attenta* Gdgr.
2	Pinnae remoti		3
	Pinnae contiguae		4
3	Lobi obtusi- *Pedem., Vallées Vaudoises* (Rostan)		*P. polystichoides* Gdgr.
	Lobi acuti- *Basses-Pyren., m. Lestibette* (Gdgr.)		*P. oreodoxa* Gdgr."

[14] I am indebted to Prof. Dr. Adolf Pascher for the references to Kratos, a periodical apparently not in the United States.

Ferns, 167 (1851). *Pteris aquilina* L. var. *pubescens* Spreng. ex Liebm. Vid. Selsk. Skr. s. 5, **1:** 225 (1849), as to basinym, *Pteris lanuginosa* Bory ex Willd., not as to plant. *Pteris aquilina* L. var. *multifida* Moore, Handb. Brit. Ferns, Ed. 3, 226 (1857). *Pteris aquilina* L. var. *crispa* Moore, Handb. Brit. Ferns, Ed. 3, 226 (1857). *Pteris aquilina* L. var. *pubescens* Afz. fil. ex Hook. Sp. Fil. **2:** 198 (1858), in synonymy. *Pteris aquilina* L. var. *lanuginosa* (Bory ex Willd.) Hook. Sp. Fil. **2:** 196 (1858). *Allosorus capensis* (Thunb.) [incorrectly attributed to Presl by] Pappe & Raws. Syn. Fil. 32 (1858). *Allosorus coriifolius* (Kze.) Pappe & Raws. Syn. Fil. 31 (1858). *Paesia coriifolia* (Kze.) Moore, Gard. Chron. **1858:** 878 (1858). *Aquilina vulgaris* Pr. ex Milde, Fil. Eur. 45 (1867), in synonymy. *Pteris Heredia* Clem. ex Colm. Enum. crypt. Esp. y Port. **1:** 16 (1867), reference taken from C. Chr. Ind. Fil. 599 (1905) and Colmeiro, Enum. Plantas Hisp.-Lusit. **5:** 437 (1889). *Paesia aquilina* (L.) Keys. Pol. Cyath. Hb. Bung. 22 (1873). *Ornithopteris aquilina* (L.) J. Sm. Hist. Fil. 298 (1875). *Cincinalis lanuginosa* (Bory ex Willd.) Trevis. Atti Soc. Ital. sc. nat. **17:** 239 (1875). *Pteris gracilis* Paterson in Hennedy, Clydesd. Fl. Mem. Ed. 255 (1878). *Pteridium aquilinum* (L.) Kuhn var. *lanuginosum* (Bory ex Willd.) Kuhn in v. d. Decken, Reisen in Ost-Afrika **3**[3]**:** 11 (1879). *Pteris aquilina* L. var. *abbreviata* Gillot, Bull. Soc. Bot. France **29:** June, xxii (1882). *Pteris abbreviata* (Gillot) Gerard, Bull. Soc. Bot. France **29:** June, xxii (1882). *Pteris aquilina* L. var. *transsilvanica* Schur, Enum. Pl. Transs. 841 (1885), nomen nudum. *Pteridium aquilinum* (L.) Kuhn var. *brevipes* (Tausch) Luerss. in Rabenh. Krypt. Fl. Ed. 2, **3:** 107 (1889). *Pteridium aquilinum* (L.) Kuhn var. *umbrosum* Luerss. in Rabenh. Krypt. Fl. Ed. 2, **3:** 107 (1889). *Pteris aquilina* L. var. *normalis* O. Ktze. Rev. Gen. **2:** 820 (1891). *Pteris aquilina* L. f. *lanuginosa* (Bory ex Willd.) O. Ktze. Rev. Gen. **2:** 820 (1891). *Pteridium aquilinum* (L.) Kuhn var. *osmundaceum* Christ, Beiträge Krypt. Schweiz **1**[2]**:** 54 (1900). *Pteridium aquilinum* (L.) Kuhn var. *capense* (Thunb.) Christ, Beiträge Krypt. Schweiz **1**[2]**:** 55 (1900). *Pteridium capense* (Thunb.) Krasser in Zahlbruckner, Ann. Nat. Hofm. Wien, **15**[1]**:** 4 (1900). *Pteridium lanuginosum* (Bory ex Willd.) Clute, Fern Bull. **8:** 38 (1900), as to name-bringing synonym, not as to plant. *Pteridium cehegínense* Barnola, Bol. Soc. Aragonesa Cienc. Nat. **11:** 35 (1912). *Pteridium aquilinum* (L.) Kuhn var. *crispulatum* Barnola, Bol. Soc. Aragonesa Cienc. Nat. **11:** 35 (1912). *Pteridium aquilinum* (L.) Kuhn ssp. *capense* (Thunb.) Bonap. Notes Ptérid. **2:** 66 (1915). *Filix aquilina* (L.) Woynar, Hedwigia **56:** 383 (1915). *Filix-foemina aquilina* (L.) Farwell, Am. Mid. Nat. **12:** 290 (1931).

In 1848 Moore published *Pteris aquilina* L. var. *vera* but he did not base it on *Pteris aquilina* L. He described it as having the secondary pinnules pinnatifid, while the Fuchs plate, the type of *Pteris aquilina,* has the secondary pinnules entire (in fact the pinnules are only pinnatifid). In contrast to his var. *vera* he had var. *integerrima,* secondary pinnules entire. He apparently thought of var. *vera* as the more common and hence more "typical" phase and his description of it excludes the type of *Pteris aquilina.*

Kuntze published a *Pteris aquilina* L. var. *normalis* in 1891 but did not actually base it on *Pteris aquilina* L. and circumscribed it much more broadly than the typical variety in the present treatment. "U. St.: Oil City" includes var. *latiusculum* and "Hongkong" includes either var. *latiusculum* or var. *Wightianum.*

Because of the above objections to taking up either var. *vera* Moore or var. *normalis* O. Ktze., I am designating the typical variety as var. *typicum,* definitely based on the type of *Pteris aquilina* L.

Growing tip of the rhizome with a tuft of dark hairs; frond 0.4–4 m., usually about *1–1.5 m. high,* the taller fronds scandent, *vernation gleichenioid;* stipe longer or shorter than the blade; *blade* 2–20 dm., usually about *6–10 dm. long,* usually *ovate-triangular,* less often ovate or broadly triangular, *not ternate,* bipinnate-pinnatifid or tripinnate, less often tripinnate-pinnatifid, rarely quadripinnate-pinnatifid; *rachis* usually *moderately pubescent,* less often densely pubescent or subglabrous; *pinnae and pinnules short-acuminate to obtuse; pinnules* usually *nearly at right angles to the costa,* sometimes at an oblique angle; costules slightly to densely pubescent beneath and less so above; penultimate segments usually pinnatifid, less often pinnate or pinnate-pinnatifid; longest entire segment or part of a segment from three to six, usually about four, times as long as broad; *ultimate segments* usually *straight,* rarely subfalcate, *adnate or broadest at the base,* the upper surface usually glabrous or slightly pubescent, rarely moderately pubescent, the *margin glabrous or subglabrous,* rarely moderately pubescent, the *lower surface* usually *densely pubescent,* less often slightly pubescent, rarely glabrous or pubescent only on the midnerve; *fertile and sterile indusium ciliate* and sometimes also *pubescent* on the outer surface, the *fertile* usually *0.3 mm. or more wide,* the *sterile* usually *0.2 mm. or more wide,* the *fertile portion broader than the sterile* on the same segment, *or no broader.*

TYPE: Figure of *Filix femina* Fuchs, Hist. 596, misprinted 569 (1542). Linnaeus did not have a specimen of *Pteris aquilina* in his herbarium in 1753 and the only illustration cited by him is taken as the type.

TYPE LOCALITY: Europe.

I have not been able to separate the African Bracken from the European. Extreme specimens from Africa differ from the typical European plant (*Tidestrom* 13295, France) in having a densely pubescent, flexuous rachis and the fertile indusium no broader than the sterile on the same segment. However, these characters are not always correlated and they show no definite geographic segregation. Specimens with the rachis densely pubescent and flexuous have been seen from Mauritius, "Ex. Herb. Wm. Boott" (G) and Madagascar, Herb. Field Mus. no. 595745. Specimens from British East Africa, *E. Heller;* Natal, *Abraham* 28; Cape of Good Hope, U. S. Nat. Herb. no. 22419; St. Thomas, *Moller* 33 and Sierre Leone, *Johnston* 7 have the rachis densely pubescent but straight. Distributed over essentially the same area are specimens that have a straight glabrous rachis: Egyptian Sudan, *Lynes* 186; British East Africa, *Mearns* 1229; Kilimanjaro, *Abbott;* Madagascar, *Webb* (?) 113 (G); Bourbon, *Halsey* (U. S. Nat. Herb. no. 1285441); and Cape of Good Hope, *Sim* 1579. Most of the European and about half of the African specimens have the fertile indusium broader than the sterile on the same segment. Specimens from the Azores, Madeira and Canary Islands and from northernmost Africa are distinctly of the European type.

Shade forms often approach var. *latiusculum* in some characters: they may be almost completely glabrous (*Ziesché*, Herb. Field Mus. no. 764960; Prov. Westfalen (G); *Kaulfup*, Bavaria (US)) or only slightly pubescent with the sterile indusium considerably less ciliate than normally (*Ziesché*, Reisengebirge, Silesia; *Richter*, Hungary).

Intermediates between var. *typicum* and var. *latiusculum* are only slightly pubescent beneath except on the midnerve and have the fertile and sterile indusium only slightly ciliate. Such are Danzig, July 24, 1876, *Baenitz* (F); Pl. Scand. ex insula Gotlandia, June 16, 1894, *Johansson* (US); Plantae Goreanae, *Taquet* 2317 (US); and Hungary, Aug., 1893, *Marton* (F).

Some specimens, here referred to var. *latiusculum,* approach var. *typicum* in one or more characters. The sterile indusium may be slightly ciliate and the blade pubescent beneath between the margin and the midnerve and the blade ovate: Pl. Sibiricae Exsicc. 1288, Tomsk; *Honig,* Bavaria; near Berlin, 1844. In *A. O. Olson,* Vestrogothia, Sweden, Aug. 17, 1915 (F) the indusium is slightly pubescent.

Several minor variations have been named, some of which may be worthy of recognition as forms, but I do not feel justified in recognizing them in view of the limited amount of material I have seen and the lack of field experience. Some of the variations that have been described certainly do not deserve recognition. *Pteris aquilina* var. *abbreviata* Gillot, for instance, is a much stunted plant found growing under extremely unfavorable conditions, on rocks and bathed in a sulphurous vapor at 20° C. *Pteridium cehegínense* Barnola is a young plant with abnormal leaf-cutting and *Pteris gracilis* Patterson is also a young plant.

Var. *typicum* differs from var. *latiusculum* in its gleichenioid rather than equal vernation, in having the undersurface of the segments densely pubescent rather than pubescent only on the midnerve, in the glabrous rather than pubescent margin of the segments and the ciliate rather than glabrous fertile and sterile indusium. Also the frond is considerably taller on the average and the blade is ovate to ovate-triangular and evenly pinnate rather than broadly triangular with the basal pinnae considerably longer and broader than the second pair. The pinnules are usually at right angles to the costa rather than at an oblique angle and the penultimate segments are usually evenly pinnatifid rather than pinnate or pinnate-pinnatifid.

The critical differences between var. *typicum* and vars. *Wightianum, pubescens* and *Feei,* with which it is also closely related are discused under those varieties. It is perhaps most closely related to var. *pubescens* of western North America—probably representing another example of the well-known relationship of the floras of western North America and Europe.

Var. *typicum* grows in open woods, in clearings, at the edge of woodlands, in thickets, in pastures, in abandoned fields, in grassy places, on open hillsides, in forests and in recently burned-over areas. It is most common in dry places and in acid soils. It grows from sea-level to about 1800 m. in the Alps and to 3000 m. in the mountainous regions of Africa.

It ranges throughout Europe and all but the drier regions of Africa, and adjacent islands.

EURASIA.—SWEDEN: Helsingborg, July, 1862, *Suetberg* (Herb. Field. Mus. no. 335698). IRELAND: Holywood, Oct. 20, 1884, (G). GREAT BRITAIN: Snowdon (Wales), July 19, 1905, *Pease* 8031 (G); Isle of Man, Sept., 1895, *Underwood* (NY). NETHERLANDS: Haaksbergen, July 20, 1918, *Boetje van Ruyven* (Herb. Field Mus. no. 840219). GERMANY: Heidelberg, Sept. 19 (Herb. Field Mus. no. 756408); Münsterland, Prov. Westfalen, Aug. 19, 1905 (G); Zabtengebirge, Mittelberg, Silesia, Aug. 29, 1906, *Ziesché* (Herb. Field Mus. no. 764960); Reisengebirge, Silesia, July 20, 1903, *Ziesché* (G); Spandau, Brandenburg, Sept., 1880, *Ruhmer* (F. Schultz herb. norm. no. 975) (G, NY); Nürnberg, Bavaria, Aug. 26, 1902, *Kaulfup* (US). CZECHOSLOVAKIA: Aug., 1911, *Petrak* (Fl. Bohemiae et Moraviae exsicc. no. 603) (G). HUNGARY: Klausenberg, Aug. 16, 1901, *Richter* (G); Piliscaba, Sept., 1916, *Filarszky & Kümmerle* (Fl. Hung. exsicc. no. 431) (F, G, US); Orawicza, *Wierzbicki* (Herb. Field Mus. no. 47805). SWITZERLAND: *Wilazek* (G). FRANCE: Bures, Sept. 26, 1909, *Jeanpert* (Herb. Field Mus. no. 815531); Perignac, Charente, Sept. 4–11, 1893, *Guillon* (Mangier, Fl. selecta exsicc. no. 3395) (F); July 11, 1934, *Tidestrom* 13295 (F, G, US); May 9, 1935, *Tidestrom* 13509 (NY); Vicinity of Paris, June 28, 1911, *Jeanpert* (Herb. Field Mus. no. 815529). SPAIN: San Sebastian, *Barbour* (NY). PORTUGAL: Porto, 1891, *Buchtien* (U. S. Nat. Herb. no. 1095027). CORSICA: July 20, 1933, *Aellen* 1306 (F, US); June 17, 1933, *Aellen* 1316 (F, US). ITALY: Venetia, Nov. 10, 1907, *Fiori, Béguinot & Pampanini* (Fl. It. exsicc. no. 705) (G); Capri, Aug. 29, 1909, *Ware* (G, US); Near Rome, *Pisotta* 34 (F). GREECE: Olympia, April 27, 1906, *Pease* 9081 (G). TURKEY: Taurus Mts., Aug. 12, 1907, *Wankow* (NY); "Plantae Tauricae," *Wankow* (US). UNION OF SOVIET SOCIALIST REPUBLICS: Dist. of Chernomose (Black Sea), *Kousenetzoff* (G); Caucasus, Kuban Prov., May 9, 1907, *Busch & Klopotow* (G); Western Grusia, Caucasus, *Meffert* 20 and 910 (G).

AFRICA.—ALGERIA: Oran, May 9, 1935, *Faure* (U. S. Nat. Herb. no. 1674024, NY). MOROCCO: 1889, *T. Williams* 118 (US). AZORES: 1890, *Chute* (G); July 18, 1894, *Brown* 334 (G). MADEIRA: 1853–56, *Wright* (G); 1838–42 (U. S. South Pacific Exploring Expedition) (G). CANARY ISLANDS: Grand Canary, Feb., 1897, *Cooke* 107 (F, G, NY, US). SIERRA LEONE: Oct., 1875 (Herb. Field Mus. no. 69396); Freetown, April 8, 1882, *H. H.*

Johnston 7 (G). Liberia: Grand Bassa, *Dinklage* 1628 (G); along Dukwai River near Firestone Plantations, 1928, *G. P. Cooper* 21 (F, NY, US). Cameroon: Jan., 1919, *Gocker* 133 (G). St. Thomas (Is.): 1885, *Moller* 33 (US). French Equatorial Africa: Fernand Vaz, French Congo, 1917, *Aschemeier* 19 (US). Union of South Africa. Cape of Good Hope: Vicinity of Cape Town (U. S. South Pacific Exploring Expedition) (U. S. Nat. Herb. no. 22419); King Williamstown, 1892, *Sim* 1579 (G). Natal: Mapumulo, 1867–69, *Abraham* 28 (G, US); *Buchanan* 534d (US). Transvaal: Bokfontein, Aug. 3, 1934, *Mogg* 4755 (US); Rustenburg, (District of) Rustenburg, Sept., 1910, *Collins* (Herb. Field Mus. no. 653635).—Madagascar: 1897 (Herb. Field Mus. nos. 595715, 595725, 595745, U. S. Nat. Herb. nos. 1431040, 1431121); *Webb*(?) 113 (G). Bourbon: (Herb. Field Mus. no. 830986); *Halsey* (U. S. Nat. Herb. no. 1285441). Mauritius: 1867, *Pike* (U. S. Nat. Herb. no. 593158); (U. S. Nat. Herb. no. 516236). Tanganyika (German East Africa): Kilimanjaro, 1889–90, *Abbott* (U. S. Nat. Herb. nos. 22433, 22472); Ulugurus, Bunduki, Aug. 2, 1935, *Bruce* 96 (US). Zanzibar: Oct., 1873, *Hildebrandt* (NY). Uganda: Mt. Debasien, Jan., 1936, *Eggeling* 2703 (G); Vicinity of Kigomma, Dec. 30, 1909, *Mearns* 2617 (US); Kikayo, *Dümmer* 551 (US). Kenya (British East Africa): Mau Range, July 27, 1923, *A. G. Curtis* 848 (G); Lake Naivasha, July 17 to Aug. 15, 1909, *Mearns* 929 (US); Wambugu, Sept. 13, 1909, *Mearns* 1229 (G, US); Mbololo, Nov. 7–11, 1911–12, *E. Heller* (U. S. Nat. Herb. no. 634399). Egyptian Sudan: Jebel Marra, Dafur, Dec., 1921, *Lynes* 186 (US). Abyssinia: 1842, *Schimper* 856 (US).

2. Pteridium aquilinum var. **Wightianum** (Ag.), n. comb. Plate 650, fig. 1, Plate 651, fig. 3, map 2. Illustration: Bedd. Ferns S. India, t. 42 (1863).

Pteris revoluta Bl. Enum. Pl. Jav. 214 (1828). *Pteris excelsa* Bl. Enum. Pl. Jav. 213 (1828). *Pteris lanigera* Bl. Enum. Pl. Jav. 214 (1828). *Pteris densa* Wall. List no. 99 (1829), nomen nudum, isotype at US. *Pteris firma* Wall. List no. 100 (1829), nomen nudum. *Pteris terminalis* Wall. List no. 101 (1829), nomen nudum. *Pteris recurvata* Wall. List no. 113 (1829), nomen nudum; ex Ag. Rec. Pterid. 50 (1839), isotype at US. *Pteris Wightiana* Wall. List no. 2178 (1829), nomen nudum. *Allosorus recurvatus* (Wall.) Pr. Tent. Pterid. 154 (1836), nomen nudum. *Pteris recurvata* Wall. ex Ag. var. *Wightiana* Ag. Rec. Pterid. 50 (1839), as *Wigtiana*, epithet taken from *Pteris Wightiana* Wall. *Pteris villosa* Fée, Gen. Fil. Mém. Fam. Foug. **5:** 128 (1850–1852). *Cincinalis villosa* (Fée) Trevis. Atti Soc. Ital. sc. nat. **17:** 239 (1875). *Pteridium aquilinum* (L.) Kuhn var. *osmundoides* Christ ex Léveillé, Bull. Acad. Geogr. Bot. **20:** no. 243, 9 (1910), nomen nudum. *Pteridium capense* (Thunb.) Krasser var. *densa* Nakai, Bot. Mag. Tokyo **39:** 109 (1925), epithet taken from *Pteris densa* Wall. *Pteridium revolutum* (Bl.) Nakai, Bot. Mag. Tokyo **39:** 109 (1925).

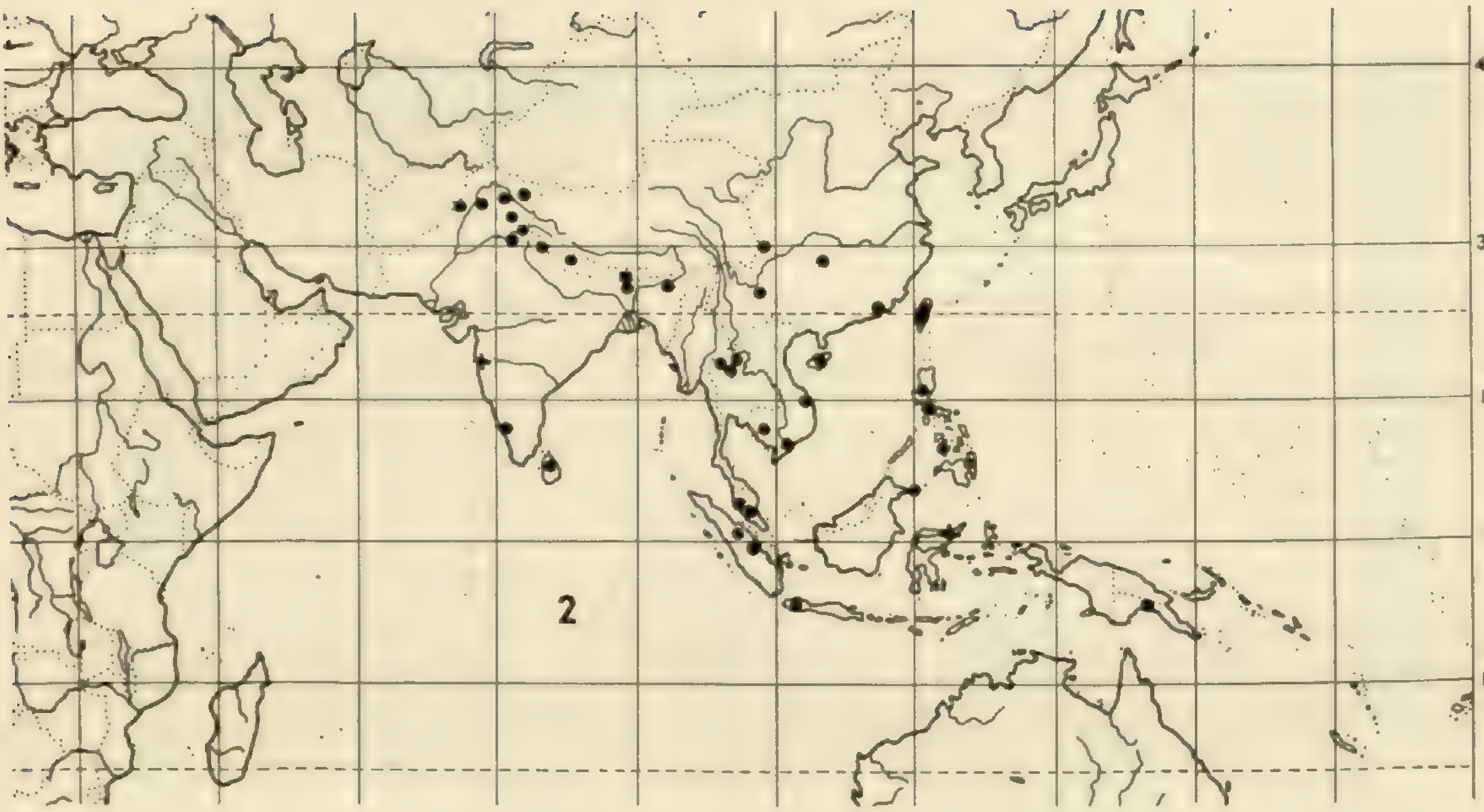
Growing tip of the rhizome with a tuft of dark hairs; *frond 0.6–4 m. high,* the taller fronds scandent, *vernation gleichenioid;* stipe usually shorter than the blade; *blade* 0.3–3 m., usually about *1.1–5 m. long, ovate-triangular,* or less often pentagonal, not ternate, usually tripinnate-pinnatifid, less often bipinnate-pinnatifid or tripinnate; *rachis* usually *densely or very densely pubescent,* rarely becoming subglabrous; *pinnae and pinnules* usually *long-acuminate,* infrequently short-acuminate; *pinnules* usually *nearly at right angles* to the costa, less often at a somewhat oblique angle; costules slightly to densely pubescent beneath and less so above; penultimate segments usually pinnatifid, less often pinnate or pinnate-pinnatifid; longest entire segment or part of a segment from three to seven, usually about four, times as long as broad; *ultimate segments* usually *falcate* or subfalcate, adnate or broadest at the base, the upper surface usually glabrous or slightly pubescent, the margin glabrous to moderately pubescent, the *lower surface* usually *densely pubescent,* less often slightly pubescent, rarely glabrous or pubescent only along the midnerve; *fertile and sterile indusium ciliate* and sometimes also *pubescent* on the outer surface, rarely glabrous, the *fertile* usually *0.3 mm. or less wide,* the *sterile* usually *0.2 mm. or less wide,* the *fertile portion no broader than the sterile* on the same segment.

Type: *Wallich* 2178, at Kew (not seen).

Type Locality: Dindygul, India.

Specimens from the Himalayas (*R. R. & I. D. Stewart* 4761, 4048; *Stewart* 6492) are almost completely glabrous and *Stewart* 6492 has the ultimate segments narrowed at the base. However, they have the long-acuminate pinnae and pinnules of typical var. *Wightianum* and probably represent only a local variation. Other material from the same region is entirely typical. Some specimens approach var. *typicum* and var. *latiusculum* in having a nearly glabrous rachis (*Henry,* China; *Fang* 3281, China) or acuminate to obtuse pinnules (*Bartsch* 153, Philippine Is.; *Sallet,* Indo-China).

Var. *Wightianum* can be separated from var. *typicum,* with which it is apparently closely related, by its much more densely pubescent rachis, its long-acuminate rather than subacute or



Ranges of PTERIDIUM AQUILINUM, var. WIGHTIANUM (map 2); var. PUBESCENS (map 3).

obtuse pinnae and pinnules, its falcate rather than straight ultimate segments and the narrower fertile and sterile indusium. The critical differences between var. *Wightianum* and var. *latiusculum*, with which it intergrades, are discussed under that variety.

Var. *Wightianum* grows on dry hillsides, in jungle clearings, on waste slopes, on craters and in grassland, usually in sterile, often dry, soil. It occurs from 700 m. to 3300 m. in India and up to 2500 m. in China and 2800 m. in Papua.

It ranges from northwesternmost India east to Formosa, south to Ceylon, Java and British New Guinea.

INDIA: N. W. India, 1871, *J. L. Stewart* 3626 (NY); Nazara, N. W. Himalayas, May 16, 1896 (US Nat. Herb. no. 1274966); Simla Region, Simla, Sept. 18, 1883, *Blanford* (NY); Sonamarg, Kashmir, July 28, 1921, *R. R. Stewart* 6492 (NY, US); Tragbal, Kashmir, July 31, 1919, *R. R. & I. D. Stewart* 4761 (NY, US); Murree Hills, Changla Gali, Punjab, Sept. 12, 1918, *R. R. & I. D. Stewart* 4048 (NY, US); Halann, Kulu, Punjab, May 21, 1931, *Koelz* 1980 (US); Kumaon, *Strachey & Winterbottom* 8 (G); Dalhousie, Punjab, June 9, 1917, *R. R. & I. D. Stewart* 2182 (NY, US); Nepal, 1820, *Wallich* 113 (US), isotype of *Pteris recurvata* Wall.; Khasi Hills, Shillong, Assam, Sept., 1888, *Mann* (NY, US); Sikkim, *Hooker* (G); Nilghiri, *Thomson* (G); 40 miles north of Darjeeling, Dec., 1884, *native collector* (NY). CEYLON: *Beckett* 182 (G); (U. S. Nat. Herb. no. 816885); (U. S. Nat. Herb. no. 22423); *G. Wall* (NY). SIAM: Doi Sutep, Dec. 15, 1928, *H. M. Smith* 410 (G, US); Doi Chang Mt. near Hue San, Chiengmai Prov., Jan. 10, 1922, *Rock* 1720 (NY, US); Jan Khien, Doi Sootep, Chiengmai, Aug. 14, 1931, *Cunniff* 7 (NY). FRENCH INDO-CHINA: Annam, Massif de Bah-Na, 30 miles southwest of Tourane, Aug., 1920, *Sallet* (G, NY, US); Cochinchina, May, 1870, *Pierre* 5793 (US); Angkor, Cambodia, Jan. 14, 1926, *H. M. Smith* 295 (US). FEDERATED MALAY STATES: Perak, 1887, *Wray* 1486 (US); Penang, 1822, *Wallich* 99 (US), isotype of *Pteris densa* Wall.; Pulan Tulai, Pahang, May 27, 1927, *Henderson* 18525 (US). CHINA. KWANGTUNG: Canton and vicinity, Nov. 11, 1917, *Levine* 1834 (G). HAINAN: Hainan, Dec. 18, 1933, *Wang* 35562 (NY). KWEICHOW: Kyingtenshan, Tsunyi, Jan. 3, 1930, *Tsiang* 5241 (G, NY); Liang Feng Yah, Tsunyi Hsien, July 31, 1931, *Steward, Chiao & Cheo* 53 (F, NY, US). YUNNAN: Between Mohei and Moakai, March 20–April 7, 1922, *Rock* 2906 (G). SZECHUAN: Mt. Omei, Omei Hsien, 1928, *Fang* 3281 (G); Patung District, Feb., 1887, *Henry* (G).—FORMOSA: Arisan, Dec. 4, 1933, *Kanehira* 2995 (NY, US); Shakko, Dec., 1913, *Faurie* (E. Rosenstock exsicc. no. 51) (G); Mt. Taihei, Taiheisan, Sept. 28, 1926, *Bartlett* 6034 (US).

Philippine Islands: Dumaguete, Island of Negros, Prov. Negros Oriental, June, 1908, *Elmer* 10349 (G, NY, US); Port of Dos Amigos, Twai Twai Island, Feb. 19, 1908, *Bartsch* 153 (G, NY, US); Twin Peaks, Benguet Road, Luzon, March 2, 1908, *Bartsch* 210 (G, NY, US); Bosoboso, Prov. Rizal, Luzon, June, 1896, *Ramos* (Herb. Phil. Bureau Sci. no. 1054) (US); Bukidnon, Mindanao, July–Aug., 1913, *Escritor* (Herb. Phil. Bureau Sci. no. 21414) (US). Borneo: *Korthals* (NY). Sumatra: Aels Kanopan, Loendoet Concession, Koealoe, March 19, 1927, *Bartlett* 6993 (US); Toba, *Ouwchand* 204 (G). Java: Tjiboeroem, Preanger Prov., April 12, 1909, *Palmer & Bryant* 171 (US); vicinity of Goenoeng Boender, Batavia Prov., May 16, 1909, *Palmer & Bryant* 529 and 541 (US). Papua (British New Guinea): Murray Pass, Wharton Range, Central Division, June–Sept., 1933, *Brass* 4634 (G, NY).

3. Pteridium aquilinum var. pubescens Underw. Our Nat. Ferns, Ed. 6, 91 (1900). Plate 650, fig. 3, Plate 652, fig. 5, map 3. Illustration: Ashton, Pl. Rocky Mt. Nat. Pk. 22 (1933), *habitat*.

Pteris aquilina L. var. *lanuginosa* Bong. Mém. Acad. St. Petersb. s. 6, **2:** 176 (1832), isotype at G. *Pteridium lanuginosum* (Bory ex Willd.) Clute, Fern Bull. **8:** 38 (1900), as to plant, not *Pteris lanuginosa* Bory ex Willd.; nomen provisorium. *Pteris lanuginosa* sensu Clute, Fern Bull. **8:** 37 (1900), not Bory ex Willd. *Pteris aquilina pubescens* (Underw.) Clute, Fern Bull. **15:** 124 (1907). *Pteridium latiusculum* (Desv.) Hieron. ex Fries var. *pubescens* (Underw.) [combination incorrectly attributed to Underw. by] Seymour, Host Ind. 25 (1929). *Filix-foemina aquilina* (L.) Farwell var. *lanuginosa* (Bong.) Farwell, Am. Mid. Nat. **12:** 290 (1931). *Pteris aquilina* L. var. *pubescens* (Underw.) [combination apparently incorrectly attributed to O. Ktze. by] Hanna, Am. F. Journ. **22:** 6 (1932). *Pteridium aquilinum* (L.) Kuhn var. *lanuginosum* (Bong.) Fernald, Rhodora **37:** 247 (1935), not (Bory ex Willd.) Kuhn (1879).

Growing tip of the rhizome usually *with a tuft of dark hairs; frond* 0.3–5 m., usually about *0.8–2 m. high*, the taller fronds scandent, *vernation subgleichenioid;* stipe usually shorter than the blade; *blade* 0.2–4 m., usually about *0.6–1 m. long*, usually *ovate-triangular*, less often pentagonal or ovate, *not ternate*, usually tripinnate or tripinnate-pinnatifid; rachis slightly to moderately pubescent; pinnae and pinnules subacute to obtuse; *pinnules* usually nearly or quite *at right angles to the costa*, sometimes somewhat at an oblique angle; costules usually slightly to moderately pubescent beneath and less so above; penultimate segments often pinnatifid, less often pinnate or pinnate-pinnatifid; longest entire segment or entire part of a segment from three to five, usually about four, times as long as broad; *ultimate segments* usually straight, adnate or broadest at the base, the *upper surface* slightly to quite *pubescent*, at least near the margin, the midnerve usually glabrous, the *margin moderately pubescent*, the *lower surface* usually *densely pubescent*, less often slightly pubescent, rarely glabrous except along the midnerve; *fertile indusium* usually slightly *ciliate* and slightly *pubescent* on the outer surface, rarely becoming glabrous with age, *sterile indusium ciliate* and sometimes also pubescent on the outer surface, the *fertile* usually *0.25–0.3 mm. wide*, rarely up to 0.5 mm. wide, the *sterile 0.25 mm. or less wide*, very rarely 0.4–0.5 mm. wide, the *fertile portion broader than the sterile* on the same segment.

Type: No type designated, specimens labeled by Underwood in the Herbarium of the New York Botanical Garden typify the variety.

Type Locality: "Utah, California and northward."

Shade forms[15] approach var. *latiusculum* in having the sterile indusium glabrous or nearly so and the lower surface of the blade nearly glabrous, or in some cases more glabrous than in typical var. *latiusculum*—for example, *Merrill & Wilcox* 923, Wyoming; *Nelson & Nelson* 6733, Wyoming.

Intermediates between var. *pubescens* and var. *latiusculum* occur along the eastern border of the range of var. *pubescens*. Hanna[16] remarked that the Wyoming Bracken was "rather intermediate between the eastern *P. aquilina* [var. *latiusculum*] and the western *P. aquilina*, var. *pubescens* (Underw.) Kuntze." In a more recent article, on the ferns of Colorado where var. *latiusculum* also occurs, Wherry[17] says that "The relations be-

[15] In regard to ecological variation I think it is worthwhile to put on record the results of the following experiment. As part of the Carnegie Institution transplant experiments, the late Prof. Hall sent two plants of var. *pubescens* from Mather, California, to Mr. C. A. Weatherby at East Hartford, Connecticut. Mr. Weatherby received the plants in September, 1922, grew them successfully, and had them under observation until July, 1929. One plant was grown next to an unprotected east wall and the other by a fence, exposed to the sun for the greater part of the day. The reactions of the two plants were similar. The outline of the blade did not change and the segments did not become noticeably broader or thinner. The fronds grew to be six feet tall and dependent upon a support to remain erect. The only marked change was that the density of the pubescence gradually decreased so that in 1929 the plants were very noticeably less pubescent than when first received. The general differences between the Connecticut and California localities are a more humid climate, a lower elevation and about a four-degree higher latitude at the former.

[16] Hanna, Distribution of the Ferns of Wyoming. Am. F. Journ. **22**: 6 (1932).

[17] Wherry, Colorado Ferns. Am. F. Journ. **28**: 136 (1938).

tween these two Brackens need further study, for their intergradation in this region is so marked as to cast doubt on their specific distinctness." Some of the intermediates have the general characters of var. *latiusculum* except that they are pubescent beneath or have the pinnules set nearly at right angles to the costa. Others have an ovate blade and the sterile indusium slightly ciliate as in var. *pubescens* but are glabrous beneath except along the midnerve; or have the general characters of var. *pubescens* but have the pinnules at an oblique angle to the costa. Intermediate specimens are: Miller's Canyon, Huachuca Mts., Arizona, July 10, 1909, *Goodding* 170 (G, NY); San Francisco Mts., Arizona, Aug. 17, 1889, *Knowlton* 14 (G, US); Buckskin Mts., Arizona, June 30, 1909, *Tidestrom* 2336 (US); Central, New Mexico, Aug., 1895, *Mulford* 398 (NY); Rindoso Creek, Lincoln Co., New Mexico, July 1, 1895, *Mearns* (US); Buffalo Pass, Colorado, Aug. 11, 1898, *Shear & Bessey* (US); Southwest of Franktown, Douglas Co., Colorado, June 17, 1937, *Wherry* (US); Silver Reef, Utah, May 5, 1894, *M. E. Jones* 5176 (US); Gibbon Canyon National Park, Wyoming, *Carleton* 204 (F); Centennial Valley, Wyoming, Aug. 18, 1896, *Nelson* 2662 (NY).

Some specimens of var. *latiusculum* approach var. *pubescens* in characters of indusium and vestiture. A specimen from a burnt-over hillside, *Moore* 2221, West Virginia, is pubescent beneath between the margin and the midnerve and the fertile and sterile indusium is slightly ciliate and pubescent. The following specimens from New York, Ohio, Massachusetts and Indiana are pubescent beneath between the margin and the midnerve: Washington Co., New York, July 30, 1890, *Burnham* (Herb. Cornell U.)[18]; Otsego Co., New York, *Frost* (Herb. Cornell U.); Cleveland, Ohio, Aug. 15, 1875 (Herb. Cornell U.); Line Station, Indiana, Aug. 2, 1876, *Grassly* (F); Granville, Hampden Co., Massachusetts, Sept. 19, 1913, *Seymour* 60 (G).

An interesting phase, approaching var. *pubescens* in outline of blade and pubescence is discussed under var. *latiusculum*.

Var. *pubescens* differs from var. *latiusculum* in having the tip of the rhizome with a tuft of dark hairs rather than nearly

[18] I am indebted to Dr. R. T. Clausen for bringing to my attention this material in the Cornell University Herbarium.

naked, and an ovate-triangular, fairly evenly pinnate blade rather than a broadly triangular, ternate blade. Also the pinnules are nearly at right angles to the costa rather than at an oblique angle, the lower surface is densely pubescent between the margin and the midnerve rather than pubescent only on the midnerve and the fertile and sterile indusium is ciliate and sometimes also pubescent rather than glabrous. The frond is a little taller on the average and certainly reaches an extreme that var. *latiusculum* never approaches.

Var. *pubescens* differs from var. *typicum* in the pubescent rather than usually glabrous margin of the segments and the markedly less ciliate and pubescent fertile and sterile indusium. The penultimate segments are usually not as evenly pinnatifid or pinnate.

Var. *pubescens* is also closely related to vars. *Feei* and *decompositum* and the differences are discussed under those varieties.

In Michigan, Ontario and Quebec var. *pubescens* probably occurs as a pre-glacial relic on or related to local nunatak areas.[19]

Var. *pubescens* grows in pastures, open forests, burnt-over areas, on open slopes, in thickets, and in woods, in damp or dry places; mostly in the Transition and Canadian Zones, from sea level up to 3000 m.

It ranges from southern Alaska to Mexico, east to Wyoming, Colorado and western Texas; isolated eastward in South Dakota, northern Michigan, Bruce Co., Ontario and Megantic Co., Quebec.

Alaska: New Metlapatla, July 5, 1895 (Herb. Field Mus. nos. 366780, 366786); Sitka, *Bongard* (G), isotype of *Pteris aquilina* var. *lanuginosa* Bong.; Sitka, Aug. 2, 1916, *J. P. Anderson* 263 (US); Heyder, June 25, 1924, *Whited* 1284 (US); McDonald Lake, July 15, 1921, *H. M. Smith* (US); Petersburg, July 3, 1918, *J. P. Anderson* 652 (NY).

Dominion of Canada.—Quebec: Caribou Hill, Black Lake, Megantic Co., Aug. 26, 1915, *Fernald & Jackson* 11960 and 11961 (G). Ontario: Tobermory, Bruce Peninsula, July 28, 1933, *Krotkov* 6319 (US); Dunk's Bay, Tobermory, Bruce Co., Aug. 20, 1933, *T. M. C. Taylor* 6100 (G). Alberta: Vicinity of Banff, Aug. 29, 1899, *McCalla* 2434 (NY). British Colum-

[19] See Fernald, Critical Plants of the Upper Great Lake Region of Ontario and Michigan. Rhodora 37: 247 (1935).

bia: Tulameen River, 1900, *Kemp* (NY); Revelstoke, Selkirks, July 3, 1905, *Shaw* 786 (G, NY, US); Near Victoria, Vancouver Island, July 28, 1908, *Macoun* 84096 (F).

United States of America.—Michigan: Lake Manganese, 1 mile southeast of Copper Harbor, Keweenaw Co., July 23, 1936, *Hermann* 8231 (US); West Bluff, 3½ miles west of Copper Harbor, Keweenaw Co., June 18, 1936, *Hermann* 7520 (NY); West Bluff, Keweenaw Co., July 4, 1934, *Fernald & Pease* 3033 (G, NY); Mackinac Island, July 28–29, 1898, *Millspaugh* 85 (F, G). South Dakota: (undoubtedly from the Black Hills) *Gifford* (G). Texas: Mt. Livermore, Davis Mts., Jeff Davis Co., Oct. 6, 1926, *E. J. Palmer* 32010 (G). Montana: Near Apgar, Glacier National Park, July 30, 1937, *T. G. & E. C. Yuncker* 7006 (F); Belton, Aug. 22, 1903, *Umbach* 732 (F, NY, US). Idaho: Trinity, Elmore Co., Aug. 13, 1910, *Macbride* 599 (F, G, NY, US); Lake Pend Oreille, Kootenai Co., Aug. 23, 1892, *Sandberg, MacDougal & Heller* 943 (US). Wyoming: Gibbon Canyon, Yellowstone National Park, Aug. 28, 1899, *E. & A. Nelson* 6733 (G, NY, US); Leigh's Lake, July 24, 1901, *Merrill & Wilcox* 923 (G, NY, US); Alpine, Lincoln Co., July 13, 1923, *Payson & Armstrong* 3486 (G); Bradley Creek, Grand Teton National Park, July 17, 1932, *L. Williams* 887 (G, NY). Colorado: Near Pagosa Peak, Aug. 25, 1899, *C. F. Baker* 128 (G, NY, US); Park Range above Steamboat Spa, Aug. 11, 1898, *Shear & Bessey* (NY). Utah: La Motte Peak, July 24, 1926, *E. B. & L. B. Payson* 5078 (G); Granite Canyon, Deep Creek Mts., Juab Co., June 20, 1933, *Maguire & Becraft* 2466 (G). Nevada: East Humboldt Mts., Aug., 1868, *Watson* 1359 (G); Little Valley, Washoe Co., Aug. 14, 1902, *C. F. Baker* 1460 (G, NY, US). New Mexico: Jemez Canyon, Aug. 10, 1932, *A. & R. A. Nelson* 212 (G); Sacramento Mts., Lincoln Co., July 30, 1923, *Eggleston* 18881 (NY). Arizona: Chiricahua Mts., Barefoot Park, Oct. 19, 1906, *Blumer* 1450 (F, G, NY, US); Washall Gulch, Santa Catalina Mts., Oct. 2, 1917, *Shreve* 5397 (F, G). California: Avalon, Santa Catalina Island, Mar., 1897, *Trask* (US); Near Forest Ranch, Sierra Foothills, Butte Co., Sept. 23, 1916, *A. A. Heller* 12660 (F, G, NY, US); Plains of Mendocino, Aug. 10, 1882, *Pringle* (F, G, NY, US). Oregon: Portland, June 25, 1920, *Fisher* 14 (G); Salem, 1871, *E. Hall* 678 (F, G). Washington: Wenatchee, Chelan Co., July 6, 7, 1916, *Eggleston* 12930 (F); Seattle, King Co., Sept. 19, 1931, *J. W. Thompson* 8106 (G).

Mexico.—Baja California: Sierra San Pedro Martir, 1923, *Gallegas* (US). Chihuahua: Majalca, Aug. 20, 1935, *LeSuer* Mex-498 (F); Southwestern Chihuahua, Aug.–Nov., 1885, *E. Palmer* 447 (G, US); Madera, May 27–June 3, 1908, *E. Palmer* 288 (F, G, NY, US); Majarachic, April 24, 1938, *Knobloch*

5114 (F). Durango: Metates, north of Cueva, Aug. 29–30, 1934, *Pennell* 18410 (US).

(*To be Continued*)

A REVISION OF THE GENUS PTERIDIUM

R. M. TRYON, JR.

(*Continued from page 31*)

4. PTERIDIUM AQUILINUM var. FEEI (Schaffn. ex Fée) Maxon ex Yuncker, Field Mus. Pub. Bot. **17:** no. 4, 308 (1938). PLATE 650, FIG. 4, PLATE 651, FIG. 1, MAP 7.

Pteris aquilina L. var. *pubescens* Kze. Linnaea **13:** 142 (1839), as to plant, not as to basinym, *Pteris lanuginosa* Spreng. *Pteris aquilina* L. var. *pubescens* Spreng. ex Liebm. Vid. Selsk. Skr. s. 5, **1:** 225 (1849), as to plant, not as to basinym, *Pteris lanuginosa* Bory ex Willd. *Pteris Feei* Schaffn. ex Fée, Mém. Fam. Foug. **8:** 73 (1857). *Pteridium Feei* (Schaffn. ex Fée) [combination incorrectly attributed to Maxon by] Faull, Contrib. Arn. Arb. **11:** 87 (1938).

Pteris aquilina L. var. *pubescens* Spreng. ex Liebm. based on *Pteris lanuginosa* Bory ex Willd. and *Pteris aquilina* L. var. *pubescens* Kze. based on *Pteris lanuginosa* Spreng. are both earlier varietal names than var. *Feei*, and were originally applied to this variety, but their basinyms refer them, respectively, to var. *typicum* and var. *latiusculum*. Also, of course, they could not to be used under *Pteridium* because of var. *pubescens* Underw.

Growing tip of the rhizome with a tuft of dark hairs; *frond* 0.2–1 m., usually about *0.5–0.7 m. high, vernation subgleichenioid;* stipe usually shorter than the blade; *blade* 1–5 dm., usually *about 3 dm. long,* usually *broadly ovate or pentagonal,* less often ovate or broadly triangular, not ternate, usually bipinnate-pinnatifid to tripinnate, less often tripinnate-pinnatifid; *rachis* usually *slightly pubescent,* sometimes strongly pubescent or glabrate; pinnae and pinnules short-acuminate to obtuse; pinnules usually nearly at right angles to the costa, sometimes at an oblique angle; costules slightly to moderately pubescent beneath and less so above; penultimate segments pinnatifid, often pinnate, or pinnate-pinnatifid; longest entire segment or entire part of a segment from three to eight, usually about four, times as long as broad; *ultimate segments* usually straight, rarely subfalcate, adnate or broadest at the base, the *upper surface* slightly to moderately *pubescent*, at least near the margin, the midnerve glabrous or slightly pubescent, the *margin* usually moderately *pubescent*, rarely glabrate, the lower surface usually densely pubescent, rarely slightly pubescent or pubescent only on the midnerve; *fertile and sterile indusium ciliate and* sometimes also *pubescent* on the outer surface, the *fertile* usually *0.3 mm. or more wide,* the *sterile* usually *0.4 mm. or more wide,* the *fertile portion no broader than the sterile* on the same segment.

Type: *Schaffner* 138, 141. Probably at Rio de Janeiro (not seen).

Type Locality: Huatusco, Mexico.

Some specimens of var. *Feei* are not entirely typical, having some character of var. *pubescens* : *Heyde & Lux* from Guatemala and *Mohr* from Vera Cruz, Mexico have the sterile indusium narrow, 0.2–0.3 mm. wide; *Rose* 2212, Tepic, Mexico has the sterile indusium only slightly ciliate; and *Palmer* 67, San Luis Potosí, Mexico has an ovate blade. *Ortega* 7400, Sinaloa, Mexico, 1934 (F) is intermediate between the two varieties.

Var. *Feei* may be separated from var. *pubescens* by its conspicuously ciliate rather than only slightly, if at all, ciliate fertile indusium, the usually much more ciliate sterile indusium, which is also almost twice as broad, and the fertile portion of the indusium no broader than the sterile on the same segment rather than broader. On the average, the fronds are considerably smaller.

It differs from var. *typicum* in having the margin of the segments pubescent rather than glabrous, the sterile indusium usually considerably broader, and in its usually smaller size. Its differences from var. *decompositum,* with which it is also closely related, are discussed under that variety.

Var. *Feei* grows in the mountains of Mexico, Guatemala and Honduras, up to 2800 m.

Mexico.—San Luis Potosi: San Miguelito Mts., 1876, *Schaffner* 925 (G); Alvarez, Sept. 5–10, 1902, *E. Palmer* 67 (F, G, NY,

Ranges of Pteridium aquilinum var. typicum (map 4); var. pseudocaudatum (map 5); var. africanum (map 6); var. Feei (map 7).

US). Terr. Tepic: near Santa Teresa, Aug. 12, 1897, *Rose* 2212 (G, NY, US). Guanajuato: 1905, *Duges* 6 (US). Hidalgo: Durango, Aug. 13, 1937, *Fisher* (NY, US); El Chico, July, 1927, *Lyonnet* 98 (G, NY); between Somoriel and Las Lajas, Aug. 5, 1905, *Rose, Painter & Rose* 9204 (NY, US). Vera Cruz: Huatusco, April, 1857, *Mohr* (U. S. Nat. Herb. no. 724103); Cordoba, 1889–91, *Fink* 18 (G, NY, US); near Jalapa, May 12, 1900, *Pringle* 8342 (US). Mexico: Oct., 1875, *Schaffner* 59 and 116 (NY); below Ajusco, Sept. 19, 1903, *Rose & Painter* 7214 (G, US). Puebla: Teziutlan, Sept. 7, 1910, *Orcutt* 4029 (US). Oaxaca: Cerro de San Felipe, Sept. 26, 1897, *Conzatti & Gonzales* 487 (G); Cuicatlan, June 16 and 22, 1898, *Conzatti & Gonzales* 747 (G, US).—Guatemala: Between Solola and Chiducadenango, Aug. 13, 1936, *Hatch & Wilson* 322 (US); Chichavac, Chimaltenango, Nov.–Dec., 1930, *Skutch* 12 (US); Laguna de Avarza, Jalapa, Sept., 1892, *Heyde & Lux* (J. D. Smith no. 4080) (G, NY, US). Honduras: Near Siguatepeque, Dept. Comayagua, July 3, 1936, *Yuncker, Dawson & Youse* 5600 (F, G, NY, US).

5. Pteridium aquilinum var. **decompositum** (Gaud.), n. comb. Plate 650, fig. 5, plate 651, fig. 2. Illustration: St. John & Hosaka, Weeds Pineapple Fields. Haw. Is., Univ. Haw. Res. Pub. 6, 24 (1932).

Pteris decomposita Gaud. in Freyc. Voy. Bot. 393 (1829). *Pteridium capense* (Thunb.) Krasser var. *decompositum* (Gaud.) Nakai, Bot. Mag. Tokyo **39:** 110 (1925).

Growing tip of the rhizome with a tuft of dark hairs; *frond* 0.5–2 m., usually about *0.7–1 m. high, vernation subgleichenioid;* stipe usually shorter than the blade; *blade* 2–10 dm., usually about *4 dm. long,* usually *ovate or broadly ovate,* not ternate, usually tripinnate or tripinnate-pinnatifid; *rachis glabrous* or slightly pubescent; pinnae and pinnules short-acuminate to obtuse; pinnules usually nearly at right angles to the costa, sometimes at an oblique angle; costules slightly pubescent beneath and less so above; penultimate segments pinnatifid, pinnate or pinnate-pinnatifid; longest entire segment or entire part of a segment from three to five, usually about four, times as long as broad; ultimate segments usually straight, adnate or broadest at the base, the *upper surface glabrous,* rarely very slightly pubescent along the midnerve, the margin glabrous, slightly pubescent, or rarely quite pubescent, the *lower surface* usually *densely subappressed-lanuginose pubescent,* sometimes only slightly so; *fertile and sterile indusium ciliate* and sometimes also *pubescent* on the outer surface, rarely becoming glabrous with age, the *fertile* usually about *0.3 mm. wide,* the *sterile* usually about *0.2 mm. wide,* the *fertile portion broader than the sterile* on the same segment, *or no broader.*

TYPE: *Gaudichaud,* in Herb. Muséum d'Histoire Naturelle, Paris (not seen).

TYPE LOCALITY: Hawaiian Islands.

Var. *decompositum* is closely related to vars. *Feei* and *pubescens.* However, it has a nearly glabrous rachis rather than a pubescent one as in those two varieties and the upper surface of the segments is glabrous or rarely slightly pubescent only along the midnerve rather than pubescent and usually with a glabrous midnerve. The sterile indusium is only about half as broad as that of var. *Feei* and on the average it is not as large a plant as var. *pubescens.* The margin of the segments is sometimes glabrous or nearly so rather than pubescent. The subappressed pubescence on the lower surface of the segments is characteristic though not always well defined.

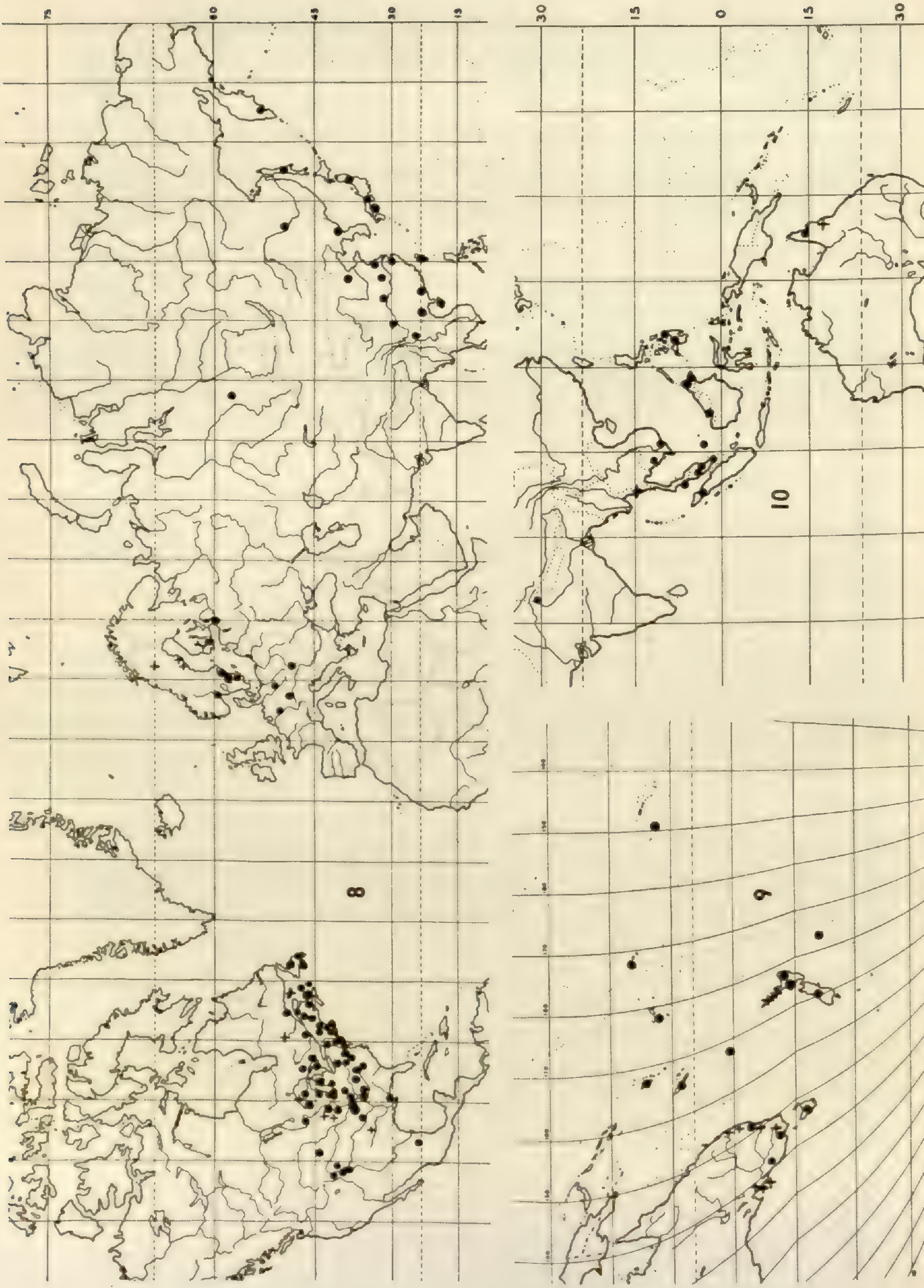
Var. *decompositum* is a part of the small element of the Hawaiian flora that is related to the American flora.

It occurs exclusively in the Hawaiian Islands, where it grows along field borders, in virgin land, on craters, on bare eroded slopes, on open grassy slopes and in thickets from 300 m. up to 2700 m.

HAWAIIAN ISLANDS.—KAUAI: June 22, 1895, *A. A. Heller* 2416 (F, G, NY, US). OAHU: Waianae Mts., Honouliuli, May 2, 1937, *Fosberg* 13810 (G); Koalau Mts., March 29, 1933, *Fosberg* 9320 (G); Wahiawa, June 3, 1909, *Forbes* (NY). MOLOKAI: Kahuaawi, May 30, 1928, *Degener* 3558 (NY, US). LANAI: Kaokahi, Nov. 28, 1935, *Fosberg* 12429 (G). MAUI: Aug. 22, 1933, *Fosberg* 9943 (G). HAWAII: Kilauea Bird Park, Aug. 5, 1925, *Neal* (NY).

6. PTERIDIUM AQUILINUM var. LATIUSCULUM (Desv.) Underw. ex Heller, Cat. N. Am. Pl. Ed. 3, 17 (1909). Plate 650, FIG. 8, PLATE 652, FIG. 1, MAP 8. Illustrations: Tilton, Fern Lover's Comp. 48, 49 (1922); Tryon et al., Ferns of Wis. 18, 19 (1940), *habitat;* Svensk Bot. **2:** t. 90 (1803).

Pteris caudata L. sensu Schk. Krypt. Gew. 88 (1809), in part, pl. 96b, a. *Pteris ciliata* Willd. ex Schk. Krypt. Gew. 89 (1809), in synonymy. *Pteris lanuginosa* Spreng. Nova Acta **10:** 231 (1821). *Pteris Sprengelii* Steud. Nom. Bot. **2:** 358 (1824). *Pteris latiuscula* Desv. Mém. Soc. Linn. **6²:** 303 (1827). *Pteris aquilina* L. var. *pubescens* Kze. Linnaea **13:** 142 (1839), as to



Ranges of Pteridium aquilinum var. latiusculum (map 8); var. esculentum (map 9); var. yarrabense (map 10).

basinym, *Pteris lanuginosa* Spreng., not as to plant. *Pteridium latiusculum* (Desv.) Hieron. ex Fries, Wiss. Ergebn. Schwed. Rhodesia-Kongo Exp. **1**^{1}: 7 (1914). *Cincinalis latiuscula* (Desv.) Vict. Contrib. Lab. Bot. Univ. Montréal no. 2, 71 (1923), nomen provisorium. *Pteridium aquilinum* (L.) Kuhn var. *japonicum* Nakai, Bot. Mag. Tokyo **39:** 106 (1925), ex char. *Pteris latiuscula lanuginosa* Small, Ferns N. Y. 241 (1935), in synonymy. *Pteridium latiusculum* (Desv.) Hieron. ex Fries var. *verum* Wherry, Am. F. Journ. **27:** 58 (1937). *Pteridium aquilinum* (L.) Kuhn f. *glabrum* Tardieu-Blot and C. Chr. in Lecomte, Fl. Gen. Indo-Chine **7**^{2}: 138 (1939). *Pteridium japonicum* (Nakai) Tardieu-Blot and C. Chr. in Lecomte, Fl. Gen. Indo-Chine **7**^{2}: 138 (1939), in synonymy.

The earliest varietal name, *Pteris aquilina* L. var. *pubescens* Kze., cannot be transferred to *Pteridium aquilinum* because of *Pteridium aquilinum* var. *pubescens* Underw.

Growing tip of the rhizome usually *naked, or with a few whitish hairs,* rarely with a tuft of dark hairs; *frond* 0.3–1.5 m., usually about *0.5–1 m. high, vernation equal;* stipe longer or shorter than the blade; *blade* 2–8 dm., usually about *5 dm. long,* usually *broadly triangular,* rarely broadly ovate or ovate, often *ternate,* usually tripinnate or tripinnate-pinnatifid, sometimes bipinnate-pinnatifid; *rachis* usually *glabrous or subglabrous,* sometimes slightly pubescent; *pinnae and pinnules subacute to obtuse; pinnules* usually *at an oblique angle to the costa,* rarely nearly at right angles; costules slightly pubescent beneath and less so above, or glabrous; penultimate segments usually pinnate or pinnate-pinnatifid; *longest entire segment* or entire part of a segment from three to seven, usually *about four, times as long as broad; ultimate segments* usually *straight,* adnate or broadest at the base, the upper surface glabrous or subglabrous, the *margin pubescent,* or rarely subglabrous, the *lower surface* usually *pubescent only along the midnerve,* rarely slightly pubescent between the margin and the midnerve; *fertile and sterile indusium* usually *glabrous,* rarely the fertile slightly pubescent on the outer surface or ciliate, and the sterile slightly ciliate, the fertile 0.25–0.4 mm. wide, the sterile 0.1–0.2 mm. wide, the fertile portion broader than the sterile on the same segment.

Type: Sheet labeled *Pteris latiuscula* Desv., Herb. Desvaux in Herb. Muséum d'Histoire Naturelle, Paris (not seen). Photograph of type in U. S. National Herbarium and Gray Herbarium (seen).

Type locality: Newfoundland and St. Pierre.

In northern Europe, Kamtchatka and occasionally throughout its range in North America, plants of var. *latiusculum* occur that have the sterile indusium slightly ciliate and the lower surface of the blade somewhat pubescent between the margin and the midnerve. Such plants in North America are discussed under var. *pubescens*. Also, occasionally, the blade is ovate rather than broadly triangular. These are apparently normal variations in any large population of var. *latiusculum*.

In northern Wisconsin and adjacent Michigan, and perhaps more widely distributed, plants with an ovate blade, pubescent beneath between the margin and midrib, and with the sterile indusium ciliate are not uncommon (plate 652, fig. 4). Representative specimens are: Boulder Junction, Vilas Co., Wisconsin, July 3, 1938, *Tryon* 3914 (G); Hersey, Osceola Co., Michigan, June 25, 1938, *Fassett* 19244 (G); Northwest of L'Anse, Baraga Co., Michigan, *Fassett* 19251 (G). They constitute a rather noticeable proportion of the var. *latiusculum* population. An attempt to identify such plants led me into this study of *Pteridium* but I am still unable to give a satisfactory interpretation of them. In the summer of 1940 I made an effort to study them in the field more closely than I had in 1938[20] but heavy late frosts had killed or mutilated most of the Bracken. They may be regarded as a scattered population intermediate between var. *pubescens* and var. *latiusculum*, closely related to the former in the characters given above but, I believe, derived from the latter by rhizomes or spores. Or, there is considerable evidence that they are merely the result of adverse growing conditions such as burning, pasturing, and extremes of exposure and soil sterility. They are found in especially dry, sunny places, often in pastures, fields, railroad rights-of-way and recently burnt-over land.

There is a certain amount of intergradation between var. *latiusculum* and var. *Wightianum*. Some specimens with the leaf-cutting of var. *latiusculum* are slightly pubescent beneath between the margin and the midnerve and have the sterile indusium slightly ciliate, while others have tapering pinnules set at right angles to the costa, as in var. *Wightianum*, and are pubescent beneath only on the midnerve. Such intermediates

[20] See Tryon, Notes on the Ferns of Wisconsin. Am. F. Journ. **29**: 1 (1939).

are: Kwangtung, China, Jan. 4, 1928, *Tsang* 16704 (F); Kwangtung, China, *Lau* 2353 (G); Canton, China, 1874, *Poli* (Herb. Field Mus. no. 593622); near Kau Fung, Loh Ch'ang Dist., Kwangtung, China, Nov. 2–30, 1932, *Tsang* 20872 (NY, US); Foochow, Fukien Prov., China, *Metcalf* 7406 (US); Wang Shan, Anhwei Prov., China, Aug. 28, 1923, *Ip* (US); Mt. Rengger, Java, Sept. 25, 1907, *Buysman* (US).

Var. *latiusculum* may be separated from var. *Wightianum* by its equal rather than gleichenioid vernation, its broadly triangular and ternate rather than ovate-triangular and evenly pinnate blade, its nearly glabrous rather than densely pubescent rachis and its subacute or obtuse rather than long-acuminate pinnae and pinnules. Also the ultimate segments are straight rather than falcate, the lower surface is glabrous except along the midnerve rather than densely pubescent, the fertile and sterile indusium are glabrous or nearly so rather than quite ciliate and the pinnules are at an oblique angle to the costa rather than at right angles.

Vars. *typicum, pubescens* and *pseudocaudatum* are also closely related to var. *latiusculum* and the critical differences are discussed under their treatments.

Var. *latiusculum,* in eastern North America and eastern Asia, is another example of the well-known relationship of the floras of those two areas. The localities in the Black Hills of South Dakota and the mountains of Wyoming, Colorado and Nuevo Leon undoubtedly represent relics of a once continuous range, the intervening population perhaps having been wiped out by aridity in the Great Plains Region. I do not have enough data at hand to interpret the occurrence of var. *latiusculum* in northern Europe. It may have survived glaciation in local nunatak areas in Scandinavia and spread since the disappearance of the ice, or it may have spread, since glaciation, westward from unglaciated areas in western Siberia. Var. *latiusculum* is probably more widely distributed in central Asia than Map 8 indicates. Several of the localities in central Asia on Map 1 probably represent var. *latiusculum.*

Var. *latiusculum* grows in pastures, open woods, thickets, on open slopes, in woods, on grassy slopes in abandoned fields and in burnt-over areas, in damp or more often dry, usually sterile soil; from sea level up to 1500 m. in eastern North America, 2300 m. and 2700 m. in the mountains of Wyoming and Colorado and up to 2000 m. in China.

It ranges from Newfoundland to Minnesota, south to Oklahoma and Tennessee; isolated in Mississippi, Wyoming, South Dakota, Colorado and Nuevo Leon; Sweden south to Germany, east to western Russia; Siberia; Kamtchatka to Amur, south to Formosa, Hainan and Szechuan.

North America.—Saint Pierre: Cape Noir, July 10, 1901, *Arsène* 6 (G); July 10, 1909, *Arsène* 5 (NY). Ile Miquelon: July 27, 1882, *Delamare* 364 (NY). Newfoundland: Holyrood, South Arm River, Aug. 23, 1894, *Robinson & Schrenk* 4 (F, G, NY, US); Grand Falls, July 10, 1911, *Fernald & Wiegand* 4281 (G). Dominion of Canada. Quebec: Boishébert, Mutton Bay, Saguenay Co., Aug. 15, 1915, *H. St. John* 90010 (G); Seven Islands, Saguenay Co., Aug. 12, 1907, *C. B. Robinson* 873 (NY); Bic, Rimouski Co., Aug. 15, 1927, *Rousseau* 26884 (G); Northwest of Three Rivers, Champlain Co., Aug. 1, 1923, *Chamberlain & Knowlton* (G); Grindstone, Grindstone Island, Magdalen Islands, Aug. 23, 1912, *Fernald, Long & St. John* 6645 (G). Prince Edward Island: Dundee, Kings Co., Aug. 26, 1912, *Fernald, Long & St. John* 6646 (G). New Brunswick: Shediac Cape, July 23, 1914, *F. T. Hubbard* (G). Nova Scotia: Brazil Lake, Yarmouth Co., July 16, 1921, *Bartram & Long* 23003 (G); Digby, July 2–7, 1901, *Howe & Lang* 258 (G, NY). Ontario: Moore Lake, Bruce Peninsula, Aug. 26, 1934, *Krotkov* 9606 (G, US); east end of Timagami Lake, Timagami Provincial Forest, Aug. 4–11, 1935, *E. C. & T. G. Yuncker* 5499 (F); Laurier, Parry Sound District, Aug. 13, 1905, *Moyer* (NY). United States of America. Maine: Mt. Katahdin, July 14, 1900, *Fernald* (G); Boundary Lake, Aroostook Co., Aug. 12, 1902, *Eggleston & Fernald* (G). New Hampshire: Randolph, Sept. 1, 1903, *A. H. Moore* 1454 (G); Jaffrey, July 25, 1897, *B. L. Robinson* 287 (G). Vermont: Manchester, July 27, 1898, *Day* 260 (G); Brandon, May 23, 1908, *E. F. Williams* (G). Massachusetts: Sharon, July, 1905, *S. F. Poole* 307 (G); Tisbury, Martha's Vineyard, June 16, 1917, *F. C. Seymour* 1001 (G, US); Granville, Sept. 19, 1913, *Seymour* 60 (NY). Rhode Island: Barrington, Bristol Co., Sept. 15, 1906, *M. H. Grant* (G). Connecticut: North Guilford, Sept. 30, 1906, *G. H. Bartlett* (G); Southington, Sept. 20, 1898, *Bissell* 830 (G). New York: Ithaca, Tompkins Co., Sept. 3, 1914, *Metcalf* 1405 (G); Staten Island, July 16, 1906, *Dowell* 4506 (G, US). New Jersey: Budd's Lake, Sussex Co., Aug. 12–14, 1890, *Small* (F). Pennsylvania: Wissahickon

Ravine, Philadelphia Co., July 19, 1924, *Lang* 626 (G); Reading, Berks Co., Sept. 11, 1929, *E. J. Palmer* 36311 (G). MARYLAND: between Oakland and Thayerville, Garrett Co., July 5, 1913, *Tidestrom* 6457 (G); Cumberland, 1894, *Shriver* (NY). DISTRICT OF COLUMBIA: Terra Cotta, June 17, 1888, *Holm* (G). WEST VIRGINIA: White Sulphur Springs, Greenbrier Co., May 14–17, 1914, *Hunnewell* (G); Whitmer, Randolph Co., Sept. 13, 1904, *A. H. Moore* 2221 (G). VIRGINIA: Bull Run Mts., Fauquier Co., June 9, 1935, *Allard* 598 (G, NY); Marion, Smyth Co., June, 1892, *Britton, Britton & Vail* (NY). NORTH CAROLINA: near Waynesville, Sept. 5, 1910, *Standley* 5529 (US). MICHIGAN: 4 miles northwest of Calumet, Houghton Co., July 24, 1936, *Hermann* 8264 (NY); Ludington, Mason Co., Sept. 17, 1910, *Chaney* 256 (F, G, US). OHIO: Berea, July, 1897, *Ashcroft* (Herb. Field Mus. nos. 140093, 140094); Hiram, Portage Co., Aug. 15, 1897, *Webb* 265 (G). INDIANA: Millers, Lake Co., July 7, 1908, *Lansing* 2759 (F, G); Lake Oliver, July 16, 1933, *Shoop* (Herb. Field Mus. nos. 907912, 907922). KENTUCKY: Burnt Bridge Ridge, Madison Co., July 7, 1937, *Smith, Hodgdon & Brown* 3625 (G); Pine Mt., Bell Co., Sept., 1893, *Kearney* (US). TENNESSEE: South of Craggie Hope, Cheatham Co., Aug. 20, 1922, *Svenson* 342 (G); Henderson, June, 1892, *Bain* (NY). MISSISSIPPI: Biloxi, June 3, 1898, *Tracy* 5171 (F, NY, US). WISCONSIN: Delavan, July 13, 1919, *Hollister* 146 (G, US); Solon Springs, Douglas Co., Sept. 7, 1930, *Somerville* 41 (G). ILLINOIS: Starved Rock, La Salle Co., Sept. 7, 8, 1914, *Lansing* 3786 (F); Joliet, Sept. 20, 1904, *Skeel* 549 (F); Pine Hills, Union Co., May 6, 1902, *Gleason* 2899 (G). MINNESOTA: St. Cloud, July, 1896, *Campbell* (F); Itasca Park, Clearwater Co., July 16, 1933, *Mayle* 654 (G, NY). IOWA: Fayette Co., July, 1894, *B. Fink* 444 (G, US); Lebanon, July 5, 1897, *Sample* 502 (G, US). MISSOURI: Monteer, Oct. 24, 1907, *Bush* 1146 (G, NY, US); Ironton, June 23, 1897, *Savage & Stull* 328 (F). ARKANSAS: Jasper, Newton Co., June 18, 1932, *D. M. Moore* 32503 (G). SOUTH DAKOTA: Custer, Black Hills, Aug. 19, 1892, *Rydberg* 1192 (NY, US); Pinecrest Camp, Deadwood, 1927, *Haywood* 1115 (F). WYOMING: Jackson's Hole, Lincoln Co., Aug. 11, 1920, *L. B. & E. B. Payson* 2275 (G); Laramie Peak, Albany Co., July 10, 1900, *Nelson* 7518 (G, NY). COLORADO: Rabbit Ear Range, Routt Co., July 18, 1903, *Goodding* 1595 (G, NY, US); Brush Creek, Sept. 9, 1910, *Tidestrom* 4166 (G).—MEXICO: Sierra Madre Mts., Monterey, Nuevo Leon, July 6, 1933, *C. H. & M. T. Mueller* 366, in part (G).

EUROPE.—NORWAY: Bygdö, June 28, 1907, *O. Anderson* (US). SWEDEN. (STOCKHOLM): near Stockholm, Sept. 18, 1887, *A. F. Carlson* (US). ÖSTERGÖTLAND: Aug. 8, 1915, *A. O. Olson* (Herb.

Field Mus. no. 821335); Ljushult, July 21, 1911, *A. O. Olson* (NY); Asunden, Aug. 17, 1915, *A. O. Olson* (NY). Kalmar (Småland): Kalmar, 1882, *Linddorff* (G).—Finland: Nyland, Aug. 20, 1908, *H. Lindberg* 409 (NY). Germany: near Berlin, July, 1844, *Gausauge* (G); Hanau, Sept., 1910, *Peipos* (Herb. Field Mus. no. 756316); Nürnberg, Bavaria, Aug. 15, 1910, *Honig* (G). Czechoslovakia: Moravia, Sept. 13, 1925, *J. Bily* 103 (G). Union of Soviet Socialist Republics: St. Petersburg, 1860 (Herb. Field Mus. nos. 29377, 162025).

Asia.—Siberia. Tomsk: near Titovka, Aug. 29, 1928, *Protopopova* (G). Kamtchatka: Savoiko, Aug. 29, 1928, *Eyerdam* (G, NY, US); Petropavlovsk, Aug. 6, 1928, *Eyerdam* (F, G, NY, US). Primorsk: Vladivostok, May–Oct., 1919, *Topping* 2343 (US). Amur: Blagowjeschtschensk, 1906, *Karo* (G, US).—Sachalin: 1872, *Augustinowicz* (G). Japan: *Maries* (U. S. Nat. Herb. no. 022422); June, 1896, *Halbrook* 40 (NY); Atago, Oct. 13, 1894, *Stanford* (Herb. Field Mus. no. 825006) (NY); Sakamoto, Aug. 8, 1929, *Dorsett & Morse* 897 (US); Kano San, Kadsusa, Sept., 1888 (U. S. Nat. Herb. no. 22432); Mt. Kano San, Kadsusa, Sept. 7, 1908 (U. S. Nat. Herb. no. 1095365); Yase near Kyoto, June, 1921, *Husimi* (U. S. Nat. Herb. no. 1704754); Nanokawa, Tosa, July 3, 1892 (U. S. Nat. Herb. no. 22439). Formosa: *Hancock* 56 (US). China. Manchuria: 1931, *Chen* 494 (NY). Chihli: Tungling Mts., May 18, 1921, *Cowdry* 1214 (US). Kiang Su: Poa Wha Mt., Chu-Yung, Oct. 10, 1915 (U. S. Nat. Herb. no. 1094030). Chekiang: Mo Kan Shan, June 28, 1926, *Cheo & Wilson* 12663 (G). Anhwei: Chiu Hua Shan, June 28, 1925, *Ching* 8478 (G, NY). Hupeh: 1885–88, *Henry* 3146 (G); Wuchang, June, 1932, *Chung* 9058 (F). Kiangsi: Lu Shan, Sept. 19, 1922, *Steward* 2724 (US). Kwangtung: Hong Kong, 1853–56, *Wright* (G, US). Hainan: Ka Chik Shan, April 25, 1933, *Lau* 1637 (G). Yunnan: Ping-pien Hsien, June 5, 1934, *Tsai* 60128 (G). Szechuan: Mt. Omei, Omei Hsien, 1928, *Fang* 3034 (G), 3231 and 3317 (G, US); Nanchuan Hsien, 1928, *Fang* 5841 (G).—French Indo-China: Nov., 1921 (U. S. Nat. Herb. no. 1505970).

7. Pteridium aquilinum var. pseudocaudatum (Clute) Heller, Cat. N. Am. Pl. Ed. 2, 12 (1900). Plate 650, fig. 7, plate 652, fig. 2, map 5. Illustration: Blomquist, Ferns of N. Car. 42 (1934).

Pteris caudata L. sensu Schk. Krypt. Gew. 88 (1809), in part, Pl. 96b, b. *Pteris novae-angliae* Bory ex Hook. Sp. Fil. **2:** 197 (1858), in synonymy. *Pteris aquilina* L. var. *pseudocaudata* Clute, Fern Bull. **8:** 39 (1900). *Pteridium aquilinum pseudocaudatum* (Clute) Clute, Fern Bull. **8:** 39 (1900), nomen provisorium. *Pteris pseudocaudata* (Clute) Anon. in Index, Proc. Biol. Soc. Wash. **14:** 200 (1901). *Pteris latiuscula pseudocaudata* (Clute) Clute, Fern Bull. **11:** 62 (1903), nomen provisorium. *Pteridium latiusculum pseudocaudatum* (Clute) Maxon, Am. F. Journ. **9:** 44 (1919). *Filix-foemina aquilina* (L.) Farwell var. *pseudocaudata* (Clute) Farwell, Am. Mid. Nat. **12:** 290 (1931). *Pteris latiuscula* Desv. var. *pseudocaudata* (Clute) E. P. St. John, Am. F. Journ. **25:** 40 (1935).

Growing tip of the rhizome usually *with a tuft of dark hairs;* frond 0.3–1.5 m., usually about 0.5–1 m. high, vernation equal; stipe longer or shorter than the blade; *blade* 2–7 dm., usually about 5 dm. long, usually *broadly triangular,* rarely broadly ovate or ovate, sometimes *ternate,* bipinnate-pinnatifid or tripinnate, rarely tripinnate-pinnatifid; *rachis glabrous;* pinnae and pinnules acute to obtuse; pinnules usually at an oblique angle to the costa, rarely at right angles; costules glabrous or less often slightly pubescent; penultimate segments pinnatifid or pinnate, rarely pinnate-pinnatifid; *longest entire segment* or entire part of a segment from six to fifteen, usually *about nine, times as long as broad;* ultimate segments usually straight, adnate or broadest at the base, the upper surface glabrous, the *margin* usually *glabrous,* rarely slightly pubescent, the *lower surface glabrous,* or sometimes pubescent along the midnerve; *fertile and sterile indusium glabrous,* the fertile 0.3–0.4 mm. wide, the sterile 0.1–0.2 mm. wide, the fertile portion broader than the sterile on the same segment.

Type: *Clute* 339, isotype in Herb. New York Botanical Garden (seen).

Type Locality: Babylon, Long Island, New York.

It is interesting to note that in 1899, one year before Clute described var. *pseudocaudatum,* Maxon identified *Ball* 511 as "*Pteris aquilina* L. var. nov." "not typical—approaching *P. caudata* Linn."

Var. *pseudocaudatum* intergrades to a considerable extent with var. *latiusculum.* Intermediate specimens have the leaf-cutting of var. *latiusculum* but are nearly glabrous or have the leaf-cutting approaching var. *pseudocaudatum* and are either glabrous or have a pubescent margin and midnerve. Such specimens are: Hammonton, New Jersey, May 30, 1919, *Killip* 2260 (US); Bladensburg, Maryland, July 31, 1919, *Maxon* 6461 (G); Table Rock, North Carolina, June, 1879 (Herb. Field Mus. no. 315115, U. S. Nat. Herb. no. 22450); near White Sulphur Springs, Greenbrier Co., West Virginia, Aug. 29, 1903, *Mackenzie*

381 (NY); Henderson, Tennessee, June, 1892, *Bain* 162 (G); Wasioto, Bell Co., Kentucky, Sept., 1893, *Kearney* (NY); Bowling Green, Kentucky, July, 1891, *Price* (NY). *Lansing* 513, West Pullman, Illinois, Sept. 18, 1898 (F) approaches var. *pseudocaudatum.* This strongly suggests that typical var. *pseudocaudatum* occurs at the southern tip of Lake Michigan, and it has been reported from the Dunes Region,[21] but I have not seen any specimens.

Var. *pseudocaudatum* may be separated from var. *latiusculum* by the glabrous or subglabrous rather than pubescent margin of the segments, the usually glabrous rather than pubescent midnerve and the long and narrow rather than relatively short and broad segments. Also the growing tip of the rhizome usually has a tuft of dark hairs.

Although not closely related, var. *africanum* approaches var. *pseudocaudatum* in some characters and the differences are discussed under the former variety.

Var. *pseudocaudatum* grows in open woods, pastures, thickets, in burnt-over areas and abandoned fields, usually in dry sterile soil but sometimes in fairly damp or rich places.

It is primarily of Coastal Plain distribution: Cape Cod, Massachusetts, and Long Island, New York, to Florida and Texas; also inland in North Carolina, Tennessee, West Virginia, Ohio, Indiana, Missouri, Arkansas and Oklahoma.

United States of America.—Massachusetts: Harwich, Barnstable Co., Sept. 2, 1918, *Fernald & Long* 15914 (Herb. New Eng. Bot. Club). New York: Babylon, Long Island, Sept. 8, 1898, *Clute* 339 (NY), isotype of *Pteris aquilina* var. *pseudocaudata* Clute. New Jersey: Hammonton, Aug. 19, 1879, *Kitchel* (G); Atsion, Burlington Co., Aug. 10, 1926, *Benner, Long & Bassett* (G). Delaware: Seaford, Aug., 1874, *Canby* (Herb. Field Mus. no. 149427); Laurel, Sussex Co., Aug. 19, 1880, *Commons* (G). Maryland: 3 miles southeast of Ridgely, Caroline Co., Sept. 24, 1938, *Wherry* (G). West Virginia: Rickett's Place, Cabell Co., Sept. 13, 1936, *F. A. Gilbert* 519 (F, NY). Virginia: Ocean View, Norfolk Co., Oct. 4, 1912, *Tidestrom* 6184 (G); Buckroe, May 18, 1912, *B. L. Robinson* 341 (G); Great Dismal Swamp, June 18, 1936, *Fulling* (NY). North Carolina: Tryon, Polk Co., May, 1918, *Millspaugh* 4083 (F); 4 miles east of Hamlet, Richmond Co., July 2, 1927, *Wiegand &*

[21] Peattie, Fl. Ind. Dunes, 29 (1930): "acc. to Clute".

Manning 21 (G); Goldsboro, Wayne Co., June 21, 1935, *Correll* 1382 (G). SOUTH CAROLINA: near Navy Yard, Charleston, May 4, 1912, *B. L. Robinson* 198 (G); Myrtle Beach, Horrey Co., June 12, 1936, *Correll* 5218 (G); Laurel Hill, July 6, 1936, *Tarbox* 735 (NY). GEORGIA: Sumter Co., July 24, 1901, *Harper* 1110 (F, G, NY, US); Near Darien, McIntosh Co., June 20, 1936, *Correll* 5456 (G). FLORIDA: Warrenton, May 23, 1903, *Tracy* 8633 (F, G, US); Eustis, Lake Co., May 1–15, 1894, *Nash* 638 (F, G, NY, US). KENTUCKY: Mammoth Cave Road, Edmonson Co., July 2, 1916, *King* 121 (F). TENNESSEE: Lookout Mt., *Eggleston* (NY). OHIO: Salem Township, Meigs Co., Oct. 10, 1931, *C. H. Jones* (Herb. Ohio U.). INDIANA: 1 mile east of Taswell, Crawford Co., Aug. 17, 1913, *Deam* 13976 (Deam Herb.); ½ mile south of Emison, Knox Co., Sept. 2, 1939, *Tryon* 4268 (G). ALABAMA: Mobile Co., June, 1905, *Dukes* (G); near Fairfax, Chambers Co., Aug. 17, 1936, *Correll* 6562 (G); Auburn, Lee Co., Oct. 14, 1897, *Earle & Baker* (NY). MISSISSIPPI: West of Kosciusko, Attala Co., May 17, 1933, *C. A. & U. F. Weatherby* 6300 (G, NY, US); French Camp, April 28, 1899, *I. M. Clute* 54 (F, NY). MISSOURI: Monteer, May 14, 1901, *Bush* 474 (G); Chadwick, Christian Co., Oct. 5, 6, 10, 1915, *Eggleston* 12187 (NY); Webb City, Jasper Co., Aug. 22, 1920, *E. J. Palmer* 18788 (NY). ARKANSAS: Nashville, Howard Co., Oct. 19, 1932, *Demaree* 9952 (G); West Otis, Sevier Co., July 26, 1937, *Brinkley* 256 (F); Wilmar, Drew Co., Oct. 12, 1936, *Demaree* 14008 (NY). LOUISIANA: Alexandria, May 31, 1899, *C. R. Ball* 511 (F, G, NY, US); Chapin, Natchitoches Parish, Oct. 5, 1915, *E. J. Palmer* 8845 (NY). OKLAHOMA: Page, LeFlore Co., Sept. 9, 1913, *Stevens* 2715 (G, US); Idabel, McCurtain Co., May 29, 1916, *Houghton* 3909 (G, NY). TEXAS: 10 miles south of Yellow Pine, Sabine Co., Oct. 3, 1934, *Cory* 10750 (G); Huntsville, June 3–12, 1908, *Dixon* 122 (F); Houston, Harris Co., May 18, 1917, *E. J. Palmer* 11942 (NY).

8. PTERIDIUM AQUILINUM var. AFRICANUM[22] Bonap. Notes Ptérid. **1:** 62 (1915). PLATE 650, FIG. 6, PLATE 652, FIG. 3, MAP 6.

Pteridium **centrali-africanum* Hieron. ex Fries, Wiss. Ergebn. Schwed. Rhodesia-Kongo Exp. **1**[1]**:** 7 (1914). *Pteridium aquilinum* (L.) Kuhn var. *caudatum* (L.) Sadebeck f. *africanum* (Bonap.) Bonap. Notes Ptérid. **14:** 321 (1923).

Growing tip of the rhizome with a tuft of dark hairs; frond 0.6–1 m. high, *vernation gleichenioid;* stipe shorter than the blade; blade 4–8 dm. long, *ovate to broadly ovate,* not ternate, tripinnate-pinnatifid, or more often quadripinnate; rachis glabrous or subglabrous; pinnae and pinnules acute to obtuse;

[22] Described under ssp. *caudatum.*

pinnules at an oblique angle to the costa; costules glabrous to slightly pubescent; penultimate segments pinnate; longest entire segment or entire part of a segment from five to eight times as long as broad; ultimate segments usually straight, at least some, often many, *narrowed at the base,* the upper surface glabrous, the *margin glabrous,* the *lower surface glabrous* or very slightly pubescent on the midnerve; *fertile and sterile indusium glabrous,* the fertile usually 0.3 mm. wide, the sterile 0.1–0.2 mm. wide, the fertile portion broader than the sterile on the same segment, or no broader.

Type: *Busse* 944, in Herb. Muséum d'Histoire Naturelle, Paris (not seen).

Type Locality: "Afrique Orientale allemande. Magaba-Thal."

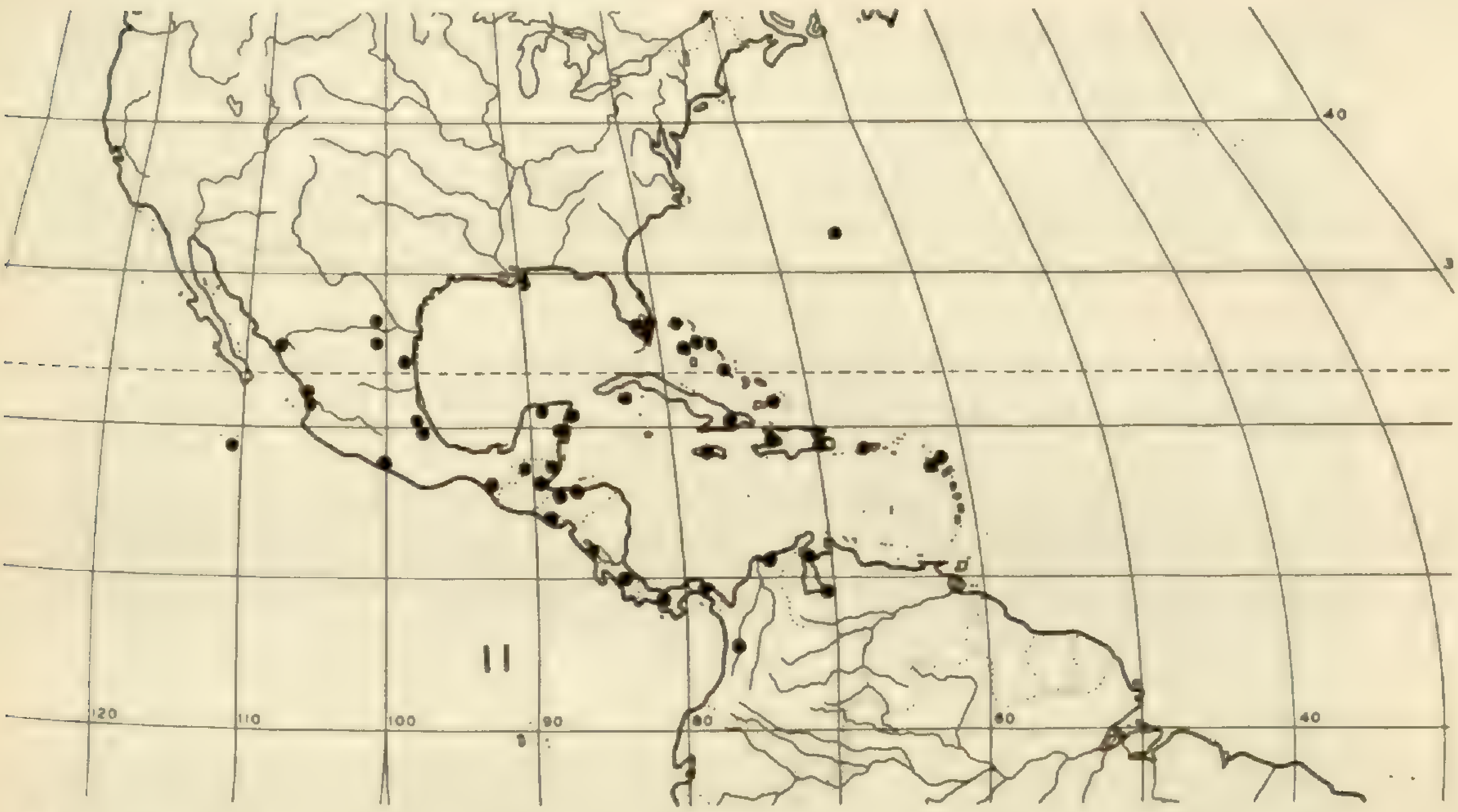
Var. *africanum* may be separated from var. *typicum* by its more finely cut, often quadripinnate, blade, its glabrous rather than pubescent rachis and its glabrous rather than ciliate fertile and sterile indusium. Also the pinnules are at an oblique angle to the costa rather than at right angles and the ultimate segments are usually narrowed at the base and glabrous or subglabrous rather than adnate or broadest at the base and densely pubescent beneath. It differs from var. *pseudocaudatum* in its gleichenioid rather than equal vernation, its ovate or broadly ovate rather than broadly triangular blade and in that the ultimate segments are usually narrowed rather than adnate or broadest at the base.

Var. *africanum* grows in dry moderately light woods, in virgin forest and in open grassland in tropical Africa, up to 1400 m.

Africa.—Belgian Congo: Stanley Pool, Sept., 1883, *H. H. Johnston* (U. S. Nat. Herb. no. 22427); Elizabethville, Dec. 30, 1919, *Shantz* 513 (US); Albertville, 1931, *Lugen* 89 (G). Portuguese West Africa: Near Cuanza River, Sept. 24, 1923, *A. G. Curtiss* 358 (G). Union of South Africa: Ndola, northern Rhodesia, *Stevensen* 400 (US). Tanganyika (German East Africa): N'Gano-N'Gano, Urundi, March 17, 1919, *Schantz* 757 (US).

Pteridium aquilinum ssp. caudatum (L.) Bonap. Notes Ptérid. 1: 62 (1915)

Growing tip of the rhizome with a tuft of dark hairs; rachis glabrous to slightly pubescent, rarely densely pubescent; costae glabrous to moderately pubescent; pinnules usually nearly at right angles to the costa, rarely at a somewhat oblique angle;



Ranges of Pteridium aquilinum var. caudatum (map 11); var. arachnoideum (map 12).

longest entire segment or entire part of a segment variable, from four to seventeen times as long as broad; *ultimate segments* usually linear to long-linear, sometimes ovate or oblong-ovate, mostly *decurrent or more strongly decurrent than surcurrent,* sometimes most, but not all, of the segments adnate, the upper surface glabrous to moderately pubescent, the *lower surface* usually *appressed-pubescent with straight hairs or arachnoid-pubescent,* rarely sublanuginose or glabrous, usually *having a farinaceous appearance* (plate 650, fig. 13), fertile indusium 0.3–0.5 mm. wide, the sterile 0.1–0.35 mm. wide. Map 1 (stars).

9. Pteridium aquilinum var. caudatum (L.) Sadebeck,[23] Jahrb. Hamb. Wiss. Anst. **14:** Beiheft 3, 5 (1897), as to indicated basinym *Pteris caudata* L., not as to plant. Plate 650, figs. 9, 12, plate 653, fig. 4, map 11. Illustrations: Plumier, Pl. Amer. t. 22 (1693); Jacquin, Ic. Pl. Rar. **3:** t. 645 (1786–1793); Britton, Fl. Bermuda, 419 (1918).

Pteris caudata L. Sp. Pl. Ed. 1, **2:** 1075 (1753). *Pteris aquilina* L. var. *caudata* (L.) Link, Hort. Berol. **2:** 33 (1833). *Allosorus caudatus* (L.) Pr. Tent. Pterid. 154 (1836). *Pteris aquilina* L. var. *mexicana* Fée, Mém. Fam. Foug. **8:** 114 (1857). *Pteris caudata* L. var. *mexicana* Fée, Mém. Fam. Foug. **9:** 8 (1857), nomen nudum. *Ornithopteris caudata* (L.) J. Sm. Hist. Fil. 298 (1875). *Cincinalis caudata* (L.) Trevis. Atti Soc. Ital. sc. nat. **17:** 239 (1875). *Pteridium caudatum* (L.) Maxon, Proc. U. S. Nat. Mus. **23:** 631 (1901). *Pteridium aquilinum* (L.) Kuhn var. *caudatum* (L.) Sadebeck f. *glabratum* Hieron. Hedwigia **48:** 246 (1909). *Pteridium aquilinum* (L.) Kuhn var. *caudatum* (L.) Sadebeck f. *pubescens* Hieron. Hedwigia **48:** 246 (1909). *Filix-foemina aquilina* (L.) Farwell var. *caudata* (L.) Farwell, Am. Mid. Nat. **12:** 290 (1931).

Frond 0.6–7 m., usually about 1.2–2.5 m. high, the taller fronds scandent, vernation not clearly observed, apparently gleichenioid; stipe usually about as long as the blade; blade 0.3–4 m., usually about 0.6–1 m. long, triangular to broadly ovate or long-triangular in large plants, tripinnate, or more usually tripinnate-pinnatifid or quadripinnate; costules of the penultimate segments usually glabrous, sometimes slightly pubescent above and beneath with long white hairs, rarely pubescent above with short white hairs, or beneath with dark or bicolorous hairs; *free lobes not present* along the rachis, costae and costules; ultimate segments usually linear or long-linear, sometimes oblong-ovate or ovate, the margin glabrous or infrequently slightly pubescent, the *lower surface* usually *densely appressed-pubescent with long straight hairs,* rarely arachnoid-pubescent, sometimes glabrous, *having a farinaceous appearance* except in the glabrous

[23] On many of my annotation labels the combination is accredited to Underwood (1900).

forms, the *midnerve usually glabrous*, rarely pubescent with dark or bicolorous hairs, *only rarely membranous wings present* along the veins and midnerve; fertile and sterile indusium usually glabrous, sometimes slightly or densely ciliate, the *fertile portion broader than the sterile* on the same segment; *cells of the sterile indusium large, in fairly definite rows* (PLATE 650, FIG. 12).

TYPE: Specimen in the Linnaean Herb. (not seen). Linnaeus had two specimens labelled *Pteris caudata* in his herbarium in 1753.[24] One is apparently var. *pseudocaudatum* and the other is clearly var. *caudatum*. The latter specimen is taken as the type. Since Linnaeus' description in the Species Plantarum was taken from his Hortus Cliffortianus, a specimen, if there is one, in the Clifford Herbarium might be considered to be the type. However, since there is a perfectly good specimen available in Linnaeus' own herbarium, it seems best to designate that as the type. Although one of Linnaeus' specimens is apparently var. *pseudocaudatum*, the application of his name is perfectly clear from the figures and localities cited by him.

TYPE LOCALITY: West Indies. Linnaeus, Sp. Pl.: "Jamaica, Dominica.", Hort. Cliff.: "Santo Domingo, Jamaica etc."[25]

The typical phase of var. *caudatum*, with the segments long and narrow and remote, occurs mainly in the West Indies, Florida and in the coastal regions of northern South America, Central America and Mexico. At the higher altitudes, mostly in Central America and Mexico, there is a phase with the segments relatively short and broad and approximate. The extremes of this phase (Lago San José, Porto Rico, July 15, 1912 (U. S. Nat. Herb. no. 566772); San Jose, Tamaulipas, Mexico, 600–1100 m., 1902, *Kemp* (NY); San Rafael de Norte, Nicaragua, March 25, 26, 1917, *Miller & Griscom* 157 (US); Costa Rica, 1800 m., Aug. 2, 1933, *Solis* 277 (F); Columbia, *Charetier* 33 (NY, US); El Salvador, 1200–1500 m., *Standley* 21537; Nicaragua, 850 m., *Maxon, Harvey & Valentine* 7421) are well marked, but there is a great deal of intergradation from one phase to the other. In fact, almost a third of the specimens I have examined are intermediate, and the ranges overlap considerably in individual

[24] Mr. C. A. Weatherby has kindly made his notes on the Linnaean Herbarium available to me.

[25] Linnaeus, Hortus Cliffortianus, 473 (1737).

cases. I do not believe that this variation can reasonably be given varietal status.

Occasional specimens, especially of the "compact" phase mentioned above, but also of the typical phase, have the segments only slightly decurrent but these can usually be placed in var. *caudatum* by the characteristic pubescence.

Anthony 400, Lower California, has the lower surface of the segments appressed-pubescent with short hairs as is often the case in var. *esculentum.*

Var. *caudatum* can be distinguished from var. *esculentum* by its lack of free lobes along the rachis, costae and costules; and the fertile indusium is broader than the sterile on the same segment rather than usually no broader. Also the glabrous phases of var. *caudatum* do not have a farinaceous appearance.

Var. *caudatum* is most closely related to var. *arachnoideum;* the differences are discussed under that variety.

It grows in clearings, rough pastures, on dry hillsides, in cut-over forest land, in fresh-water marshes, in pinelands, scrublands and in shady rocky places, mostly at the lower altitudes but up to 2000 m. in Central America and Mexico, and 3000 m. in Venezuela; and from 1000 m. to 1300 m. in the Revillagigedo Islands.

It occurs from Bermuda to Florida, West Indies, Mexico, Central America and northernmost South America.

United States of America.—Florida: Fort Myers, Lee Co., June 1, 1916, *J. P. Standley* 213 (F, G, NY, US); Cape Sable, July, *A. H. Curtiss* 3705* (F, G, NY, US).

Bermuda: Devonshire Marshes, Aug. 31–Sept. 20, 1905, *Brown & Britton* 159 (F, G, NY, US).

West Indies:—Bahama Islands: Near Nassau, Feb. 11, 1903, *A. H. Curtiss* 74 (F, G, NY, US); Orange Creek and vicinity, Cat Island, Feb. 27, 28, 1907, *Britton & Millspaugh* 5754 (F, NY). Cuba: Monte Verde, Jan.–July, 1859, *Wright* 872 (F, G, NY, US); Josephina, north of Jaguey, Yateras, Oriente, April 23, 1907, *Maxon* 4129 (G, NY, US). Jamaica: Mulgrove, north of Ipswich, St. Elizabeth, April 1, 1920, *Maxon & Killip* 1488 (F, G, NY, US). Hispaniola: Anse Galette, Gonave Island, Haiti, March 3–14, 1920, *Leonard* 3210 (F, G, US), 3208 (NY); Vicinity of Mission, Haiti, April 17–May 4, 1920, *Leonard* 3916 (US); San Lorenzo Bay, south coast of Samana Bay, Dominican Republic, April 5–11, 1921, *Abbott* 1275 (G, US); Province of

Barahona, Dominican Republic, July, 1911, *Fuertes* 1053 (F, G, NY, US). PORTO RICO: Santurce, Jan. 22, 1903, *A. A. Heller* 6446 (F, G, NY, US). MONTSERRAT: *Turner* (U. S. Nat. Herb. no. 428409). ANTIGUA: (US).

MEXICO.—Islands off the coast of Lower California and on the adjacent mainland, March–June, 1897, *Anthony* 400 (F, G, NY, US). NUEVO LEON: Sierra Madre, July 6, 1933, *C. H. & M. T. Mueller* 366, in part (G). TAMAULIPAS: La Vegonia, San Jose, July 5, 1930, *Bartlett* 10096 (US). SINALOA: Sierra de Chabarria, 1927, *Ortega* 4079 (US). NAYARIT (TERR. TEPIC): Jan. 5–Feb. 6, 1892, *E. Palmer* 1948 (G, US); Jalisco, Nov. 11, 1925, *Ferris* 5958 (G, US). VERA CRUZ: Mt. Orizaba, Aug. 21, 1891, *Seaton* 110 (F, G, NY); near Jalapa, May 12, 1900, *Pringle* 8342 (G, NY, US). COLIMA: Socorro Island, Revillagigedo Islands, May 8, 1925, *Mason* 1662 (G, US). GUERRERO: Montes de Oca, San Antonio-Buenos Aires, May 5, 1938, *Hinton* 14083 (G, US). OAXACA: Tolosita, June, 1937, *L. Williams* 9614 (F). CHIAPAS: Tacnalpan, July 28, 1890, *Rovirosa* 835 (G, NY). YUCATAN: Tuxpena, Campeche, March 23, 1932, *Lundell* 1431 (F). TERR. QUINTANA ROO: Cozumel Island, Feb. 20, 1899, *Millspaugh* 1551 (F, G).

CENTRAL AMERICA.—BRITISH HONDURAS: Big Creek, April 27, 1929, *Schipp* 190 (F, G, NY, US). GUATEMALA: Vaxactum, Dept. Peten, April 7, 1931, *Bartlett* 12521 (F, US); Vicinity of Puerto Barrios, Dept. de Izabal, June 2–6, 1922, *Standley* 25028 (US). EL SALVADOR: Volcan de San Vicente, Dept. San Vicente, March 7, 8, 1922, *Standley* 21537 (G, US). HONDURAS: San Pedro Sula, Dept. Santa Barbara, May, 1888, *Thieme* (J. D. Smith no. 5650) (G, NY, US); Ceiba, Oct. 18, 1916, *Dyer* A134 (F, G, US). NICARAGUA: Casa Colorado and vicinity, south of Managua, June 27, 1923, *Maxon, Harvey & Valentine* 7421 (G, US). COSTA RICA: 1881, *J. J. Cooper* (Herb. Field Mus. no. 347710, G, U. S. Nat. Herb. nos. 22440, 154190); San Jose, Prov. San Jose, 1887, *J. J. Cooper* (J. D. Smith no. 6018) (US). PANAMA: Pedro Miguel, Jan. 27, 1918, *Killip* 2825 (US); vicinity of El Boquete, Chiriqui, March 2–8, 1911, *Maxon* 4926 (US).

SOUTH AMERICA.—COLUMBIA: Santa Marta, near Onaca, Aug. 22, 1898–1901, *H. H. Smith* 1088 (F, G, NY, US); Vicinity of Medellin, 1911, *Charetier* 33 (NY, US). VENEZUELA: 2½ miles east of Merida, State of Merida, Jan. 23, 1931, *Reed* 210 (US).

10. PTERIDIUM AQUILINUM var. ARACHNOIDEUM (Kaulf.) Herter, Rev. Sudam. Bot. **5:** 21 (1937).[26] PLATE 650, FIGS. 10, 13, 14, PLATE 653, FIG. 3, MAP 12. Illustrations: Vellozo, Fl. Flum. **11:** t. 80 (1827); Christ, Geog. Farne, Fig. 9 (1910), *habitat.*

[26] Combination incorrectly attributed to Baker.

Pteris psittacina Pr. Delic. Prag. **1:** 185 (1822). Although I have not seen Presl's type, his description clearly refers his name to *Pteridium aquilinum* and the locality, Rio de Janeiro, to var. *arachnoideum.* Material recently referred to *Pteridium psittacinum* represents juvenile leaf-forms of var. *arachnoideum* and var. *caudatum.* The leaf-cutting of young plants of these varieties is considerably different from the mature condition and the typical types of pubescence are not developed. *Pteris campestris* Schrad. Gött. gel. Anz. **1824**[1]**:** 871 (1824). *Pteris arachnoidea* Kaulf. Enum. Fil. 190 (1824). *Allosorus psittacinus* (Pr.) Pr. Tent. Pterid. 153 (1836), as *A. psitaccinus. Allosorus arachnoideus* (Kaulf.) Pr. Tent. Pterid. 153 (1836). *Pteris aquilina* L. var. *arachnoidea* (Kaulf.) D. C. Eaton, Proc. Amer. Acad. n.s. **8:** 203 (1861). *Pteris Gardneri* Pr. ex Ettingsh. Denkschr. Ak. Wiss. Wien, **23:** 42 (1864). *Aquilina Gardneri* Pr. ex Ettingsh. Farnkr. 91 (1865), in synonymy. *Pteris aquilina* L. var. *psittacina* (Pr.) Baker in Martius, Fl. Brasil. **1**[2]**:** 404 (1870). *Cincinalis arachnoidea* (Kaulf.) Trevis. Atti Soc. Ital. sc. nat. **17:** 239 (1875). *Pteridium aquilinum* (L.) Kuhn var. *esculentum* (Forst.) Kuhn f. *arachnoideum* (Kaulf.) Hieron. Hedwigia **48:** 246 (1909). *Pteridium arachnoideum* (Kaulf.) Maxon, Journ. Wash. Acad. Sci. **14:** 89 (1924). *Filix-foemina aquilina* (L.) Farwell var. *arachnoidea* (Kaulf.) Farwell, Am. Mid. Nat. **12:** 290 (1931). *Pteridium psittacinum* (Pr.) Maxon, Proc. Biol. Soc. Wash. **46:** 141 (1933).

Frond 1–3 m. high, vernation not clearly observed, apparently gleichenioid; stipe usually shorter than the blade; blade 0.5–2 m. long, ovate-triangular to long-triangular in large plants, tripinnate to quadripinnate; costules of the penultimate segments usually pubescent beneath and less so above with short white and also dark or bicolorous hairs, sometimes glabrous; *free lobes present* along the rachis, costae and costules; ultimate segments ovate to linear, the margin often pubescent, the *lower surface arachnoid-pubescent,* rarely appressed-pubescent with short straight hairs, or glabrous, nearly always *having a farinaceous appearance,* the *midnerve* usually *pubescent with dark or bicolorous hairs, membranous wings* usually *present* along the veins and midnerve (plate 650, fig. 14); fertile and sterile indusium ciliate and sometimes also pubescent on the outer surface, or glabrous, the *fertile portion no broader than the sterile* on the same segment; *cells of the sterile indusium small, irregularly arranged* (cf. plate 650, fig. 11).

Type: *Chamisso,* probably at Berlin (not seen).

Type locality: Brazil.

Riedel, Brazil, "Ex. herb. hort. Petropolitani" (G) and *Curran* 128, Bahia, Brazil (G, US) differ from typical var. *arachnoideum* in having no free lobes along the rachis, costae and costules.

The following are intermediate between this and var. *caudatum*. *Hitchcock* 17031, Penal Settlement, British Guiana, Dec. 3–9, 1919 (G, US) has free lobes present and a farinaceous appearance, even though glabrous, as in var. *arachnoideum* but has the fertile indusium broader than the sterile as in var. *caudatum*; *Heller* 4468, 14 miles northeast of Mayaguez, Porto Rico, Feb. 1, 1900 (G, F, NY, US) and *Maxon* 4075, San Piedra, Oriente, Cuba, April 14, 1907 (G, US) are similar to var. *caudatum* in characters of pubescence and of the indusium but they have a few free lobes as in var. *arachnoideum*; *Rose & Painter* 7595, Jalisco, Mexico (US) is arachnoid-pubescent but has no free lobes; and *Pennell* 5162, La Cumbre, El Valle, Columbia (US) and *Ariste-Joseph* A207, Bogota, Columbia (US) are arachnoid-pubescent as in var. *arachnoideum* but have the fertile indusium broader than the sterile and have no free lobes as in var. *caudatum*.

Var. *arachnoideum* differs from var. *caudatum* in having free lobes along the rachis, costae and costules rather than not having them; the midnerve is usually pubescent with dark hairs rather than usually glabrous and the fertile portion of the indusium is no broader than the sterile on the same segment rather than broader. Also the lower surface is arachnoid-pubescent rather than appressed-pubescent with straight hairs, the cells of the indusium are smaller and irregularly arranged and membranous wings are usually present on the veins and midnerve beneath rather than usually not present. Even the glabrous phases have a farinaceous appearance beneath.

The differences between var. *arachnoideum* and var. *esculentum*, with which it has often been confused in the past, are discussed under the latter variety.

Var. *arachnoideum* grows on open slopes, in open rocky places, in thickets, forests, grassland, in cleared land and on the edge of forests from the lower elevations up to 3000 m.; and from 300 m. to 700 m. in the Galapagos Islands.

It ranges from the West Indies, Cuba to Trinidad, to southern Mexico, Central America, Galapagos Islands and throughout

South America except the southern portion; also it is apparently absent from most of the Amazon Basin.

West Indies:—Cuba: Monte Verde, Jan.–July, 1859, *Wright* 985 (G); Loma del Gato and vicinity, Sierra Maestra, Aug., 1923, *Hioram & Clement* 6497 (US); Santiago, Santa Ana, March 23, 1902, *Hamilton* 240 (NY). Jamaica: Vicinity of St. Helens Gap, St. Andrew, March 4, 1920, *Maxon & Killip* 619 (F, G, NY, US). Hispaniola: vicinity of Furcy, Haiti, May 26–June 15, 1920, *Leonard* 4339 (G, US); Prov. Monte Cristi, Santo Domingo, June 24, 1929, *Ekman* 12990 (NY, US). Porto Rico: Aug. 28, 1885, *Sintenis* 2658 (G, US). Santa Lucia: Ventine Sulphur Springs (Soufrière), May, 1935, *Box* 449 (US). Trinidad: St. Ann, March 17, 1920, *Britton, Hazen & Mendelson* 676 (G, NY); 1877–8, *Fendler* 77 (G, NY, US).

Mexico.—Mexico: Nanchititla, Temascaltepec, Feb. 14, 1935, *Hinton* 7371 (G, NY). Vera Cruz: Zacuapan, Dec., 1912, *Purpus* 6191 (F, G, NY, US). Guerrero: Montes de Oca, San Antonio-Buenos Aires, May 3, 1938, *Hinton* 14069 (G, US). Oaxaca: Cuicatlan, June 16–22, 1898, *Conzatti & Gonzalez* 748 (G).

Central America.—Guatemala: Volcan de Fuego, *Salvin* (G); Yzabal, Dept. Yzabal, *J. D. Smith* 1565 (G, US). El Salvador: Cerro del Guayabal, Jan., 1924, *Calderon* 2008 (G, US). Honduras: about 15 miles east of Ceiba, Dept. Atlantida, July 21, 1938, *Yuncker, Koepper & Wagner* 8555 (NY). Nicaragua: San Rafael de Norte, March 25, 26, 1917, *Miller & Griscom* 152 (US). Costa Rica: from Vara Blanca to La Concordia, July 23, 1923, *Maxon & Harvey* 8400 (US); 1901–1905, *Werckle* (U. S. Nat. Herb. no. 575231); San Ramon, April, 1913 (Herb. Field Mus. no. 404457). Panama: Vicinity of Monte Lirio, Prov. Chiriqui, June 27–July 13, 1935, *Seibert* 234, in part (G).

South America.—Columbia: Palmira, Dept. El Valle, May 27, 1922, *Pennell & Killip* 6100 (G, NY, US); Santa Marta, Aug. 26, 1898–99, *H. H. Smith* 1091 (NY). Venezuela: Maracai, *Vogl* (G); Island of Margarita, Aug. 28, 1903, *J. R. Johnston* 177 (G); Tovar, 1854–5, *Fendler* 104 (G); 1917, *Curran & Haman* 1111 (G, NY). British Guiana: Malali, Demerara River, Oct. 30–Nov. 5, 1922, *de la Cruz* 2658 (F, G, NY, US); Mt. Iramaikpang, northwest part of Kanuku Mts., April 22, 1938, *A. C. Smith* 3657 (G). French Guiana: Near Cayenne, Oct. 8, 1830, *Leprieur* 100 (F, G, US). Ecuador: Western San Miguel Mts., Oct. 21, 1933, *Schimpff* 247 (F); Andes, 1857–9, *Spruce* 5601 (G, NY); Wreck Bay, Chatham Island, Galapagos Islands, July 6, 1905–6, *A. Stewart* 996 (F, G, NY, US). Peru:

Estrella, Dept. Ayacucho, May 8, 14, 1929 *Killip & Smith* 23095 (NY, US); Cero de Cusilluyoc, Dept. Cusco, May 3–6, 1925, *Pennell* 13936 (G, NY, US); Tarapoto, Dept. San Martin, Dec., 1929, *L. Williams* 5971 (F). BRAZIL: Pará, Nov., 1913, *Petelot* (Herb. Field Mus. no. 593026); Near Petropolis, July 10–16, 1882, *J. Ball* (G); Mt. Itatiaya, vicinity of Monte Serrat, State of Rio de Janeiro, Dec. 31, 1928, *L. B. Smith* 1587 (F, G, NY, US); São Leopoldo, Rio Grande do Sul, *Rick* 24 (G). BOLIVIA: Incachaca, Dept. Cochabamba, Prov. Chapare, Jan. 24, 1929, *Steinbach* 8927 (F, G); Lacotal, Dept. Cochabamba, Prov. Chapare, Feb. 25, 1929, *Steinbach* 9363 (F, G, NY); Tipuani, April, 1920, *Buchtien* 5271 (F, US). PARAGUAY: Y-acá River, Cordillera Centralis, 1900, *Hassler* 6997 (G); Paraná River, 1909–10, *Fiebrig* 6138 (G). URUGUAY: Catalan, Dept. Artigas, Nov., 1927, *Herter* 996 (NY); Pan de Azucar, Dept. Maldonado, Jan. 21, 1912, *Osten* 5688 (US). ARGENTINA: Fontana, Resistencia, Chaco, Feb., 1933, *Schulz* 727 (G); Dept. Punilla, Prov. Cordoba, March 16, 1939, *Dawson* 588 (G); Prov. de Catamarca, Nov. 11, 1910 (U. S. Nat. Herb. no. 1113401).

11. PTERIDIUM AQUILINUM var. ESCULENTUM (Forst.) Kuhn, Chaetopt. 347 (1882). PLATE 650, FIGS. 11, 15, PLATE 653, FIG. 1, MAP 9. Illustrations: Domin, Bibl. Bot. **85¹:** figs. 33, 34 (1914); Schk. Krypt. Gew. t. 97 (1809); Dobbie, New Zealand Ferns, Ed. 3, 183 (1930).

Pteris esculenta Forst. Pl. Escul. 74 (1786). *Allosorus esculentus* (Forst.) Pr. Tent. Pterid. 154 (1836). *Pteris auriculata* Goldm. in Meyen, Nova Acta **19:** supp. 1, 458 (1843). *Pteris aquilina* L. var. *esculenta* (Forst.) Hook. fil. Fl. N. Zel. **2:** 25 (1854). *Cincinalis esculenta* (Forst.) Trevis. Atti Soc. Ital. sc. nat. **17:** 239 (1875). *Ornithopteris esculenta* (Forst.) J. Sm. Hist. Fil. 298 (1875). *Pteridium esculentum* (Forst.) Diels in Engl. & Prantl, Nat. Pfl. **1⁴:** 296 (1899). *Pteris aquilina* L. f. *esculenta* Christ in Warb. Monsunia **1:** 68 (1900), without bibliography or reference. *Pteris aquilina* L. f. *caudata* Christ in Warb. Monsunia **1:** 68 (1900), without bibliography or reference. *Pteridium aquilinum* (L.) Kuhn var. *aequipinnulum* Domin, Bibl. Bot. **85¹:** 162 (1914). *Pteridium aquilinum* (L.) Kuhn var. *pseudocaudatum* Domin, Bibl. Bot. **85¹:** 161 (1914), not (Clute) Heller. *Pteridium aquilinum* (L.) Kuhn ssp. *esculentum* (Forst.) Bonap. Notes Ptérid. **4:** 116 (1917).

Frond 0.6–3 m. high, vernation subgleichenioid; stipe about as long as the blade; blade 0.3–1.5 m. long, ovate to triangular, tripinnate to quadripinnate; costules of the penultimate segments glabrous above, glabrous to slightly pubescent beneath with white and often also dark hairs; *free lobes* usually *present* along the rachis, costae and costules; ultimate segments oblong or usually linear, the margin glabrous, the *lower surface* densely *appressed-pubescent with long, or short, straight hairs, always having a farinaceous appearance,* the *midnerve* usually *glabrous,* sometimes moderately pubescent with white and sometimes also dark hairs, *no membranous wings present* on the veins and midnerve; *fertile and sterile indusium* usually *glabrous,* rarely slightly ciliate, *the fertile portion* usually *no broader than the sterile* on the same segment; *cells of the sterile indusium small, irregularly arranged* (PLATE 650, FIG. 11).

TYPE: *Forster,* location unknown. A fragment of the type "ex Forster Herb." "collected" by L. M. Underwood is at Herb. New York Botanical Garden (seen).

TYPE LOCALITY: Society Islands. Copeland[27] says that: "The sole Tahitian record is that of Forster . . . its absence from all later collections suggests that it does not beseem a wild plant to be edible."

Var. *esculentum* differs from var. *arachnoideum* in its pubescence,—appressed with straight hairs rather than arachnoid,—the absence rather than presence of membranous wings along the veins and midnerve and the midnerve usually glabrous or with white hairs rather than pubescent with dark or bicolorous hairs.

De la Cruz 2658, British Guiana and *Gleason* 423, Tumatumari, British Guiana, June 18–July 8, 1921 (G), var. *arachnoideum,* approach var. *esculentum* in being appressed-pubescent with short hairs.

The differences between var. *esculentum* and vars. *caudatum* and *yarrabense* are discussed under those varieties.

Var. *esculentum* grows in open places, pastures, thickets and clearings, from sea-level up to 1300 m.

It ranges from Australia to the Society Islands.

AUSTRALIA: Sassafras, Victoria, July 3, 1936, *Lothian* (G); Hall's Gap, Grampian Mts., Victoria, Dec., 1912, *Tilden* 848 (F, G); Port Lonsdale, Victoria, Oct.–Nov., 1912, *Tilden* 762 (F, G); Bondi Bay, Sidney, New South Wales, Sept., 1912, *Tilden* 570 (F, G); near Mareton Bay, 1850–51, *Strange* (G); east coast (Nouvelle Hollande), 1845, *Verreaux* 267 (G, US). TASMANIA: *Gunn* (G). NORFOLK ISLAND: 1884, *Metcalfe* (U. S. Nat. Herb. no. 22443). NEW ZEALAND: Whakarewarewa, Nov., 1909, *Leland, Chase & Tilden* 143 (F, G); South Island (Herb. Field Mus. no. 355839); *Craig* (Herb. Field Mus. no.

[27] Copeland, Pteridophytes of the Society Islands. Bishop Mus. Bull. 93, 57 (1932).

596860, G); Taranaki, *Heywood* 56 (G); Mt. Ngongotaka, May–July, 1898, *Prince* (G); North Island (Ex. Herb. T. Kirk) (G). CHATHAM ISLAND: Oct., 1874, *Kershner* (US); Dec., 1874, *Scott* (US). NEW CALEDONIA: (Herb. Field Mus. no. 596487); 1861–67, *Deplanche* 1563 (G); 1874–76, *Germain* (NY). NEW HEBRIDES: Aneiteum, Feb., 1859 (Herb. Field Mus. no. 596565). FIJI ISLANDS: 1860, *Seemann* 809 (G); 1877–78, *Horne* 601 (G); (Herb. Field Mus. no. 593802). NAVIGATOR ISLANDS (SAMOA): 1873, *McAlesber* (NY). SOCIETY ISLANDS: "Ex. Forster Herb." (NY), fragment of type.

12. PTERIDIUM AQUILINUM var. YARRABENSE Domin, Bibl. Bot. **85**[1]: 161 (1914). PLATE 650, FIG. 16, PLATE 653, FIG. 2, MAP 10. Illustration: Domin, Op. cit. fig. 32.

Pteris lorigera Wall. List no. 103 (1829), nomen nudum; isotype at US. *Pteris semihastata* Wall. List. no. 102 (1829), nomen nudum; ex Ag. Rec. Pterid. 48 (1839). *Allosorus lorigerus* (Wall.) Pr. Tent. Pterid. 154 (1836), nomen nudum.

Frond 0.5–3 m. high, vernation not observed; stipe about as long as the blade; blade 0.3–1.5 m. long, ovate to triangular, tripinnate to quadripinnate; costules of the penultimate segments subglabrous above, moderately pubescent beneath with white and rarely also dark hairs; *free lobes* usually *not present* along the rachis, costae and costules; ultimate segments usually linear, sometimes oblong-ovate, the margin glabrous or rarely pubescent, the *lower surface* usually densely *sublanuginose* or rarely arachnoid-pubescent, *not having a farinaceous appearance,* the *midnerve* usually densely *pubescent with white* and infrequently also dark *hairs, no membranous wings present* on the veins and midnerve; the *fertile and sterile indusium* rather densely *ciliate and* usually also *pubescent* on the outer surface, the *fertile portion broader than the sterile* on the same segment, *or no* broader; cells of the sterile indusium small, irregularly arranged.

TYPE: 1910, *Domin,* probably at Praha (not seen).

TYPE LOCALITY: "Nordost-Queensland bei Yarraba."

Var. *yarrabense* differs from var. *esculentum* in having the lower surface of the blade sublanuginose rather than appressed-pubescent with straight hairs, the midnerve on the lower surface of the segments pubescent with white hairs rather than usually glabrous and the fertile and sterile indusium ciliate and pubescent rather than glabrous. Also it does not have a farinaceous appearance beneath and usually does not have free lobes along the rachis, costae and costules.

Strange, Australia, and *Seemann* 809, Fiji Islands, var. *esculentum,* approach var. *yarrabense* in having the fertile and sterile indusium ciliate and the midnerve of the segments slightly pubescent beneath with white hairs.

Ching 5360, Kwangsi Prov., China (NY, US) is intermediate between var. *yarrabense* and var. *Wightianum* and therefore represents an intermediate between ssp. *caudatum* and ssp. *typicum.*

Var. *yarrabense* grows in clearings, thickets, open slopes and at the edge of woods, up to 2500 m. from northern India to Sumatra, east to the Philippine Islands and northeastern Australia.

India: Kumaon, *Blinkworth, Wallich,* 103 (US), isotype of *Pteris lorigera* Wall. French Indo-China: Cochinchine, 1862–66, *Thorel* (Herb. Field Mus. no. 540736); Bokor, Cambodia, Jan. 18, 1926, *H. M. Smith* 288 (G, US). Siam: Koh Chang, April 2, 1924, *H. M. Smith* 197 (US). Federated Malay States: Penang, Dec., 1902 (U. S. Nat. Herb. no. 1097164); Penang (ex Herb. Oldfield) (NY); Larut, Perak, April, 1884, *King's collector* 5926 (US); Tekik Sisih, Pahang, Aug. 19, 1929, *Henderson* (US); Singapore (U. S. Nat. Herb. nos. 22437, 1097181). Anamba Islands: Jemaja, Nov. 4, 1928, *Henderson* 20306 (US). Sumatra: Vicinity of Rantau, Parapot, Bila, March 28–May 10, 1932, *Toroes* 1832 (NY). Philippine Islands: Mindanao, *Clemens* 166 (F); Bucas Island, Oct. 4, 1906, *Merrill* 5264 (US); *Cuming* (U. S. Nat. Herb. no. 853691); *Cuming,* "without a number" (G, NY). British North Borneo: Mt. Kinabalu, Kundasang, April 7, 1932, *J. & M. S. Clemens* 29107 (NY, US); Kuching, Sarawak, *Mjoberg* (NY); Sandakan and vicinity, Sept.–Dec., 1920, *Ramos* 1697 (G, US). Australia: Daintree River, North Queensland, Feb. 29, 1932, *Brass* 2199 (G).

Dubious and Rejected Names

Pteris aquilina L. var. *mexicana* Fée, Mém. Fam. Foug. **9:** 8 (1857), nomen nudum.—Fée in Mém. Fam. Foug. **8:** 114 (1857) described *Pteris aquilina* L. var. *mexicana,* which is clearly *Pteridium aquilinum* var. *caudatum.* In Mém. Fam. Foug. **9:** 8 (1857) he lists *Pteris caudata* L. var. *mexicana,* without reference, but it undoubtedly represents a transfer of his earlier var. *mexicana.* However, he also lists *Pteris aquilina* L. var. *mexicana* which, while it apparently is not the same as his var. *mexicana,* Mém. Fam. Foug. **8:** 114 (1857), cannot be definitely placed without an examination of the collections cited by him: "Orizaba, W. Schaffner (1834) No 136 et (1856) No 468."

Pteris aquilina L. var. *lanuginosa* Fée, Mém. Fam. Foug. **9:** 8 (1857), nomen nudum.—Although probably a synonym of *Pteridium aquilinum* var. *Feei,* this name cannot certainly be placed without an examination of the collection cited by Fée: "W. Schaffner, No 137 Orizaba (1854)."

Pteridium aquilinum longifolium, Am. F. Journ. **1:** 88 (1910).—The publication of this name was an error. It was a new combination based on *"Pteris aquilina longifolium* Hook.", a name taken from sheet number 583 in the Herbarium of the American Fern Society. Dr. L. S. Hopkins informs me that the sheet is actually labeled *Pteris aquilina lanuginosa* Hook. and that *lanuginosa* was misread *longifolium.*

Pteris aquilina L. var. *decipiens* Lawson, Edinb. New Phil. Journ. n. s. **19:** 110 (1864). *Pteridium aquilinum* (L.) Kuhn var. *lanuginosum* (Bong.) Fernald f. *decipiens* (Lawson) Fernald, Rhodora **37:** 248 (1935).—Lawson's name cannot be definitely placed without an examination of the type, which is apparently lost. Lawson says he sent a specimen to D. C. Eaton, but an examination of Eaton's Herbarium at Yale University failed to reveal such a specimen. The name has been placed under var. *pubescens* and if this is correct would take precedence over it as an earlier varietal name. However, there is considerable doubt that the plant in question is var. *pubescens* and I am rejecting the name.

Although the plant was collected in the Gaspé, a likely place for var. *pubescens* to occur as a preglacial relic, and described as lanuginose, authentic material has never been collected in Gaspé Co., Quebec and the remainder of the description: "frond bipinnate, thin and membranous, . . . barren." indicates that the specimen was taken from a young plant. "Lanuginose" may apply to some part of the frond other than the lower surface between the margin and the midnerve. In a footnote Lawson himself says that: "Since the above was written, I have had an opportunity of studying the forms and development of *Pteris aquilina* [this would be var. *latiusculum*] and am quite satisfied that the doubtful plant [var. *decipiens*] is a state of that species, not old enough to be mature."

Pteris aquilina L. var. *glabra* Hook. Sp. Fil. **2:** 196 (1858). *Pteridium aquilinum* (L.) Kuhn var. *glabrum* (Hook.) Luerss. Rabenh. Kr. Fl. Ed. 2, **3:** 107 (1889).—This name includes such a mixture that it cannot be definitely placed in any one variety. Hooker placed the following names under it in synoyiny: *Pteris aquilina* L. (= var. *typicum*), *Pteris caudata* Schkuhr (= var. *latiusculum* and var. *pseudocaudatum*), *Pteris recurvata* Wall., *Pteris firma* Wall. and *Pteris excelsa* Bl. (= var. *Wightianum*) and *Pteris latiuscula* Desv. (= var. *latiusculum*). His range-citations include the following localities: Europe, Cape of Good Hope (= var. *typicum*), Java (= var. *Wightianum*), Massachusetts (= var. *latiusculum*), New Orleans (= var. *pseudocaudatum*) and Brazil (= var. *arachnoideum*).

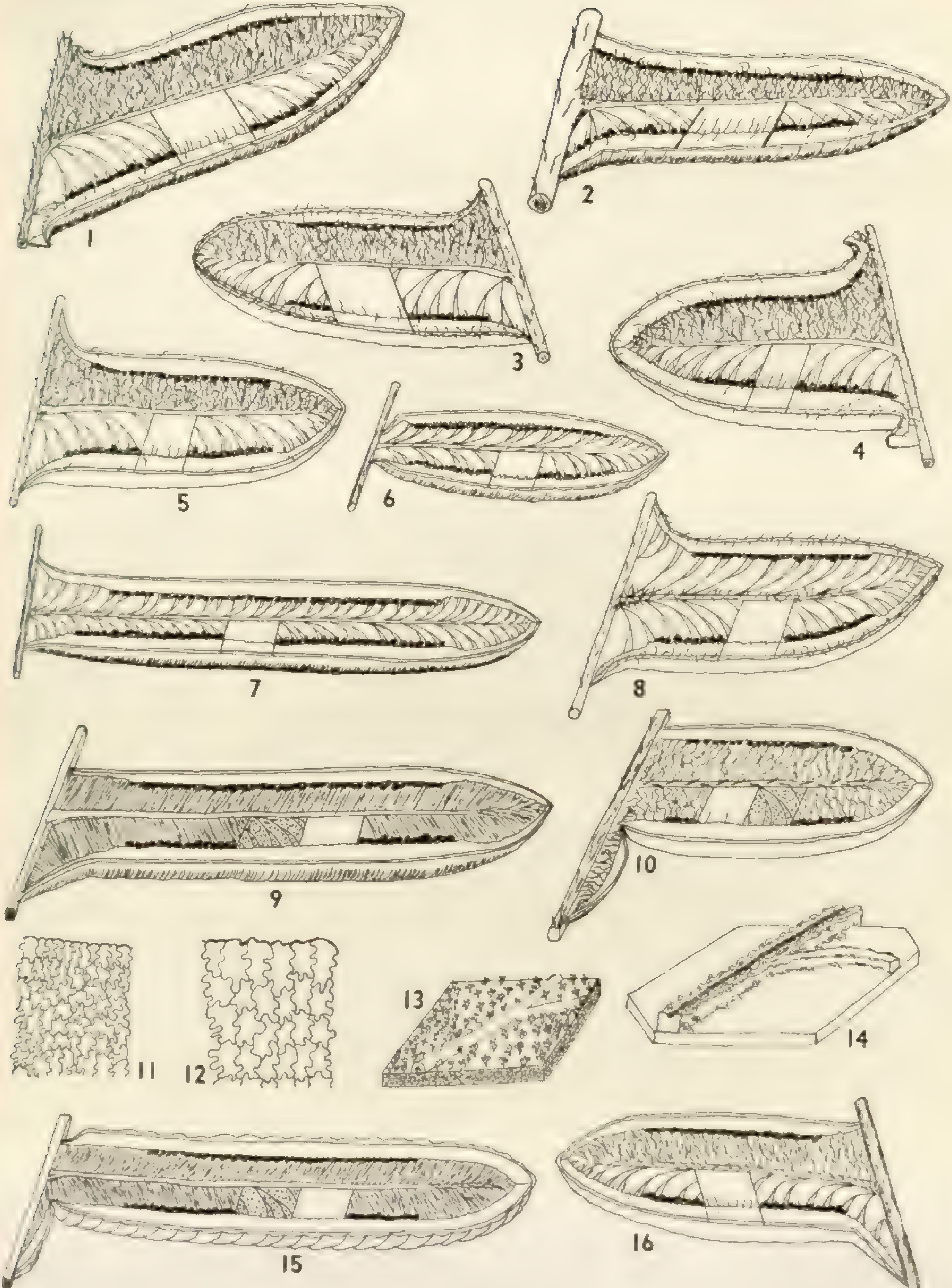
EXPLANATION OF PLATES

Plate 650. Fig. 1, Segment of var. *Wightianum*, × 4, pubescence on one half not shown, on part of this half the sporangia and venation are not shown; Fig. 2, Segment of var. *typicum*, × 4, pubescence on one half not shown, on part of this half the sporangia and venation are not shown; Fig. 3, Segment of var. *pubescens*, × 4, pubescence on one half not shown, on part of this half the sporangia and venation and marginal pubescence are not shown; Fig. 4, Segment of var. *Feei*, × 4, pubescence on one half not shown, on part of this half the sporangia and venation and marginal pubescence are not shown; Fig. 5, Segment of var. *decompositum*, × 4, pubescence on one half not shown, on this half the sporangia and venation are not shown; Fig. 6, Segment of var. *africanum*, × 4, no pubescence removed, on part of the segment the sporangia and venation are not shown; Fig. 7, Segment of var. *pseudocaudatum*, × 4, no pubescence removed, on part of the segment the sporangia and venation are not shown; Fig. 8, Segment of var. *latiusculum*, × 4, no pubescence removed, except on part of the segment the marginal pubescence, sporangia and venation are not shown; Fig. 9, Segment of var. *caudatum*, × 4, on part of the segment the pubescence and sporangia are not shown and on another part the venation and farinaceous appearance are also not shown; Fig. 10, Segment of var. *arachnoideum*, × 4, on part of the segment the sporangia and pubescence are not shown and on another part the venation and farinaceous appearance are not shown; Fig. 11, Sterile indusium of var. *esculentum*, about × 75; Fig. 12, Sterile indusium of var. *caudatum*, about × 75; Fig. 13, Farinaceous appearance of var. *arachnoideum*, about × 50, pubescence not shown; Fig. 14, Membranous wings along vein of var. *arachnoideum*, about × 40, pubescence and farinaceous appearance not shown; Fig. 15, Segment of var. *esculentum*, × 4, on part of the segment the pubescence and sporangia are not shown and on another part the venation and farinaceous appearance are not shown; Fig. 16, Segment of var. *yarrabense*, × 4, on one half the pubescence is not shown, and on part of it the sporangia and venation are not shown.

Plate 651. Fig. 1, Middle pinna of var. *Feei*, × ½; Fig. 2, Upper pinna of var. *decompositum*, × ½; Fig. 3, Tip of middle pinna of var. *Wightianum*, × ⅓; Fig. 4, Upper half of middle pinna of var. *typicum*, × ½.

PLATE 652. Fig. 1, Basal pinna of var. *latiusculum*, × ⅓; Fig. 2, Basal pinna of var. *pseudocaudatum*, × ½; Fig. 3, Next to basal pinnule of a basal pinna of var. *africanum*, × ½; Fig. 4, Frond of variant of var. *latiusculum*, × 1/6; Fig. 5, Next to basal pinna of var. *pubescens*, × ⅓.

PLATE 653. Fig. 1, Upper half of middle pinna of var. *esculentum*, × ½; Fig. 2, Basal pinna of small plant of var. *yarrabense*, × ½; Fig. 3, Upper pinna of var. *arachnoideum*, × ⅓; Fig. 4, Tip of frond of var. *caudatum*, × ½.



Segments and their characters in PTERIDIUM.

FIG. 1, middle pinna of PTERIDIUM AQUILINUM, var. FEEI, × ½; FIG. 2, upper pinna of var. DECOMPOSITUM, × ½; FIG. 3, tip of middle pinna of var. WIGHTIANUM, × ⅓; FIG. 4, upper half of middle pinna of var. TYPICUM, × ½.

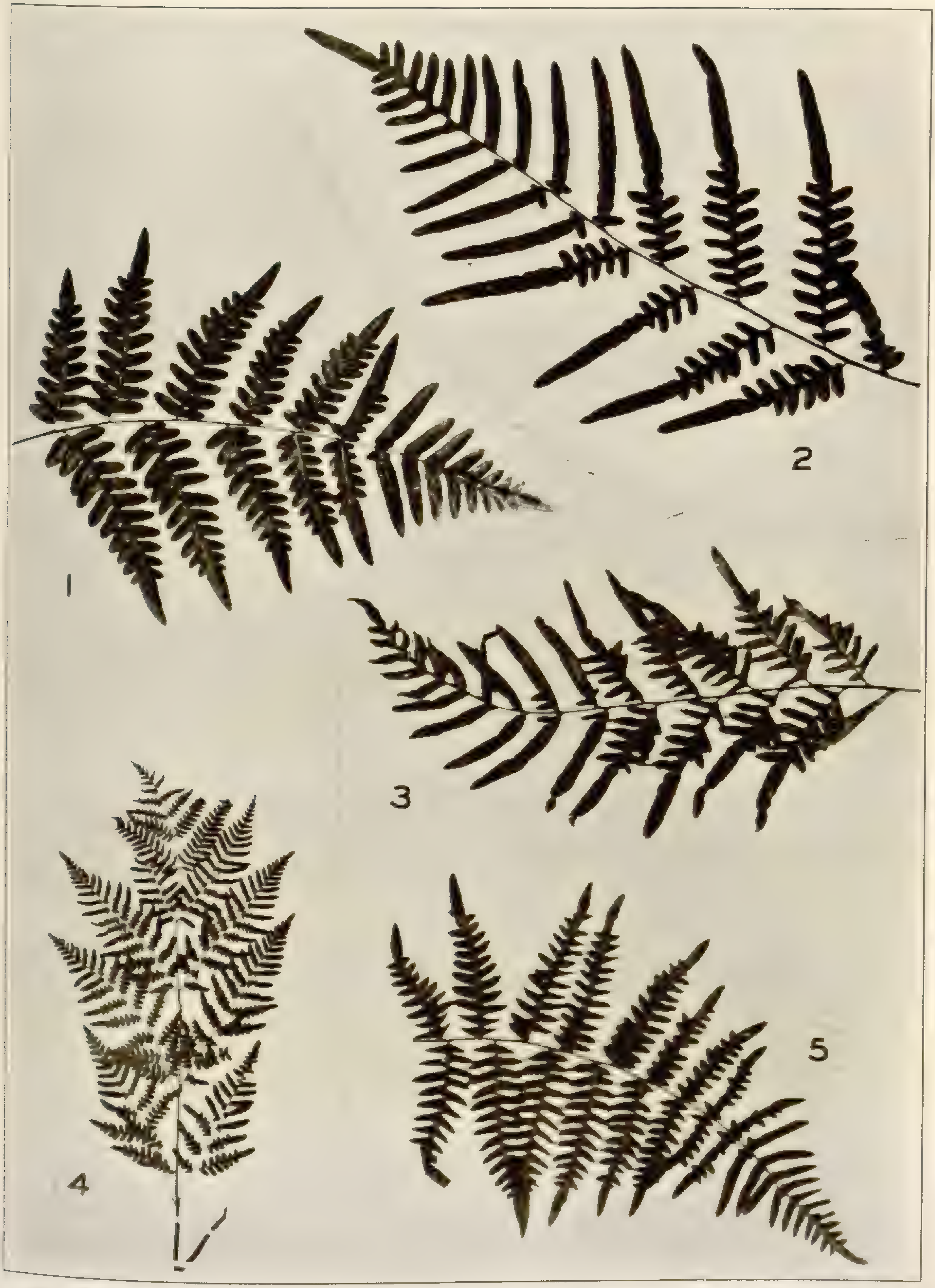


FIG. 1. basal pinna of PTERIDIUM AQUILINUM, var. LATIUSCULUM. × 1/3; FIG. 2. basal pinna of var. PSEUDOCAUDATUM. × 1/2; FIG. 3. next to basal pinnule of a basal pinna of var. AFRICANUM, × 1/2; FIG. 4, frond of variant of var. LATIUSCULUM. × 1/6; FIG. 5. next to basal pinna of var. PUBESCENS, × 1/3.

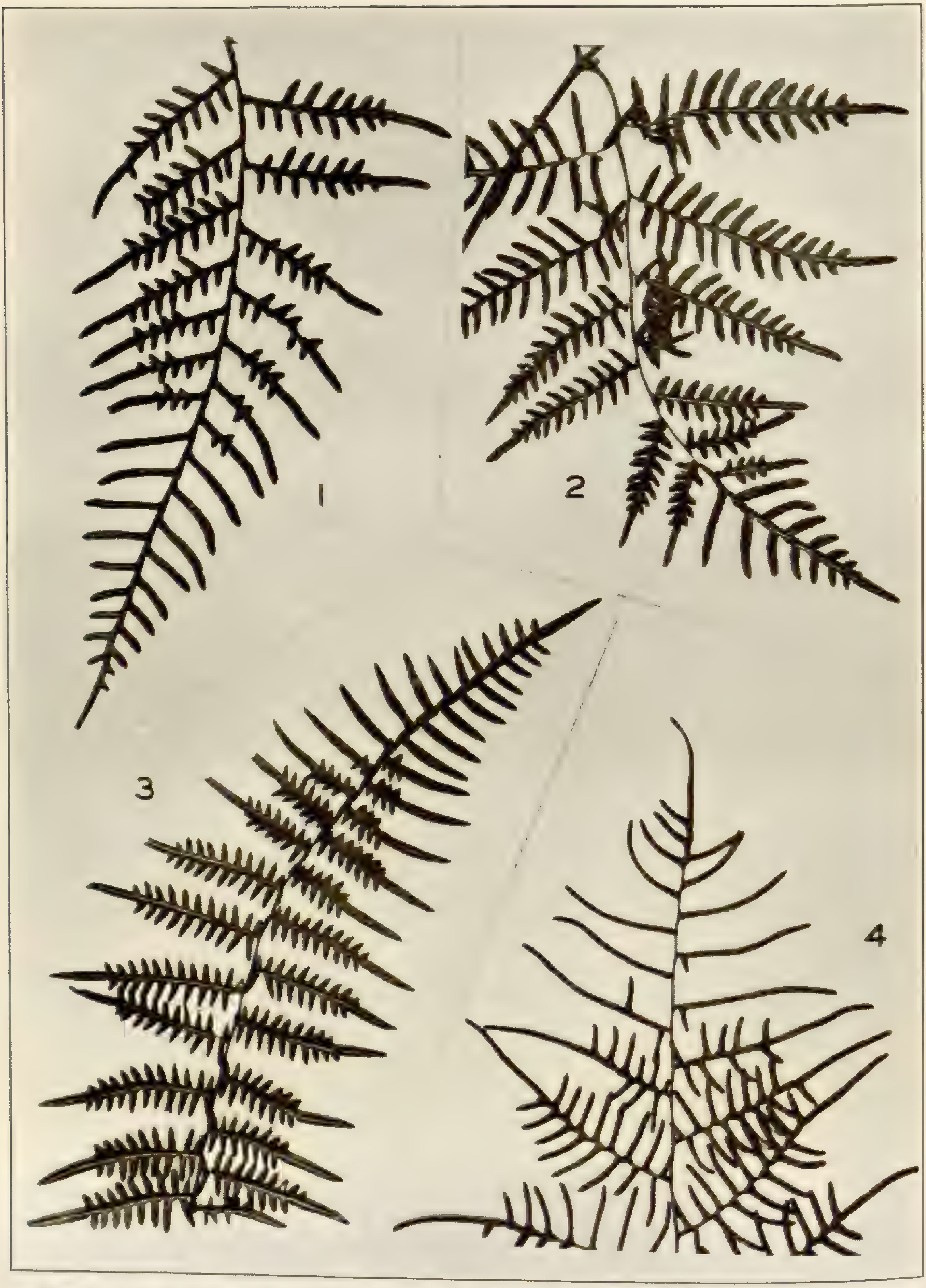


FIG. 1, upper half of middle pinna of PTERIDIUM AQUILINUM, var. ESCULENTUM. × ½; FIG. 2, basal pinna of small plant of var. YARRABENSE, × ½; FIG. 3, upper pinna of var. ARACHNOIDEUM, × ⅓; FIG. 4, tip of frond of var. CAUDATUM, × ½.

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New scientific names are printed in full-face type

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CONTRIBUTIONS FROM THE GRAY HERBARIUM
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1. STUDIES IN THE IRIDACEAE—II. A REVISION OF GEISSORHIZA KER-GAWL.

By Robert C. Foster

Introduction

For several years it has seemed to me that the widespread family of *Iridaceae* offers an interesting field for cytotaxonomic investigation, and a beginning has been made with a survey of the North American species of *Iris*.[1] It appears desirable to consider the two aspects simultaneously, when possible. Unfortunately, in this country, at least, living material of genera other than *Iris* and *Sisyrinchium* is rather scanty, and can be procured only slowly. A second disadvantage is that the only taxonomic work treating the family as a whole is Baker's *Handbook of the Irideae*, now almost fifty years old and therefore completely out of date in large portions. Furthermore, as even a brief investigation will show, it is full of nomenclatural and taxonomic errors. As a result of these facts, it is essential to provide a sounder taxonomic basis if cytological work is to be done upon any group within the family. The present study of *Geissorhiza* Ker-Gawl. is the first of a series of generic revisions, to be followed shortly by a similar revision of the closely related genus *Hesperantha* Ker-Gawl.

The work has been based almost entirely upon a study of types and isotypes, with which a large series of material from Kew, Berlin, and Geneva has been compared. The types of Linnaeus, Linnaeus fil., and Thunberg are the principal ones which it has been impossible to see, but this deficiency has been in large part remedied by seeing a splendid series of critically annotated specimens from Kew. These were carefully compared by the late N. E. Brown with the Linnaean and Thunbergian types and marked accordingly. Photographs of several other types have been available, although it must be admitted that even the best photographs of this group are not satisfactory in certain respects. Where only poor and scanty material has been seen, as in several instances, the *status quo* has been maintained, although more and better material might well have caused changes to be made.

[1] See Contrib. Gray Herb. cxix. (1937).

History, Distribution, and Relationships

The genus *Geissorhiza* was first described by Ker-Gawler in Bot. Mag. xviii. t. 672 (1803), followed by a description of *G. obtusata* Ker-Gawl., which therefore automatically becomes the type of the genus. The generic name refers to the imbricate corm-tunics characteristic of *G. obtusata* and numerous other species in the genus. To the single species described, *G. secunda* (Berg.) Ker-Gawl. was added in the text discussion. In his lengthy paper on the *Iridaceae* (*Ensatae*) in Koenig and Sims, Ann. Bot. i. 219–247 (1804), Ker-Gawler redefined the genus (l. c., pp. 223–224), adding a few details, and increasing the number of species to eleven. Of these, *G. sublutea* (Lam.) Ker-Gawl. is a *Romulea*, and one name, *G. furva* Ker-Gawl., is a *nomen nudum*. The remainder, other than *G. obtusata*, were new combinations based upon species originally described in *Ixia* L. Still more details, undoubtedly a result of studying living material, were incorporated in Ker's account of the genus in his Irid. Gen. 83–88 (1827). *G. sublutea* was dropped from the list of species, and *G. quadrangula* (DelaR.) Ker-Gawl. was added. In 1827, too, numerous new species were proposed by Ecklon, Top. Verz. 20–22, but descriptions were not given and these names are all invalid.

Little attention seems to have been given the genus until Klatt, in Linnaea xxxiv. 651–659 (1865–66), treated it in the course of a review of the family. Klatt's treatment was not without error. The fourteen species considered were divided into two groups (not designated as either subgenera or sections) on the basis of the number of cauline leaves. Several of Ecklon's *nomina nuda*, such as *G. lutea*, *G. Brehmii*, and *G. quinquangularis*, were validated by descriptions, but *G. lutea* is a *Hesperantha*, and has since been transferred to that genus. Concerning the others recognized by Klatt, it might be noted that *G. Rocheana* Sweet is an illegitimate name for *G. Rochensis* Ker; *G. Brehmii* was based on two different plants; *G. recurvifolia* was based nomenclaturally on *Ixia recurvifolia* Poir., which is a *Romulea*, and taxonomically on a mixture of specimens, in part *G. Dregei* Baker. *G. ornithogaloides* Klatt was described as a new species, the trivial name being taken from the Lichtenstein specimen cited, while actually it should have been a new combination based on *Ixia ornithogaloides* Lichtenst. in Roem. & Schult. *G. setacea* in Klatt's description and specimens cited was quite unlike true *G. setacea* (Thunb.) Ker-Gawl., as Klatt himself recognized in 1893;[2] it was the plant here treated as *G. juncea* (Link) A. Dietr. *G. anemonaeflora* (Jacq.) Klatt, a new

[2] See Durand and Schinz, Conspect. Fl. Afr. v. 180 (1893).

combination based on *Ixia anemonaeflora* Jacq., is an *Ixia* nomenclaturally and a taxonomic mixture as to specimens cited.

Ten years later, Baker, in Journ. Bot. xiv. 239 ff. (1876), described six new species, of which two should have been described in *Hesperantha*. His résumé of the genus, dividing it into two sections based on the length of the perianth-tube in relation to spathe-length, appeared in Journ. Linn. Soc. xvi. 93–95 (1877), listing twenty-six species and two varieties. A series of comments upon and additions to Baker's paper was published by Klatt in 1882,[3] in the course of which he described several new species.

Baker's treatment of the genus in his Handbook of the Irideae (1892) included thirty species and eleven varieties. As was his custom, when he reduced a specific name to varietal status, he cited the binomial for the third part of the trinomial, so that most of his new combinations in varietal status were invalid; the same practice was followed in the Flora Capensis. In the index to the latter book, some of these were properly cited as trinomials, with the correct page references, so that it should probably be assumed that the new combinations were made in the index, which may well have been the work of some publisher's clerk. In the following year (1893), Klatt published a synopsis of the genus in Durand and Schinz, Conspect. Fl. Afr. v. 176–181; this was merely a list of forty species, with synonymy and an occasional citation of specimens, retaining nearly all the errors which he himself had ever made, with most of Baker's in addition.

The treatment of the genus in Thiselton-Dyer, Fl. Cap. vi. 65–76 (1896),[4] differed little from the treatment in Baker's Handbook, but specimens were cited and a key to the species added. The principal division of the key was made on length of perianth-tube, a highly unreliable character where large groups of species are concerned. Actual errors occur in the key, also; e. g., *G. secunda* is found opposite the category "Stem and leaves glabrous." In point of fact, the specimens which Baker cited have densely short-villous stems, a very prominent character which can hardly be overlooked.

Within recent years, a few more species have been described, particularly by South African botanists. One appears to be an old and "lost" species rediscovered and redescribed as new, while others are distinct additions to the genus. In the present paper, a number of new species and varieties will be described.

[3] In Abhandl. Naturf. Ges. Halle xii; reprinted with separate pagination, and cited in this work under the abbreviation Ergänz., since only the reprint is available to me at present.

[4] The entire volume was the work of J. G. Baker.

From this brief survey it is clear that *Geissorhiza* was erected by Ker-Gawler as a segregate from *Ixia*, and, for a considerable period of time, its members were largely transfers from that genus. A year after the segregation of *Geissorhiza*, another segregate, *Hesperantha*, was proposed by Ker-Gawler.[5] The line of demarcation between the two closely related genera was clear to Ker-Gawler, but has not always been equally clear to later workers. To this later blurred concept of generic characters, a further source of error has been added in failure to make the essential dissections of floral structures. The types of several species described by Baker in *Geissorhiza* show no signs of dissection. Had this been done, the plants would undoubtedly have been described in *Hesperantha*, where they properly belong. The chief, and easily recognizable, character separating the two genera is the length of the style relative to the perianth-tube:

Style longer than perianth-tube, the stigmatic branches usually short, recurved, and exceeding the anthers . . . . *Geissorhiza*.
Style shorter than or equal to the perianth-tube, the branches long, ascending, often not equalling the anther-apex . . . . *Hesperantha*.

For the most part, it is not difficult to distinguish *Geissorhiza* from *Ixia*. In all but five of the species whose corms are known, the tunics are solid (either imbricate or concentric), not finely fibrous as in *Ixia*. The spathes are herbaceous, or membranous in the upper portion, but not entirely membranous, scarious, or chartaceous, as in *Ixia*. The five species of *Geissorhiza* known to have at least the outer corm-tunics fibrous or fibrous-reticulate have herbaceous spathes, and the seeds, where known, appear to be quite distinct from those of *Ixia*. These five species are regarded in this treatment as constituting a separate subgenus of *Geissorhiza*.

To discuss the relationships of these three genera adequately can be done only when much more information has been accumulated about their cytology, genetics, and comparative anatomy. At present, nevertheless, some of the salient facts may be outlined.

Of the three groups, *Geissorhiza* is found in the southwestern and western portions of Cape Province in South Africa, with two species known to occur in Madagascar. One species, *G. gracilis* Baker, has been described from Griqualand East, and another, *G. macra* Baker, from the Transvaal. A photograph of the type of the latter has been seen, and I doubt very much if it belongs in *Geissorhiza*; it strongly suggests *Hesperantha* or *Acidanthera*. I have been unable to find any material which can be assigned to *G. gracilis*, which, to judge from the

[5] Ker-Gawl. in Koenig and Sims, Ann. Bot. i. 224 (1804).

description, might well be an *Ixia*. These two species will be discussed more fully at a later point. With the exception of these two doubtful species, the genus as it occurs in South Africa is found chiefly in the region shown on Pole Evans's vegetation map[6] as the evergreen sclerophyll bush. A few species are to be found on the western edge of the Karroo and Upper Karroo, and in Little Namaqualand, desert areas, where they tend to occur at higher altitudes.[7] *Geissorhiza*, then, is primarily a component of the non-tropical flora of western and southwestern Cape Province, where it is differentiated into easily distinguishable subdivisions, with numerous endemic species. One of the two species in Madagascar, it should be noted, is an element of the high montane flora, which has marked affinities with the flora of South Africa.[8]

On the other hand, *Hesperantha* is well-developed in the eastern portion of Cape Province, in Natal, in the Transvaal, with one species in western tropical Africa (in the Kamerun mountains), and two in eastern tropical Africa, in the high mountains from Kenya Colony south to Lake Nyassa; it has no representatives in Madagascar. Of the species listed by Baker in Fl. Cap. vi. 58–65 (1896), half are components of the tropical flora of the eastern portion of the Union of South Africa, and only rarely is a species of the tropical flora present also in the western part of Cape Province. So far as can be seen from incomplete studies, *Hesperantha* is perhaps less easily divisible into well-marked subgroups than is *Geissorhiza*. Although many species are highly localized in range, there is perhaps less sharp distinction between many species of *Hesperantha* than is true of *Geissorhiza*.

With regard to *Ixia*, the situation is still far from clear. The distribution of that genus in South Africa is similar to that of *Geissorhiza*, with two species described from Griqualand East, and one from Hereroland in the former German Southwest Africa. The description of this last species, *I. Dinteri* Schz., seems to suggest that it is a *Lapeyrousia*, since the stigmas are said to be briefly bifid, a characteristic found in several species of *Lapeyrousia* in that part of Africa. Like *Geissorhiza*, *Ixia* is clearly a part of the non-tropical flora of Cape Province. The question of whether *Geissorhiza* developed out

[6] Bot. Surv. S. Afr., Mem. no. 15 (1936).

[7] See Pearson in Ann. S. Afr. Mus. ix. 9, 27 (1911); on the latter page he notes that at Vogelklip a Cape flora predominates at elevations above 3800 ft.

[8] See, e. g., Baker in Journ. Bot. xix. 362–365 (1881); Baron in Journ. Linn. Soc. xxv. 246–294 (1889); Humbert, Les Composées de Madagascar, esp. pp. 248–265 (1923).

of *Ixia* through the small group of species containing *G. Bojeri* Baker, or *vice versa,* is one which cannot be answered at present. All that can be said is that the genera are closely related, and that the connection lies in *G. Bojeri* and its relatives on the one hand and *Ixia* subgen. *Morphixia* on the other. In the latter group, the perianth-tube becomes funnel-form as in *Geissorhiza,* although the spathes, and probably the seeds, are different from those of *G. Bojeri.*

Diagnostic Characteristics

Corms. The corms are more or less globose, or ovoid, or even conic in shape, always with a flattened base, although in some this is barely perceptible. It is unfortunate that corms are not known for all members of the genus, but most have been described. On the whole, the shape of the corm seems rather less significant than the nature of the corm-tunics. Of those known, all but five have solid tunics of two types: imbricate or concentric. Imbricate tunics have the basal edges regularly and deeply notched, with the notches smoothly margined. The exception to this is *G. ornithogaloides,* in which the basal edges are irregularly frayed and serrate, as in some species of *Hesperantha.* The second type is exemplified by *G. juncea,* with the tunics completely concentric, tending to split downward from the top, and with the sections of the tunic cusped at the apex. There are, in addition, slight differences in size, color, texture, and hardness which are useful on occasion.

The five known exceptions which do not have solid tunics have at least the outer coats fibrous. The limitation is necessary because *G. Patersoniae* L. Bol., with coarsely fibrous-reticulate outer tunics, has solid, papery, light yellow-brown inner coats, suggesting the inner tunics of some species of *Gladiolus.*

I regard this differentiation of corm-tunics as of great importance, especially since the corm differences are associated with others which will be noted in the discussion of the proper characters. It is this difference in corms, primarily, which has led to the division of the genus into two subgenera.

Leaves. Thorough study of the available material shows that leaf-venation occurs in two types. In one, the veins are large and rounded, with the edges thickened and downward-revolute. In such plants, the leaf-margin is revolutely incurved, often almost touching the midrib, when no other veins are present. A cross-section of such a leaf has an elaborately cruciform outline, if only one conspicuous vein occurs in it. One large group of species has only one such vein present in the basal and cauline leaves. The basal and cauline leaf-sheaths contract abruptly into a straight, linear-filiform blade, which often appears terete or subterete through the approximation of the leaf-margin and midrib. On the other hand, a second group of species possesses a similar type of venation, but often with more than one vein prominent in the basal leaves, and always several in the cauline leaves. The sheath of the cauline leaves in this group is always ventricose, presenting a heavily striate appearance. The midrib is scarcely more outstanding than the others, when more than one is present.

Contrasted with this, a second major type is found with leaves more like those of *Ixia* in appearance. The veins do not have a rounded appearance, with the edges thickened and downward-revolute, but are more nearly simple ridges. The midrib is far more conspicuous than the others when more than one is present. In cross-section, a single-ribbed leaf in this group presents a simple cruciform outline. Rarely, the cauline leaf-sheaths in this group are ventricose, but if so they are seldom as heavily striate as in the preceding group.

In view of the comparative stability of these venation types, this character is the one upon which rests the sectional divisions proposed in this study. An occasional transition form occurs (*G. subrigida* L. Bol. is the most puzzling of these), but there is far less uncertainty in regard to venation than there is concerning which of several categories should receive the rather variable length of perianth-tube.

Leaf-shape is not remarkably diversified. The linear-filiform type and ventricosely-sheathed cauline leaves have already been mentioned. A few species, such as *G. ovata* (Burm. f.) Aschers. & Graebn. and *G. ovalifolia* Foster, have distinctly, if sometimes narrowly, oval leaf-blades. Most of the rest have linear-attenuate leaves, often with the blade contracted above the sheath in a subpetioloid manner, as in *G. setacea* (Thunb.) Ker and *G. subrigida*. *G. Dregei* Baker and *G. rupestris* Schltr. have bulbils in both cauline and basal leaf-sheaths, while some of their relatives have bulbils in the cauline leaf-sheaths only. The leaf of *G. corrugata* Klatt is highly distinctive in its extreme flexuosity.

Stem and Inflorescence. If the stem is not simple, the branching may occur near the base within the sheath of the cauline leaf, as in *G. monantha* (Thunb.) Eckl., or from the very base, as in *G. foliosa* Klatt. In more cases, branching occurs near or above the middle of the stem. When branches occur near the top of the stem, they are likely to emerge from a pair of spathiform bracts. *G. subrigida* has such markedly divergent branches for its group that it is possible to utilize this character in the key. For the most part, however, the branches are rather upright. Stems are glabrous, on the whole, although a few species such as *G. splendidissima* Diels have densely short-villous stems. This tends to disappear on the axis of the inflorescence.

The inflorescence varies from a single terminal flower to a many-flowered spike, with the floral arrangement distichous to secund. In such species as *G. Louisabolusae* Foster, the inflorescence is bent at an angle, although the angle is never so great as in the genus *Freesia*.

Spathes. The spathes vary in shape from lanceolate-acute to oblong-ovate and obtuse. In the latter case, there are sometimes further variations, with the apex somewhat trilobulate, the middle lobe occasionally longer and apiculate. In the past, as in Baker's key, Fl. Cap. vi. 66 (1896), much stress has been laid on the difference between entirely herbaceous spathes and those which are partially brown-membranous. It cannot be denied that the differences exist and are often pronounced, but they are too inconstant to permit one to lay great stress on them. In the case of *G. Bellendeni* MacOwan (a synonym of *G. monantha*), the type and several isotypes have been seen. On the type the spathes are herbaceous, but on some of the isotypes the upper portion of the spathe is quite brown-membranous. The inner spathe is almost always membranous or scarious, bicarinate, with the nerves green, and usually slightly bifid at the apex.

Perianth. The perianth-tube is a character which may be of considerable value in differentiating species if it is used with discretion. As between very short tubes, infundibuliform almost from the very base, e. g. *G. quinquangularis* Eckl. ex Klatt, and long, straight tubes, ampliate near the top, as in *G. violacea* Baker, there is no question of diagnostic value. Between related species with a comparatively small difference in tube-length, the character seems valueless. The tubes of the lowermost flowers in an inflorescence are almost always longer than those of the uppermost flowers. Consequently, it is necessary to measure the tubes on flowers of approximately the same position in the spike, if the comparative measurements are to be significant. Another possible source of error lies in the fact that in a number of species the tube appears to lengthen as the flower matures and withers. Without studying living plants it is impossible for me to be certain of this, but it appears sometimes to be the case. In any event, care has been taken to make comparisons of tube-length on mature but not withering flowers in approximately the same position in the spike, whenever this could be done. Scanty and poor material has sometimes made it impossible.

To use the length of the perianth-tube relative to the length of the outer spathe as a means of separating groups of species, as Baker has done, Fl. Cap. vi. 66 (1896), and even as a basis for creating sections, appears to me to be highly questionable. For example, Baker, in Journ. Linn. Soc. xvi. 95 (1877), placed *G. ovata* (*G. excisa*) in Section *Weihea*, on the ground that its perianth-tube greatly exceeds the outer spathe. A casual inspection of even a few specimens of this species will show a high degree of variability in this respect, the tube varying from almost equal to the spathe to much longer. It must be admitted that in this species the tube is ordinarily very long, but the variability in this and many other species is too great to permit sections to be distinguished on the basis of tube-length alone.

The perianth-segments, or tepals, are usually subequal in size, there being little difference between the exterior and interior ranks in this respect. More often, there is a difference in color, a difference most frequently noted when the perianth is yellow or white. In such species, the outer tepals are often suffused or striped with red or pink on their exterior, so that a bicolored effect is produced. Here again the study of living plants would be of value, for the suspicion arises that in a number of such instances the reddish suffusion is the result of aging of the flower or an after-effect of drying in the process of pressing the plant. Within limits, however, this red color appears to be constant. In fact, in most cases, color seems to be a fairly constant character. Certain blue- or red-purple species, such as *G. secunda*, are more variable in this respect than other species. Again, such yellow-flowered species as *G. bicolor* (Thunb.) N. E. Br. and some of its relatives vary in the amount of purple found on the tube and base of the tepals.

Size and shape of the tepals are naturally of great value in distinguishing not only individual species but also groups of species in some instances. If it were possible to deal with living material in this study, the nature of the flower-shape, whether rotate or open-campanulate or, more rarely, somewhat turbinate, would be of considerable value, but too often this character is obscured in the pressed plant.

STAMENS. Aside from a few cases, the stamens offer little of diagnostic value. Such species as *G. inaequalis* L. Bol., *G. rosea* (Ker.) Foster, *G. ramosa*, and several others, have unequal stamens, one being distinctly shorter. The relative lengths of stamens and tepals is often a point worth consideration, although it is hardly of major importance. By definition of the genus, the stamens are supposed to be equilateral in arrangement, but the studies of Dr. Louisa Bolus on living material indicate that this is by no means invariably true. The exceptions will be dealt with in the taxonomic treatment of species.

Style and Stigma. The length of these two characters is often useful. *G. corrugata* has stigmas so long that the plant might easily be mistaken for a *Hesperantha*, except for the fact that the style exceeds the perianth-tube by several millimeters. In *G. ixioides* Schltr. ex Foster, the style is short and the stigmas do not exceed the anthers. Generally, however, the long style nearly equals the anther apex, while the relatively short, recurved stigmas exceed the anthers. The style is rarely somewhat unilateral. Two exceptions to the usual type of narrow, conduplicate stigma are found. In these, described by Dr. Bolus as *G. eurystigma* and *G. Mathewsii*, the stigma is broad, flat, thick, and crenate-edged.

Capsule and Seeds. Except in the case of three species in the group with fibrous corm-tunics, the capsules are small and either turbinate or subturbinate, with numerous small, more or less globose seeds, which are often angular from pressure within the capsule. This statement must be qualified by the admission that, in too many cases, mature capsules and seeds are not available for study. The three exceptions mentioned, *G. Bojeri*, *G. ambongensis* H. Perr., and *G. Patersoniae*, have rather large, ovoid or obovoid, or even almost cylindrical capsules, with winged seeds like those of *Gladiolus*.

Acknowledgments

At the conclusion of this study, it is pleasantly inevitable that I should find myself under considerable obligations to members of the Gray Herbarium staff, above all to Professor M. L. Fernald and Mr. C. A. Weatherby. Despite the numerous demands upon their time, they have always been most generous in their willingness to discuss and to advise upon difficult points. Mr. Weatherby increased my indebtedness by photographing several types at the British Museum and at Paris during the summer of 1939.

In addition to the material in the Gray Herbarium (G), material has been seen from the Royal Botanic Gardens, Kew (K), the Botanic Museum, Berlin (B), and the Geneva Conservatoire (Gen). To the Directors of these institutions, Sir Arthur W. Hill, Professor Ludwig

Diels, and Professor B. P. G. Hochreutiner, I am deeply grateful for their kindness in lending specimens.

Synoptic Treatment of the Genus

Geissorhiza. Corms ovoid, subglobose, or somewhat conic, the tunics entire and imbricate or concentric, or rarely at least the outer ones fibrous: leaves basal and cauline, few, erect, sometimes recurved, or (in one instance) tortuose-flexuose, mostly linear-attenuate, glabrous or pubescent, all sheathing at the base; the cauline leaf-sheath often ventricose: stem simple or branched, erect, usually terete, glabrous or short-villous or hispidulous: inflorescence 1–many-flowered, spicate, secund or distichous, usually lax and somewhat flexuose: outer spathe herbaceous or partially membranous, lanceolate to oblong-ovate, acute or obtuse, or trilobulate; inner spathe usually shorter, membranous-scarious (rarely green), hyaline, bicarinate, the nerves green, usually shortly bifid at the acute apex: ovary small, ellipsoid-turbinate: perianth-tube long or short, cylindrical at the base, usually becoming infundibuliform above; tepals subequal, oval to obovate or subspatulate, entire or slightly retuse at the apex, the entire flower regular, infundibuliform to open-campanulate: stamens equal, or sometimes unequal, inserted at the throat of the tube, the filaments free, usually flattened, the anthers linear or lanceolate, basifixed, sagittate: style extruded from the perianth-tube, unilateral in a few species, usually equalling or slightly exceeding the anthers; stigmas entire, usually short, narrow, recurved, fimbriate- or ciliate-edged, conduplicate (broad, flat, rounded-quadrate, crenate-edged in two species): capsules more or less small, thin-walled, trigonal, turbinate, a few ovoid-obovoid and large; seeds numerous, small, globose or angled through pressure, alate in a few species.—Ker-Gawler in Bot. Mag. xviii. t. 672 (Aug. 1, 1803). *Rochea* Salis. in Trans, Hort. Soc. Lond. i. 322 (1812), *nomen nudum*. *Weihea* Ecklon, Top. Verz. 22 (1827), *nomen nudum*.

Type-species: *G. obtusata* Ker-Gawl. in Bot. Mag. xviii. t. 672 (1803).

Key*

a. Corm-tunics solid, imbricate or concentric; seeds (so far as known) not winged; capsules small, turbinate or subturbinate. . . .*b*.
- *b*. Leaves not flexuose-tortuose. . . .*c*.
  - *c*. Leaves with conspicuous veins, the midrib hardly more conspicuous than the rest, veins rounded and the edges revolute downward; glabrous (except nos. 3, 14, 16). . . .*d*.
    - *d*. Leaves narrow, filiform or subterete, the basal leaf-sheaths tapering abruptly into the linear-filiform

* Since so few species are known to have fibrous corm-tunics, it has been assumed that in unknown cases the corm-tunics were solid.

blade; cauline leaf-sheath not ventricose; corm-tunics concentric, not imbricate (except in nos. 7 and 8). . . . *e*

e. Stamens equal. . . . *f*.

f. Inflorescence several-flowered; flowers yellow, at least in part. . . . *g*.

g. Leaves glutinous.

Flowers clear yellow, unmarked . . . . 1. *G. humilis.*

Flowers red-striped or -flushed on the exterior of outer tepals.

Leaves not hispidulous . . . . 2. *G. humilis* var. *bicolor.*

Leaves hispidulous on midrib and margins 3. *G. humilis* var. *hispidula.*

g. Leaves not glutinous.

Plant small, about 11 cm. tall, 2–3-fld.; upper part of cauline leaf-sheath subnaviculate; basal leaves not exceeding inflorescence . . . 4. *G. Pappei.*

Plant 20–50 cm. tall, several–many-fld.; cauline sheath not naviculate; basal leaves often exceeding inflorescence.

Flowers pale yellow, outer tepals red-flushed on exterior; inflorescence secund. 5. *G. juncea.*

Flowers deep yellow, outer tepals sometimes deeply flushed red-brown on exterior; inflorescence distichous or subsecund . . . . 6. *G. juncea* var. *pallidiflora.*

f. Inflorescence a single red-purple flower . . . . 9. *G. furva.*

e. Stamens unequal; corm-tunics imbricate or subimbricate.

Flowers numerous, small, pink to deep purple; stem usually branched . . . . 7. *G. ramosa.*

Flowers 2–3, large, deep purple; stem simple. . . 8. *G. Burchellii.*

d. Leaves narrow or broad, basal leaves contracted above sheath, widening into blade; cauline leaf-sheath ventricose; corm-tunics imbricate. . . . *h*.

h. Flowers deep purple, unmarked with yellow. . . . *i*.

i. Stigmas broad, thick, flat, crenate-edged.

Perianth-tube 1–2 mm. long . . . . 10. *G. Mathewsii.*

Perianth-tube 6–10 mm. long 11. *G. Mathewsii* var. *eurystigma.*

i. Stigmas narrow, somewhat conduplicate.

Leaves and stem glabrous.

Plant 1–2(–3)-fld., unbranched, usually quite small . . . . 12. *G. Rochensis.*

Plant 2–many-fld., branched, usually large. 13. *G. Rochensis* var. *spithamaea.*

Leaves and stem hirtellous . . . . 14. *G. splendidissima.*

h. Flowers yellow, at least in part, or whitish. . . . *j*.

j. Perianth-tube and tepal base deep purple.

Plant usually large, tepals ± 3 cm. long.

Outer tepals clear yellow; cauline leaf-blade equalling or slightly exceeding inflorescence . . . . 15. *G. bicolor.*

Outer tepals striped rose-purple on exterior; cauline leaf-blade usually much exceeding inflorescence . . . . 16. *G. bicolor* var. *Macowani.*

Plant small, tepals ± 1.5 cm. long. . . . 17. *G. purpureo-lutea.*

j. Perianth-tube and tepal base not purple. . . . *k*.

k. Stamens unequal.
Leaves not exceeding inflorescence . . . 18. *G. Louisabolusae.*
At least one basal leaf and the cauline leaf exceeding inflorescence
19. *G. Louisabolusae* var. *longifolia.*
k. Stamens equal . . . . *l.*
l. Perianth-tube to 5 mm. long; tepals to 2.2 cm. long, flushed pink . . . . 20. *G. rubicunda.*
l. Perianth-tube not over 3 mm. long; tepals seldom 1.5 cm. long . . . . *m.*
m. Perianth bicolored, pink and yellowish white, tending to dry a uniform, dull, red-purple . . . . 21. *G. Wrightii.*
m. Perianth yellow or yellowish . . . . *n.*
n. Perianth yellow . . . . *o.*
o. Perianth pale sulphur-yellow; leaves narrow, few-nerved.
Basal leaves 1–1.5 mm. wide, 1(–3)-nerved; flowers unmarked . . . . 22. *G. sulphurea.*
Basal leaves 2–3 mm. wide; outer tepals striped red on exterior.
23. *G. sulphurea* var. *arenicola.*
o. Perianth deeper yellow, not sulphur-yellow; leaves usually wider and many-nerved.
Outer tepals reddish on exterior . 24. *G. imbricata.*
Outer tepals unmarked.
Basal leaves and cauline leaf-blades 3–7-nerved, apically obtuse, often recurved.
25. *G. imbricata* var. *concolor.*
Basal leaves and cauline leaf-blades 1-nerved, very narrow, acute, exceeding inflorescence.
26. *G. imbricata* var. *Brehmii.*
n. Perianth almost white, unmarked
27. *G. sulphurascens.*
c. Leaves seldom with prominent veins other than the midrib (except in no. 37); if so, the midrib more prominent than the others; veins not with downward-revolute edges, often pubescent; corm-tunics imbricate, rarely concentric . . . . *p.*
p. Leaves or stems, or both, pubescent . . . . *q.*
q. Leaves glabrous, or sparsely hispidulous on the subpetioloid base of the blade.
Inflorescence 1–3-fld.; branching (if present) near the stem base; flowers large.
Stem several-fld.; tepals dark blue- or red-purple, the base lighter and pellucid . . . . . . 28. *G. monantha.*
Stem and each branch 1-fld.; tepals nearly white, the base dark red-purple . . . . . . 29. *G. tulbaghensis.*
Inflorescence many-fld.; if branched, from the middle of stem, or above; flowers relatively small . . . . 30. *G. secunda.*
q. Leaves pubescent . . . . *r.*
r. Stem puberulent . . . . *s.*
s. Stamens equal; puberulence sparse . . . . 31. *G. ixioides.*

s. Stamens unequal; puberulence more pronounced . . . . *t*.
t. Anthers equal in length, 1 filament much shorter than the others.
Tepals ovate or obovate.
Tepals purple, acute.
Tepals lavender-purple . . . . 32. *G. heterostyla.*
Tepals deep blue-purple . . . . 33. *G. Lewisae.*
Tepals pale rosy-lilac, obtuse . . . . 34. *G. Rogersii.*
Tepals oblong-elliptic, obtuse, blue-violet
35. *G. inaequalis.*
t. Anthers unequal in length, 1 filament much shorter, its anther much longer than the others . . . . 36. *G. Leipoldtii.*
r. Stem glabrous . . . . *u*.
u. Stem divaricately branched . . . . 37. *G. subrigida.*
u. Stem simple; if branched, the branches more or less upright . . . . *v*.
v. Stamens unequal . . . . 38. *G. rosea.*
v. Stamens equal . . . . *w*.
w. Corm-tunics concentric.
Perianth-tube ± 1.5 mm. long; style and stigma exceeding anther apex . . . 39. *G. pusilla.*
Perianth-tube to 9 mm. long; style and stigma hardly exceeding anther apex
40. *G. namaquensis.*
w. Corm-tunics imbricate.
Flowers deep red- or blue-purple.
Inflorescence 3–7-fld.; tepals to 2.4 cm. long . . . . 41. *G. erosa.*
Inflorescence 2–3(–4)-fld.; tepals to 1.5 cm. long . . . . 42. *G. erosa* var. *kermesina.*
Flowers not deep purple.
Flowers whitish or yellowish; outer tepals usually red-striped externally; perianth-tube light in color
43. *G. quinquangularis.*
Flowers yellowish; tepals not striped externally; perianth-tube dark
44. *G. quinquangularis* var. *atrofaux.*
p. Leaves and stem glabrous . . . . *x*.
x. Stamens unequal . . . . 45. *G. montana.*
x. Stamens equal . . . . *y*.
y. Leaves bulbilliferous; corm-tunics imbricate, thin, rather soft.
Basal and cauline leaves bulbilliferous.
Inflorescence compact; perianth-tube dark-blue; leaves short . . . . 46. *G. Dregei.*
Inflorescence loose and flexuose; flower concolorous; basal leaves attenuate, rather long . . . . 47. *G. rupestris.*
Only the cauline leaves bulbilliferous.
Leaves to 10 cm. long, linear-attenuate . . . . 48. *G. Bolusii.*
Leaves to 2 cm. long, elliptic-oval . . . . 49. *G. ovalifolia.*
y. Leaves not bulbilliferous; corm-tunics concentric (where known), except in nos. 61 and 62 . . . . *z*.
z. Basal leaves broadly elliptic-ovate, thick-textured, with a pronounced adaxial incision above the sheath . . . . 50. *G. ovata.*

z. Basal leaves not broadly elliptic-ovate, rather thin-textured. . . . *A*.

A. Tepals not over 6–7 mm. long.

Flowers light yellow, concolorous. . . . . . .51. *G. parva.*

Outer tepals dark (blue-purple?), inner tepals white. .52. *G. nana.*

A. Tepals at least 1 cm. long, usually longer. . . . *B*.

B. Flowers light purple or violet.

Plant over 30 cm. tall; basal leaves long, erect, narrow; flower clear violet, sometimes pale. . . . . .53. *G. violacea.*

Plant seldom over 25 cm. tall; basal leaves short, broad, usually falcate; flower light rosy-purple, with darker veins. . . . . .54. *G. foliosa.*

B. Flowers yellow (clear or suffused with red or green), or white. . . . *C*.

C. Inflorescence 2–several-fld. . . . .58. *G. inconspicua.*

C. Inflorescence 1- (rarely 2-)fld. . . *D*.

D. Basal leaves to 8 mm. wide, numerous. . . . . .55. *G. bracteata.*

D. Basal leaves 0.5–1.5 mm. wide, few. . . . *E*.

E. Plant (17–)30(–35) cm. tall. . .56. *G. geminata.*

E. Plant barely 10 cm. tall (to 15 cm. in no. 62). . . . *F*.

F. Tepals 2.5 cm. or more long 59. *G. malmesburiensis.*

F. Tepals 1.5 cm. or less in length.

Corm-tunics concentric.

Flower pale yellow or whitish, outer tepals red externally; leaves 1.5 mm. wide. . . . . . . .57. *G. setacea.*

Flower deep yellow; leaves 0.5 mm. or less in width. . . . . .60. *G. Marlothii.*

Corm-tunics imbricate, the basal edges irregularly frayed and serrate.

Basal leaves 0.5 mm. wide; tepals to 1.2 cm. long. . . . . .61 *G. ornithogaloides.*

Basal leaves 1.5 mm. wide; tepals to 1.5 cm. long. 62. *G. ornithogaloides* var. *flava.*

b. Leaves tortuose-flexuose. . . . . .63. *G. corrugata.*

a. Corm-tunics, at least the outer ones, fibrous or fibrous-reticulate; capsules rather large, ovoid to oblong-ovoid; seeds (so far as known) alate. . . . *G*.

G. Perianth-tube straight; flowers relatively small.

Perianth-tube shorter than outer spathe.

Perianth pale lilac-gray, the tepals somewhat apiculate; South Africa. . . . . .64. *G. Patersoniae.*

Perianth pale rose or yellow; Madagascar. . . . . .65. *G. Bojeri.*

Perianth-tube longer than outer spathe; tepals purple 65. *G. hesperanthoides.*

G. Perianth-tube curved; flowers large, yellow, striped red. . .67. *G. grandis.*

Subgenus **Eugeissorhiza**, subgen. nov. Cormi tunicae omnes solidae, imbricatae vel concentricae; capsulae parvae, turbinatae vel subturbinatae; semina exalata. TYPE: *G. imbricata* (DelaR.) Ker-Gawl.

It is possible and convenient to divide this subgenus into three sections, retaining the names which Baker first used for two, but radically altering the bases on which they were founded. Originally, the length of the perianth-tube relative to the outer spathe was used, but the nature of the leaf-venation seems to provide a more stable character upon which to base such divisions.

Section ROCHEA Baker, emend. Baker in Journ. Linn. Soc. xvi. 93 (1877). Nerves of leaves thick, the midrib hardly more prominent than the others, if, indeed, more than one is present, the nerves rounded and their edges somewhat revolute downward; leaf-margins thickened and inwardly revolute; leaves and stems mostly glabrous. Standard-species: *G. imbricata*.

This section, again on the basis of leaf-types and venation, almost automatically divides into two subsections.

Subsection **Filiformes**, subsect. nov. Folia angusta, filiformia, vaginae basales abrupte in lamina lineari-filiforme contracta; laminae omnes uni-nervatae; vagina folii caulini non ventricosa; cormi tunicae concentricae, non imbricatae (*G. ramosa* et *G. Burchellio* exceptis). Type: *G. juncea* (Link) A. Dietr.

1. G. HUMILIS (Thunb.) Ker. Plant small, 10–14 cm. high; corm ovoid; the coats concentric, hard, brittle, dull brown, long-cusped at the apex (the cusps to 4 mm. long), to 1.2 cm. high and ± 1 cm. wide: basal leaves 2, linear, recurved, acute, glabrous but glutinous, the midrib and edges thick, to 15 cm. long and 1 mm. wide, equalling or exceeding the inflorescence; the single cauline leaf sheathing for ¼–⅓ its length, to 5 cm. long: stem simple, terete, glabrous, flexuose, purple-tinged; the inflorescence a lax or semi-lax, 3-flowered, secund or subsecund spike: outer spathe to 1.1 cm. long, oblong-ovate, truncately obtuse, entire, herbaceous, striate, white-membranous around the apical portion, equal to or a little shorter than the perianth-tube; the inner spathe as long as the outer, slightly emarginate at the apex: ovary to 4 mm. long, subturbinate: perianth-tube to 4.5 mm. long, drying darker than the tepals: outer tepals to 1.7 cm. long, 7 mm. wide, obovate-elliptic, acute; the inner tepals to 1.5 cm. long, ± 8 mm. wide, obovate, acute; both sets clear unmarked yellow: stamens half as long as the tepals, the anther and filament each 5 mm. long: style 1.3 cm. long, almost equal to the anther-apex; the stigmas 4 mm. long, exceeding the anther: capsule and seeds not seen.—Ker-Gawl. in Koenig and Sims, Ann. Bot. i. 224 (1804). *Ixia humilis* Thunb., Diss. Ixia 8 (1783). *G. humilis* var. *grandiflora* Baker,

Handbk. Irid. 153 (1892). *G. humilis* var. *G. juncea* (Link) Baker, Handbk. Irid. 153 (1892), as to plant.

TYPE: sheet alpha of *Ixia humilis* in Herb. Thunb. (not seen).

HABITAT: sandy places, locally abundant in Cape Div.

SPECIMENS SEEN: South Africa, without precise locality, *Bowie*, no. 402 (Gen); *W. M. Rogers* (K); *Zeyher*, no. 3964 (K): Cape Div.: Cape Flats, *Pappe* (K); Wynberg, *Schlechter*, no. 1559 (B, Gen); Fish Hoek, Aug. 30, 1896, *Wolley Dod*, no. 1616 (K); Klein Slangkop, Sept. 26, 1897, *Wolley Dod*, no. 3303 (K); Simons Bay, *C. Wright*, no. 253 (G, K): Paarl Div.: by the Berg River, near Paarl, *Drège*, no. 8472 (K, Gen).

On the sheet of *Wolley Dod*, no. 1616, N. E. Brown has noted: "Matches and is quite identical with the type of *Ixia humilis* Thunb., sheet α! in Thunberg's Herbarium." In view of this resemblance, the description has been based primarily on this collection. True *G. humilis* has been seen only from Cape Division; *Drège*, no. 8472, from Paarl, lacks the glutinous leaves and may well be a hybrid in the ancestry of which *G. imbricata* var. *concolor* Baker has been involved.

2. G. HUMILIS, var. BICOLOR Baker. Differs from the species in having the usually smaller flowers suffused or striped with red on the exterior of the outer tepals: flowers more numerous: stems rarely branched, from near the base: leaves narrowed above the sheath, becoming wider.—Baker, Handbk. Irid. 153 (1892). *G. setacea* β Ker-Gawl. in Bot. Mag. xxxi. t. 1255 (1810).

TYPE: no specimens cited in the original description.

HABITAT: as in the species, but extending into Caledon and Stellenbosch Divs.

SPECIMENS SEEN: South Africa, without precise locality, in 1822, *Dr. Thom*, no. 723 (K): Cape Div.: Capetown, *Spielhaus* (B); Claremont, below 100 ft. alt., Sept., 1880, *H. Bolus*, no. 4602 (K); Table Mt., at 3800 ft., Nov., 1880, *H. Bolus*, no. 4615 (G, K), at 250 ft., Sept., 1884, *MacOwan in Herb. Norm.*, no. 258 (Gen in part), in 1875, *Spielhaus* (B in part); Muizenberg Hills, Sept., 1883, *MacOwan in Herb. Norm.*, no. 257 (G in part, B, Gen), summi montis Muizenberg pone Sinum False Bay, Sept., 1883, *MacOwan*, no. 2474 (K): Caledon Div.: Zwartberg, near Caledon, at 2500 ft., Oct. 21, 1897, *Galpin*, no. 4672 (K); eastern side of the Hottentotsholland Mts., at ± 350 met., Oct. 10, 1900, *Diels*, no. 1355 (B); Shaws Mt., Sept. 13, 1931, *W. F. Barker*, no. 8 (K): Stellenbosch Div.: near Somerset in Hottentotsholland, *Ecklon & Zeyher*, Irid. no. 295 in part (B, Gen).

Except for the smaller and more numerous flowers, it would be difficult to consider this as anything but a color form of *G. humilis*.

3. G. HUMILIS, var. **hispidula**, var. nov. A *G. humile* et var. *bicolore* nervo primario et foliorum marginibus hispidulis recedit.

TYPE: *Zeyher*, no. 1599, Cape Flats, Cape Div. (K, ISOTYPES in B, Gen).

HABITAT: chiefly in Cape Div., in sandy places.

SPECIMENS SEEN: South Africa, without precise locality, *Lalande in Hb. Kunth*, no. 1018 (B), *Leibold*, no. 567 (B), *Leibold*, no. 574 (B), *Ludwig* (B), *Niven* (K): Cape Div.: Wynberg Flats, Sept. 16, 1846, *Prior* (K, G); eastern side of Table Mt., near Constantia, *Ecklon & Zeyher*, Irid. no. 296 (B, Gen); Table Mt., 2300 ft., Feb. 21, 1892, *Schlechter*, no. 412 (B in part); Claremont, Sept., 1892, *Schlechter*, no. 1568 (B, Gen); Simons Bay, *C. Wright*, no. 248 in part (G, K), no. 265 (G): Stellenbosch Div.: near Somerset in Hottentotsholland, *Ecklon & Zeyher*, Irid. no. 295 in part (B, Gen): Caledon Div.: Caledon, in 1862, *W. M. Rogers* (K).

This variety differs from typical var. *bicolor* in having the leaf-margins and midrib shortly hispidulous, the hairs being appressed against the leaf-blade.

4. G. PAPPEI Baker. Plant about 11 cm. tall: corm ovoid, 3–5 mm. wide and 4.5–7 mm. high; the tunics concentric, long-cusped at the apex, light brown: 2 basal leaves to 9 cm. long, closely superposed, subterete-filiform, acute, glabrous; the cauline leaf sheathing for ⅓ its length, 5 cm. long: stem simple or 1-branched, filiform, flexuose, glabrous; the inflorescence a 1–5-flowered lax, distichous spike, the branch 1-flowered: outer spathe as long as the perianth-tube, to 5 mm. long, oblong-ovate, abruptly acute or subobtuse, herbaceous, hyaline-edged and membranous at the tip; the inner spathe to 4.5 mm. long: ovary 1–2 mm. long, subturbinate: perianth-tube to 2.5 mm. long, darker in color than the tepals: outer tepals to 6.5 mm. long and 2 mm. wide, obovate-elliptic, obtuse; the inner to 5 mm. long, 2.5 mm. wide, obovate, obtuse, concolorous (?): stamens about ½–⅔ as long as the outer tepals; the anthers 2.5 mm. long; the filaments 2 mm. long: style 6 mm. long, equal to the anthers; the stigmas about 0.75 mm. long: capsule and seeds not seen.—Handbk. Irid. 154 (1892).

TYPE: *Zeyher*, no. 3965, from the Zonder Einde Mts. (?), Cape Prov. (K, ISOTYPE in B).

HABITAT: sandy places.

SPECIMENS SEEN: Cape Province: in arenosis prope Sir Lowry's Pass, 300 ft., July 16, 1892, *Schlechter*, no. 1186 (B).

Although Baker named this species for Dr. Pappe, and cited one of his collections in the original description, I have not seen this specimen. The Kew specimen of *Zeyher*, no. 3965 (cited in the original description) is marked "type," in the handwriting of N. E. Brown, and the Berlin sheet of this number is marked "Typus." Consequently, I am accepting this as the type collection. Baker, in Fl. Cap. vi. 68 (1896), states that the leaves are dilated at the base, but I am unable to see that this is the case. Baker also referred to the flower as "concolorous, reddish." From an examination of the type and isotype, it appears to me that the flowers were probably whitish or very light yellow, with the outer tepals red-flushed on the exterior. If the identification of *Schlechter*, no. 1186 as this species is correct, the flower was undoubtedly somewhat bicolored.

5. G. JUNCEA (Link) A. Dietr. Plant 20–35 cm. tall: corm ovoid or subglobose, 1 cm. high (excl. cusps) and 8–9 mm. wide; the tunics concentric, smooth, shiny brown, the apical cusps to 1 cm. long: basal leaves 3, the lowermost reduced to a dark brown sheath; the others superposed, long-sheathing, 10–36 cm. long, 1 mm. wide, filiform, subquadrangular or subterete, glabrous, acute, the edges and midrib very thick; the single cauline leaf inserted on the stem below the middle, long-sheathing, 5.5–7 cm. long, glabrous: stem simple, terete, glabrous, to 30 cm. long, shorter or longer than the leaves; the inflorescence a lax, flexuose, secund, 3–6-flowered spike: outer spathe to 6 mm. long, oblong-lanceolate, obtuse or mucronate, herbaceous below, white- or brown-membranous above, longer than the perianth-tube; the inner spathe as long as the outer: ovary to 3 mm. long, turbinate: perianth-tube 1–2 mm. long: outer tepals to 8.5 mm. long (1 cm. on the type), 2.5 mm. wide, elliptic-obovate, subacute or obtuse, white or pale yellow, flushed red on the exterior; the inner tepals to 7.5 mm. long, whitish: stamens ½–⅔ as long as the outer tepals; the anthers to 3 mm. long; the filaments to 2.5 mm.: style about 6 mm. long, equalling the anther apex; stigmas 1 mm. long: capsule and seeds not seen.— A. Dietr., Sp. Pl. ii. 587 (1833). *Ixia juncea* Link, Enum. i. 50 (1821). *Ixia scillaris* Thunb., Diss. Ixia 13 (1783), non L. *Ixia ramosa* Ker-Gawl. in Bot. Mag. xvi. sub t. 549 (1802). *Ixia phalangioides* Roem. & Schult., Syst. i. 385 (1817), *nomen illegitimum*. *Geissorhiza setacea* sensu Klatt in Linn. xxxiv. 656–657 (1865–66), non (Thunb.) Ker-Gawl. *G. humilis* var. *G. juncea* (Link) Baker, Handbk. Irid. 153 (1892), as to name but not as to plant. *G. secunda* var. *G. setifolia* (Eckl.) Baker in Journ. Linn. Soc. xvi. 94 (1877), as to name. *G. ramosa* (Ker.) Klatt in Durand & Schinz, Conspect. Fl. Afr. v. 180 (1893), as to name. *G. humilis* var. *juncea* (Link) Baker ex Klatt in Durand & Schinz, Conspect. Fl. Afr. v. 178 (1893), as to name. *G. setifolia* Eckl. ex Klatt in Durand & Schinz, op. cit. v. 180 (1893).

TYPE: *Bergius*, from Cape of Good Hope, without precise locality, collected Sept. 19, 1815 (?) (B).

HABITAT: abundant on hills and mountain slopes in Cape Div., occurring elsewhere infrequently.

SPECIMENS SEEN: South Africa, without precise locality, *Burmann f.* (Gen), *Leibold* (B), *Lichtenstein* (B), *Hb. Link*, no. 1205 (B), *Mund & Maire* (B), *Otto*, no. 13, in Hb. Spr. (B), *W. M. Rogers* (K), *Hb. Schlechtendal*, coll. in 1826 (Gen), *Verreaux* (Gen), *Zeyher*, no. 3963

(B): Cape Div.: top of Table Mt., *Ecklon*, no. 315 (K, Gen), Table Mt., at 2300 ft., Dec. 25, 1891, *Schlechter*, no. 92 (B), at 2500 ft., Dec. 25, 1891, *Schlechter*, no. 130 (B, K), Platte Klip Gorge, Table Mt., 3300 ft., Nov. 18, 1897, *Galpin*, no. 4688 (K), Platte Klip Gorge, at 2500 ft., Nov. 18, 1897, *Galpin*, no. 4689 (K); Devil's Peak, Aug. 25, 1895, *Wolley Dod*, no. 520 (K), wet rocks beyond Waterfall, Devil's Peak, Oct. 24, 1897, *Wolley Dod*, no. 3368 (K); eastern side of Lion's Head, 300 met., Aug. 28, 1900, *Diels*, no. 133 (B), Lion's Head, Aug. 27, 1883, *Wilms*, no. 3702 (B); Lion's Rump, Sept., *Dr. Pappe* (K); Muizenberg, Sept., 1846, *Prior* (K); Kalk Bay, Sept. 1, 1846, *Prior* (K); Simons Bay, *C. Wright*, no. 248 in part (G, K): George Div.: George, Sept., 1827, *Verreaux* (Gen): near Worcester, *Ecklon & Zeyher*, Irid. no. 217 (B).

A glance at the synonymy of this species will show that there has been much confusion. It is the plant which is commonly known as *G. setifolia* Eckl., but the original use of that name was invalid. Before the name was finally validated, others had been used for the species, preventing the use of Ecklon's name. The first valid name which I can find is *Ixia ramosa* Ker-Gawl., a new name given in 1802 to *Ixia scillaris* Thunb., non L. So far as can be determined, this name was not transferred to *Geissorhiza* until Klatt did so in 1893. As his reference to an earlier publication in Linnaea xxxiv. 657 (1865–66) shows, he was under the impression that he was dealing with another plant, the species which will be treated later in this study as *G. ramosa* Ker ex Klatt. Unfortunately, the presence of this earlier *G. ramosa* bars the use of this trivial for the plant here called *G. juncea*. In 1893, also, Klatt validated Ecklon's name, *G. setifolia*, by reference to *G. setacea* sensu Klatt, non (Thunb.) Ker-Gawl. Inasmuch as Link described *Ixia juncea* in 1821, the name being transferred to *Geissorhiza* in 1833 by A. Dietrich, most of the confusion of nomenclature seems unnecessary.

The identity of *Ixia scillaris* Thunb., non L., and hence of *I. ramosa* Ker-Gawl., with *I. juncea* and *G. setifolia* is shown by N. E. Brown's annotation on a specimen collected by W. M. Rogers (K): "Identical with the type specimens of *Ixia scillaris* Thunb. sheet alpha, not sheet beta of Thunberg's Herb." This specimen, most of the specimens cited under *G. setacea* sensu Klatt, and the Bergius specimen (B) which I take as the type of *I. juncea* Link are all conspecific. The details in the original description of *I. juncea*, especially the measurements, are apparently all taken from this Bergius specimen, except for the details of the corm. These were probably taken from *Hb. Link*, no. 1205 (B), which is labelled "*I. juncea* m[ihi]."

An additional note of confusion was added by Baker, in Journ. Linn. Soc. xvi. 94 (1877), who regarded *G. setifolia* as a variety of *G. secunda*, and, as usual, made the new combination illegitimately. This was continued in Handbk. Irid. 155 (1892) and in Fl. Cap. vi. 69 (1896); in the index of this last work, the combination *G. secunda* var. *setifolia* was validly made. Baker's brief description does not fit *G. juncea*, nor do the specimens cited belong to that species. As previously noted, Baker regarded *G. juncea* as a variety of *G. humilis*. No other species in the genus, I think, has been so completely misunderstood and confused as *G. juncea*.

6. G. JUNCEA, var. **pallidiflora** (Schltr.), comb. nov. Plant 20–50 cm. tall: corm ovoid, 1 cm. wide, 1.5 cm. high; the concentric tunics long-cusped at the apex: basal leaves to 33 cm. long, but usually shorter than the base of the inflorescence; the cauline leaf over ½ sheathing, 5–11 cm. long, details as in the species; inflorescence a 2–9-flowered lax, distichous spike: outer spathe exceeding the perianth-tube, to 7 mm. long; inner spathe as long: ovary ± 3 mm. long: outer tepals to 9 mm. long, 3 mm. wide, obovate, obtuse, yellow, flushed red-brown on the exterior; the inner tepals to 7.5 mm. long, obovate, obtuse, yellow: stamens about ¾ as long as the outer tepals; the anthers 4 mm. long; the filaments 3 mm. long: style to 7 mm. long, not quite equalling the anther; the 3 mm. stigmas recurved, exceeding the anther: capsule and seeds not present.—*G. pallidiflora* Schltr. in Engler, Bot. Jahrb. xxvii. 98 (1899).

TYPE: *Schlechter*, no. 9088, in arenosis humidis inter Ceres Road et Bainskloof, at 1000 ft. alt., Nov. 11, 1896 (B).

HABITAT: Ceres, Malmsbury, Piquetberg, Tulbagh, and Paarl Divs.

SPECIMENS SEEN: South Africa, without precise locality, *Burmann f.* (Gen); Drakenstein Mts., 2000–3000 ft., *Drège* (B, Gen): Piquetberg Div.: in collibus ad flum. Berg Rivier pr. Piquetberg, Sept. 10, 1892, *Schlechter*, no. 5273 (B): Malmesbury Div.: in the neighborhood of Hopefield, Sept., 1883, *Bachmann*, no. 228 (B), Hopefield, Zwartland, Sept., 1885, *Bachmann*, no. 1090 (B), 6 miles from Malmesbury on the road to Moorreesburg, Aug. 25, 1932, *L. Bolus in Hb. Bolus*, no. 20647 (K), in collibus, Malmesbury, 1000 ft., Oct. 3, 1892, *Schlechter*, no. 1652 (B): Tulbagh Div.: Tulbagh Cataract, 1500 ft., Oct., 1884, *H. Bolus*, no. 5388 (K), top of Witsenberg Mt. near Steendahl, 3300 ft., Oct., 1884, *H. Bolus*, no. 5477 (K), Winterhoeksberg, 1000–5000 ft., *Ecklon & Zeyher*, Irid. no. 227 in part (B, Gen), Winterhoeksberg, 1000–5000 ft., *Zeyher*, no. 3963 (B): Paarl Div.: between Paarl and Pont, *Drège*, no. 8460 (K, Gen).

If only the type and other specimens from the more northern portion of its range were seen, it might be possible to maintain this plant as specifically distinct from *G. juncea*. Unfortunately, in the more southern parts, it intergrades rather badly with *G. juncea.* On the whole, it tends to have deeper yellow flowers, often, but not invariably, distichous rather than secund in arrangement. The reddish flush on the exterior of the outer tepals may be lacking in some cases. Generally, it is somewhat taller and fewer-flowered than *G. juncea*, but specimens have been seen with more flowers than are found in the species.

7. G. RAMOSA Ker-Gawl. ex Klatt. Plant to 48 cm. tall: corm ovoid to subglobose, to 1.3 cm. wide and 1.3 cm. high; the imbricate tunics cusped at apex: basal leaves 2, to 30 cm. long and 2 mm. wide, nearly equal to or shorter than the base of the inflorescence, linear, acute, glabrous, the midrib and edges very thick; the single long-sheathing cauline leaf to 24 cm. long: stem terete, glabrous: the inflorescence branched (rarely simple); the branches subtended by short spathiform bracts, erect or divaricate, each branch 3–8-flowered in a secund, subflexuose spike: outer spathe to 7 mm. long; those of the upper flowers in the inflorescence obscurely tridentate, the lower portion herbaceous, the upper part membranous, oblong-ovate, somewhat obtuse, the inner spathe about as long as the outer: ovary turbinate, 2–3 mm. long: perianth-tube shorter than spathes, 2–3 mm. long, light straw-brown in color: tepals subequal, to 1.3 cm. long and 4 mm. wide, but usually smaller, oblong-obovate, obtuse, reddish-purple: stamens often nearly equal to the tepals in length, one stamen much shorter than the others; anthers to 3 mm. long; filaments to 7 mm. long: style nearly equal to the anthers; the stigmas exceeding them: capsule turbinate, to 7 mm. long; seeds subglobose to reniform, 0.75 mm. long, dark-brown.—Ker-Gawl. ex Klatt in Linn. xxxiv. 657 (1865–66). *G. ramosa* (Ker-Gawl.) Klatt in Durand & Schinz, Conspect. Fl. Afr. v. 180 (1893), as to plant. *G. secunda*, var. *G. ramosa* (Klatt) Baker, Handbk. Irid. 155 (1892).

TYPE: *Ecklon & Zeyher*, Irid. no. 229 in part (B; ISOTYPE in Gen), collected near Worcester, Cape Province.

HABITAT: sandy places, from Tulbagh Div. to Riversdale Div.

SPECIMENS SEEN: Tulbagh Div.: Tulbagh, *Pappe* (K); Winterhoeksberg, 1000–5000 ft., *Ecklon & Zeyher*, Irid. no. 227 in part (B); on the Witsenberg (?), *Ecklon & Zeyher* (G, B); Witsenberg, 2000–3000 ft., *Zeyher*, no. 1596 (B, Gen): Worcester Div.: Dutoits Kloof, *Drège*, no. 8481a (K, B, Gen): Cape Div.: Rietvalley, *Mund & Maire* in part (B): Caledon Div.: Vogelgat, Dec. 2, 1896, *Schlechter*, no. 9577 (K, B, Gen): Swellendam Div.: Swellendam Mt., ca. 2500 ft., Oct. 16, 1897, *Galpin*, no. 4680 (K); Tradouw Pass near Zuurbraak, 1200 ft., Oct. 15, 1897, *Galpin*, no. 4697 (K): Riversdale Div.: Valley River, on the Lange Bergen near Kamscheberg, *Burchell*, no. 7044 (K).

So far as can be determined, Ker-Gawler never described a *G. ramosa*, nor did he use it as a new combination. He did create *Ixia* *ramosa* as a new name for *I. scillaris* Thunb., non L., both names occurring in the synonymy of *G. juncea* of the present treatment. Klatt described this species, cited specimens, and gave no synonymy, so that as it stands it is a new species, incorrectly ascribed to Ker-Gawler. In 1893, Klatt cited it (in Durand & Schinz, Conspect. Fl. Afr. v. 180) as *G. ramosa* (Ker) Klatt, giving *I. ramosa* Ker as a basinym, and the place of publication as Klatt in Linn. xxxiv. 657 (1865–66), showing that he probably intended it as a new combination in the first place. It seems to me that a time-lapse of nearly thirty years is too long to permit treating this as a new combination dating from 1865–66. Unless *G. ramosa* Ker-Gawl. ex Klatt is treated as having been described as a new species, *G. juncea* would become a nomenclatural synonym of *G. ramosa* (Ker) Klatt, as would the name *G. setifolia* Eckl. ex Klatt, forcing the use of the trivial *ramosa* for an unbranched plant, and leaving the plant here treated as *G. ramosa* nameless. I see no point in upsetting the nomenclature in this manner.

In his description in 1865–66, Klatt cited three specimens, all of which have been seen. The first, a *Drège* collection, is not *G. ramosa* as that plant is generally understood, and the third, *Ecklon & Zeyher*, Irid. no. 234, is a mixture of two species of *Hesperantha*. The second, *Ecklon & Zeyher*, Irid. no. 229, now at Berlin, agrees reasonably well with the description, despite the fact that the two left-hand specimens appear to be *G. juncea*. Consequently, I have selected this sheet as the type of *G. ramosa* Ker-Gawl. ex Klatt, excluding the two left-hand specimens.

Superficially, this species bears a close resemblance to *G. juncea*, but it has imbricate corm-tunics, purplish flowers, unequal stamens, and is usually well-branched, so that the two species should be fairly easily distinguishable.

Baker, possibly in despair, treated this plant as a variety of *G. secunda*, Handbk. Irid. 155 (1892). Most of the specimens cited for the variety in Fl. Cap. vi. 70 (1896) are actually *G. ramosa*, except for *Mader in Herb. MacOwan*, no. 2165, which seems to me to be *G. secunda*.

8. G. **Burchellii,** spec. nov. Cormus incompletus, ovoideus vel subglobosus, ± 9 mm. altus, 7 mm. latus; tunicae imbricatae (?), brunneae, nitidae, apice cuspidatae: folia basalia 2–3, 10–20 cm. longa, 2 mm. lata, basi vaginantia, lamina filiformis, longe attenuata, acuta, glabra, nervo primario prominente, marginibus incrassatis; folium caulinum 4–9 cm. longum, ½–⅔ vaginans: caulis simplex, teres, glaber, 2–3-fl., 23–38 cm. longus, bracteis 2 brevibus, 1–2 cm. longis,

appressis, ornatus: spatharum valvae aequales, ad 1 cm. longae, exterior oblongo-ovata, subtrilobulata vel obtusa, herbacea, apice rubro-purpurea suffusa: ovarium ad 4 mm. longum, turbinatum: perianthii tubus tenuis, ad 4 mm. longus: tepala subaequalia, ad 1.8 cm. longa, 5 mm. lata, elliptico-obovata, apice obtuse rotundata, vix retusa, concolora, lilacino-purpurea: antherae ad 5 mm. longae, filamenta inaequalia, 2 ad 1.3 cm. longa, 1 ad 1 cm. longum: stylus ad 1.2 cm. longus, quam stamina longiora parum brevior; stigmata ad 2 mm. longa, stamina excedentia: capsula seminaque non visa.

TYPE: *Schlechter*, no. 2160 (B), from Swellendam Div.: Langebergen near Zuurbraak, Jan. 23, 1893.

HABITAT: apparently in moist places, at rather high altitudes (3500 ft., according to the data on the type).

SPECIMENS SEEN: South Africa, without precise locality, *Burchell*, no. 7322B (K).

This species bears a deceptive resemblance to *G. hesperanthoides* Schltr., but the corm-tunics are not fibrous and the stamens are very unequal. It resembles *G. ramosa* in its unequal stamens, but the flower-shape and -color, as well as the size and number of the flowers, differentiate it easily from that plant.

Although this species has been named for the great collector, W. J. Burchell, whose no. 7322B was the first specimen seen, it has seemed advisable to designate *Schlechter*, no. 2160 as the type, since that has full data as to locality and habitat. The Burchell specimen may be regarded as a co-type, if the locality-data can be ascertained.

9. G. FURVA Ker. ex Baker. Plant about 10–11 cm. tall: corm small, ± 1 cm. high, 5 mm. wide, ovoid; tunics concentric, hard, brown, apically cusped: basal leaves 2, filiform, subquadrangular, glabrous, acute, to 11.6 cm. long; the cauline leaf about 3.5 cm. long, sheathing for half its length: stem simple, terete, glabrous, to 10 cm. long, one-flowered: outer spathe to 8 mm. long, longer than the perianth-tube, oblong-ovate, blunt, brown-membranous in the upper portion; the inner as long as the outer: ovary 2 mm. long, ovoid: perianth-tube ± 2 mm. long: tepals subequal, 1.7–1.6 cm. long, 6 mm. wide, obovate, subacute, red-purple: stamens ⅔–¾ as long as the tepals; the anthers 4 mm. long; the filaments 8 mm. long: style 1.4 cm. long, little over half as long as the anthers; the stigmas 3 mm. long, exceeding the anthers: capsule and seeds not present.—Baker, Handbk. Irid. 155 (1892); Ker-Gawl. in Koenig and Sims, Ann. Bot. i. 224 (1804), *nomen nudum*.

TYPE: *Drège*, no. 8478 (K; ISOTYPE in Gen), collected between Paarl and Pont, Cape Province.

HABITAT: low (under 1000 ft.), stony hills, covered with shrubs, according to Drège's label.

Although Baker attributed this species to Ker-Gawler, the latter's *G. furva* was a *nomen nudum*, and apparently remained so until Baker validated the name by a description in 1892. Of the three specimens cited in the original description, I have seen only one. Since this fits the description reasonably well, and even has the remnant of a corm, it may be designated as the type. Baker stated that the anthers were longer than the filaments, but in the type, they are obviously only half as long.

G. furva can be regarded as a connecting link between subsection *Filiformes*, where its leaf-structure would place it, and the next subsection, for its flower has definite similarities to that of *G. Rochensis*.

Subsection **Ventricosae**, subsect. nov. Folia angusta vel lata; folia basalia super vaginas angustata, in lamina dilatata; vagina folii caulini ventricosa; laminae omnes pluri-nervatae; cormi tunicae imbricatae. Type-species: *G. imbricata* (DelaR.) Ker-Gawl.

10. G. Mathewsii L. Bol. Plant 10–22 cm. tall: corm ovoid, to 1 cm. high, 8 mm. diam.: basal leaves 2, 7–15 cm. long, 2–3.5 mm. wide, linear-ensiform, the blade narrowed above the sheath then widening, multinervate (7–9), acute, glabrous; the cauline leaf 8–12 cm. long, with a ventricose sheath, the blade linear-ensiform, indented adaxially above the sheath, multinervate: stem simple or 1-branched within the cauline leaf-sheath, 7–21 cm. long, terete, glabrous; the inflorescence a 1 5-flowered flexuose, secund spike: outer spathe to 1 cm. long, ovate, somewhat membranous in the upper half, trilobulate, the middle lobe acute or mucronate; the inner spathe nearly as long: ovary $\pm$ 3 mm. long, subturbinate: perianth-tube about 2 mm. long: tepals subequal, to 1.6 cm. long, 9 mm. wide, obovate-cuneate, reddish on the lower half, the remainder dark blue-purple: anthers 4–5 mm. long; filaments 9 mm. long: style 7 mm. long; the stigmas to 4 mm. long, broad, flat, thick, the edge heavily papillate.—L. Bol. in Ann. Bol. Herb. iv. 42 (1926).

Type: *J. W. Mathews*, Aug.–Sept., 1923, near Darling (in Bolus Herb., no. 18502, not seen).

Habitat: damp and marshy places.

Specimens seen: Malmesbury Div.: Malmesbury, Sept., 1892, *Th. Kässner* (B).

Although I have not been able to see the type, the single specimen seen agrees so well with the excellently detailed description given by Dr. Bolus that there seems no doubt of its identity. Certain portions of the description given here have been drawn from the original description.

11. G. Mathewsii L. Bol., var. **eurystigma** (L. Bol.), comb. nov. Differs from the species primarily in its longer perianth-tube (6–7

mm.), shorter filaments (4.5 mm.), and longer style (1.4 cm.).—*G. eurystigma* L. Bol. in S. Afr. Gard. xxi. 281–282, fig. E (1931). *Ixia secunda* DelaR., Descr. 17 (1766), non Bergius, Pl. Cap. 6 (1767).

TYPE: *L. Bolus*, Sept., 1931, near Mamre, Malmesbury Div. (in Herb. Bolus, no. 19876, not seen; ISOTYPE in K).

HABITAT: known to me only from Malmesbury Div., in damp or marshy, sandy places.

SPECIMENS SEEN: South Africa, without precise locality, *Burmann f.* (Gen), *Hb. Ventenat* (Gen): Malmesbury Div.: Groenekloof, ca. 500 ft. alt., Sept., 1884, *MacOwan in Herb. Norm.*, no. 506 in part (G, K, B, Gen); between Mamre and Darling, Sept., 1932, cult. in Nat. Bot. Gard., no. 2316/32, *J. Steytler* (K).

With the exception of Ker-Gawler, in Bot. Mag. xvii. t. 597 (1802), authors have generally assumed that *Ixia secunda* De la Roche and *I. secunda* Berg. are identical. Such an assumption was even made by Bergius himself in the Addenda to his work, Pl. Cap. 360 (1767). Nevertheless, the two, as Ker recognized, are not the same. De la Roche's plant was apparently glabrous, for no mention of pubescence was made; the flowers were described as having a purple throat and a very dark blue limb, not concolorous; the perianth-tube was longer than the spathes; and the stigma was broad and membranous, with a crenate margin. *I. secunda* Berg., on the other hand, was reported as having a shortly villous stem, long, glabrous leaves, several to many red-purple or blue-purple concolorous flowers in a secund spike, with the perianth-tube shorter than the spathes, and the stigma narrow and apparently conduplicate. This latter plant, common and widespread in western and southwestern Cape Province, is the one transferred to *Geissorhiza* by Ker-Gawler in Bot. Mag. xviii. sub t. 672 (1803). Therefore, it serves to block the transfer of *I. secunda* DelaR. to *Geissorhiza* under that trivial name.

As it happens, Dr. Louisa Bolus has described two species with stigmas similar to that described by De la Roche, and they are the only plants in the genus which do fit that description. As they appear to me to be conspecific, although varietally distinct, the long-tubed plant, *G. eurystigma*, which can be identified with *I. secunda* DelaR. with some confidence, is here treated as a variety of *G. Mathewsii*.

Although these plants have a superficial resemblance to *G. monantha*, they can readily be distinguished by their smooth stems, usually 3–4-flowered inflorescences, trilobulate spathes, longer perianth-tubes (at least in var. *eurystigma*), and, above all, by the broad flat stigmas. In the variety, there is a tendency for the style and stamens to be unilateral, but this is difficult to distinguish in pressed material. Occasionally, it should be noted, the basal leaves are very few-nerved.

12. C. ROCHENSIS (Ker-Gawl.) Ker-Gawl. Plant rather slight, 10–14 cm. tall: corm ovoid, ± 1 cm. high; the imbricate tunics finely cusped at the apex: basal leaves 2, glabrous, filiform-subulate (or almost quadrangular), exceeding the inflorescence, ± 1.5 mm. wide; the cauline leaf with a very ventricose sheath, to 8.5 cm. long: stem simple, terete, glabrous, 1–2-flowered: outer spathe to 1.1 cm. long, ovate-lanceolate, longer than the perianth-tube, herbaceous, membranous at the truncate, trilobulate apex, the middle lobe somewhat longer than the others; the inner spathe somewhat shorter, sometimes subherbaceous: ovary to 3 mm. long: perianth-tube to 6–7 mm. long: tepals subequal, to 1.8 cm. long, ± 1.1 cm. wide, obovate-cuneate, obtuse, dark purple, with a basal foveole: stamens nearly as long as the tepals; the anthers 4–5 mm. long; the filaments ± 8 mm. long: style equalling the anthers; the recurved stigmas exceeding them: capsule and seeds not seen.—Ker-Gawl. in Koenig and Sims, Ann. Bot. i. 224 (1804). *Ixia Rochensis* Ker-Gawl., var. *palmaris* Ker-Gawl. in Bot. Mag. xvii. t. 598 (1802). *G. Rochensis* var. *pauciflora* A. Dietr., Sp. Pl. 586 (1833). *G. Rocheana* Sweet, Hort. Brit. (ed. 1) 399 (1826–27). *G. tulipifera* Klatt, Ergänz. 56 (1882), in part. *Rochea venusta* Salisb. in Trans. Hort. Soc. Lond. i. 322 (1812). *G. Rochensis*, var. *G. monantha* (Sweet) Baker, Handbk. Irid. 156 (1892), as to plant, but not name.

TYPE: described and figured from living material, with a sheet labelled *Ixia azurea* in Herb. Banks. cited in addition.

HABITAT: sandy places, Malmesbury Div. to Cape Div.

SPECIMENS SEEN: Malmesbury Div.: Groenekloof, 500 ft., Sept., 1884, *MacOwan in Herb. Norm.*, no. 506 in part (G, B, K); near Yserfontein, Sept. 13, 1931, *T. M. Salter*, no. 1345 (K); ad rivulos prope Malmesbury, 250 met., Oct. 1, 1892, *Schlechter*, no. 1610 in part (B): Paarl Div.: near Paarl, *Drège*, no. 8486 in part (B, type of *G. tulipifera;* Gen): Cape Div.: Table Mt., *Ludwig* in part (B); sand dunes at Saldanha Bay, *Ecklon & Zeyher*, Irid. no. 219 in part (Gen).

Since *Ixia Rochensis* var. *palmaris* was the first to be described and the only variety figured by Ker-Gawler in 1802, it must be taken as the typical variety of *Geissorhiza Rochensis*. In its extreme forms it appears distinct, but it intergrades markedly with the following variety, occurs with it, and possibly should not be separated from it.

13. G. ROCHENSIS, var. SPITHAMAEA (Ker-Gawl.) Ker ex Baker. Plant tall, 10–30 cm.: corm ovoid, 1 cm. wide and 1.2 cm. high; the imbricate tunics hard, dark brown, finely cusped at apex: basal leaves 2, 8.5–24 cm. long, 1–2.5 mm. wide, thick, sometimes almost quadrangular, linear, acute, glabrous, edges, midrib, and sometimes

1–2 other nerves thick and prominent; the cauline leaf with a very ventricose sheath, multinervate, glabrous, the blade extremely narrow, 7–18 cm. long, usually equalling or exceeding the inflorescence: stem simple or branched, terete, glabrous, slender or stout, flexuose; the inflorescence a 2–7-flowered lax, secund, flexuose spike: outer spathe to 2 cm. long, usually 1–1.5 cm. long, ovate-lanceolate, longer than the tube, herbaceous except at the truncate, trilobulate apex; the inner to 1.5 cm. long, usually shorter, sometimes subherbaceous: ovary to 4 mm. long, oblong-ovoid: perianth-tube 6–8 mm. long: outer tepals to 2.3 cm. long, 1.3 mm. wide, obovate-cuneate, obtuse, dark purple; the inner like the outer, but 3 mm. shorter: stamens ¾ as long as the tepals; the anthers 6 mm. long; the filaments to 1.2 cm. long: style to 2.5 cm. long, nearly as long as the tepals; stigmas 4 mm. long, dark purple: capsule turbinate, 6 mm. long; seeds small, brown, subglobose.—Baker, Handbk. Irid. 156 (1892), incorrectly attributed to Ker. *Ixia Rochensis*, var. *spithamaea* Ker-Gawl. in Bot. Mag. xvii. sub t. 598 (1802). *G. Rochensis*, var. *multiflora* A. Dietr., Sp. Pl. 586 (1833). *Ixia radians* Thunb. in Hoffm., Phyt. Blätt. i. 3 (1803). *G. radians* (Thunb.) Diels in Engler and Prantl, Nat. Pflanzenfam. (rev. ed.) xva. 484 (1930), incomplete combination. *Ixia LaRochei* Roem. & Schult., Syst. i. 379 (1817). *G. LaRochei* (R. & S.) Loud., Hort. Brit. (ed. 1) 16 (1830). *G. monantha* Sweet, Hort. Brit. (ed. 2) 503 (1830), non (Thunb.) Eckl. *G. tulipifera* Klatt in part, Ergänz. 56 (1882). *Ixia secunda* sensu Houtt., Nat. Hist. Deel II, xii. 33–34, t. 78, f. 1 (1780), non DelaR. *G. Rochensis*, var. *G. monantha* (Sweet) Baker, Handbk. Irid. 156 (1892), as to name, but not as to plant.

Type: original description cited a sheet in Herb. Banks., labelled *Ixia violacea*. In the British Museum, if the specimen has been preserved (not seen).

Habitat: with the species.

Specimens seen: South Africa, without precise locality, *Burmann f.* (Gen), *Leibold* (Gen): Malmesbury Div.: near Malmesbury, 250 met., Oct. 1, 1892, *Schlechter*, no. 1610 in part (B); Groenekloof, 500 ft., Sept., 1884, *MacOwan in Herb. Norm.*, no. 506 in part (G, K, B, Gen), Sept. 23, 1883, *MacOwan*, no. 2281 (K); Malmesbury, Sept., 1892, *Th. Kässner* in part (B); near Groenekloof, 300 ft., Oct., 1878, *H. Bolus*, no. 4340 (K): Paarl Div.: near Paarl, *Drège*, no. 8486 in part (B, K): Cape Div.: Table Mt., *Ludwig* (B); dunes at Saldanha Bay, below 1000 ft., *Ecklon & Zeyher*, Irid. no. 219 (B); Caapsche Vlakte, Oct. 14, 1815, *Bergius* (B).

Like *G. monantha*, this species and its variety might be confused with *G. Mathewsii*, var. *eurystigma*, but the stigma and cauline leaf of *G. Rochensis* are quite different. The latter has the cauline leaf adaxially incised above the sheath, then widened into a relatively broad, many-nerved, tapering, linear-ensiform blade. *G. Rochensis* has the cauline leaf sheath very ventricose, narrowing abruptly into a narrowly linear, sometimes almost subulate, blade. Its stigma is narrow in comparison with that of *G. Mathewsii*, var. *eurystigma*.

On the Kew sheet of *MacOwan in Herb. Norm.*, no. 506, N. E. Brown has noted: "Matches the type specimen of *Ixia radians*, Thunb. in Thunberg's Herbarium." If this is the case, it is rather surprising to find Diels, in his treatment of the family in the revised edition of Engler and Prantl, making *I. radians* synonymous with *Geissorhiza hirta*. It becomes even more surprising in view of the fact that the basinym, *Ixia hirta*, was described in 1783, while *I. radians* dates from 1803.

The Burmann specimen cited above, it might be noted, is apparently that from which Houttuyn made his drawing of the plant which he called *Ixia secunda*. His drawing is so faithful that it even reproduces one or two tears or breaks in tepals and spathes, which are plainly visible in the pressed specimen.

14. G. SPLENDIDISSIMA Diels. Plant 15–22 cm. tall: corm ovoid or subglobose, basally somewhat truncate, to 1.3 cm. high, 1 cm. wide; the thick tunics imbricate: basal leaves 2, to 17 cm. long, 1–2 mm. wide, linear-attenuate, acute, the edges thickened, hirtellous; the cauline leaf with a ventricose sheath 6.5 cm. long, the blade 6 cm. long, 4 mm. wide, the numerous prominent ribs hirtellous: stem 1-branched, or simple, the main axis to 13 cm. long, terete, hispidulous, the hairs recurved upwards, slightly hooked; the inflorescence a 4–5-flowered, lax, secund spike: outer spathe to 1.9 cm. long, ovate-lanceolate, acute, herbaceous, subglaucous, membranous at the apex, very much longer than the perianth-tube, carinate, many-nerved, the nerves slightly hirtellous; the inner spathe to 1.4 cm. long: ovary 2–4 mm. long, oblong-turbinate: perianth-tube to 5 mm. long: tepals brilliant dark purple, deeper at the base, subunguiculate, the claw and tube yellowish-green; outer tepals to 2.5 cm. long, 1 cm. wide, obovate, acute; the inner to 2.2 cm. long, 1.3 cm. wide, ovate-obovate, subobtuse: anthers 7 mm. long; filaments to 1 cm. long: style 1.5 cm. long; the stigmas recurved, papillose, 3 mm. long, a trifle exceeding the anthers: capsule and seeds not present.—Diels in Engler, Bot. Jahrb. xliv. 117 (1909).

TYPE: *Diels*, no. 627, Sept. 13, 1900, from Oorlogskloof, on the Bokkeveld, Calvinia Div., at 750 met. alt. (B).

HABITAT: hard clay-loam, in scanty shrubbery, Calvinia Div.

SPECIMENS SEEN: Calvinia Div.: Loeriesfontein Road, Nieuwoudtville, Sept., 1930, *L. Bolus, in Herb. Bolus*, no. 19439 (K); Nieuwoudtville, Sept., 1931, *H. Buhr*, cult. in Nat. Bot. Gard., no. 823/30 (K).

This beautiful plant is well-deserving of its name, for it is probably the most striking member of the genus, as to color. Diels speaks of its relationship to *G. hirta* (to use the name then current), saying that it can be distinguished by its green spathes and by the perianth-color. Still more distinctive are the facts that it has a hispidulous or hirtellous stem, while *G. hirta* has a glabrous stem, its basal leaves are of a wholly different type, and the pubescence on the leaf nerves is quite different. It appears to me to be much closer to *G. Rochensis* var. *spithamaea.*

15. G. BICOLOR (Thunb.) N. E. Br. Plant about 12 cm. tall: corm not seen: basal leaves 2, to 10 or 12 cm. long, basally sheathing, narrowed above the sheath and widening into a linear-attenuate, subobtuse, glabrous, subfalcate blade, 3–4 mm. wide, 3–7-nerved, the edges thickened; the cauline leaf to 10 cm. long, with a basal ventricose, multinerved sheath, adaxially incised at the apex, widening into a linear-falcate, attenuate, ± 7-nerved, glabrous blade: stem simple, or 1-branched within the cauline leaf-sheath, terete, glabrous, 4–11 cm. long; the main axis 1–3-flowered, the branch 1-flowered: outer spathe to 1.3 cm. long, oblong-ovate, obtuse or abruptly acute, herbaceous, brown- or purple-tinged at the apex; the inner spathe nearly as long: ovary 2–4 mm. long, subturbinate: perianth-tube to 5 mm. long, shorter than the spathes, dark purple: tepals subequal, ± 3 cm. long, 1 cm. wide, obovate, obtuse, yellow, with the base dark purple: stamens little more than half the length of the tepals; the anthers to 6 mm. long; the filaments to 1.3 cm. long: style to 2.5 cm. long, about equal to the anther apex; the stigmas to 5–6 mm. long, exceeding the anthers: capsule to 8 mm. long, obovoid-turbinate; the seeds immature.—N. E. Brown in Journ. Linn. Soc. xlviii. 44 (1928). *Ixia bicolor* Thunb. in Hoffm., Phyt. Blätt. i. 3 (1803).

TYPE: sheet alpha, labelled *Ixia bicolor* in Herb. Thunb. (not seen).

HABITAT: sandy places; known to me only from Malmesbury Div.

SPECIMENS SEEN: Malmesbury Div.: near Malmesbury, 400 ft., Oct. 2, 1892, *Schlechter*, no. 1625 (B); near Mamre, Sept., 1888, *MacOwan*, no. 2488.

This little-understood species was treated as identical with *G. purpureo-lutea* Baker, by Baker in Fl. Cap. vi. 68 (1896), but it seems to me that N. E. Brown was correct in regarding it as distinct. By error, Brown gave the reference for the basinym, *Ixia bicolor*, as Thunb., Diss. Ixia 15 (1783), but no such species is included in the work; the correct reference is given above. In his description of the type, Brown stated that the perianth-tube was nearly twice the length of the spathes. Except in the case of *G. ovata*, in which this condition is sometimes true, I know of no species of *Geissorhiza* in which the tube is anywhere nearly twice the length of the spathes. At times a flower becomes detached from the ovary in pressing, with the resulting gap concealed by the spathes, and unless a complete dissection is made, or unless the specimen is held up against a powerful light, the gap will not be discovered. This may be the case with *G. bicolor*, but in any event, I regard the length given as exceptional, and feel that the length given in the above description it probably more characteristic of the species. On the whole, it appears to me that the plant is a state of a species better-characterized by the following variety with which it intergrades.

16. G. BICOLOR, var. **Macowani,** var. nov. A specie floribus numerosioribus, folio basale uno et folio caulino inflorescentiam excedentibus, et lamina perlonga folii caulini differt.—*G. inflexa* sensu Baker, Fl. Cap. vi. 73 (1896), for the most part, non (DelaR.) Ker-Gawl.

TYPE: *MacOwan in Herb. Austr.-Afr.*, no. 1568, near Malmesbury, 400 ft., Sept., 1894 (G; ISOYTPES in K, B, Gen).

HABITAT: sandy places, Malmesbury and Tulbagh Divs.

SPECIMENS SEEN: Tulbagh Div.: Tulbagh, *Dr. Thom* (K).

This differs from the species chiefly in having more numerous flowers, and at least one basal, as well as the cauline, leaf exceeding the inflorescence. The corm is ovoid, subglobose, the imbricate tunics hard, dark brown.

17. G. PURPUREO-LUTEA Baker. Plant 6–17 cm. high: corm ovoid-conic, 1 cm. high, 7 mm. wide; the imbricate tunics hard, dull gray-brown, apically cusped: basal leaves 2, to 13 cm. long, 3 mm. wide, shorter than the stem, narrowed above the sheath and expanding into a linear-falcate, glabrous, acute blade, the edges, midrib, and sometimes 2 other nerves thickened; the single cauline leaf with a subventricose basal sheath, heavily ribbed, 2–10 cm. long, incised above the sheath, the blade few- to many-nerved: stem simple or once-branched, terete, glabrous, terminating in a 1–4-flowered lax, distichous spike, the branch 1–2-flowered: outer spathe to 1 cm. long, exceeding the tube, lanceolate, herbaceous, purple at the acute apex; the inner spathe nearly as long: ovary to 2 mm. long, turbinate or subglobose: perianth-tube 2–4 mm. long, dark purple: tepals subequal, 1.5–1.3 cm. long, 5 mm. wide, ovate, obtuse, entire, purple at the base, the remainder yellow, often with a broad purple or red strip on the exterior of the outer series: stamens about 2/3 as long as the tepals; the anthers to 4.5 mm. long; the filaments as long, purple-based: style to 1.3 cm. long, about equalling the anthers; stigmas 3 mm. long, exceeding the anthers: immature capsule turbinate, 5 mm. long; seeds not seen.—Baker in Journ. Bot. xiv. 238 (1876).

TYPE: *Drège*, no. 8476, between Paarl and Pont, below 1000 ft. (K; ISOTYPE in Gen).

Habitat: the type was collected on low, stony hills.

Specimens seen: Malmesbury Div.: Oude Post, Sept. 13, 1934, *T. M. Salter*, no. 4756 (K, in part): Paarl Div.: near Wellington, Sept. 17, 1932, *L. Bolus, in Herb. Bolus*, no. 20327 (K); between Paarl and Pont, on low, stony hills, in sparse shrubbery, in Sept., *Drège*, no. 8475 (Gen).

The species is undoubtedly close to *G. bicolor* and is perhaps only doubtfully distinct from it. In the original description, Baker stated that the species was close to *G. humilis;* I do not understand this.

18. G. **Louisabolusae**, spec. nov. Cormus ovoideo-subglobosus, 1 cm. altus, 1 cm. latus; tunicae imbricatae, apice cuspidatae: folia basalia 2, basi breviter vaginantia, ad 17 cm. longa, super vaginam paullum angustata, in lamina 1.5 mm. lata, filiformis, acuta, glabra, dilatata; folium caulinum ad 13 cm. longum, vagina longa, multinervata, ventricosa, in lamina lineare, acuta, 2 mm. lata dilatata, super vaginam adaxialiter paullum incisum: caulis in vaginam folii caulini 1-ramosus paullum super basim, axis primarius ad 20 cm. longus, teres, glaber; inflorescentia spica laxa, secunda, flexuosa, 4–6 fl., ramus 1–3-fl.: spatharum valva exterior ad 1.2 cm. longa, oblongo-ovata, herbacea, apice obtusa, crenulata, purpureo-suffusa; interior ad 1 cm. longa: ovarium subturbinatum, ad 3 mm. longum: perianthii tubus ad 3 mm. longus: tepala subaequales, ad 2.6–2.4 cm. longa, 1 cm. lata, subunguiculata, lamina ovata, subobtusa, pallide flava, clara: stamina inaequalia; filamenta 2 ad 1.2 cm. longa, 1 ad 8–9 mm. longum; antherae ad 7 mm. longae: stylus ad 1.7 cm. longus, quam apicem antherarum parum brevior, fortasse unilateralis; stigmata 5–6 mm. longa, antheras excedentia: capsula valde immatura, semina non visa.

Type: *T. M. Salter*, no. 2790, 6 miles east of Graafwater, Clanwilliam Div., Sept. 30, 1932 (K).

This species is in all respects a member of the *imbricata* group, but is distinguished easily by its unequal stamens, and by the rather medium-sized, light, unmarked yellow flowers. It gives me much pleasure to name this distinct and attractive species for Dr. Louisa Bolus, who has been deeply interested for many years in South African *Iridaceae*, although possibly her work on *Mesembrianthemum* is more widely known in this country.

19. G. Louisabolusae, var. **longifolia**, var. nov. A specie floribus paucioribus, folio basale uno et folio caulino inflorescentiam excedentibus, foliis omnibus perangustis, 1(–3)-nervatis, ad 35 cm. longis, planta plerumque altiora, differt.

Type: *Bachmann*, no. 1091 (B), on the road to Moorreesburg, in the neighborhood of Hopefield, Malmesbury Div., Sept., 1885.

Specimens seen: South Africa, without locality, *Burmann f.* (Gen) apparently belongs here.

The details given in the diagnosis are enough to distinguish this plant from the species. Both are unlike other members of the group to which they belong.

20. G. **rubicunda**, spec. nov. Cormus ovoideus, 1 cm. altus, 8 mm. latus; tunicae imbricatae, apice cuspidatae: folia basalia 2, super vaginam subpetioloideo-angustata, in lamina lineari-attenuata, 16–20 cm. longa, 3 mm. lata, glabra, subacuta, prominente 3–5-nervata, marginibus incrassatis, dilatata; folium caulinum 1, vagina subventricosa, multi-nervata, lamina super vaginam adaxialiter incisa, 7-nervata, subobtusa: caulis simplex vel 1-ramosus in vagina folii caulini, teres, glaber, ad 24 cm. longus; inflorescentia spica laxa, secunda, flexuosa, 2–5-fl.: spatharum valva exterior ad 1.4 cm. longa, oblongo-ovata, abrupte acuta, quam perianthii tubum longior, herbacea, apice rubro-purpurea; valva interior ad 1 cm. longa: ovarium ad 3 mm. longum, subturbinatum: perianthii tubus ad 5 mm. longus, summo ampliatus: tepala subaequalia, ad 2.2 cm. longa, 6–7 mm. lata, obovata, obtuso-rotundata et apice retusa, exteriora pallide lutea clara, externe rubro-lineata, interiora non-maculata: antherae ad 7 mm. longae; filamenta ad 1.1 cm. longa: stylus ad 2.3 cm. longus, unilateralis (?), antheras aequans vel excedens; stigmata 4 mm. longa, antheras excedentia: capsula seminaque non visa.

TYPE: *Schlechter*, no. 8931, from Mitchels Pass, at 1500 ft., Sept. 10, 1896 (B; ISOTYPE in Gen).

HABITAT: damp places.

This species is close to *G. Louisabolusae*, but can readily be distinguished by the fact that its stamens are equal and the flower a deeper yellow, with reddish or purple stripes on the exterior of the outer tepals. From *G. bicolor* it is separated easily by the lack of the purple base and purple perianth-tube. Possibly *MacOwan in Herb. Austr.-Afr.*, no. 1969, from Pakhuisberg, in Clanwilliam Div., is to be included in this species.

21. G. WRIGHTII Baker. Plant 30–40 cm. tall: corm globose, 1 cm. high and 1 cm. wide; the imbricate tunics dark brown, hard, cusped at the apex: basal leaves 2–3, to 29 cm. long, 1.5–3 mm. wide, exceeding the base of the inflorescence, narrowed above the sheath, linear, acute, glabrous, the midrib, 2–4 other nerves, and the edges thickened; the single cauline leaf 17–18 cm. long, the basal sheath ventricose, many-nerved, adaxially indented a little above the sheath: stem simple or deeply branched, terete, glabrous, about 30 cm. long; the inflorescence a 6–11-flowered lax, secund spike: outer spathe to 8 mm. long, ovate-lanceolate, herbaceous, membranous at apex, obtuse, longer than the perianth-tube; the inner spathe to 6 mm.: ovary 2–3 mm. long, ellipsoid-turbinate: perianth-tube to 2 mm. long, lighter than the tepals: tepals subequal, to 1.3 cm. long, 5 mm. wide,

the outer reddish, the inner white or light yellow, ovate-elliptic, obtuse: stamens ⅔ as long as the tepals; the anthers 4 mm. long; the filaments ± 5 mm. long: style to 1.1 cm. long, exceeding the anthers; the stigmas 3 mm. long, recurved: capsule immature, turbinate, to 8 mm. long; seeds not seen.—Baker in Journ. Bot. xiv. 238 (1876).

TYPE: *C. Wright*, no. 243, from Simons Bay, Cape Div. (K; ISOTYPE in G).

HABITAT: mountain slopes, rare in Cape Div., according to Bolus and Wolley Dod in Trans. S. Afr. Phil. Soc. xiv. 331 (1903).

SPECIMENS SEEN: South Africa, without locality, *Bergius* (B), in part; *Drège*, without number (Gen): Cape Div.: foot of Table Mt., near Kirstenbosch, 400 ft. alt., Sept., 1879, *H. Bolus*, no. 4710 (K); by Orange Kloof swamp, Oct. 26, 1897, *Wolley Dod*, no. 3454 (K).

Most of the material seen of this species is rather poorly preserved, with the result that it has been difficult to form a clear conception of it. Even the color of the flower is a little uncertain, although it is certainly not concolorous as Baker stated, Handbk. Irid. 154 (1892), thereby contradicting his own statement in the original description. The species clearly belongs in the *imbricata* group, but it is difficult to say more than that without actually studying it in the field.

22. G. SULPHUREA Schltr. Plant 8–18 cm. tall: corm ovoid, 7 mm. high, 5 mm. wide; the imbricate tunics hard, dull brown, apically cusped: basal leaves 2, 6–14 cm. long, 1–1.5 mm. wide, filiform, setaceous-acute, 1 (–3)-nerved, the edges thickened, glabrous, slightly narrowed above the sheath; the cauline leaf inserted near or below the middle of the stem, 2.5–10 cm. long, the sheath ventricose, multistriate, tapering abruptly into a narrowly linear-attenuate, glabrous, several-nerved blade which is slightly incised adaxially above the sheath: stem simple or once-branched within the sheath of the cauline leaf, exceeding or shorter than the basal leaves, terete, glabrous; the inflorescence a 1–6-flowered, lax, distichous spike: outer spathe oblong to suborbicular, subtrifid or trilobulate at the slightly red-membranous apex, to 5 mm. long, exceeding the perianth-tube; the inner spathe nearly as long: ovary 1–2 mm. long, subturbinate: perianth-tube 1.5–2 mm. long: tepals subequal, 9–10 mm. long, 4 mm. wide, oblong-ovate, obtuse, yellow: stamens over half as long as the tepals; the anthers 3–4 mm. long; the filaments 3–4 mm. long: style 8–9 mm. long, equalling or slightly exceeding the anthers; stigmas 1.5–2 mm. long: immature capsule 4 mm. long, turbinate; seeds not seen.—Schlechter in Engler, Bot. Jahrb. xxvii. 99 (1899).

TYPE: *Schlechter*, no. 8981, from damp places near Ceres Road, at 700 ft. alt., Sept. 12, 1896 (B; ISOTYPES in K, Gen).

In the original description, Schlechter associated this species with *G. ornithogaloides*, but it appears to me to be much closer to the *imbricata* complex. It differs from *G. ornithogaloides* in its corm-tunics, in the shape of the corm, in its very ventricose cauline leaf-sheath, and in the shape of the spathes. The color was reported by Schlechter to be a brighter yellow than that of *G. ornithogaloides*.

23. G. SULPHUREA, var. **arenicola**, var. nov. A *G. sulphurea* foliis basalibus latioribus (2–3 mm. lata), semper 3-nervatis, foliis omnibus plerumque brevioribus quam basis inflorescentiae (1–2-fl.), floribus parum majoribus (tepala ad 1.4 cm. longa), pallide sulphureo-luteis, exterioribus externe rubro-lineatis differt.

TYPE: *Schlechter*, no. 8992, Ceres Road, in arenosis, 800 ft. alt., Oct. 11–12, 1896 (B; ISOTYPES in K, Gen).

The differences between this variety and the species are sufficiently indicated in the diagnosis. Apparently, there is some difference in habitat.

24. G. IMBRICATA (DelaR.) Ker-Gawl. Plant 12–18 cm. high: corm ovoid, 1.5 cm. high, 1.3 cm. wide; the imbricate tunics hard, slightly cusped at apex: basal leaves 2, to 23.5 cm. long, 3.5 mm. wide, briefly subpetioloid above the sheath, the blade wider, linear, glabrous, acute, the edges, midrib and 2–6 other nerves prominent; the single cauline leaf to 15 cm. long, markedly striate, basally sheathing, but hardly ventricose, adaxially incised above the sheath: stem simple, glabrous, somewhat flexuose; the inflorescence a 3–6-flowered, lax, secund, flexuose spike, whose base usually exceeds the leaf-tips: outer spathe to 9 mm. long, longer than the perianth-tube, oblong-ovate, obtuse, mucronate, herbaceous but membranous at the apex; the inner spathe to 8 mm. long: ovary to 2.5 mm. long, subturbinate: perianth-tube to 2 mm. long, dark in color: tepals subequal, to 1.4 cm. long, 4 mm. wide, elliptic-obovate, obtuse, whitish yellow or white, with a broad red stripe on the exterior of the outer series, the inner completely white: stamens less than ⅔ as long as the tepals; the anthers 4 mm. long; the filaments 5 mm. long: style to 1 cm. long, about equalling the anthers; the stigmas 3 mm. long, exceeding the anthers: capsule and seeds not present.—Ker-Gawl. in Koenig and Sims, Ann. Bot. i. 224 (1804). *Ixia imbricata* DelaR., Descr. 17 (1766). *G. obtusata* Ker-Gawl. in Bot. Mag. xviii. t. 672 (1803), type-species of the genus. *G. arenaria* Ecklon, Top. Verz. 21 (1827), *nomen nudum*. *G. sabulosa* Klatt in Trans. S. Afr. Phil. Soc. iii (2). 203 (1885). *G. imbricata*, var. *G. obtusata* (Ker-Gawl.) Baker, Handbk. Irid. 157 (1892).

TYPE: the location of the DelaRoche specimen, if indeed it still exists, is not known to me.

HABITAT: damp places, according to H. Bolus and Wolley Dod in Trans. S. Afr. Phil. Soc. xiv (3). 332 (1903).

SPECIMENS SEEN: South Africa, without precise locality, *Verreaux* in part (Gen), *Herb. Schlechtendal* (Gen), *Prior* (K), *Leibold*, no. 569, no. 570, no. 576 (all in B), *Leibold* (B), *Herb. Link*, no. 1201 (B), *Herb. Banks* (Brit. Mus., not seen, photo in G; possibly to be regarded as the type of *G. obtusata*): Worcester Div.: Worcester, *T. Cooper*, no. 3205 (K): Cape Div.: Tygerberge, July 27, 1816, *Bergius* (B); Victoria Road, near Little Lion's Head, Sept. 12, 1896, *Wolley Dod*, no. 1533 (K); Table Mt., Sept. 10, 1815, *Bergius* (B), Table Mt., Aug., 1882, *MacOwan in Herb. Norm.*, no. 258 (G, B, Gen in part); above Camp's Bay, Aug. 29, 1897, *Wolley Dod*, no. 2767 (K), Van Kamp's Bay, Sept. 10, 1881, *MacOwan*, no. 2273 (K), isotype of *G. sabulosa;* Wynberg, Aug., 1892, *Schlechter*, no. 1557 (B, Gen); Maitland Flats, near cemetery, Aug. 28, 1897, *Wolley Dod*, no. 2888 (K); Cape Flats, *Pappe* (K), near Doornhoogte, *Ecklon*, no. 313 (K, B, Gen; *G. arenaria* Eckl.), *Zeyher*, no. 1597 (K, B, Gen); Algoa Bay?, in 1860, *T. Cooper*, no. 3203 (K): Somerset West Div.: near Sir Lowrys Pass, 25 met., Oct. 9, 1900, *Diels*, no. 1252 (B).

The leaves and corm of this species show obvious relationship with *G. Mathewsii* and its variety *eurystigma*, but the shape and color of the flower, as well as the shape of the stigma, are utterly different.

25. G. IMBRICATA, var. CONCOLOR Baker. Differs from the species in often shorter leaves, which are much broader, with more numerous nerves, the stem often branched, the perianth-tube longer (to 4 mm.), larger flowers (tepals to 1.8 cm. long, 7 mm. wide), which are clear unmarked yellow, the style definitely shorter than the anthers, and the 4.5 mm. stigmas exceeding them.—Baker in Fl. Cap. vi. 72 (1896).

TYPE: *H. Bolus*, no. 5567 (K), from Somerset West, below 100 ft. alt., Oct., 1880.

SPECIMENS SEEN: South Africa, without precise locality, *Ecklon* (B), *Roxburgh* (Gen), *Verreaux* (Gen): Hottentotsholland, near Somerset, *Ecklon & Zeyher*, Irid. no. 211 (K, B, Gen): Cape Div.: Devil's Peak, *Ludwig* (B); Capetown, *Spielhaus* (B); Wynberg, Aug. 10, 1883, *Wilms*, no. 3733 (B).

26. G. IMBRICATA, var. **Brehmii** (Klatt), comb. nov. Similar to var. *concolor* in color, but the basal leaves and cauline leaf-blade 1-nerved, usually exceeding the inflorescence. *G. Brehmii* Eckl. ex Klatt in Linn. xxxiv. 653–654 (1865–66).

TYPE: *Ecklon & Zeyher*, Irid. no. 295 (B in part; ISOTYPE in Gen), from Somerset, in Hottentotsholland.

SPECIMENS SEEN: Cape Div.: Table Mt., 1887, *Schinz*, no. 92 (K).

In his description, Klatt cited *Ecklon & Zeyher*, Irid. no. 211 in addition to no. 295, but no. 211 appears to me to be var. *concolor*, and no. 295 fits the description rather better. For this reason I have selected it as the type.

27. **G. sulphurascens** Schltr. in herb., spec. nov. Cormus ignotus: folia basalia 2, 7–17 cm. longa, 0.5–1.5 mm. lata, acuta, glabra, super vaginam paullum angustata, in lamina dilatata, caulinum 1, 7.5–16 cm. longum, quam inflorescentiam parum brevius, longe vaginante, paullum ventricosum, vagina gradatim in lamina lineari-attenuata, acuta, glabra, 1–3-nervata, transiente: caulis simplex vel 1-ramosus, glaber, teres, brunneo-purpureus, paullum geniculatus, ad 15–28 cm. longus, inflorescentia spica laxa, flexuosa, secunda, 4–8-fl., ramus pauciflorus: spatharum valva exterior ad 1 cm. longa, oblongo-ovata, abrupte acuta vel obtusa, herbacea, apice purpurea, tubum excedens, valva interior ad 8 mm. longa, purpureo-membranacea: ovarium ad 3 mm. longum, ellipsoideo-turbinatum: perianthii tubus ad 3–4 mm. longus: tepala subaequalia, 1.2 cm. longa, 4 mm. lata, obovata, obtusa, alba vel pallide sulphurea: antherae ad 5 mm. longae, filamenta ad 7 mm. longa: stylus ad 1.3 cm. longus, antheras aequans, stigmata ad 2–3 mm. longa, antheras excedentia: capsula immatura turbinata, 4 mm. longa, semina non visa.

TYPE: *Marloth*, no. 7658, on the Bokkeveld, west of Nieuwoudtville, in Calvinia Div., at 750 met. alt., Oct., 1916 (B).

HABITAT: probably in rather dry, sandy places.

At a first glance, this species appears to be a miniature version of *G. Louisabolusae*, but it can readily be distinguished by its smaller, whitish flowers, equal anthers, and its much smaller size.

Section WEIHEA Baker, emend. Baker in Journ. Linn. Soc. xvi. 95 (1877). Leaves 1–several-nerved, the midrib much more prominent than the others, the nerves more nearly simple ridges with the edges not revolute downward; stems or leaves, or both, often pubescent. TYPE-SPECIES: *G. ovata* (Burm. f.) Aschers. & Graebn.

In the original description of the section, Baker included two species, *G. minima* Baker and *G. excisa* (L. f.) Ker-Gawl. Since the former is a *Hesperantha*, the latter automatically becomes the type of the section, with the earlier specific epithet used, instead of *excisa*. This section, also, can be divided into two subsections, although the groups are in some respects, perhaps, less homogeneous than those of section *Rochea*.

Subsection **Pubescentes**, subsect. nov. Folia vel caules, vel utraque, pubescentia; spatharum valva exterior in parte superiore valde brunneo-membranacea; antherae saepe inaequales. Type-species: *G. erosa* (Salisb.) R. C. Foster.

28. G. MONANTHA (Thunb.) Eckl. Corm ovoid-conic, 8 mm. high, 7 mm. wide, the tunics imbricate: basal leaves to 15–20 cm. long, 3–4 mm. wide, subpetioloid above the sheath, mostly glabrous but sometimes very sparsely hispidulous at the edge near the base of the blade,

linear, acute, the midrib prominent, 3–7-nerved, the edges thickened, the lower leaf exceeding the inflorescence; the single cauline leaf ventricose at the base, to 4.5 cm. long: stem three-branched, with a leaf or leaf-like bract at the vase of each branch, densely hispidulous, somewhat lax, each branch 1-flowered: outer spathe to 1.5 cm. long, ovate-lanceolate, acute, entire, hispidulous along the basal portions of several nerves, herbaceous, colored at the tip, becoming brown after the flower has withered; the inner spathe to 1.1 cm. long; both spathes exceeding the perianth-tube: ovary to 5 mm. long, subturbinate: perianth-tube 2.5 mm. long, tubular: tepals subequal, to 2 cm. long, subunguiculate, 1 cm. wide, obovate-spatulate, subacute, dark blue-purple except for 6 mm. at the base above the tube, this being pellucid; the outer tepals somewhat longer and narrower than the inner: anthers to 6 mm. long, the filaments to 1 cm. long: style 1.5 cm. long, the recurved stigmas about equalling the anther apex: capsule and seeds not seen.—Ecklon, Top. Verz. 21 (1827). *Ixia monanthos* Thunb., Fl. Cap. (ed. 1) 226 (1811), non DelaRoche. *Geissorhiza Bellendeni* MacOwan in Journ. Linn. Soc. xxv. 393 (1890).

TYPE: sheet labelled *Ixia monanthos* in Herb. Thunb. (not seen).

HABITAT: in slightly damp sandy or grassy places.

SPECIMENS SEEN: South Africa, without locality, *Leibold* (B): Malmesbury Div.: Groenekloof, at about 300 ft. alt., Oct., 1878, *H. Bolus*, no. 4341 (K); Groenekloof, ± 500 ft. alt., Oct., 1887, *MacOwan in Herb. Norm.*, no. 810 (K type of *G. Bellendeni*, G, B, Gen); near Yserfontein, Sept. 13, 1931, *T. M. Salter*, no. 1350 (K); between Darling and Yserfontein, Sept. 23, 1932, *T. M. Salter*, no. 2709 (K).

Ixia monanthos Thunb. is a later homonym of *I. monanthos* DelaR., Descr. 21 (1766), but was transferred to *Geissorhiza* by Ecklon in 1827, at which time, so far as I know, no synonym was available. Since *G. Bellendeni* was not described until 1890, it appears legitimate to continue the use of the specific epithet *monantha*.

On the sheet of *H. Bolus*, no. 4341 in Kew, N. E. Brown has noted: "These specimens of 4341 match the type specimen of *Ixia monanthos* Thunb. in Thunberg's Herb." He also wrote on the sheet "*G. monantha* Sweet" and "*G. Bellendeni* MacOwan." The latter is correct, but the identification of this plant with *G. monantha* Sweet is not. This was merely a new name given by Sweet to *Ixia secunda* sensu Houttuyn, non DelaRoche, a plant which is *G. Rochensis*. As pointed out in the discussion of that species, I have seen the plant in the Burmann Herbarium from which Houttuyn made his very exact drawing; it is certainly not *G. monantha* (Thunb.) Eckl., but is *G. Rochensis*.

29. G. TULBAGHENSIS Bol. f. Corm ovoid-subglobose, 7 mm. high; the imbricate tunics hard, smooth, dark brown: basal leaves 2–3,

brief-sheathing, subpetioloidly narrowed above the sheath, broadening into a linear-falcate blade, acute, glabrous (the edges of the leaves slightly pilose in some cases, especially the narrow basal portion), the edges and midrib thick, to 15 cm. long and 3 mm. wide; the 1–2 cauline leaves hardly ventricose at the base, to 5 cm. long, mostly free, many-nerved, the edges and keel of the sheath somewhat pilose: stem 1–2-branched, flexuose, terete, densely short-pilose, the lower branch usually occurring not far above the base, the main axis and the branches each 1-flowered: outer spathe to 1.2 cm. long, oblong-ovate, acute, herbaceous at the base, brown-membranous above, slightly pilose or ciliolate near the edges at the base, many-nerved, exceeding the perianth-tube; the inner spathe almost as long, membranous-herbaceous at the base, brown-membranous above, with at least 4–6 prominent nerves, entire: ovary subturbinate, 2–3 mm. long: perianth-tube 4 mm. long, dull purple: tepals subequal, 1.8–1.6 cm. long, 8–6 mm. wide, obovate-spatulate, subacute, the base dull purple, the upper portion white: stamens about ¾ as long as the outer tepals, unilateral; the anthers 5 mm. long; the filaments to 1 cm. long, purple: style to 1.7 cm. long, almost as long as the anthers; the stigmas to 2.5 mm. long, exceeding the anthers: immature capsule to 6 mm. long, turbinate, the seeds not seen.—Bolus f. in Ann. Bolus Herb. ii. 160 (1918).

Type: *L. Bolus in Herb. Bolus*, no. 14851 (in Herb. Bolus, not seen; isotype in K), near the village of Tulbagh, about 490 ft. alt., Oct., 1915.

Habitat: sandy places.

Specimens seen: South Africa, without locality, *J. C. Breutel* (B): Piquetberg Div.: near Piquetberg Road, 80 met. alt., Aug. 30, 1900, *Diels*, no. 1164 (B).

Mr. Bolus, in the original description, differentiated this species from *G. Bellendeni* (= *G. monantha*) by its pubescent stem, but *G. monantha* likewise has a pubescent stem. It is undoubtedly most closely related to *G. monantha*, but its color is completely distinctive, the cauline leaves are less ventricose, and its stamens are unilateral, thus approaching *Tritonia*, as Mr. Bolus pointed out.

30. G. secunda (Berg.) Ker-Gawl. Corm ovoid-conic, 1.2 cm. high, 9 mm. wide; the imbricate tunics hard: basal leaves 2, to 28 cm. long, 4–6 mm. wide, attenuate below, linear, acute, glabrous, the edges, midrib and occasionally 2 other nerves prominent; the 3 cauline leaves 17–2.5 cm. long, the longer sheathing the stem for several cm., the uppermost not sheathing, slightly hispidulous along the lower edges of the sheath and the basal portion of some nerves: stem many-branched, slender, terete, flexuose, shortly hispid, exceeding the leaves; the inflorescence a 3–6-flowered lax, secund spike: outer spathe

to 1.2 cm. long, oblong-ovate, herbaceous, the upper portion brown-membranous, the apex acute or somewhat truncate, the inner spathe to 8 mm. long: ovary 2–3 mm. long, ovoid-subturbinate: perianth-tube 1–2 mm. long, lighter than the tepals in color: tepals subequal, 1.2–1 cm. long, 3.5–4 mm. wide, elliptic-obovate, subacute, blue-purple, the inner slightly emarginate: stamens ½ as long as the tepals; the anthers 3 mm. long, the filaments 4 mm. long: style 8 mm. long, equalling the anther apex; the stigmas 1.5 mm. long, recurved, exceeding the anthers: immature capsule to 7 mm. long, the seeds globose-angular.—Ker-Gawler in Bot. Mag. xviii. t. 672 in textu (1803). *Ixia secunda* Berg., Pl. Cap. 6 (1767), non DelaRoche. *Gladiolus junceus* Burm f., Prodr. 2 (1768).

TYPE: unknown; may no longer be in existence.

HABITAT: common, widespread, in sandy places.

SPECIMENS SEEN:* South Africa, without locality, *Burmann f.* (Gen, type of *Gladiolus junceus* Burm. f.): Clanwilliam Div.: Modderfontein, on the Olifant River, 200 met. alt., Aug. 31, 1900, *Diels*, no. 209 (B); Olifant River valley, Sept. 1900, *Diels*, no. 366 (B); banks of the Olifant River, 130 met. alt., Aug. 25, 1894, *Schlechter*, no. 5029 (G, K, B); alluvial sand in Olifants River valley, near Warm Bath, Sept. 22, 1911, *E. L. Stephens*, no. 6884 (B); Clanwilliam, Sept., 1900, *E. Pritzel* (B); Pedrousberg, north of Brakfontein, Sept. 25, 1900, *Diels*, no. 838 (B); on the Olifant River near Brakfontein, *Ecklon & Zeyher*, Irid. no. 213 (B in part, Gen): Malmesbury Div.: near Hopefield, Sept., 1883, *Bachmann*, no. 217 (B); Moorreesburg, Oct., 1885, *Bachmann*, no. 1089 (B); Darling, Aug., 1883, *Bachmann*, no. 519 (B); sandy places near Groenekloof, Sept., 1883, *P. A. Mader in Herb. MacOwan*, no. 2165 (K); near Groenekloof (Mamre), 300 ft. alt., Oct., 1878, *H. Bolus*, no. 4338 (K), Sept., 1883, *MacOwan*, no. 2165 (K); roadside between Mamre and Darling, Sept., 1931, *B. P. Lamb* (K): Cape Div.: hilly places near Capetown, to 2000 ft., *Ecklon & Zeyher*, Irid. no. 228 (G, B, Gen); Capetown, *Prior* (K), *F. A. Rogers*, no. 11318 (K); Tartville (?), near Capetown, 1879, *Spielhaus* (B); north base of Devil's Peak, 35 met. alt., Oct. 3, 1900, *Diels*, no. 1139 (B); north side of Devil's Peak, Sept. 13, 1883, *Wilms*, no. 3705 in part (B); Lion Mt., 150 met. alt., Aug., 1892, *Schlechter*, no. 1579 (B); near Lion Mt., *Bergius* (B); Lion's Head, Sept. 7, 1936, *Hafström & Lindeberg* (G); east side of Table Mt., 2000 ft. alt., Oct., 1887, *MacOwan in Herb. Norm.*, no. 807 (G. K, B, Gen); shade of thicket, Brinkwater Ravine, Oct. 31, 1920, *F. T. McClean*, no. 65 (G); Table Mt., *Ecklon*, no. 310 (K, B, Gen); Kirstenbosch, Oct. 19, 1931, *W. F. Barker*, no. 23 (K); Red Hill, *Mrs. Hugh Jameson* (K); Signal Hill, Oct. 3, 1883, *Wilms*, no. 3739 (B); Rosebank, near Capetown, below

* With one exception, no material from unknown locality has been cited, although much was seen.

100 ft., Sept., 1879, *H. Bolus*, no. 4804 (K); Camp Ground, near Rondebosch, below 100 ft. alt., Sept., 1880, *H. Bolus*, no. 4609 (G, K); Simons Bay, *C. Wright* (G); Hout Bay, Sept. 2, 1846, *Prior* (K); Caapsche Vlakte, Oct. 14, 1815, *Bergius* (B); Rietvallei, *Mund & Maire* (B); Constantia, Sept., 1827, *Verreaux* (Gen): Paarl Div.: between Paarl and Pont, *Drège*, no. 8483c (B, K, Gen), no. 8483b (B); Paarlberg, 1000–2000 ft., *Drège*, no. 8483a (B, Gen): Swellendam, Sept., 1827, *Verreaux* (Gen): Stellenbosch Div.: near Somerset in Hottentotsholland, *Ecklon & Zeyher*, no. 226 (K, B, Gen).

Almost without exception, as was pointed out in the discussion of *G. Mathewsii*, this species has been attributed to (DelaR.) Ker-Gawl., but actually the basinym is *Ixia secunda* Berg., not *I. secunda* DelaR. The only synonym, so far as is known to me, is *Gladiolus junceus* Burm. f., which cannot be transferred to *Geissorhiza* without creating a later homonym in that genus. *Ixia pusilla* Andr., given by Ker-Gawler as a synonym of this species, is actually distinct. Consequently, it seems proper to retain this old and well-established specific name, despite the fact that its basinym is a later homonym.

In the large number of specimens studied, a very considerable range of variation was found in the size and shape of the leaf, in the size and color of the flower, as well as in the number of flowers in an inflorescence, in the size of the plant, and in the degree of branching of the inflorescence. No one character or combination of characters remained sufficiently constant to warrant recognition as a variety. From the very dwarf, few-flowered, narrow-leaved group to the very large, many-flowered, broad-leaved group, it is possible to establish an almost perfect series of intergrades. Since most of the specimens seemed to be in the middle of the range of variation, a group of which *MacOwan in Herb. Norm.*, no. 807 is a good sample, that has been chosen as typical and the description based primarily upon it. The glabrous leaves and densely short-villous stem serve to distinguish this species easily from its immediate relatives which have glabrous stems. In his key to the genus, in Fl. Cap. vi. 66 (1896), Baker incorrectly states that the stem is glabrous.

It is possible that some of the more extreme departures from the norm are the result of hybridization, but it seems more likely that much is due to difference in habitat, or as a response to temporary climatic changes. A thorough study of the species in the field would do much to answer questions here left unanswered.

31. G. **ixioides** Schltr. in herb., spec. nov. Cormus ovoideus, 1 cm. altus, 8 mm. latus, tunicae imbricatae, apice cuspidatae: folia basalia 2, ad 20 cm. longa, 4 mm. lata, superius quam inferius longius, super

vaginam subpetioloideo-angustata, lamina lineari-attenuata, acuta, nervus primarius marginesque incrassati, sparse pilosa, pilis appressis; folium caulinum 1, ad 12 cm. longum, pluri-nervatum, vaginae margines et nervus primarius sparse appresso-hispiduli: caulis simplex vel 1-ramosus, persparse pilosus, ad 14–20 cm. altus; inflorescentia spica laxa, disticha, flexuosa, 2–4-fl.: spatharum valva exterior ad 1.5 cm. longa, oblongo-ovata, acuta, glabra, herbacea, apice aliquanto membranacea; valva interior ad 1.3 cm. longa: ovarium 1–1.5 mm. longum, subglobosum: perianthii tubus 0.5–1 mm. longus: tepala subaequalia, 1.2–1 cm. longa, 5–4 mm. lata, obovata, apice retusa, pallide rubropurpurea (in siccis): antherae ad 5 mm. longae; filamenta ad 3 mm. longa: stylus et stigmata 6 mm. longa, antheras valde breviora: capsula turbinata, ad 6 mm. longa, semina 2 mm. longa, angulato-globosa.

TYPE: *Schlechter*, no. 10866, from Agtertuin, northwestern Cape Province, 900 met. alt., Aug. 15, 1897 (B; ISOTYPES in K, Gen).

SPECIMENS SEEN: South Africa, without locality, *Prior*, in 1847 (K).

In its short style and open flower, this species has a real resemblance to *Ixia*. Nevertheless, the spathes and corm are those of *Geissorhiza*. The isotype at Kew appears to have light red-purple flowers with a darker purple blotch at the base of the tepals, but this may be an artificial result of drying.

32. G. HETEROSTYLA L. Bol. Corm not known to me: basal leaves 2, with a third reduced to a brown-membranous, brown- and red-striate sheath, to 36 cm. long, 2 mm. wide, narrowed but hardly subpetioloid above the sheath, gradually widening into a linear, acute blade, the midrib and edges thick, with appressed, somewhat hispid hairs; the cauline leaf 12–25 cm. long, ½–¾ sheathing, pilose: stem simple or 1-branched not far below the inflorescence, terete, puberulous; the inflorescence a lax, 2–4-flowered, secund spike: outer spathe to 1.2 cm. long, ovate-lanceolate, acute, with a broad, hyaline, scarious border, the rest red-purple-membranous; the inner spathe to 1 cm. long, entire: ovary 2 mm. long, subturbinate: perianth-tube to 1.5 mm. long, pale yellow: tepals subequal, to 1.6 cm. long, 7 mm. wide, subacute or obtuse, lavender-purple: stamens half as long as the outer tepals, the anthers 5–7 mm. long; 2 filaments equal, to 5 mm. long, the third shorter by 2 mm.: style variable in length, to 1 cm. long; the stigmas 2.5 mm. long, usually exceeding the anthers: capsule subglobose-turbinate, trigonal, apically depressed, to 6 mm. long; the seeds angled, with narrow ridges along the angles.—L. Bolus in S. Afr. Gard. xx. 346, Fig. A (1930).

TYPE: *L. Bolus in Herb. Bolus*, no. 19148 (in Bolus Herb.; not seen), near Whitehill in Laingsburg Div., Aug., 1929.

SPECIMENS SEEN: Laingsburg Div.: Tweedside, Sept. 25, 1932, *G. J. Lewis and W. Barker*, cult. in Nat. Bot. Gard., no. 2694/32 (K).

Although it has not been possible for me to see the type, the single specimen seen was sent to Kew by the Bolus Herbarium, and it may therefore be presumed to be authentic material. According to the original description, the style is unilateral, and highly variable in length, being shorter than, equal to, or longer than the stamens. The stamens themselves appear to be unequal, this being due to different filament lengths. In general, the species resembles a large *G. secunda*.

33. G. **Lewisae**, spec. nov. Cormus ignotus: folia basalia 2–3, 2–3 cm. basi vaginantia, ad 19 cm. longa, quam inflorescentiam primariam breviora, super vaginam angustata, in lamina lineare, acuta, 1.5–2.5 mm. lata, dilatata, nervo primario et marginibus incurvatis foliorum breve villosis; folia caulina ramos subtentia, vagina basale non ventricosa 3–1.5 cm. longa, multinervata, nervis breviter pubescentibus, lamina 10–3 cm. longa: caulis 1–3-ramosus, paullum angulatus (?), dense puberulus, ad 25 cm. longus; inflorescentiae axis primarius spica laxa, 3–4-fl., secunda, flexuosa, ramis 1–3-fl.: spatharum valva exterior ad 1.5 cm. longa, perianthii tubum valde excedens, oblongo-ovata, obtusa, mucronata vel abrupte acuta, vel apice trilobulata, herbacea, pars superior pallide brunneo-membranacea; valva interior ad 1.1 cm. longa, pallide brunnea, hyalina: ovarium ad 2.5 mm. longum, ellipsoideo-turbinatum: perianthii tubus 2–3 mm longus, pallide caeruleo-albidus: tepala subaequalia, ad 1.5 cm. longa, 7 mm. lata, obovata, obtusa, atrocaeruleo-purpurea, basi ochracea: antherae ad 6 mm. longae; filamenta subinaequalia, basi pallide lutea, supra pallide purpurea: stylus ad 1.1 cm. longus, apicem antherarum vix aequans; stigmata ad 3 mm. longa, antheras excedentia, purpurea: capsula seminaque non visa.

Type: *G. Lewis in Herb. Bolus*, no. 20303 (K), from Langebaan in Malmesbury Div., Sept. 7, 1932 (distributed as *G. furva*).

In this species, the difference in filament lengths is not so pronounced as in some of its relatives. The spathes are like those of *G. Rogersii* N. E. Br., but the brilliant, deep blue-purple flowers and the spike itself are more like those of the *Rochensis* group.

34. G. inaequalis L. Bol. Plant 30–40 cm. tall: corm ovoid-conic, 1.8 cm. high, 1.5 cm. wide; the hard tunics imbricate: basal leaves 2, 20–28 cm. long, 7–8 mm. wide, linear-recurved, acute, with 7 nerves and the margins prominent and edged with appressed simple hairs, the upper of the two with a subventricose sheath; cauline leaves 2–3, subventricosely sheathed, to 16 cm. long, adaxially incised above the sheath, pilose: stem somewhat ridged, densely hispidulous, much-branched, the inflorescence of the main axis about 8-flowered, the spike lax, distichous, secund: outer spathe to 2.3 cm. long, 15-nerved, the nerves hispidulous, obovate, acute, herbaceous, with the apex purple-membranous, much longer than the tube, the inner spathe to

1.7 cm. long, 4-nerved: ovary 3.5 mm. long, subturbinate: outer tepals to 2.6 cm. long, inner to 2.2 cm. long, 8 mm. wide, oblong-ovate, obtuse, emarginate, yellow-white at the base, the remainder blue-violet: stamens unequal, the anthers to 8 mm. long, the filaments unequal, 2 being 1 cm. long, the third, 5–6 mm. long, the longest stamen about half the length of the outer tepals: style to 1.4 cm. long, not quite equalling the anthers, unilateral, stigmas 3–5 mm. long, exceeding the anthers: immature capsule 5 mm. long, oblong-ellipsoid, the seeds not seen.—L. Bolus in S. Afr. Gard. xx. 346 (1930), and Fig. B on p. 345.

Type: *L. Bolus in Herb. Bolus*, no. 19256 (in Bolus Herb., not seen), from Calvinia Div., near Nieuwoudtville, Sept., 1930.

Specimens seen: Calvinia Div.: near Nieuwoudtville, Sept., 1931, *H. Buhr*, cult in Nat. Bot. Gard., no. 376/31 (topotype, K).

As was true of *G. heterostyla*, the type has not been seen, but in this instance, too, the single specimen seen was sent out from the Bolus Herbarium so that it may well be regarded as authentic, especially since it is apparently a topotype. A note on the label indicates that this cultivated specimen is stouter than the type. Superficially, this species resembles *G. namaquensis* Barker, but it has a very short tube, a hispidulous stem, and unequal stamens; the corm, too, is distinctive.

35. G. Rogersii N. E. Br. Corm not present: basal leaves 2, 5–16 cm. long, 1.5–4 mm. wide, narrowed above the sheath and enlarging into a linear, acute blade, the midrib and margins thick, with appressed hispid hairs; the 1–2 cauline leaves to 10.5 cm. long, sheathing for about half their length: stem terete, puberulent, flexuose, 1–2-branched, the inflorescence of the main axis a 3–5-flowered, lax, secund spike, the branches 1–3-flowered: outer spathe to 1 cm. long, apparently lengthening in fruit, ovate-lanceolate, subtrilobulate or abruptly acute, herbaceous at the base, reddish-brown-membranous above; the inner a trifle shorter: ovary ± 2 mm. long, subturbinate: perianth-tube to 1.5 mm. long: tepals subequal, to 1.5 cm. long, 3 mm. wide, elliptic, obtuse, light reddish-lilac; the inner tepals probably white: stamens unequal, about half as long as the tepals; the anthers 4 mm. long; 2 filaments to 4 mm. long, the third to 2 mm. long: style to 1.3 cm. long, the stigmas 2 mm. long: capsule to 6 mm. long, turbinate; the immature seeds with a purple funicle.—N. E. Brown in Kew Bull. 1931: 452 (1931).

Type: *F. A. Rogers*, no. 16275, from Worcester Div., between Osplaats and Tunnel Sidings, 2000–3000 ft. alt., Aug., 1915 (K).

This species is close to *G. pusilla* (Andr.) Klatt, but differs as follows: it is more openly branched, the stem is pubescent, the hairs on the leaves are hispid, appressed, the spathes are longer, and the stamens are unequal. From *G. secunda* it can be distinguished by its hispid leaves, the unequal stamens, the very short tube, and the color of the flowers.

36. G. **Leipoldtii**, spec. nov. Cormus ovoideus, 9 mm. altus, 7 mm. latus, tunicae imbricatae: folia basalia 3, basale infimum pallide brunneo-membranaceum cataphyllum; basalia altera ad 25 cm. longa, super vaginam adaxialiter incisa, lamina linearis, ad 7 mm. lata, attenuata, acuta, marginibus dense pubescentibus (pilis non adpressis), nervo primario prominente et sparse hirtulo (pilis ad laminam adpressis); folium caulinum ad 10 cm. longum, vagina ad 6.5 cm. longa, non ventricosa, nervis 2–3 prominentibus, hirtulis, pilis plerumque patentibus: caulis simplex vel in vagina folii caulini 1-ramosus, teres, dense breviterque puberulus, ad 35 cm. altus; inflorescentia primaria spica laxa, subflexuosa, secunda vel subsecunda, 3-fl., ramus 1–3-fl.: spatharum valva exterior ad 1.9 cm. longa, quam perianthii tubum valde longior, ovata, trilobulata, lobulo medio longo et acuto, herbacea sed pars superior pallide brunnea; valva interior pallide roseo-brunnea: ovarium ad 4 mm. longum, turbinatum: perianthii tubus ± 1–1.5 mm. longus, virescens, colore in basim tepalum diffuso: tepala subaequalia, ad 2.6–2.4 cm. longa, 7 mm. lata, obovata, obtusa, pallide rosacea: antherae ad 7 mm. longae, una quam alteras longior; filamenta 2 ad 6 mm. longa, tertium ad 5 mm. longum: stylus ad 1.2 cm. longus, antheras aequans vel excedens; stigmata ad 4 mm. longa, antheras excedentia: capsula seminaque non visa.

TYPE: *Leipoldt in Herb. Bolus*, no. 20778 (K), from the Pakhuis-Wupperthal Road, in Clanwilliam Div., Sept. 3, 1933.

HABITAT: "in fruticetis," according to Schlechter.

SPECIMENS SEEN: Clanwilliam Div.: Pakhuisberg, 2900 ft., Aug. 23, 1896, *Schlechter*, no. 8621 (K, B, Gen).

This rather attractively colored species is clearly most closely related to *G. Rogersii*. In general, it is a larger plant, less branched (even in large specimens), with the leaf pubescence spreading on the edges, not inwardly appressed. The flower is larger, different in shape and color. The Schlechter specimen is smaller than the type, and the flower has a little more blue in it; it undoubtedly comes from a higher altitude. One rather striking aspect of the stamens is that one anther is definitely longer than the other two, and the filament of this stamen is shorter than the other two filaments.

37. G. SUBRIGIDA L. Bol. Corm not seen: basal leaves 2, 15–19 cm. long, 8 mm. wide, shortly sheathing, widening above the sheath into a linear-elliptic, 7–8-nerved blade, the nerves and edges densely short-pilose, the subobtuse apex brown; the cauline leaf 13.5–15.5 cm. long, sheathing for half its length, ventricose, nerves pilose: stem once-branched, each of these again branched, the branches very

strongly divergent, terete, glabrous, subrigid, flexuose, brownish; the inflorescence a lax, secund, 4-flowered, occasionally 3-flowered, spike: outer spathe to 9 mm. long, oblong-ovate, emarginate or subtrifid, red-purple to the middle, the remainder bright brown, membranous; the inner spathe to 7 mm. long, brown-membranous, the nerves red-purple: ovary ± 2 mm. long, turbinate: perianth-tube ± 3 mm. long, yellowish: outer tepals to 1.7 cm. long, inner to 1.4 cm. long, 5–6 mm. wide, elliptic-ovate, acute, bright, dark, blue-purple: stamens a little more than half as long as the tepals; the anthers 6 mm. long, the purple filaments 4 mm. long: style 9 mm. long, not quite equalling the anthers; the stigmas about equalling them: immature capsule turbinate, ± 5 mm. long, the seeds not seen.—L. Bolus in S. Afr. Gard. xxii. 276–77 (1932).

Type: *Buhr, in Herb. Bol.*, no. 19943 (in Bolus Herb., not seen), from Calvinia Div., near Nieuwoudtville.

Specimens seen: Calvinia Div.; Nieuwoudtville, Sept., 1930, *H. Buhr, in Herb. Bolus*, no. 19995 (K). These two specimens were collected from cultivated plants in the garden of Dr. Louisa Bolus, in September, 1933, and September, 1934.

This is a very striking species, both in form and color, and not likely to be confused with any other. The broadly linear, obtuse, pilose leaves, the dichotomous, divergent branching, and the bright reddish-brown spathes cause it to stand out with great clarity.

The two specimens seen, both marked no. 19995 in Herb. Bolus., are labelled "Type," but the original description gives the type number as Bolus Herb. no. 19943.

38. G. **rosea** (Klatt), comb. nov. Plant 15–40 cm. tall: corm ovoid-subglobose, 1.2 cm. high, 1 cm. wide; the imbricate tunics hard, dull gray-brown, apically cusped: basal leaves 2, to 22 cm. long, 2–5 mm. wide, linear, acute, the upper with a longer sheath than the lower, the edges and midrib thick, edged with rather stiff hispidulous hairs appressed against the blade; cauline leaf 2–16 cm. long, sheathing for over half its length, hispidulous along the nerves and edges, all leaves with brown, resinous (?) striae (in siccis), and all shorter than the inflorescence: stem 1-branched above the middle, terete, glabrous, flexuose; the inflorescence a 3–6-flowered, lax, secund or subsecund spike, the branch 1-flowered: outer spathe to 1.3 cm. long, much exceeding the tube, oblong or ovate-lanceolate, the truncate apex somewhat crenately incised, herbaceous in the lower portion, brown-membranous above; inner spathe nearly as long; both spathes brown-striate: ovary to 2–3 mm. long, turbinate: perianth-tube very short, 2 mm. or less: tepals subequal, to 1.4–1.2 cm. long, 4 mm. wide, elliptic-ovate or -obovate, apically subobtuse or slightly retuse, white (if so, the outer tepals slightly flushed with pink), pink, or reddish-

purple, usually concolorous: stamens unequal, about half as long as the tepals; the anthers 3–5 mm. long; the filaments unequal, 3–7 mm. long, but one always shorter than the other two: style as long as the anthers, to 8–9 mm. long, the stigmas 3 mm. long, exceeding the anthers: capsule and seeds not seen.—*Hesperantha rosea* Klatt, Ergänz. 61 (1882). *Geissorhiza graminifolia* Baker, Handbk. Irid. 155 (1892). *Hesperantha ciliata* E. Mey. ex Klatt, Ergänz. 60 (1882).

Type: *Miss Newdegate,* from Knysna (B).

Habitat: stony ground and open sunny banks, from Swellendam and Worcester Divs. east to Port Elizabeth Div.

Specimens seen: Worcester Div. (?): Hexrivierskloof, 1000–2000 ft. alt., in Dec., *Drège,* no. 525 in part (B; type of *Hesperantha ciliata* Klatt): Swellendam Div.: Swellendam, July, 1900, *Harold Fry* (K): George Div.: near George, Oct. 6, 1814, *Burchell,* no. 6088 (K): Knysna Div.: near Keurboom's River, 100 ft. alt., Sept. 17, 1897, *Galpin,* no. 4681 (K): Riversdale Div.: Riversdale, 1891–93, *C. Rust,* no. 13 (B), no. 555 (B): Humansdorp Div.: Oudebosch Flats, 800 ft. alt., Oct., 1927, *Fourcade,* no. 3364 (K); near Humansdorp, 500 ft. alt., Sept., 1888, *W. Tyson,* no. 3067 (K): Port Elizabeth Div.: Baaken's River, near Port Elizabeth, 150 ft. alt., Aug. 15, 1931, *F. R. Long,* no. 441 (K); Patons Farm, on Baaken's River, Aug. 22, 1931, *F. R. Long,* no. 470 (K).

The original description of *G. graminifolia* cited no specimens, so that *Burchell,* no. 6088 (K), marked as being the type of that species cannot actually be so. This specimen and *Drège,* no. 3496 (K) were cited as *G. graminifolia* by Baker in Fl. Cap. vi. 70 (1896). The two specimens are not conspecific, and I am unable to separate the Burchell specimen from the plant described by Klatt as *Hesperantha rosea.* The type of Klatt's species is rather narrow-tepalled and is more delicate than other specimens seen, but there are no real points of difference between it and them. Consequently, the transfer has been made to *Geissorhiza.* Although Ecklon, Top. Verz. 20 (1827), included a *G. rosea* in his list of species, the name was a *nomen nudum;* it has never been taken up and validated, and therefore cannot bar the transfer of *Hesperantha rosea.*

Hesperantha ciliata Klatt, the type of which is *Drège,* no. 525 (B), was based on a mixture. Of the three specimens on the type-sheet, the two on the left have sparsely pubescent leaves, thus having the character for which the species was named, and are actually *Geissorhiza,* conspecific with the type of *G. rosea* (Klatt) Foster. The third specimen is a *Hesperantha,* allied to if not identical with *H. radiata* (Jacq.) Ker-Gawl. Since it is thus a mixture, it has seemed to me preferable to retain the specific epithet *rosea* and transfer that name to *Geissorhiza.*

The species is well-characterized by its unequal stamens, concolorous flowers, rather narrow tepals, and the rather short, stiff hairs appressed against the leaf-blade. Only the midrib is prominent. In his key, Fl. Cap. vi. 66 (1896), Baker places his *G. graminifolia* under the heading "Stem and leaves hairy." Actually, the stems are glabrous.

39. G. PUSILLA (Andr.) Klatt. Corm ovoid-globose, to 8 mm. high and 8 mm. wide; the tunics concentric, apically cusped, smooth, light chalky or clay-brown: basal leaves 3, the lowermost reduced to a brown sheath, the others normally 9–14 cm. long (rarely much longer), and 2–3 mm. wide, linear-ensiform, adaxially indented above the sheath, acute, the midrib and edges thick and densely pilose, 2 other nerves sometimes subprominent and slightly pilose; the lower cauline leaf half-sheathing, subventricose, 6–12 cm. long, many-nerved, the nerves pilose; the upper cauline leaf half-sheathing, 1–1.7 cm. long, sometimes with a short, 1-flowered branch in its axil: stem simple or 1-branched, terete, glabrous; the inflorescence a 1–4-flowered secund spike: outer spathe to 6 mm. long, oblong-ovate, herbaceous at the base, the remainder bright red-brown, membranous, the apex somewhat crenate or even tridentate; the inner spathe nearly as long, slightly herbaceous at the base, the rest hyaline, brown-membranous: ovary to 3 mm. long, turbinate; perianth-tube to 1.5 mm. long: tepals equal or subequal, to 9 mm. long and 3 mm. wide, ovate-elliptic, somewhat acuminate, acute, blue-purple, the inner lighter: stamens little more than half as long as the tepals; the anthers 3 mm. long, the filaments 2.5 mm. long: style to 6 mm. long, about equal to the anther; the stigmas recurved, exceeding the anthers: immature capsule to 5 mm. long, turbinate, the seeds not seen.—Klatt, Ergänz. 58 (1882). *Ixia pusilla* Andr., Bot. Rep. iv. t. 245 (1802). *Geissorhiza secunda* var. *G. pusilla* (Andr.) Baker, Handbk. Irid. 155 (1892), *nomen illegitimum*. *G. pubescens* Wolley Dod in Journ. Bot. xxxviii. 171 (1900).

TYPE: Andrews's plate.

HABITAT: locally abundant on hill slopes around Capetown, among shrubs or rocks.

SPECIMENS SEEN: without precise locality, *Bergius* (B), *Lalande* (B), *Hb. Link*, no. 1204 (B), *Mund* (K), *Mund & Maire* (B), *Verreaux* (Gen): Cape Div.: Devil's Peak, 250 ft. alt., Aug., 1882, *MacOwan in Herb. Norm.*, no. 260 (Gen), Sept. 27, 1895, *Wolley Dod*, no. 518 (K in part), above Groote Schuur, Aug. 25, 1895, *Wolley Dod*, no. 583 (K), north side of Devil's Peak, Sept. 13, 1883, *Wilms*, no. 3705 (B in part); west slopes of Signal Hill, Sept. 5, 1896, *Wolley Dod*, no. 1602 (K, type of *G. pubescens* Wolley Dod; B); Lion Mt., 400 ft. alt., Sept. 1, 1892, *Schlechter*, no. 1360 (B); Table Mt., *Zeyher* (K); Capetown, in 1877, *Spielhaus* (B).

For this plant, frequently and unnecessarily confused with *G. secunda*, I have taken up Klatt's name, based on *Ixia pusilla* Andr. The description given by Andrews was, as usual, somewhat inadequate, and his plate is not clear on certain points, but from the text and figure enough can be learned to make it impossible to subordinate the plant to *G. secunda.* The corm was described as having a "hard, smooth skin," is colored a light brown, and shows no sign of imbricate tunics. In this respect, it is in marked contrast to the corm of *G. secunda*, which is dark brown, with imbricate tunics, these being regularly and smoothly notched at the base. *G. secunda* has a villous stem and glabrous leaves, while no mention of either is made by Andrews. Nevertheless, *G. pubescens* Wolley Dod has a corm like that of Andrews's plant, has blue flowers very similar to it, and in general appearance seems identical with *Ixia pusilla.* Except for *G. pubescens*, there is no plant of similar appearance and identical corm, with which *I. pusilla* could be identified. It might be noted that the original description of *G. pubescens* describes it as having a subglabrous stem, but an examination of the type and an isotype shows that the stem is completely glabrous.

40. G. NAMAQUENSIS Barker. Plant about 26–27 cm. high: corm globose-ovoid, 1.4 cm. high, 1 cm. wide; the tunics concentric, rather shiny, dark brown, apically cusped: basal leaves 2, to 16 cm. long, 3 mm. wide, basally long-sheathing, not especially indented above the sheath, linear, acute, apically somewhat incurved, the five nerves edged with appressed hairs; the cauline leaf to 11 cm. long, long-sheathing but mostly free, not ventricose, pilose: stem glabrous, terete, 1-branched from below the middle; the inflorescence a 6-flowered lax, distichous, flexuose spike, the branch 2–3-flowered: outer spathe to 1.6 cm. long, ovate-lanceolate, abruptly acute, herbaceous, the apex membranous reddish-brown; the inner spathe to 1.1 cm. long: ovary to 3 mm. long, subturbinate: perianth-tube to 9 mm. long, ampliate at the top, greenish: tepals subequal, 2–1.8 cm. long, 4–6 mm. wide, the outer linear-elliptic, subunguiculate, the inner elliptic-obovate, both emarginate at the apex, dark blue-purple, yellow at the base: stamens a little over half as long as the tepals; the anthers 6 mm. long, the filaments to 9 mm. long: style unilateral, 1.2 cm. long, equalling the filaments of the stamens; the short stigmas recurved: capsule (slightly immature) globose-turbinate, 5 mm. long, the seeds not seen.—Barker in Pole Evans, Fl. Pl. S. Afr. xviii. pl. 688 (1938).

TYPE: *Phillips in Herb. Bolus*, no. 22163 (in Bolus Herb., not seen).

SPECIMENS SEEN: Little Namaqualand, Klipfontein, July, 1930, *Mrs. E. Phillips*, cult. in Nat. Bot. Gard., no. 1471/30 (K); Kleinkopf, in the Richtersveld, August, 1925, *Marloth*, no. 6782 (B).

Although the type has not been seen, it appears probable that the Kew specimen was prepared from the living plants sent in to the National Botanic Gardens by Mrs. Phillips in 1930, as was the actual type.

This distinct species is well-separated from its relatives by its long perianth-tube, virtually herbaceous spathes, and by its unilateral style. The figure shows the flower to be open-spreading, with the tips of the tepals incurved. The leaf-tips, likewise, are slightly incurved, almost uncinate.

41. G. **erosa** (Salisb.), comb. nov. Corm ovoid-subglobose, 1.3 cm. high, 1 cm. wide; the tunics imbricate, dull black-brown, short-cusped at the apex: basal leaves 2, 12–23 cm. long, to 7 mm. wide, subpetioloidly narrowed above the sheath, widening into a rather broadly linear blade, the edges, midrib, and 2 other nerves thickened and pilose, the inner ribs with the hairs appressed against the blade; the cauline leaf to 14 cm. long, the sheath ventricose, many-ribbed, all ribs pilose: stem simple, to 34 cm. tall, terete, glabrous; the inflorescence a 3–7-flowered, lax, secund, flexuose spike: outer spathe to 2.3 cm. long, oblong-ovate, slightly trilobulate or entire and obtuse, basally herbaceous and slightly hispidulous on a few nerves (usually glabrous on most flowers), brown-membranous above, much exceeding the perianth-tube; the inner spathe nearly as long: ovary to 4 mm. long, subturbinate: perianth-tube 2–4 mm. long: tepals subequal, to 2.4 cm. long, 1 cm. wide, obovate, obtusely rounded at the apex, deep red-purple: stamens ⅔ as long as the tepals; the anthers to 7 mm. long, the filaments to 7 mm. long: style to 1.4 cm. long; stigmas 3 mm. long, exceeding the anthers: capsule and seeds not seen.—*Ixia erosa* Salisb., Prodr. 36 (1796).

TYPE: unknown to me; *Salisbury*, cult. in Britain, 1816 (Gen), and sent to DeCandolle by Salisbury, may be taken as the standard.

HABITAT: damp fields, more northerly than the commoner variety.

SPECIMENS SEEN: South Africa without precise locality, *Prior* (K): near the Bergrivier at Tulbagh, Sept., 1885, *MacOwan*, no. 2678 (K); near Groenekloof, 500 ft. alt., Sept., 1886, *MacOwan in Herb. Norm.*, no. 590 (G, K, Gen, B).

The plant here treated as *G. erosa* is conspecific with, but varietally distinct from, the plant ordinarily known as *G. hirta*. It is unfortunate that this well-known plant must be renamed, and since *I. erosa* is the earliest available synonym, it has been transferred to *Geissorhiza*. When Thunberg described *I. hirta*, he seemed to regard it as a new species, but in his list of synonyms, he gave *I. inflexa* DelaR. as a synonym, this name having been validly published in 1766. Consequently, by Article 60, part 1, of the current Rules of

Nomenclature, *I. hirta* is invalid because it was superfluous when published. That *I. hirta* and *I. inflexa* are not actually conspecific, that, indeed, they do not even belong in the same genus is immaterial. Thunberg so circumscribed his *I. hirta* as to include the earlier *I. inflexa;* hence, his name is invalid.

42. G. EROSA, var. **kermesina** (Klatt), comb. nov. Differs from the species in being generally smaller; the stem simple or rarely 1-branched; the inflorescence a 2–3 (–4)-flowered spike: the flowers deep blue- or red-purple, the tepals to 1.5 cm. long, 8 mm. wide: the anthers to 7 mm. long; the filaments 3 mm. long: the style to 7 mm. long; the stigmas sometimes to 4 mm. long, exceeding the anthers.—*Hesperantha kermesina* Klatt, Ergänz. 61 (1882). *Ixia hirta* Thunb., Diss. Ixia 9 (1783). *G. hirta* (Thunb.) Ker-Gawl. in Koenig and Sims, Ann. Bot. i. 224 (1804).

TYPE: *Drège,* no. 8480, except the two specimens marked *a* (B; ISOTYPES in K, Gen), from between Paarl and Pont.

HABITAT: sandy or stony places, sometimes damp.

SPECIMENS SEEN: South Africa without locality, *Burmann f.* (Gen), *W. M. Rogers* (K): Ceres Road, at 700 ft. alt., Sept. 12, 1896, *Schlechter,* no. 8975 (B); Gordon's Bay, False Bay, 50 ft. alt., Sept., 1902, *H. Bolus,* no. 9939 (K); near the Bergrivier and in Zwartland, *Ecklon & Zeyher,* Irid. no. 215 (B, Gen).

This plant, which I cannot separate specifically from *G. erosa,* has been given, in varietal status, the name which Klatt gave to it in 1882, when he was under the misapprehension that it belonged in *Hesperantha.* The type of *H. kermesina* proves, on examination, to consist of material of two species. The two large specimens (which I have marked *a*) in a more or less central position on the sheet appear to be *G. quinquangularis,* a species closely related to *G. erosa.* A study of Klatt's original description will show that virtually all the measurements and details were drawn from the other specimens on the sheet, probably because the two large specimens lacked good flowers. With this limitation, then, as to the type material, Klatt's species is clear, and is unquestionably the same as that heretofore known as *G. hirta.* For that reason, I have transferred his name, altering the category, despite the mixture of plants on the type sheet. The *Rogers* specimen (K), cited above, has been annotated as follows by N. E. Brown: "Matches the type of *Ixia hirta* Thunb. in Thunberg's Herbarium."

43. G. QUINQUANGULARIS Eckl. ex Klatt. Plant 20–30 cm. tall: corm ovoid, 1.2 cm. high, 1 cm. wide; the tunics imbricate, apically cusped: basal leaves 2, to 16 cm. long, 2–5 mm. wide, narrowed above the sheath, widening into the linear, recurved, acute blade, the edges, midrib, and 2–5 other nerves thick and edged with appresssed hairs;

the single cauline leaf 5.5–11 cm. long, the sheath ventricose, with many pilose ribs: stem simple or 1-branched from near the base, glabrous, ridged; the inflorescence a 3–5-flowered, lax, secund spike, the branch 2–3-flowered: outer spathe to 1.3 cm. long, longer than the perianth-tube, oblong to ovate, herbaceous at the base, red-brown-membranous above; the inner spathe nearly as long: ovary to 3 mm. long, subturbinate: perianth-tube not over 3 mm. long: tepals subequal, to 2.3 cm. long, 7–8 mm. wide, elliptic-ovate, apically blunt, the outer tepals externally red-striate, the inner tepals white, or creamy-yellow: stamens less than half as long as the tepals; the anthers 5 mm. long, the filaments ± 5 mm. long: style to 1 cm. long, equalling the anthers; the stigmas to 5 mm. long, much exceeding the anthers: capsule to 8 mm. long, turbinate, obovoid; the seeds immature.—Klatt in Linn. xxxiv. 654 (1865–66). *G. hirta*, var. *G. quinquangularis* (Eckl.) Baker, Handbk. Irid. 156 (1892) at least as to name; the combination invalid and based upon a *nomen nudum. Hesperantha quinquangularis* Eckl., Top. Verz. 23 (1827), *nomen nudum. Geissorhiza graminifolia* var. *bicolor* Baker, Handbk. Irid. 155 (1892). *Hesperantha quinquangularis* (Eckl.) Eckl. ex Klatt in Durand and Schinz, Conspect. Fl. Afr. v. 176 (1893).

TYPE: *Ecklon & Zeyher*, Irid. no. 214 (B; ISOTYPE in Gen), from the Zwarteberg, in Caledon Div.

HABITAT: rather variable, in damp sands, or grassy or rocky places.

SPECIMENS SEEN: South Africa, without precise locality, *Burmann f.* (Gen), *Ecklon* (B), *Ludwig* (B), *Niven* (K): Cape Div.: near Capetown, below 100 ft., Aug., 1879, *H. Bolus*, no. 4805 (K); Lion Mt., *Ecklon*, no. 312 (K, Gen, B); Hout Bay, ± 500 ft. alt., Sept., 1889, *MacOwan in Herb. Norm.*, no. 261 (G, B, Gen): Caledon Div.: above vlei, 1 mile from turnout to Villiersdorp from Caledon, Sept. 14, 1931, *W. F. Barker*, no. 6 (K); Zwarteberg, 1000–2000 ft. alt., in Aug., *Ecklon & Zeyher* (G, B); Zwarteberg, 3200 ft. alt., Oct. 17, 1894, *Schlechter*, no. 5561 (B); Caledon, *Ecklon* (K): Paarl Div.: between Paarl and Pont, *Drège*, no. 8480 in part (Gen, B): Swellendam Div.: on hills by the Breede River, near Swellendam, *Drège*, no. 3496 (K, Gen, B).

Like a few others in the genus, this species has a rather confused history. Apparently the first name given to it was *Hesperantha quinquangularis* Eckl., which was a *nomen nudum.* The specimens cited by Ecklon came from the same locality as his no. 312, which he labelled and distributed as *G. quinquangularis* Eckl., likewise a *nomen nudum.* The first valid publication came when Klatt described the species in *Geissorhiza,* in 1865–66. Of the specimens there cited, which actually belong to the species, *Ecklon & Zeyher*, no. 214 seems most characteristic, and therefore I have chosen it as the type. In 1892, Baker, Handbk. Irid. 156, attempted to reduce it to varietal status under *G. hirta*, but as usual he did so illegitimately (*G. hirta* var. *G. quinquangularis* Eckl.), and, moreover, based his attempt upon the *nomen nudum*, *G. quinquangularis* Eckl. This attempt was not improved by the fact that as synonym he cited *Hesperantha ciliata* Klatt, a very different plant, the species treated in this study as *G. rosea* (Klatt) Foster. His brief description and the synonym cited make it quite probable that he had this other species in mind, but in Fl. Cap. vi. 71 (1896), he cited two specimens for the variety, one of which I have seen. It is *Ecklon*, no. 312, which is certainly not *G. rosea.* In Handbk. Irid. 155 (1892), Baker made no improvement by describing *G. graminifolia* var. *bicolor*, which is perfectly characteristic *G. quinquangularis*. To complete the confusion, Klatt, in the following year, decided that the species was, after all, a *Hesperantha* (he was quite incorrect in his decision), and published *H. quinquangularis*, attributing it to Ecklon, Top. Verz. 23 (1827), a *nomen nudum*, and then validated it by citing in the synonymy his own *G. quinquangularis* of 1865–66. Comment seems unnecessary.

Beyond any doubt, the plant is closely related to *G. erosa*, and is possibly not separable from it. It differs chiefly in the number of flowers in the inflorescence, markedly in flower color, and somewhat in leaf pubescence, for the hairs on the leaf edges are spreading and not appressed against the leaf blade.

44. G. QUINQUANGULARIS, var. **atrofaux**, var. nov. Flores et folia *G. quinquangulare* similis, sed flores pallide lutei clares, perianthii tubo et tepalis basi atrocaeruleo- vel brunneo-purpureis.

TYPE: *Schlechter*, no. 5210 (B), from Piquetberg Mt., 1000–1500 ft. alt., Sept. 6, 1894 (ISOTYPES in Gen).

Perhaps this is no more than a color form of *G. quinquangularis*, but it occurs much to the north of the range of that species.

Subsection **Foliosae**, subsect. nov. Folia caulesque glabra; spatharum valva exterior herbacea; folia basi dense superposita. Type: *G. foliosa* Klatt.

45. G. **montana**, spec. nov. Cormus ovoideo-obconicus, 1 cm. altus, 1 cm. latus; tunicae imbricatae, apice cuspidatae: folia basalia 3, infimum vagina sine laminam, 4.5 cm. longum, apice breviter liberum, basalia altera ad 15 cm. longa, 2 mm. lata, superposita, vaginis basalibus 4.5 cm. longis, super vaginam angustata, in lamina lineari-attenuata, acuta dilatata, marginibus nervoque primario incrassatis; folium caulinum ad 15 cm. longum, vagina non ventricosa 4 cm. longa: caulis ad 27 cm. longus, teres, glaber, supra medium ramosus, ramus e bracteis duabus spathiformibus originans; inflorescentia spica disticha, flexuosa, 6–9-fl., ramis 3–4-fl.: spatharum valva exterior ad

5 mm. longa, oblongo-ovata, obtusa, subtrilobulata vel apiculata, herbacea, apice margine purpurea, perianthii tubum aequans vel paullo excedens; valva interior exteriorem aequans: ovarium ad 2 mm. longum, subturbinatum: perianthii tubus 2 mm. longus: tepala subaequalia, ad 7–8 mm. longa, 2 mm. lata, elliptico-obovata, obtusa, integra, pallida (in siccis): antherae 2–3 mm. longae, filamenta ± 2 mm. longa, unum quam altera brevius: stylus ad 7 mm. longus, antheras aequans; stigmata 1 mm. longa, antheras excedentia: capsula immatura 4 mm. longa, subturbinata, semina non visa.

TYPE: *Drège*, s. n. (B; ISOTYPES in K, Gen), from Genadendal, 3000–4000 ft., fl. Oct.

HABITAT: stony and rocky places.

SPECIMENS SEEN: Genadendal, 3000–4000 ft., *Drège*, no. 1553 (B).

Superficially, this plant is very similar to small plants of *G. ramosa*, but it has a broader leaf with a different type of venation; the corm tunics are highly imbricate, rather thin and soft. I place it with the *Foliosae* because of the corm-tunics and because of the crowded, superposed basal leaves.

46. G. DREGEI Baker. Plant to 14 cm. high, usually much shorter: corm ovoid, 6 mm. high, 3–4 mm. broad; the tunics imbricate, cusped at the apex: leaves in a basal cluster through superposition, about 3, to 4.5 cm. long and 4 mm. wide, linear-lanceolate, somewhat recurved, acute, glabrous, the midrib and edges thickened, and at least one bulbil contained near the base of the superposed sheaths; the cauline leaf to 3 cm. long, the sheath somewhat ventricose, and sometimes lacking a bulbil: stem 1-branched, to 7.5 cm. tall, filiform, glabrous; the inflorescence a 5–7-flowered distichous spike, rarely with a bulbil in the spathes of the lower flowers: outer spathe to 6 mm. long, oblong, truncate, mucronate, herbaceous, membranous at the apex; the interior spathe as long: ovary ± 2 mm. long, subturbinate: perianth-tube to 3 mm. long, about equal to the outer spathe: tepals subequal, to 1.6 cm. long, 3 mm. wide, ovate-elliptic, acute, yellow with a blue-green blotch at the base, continued downward on the tube: stamens about ¼ as long as the tepals; the anthers to 3 mm. long, the filaments to 1.5 mm. long: style about 8 mm. long, as long as the anthers; stigmas recurved, exceeding the anthers: capsule and seeds not seen.—Baker, Handbk. Irid. 158 (1892).

TYPE: *Drège* (K), from the Paarl Mts. (ISOTYPE in Gen).

HABITAT: details not known to me.

SPECIMENS SEEN: South Africa, without precise locality, *Burmann f.* (Gen), *Bergius* (B): Paarl Div.: Paarlberg, *Drège*, no. 1552 (B): Cape Div.: Table Mt., *Ecklon*, no. 311 (Gen): Swellendam Div.: near the Zondereinderivier, at Appelskraal, and in the mts., *Ecklon & Zeyher*, Irid. no. 222 (B, Gen): Uitenhage Div.: Olifantshoek, between

Boschmansrivier and Zondagrivier, *Ecklon & Zeyher,* Irid. no. 221 (K, B).

In no description known to me have I seen mention made of the bulbils in the sheaths of the basal and cauline leaves. In this species, they are sometimes absent from the cauline leaves.

47. G. RUPESTRIS Schltr. Corm ovoid, 6 mm. high, 4–5 mm. wide, the tunics imbricate: basal leaves 3–4, to 4 cm. long, 4 mm. wide, slightly indented adaxially above the sheath, widening into a linear-ensiform, or ligulate, or even subfalcate, acute blade, glabrous, the midrib and edges thick; cauline leaves 2–3, 1.5–0.7 cm. long, bract-like, with bulbils in the axils or bases of the sheaths: stem simple, terete, slender, glabrous, purplish, rarely 1-branched; the inflorescence a 3–10-flowered, distichous, flexuose spike: outer spathe to 5 mm. long, oblong, obtuse, herbaceous, membranous at the apex; the inner nearly as long, subherbaceous, purple-membranous at the bifid apex: ovary to 2 mm. long, subturbinate: perianth-tube 2.5–3 mm. long: tepals subequal, 8–7 mm. long, 2 mm. wide, elliptic-obovate, acute, probably white: stamens half as long as the outer tepals; the anthers to 2 mm. long, filaments to 2 mm. long: style to 7 mm. long, exceeding the anthers; stigmas 1.5 mm. long, recurved: capsule and seeds not present.—Schlechter in Engler, Bot. Jahrb. xxvii. 98 (1899). *G. recurvifolia* (Poir.) Klatt in Linn. xxxiv. 655 (1865–66), as to specimens cited, in part, but not as to name.

TYPE: *Schlechter,* no. 9167 (B; ISOTYPES in K, Gen), from Bainskloof in Wellington Div., at 2400 ft. alt., Nov. 19, 1896.

HABITAT: damp places.

SPECIMENS SEEN: South Africa, without precise locality, *Bergius* in part (B), *Hb. Link,* no. 1197 (B): Dutoit's Kloof, at 2300 ft. alt., Jan., 1880, *H. Bolus,* no. 5247 in part (K).

On the type sheet the anthers are about 3 mm. long and the filaments about 5 mm. long. It is undoubtedly close to *G. Bolusii* Baker, and possibly should be made a variety of that species. On the whole it is rather smaller, the basal leaves are smaller and much less long-sheathing in proportion to their size, and the style exceeds the anthers. The material seen is too inadequate, however, to permit final judgment on this point. Certainly, it is curious that *Bolus,* no. 5247 appears to contain a mixture of the two species, for this is the type of *G. Bolusii.*

48. G. BOLUSII Baker. Plant 16–28 cm. high: corm small, ovoid, 1 cm. high, 5 mm. wide; the tunics imbricate, rather chartaceous, apically cusped: basal leaves 2–3, 3–10 cm. long, 3–5 mm. wide, long-sheathing, acute, the blades ensiform or almost ligulate, glabrous, the midrib prominent; cauline leaves 2–3, 4 cm. to 4 mm. long, all cauline

leaves with bulbils in their sheaths: stem simple, terete, glabrous; the inflorescence a 3–8-flowered spike: outer spathe to 5 mm. long, oblong, truncate, serrate at the apex, and membranous-tipped, equalling the perianth-tube; the inner nearly as long: ovary ovoid, to 2 mm. long: perianth-tube ± 2 mm. long: tepals subequal, to 8 mm. long and 2.5 mm. wide, elliptic-ovate, acute, probably white: stamens half as long as the tepals; the anthers to 1.5 mm. long, the filaments to 3 mm. long: style 7 mm. long, as long as the anthers; the stigmas exceeding the anthers: capsule and seeds not present.—Baker, Handbk. Irid. 158 (1892).

TYPE: *H. Bolus*, no. 5247 in large part (K), in saxosis montium circa Dutoit's Kloof, 2300 ft. alt., Jan., 1880.

In this species, so far as can be told from the exceedingly scanty material available, the basal leaves are not bulbilliferous, a point in which it differs from *G. rupestris*, but with this exception and the relatively unimportant points mentioned in the discussion of that species, the differences are slight and the two species should probably be united.

49. G. **ovalifolia**, spec. nov. Cormus parvus, ovoideus, 6 mm. altus, 4 mm. latus; tunicae imbricatae, apice cuspidatae: folia basalia 3, superposita, longe vaginantia, ad 2 cm. longa, 5 mm. lata, super vaginam adaxialiter incisa, lamina ovato-oblanceolata, acuta, glabra, nervus primarius incrassatus: caulis simplex, teres, glaber, 1–3-fl., ad 5 cm. altus; bractea caulina 1(–2), bulbillifera ornata: spatharum valva exterior ad 7 mm. longa, plerumque perianthii tubum brevior, ovato-oblonga, obtusa, integra, herbacea; valva interior aequalis vel parum longior, subherbacea, integra, acuta: ovarium ad 2 mm. longum, subturbinatum: perianthii tubus ad 3 mm. longus, summo ampliatus, atro-caeruleo-viridis (in sicco): tepala subaequalia, ad 7 mm. longa, 2–2.5 mm. lata, oblongo-ovata, obtusa, albida (in sicco): antherae ad 2 mm. longae; filamenta ad 4 mm. longa: stylus ad 7 mm. longus; stigmata 1 mm. longa, antheras parum excedentia: capsula turbinata, ad 4 mm. longa; semina minuta, 0.5 mm. longa.

TYPE: *Drège*, from the Drakensteinsbergen, 4000–5000 ft. alt., in October (B; ISOTYPE in Gen).

SPECIMENS SEEN: Tulbagh, by the waterfall, 1000–2000 ft. alt., in November, *Ecklon & Zeyher*, Irid. no. 223 (B, Gen).

This small species of relatively high altitudes is similar to *G. Dregei* in flower and tube color, and to *G. Bolusii* and *G. rupestris* in its cauline bulbilliferous bracts and in the absence of bulbils in its basal leaf-sheaths. Its general appearance and in particular its short, broad, almost oval leaves give it so distinctive an appearance that it seems worthy of specific rank. Certainly, there is more to separate it from its relatives than there is to separate *G. Bolusii* and *G. rupestris*.

To judge from the specimens cited by Klatt for his *G. recurvifolia*, it is probable that *G. recurvifolia* in part, at least as to some specimens cited, but not as to name, should be regarded as a synonym of this species.

50. G. OVATA (Burm. f.) Aschers. and Graebn. Corm ovoid, to 1 cm. high, 4–5 mm. wide; the tunics concentric, crustaceous, apically cusped: basal leaves 2–3, so closely superposed as to appear opposite, to 7 cm. long (usually shorter) and 1 cm. wide, thick-textured, erect, the midrib prominent, the edges slightly thickened and densely short-ciliate, the blade ovate-elliptic to ensiform, abruptly acute, lightly or heavily black-dotted, with a pronounced adaxial excision above the sheath; the single cauline leaf half-sheathing, the free portion to 1.8 cm. long, one edge ciliolate: stem usually simple, sometimes 1-branched, terete, glabrous, 5–23 cm. long, averaging about 10–12 cm. long; the inflorescence a lax, distichous, 1–7-flowered spike: outer spathe to 1.4 cm. long, oblong-ovate, acute or truncate at the apex, herbaceous, but edged and tipped with red-purple, the nerves inconspicuous; the inner spathe almost as long: ovary to 7 mm. long, ovoid to turbinate: perianth-tube to 2 cm. long, usually much shorter, but exceeding the outer spathe as a rule, slightly ampliate at the top: tepals subequal, to 1.8 cm. long, 6 mm. wide, the outer red-purple, with deeper veining on the exterior, the inner white, oblanceolate-ovate, subacute or rounded at the apex: anthers to 3 mm. long; filaments nearly as long as the anthers: style to 2.8 cm. long; the stigmas 2.5 mm. long, recurved, equalling or slightly exceeding the anthers: capsule and seeds not seen.—Ascherson and Graebner, Synops. Mitteleurop. Fl. iii. 540 (1906). *Ixia ovata* Burm. f., Prodr. 1* (1768). *Ixia excisa* L. f., Suppl. 92 (1781). *Geissorhiza excisa* (L. f.) Ker-Gawl. in Koenig and Sims, Ann. Bot. i. 224 (1804). *Weihea excisa* (L. f.) Eckl., Top. verz. 22 (1827). *Hesperantha latifolia* Spreng. ex Steud., Nom. (ed. 2) i. 753 (1840), *nomen nudum.*

TYPE: no longer in Burmann's Herbarium.

HABITAT: stony places.

SPECIMENS SEEN: Worcester Div.: Bainskloof, Sept. 27, 1936, *Hafström & Lindeberg* (G): Cape Div.: Lion Mt., *Zeyher* (K); Table Mt., 2100 ft. alt., Oct., 1879, *H. Bolus*, no. 4704 (G, K); Table Mt., *Ecklon*, no. 831 (B); Table Mt., Aug. 26, 1881, *MacOwan*, no. 2271 (K, Gen); Table Mt., near rivulets, Aug. 27, 1846, *Prior* (G); Devil's Peak, Aug., 1882, *MacOwan in Herb. Norm.*, no. 259 (G, B, Gen); Devil's Peak, Sept. 27, 1895, *Wolley Dod*, no. 518 in part (K); Stanford Valley, Aug., 1901, *A. Engler* (B); Constantiaberg, 1500 ft., Sept. 17, 1899, *Schlechter*, no. 1458 (B, Gen); Capetown, *Spielhaus* (B); Newlands, Sept. 9, 1883, *Wilms*, no. 3707 (B); Simons Bay, *C. Wright* (G, K): near Somerset in Hottentotsholland, *Ecklon & Zeyher*, Irid. no. 294 (Gen, B); Hottentotsholland, *Zeyher*, Fl. Cap. no. 39 (Gen, B); Stellenbosch, Aug. 20, 1846, *Prior* (K); Stellenbosch, *J. Sanderson*, no. 980 (K): Paarl Div.: between Paarl and Pont, below 1000 ft., *Drège* (B, Gen): Caledon Div.: Hermanus, July 24, 1931, *T. M. Salter*, no. 1184 (K); Kleinriviersberg, 1000–3000 ft. alt., *Ecklon & Zeyher* (B); Kleinriviersberg, *Zeyher*, no. 3959 (K, B); Shaws Mt., Sept. 13, 1931, *W. F. Barker*, no. 11 (K). Note: in view of the plentiful material available, specimens lacking locality data have not been cited.

This distinctive species seems almost never to be misidentified, unlike so many other species in the genus. Its long perianth-tube, thick-textured, ovate to lance-ovate leaves, and its color cause it to be easily recognizable. Its leaf-shape and arrangement lead me to associate it with the *Foliosae*.

51. G. PARVA Baker. Plant 6–10 cm. tall: corm small, ovoid, 7 mm. high, 4 mm. wide; the tunics concentric, hard, apically cusped: basal leaves 2, long-sheathing, the blades 1–2.5 cm. long, 1–2 mm. wide, thin-textured, subfalcate, acute, glabrous, the edges and midrib thick; the cauline leaf sheathing at the base but mostly free, 8–16 mm. long, inserted slightly below the middle of the stem: stem simple, terete, glabrous, flexuose; the inflorescence a 3–7-flowered, distichous, flexuose spike: outer spathe to 5 mm. long, oblong-ovate or suborbicular, as long as or slightly shorter than the perianth-tube, herbaceous, the truncate or subtrilobulate apex red-membranous; the inner spathe nearly as long: ovary 2 mm. long, subturbinate: perianth-tube 2–3 mm. long: tepals subequal, 7–5.5 mm. long, 2.5 mm. wide, obovate-spatulate, obtuse, light yellow: anthers 1.5–2 mm. long; filaments 3 mm. long: style 7 mm. long, exceeding the anthers; the stigmas short, recurved, exceeding the anthers: capsule turbinate, 4 mm. long; the seeds globose, ⅓ mm. long.—Baker in Kew Bull. 1906: 26 (1906).

TYPE: *Penther*, no. 723, Houw Hoek in Caledon Div., Oct., 1894 (K).

In his original description, Baker suggested that this plant was close to *G. rupestris*, from which it differed by having the outer spathe orbicular in shape. To me it appears to have the spathes of *G. inconspicua* Baker and the corm of *G. setacea*.

52. G. NANA Klatt. Plant 4–9 cm. tall: corm ovoid, 5 mm. high, 3 mm. wide; the hard tunics concentric, but sometimes giving the appearance of being slightly imbricate: basal leaves 3, to 5 cm. long, 1.5 mm. wide, sheathing at the base, slightly narrowed above the sheath, the blade linear-falcate, acute, glabrous, the edges and midrib thick; the single cauline leaf subventricose at the base, 1–2.5 cm. long: stem simple, or 1–2-branched, terete, glabrous, filiform, flexuose; the main axis 1–2-flowered, the branches 1-flowered: outer spathe to 5 mm. long, ovate, abruptly acute or subobtuse, herbaceous, mem-

branous at the apex; the inner spathe as long as the outer: ovary oblong, 1–2 mm. long: perianth-tube to 2 mm. long, equal to or slightly shorter than the spathes: tepals subequal, to 4 mm. long, 1 mm. wide, ovate-elliptic, acute, the outer tepals dark (purple?), the inner white: stamens a little over half as long as the tepals; the anthers to 1.5 mm. long, the filaments 1.5 mm. long: style about 4 mm. long, as long as the filaments; the stigmas 1 mm. long, recurved: immature capsule 4.5 mm. long, oblong-ellipsoid, seeds not seen.—Klatt, Ergänz. 57 (1882).

TYPE: *Zeyher*, no. 3967, from Appels Kraal by the Zondereinde River, in Caledon Div. (B; ISOTYPE in K).

This is the smallest and most delicate species in the genus; its inconspicuousness is probably the explanation for its not having been collected since the time of Zeyher.

53. G. VIOLACEA Baker. Corm unknown: basal leaves 2, shortly sheathing, linear, acute, glabrous, the edges and midrib thick, with 2–4 other nerves somewhat prominent, 18–22 cm. long, 4 mm. wide; the 2 cauline leaves subtending branches, 12–3 cm. long, almost entirely free: stem 2-branched, terete, glabrous, main axis 28 cm. long; the inflorescence a 7-flowered distichous spike, the branches 3–4-flowered: outer spathe to 9 mm. long, oblong-ovate, herbaceous at the base, hyaline-edged, the acute apex membranous, lavender-tipped; the inner spathe nearly as long, the two nerves red-tinged: ovary 2–3 mm. long, subturbinate: perianth-tube about 6 mm. long, yellowish, sometimes exceeding the spathes by 1–2 mm.: tepals subequal, 1.5–1.3 cm. long, 4–5 mm. wide, oblanceolate, obtuse, rather dark violet, unveined: stamens ⅔ as long as the tepals; the anthers 3 mm. long, filaments 7 mm. long: style 1.4 cm. long, about equal to the anthers; the stigmas 2.5 mm. long, exceeding the anthers: capsule 7 mm. long, turbinate; the seeds subglobose, slightly flattened, 0.75 mm. diam., dark-brown.—Baker in Kew Bull. 1906: 26 (1906).

TYPE: *Penther*, no. 677, from Blau Krantz River, Knysna Div., Nov., 1894 (K).

HABITAT: along rivers at low altitudes.

SPECIMENS SEEN: Knysna Div.: Keureboom's River, 100 ft. alt., Nov. 11, 1894, *Schlechter*, no. 5949 (B).

This plant, large for its group of species, is at present known only from Knysna Div. Its leaves suggest those of *G. Bolusii*, but are longer and narrower. Like those of several species in this group, they seem not unlike the leaves of some species of *Hesperantha*.

54. G. FOLIOSA Klatt. Corm ovoid-subglobose, 8 mm. high, 5 mm. wide; tunics concentric, oak-brown: basal leaves 4–5, closely superposed, to 8–9 cm. long, 5 mm. wide, linear-falcate, acute, glabrous, several-nerved; the 2–3 cauline leaves basally sheathing for about

half their length, 5–2 cm. long: stem 1–3-branched, terete, glabrous, 16–18 cm. long; the inflorescence a 4-flowered, lax, secund spike, branches 1-several-flowered: outer spathe to 1.2 cm. long, oblong-ovate, somewhat obtuse, herbaceous, membranous at the apex, several-nerved, longer than the perianth-tube; the inner spathe nearly as long: ovary subturbinate, 2–3 mm. long: perianth-tube to 4 mm. long: tepals subequal, to 1.4 cm. long, 4 mm. wide, elliptic-obovate, acute, lilac, with darker veins: stamens ⅔ as long as the tepals; the anthers 4 mm. long, the filaments 5 mm. long: immature capsule to 6 mm. long, turbinate; seeds not seen.—Klatt in Linn. xxxiv. 658 (1865–66).

TYPE: *Ecklon & Zeyher*, Irid. no. 218, from the mountains near Puspasvallei, Swellendam Div. (B; ISOTYPE in G).

HABITAT: 1000–4000 ft. alt.

SPECIMENS SEEN: Robertson Div.: Buffeljagt's River, near Rietkuil, in October, *Zeyher*, no. 3961 (K).

On occasion, the stem is branched from the very base; the corm is very similar to that of the following species.

55. G. BRACTEATA Klatt. Corm subglobose, strongly flattened at the base; the tunics concentric, 8 mm. high, 8 mm. wide: basal leaves numerous, to 10 cm. long, 6–8 mm. wide, indented adaxially above the sheath, linear-recurved, abruptly acute, the midrib prominent, glabrous; the cauline leaves 7–8 cm. long, sheathing for 2–2.5 cm., the midrib prominent: stem branched at the base and then branched again several times, the branches glabrous, terete, 1(–2)-flowered, to 22 cm. tall: outer spathe to 9 mm. long, equalling the perianth-tube, oblong-ovate, obtuse, several-nerved, herbaceous; the inner spathe nearly as long, apparently herbaceous, entire: ovary to 4 mm. long, subturbinate: perianth-tube 4 mm. long: tepals subequal, to 1 cm. long, 3 mm. wide, ovate or obovate, subobtuse, whitish (?) or yellow: stamens ½ as long as the tepals; the anthers to 3 mm. long, the filaments to 2 mm. long: style about 9 mm. long; the stigmas exceeding the anthers: capsule to 9 mm. long, turbinate; the seeds flattened-globose, 1 mm. in diam., dark-brown.—Klatt, Ergänz. 57 (1882).

TYPE: *Ecklon & Zeyher*, virgin forests at Olifantshoek, between the mouths of the Boschmansrivier and Zondagrivier, below 300 ft. alt., in September; Uitenhage Div. (B; ISOTYPE in G).

SPECIMENS SEEN: South Africa, without precise locality, *Verreaux* (Gen), *Krebs*, no. 339 (B): Riversdale, in the hills, Oct., 1892, *Schlechter* (B); Humansdorp, hillside, 400 ft. alt., Sept. 10, 1897, *Galpin*, no. 4674 (K); E. Olifants River, Oudtshoorn Div., *Dr. Gill* (K); woods at Olifantshoek, between the mouths of the Boschmansrivier and the Zondagrivier, in September, *Ecklon & Zeyher*, Irid. no. 221 (B, Gen); Uitenhage, *Zeyher* (K); brickfields at Grahamstown, Oct. 25, 1905, *Miss M. Daly*, no. 861 (B).

Not unlike *G. foliosa*, this species can readily be distinguished by its rather broader leaves and yellowish or whitish flowers.

56. G. GEMINATA E. Mey. ex Baker. Plant 20–30 cm. tall: corm ovoid (incomplete on all specimens): basal leaves 2–3, superposed, sheathing the stem for at least 5 cm., to 12 cm. long, 1.5 mm. wide, glabrous, linear, setaceously acute, midrib prominent, seldom equalling the base of the inflorescence; cauline leaves 2, 3–9 cm. long, sheathing for half their length: stem simple or 1-branched, each axis sometimes 1-branched again, each 1–3-flowered, terete, glabrous: outer spathe to 8–9 mm. long, much shorter than the perianth-tube, oblong-ovate, herbaceous, but purple-membranous at the acute or obtuse apex; the inner spathe nearly as long as the outer: ovary 3 mm. long, oblong-ellipsoid: perianth-tube dark green, to 8 mm. long: tepals subequal, 1.4–1.2 cm. long, 5 mm. wide, lance-ovate, subobtuse, light yellow, the outer rank with red pencillings near the base: stamens little more than half as long as the outer tepals; the anthers 3–4 mm. long, the filaments 4 mm. long: style 1.2–1.5 cm. long; stigmas 3 mm. (7 mm. in one instance) long, somewhat exceeding the anthers: capsule ovoid-turbinate, to 9 mm. long; immature seeds dark brown, angular-globose to subpyriform, 0.75 mm. in diam.—Baker, Handbk. Irid. 159 (1892). *G. geminata* E. Mey. ex Drège in Flora ii, Besond. Beigab. 83 (1843), *nomen nudum*. *G. geminata* (Vahl), incorrectly attributed to E. Mey. ex Baker by Klatt in Durand and Schinz, Conspect. Fl. Afr. v. 178 (1893). *Ixia geminata* Vahl, Enum. ii. 68 (1805).

TYPE: *Drège*, between Slangheuvel, Frenchhoek, and Donkerhoek (K; ISOTYPE Gen).

HABITAT: apparently in marshy ground.

SPECIMENS SEEN: Slangheuvel, on the Breede River, *Drège*, no. 1540 (B); Bergrivier, near Paarl, under 500 ft. alt., *Drège*, no. 8472 (B); near Brand Vlei, Worcester Div., in marshy ground, Sept. 23, 1932, *G. J. Lewis*, in Herb. Bolus, no. 20414 (K).

Through carelessness, this species has an unnecessary nomenclatural history. The first publication of the name in the genus *Geissorhiza* by E. Meyer in 1843 was not only without description, but also without any indication that it might be a new combination. It was, therefore, a *nomen nudum*. Apparently the first valid publication of the name in this genus was that of Baker in 1892, who not only gave a description but cited a single collection; this must therefore become the type. Actually, however, it is probable that Meyer intended his name to be a new combination, based on *Ixia geminata* Vahl. The sheet of *Drège*, no. 1540 in Meyer's herbarium (now at Berlin) bears the label "*Geissorhiza geminata* mihi," followed by "*Ixia geminata* Vahl sed non *Geissorhiza obtusata* Ker." This, I think, shows that a new combination was intended, but the combination *G. geminata* (Vahl) was not validly published until Klatt did so in 1893. As usual, he added a blundering touch by attributing the new combination to E. Mey. ex Baker. From the description of *I. geminata* Vahl I am inclined to believe that the identification of it with *G. geminata* may well be correct, but the proper authority for the specific name remains E. Mey. ex Baker.

All but one of the specimens seen by me are in very poor condition, and it is hardly surprising that the species has remained little-known and misunderstood. Miss Lewis's collection was distributed as *G. humilis;* from it the details of the flower have been drawn for the description given above. No complete corms remain on any of the specimens, so that it is uncertain whether the tunics are imbricate or concentric.

57. G. SETACEA (Thunb.) Ker-Gawl. Plant 7–12 cm. tall: corm somewhat tubular at the base, enlarging to become ovoid; tunics concentric, hard, dull-brown, long-cusped at the apex: basal leaves about 3, to 8 cm. long, 1.5 mm. wide, subpetioloid above the sheath, widening into a linear or recurved portion, acute, glabrous, the midrib and edges thick; the 1–2 cauline leaves 1.5–3 cm. long, sheathing at the base, narrowed above the sheath, widening into a 1.5 mm. wide ac[illegible]le: stem usually simple, occasionally 1–2-branched, terete, filif[illegible] glabrous, 1(–2)-flowered: outer spathe to 1 cm. long, ovate-lanceolate, acute, glabrous, herbaceous, many-nerved, equal to or shorter than the perianth-tube; the inner spathe as long as the outer, herbaceous: ovary 2–3 mm. long, subturbinate: perianth-tube to 7 mm. long, ampliate near the apex: tepals subequal, to 1.4 cm. long, 4–5 mm. wide, subacute or obtuse, obovate-elliptic, whitish or pale yellow, the outer rank reddish on the exterior: stamens less than half as long as the tepals; the anthers 3 mm. long, the filaments 2 mm. long: style to 1.4 cm. long, exceeding the anthers; the stigmas 2/5 mm. long, recurved: capsule and seeds not seen.—Ker-Gawler in Koenig and Sims, Ann. Bot. i. 224 (1804). *G. setacea* (Thunb.) Baker in Journ. Linn. Soc. xvi. 95 (1877), non Ker-Gawl. *Ixia setacea* Thunb., Diss. Ixia 13 (1783).

TYPE: sheet labelled *Ixia setacea* in herb. Thunb. (not seen).

HABITAT: rather damp sands, or in shrubbery.

SPECIMENS SEEN: South Africa, without locality, *Bergius* (B in part), *Drège*, no. 8493 (Gen in part): near Capetown, 1880, *H. Bolus*, no. 4803 (K); Table Mt., 2300 ft. alt., Feb. 2, 1892, *Schlechter*, no. 412 (B in part): in arenosis inundatis pr. Sir Lowry's Pass, 300 ft. alt., July 5, 1892, *Schlechter*, no. 1154: along the rivulet at Grahamstown, *Burchell*, no. 3546 (K).

The corm of this species is rather remarkable for its almost tubular base, above which it expands to become ovoid; the inner spathe seems to be herbaceous, a condition not at all usual in this genus. For the most part, the description given has been based on *Bolus*, no. 4803, which has been annotated as follows by N. E. Brown: "These match the type specimens of *Ixia setacea* Thunb. in Thunberg's Herbarium . . . Thunberg collected it near Capetown."

58. G. INCONSPICUA Baker. Plant to 18 cm. high, usually much shorter: corm unknown: basal leaves 3, to 8 cm. long, 1–3 mm. wide, slightly indented adaxially above the sheath, the blade linear, recurved, glabrous, acute, the edges and midrib thick; the cauline leaf inserted on the stem near the middle, 1.5–2.8 cm. long, half-sheathing, subtending the branch: stem simple or 1-branched, terete, glabrous, much exceeding the leaves; the inflorescence a 2–5-flowered, lax, distichous spike: outer spathe oblong-ovate, obtuse or abruptly acute, to 7 mm. long, herbaceous, purple-membranous at the apex and in part along the margin, about equal to the perianth-tube; the inner spathe as long, herbaceous-membranous, red-purple at the bifid apex: ovary 2–3 mm. long, turbinate: perianth-tube $\pm$ 3 mm. long: tepals subequal, 1.2–1 cm. long, 4 mm. wide, obovate, obtuse, pale yellow, the outer rank red-tinted externally: stamens $\frac{3}{4}$ as long as the tepals, or nearly equal in some cases; the anthers 3.5 mm. long, the filaments 6 mm. long: style to 1.1 cm. long, about equalling the anthers; the stigmas 1.5 mm. long, exceeding the anthers: immature capsule 5 mm. long, turbinate; the seeds not seen.—Baker in Kew Bull. 1906: 26 (1906).

TYPE: *Penther*, no. 713, from Montagu Pass in George Div. (not seen; possibly at Zürich).

HABITAT: stony places (?).

SPECIMENS SEEN: South Africa, without locality, *W. M. Rogers* (K): George Div.: Montagu Pass, 660 met. alt., Nov. 2, 1894, *Schlechter*, no. 5796 (G, B, K, Gen), topotype.

Although the type has not been available to me, *Schlechter*, no. 5796, from the type locality, appears to fit the original description reasonably well, except that it is larger in almost every respect. The determination of the Kew specimen, incidentally, was made by N. E. Brown. There seems to have been some carelessness in drawing up the original description, for Baker stated that the perianth-tube was as long as the spathe and also as long as the perianth-limb, which was 6.3 mm. (3 lines) long. Since the spathe also was only 3 lines long, the tube could hardly have equalled the limb unless the ovary was completely lacking. As this could not have been the case, and since the ovary was probably about 2 mm. long, the tube was probably about 4 mm. long. Baker considered the plant to be close to *G. humilis*, but it appears to me to be much nearer *G. setacea*. In fact, it seems only doubtfully separable as a species. Without seeing the type, however, no change in its status will be made.

59. G. **malmesburiensis**, spec. nov. Cormus ignotus: folia basalia 3, superposita, ad 8 cm. longa (plerumque breviora), super vaginam longe attenuata, in lamina lineari-attenuata, glabra, acuta, ad 1.5 mm. lata, nervo primario marginibusque incrassata, expansa; folium caulinum cum vagina naviculata vel subventricosa, super vaginam abrupte angustata, in lamina lineari-attenuata, glabra, acuta, expansum: caulis simplex, 3–9 cm. longus, vel 1-ramosus, teres, glaber; axis primarius ramusque 1-fl.: spatharum valva exterior ad 1.1 cm. longa, oblongo-ovata, obtusa, vel abrupte acuta, herbacea; valva interior aequilonga, herbacea: ovarium ad 3.5 mm. longum, ellipsoideo-turbinatum: perianthii tubus ad 2 mm. longus, breviter infundibuliformis: tepala subaequalia, ad 2.7–2.5 cm. longa, 6–7 mm. lata, elliptico-ovata, apice obtuse rotundata, flava: antherae ad 5 mm. longae, filamenta ad 1.7 cm. longa, plerumque 1–1.2 cm. longa: stylus ad 1.7 cm. longus, quam apicem antherarum parum brevior; stigmata ad 4 mm. longa, antheras excedentia: capsula seminaque non visa.

TYPE: *Schlechter*, no. 1654, in collibus pr. Malmesbury, 1000 ped. alt., Oct. 3, 1892 (B).

This new species is related to *G. ornithogaloides* in general habit, but its flowers, which are enormous for this group of species, as well as for the size of the plant, and its almost filiform leaves will enable it to be readily distinguished. Flowers seem in dried material to have a greenish tinge to the yellow, but this may not be true of the living plant.

60. G. **Marlothii**, spec. nov. Cormus ovoideus, 9 mm. altus, 6 mm. latus; tunicae concentricae, apice cuspidatae: folia basalia 3, ad 4–7 cm. longa, ± 0.5 mm. lata, filiformia, acuta, subglauca, nervus primarius subprominens; folia caulina 1–2, vagina subventricosa, multinervata, super vaginam adaxialiter parum incisa, lamina longe attenuata, ad 5 cm. longa: caulis simplex vel 1–2-ramosus, teres, glaber, rubro-brunneo-suffusus (in sicco); axis et rami 1-fl.: spatharum valva exterior ad 8 mm. longa, lanceolato-ovata, acuta, vel subobtusa, integra, herbacea, pars superior saepe rubro-suffusa; valva interior aequalis, integra: ovarium 2–3 mm. longum, subturbinatum: perianthii tubus ad 3 mm. longus, summo ampliatus: tepala subaequalia, ad 1.3–1.1 cm. longa, 4–5 mm. lata, obovata, obtusa vel subacuta, lutea, exteriora aliquando externe rubro-suffusa: antherae ad 4 mm. longae, filamenta ad 6 mm. longa: stylus ad 1.2 cm. longus, stamina aequans; stigmata ad 1.5 mm. longa, recurvata, antheras excedentia: capsula ad 9 mm. longa, turbinata; semina subglobosa, 0.5 mm. diam., atrobrunnea.

TYPE: *Marloth*, no. 10612, from Houdenbeck Farm on the Cold Bokkeveld, Clanwilliam Div., 850 met. alt., Oct. 13, 1921 (B).

HABITAT: sandy soil.

SPECIMENS SEEN: Malmesbury Div.: Oude Post, Sept. 13, 1934, *T. M. Salter*, no. 4756 (K, in part).

This species differs from *G. ornithogaloides* in color, since it does not turn blue-green on drying; nor is it a sulphur-yellow, but is clear. Moreover, the ovoid corm has concentric rather than imbricate corm-tunics. This may appear to be a rather fine line of distinction, but the difference in corm-tunics alone would warrant the separation of this plant as a new species.

It has been named for the late Dr. Rudolph Marloth, the original collector, whose contributions to South African botany were numerous and distinguished. The type bears an unpublished name written in the hand of Rudolph Schlechter, but as he had assigned the plant to the wrong genus, it has seemed advisable to adopt another trivial for the species.

61. G. ORNITHOGALOIDES Klatt. Plant 4–12 cm. tall: corm strongly flattened at the base, ovoid-globose, to 7 mm. high and 5 mm. wide; the tunics hard, dull dark brown, apically cusped, imbricate, the basal edges irregularly frayed and serrate, not regularly notched: basal leaves 3, to 11–12 cm. long, equalling or exceeding the inflorescence, narrowed subpetioloidly above the sheath, expanding into a blade about 0.5 mm. wide, linear-subulate, glabrous, the midrib prominent, but the edges less so; the single cauline leaf to 8 cm. long, usually much shorter, the basal sheath somewhat ventricose: stem simple or occasionally 1-branched, terete, filiform, glabrous, 1–2-flowered: outer spathe to 1 cm. long, exceeding the perianth-tube, lanceolate, acute, entire, herbaceous, with a membranous margin in the upper part; the inner spathe almost as long: ovary $\pm$ 2 mm. long, oblong-ellipsoid: perianth-tube about 2 mm. long: tepals subequal, to 1.2 cm. long, 3 mm. wide, oblanceolate-spatulate, subobtuse, uniform greenish-yellow, tending to dry blue-green: stamens little more than half as long as tepals; the anthers to 4 mm. long, the filaments 4 mm. long: style to 8 mm. long; stigmas about 1 mm. long; capsule to 8 mm. long, obovoid-turbinate; seeds about 0.5 mm. in diam., angular-globose.—Klatt in Linn. xxxiv. 656 (1865–66). *G. romuleoides* Eckl., Top. Verz. 21 (1827), *nomen nudum*. *Ixia ornithogaloides* Lichtenstein in Roem. and Schult., Syst. i. 376 (1817).

TYPE: *Lichtenstein*, collected on the Koude Bokkeveld (B).

HABITAT: in hills and mountains, possibly in dry locations.

SPECIMENS SEEN: near Worcester, *Ecklon & Zeyher*, Irid. no. 224 (B): Caledon Div.: Zwarteberg, and in the neighborhood of the warm baths, *Ecklon & Zeyher*, no. 225 (B, Gen); Zwarteberg, 1000–2000 ft.

alt., in August, *Ecklon & Zeyher* (G, B); Zwartberg, near Caledon, in September, *Zeyher* (K).

The first specimen cited by Klatt in his description of *G. ornithogaloides,* which was published as a new species, was the Lichtenstein collection from the mountains of the Cold Bokkeveld. As it happens, this specimen is the type of *Ixia ornithogaloides* Lichtenstein, of the existence of which Klatt seems to have been unaware. The result is that the binomial which should have been treated as a new combination must be attributed to Klatt alone. Since the Lichtenstein specimen fits Klatt's description reasonably well, and since it is the first specimen cited, I am selecting it as the type of this species.

One of the most remarkable things about this plant is the corm. If the corm alone were to be seen, there is little doubt that it would instantly be regarded as having come from a small plant of some species of *Hesperantha.* The entire aspect, in particular the irregularly frayed and serrate basal edges of the imbricate tunics, is that of many species of *Hesperantha.* Nevertheless, the style and the spathes are those of *Geissorhiza,* so that it can be left in that genus without difficulty. The color of the flower, a greenish or sulphury yellow, is also worthy of mention, especially since in drying it often turns to a rather dark blue-green. Baker has utilized this point in his key, Fl. Cap. vi. 66 (1896), as a means of differentiating between *G. humilis* and *G. ornithogaloides,* but as the two species are unlike in so many ways, this seems a rather inadequate character, especially since it does not always hold true.

62. G. ORNITHOGALOIDES, var. **flava** (Klatt), comb. nov. Plant 11–15 cm. high: corm and leaves as in the species; the basal leaves to 11 cm. long and 2 mm. wide: stem 1–2-branched from near the base, or simple, 1–2-flowered: outer spathe to 1.2 cm. long; the inner spathe subherbaceous: ovary to 4 mm. long: perianth-tube 2.5–3.5 mm. long, yellowish-green: tepals subequal, to 1.5 cm. long, 5 mm. wide, greenish-yellow, veined brown-purple (in some specimens) on the exterior of the outer series, obovate-spatulate, obtuse: anthers and filaments each 4 mm. long: style to 1 cm. long; the stigmas 2 mm. long, exceeding the anthers.—*Geissorhiza flava* Klatt, Ergänz. 58 (1882).

TYPE: *J. C. Breutel,* from the Cape of Good Hope, without precise locality (B).

HABITAT: dry hillsides.

SPECIMENS SEEN: Clanwilliam Div.: Koude Berg, at 3400 ft. alt., Aug. 29, 1896, *Schlechter,* no. 8749 (K, Gen, B): Worcester Div.: Orchard Siding, August, 1915, *F. A. Rogers,* no. 16570 (K): Cape Div?: near Hercules Pillar, Sept., 1931, *J. W. Mathews,* cult. in Nat. Bot. Gard., no. 1419/30 (K): in Hottentotsholland, *Prior* (K): Caledon

Div.: hillside above a vlei on the Villiersdorp Road, 1 mile from the turnout from Caledon, Sept. 14, 1931, *W. F. Barker*, no. 13 (K); between Caledon and Villiersdorp, Zondereinde River Bridge, Sept. 15, *T. M. Salter*, no. 4792 (K).

A comparison of the type of *G. flava* with *G. ornithogaloides* shows that the former is a trifle larger in general, and is usually 2-branched instead of simple or 1-branched. Klatt described the stem as hirsute, but apparently he mistook a few fibres from the driers or some other foreign substance for hairs. Actually, the Breutel specimen, like its very close match, *Barker*, no. 13, is quite glabrous. So close is the resemblance between the two species that it seems impossible to retain specific rank for *G. flava*. Even in the matter of size and branching there is a tendency for the two to intergrade.

Section **Tortuosa**, sect. nov. Folia basalia teretia, tortuoso-flexuosa, quasi spiralia. TYPE: *G. corrugata* Klatt.

In view of the very peculiar leaves, and the fact that the single species in this section has flowers closely resembling those of *Hesperantha*, it seems advisable to recognize its distinctness from the other species of *Geissorhiza*.

63. G. CORRUGATA Klatt. Plant 4–6 cm. tall: corm ovoid, to 1 cm. high, 6 mm. wide; the hard, shining, chestnut-brown tunics concentric, apically cusped: leaves about 4, basally superposed, long sheathing, to 4–5 cm. long, nearly 1 mm. wide, recurved, strongly flexuose-tortuose, terete or subterete, acute, glabrous, the midrib subprominent, the uppermost leaf with a subventricose sheath: stem terete, glabrous, simple, terminated by a single large flower: outer spathe to 1.3 cm. long, much exceeding the perianth-tube, lanceolate-ovate, subobtuse, entire, the edges united at the base for nearly 2.5 mm., membranous-herbaceous, edged and tipped with dull red-purple; the inner spathe nearly as long, more membranous, entire: ovary to 5 mm. long, turbinate: perianth-tube to 3.5 mm. long, ampliate at the top, brown: tepals subequal, 1.6–1.4 cm. long, 6–5 mm. wide, obovate, subacute, clear yellow: stamens over half the length of the tepals; the anthers to 6 mm. long, the filaments to 4 mm. long: style 6 mm. long, exserted from the tube for 3 mm.; the stigmas 7 mm. long, filiform, fimbriate, exceeding the anthers: capsule and seeds not present.—Klatt, Ergänz. 57 (1882).

TYPE: *Dr. Meyer*, no. 24, from the Hantam Mts., in Calvinia Div., 1869 (B).

HABITAT: probably dry, sandy places, but data not available.

This extraordinary species, of which the type collection is apparently the only one known, is so completely on the border-line between *Geissorhiza* and *Hesperantha*, that its actual disposition is one of some difficulty. The corm, or what is left of one, seems more like that of *Geissorhiza*, while the style protrudes from the perianth-tube, even if only for 3 mm. This being so, it seems desirable to leave the species in *Geissorhiza*, although the 7 mm. long stigmas are certainly those of *Hesperantha*, as are the spathes. The leaves are curiously twisted in the manner of some species of *Romulea*.

A search through earlier literature produced the description of *Ixia tortuosa* Lichtenst. in Roem. and Schult., Syst. i. 375 (1817), a plant which Baker, in Journ. Linn. Soc. xvi. 88 (1877), transferred to *Romulea*. In Fl. Cap. vi. 37 (1896), he gave a description of it and cited two specimens, *Burchell*, no. 1343, and the *Lichtenstein* type of *I. tortuosa* (which he had not seen, incidentally), both from the same region, the Middle Roggeveld, near Jakhals Fontein. His description and that of Lichtenstein strongly suggest the plant here treated as *G. corrugata*. The outbreak of war in Europe has made it impossible to secure either the Burchell or the Lichtenstein specimen. It is only too probable that Baker did not dissect the Burchell specimen, and without doing so, it would be very difficult to tell whether or not the stigmas are bifid, the distinguishing mark of the genus *Romulea*. I quote Lichtenstein's description and the amplification of it given by Roemer and Schultes: "Flore solitario subsessili, spathis tubo longioribus, foliis filiformibus flexuoso-tortuosis. Lichtenstein Spicileg. Fl. cap. MSS.

"Bulbus magnitudine pisi majoris. Scapi bipollicares plerumque bini, toti vagina laxa membranacea tecti, in terra reconditi, ut flos acaulis videatur. Folia plerumque sex cum vagina connata, teretia, flexuoso-tortuosa apice recto subulato. Spatha tubo longior, valvulis pellucido-membranaceis, costa media solummodo viridi. Limbi laciniae flavae, erectae aequales, tubo duplo longiores. Habitat in regione Middelroggeveld prope Jakhals Valley, cap. b. spei." There is hardly a word in this description which could not with equal accuracy be applied to the type of *G. corrugata*. Nevertheless, a final verdict cannot be given without actually seeing the type of *Ixia tortuosa*.

Subgenus **Ixiopsis**, subgen. nov. Cormi tunicae (quidem exteriores) fibrosae vel reticulato-fibrosae; capsulae oblongo-ovideae, nec turbinatae nec subturbinatae; semina alata. TYPE: *G. Bojeri* Baker.

In corm-tunics, capsules and seeds, this small group of species stands well apart from the rest of the genus. The spathes, indeed, are the deciding factor which leads me to retain the group in that genus, although the general aspect of the flowers is also that of *Geissorhiza*.

At present, it does not appear to be a completely homogeneous group, and there is a suspicion that at least one species belongs in *Acidanthera*.

64. G. PATERSONIAE L. Bol. Plant 16–74 cm. tall: corm globose, flattened, 1 cm. high, 1.5 cm. wide; the outer coats rather coarsely fibrous-reticulate, the inner coats smooth and papery: basal leaves 2, to 40 cm. long, shorter than the stem, long-sheathing, the sheaths many-nerved and narrowing abruptly into a linear, acute, glabrous blade, ± 1 mm. wide, the midrib and edges thick; cauline leaves 3–4, the upper ones reduced more or less to sheaths: stem simple or 1–2-branched, terete, glabrous, stout; the inflorescence a somewhat lax, distichous or equilateral, 3–18-flowered spike, the branches few-flowered: outer spathe to 1.5 cm. long, somewhat exceeding the tube, oblong-ovate, acute, entire, herbaceous, membranous at the apex and along the edges; the inner spathe 3–5 mm. shorter than the outer: ovary to 4 mm. long, oblong-ellipsoid: perianth-tube to 5 mm. long, narrow, ampliate at the top: tepals subequal, subunguiculate, to 1.7 cm. long and 6 mm. wide, usually smaller, lanceolate or oblanceolate-ovate, acuminate, sometimes submucronate at the apex, lilac-gray with darker veins: stamens a little over half as long as the tepals; the anthers about 5 mm. long, the filaments about 4 mm. long: style 8–9 mm. long; the stigmas 3.5 mm. long, exceeding the anthers: capsule oblong-ovoid, about 1.5 cm. long; the seeds subglobose, alate, about 5 mm. in diam., with the wing ± 1.5 mm. wide.—L. Bolus in Ann. Bolus Herb. i. 132 (1915).

TYPE: *Mrs. T. V. Paterson*, no. 47, from Redhouse, Uitenhage Div., August, 1908 (in Bolus Herb., not seen; ISOTYPE in K).

HABITAT: in stony clay.

SPECIMENS SEEN: South Africa, without locality, *Burchell*, no. 4048 (G): Swellendam Div.: mountains near Buffeljagt's River, 1000–2000 ft. alt., *Zeyher*, no. 3990 (K): Riversdale Div.: prope pagum Riversdale, in collibus argillaceis lapidosisque, 850 ft. alt., Oct., 1904, *H. Bolus*, 11385 (K): Humansdorp Div.: Zuurbron, 800 ft. alt., Oct., 1927, *H. G. Fourcade*, no. 3332 (K): Albany Div.: heights between Boschmansrivier and Karegarivier, near Jagersdrift, below 1000 ft. alt., in June, *Ecklon & Zeyher*, Irid, no. 286 (B): Mossel Bay Div.: Mossel Bay, Sept., 1862, *W. M. Rogers* (K): Uitenhage Div.: Zwartkopsrivier, in Sept., *Ecklon & Zeyher*, Irid. no. 230 (Gen, B); Bethelsdorp, Sept. 28, 1930, *F. R. Long*, no. 242 (K).

The original description cited five collections; material of two of these has been available to me. Since the species is named for Mrs. T. V. Paterson, I am selecting *Paterson*, no. 47 as the type.

In dried material, this distinctive species has a certain resemblance to *Gladiolus*, a resemblance heightened by the alate seeds. The Kew sheet of *Zeyher*, no. 3990 was, indeed, first determined as *Gladiolus* *permeabilis* DelaR. by Baker, and then as *Gl. dichotomus* Thunb. by Klatt. Dr. Bolus noted in the original description, however, that in living plants the perianth is regular and that the stamens are equilateral.

65. G. Bojeri Baker. Plant 25–50 cm. tall: corm ovoid-conic, the outer tunics finely fibrous-reticulate, 1.5 cm. high, 1 cm. wide: basal leaves about 4, the lower 2 being reduced to sheaths about 3 cm. long; the true leaves 11–25 cm. long, 1–3 mm. wide, basally sheathing 3–8 cm., narrowed slightly above the sheath, widening into a linear, acute, glabrous blade, the midrib and edges thick; cauline leaves 2, 10–15 cm. long, sheathing basally for 1–3 cm.: stem usually simple, terete, glabrous, somewhat flexuose; the inflorescence 1–2-flowered, exceeding the leaves: outer spathe to 1 cm. long, exceeding the perianth-tube, oblong-ovate, abruptly acute, herbaceous; the inner spathe slightly shorter, subherbaceous: ovary to 6 mm. long, ellipsoid: perianth-tube to 1.5–2 cm. long: tepals subequal, to 9 mm. long, 2.5 mm. wide, ovate-elliptic, acute, yellow (or pinkish?): stamens a little over half as long as the tepals; the anthers 3 mm. long, the filaments 2.5 mm. long: style about 7 mm. long; the stigmas recurved, exceeding the anthers: capsule obovoid-oblong to narrowly subcylindrical; subpedicellate, 1–3 cm. long; the seeds brown, 4 mm. in diam., alate.—Baker in Journ. Bot. xiv. 239 (1876).

Type: *Hilsenberg & Bojer*, from the Antoungoun Mts., Emirne Prov., Madagascar (K).

Habitat: dry places, 1500–2500 met. alt., confined to Madagascar.

Specimens seen: Madagascar: in the interior, at Ankaratra, *Scott Elliot*, no. 2092 (B); Mt. Anteby above Ambositre, Dec. 11, 1894, *C. J. Forsyth-Major*, no. 662 (B); massif de l'Andringitra, vallées de la Riambava et de l'Antsifotra, 1600–2000 met. alt., Nov. 27–Dec. 8, 1924, *H. Humbert*, no. 3655 (G); central portion, Sakoerintang, *G. W. Parker* (K).

The only species with which this could be confused is the recently described *G. ambongensis* H. Perr., which is, like it, confined to the island of Madagascar. From the description of the latter, it appears to differ in having a longer perianth-tube, orange-yellow flowers, with two blood-red triangular marks at the base of each tepal, and in being a plant of lower altitudes. *G. Bojeri* has clear yellow flowers, which sometimes turn pink in drying, a relatively short perianth-tube, and is confined to the higher altitudes of the mountains in the more central portions of the island.

The only capsules seen, on *Parker* (K), are very long and narrow. It has been suggested by Scott Elliot, in Journ. Linn. Soc. xxix. 59 (1891), that a broader capsule is more characteristic. In the original description, Baker suggested a relationship with *G. alpina* Hook. f., but this species is a *Hesperantha.*

66. G. HESPERANTHOIDES Schltr. Plant to 32 cm. tall: corm ovoid, 1 cm. high, 7 mm. wide; the outer coats finely fibrous or fibrous-reticulate, the inner coats solid, probably becoming fibrous with age: basal leaves 2, 12–26 cm. long, 0.5–1.5 mm. wide, much shorter than the stem, linear-recurved, acute, glabrous, the midrib and edges very thick; the single cauline leaf 3–12 cm. long, sheathing for about half its length: stem simple, terete, glabrous, 1–3-flowered: outer spathe to 1 cm. long, shorter than the perianth-tube, oblong-ovate, truncately acute, herbaceous, becoming purple-membranous near the apex, the apical edge white-membranous; the inner spathe as long as the outer: ovary 2 mm. long, oblong-ovoid: perianth-tube to 9 mm. long, ampliate near or above the middle, pale in color: tepals subequal, to 1.6 cm. long, 4 mm. wide, obovate, obtuse, purple: stamens about ⅔ as long as the tepals; the anthers 4 mm. long, the filaments 7–8 mm. long, inserted at the middle of the tube according to Schlechter: style to 1.8 cm. long, not quite equal to the anthers; the stigmas short, curved, exceeding the anthers: capsule and seeds not seen.—Schlechter in Engler, Bot. Jahrb. xxvii. 97 (1899).

TYPE: *Schlechter*, no. 9555, from Vogelgat, in Caledon Div., at 3500 ft. alt., Dec. 2, 1896 (B; ISOTYPES in K, Gen).

HABITAT: among rocks, at relatively high altitudes.

SPECIMENS SEEN: Bredasdorp Div.: among rocks on top of Zoutmelkskop (highest peak on range), Jan. 5, 1931, *Galpin*, no. 11334 (K).

The Galpin collection lacks the corm, and without this it is impossible to state definitely that his plant belongs to this species, but in all other respects it appears to be *G. hesperanthoides.* On the isotype in Kew, N. E. Brown has noted: "*Schlechter* 2160 from the Langebergen is the same as this." Since *Schlechter*, no. 2160 is the type of *G. Burchellii*, a species in a different subgenus, it might be desirable to point out one or two differences, for the two plants superficially do resemble one another. In *G. Burchellii* all the corm-tunics are solid and imbricate, not fibrous; the stamens are markedly unequal. Neither of these characteristics occurs in *G. hesperanthoides.*

67. G. GRANDIS Hook. f. Plant about 25–30 cm. tall: corm small globose; tunics finely fibrous-reticulate: basal leaves 2–3, to 20 cm. long, 2 cm. wide, linear-ensiform, the midrib prominent; the cauline leaves shorter: stem to 30 cm. tall, stout, terete, glabrous, simple; the inflorescence a 6-flowered, rather lax, secund spike: outer spathe to 4.2 cm. long, elliptic- or lance-ovate, acute, herbaceous, much exceeding the perianth-tube; the inner spathe to 2.5 cm. long: ovary about 8 mm. long, more or less ovoid: perianth-tube very slender, to 2.5 cm. long, slightly curved: tepals subequal, to 4.5 cm. long, 1 cm. wide, elliptic-

obovate, obtuse, yellow with a red midrib: anthers 7 mm. long, the filaments 7 mm. long: style about 4 cm. long, not quite equal to the anthers; the stigmas to 9 mm. long, much exceeding the anthers: capsule and seeds not seen.—Hooker f. in Bot. Mag. xcvi. t. 5877 (1870).

TYPE: described from living material sent from Port Elizabeth, Cape Province, South Africa, in 1868.

SPECIMENS SEEN: *Hort. Barr,* in June, 1881 (K); *Hort. Barr,* in June, 1889 (K).

Since the two specimens seen consist only of the inflorescence, and upper portion of the stem, the details of the vegetative parts have been taken from Hooker's plate and the original description. Neither capsule nor seeds were mentioned by Hooker, nor does Baker mention them, so that it cannot be determined whether or not the seeds were alate.

In Handbk. Irid. 159 (1892), Baker stated that the style is "but little exserted from the tube." Hooker's plate shows the style well-exserted, and this is true of the specimens seen by me. Baker's additional comment that the plant "recedes in the direction of *Acidanthera*" seems quite correct. The material available is so scanty that final judgment cannot be passed on this point, but the species seems almost certainly not to belong in *Geissorhiza.*

DOUBTFUL OR UNKNOWN SPECIES

G. AMBONGENSIS H. Perr. in Notul. Syst. Mus. Hist. Nat. viii (2). 130 (1939).

This species, described in great detail by M. Perrier, is closely related to *G. Bojeri,* but seems, *ex descr.,* to be distinct. No material has been seen, and Mr. Weatherby was unable to locate and photograph the type for me. Consequently, it has been placed in the category of species unknown to me, although there seems no doubt of its distinctness.

G. FILIFOLIA Baker in Journ. Bot. xiv. 238 (1876).

No material has been seen which can certainly be assigned to this species. Through the kindness of Mr. Weatherby, a photograph of the type, *Prior,* collected in 1847, in the British Museum has been received. The narrow leaves are filiform, about 1 mm. wide, the longest about 25 cm. long, exceeding the inflorescence by about 2 cm. The inflorescence is a lax, 3-flowered, secund spike. In the original description, the flowers are said to be whitish, with a purple throat, and the relationship is said to be with *G. secunda,* although the spathes are reported to be entirely green. From the photograph, which is very clear, I should be inclined instead to relate it to *G. juncea*, but no definite statement can be made until the type or other material is seen.

G. MACRA Baker in Bull. Herb. Boiss. (ser. II) iv. 1004 (1904).

A photograph of the type, *Jacottet*, no. 1937, at Geneva is all that has been available to me. It was collected on Mt. Matchatchi, in the Transvaal. Since this region is so far from the normal range of the genus, it is hardly surprising to find that the plant has the aspect of *Hesperantha* or *Acidanthera.* The corm, which would assist materially in making a decision, is lacking. If Baker were correct in saying that the style is extruded from the perianth-tube and has short stigmatic branches, the plant cannot be a *Hesperantha.* The perianth-tube seems in the photograph to be somewhat bent, rather than "erectus" as Baker originally described it. This fact, the general appearance of the flowers, the shape of the leaves, and the locality—all make me think that the species should probably be in *Acidanthera.* Certainly, the plant does not appear to be a relative of *G. setacea*, as Baker stated.

G. QUADRANGULA (DelaR.) Ker-Gawl., Irid. Gen. 88 (1827). *Ixia quadrangula* De la Roche, Descr. 16 (1766).

So far as I know, no one has seen any material which can certainly be assigned to this species since the time of its original description by De la Roche. The type is probably no longer in existence. It has seemed possible that it may be close to or identical with *G. splendidissima*, but there are several points of difference between the descriptions of the two plants, and I should hesitate to make the identification, without seeing the type of *I. quadrangula.*

G. GRACILIS Baker, Handbk. Irid. 155 (1892).

No material has been seen which can be assigned to this species, nor was the type, *Tyson*, no. 1872, included in the specimens received from Kew. The locality given for the type, the Zuurberg in Griqualand East, is in itself enough to raise doubt as to the correct generic attribution of the species. As it happens, another species, *Ixia brevifolia* Baker, Handbk. Irid. 165 (1892), was described from *Tyson*, no. 1892, this specimen likewise coming from the Zuurberg; in Fl. Cap. vi. 84 (1896), this number was reported as no. 1872. Consequently, it would appear that *G. gracilis* and *I. brevifolia* were described from the same collection. Baker reported that *I. brevifolia* belongs in *Ixia*, subgenus *Morphixia*, which, as pointed out previously, is very close to *Geissorhiza* in appearance. The descriptions are similar, differing chiefly in the lengths given for the perianth-tubes. For each species, too, the corm is unknown. To find two species in different genera, so closely resembling one another, *ex descr.*, from the same altitude on one mountain, with probably the same collector's number as type, and the locality well outside the range of one of the genera involved is rather unusual. Until further information can be received concerning the types of these two species, *G. gracilis* must be regarded with some scepticism. It appears quite probable that the plant does not belong in *Geissorhiza*.

Species Excluded from the Genus

G. *abyssinica* R. Br. ex A. Rich., Tent. Fl. Abyss. ii. 308 (1851?) = Lapeyrousia abyssinica (R. Br.) Baker in Journ. Linn. Soc. xvi. 155 (1877).

G. anemonaeflora (Jacq.) Klatt in Linn. xxxiv. 657 (1865–66). *Ixia anemonaeflora* Jacq., Ic. Pl. Rar. ii. t. 273 (1786–93); Collect. v. 10 (1796).

The specimens cited by Klatt belong in *Geissorhiza*, but the plant figured and described by Jacquin does not. The spathes are shown as short, and are described as scarious, one being tridentate, and the other bidentate. It is probably an *Ixia*.

G. Briartii DeWild. & Th. Dur. in C. R. Soc. Bot. Belg. xxxix. 105 (1900).

Originally described from a Briart specimen collected at Mussima (Haut-Lualaba), in the Belgian Congo, this plant is reported to be very similar in general appearance to *Lapeyrousia Welwitschii* Baker, but differs in having the stigmas entire as in the genus *Geissorhiza*. In recently studying a number of species of *Lapeyrousia*, I have found several which have entire or only slightly retuse stigmas. These include such species as *L. abyssinica*, *L. coerulea* Schz., *L. avasmontana* Dinter, and probably others. Consequently, it appears proper to exclude *G. Briartii* from *Geissorhiza* and to consider it a *Lapeyrousia*. Without seeing the type, it would be improper to make a formal transfer or to identify the plant with any species now in *Lapeyrousia*.

G. inflexa (DelaR.) Ker-Gawl. in Koenig and Sims, Ann. Bot. i. 223 (1804). *Ixia inflexa* DelaR., Descr. 1 (1766).

There has been some question concerning this species virtually since its original description. Baker, in Journ. Linn. Soc. xvi. 94 (1877), regarded *G. vaginata* Sweet, Brit. Flow. Gard. ii. t. 138 (1826), as synonymous with it, and retained this opinion in all his published work. To me, this seems quite correct. De la Roche described the spathes of his plant as large, erect, almost as long as the perianth, and the flower color as "subviolacea luteoque insignitis," a description with which Sweet's plate agrees. Nevertheless, the specimens cited by Baker, Fl. Cap. vi. 73 (1896), agree neither with this description nor with Sweet's plate. Sweet's original description contains the significant statement that the style does not protrude from the perianth-tube, while the stigmas are relatively long. In other words, his plant was a *Hesperantha.*

Upon discovering this, a study was made of *Hesperantha*, and it was found that *H. Metelerkampiae* L. Bol. is a perfect match for Sweet's figure of *G. vaginata.* Although the type of *H. Metelerkampiae* has not been seen, I have seen a specimen sent to Kew from the Bolus Herbarium. Consequently, the species must be transferred to *Hesperantha,* so that it becomes

HESPERANTHA **inflexa** (DelaR.), comb. nov. *Ixia inflexa* DelaR. *G. inflexa* (DelaR.) Ker-Gawl. *G. vaginata* Sweet. *H. Metelerkampiae* L. Bol. in Ann. Bol. Herb. iv. 114 (1927).

G. latifolia (DelaR.) Baker in Journ. Linn. Soc. xvi. 94 (1877). *Ixia latifolia* DelaR., Descr. 22 (1766). = TRITONIA LATIFOLIA (DelaR.) N. E. Br. in Kew Bull. 1929: 135 (1939).

G. longituba Klatt in Linn. xxxv. 383 (1867–68) = HESPERANTHA LONGITUBA (Klatt) Baker in Journ. Linn. Soc. xvi. 96 (1877).

G. lutea Eckl. ex Klatt in Linn. xxxiv. 652 (1865–66) = HESPERANTHA LUTEA (Eckl.) Benth. ex Baker, Handbk. Irid. 149 (1892).

G. minima Baker in Journ. Bot. xiv. 239 (1876).

Dissection of the type shows that this species is a *Hesperantha,* so that it becomes

H. **minima** (Baker), comb. nov.

G. pauciflora Baker in Bull. Herb. Boiss. (ser. II) iv. 1004 (1904).

Dissection of the type shows that this species, too, is a *Hesperantha.* Comparison with material of that genus shows further that it is identical with H. PENTHERI Baker, and must retain that name because of the existence of *H. pauciflora* (Baker) Lewis in Pole Evans, Fl. Pl. S. Afr. xvii. pl. 682 (1938), this being based on *Tritonia pauciflora* Baker.

G. recurvifolia (Poir.) Klatt in Linn. xxxiv. 655 (1865–66).

Based on *Ixia recurvifolia* Poir. in Lam., Encyc. Suppl. iii. 201 (1813), this is a *Geissorhiza* as to specimens cited, and a *Romulea* nomenclaturally, for *I. recurvifolia* is a *Romulea.*

G. Schlechteri Baker in Bull. Herb. Boiss. (ser. II). i. 863 (1901) = HESPERANTHA SCHLECHTERI (Baker) R. C. Foster in Contrib. Gray Herb. cxiv. 50 (1936).

G. vaginata Sweet, Brit. Flow. Gard. ii. t. 138 (1826) = HESPERANTHA INFLEXA (DelaR.) R. C. Foster.

ADDENDUM

While this paper was going through the press, two new species were described and one new combination made by Miss G. J. Lewis, in Journ. S. Afr. Bot. vii (1941). In revising *Acidanthera* (in the broad sense), it was found necessary to transfer *A. Fourcadei* L. Bol., which now becomes Geissorhiza Fourcadei (L. Bol.) Lewis. Although no material is available to me at the moment, Miss Lewis's remarks on the inflorescence indicate its distinctness as a species.

Geissorhiza umbrosa Lewis, l. c., p. 46 (1941), is indicated as nearest in relationship to *G. setifolia* (*G. juncea* of the present study). Three collections are cited; one of these, *Bolus*, no. 4615 (K), from the summit of Table Mt., has been seen by me. I find that, with considerable doubt, I have treated it as an unusually tall specimen, possibly of hybrid origin, of *G. humilis* var. *bicolor*. It is quite possible that *G. umbrosa* is a distinct species.

G. teretifolia Lewis, l. c., p. 48 (1941), is said to be related to *G. imbricata*, differing especially in its terete, fleshy leaves. One of the specimens cited, *Lewis* in Herb. Bolus, no. 20414, has been seen by me. It was regarded as being *G. geminata*. Re-examination of the material of this species convinces me that my original determination was correct, and that *G. teretifolia* should be regarded as identical with *G. geminata*. It is worth noting that the corm is described and figured as having imbricate tunics, these being split from the base upwards.

One point of difficulty has been definitely settled by Miss Lewis (l. c., pp. 54–55). She has examined the types of *Ixia brevifolia* and *Geissorhiza gracilis*, finding that they are identical and that they are *Gladiolus subaphyllus* N. E. Br.

The fact that *Geissorhiza pauciflora* is actually a *Hesperantha* was noted by Miss Lewis, as it has been in the present study. Because the name *pauciflora* is preoccupied, the name H. insipida Lewis is proposed (l. c., p. 56). Unfortunately, as I noted earlier, *G. pauciflora* is identical with *H. Pentheri*, so that *H. insipida* must become a new synonym of that name.

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2. DESMODIUM: PRELIMINARY STUDIES—II

By Bernice G. Schubert

(Plates 1–3)

In this paper, as in the first of the series (Contrib. Gray Herb. cxxix. 3–31 (1940)), an attempt is made to clarify the status of certain species for a long time overlooked or poorly understood. Wherever possible keys to the groups are presented and illustrations and maps have been prepared.

I am again very glad to acknowledge the loans of specimens generously made available for study by the curators of the following herbaria: Dudley Herbarium, Stanford University (D); Field Museum of Natural History (F); Royal Botanic Gardens, Kew (K); Missouri Botanic Garden (M); New York Botanical Garden (NY); Academy of Natural Sciences, Philadelphia (P); Desert Laboratory, Tucson, Arizona (T); the University of California (UC); United States National Herbarium (US); and by Mr. H. S. Gentry, from his personal collection (HG). Specimens not otherwise designated are in the Gray Herbarium (G). It is a pleasure to express my appreciation for the cordial and generous use of facilities offered me for study at the Field Museum of Natural History, the Missouri Botanic Garden, the New York Botanic Garden and the United States National Herbarium during the spring of 1940. I am indebted to Mr. C. A. Weatherby for aid in nomenclatural problems and in the Latin descriptions and to Dr. Lyman B. Smith for the use of his base maps. For his constant help and guidance in supervising my studies I am particularly grateful to Professor M. L. Fernald.

A. The Varieties of Desmodium axillare

Desmodium axillare (Sw.) DC. Herbaceous; stem repent, rooting at the nodes; internodes 1.3–11 cm. long: leaves trifoliolate, petiolate; petiole about 10 times as long as leaf-rachis; leaf-rachis up to 12 mm. long (or occasionally lacking); petiolules of the lateral leaflets usually somewhat longer than those of the terminal leaflets: stipules connate up to half their length, rather early deciduous: bracts very early deciduous: calyx uncinulate-puberulent over whole surface with stout straight trichomes along the teeth of both lobes: corolla always exceeding calyx; standard obovate or more rarely ovate, broadly acute below or narrowing slightly to an obtuse or truncate base, rounded at apex, retuse; wings obliquely obovate, truncate or obtuse at apex, auriculate at base, short-clawed; keel-petals fused, more or less falcate, obtuse at apex, broadish-clawed: loment 1–3-, mostly 2-articulate, stipitate; upper suture continuous, essentially straight.

Desmodium axillare was assigned by Schindler[1] to his subgenus *Swartziella* of the genus *Nephromeria* (Benth.) Schindl. The affinities of the species, however, seem to be with another group which Schindler retains in *Desmodium* (as limited by him[2]). This question, with many others of similar character, will be considered in a forthcoming study of the subgeneric categories.

[1] A. K. Schindler in Rep. Spec. Nov. Reg. Veg., xx. 284 (1924).
[2] A. K. Schindler, op. cit., 136, 137.

The species belongs to a small group which possesses connate stipules; it is further characterized (1) by its habit, the petioles and racemes arising from a repent stem which roots at the nodes; (2) by its mostly long-petiolate leaves with extremely short (or without) leaf-rachises; (3) by its loments, borne in pairs, almost constantly 2-articulate and with large semi-elliptic articles. The following key may help in distinguishing the varieties of the species from each other and from the habitally similar *D. Wydlerianum.*

Habit delicate; leaflets thin with sinuolate margins and truncate to subcordate base; loments sessile to substipitate, borne singly; articles semi-ovate . . . . *D. Wydlerianum.*
Habit stout; leaflets rather thick with entire margins, base usually rounded-obtuse; loments long-stipitate, borne in pairs, upper suture essentially straight with articles semi-elliptic . . . . . . *D. axillare.*
  Stems with rather inconspicuous pubescence of short hooked hairs; leaflets short-pilose beneath.
    Leaflets rhombic, rhombic-ovate or rhombic-orbicular, obtuse or rounded at apex; stipe 3–4.6 mm. long . . . . Var. *genuinum.*
    Leaflets ovate, rather abruptly short-acuminate; stipe 4.6–8 mm. long . . . . Var. *Sintenisii.*
  Stems with long, dense pubescence of straight hairs; leaflets ovate or elliptic-ovate, long-pilose beneath, acute to gradually (usually long-) acuminate . . . . Var. *acutifolium.*

D. AXILLARE (Sw.) DC., var. GENUINUM Urban. Stem rather finely striate, terete to subangular, uncinulate-puberulent: petioles[3] angular, striate, rather densely uncinulate-pubescent and moderately patent-pilose becoming rather densely so toward petiolules and rachis, 3.6–11.5 cm. long; leaf-rachis with rather short spreading pilosity and with uncinulate-puberulence or -pubescence, very short (or lacking), up to 5 mm. long; petiolules dark, rugulose, with long spreading pilosity, 2.3–4 mm. long: leaflets glabrescent to appressed short-pilose above, prominently reticulate and rather densely pilose below, slightly revolute, ciliate, densely so about base; terminal leaflets ovate-elliptic to ovate, rhombic or less often orbicular or cuneate, broadly acute to obtuse or almost rounded at apex, with base acute, obtuse or becoming rounded, 4–9 cm. long, 2.5–5.5 cm. wide; lateral leaflets obliquely ovate or ovate-elliptic (rarely rhombic or nearly orbicular), obtuse, acute or short-acuminate, mostly broadly obtuse at base, 3.4–8 cm. long, 2.2–4.5 cm. wide: connate stipules ovate with long-acuminate to filiform apices, finely striate and moderately spreading-pilose over dorsal surface, long-ciliate, 4.8–6 mm. long, ± 5 mm. wide (fused); stipels linear-lanceolate, often with long-filiform apex, striate, ciliate,

[3] Petiole-measurements, contrary to the practice followed in the previous paper (Contrib. Gray Herb. cxxix. 5 (1940), footnote), are taken from the base of the petiole (including swollen pulvinus) to the petiolules of the lateral leaflets. Measurement of the leaf-rachis is taken from the petiolules of the lateral leaflets to the base of the petiolule of the terminal leaflet.

rather early deciduous, 1.3–4 mm. long: inflorescence-rachis finely multistriate, uncinulate-puberulent: bracts ovate-acuminate, striate and pilose over dorsal surface, ciliate, 2.5–4.5 mm. long, 1.5–2.5 mm. wide: pedicels uncinulate-pubescent and with short, stiff, straight hairs, 0.5–1.2 cm. long at time of flowering, 1–1.7 cm. long at fruiting time: calyx[4] with central tooth of lower lobe 2.5–3.5 mm. long, lateral teeth 2–3 mm. long; upper lobe bifid, 2–2.6 mm. long: corolla about twice as long as calyx; standard 4–4.6 mm. long, 3–5 mm. wide; wings 3.5–4.5 mm. long, 1.8–2.6 mm. wide; keel-petals 3–4.6 mm. long, 2.2–3.5 mm. wide: loment stipitate, 1–3-, mostly 2-articulate, shortly and finely spreading-uncinulate-pilosulous along sutures and stipe, uncinate-pubescent with stout trichomes over surface; stipe 3–4.6 mm. long; subterminal article (5.5–) 6–10 mm. long, (4.4–) 4.6–5.5 mm. wide; terminal article (5.8–) 6–7 mm. long, (4–) 4.4–4.8 mm. wide.—Pl. 1, figs. A15–21. Map 1.—*D. axillare* (Sw.) DC., Prod. ii. 333 (1825). *Hedysarum axillare* Sw. Prod. 107 (1788); Fl. Ind. Occ. 1274 (1806) emend. *Meibomia axillaris* (Sw.) O. Ktze., Rev. Gen. i. 195 (1891). *Nephromeria axillaris* (Sw.) Schindl. in Rep. Spec. Nov. Reg. Veg. xx. 284 (1924). *D. axillare* (Sw.) DC., var. α. *genuinum* Urb., Symb. Ant. ii. 303 (1900). *Meibomia axillaris* (Sw.) O. Ktze., var. α. *obtusifoliola* O. Ktze., loc. cit.; *D. axillare* (Sw.) DC., var. α. *obtusifoliola* (O. Ktze.) Urb., op. cit., iv. 291 (1905). *Nephromeria axillaris* (Sw.) Schindl., var. α. *obtusifoliola* (O. Ktze.) Schindl., loc. cit. *Hedysarum reptans* Poir. in Lam. Encyc. Meth. Bot. vi. 422 (1804). *D. reptans* (Poir.) DC., loc. cit. *Meibomia reptans* (Poir.) O. Ktze., op. cit. i. 198 (1891). *D. radicans* Macfadyen, Fl. Jam. i. 269 (1837). *Meibomia andina* Rusby in Mem. Torr. Bot. Cl. iii^3. 21 (1893), as to isotypes in Gray Herbarium, the Missouri Botanic Garden and the U. S. National Herbarium, not as to type in the herbarium of the N. Y. Botanical Garden.—Southernmost Mexico, Central America, West Indies, South America south to Bolivia, Paraguay and Brazil.—MEXICO: Vera Cruz: Misantla, August 1912, *Purpus*, no. 5887 (G, M, US). GUATEMALA: Izabal: vicinity of Quiriguá, 75–225 m. alt., May 15–31, 1922, *Standley*, no. 24157 (G, US); clearing, Rio Mojanales, May 17, 1919, *Blake*, no. 7485. BRITISH HONDURAS: El Cayo: in clearing on river bank, Macaw Bank, June–August, 1936, *Lundell*, no. 6575. HONDURAS: Atlantida: near trail in foothills, back of Ceiba, July 8, 1938, *Yuncker, Koepper & Wagner*, no. 8300. COSTA RICA: Comarca de Limon: Hacienda de Zent, *Tonduz*, no. 237 (US); Jiménez, Llanos de Santa Clara, 650 ft. alt., April 1894, *J. D. Smith*, no. 4794; San José: on open ground, basin of El General, 675–900 m. alt., May 1940, *Skutch*, no. 4908 (US). PANAMA: Canal Zone: along Pearson trail, Barro Colorado Island, July 11, 1925, *C. W. Dodge*, nos. 3463 and 3478; Gatun Station, P. R. R., November 1859, *S. Hayes*, no.

[4] Measurements of calyx-lobes, unless otherwise stated, include length of calyx-lobe plus calyx-tube.

62. BOCAS DEL TORO: November 6, 1920, *Carleton*, no. 68. CUBA: HAVANA: Calvario, July 15, 1909, *León*, no. 1326 (NY). SANTA CLARA: creeping in rich shaded woods, Cieneguita, May 21, 1895, *Combs*, no. 70. ORIENTE: prope villam Monte Verde dictam, January–July, 1859,[5] *C. Wright*, no. 128 (G, NY). Prov. Indefinite: ad montes in valle Yumurey, 1849, *Rugel*, no. 379 (NY). JAMAICA: SURREY COUNTY: moist shady places, St. Thomas Parish, 200 ft. alt., July 31, 1903, *G. E. Nichols*, no. 177. CORNWALL COUNTY: damp roadside beneath trees, near Ipswich, St. Elizabeth Parish, 200–300 m. alt., April 1, 1920, *Maxon & Killip*, no. 1518. County Indefinite: Carleton Hill, 333 m. alt., September 5, 1900, *Fawcett*, no. 8029 (NY). HISPANIOLA: DOMINICAN REPUBLIC: Santo Domingo, 1839, *Ehrenberg*, s. n. (NY). Puerto Plata: in sylvestribus repens, Rio Mameyes, 100 m. alt., June 16, 1887, *Eggers*, no. 2497 (NY). Barahona: April 1910, *Fuertes*, no. 214B. HAITI: Ouest: roadside ravine, vicinity of Pétionville, ca. 350 m. alt., June 15–28, 1920, *Leonard*, no. 4921. Sud: along brook, Delcom village, Montagnes de la Hotte, 500 m. alt., August 26, 1927, *Eyerdam*, no. 374. PUERTO RICO: AGUADILLA: Adjuntas, in sylva montis, la Vaca, May 11, 1886, *Sintenis*, no. 4290 (M). BAYAMO: prope Bayamon, September 1887, *Stahl*, no. 355. HUMACAO: Sierra de Luquillo, in monte Jimenes, June 1885, *Sintenis*, no. 1688. GUAYAMA: Cayey, 1000 ft. alt., March 13, 1874, *Kuntze*, no. 436 (NY, type of var. *obtusifoliola*). Indefinite: 1827, *Wydler*, s. n. (NY). LESSER ANTILLES: ST. CROIX: Crequis, June 11, 1896, *Ricksecker*, no. 428. SABA: between Bottom and Marypoint, 100–200 m. alt., July 9, 1906, *Boldingh*, no. 1501B (NY). DOMINICA: ad vias et in pratis Grande Bay, October 1887, *Eggers*, no. 537; moist forests along Carib trail from Salybia to Concorde Valley (Roseau Track), Carib Reserve, May 1, 1940, *W. H. & B. T. Hodge*, no. 3232. GRENADA: roadside, Mount Gay Byeway, May 11, 1905, *Broadway*, s. n. TRINIDAD: Ortoire River, Guayaguayare Road, March 25, 1921, *Britton, Freeman & Nowell*, no. 2524 (G, NY). VENEZUELA: CARABOBO: in forest and clearings, upper Guaremales, road from Puerto Cabello to San Felipe, 100–500 m. alt., April 18, 1920, *Pittier*, no. 8799. COLOMBIA: MAGDALENA: Caeagualito, 1500 ft. alt., June 1898–99, *H. H. Smith*, no. 44 (NY). SANTANDER: thicket, Puerto Wilches and vicinity, 100 m. alt., November 28–December 2, 1926, *Killip & Smith*, no. 14760. BOLIVAR: woods along river, Barro Blanco on Rio Sinu, 50–80 m. alt., February 6, 1918, *Pennell*, no. 4165. TOLIMA: brushy slope, Libano, 700–900 m. alt., December 26–29, 1917, *Pennell*, no. 3419 (G, M). VALLE DEL CAUCA: La Paila, May 12,

[5] There are two specimens of this number in the Gray Herbarium; on one label the date is printed "Jan.–July, 1859," on the other it is "1856–7." According to L. M. Underwood in Bull. Torr. Bot. Cl. xxxii. 293 (1905), Wright was in Monte Verde from April 23 to May 3, 1857 and from December 3, 1858 at intervals until October 1861, and again in May 1867. The exact date is, therefore, uncertain.

1853, *Holton*, no. 957 (NY); open hillside east of Dagua, 1200–1500 m. alt., May 13–14, 1922, *Pennell*, no. 5603; in Rio Rela, Buenos Aires, 1000–1300 m. alt., 1896, *Lehmann*, no. 8657 (G, US). PERU: LORETO: dense forest, Yurimaguas, lower Río Huallaga, ca. 135 m. alt., August 23–September 7, 1929, *Killip & Smith*, no. 27629 (US). CUZCO: Hacienda Potrero, Prov. Convencion, 1300 m. alt., January 10, 1940, *Vargas*, no. 1699. BOLIVIA: COCHABAMBA: Antahuacana, Espiritu Santo, about 160 kilometers ne. of Cochabamba, 750 m. alt., June 1909, *Buchtien*, no. 2280 (US). LA PAZ: Hacienda Simaco sobre el camino a Tipuani, 1400 m. alt., January 1920, *Buchtien*, no. 5431 (G, NY); Charopampa near Mapiri, 570 m. alt., November 1907, *Buchtien*, no. 1795 (NY). EL BENI (?): Yungas [15° S. lat., 65° W. long.], *Bang*, no. 650 (G, M, US, isotypes of *M. andina*). BRAZIL: MATTO GROSSO: July 1892, *Kuntze*, s. n. (NY). MINAS GERAES: overgrown pasture, Fazenda de Aguada, 1 km. within gate, 700 m. alt., December 24, 1930, *Mexia*, no. 5444 (G, M). ESPIRITU SANTO: border of tangled woods, November 20, 1929, *Mexia*, no. 4004 (G, M). PARAGUAY: in regione vicine Igatimí, November 1898–9, *Hassler*, no. 5417.

Variety *genuinum* is the most wide-spread of the varieties of *Desmodium axillare*, extending both farther north and south than either of the other two.

There seems to be no doubt that *Hedysarum reptans* Poir. is identical with var. *genuinum*. Poiret distinguished it chiefly by the leaflets which he said were oval and not acuminate, differing from those in *D. axillare* which are ". . . rhomboidales, un peu arrondies."[6] From study of a large series of specimens it is clear, however, that the shape of the leaflets varies within broad limits and the difference cited can hardly be diagnostic. Schindler,[7] who saw the type of *H. reptans*, considered it identical with var. *obtusifoliola* O. Ktze. which is synonymous with var. *genuinum* Urban, as here considered.

In *Meibomia andina* of Rusby a mixture exists, as noted also by Schindler (op. cit., 184), in the type-collection. The isotypes in the Gray Herbarium, the herbarium of the Missouri Botanic Garden and the United States National Herbarium are *M. andina* as described by Rusby and are referable to *D. axillare*, var. *genuinum*, but the type-specimen in the New York Botanic Garden is another species also earlier described.

Var. ACUTIFOLIUM (O. Ktze.) Urban. Stem stoutish, densely and softly patent-pilose, terete: petioles angular, ridged and grooved, pilose as stem, 4–10 cm. long; leaf-rachis similar to petiole, 0.5–1.2

[6] Poiret in Lam. Encyc. Meth. Bot. vi. 422 (1804).

[7] A. K. Schindler in Rep. Spec. Nov. Reg. Veg. Beihefte, Bd. xlix. 20 (1928).

cm. long; petiolules dark, flattened, somewhat rugulose, more densely pilose than petiole and leaf-rachis, those of terminal leaflets 1.5–3 mm. long, those of lateral leaflets 2.5–3 mm. long: leaflets ovate or ovate-elliptic (always more narrowly so than in var. *Sintenisii*) becoming gradually acuminate to the apex, with base (broadly acute to) rounded to truncate; upper surface darkish green, short-pilose; lower surface densely soft-pilose, with midrib and chief lateral veins rather prominent; terminal leaflet 5–11 cm. long, 3–6 cm. wide; lateral leaflets 4.5–9 cm. long, 2–4.5 cm. wide: connate stipules obliquely ovate, long acuminate, with dorsal surface striate and patent-pilose, long-ciliate, 5–10 mm. long, 2–4 mm. wide (i. e. when separated); stipels lance-attenuate, striate and pilose, rather early deciduous, 3–5 mm. long: inflorescence-rachis subangular, ridged and grooved, pilose and uncinulate-pubescent below, becoming simply uncinulate-pubescent above: bracts ovate-acuminate, striate and long-silky-pilose over dorsal surface, ciliate, 3.5–5 mm. long, 2–3 mm. wide: pedicels rather densely uncinulate-puberulent, 0.6–1 cm. long at flowering time, 1–1.8 cm. long at fruiting time: calyx with central tooth of lower lobe 2.4–3.2 mm. long, lateral teeth 2.4–3 mm. long; upper lobe bifid, 1.8–2.6 mm. long: corolla about twice as long as calyx; standard 4–6.2 mm. long, 3.5–4.5 mm. wide; wings 3.8–6 mm. long, 1.5–3.5 mm. wide; keel-petals 4–5.5 mm. long, 1.5–2 mm. wide: loment stipitate, 2-articulate, densely uncinulate-pilosulous along stipe and sutures, uncinate-pubescent on surfaces, with trichomes not as stout as in other varieties; stipe 4–7 mm. long; subterminal article 6–8 mm. long, 3.5–5 mm. wide; terminal article 6.5–8 mm. long, 3–5 mm. wide.—PL. 1, FIGS. A8–14. MAP 2.—*D. axillare* (Sw.) DC., var. β. *acutifolium* (O. Ktze.) Urb., Symb. Ant. iv. 292 (1905). *Meibomia axillaris* (Sw.) O. Ktze., var. β. *acutifolia* O. Ktze., Rev. Gen. i. 195 (1891). *Nephromeria axillaris* (Sw.) Schindl., var. β. *acutifolia*[8] (Urb.) Schindl. in Rep. Spec. Nov. Reg. Veg. xx. 284 (1924). *D. axillare* (Sw.) DC., var. β. *angustatum* Urb., op. cit. ii. 303 (1900). *D. axillare* (Sw.) DC., var. β. *angustatum* Urb., f. *robustius* Urb., loc. cit. *D. axillare* (Sw.) DC., var. β. *acutifolium* (O. Ktze.) Urb., f. *robustius* (Urb.) Urb., op. cit. iv. 292 (1905). *Nephromeria axillaris* (Sw.) Schindl., var. β. *acutifolia* (Urb.) Schindl., f. *robustior* (Urb.) Schindl., loc. cit. *Hedysarum stoloniferum* Rich. ex Poir. in Lam. Encyc. Meth. Bot. vi. 421 (1804). *D. stoloniferum* (Rich. ex Poir.) Steud., Nomencl. Ed. 2. i. 496 (1840). *Hedysarum oblongifolium* Bertero ex DC., Prod. ii. 332 (1825) in synon. *D. oblongifolium* Bertero ex DC., loc. cit. *Meibomia umbrosa* Britton in Bull. Torr. Bot. Cl. xxxvii. 353 (1910). *M. prorepens* Blake in Contrib. U. S. Nat. Herb. xxiv. 6 (1922).—Central America and the West Indies to Colombia with two stations in Brazil.—GUATEMALA: IZABAL: edge

[8] Incorrectly given by Schindler, loc. cit., as "*acutifoliola*."

of woods, Los Amates, May 29, 1919, *S. F. Blake*, no. 7718 (US, type of *Meibomia prorepens*). BRITISH HONDURAS: Roaring Creek, August 1929, *Lundell*, no. 374 (D). Belize District: Maskall, July 16, 1934, *Gentle*, no. 2165. Orange Walk District: Honey Camp, November 1929, *Lundell*, no. 624 (M). PANAMA: Colon: June 1874, *Kuntze*, s. n. (NY, type). Canal Zone: Tower Trail, Barro Colorado Island, July 24, 1934, *Shattuck*, no. 1046. CUBA: Pinar del Rio: Rangel, Loma del Sabicú, August 1926, *León*, no. 12610 (NY); along stream, vicinity of Herradura, August 26–30, 1910, *Britton, Britton, Earl & Gager*, no. 6487 (NY). Isle of Pines: Arroyo, La Cunagua, February 19, 1916, *Britton, Britton & Wilson*, no. 14556 (NY). Santa Clara: Valle del Caracusey, grupo de Sancti Spiritus, August 1–11, 1916, *León & Clement*, no. 6454 (NY); deep woods on the hillside, San Blas, ca. 1000 ft. alt., September 3, 1940, *Hodge, Howard & Godfrey*, no. 4498. Oriente: Loma San Juan, Cobre range of Sierra Maestra, July 1925, *Bro. Hioram*, no. 7197 (NY). JAMAICA: [locality not given] in sylvis collinum editiorum, 1821, *Bertero*, no. 2193 (NY, tracing and fragment of type of *Desmodium oblongifolium*). Middlesex County: Trelawney Parish, shaded grassy hillside, Troy, Cockpit Country, September 13–18, 1906, *Britton*, no. 444 (NY, type of *Meibomia umbrosa*). Cornwall County: Manchester Parish, woodlands near Newport, September 3–7, 1908, *Britton*, no. 3209 (NY). PUERTO RICO: Humacao: Luquillo Mountains, in regione media montis Jimenes in sylvis, March 1885, *Sintenis*, no. 1689 (G, M, NY, isotypes of var. *angustatum*, f. *robustius* Urb.). LESSER ANTILLES: Trinidad: roadside, Trinidad Cascade, June 9, 1903, *J. R. Johnston*, nos. 3 & 4; *Sieber* (Fl. Trinitatis) no. 267 (M, cited by Urban as var. *angustatum*). COLOMBIA: Magdalena: Santa Marta, 250 ft. alt., May 1898–1901, *H. H. Smith*, no. 43(G, M, NY[9]). BRAZIL: Bahia: in umbrosis [no further data] (G). Rio de Janeiro: 1841, *Gardner*, no. 5437.

Variety *acutifolium* has, perhaps, the most striking aspect of the three varieties of *D. axillare*, chiefly because of the very long and dense pubescence of the stem and lower surface of the leaflets.

In the synonymy cited above *Hedysarum stoloniferum* Rich. ex Poir. has been questioned. The detailed french diagnosis by Poiret says "folioles . . . glabres à leurs deux faces . . .". Schindler[10] assigns the species to synonymy under *Nephromeria axillaris*, var. *acutifoliola* [for *acutifolia*] and his examination of the type may have proven Poiret's statement erroneous. However, since study of the type is at present impossible it seems wiser to make no definite

[9] Collector's note on NY specimen: "43 Near Bonda
(below 500 ft. July
No note."

[10] A. K. Schindler in Rep. Spec. Nov. Reg. Veg. Beihefte. Bd. xlix[1]. 20 (1928).

disposition of the name at this time. DeCandolle (Prod. ii. 333 (1825)) gives *Hedysarum stoloniferum* as a synonym of his *D. spirale* (Sw.) DC., var. β. *stoloniferum* (Rich. ex Poir.) DC. If it were certain that Poiret's specimen and also DeCandolle's were identifiable with Kuntze's var. *acutifolia* then, of course, the name *stoloniferum* would have to be maintained for the variety here considered, because it is the first epithet in the varietal category. Schindler considered DeCandolle's name a synonym of *D. Wydlerianum*. Therefore, this case, also, seems best left open for further study when the type-specimens are available.

Schindler (Rep. Spec. Nov. Reg. Veg. Beih. Bd. lxix. (1928)) assigns *Hedysarum violaceum* Vell. Fl. Flum. 318 (1825), vii. t. 148 (1827), to synonymy under *Nephromeria axillaris* (p. 329) and on page 78 states more specifically:

"? *Hedysarum violaceum* Vell., Fl. flum. VII. t. 148 [= *Nephr. axillaris* var. *obtusifoliola*]."

Examination of the plate makes this disposition of the name somewhat questionable because the leaflets have the outline of those of typical var. *acutifolium*. The original diagnosis ["2. H. *violaceum*. H. foliis ternatis, subtus scabris; caule hispido floribus racemosis, conjugatis. (Tab. 148ª. T. 7)"] increases the confusion because no one of the varieties has the leaflets "subtus scabris". The amplified description continues "Foliola lanceolata-ovata", which seems better applicable to var. *acutifolium* than var. *genuinum* (var. *obtusifoliola*).

Meibomia umbrosa was described by Britton as being "nearest to *M. axillaris* (Sw.) Kuntze, which is nearly glabrous, with blunt leaflets". This statement, obviously, cannot apply to *D. axillare*, var. *acutifolium* (but rather to var. *genuinum*) with which the type-specimen of *M. umbrosa* is readily identified.

Meibomia prorepens Blake has been carefully examined and I can find no character by which this species can be distinguished from *D. axillare*, var. *acutifolium*. Blake stated that his species was closely related to *M. umbrosa* but that the descriptions varied on several points. After careful study of the types I find the leaflets have precisely the same kind of pubescence beneath; the bases of the lateral leaflets of both type-specimens are equally obliquely obtuse; the difference in length of fruiting pedicels seems to be due to a difference in age of the specimens, which would account also for the variation in the loments.

D. axillare, var. *angustatum*, described by Urban and later reduced by him to synonymy under var. *acutifolium* (O. Ktze.) Urb., and forma *robustior* of the same variety, the latter with somewhat denser pubescence, seem both to be properly placed under variety *acutifolium.*

Var. SINTENISII Urban. Stem striate, terete to subangular, with very short uncinulate puberulence: petioles angular, ridged and grooved, with dense short uncinulate puberulence, 5.5–15 cm. long; leaf-rachis similar, 5–11 mm. long; petiolules rugulose, rather densely pilose, those of terminal leaflets 4 mm. long, those of lateral leaflets 3.8–5.5 mm. long: leaflets dark green and dull or sublucid above, with veins more or less prominent, glabrous or with short, rather sparse puberulence mostly along midrib and veins; lower surface much paler, densely short appressed-pilose, with venation quite prominently reticulate and with margins only slightly, if at all, revolute; leaflets all ovate-acuminate, broadly acute to rounded at base (somewhat obliquely so in lateral leaflets), becoming rather abruptly acuminate at apex; terminal leaflets 6.5–10 cm. long, 4–6 cm. wide; lateral leaflets 6–9.5 cm. long, 3–5.5 cm. wide: stipules connate for about ¼ their length, ovate, acute, truncate at base, striate on dorsal surface, puberulent, rather short-ciliate, 6–9.5 mm. long, 3–4.5 mm. wide (i. e. separated); stipels linear-lanceolate, striate, puberulent, sometimes pilose and ciliate, early deciduous, 3–7 mm. long: inflorescence-rachis uncinulate-puberulent with hairs longer than those of petiole (but of same type): bracts ovate-acuminate, striate on dorsal surface and uncinulate-puberulent with stiff, short pilosity near base, ciliate with stout stiff hairs, 4–5 mm. long, 1.6–2 mm. wide: pedicels densely and finely uncinulate-puberulent, 0.7–1 cm. long at flowering time, 1–2 cm. long at fruiting time: calyx with central tooth of lower lobe 2.4–3.4 mm. long, lateral teeth 2–3 mm. long; upper lobe bifid, 2–2.8 mm. long: corolla exceeding calyx; standard 4.8–5.8 mm. long, 4.4–5 mm. wide; wings 5.2–5.4 mm. long, 2.6–3 mm. wide; keel-petals 4.6–5.4 mm. long, 2–2.8 mm. wide: loment stipitate, 2-articulate, with short, stiff uncinulate puberulence along the stipe and sutures, which becomes less dense in age; stipe 4.6–8 mm. long; subterminal article 6.5–10.5 mm. long, 3.5–7 mm. wide; terminal article 6.5–10.5 mm. long, 4–6.5 mm. wide.—PL. 1, FIGS. A1–7. MAP 3.—*Desmodium axillare* (Sw.) DC., var. γ. *Sintenisii* Urb., Symb. Ant. ii. 303 (1900). *Meibomia Sintenisii* (Urb.) Britton in Britton & Wilson, Sci. Surv. Porto Rico & Virgin Islands, v. 402 (1924). *Nephromeria axillaris* (Sw.) Schindl., var. γ. *Sintenisii* (Urb.) Schindl. in Rep. Spec. Nov. Reg. Veg. xx. 284 (1924). *Meibomia albida* Blake in Contrib. U. S. Nat. Herb. xxiv. 5 (1922).—Central America, the Greater Antilles and northern South America.—GUATEMALA: IZABAL: wood path, Quebradas, May 19, 1919, *Blake*, no. 7510 (G, isotype; US, type of *Meibomia albida*). BRITISH HONDURAS: EL CAYO: limestone valley in advanced forest, Valentin, June–July 1936, *Lundell*, no. 6201. JAMAICA: SURREY COUNTY: wet woods, Mansfield, St.

Thomas Parish, 400 m. alt., September 15–19, 1908, *Britton*, no. 3574 (NY). HISPANIOLA: DOMINICAN REPUBLIC: Barahona, Mt. Ma Figaro, near Paradise, 750 m. alt., October 1910, *Fuertes*, no. 484 (G, NY). PUERTO RICO: HUMACAO: mountain forest, Sierra de Naguabo, Barrio de Maizales, 750 m. alt., March 8, 1914, *Britton & Cowell*, no. 2183 (NY); open places by trail, Sierra de Naguabo, Rio Icaco and adjacent hills, 465–720 m. alt., July 30–August 5, 1914, *J. A. Shafer*, no. 3542 (NY); Sierra de Yabucoa, in sylva primaeva montis Cerro Gordo, October 4, 1885, *Sintenis*, no. 2781 (cited as var. *Sintenisii* by Urban). COLOMBIA: SANTANDER: Magdalena Valley (Camp Carare VI), vicinity of Puerto Berrio, between Carare and Magdalena Rivers, 100–700 m. alt., July 24, 1935, *Haught*, no. 1851. PERU: LORETO: in dense forest, mouth of Rio Santiago above Pongo de Manseriche, January 1, 1932, *Mexia*, no. 6364. BRITISH GUIANA: NORTHWEST DISTRICT: Mabaruma Compound, July 11, 1934, *Archer*, no. 2234 (US). BRAZIL: AMAZONAS: falls of Madeira, October 1886, *Rusby*, no. 960 (US).

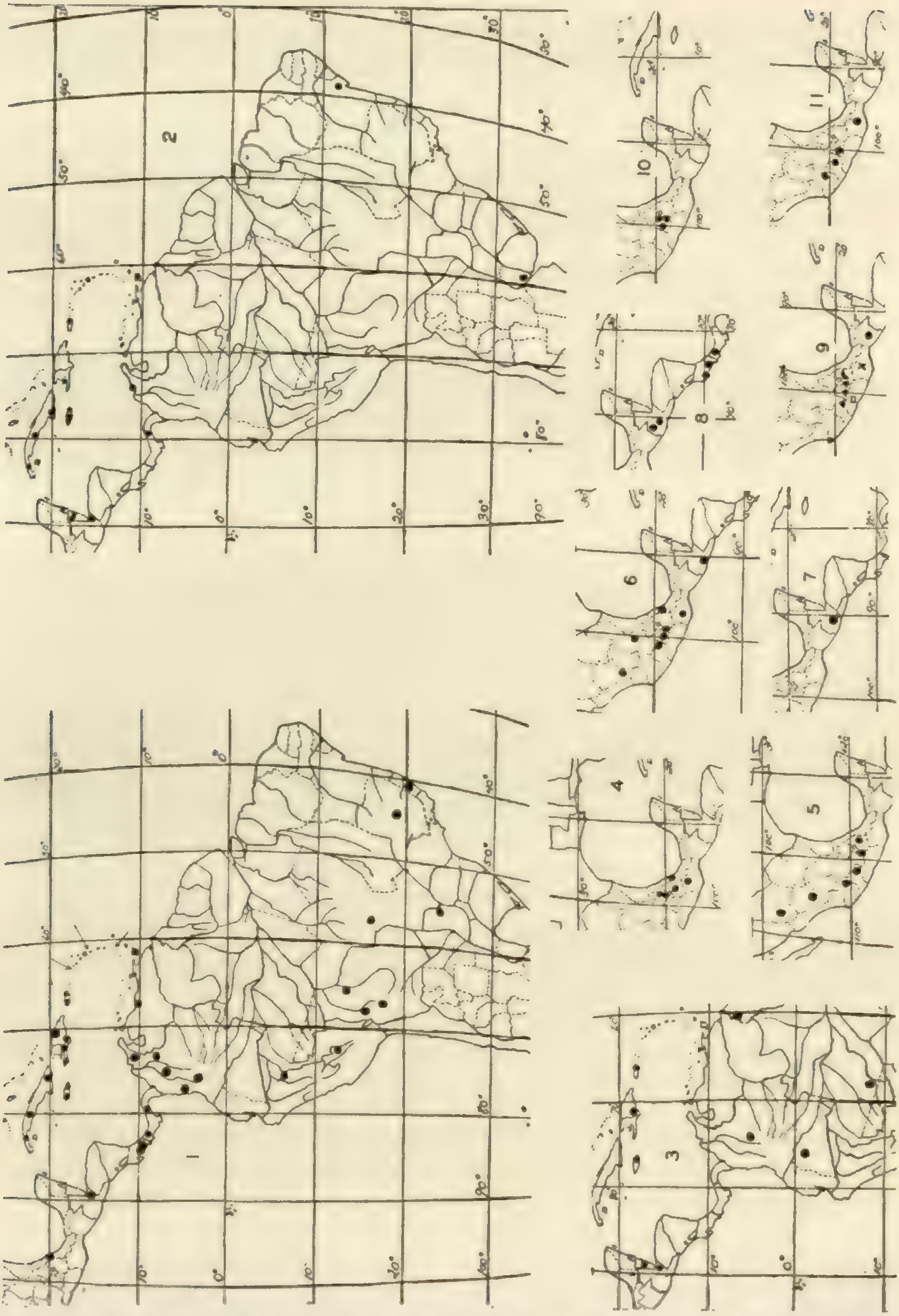
In its aspect var. *Sintenisii* is intermediate between var. *genuinum* and var. *acutifolium*. It is however, easily distinguished by the characteristic shape of its leaflets. It differs from var. *acutifolium* also in the lack of pilosity on the stem, and from var. *genuinum* in having denser pilosity on the under surface of the leaflets as well as rather longer pedicels and loment-stipes. I have been able to find no basis on which to differentiate Blake's *Meibonia albida* from this variety.

B. DESMODIUM SUBSESSILE AND ITS RELATIVES

Desmodium subsessile and its allies, *D. Hartwegianum*, varieties *typicum* and *amans*, and *D. Johnstonii*, form a small, natural group closely united structurally, habitally and ecologically. *D. subsessile* was for many years apparently overlooked until Blake,[11] in 1924, published a list of citations referred to this species. The varieties of *D. Hartwegianum* have long been confused because the only distinction between them was considered to be possession or lack of petiolate leaves. This character, although helpful in distinguishing the varieties, is not absolute and cannot with certainty be used as a basis for separation. *D. Johnstonii*, here newly proposed, is a very close relative of *D. Hartwegianum*, var. *amans*, although in its general aspect it seems to bear a greater similarity to var. *typicum*.

Leaves usually sessile to short-petiolate (petioles not more than 1.5 cm. long); some long, straight or bent (in addition to hooked) hairs present on stem.

[11] S. F. Blake in Bot. Gaz. lxxviii. 283 (1924).



MAP 1, range of DESMODIUM AXILLARE, var. GENUINUM; 2, var. ACUTIFOLIUM; 3, var. SINTENISII; 4, D. SUBSESSILE; 5, D. HARTWEGIANUM, var. TYPICUM; 6, var. AMANS; 7, D. JOHNSTONII; 8, D. MAXONII; 9, D. VENUSTUM (●), D. BELLUM (▲), D. CANALICULATUM (□), D. SCHINDLERI (×), D. PURPUSIANUM (⌒); 10, D. ALAMANI; 11, D. GHIESBREGHTII.

Upper surface of coriaceous, mostly rhombic to lance-ovate leaflets with veins rather deeply impressed................*D. subsessile.*
Upper surface of oblong to elliptic (or obovate) leaflets soft, appressed-pilose, with veins not impressed above.
D. Hartwegianum, var. *typicum.*
Leaves petiolate (rarely subsessile); pubescence of stem uncinate or uncinulate only; leaf-rachises shorter than petioles.
Leaflets narrowly to broadly elliptic to lance-oblong or broadly lanceolate, not more than 6 cm. long; loment stipitate, stipe 2–3.5 mm. long........................*D. Hartwegianum*, var. *amans.*
Leaflets linear-lanceolate, not more than 1.3 cm. wide, up to 7.6 cm. long: loment with stipe never exceeding calyx....*D. Johnstonii.*

D. SUBSESSILE Schlecht. Herbaceous, erect (or spreading-procumbent (?)), simple or only slightly branched below the inflorescence (occasionally with branches arising from a rhizomatous stem): stem angular to subterete, ridged and grooved, uncinulate-puberulent and (usually) pubescent with few to a preponderance of long, straight or bent hairs interspersed: leaves trifoliolate, sessile to short-petiolate; petioles, when present, ridged and grooved, (sparsely to) rather densely patent-pilose with straight, stiff or soft hairs, 1.5–10 mm. long; leaf-rachises similar, often longer, slightly more slender and less pilose, 3.5–9 mm. long; petiolules neither ridged nor grooved, stouter, darker and more densely pilose, with surface often wrinkled, 1–2.5 mm. long: leaflets thick, with reticulate venation, revolute and somewhat ciliate, usually somewhat pustulate and with veins impressed on upper surface, usually uncinulate-puberulent and (glabrescent to) pilose with straight white hairs, more densely pilose on lower surface especially on midrib and prominent lateral veins; terminal leaflets (orbicular or) rhombic to (lanceolate or) lance-ovate or, less often, broadly subelliptic, narrowing slightly to the (acute or more generally) obtuse and mucronate apex, rounded to truncate at base, 3–6 cm. long, 1–3.5 cm. wide; lateral leaflets lanceolate to lance-ovate (or subelliptic), acute to obtuse at apex, truncate to retuse at base, 1–4 cm. long, 0.5–2 cm. wide: stipules linear- (to deltoid-) lanceolate, long-attenuate to apex, striate, ciliate, pilose and puberulent on outer surface, truncate at base, 3.5–10 mm. long, 1–2 mm. wide, usually persistent; stipels subulate or narrowly linear, ciliate, those of terminal leaflets 0.8–2.5 mm. long, those of lateral leaflets 1.5–4 mm. long: inflorescence paniculately branched, more or less spreading, with its rachis subangular to terete, finely striate, uncinulate-puberulent (densely so above) with longer straight hairs interspersed mostly at base: bracts narrowly to broadly ovate, terminating more or less abruptly in a long, slender, usually attenuate apex, ciliate, striate and somewhat pilose on the outer surface, truncate at base, subclasping, 4.5–7.5 mm. long, 1.5–3 mm. wide; the early-deciduous, essentially linear secondary bracts only occasionally observed: pedicels densely to moderately short- and finely uncinulate-puberulent, 5.5–13.5 mm.

long: calyx very finely short-puberulent, somewhat long-pilose especially along central tooth of lower lobe; teeth of both lobes ciliate; upper lobe bifid, 2.2–3 mm. long; central tooth of lower lobe 2.4–4.8 mm. long; lateral teeth of lower lobe 1.8–3.5 mm. long: corolla exceeding calyx; standard obovate, orbicular, gradually tapering to a broad base, 6–8.5 mm. long, 4.8–7 mm. wide; wings obliquely subelliptic or suboblong, obtuse at apex, truncate and tapering to short claw, 5.6–8.2 mm. long, 1.5–3.2 mm. wide; keel-petals obliquely cuneate with truncate apex, tapering to the long slender claw, 6–8.8 mm. long, 1.8–3 mm. wide: loment 2–7-articulate, stipitate; stipe 2–4.2 mm. long; articles suborbicular to subelliptic, with lower suture more deeply constricted than upper, with prominent, reticulate venation, and uncinulate-puberulent sutures and surfaces, 3.8–5.5 mm. long, 3–4.5 mm. wide.—PL. 2, FIGS. 1–9. MAP 4.—*D. subsessile* Schlecht. in Linnaea, xii. 319 (1838), non *D. subsessile* Seaton. *Meibomia subsessilis* Schindl. in Fedde, Rep. Spec. Nov. Reg. Veg. xx. 141 (1924).—Vera Cruz and Hidalgo southward into Puebla and Oaxaca.—MEXICO: VERA CRUZ: Orizaba, 1855, *Müller*, no. 658 (NY). HIDALGO: El Salto, September 16, 1903, *Rose & Painter*, nos. 7086 (NY, US) and 8014 (US); valley near Tula, Dublan, September 11, 1899, *Pringle*, no. 7913 (US). PUEBLA: Fort de Guadalupe, vicinity of Puebla, July 15, 1909, *Arsène*, no. 227 (US); same locality, October 6, 1907, *Arsène*, no. 1191 (US); same locality, 2200 m. alt., August 8, 1910, *Arsène*, no. 5418 (G, M, US); barranque de l'Alseseca, à l'hacienda Guadalupe, 2130 m. alt., September 26, 1907, *Arsène*, no. 1251 (US); barranque de l'Alseseca, hacienda Batan, près de Totimehuacan, 2120 m. alt., August 8, 1907, *Arsène*, no. 1292 (US); barranque près l'hacienda Alamos, route de Vera-Cruz, 2170 m. alt., October 10, 1907, *Arsène*, no. 7194 (US); rocky slopes along the railway, Esperanza, September, 1907, *Purpus*, no. 2682 (F, G, M, NY, US). OAXACA: moist soil, Las Naranjas, August, 1908, *Purpus*, no. 3047 (F, G, M, NY, US); valley of Oaxaca, 6500–7800 ft. alt., October 3, 1894, *Nelson*, no. 1585 (US); calcareous hills, Las Sedas, 6000 ft. alt., August 11, 1894, *Pringle*, no. 4780 (F, G, M, NY, US); Monte Alban, 6200 ft. alt., October 11, 1895, *L. C. Smith*, no. 937.

The type of *Desmodium subsessile*, collected by C. Ehrenberg at Regla, state of Hidalgo, has not been available for examination by me. It was presumably, however, studied by Schindler, who has annotated some of the specimens cited above. All the specimens here cited agree in diagnostic characters with the detailed description of Schlechtendal.

D. HARTWEGIANUM Hemsley, var. **typicum**. Herbaceous, perennial, erect (or rarely trailing with upright shoots), root unknown: stem essentially unbranched, subterete, ridged and grooved, moderately to densely patent-pilose with long white hairs, and uncinate-puberulent or -pubescent: leaves trifoliolate, sessile to short-petiolate, mostly longer than the internodes and so appearing crowded; petioles angular, 0.1–1.5 cm. long, striate, finely uncinate-puberulent and densely white-pilose (like stem); leaf-rachises similar to petioles in character, in general longer, 0.3–2 cm. long; petiolules darker, more flattened than petioles and rachises, similarly but more densely pilose, 1–3 mm. long; leaflets oblong to elliptic or obovate, obtuse to acute at apex, also often slightly retuse and mucronate, rounded to cuneate or acute at base, with venation reticulate and midrib and chief lateral veins more prominent below than above, ciliate; moderately to densely soft-appressed- (to rarely patent-) pilose above; more densely pilose beneath especially on midrib and chief lateral veins; terminal leaflets 3–8 cm. long, 1–2 cm. wide; lateral leaflets 2–5.5 cm. long, 0.7–1.5 cm. wide: stipules striate, somewhat pilose on outer surface, ciliate, ovate-acuminate (usually obliquely so), tapering rather abruptly into a long tenuous apex, 0.8–1.5 cm. long, 0.2–0.4 cm. wide, usually persistent; stipels subulate (or more rarely slenderly lance-ovate or linear-lanceolate), ciliate, those of lateral leaflets (2–) 4–6 mm. long, those of terminal leaflets 1.5–4 mm. long: inflorescence simple or paniculately branched; rachises angled and striate, densely uncinulate-puberulent to -pubescent with rather stoutish white or yellow hairs, somewhat pilose below, becoming less so or not at all above: bracts narrowly to broadly ovate, terminating rather abruptly in a very slender apex, ciliate, striate, pilose on outer surface, 0.5–1.5 cm. long, 0.25–0.6 cm. wide; the small, slender, strap-shaped, early-deciduous secondary bracts occasionally seen: pedicels stout, pubescent like the rachis, but more pilose, 0.5–1.5 cm. long: calyx slightly pilose and uncinulate-puberulent; teeth of lobes finely ciliate; upper lobe 3.2–5.6 mm. long; central tooth of lower lobe 4.5–9 mm. long; lateral teeth of lower lobe 4–7 mm. long: corolla exceeding calyx; standard obovate, orbicular above, deltoid, barely clawed at base, 0.7–1.3 cm. long, 0.3–1 cm. wide; wings short-clawed, more or less obliquely elliptic, cuneate or obtuse at apex, tapering or truncate-acute to the claw, 0.6–1.5 cm. long, 0.25–0.6 cm. wide; keel-petals cuneate-truncate, long-clawed, 0.6–1.6 cm. long, 0.3–0.5 cm. wide: loment 4–8-articulate, stipitate; stipe 3–5 mm. long; articles rather obliquely subelliptic, densely uncinate-puberulent on surfaces and margins, somewhat pilose when very young, 3–5.5 mm. long, 3–4.5 mm. wide.—Pl. 2, figs. 10–18. Map 5.—*D. Hartwegianum* Hemsley, Biol. Cent.-Am. Bot. i. 279 (1880). *Meibomia Hartwegiana* (Hemsl.) O. Ktze., Rev. Gen. i. 198 (1891). *D. strobilaceum* sensu Benth., Pl. Hartweg. i. 11 (1839); see also Emend. et corrig. 343 (1857) for change of opinion.—Chihuahua south to Durango, Jalisco and Michoacan, east to Hidalgo, Morelos and Puebla.—MEXICO: Chihuahua: pine-oak country, Sierra Canelo, Rio Mayo, August 30, 1936, *Gentry*, no. 2522 (T); transition, pine-slopes, same locality, August 31, 1936, *Gentry*, no. 2545 (HG); oak savanna, Batopilillas, Rio Mayo, September 8, 1936, *Gentry*, no. 2622 (T). DURANGO: Cacaria, August 5, 1898, *Nelson*, no. 4646 (US); at city of Durango and vicinity, April to November, 1896, *Ed. Palmer*, no. 663 (G, M, NY, US). HIDALGO: wet meadows near Tula, September 12, 1899, *Pringle*, no. 8245 (G, M, NY, US). JALISCO: on the road from San Juan Capistrano, August 23, 1897, *Rose*, no. 2511 (US); road between Huejuquilla and Mesquitec, August 25, 1897, *Rose*, no. 3568 (US). MICHOACAN: Morelia, Loma St. Maria, 2000 m. alt., September 15, 1909, *Arsène*, no. 10030 (US). MORELOS: mountain side, near Cuernavaca, 6500 ft. alt., November 1,[12] 1896, *Pringle*, no. 7353 (G, US); Huitzilac, October 16, 1937, *Lyonnet & Elcoro*, no. 1791 (US). PUEBLA: Lagune San Baltasar, 2138 m. alt., September 20, 1906, *Arsène*, no. 480 (US); Cerro Chiquihuite près Totimehuacan, 2205 m. alt., August 8, 1907, *Arsène*, no. 10026 (US). State not given: *Hartweg*, no. 56 (G, NY, ISOTYPES); *Mendez*, s. n. (F, G, M).

Var. **amans** (Watson) comb. nov. Herbaceous, perennial (?), erect; root unknown; stem unbranched, terete to subangular, ridged and grooved, densely uncinate-pubescent with rather stiff hairs, also finely uncinulate-puberulent: leaves trifoliolate, petiolate (rarely sessile); petioles 0.3–3.5 cm. long, subangular, striate, pubescent like the stem, usually more densely so, occasionally with long, straight, white hairs interspersed (sometimes with only straight hairs and short puberulence); leaf-rachises more nearly terete, shorter, 0.3–1 cm. long, more slender and less pubescent; petiolules broader, darker, densely long, white, spreading-pilose and finely, very short-puberulent, 1.5–3 mm. long: leaflets narrowly to broadly elliptic to lance-oblong or broadly lanceolate, apex obtusish, sometimes retuse, mucronate, rounded-obtuse or becoming narrowed from below the middle, with reticulate venation, and with midrib and veins more prominent on the paler lower surface, ciliate, the upper surface moderately to densely long-pilose with soft appressed hairs, the lower surface more densely pilose; terminal leaflets 3–6 cm. long, 0.8–2 cm. wide; lateral leaflets 1–4.5 cm. long, 0.7–1.8 cm. wide: stipules obliquely ovate, acuminate to a (usually) tenuous apex, truncate to obliquely cordate at base, long-ciliate, striate and glabrescent to pilose on outer surface, 0.6–1.2 cm. long, 0.2–0.4 cm. wide, persistent; stipels linear-lanceolate or subulate, ciliate, pilose and puberulent on outer surface, those of terminal leaflets more often subulate and 1.6–5 mm. long; those of lateral leaflets 3.5–8 mm. long: inflorescence paniculately branched;

[12] The specimen in the Gray Herbarium is dated November 1, the specimen in the United States National Herbarium is dated May 1. According to Davis (H. B. Davis, Life and Work of Cyrus Guernsey Pringle, 1936), Pringle did not start his trip until May 21; and in the journal for November 1, 1896 the Cuernavaca locality is noted (see pages 146 and 156). The May 1st date is, therefore, an error.

rachises striate, densely uncinate-pubescent with stoutish hairs: bracts ovate, long-acuminate at apex, truncate at base, ciliate, striate, puberulent and pilosulous on outer surface, 0.5–1.2 cm. long, 0.2–0.4 cm. wide, not long persistent; smaller secondary bracts early deciduous: pedicels uncinulate- to uncinate-pubescent and very short-puberulent, sometimes with a few straight hairs interspersed, often glabrescent in age, 0.5–1 cm. long: calyx rather densely puberulent and somewhat long-pilose, especially along the midrib of the central tooth of the lower lobe; upper lobe deeply bifid to subentire, 2–4.6 mm. long; central tooth of lower lobe 3–6.2 mm. long; lateral teeth of lower lobe 1.8–5 mm. long: corolla exceeding calyx; standard obovate or almost orbicular and usually retuse at apex, moderately to not at all clawed at base, 0.5–1 cm. long, 0.5–0.7 cm. wide; wings obliquely and narrowly obovate or suboblong, obtuse at apex, acutish to the short claw, 0.6–1 cm. long, 0.2–0.3 cm. wide; keel-petals obliquely cuneate, truncate at apex, tapering to the long, slender claw, 0.6–1 cm. long, 0.28–0.4 cm. wide: loment 5–7-articulate, stipitate; stipe 2–3.5 mm. long; articles orbicular to subelliptic, chiefly densely uncinate-pubescent with finer types of vestiture interspersed, 3–5 mm. long, 2.6–4.2 mm. wide.—Pl. 2, figs. 19–27. Map 6.—*Desmodium amans* Watson in Proc. Am. Acad. xxvi (n. s. xviii). 135 (1891). *Meibomia amans* (Wats.) Schindl. in Fedde, Rep. Spec. Nov. Reg. Veg. xx. 141 (1924).—Durango and San Luis Potosi south to Guatemala.—MEXICO: Durango: August 16, 1897, *Rose*, no. 2328 (US). San Luis Potosi: hills, Las Canoas, October 4, 1890, *Pringle*, no. 3291 (G, type; NY, US, isotypes). Vera Cruz: Orizaba, 1855, *Müller*, no. 284 (NY). Michoacan: Punguata, 2100 m. alt., August 9, 1909, *Arsène*, no. 7226 (US). Mexico: Rincon del Carmen, Temascaltepec, 1340 m. alt., September 6, 1932, *Hinton*, no. 1621 (K). Morelos: mountain cañon, near Cuernavaca, 6000 ft. alt., July[13] 19, 1896, *Pringle*, no. 7098 (M, US). Oaxaca: hills, San Felipe del Agua, 1700 m. alt., September 1, 1895, *Conzatti*, no. 566; distrito del centro, camino de San Felipe, 1600 m. alt., September 7, 1921, *L. & C. Conzatti*, no. 4211 (US); 1750 m. alt., July–August, 1900, *Conzatti & Gonzalez*, no. 1033; hills above Oaxaca, 5500 ft. alt., September–October, 1894, *Pringle*, no. 4993 (G, US). GUATEMALA: Guatemala: 1485 m. alt., October, 1928, *J. Morales R.*, no. 1125 (F).

Desmodium Hartwegianum var. *amans* is distinguished from var. *typicum* by many characters as indicated in the following table:

[13] The specimen in the Missouri Botanical Garden is dated July 19, the specimen in the United States National Herbarium is dated September 19. According to Davis (op. cit. p. 153), *September* 19 is the correct date.

	Var. TYPICUM	Var. AMANS
STEM	Subterete, ridged and grooved, moderately white-pilose, with shorter hooked hairs interspersed.	Subterete, striate, densely uncinate-pubescent.
STIPULES	Lance-subulate, ciliate, long-attenuate, striate and puberulent.	From lance-subulate and very long-attenuate to rather broadly ovate-acuminate.
PETIOLES	Leaves sessile to short-petiolate; petioles usually not more than 1.5 cm. long, densely white-pilose.	0.5–3.5 cm. long, fulvous, uncinulate-pubescent.
BRACTS	Broad, terminating abruptly in a long-attenuate apex, striate, puberulent and ciliate, early deciduous.	More or less narrow, and rather gradually long-acuminate, short-pilose, striate and long-ciliate.
INFLORESCENCE-RACHIS	With pubescence similar to that of stem, but less densely pilose.	With pubescence similar to that of stem but not so dense, and with delicate white hairs present.
PEDICELS	With pubescence similar to that of stem (more pilose than rachis).	Uncinulate- to uncinate-pubescent and very short-puberulent; occasionally some straight hairs present.
LOMENTS	Fulvous, uncinulate-puberulent, up to 6-articulate; both sutures shallowly and almost equally constricted.	Uncinulate-puberulent, with sutures rather unequally constricted, up to 7-articulate; articles smaller than in var. *typicum*.

D. **Johnstonii**, Standl., sp. nov., planta herbacea, erecta, gracile, 1.2–1.8 m. alta; caule simplici, tereti, tenuiter multistriato, dense uncinulato- vel uncinato-pubescenti (et -puberulenti); foliis trifoliolatis, petiolatis: petiolis angulatis striatisque, uncinulato-hispidis, pilis rectis, longioribus intermixtis, 2.5–3.5 cm. longis; rhachi folii petiolo simili, 0.7–1.2 cm. longa; petiolulis 2 mm. longis, quam petiolis fuscioribus et crassioribus, patenti-pilosis pilis longis albis mollibusque: foliolis lineari-lanceolatis, apice breve acuminato mucronatoque, basi obtuso, nervo medio venisque prominentioribus in superficie inferiore pallidiore quam supra; superficiebus utraque dense longe, molle et appresso-pilosis; foliolis terminalibus 5.5–7.5 cm. longis, 1–1.2 cm. latis, foliolis lateralibus, 4–6 cm. longis, ca. 1 cm. latis: stipulis late, saepe oblique deltoideo- vel ovato-lanceolatis, striatis, dense ciliatis, plus minusve dense tenuiterque pilosis in superficie exteriore, minus vel solum pilosulis intus, persistentibus, apice longo-attenuatis, basi truncato, subauriculato, 1–1.2 cm. longis, 0.2–0.5 cm. latis; stipellis ciliatis, puberulentibus, eis foliolorum terminalium plerumque subulato-attenuatis, 2–3 mm. longis, eis foliolorum lateralium anguste ovato- vel lineari-lanceolatis, striatis, apice attenuatis, 5–7 mm. longis: inflorescentia paniculate ramosa, rhachi ramisque angulatis et profunde sulcatis, uncinulato-pilosis vel -strigosis et puberulentibus: bracteis primariis ovatis, apice longo-attenuatis, basi truncato-amplectescentibus, marginibus longo-ciliatis, dense pilosulis in pagina dorsali, solum leviter intus vel nihil omnino, mox deciduis, 4.5–5 mm. longis, 2–3 mm. latis: pedicellis plus minusve crassis, puberulentibus et sparse pilosis, 4.6 (tempore florescentiae)–8.5 (tempore fructescentiae) mm. longis: calice pilosulo, dentibus loborum tenuiter ciliatis, dente centrali lobi inferioris 4–6 mm. longo; dentibus lateralibus lobi inferioris, 4–4.6 mm. longis; lobo superiore plerumque integro, 3.8–4.8 mm. longo: corolla quam calice longiore, vexillo obovato, apice orbiculato, ex medio ad basem gradatim angustato, 7.8–9 mm. longo, 4.8–6 mm. lato; alis oblique subellipticis, apice cuneato-obtuso, ad basem truncato, breve- vel longo-unguiculatis, 7–8.4 mm. longis, 2.6–2.8 mm. latis; petalis carinae oblique cuneatis, apice truncato, ad unguem tenuem gradatim angustatis, 7–8.5 mm. longis, 3 mm. latis: lomento 4–6-articulato, articulis subellipticis vel orbiculatis, suturo inferiori saepissime maiore profundius constricto, paginis uncinulato-pubescentibus et tenuiter puberulentibus, suturis solum puberulentibus, 3.5–4.5 mm. longis, 3–3.2 mm. latis.—Tab. 2, fig. 28–37. Map 7.—*D. Johnstonii* Standl. in Johnston, Cat. Pl. Guat. 17 (1938) *nomen nudum*.—GUATEMALA: Sacatepequez: brushy slope near Antigua, 1500–1600 m. alt., November 1938–February 1939, *Standley*, no. 58603 (F); in Cupressus grove, same locality, altitude and date, *Standley*, no. 60295 (F); wooded hillside, same locality, altitude and date, *Standley*, no. 63068 (F); Manchen, November 11, 1936, *J. R. Johnston*, no. 344 (F, type).

Desmodium Johnstonii, named for Dr. J. R. Johnston, Director of the Escuela Nacional de Agricultura, Chimaltenango, Guatemala, and collector of the type-specimen, is apparently endemic in a limited region of Guatemala. In general aspect it closely resembles the varieties of *D. Hartwegianum;* it has, however, leaves constantly long-petiolate, with longer, more slender leaflets, and in general, loments of smaller articles than either of the varieties. It possesses no white pilosity on the stem, in which character it is similar to *D. Hartweg-*

ianum, var. *amans*. The loment is usually sessile or at least, with the stipe never exceeding the calyx.

C. Desmodium Maxonii[13a] and Some Related Species

The species next to be considered are related chiefly through characters of the inflorescence: (1) the rachis is always uncinulate-puberulent or -pubescent; (2) the primary bracts are ovate, each subtending two pedicels only; (3) each pedicel is usually further subtended by a smaller, secondary bract (which may, however, be abortive); (4) the loments are stipitate, in general multi-articulate; (5) the articles are orbicular or rhombic.

The group differs from that of *Desmodium procumbens* and its relatives, to which its loments are somewhat similar, chiefly in its ultimate inflorescences. In the *D. procumbens*-group the pedicels appear to be borne in fascicles of three to five. Each of these pseudo-fascicles is, however, a compressed inflorescence subtended by a lance- or ovate-acuminate primary bract, with each pedicel in turn subtended by a similar, smaller (sometimes almost filiform) secondary bract. The flowers in each ultimate inflorescence do not reach maturity simultaneously (as in the group here treated); rather, the two outer flowers mature at the same time, the inner one (or more) very much later or not at all.

The series here treated is composed chiefly of localized species of southern Mexico and Central America, no member so far considered attaining the wide-spread or northern distribution of *D. procumbens* or its allies.

Two of the species which follow were described by Schindler[14] and the description of one emended by him (*D. venustum*, as *M. elegans* (Schlecht.) Schindl.). Another species, *Meibomia Blakeana*, was described in the same paper but, unfortunately, no material of the one collection cited (*Dehesa*, no. 1531) has been available. The description is placed by Schindler, in sequence between *M. hispida* and *M. elegans* and the species is presumably related to one of them, but the statement "Bracteae non visae" does not suggest particularly close relationship with either, since both of them have quite long-persistent bracts. The short pedicels and deciduous bracts suggest,

[13a] In a general reorganization of the section of the genus of which these species are members, it has become clear that *D. Maxonii* is a transitional species uniting two series; one, composed of the seven species treated here, and the other, a group characterized by its long-pilose and often canescent branches and rachi with pilosity which for a long time obscures the presence of any uncinulate puberulence.

[14] A. K. Schindler, Rep. Spec. Nov. Reg. Veg. xxii. 277 et seq. (1926).

rather, an affinity with *D. Ghiesbreghtii* which also has reticulate leaflets said to be possessed by *M. Blakeana.*

a. Bracts in general large, 6–14 mm. long, ovate, gradually or abruptly narrowed to a long-attenuate apex, long-persistent.
  b. Midrib and chief lateral veins impressed above; young branches long-canescent . . . . *D. Maxonii.*
  b. Midrib and chief lateral veins prominent or inconspicuous above, never impressed; stem never long-canescent.
    c. Leaflets firm; bracts glabrate or puberulent on dorsal surface.
      d. Stem glabrate to uncinate-puberulent; bracts inconspicuously ciliate; leaf-tissue much darker above than midrib and chief lateral veins . . . . *D. venustum.*
      d. Stem with white upwardly-appressed pilosity; bracts long-ciliate; upper leaf-surface prominently and reticulately veined . . . . *D. bellum.*
    c. Leaflets rather thin; bracts long-pilose on dorsal surface.
      e. Leaflets large, up to 9 cm. long; bracts gradually very long-acuminate . . . . *D. canaliculatum.*
      e. Leaflets smaller, not more than 4 cm. long; bracts abruptly long-acuminate.
        f. Stipules very early deciduous; leaflets elliptic, obtuse at base and apex . . . . *D. Schindleri.*
        f. Stipules persistent; leaflets ovate to rhombic-ovate. *D. Purpusianum.*
a. Bracts small, up to 5 mm. long, with apex gradually and shortly acuminate or sharply acute; early deciduous.
  g. Racemes densely, narrowly pyramidal, remaining so throughout flowering period (i. e. not becoming broad at apex nor elongating until complete maturity); pedicels long, up to 11 mm. in length . . . . *D. Alamani.*
  g. Racemes elongate, virgate; pedicels short, never more than 5 mm. in length . . . . *D. Ghiesbreghtii.*

D. Maxonii (Standl.) Standl. Shrubby: stem terete, finely uncinulate-puberulent and long-pilose when young, becoming simply uncinulate-puberulent or glabrate in age: leaves trifoliolate, petiolate; petioles angular, finely ridged and grooved, puberulent and rather densely spreading-pilose, 1–3.5 cm. long; leaf-rachis similar to petiole, not as stout, 0.5–1 cm. long; petiolules somewhat flattened, rugulose, pilose, 2–3.8 mm. long: leaflets broadly lanceolate to ovate, rounded or obtuse at base, acute to obtusish and mucronate at apex, darkish green and puberulent to short-pilose above, paler beneath with venation more prominent, pilose with pubescence often widely spreading from midrib and chief lateral veins, slightly revolute, ciliate; terminal leaflet 3–6.5 cm. long, 1.5–3.5 cm. wide; lateral leaflets 2.8–5.5 cm. long, 1.2–2.5 cm. wide: stipules rather obliquely ovate, long-persistent, mostly reflexed, with long-acuminate apex and truncate base, very finely striate, puberulent and long-pilose on dorsal surface, densely long-ciliate, 4.5–8 mm. long, 3–4.5 mm. wide; stipels subulate to linear-lanceolate, striate, pilose and ciliate, those of terminal leaflet 3–3.6 (–5.5) mm. long, those of lateral leaflets

4–5.5 mm. long: inflorescence composed of numerous fairly short racemes; rachis ridged and grooved, uncinate-pubescent, also pilose when young: primary bracts ovate, apex abruptly long-attenuate, base truncate and somewhat clasping, with dorsal surface striate and pubescent as that of the stipules, 0.62–1 cm. long, 0.2–0.5 cm. wide; secondary bracts lance-subulate, ciliate, pilose over dorsal surface, truncate at base, with apex becoming filiform, 2.2–6 mm. long, 0.2–0.6 mm. wide: pedicels puberulent and moderately pilose with very slender hairs, 0.2–1.1 cm. long in flower, 0.7–1.2 cm. long in fruit: calyx puberulent over whole surface, with long, straight or curved stout trichomes crowded along central tooth of lower lobe and less densely scattered on lateral teeth, with fewer and slenderer long trichomes on upper lobe; upper lobe entire to bifid, 3–5.4 mm. long; lateral teeth of lower lobe 3–5.4 mm. long; central tooth of lower lobe 5–8 mm. long: corolla exceeding calyx; standard obovate with apex rounded, entire to prominently retuse and becoming narrowed toward the acutish base from below the middle, 1–1.3 cm. long, 0.6–1.1 cm. wide; wings obliquely obovate, rounded to broadly acute at apex, obtusely auriculate at base, short-unguiculate, 0.7–1.25 cm. long, 0.36–0.5 cm. wide; keel-petals fused, broadly truncate at apex, becoming narrowed to a long slender claw, 0.94–1.3 cm. long (0.2–) 0.4–0.52 cm. wide: loment stipitate, 5–6-articulate; stipe 2.2–4 mm. long, glabrous; articles rhomboidal, reticulate, 3.6–4.4 mm. long, 2.6–3.6 mm. wide, uncinulate-puberulent to almost glabrous, with prominent sutures and somewhat revolute margins.—PL. 3, FIGS. 28–35. MAP 8.—*D. Maxonii* (Standl.) Standl. in Field Mus. Pub. Bot. xi. 161 (1936). *Meibomia Maxonii* Standl. in Contrib. U. S. Nat. Herb. xviii. 108 (1916). *Meibomia costaricensis* Schindl. in Rep. Spec. Nov. Reg. Veg. xx. 140 (1924).[14a]—Central America.—GUATEMALA: HUEHUETENANGO: between Jacaltenango and San Martin, 5300–7000 ft. alt., December 24, 1895, *Nelson*, no. 3599 (US, annotated by Schindler as *M. costaricensis*). CHIMALTENANGO: open oak woods, Chichavac, 2400–2700 m. alt., November 17, 1933, *Skutch*, no. 696 (US). COSTA RICA: GUANACASTE: plantations de mais de Santa Rosa du Copey, 1800 m. alt., February, 1898, *Tonduz* (herb. Inst. Physico-Geogr.) no. 11,769 (US, spec. no. 578570, annotated by Schindler as *M. costaricensis*). SAN JOSE: brushy slope near El Copey, 2300 m. alt., December 29, 1925, *Standley*, no. 43517 (US); dry oak forest, vicinity of Santa Maria de Dota, 1500–1800 m. alt., December 26, 1925–January 3, 1926, *Standley & Valerio*, no. 43478 (US). PANAMA: CHIRIQUI: open brushy slopes among scrub, Cuesta de Cerro Quemado, eastern slope of Chiriqui Volcano, 1800–2600 m. alt., March 10–13, 1911, *Maxon*, no. 5370 (US, TYPE; NY, ISOTYPE); near El Potrero camp, Chiriqui Volcano, 1900 m. alt., February 28, 1918, *Killip*, no. 3606 (US, annotated by Schindler as *M. costaricensis*).

[14a] *Desmodium costaricense* (Schindl.) Standl. in Field Mus. Pub. Bot. xviii. 534 (1937).

The type-collection of *Desmodium Maxonii* is from Panama and additional material has been collected in Guatemala and Costa Rica. I have not been able to distinguish from *D. Maxonii* in any way, *Meibomia costaricensis*, described by Schindler in 1924. In the United States National Herbarium are three specimens which Schindler annotated: (1) *Tonduz*, no. 11769, on which, in part, the original description of *M. costaricensis* is based. This portion of an apparently mixed collection is composed only of fruiting branches with very small leaflets; (2) *Killip*, no. 3606, a mature specimen with flowers and fruit, a good match for the type-specimen of *D. Maxonii;* (3) *Nelson*, no. 3599, young, in flower only, and rather larger in all its parts (especially leaflets) than *Maxon*, no. 5370. Aside from these slight variations in the size of the parts of individual specimens there is no apparent basis for differentiation between these three specimens and the type of *D. Maxonii.* Schindler does not discuss the relationships of his species, nor does he designate the section to which it belongs. In his list of species of *Desmodium* in the botanical literature since Linnaeus,[15] Schindler does not note *D. Maxonii*, although he must have known of its publication because at least one of the specimens which he annotated as *M. costaricensis* (in 1924) had been previously annotated by Blake (in 1923) as *M. Maxonii.* I can find no valid taxonomic basis for maintaining the later species.

D. VENUSTUM Steud. Shrubby: stem subterete to angular, uncinulate-puberulent: leaves trifoliolate, petiolate; petioles striate, channeled on adaxial surface, finely puberulent to glabrescent, 2.8–5 cm. long; leaf-rachis similar to petiole, more slender, 1–1.3 cm. long; petiolules darker, rugulose, spreading-pilose, 2–3 mm. long: leaflets essentially glabrous above, with the light vein-tissue very obvious, paler beneath and pilose along midrib and chief lateral veins, the margins slightly revolute, ciliate; terminal leaflets lanceolate to lance-ovate, acute to obtuse and mucronate, rounded at base, 3.5–5.3 cm. long, 2–2.6 cm. wide; lateral leaflets suboblong to subelliptic, obtuse or broadly acutish at apex, truncate to rounded at base, 3–4.3 cm. long, 1–2 cm. wide: stipules[16] very early deciduous (only one seen), reflexed, lance-acuminate, with apex filiform; stipels lance-attenuate, those of terminal leaflets 1.5–2.5 mm. long, those of lateral leaflets 3.5–4 mm. long: inflorescence-rachis angular, ridged and grooved, uncinulate-pubescent: bracts striate, ciliolate, broadly ovate, rather gradually acuminate, finely pilose and puberulent to glabrescent, 0.9–1.5 cm. long, 0.5–0.6 cm. wide: pedicels puberulent and somewhat

[15] A. K. Schindler in Rep. Spec. Nov. Reg. Veg. Beihefte, Bd. xlix (1928).

[16] A. K. Schindler in Rep. Spec. Nov. Reg. Veg. xxii. 278 (1926). "Stipulae brunneae, scariosae, deciduae (rudimenta tantum vidi)."

pilose with very fine, spreading, viscidulous hairs, 0.4–1 cm. long in flower, 1.2–1.7 cm. long in fruit: calyx puberulent, with ciliolate teeth; central tooth of lower lobe with stout, stiff, trichomes, 5–5.5 mm. long, lateral teeth 3.5–4 mm. long; upper lobe 3.5–3.8 mm. long: standard obovate, retuse, rounded at apex, gradually narrowed to stoutish base, 0.9–1.2 cm. long, 0.5–0.9 cm. wide; wings obliquely obovate to almost oblong, obtuse at apex, slightly auriculate and short-unguiculate at base, equal to standard in length, 0.3–0.4 cm. wide; keel-petals falcate, truncate at apex gradually narrowed to very slender claw, 0.9–1 cm. long, 0.3–0.5 cm. wide: loment (very young) stipitate, to 5-articulate; stipe glabrous, 4–4.5 mm. long; articles densely uncinulate-pubescent when young, moderately so toward maturity, with venation not at all prominent, their sutures darker, and their margins somewhat revolute, 4 mm. long, 3 mm. wide.—MAP. 9.—*D. venustum* Steud., Nomencl. ed. 2. i. 496 (1840). *Meibomia venusta* (Steud.) Ktze., Rev. Gen. i. 197 (1891). *D. elegans* Schlecht. in Linnaea xii. 320 (1838) non DC. in Ann. Sci. Nat. iv. 100 (1825). *M. elegans* (Schlecht.) Schindl. in Rep. Spec. Nov. Reg. Veg. xxii. 278 (1926) non O. Ktze., Rev. Gen. i. 198 (1891). *D. Schlechtendalii* Dietr. Syn. Pl. iv. 1151 (1847).—Apparently limited to the state of Chiapas in Mexico, although the locality for the type-specimen is not given. MEXICO: CHIAPAS: *Ghiesbreght*, no. 77, p.p. (G); 1864–70, *Ghiesbreght*, no. 588 (G); near San Cristobal, 7000–8000 ft. alt., September 18, 1895, *Nelson*, no. 3195 (G); same locality, altitude and date, *Nelson*, no. 3198 (NY, US).

In 1926 Schindler (loc. cit.) made the new combination *Meibomia elegans*, based on *Desmodium elegans* Schlecht. His exact citation follows:

—"**Meibomia elegans** (Schlecht.) Schindl. nov. comb.—non O. Ktze.—"

In 1891 Kuntze had made the combination *Meibomia elegans* (DC.) O. Ktze. Under these circumstances *M. elegans* (Schlecht.) Schindl. (which as *D. elegans* Schlecht. was a later homonym of *D. elegans* DC.) is twice a later homonym (i. e. in both *Desmodium* and *Meibomia*). The basis for Schindler's transfer was the fact that he considered Kuntze's combination taxonomically incorrect. His action, however, is contrary to Article 61 of the International Rules of Botanical Nomenclature (1932) which states: "A name of a taxonomic group is illegitimate and must be rejected if it is a *later homonym*, that is if it duplicates a name previously and validly published for a group of the same rank based on a different type. Even if the earlier homonym is illegitimate, or is generally treated as a synonym on taxonomic grounds, the later homonym must be rejected." The next available name, then, for *D. elegans* Schlecht. is *D. venustum* Steud., and *D. Schlechtendalii* Dietr. Syn. Pl. iv. 1151 (1847) remains a synonym. Blake in 1924 stated that he considered *M. subtilis* (Hemsl.) O. Ktze. probably identical with *M. venusta;* the former species is, however, as pointed out by Schindler,[17] referable to *D. Alamani* DC.

The plant described by Schlechtendal was collected by Hegewisch in flower. The same collection was cited by Hemsley,[18] although it is not certain that he saw the specimen. Steudel placed Schlechtendal's name in synonymy under his *D. venustum,* a name published without description and proposed because *D. elegans* was invalid. Kuntze made the combination *Meibomia venusta* (Steud.) Ktze. and placed *D. elegans* Schlecht. in synonymy under it; he gave no taxonomic discussion. Dietrich, probably unaware of Steudel's name, proposed *D. Schlechtendalii,* published a short, general diagnosis and placed Schlechtendal's name in synonymy. Schindler, at the time of making his combination *Meibomia elegans* (Schlecht.) Schindl.,[19] published a detailed description and said: "Die neue Diagnose war nötig, weil die älteren Beschreibungen zur Unterscheidung von den vielen jetzt bekannten verwandten Arten nicht ausreichen, und weil ich das Originalexemplar nicht gesehen habe." He cited two collections, (1) *Ghiesbreght,* no. 588 and (2) *Nelson,* no. 3198; agreeing with these are two others which the author has examined—*Ghiesbreght,* no. 77, p. p., and *Nelson,* no. 3195. These four collections form a taxonomic unit quite distinct from the other members of the group; and so far as can be determined agree with the original description of Schlechtendal.

D. **bellum** (Blake), comb. nov. Herbaceous (?), branching, (2–3.3 m. high in *Pringle,* no. 9744); stem and branches subangular, multistriate, very finely uncinulate-puberulent, pilose with sparsely to densely scattered, closely appressed, upwardly-directed, stiff, white hairs; base unknown: leaves trifoliolate, petiolate; petioles slender, triangular, ridged, rather densely pilose with stiff white hairs (like those of stem) and finely puberulent, 2–6 cm. long; leaf-rachises similar, not usually triangular, much shorter than petioles, 0.7–1.3 cm. long; petiolules with rugulose surface, rather densely spreading- (and glandular-) pilose chiefly on adaxial surface, those of terminal leaflets 2–3.5 mm. long, those of lateral leaflets 2.5–3 mm. long: leaflets membranaceous, lance-ovate, with very slightly revolute margins, with lower surface paler and sparsely to densely appressed-

[17] A. K. Schindler, op. cit. 286: "*Desmodium subtile* Hemsl., l. c. 47 [Diagn. pl. nov III (1880)] = **Meibomia Alamanii** (DC.) O. Ktze."

[18] W. B. Hemsley in Biol. Cent.-Am. Bot. i. 278 (1880).

[19] A. K. Schindler, op. cit. 278, 279.

pilose (more densely so along midrib) and with upper surface glabrous to moderately short-pilose (rather densely so near base), reticulately and rather prominently veined on both surfaces, lance-ovate to elliptic-lanceolate (or rarely elliptic), acute and mucronate at apex, rounded at base; terminal leaflets 3.9–5.8 cm. long, 1.4–2.1 cm. wide; lateral leaflets 3.4–4.6 cm. long, 1.1–2 cm. wide: stipules lance-attenuate to the apex, ca. 6 mm. long, 0.8 mm. wide, ciliate, puberulent on dorsal surface, mostly early deciduous; stipels linear-lanceolate, those of lateral leaflets broader, 3–6 mm. long, those of terminal leaflets 0.6–4 mm. long, ciliate, puberulent on dorsal surface: inflorescence paniculately branched; rachis and branches multistriate, usually somewhat glandular-hispidulous and uncinate-puberulent; bracts ovate, with long-acuminate apex, ciliate, puberulent on dorsal surface, 7.5–9 mm. long, 2.6–4 mm. wide; pedicels glandular-hispidulous as are rachises, 0.6–1 cm. long: calyx glabrescent to puberulent except for long, straight, somewhat spreading hairs along central tooth of lower lobe; teeth ciliolate; upper lobe entire, 2.8–3.8 mm. long; central tooth of lower lobe 4–6.8 mm. long, lateral teeth 3–4.4 mm. long: corolla much exceeding calyx; standard obovate, rounded and sometimes retuse at apex, broadly acutish to short-clawed at base, 0.9–1.3 cm. long, 0.6–1.2 cm. wide; wings obliquely obovate, obtuse at apex, narrowing rather gradually to a short claw, 0.8–1.2 cm. long, 0.3–0.5 cm. wide; keel-petals falcate, truncate at apex, narrowing to the long slender claws, 0.9–1.3 cm. long, 0.3–0.5 cm. wide: loment to 7-articulate, stipitate; stipe 3.2–3.5 mm. long; articles rhombic, reticulate, moderately puberulent, with margins somewhat revolute, 3.4–4 mm. long, 2.3–3 mm. wide.—Pl. 3, figs. 9–17. Map 9.—*Meibomia bella* Blake in Bot. Gaz. lxxviii. 282 (1924).—Southern Mexico—Michoacan, Mexico and Morelos.—MEXICO: Michoacan: vicinity of Morelia: Quinceo, 2800 m. alt., November 11, 1909, *Arsène*, no. 3249 (M, US); Cerros San Miguel, 2200 m. alt., December, 1910, *Arsène*, no. 5303 (G, M, NY, US); Loma Sta. Maria, 1950 m. alt., 1910, *Arsène*, no. 5346 (G, M); same locality, altitude and date, *Arsène*, no. 5783; talus, *Arsène*, s. n. (F, no. 416654). Mexico: hill, Ixtapan, dist. Temascaltepec, December 12, 1932, *Hinton*, no. 2920 (G, K). Morelos: mountain woods above Cuernavaca, 7000 ft. alt., November 19, 1895, *Pringle*, no. 6206 (F, G, M, NY, P, US, isotypes); mountain-side above Cuernavaca, 6500 ft. alt., December 6, 1907, *Pringle*, no. 15027 (G, US); Sierra de Tepoxtlan, 7500 ft. alt., February 7, 1899, *Pringle*, no. 7729 (F, G, M); same locality and altitude, November 27, 1902, *Pringle*, no. 9744 (F, G, M)[20]; valley near Yautepec, 4000 ft. alt., October 30, 1902, *Pringle*, no. 9745 (NY).

Desmodium bellum differs from *D. venustum* in the upwardly ap-

[20] The specimen of this number in the New York Botanic Garden is not this species; apparently the labels were mixed.

pressed pilosity of its stem, in its lanceolate leaflets prominently reticulate above, and in its prominently ciliate primary bracts. From *D. canaliculatum* it may be distinguished in part by its smaller leaflets (3.4–5.8 cm. long, 1.1–2.1 cm. wide, whereas those of *D. canaliculatum* are 4.7–9.2 cm. long and 2.1–4.15 cm. wide and not reticulate); by its primary bracts which are only puberulent on the dorsal surface and by its usually well-developed secondary bracts which are long and ligulate.

D. **canaliculatum**, sp. nov., planta herbacea, perennis, 1.5–4 m. alta, caule ramoso, (paene quadrangulata), caule ramisque angulatis et profunde sulcatis, subtiliter uncinulato-puberulentis vel -pubescentibus pilis longis rectisque sparse vel moderate intermixtis; foliis trifoliolatis, petiolatis: petiolis fere triangulatis, canaliculatis, pilis longis patentibus praecipue in angulis, 4.6–7.6 cm. longis; petiolulis plus minusve planis, rugosis, eis foliolorum lateralium 2–4 mm. longis, foliolorum terminalium 3–4 mm. longis: rhachi folii 0.9–1.7 cm. longa (unusquisque longiore quam eius petiolus) petiolo simili sed tenuiore: foliolis ovatis vel ellipticis, apice acuto vel late acuminato, apiculato, basi obtuso vel rotundato, marginibus paullo revolutis, ciliatis, praecipue basem versus, utrisque superficiebus appresse longe pilosis pilis glandulosis praecipue in nervo medio et venis lateralibus, maturitate plus minusve glabrescentibus; foliolis terminalibus 6.3–9.2 cm. longis, 2.7–4.1 cm. latis, foliolis lateralibus 4.7–8.6 cm. longis, 2.1–3.4 cm. latis: stipulis lineari- vel ovato-lanceolatis apice longe acuminato vel longe subulato, ciliatis, puberulentibus in pagina dorsali (et pilosis (?)), non longe persistentibus, 5.4–7 mm. longis, 1.5–1.7 mm. latis; stipellis lineari-lanceolatis, ciliatis pilis longis albisque, apice filiformi, superficie dorsali puberulente, eis foliolorum terminalium 1.6–4 mm. longis, eis foliolorum lateralium 2.8–8 mm. longis, saepe etiam latius: inflorescentiae paniculate ramosae, rhachi ramisque uncinulato-pubescentibus et glanduloso-pilosis pilis basi inflatis et apice abrupte filiformibus: bracteis primariis ovato-lanceolatis, basi truncatis, apice in cacumen longum subulatum angustatis, tenuissime striatis, longe patenti-pilosis et puberulentibus in pagina dorsali, ciliatis, 1–1.3 cm. longis, 0.2–0.3 cm. latis; bracteis secundariis anguste vel late linearibus, ciliatis praecipue ad apicem, pagina dorsali puberulentibus, 2.5–5 mm. longis, 0.2–0.8 mm. latis: pedicellis juventute plus minusve patenter glanduloso-pilosis (ut in rhachi inflorescentiae) maturitate minus pilosis, 1–1.4 cm. longis: calice pilis glandulosis, lobi inferioris dente centrali quoque pilis longis, rectisque et sine glandulis pilosis, dentibus omnibus tenuiter ciliatis, dente centrali lobi inferioris 5.8–6.8 mm. longis; dentibus lateralibus 4–4.2 mm. longis; lobo superiore subintegro vel bifido 3.4–4 mm. longo: corolla quam calice longiore, purpurascente, purpurascenti-caerulea vel caerulea, vexillo late obovato, apice late orbiculato, late et breviter unguiculato, vel ad basem truncatum acuto, 1.3–1.5 cm. longo, 1.1–1.4 cm. lato; alis oblique obovatis, apice obtuso, basi leviter auriculato, ungue brevissimo, 1.2–1.4 cm. longis, 0.5–0.6 cm. latis, carinae petalis cuneato-falcatis, ad unguem tenuem gradatim angustatis, 1.3–1.4 cm. longis, 0.5–0.6 cm. latis: lomento 7-articulato, inter articulos profunde constricto, stipitato, stipite 3.6–3.8 mm. longo; articulis 4–5.4 mm. longis, 2.4–3.8 mm. latis, quadrangulatis plus minusve dense patenti-pilosis pilis glandulosis.—TAB. 1, FIG. B1–8. MAP 9.—Known only from the state of Guerrero.—MEXICO: GUERRERO: Sierra Madre del sur: distrito Mina: undergrowth in pine and oak forest, second ridge west of Petlacala, ca. 1910 m. alt., January 1, 1938, *Mexia*, no. 9061 (G, NY, US); opening in an oak forest, cerro de los Amoles, ca. 2005 m. alt., January 5, 1938, *Mexia*, no. 9078 (G, TYPE; NY, US, ISOTYPES); mixed forest Teotepec, 3000 m. alt., November 5, 1939, *Hinton et al.*, no. 14793.

The differences between *D. canaliculatum* and *D. bellum* have already been noted under the latter species. *D. canaliculatum* and *D. Schindleri* differ in the character of the pubescence of various parts and in their bracts. *D. Schindleri* never has long pilosity on the stem, and possesses almost glabrous petioles and elliptic leaflets (obtuse at base and apex), glabrous to sparsely and shortly pilose above and below. The leaflets of *D. canaliculatum* are ovate or elliptic (acute or broadly acuminate at apices) and pilose with long, glandular hairs. The bracts of *D. canaliculatum* are gradually long-acuminate, those of *D. Schindleri* abruptly acuminate.

D. **Schindleri**, nom. nov. Shrub; stem subterete to angular, glabrescent to finely puberulent: leaves trifoliolate, petiolate; petioles glabrous, striate, rather deeply channeled on adaxial surface, about 3 cm. long; leaf-rachis similar to petiole, more slender, 0.6 cm. long; petiolules dark, flattened, rugulose, those of terminal leaflet 1.5 mm. long, those of lateral leaflets 1.5–3.5 mm. long: leaflets elliptic, obtuse or becoming acute at base and apex, glabrous to sparsely pilose above and below, paler beneath, with margins slightly revolute, ciliate; terminal leaflet 3–3.3 cm. long, 1.9 cm. wide; lateral leaflets ca. 3.1 cm. long and 1.5 cm. wide: stipules early deciduous, not seen[21]; stipels lance-attenuate, ciliate, puberulent on dorsal surface, those of terminal leaflet 1.5 mm. long, those of lateral leaflets 2 mm. long: inflorescence-rachis angular, finely uncinulate-puberulent; bracts ovate-acuminate, abruptly attenuate, striate, long-pilose on dorsal surface and ciliate, 6.5 mm. long, 3 mm. wide: pedicels[22] diseased on

[21] According to Schindler (Rep. Spec. Nov. Reg. Veg. xxii. 277 (1926): "Stipulae brunneae, scariosae, triangulares, acutae, apice ciliatae, ceterum glabrae, circ. 4 mm. longae, caducissimae".

[22] Schindler, op. cit. 278: "Pedicelli pilis tenuibus, rectis, patentibus laxe vestiti, florigeri ad 11 mm, fructiferi ad 16 mm longi".

specimen seen: calyx glabrate; teeth of both lobes ciliate; central portion of lower lobe long-pilose; central tooth of lower lobe 6.5 mm. long; lateral teeth 5 mm. long; upper lobe bifid, acute, 4 mm. long: standard obovate, broadly rounded at apex, clawed at base, 1 cm. long, 0.8 cm. wide; wings semi-obovate, obtuse, narrowed at base, auriculate, short-unguiculate, 1 cm. long, 0.45 cm. wide; keel-petals falcate, truncate at apex, narrowed to a longish, slender claw, 1 cm. long, 0.3 cm. wide: loment stipitate, up to 4-articulate; stipe glabrous, 3 mm. long; articles orbicular, reticulate, with venation and sutures dark and prominent, with moderately uncinulate-puberulent surfaces, and revolute margins, 4.5 mm. long, 3 mm. wide.—MAP 9.—*Meibomia hispida* Schindler in Rep. Spec. Nov. Reg. Veg. xxii. 277 (1926).—Known from only one collection from Oaxaca.—MEXICO: OAXACA: Santa Inés del Monte, Zimatlan-Oaxaca Mts., 2700 m. alt., December 8 & 9, 1905, *Conzatti*, no. 1318 (US, ISOTYPE).

Desmodium Schindleri is proposed as a new name for this species because a transfer of the epithet *hispidum* from *Meibomia* would be antedated in *Desmodium* by *D. hispidum* Franch. Pl. Delavay. 147 (1889).

Only one specimen, which is from the type-collection and annotated by Schindler, has been examined. *Conzatti*, no. 1318 is the only collection cited by Schindler under his new species and no other specimen has been found which can be assigned to it.

Under *D. canaliculatum* were cited the differences between that species and *D. Schindleri*. From the species which follows, *D. Purpusianum*, *D. Schindleri* differs in its deciduous stipules and its firmer, elliptic, obtuse, less pubescent leaflets. The general aspect of the two species is so different that with more adequate flowering and fruiting material additional definitive characters are sure to be found.

D. **Purpusianum** (Schindl.) comb. nov. Shrubby; stem ridged and grooved, glabrous to uncinulate-puberulent (rather densely so above); leaves petiolate, trifoliolate; petioles stout, very prominently ridged and grooved, sparsely pilose, 2.8–3.3 cm. long; leaf-rachis similar to petiole but more slender and not so prominently ridged and grooved, ca. 1 cm. long; petiolules dark, rugulose, puberulent and pilose, those of terminal leaflets 2–2.5 mm. long, those of lateral leaflets 1.5–2 mm. long: leaflets ovate to rhombic-ovate, mostly obtuse at apex, with upper surface sparsely to moderately, short- and appressed-pilose (with pilosity parallel to the chief lateral veins), paler on lower surface and not so regularly pilose, clearly but not very prominently reticulate both above and below, ciliate; terminal leaflets ca. 3 cm. long and 2 cm. wide; lateral leaflets ca. 2.5 cm. long and 1.5 cm. wide; stipules striate, ovate- or lanceolate-acuminate, long-attenuate, ciliate, persistent, often reflexed, 5.5–6 mm. long, 1.5–1.8 mm. wide; stipels linear-lanceolate to -attenuate, puberulent and pilose; those of terminal leaflet 2–3 mm. long, those of lateral leaflets 2.5–4 mm. long: inflorescence-rachis finely striate to rather densely ridged and grooved, uncinulate-puberulent: bracts ovate-acuminate, abruptly attenuate (except those at apex of raceme which are gradually acuminate), ciliate, pilose on dorsal surface, especially when young, 0.7–1 cm. long, 0.2–0.4 cm. wide: pedicels uncinulate-puberulent, 0.5–1 cm. long in flower, ca. 1 cm. long in (young) fruit: calyx puberulent over whole surface; teeth of both lobes pilose and ciliate; upper lobe acute, 3.5–4 mm. long; central tooth of lower lobe long-acuminate, 5–5.5 mm. long, lateral teeth 3.5 mm. long: standard obovate, retuse, broadly rounded at apex, narrowed to a broadish base, ca. 7 mm. long and 5 mm. wide; wings obliquely subelliptic, obtuse, auriculate and short-unguiculate at base, 7 mm. long and 3 mm. wide; keel-petals falcate, apex truncate, narrowed to slender claw, 7 mm. long and 3 mm. wide. Loment[23] not seen, plant too young.—MAP 9.—*Meibomia Purpusiana* [as Purpursiana] Schindl. in Rep. Spec. Nov. Reg. Veg. xxii. 277 (1926).—Known only from Puebla. MEXICO: PUEBLA: Alta Luz, August, 1907, *Purpus*, no. 2684 (F, G, M, NY, US) (US specimen annotated by Schindler); in forests, Esperanza, September, 1907, *Purpus*, no. 2910 (M).

D. ALAMANI DC. Shrub, 1.5–2 dm. high, stem simple or little branched, angular, ridged and grooved, glabrate to moderately and softly uncinulate-pubescent and -puberulent (often densely so) with curved (but not hooked) hairs interspersed: leaves trifoliolate, petiolate; petioles angular, ridged and grooved, glabrate to long-pilose on the ridges and uncinulate-puberulent in the grooves, flattened or rather deeply channeled on the adaxial surface, 1–4.5 cm. long; leaf-rachis similar to petiole, but more slender, 0.5–1 cm. long; petiolules rugulose, pustulate-pilose and puberulent, paler than the very dark stipels, those of terminal leaflets (2–) 2.5–3.5 mm. long, those of lateral leaflets (1.5–) 2.5–3 mm. long: leaflets appressed-pilose above and below on midrib and veins, with the pilosity mostly parallel to the chief lateral veins, and with venation more prominent on the paler lower surface; terminal leaflet ovate to almost rhombic-ovate, obtuse, mucronate, rounded or (occasionally) becoming cordate at base, (2.1–) 3.5–5 cm. long, (0.9–) 1.8–2.8 cm. wide; lateral leaflets broadly lanceolate to elliptic or nearly ovate, obtuse, mucronate, rounded at base, (2.2–) 3–4.5 cm. long, 1.5–2 cm. wide: stipules lance-acuminate, truncate at base, with long-attenuate apex, finely puberulent on dorsal surface, usually reflexed and long-persistent, 3–7 mm. long, 1–2 mm. wide; stipels slender, subulate to lance-attenuate, puberulent and occasionally somewhat pilose on dorsal

[23] According to Schindler, op. cit. 277: "Legumen (valde immaturum) breviter stipitatum, ubique breviter uncinato-pilosum, utrinque fere aequaliter constrictum, 5–7-articulatum, articulis ellipticis vel rhombeo-ellipticis".

surface, ciliate, long-persistent, those of terminal leaflets 1–3 mm. long, those of lateral leaflets 2.5–4 mm. long: inflorescence racemose-paniculate; racemes densely pyramidal; rachis of racemes rather finely ridged, uncinulate-pubescent: primary bracts ovate-acuminate, attenuate with apex dark and thickened, appearing almost aristate, very finely puberulent to glabrate on dorsal surface, ciliate, early-deciduous, 2.5–4 mm. long, 1.3–1.8 mm. wide; secondary bracts very inconspicuous (if developed at all), almost filiform, puberulent and ciliate, 1–1.5 mm. long: pedicels glabrate to uncinulate-pubescent when young, puberulent to glabrate in age, 0.6–1 cm. long in flower, slightly longer in fruit: calyx with surface glabrate to puberulent, and with long stout trichomes along central tooth of lower lobe and occasionally a few on other teeth; teeth ciliolate, somewhat darkened, especially the central tooth of lower lobe; upper lobe bifid, 2.2–3.5 mm. long; lateral teeth of lower lobe 2.5–4 mm. long, central tooth 3.5–5 mm. long: corolla exceeding calyx; standard obovate, rounded at apex, retuse, gradually narrowed to base, short-clawed (if at all), 0.7–1.1 cm. long, 0.5–0.9 cm. wide; wings with apex obtusish, obtusely short-auriculate at base, short-clawed, 0.7–1 cm. long, 0.3–0.5 cm. wide; keel-petals subfalcate, apex truncate, tapering gradually to short, narrow claw, 0.8–1 cm. long, 0.2–0.5 cm. wide: loment stipitate, 2–6-articulate; stipe glabrous below, 2–4 mm. long; articles orbicular to rhombic, equally constricted on both sutures; sutures prominent, with surfaces sparsely to densely uncinulate-puberulent to -pubescent, 3.5–5 mm. long, 3–4 mm. wide.—PL. 3, FIGS. 18–27. MAP 10.—*Desmodium Alamani* DC., Prod. ii. 330 (1825). *Hedysarum Alamani* Spreng. Syst. iv. Cur. Post. 291 (1827). *Meibomia Alamani* (DC.) O. Ktze., Rev. Gen. i. 197 (1891). *D. subtile* Hemsley, Diag. Pl. Nov. iii. 47 (1880). *Meibomia subtilis* (Hemsl.) O. Ktze. Rev. Gen. i. 198 (1891). Known from Mexico, Federal District and Morelos.—MEXICO: MEXICO: Cajanes, dist. Temascaltepec, September 22, 1935, *Hinton et al.*, no. 8297 (K). FEDERAL DISTRICT: Pedrigal (lava beds), Valley of Mexico, 3500 ft. alt., September 30, October 29, 1896, *Pringle*, no. 6551 (F, G, M, NY, P, US); lava fields above the Valley of Mexico, 8000 ft. alt., November 6, 1900, *Pringle*, no. 9103 (G, US); lava fields near Eslaba, 8000 ft. alt., November 11, 1903, *Pringle*, no. 11409 (F, G, US); Sierra de Ajusco, 8500 ft. alt., November 13, 1907, *Pringle*, no. 15022 (G, US); Cerro Magdalena, Serranía de Ajusco, October 23, 1937, *Lyonnet & Elcoro*, no. 1890 (US); El Carbonera, August 22–September 19, 1930, *Russell & Souviron*, no. 111 (US). MORELOS: inter Huitzilac et Cuernavaca, December 5, 1925, *Woronow & Juzepczuk*, no. 824 (F); Huitzilac, October 16, 1937, *Lyonnet & Elcoro*, no. 1785 (US); near Cuernavaca, December, 1937, *Martinez*, no. 92 (US). State unknown: ex hb. *J. S. Mill*, s. n. (G). *Alaman* (TYPE, herb. Delessert (not seen); G, photo).

D. GHIESBREGHTII Hemsl. Shrub; stem terete, striate, often rugulose, finely and rather densely and shortly uncinulate-puberulent: leaves trifoliolate, petiolate; petioles subterete, striate, finely puberulent, more than twice as long as leaf-rachis, (1.8–) 3–4.5 cm. long; leaf-rachis similar, slender, 0.7–1.5 cm. long; petiolules subangular, rugulose, uncinulate-puberulent to glabrescent, those of terminal leaflets 1.5–3 mm. long, those of lateral leaflets 2–3.5 mm. long: leaflets glabrous, finely and prominently reticulate above, paler beneath and essentially glabrous except for some occasional white hairs on midrib, occasionally somewhat ciliate toward the base, and with margins revolute, mostly ovate or elliptic to elliptic-ovate, obtuse, mucronate, broad at base; terminal leaflet 3.5–5 cm. long, 1.5–2.5 cm. wide; lateral leaflets 2–4 cm. long, 1–2 cm. wide: stipules, striate, lance-acuminate, with long-attenuate apex, puberulent on dorsal surface, ciliate, 9.5 mm. long, 1 mm. wide, very early-deciduous; stipels subulate to linear-lanceolate, puberulent on dorsal surface, ciliate, also early deciduous, especially those of terminal leaflets, those of lateral leaflets 3–5 mm. long: inflorescence racemose-paniculate; rachis angular, striate, uncinulate-puberulent (usually uncinulate- and spreading-pilose near base); racemes often subtended by 2 fused bracts: primary bracts striate, ovate-acuminate, puberulent on dorsal surface, occasionally also finely short-pilose, ciliate, 2.5–4.5 mm. long, 1–2.3 mm. wide; secondary bracts, when developed, filiform to ob-spatulate, thin, ciliate, with fairly prominent venation, 0.8–2.4 mm. long: pedicels very short, puberulent, 2–4 mm. long in flower, 3–4 mm. long in fruit: calyx puberulent over whole surface; teeth of both lobes ciliolate; central tooth of lower lobe ciliate and pilose; upper lobe bifid, obtuse, 2.2–3 mm. long; lateral teeth of lower lobe acute, 2.4–3.5 mm. long; central tooth of lower lobe acute to acuminate, 3–4 mm. long: standard obovate, retuse, orbicular at apex, narrowed to a short or not-at-all clawed base, 5.5–8.5 mm. long, 3.5–7.5 mm. wide; wings obliquely suboblong, obtuse, short-auriculate at base, narrowly unguiculate, 5.8–9.5 mm. long, 1.5–3 mm. wide; keel-petals falcate, obtuse, narrowed to a very slender claw, 5.5–9 mm. long, 2–3 mm. wide: loment stipitate, 2–6-articulate; stipe glabrous, 2–2.5 mm. long; articles orbicular to rhombic, quite prominently reticulate, essentially glabrous to puberulent (usually so on constrictions), 3–4 mm. long, 3–3.5 mm. wide.—MAP 11.—*Desmodium Ghiesbreghtii* Hemsl. in Biol. Cent.-Am. Bot. i. 279 (1880). *Meibomia Ghiesbreghtii* (Hemsl.) Ktze., Rev. Gen. i. 198 (1891) [as Giesbreghtii].—Known from Jalisco, Michoacan and Oaxaca, and farther inland from the state of Mexico.—MEXICO: JALISCO: near Guadalajara, September, 1903, *Rose & Painter*, no. 7427 (G, NY); barranca of Rio Blanco near Guadalajara, 5000 ft. alt., October 15, 1903, *Pringle*, no. 11412 (G); hills near Guadalajara, October 7, 1889, *Pringle*, no. 2956 (F, G); near Etzatlan, October 2, 1903, *Rose & Painter*, no. 7577 (G, US). MICHOACAN: vers la Huerta, vicinity of Morelia, September 1, 1910, 1950 m. alt., *Arsène*, no. 5139 (G, K, M, NY, US); Loma Sta. Maria, vicinity of Morelia, 2000 m. alt., August 26, 1909, *Arsène*,[24] no. 10027 (M, US). MEXICO: Rincon del Carmen, dist. Temascaltepec, 1340 m. alt., September 15, 1932, *Hinton*, no. 1734 (G, K). OAXACA: Sierra de San Felipe, 6800 ft. alt., September 11, 1894, *Pringle*, no. 5822 (G, US); Cerro San Antonio, dist. del Centro, 1900 m. alt., September 8, 1921, *Conzatti*, no. 4233, p.p. (US); 1750 m. alt., July–August, 1900, *Conzatti & Gonzalez*, no. 42 (M, US); province d'Oaxaca, 1842, *Ghiesbreght*, s.n. (K, TYPE).

Desmodium Alamani and *D. Ghiesbreghtii* differ from the other members of this group chiefly in their small, early-deciduous, primary bracts. From each other the two species may be at once distinguished by characters of the inflorescence. The racemes of *D. Alamani* are densely pyramidal, becoming broad at the apex and elongate only at the maturity of the loments; the central tooth of the lower calyx-lobe of the individual flowers and the sharp-pointed primary bracts protrude at an angle from the rachis giving a characteristic appearance to the raceme. In contrast, the racemes of *D. Ghiesbreghtii* are elongate and slender and the pedicels extremely short. The leaflets of *D. Ghiesbreghtii* are rather prominently and reticulately veined above.

D. MISCELLANEOUS RECORDS

D. JALISCANUM S. Wats in Proc. Am. Acad. xxii. (n. s. xiv.) 406 (1887). *Meibomia jaliscana* (S. Wats.) Standl. in Contrib. U. S. Nat. Herb. xxiii. 486 (1922).

This species, member of another group of the same section as the eight species just discussed, is not treated in detail here. The chief purpose in noting it is to make available identifications for several widely distributed collections which have been unnamed up to now. While studying various collections of Mexican *Desmodium*, the material collected by Mr. G. B. Hinton (nos. 2020, 2528 and 6771) in the state of Mexico and additional material collected by Lyonnet and Elcoro (no. 1836) in Morelos seemed to form a distinct and definite taxonomic unit, new to science; for which, accordingly, illustrations were prepared. Further study, however, has proven the material to be *Desmodium jaliscanum* Wats. There is some slight variation in pubescence-characters between the collections noted above and typical *D. jaliscanum*, but after critical examination of a large series of speci-

[24] This collection is not representative of *M. bella*, as cited by Blake in Bot. Gaz. lxxviii. 283 (1924).

mens no constant differences have been detected.—PL. 3, FIGS. 1–8. The following specimens are referred to this species:

MEXICO: JALISCO: Rio Blanco, October, 1886, *Ed. Palmer*, no. 667 (G, TYPE); canyons near Guadalajara, October 8, 1891, *Pringle*, no. 3859 (F, M); near Etzatlan, October 2, 1903, *Rose & Painter*, no. 7574 (NY, US); mountains above Etzatlan, October 27, 1903, *Pringle*, no. 11411 (G, US). MICHOACAN: vicinity of Morelia: Loma Sta. Maria, 1950 m. alt., August 26, 1909, *Arsène*, no. 2983 (K, NY); same locality and altitude, August 28, 1910, *Arsène*, no. 5836 (NY); vers la Huerta, 1950 m. alt., September 1, 1910, *Arsène*, no. 5137 (US). MEXICO: dist. Temascaltepec: Socabón, 2320 m. alt., September 28, 1932, *Hinton*, no. 1862 (K); Bejucos, 610 m. alt., October 7, 1932, *Hinton*, no. 2020 (G, K); by the river, same locality and altitude, November 8, 1932, *Hinton*, no. 2528 (G, K); oak woods, Yperricones, October 19, 1934, *Hinton*, no. 6771 (G, K). MORELOS: October 14, 1899, *Holway*, no. 3633; Valle de Cuernavaca, Huitzilac, August, 1930, *Lyonnet*, no. 705 (M, US); Valle del Tepeite, *Lyonnet & Elcoro*, no. 1836 (US).

D. **Mexiae**, sp. nov., planta suffrutescens 2 m. alta, caule ramoso (ramis longis et virgatis), tenuiter striato, dense appresse piloso (paene tomentoso pilis mollissimis); foliis trifoliatis, petiolatis: petiolis angulatis pilosis (ut caule sed pilis plus minusve patentibus), 1.5–3 cm. longis; petiolulis quam petiolis fuscioribus et crassioribus, etiam moderate pilosis, ca. 2.5 mm. longis: foliolis ovatis, apice obtusis, mucronatis, base late obtusis vel rotundatis, pagina superiore viride et tenuiter molliter appresseque pilosa, pagina inferiore alba, mollissime tomentosa et paene alba; foliolis terminalibus, 4–7 cm. longis, 2–3.5 cm. latis, foliolis lateralibus 4–5.5 cm. longis, 1.5–2.5 cm. latis: stipulis oblique ovato-lanceolatis, basi plus minusve truncatis, apice abrupte longeque acuminatis, striatis, puberulentibus, in utroque pilosis, 5–6 mm. longis, 3–4 mm. latis, saepissime reflexis; stipellis foliolorum terminalium saepissime longe subulatis, ciliatis, 2–4 mm. longis, eis foliolorum lateralium saepissime lineari-lanceolatis, 2.5–4.5 mm. longis, puberulentibus: inflorescentia e paniculis multis parvis axillaribusque composita, rhachibus striatis, patenti-pubescentibus: bracteis primariis ovatis vel lineari-lanceolatis striatis, puberulentibus, ciliatis apice longe acuminatis, attenuatisque, 6–10 mm. longis, 1–1.8 mm. latis, saepissime deciduis; bracteis secundariis similibus tenuioribus, 5–8 mm. longis, subulatis, puberulentibus: pedicellis tenuissimis, ut rhachibus pubescentibus, patentibus, 1.2–1.5 cm. longis: calice puberulente et plus minusve pilosa, pilis longis rectisque, dentibus loborum tenuiter brevi-ciliatis; lobi inferioris dente centrali ca. 3.8 mm. longo, dentibus lateralibus ca. 3.7 mm. longis; lobo superiore bifido 3.3 mm. longo: corolla quam calice longiore, vexillo obovato, apice retuso basi acutiusculo, ca. 7.8 mm. longo, 5.8 mm. lato, alis vexillo aequantibus, ca. 2.6 mm. latis, plus minusve elliptico-oblongis apice obtuso basi auriculato, unguiculato; petalis carinae cuneato-falcatis, unguiculatis, ca. 7 mm. longis, 2.7 mm. latis: lomento 3–5 articulato, stipitato, stipite circa 4.5 mm. longo; articulis pilosis, in formam rhomboideam contortis, ca. 3 mm. longis, 2.5 mm. latis.—Tab. 1, figs. C1–7.—Known only from the state of Guerrero.—MEXICO: Guerrero: Sierra Madre del sur, dist. Mina, Petlacala, Barranca del Ranchito, streambank in shade, 1910 m. alt., January 8, 1938, *Mexia*, no. 9091 (G, type; NY, US, isotypes).

Desmodium Mexiae is a very distinctive representative of the group of *D. procumbens*, many members of which were discussed in the first paper of the series.[25] In the key there presented[26] *D. Mexiae* would come closest to *D. procumbens*, var. *longipes;* that branch of the key may now be emended to read:

Pedicels long, flexuous, filiform; bracts persistent; rachis glabrous to pilose.
  Leaflets moderately appressed-pubescent below; branches glabrous to moderately pilose. . . . . *D. procumbens*, var. *longipes.*
  Leaflets densely and softly tomentose beneath; stem densely appressed-pilose with soft hairs. . . . . *D. Mexiae.*

E. Hedysarum of Sessé and Mociño (in part)

Through the kindness of Dr. Paul C. Standley of the Field Museum of Natural History, the entire collection of *Hedysarum* of Sessé and Mociño has been made available to me for study. It seems well at this time, to publish a list of identifications, in so far as the specimens represent species considered in this paper. Wherever necessary explanatory notes and bibliographical references will follow the identifications. In most cases two specimens of each number exist, one of the Herbarium of the Madrid Botanic Garden, Spain, the other of the Field Museum. Unless otherwise specified all numbers listed are in both herbaria, and except in cases of mixtures the herbaria will not be designated; where mixtures occur however, the Herbarium of the Madrid Botanic Garden will be designated—(Mad.) and the Field Museum, as usual,—(F).

Plantae Novae Hispaniae, 1787–1795–1804, *Sessé, Mociño, Castillo et Moldonado* lectae:

No. 2007. *Desmodium Hartwegianum* Hemsl., var. *amans* (Wats.) Schubert. This specimen is labeled *Hedysarum viridiflorum.* An original diagnosis is given for the species in Pl. Novae Hispaniae 123 (1889), but the additional diagnosis from Gronovius (cited also by

[25] Contrib. Gray Herb. cxxix. 3–26 (1940).
[26] Op. cit. 5.

Linnaeus) may be found in Linnaeus's Sp. Pl. Ed. 1. 748 (1753) and Ed. 2. 1055 (1763)) where Linnaeus published the name *H. viridiflorum*. A photograph of Linnaeus's type proves that his specimen was not at all related to the plant of Sessé and Mociño, referred to this species. The plate cited in Pluk. Alm. by Sessé and Mociño is another species, neither *H. viridiflorum* L., nor the plant which the authors possessed. This was simply a misidentification.

Nos. 1950, 1951, 1952. *D. Hartwegianum* Hemsl., var. *amans* (Wats.) Schubert. These specimens are labeled with an unpublished name which there is no need to take up. A note on no. 1951 bears the initials N. E. [Nueva España] signifying that the plant came from Mexico. On no. 1952 is an annotation "affinis frutescens".

No. 1967. *D. Hartwegianum* Hemsl., var. *typicum*. The label on this plant bears the annotation:

"Hedysarum longifolium N [obis]"

"parece especie nueva"

The species was described by Sessé and Mociño in Fl. Mex. Ed. 2. 171 (1895). The name is antedated in *Hedysarum*, however, by *H. longifolium* Rottl. ex Spreng., Syst. Veg. Ed. 16, iii. 319 (1826), which represents a plant of the East Indies.

No. 1949. *D. Alamani* DC. This specimen is annotated simply "Hedysarum sp. nova N [ueva] E [spaña]".

No. 1957. *D. Alamani* DC. This collection is annotated with an unpublished name which need not here be taken up, and the additional note "caule sufrut. 4 pedal.".

No. 2000. *D. Ghiesbreghtii* Hemsl. This specimen is labeled *Hedysarum frutescens*. The references cited in Sessé & Mociño, Pl. Nov. Hisp. Ed. 1. 123 (1889) and Ed. 2. 114 are (1) Gronov. Fl. Virg. 109 and (2) Miller, Gard. Dict., Hedysarum no. 16. The reference to Gronovius is to the second edition (1762) of his Flora, in which a page reference to the first edition (p. 174) and a synonym, Hedysarum minus Clayt. n. 274, are given. The Clayton number is apparently an error for Clayton, no. 174, which is given in the first edition (1739). Miller, in his Dictionary, also cited the reference to Gronovius (ed. 1). *Hedysarum frutescens* as a name will be considered elsewhere, it is sufficient to say here, that the name was based on a mixed collection, neither part of which can be identified with this Mexican plant. (F, Mad. p. p.)

Explanation of Plates 1–3[27, 28]

Plate 1. Desmodium axillare (Sw.) DC., var. Sintenisii Urban: [figs. A1–7] fig. 1, habit, × ¼, from *Sintenis*, no. 2781; fig. 2, mature loment, × 1½, from *Lundell*, no. 6201; fig. 3, keel-petals, × 3, from *Blake*, no. 7510; fig. 4, diadelphous stamens (tube cut open) × 3, from same specimen; fig. 5, wing, × 3, from same specimen; fig. 6, standard, × 3, from same specimen; fig. 7, calyx, × 3, from same specimen.

Var. acutifolium (O. Ktze.) Urban: [figs. A8–14] fig. 8, trifoliolate leaf and portion of stem, × ½, from *Kuntze*, s. n. (type, NY); fig. 9, mature loment, × 1½, from same specimen; fig. 10, standard, × 3, from *Lundell*, no. 1265; fig. 11, keel-petals, × 3, from same specimen; fig. 12, diadelphous stamens (tube cut open), × 3, from same specimen; fig. 13, wing, × 3, from same specimen; fig. 14, calyx, × 3, from same specimen.

Var. genuinum Urban: [figs. A15–21] fig. 15, habit, × ¼, from *Kuntze*, no. 436 (type, NY); fig. 16, mature loment, × 1½, from *Sintenis*, no. 1688; fig. 17, wing, × 5, from *Kuntze*, no. 436; fig. 18, calyx, × 5, from same specimen; fig. 19, standard, × 5, from same specimen; fig. 20, diadelphous stamens (tube cut open), × 5, from same specimen; fig. 21, keel-petals, × 5, from same specimen.

D. canaliculatum, n. sp.: [figs. B1–8, figs. 1–7 all from *Mexia*, no. 9078 (type)] fig. 1, portion of plant showing trifoliolate leaf and inflorescence, × ½; fig. 2, mature loment, × 1; fig. 3, keel-petals, × 1½; fig. 4, standard, × 1½; fig. 5, wing, × 1½; fig. 6, calyx, × 1½; fig. 7, diadelphous stamens (tube cut open), × 1½; fig. 8, trifoliolate leaf, to show outline, × ½, from *Mexia*, no. 9061.

D. Mexiae, n. sp.: [figs. C1–7, all figs. from *Mexia*, no. 9091 (type)] fig. 1, portion of plant showing trifoliolate leaves and inflorescence, × ½; fig. 2, mature loment, × 1½; fig. 3, keel-petals, × 2; fig. 4, standard, × 2; fig. 5, calyx, × 2; fig. 6, wing, × 2; fig. 7, diadelphous stamens (tube cut open), × 2.

Plate 2. D. subsessile Schlecht.: [figs. 1–9, figs. 1–3 all from *Pringle*, no. 4780; figs. 4–9 all from *Arsène*, no. 5419] fig. 1, portion of stem with trifoliolate leaves showing both surfaces of leaflets, × ½; fig. 2, portion of inflorescence, × ½; fig. 3, mature loment, × 1½; fig. 4, calyx, × 2; fig. 5, diadelphous stamens (tube cut open), × 2; fig. 6, ovary, × 2; fig. 7, wing, × 2; fig. 8, keel-petals, × 2; fig. 9, standard, × 2.

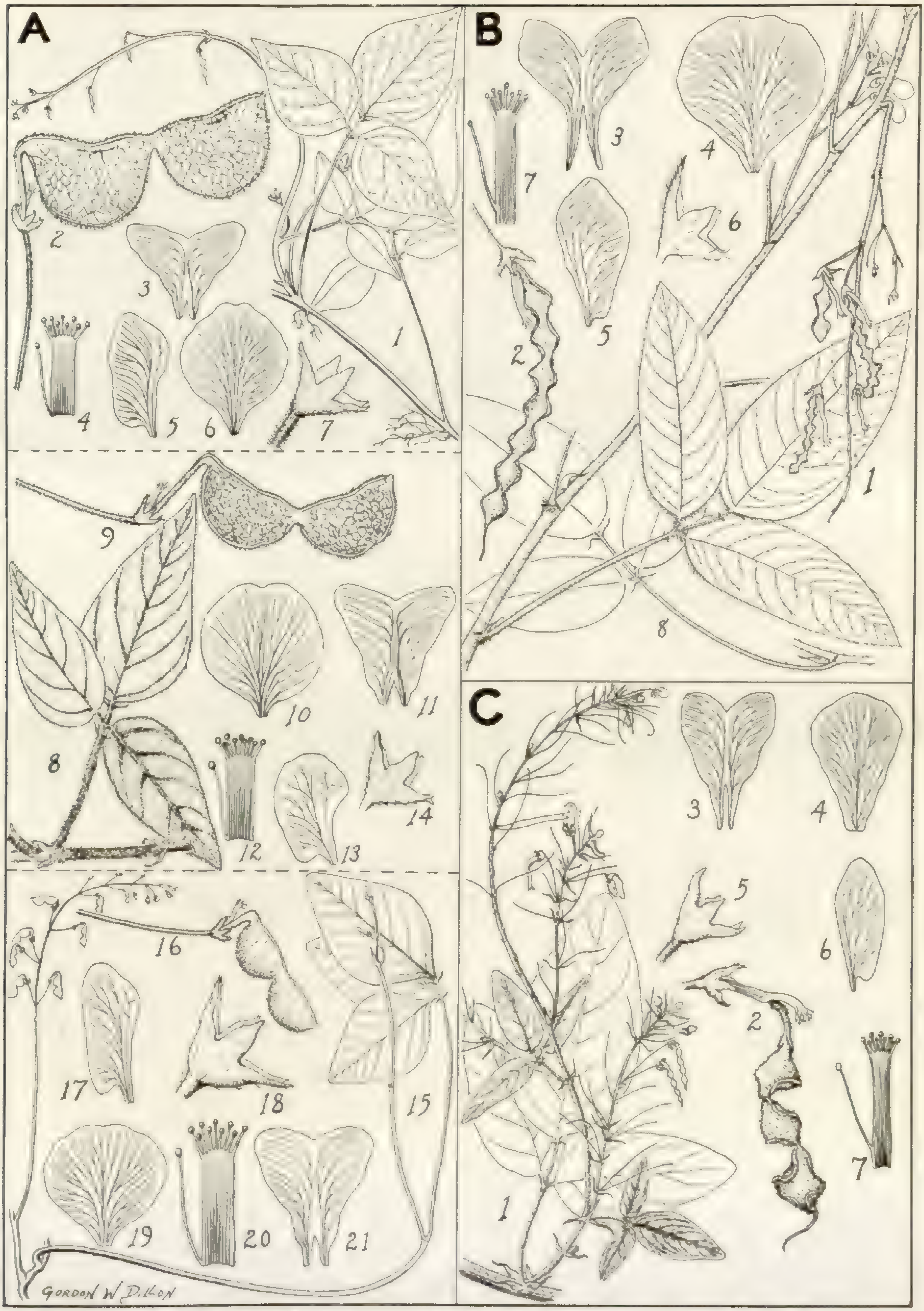
D. Hartwegianum Hemsl., var. typicum: [figs. 10–18, figs. 11–18 all from *E. Palmer*, no. 663] fig. 10, portion of stem with a trifoliolate leaf, × ½, from *Hartweg*, no. 56 (isotype, G); fig. 11, portion of fruiting inflorescence, × ½; fig. 12, mature loment, × 1; fig. 13, calyx, × 2; fig. 14, standard, × 2; fig. 15, wing, × 2; fig. 16, keel-petals, × 2; fig. 17, ovary, × 2; fig. 18, diadelphous stamens (tube cut open), × 2.

Var. amans (Watson) Schubert: [figs. 19–27, all figs. from *Pringle*, no. 3291 (type)] fig. 19, fruiting inflorescence, × ½; fig. 20, portion of stem with trifoliolate leaf, × ½; fig. 21, mature loment, × 2; fig. 22, calyx, × 2½; fig. 23, standard, × 2½; fig. 24, wing, × 2½; fig. 25, keel-petals, × 2½; fig. 26, diadelphous stamens (tube cut open), × 2½; fig. 27, ovary, × 2½.

D. Johnstonii Standl. n. sp.: [figs. 28–37, all figs. from *J. R. Johnston*, no. 344 (type, F)] fig. 28, portion of stem with trifoliolate leaf, × ½; fig. 29, portion of inflorescence, × ½; fig. 30, bract, × 2; fig. 31, calyx, × 2; fig. 32, mature loment with bract subtending pedicel, × 2; fig. 33, standard, × 2; fig. 34, wing, × 2; fig. 35, keel-petals, × 2; fig. 36, diadelphous stamens (tube cut open), × 2; fig. 37, ovary, × 2.

[27] The plates were drawn, under the author's direction, by Mr. Gordon W. Dillon.

[28] In all drawings of the calyx the normal position is reversed, *i. e.*, the upper (*bifid*) lobe is below. This unfortunate error was also made in plates 1 and 2 of the author's previous paper, Contrib. Gray Herb. CXXIX (1940).



DESMODIUM AXILLARE varieties: FIGS. A1–21. Var. SINTENISII: FIGS. 1–7. Var. ACUTIFOLIUM: FIGS. 8–14. Var. GENUINUM: FIGS. 15–21.
D. CANALICULATUM, n. sp.: FIGS. B1–8.
D. MEXIAE, n. sp.: FIGS. C1–7.

DESMODIUM SUBSESSILE: FIGS. 1–9.
D. HARTWEGIANUM varieties: FIGS. 10–27. Var. TYPICUM: FIGS. 10–18. Var. AMANS: FIGS. 19–27.
D. JOHNSTONII, n. sp.: FIGS. 28–37.

DESMODIUM JALISCANUM: FIGS. 1–8.
D. BELLUM: FIGS. 9–17.
D. ALAMANI: FIGS. 18–27.
D. MAXONII: FIGS. 28–35.

PLATE 3. D. JALISCANUM S. Wats.: [FIGS. 1–8, all figs. from *Hinton*, no. 2528] FIG. 1, portion of plant showing trifoliolate leaves (upper and lower surfaces of leaflets) and portion of inflorescence, × ½; FIG. 2, mature loment, × 2; FIG. 3, calyx, × 2; FIG. 4, standard, × 2; FIG. 5, wing, × 2; FIG. 6, keel-petals, × 2; FIG. 7, diadelphous stamens (tube cut open), × 2; FIG. 8, ovary, × 2.

D. BELLUM (Blake) Schubert: [FIGS. 9–17, all figs. from *Pringle*, no. 6206 (TYPE)] FIG. 9, mature trifoliolate leaf, × ½; FIG. 10, portion of mature inflorescence, × ½; FIG. 11, mature loment, × 1½; FIG. 12, calyx, × 1½; FIG. 13, standard, × 1½; FIG. 14, wing, × 1½; FIG. 15, keel-petals, × 1½; FIG. 16, diadelphous stamens (tube cut open), × 1½; FIG. 17, ovary, × 1½.

D. ALAMANI (HBK.) DC.: [FIGS. 18–27] FIG. 18, portion of plant showing trifoliolate leaf and immature fruit, × ½, from *Pringle*, no. 6551; FIG. 19, portion of inflorescence, × ½, from *Hinton*, no. 8297; FIG. 20, mature loment, × 1½, from *Pringle*, no. 6551; FIG. 21, bract, × 5, from *Hinton*, no. 8297; FIG. 22, calyx, × 2, from same specimen; FIG. 23, standard, × 2, from same specimen; FIG. 24, wing, × 2, from same specimen; FIG. 25, keel-petals, × 2, from same specimen; FIG. 26, diadelphous stamens (tube cut open), × 2, from same specimen; FIG. 27, ovary, × 2, from same specimen.

D. MAXONII Standl.: [FIGS. 28–35, all figs. from *Maxon*, no. 5370 (US, TYPE)] FIG. 28, portion of specimen, showing mature trifoliolate leaf and axillary inflorescence, × ½; FIG. 29, mature loment, × 1½; FIG. 30, calyx, × 1½; FIG. 31, standard, × 1½; FIG. 32, wing, × 1½; FIG. 33, keel-petals, × 1½; FIG. 34, diadelphous stamens (tube cut open), × 1½; FIG. 35, ovary, × 1½.

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3. THE GENUS CHARIANTHUS

W. H. HODGE

(Plates 4–6)

Charianthus is a very small genus of the family *Melastomaceae*. It is composed of eleven species and varieties of much-branched shrubs or small trees with showy crimson-purple flowers borne in corymbose or paniculate cymes. The genus is probably endemic in the mountains of the West Indies, one species being found in Jamaica and the remainder segregated on the volcanic peaks of the highest islands in the Lesser Antilles.

According to Cogniaux twenty-five genera are included in the tribe *Miconieae*, to which *Charianthus* belongs. The tribe as a whole possesses stamens of equal length with connectives generally non-appendaged and seldom prolonged at their bases; its fruits are baccate. *Charianthus* is most closely related to *Tetrazygia* and *Miconia*, the latter possibly being the progenitor. There are no sharp distinctive characters but rather an accumulative group of characters which set off the three genera. The pseudo-campanulate corolla is most commonly used in keys to separate *Charianthus* from the other two, which possess spreading or reflexed petals. Both *Miconia* and *Tetrazygia* possess corymbs or panicles of varying white to yellowish flowers; *Charianthus* has inflorescences which are cymose with flowers invariably bright red to crimson-purple. The long-exserted anthers in *Charianthus* open by longitudinal slits (*C. Fadyeni* excepted) while in the related genera pollen is generally shed through a varying number of terminal pores. Finally, *Charianthus* has 4-parted flowers, whereas those of *Miconia* and *Tetrazygia* (at times in fours) commonly follow a plan of 5.

Miconia is distributed throughout all the West Indies and tropical America; *Tetrazygia* is a widespread West Indian genus, but *Charianthus* is localized in Jamaica and the southern Caribbees. Such a limited distribution suggests that *Charianthus* has evolved as a high-altitude off-shoot directly from *Miconia* or indirectly through *Tetrazygia.*

The first two species of this genus were described in 1792 by Richard as *Melastoma corymbosa* and *M. coccinea.* Four years later, in 1796, Vahl described quite a different species under the name *M. coccinea* and in the same year there appeared Desrousseaux's *M. nodosa. Charianthus* was set up as a new genus by D. Don in 1823 at which time Richard's original *Melastoma coccinea* was transferred to the genus and the name *C. purpureus* was given by Don to the second *M. coccinea*, of Vahl. In the same treatment there was first described *C. tinifolius* which is probably the small-leaved variety of true *C. coccineus.* Don overlooked both *M. corymbosa* Richard and *M. nodosa* Desr., the proper combinations finally being made by Cogniaux in 1891 and Triana in 1871. *Charianthus*, as defined by Don, has been successfully upheld by the three great students of the *Melastomaceae*, Naudin, Triana, and Cogniaux. Baillon (Hist. des Pl. vii. 18 and 54, 1881) alone included the genus under *Miconia.*

After Don, "additions" to the genus were first made by DeCandolle, who in 1828 described *C. glaberrimus*, which is identical with *Melastoma corymbosa* Richard, not Vahl (as stated by DC). DeCandolle had no knowledge of *Melastoma nodosa* Desr. and so published as a synonym *C. ciliatus* from typical material of *C. nodosus.* Naudin, in 1852, also overlooking Desrousseaux's *M. nodosa*, described the ciliate-leaved form as *C. ciliatus;* and at the same time he described *C. crinitus*, without having examined material of *C. purpureus* Don. In 1864, in his flora, Grisebach called attention to the fact that a *Charianthus* had been described from Jamaica by Hooker in 1849 as *Tetrazygia Fadyeni.* With apical monoporous anthers, it opposed the concept of *Charianthus*, as proposed by Don from Lesser Antillean material, which possessed longitudinal anther-slits. Although divergent in certain characters, *Tetrazygia Fadyeni* was closer to *Charianthus* than to any other genus of melastomes, and so was included by Grisebach as a monotype in a new section *Eccharianthus* as opposed to his other section, *Eucharianthus*. Grisebach as well as Triana also perpetuated DeCandolle's *C. glaberrimus*, a synonym of *C. corymbosus*. The most recent and most thorough treatment of the genus is that of Cogniaux in his Monograph of the *Melastomaceae* (1891). Of his eight species the present paper, on the basis of much new material and actual field observation, upholds five, reducing the others either to synonymy or to the status of varieties.

The species of *Charianthus* are generally well marked and separable by several sets of morphological characters, while within a few of the species the amount of variation is enough to justify recognizing geographical varieties.

The leaves within the genus vary sufficiently to be used as accessory characters in separating species and as strong characters in the delimitation of varieties. The 3–5-nerved leathery blades vary in shape from lanceolate to broadly elliptical, from long-acuminate to bluntly cuspidate or obtuse at the apex, from long-attenuate to subcordate at the base. Good taxonomic characters are to be found in the nature of the vestiture and all types found in the genus occur on the leaves.

The cymose inflorescence is essentially stable but minor differences between the species exist, for instance, in the size and the relative compactness of the individual flowers. *C. nodosus* is, however, separable from the other species in the genus by its axillary, as opposed to terminal, cymes. The flower-parts are mostly uniform and offer little of diagnostic value other than in size of corolla, stamens, and style to distinguish between species. Flower-size is important in the separation of *C. corymbosus* and *C. coccineus*.

Sepals are small, of firm texture, and persistent. In all species except *C. Fadyeni* (where the limb is erect and obscurely undulate) the calyx-limb is broadly 4-lobed with apiculate exterior teeth and is slightly spreading in fruit. Scales when present are similar to those found on the pedicels and hypanthia but are seldom in such abundance. The quickly deciduous petals are always glabrous; their shape is ovate in the Lesser Antillean series, oblong-spatulate in the Jamaican species.

Aside from variations in size the stamens have a similar pattern; *C. Fadyeni* is alone in lacking longitudinally chinked anthers and non-pruinose filaments. The style varies in length alone. The berry-fruits in all species are black at maturity; those of the Lesser Antillean species are identically subglobose, those of the Jamaican, urceolate. The pyramidal seeds are similar throughout the genus.

Indument is valuable in the delimitation of varieties and forms. The most widely spread type is the stellate-fimbriate scale which is universal in the genus and commonly found as a close, brown covering on the youngest, unfolding leaves, on the inflorescence-branches, and on the pedicels, hypanthia, and calyces of the flowers. These scales vary in persistence but are rarely found on the upper leaf-surfaces at maturity. On some species they are found below, at maturity, as scattered dots, almost glandular in appearance, sunken in tiny pits on the leaf-tissue. The same scale-type can frequently be found persisting on maturing fruits. Another form of the scale is whitish in color and is more loosely furfuraceous in nature; it occurs principally on the veins and veinlets (below) of *C. purpureus* var. *rugosus*.

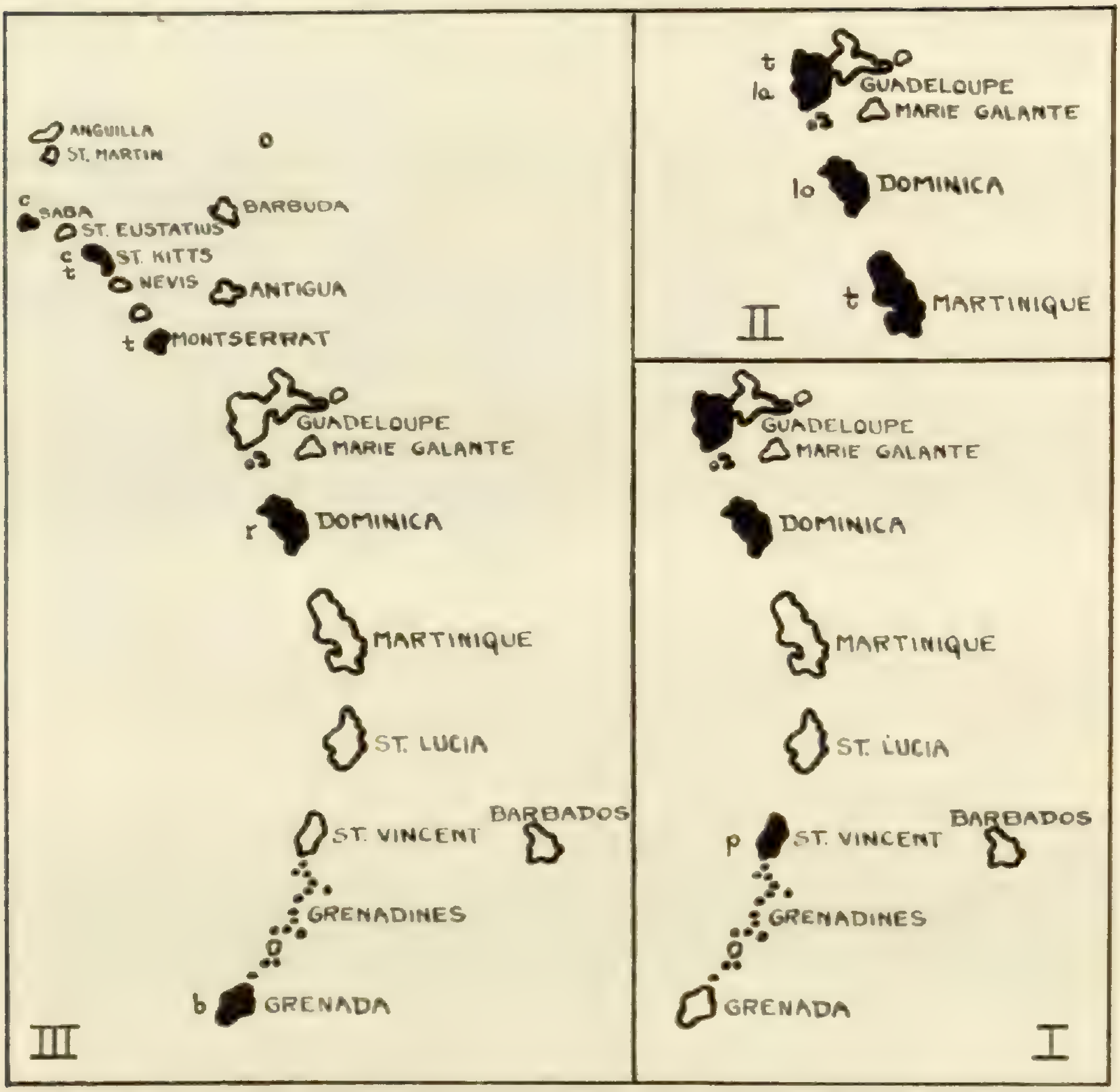
In *C. purpureus* and *C. nodosus* setae are found in addition to the scales. In certain varieties or forms of these species the hairs are found either all over the twigs or in nodal rings, at the joints of inflorescence-branches; on the margins of the slightly sulcate petioles, sparingly below on the principal veins, and rarely on leaf-tissue above. The brownish setae may be crinite or villose, dense or sparse, short or long (from less than 1 mm. to 5 mm. in length).

The dividing of *Charianthus* into two sections may be directly correlated with the distribution of the genus, for the two divisions are widely separate in the Antilles. The divergence of their morphological characters, resulting in general dissimilarity, suggests that § *Euchari-anthus* and § *Eccharianthus* have no direct relation but rather represent parallel evolution. The geological evidence as shown in the history of the Antillean arc supports this viewpoint.

Jamaica lies about 900 miles from Saba, the nearest station of § *Eucharianthus;* and the present distance to the central Lesser Antilles, the focal point of the section, is practically 1000 miles. Geologists,[1] as well as biogeographers in general, believe that Jamaica and the main islands of the Greater Antilles represent continental fragments—all that are left of an easterly extension of Central America which existed intermittently from pre-Eocene to Lower Pliocene and which terminated in the southeast with the American Virgin Islands. At this time the Caribbee islands to the south were non-existent. Subsequent submergence separated the larger islands, and in its separation Jamaica claims the longest period of isolation.

The volcanic Lesser Antilles are much younger (late Cenozoic) and

[1] Schuchert, Historical Geology of the Antillean-Caribbean Region. 106 (1935).



MAP I. Distribution of CHARIANTHUS COCCINEUS, and its var. PARVIFOLIUS (p).

MAP II. Distribution of C. CORYMBOSUS and its varieties: var. TYPICUS (t); var. LATIFOLIUS (la); var. LONGIFOLIUS (lo).

MAP III. Distribution of C. PURPUREUS and its varieties: var. TYPICUS (t); var. CRINITUS (c); var. RUGOSUS (r); var. BREVISETOSUS (b).

show no proof of ever having been connected in the north with the Greater Antilles or in the south with the continent. Therefore, their biota, in the opinion of most Antillean biogeographers, is probably of waif-origin. The geological evidence thus suggests that the endemism of *Charianthus* in the West Indies is not relict but recent.

§ *Eccharianthus* in Jamaica is found at middle elevations, whereas, with the exception of *C. corymbosus*, var. *typicus*, the four species of § *Eucharianthus* in the Lesser Antilles are limited to the summits of the highest volcanic islands. Altitude with its concomitant factors is apparently decisive in the distribution of the genus, for on the low-lying islands of the arc—St. Eustatius, Antigua, Barbados, and the Grenadines—*Charianthus*, in spite of thorough collecting, has not been found. All four species of § *Eucharianthus* have close affinity, but the two setose species, *C. purpureus* and *C. nodosus*, and the two glabrous species, *C. corymbosus* and *C. coccineus*, are between themselves even more nearly related. Species of highest altitudes (all but *C. corymbosus*) are the largest flowered; and since this habitat, in a region of active vulcanism, would be the last presumably available, it may be suggested that these species are the most recent in origin—and are possibly derivatives of *C. corymbosus* by way of *C. coccineus*.

In connection with this study, loans have been kindly forwarded from the herbaria of the Arnold Arboretum (A), and the New York Botanical Garden (NY). Collections bearing the symbol (G) are in the Gray Herbarium. To Dr. H. A. Gleason of the New York Botanical Garden, for helpful advice, and to Professor M. L. Fernald for invaluable suggestions and guidance, I wish to express my appreciation.

Synoptic Treatment of the Genus

CHARIANTHUS D. Don. Shrubs or small trees, generally much branched: *leaves* 3–5-nerved, decussate, lanceolate to ovate or elliptical, petiolate, often coriaceous, entire, glabrous to setose, the youngest leaves usually covered with either close, brown or whitish-scurfy scales: *flowers* showy, in terminal (rarely lateral-axillary), paniculate or corymbose cymes, parts in fours: *calyx*-tube campanulate or urceolate, obscurely and obtusely 4-lobed or repand; the limbs persistent, each with a minute, bluntish, exterior tooth: *petals* 4, ovate to obovate or narrowly oblong-spatulate, glabrous, free, erect, usually forming an imbricate, bell-shaped corolla, bright red to crimson-purple, sometimes with creamy margins: *stamens* 8, in two equal series, inflexed in bud, much longer than the petals; anthers with longitudinal slits or rarely a terminal pore; connective not elongate and without any appendage: *ovary* completely fused to hypanthium, glabrous at apex, 2–4-locular; style very long, filiform, with simple, rounded stigma: *fruit* baccate, crowned by the persistent calyx, sub-globose or urceolate, juicy and black at maturity; seeds pyramidal.—Mem. Wern. Soc. iv. 327 (1823); DeCandolle, Prod. iii. 196 (1828) and Mém. Melast. 81 (1828); Endlicher, Gen. no. 6263 (1836–1840); Naudin in Ann. Sci. Nat. sér. 3, xviii. 111 (1852); Grisebach, Fl. Br. W. I. Isl. 263 (1864); Bentham & Hooker, Gen. Pl. i. 762 (1862–1867); Triana, Melast. 99 (1871); Urban, Symb. Ant. viii. 492 (1921); Cogniaux in DC. Monogr. Phan. vii. 713 (1891); Mazé, Contr. Fl. Guadel. 50 (1892); Duss. Fl. Phan. Ant. Fran. 285 (1897); Boldingh, Fl. Dutch W. I. i. 149 (1909); Fawcett & Rendle, Fl. Jam. v. 365 (1926); Williams & Cheesman, Fl. Trinid. & Tob. i. 366 (1934). Type Species: *C. corymbosus* (L. C. Rich.) Cogniaux.

The sections *Eucharianthus* and *Eccharianthus* are retained in this treatment and are separable by the characters under the two primary headings in the key.

Sect. I. Eucharianthus Grisebach, Fl. Br. W. I. Isl. 263 (1864); Cogniaux in DC. Monogr. Phan. vii. 714 (1891).

Sect. II. Eccharianthus Grisebach, Fl. Br. W. I. Isl. 264 (1864); Cogniaux in DC. Monogr. Phan. vii. 717 (1891).

Key to Species

a. Petals broadly ovate; filaments not pruinose; anthers with longitudinal slits; ovary 4-loculed; fruit subglobose with a spreading, persistent calyx-limb. Sect. Eucharianthus Grisebach....*b.*

b. Young growth, i. e. twigs, leaves and petioles, essentially glabrous, lacking setae....*c.*

c. Flowers large, petals 10–12 mm. long; filaments 15–18 mm. long; style 15–30 mm. long; leaves usually punctate beneath with persistent, appressed scales......1. *C. coccineus.*

c. Flowers small, petals 5–7 mm. long; filaments 5–6 mm. long; style 10 mm. long; leaves mostly glabrous beneath, usually lacking persistent appressed scales. .2. *C. corymbosus.*

b. Young growth, i. e., twigs, leaves or petioles, setose....*d.*

d. Cymes terminal, erect; leaves not punctate beneath with closely appressed scales........................3. *C. purpureus.*

d. Cymes lateral, axillary, pendulous; leaves punctate beneath, with closely appressed scales..................4. *C. nodosus.*

a. Petals narrowly-oblong to spatulate; filaments pruinose, anthers with a single apical pore; ovary 2-loculed; fruit urceolate, with an erect persistent calyx-limb. Sect. Eccharianthus Grisebach..........................5. *C. Fadyeni.*

1. Charianthus coccineus (L. C. Richard) D. Don, var. **typicus**. Shrub, up to 3 m. tall; twigs stout, terete to obscurely tetragonal, glabrous: *leaves* 5-nerved, ovate-elliptical, entire, abruptly short-acuminate, subacute to broadly rounded at base; blades 5–11 cm. long, 3–6 cm. broad, youngest leaves closely and densely brown-lepidote beneath, at length glabrescent with scattered, punctiform appressed scales, upper surface glabrous, coriaceous; petiole 0.5–3 cm. long, glabrous: *cymes* many-flowered, loosely-corymbose or -paniculate, 2–5 cm. long, the basal peduncles 1–3 cm. long; the inflorescence-branches, pedicels, hypanthia and calyx-tubes lightly lepidote: *pedicels* 1–5 mm. long; hypanthia 3–4 mm. long: *calyx*-tube 2–2.5 mm. long, with a minute, blunt, exterior tooth just below the retuse tip of each lobe: *corolla* red; petals 10–12 mm. long, ovate, obtuse: *stamens* inflexed in bud; filaments red, 15–18 mm. long; anthers arcuate, 2 mm. long: *style* red, 1.5–3 cm. long, the tip rounded: *berry* subglobose, 4–7 mm. in diameter, juicy-black at maturity.—Mem. Wern. Soc. iv. 328

(1823); DeCandolle, Prodr. iii. 196 (1828); Naudin, Monogr. Melast. in Ann. Sc. Nat. sér. 3, xviii. 111 (1852); Grisebach, Fl. Br. W. I. I., 263 (1864); Triana, Melast. 99 (1871); Cogniaux in DC. Monogr. vii. 714 (1891). *Melastoma coccinea* L. C. Richard in Act. Soc. Hist. Nat. Paris. 109 (1792). *M. alpina* Swartz, Prodr. 71 (1788); Swartz, Fl. Ind. Occ. ii. 800 (1797); Willdenow, Sp. Pl. 2, 597 (1800). *C. tinifolius* D. Don in Mem. Wern. Soc. iv. 329 (1823); DeCandolle, Prodr. iii. 197 (1828); Cogniaux in DC. Monogr. Phan. vii. 715 (1891); Fawcett & Rendle, Fl. Jam. v. 367 (1926). *C.* "*coriaceus* DC." Duss, Fl. Phan. Ant. Fran. 285 (1897), an error, presumably for *C. coccineus* (L. C. Rich.) D. Don.—In mossy forests on the highest volcanic peaks, Lesser Antilles. I have seen the following specimens. GUADELOUPE: *Madiana* s. n. (NY); Savane a Mulets, chemin de la grande-Citerne, 1000–1200 m., July 15, 1892, *Duss*, no. 2259 (G, NY); sphagnetum de la Soufrière, chemin de la Soufrière, 1100–1480 m., Feb. 16, 1936, *Stehlé*, no. 318 (NY); cones et savanes volcaniques, savane aux Ananas, 1100 m., April 25, 1936, *Stehlé*, no. 878 (NY); foret, sommets, volcaniques, Lac Flammarion, 1100 m., Oct. 11, 10, 1936, *Stehlé*, no. 1154, no. 1255 (NY); mountains above Bain Jaunes, Oct. 31, 1938, *L. H. & E. Z. Bailey*, no. 161 (NY). DOMINICA: middle rainforest-clad slopes, 800 m., Morne Anglais, Aug. 3, 1938, *Hodge*, no. 516, (G). PLATE 6, FIG. 1; MAP I.

C. coccineus is recorded by Cogniaux from Porto Rico (*Stahl*), Santa Domingo (*Bertero; Eggers*, no. 6916b), and from British Guiana (*LeBlond*, TYPE). *Eggers* no. 6916b has been shown by Urban to be a misidentification; while the Bertero specimen, which DeCandolle described from fruiting material as *Conostegia discolor*, is very questionable. The other extra-limital (outside the Lesser Antilles) citations are doubtful, particularly the LeBlond specimen which is discussed under *C. corymbosus*.

Var. PARVIFOLIUS Cogniaux. This variety differs from var. *typicus* in its smaller leaves, with petioles 5–10 mm. long; blades ovate-lanceolate to ovate-elliptical, 4–6 cm. long, 1.5–3 cm. broad.—Cogn. in DC. Monogr. vii. 1190 (1891).—ST. VINCENT; known only from this island: *Guilding* s. n. (NY); Soufrière, 2000 ft., Jan. 1890, *Eggers*, no. 6916 (p. p.) (A); Mt. St. Andrews, 2200 ft., Jan. 1890, *Eggers*, no. 6916 (p. p.), (ISOTYPE, in herb. Arnold Arboretum.) PLATE 6, FIG. 2; MAP I.

Charianthus coccineus and *C. corymbosus* are the only two glabrous (lacking long setae) species of the genus in the Lesser Antilles. They are apparently of very close affinity, and unless specimens are collected in full flower are difficult to separate in the herbarium. Richard's descriptions are poor, and the only good clue (aside from an examination of his types) to the identity of the species is the statement that *C. coccineus* is laxly flowered and "racemous", while *C. corymbosus* has many flowers in terminal, subcymose corymbs. The leaves of *C. coccineus* are always coriaceous but the variable *C. corymbosus* frequently approaches *C. coccineus* in this character as well as in leaf-shape. Grisebach, referring to the closely appressed scales as "black dots beneath", states that *C. coccineus* always possesses them, whereas *C. corymbosus* (*C. glaberrimus* DC.) does not. This generalization is not infallible, for, although the scales on the leaves of *C. coccineus* generally persist for a very long time, nevertheless nearly all the species possess this type of scale for a time, at least, in their youth. *C. coccineus* always has much larger flowers; this difference, coupled with its distribution at the highest elevations, is sufficient to distinguish it specifically from *C. corymbosus.*

Since the original description by Don in 1823, the identity of *Charianthus tinifolius* has been very questionable. The type is an Anderson specimen ("Hab. in India Occidentali"), in Don's time in the Lambert herbarium but cited by Cogniaux as in the herbarium of Delessert. It was not seen by DeCandolle, Naudin, Grisebach or Triana, the majority of whom placed the name in their lists of species dubious or unknown. Cogniaux, in his monograph, elaborated the description of the species for the first time, and cited an additional specimen of MacNab from Jamaica. In their Jamaica Flora, Fawcett & Rendle take up Cogniaux's description and citations, but question the MacNab specimen, referring it to St. Vincent (?) rather than to Jamaica. This seems more logical, for section *Eucharianthus* is not known from Jamaica, and Anderson made his chief collections in the Lesser Antilles. In the absence of type material, I am unable to separate, from Cogniaux's description, *C. tinifolius* from *C. coccineus.* If St. Vincent is the actual locality for the Anderson and MacNab specimens, it is probable that they both represent *C. coccineus* var. *parvifolius.*

In his flora of the French Antilles, Duss published the name *C. coriaceus* DC., and this epithet also appears on many of his herbarium labels. Several specimens so named (*Duss*, no. 2259, G, NY), which I have seen, represent material of *C. coccineus.* Since the published description also applies to *C. coccineus*, it is safe to assume that *C. coriaceus* was published in error for *C. coccineus. Coriaceus*, as a specific or varietal epithet, has never been more formally applied in the genus *Charianthus*, and certainly not by DeCandolle. Duss, working alone, in Guadeloupe, apparently had to rely on his memory for a great many of his names, for errors of this type also appear under *C. corymbosus* and *C. nodosus.*

2. Charianthus corymbosus (L. C. Rich.) Cogniaux. Large shrub or small tree, up to 8 m. tall; crown spreading, much branched; bole fluted, bark finely furrowed; wood medium-hard, close-grained; twigs terete to subtetragonal, glabrous: *leaves* 5-nerved, lanceolate to broadly ovate-elliptical, entire to minutely-crenulate or serrulate, abruptly short-acuminate or gradually long-attenuate, cuneate-attenuate to obtuse or subcordate at base; blades 7–16 cm. long, 2.5–9 cm. broad, the lower surfaces of youngest leaves minutely brown-lepidote, at length glabrous, upper surfaces glabrous, membranaceous to subcoriaceous; petioles 1.5–6.5 cm. long, glabrous: *cymes* generally closely corymbose, many-flowered, 5–10 cm. long, the branches often reddish: *pedicels* 2–4 mm. long; hypanthia 2–3 mm. long: *calyx* 1–2 mm. long, minutely but sparingly lepidote, each calyx-lobe bearing a blunt exterior tooth near its obtuse apex: *corolla* red, often with buff-colored margins, petals 5–7 mm. long, ovate: *stamens* inflexed in bud; filaments 5–6 mm. long; anthers 2 mm. long, arcuate: *style* 10 mm. long, the tip rounded: *berry* globose, 5 mm. in diameter, black.

a. Leaf-apices abruptly short-acuminate; leaf-bases rounded to subcordate, never attenuate. . . .*b.*
  b. Cymes small, short-peduncled, closely corymbose; leaves ovate, the blades averaging 8 cm. long, 5 cm. wide . . . . . . Var. *typicus.*
  b. Cymes large, long-peduncled, loosely corymbose; leaves broadly elliptical, the blades averaging 13 cm. long, 8 cm. wide. . . . . Var. *latifolius.*
a. Leaf-apices gradually long-attenuate-acuminate; leaf-bases attenuate to narrowly rounded . . . . Var. *longifolius.*

Var. **typicus**. *Leaves* 5-nerved, ovate to ovate-lanceolate, entire to minutely-crenulate or serrulate, apex abruptly short-acuminate, base narrowly-obtuse to subcordate, blades 7–13 cm. long, 2.5–6 cm. broad, membranaceous to subcoriaceous; petioles 1.5–3 cm. long: *cymes* closely corymbose, 5–8 cm. long.—*C. corymbosus* (L. C. Rich.) Cogniaux, in DC. Monogr. vii. 714 (1891); Duss, Fl. Phan. Ant. Fr. 286 (1897); Williams & Cheesman, Fl. Trin. & Tob. i. pt. 6, 367 (1934). *Melastoma corymbosa* L. C. Richard, Act. Soc. Hist. Nat. Paris 109 (1792). *M. splendens* Sieber, Fl. Mart. no. 120 (exsiccatae). *M. Berterianum* Spreng. ex DC. Prod. iii. 197 (1828), in synon. *C. Berteroanus* Ser. ex DC. loc. cit., in synon. *Chaenanthera mucronata* L. C. Rich. ex DC. loc. cit., in synon. *C. glaberrimus* DeCandolle, op. cit. 196; DeCandolle, Mém. Melast. 82 (1828); Grisebach, Fl. Br. W. I. I. 264 (1864). *C. corymbosus* (L. C. Rich.) Cogn., "var. *glaberrimus* DC." Duss, loc. cit., nomen nudum.—Woodlands and cleared slopes at lower and middle elevations, Lesser Antilles. I have seen the following specimens. Guadeloupe: savanes ferugineuses, Lamentin, 100–400 m., Nov. 18, 1934, *H. Stehlé*, no. 38 (NY); plaines lateritiques, Capesterre, 100 m., Nov. 8, 1934, *H. Stehlé*, no. 43 (NY). DOMINICA: woodland borders at village of Laudat, 665 m., March 8 & 9, 1940, *W. H.* & *B. T. Hodge*, no. 1752 (G). MARTINIQUE: *Sieber*, Fl. Mart. no. 120 (G); Bois du Cocoyer, Dec. 1867, *Hahn*, no. 457 (G); dans les endroits ventes de la Calebasse versant du Morne Rouge, 1878, 1880, *Duss*, no. 1166 (NY); above L'Alma, Nov. 14, 1938, *L. H.* & *E. Z. Bailey*, no. 275 (NY). PLATE 4, FIG. 1; MAP II.

Var. **latifolius**, var. nov., foliis 5-nervatis, ovatis vel late ellipticis, integris, apice abrupte vel breve acuminatis, basi obtusis vel late rotundatis; laminis 6–16 cm. longis, 4–9 cm. latis, juventute squamis, fuscis, lepidotis, tandem glabrescentibus; petiolis 2–6 cm. longis, setis perpaucibus rare et inaequale; cymis grandis, 6–12 cm. longis, saepe laxe corymbiformibus, pedunculis longis.—*C. corymbosus* Cogn., var. "*grandiflorus* Cogn." Duss, Fl. Phan. Ant. Fran., 286 (1897), nomen nudum. *C. corymbosus* Cogn. "var. *diffusus* Cogn." Duss. loc. cit. nomen nudum. GUADELOUPE: known only from this island at lower to middle elevations. Abondant a la Calebasse, des hauteurs du Prêcheur, des Fonds St. Denis, 1879, 1881, *Duss*, no. 664 (NY); hauteurs du Matouba, alt. 810 m., 1892, 1893, *Duss*, no. 2250 (TYPE in Gray Herb.; NY, ISOTYPE); hauteurs des Trois Rivières et Trou-aux-Chiens, alt. 320 m., March 1, 1892, 1893, *Duss*, no. 2267 (NY); Camp Jacob, Cascade de Vauchelet, alt. 460–500 m., 1894, *Duss*, no. 3204b, (G); same locality, 1896, *Duss*, no. 3204c (NY); forêts humides a chemin Soufrière, 500–900 m., Jan. 20, 1935, *H. Stehlé*, no. 34 (NY). PLATE 4, FIG. 3; MAP II.

Var. **longifolius** (Cogniaux) stat. nov. *Leaves* 5-nerved, ovate to ovate-lanceolate, entire, with apex gradually long-acuminate and base narrowly-obtuse to cuneate-attenuate; blades 10–16 cm. long, 4–8 cm. broad; youngest leaves closely brown-lepidote beneath, at length glabrescent, waxy-subcoriaceous and glabrous above; petioles 1.5–7 cm. long, glabrous: *cymes* many-flowered, generally closely corymbose. *C. longifolius* Cogniaux in DC. Monogr. vii. 713 (1891). DOMINICA: known only from this island at middle to higher elevations. In silvis prope Lagunam Roseau, 1000 m., December 1882, *Eggers*, no. 654, (ISOTYPE in Gray Herbarium); Laudat, 1903, *Lloyd*, no. 331 (NY); Sylvania estate, 1500–1800 ft., June 21, 1933, *Cooper*, no. 31 (G, NY); same locality, Jan. 27, 1933, *Cooper*, no. 79 (G, NY); rain-forest on the precipitous slopes of Morne Colla-Anglais, 610–732 m., Sylvania, Aug. 10–23, 1938, *Hodge*, no. 515, (G, NY); cleared forest-land, Sylvania, 549 m., Feb. 16, 1940, *W. H.* & *B. T. Hodge*, no. 1310, (G, NY); woodlands about Lisdara estate, 457 m., March 28, 1940, *W. H.* & *B. T. Hodge*, no. 2451 (G); woodlands near base of Morne Anglais, 700 m., March 21, 1940, *W. H.* & *B. T. Hodge*, no. 2256 (G); moist forests bordering Pegoua River in vicinity of Deux Branches, Concorde Valley, May 6 & 7, 1940, *W. H.* & *B. T. Hodge*, no. 3436 (G);

mossy forest at the summit of Morne Nichols, 990 m., March 10, 1940, *W. H.* & *B. T. Hodge*, no. 1931 (G, NY); shrubby summit of Morne Megre Maron, near headwaters of Layou River, 700 m., Feb. 11, 1940, *W. H.* & *B. T. Hodge*, no. 1066 (G, NY); steep, wet, north valley-walls near base of Roseau Valley Waterfalls, below Laudat, 500 m., March 12, 1940, *W. H.* & *B. T. Hodge*, no. 2021 (G). PLATE 4, FIG. 2; MAP II.

Charianthus corymbosus and *C. coccineus* were described by L. C. Richard at Paris from material sent him by LeBlond from Cayenne (French Guiana). Remarking on the LeBlond collection, Richard,[2] in his "OBS.I" on p. 114, says, "*Pleraeque plantae Gallo-guyannenses:* NONNULLAE MARTINICENSIS." (Capitals are the author's.) The LeBlond *Charianthus* types apparently represent some of this Martinique material, yet all monographers of the genus have cited LeBlond's collections as originating either in Cayenne or British Guiana. There are two citations of *C. corymbosus* and *C. nodosus* from Trinidad based solely on Sieber specimens; but, despite the thoroughness of recent Trinidad collectors, no additional material has been accumulated from that island. Much of Sieber's collecting, also, was done on Martinique and it seems likely that this is a case of mixed labels. Grenada, the southernmost island in the true Lesser Antillean chain, is then the nearest station to South America from which *Charianthus* has been authentically recorded.

Charianthus corymbosus, a close relative of *C. coccineus*, differs from it in its flowers which are about one half as large; and in its mature leaves which are generally glabrous on both surfaces. *C. coccineus* is a small shrub of the highest volcanic peaks, whereas the taller *C. corymbosus* is often a small tree, most abundant at lower and middle elevations.

C. corymbosus is a variable species but the variants show a pronounced segregation by islands, and thus lend themselves well to treatment as geographical varieties. Richard's original description states that the leaves are "subcordato-ovatis." I have not seen the type-material, but all Martinique specimens examined are ovate with slightly subcordate or emarginate bases. Until an examination of the type proves otherwise, *C. corymbosus*, as it is represented by all Martinique material, is here considered as typical. Var. *typicus* is apparently a plant of lower elevations, for all Guadeloupe and Martinique specimens are from such altitudes.

Duss, who collected chiefly in Guadeloupe, noted the variability of *C. corymbosus*. On some of his labels, as well as in his published

[2] Richard, Act. Soc. Hist. Nat. Paris. (1792).

flora, there appear three varietal names without descriptions which are incorrectly attributed to Cogniaux and DeCandolle. Since this Guadeloupe material is sufficiently distinct to warrant its separation, var. *latifolius* is presented as a substitute for the illegitimate varietal names of Duss. Var. *latifolius* is easily distinguished from var. *typicus* by its long-petioled, broadly elliptical leaves with obtusely rounded, rather than subcordate bases. The cymes of var. *latifolius* are also longer and more loosely corymbose, with flowers which tend to be slightly larger.

Examination of the isotype material of *Charianthus longifolius* Cogn. in the Gray Herbarium shows that it has insufficient characters to separate it as a species, and so I have reduced it to varietal rank. Its flower-characters are identical with those of *C. corymbosus* varieties *typicus* and *latifolius*. From var. *typicus* it can be separated only by its leaves, which are long-petioled and ovate-lanceolate, with long, gradually acuminate apices, and bases obtuse to attenuate. Base- and apex-characters are together sufficient to distinguish it from var. *latifolius*, with its broadly rounded bases and abruptly short-acuminate apices.

Var. *longifolius* varies considerably: plants of open situations possess the narrowly lanceolate leaf-type while specimens from shaded habitats approach var. *latifolius* in size but not in shape. The stems of plants from higher elevations are frequently more nearly tetragonal than terete, but this morphological condition can apparently be correlated with high altitude and exposed mountain summits, for other mossy-forest species of *Charianthus*, as well as of *Miconia*, invariably possess strongly angled twigs. The slow growth in such regions of species with a decussate phyllotaxy shortens the internodes, with the result that the quadrangular nodes strongly influence the shape of the internodal surfaces.

Certain duplicate specimens of *C. corymbosus*, cited above and collected by Duss, possess herbarium-labels on which the field data varies considerably. Some of his numbers have two collection-dates on the same label; other numbers may show a certain date on one sheet, another date on the duplicate sheet. In all cases I have included in the citation of specimens all the collection-dates that appear on each label.

3. Charianthus purpureus D. Don. Shrub, 1–10 m. tall; twigs slender to stout, obtusely tetragonal, the youngest often densely or lightly covered with brown, stiffish hairs or glabrate except for a setose ring at the nodes, the persistent hair-bases often remaining on

the older twigs as tubercles: *leaves* 5-nerved, broadly ovate to ovate-elliptical or subrotund, with entire or slightly undulate or crenulate margin, at times inrolled, and in young leaves of certain forms sparsely setose-ciliate, very shortly cuspidate, or often abruptly blunt-acuminate, with base rounded to subcordate; blades 7–16 cm. long, 3–11 cm. broad; the youngest leaves remotely scurfy-lepidote above, at length glabrous, below closely brown-lepidote or white-furfuraceous on veins and leaf-tissue, at length glabrescent, the main longitudinal and lateral veins at times sparsely-setose beneath with lax hairs 1–2 mm. long; petioles obscurely sulcate, 1–5 cm. long, the margins densely to sparingly-setose: *cymes* corymbose, few- to many-flowered, terminal, sessile, 3–8 cm. long; the branches, pedicels, hypanthia and calyx-tubes with scattered close or furfuraceous scales: *pedicels* 1–3 mm. long; hypanthia ca. 3 mm. long: *calyx* 1.5–2 mm. long, each lobe bearing a blunt often obscure exterior tooth near its middle: *corolla* bright to deep crimson-purple; petals oval, 7–12 mm. long, 6–7 mm. broad at their middle: *stamens* inflexed in bud; filaments 12–14 mm. long; anthers arcuate, 2–3 mm. long: *style* red, 1.5–2.5 cm. long, rounded and yellowish at the tip: *berry* subglobose, 5–7 mm. in diam., maroon, turning black at maturity.

a. Youngest leaves not rugose, the main vein-system beneath, as well as the leaf-tissue, often thickly covered with close, brownish, early deciduous scales; veins often setose beneath, especially on the youngest leaves; petioles of young leaves setose on channel-margins above, not white-scurfy below; setae on the young twigs both nodal and internodal. . . . *b.*

b. Leaves large (averaging 8 cm. or more long), ovate; longest setae of petioles or twigs well over 2 mm. long; cymes over 5 cm. long, many-flowered. . . . *c.*

c. Petioles and young twigs lightly setose, the hairs frequently limited to an adaxial ring and to the upper third of the petiole; veins of the lower surface of young leaves usually devoid of setae; leaf-blades large, up to 16 cm. long by 11 cm. broad, the apex short-acuminate and never recurved, margins not revolute. . . . . Var. *typicus.*

c. Petioles and young twigs densely setose, the setae thick on the internodes and petioles; veins of the lower surfaces of young leaves generally setose; leaf-blades smaller, up to 10 cm. long, to 8 cm. broad, the apex acute to bluntly cuspidate and often recurved, the margins setose-ciliate, frequently revolute. . . . . Var. *crinitus.*

b. Leaves small (averaging 6 cm. long), subrotund; longest setae of petioles or twigs scarcely over 1 mm. long; cymes ca. 3 cm. long, few-flowered. . . . . Var. *brevisetosus.*

a. Youngest leaves strongly rugose, the main vein-system beneath thickly covered with loose, whitish, stellate, scurfy, persistent scales; veins beneath entirely devoid of setae; petioles setose on the channel-margins above, copiously white-scurfy beneath; setae on the young twigs nodose, i. e., limited to a narrow ring surrounding the stem. . . . . Var. *rugosus.*

Var. **typicus.** Twigs sparingly setose to glabrous, the hairs long-persistent at the adaxial region just above the nodes: *leaves* ovate to broadly elliptical, entire to slightly undulate, short-acuminate, rounded to emarginate or subcordate at base; blades 8–16 cm. long, 6–11 cm. broad, subcoriaceous; the young leaves often with scattered scales above, at length glabrous, often with closely appressed, brown scales on the veins and leaf-tissue below, at length glabrescent; petioles 2.5–5 cm. long, sparsely setose on the channel-margins above.—*Charianthus purpureus* D. Don, Mem. Wern. Soc. iv. 329 (1823); DeCandolle, Prodr. iii. 197 (1828); Grisebach, Fl. Br. W. I. I. 264 (1864); Triana, Melast. 99 (1871); Cogniaux in DC. Monogr. vii. 715 (1891). *Melastoma coccinea* Vahl. Eclog. i. 48 (1796); Vahl, Icon. Am. tab. 16 (1799), not Rich.; Willdenow, Sp. Pl. ii. 599 (1800); Poiret in Lam. Encycl. Meth. Bot., Suppl. iii. 640 (1813). *Melastoma Dodandiana* Hamilton, Prodr. Fl. Ind. Occ. 37 (1825).—In forests on the highest volcanic peaks of the northern Lesser Antilles. I have seen the following specimens. ST. KITTS: edges of mountain pasture, Molyneux estate, Sept. 8–Oct. 5, 1901, *Britton & Cowell*, no. 310 (NY), p. p. MONTSERRAT: Gages, near the Soufrière, Jan. 23, 1907, *Shafer*, no. 193 (NY); Feb. 12, 1907, *Shafer*, no. 675 (NY); borders of Chaners Pond, 2800 ft., Jan. 26, 1907, *Shafer*, no. 676 (NY). MAP III.

Var. **crinitus** (Naudin), stat. nov. Twigs densely setose; the hairs 3–5 mm. long, especially abundant on the internodal areas: *leaves* ovate to obovate, entire to minutely undulate, with recurved margin and subacute to bluntly-cuspidate, often recurved apex; base emarginate to subcordate; blades 6–12 cm. long, 5–9 cm. broad, subcoriaceous above, in youth with scattered, closely appressed, brown scales, at length glabrous above, glabrescent below; the main veins of younger leaves setose below, at length glabrescent; petioles 1.5–5 cm. long, setose on the channel-margins above.—*Charianthus crinitus* Naudin in Ann. Sc. Nat. sér. 3, xviii. 112 (1852); Triana, Melast. 99 (1871); Cogniaux in DC. Monogr. vii. 716 (1891); Boldingh, Fl. Dutch W. I. I. i. 149 (1909).—In mossy forests on the highest peaks of the northern Lesser Antilles. I have seen the following specimens. SABA: mountain, 600–800 m., (1906), *Boldingh*, no. 1784b (NY). ST. KITTS: Mt. Misery, Sept. 8–Oct. 5, 1901, *Britton & Cowell*, no. 310 (NY), p. p. PLATE 5, FIGS. 1 & 2; MAP III.

Var. **brevisetosus**, var. nov. Ramulis leviter setosis; setis brevibus, ca. 1 mm. longis; foliis late ovatis vel subrotundis, integris vel minute crenulatis, apice obtuse cuspidatis, basi emarginatis vel subcordatis; laminis 4–6.5 cm. longis, 2.5–5.5 cm. latis, coriaceis, utrinque leviter stellato-lepidotis juventute, tandem glabrescentibus, subtus venis principibus saepe setis paucibus-brevibus; petiolis 1–2.5 cm. longis, supra sulcatis marginibus setosis; cymis brevibus, 3 cm. longis, sessilibus, floribus paucibus. GRENADA: known only from this island.

Morne au camp, 2400 ft. alt., Dec. 1889, *Eggers*, no. 6221 (TYPE in Herb. Arnold Arboretum). PLATE 5, FIGS. 5 & 6; MAP III.

Var. **rugosus**, var. nov. Ramulis ad nodos villosis, villis 2–3 mm. longis; foliis ovatis vel ellipticis, integris vel apicem versus crenulatis, marginibus firmis revolutis, apice reflexis cuspidatis vel abrupte obtuseque acuminatis, basi rotundatis vel emarginatis vel subcordatis; laminis 6–12 cm. longis, 4–8 cm. latis, rigido-coriaceis, juventute valde rugosis; venis subtus squamis copiosis laxis albis stellato-furfuraceis persistentibus, petiolis 1–3 cm. longis, supra sulcatis marginibus setosis, subtus albo-furfuraceis. DOMINICA: endemic, in mossy forests at the summits of the highest peaks. In mossy forest at the summit of Morne Trois Pitons, alt. 1400 m., rainfall 762 cm., Feb. 23, 1940, *W. H.* & *B. T. Hodge*, no. 1421 (TYPE in Gray Herb., ISOTYPE NY); same locality, Aug. 15, 1938, *Hodge*, no. 509 (G, NY); rain-forest borders betweeen Laudat and Freshwater Lake, alt. 665 m., rainfall 902 cm., March 8 & 9, 1940, *W. H.* & *B. T. Hodge*, no. 1751 (G), a low altitude form; mossy forest on summit of Morne Plat Pays, 981 m., March 3, 1940, *W. H.* & *B. T. Hodge*, no. 1685 (G); rain-forest borders, Freshwater Lake, 665 m., March 8 & 9, 1940, *W. H.* & *B. T. Hodge*, no. 1850, (G). PLATE 5, FIGS. 3 & 4; MAP III.

Charianthus in the Lesser Antilles is represented principally by two species, one of which, *C. corymbosus*, is glabrous, while the other, *C. purpureus*, is distinctly setose. The varieties of the latter species, like those of *C. corymbosus*, are indistinguishable from each other in floral characters, but show well marked differences in size and shape of leaves, as well as in type and disposition of vestiture. Such differences, I believe to be varietal rather than specific.

Charianthus purpureus was first described and illustrated by Vahl from material collected by Ryan on the island of Montserrat. His description follows fairly well the specimens examined by me from that island, and on these I have based var. *typicus*. Naudin, from a plant (locality unknown) in the Bonpland herbarium, described *C. crinitus*—apparently without having seen material of *C. purpureus*, for he places the latter in a list of species "non omnino certae." That the degree of villosity is variable was recorded by Ryan on the labels which Vahl later examined. It appears that specimens from the higher more exposed peaks generally possess heavily setose twigs and petioles; leaf-size is also reduced in such situations. These characters apparently can be correlated with habitat—altitude, exposure to constant wind-action, and high precipitation. For the present it seems proper to separate this crinite, mossy-forest form, not as a species, but as var. *crinitus*, while the broad-bladed, sparingly setose, lower-altitude form may be considered var. *typicus*. Future collections may indicate, however, that these two varieties should be merged.

The remaining varieties of *C. purpureus* show a definite geographical segregation; var. *brevisetosus* is at present known only from Grenada—the most southern of the Lesser Antilles, while var. *rugosus* is represented only by Dominica collections. I have seen but a single specimen of var. *brevisetosus*, namely the type, *Eggers*, no. 6221, which has well marked differences warranting its varietal separation. Because of its very short (1 mm. long) sparse setae, the short, few-flowered cymes, and its small, distinctly subrotund leaves, it does not resemble any of its more northern relatives.

Var. *rugosus* was first collected by the writer while prosecuting field-work in Dominica in 1938. In 1940, further, more abundant collections were made, showing that this variety is very distinct from its relatives in several vegetative characters. It is, therefore, recognized as a geographical segregant. Var. *rugosus* possesses the leaf-size and habit of var. *crinitus*, but the presence of abundant white scurf on the veins beneath, and the total lack of laminal setae on the strongly rugose leaves easily distinguish var. *rugosus* from its closest relatives.

4. Charianthus nodosus (Desr.) Triana. Shrub, up to 2 m. tall; branches thick, tortuous, terete, nodose; the youngest twigs villose with rusty-colored setae, 2–4 mm. long: *leaves* borne at the ends of the branches, 5-nerved, coriaceous, obovate to subrotund, with margins strigose-serrulate with setae curved towards the apex, obtuse to rounded, with base obtuse to rounded or subcordate; blades 3–7 cm. long, 2–5.5 cm. broad, glabrous above, punctate below with sunken, appressed scales; petiole 2–10 mm. long, glabrous: *cymes* pendulous, axillary on the old, leafless twigs, 2–4 cm. long, on slender peduncles, many-flowered; *pedicels* slender, 6–8 mm. long: hypanthium plus *calyx*-tube 7–8 mm. long, the tube short-lobed; the minute, exterior tooth near the tip of each triangular lobe extended into a seta ca. 1 mm. long: *corolla* red to purple, with petals 12–14 mm. long: *anthers* ca. 2 mm. long: *style* 2 cm. long: *berries* 4 mm. long, rosy at maturity.—Triana, Melast. 99 (1871); Cogniaux in DC. Monogr. vii. 716 (1891), in part; Duss in Fl. Phan. Ant. Fran. 285 (1897); Williams & Cheesman, Fl. Trin. & Tob. i. pt. 6, 367 (1934). *Melastoma nodosa* Desrousseaux in Lam. Encycl. Méth. Bot. iv. 55 (1796); DeCandolle, Prodr. iii. 202 (1828); *Melastoma aculeata* Presl. in Isis xvi. 272 (1828). *Charianthus ciliatus* DeCandolle, Prodr. iii. 197 (1828), and Mém. Melast. 83 (1828). *Tetrazygos ciliatus* Richard ex. DC. Prodr. iii. 197 (1828), in synon.—Martinique: region supérieure de la Montagne Pelée, August 1899, *Duss*,[3] no. 666 & 4044 (NY); *Duss*, no. 4044 (NY). Plate 6, fig. 3.

[3] Duss' herbarium labels frequently possess, as in this case, two collection-numbers, and often two different dates; since he often collected during the same year on both Guadeloupe and Martinique, it is a problem to know which number and which date is correct.

Forma **crinitus**, (Duss) stat. nov., differs from the preceding in the abundant, dense, villose setae on the young growth, i. e., stems, leaves, peduncles; setae rusty-brown, 2–5 mm. long, crowded on stems and petioles, loosely scattered on leaf-surfaces, borne on the leaf-tissue above, limited to the principal longitudinal and lateral veins beneath. *Charianthus nodosus* (Desr.) Triana, var. *crinitus*, incorrectly attributed by Duss to Naudin in Fl. Phan. Ant. Fran. 286 (1897). *Melastoma crinita* Vahl, Eclog. iii. 28 (1807); DeCandolle, Prodr. iii. 199 (1828); *Charianthus ciliatus* Naudin in Ann. Sc. Nat. sér. 3, xviii. 112 (1852). I have seen the following specimens. MARTINIQUE: Montagne Pelée, 900–1000 m., *Duss*, no. 665 (TYPE in Herb. N. Y. Bot. Gard.); sylve rabougrie d'altitude 1300 m., Piton du Carbet, Morne Nert, Sept. 5, 1937, *H. Stehlé*, no. 2205 (NY). PLATE 6, FIG. 4.

This is another species of the genus the distribution of which, as cited in the Cogniaux monograph, is probably incorrect. I have seen only Martinique material, but according to Cogniaux this species also occurs on Guadeloupe (*Purdie*), Montserrat (*Ryan*), St. Christopher (*Masson*), Trinidad (*Sieber*) and British Guiana (LeBlond). It is possible that some of the Lesser Antillean citations are based on misidentifications of *C. purpureus*. Vahl, for instance, records only *Charianthus purpureus* from Ryan's collections on Montserrat; and Duss, who spent many resident-years collecting both in Guadeloupe and Martinique, writes concerning *C. nodosus*, "Cette belle espèce avec sa variété n'existent pas à la Guadeloupe." *Sieber* nos. 113 and 279, on which the Trinidad citation is based, are probably specimens from Martinique (see discussion under *C. corymbosus*).

Desrousseaux, describing the type of *C. nodosus* in Lamarck's Encyclopedie, states, "cette plante est originaire des Antilles, et se trouve au no. 93 de l'herbiere de Surian." Triana, apparently citing the same specimen, lists it in error as no. 733. Cogniaux refers to the Surian herbarium-specimen, but gives no number; and, in addition, he cites, for the first time, *LeBlond* no. 93 from British Guiana. Desrousseaux probably did not realize that his type represented one of the three species of *Charianthus* (*C. coccineus*, *C. corymbosus*, and *C. nodosus*) collected by LeBlond on Martinique and that it was sent, mixed with British Guiana collections, to Richard at Paris. Apparently the material of *C. nodosus* was overlooked by Richard and so was described later by Desrousseaux as "originaire des Antilles." It is apparent, from Desrousseaux's original description, that the type-specimen of *Charianthus nodosus* (not seen) represents the glabrous-leaved form.

Forma *crinitus*, growing intermixed with material of typical *C.*

CHARIANTHUS CORYMBOSUS, var. TYPICUS: FIG. 1, leafy twig, × 1/2.
C. CORYMBOSUS, var. LONGIFOLIUS: FIG. 2, flowering twig, × 1/2.
C. CORYMBOSUS, var. LATIFOLIUS: FIG. 3, leafy twig, × 1/2.

CHARIANTHUS PURPUREUS, var. CRINITUS: FIG. 1, lower surface of young leaf and flowers, $\times 1\frac{3}{16}$. FIG. 2, twig and petioles showing long crinite hairs, $\times 1\frac{1}{8}$.

C. PURPUREUS, var. RUGOSUS: FIG. 3, flowering twig of plant growing at type locality. FIG. 4, lower surface of young leaf, $\times$ 5, from ISOTYPE.

C. PURPUREUS, var. BREVISETOSUS: FIG. 5, flowering twig, $\times \frac{1}{2}$, from TYPE. FIG. 6, twig and petioles showing short stiff setae, $\times 1\frac{1}{8}$, from TYPE.

Charianthus coccineus: fig. 1, flowering twig, × ½.
C. coccineus, var. parvifolius: fig. 2, flowering twig, × ½, from isotype.
C. nodosus: fig. 3, leafy twig, × ½.
C. nodosus, forma crinitus: fig. 4, leaves, × ½.
C. Fadyeni: fig. 5, flowering twig, × ½. fig. 6, fruits, × ½.

HELICONIA BIHAI: FIG. 1, plant showing short-peduncled inflorescence *W. H. & B. T. Hodge*, no. 1086. FIG. 2, single flower, ca. × 1 (drawn from Bot. Reg. t. 374).
H. CARIBAEA: FIG. 3, crimson-bracted form showing sessile inflorescence, *W. H. & B. T. Hodge*, no. 2632. FIG. 4, yellow-bracted form showing habit, *W. H. & B. T. Hodge*, no. 1442. FIG. 5, single flower, ca. × 1.

nodosus, possesses dense, villous setae on both leaves and stems, and is thus readily distinguished. This epithet, validly published by Duss as var. *crinitus*, was incorrectly attributed by him to Naudin, who had previously published a *C. crinitus* (*C. purpureus*, var. *crinitus*). Duss probably had Naudin's name in mind but misapplied it to *C. nodosus*.

5. Charianthus fadyeni (Hook.) Grisebach. Tall shrub or slender tree 2–9 m. tall; twigs slender and terete (stout, thickly-corticate on plants from exposed summits); young growth with scattered stellate scales, at length glabrous: *leaves* rigid, coriaceous, yellow-green (when dry), darker above, 3-nerved, the laterals not prominent, ovate, obovate, or narrowly elliptical; margin entire; apex bluntly acute, rounded, or infrequently emarginate; base acute to rounded; blades 3–7 cm. long, 1.5–4 cm. broad; budding leaves densely covered with stellate scales, at length glabrous above, but punctate below with dark, sunken, appressed scales; petioles 5–16 mm. long, remotely stellate-lepidote in youth, at length glabrous: *panicles* terminal, 3–9 cm. long, with basal peduncle 1–3.5 cm. long, the branches, pedicels, buds, and fruits remotely stellato-lepidote: *pedicels* 1–3 mm. long; hypanthia 2–3 mm. long: *calyx*-tube 1.5–3 mm. long, cup-like, indistinctly lobate with a minute, obscure, exterior tooth near the top of each lobe: *corolla* bright to dark crimson; petals narrowly oblong to spatulate, 10–15 mm. long, 4–5 mm. broad: *stamens* inflexed in bud; filaments pruinose, 10–15 mm. long, narrowly linear to subcapillary at their summit; anthers 4–5 mm. long, slightly arcuate, with a single apical pore: *style* 2–2.5 cm. long, rounded at the tip: *berry* urceolate, 2-loculed, 5–6 mm. in diameter.—Grisebach, Fl. Br. W. I. I. 264 (1864); Triana, Melast. 99 (1871); Cogniaux in DC. Monogr. vii. 713 (1891); Fawcett & Rendle, Fl. Jam. v. 366, t. 135 (1926). *Tetrazygia Fadyeni* Hooker in Journ. Bot. i. 379, t. 12 (1849); MacFadyen, Jam. ii. 57, fide Fawc. & Rendle., loc. cit., an unpublished manuscript in the British Museum. Jamaica: endemic on this island. *Alexander* s. n. (G, NY); Holly Mount near Ewarton, 2600 ft. alt., Aug. 11, 1896, *Harris*, no. 6512 (NY); same locality, Feb. 15, 1905, *Harris* no. 8883, (NY); Holly Mount, Mt. Diablo, Aug. 29, 1905, *Harris*, no. 8994 (NY); Dolphin Head, 1500 ft., May 18, 1906, *Harris*, no. 9234 (A, NY); Peckham Woods, Upper Clarendon, 2500 ft. alt., July 7, 1911, *Harris*, no. 10997 (NY); Sept. 27, 1912, *Harris*, nos. 11181 & 11190, (NY); Mulgrave, St. Elizabeth, 1300 ft. alt., June 14, 1916, *Harris*, no. 12373 (NY). Plate 6, fig. 5.

Charianthus Fadyeni is perhaps the most distinctive species of the genus. Endemic to Jamaica, it stands alone in a section unrelated to the species of the Lesser Antilles. Its slender petals, single, apical-pored anthers with pruinose filaments, and a 2-loculed ovary, at once set it off from its congeners.

4. THE TYPE SPECIES OF HELICONIA

W. H. Hodge

(Plate 7)

During several seasons of field work on the island of Dominica in the British West Indies I have had excellent opportunity carefully to observe the two species of *Heliconia* which abound in the well-drenched mountainous interior. One of these species has been known as *Heliconia Bihai* L., the other *H. rutila* R. F. Griggs.

The two species are very similar in vegetative habit but are readily separable in the field by the shape, color, and size of the inflorescence-bracts as well as by the shape and size of the perianth-members. The color-differences in the inflorescence-bracts are striking for in the species known until now as *H. Bihai* the hue is invariably a deep crimson-red, frequently almost maroon (or sometimes solid green, or yellow), whereas in *H. rutila* the bracts are bright red, nearly scarlet, with yellow margins (variegate). That two species of *Heliconia* growing on this island—as well as on the other neighboring Lesser Antillean islands—should possess just these readily recognizable color-differences is significant in the interpretation of the type-species. For from this very area (particularly from neighboring Martinique) was collected the herbarium-material from which Plumier, Linnaeus, Jacquin and other authors described many of their West Indian species.

The collections from which Linnaeus described the type-species, *Heliconia Bihai* L., Mant. ii. 211. 1771, probably came from this region as R. F. Griggs suggests (Bull. Torr. Bot. Club. xxx. 656. 1903). If we refer to Linnaeus' first description of this plant, in Sp. Pl. 1043. 1753, under the name *Musa Bihai* L., we learn that his species had "amplissimis foliis, florum vasculis variegatis." Linnaeus listed two varieties under the species, var. β " . . . vasculis coccineis", and var. γ " . . . vasculis subnigris"; with var. γ we need not deal.

Linnaeus' species, *Musa Bihai* and its variety β represent, without doubt, the most common Lesser Antillean species of *Heliconia*. However, Griggs (Bull. Torr. Bot. Club xxx. 655. 1903), believing that Linnaeus' species, with "vasculis variegatis", was not determinable, rejected it and took up, as his concept of *Heliconia Bihai*, var. β, "vasculis coccineis". Var. β was figured by Plumier (N. Pl. Am. Gen. 50. 1703 and Am. ed. Burm. 49, pl. 59. 1756) yet, even with these supplementary illustrations, there is little excuse for setting up this variety as true *H. Bihai* when the succinct and sufficient diagnosis "vasculis variegatis" exists. The latter Linnaean description is even more significant when we realize that there is but one variegate-bracted species of *Heliconia* inhabiting this geographical area from which the early collections were sent, hence little reason to doubt that the plant now passing as *H. rutila* is actually the species which Linnaeus had in mind when describing *H. Bihai*. Grigg's conception of *H. Bihai* as a plant possessing solid red inflorescence-bracts should be replaced by Linnaeus' own concept of *H. Bihai*, a plant with variegate bracts. Thus to the plant at present known as *H. rutila* Griggs, should be applied the correct name, *H. Bihai* L., and for the species until now passing as *H. Bihai* must be resurrected the next valid name, *H. caribaea* Lamarck (Encycl. i. 426, 1783), which was based on the solidly red-bracted var. β figured by Plumier.

The revised synonymy of the two species involved in this discussion is as follows:

HELICONIA BIHAI L., Mant. ii. 211 (1771); Lodd. Bot. Cab. pl. 252 (1818); Edwards, Bot. Reg. t. 374 (1819). *Bihai florum vasculis variegatis*, Plumier Nov. Pl. Am. Gen. 50 (1703), in part. *Musa Bihai* L. Sp. Pl. ii. 1043 (1753) and ed. 2. ii. 1477 (1763). *H. variegata* Jacq. Pl. Rar. Hort. Schoen. i. 25 (1797). *H. rutila* Griggs in Bull. Torr. Bot. Club xxx. 657 (1903). *Bihai rutila* (Griggs) Griggs, op. cit. xxxi. 445 (1904). *B. Bihai* (L.) Griggs, loc. cit., as to source of name only.

HELICONIA CARIBAEA Lamarck, Encycl. i. 426 (1783). *Bihai florum vasculis coccineis*, Plumier Nov. Pl. Am. Gen. 50 (1703) and Am. ed. Burm. 49, pl. 59 (1756). *Musa Bihai* var. β., L. Sp. Pl. 1043 (1753). *Heliconia Bihai* sensu authors: Jacq. Pl. Rar. Hort. Schoen. i. 24 (1797), L. C. Richard in Nov. Act. xv. suppl. 22. pl. 10 (1831); Griggs in Bull. Torr. Bot. Club xxx. 657 (1903); non L. *H. borinquena* Griggs, op. cit. 658 (1903). *Bihai Bihai* sensu Griggs, op. cit. xxxi. 445 (1904), not as to typonym.

Heliconia, like many another large succulent tropical genus, is represented in most herbaria by only a few, often poorly made specimens with insufficient field-data. It is to the interest of a better knowledge of the genus that field-notes be full and accompanied by ample photographs particularly of the flowering portions, for, as Griggs has pointed out, the color as well as the shape of the inflorescence-bracts are diagnostic features which are easily lost in shrunken herbarium specimens.

In Dominica, *Heliconia Bihai* and *H. caribaea* are familiar species in shade or sun along the streams and wet ravines of the interior or even becoming gregarious on drenched mountainsides at higher elevations. When, due to the clearing of the surrounding forest, the species are forced to grow in full sunlight, the plants are usually much dwarfed. *H. caribaea* is perhaps the more common of the two and, in addition, is a more robust plant as far as height (5 m.,), size of leaves and inflorescence-bracts is concerned. In leaf-characters the species are practically inseparable. The leaves of *H. caribaea*, though somewhat rounded at the tip, always possess an abruptly acute tip while those of true *H. Bihai* are more gradually acute. The majority of plants possess leaves which are green on both surfaces, although now and then an individual in a colony will exhibit leaves which are glaucous below—one of the characters on which Griggs based *H. borinquena*.

In *H. caribaea* the inflorescence-bracts show much variation in color, a condition not observed in *H. Bihai*. The most common form of *H. caribaea* is one with deep crimson bracts (not scarlet as described by various authors), but sometimes mature individuals, in full flower, are seen with solid green, solid yellow, or green and yellow inflorescence-bracts. Since such individuals differ only in the color of their bracts they can be considered simply as forms. In his key to the species confounded with *H. Bihai*, Griggs uses as a distinctive character the presence of a "peduncle—long, stiff, erect"—in *H. Bihai* (i. e. *H. caribaea*) and the absence of such in *H. rutila* (i. e. *H. Bihai*). My field observations of these two species, as illustrated in the accompanying photographs, PLATE 7 (plant-specimens here illustrated are in the Gray Herbarium), show that exactly the opposite holds—true *H. Bihai* possesses a short peduncle (the lowest inflorescence-bract is separate from the sheathing petioles), while in *H. caribaea* the inflorescences are always sessile (the lowest inflorescence-bract is in contact with the sheathing petioles).

Although occasional plants of each species may be found in flower throughout the year, the greater proportion of Dominica's Heliconias exhibit a somewhat seasonal anthesis. *H. Bihai* blooms from February to April, *H. caribaea*, with more tardy flowering, from April to June; the bright blue fruits appear throughout the summer months. Jacquin, visiting Martinique a century and a half ago, observed that the local species of *Heliconia* were known as "balisiers." Today the natives of the patois-speaking islands still use the same name and make use of "balisier" leaves for thatch and as waterproof lining in baskets.

The following key may be used to separate *H. Bihai* and *H. caribaea*. All measurements used are from fresh material, now dried, and the herbarium specimens deposited in the Gray Herbarium.

Leaf-apices gradually acute: inflorescence short-peduncled; the bracts always variegate, scarlet with bract-tips, upper margins and inner surface bright yellow (see Bot. Reg. t. 374), up to 6 in number, shallowly boat-shaped (each bract ca. 2.5–4 cm. wide), narrowly triangular, widely separate and never overlapping at the base; sepal- and petal-extremities white; the free sepal ca. 1 cm. wide, perfectly flat, always coiled back on itself . . . . *H. Bihai.*

Leaf-apices abruptly acute: inflorescence sessile; the bracts deep crimson (but sometimes yellow or green), 6 to 15 in number, deeply boat-shaped (each bract ca. 5–6.5 cm. wide), broadly triangular, overlapping at the base; sepal- and petal-extremities greenish; the free sepal ca. 5 mm. wide, with somewhat downcurved margins, the sepal never coiled back on itself . . . . *H. caribaea.*

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New scientific names are printed in full-face type

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CONTRIBUTIONS FROM THE GRAY HERBARIUM
OF HARVARD UNIVERSITY

CXXXVI

EUPHORBIA SUBGENUS CHAMAESYCE IN CANADA AND THE UNITED STATES EXCLUSIVE OF SOUTHERN FLORIDA

LOUIS CUTTER WHEELER

DATES OF ISSUE

Pages 97–154 and Plates 654–656 .... 8 April, 1941
Pages 168–205 and Plates 657–664 .... 9 May, 1941
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EUPHORBIA SUBGENUS CHAMAESYCE IN CANADA AND THE UNITED STATES EXCLUSIVE OF SOUTHERN FLORIDA

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(Plates 654–668)

INTRODUCTION

From an early curiosity about the peculiar "flower" of *Euphorbia*, the writer's interest developed into a serious study of the genus, which soon led to the realization that not only was the structure of the "flower" involved but that the classification of the genus was in a remarkable state of confusion. Boissier in DC. Prod. **15** (**2**)**:** 3–188. 1862, published the first revision of the entire genus since Linnaeus' time. Since 1862 the number of species of *Euphorbia* published has about doubled. Whereas Boissier recognized about seven hundred species as valid, Pax & Hoffmann in Engler & Prantl, Nat. Pflanzenfam. 2 Aufl., **19c.:** 209. 1931, *guess* that there are about one thousand six hundred species. With this great increase since an organized treatment of the genus the need of taxonomic revision is evident.

I. GENERAL DISCUSSION

HISTORY

The following remarks apply only to the subgenus *Chamaesyce* except where expressly stated to be of broader scope. Wiman, in Linnaeus, Amoen. Acad. **3:** 102. 1756, lists *Chamaesyce* as a synonym of *Euphorbia*. S. F. Gray, Nat. Arr. Brit. Pl. **2:** 260. 1821, in describing *Chamaesyce* as a genus, credits it to Dioscorides. Thus it is evident, if Gray's interpretation was correct, that the group was recognized in antiquity. Persoon, Syn. Pl. **2:** 12. 1806,[1] used *Chamaesyce* as a synonym of a defined but unnamed subdivision, of subgeneric rank, of *Euphorbia*. Rafinesque, Amer. Mo. Mag. **2:** 119. 1817, independently published *Chamaesyce* as a subgenus. Haworth, Syn. Pl. Succ., 159. 1812, proposed the genus *Anisophyllum* for the same entity but the name was preoccupied. Quite independently, Duby in A. P. DeCandolle, Botanicon Gallicum ed. 2, **1:** 412. 1828, took up the formerly unpublished *Euphorbia* section *Anisophyllum* of Roeper. Authors who have assumed that nomenclaturally this was based on *Anisophyllum* Haworth would do well to note this point. This sort of confusion of the independent use of the same name in either the same or different categories by different authors is common under *Euphorbia* and the genera segregated from it. This is due to the fact that many of these names are either traditional, as *Chamaesyce*, or suggested by some striking characteristic of the group, as *Anisophyllum*. For the more detailed history of the uses of the name applicable to this subgenus see beyond under the taxonomic section.

The workers who have made the principal contribution to our knowledge of *Euphorbia* subgenus *Chamaesyce* in the area under consideration are Boissier, George Engelmann, Millspaugh, and Small. Boissier revised the entire genus *Euphorbia* in 1862. Engelmann described many of the species discovered in the United States. Millspaugh's contribution was mainly new species, a multitude of new combinations, and the accumulation of invaluable fragments of types. His work is notable for the number of worthless new species that he proposed. Small either contributed the actual text for several of the principal floras of the region, or exerted a strong influence, as in the case of Rydberg's works.

My own publications relating wholly or partly to *Euphorbia* subgenus *Chamaesyce* are listed in the bibliography at the end of this section (pp. 106 and 107).

[1] As noted by Blake, Rhodora 17: 134, footnote 1. 1915, pages 1–277 of "pars secunda" of Persoon's Synopsis Plantarum were published in 1806, as shown by the review of these pages in Botanische Zeitung, Regensburg 5: 321. 1806 (Nov. 15).

Morphology

Roots: The lateral roots are ordinarily slender and branching in the manner common in small annual and perennial herbs. Occasionally the taproots become thickened and even subfarinaceous. Certain of the longer-lived perennials often develop buds well beneath the surface of the ground and the stems arise beneath the ground and come to the surface more or less scattered instead of originating from a common point at the surface.

Stems: The stems ordinarily have an interrupted main axis. After the first pair of primary leaves the main axis ceases to elongate. Lateral branches arise from the apex without any particular relation to the leaves. In species developing a single erect stem one branch only arises or, if more than one, then one soon dominates. If this stem attains any appreciable diameter the interruption of the main axis becomes completely concealed in the manner illustrated by Croizat in Degener, Fl. Hawaii, fam. 190, *Chamaesyce*$_{2-3}$. 1937. Whether this type of axial growth obtains in *Euphorbia gracillima* and *revoluta* is uncertain from herbarium specimens.

The origin of this type of branching was first suggested by Roeper, Enum. Euph., 30. 1824. He suggested that the branches arising from the crown of the main stem in subgenus *Chamaesyce* were homologous with the rays of the pleiochasium of *Euphorbia* subgenus *Esula* Pers. (*Euphorbia* sect. *Tithymalus*). This seems to be a very reasonable explanation. It is only necessary to add that, whereas the main axis in subg. *Esula* is terminated by a cyathium, in subg. *Chamaesyce* it is not. This would seem to be a fundamental difference but it is not. When by progressive reduction of the main axis subg. *Chamaesyce* finally arrived at the habit of branching after the first pair of true leaves appeared, the plant was obviously too small to produce all the elaborated food necessary for the production of a cyathium with its reproductive structures requiring abundant protein, fats, and carbohydrates; so we find that the cyathium which would otherwise terminate the main axis is omitted.

The often apparently lateral type of branching of the stems of subgenus *Chamaesyce* appears to differ from the plainly dichotomous or sometimes trichotomous type of the rays of subgenus *Esula*. But Roeper was equal to this difficulty. While potentially dichotomous, the branching in subg. *Chamaesyce* often, by reduction, becomes apparently ordinary lateral branching though it is really sympodial as shown by the position of the cyathia. But in species with this type of branching the stem-tips often exhibit symmetrical dichotomy with actually terminal cyathia. All the cyathia are morphologically terminal even though they appear axillary when the suppressed branch of the scorpioid sympodium is absent. Collateral branching, i. e., subsidiary branching in addition to the main and more or less suppressed branches of the dichotomy, is common.

Plate 655B, figs. 1–4, shows a possible reductional series from a member of either *Euphorbia* subg. *Esula* or *Agaloma*. Fig. 1 represents the ancestral type with stem-leaves alternate between the whorled leaves subtending the terminal pleiochasium and the first pair of true leaves. Both *E. Peplus* L. (subg. *Esula*), and *E. marginata* Pursh (subg. *Agaloma*) have this habit. The cotyledons are represented by the lowermost pair of lateral outgrowths of the stem. Fig. 2 shows the apparent type of axial growth of *E. gracillima* S. Wats. and *E. revoluta* Engelm. (subg. *Chamaesyce*). Whether this is actually the type of growth obtaining in these two species awaits confirmatory study of their seedlings. In any event, the type of axial growth shown in fig. 2 represents a plausible intermediate between fig. 1 and the type commonly found in subg. *Chamaesyce*. Fig. 3 is a diagrammatic representation of a branch of *E. maculata* L. showing the easy transition from a sympodium below to a subsymmetrical dichotomy at the apex. Fig. 4 shows a branch of the sort commonly found in members of subg. *Chamaesyce*, e. g. *E. supina* Raf. Here is shown the gradual suppression of alternate branches of the dichotomy until there is derived a scorpioid sympodium simulating an ordinary monopodium, In prostrate species such as *E. supina* the branches radiate from the sides of the short main axis. Whereas in fig. 2 the distance from the cotyledons to the first pair of true leaves is represented as about 1 cm., in more reduced species, as *E. supina*, it is of the order of a millimeter. Conclusion: The branches of members of subg. *Chamaesyce* are homologous with the pleiochasial rays of members of subgenera *Esula* and *Agaloma*.

Whether subgenera *Agaloma* and *Chamaesyce* are independent developments from subgenus *Esula*, or subg. *Esula* gave rise to subg. *Agaloma*, and that in turn to subg. *Chamaesyce*, or subg. *Agaloma* gave rise to two independent lines represented by subgenera *Esula* and *Chamaesyce*, is an obscure question which will occupy the attention of phylogenetic speculators for many unprofitable hours. Some members of *Euphorbia* subg. *Agaloma*, e. g. *E. marginata* Pursh and *E. corollata* L., have a pleiochasial inflorescence, and similar species, rather than any members of subg. *Esula*, may be the ancestors of subg. *Chamaesyce*, though the occurrence of subg. *Agaloma* only in the New World, as contrasted with the occurrence of subg. *Chamaesyce* on all continents, suggests that such ancestry is improbable.

LEAVES: The leaves are simple, thin to thick. The margin is entire to variously toothed. The base is usually markedly inequilateral. The leaves, when sufficiently thin, exhibit a curiously mottled appearance when viewed by transmitted light. The venation is reticulate and the chlorophylliferous cells, instead of being distributed in the usual manner, are around the veinlets, thus leaving clear areas between. Veh, Ann. Jard. Buit. **38:** T. XV, figs. 32–34. 1928, illustrates this.

STIPULES: The stipules are small, variously membranous, lacerate, connate, or distinct.

VESTITURE: The trichomes, which constitute the only vestiture, are always simple. Most of them, unless very short, are multicellular, with the cells end to end. Occasionally, as in *Euphorbia hirta*, the distinction in size between hairs and capillary multiseriate segments disappears. Some of the divisions of the involucral lobes in *E. hirta* are no thicker than the trichomes on the lobes. The walls of the hairs are usually microscopically rugulose. In a few species such as *E. arizonica* and *setiloba* the cell-wall is quite smooth.

CYATHIA: The cyathia are compound inflorescences simulating simple flowers yet consisting of few to numerous staminate flowers and a central pistillate flower, these surrounded by a cuplike involucre composed of commonly five foliar structures united by their margins. Alternating with the tips (lobes of the involucre) of these modified leaves are nectariferous glands. Each gland is supplied by two traces, one from each of the adjacent modified leaves. The glands often bear petaloid appendages. Usually one of the glands is missing and the pistillate pedicel is commonly deflexed into the interval thus created. Plate 655B, figs. 5 and 6, illustrate the structure of the cyathium and involucre.

The voluminous literature relating to the interpretation of the cyathium can be found by examining the bibliographies given by Pax 1884, Schmidt 1906, Denis 1921, Haber 1925, Bodmann 1937, and Schoute 1937.

The staminate flowers are pedicellate, naked and monandrous. Each staminate flower is primitively subtended by a bracteole. These bracteoles may be entirely free but are generally more or less connate and often adnate below to the involucre. The staminate pedicels are termed androphores in this paper.

The pistillate flowers are pedicellate and naked or with a rudimentary 3-lobed calyx. The pistillate pedicels are termed gynophores in this paper. The ovary is 3-locular and sessile. The styles are usually bifid. The structure of the dehiscent 3-locular capsule is illustrated in Plate 655B, fig. 7.

The embryo and endosperm are surrounded first by a light tan to nearly black structure here called the testa. Outside the testa is a layer of dried mucilage which is white and, depending on the thickness, makes the seed more or less white by obscuring the testa beneath. This dried mucilage is here called the coat. Pammel, 1891, has considered the structures surrounding the embryo and endosperm in the seeds of *Euphorbia.*

Relationships of Subgenus Chamaesyce

The subgenus *Chamaesyce* has probably, as suggested in the discussion above under stems, been derived from either subgenus *Esula* or *Agaloma*. It is with the greatest difficulty that, aside from the supposedly constant difference in the development of the main axis, subgenus *Chamaesyce* can be defined so as to exclude all members of those subgenera and at the same time include all members of subgenus *Chamaesyce*.

Geographical Distribution of the Subgenus Chamaesyce

Subgenus *Chamaesyce* occurs native in the warmer parts of all the continents including Australia. It reaches its greatest development in subtropical regions. It has attained a remarkable development in Hawaii where some species are arborescent.

An analysis of the geographical distribution of *Euphorbia* subgenus *Chamaesyce* in Canada and the United States exclusive of southern Florida has yielded the following data: Of the 48 species occurring in this area, 17 are originally endemic though 3 are now established in other parts of the world. Of the 17, 11 are found only west of the Mississippi River, 1 only east, and 5 on both sides. Of the 31 species not native solely within the specified area, 21 are native in this area plus Mexico. Few of these 21 range south of the northern half of Mexico. Of the 10 species not included in the two preceding categories, 3, viz. *E. glomerifera, hirta,* and *hyssopifolia,* are predominantly subtropical or tropical, and, within the area under consideration, are found native only in southern U. S. Most of the remainder are species with wide ranges in North and South America. While no introduced species has become established in the United States or Canada there have been local introductions of species native within the area. Notable examples are *E. maculata* and *supina.* On the other hand, some of the species native solely within the area have been introduced into Europe and elsewhere, e. g. *E. polygonifolia* and *supina.*

In order to determine what region had the largest number of species the distributional maps were examined to ascertain where a circle with a fifty-mile radius would include the largest number of species. Such a circle centering at Marsh, Pima County, Arizona, includes 25 species. Of this number probably only *E. supina* is introduced. This area is fairly well known botanically and it is not likely that there will be many additional species discovered in it. Curiously enough no species is endemic within the area circumscribed by this circle. A second center of density is Elephant Mountain, Brewster County, Texas. Within a fifty-mile radius of this point 21 species occur. Probably all of these are native. In view of the fact that this region is not well known botanically and that there are several more species in adjacent regions, it is highly probable that additional species will be found here. Two species and one very distinctive variety are endemic in this region.

It may be protested that both of these centers are merely points adjacent to the Mexican deserts and owe their density to a greater density southward. If an equal area is chosen anywhere in Sonora it is not likely to surpass the Arizonan center much if at all since several species which are common in Arizona are absent in Sonora. Similarly, several species have their southern limit included in the Big Bend area of Texas and the loss of these and the species endemic in the Big Bend area would scarcely be offset by species occurring in Chihuahua or Coahuila but not in Texas. Probably a third center of density is in southern Florida but determination of that must await examination of all the species found there.

Economic Value

The members of *Euphorbia* subgenus *Chamaesyce* are generally of little economic value. The species are often weedy but are rarely if ever classed as noxious weeds. Occasionally stock are supposed to be poisoned by accidentally eating some of these plants mixed with other herbage. Ordinarily not even grasshoppers will eat these plants. One Kansan correspondent informed me in 1938 that grasshoppers ate nearly everything except the spurges! Some use is made of *Euphorbia hirta* as a drug plant. Aboriginal peoples often utilize the latex in their medicine. There are persistent reports that these plants are remedies for snake bite. H. M. Hall, Yosemite Flora, 151. 1912, mentions that *E. serpyllifolia* is often used for this purpose by "Indians and others". C. R. Orcutt, 1890, also discusses the supposed virtues of these plants. No serious study of the allegedly theriacal qualities of the group seems ever to have been made.

It has been stated by Standley, Field Mus. Pub. Bot. **3:** 1930, and doubtless others, that *Euphorbia hirta* harbors the organisms causing tropical leg-ulcers. Dr. J. C. Bequaert of the Harvard Medical School assures me (in conversation) that there is no proof of this. Nevertheless I consider it entirely possible. Flagellates are common in many herbaceous species of *Euphorbia* and are by no means confined to even subtropical regions, for they have been found in Europe. No study seems to have been made of the species occurring in the United States, to determine whether they, too, harbor these organisms. The literature relating to flagellates in *Euphorbia* and other laticiferous plants is voluminous. Mesnil, Ann. Sci. Nat. ser. 10, Bot. **3:** xlii–lvii. 1921, gives an interesting resumé up to that date.

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II. TAXONOMY

SCOPE OF THIS TREATMENT

This paper is intended to include all native or naturalized species of the subgenus *Chamaesyce* occurring in Canada and the United States, exclusive of Southern Florida. The species occurring in the United States only in southern Florida are mostly closely related to, or even conspecific with, the West Indian species and can be satisfactorily treated only in relation to them. The line of demarcation in Florida is at about 26°–27° north latitude. This conclusion was drawn from examination of the abundant Floridan material of the subgenus at the New York Botanical Garden. After I had reached this conclusion, Mr. E. J. Alexander stated, in conversation, that 26° north latitude is the usual northern limit of subtropical species in Florida.

It is intended to treat all members of subgenus *Chamaesyce* growing in the area specified. For species occurring primarily within the area all synonyms or alleged synonyms have, so far as possible, been considered and referred to their proper position. In order that the exact basis of all conclusions may be evident, names are treated according to their types. All names based on one type are included in one paragraph. In this paragraph the type, its location, and whether it has been examined are all concisely indicated. An exclamation point (!) is used, as is customary, to indicate that the type, photograph of the type, or isotype has been examined.

MEASUREMENTS

All measurements have been made on dried material with the exception of those of involucres, glands, androphores, bracteoles, and styles which were made after the parts were boiled in water. If in some cases it appears that the seeds would be a rather tight fit for the capsules, remember that *fully* mature capsules dehisce on drying. Consequently the capsules measured on dry herbarium specimens are not only *slightly* immature but, in addition, must have shrunk a little in drying. This method of measuring, while open to some theoretical objections, is eminently practical since these plants are nearly always dry before identification is attempted.

The tangential dimension of the seed is the dimension in the plane normal to the radius when the seed is oriented as it is in the capsule. The radial dimension is comparable and is measured along the radius. A possible source of confusion is the statement as to the "radial" shape. This is the outline seen when looking along the radius and viewing the inner (raphal) face of the seed. The raphal face or the ventral side of the seed is the side toward the center of the capsule; the dorsal side is that away from the center.

Abbreviations

The herbaria from which material has been studied and from which specimens are cited in this revision are indicated by the following abbreviations:

A—United States Field Station, Sacaton, Arizona.
B—Berlin-Dahlem, Germany
C—University of California, Berkeley.
CA—California Academy of Sciences, San Francisco.
CL—University of California, Los Angeles.
Cl—Clokey Herbarium at Los Angeles Museum.
D—Dudley Herbarium, Stanford University, California.
Deam—private herbarium of C. C. Deam, Blufton, Indiana, now at or in process of transfer to Indiana University.
F—Field Museum, Chicago, Illinois.
G—Gray Herbarium, Harvard University, Cambridge, Mass.
Ge—Geneva, Switzerland.
I—Intermountain Herbarium, Utah State Agricultural College, Logan, Utah.
J—Herbarium of W. L. Jepson at University of California, Berkeley.
K—Royal Botanical Gardens, Kew, England.
Lam—Los Angeles Museum, Los Angeles, California.
M—Missouri Botanical Garden, St. Louis, Missouri.
Ma—Maria Mitchell Society, Nantucket, Mass.
Mi—University of Minnesota.
Mn—University of Michigan, Ann Arbor.
Mo—University of Missouri, Columbia.
N—National Arboretum, Washington, D. C.
NE—New England Botanical Club at Gray Herbarium.

NY—New York Botanical Garden, New York City.
O—Oberlin College, Oberlin, Ohio.
P—Pomona College, Claremont, California.
Peir—Herbarium of Frank W. Peirson, 1077 New York Ave., Altadena, California.
Ph—Academy Natural Sciences, Philadelphia.
PhB—Philadelphia Botanical Club at Acad. Nat. Sci., Philadelphia.
RS—Rancho Santa Ana Botanic Garden, Anaheim, California.
SB—Santa Barbara Museum, California.
Sh—Forrest Shreve, private herbarium, Tucson, Arizona.
T—University of Arizona, Tucson.
US—United States National Herbarium, Washington, D. C.
W—Herbarium of the author.

Since completing the manuscript, the herbarium of Catholic University of America, Washington, D. C., and specimens from Southern Branch, University of Idaho, Pocatello, have been examined and important extensions of ranges incorporated in the maps, but no specimens from these herbaria are cited.

Key to Subgenera of Euphorbia Occurring in Canada and the United States

In order that it may be ascertained whether the *Euphorbia* in hand is to be found in this paper the following key to the subgenera in this area is offered.

1. Glands of the involucre without petaloid appendages; glands deeply cupped if leaves opposite below the inflorescence; leaves essentially symmetrical.
   2. Glands of the involucre either deeply cupped or concealed by the inflexed linear segments of the margin; stem never branching into a symmetrical 3–several-rayed inflorescence . . . . I. *Poinsettia.*
   2. Glands of the involucre flat or convex, never concealed; leaves nearly always alternate below (stem-leaves), in a single whorl beneath the pleiochasium which is a cyme resembling an umbel (whorled leaves), opposite in the symmetrically forking inflorescence (floral leaves) . . . . II. *Esula.*
1. Glands of the involucre with petaloid appendages or, if appendages wanting, leaves all strictly opposite and with inequilateral bases.
   3. Leaves alternate, opposite, or even whorled, their bases symmetrical; stipules glandlike or none . . . . III. *Agaloma.*
   3. Leaves all strictly opposite, their bases usually strongly inequilateral; stipules mostly well developed, always evident in species with symmetrical leaves . . . . IV. *Chamaesyce.*

I. Subg. Poinsettia (Graham) House, N. Y. State Mus. Bull. **254:** 473. 1924. (*Poinsettia* Graham, New Philos. Journ. **20:** 412. 1836). For additional synonymy see Contr. Gray Herb. **127:** 58–59. 1939.

II. Subg. Esula Pers., Syn. Pl. **2:** 14. 1806. (*Euphorbia* sect. *Tithymalus* of various authors. *Tithymalus* Adans., Fam. Pl. **2:** 356, 611. 1763, et al. *Galarhoeus* Haw., Syn. Pl. Succ., 143. 1812.)

III. Subg. Agaloma (Raf.) House, N. Y. State Mus. Bull. **254:** 471. 1924. (*Agaloma* Raf., Fl. Tellur. **4:** 116. 1838; *Lepadena* Raf., op. cit., 113; *Dichrophyllum* Klotzsch & Garcke, Monatsb. Akad. Berlin **1859:** 249. 1859; *Tithymalopsis* Klotzsch & Garcke, l. c.; *Zygophyllidium* (Boiss.) Small, Fl. SE U. S. 715. 1334. 1903). For additional synonymy see Contr. Gray Herb. **127:** 57–58. 1939.

IV. Subg. Chamaesyce Raf., Amer. Mo. Mag. **2:** 119. 1817. Type: *Euphorbia supina* Raf.—*Chamaesyce* Raf. l. c., *nomen provisorium* under the above name. Both proposed without reference to Persoon.

Chamaesyce, Pers., Syn. Pl. **2:** 12. 1806 (as synonym of a defined subdivision of *Euphorbia* of subgeneric rank). Type: *Euphorbia Chamaesyce* L.

Anisophyllum Haw., Syn. Pl. Succ., 159. 1812, not Jacquin, Select. Stirp. Amer. Hist., 283, T. CLXXX, fig. 5. 1763. Type: *A. Peplis* (L.) Haw.; based on *Euphorbia Peplis* L. Klotzsch, Monatsb. Akad. Berlin **1859:** 247. 1859; Klotzsch, Abh. Akad. Berlin, Phys. **1859:** 13, 21. 1860.—Schweinfurth, Beitrag Fl. Aethiop. **1:** 34. 1867.—*Euphorbia* section *Anisophyllum* (Haw.) Pax in Engler & Prantl, Nat. Pflanzenfam. **3** (**5**): 104. 1891; Pax & Hoffman, Nat. Pflanzenfam. 2 Aufl. **19c:** 210. 1931.—*Euphorbia* subgenus *Anisophyllum* (Haw.) Heinrich Ludwig Schmidt, Über die Entwicklung der Blütenstände von *Euphorbia* L. und *Diplocyathium* n. g., 16. 1906, preprint from Beih. Bot. Centralblatt **22:** 32. 1907, published merely as "Untergattung Anisophyllum Haw." Without basinym, hence not valid.

Chamaesyce S. F. Gray, Nat. Arr. Brit. Pl. **2:** 260. 1821. Type: *Chamaesyce maritima* S. F. Gray, an actually and avowedly superfluous name for *Euphorbia Peplis* L. Small, Fl. SE U. S., 707. 1903; Millsp., Field Mus. Pub. Bot. **2:** 300. 1909; Lunell, Amer. Midl. Nat. **1:** 204. 1910; Small in Britton & Brown, Ill. Fl. No. U. S. & Canada, ed. 2, **2:** 462. 1913; Millsp., Field Mus. Pub. Bot. **2:** 384. 1914; Millsp., op. cit., 401. 1916; Britton, Fl. Bermuda, 212. 1918. Britton & Millsp., Bahama Fl., 237. 1920; Prokhanov, Consp. Syst. Tith. Asiae Mediae, 14. 1933; Hara, Journ. Jap. Bot. **11:** 511. 1935; Degener & Croizat in Degener, Fl. Hawaii, fam. 190, Chamaesyce. 1936 & 7.—*Euphorbia* subgenus *Chamaesyce* (S. F. Gray) House, Bull. N. Y. State Mus. **254:** 470. 1924.

Euphorbia section *Anisophyllum* Roeper in Duby, A. P. De Candolle, Bot. Gall. ed. 2, **1:** 412. 1828. Type: *Euphorbia*

Peplis L., designated here. G. D. J. Koch, Syn. Fl. Germ. Helv., 627. 1837; Ledebour, Fl. Ross. **3** (**2**): 557. 1849–51; Baillon, Étude Gen. Euphorb., 284. 1858; Engelmann in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 185. 1859; Boissier in DC. Prod. **15** (**2**). 1862; Muell. Arg. in Martius, Fl. Brasil. **11** (**2**): 669. 1874; Bentham & Hooker, Gen. Pl. **3**: 258. 1883; Chiovenda, Bull. Soc. Bot. Ital. **1895**: 61. 1895; Thellung, Bull. Herb. Boiss. sér. 2, **7**: 746. 1907; Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7**: 422. 1917; Denis, Euphorb. Iles Austr. Afr., 27. 1921.—*Tithymalus* [Tourn.] section *Anisophyllon* Gomez de la Maza, Fl. Habanera, 152. 1897.

Euphorbia A. *Chamaesyce* Reichenbach, Fl. Germ. Excurs., 755. 1832.[1] Type: *Euphorbia Chamaesyce* L. Reichenbach, Repert. Herb. Nom., 193. 1841, as *Euphorbia* "1. Chamaesyce *Caesalp.*"; Nyman, Consp. Fl. Eur. **3**: 655. 1881, merely as *Euphorbia* "g. Chamaesyce Rchb."

Xamesike Raf., Fl. Tellur. **4**: 115. 1838. Type: *X. vulgaris* Raf.; based on *Euphorbia Chamaesyce* L. Rafinesque, Aut. Bot., 96. 1840.—*Xamesike* subgenus *Xamesike* Raf., op. cit., 97.

Xamesike subgenus *Xamobala* Raf., Fl. Tellur. **4**: 115. 1838; Type: *Xamesike supina* (Raf.) Raf., based on *Euphorbia supina* Raf.; Rafinesque, Aut. Bot., 97. 1840.

Aplarina Raf., New Fl. No. Amer. **4**: 98. 1838. Type: *A. prostrata* Raf. proposed without reference to *Euphorbia prostrata* Aiton.—*Xamesike* subgenus *Aplarina* (Raf.) Raf., Aut. Bot., 97. 1840.

Euphorbia section *Anisophyllum* § *Acutae* Boiss. in DC. Prod. **15** (**2**): 18. 1862. Type: *Euphorbia acuta* Engelm. Pax in Engler & Prantl, Nat. Pflanzenfam. **3** (**5**): 104. 1891; Pax & Hoffmann in Engler & Prantl, Nat. Pflanzenfam. 2 Aufl. **19c**: 210. 1931.

Euphorbia section *Anisophyllum* § *Chamaesyceae* Boiss. in DC. Prod. **15** (**2**): 27. 1862. Type: *Euphorbia Chamaesyce* L. Proposed without reference to earlier uses of similar names though Boiss., op. cit., 11, cites in synonymy under sect. *Anisophyllum*, genus *Chamaesyce* Haw., and "Sect. Chamaesyce *Reichb. Fl. Germ. exc. p.* 755."

Euphorbia section *Anisophyllum* § *Hypericifoliae* Boiss. in DC. Prod. **15** (**2**): 20. 1862. Type: *Euphorbia hypericifolia* L. Pax in Engler & Prantl, Nat. Pflanzenfam. **3** (**5**): 104. 1891; Pax & Hoffmann, in Engler & Prantl, Nat. Pflanzenfam. 2 Aufl. **19c**: 210. 1931.

Euphorbia subgenus *Anisophyllum* Gaucher, Étude anat. genre Euphorbia, 123. 1898; proposed independently and described, no species assigned.

Glabrous to vestite herbs or sometimes sub-shrubs; leaves

[1] See page preceding title page between 434 & 435 for dates.

opposite, simple, mostly with inaequilateral bases, petioles short to none; stipules small, often united; cyathia solitary at the nodes and bifurcations or more or less congested into cymes; glands mostly 4, appendiculate or exappendiculate; staminate flowers few to numerous; bracteoles few to numerous, free to variously connate and adnate; ovary 3-celled; styles 3, bifid to entire, mostly free; capsules small, dehiscent; seeds small, ecarunculate, smooth to variously sculptured, with a gelatinous coat of varying thickness.—This description applies only to the species included in this paper.

Key to the Species of Subgenus Chamaesyce

1. Ovary and capsule vestite.
  2. Perennial (except no. 3b with capsule ca. 2.5 mm. in diam.); staminate flowers 16–60 or rarely as few as 15 in nos. 25 and 26; involucres never urceolate.
    3. Cyathia borne in dense cymose glomerules, or a few in addition sometimes solitary in the upper bifurcations; leaves often serrate . . . . 17. *E. capitellata.*
    3. Cyathia solitary at the nodes and at the tips of the branches; leaves always entire.
      4. Seeds scarcely angled, narrowly ovoid, encircled by 4–5 rounded ridges . . . . 22. *E. pediculifera.*
      4. Seeds quadrangular, variously smooth to slightly wrinkled.
        5. Herbage with short, straight spreading hairs.
          6. Capsules 1.1–1.3 mm. in diam.; seeds sharply quadrangular . . . . 26b. *E. polycarpa* var. *hirtella.*
          6. Capsules ca. 2.5 mm. in diam.; seeds ovoid to ovoid-quadrangular . . . . 3b. *E. ocellata* var. *Rattanii.*
        5. Herbage variously clothed with appressed, long and weak, or matted hairs.
          7. Leaves acuminate, median mostly over 1 cm. long.
            8. Stems strigose; seeds 1.6–1.9 mm. long; capsules 2.1–2.4 mm. long . . . . 19. *E. angusta.*
            8. At least the young stems villous; seeds 2.2–2.5 mm. long; capsule ca. 3 mm. long . . . . 18. *E. acuta.*
          7. Leaves mostly blunt, never more than sub-acute, rarely as much as 1 cm. long.
            9. Capsules ca. 2.5 mm. long; seeds ca. 2 mm. long . . . . 20. *E. lata.*
            9. Capsules not over 2 mm. long; seeds not over 1.7 mm. long.
              10. Appendages wider than the glands and with short spreading hairs beneath and on the margins . . . . 24. *E. vallis-mortae.*
              10. Appendages wide to absent, glabrous or rarely with a few hairs beneath next to the involucre.
                11. Appendages usually conspicuous; styles not clavate; involucres open-campanulate . . . . 25. *E. melanadenia.*
                11. Appendages absent or very narrow; styles clavate; involucres turbinate. 23. *E. cinerascens.*

2. Annual (except no. 39 with urceolate involucre); staminate flowers up to 12, or sometimes to 15 in nos. 35b and 43; capsules less than 2 mm. in diam.
  12. Involucre urceolate.
    13. Appendages entire or crenate; hairs mostly clavate; perennial . . . . .39. *E. arizonica.*
    13. Appendages deeply parted into a few attenuate segments; hairs tapering; annual . . . . .40. *E. setiloba.*
  12. Involucres obconical to campanulate.
    14. Cyathia borne in dense axillary and terminal leafless glomerules . . . . .16. *E. hirta.*
    14. Cyathia solitary or on short leafy lateral branchlets.
      15. Proximal appendages greatly prolonged, often concealing the capsule . . . . .43. *E. indivisa.*
      15. Proximal and distal appendages without marked disparity in size.
        16. Seeds punctately pitted and mottled, base depressed-truncate, apex sharply acute; styles entire, sometimes emarginate . . . . .47. *E. stictospora.*
        16. Seeds neither punctately pitted nor mottled, base obtuse, apex not sharply acute; styles bifid.
          17. Glands without appendages or with but the merest rudiment; seeds smooth; leaves entire, not over 8 mm. long; vestiture short, straight, and spreading . . . . .28. *E. micromera.*
          17. Glands appendiculate; seeds variously ridged or granular; leaves often serrulate, some often over 8 mm· long; vestiture long and weak, crisped, or appressed.
            18. Capsule sparsely villous; seeds not transversely ridged . . . . .35b. *E. serpyllifolia* var. *hirtula.*
            18. Capsule strigose, or if with spreading hairs, seeds with transverse ridges.
              19. Seeds with low rounded transverse ridges not whitened on the summit or with merely granular surfaces; capsules strigose.
                20. Styles ca. 0.4–0.5, rarely to 0.6, mm. long, clavate; seed coat not granular; nodes never rooting.
                  21. Capsules all exserted from the involucre . . . . .45. *E. supina.*
                  21. Capsules mostly half included and distending the involucre at maturity . . . . .44. *E. thymifolia.*
                20. Styles ca. 0.7 mm. long, slender; seed coat granular; nodes often rooting 46. *E. humistrata.*
              19. Seeds with narrow sharp transverse ridges, or rounded transverse ridges whitened on the summit; capsules tomentose or with crisped spreading hairs.
                22. Herbage grayish-pilose-tomentose; seeds 1.1–1.3 mm. long, the rounded ridges about the same width as the intervals between . . . . .49. *E. laredana.*
                22. Herbage green or greenish, less densely vestite to sub-glabrous; seeds 0.9–1

mm. long, the minute sharp ridges narrower than the intervals between 48. *E. Chamaesyce.*

1. Ovary and capsule glabrous.
23. Stipules united into a white, glabrous, membranous scale.
24. Annual; staminate flowers 5–10 .... 30. *E. serpens.*
24. Perennial; staminate flowers 12 or more .... 31. *E. albomarginata.*
23. Stipules not united into a white, glabrous membranous scale.
25. Styles entire, either very short and capitate or as long as the capsule and very slender.
26. Styles about as long as the capsule, slender; leaves sharply serrulate; annual .... 34. *E. Hooveri.*
26. Styles very short, capitate; leaves entire; perennial. . . . 33. *E. astyla.*
25. Styles bifid or if entire neither extremely short and capitate nor about as long as the capsule.
27. Face of seed virtually flat, the inflexed apical mucro overhanging the raphe .... 2. *E. platysperma.*
27. Face of seed not flat; apical mucro wanting or minute and by no means overhanging the raphe.
28. Delicate erect annuals with symmetrical linear leaves and capsules 1.3–1.4 mm. long.
29. Seeds transversely wrinkled or ridged; involucre 0.9–1 mm. in diam.; appendages no longer than the glands; ultimate branchlets 0.15–0.25 mm. in diam.; longest leaves rarely as short as 1 cm. .... 9. *E. revoluta.*
29. Seeds smooth; involucre 0.5–0.7 mm. in diam.; appendages usually longer than the glands; ultimate branchlets ca. 0.1 mm. in diam.; longest leaves mostly shorter than 1 cm. . . 8. *E. gracillima.*
28. Annuals or perennials, if leaves linear and symmetrical plants coarse and/or capsules more than 1.8 mm. long.
30. Capsules 3–3.5 mm. long.
31. Seeds sharply angled, larger leaves 2 cm. or more long .... 11. *E. trachysperma.*
31. Seeds compressed-ovoid; leaves not over 16 mm. long .... 1. *E. polygonifolia.*
30. Capsules less than 3 mm. long.
32. Erect annual; leaves linear, symmetrical, with sharp discrete serrulations; capsule ca. 2.5 mm. long; appendages conspicuous; seed subalately angled .... 10. *E. florida.*
32. Perennial, or if erect and annual, leaves not as above, and seeds not subalately angled.
33. Glands exappendiculate or with but a minute rudiment; leaves always entire, never linear, never more than 10 mm. long.
34. Seeds with transverse ridges .... 38. *E. theriaca.*
34. Seeds smooth to rugulose but never transversely ridged.
35. Capsule 2–2.3 mm. long; seeds 1.1–1.4 mm. in diam. .... 3. *E. ocellata.*
35. Capsule not over 1.8 mm. long; seeds not over 0.8 mm. in greatest diam.
36. Annual; staminate flowers 2–5 . . 28. *E. micromera.*
36. Perennial; staminate flowers 15–50.

37. Glands discoid; staminate flowers 40–50 . . . . 27. *E. Parishii.*
37. Glands transversely oblong; staminate flowers 15–32 . . . . 26. *E. polycarpa.*
33. Glands with appendages; leaves sometimes serrate, sometimes more than 10 mm. long.
38. Robust erect annuals with the larger leaves mostly over 15 mm. long, margins serrate.
39. Capsule 1.6–2.3 mm. long, wider below the equator, cymes not very dense and of mostly few to several cyathia.
40. Stems usually crisply hairy at least on the young tips, rarely pilose; seeds finely wrinkled . . . . 13. *E. maculata.*
40. Stems mostly glabrous, sometimes pilose; seeds with broad very shallow depressions separated by low smooth ridges . . . . 12. *E. hyssopifolia.*
39. Capsule 1.3–1.4 mm. long, widest at the equator or nearly so; cymes mostly very dense with numerous cyathia . . . . 15. *E. glomerifera.*
38. Small prostrate to erect annuals or perennials with largest leaves mostly less than 15 mm. long, if robust and erect, leaves all entire, herbage completely glabrous, and seeds smooth.
41. Cyathia in leafless terminal cymes, a few in addition sometimes in the upper bifurcations; stems not pilose 17. *E. capitellata.*
41. Cyathia solitary, or if in leafy cymes, stems pilose.
42. Seeds with definite transverse ridges.
43. Seeds radially oblong-ovate to oblong; capsule widest at the equator; at least the stems often vestite . . . . 37. *E. Abramsiana.*
43. Seeds ovate radially; capsule widest well below the equator; herbage always glabrous . . . . 36. *E. glyptosperma.*
42. Seeds smooth to rugulose but never with regular transverse ridges.
44. Herbage variously vestite.
45. Seeds smooth and mostly chalky white, sharply angled; leaves sharply serrulate; annual . . . . 42. *E. serrula.*
45. If seeds smooth and white leaves entire and plant perennial.
46. Leaves entire; perennial; herbage pubescent . . . . 26. *E. polycarpa.*
46. Leaves not entire, or if entire and plant perennial, stem pilose.
47. Carpels mostly prolonged into an empty carina; stems white with long tapering hairs . . . . 41. *E. villifera.*

47. Carpels never prolonged; stems never white with long tapering hairs.

48. Leaves 5–15 or rarely 19 mm. long, ovate to lanceolate . . . . . . 14. *E. vermiculata.*

48. Leaves 3–7 mm. long, broadly oblong to oblong-cuneate . . . . . . 35b. *E. serpyllifolia* var. *hirtula.*

44. Herbage glabrous except stipules sometimes with cilia.

49. Seeds smooth, plump; leaves always entire, plants annual, mostly drying yellowish green.

50. Appendages narrow and ascending; involucre cupuliform-campanulate . . . . 4. *E. Parryi.*

50. Appendages narrow to wide but spreading; involucre obconical to campanulate.

51. Staminate flowers 5–20; plants mostly prostrate.

52. Styles slender, not thickened at the tip; involucres 1–1.1 mm. in diam.; androphores 1–1.3 mm. long; seeds 1.3–1.6 mm. long, leaf-blades 4–10 mm. long; appendages mostly 1–3 times as wide as gland . . . . . . 6. *E. Geyeri.*

52. Styles thickened at the tip or rarely thicker below and somewhat tapering; involucres 1.2–1.6 mm. in diam.; androphores 1.4–2 mm. long; seeds 1.5–1.9 mm. long, leaf-blades 4–15 mm. long; appendages mostly narrower than the gland. . . . . . 5. *E. ammannioides.*

51. Staminate flowers more than 20; plants ascending to erect . . . . 7. *E. missurica.*

49. Seeds often wrinkled, if smooth mostly slender; leaves sometimes serrulate; plants annual or perennial mostly drying brownish to green.

54. Epidermis papillate at least on the nodes; carpels often prolonged into an empty carina . . . . . . 41b. *E. villifera* var. *nuda*

54. Epidermis not papillate; carpels not prolonged.

55. Stipules parted into numerous filiform segments; leaves entire and mostly with cordate bases....29. *E. cordifolia.*
55. Stipules not as above; leaves serrulate or entire, not cordate-based.
56. Capsules more than 2 mm. long..........32. *E. Fendleri.*
56. Capsules less than 2 mm. long.
57. Annual with entire leaves; seeds 1.6–1.8 mm. long......21. *E. Golondrina.*
57. Perennial, or leaves mostly serrulate if annual; seeds 1–1.4 mm. long.
58. Perennial; leaves entire; stipules ciliate (except in var. *simulans*); stems never winged.....26. *E. polycarpa.*
58. Annual; leaves mostly serrulate; stipules glabrous; stems often winged 35. *E. serpyllifolia.*

1. Euphorbia polygonifolia L., Sp. Pl. **1:** 455. 1753. Type: "*Habitat in* Canada, Virginia", *Kalm* (Linnaean Herbarium, not seen; photograph G!). Boissier in DC. Prod. **15 (2):** 28. 1862; Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 439. 1917. *Anisophyllum polygonifolium* (L.) Haw., Syn. Pl. Succ., 160. 1812. *Xamesike polygonifolia* Raf., Aut. Bot., 98. 1840; based on "Euph. O[mnes]", i. e. doubtless *E. polygonifolia* of everybody, hence, by inference, Linnaeus.—*Chamaesyce polygonifolia* (L.) Small, Fl. Se. U. S., 708, 1333. 1903.

E. maritima Nutt., Trans. Amer. Philos. Soc. **5:** 171. 1837. Type: "Sea coast, L[ittle?] Egg Harbor", New Jersey, [*Nuttall*?] (Ph!, possibly only isotype; photographs G!, W!).

Glabrous annual; stems few to several, mostly prostrate, sometimes ascending to erect, 1–25 cm. long, 1–2 mm. in diam., internodes 0.5–5 cm. long; leaf-blades 6–16 mm. long, oblong-linear to oblong-lanceolate, midrib prominent beneath, margin entire, base oblique, apex usually mucronate; petioles 1–3 mm. long; stipules distinct or ventral more or less united toward apex of stem, subulate to triangular-subulate, entire or few-parted; cyathia solitary at the upper nodes; peduncles 0.5–5 mm. long; involucres obconical-campanulate, 1–1.4 mm. in diam., glabrous without, with a ring of short hairs within at the level of the intervals between lobes and glands, sometimes extending downward beneath the glands; lobes triangular, acuminate, mostly

Map 1, range of Euphorbia Abramsiana in the U. S.; 2, E. glomerifera in the U. S.; 3, E. polycarpa var. hirtella in the U. S.; 4, E. polycarpa var. typica in the U. S.; 5, dots E. polycarpa var. typica and var. hirtella intergrades, circles E. polycarpa var. simulans; 6, E. pediculifera var. typica in the U. S.; 7, dots E. serrula in the U. S., circles E. theriaca; 8, dots E. revoluta, circles E. platysperma; 9, E. Parryi; 10, dots E. maculata in Canada and the U. S., circles E. gracillima; 11, E. indivisa in the U. S.; 12, E. melanadenia in the U. S.; 13, dots E. missurica var. intermedia, circles E. missurica var. typica, half filled circles intergrades between E. missurica vars. typica and intermedia; 14, E. serpyllifolia var. hirtula in U. S.; 15, E. serpyllifolia var. genuina in U. S. and Canada; 16, E. villifera var. typica in the U. S.; 17, E. florida in the U. S.

entire, slightly exceeding the glands, proximal often narrower; glands 0.3–0.4 mm. long, broadly transversely oval to subcircular or sometimes nearly double and figure-eight-shaped, shallowly cupped; appendages rudimentary or absent; fifth gland small or absent, the involucre irregular and the parts difficult to identify in this interval; sinus narrowly U-shaped to V-shaped, little depressed; bracteoles glabrous, united below, free above, forming a three- to several-parted tangential structure between and outside the fascicles, shorter than the androphores; staminate flowers 1–3 per fascicle, 5–14 per cyathium, or some of the uppermost cyathia with staminate flowers abortive or wanting; androphores 0.8–1.3 mm. long, glabrous; gynophore glabrous, soon exserted and reflexed; ovary roundly 3-lobed; styles 0.7–1 mm. long, bifid to the middle, mostly closely reflexed; capsules 3–3.5 mm. long, roundly 3-lobed, broader below the equator; seeds compressed-ovoid, base subtruncate, apex subacute, back strongly rounded, face slightly rounded, 2–2.6 mm. long, 1.6–1.9 mm. tangentially, 1–1.6 mm. radially, coat white, irregularly cellular-reticulate microscopically, the brown microfavose macroscopically smooth testa showing through.—PLATE 654A.

Sandy or gravelly beaches above high tide and sand dunes, both maritime and lacustrine, Magdalen Islands, Quebec, south to Georgia; shores of Lake Ontario, Erie, Michigan and the southern tip of Lake Huron; introduced in western Europe (MAP 42). Representative specimens seen: QUEBEC. Gaspé Co.: near the Lobster Hatchery, Grindstone, Magdalen Islands, *Fernald, Long & St. John 7720* (G, Ph). PRINCE EDWARD ISLAND. Prince Co.: near Campbell's Pond, Malpeque, *Fernald & St. John 11114* (G); Lower Sea Cow Pond, *Fernald, Long & St. John 7719* (G, Ph, US). Queens Co.: Grand Tracadie, *Fernald, Long & St. John 7722* (G, Ph, US); Brackely Point, *Fernald, Long & St. John 7721* (G, Ph). NOVA SCOTIA. Cape Breton Co.: Sydney Mines, *Bissell & Linder 21755* (G, Ph, NY). Pictou Co.: Little Cariboo Island, *C. B. Robinson 187* (NY). Cumberland Co.: Linden, Aug. 11, 1885, *Trueman* (G). Queens Co.: Central Port Mouton, *Graves, Long & Linder 21754* (G, Ph, US). NEW BRUNSWICK. Charlotte Co.: Long Pond Beach, Grand Manan, *Weatherby 5700* (G). Gloucester Co.: Tracadie Beach, *Blake 5651* (G, NY, US). MAINE. Knox Co.: Matinicus, *C. A. E. Long 74* (NE). Cumberland Co.: Brunswick, railroad track, Sept. 21, 1907, *Kate Furbish* (NE). Sagadahoc Co.: Popham Beach, Aug. 6, 1894, *Fernald* (G, NE). York Co.: between Cutts Island and Gerrish Island, Kittery, *Fernald & Long 13994* (NE, Ph); Old Orchard, *Fernald 2733* (NE). NEW HAMPSHIRE. Rockingham Co.: Little Harbor, Rye, Sept. 19, 1901, *E. F. Williams* (G); Hampton, Oct. 5, 1901, *Knowlton* (G, NE). MASSACHUSETTS. Essex Co.: Salisbury, *D. White 296*

(NE); Plum Island, Newbury, *Pease 2716* (G); Rockport, Aug. 14, 1898, *E. F. Williams* (NE). Suffolk Co.: Revere Beach, *Pease 9858* (NE). Norfolk Co.: Quincy (Rufe's Hummock), Sept. 4, 1894, *Fuller* (NE); Cohasset, sand by shore, Aug. 9, 1882, *Deane* (NE). Plymouth Co.: Scituate, Sept. 17, 1893, *S. Harris* (NE); Marshfield, Aug. 9, 1897, *Morss* (NE); Duxbury Beach, *St. John 787* (NE); Plymouth, *Fernald, Hunnewell & Long 9818* (NE, Ph); Wareham, *Fernald & Long 9821* (NE, Ph). Barnstable Co.: Barnstable, Sept. 16–17, 1916, *Bean, Bird & Knowlton* (NE, Ph); Brewster, *Fernald & Long 17038* (NE); Truro, Aug. 6, 1896, *Rich* (NE); Provincetown, *Fernald & Long 18584* (NE, Ph); Wellfleet, Sept. 4, 1916, *F. S. Collins* (NE); Hyannis, *Fernald, Butters & St. John 15261* (NE); Woods Hole, *Safford 233* (US). Bristol Co.: Dartmouth, *Collins 2872* (NE). Dukes Co.: South Shore, Nonamesset Island, *Fogg 2870* (NE); Nashawena, Elizabeth Islands, July–Aug., 1901, *Northrop* (NY); Edgartown, Marthas Vineyard, *Fernald* in *Pl. Exs. Gray. 69* (G, M, NE, NY, Ph, US). Nantucket Co.: Wauwinet, *Churchill 545* (G, M); Tuckernuck Island, Aug. 6, 1909, *Cushman* (Ma); Nantucket, 1912, *Brewster* (NE); Coatue, Aug. 12, 1933, *Wyatt & Franklin* (Ma); southwest beach, Nantucket Island, July 20, 1910, *Cushman* (Ma). Rhode Island. Newport Co.: Prudence Island (Portsmouth), *Sanford 10384* (NE); Block Island, *Fernald & Long 9817* (G, NE, Ph). Kent Co.: Greens Island, Warwick, Aug. 13, 1921, *Hope* (NE). Washington Co.: Quonochontaug, Oct. 12, 1919, *Hope* (NE); Westerly, Aug. 31, 1919, *Weatherby & Collins* (NE). Connecticut. New London Co.: Old Lyme, Sept. 29, 1917, *Woodward* (NE). New Haven Co.: New Haven, *Blewitt 849* (NE); Orange, *Bissell 528* (NE); Guilford, July 30, 1906, *Bartlett* (G). Fairfield Co.: Bridgeport, Sept. 4, 1898, *Eames* (G). New York. Suffolk Co.: Fishers Island, *St. John 2787* (G); Riverhead, Long Island, *St. John 2788* (G); Southampton, Long Island, *Clute 257* (NY). Nassau Co.: Sand's Point, Long Island, Oct. 9, 1876, *E. G. Knight* (NY). Queens Co.: Laurelton, Long Island, *Moldenke 2931* (NY). Jefferson Co.: along shore of Lake Ontario near Woodville, *House 16990* (G). Oswego Co.: north spit, west of North Sand Pond, *House 19977* (US). Monroe Co.: Windsor Beach, *Bartram 1793* (NY, Ph). Erie Co.: Buffalo, *Williamson 2418* (Ph). New Jersey. Middlesex Co.: Long Branch, 1852, *Short* (Ph). Monmouth Co.: Sandy Hook, Aug. 15, 1887, *Stabler* (G). Ocean Co.: below Mantoloking, sand dunes, Aug. 11, 1902, *Lyons* (US). Atlantic Co.: Atlantic City, *Gross 2498* (NY). Cape May Co.: Cape May, *Pennell 2214* (US). Salem Co.: along Delaware River, between Straight & Black Ditches, 3.75 miles west-northwest of Hancocks Bridge, *Fogg 7753* (G). Pennsylvania. Erie Co.: Presque Isle, Erie, Sept. 3, 1868, *Porter* (US); Presque Isle, Erie, Sept. 4, 1868, *Garber* (Ph). DELAWARE. Kent Co.: ½ mile south of Smyrna River, *Larsen 1044* (US). Sussex Co.: Ellendale, along railroad, Aug. 29, 1908, *Williamson* (Ph); Rehoboth, *Larsen 425* (G, M, Ph); south of Bethany Beach, *Fogg 11208* (G). MARYLAND. Worcester Co.: Ocean City, *Killip 7343* (US). Baltimore Co.: Gunpowder River, *Plitt 857* (G). Calvert Co.: sandy shore, Chesapeake Beach, *House 371* (NY, US). St. Mary's Co.: beach, Tall Timbers, *Killip 32209* (G, US). VIRGINIA. Elizabeth City Co.: Fortress Monroe, 1879, *Vasey* (US). Northampton Co.: Savage Neck, *Fernald & Long 5350* (G, NY). Princess Anne Co.: Virginia Beach, *Heller 1231* (G, M, Ph, US); Cape Henry, *Kearney 1812* (US). NORTH CAROLINA. New Hanover Co.: Carolina Beach (below Wilmington), *Biltmore Herb. 3838*[a] (G, M, NY, US). Carteret Co.: Atlantic Beach, *R. K. Godfrey 6490* (G); Sold, Salter Path, Bogue Island, July 15, 1926, *Anonymous* (Ph). SOUTH CAROLINA. Charleston Co.: Isle of Palms, *Biltmore Herb. 3838*[b] (US). Beaufort Co.: Bulls Point Beach, St. Helena Island, *Cuthbert 707* (NY). GEORGIA. Chatham Co.: Tybee Island, *Harper 736* (NY, US). Glynn Co.: Saint Simons Island, *Biltmore Herb. 3838*[c] (US). ONTARIO. Prince Edward Co.: Wellington, Sept. 3, 1902, *Fowler* (G, US). Welland Co.: Point Abino, *Biltmore Herb. 3838*[d] (US), *McCalla 287* (US). Lambton Co.: Point Edward, *Macoun 88089* (G). MICHIGAN. St. Clair Co.: shore of Lake Huron, near Port Huron, Aug. 8, 1895, *C. K. Dodge* (G, US); Fort Gratiot, along St. Clair River, July 20, 1870, *Gillman* (G). Leelanau Co.: ¾ mile east of shore of Lake Michigan, Glen Haven, *Hermann 2248* (G). Berrien Co.: Harbert, *Johnson 1132* (US); lake shore, St. Joseph, Aug. 10, 1838, *Houghton* (NY). OHIO. Lake Co.: Lake Erie, Salida Beach, *Webb 1436* (G). Cuyahoga Co.: Lake Erie, Cleveland, 1840, *Sullivant* (Ph). Erie Co.: lake shore, Vermilion, Sept. 16, 1895, *Dick* (US); Lake Erie, Cedar Point, July 17, 1914, *MacDaniels* (G). INDIANA. La Porte Co.: frequent at Michigan City, *Deam 5206* (G, NY). Porter Co.: Lake Michigan, Mineral Springs, *Lansing 3359* (G, US); Dune Park, *V. H. Chase 205* (G, M), *A. Chase 2111* (US), *Umbach 1917* (Ph). Lake Co.: Lake Michigan, Miller's, Aug. 14, 1897, *Umbach* (US), Sept. 4, 1911, *Sherff* (G); Lake Michigan, Whiting, Aug. 18, 1897, *A. Chase* (Ph). WISCONSIN. Door Co.: Lake Michigan, Sturgeon Bay, *Fassett 18156* (G, M). Kewaunee Co.: Algoma, *Fassett & Wilson 14674* (G, M). Milwaukee Co.: Milwaukee, 1865, *Lapham* (G). Racine Co.: Racine, Sept. 1878, *Davis* (G). ILLINOIS. Lake Co.: Waukegan, *Gleason & Shobe 336* (G). Cook Co.: near shore, Sheridan Park, Chicago, *A. Chase 1896* (US). FRANCE: Gironde, sables maritimes, Soulac, Oct., 1903, *Pitard* (G).

2. EUPHORBIA PLATYSPERMA Engelm. ex S. Watson, Bot. Calif. **2:** 482. 1880. TYPE: Near the mouth of the Colorado

River, southern Arizona, 1869, *Ed. Palmer 2* (M 144649!; photographs G!, W!; ISOTYPES F!, G!, NY!, US!).

E. eremica Jepson, Man. Fl. Pl. Calif., 600, 1925. TYPE: Coachella Valley (Conchilla Desert), Riverside County, California, alt. ca. 200 feet, May, 1914, *Jepson 6074* (J!). According to Jepson in litt. "*Euphorbia eremica* was collected in the Conchilla Desert between Thousand Palms Canyon and Palm Springs, but much nearer the former place." This species was proposed without consideration of *E. platysperma* which was hidden in "Additions and Corrections to Vol. II".

Annual; stems prostrate, 1–1.5 mm. thick, slightly longitudinally wrinkled, 10–27 cm. long, very slightly glutinous, glabrous, internodes 1–3 cm. long; leaves yellowish green, glabrous; blades oblong to obovate, often mucronate, 5–10 mm. long, margin entire, base slightly oblique, midrib evident; petioles 1.5–2.5 mm. long; stipules glabrous, 1.5–2 mm. long, with two or three divisions, distinct, or united below toward stem-apex; cyathia solitary at the nodes; peduncles slightly angled, as much as 5 mm. long, glabrous; involucres glabrous without, glabrous within except for a tuft of short hairs below each gland and a small fringe at the base of each lobe, shallowly campanulate, 1.5–2 mm. in diam.; lobes equaling the glands, glabrous except within below, deltoid-truncate, apex entire or slightly bifid; glands mostly slightly radially elongate, 1 mm. wide, facing obliquely outward, sessile, outer margin sometimes produced into two short rounded lobes, i. e., emarginate, margin lighter color than the brownish inner portion but scarcely differentiated into an appendage; fifth gland subulate, half as long as the lobes, glabrous; sinus U-shaped, slightly depressed; bracteoles 1–1.5 mm. long, distinct, with a few short hairs above, forming a fringe of 20–25 bracteoles around the outside of each fascicle of staminate flowers, not adnate to the involucre; staminate flowers mostly 10 per fascicle, 50 per cyathium; androphores glabrous, 2 mm. long, exserted; gynophore glabrous, long-exserted and reflexed at maturity, slightly angled; ovary glabrous, scarcely lobed, carpels evidently channeled on back; styles stout, parted to the base, 0.5 mm. long; capsule rotund-ovoid, slightly 3-lobed, ca. 4 mm. long, glabrous, carpels slightly ridged on back; seeds white, microreticulate, 2.4–3 mm. long, 1 mm. radially, 1.7 mm. tangentially, broadly oblong radially, base truncate obliquely inward, apex with an inflexed mucro, back rounded, smooth, face with two smooth, flat, nearly approximate, slightly depressed facets separated by the elevated raphe.—PLATE 665D.

California to Arizona? (MAP 8).

Only the two above-cited collections of this species are known. Jepson found but one plant and Palmer appears likewise to have found only one. The exact locality of Palmer's collection is uncertain. The data on labels vary. Some read merely "Southern Arizona", others "Near mouth of Colorado R.", and Engelmann's own "near the mouth of the Colorado River, Ariz."

This species is of particular phytogeographic interest in that it is seemingly an originally littoral species closely related to the common *E. polygonifolia* of the Great Lakes and Atlantic Coast. The rarity of this plant may well be due to the change from littoral to inland desert habitat caused by the geologically recent recession of the sea from the Salton Sink. The sea covered this area so recently that the old beach-line is plainly discernible and small delicate gastropod shells left lying on the desert have yet to disintegrate. Perhaps examination of the old beach line, particularly in sandy areas, will yield further collections.

3. Euphorbia ocellata Durand & Hilgard, Journ. Nat. Acad. Sci. ser. 2, **3:** 46. 1854.

Annual; stems prostrate, few to numerous, to 20 cm. long, often to 1.5 mm. diam., slightly longitudinally wrinkled, glabrous or pubescent, internodes 1–3 cm. long; leaves glabrous or pubescent, blades entire, ovate-deltoid-falcate, 4–10 mm. long, apex blunt or mucronulate, base oblique, midrib elevated beneath and lateral veins prominent, margin revolute, or ovate-lanceolate, 7–15 mm. long, acuminate, base obtuse and only slightly oblique, midrib not elevated below and lateral veins mostly obscure, margin plane; petioles 1.5–2 mm. long, amplexicaul on lower side of stem; stipules distinct or lower slightly united at the base toward the stem-tips, filiform or broader, entire or parted, glabrous or pubescent, 1–1.3 mm. long; peduncles stout, 2–4 mm. long, glabrous or pubescent; cyathia solitary at the nodes; involucres turbinate to campanulate, 1.5–2 mm. diam., five-lobed especially in the late season, glabrous or pubescent without, pubescent above within; lobes broadly deltoid, pubescent on inner side or both sides and opaque throughout or glabrous and hyaline above, variously toothed or nearly entire, equaling the glands; glands discoid or slightly radially elongate, 0.5–0.7 mm. diam., yellowish or reddish, on short stout stipes, glabrous or pubescent without and pubescent within; fifth gland linear, equaling the glands; glands exappendiculate or rarely with narrow white appendages; bracteoles nearly equaling the glands, in a group opposite each gland, more or less united below and adnate to the involucre, ca. 5–10 per group, tips heavily or sparsely beset with short stout hairs; staminate flowers 8–13 per fascicle, 40–60 per involucre; androphores 1.7–2 mm. long, glabrous, barely equaling or mostly shorter than the glands; gynophore glabrous or with short hairs above, long-exserted and usually reflexed at maturity; ovary three-angled, glabrous or pubescent; style ca. 0.5 mm. long, parted to the middle, glabrous throughout or pubescent below, divisions terete; capsules strongly three-lobed, 2–2.3 mm. long, broader than long, glabrous or with short spreading hairs, carpels rounded on the back and mostly with a very low channeled ridge on the back; seeds ovoid, with lateral angles barely visible or wanting, or turgidly quadrangular, suborbicular to ovate-acute radially, 1.4–1.7 mm. long, 1.1–1.3 mm. radially and tangentially, smooth to rugose, coat white, microreticulate, sometimes little obscuring the brown to gray testa.

Key to Varieties

Herbage glabrous.
  Median leaves ovate-lanceolate, not at all or very slightly falcate, acuminate, usually without evident lateral veins; seeds always smooth . . . . c. var. *arenicola*.
  Median leaves ovate-deltoid-falcate, blunt or mucronulate, lateral veins evident below; seeds often rugulose or rugose . . a. var. *typica*.
Herbage pubescent . . . . b. var. *Rattanii*.

3a. E. OCELLATA D. & H., Journ. Nat. Acad. Sci. ser. 2, **3**: 46. 1854, var. TYPICA L. C. Wheeler, Bull. Torr. Bot. Club **63**: 402. 1936. TYPE: Poso Creek, Kern County, California, *Dr. A. Heermann* (Ph!, possibly only isotype; photographs G!, W!). An average member of the species. Durand & Hilgard, Rep. Expl. Miss. R. to Pacific Ocean **5** (**3**): 15, t. 18. 1855, seed bad.—*Chamaesyce ocellata* (D. & H.) Millsp., Field Mus. Pub. Bot. **2**: 410. 1916.

Chamaesyce sulfurea Millsp., Field Mus. Pub. Bot. **2**: 405. 1916. TYPE: hills near Big Chico Creek, east of Chico, Butte County, California, Sept. 16, 1913, *A. A. Heller 11140* (F 411411!; photographs G!, W!; isotypes C!, D!, G!, M!, Ph!, US!). A local race with rugose-tuberculate seeds, seemingly too ill-defined for recognition.—*E. ocellata* D. & H. var. *sulfurea* (Millsp.) Jepson, Fl. Calif. **2**: 427. 1936.

Glabrous except within the involucre; median leaves ovate-deltoid-falcate, 4–10 mm. long, apex blunt or mucronulate, base oblique, midrib conspicuous, elevated, lateral veins evident, margin revolute; glands exappendiculate; seeds smooth to rugose, back and lateral angles visible.—PLATE 665A.

Cismontane valleys of California from Shasta County south to San Bernardino County (MAP 22). Representative specimens seen: CALIFORNIA. Siskiyou Co.: Dunsmuir, *Jepson 6159* (J). Tehama Co.: near Red Bluff, northeast side of Sacramento River, in the low hills, *Jepson 15279a* (J). Contra Costa Co.: Mount Diablo, *Jepson 13926* (J). Stanislaus Co.: La Grange, *Jepson 13925* (J). Monterey Co.: Jolon, *Vasey 577* (Ph).

Fresno Co.: Rancho Cantua, Cantua Creek, Sept., 1908, *Lillis* (J). Tulare Co.: Halstead's Ranch to Davis Ranch, north fork of Kaweah River, Sierra Nevada, *Jepson 577* (J). Kern Co.: Cottonwood Creek on River Road, between Bakersfield and Bodfish, *Abrams 5341* (NY); near Havilah, *Coville & Funston 1081* (US). San Bernardino Co.: sandy plains, Colton, 1882, *Pringle* (G, NY, Ph). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 403. 1936.

This entity is very uniform throughout most of its range. The plants of the San Bernardino region, though probably isolated at the same time as those of the Mohave Desert, show no significant differences from those of the Central Valley. Incidentally, collectors would do well to search for this plant near San Bernardino. Parish made several collections in this vicinity before 1900 but recent collectors have not found it. The uncultivated brushy plain northwest of Slover Mountain and north of Jurupa Mountains (Hills) is a likely place. The specimen from Dunsmuir in the Sacramento River canyon is probably a chance introduction. The small leaves, long internodes, and slender stems support this supposition.

At the extreme north end of its range *E. ocellata* breaks into local races. Var. *Rattanii*, q. v. infra, is the best marked. Var. *sulfurea* (Millsp.) Jepson is one of these ill-defined local races. I have no particular quarrel with anyone wishing to recognize it. Collectors will do well to secure a close series of *E. ocellata* at the north end of the Sacramento Valley around Chico and Oroville in order to determine the stability and range of var. *sulfurea* and the race north of Oroville. This race, which is usually readily recognizable by color, occurs at Table Mt. Olive Ranch, 7 miles north of Oroville, Butte Co. and is well represented by *A. A. Heller 11143* (C, G, M, NY, Ph, US). Another collection made at apparently the same place and season three years later, *Heller 12645* (F, G, M, NY, Ph, US) largely lacks the reddish cast but the foliage agrees fairly well in shape. The foliage and long internodes of this Oroville race bear a close resemblance to the var. *sulfurea* of the foothills near Chico. But the seed coats of the Oroville plants are only very slightly wrinkled instead of strongly rugose as in var. *sulfurea*. The plants of this Oroville race are usually reddish in color. Otherwise the species is yellow-green throughout except for some individuals of the pubescent var. *Rattanii.* Besides the elongate internodes the Oroville facies differs from var. *typica* in the slightly larger and less falcate leaves.

3b. E. OCELLATA D. & H. var. RATTANII (S. Wats.) L. C. Wheeler, Bull. So. Calif. Acad. Sci. **33:** 107. 1934.—*E. Rattanii* S. Wats., Proc. Amer. Acad. Arts & Sci. **20:** 372. 1885. TYPE: Stony Creek, Glenn County (formerly part of Colusa Co.), California, June 1884, *V. Rattan 57* (G!, fragment F!).—*Chamaesyce Rattanii* (S. Wats.) Millsp., Field Mus. Pub. Bot. **2:** 411. 1916.

Like variety *typica* but the herbage beset throughout with short stout hairs; upper half of the gynophore, the ovary, and styles pubescent in like manner; glands often with very narrow white appendages; seeds turgidly quadrangular, ovate-acute radially.—PLATE 665B.

Local in the Lower Stony Creek drainage, Glenn Co., California (MAP 24). Additional specimens seen: CALIFORNIA. Glenn Co.: Stony Creek, two miles north of Orland, *L. C. Wheeler 4041* (CL, Peir, P, W); gravelly bed of a large winter stream 5 miles east of Newville, *A. A. Heller 11555* (C, CA, D, F, G, M, NY).

This is certainly an incipient species. With only the type Watson was fully justified in believing it a distinct species for, in addition to the presence of appendages and pubescence, the seeds of the type are all dark gray and evidently angled. But in my collection made at the type locality some seeds were distinct as in the type but others matched those of var. *typica*.

3c. E. OCELLATA D. & H. var. ARENICOLA (Parish) Jepson, Man. Fl. Pl. Calif., 600. 1925.[1] *E. arenicola* Parish, Erythea **7:** 93. 1899. TYPE: Camp Cady (Sink of the Mohave River on some labels), Mohave Desert, San Bernardino County, California, *S. B. & W. F. Parish 1370* (D!; ISOTYPES C!, F!, G!, M!, Ph!, US!).—*Chamaesyce arenicola* (Parish) Millsp., Field Mus. Pub. Bot. **2:** 408. 1916.—*E. cuspidata* Engelm. ex Parish, Erythea **7:** 93. 1899, in synonymy; not A. Bertoloni, Misc. Bot. **2:** 9. 1843.

Leaves ovate-lanceolate, acute, to 15 mm. long, base slightly oblique, midrib straightish, not elevated below, lateral veins mostly obscure; seeds strictly ovoid or the back and lateral angles slightly evident, very smooth.—PLATE 665C.

Mohave Desert, California, east to Nevada, Utah, and northwestern Arizona (MAP 22). CALIFORNIA. Inyo Co.: Searle's Lake, *Jepson 7144* (J). San Bernardino Co.: sand hills, Soda

[1] Title-page date questionable but here accepted as no conflict as to priority is involved.

Lake, *Parish 10375* (CA, F, J). Nevada. Washoe Co.: Wadsworth, *Kennedy 918* (C, D, M, NY, US). Churchill Co.: Fallon, *Headley 42* (US). Truckee Desert, *S. Watson 1077* (US). Utah. near Pahvant Butte, *J. A. Harris 2534* (G). Arizona. Mohave Co.: Virgin River, *Purpus 6187* (C, NY). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 404. 1936.

4. Euphorbia Parryi Engelm., Amer. Nat. **9:** 350. 1875. Type: loose drifting sand, St. George, Washington County, Utah, 1874, *C. C. Parry 274* (M 144658!; photographs G!, W!; isotype G!). Rather small plants.—*Chamaesyce Parryi* (Engelm.) Rydb., Bull. Torr. Bot. Club **40:** 53. 1913.

E. petaloidea Engelm. δ *flagelliformis* Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 185. 1859. Type: valley of the Rio Grande near Frontera, subsaline sandy soil, El Paso County, Texas, July 26, 1851, *C. Wright 1826* (M 149817!; photographs G!, W!; isotype G!). Large plants.—*E. zygophylloides* Boiss. var. *flagelliformis* (Engelm.) Engelm. ex Boiss. in DC. Prod. **15** (**2**): 29. 1862.—*E. flagelliformis* (Engelm.) Engelm. in T. S. Brandegee, Bull. Geol. Geogr. Surv. Terr. **2:** 243. 1876.—*Chamaesyce flagelliformis* (Engelm.) Rydb., Bull. Torr. Bot. Club **33:** 144. 1906, Bull. Colo. Agr. Exper. Sta. **100:** 223. 1906 (Fl. Colorado).

E. longeramosa S. Watson, Proc. Amer. Acad. Arts & Sci. **25:** 161. 1890. Type: sand hills near Samalayuca, Chihuahua, Mexico, Sept. 13, 1888, *C. G. Pringle 2000* (G!; isotype M!). Large plants like type of *E. flagelliformis.*—*Chamaesyce longeramosa* (S. Wats.) Millsp., Field Mus. Pub. Bot. **2:** 410. 1916.

Annual, glabrous; stems prostrate to erect, 5–70 cm. long, leaves 5–28 mm. long, linear, entire, aequilateral, shortly petiolate; stipules distinct, linear, entire or parted; cyathia long-peduncled; involucres cupuliform-campanulate, 1.5–1.75 mm. in diam.; glands 0.3–0.5 mm. long, transversely oval, cupped; fifth gland linear, equaling the glands; sinus very broadly U-shaped, not depressed; appendages narrow, white, glabrous, entire, margining all except the inner side of the gland, ascending; androphores 40–55, 1–1.2 mm. long; capsule deeply 3-lobed to bluntly 3-angled, oblate-spheroid, 2 mm. long; seeds ovoid-triangular, 1.8 mm. long, narrowly ovate radially, mottled brown and white.—Plate 654D.

Southwestern Colorado; Utah and Nevada; San Bernardino County, California; Arizona; New Mexico; Western Texas; and northern Chihuahua, Mexico (Map 9). Representative specimens seen: Colorado. Montezuma Co.: sandy plains, San Juan Valley, 1875, *T. S. Brandegee* (M). Utah. Grand Co.: 5 miles west of Moab on desert, *Maguire & Redd 1958* (I, M). Kane Co.: Kanab, in sand, *Jones 6044* (M, NY). Washington Co.: 2½ miles west of Toquerville, *B. Maguire, Ruth Maguire & G. Piranian 12315* (G, I); Anderson's Ranch, *Maguire & Blood 1435*

(I). San Juan Co.: Copper Canyon, 2 miles from San Juan River, *Cutler 2286* (US); Wayland farm, Cottonwood Canyon, Bluff, *Maguire, Richards & Hammond 5744* (I); San Juan River near Montezuma Creek, *Eastwood 137* (G). NEVADA. Clark Co.: near Moapa, *Train 1875* (N). CALIFORNIA. San Bernardino Co.: Devil's Playground near Kelso, June, 1905, *K. Brandegee* (C); sand dunes near Kelso, May 15, 1939, *Jaeger* (G). ARIZONA. Mohave Co.: sand dunes, Beaver Dam Creek, Virgin River, *Goodding 759* (G, M, NY, US). Coconino Co.: Moqui Village, Aug., 1891, *Owens* (G); cindery soil near Tolchaco, *H. C. Hanson A210* (M, NY). Navajo Co.: Holbrook, *Rusby 827* (F, NY, Ph, US); Winslow, *Peebles 9599* (US). Apache Co.: Adamana, Sept. 1, 1909, *Rusby* (NY); Billings, on Puerco River, *Jones 4720* (I, NY, US). Graham Co.: Camp Goodwin, Gila Valley, *Rothrock 339* (M, US). Cochise Co.: Bowie, Sept., 1884, *Jones* (US); near Wilcox, Sept. 8, 1914, *Shreve* (W). NEW MEXICO. Doña Ana Co.: 2 miles northwest of San Miguel, *Fosberg S3785* (G, O); Straus' Station, 1912, *Stearns* (M). Socorro Co.: Sabinol, *Wooton 349* (M). TEXAS. El Paso Co.: *Cory 1922* (G). MEXICO. CHIHUAHUA: 36 miles south of Ciudad Juarez, *Shreve 7922* (W); Sapio, Sierra Madre, Sept. 10, 1903, *Jones* (M, US); Colonia Diaz, *Nelson 6455* (US).

5. EUPHORBIA AMMANNIOIDES HBK., Nov. Gen. & Sp. **2**: 55 (quarto), 44 (folio). 1817.[1] TYPE: In arenosis, Cumana, Venezuela, *Bonpland 406* (Herb. Mus. Paris; fragment F!, photograph G!).—*E. maritima* Willd. ex Boiss. in DC. Prod. **15** (**2**): 28. 1862, in synonymy.—*Chamaesyce ammannioides* (HBK.) Small, Fl. Se U. S., 709, 1333. 1903.

Chamaesyce Ingallsii Small, Fl. Se U. S., 708, 1333. 1903. TYPE: New Orleans, Louisiana, 1835, *Dr. Ingalls* (NY!, photographs G!, W!).—*E. Ingallsii* (Small) Cory, RHODORA **38**: 406. 1936.

Glabrous annual; stems usually prostrate, 4–40 cm. long, mostly 1–2 mm. thick, internodes 0.5–4.5 cm. long; leaf-blades 4–15 mm. long, mostly narrowly to broadly oblong, occasionally elliptic-oblong, apex sometimes mucronate, usually obtuse, base obtuse, inequilateral; petioles 1–2 mm. long; stipules glabrous, 1–1.3 mm. long, distinct, parted into usually 3 linear segments; peduncles short; cyathia solitary at the nodes; involucre obconical-campanulate, 1.2–1.6 mm. in diam., glabrous outside, short-hairy at the summit inside; lobes triangular, acuminate, tips glabrous, slightly exceeding the glands; glands subcircular to transversely elliptical or oblong, 0.4–0.6 mm. in diam., slightly cupped; appendages mostly narrower than the

[1] See J. H. Barnhart, Dates of the "Nova Genera" of Humboldt, Bonpland and Kunth, Bull. Torr. Bot. Club **29**: 585–598. 1902. The name, originally printed as *E. amannioides*, corrected to *E. ammannioides* by HBK. op. cit. **7**: 294 (quarto). 1825.

glands, rarely up to twice as wide; 5th gland linear, rarely of two parallel linear segments, ½ as long as to equaling the lobes; sinus U- to V-shaped, slightly depressed; bracteoles numerous, linear, often somewhat united below, glabrous below, short-hairy above, between and outside the staminate flowers, some adnate to involucre beneath the glands, a little shorter than the androphores; staminate flowers 5–16 per cyathium; androphores 1.4–2 mm. long, glabrous; gynophore glabrous, soon exserted and reflexed; ovary roundly 3-lobed; styles 0.35–0.5 mm. long, thick, bifid to about the middle, mostly clavate; capsule 2–2.1 mm. long, broader than long, wider below the equator, strongly roundly to subacutely lobed; seeds ovoid sub-triangular, 1.5–1.9 mm. long, 1.3–1.5 mm. tangentially, 1.3–1.5 mm. radially, coat mottled white, microreticulate.—PLATE 654B.

Coastal sands: southern Virginia, North Carolina, Florida west to Texas; northern South America (MAP 39). Representative specimens seen: VIRGINIA. York Co.: York River northwest of Yorktown, *Fernald & Long 7510* (G); York River above Yorktown, *Fernald & Long 12703* (W). Surry Co.: inner border of sand-beach of Cobham Bay, James River, northwest of Chippokes, *Fernald & Long 12705* (W). Isle of Wight Co.: inner border of sandy beach, Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), *Fernald & Long 12706* (W); inner border of sand beach along James River, Ragged Island, northeast of Carrollton, *Fernald & Long 12704* (W). Princess Anne Co.: Virginia Beach, *Heller 1231* (NY). NORTH CAROLINA. Carteret Co.: sand banks near Beaufort, *Lewis 164* (NY). FLORIDA. Duval Co.: Pablo Beach, *Lighthipe 427* (NY). Volusia Co.: Mosquito Inlet, *Moldenke 5301* (NY). Dade Co.: beach opposite Miami, *Small 2113* (NY). Lee Co.: seashore, Punta Rassa, *A. S. Hitchcock 320* (F, G, M, NY). Manatee Co.: Palmetto, *Nash 2448* (G, NY); Snead's Island, *Tracy 6376* (G, M, NY). Pinellas Co.: St. Petersburg, Aug. 5, 1894, *Lewton* (NY). MISSISSIPPI. Jackson Co.: Horn Island, *Tracy 4717* (NY); Dog Key, *Tracy & Earle 2882* (NY). Harrison Co.: Cat Island, *Lloyd & Tracy 207* (NY). LOUISIANA. Quemines Co.: Battledore Island, *Lloyd & Tracy 214* (G, M, NY). Jefferson Co.: south central Grande Isle, *Cangemi & Andrus 1* (NY). TEXAS: Cameron Co.: Boca Chica, *Clover 356* (NY).

Boissier in DC. Prod. **15** (**2**): 28. 1862 included *E. bombensis* Jacquin, Enum. Pl. Carib., 22, 1760 (not seen, but ed. 2, 1762 examined), Select. Stirp. Amer. Hist., 151. 1763, as a possible synonym, judging by the description, of *E. ammannioides*. I draw the same conclusion. However, until some of Jacquin's specimens of this species are located, I hesitate to use the name since the description is too vague to apply to any one species with certainty.

E. ammannioides presents a very puzzling problem, not only in its marked similarity to and close relationship with *E. Geyeri* but also in its internal heterogeneity. Floridan, Mississippian, and Louisianan specimens examined present, with but two exceptions, a reasonably uniform unit characterized by very narrow appendages, styles markedly clavate, and staminate flowers generally 5–7. The two exceptional collections are: FLORIDA. Manatee Co.: Snead's Island, Sept. 10, 1899, *Tracy 6376* (NY). Dade Co.: Sand dunes opposite Miami, Mar. 7, 1915, *J. K. & E. W. Small 5869* (NY). The first has 10–15 staminate flowers and appendages sometimes as wide as the glands. The second has the glands virtually obsolete on some involucres and the lobes strongly inflexed, making the involucre 5-lobed. The Virginian specimens are rather stunted and can be fairly well matched in aspect, though not in technical details, by some specimens of *E. Geyeri*. The Texan plants, of which there are but two collections available, have 7, 9, 9, 15, and 16 staminate flowers per cyathium in the five counted. *Clover 356* is particularly marked in its general coarseness and its appendages up to twice as wide as the glands. It has the styles thickened below and slightly tapering. The fragment of the type of *Euphorbia ammannioides* has 15 staminate flowers in the one cyathium dissected, appendages from narrower than to a little wider than the glands, and thick, very slightly clavate styles. The type, from Venezuela, seems about intermediate between the Texan and Floridan plants.

Heller 1231 from Virginia is *Euphorbia polygonifolia* in some herbaria. *Fernald & Long 7510* was also probably *E. polygonifolia* in part, for seeds of that species were intermixed. Professor Fernald informs me that at all stations in Virginia where *E. ammannioides* has been found *E. polygonifolia* is also present. The latter is paler in color and more inclined to occupy the lower border of the beach, near high-water mark, while *E. ammannioides* characterizes the sands farther back from shore.

6. EUPHORBIA GEYERI Engelm. in Engelm. & Gray, Bost. Journ. Nat. Hist. **5:** 260. 1845. TYPE: Beardstown, Cass County, Illinois, Aug., 1842, *C. A. Geyer* (M 47878!; photographs G!,

W!; ISOTYPES G!, NY!).—*E. Geyeri* Engelm. var. *microsperma* A. Gray, Man. Bot. No. U. S. ed. 2, 386. 1856.—*Anisophyllum Geyeri* (Engelm.) Klotzsch & Garcke, Abh. Akad. Berlin, Phys. **1859:** 23. 1860.—*Chamaesyce Geyeri* (Engelm.) Small, Fl. SE U. S., 709, 1333. 1903.

E. polyclada Boiss., Cent. Euph., 10. 1860. TYPE: "Collection du Texas oriental, faite en 1848–49, recue en 1850," *C. Wright* (Ge!; photographs G!, W!). The Texan phase with slightly more blunt seeds.—*Chamaesyce polyclada* (Boiss.) Small, Fl. Se. U. S., 711, 1333. 1903.

Glabrous annual; stems several, mostly prostrate, occasionally erect, 6 to 37 cm. long, 0.4–1.4 mm. thick, internodes up to 3 cm. long, average about 1 cm.; leaf-blades oblong to ovate-oblong to elliptic-oblong, 4–10 mm. long, margin entire, base oblique, apex obtuse or emarginate, usually mucronate; petioles 1–2 mm. long; stipules distinct, or the ventral united, glabrous, ca. 1.5 mm. long, mostly parted into 3 filiform segments; cyathia solitary, sometimes somewhat clustered by the shortening of the uppermost internodes; peduncles up to 2 mm. long; involucres broadly campanulate, slightly tapering to the peduncle, 1–1.1 mm. in diam., glabrous outside, with a few hairs at the summit inside; lobes triangular, acuminate, tips glabrous, slightly exceeding the glands; glands broadly oval to subrotund, slightly cupped to folded, 0.2–0.6 mm. long; appendages white, from one half to twice as wide as the gland, rounded or sometimes pointed, entire or slightly toothed; fifth gland linear, hairy below inside, ⅔ as long as, to equaling the lobes; sinus U-shaped, not depressed; bracteoles forming a radial partition beneath each gland, adnate to the involucre nearly up to the base of the stipe of the gland but with inwardly branching linear segments scattered along the inner edge, segments linear, bearing a few to many hairs at the apex, about equaling the androphores, bracteoles in addition often forming a sheath, parted into hairy segments above, outside each fascicle; staminate flowers 1–5 per fascicle 5–17 per cyathium; androphores glabrous, 1–1.3 mm. long; gynophore glabrous, soon exserted and reflexed; ovary 3-lobed; styles 0.3–0.6 mm. long, ⅓–½ bifid; capsule 2 mm. long, roundly and deeply 3-lobed, wider below the equator, base truncate; seed ovoid-subtriangular, ovate to narrowly ovate radially, 1.3–1.6 mm. long, 1 mm. tangentially and radially, coat smooth, microreticulate, white but the brown testa often showing through.—PLATE 654C.

Sandy barrens or dunes mostly along rivers, Wisconsin, Illinois, Minnesota, Iowa, North Dakota, Nebraska, south to northern Texas, west to eastern Colorado and New Mexico (MAP 20). Representative specimens seen: WISCONSIN. Pepin Co.: open dunes, upper terrace, Pepin, *Fassett 10260* (G). Trempealeau Co.: Trempealeau, *Fassett & Wilson 5308* (G). La

Crosse Co.: La Crosse, 1861, *Hale* (M). Lancaster Co.: Boscobel, 1861, *Hale* (G, M, NY). Illinois. Lee Co.: Dixon, *Vasey* (G). Henderson Co.: banks of Mississippi River, near Oquawka, Sept. 18, 1871, *Patterson* (G). Mason Co.: Havana, Aug. 18, 1904, *Gleason* (G). Minnesota. Anoka Co.: Moore Lake, sand dunes, *Rosendahl & Rydberg 5135* (G, Mi). Wabasha Co.: open sand, Weaver, *Fassett & Hotchkiss 3437* (NY). Winona Co.: Winona, Aug. 1898, *Holzinger* (Mi). Hennepin Co.: St. Anthony, 1861, *Hale* (M). Iowa. Benton Co.: Vinton, 1876, *Davis* (M). Muscatine Co.: Moscow, Aug. 1887, *Hitchcock* (M). North Dakota. McHenry Co.: Denbigh, sand hills, Aug. 18, 1935, *Stevens & Kluender* (G). Nebraska. Holt Co.: Paddock, *Clements 2784* (G, NY). Thomas Co.: near Plummer Ford, Dismal River, sand hills, *Rydberg 1504* (G, NY). Brown Co.: Long Pine, Aug. 13, 1898, *Bates* (G). Kansas. Hamilton Co.: sand hills, *Hitchcock 466* (G, M, NY). Oklahoma. Payne Co.: sandy woods, *Oliver 137* (NY). Creek Co.: Sapulpa, *Bush 527* (G, M, NY). Texas. Dallas Co.: Dallas, 1878, *Reverchon* (M). Parker Co.: Weatherford, *Tracy 7860* (G, M, Mo, NY). Andrews Co.: Shafter Lake, *Cory 16614* (W). New Mexico. Roosevelt Co.: 2 miles west of Bledsoe, Cochran Co., Texas, *Cory 16525* (W). Colorado. Morgan Co.: sand hill 4 miles south of Brush, *Ramaley & Ewan 16326* (W).

7. Euphorbia missurica Raf., Atlantic Journ. **1:** 146. 1832; L. C. Wheeler, Proc. Biol. Soc. Wash. **53:** 10. 1940.

Annual, glabrous; stems decumbent to erect, 5–65 cm. long, internodes of the main branches mostly 2–5 cm. long; leaf-blades broadly oblong to linear, mostly 1–3 cm. long, margin entire, base symmetrical to slightly inequilateral, apex obtuse to retuse, often mucronate, petioles 1–3 mm. long; stipules linear to triangular-subulate, distinct to partially united, entire to parted, glabrous, 1–1.5 mm. long; peduncles 1–11 mm. long; cyathia solitary but sometimes in terminal cymes of 3–5; involucres campanulate, 1.7–1.9 mm. in diam., glabrous outside, pubescent within at the summit; lobes triangular, about equaling to slightly exceeding the glands; glands subcircular to transversely oblong, 0.4–0.7 mm. in diam., cupped or folded; appendages white to pink, mostly conspicuous, glabrous, radially ovate to oblong-ovate, entire to slightly emarginate; fifth gland of one or two linear segments from ⅔ as long as to about equaling the lobes, pubescent below; sinus U-shaped, little or not at all depressed; bracteoles from partly united below into a radial partition adnate below to the involucre to mostly free, mostly glabrous throughout, sometimes pubescent at the tips; staminate flowers 29–48 per cyathium; androphores glabrous, 1.4–1.9 mm. long; gynophore glabrous, well-exserted and reflexed; ovary glabrous, 3-lobed; styles ca. ½ bifid, 0.7–0.9 mm. long; capsule strongly

3-lobed, 2–2.5 mm. long, from about as broad as long to broader than long; seeds ovoid to broadly ovoid-triangular, 1.5–2 mm. long, 1.1–1.4 mm. tangentially and radially, rotundly ovate to ovate-acute radially, angles faint to evident but blunt, coat mottled whitish and brown.

Key to Varieties

Leaves broadly oblong to linear, apex obtuse to slightly retuse; ultimate branchlets mostly more or less capillary; seeds scarcely angled, micropylar area not markedly flattened and truncate; peduncles up to 11 mm. long, capillary . . . . a. var. *typica*.

Leaves linear, apex truncate, mostly emarginate; ultimate branchlets not capillary; seeds mostly definitely angled, micropylar area obliquely truncate; peduncles up to 4 mm. long, stouter . . . . b. var. *intermedia*.

7a. E. missurica Raf., Atlantic Journ. **1:** 146. 1832, var. **typica.** Type: "Arkansa", *Nuttall* (NY!; photographs G!, W!). A fairly typical, though young, specimen.

E. zygophylloides Boiss., Cent. Euph., 10. 1860. Type: None of the original specimens from which Boissier drew his description has been seen. Consequently it seems inadvisable to select any type. The interpretation is certain since two of the numbers cited by Boissier have been seen at M.—*Chamaesyce zygophylloides* (Boiss.) Small in Britton & Brown, Ill. Fl. No. U. S. & Canada ed. 2, **2:** 161. 1913.

E. arenaria Nutt., Trans. Amer. Philos. Soc., n. s. **5:** 171. 1837, not H.B.K., Nov. Gen. et Sp. **2:** 57 (quarto), 45 (folio). 1817. Type: "Arkansa", [*Nuttall*?] (Ph!, perhaps only isotype; photographs G!, W!). Engelm. & Gray, Bost. Journ. Nat. Hist. **5:** 260. 1845 (Pl. Lindh.).—*E. petaloidea* γ *Nuttallii* Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 185. 1859.—*E. Nuttallii* (Engelm.) Small in Britton & Brown, Ill. Fl. No. U. S. & Can. **2:** 371. 1897.—*Chamaesyce Nuttallii* (Engelm.) Small, Fl. SE U. S., 711, 1333. 1903.—Plate 666B.

Missouri, northwestern Arkansas, Kansas, south to Texas (Map 13). Representative specimens seen: Missouri. Barry County: Eagle Rock, *Bush 75* (M, NY). Cass Co.: July, 1865, *Broadhead* (M). Henry Co.: 3 miles northeast of Finey, *Steyermark 15972* (M, Mo). Jackson Co.: Greenwood, *Bush 10336A* (M, NY); Dodson, *Bush 506* (M, NY); Cockrell, *Bush 6487A* (M); Westport, Sept. 13, 1896, *K. K. Mackenzie* (M, Ph). Stone Co.: along east side of White River, south of mouth of Big Creek, north of Mill Creek, *Steyermark 19642* (M, Mo). Arkansas. Carroll Co.: Beaver, *E. J. Palmer 6333* (M). Kansas. Ellis Co.: near Hays, *Bondy 291* (M, Mo). Geary Co.: Junction City, *A. Brown 178* (NY). Miami Co.: Paola, *Oyster 7306* (NY). Osage Co.: Osage City, Aug., 1890, *Bodin* (NY). Riley Co.: Stony hills, *Norton 468* (M, NY). Oklahoma. Comanche Co.: Fort Sill, *Clemens 11671* (M). Johnston Co.: Tishomingo, *E. J. Palmer 6426* (M). Kiowa Co.: Wichita Mountains, July 27, 1891, *Sheldon* (M). Love Co.: Marietta, *E. J. Palmer 10406* (M). Murray Co.: Platt National Park, Bromide Hill, *G. M. Merrill 676* (NY). Ottawa Co.: near Miami, *G. W. Stevens 2344* (NY). Pawnee Co.: Cleveland, *E. J. Palmer 6379* (M). Payne Co.: 18 miles southeast of Stillwater, *Stratton 206* (M). Texas. Austin Co.: Industry, July, 1844, *Lindheimer* (M, Ph). Bexar Co.: near Bracken, *Groth 55* (NY). Burnet Co.: 3.1 miles north of Burnet, *Cory 15617* (W). Dallas Co.: Dallas, *Bush 1140* (M, NY). Gillespie Co.: Squaw Creek, *Jermy* (M). Grimes Co.: Anderson, *G. L. Fisher 37217* (F). Hays Co.: San Marcos, *Stanfield* (NY). Houston Co.: Grapeland, *E. J. Palmer 12832* (M). Parker Co.: Weatherford, *Tracy 8124* (M, Mo, NY, Ph). Tarrant Co.: Fort Worth, *Tracy 8168* (M, Mo, NY). Travis Co.: Austin, *Tharp 2854* (US). Washington Co.: Mill Creek, *Lindheimer 186* (M).

The Nuttallian rather than the James specimen is taken as type of *E. missurica* because the latter is a sterile seedling while the former *had* at least one cyathium from which Torrey drew the essential characters.

E. zygophylloides var. *cymulosa* Engelm. ex Boiss. in DC. Prod. **15** (**2**): 29. 1862. This probably belongs here but the only apparently authentic material seen bore this varietal name but was placed under another species.

The intergradation between var. *typica* and var. *intermedia* is complete and there are plants which cannot be definitely assigned to either. Examples of such intergradation are the following collections:

Kansas. Barber Co.: Kiowa, *Rydberg & Imler 662* (NY). Cowley Co.: no loc., Aug. 3, 1898, *M. White* (NY). Oklahoma. Woods Co.: Alva, *G. W. Stevens 2960* (NY). Texas. Llano Co.: Llano, *E. J. Palmer 10285* (M).

7b. Euphorbia missurica Raf. var. intermedia (Engelm.) L. C. Wheeler, Proc. Biol. Soc. Wash. **53**: 11. 1940; based on *E. petaloidea* Engelm. β *intermedia* Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 185. 1859. Type: Fort Pierre, Standley County, South Dakota, June 21, 1853, *F. V. Hayden* (M 149949!; photographs G!, W!).

E. petaloidea Engelm., l. c. Type: Forks of the Platte River, Lincoln County, Nebraska, July, 1858, *Henry Engelmann* (M 149966!; photographs G!, W!). Boiss. in DC. Prod. **15** (**2**): 28. 1862; Small in Britton & Brown, Ill. Fl. No. U. S. & Canada **2**: 371. 1897, seeds poor.—*Chamaesyce petaloidea* (Engelm.) Small, Fl. Se. U. S., 711, 1333. 1903.

E. petaloidea α *Nicolletii* Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 185. 1859. TYPE: mouth of Powder River, Yellowstone, Prairie County, Montana, July, 1854, *F. V. Hayden* (M 202539!).

Minnesota, west to eastern Montana, south to Texas and New Mexico (MAP 13). Representative specimens seen: MINNESOTA. Ottertail Co.: Clitherall, July, 1897, *J. E. Campbell* (M, Mi, US); sandy beach of Ottertail Lake, *Moyle 2333* (Mi); sandy shore of Battle Lake, *Rosendahl 4177* (Mi). NORTH DAKOTA. Slope Co.: Bad Lands, Marmarth, *L. R. Moyer 741* (Mi). SOUTH DAKOTA. Fall River Co.: Hot Springs, *Hayward 546* (NY). Potter Co.: Forest City, Sept., 1892, *T. A. Williams* (M). NEBRASKA. Banner Co.: *Rydberg 353* (NY). Brown Co.: Long Pine, *Conklin* (NY). Cherry Co.: Valentine Lakes Refuge, Aug. 10, 1937, *Tolstead* (W). Custer Co.: Anselmo, *Webber 11* (NY). Dawson Co.: Near Gothenburg, *Heller 14300* (M). Deuel Co.: July, 1890, *Rydberg* (NY). Hooker Co.: on Middle Loup River, near Mullen, *Rydberg 1372* (NY). Scott's Bluff Co.: Kiowa Valley, *Rydberg 353* (NY). Sioux Co.: *Kramer 152* (M). Thomas Co.: Dismal River, *Webber 2* (NY). KANSAS. Clark Co.: 10 miles south of Ashland, *Rydberg & Imler 747* (NY). Graham Co.: Bogue, *Imler 63* (M, NY). Grant Co.: Ulysses, *C. H. Thompson 60* (M, NY). Hamilton Co.: Syracuse, *Rose & Fitch 17099* (NY). Kearney Co.: 13 miles south west of Lakin, *Rydberg & Imler 919* (M, NY). Logan Co.: *A. S. Hitchcock 467a* (M, NY). Osborne Co.: Osborne City, *Shear 126* (NY). Reno Co.: Hutchinson, *Smyth 45* (US). Riley Co.: *Norton 467* (M, NY). OKLAHOMA. Alfalfa Co.: near Cherokee, *G. W. Stevens 622* (M). Beaver Co.: north of Beaver, *E. J. Palmer 41887* (M). Cleveland Co.: Norman, *Emig 525* (M). Harper Co.: north of Rosston, *G. J. Goodman 2197* (M). Payne Co.: 18 miles southeast of Stillwater, *Stratton 656* (M). TEXAS. Bailey Co.: 2 miles south of Muleshoe, *Ferris & Duncan 3422* (M, NY). Callahan Co.: Baird, *E. J. Palmer 14542* (M). Eastland Co.: 3½ miles east of Ranger, *Cory 13130* (W). Grayson Co.: Denison, *Stuart 147* (M). Hall Co.: Estelline, *Reverchon 3799* (M). Hartely Co.: 5.3 miles southwest of Middlewater, *Cory 16313* (W). Hemphill Co.: prairie north of Canadian, Aug. 10, 1900, *Eggert* (M). Hood Co.: Granberry, *Reverchon 3797* (M). Mitchell Co.: Colorado, *Tracy 8121* (M, Mo, NY). Motley Co.: 16.4 miles north of Matador, *Cory 16037* (W). Wilbarger Co.: Pease River near Vernon, *Ferris & Duncan 3353* (M). WYOMING. Natrona Co.: Alcova, *Goodding 161* (M, NY). COLORADO. Boulder Co.: Boulder, *Penard 301* (NY). Cheyenne Co.: S1, T14S, R51W, *Owenby 1350* (M, NY). Denver Co.: Denver, *Jones 292* (M). Huerfano Co.: La Veta, *Clements 152* (NY). Morgan Co.: 4 miles south of Brush, *Ramaley & Ewan 16325* (W). Weld Co.:

Crow Creek, *Pollard 92* (NY). New Mexico. Chaves Co.: 20 miles south of Roswell, *F. S. & E. S. Earle 279* (M, NY). Lea Co.: sandhills near Loving, *Standley 40362* (US). Union Co.: on the Cimarron, *Wislizenus 464* (M).

8. Euphorbia gracillima S. Watson, Proc. Amer. Acad. Arts and Sci. **21:** 438. 1886. Type: Hacienda San Miguel, near Batopilas, southwestern Chihuahua, Mexico, Aug., 1885, *Ed. Palmer 68* (G!). (Watson published the locality as "Hacienda San Jose" which seems to have been a *lapsus calami.*)—*Chamaesyce gracillima* (S. Wats.) Millsp., Field Mus. Pub. Bot. **2:** 409. 1916.

Glabrous erect annual 8–18 cm. tall; main stem up to 2 mm. thick at base, soon forking repeatedly into branches with internodes up to 2 cm. long below, progressively shorter toward the tips, ultimate branchlets ca. 0.1 mm. thick; leaves 2–15 mm. long; blades narrowly linear, margin entire, revolute; petioles 0.3–0.6 mm. long; stipules entire, distinct, glabrous, linear-subulate, 0.3–0.5 mm. long; cyathia solitary in the bifurcations; peduncles 0.3–0.9 mm. long; involucre turbinate, tapering to the peduncle, 0.5–0.7 mm. in diam., glabrous outside, with short hairs within at the summit; lobes triangular, acuminate, slightly exceeding the glands, ciliate on the margin; glands transversely oval, slightly cupped, 0.15–0.3 mm. long; appendages radially as long as glands or longer, slightly tapering and obtuse to bifid; 5th gland filiform, ca. ½ as long as the lobes or wanting; sinus U-shaped, little depressed; bracteoles linear, entire, glabrous or with a few short hairs above, slightly shorter than the androphores, one united to the involucre beneath each gland; staminate flowers 1–2 per fascicle, 5–12 per cyathium; androphores glabrous, included, 0.6–0.7 mm. long; gynophore glabrous, soon exserted and reflexed; ovary 3-angled, glabrous; styles ca. 0.5 mm. long, bifid; capsules glabrous, ca. 1.3 mm. long, sharply 3-angled, slightly wider below the equator, base truncate; seeds tetragonal, sharply angled, 1–1.1 mm. long, ca. 0.6 mm. radially and tangentially, radially narrowly ovate, acute, base truncate, facets all smooth, coat white but very thin, the brown testa scarcely obscured, with longitudinal rows of reticulations.—Plate 667A.

Arizona, south to Sinaloa, east to the Pacific slope of Chihuahua (Map 10). Representative specimens seen: Arizona. Pima County: Recreation Center, Tucson Mountains, *Shreve 6320* (Sh); Sells, *Harrison & Kearney 8037* (NY); near Tucson, *Harrison 8142* (A, US). MEXICO. Sonora: Bajada south of Las Trincheras, *Shreve 6375* (Sh); hills and mesas near Altar, Aug. 12, 1884, *Pringle* (G, US); San Bernardo, gravelly soil, alt. 250–300 m., *Pennell 19730* (US); Hermosillo, *M. E. Jones 22604* (possibly *21605*) (G); Chorijoa, Rio Mayo, in the sand, river bank, *Gentry*

1608 (G). SINALOA: Culiacan, Sept. 8, 1904, *T. S. Brandegee* (G); Culiacan, Oct., 1904, *T. S. Brandegee* (US).

9. EUPHORBIA REVOLUTA Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 186. 1859. TYPE: between Santa Fe and Moro (Mora?) River, in the mountains about the base of trees and shrubs, New Mexico, Aug. 10–16, 1847, *A. Fendler 789* (M 200216!; photographs G!, W!; ISOTYPE G!). Boiss., Icon. Euph., t. 13. 1866.—*Chamaesyce revoluta* (Engelm.) Small, Fl. SE U. S., 711, 1333. 1903.

Glabrous erect annual 3–20 cm. tall: main stem up to 2 mm. thick at the base, soon forking repeatedly into branches with internodes up to 3 cm. long below, progressively shorter toward the tips, ultimate branchlets 0.15–0.25 mm. thick; leaves 2.5–26 mm. long, largest leaves on any plant mostly over 1 cm. long; blades narrowly linear, margin entire, revolute; petioles 0.5–1.5 mm. long; stipules entire, distinct, glabrous, linear-subulate, attenuate, 0.3–0.8 mm. long; cyathia solitary in the bifurcations; peduncles 0.5–1.4 mm. long; involucres broadly obconical to turbinate, tapering to the peduncle, 0.9–1 mm. in diam., glabrous outside, with short hairs around the summit inside or glabrous; lobes triangular, acuminate, slightly to markedly exceeding the glands; glands subcircular, 0.15–0.3 mm. in diam., slightly cupped; appendages from a mere swelling beneath the gland to radially elongated and nearly as long as the gland; 5th gland linear, ca. half as long as the lobes; sinus V-shaped, little depressed; bracteoles linear, entire, or bifid, with a few short hairs above or glabrous, ca. ⅔ as long as the androphores, one united to the involucre beneath each gland; staminate flowers 1–3 per fascicle, 5–10 per cyathium; androphores 0.7–0.9 mm. long, glabrous, included; gynophore glabrous, soon exserted and usually reflexed; ovary 3-angled, glabrous; styles ca. 0.5 mm. long, entire or sometimes very shortly bifid, spreading, with erect tips; capsule glabrous 1.3–1.4 mm. long, sharply 3-angled, slightly wider below the equator, base truncate; seeds triangular-pyramidal to tetragonal, sharply angled, 1–1.3 mm. long, 0.7–0.9 mm. tangentially, 0.6–0.8 mm. radially, radially ovate-acute with truncate base, ventral facets concave and nearly smooth or face rounded, traversed by two (rarely 1) transverse rounded ridges, angles sharp, the ridges and valleys passing through them but slightly, or not at all, coat white, microreticulate, the brown testa sometimes showing through.—PLATE 667B.

Colorado, New Mexico, Chihuahua, and Arizona (MAP 8). Representative specimens seen: COLORADO. Fremont County: Canyon City, *Clements 272* (NY); rocky hills near Canyon City, *Biltmore Herb. 6415* (US). NEW MEXICO. San Miguel-Guadalupe County: between Anton Chico and Las Vegas, *Rose & Fitch 17638* (M, NY, US). Sandoval-Bernalillo County: Sandia

Mountains near La Luz Mine, *Ellis 555* (US). Sante Fe Co.: Santa Fe, *Rose & Fitch 17690* (M, NY, US). Lincoln County: Gray, *Skehan 118* (NY, US). Sierra County: 1 mile west of Hillsboro, *Metcalfe 1267* (G, M, NY, US). Doña Ana County: Little Mountain near Las Cruces, *Wooton 348* (M, US); west of the Organ Mountains, Sept. 1, 1908, *Wooton & Standley* (US). Grant County: Fort Bayard, *Mulford 945* (M, NY). ARIZONA: Mohave County: Kingman, Aug. 13, 1911, *Wooton* (US). Coconino County: northern foothill region of San Francisco Peaks, *Leiberg 5969* (US). Yavapai County: Clarksdale, *W. W. Jones C287* (G). Pima County: Davidson's Canyon, Sept. 8, 1884, *Pringle* (US). Gila County: Pinal Creek, *Harrison & Kearney 8291* (G). Santa Cruz County: Nogales, *Peebles, Harrison & Kearney 4589* (US). Cochise County: Bisbee, Oct. 4, 1890, *Lloyd* (G, US); Cave Creek, Chiricahua Mountains, *Harrison & Kearney 6164* (G). MEXICO. CHIHUAHUA: near Colonia Garcia in the Sierra Madre, *Townsend & Barber 284* (M, US); hills near Chihuahua, *Pringle 299* (M); 6 miles east of Piloncillo, road from Jimenez to Camargo, via El Arroyo del Fierro, *I. M. Johnston 7874* (G).

Chas. Wright no. 1830 would have been taken as the type collection, as it was more widely distributed in herbaria than *Fendler 789*, if it were not for the fact that Asa Gray, in making up Wright's sets, combined two of Wright's collections under *no. 1830*. This fact is inferred from the presence in the pocket on one of the two sheets of this *no. 1830* at the Gray Herbarium of two of Wright's original collection-numbers. Omitting the details of the method of elimination, the data for the numbers are "298. Stony hills at the Copper Mines, Aug. 18, 1851", New Mexico; and "524. On the Sonoita near Deserted Rancho, Sept. 15, 1851", Santa Cruz County, Arizona.

10. EUPHORBIA FLORIDA Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** [1]: 189. 1859. TYPE: Valley west of the Chiricahua Mountains, Cochise County, Arizona, Sept. 8, 1851, *C. Wright 1829* (M 149820!; photographs G!, W!; ISOTYPE G!). Boiss., Icon. Euph., t. 14, 1866.—*Chamaesyce florida* (Engelm.) Millsp., Field Mus. Pub. Bot. **2**: 409. 1916.

Glabrous erect annual 15–65 cm. tall; stem mostly branched from the base, rarely simple, 1–6 mm. thick at the base, internodes up to 7 cm. long, gradually shortened toward the stem tips; leaves linear, 1.5–6 cm. long or the uppermost much reduced in late season, margin remotely and sharply serrulate, revolute at least on drying, petioles 1.5–2 mm. long; stipules 1–2 mm. long, distinct, linear-subulate, mostly with one or two linear lobes near the base, glabrous or sometimes with a few cilia; cyathia solitary at the nodes or somewhat clustered at the branch-tips; peduncles up to 6.5 mm. long but mostly much shorter; involucre campanulate, 1.4–2 mm. in diam., glabrous without, densely pubescent above inside; lobes slightly exceeding the glands, triangular, acuminate, entire or the distal with one or two erect teeth on the sides and the proximal sometimes many-toothed; glands circular or nearly so but often folded together, 0.5 mm. in diam.; appendages conspicuous, white, often rubescent, obovate to elliptic to elliptic-oblong (radially) 1–2.8 mm. long, glabrous; 5th gland filiform, ca. ⅔ as long as to nearly equaling the lobes; sinus U-shaped, slightly depressed; bracteoles forming a radial partition opposite the glands, adnate to the involucre for about half its length, united to the gynophore at the very base, upper half of 3–6 filiform ciliate segments equaling the androphores; staminate flowers 9–12 per fascicle, 37–58 per cyathium; androphores 1.9–3 mm. long, glabrous, included; gynophore glabrous, soon exserted and reflexed; ovary glabrous, roundly 3-lobed; styles bifid ½–¾ distance to the base, 1–1.3 mm. long; capsule glabrous, oblate-spheroidal and nearly symmetrical, rounded-triangular in horizontal cross section, ca. 2.5 mm. long; seeds subtetragonal, lateral and dorsal angles slightly winged, ventral angle very low, 1.7–2 mm. long, 1.3–1.6 mm. radially, 1.4–1.7 mm. tangentially, radially broadly ovate, base truncate, facets smooth except for two (rarely three on dorsal facets) low transverse ridges which do not pass through the angles, occasionally the ridges irregular; white cellularly microreticulate coat mostly thick enough to make the seeds a dull white to sordid.—Plate 667C.

Southern Arizona, south to Sinaloa (Map 17). Representative specimens seen: Arizona. Yavapai Co.: Fort Whipple, Rio Verde, *Coues & Palmer 531* (M). Gila Co.: Rock Creek, *Collom 314* (M, US). Graham Co.: Camp Grant, *Ed. Palmer 237* (M). Pima Co.: near Baboquivari Canyon, *Peebles, Harrison & Kearney 2773* (M, US); foothills of Santa Catalina Mountains, July 30, 1881, *C. G. Pringle* (M, US); Baboquivari Mountains, *M. E. Jones 24862* (G, NY); Santa Rita Forest Reserve, *Griffiths & Thornber 8* (NY, US); small range reserve near Tucson, *Griffiths 6172* (US); common on range reserve, Wilmot, *Thornber 136* (M). Cochise Co.: San Bernardino Ranch, Mex. Boundary line, *Mearns 611* (US); Rucker Valley, *Lemmon 469* (G); Bowie, *M. E. Jones 4263* (I, NY, US). MEXICO. Sonora: arroyo, Los Conejos, Rio Mayo, *Gentry 1119* (G, W); La Cruz de las Cañadas, *Lloyd 463* (G); high mountains, Guaymas, Sept., 1887, *Palmer 209* (G, US); Alamos, *Palmer 640* (G, US); San Bernardo, Rio Mayo, *Gentry 1148* (Sh); 5 miles east of Garumbullo, *Wiggins 6124* (US). Sinaloa: Cofradia, vicinity of Culiacan, Oct. 21, 1904, ***T. S. Brandegee*** (G).

11. Euphorbia trachysperma Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 189. 1859. Type: low damp soil near the San Pedro River, Cochise County, Arizona, Sept. 9, 1851, *Wright 1832* (M 200493!; photograph G!, W!; isotypes G!, NY!). —*Chamaesyce trachysperma* (Engelm.) Millsp., Field Mus. Pub. Bot. **2**: 412. 1916.

Erect glabrous annual 15–40 cm. tall; stems mostly branching from the base, 0.7–3 mm. thick, internodes up to 6 cm. long; blades linear, lanceolate, ovate-lanceolate and obtuse, to oblong, 1–4 cm. long, margin serrulate at least at the apex; petioles 1–2 mm. long; stipules distinct, 1–1.4 mm. long, bearing a few cilia or glabrous, mostly divided above into 3 segments, the middle greatly exceeding the two lateral; cyathia solitary at the nodes; peduncles up to 5 mm. long but mostly shorter; involucres campanulate, 1.7–2.1 mm. in diam., 3–3.5 mm. long, glabrous outside, shortly hairy on upper half inside; lobes broadly triangular, acuminate, slightly to markedly exceeding the glands; glands transversely oval to subcircular, more or less folded, 0.5–0.7 mm. long; appendages white, about half as wide as to a little wider than the glands, entire; fifth gland filiform, ca. ⅔ as long as lobes; sinus broadly V-shaped, not depressed, with a tuft of hair in the fundus; bracteoles forming a radial partition adnate to the lower half of the involucre and completely surrounding the inner side of the fascicles at the base, parted above into 3 or 4 linear, shortly hairy segments about equaling the androphores; staminate flowers 10–13 per fascicle, 54–63 per cyathium; androphores glabrous, 2–2.8 mm. long; gynophore glabrous or rarely with a few hairs, soon exserted and reflexed; ovary glabrous, roundly 3-lobed; styles 0.7–1 mm. long, bifid to the middle; capsule glabrous, 3.1–3.3 mm. long, very short-cylindric but slightly narrower above, sharply 3-angled, base truncate, apex obtuse; seeds grayish-brown, quadrangular, dorsal and lateral angles sharp, ovate to narrowly ovate radially, base truncate, apex acute, 2–2.3 mm. long, tangentially 1.3–1.7 mm., radially 1.3–1.6 mm., ventral facets plane or slightly concave, dorsal facets convex, surface of seed slightly rough with scattered irregular pits, angles irregularly notched, or ventral facets with two or three faint transverse grooves.—Plate 667D.

Southern Arizona, south to Sonora (Map 21). Representative specimens seen: Arizona. Yuma Co.: west of La Paz, 1869, *Ed. Palmer 20* (US). Pima Co.: Tucson, 1867, *Dr. Smart* (US). Pinal Co.: Maricopa, *Thornber 9141* (T). MEXICO. Sonora: high mesas, Guaymas, Sept., 1887, *Ed. Palmer 183* (G, US); in an enclosure, Guaymas, Oct., 1887, *Ed. Palmer 319* (G, US); Ciudad Obregon, *Gentry 266* (G).

12. Euphorbia hyssopifolia L., Syst. Nat. ed. 10, **2**: 1048. 1759. Type: Probably from Jamaica, *Patrick Browne* (Linnaean

Herb., not seen; photograph G!; rephotograph W!). The narrow-leaved extreme. Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 432. 1917.—*Anisophyllum hyssopifolium* (L.) Haw., Syn. Pl. Succ., 161. 1812; Klotzsch & Garcke, Abh. Akad. Berlin, Phys. **1859:** 35. 1860.—*E. hypericifolia* L. "β *hyssopifolia*, L.", Griseb., Fl. Brit. W. I. Is., 54. 1859; published as quoted.—*E. brasiliensis* Lamarck var. *hyssopifolia* (L.) Boiss. in DC. Prod. **15** (**2**)**:** 24. 1862.—*Chamaesyce hyssopifolia* (L.) Small, Journ. N. Y. Bot. Gard. **3:** 429. 1905.

E. brasiliensis Lamarck *sensu* Boiss. in DC. Prod. **15** (**2**)**:** 24. 1862 and most subsequent authors.—*Chamaesyce brasiliensis* (Lamarck) Small, Fl. Se. U. S., 712, 1333. 1903, *sensu* Small, l. c., and subsequent publications in part.

E. Jonesii Millsp., Pittonia **2:** 89. 1890. Type: Bowie, Cochise County, Arizona, Sept. 17, 1884, *M. E. Jones 4247* (F 196592!; photographs G!, W!; isotypes O!, US!). The large-seeded western facies of the species.—*Chamaesyce Jonesii* (Millsp.) Millsp., Field Mus. Pub. Bot. **2:** 410. 1916.

E. stenomeres Blake, Contr. U. S. Nat. Herb. **24:** 13. 1922. Type: Open hillsides wooded with pine, trail from Los Amates to Izabal, Department of Izabal, Guatemala, May 31, 1919, *S. F. Blake 7776* (US 989628!, photograph G!, W!). Appears to be a good match for the type of *E. hyssopifolia* L.

Annual or sometimes perhaps overwintering; stems mostly erect, mostly glabrous, sometimes sparsely pilose in Arizonan plants, simple below or sometimes branched from the base, 8–60 cm. tall, mostly 1–3 mm. thick, internodes mostly 1–3 cm. long, rarely up to 6; leaves 5–30 mm. long, lanceolate and often falcate to oblong, all leaves often small in over-wintering plants, mostly glabrous, sometimes sparsely pilose especially toward the base, base inequilateral, margin usually serrate; petioles 1–1.5 mm. long; stipules mostly united, for the most part triangular and as broad as high with slightly lacerate and occasionally ciliate margin, toward the branch-tips sometimes partly distinct, narrowly triangular, up to ca. 1 mm. long, with erect linear teeth; cyathia solitary in the upper bifurcations and in few-flowered leafy cymes; peduncles 0.5–2 mm. long, glabrous; involucres obconical to obconic-campanulate, tapering to the peduncle, 0.7–0.9 mm. in diam., glabrous outside, glabrous inside except at the base of the lobes and on the stipes; lobes triangular, attenuate, slightly exceeding the glands, distal mostly entire, proximal often with erect linear teeth; glands circular to broadly elliptical transversely, 0.15–0.3 mm. long; appendages white or sometimes reddish in age, glabrous, entire, ⅓ as wide as to twice as wide as the gland, semilunate; fifth gland linear, ca. ½ as long as the lobes; sinus U-shaped, slightly depressed; bracteoles forming a very narrow radial partition adnate to the involucre below each gland, free portion parted into few linear subglabrous segments; staminate flowers 4–15 per cyathium; androphores glabrous, 0.9–1.3 mm. long; gynophore glabrous, well-exserted and usually reflexed; ovary glabrous, strongly 3-lobed; styles glabrous, 0.5–0.9 mm. long, bifid ½–⅔ to base; capsule glabrous, broadly ovoid, wider below the equator, 1.6–2.1 mm. long, strongly and subacutely 3-lobed; seeds ovoid-subquadrangular, 1–1.4 mm. long, 0.7–1.1 mm. tangentially and radially, radially ovate to elliptical-ovate, ventral facets slightly concave to slightly convex, dorsal facets convex, both with very shallow depression from half as wide as to as wide as the facet, separated by very low smooth ridges, chocolate-brown to grayish-white.—Plate 656D.

South Carolina, Florida, Louisiana, western Texas, southern New Mexico, and Arizona; generally distributed south to temperate South America (Map 38). Representative specimens from the United States: South Carolina. Colleton Co.: 3 miles south of Walterboro, *Wiegand & Manning 1817* (G). Florida. Alachua Co.: campus, Gainesville, *O'Neill 458* (US). Lake Co.: near Eustis, *Nash 930* (G, M, NY, US). Orange Co.: Orlando, *Curtiss 6670* (G, M, US). Dade Co.: Miami, *Demaree 10214* (M, US); Arch Creek Prairie, *J. K. Small, Mosier & G. K. Small 6800* (NY, US); Buena Vista, *Moldenke 328* (M, NY, US). Lee Co.: Myers, *A. S. Hitchcock 324* (G, M, NY, US); near Punta Rassa, *J. P. Standley 307* (G, M, US); near Fort Myers, *P. C. Standley 12656* (US). Manatee Co.: Manatee, *Webber 26* (M). Hillsborough Co.: *Fredholm 6280* (G, US). Pinellas Co.: St. Petersburg along beach, *Tidestrom 7028* (US); near St. Petersburg, *Deam 2758* (G, M). Franklin Co.: cultivated at Apalachicola, *Biltmore Herb. 3844*[a] (G, M, NY, US). Louisiana. Plaquemines Co.: Port Eads, *Lloyd & Tracy 213* (NY). Texas. Jeff Davis Co.: Fort Davis, Davis Mountains, *Ferris & Duncan 2698* (M, NY). Brewster Co.: Alpine, *Hughes 22* (NY); Oak Canyon, Chisos Mountains, *Cory 7005* (G); Lower Green Gulch, Chisos Mountains, *Sperry 450* (US); Sunny Glenn, *Sperry T244* (US). New Mexico. Doña Ana Co.: Organ Mountains, *Wooton 609* (M, NY, US); east side Organ Mountains, Aug. 17, 1895, *Wooton* (NY, US); Van Pattens, Organ Mountains, Sept. 10, 1899, *Wooton* (NY, US). Luna Co.: Cedar Springs, Florida Mountains, *Mulford 1037a* (M, NY). Arizona. Yavapai Co.: Camp Lincoln, 1869, *Ed. Palmer* (US). Maricopa Co.: Mesa, *Peebles, Harrison & Kearney 224* (US). Gila Co.: Sierra Ancha, *Harrison & Kearney 5682* (A, US). Graham Co.: near Safford, *Maguire, Richards & Moeller 16018* (G, I). Pima Co.: Tucson, May 1, 1894, *Toumey* (NY, US); Santa Cruz Valley near Tucson, June 20, 1881, *Pringle* (G, M, NY, US); Baboquivari Mountains, *M. E. Jones 24859* (G, NY); Santa Catalina Mountains, *Harrison*

& Kearney 8045 (US). Santa Cruz Co.: Nogales, *Peebles, Harrison & Kearney 4590* (US); Nogales, *Peebles & Harrison 4692* (US). Cochise Co.: near Fort Huachuca, *Wilcox 320* (US); Portal, Chiricahua Mountains, *Eggleston 10725* (US); Fort Lowell, *Thornber 209* (M, NY).

E. brasiliensis Lamarck, Encyc. Meth. Bot. **2:** 423. 1786, has generally been considered as conspecific with *E. hyssopifolia* L. However, the ovary and capsule of *E. hyssopifolia* and what has been known as *E. brasiliensis* are noted for being quite glabrous. Examination of two fragments of *E. brasiliensis* at F, one supposedly from the type, collected by *Commerson* in Brazil, and the other from an isotype both at Herb. Mus. Paris, shows that Lamarck did not err when he wrote "L'ovaire est chargé de poils blancs." The hairs are mainly on the backs of the carpels and seem to be at least partially deciduous. The rather young seeds do appear to be identical with those of *E. hyssopifolia.* The type collection of *E. brasiliensis* may represent merely a trivial variant of *E. hyssopifolia* but whatever the entity, it does not occur in the United States or Canada.

The plants of Texas, New Mexico, and Arizona are generally larger-seeded than those of South Carolina, Florida, and Louisiana. The western plants also tend to be slightly vestite. The absence of the species in southern Texas and its presence in western Texas further suggest that there are two distinct races involved. However, since the differences are so trifling when many specimens are examined and Mexican specimens seem to be intermediate, it seems futile to try to separate as named categories the northern tips of two lines of northward migration of a widespread and variable tropical species. Examination of the total variation of the species is necessary before a proper evaluation of any of its facies can be made.

13. Euphorbia maculata L., Sp. Pl. **1:** 455. 1753. Type: "*America septentrionalis*" (Linnaean Herb., not seen; photograph G!; rephotograph W!). A good representative of the species as here interpreted. Linnaeus, Mantissa Altera, 392. 1771; Elliott, Sketch Bot. So.-Car. & Georgia **2:** 654. 1824, and probably other early writers.—*E. hypericifolia* L. β. *E. maculata* (L.) Lam., Enyc. Meth. Bot. **2:** 422. 1786.—*Tithymalus maculatus* (L.) Moench. Meth. Pl., 666. 1794.—*Anisophyllum maculatum* (L.) Haw., Syn. Pl. Succ., 162. 1812.—*E. hypericifolia* L. var. *maculata* (L.) Raf., Med. Fl. U. S. **1:** 183. 1828 (basinym

given above in synonymy, and the plant described belongs here). *Xamesike maculata* Raf., Aut. Bot., 97. 1840, basinym indicated only as "Euph. d[itt]o. O.[mnes]."—*E. trinervis* Bertoloni, Fl. It. **5:** 37. 1842, a renaming of "E. maculata *Mant. alt. p.* 392" under the misapprehension that Linnaeus' use there was a misapplication.—*Chamaesyce maculata* (L.) Small, Fl. Se. U. S., 713, 1333. 1903.

E. nutans Lag., Gen. et Sp. Pl., 17. 1816. Type: "Habit.[at] in N.[ova] H.[ispania]" (Perhaps at Madrid judging by Alph. DC., Phytographie, 426. 1880). See discussion after citation of specimens.—*Chamaesyce nutans* (Lag.) Small, Fl. Se. U. S. 712, 1333. 1903.

E. Preslii Guss., Fl. Sic. Prod. **1:** 539. 1827. Type: Palermo, Italia, *Todaro* (Praha?; fragment F!). May be only isotype material at best but marked in Millspaugh's hand "From the type material Herb. Praag.". The specimen belongs in this entity. Boiss. in DC. Prod. **15 (2):** 23. 1862.—*Chamaesyce Preslii* (Guss.) Arthur, Torreya **11:** 260. 1912.

E. hypericifolia L. var. *communis* Engelm. in Emory, U. S. & Mex. Bound. Surv. **2 (1):** 188. 1859. Type: New Mexico, 1851–2, *C. Wright 1842* (M?, not found; isotypes NY!, US!). Engelm. in Chapman, Fl. So. U. S., 403. 1865. *Wright 1842* was a mixture of two species (see under 16a) and the locality printed on the labels of these collections is general and often *erroneous.*

Chamaesyce Lansingii Millsp., Field Mus. Pub. Bot. **2:** 376. 1913. Type: paved ditches, 56th Street, Chicago, Cook County, Illinois, Aug. 6, 1898, *O. E. Lansing Jr. 402* (F 196688!).

"**E.** (bezw. **Chamaesyce**) [*nutans* var.?] **pseudonutans**", Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 431. 1917. See discussion of this after citation of specimens. "**E.**" stands for *Euphorbia.*

E. hypericifolia L. *sensu* American authors in large part.

Many extralimital synonyms listed by Boissier in DC. Prod. **15 (2):** 23. 1862, and Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 426–432. 1917, are omitted here since no authentic material has been available.

Annual; stems mostly erect, mostly simple below, 8–80 cm. tall (or taller according to collector's notes), 1–4 mm. thick, internodes mostly 1–4 cm. long, crisply pubescent at least on a line and on the young tips, then becoming glabrous; leaves oblong-lanceolate to oblong or even occasionally falcate-lanceolate, 8–35 mm. long, mostly glabrous above, sometimes sparsely long-pilose, usually long-pilose beneath especially toward the base, base inequilateral, margin serrate; petioles 1–1.5 mm. long; stipules mostly united, mostly broadly triangular-acuminate, up to ca. 1 mm. long, margin ciliate, slightly toothed, uppermost often nearly distinct, narrowly triangular, margin with erect linear teeth; cyathia both solitary at the nodes and clustered in cymes; peduncles 0.5–5 mm. long, glabrous; involucres glabrous outside, sparsely pubescent inside on the bases of the lobes and stipes, obconical to obconical-campanulate, tapering to the peduncle, 0.7–1 mm. in diam.; lobes triangular, slightly exceeding the glands, the distal mostly entire, the proximal often with erect linear teeth; glands long-stipitate, circular to broadly transversely elliptical, 0.1–0.3 mm. in diam.; appendages rudimentary to 0.5 mm. long, oval, white to reddish, glabrous, entire or bluntly lobed; fifth gland linear, ca. ⅔ as long as lobes; sinus U-shaped, slightly depressed; bracteoles forming a slender segment below each gland, united to the involucre below, entire or with two to four filiform glabrous or sparsely hairy divisions above; staminate flowers 5–11 per cyathium; androphores glabrous, 1–1.1 mm. long; gynophore glabrous, well-exserted and usually reflexed; ovary glabrous, roundly 3-angled; styles ⅓–½ bifid, 0.6–1 mm. long; capsule glabrous, broadly ovoid, wider below the equator, 1.9–2.3 mm. long, strongly and subacutely 3-lobed; seeds ovoid-subquadrangular 1.1–1.6 mm. long, 0.9–1.1 mm. tangentially and radially, elliptic-ovoid radially, facets convex, with a finely rippled surface, coat dark grayish, brown or sometimes pale gray.—Plates 656B and 668B.

Ontario; all states east of the Mississippi River except Maine; Minnesota and South Dakota south to northern Florida and Texas; introduced in California and Washington; southward to South America; and introduced in the Old World (Map 10). Representative specimens seen from the United States and Canada: New Hampshire. Belknap Co.: Meredith, Aug., 1894, *Carter* (NE). Strafford Co.: near Dover, *Hodgdon 677* (NE). Hillsborough Co.: Milford, Sept. 5, 1902, *J. A. Wheeler* (NE). Vermont. Rutland Co.: Brandon, Sept. 11, 1909, *Dutton* (M); Wallingford, Aug. 3, 1907, *Kennedy* (G). Massachusetts. Middlesex Co.: Concord, Sept., 1857, *Hoar* (NE); Somerville, Aug. 31, 1899, *Flynn* (NE). Hampshire Co.: South Hadley, 1887, *Cook* (US). Berkshire Co.: Pittsfield, Sept. 23, 1899, *Hoffmann* (NE). Connecticut. Hartford Co.: Southington, *Bissell 529* (NE). Litchfield Co.: North Canaan, Aug. 17, 1910, *Woodward* (NE). Middlesex Co.: Middletown, *Blewitt 850* (NE). New Haven Co.: Oxford, Sept. 28, 1916, *Harger* (Ph). Fairfield Co.: Fairfield, Aug. 11, 1893, *Eames* (Ph). New York. Orange Co.: Newburgh, Sept. 8, 1895, *Pollard* (US). Westchester Co.: Worthington, *Pennell 8282* (Ph). Warren Co.: Lake George, 1882, *Vasey* (US). Tompkins Co.: Ithaca, July 20, 1893, *Wiegand* (US). Dutchess Co.: near Clove, *Standley & Bollman 12243* (US). New York Co.: Bronx Park, Sept. 3, 1896, *Nash* (Ph). Suffolk Co.: Wading River, *Miller 119* (US). New Jersey. Middlesex Co.: Stelton, *Mackenzie 2857* (M, US).

Somerset Co.: Peapack, *Perry* (M). Hunterdon Co.: Stockton, on Delaware River, *Benner 7008* (PhB). Ocean Co.: near Bay Head, Sept. 21, 1914, *Lighthipe* (M). Camden Co.: Oaklyn, Sept. 22, 1922, *Bassett* (PhB). Burlington Co.: north of Birmingham, *Long 19622* (PhB). Gloucester Co.: Sewell, *Long 17121* (PhB). Salem Co.: Centerton, *Long 32522* (PhB). Atlantic Co.: northwest of Bakersville, *Long 15194* (PhB). Cumberland Co.: south of Millville, *Fogg 5934* (PhB). Cape May Co.: Cape May City, Aug. 26, 1918, *Stone* (PhB). Pennsylvania. Luzerne Co.: above Nescopec on Susquehanna River, *Heller 14207* (M). Northampton Co.: Easton, Sept. 19, 1895, *Porter* (US). Lehigh Co.: south of Walbert's station, *Pretz 11116* (PhB). Allegheny Co.: Sharpsburg, Aug. 31, 1902, *Hatry* (Ph). Lebanon Co.: South Mountain, *Heller 668* (US). Lancaster Co.: Lancaster, Sept. 26, 1901, *Heller* (US). Philadelphia Co.: Gibson's Point, *McElwee 691* (Ph). Chester Co.: West Chester, Aug. 31, 1844, *Darlington* (M). Delaware. Queen Anne's Co.: Centreville, Aug. 14, 1868, *Commons* (Ph). Maryland. Montgomery Co.: above Cabin John, *Painter 1027* (M). Prince Georges Co.: Laurel, Sept. 12, 1897, *Knowlton* (US). Calvert Co.: Chesapeake Beach, *House 1451* (US). Wicomico Co.: Salisbury, *Tidestrom 7460* (US). Worcester Co.: Snow Hill, *Moldenke 6632* (NY). District of Columbia. Washington, Rock Creek, near west gate of zoo, *Pollard 648* (US). West Virginia. Ritchie Co.: Laurel Junction, Sept. 12, 1879, *Smith* (US). Upshur Co.: near Buckhannon, July 29, 1895, *Pollock* (US). Virginia. Page Co.: near Luray in the Blue Ridge, *Steele 37* (US). Alexandria Co.: Glencarlyn, *Dewey 40* (US). Fairfax Co.: Clifton, Oct. 10, 1884, *Ward* (US). James City Co.: Williamsburg, *Grimes 4433* (NY). Campbell Co.: near Lynchburg, Aug. 24, 1900, *U. C. Smith* (Ph). Amherst Co.: Monroe, Aug. 16, 1899, *Pieters* (US). Montgomery Co.: Allegheny Springs, Aug. 10, 1898, *Mohr* (US). Princess Anne Co.: near Virginia Beach, *Kearney 2108* (US). Greensville Co.: Emporia, *Tidestrom 6902* (US). North Carolina. Durham Co.: Durham, Aug. 18, 1931, *Blomquist* (Ph). Iredell Co.: Statesville, *Hyams* (US). Swain Co.: Swayney, Sept. 10, 1913, *Mooney* (US). Buncombe Co.: Biltmore, *Biltmore Herb. 403ᵇ* (NY). Haywood Co.: Lake Junaluska, *Oosting 34403* (Ph). Cherokee Co.: Andrews, Sept., 1900, *Huger* (NY). South Carolina. Pickens Co.: Clemson College, *House 2885* (US). Oconee Co.: *Anderson 1537* (US). Charleston Co.: Santee Canal, Sept., ?, *Ravenel* (M). Georgia. De Kalb Co.: Stone Mountain, *Pennell 4042* (NY). Richmond Co.: Augusta, Oct. 2, 1898, *Cuthbert* (NY). Florida. Citrus Co.: June–July, 1898, *A. S. Hitchcock* (M). Brevard Co.: Okeechobee region, *Fredholm 6014* (NY). Leon Co.: Tallahassee, *Nash 2519* (NY, US). Ontario. Kent Co.: Chatham, *Macoun 5898* and *24716* (NY).

MICHIGAN. Saint Clair Co.: Port Huron, *Dodge 7* (US). Ingham Co.: East Lansing, Aug. 19, 1891, *C. F. Wheeler* (US). Van Buren Co.: South Haven, *Lansing 3339* (US). Washtenaw Co.: 3 miles northwest of Ann Arbor, *Hermann 9073* (NY). Wayne Co.: River Rouge south of Detroit, Aug. 17, 1916, *Chandler* (US). OHIO. Lorain Co.: Oberlin, Aug. 17, 1894, *Ricksecker* (US). Cuyahoga Co.: Berea, June, 1897, *Ashcroft* (US). Holmes Co.: Salt Creek Township, *Drushel 9470* (US). Shelby Co.: Sept., 1904, *Clevenger* (US). Miami Co.: Fletcher, Aug. 20, 1897, *Clevenger* (US). Franklin Co.: Columbus, Oct. 24, 1898, *Clevenger* (US). Pickaway Co.: Circleville, Aug. 25, 1926, *Dreisbach* (Ph). Greene Co.: Jamestown, Sept., 1896, *Wooton* (US). Hamilton Co.: Cincinnati, Aug., ?, *Lea* (Ph). Scioto Co.: Friendship, *Demaree 10809* (US). INDIANA. Marshall Co.: Lake Maxinkuckee, *Evermann 1021* (US). Lake Co.: Gary, *Lansing 4028* (Ph). Hamilton Co.: Mattsville, *Wilson 27* (US). Lake Co.: Clarke, *Lansing 4020* (Ph). Dubois Co.: 2 miles east of Clear Springs, *Deam 26793* (Ph). Spencer Co.: 4 miles southwest of Chrisney, *Deam 37495* (Ph). Warrick Co.: 2 miles southeast of Yankeetown, *Deam 37598* (Ph). KENTUCKY. Franklin Co.: Frankfort, *Biltmore Herb. 403*[d] (US). Scott Co.: Stamping Ground, *Singer 353* (US). Fayette Co.: Lexington, *McFarland 136* (Ph). Bell Co.: Aug. 15, 1888, *F. E. Lloyd* (NY). TENNESSEE. Carter Co.: Roan Mountain Station, *Rydberg 8223* (NY). Coffee Co.: Tullahoma, *Biltmore Herb. 403*[a] (US). Knox Co.: Knoxville, *Ruth 2498* (NY). Davidson Co.: Nashville, *Svenson 139* (G). Hamilton Co.: Chattanooga, *Lippincott 98* (Ph). ALABAMA. Jefferson Co.: Birmingham, *H. E. Wheeler 1207* (NY). Lee Co.: Auburn, *F. S. & E. S. Earle 36* (G, US). Hale Co.: south of Rosemary, *Harper 3246* (G, M, NY, US). Baldwin Co.: Tensaw, *Tracy 9018* (NY, US). Mobile Co.: Mobile, Sept., 1892, *Mohr* (US). MISSISSIPPI. Tunica Co.: west of Dundee, *Anderson 4479* (Ph). Warren Co.: Vicksburg, *Demaree 14104* (M). Hinds Co.: Raymond, *Holt 74* (US). WISCONSIN. Saint Croix Co.: Hudson, Sept. 1896, *Moyer* (US). ILLINOIS. Cook Co.: Chicago, *Lansing 2780* (NY). Stark Co.: Wady Petra, Aug. 21, 1894, *V. H. Chase* (Ph, US). McLean Co.: Bloomington, *Robinson* in *Pl. Exs. Gray. 229* (M, NY, Ph, US). Vermilion Co.: Catlin, *Lansing 3494* (US). Richland Co.: near Olney, *Ridgway 3260* (Ph). MINNESOTA. Hennepin Co.: Fort Snelling, *Mearns 549* (US). Chippewa Co.: Myers, *Moyer 2319* (Mi). Washington Co.: Lake St. Croix, Afton, Sept., 1919, *Butters* (Mi). Goodhue Co.: Red Wing, July, 1886, *Sandberg* (Mi). Scott Co.: Prior Lake, *Moyle 2084* (Mi). Wabasha Co.: Lake City, *Manning 3019* (Mi). Winona Co.: Dresbach, *Arthur 79* (Mi). Houston Co.: Crooked Creek, *W. A. Wheeler 336* (Mi). IOWA. Fayette Co.: *Fink 451* (US). Marshall Co.: LaMoille to Marshalltown, Aug. 21, 1927, *Lounsberry* (Ph). Johnson Co.: Coralville, *Somes 3569* (US). Missouri. Pike Co.: Aberdeen, *Davis 955* (US). Nodaway Co.: Burlington Junction, *Singleton 213* (Mo). Clay Co.: Randolph, *Mackenzie 380* (M). Jackson Co.: Eton, *Bush 7749* (US). St. Louis Co.: Allenton, Oct. 1, 1896, *Letterman* (M, Ph). Cole Co.: Osage, Oct. 15, 1900, *Norton* (M). Jefferson Co.: Kimmswick, *Wislizenus 377* (M). Miller Co.: Bagnell, *Trelease 880* (M). St. Francois Co.: Flat River, *Trelease 878* (M). Greene Co.: Sac River, *Trelease 877* (M). Jasper Co.: Joplin, *Trelease 874* (M). Barry Co.: Roaring River, *Trelease 1178* (M). McDonald Co.: Butler Creek, Noel, *E. J. Palmer 4261* (M). Taney Co.: Forsyth, *Trelease 873* (M). Arkansas. Carroll Co.: Oakgrove, *Bush 15918* (M). Benton Co.: *Bush 15743* (M). Crittenden Co.: West Memphis, *Demaree 11097* (M). Pulaski Co.: Pulaski Heights, Little Rock, *Demaree 8239* (M, US). Garland Co.: Hot Springs, *Runyon 1495* (US). Jefferson Co.: Bayou Bartholomew, *Demaree 13972* (M). Pike Co.: Murfreesboro, *Demaree 9430* (M). Howard Co.: Mineral Springs, *Demaree 9736* (M). Hempstead Co.: Fulton, *Bush 949* (M). Nevada Co.: 4 miles southeast of Prescott, *Hollister 81* (US). Miller Co.: Texarkana, *Demaree 13470* (M). Louisiana. Ouachita Co.: Bastrop, *Demaree 14116* (NY). Natchitoches Co.: Natchitoches, *E. J. Palmer 8729* (NY, US). Rapides Co.: near Alexandria, *Ball 405* (NY, US). Calcasieu Co.: near Lake Charles, *Allison 148* (NY). Orleans Co.: New Orleans, *Tracy 7429* (US). South Dakota. Clay Co.: Vermilion, *Visher 4103* (M). Bon Homme Co.: Running Water, Sept., 1892, *Thornber* (M). Nebraska. Knox Co.: Pishelville, *Clements 2751* (US). Saunders Co.: Ashland, July, 1888, *Williams* (US). Cass Co.: Weeping Water, June, 1887, *Williams* (US). Otoe Co.: Nebraska City, Oct. 14, 1900, *Hedgcock* (M). Saline Co.: Crete, *Dreisbach 6025* (Ph). Kearney Co.: Minden, Aug., 1892, *Milligan* (US). Nuckolls Co.: Aug., 1899, *Hedgcock* (M). Kansas. Riley Co.: *Norton 473* (US, M). Osborne Co.: Osborne City, Sept. 2, 1894, *Shear* (US). Graham Co.: Bogue, *Imler 46* (M). Geary Co.: along Otter Creek, *Gates 18947* (M). Douglas Co.: Lawrence, July, ?, *W. C. Stevens* (US). Morris Co.: Dwight, Oct., 1900, *Norton* (M). Oklahoma. Kay Co.: near Ponca, *G. W. Stevens 1917½* (M, US). Grant Co.: near Lamont, *G. W. Stevens 1798* (M, US). Delaware Co.: *Bush 15733* (M). Payne Co.: Stillwater, *Waugh 381* (M). Oklahoma Co.: Oklahoma City, *Waugh 397* (US). Texas. Tarrant Co.: *Killian 6873* (US). Randall Co.: Palo Duro Canyon, *Ball 1259* (US). Denton Co.: *Graham 31* (US). Parker Co.: Weatherford, *Tracy 8119* (Ph, US). Dallas Co.: near Dallas, June–Sept., ?, *Reverchon* (M, Ph, US). Bowie Co.: Texarkana, *Heller 4190* (Ph, US). Taylor Co.: Abilene, *Tracy 7842* (G, M, Mo, NY, Ph, US). El Paso Co.: El

Paso, *M. E. Jones 4174* (I, NY, US). Jeff Davis Co.: Musquiz Creek Canyon, *Sperry T243* (US). Travis Co.: Austin, *Schulz 720* (US). Montgomery Co.: Willis, Aug., ?, *Warner* (M). Gillespie Co.: Cherry Springs, *Jermy* (M). Val Verde Co.: 48 miles south of Ozona, *Ferris & Duncan 3012* (M, NY). Kerr Co.: Kerrville, *Heller 1922* (Ph, US). Austin Co.: Industry, *Wurzlow 19* (US). Harris Co.: Houston, *Fisher 607* (US). Bexar Co.: San Antonio, *Wilkinson 56* (M). Comal Co.: Bracken, bed of Cibolo River, *Groth 208* (US). Wharton Co.: Pierce, *Tracy 7432* (US). California. Placer Co.: Dutch Flat, *MacFadden 12754* (NY, W). Tuolumne Co.: near Bear Creek, *Williamson 242* (NY). Amador Co.: Middle Fork, *Hansen 1216* (US). Butte Co.: east of Chico, *Heller 11139* (F, G, NY, Ph, US). Washington. Skamania Co.: near Hood, *Suksdorf 12327* (G, M, NY, Ph, US).

According to Thellung in a postal card of Feb. 6, 1916, filed at Gray Herbarium, Dr. E. Bonnet examined an authentic specimen of *E. nutans* in the Cosson herbarium at Paris and found it to be identical with *E. Preslii*. (How the identity of *E. Preslii* was ascertained is not explained.) Dr. Bonnet even communicated a fragment of the specimen in the Cosson herbarium to Thellung that he might judge for himself. However, Lagasca described his plant as "Caule . . . villoso" and Thellung verifies the fact and terms it "fortement poilue". Having satisfied himself that *E. nutans* and *E. Preslii* were identical and the type of *E. nutans* had villous stems, Thellung became concerned over the fact that Millspaugh had somewhere characterized *E. nutans* of the United States as glabrous. As a consequence Thellung decided that the plant of the United States differed from *E. nutans* and therefore required a new name which he proposed in the ambiguous manner quoted above near the end of the synonymy. A more confusing way of proposing a new name can hardly be imagined but is matched by "Gerbera (viridifolia var.?) Conrathii Thell., spec. vel var. nov." Vierteljahrsschrift der Naturf. Gesell. in Zurich **68**: 454. 1923. Not only is the type of the new name practically impossible to determine but the position and rank of the new name are exceedingly uncertain. Nevertheless, the problem for me is fairly simple. I am satisfied that the plants known to American authors as either *E. Preslii* or *E. nutans* are *E. maculata* L. Consequently Thellung's new name is a synonym of *E. maculata*.

There is a specimen at F which probably represents the plant which Lagasca described as *E. nutans.* It bears the data: "ex antiquo herbario generali, Herbarium Horti Botanici Matritensis, *E. Preslii, E. nutans* Lag., in hort Madrid." The stems are pilose-tomentose on the young portions and subglabrate at maturity. This agrees with the observations of Thellung. It appears that *E. nutans* was based on unusally vestite plants of *E. maculata.*

The history of the misapplication of the name *E. maculata* L. to the small-leaved prostrate plant properly known as *E. supina* Raf. has been amply reviewed in Contr. Gray Herb. **127:** 74–76. 1939. Evidence that *E. hypericifolia* L. is properly applicable to a plant ranging from the West Indies and Mexico south to South America is presented, op. cit., 73–74, and Proc. Biol. Soc. Wash. **53:** 10. 1940.

14. Euphorbia vermiculata Raf., Amer. Monthly Mag. **2** (**2**): 119. 1817, op. cit., **2** (**3**): 206. 1818. Type not known to exist, "Found in August, 1816, near Sandyhill and Glen's Falls, state of New York in fields." House, N. Y. State Mus. Bull. **254:** 471. 1924.—*Xamesike vermiculata* (Raf.) Raf., Aut. Bot., 97. 1840.—*Chamaesyce vermiculata* (Raf.) House, N. Y. State Mus. Bull. **233–234:** 8. 1922.[1]

E. hypericifolia L. β? *hirsuta* Torr., Comp. Fl. No. & Mid. States, 331. 1826, fully accepted in this category by Torrey, Fl. State N. Y. **2:** 176. 1843. Type: (NY?, not found). Perhaps reference to synonymy here is erroneous since Torrey, l. c., 1843, states "capsules even, sometimes pubescent." As applied here the capsules are always glabrous.—*E. hirsuta* (Torr.) Wiegand, Bot. Gaz. **24:** 50, Pl. III. 1897 (July); Robinson & Fernald, Gray's New Man. Bot. ed. 7, 546. 1908. *E. Rafinesquii* Greene, Pittonia **3:** 207. 1897 (Sept.).—*Chamaesyce Rafinesquii* (Greene) Arthur, Torreya **11:** 260. 1912 (Jan.)[2] Heller, Muhlenbergia **8:** 48. 1912 (Apr.); Small in Britton & Brown, Illus. Fl. ed. 2, **2:** 467. 1913.

Chamaesyce Rothrockii Millsp., Field Mus. Pub. Bot. **2:** 376. 1913. Type: Camp Crittenden, Santa Cruz Co., Arizona, Sept., 1874, *J. T. Rothrock 672* (F 197499!; photographs G!, W!; isotype M!). Intergrade between *E. vermiculata* and *E. maculata.*

Annual; stems prostrate to suberect, sparsely pilose, few to several from the base, 8–40 cm. long, 0.5–1.5 mm. thick, inter-

[1] Title-page date 1921, but cited by House, N. Y. State Mus. Bull. **254:** 471. 1924. as 1922 and received at Gray Herb. Feb. 24, 1922.

[2] Date of issue fide Torreya **12:** 1. 1912.

nodes up to 6 cm. long, mostly 1–2 cm. long; leaf-blades ovate to lanceolate, 5–15 or sometimes 19 cm. long, upper surface glabrous or very sparsely pilose, lower surface more or less pilose especially toward the base, margin serrulate; petioles ca. 1 mm. long; stipules distinct or united, up to 1 mm. long, ciliate or glabrous, margin fimbriate to divided into a few linear segments; cyathia solitary at the nodes or the uppermost terminal in the bifurcations of the small leafy cyme; peduncles 0.5–2 mm. long, glabrous; involucres glabrous outside, sparsely pubescent inside on the bases of the lobes and stipes, obconical to obconical-campanulate, tapering to the peduncle, 0.7–1 mm. in diam.; lobes triangular, slightly exceeding the glands, the distal mostly entire, the proximal often with erect linear teeth; glands long-stipitate, circular to broadly transversely elliptical, 0.2–0.3 mm. in diam.; appendages white, glabrous, to 0.6 mm. long, entire or bluntly toothed; fifth gland linear, ca. ⅔ as long as the lobes; sinus U-shaped, slightly depressed; bracteoles forming a slender segment below each gland, united to the involucre below, entire or with two to four filiform glabrous or sparsely hairy divisions above; staminate flowers 5–15 per cyathium; androphores glabrous, 1–1.1 mm. long; gynophore glabrous, exserted and mostly reflexed; ovary glabrous, roundly 3-angled; styles ca. ⅔ bifid, ca. 0.6 mm. long; capsule glabrous, broadly ovoid, wider below the equator, 1.6–1.9 mm. long; seeds quadrangular, 1.1–1.3 mm. long, 0.9–1 mm. tangentially, 0.7–0.9 mm. radially, radially ovate, ventral facets mostly slightly concave, dorsal facets plane to slightly convex, smoothish to slightly wrinkled, coat dark grayish brown or sometimes pale gray.—Plate 656A.

Nova Scotia, New Brunswick and Quebec to Pennsylvania and New York, west to Ontario, Michigan and Ohio; also in British Columbia, Arizona, and New Mexico (Map 41). Representative specimens seen: Nova Scotia. Hants Co.: Windsor, *Fernald, Bartram & Long 24085* (G). Digby Co.: Weymouth, *Fernald, Bissell, Graves, Long & Linder 21756* (G). Cape Breton Co.: North Sydney, *Bissell & Linder 21757* (G). New Brunswick. Victoria Co.: Aroostook Junction, Andover, *Fernald 1983* (G). Quebec. Bonaventure Co.: Matapedia, on ballast, July 10, 1904, *Collins & Fernald* (G). Megantic Co.: east of Black Lake, *Fernald & Jackson 12118* (G). Deux-Montagnes Co.: La Trappe, *Louis-Marie 198* (G). Longueuil Co.: shores of the St. Lawrence, *Marie-Victorin 1062* (G). D'Argenteuil Co.: Grenville, *Marie-Victorin & Rolland-Germain 34052* (G). Pontiac Co.: Fort-Coulonge, *Marie-Victorin, Rolland-Germain & Meilleur 43720* (G). Ontario: Kingston, Sept. 23, 1901, *Fowler* (G); Gananogue Junction, July 22, 1908, *Kennedy* (G); Minto bridge, Ottawa, *Macoun 87831* (G); Southampton, *Macoun 88079* (G). British Columbia: Englishman's River, Parksville, July, 1915, *Carter* (G). Maine. Penobscot Co.: Bangor, *Fernald & Long 13996* (NE); Orono, Aug. 27, 1908, *Fernald* (NE). Kennebec Co.: near the Messalonskee, Oakland, Aug. 29, 1906, *Nye* (G); Winslow, *Fernald 2737* (G). Sagadahoc Co.: Topsham, *Furbish* (NE). Oxford Co.: Woodstock, 1887, *Parlin 52* (G); Bethel, 1897, *Furbish* (NE). Cumberland Co.: Portland, *Fernald, Long & Norton 13995* (NE). York Co.: York Beach, 1879, *Furbish* (NE). New Hampshire. Cheshire Co.: Hinsdale, *Raup & Weatherby* in *Pl. Exs. Gray. 565* (G, I, M, Mo, NE, NY); Hinsdale, *Robinson 578* (G, NE). Sullivan Co.: West Claremont, *Robinson 581* (G). Grafton Co.: Haverhill, *Pease 14469* (NE); Lebanon, *Kennedy 10* (G). Coös Co.: Randolph, *Pease 19128* (NE); Berlin, *A. H. Moore 44170* (G). Vermont. Franklin Co.: Maquam Bay, Hog Island, *Pease 25345* (NE). Grand Isle Co.: Lake Champlain, Aug. 15, 1885, *Morong* (NE). Chittenden Co.: Essex Junction, *Blake 2033* (NE); Burlington, *Blake 1813* (NE). Addison Co.: Shoreham, *Pease 25316* (NE). Rutland Co.: Brandon, *Pease 23971* (NE); Rutland, *Eggleston 1565* (G); Brandon, *Kennedy 9* (G). Windham Co.: Vernon, *Robinson 97* (G, NE). Bennington Co.: Dorset, *Day 376* (G, NE). Massachusetts. Middlesex Co.: West Cambridge, Sept. 4, 1896, *Harris* (NE). Suffolk Co.: South Boston, Sept. 1, 1880, *Perkins* (NE). Worcester Co.: Harvard, *Pease & Hopkins 24006* (NE). Franklin Co.: Deerfield, *Day 87* (G). Hampshire Co.: Worthington, *Robinson 616* (G); Amherst, *Seymour 2009* (NE). Hampden Co.: Springfield, Aug. 19, 1914, *Andrews* (NE). Berkshire Co.: Adams, *Day 42* (G); Sheffield, Oct. 1, 1919, *Churchill* (NE); Pittsfield, Aug. 15, 1915, *Churchill* (NE). Rhode Island. Providence Co.: Lincoln, Sept. 23, 1906, *Fernald* (G). Connecticut. Windham Co.: Killingly, Aug. 23, 1908, *Knowlton* (NE). Hartford Co.: Southington, Aug. 12, 1897, *Bissell* (G). Litchfield Co.: Canaan, Aug. 19, 1910, *Woodward* (NE). New London Co.: New London, Aug. 23, 1899, *Graves* (G). New Haven Co.: Prospect, *Blewitt 848* (NE). Fairfield Co.: Stepney, *Eames 54* (G, NE). New York. Clinton Co.: Plattsburg, beach, Sept. 16, 1917, *Hunnewell* (G). St. Lawrence Co.: Canton, *Phelps 635* (G). Washington Co.: Big Hollow, Bakers Falls, Hudson Falls, Aug. 3, 1914, *Burnham* (G). Rensselaer Co.: Tomhannock reservoir, *House 10618* (G). Albany Co.: Hudson River, Albany, Sept. 10, 1910, *Burnham* (G). Chenango Co.: Oxford, July 10, 1884, *Coville* (US). Oswego Co.: Cooperstown, *Hunnewell 6876* (G). Oneida Co.: east of Utica, *Haberer 776* (G). Cayuga Co.: North Fair Haven, Sterling, sand bar of Lake Ontario, *Whetzel 12388* (G). Tompkins Co.: Ithaca, *Wiegand 755* (G). Schuyler Co.: Montour, *Wiegand 8408* (G). New Jersey. Hunterdon Co.: southeast of Linvale, *Long 51421* (G). Ocean Co.: Lakewood, *Hunnewell 6977* (G). Pennsylvania. Lancaster Co.: between

Churchtown and Beartown on Welsh Mountains, Sept. 7, 1892, *Small* (G); Chikis quartzite, between Churchtown Road and Beartown, *Heller 670* (G, M, NY). Columbia Co.: Aristes, *Fosberg 15754* (G). MICHIGAN. Washtenaw Co.: 2.3 miles east of Ann Arbor, *Hermann 9116* (G). Shiawassee Co.: Owosso, July 30, 1890, *Hicks* (G). Saginaw Co.: Saginaw, Aug. 20, 1897, *C. F. Wheeler* (G). St. Clair Co.: near Port Huron, Aug. 28, 1896, *C. K. Dodge* (G). INDIANA. Steuben Co.: 5 miles northeast of Angola, *Deam 32533* (Deam, G). OHIO. Lake Co.: Painesville, Aug. 24, 1886, *Werner* (G). Erie Co.: Perkins, Aug. 20, 1895, *Moseley* (G). Lucas Co.: Swanton, Sept. 26, 1926, *Moseley* (G). NEW MEXICO. Grant Co.: Mangas Springs, Aug., 1901, *Metcalfe* (US); Mogollon Creek, 2 miles above falls, *Maguire, Richards & Moeller 11982B* (G). Socorro Co.: Frisco, July 25, 1900, *Wooton* (US). ARIZONA. Cochise Co.: Tanner Canyon, Huachuca Mountains, *Goodding 798* (G, NY, T, US).

After a careful consideration of Rafinesque's description, I am forced to conclude, as did House, that it applies to this entity.

The plant is probably introduced in British Columbia. In Arizona and New Mexico it may be native and represent the fringes of a puzzling Mexican complex centering around *E. maculata.* Most of the Arizonan and New Mexican plants approach or even intergrade with *E. maculata.* To identify plants of Arizona and New Mexico with those of New England when they are not found between may seem fantastic but even worse is the fact that some Argentinian specimens seem identical. In New England and vicinity the entity here recognized as *E. vermiculata* is distinct; elsewhere it is vague and seems to intergrade. A complete study must be made of *E. maculata* and its satellites in order to evaluate properly *E. vermiculata.*

A collection from Bangor, Penobscot Co., Maine, Sept. 13, 1898, *Fernald 2741* (NE) has one small plant with overlapping leaves, capsules widest at the summit, and peculiar seeds half sordid white and half dark gray. It appears to be an abnormal plant.

E. hirsuta Schur, Verh. Siebenb. Ver. Naturw. **4:** Abhang, 66. 1853, has been given as preoccupying *E. hirsuta* (Torrey) Wiegand 1897. Schur published his name as a subdivision, of unstated rank, of *E. Esula* L. The fact that he published it as a binomial does not make it capable of preoccupying an identical specific name but rather makes it invalid in the rank proposed since binomial nomenclature is not admissible for subdivisions of species (International Rules of Botanical Nomenclature ed. 3, Art. 28. 1935). Boissier in DC. Prod. **15** (**2**):—1862, omits this name of Schur's. Unless someone can find a validation of Schur's name in specific rank prior to 1897, Wiegand's name is not preoccupied though it is a later synonym. Fernald, Rhodora **36:** 417–420. 1934, has discussed a case in which a similar name of Schur's was validated in specific rank. The listing of *E. hirsuta* Schur in Index Kewensis as a synonym of *E. Esula* obviously does not validate Schur's name.

EUPHORBIA SUBGENUS CHAMAESYCE IN CANADA AND THE UNITED STATES EXCLUSIVE OF SOUTHERN FLORIDA

Louis Cutter Wheeler

(*Continued from page 154*)

15. Euphorbia glomerifera (Millsp.) L. C. Wheeler, Contr. Gray Herb. **127:** 78. 1939; based on *Chamaesyce glomerifera* Millsp., Field Mus. Pub. Bot. **2:** 377. 1913. Type: El Rancho, Dept. Jalapa, Guatemala, alt. 1000 ft., Jan. 20, 1908, *W. A. Kellerman 8053* (F 224827! [a "6" is pencilled after the stamped herbarium number; why?]). A very robust specimen.

E. hypericifolia L. *sensu* most authors not only under *Euphorbia* but also *Anisophyllum* and *Chamaesyce.* See Contr. Gray Herb. **127:** 73–74. 1939 concerning the corrrect application of this name.

Glabrous, annual, or perhaps sometimes of slightly longer duration; stems erect, with occasional branches below, 12–50 cm. tall, from 1 mm. thick above to 4 mm. thick and slightly woody below, internodes 2–4.5 cm. long on the main stem; leaf-blades prevailingly oblong-oblanceolate but varying from oblong and oblong-spatulate to lanceolate, 1–3.5 cm. long, margin serrate or serrulate especially toward the apex and on the lower margin, base oblique; petioles 1–1.5 mm. long; stipules distinct or united, triangular, membranous, brown, 1–2 mm. long, sometimes ciliate on the inner edge; cyathia clustered in lateral and terminal cymes of mostly several to numerous cyathia; peduncles 0.6 to rarely as much as 4 mm. long, glabrous; involucre obconical, tapering gradually to the peduncle, 0.4–0.9 mm. in diam., glabrous outside, glabrous inside except for occasional short hairs at the bases of the lobes and stipes and sometimes a few above the middle of the involucre on the vascular trace leading to the gland; lobes triangular-attenuate, markedly exceeding the glands, mostly with 1–4 linear erect lateral lobes above; glands subcircular, from the merest microscopic point to 0.2 mm. in diam., on long stipes; appendages white, rotund and thrice as wide on the larger to completely wanting on the smaller glands, but some present on most of the cyathia; fifth gland from minute linear segment ¼ as long as the lobes to wholly wanting; sinus U-shaped, scarcely or not at all depressed; bracteoles from a membranous structure 2–3-parted above to a mere filiform segment opposite each gland or often wanting in some of the intervals, adnate below to the involucre, glabrous or with a few short hairs on free portion; staminate flowers 2–20 or wholly wanting in some cyathia; androphores glabrous, 1–1.1 mm. long; gynophore glabrous and sometimes reflexed; ovary glabrous, 3-lobed;

styles glabrous, bifid to about the middle, subclavate, ca. 0.4 mm. long; capsules depressed-globose, roundly 3-lobed, glabrous, 1.3–1.4 mm. long, widest at about the equator; seeds ovoid-triangular, 0.9–1 mm. long, ca. 0.5 mm. tangentially and radially, radially ovate, facets with slight irregular depressions separated by very low smooth ridges, gelatinous coat so thin as to little obscure the light brown testa.—Plate 656C.

Southern Florida and extreme southern Texas; Bermuda, West Indies, Central America, northern South America (British Guiana, Venezuela, and Colombia), and Hawaii (Map 2). Representative specimens seen from the United States: Florida. Dade Co.: Ft. Lauderdale, *Small & Carter 644* (NY); Miami, *Tracy 9127* (G, M, NY, US); Old Rhodes Key, *Small & Mosier 5699* (NY, US); Brickell Hammock south of Miami, *Small 4036* (NY); Buena Vista, *Moldenke 330* (M, NY, US); Soldier's Key, *Britton 330* (NY); hammocks between Miami & Cocoanut Grove, *J. K. & G. K. Small 4619* (NY). Monroe Co.: Ten Thousand Islands, *Simpson 388* (G, US); Doctor's Arm, Big Pine Key, *Simpson 310* (NY, US); Big Pine Key, *Killip 31582* (US); lower portion of Key Largo, *Small & Carter 3209* (NY); No Name Key, *Pollard, Collins & Morris 126* (NY, US); Upper Metacombe Key, *Curtiss 2486* (G, M, NY, US); West Summerland Keys, *J. K. Small, J. J. Carter & G. K. Small 3627* (NY). Texas. Hidalgo Co.: 8 miles south of Alamo, *Clover 783* (NY); near Swallow's Club House, south of Alamo, *Clover 1475* (NY). Cameron Co.: near Brownsville, *Ferris & Duncan 3129* (NY); Brownsville, *Clover 1537* (NY); southeast of Brownsville, *Clover 1524* (NY).

16. Euphorbia hirta L., Sp. Pl. **1:** 454. 1753.

Annual; stems mostly few, mostly erect to decumbent, sometimes prostrate, 2–60 cm. long, 1–1.5 mm. thick, strigose and commonly pilose with long yellow tapering hairs especially toward the stem-tips, internodes up to 7 cm. long but mostly 1–4; leaf-blades prevailingly broadly rhombic-lanceolate, varying from narrowly lanceolate to ovate, 4–40 cm. long, sparsely strigose and glabrate above, with appressed to spreading crisped hairs beneath, base strongly inequilateral, apex acute, margin sharply to bluntly serrate; petioles 1–2 mm. long; stipules triangular, long and slenderly attenuate, ca. 1 mm. long, distinct or barely united at the base, mostly with linear divisions below, with short scattered hairs; cyathia in dense pedunculate cymose heads of numerous cyathia; peduncles glabrous to sparsely strigose; involucre obconic-campanulate, 0.6–0.9 mm. in diam., upwardly strigose outside, glabrous inside or a few hairs on the inside faces of the stipes; lobes ciliate on the outer margin, triangular, mostly about equaling the glands, the margins lacerate into erect filiform segments; glands on long stipes, cupuliform to patelliform, circular to transversely oval, 0.15–0.3 mm. in diam.; appendages white, glabrous, entire, from narrower than to twice as wide as the gland, or sometimes wholly absent; fifth gland ca. ½ as long as the lobes; sinus U-shaped, scarcely depressed; bracteoles sometimes reduced to one filiform segment below each gland but mostly forming a radial, upwardly expanding partition adnate for ca. ⅔ its length to the involucre below the glands, free portion parted into few linear shortly hairy segments shorter than the androphores; staminate flowers 2–8 per cyathium; androphores glabrous, 0.9–1 mm. long; gynophore glabrous, shortly exserted and mostly reflexed; ovary shortly strigose upwardly, 3-lobed; styles glabrous, bifid ½–⅔, 0.2–0.4 mm. long, slightly clavate; capsule 1–1.15 mm. long, sharply 3-angled, wider below the middle, shortly strigose, base truncate; seeds sharply quadrangular, 0.7–0.9 mm. long, 0.5–0.6 mm. tangentially and radially, ovate-acute radially, base truncate, facets with sub-regular to quite irregular low smooth wrinkles, ventral facets concave, dorsal concave to plane, microreticulate white coat often so thin as to little obscure the light brown to tan testa.

Key to Varieties

Cymules (clusters of cyathia) both terminal and lateral (except in depauperate plants), on *leafless* peduncles; stems sparingly branched above the base, unbranched at the tip; mostly robust erect plants with large leaves . . . . a. var. *typica*.

Cymules terminal or, if lateral, on *leafy* branchlets; stems branching freely, often forking symmetrically (or nearly so) at the tip; mostly low plants with small leaves . . . . b. var. *procumbens*.

16a. E. hirta L., Sp. Pl. **1**: 454. 1753, var. typica L. C. Wheeler, Contr. Gray Herb. **127**: 68. 1939. Type: source unknown (Linnaean Herb., not seen; photograph G!; rephotograph W!). Quite typical of this widespread entity.—*E. capitata* Lam., Encyc. Meth. Bot. **2**: 422. 1786, substituted for *E. hirta* on the ground that the name was bad.—*Chamaesyce hirta* (L.) Millsp., Field Mus. Pub. Bot. **2**: 303. 1909.—*E. pilulifera* L. I *hirta* (L.) Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7**: 425. 1917.

E. globulifera HBK., Nov. Gen. et Sp. **2**: 56 (quarto), 45 (folio). 1817. Type: Cumana, Venezuela, *Bonpland 403* (Herb. Mus. Paris, not seen; fragment F!; photograph G!).

E. verticillata Velloso, Fl. Flum., 202. 1825, & vol. **5**: t. 16. 1827, not Poiret in Lam., Encyc. Meth. Bot. Suppl. **2**: 611. 1811. This disposal of the name is based on the plate cited.—*E. nodiflora* Steudel, Nom. Bot. ed. 2, **1**: 613. 1840.

E. pilulifera L. β *discolor* Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 188. 1859. Type: "On the Sonoita [Creek] near Deserted Rancho," Santa Cruz County, Arizona, Sept. 16, 1851, *C. Wright 1842* (M 144667!; photographs G!, W!; isotypes

G!, US p. p.!). Merely plants with red-spotted leaves.—*E. discolor* Engelm. ex Millsp., Field Mus. Pub. Bot. **2:** 402, 440. 1916 (without basinym) by error, as synonym of *Chamaesyce hirta*.—*E. pilulifera* L. *1*. ["Spielart"] *discolor* (Engelm.) Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 426. 1917.

Chamaesyce Rosei Millsp., Field Mus. Pub. Bot. **2:** 402. 1916. TYPE: along an arroyo in the vicinity of Alamos, Sonora, Mexico, Mar. 13, 1910, *Rose, Standley, & Russell 12728* (NY!; fragment F!; ISOTYPE F!). A rather stunted and perhaps overwintering plant probably belonging to a race found in Sonora and Sinaloa, rather intermediate between *E. hirta* vars. *typica* and *procumbens*.

E. pilulifera L. var. *guaranitica* Chodat & Hassler, Bull. Herb. Boiss., ser. 2, **5:** 679. 1905. TYPE: in regione cursus superioris fluminis Apa, Paraguay, Nov. 1901/2, *E. Hassler 7735* (Ge?, not seen; ISOTYPE G!). A low plant with smaller leaves than usual for var. *typica*.

E. pilulifera L. *sensu* Jacquin, Icones Pl. Rar. **3:** t. 478. 1786-93; Boiss. in DC. Prod. **15 (2):** 21. 1862; A. M. Marselt, Contribution à l'Étude Botanique, Physiologique, et Therapeutique de l'Euphorbia pilulifera, thèse pour le Doctorat en Medecine, Année 1884, No. 36, pp. VI, 62 [2], 2 plates; J. D. Hooker, Fl. Brit. India **5:** 251. 1887; Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 423. 1917; Farwell, RHODORA **38:** 331–2. 1936; and many other authors under *Euphorbia, Anisophyllum, Chamaesyce*, and *Tithymalus*.

The following Australian forms probably belong here: *E. pilulifera* L. forma *rubromaculata*, f. *humifusa*, & f. *viridis* K. Domin, Bibliotheca Bot. Band. 22, Heft 89 **(4):** 866. 1927.

Plate 657A. Casual and not persisting in Michigan and New York; South Carolina, Florida, Alabama, Arizona, West Indies, Mexico, south to Argentina; widely introduced in the Old World (MAP 24). Representative specimens seen from the United States: MICHIGAN. Wayne Co.: Detroit, *Farwell 8756* (G). SOUTH CAROLINA. Charleston Co.: Charleston, *Fernald & Long 9747* (G). FLORIDA. Brevard Co.: Indian River region, *Fredholm 5517* (G). Hillsborough Co.: *Fredholm 6348* (G). Lake Co.: near Eustis, *Nash 157* (G). Lee Co.: Myers, *A. S. Hitchcock 326* (F, G). Manatee Co.: near Bradentown, June 2, 1890, *Simpson* (F). Monroe Co.: Upper Metacombe Key, *A. H. Curtiss 2496* (F, G). Orange Co.: *Fredholm 5429* (G). Palm Beach Co.: Palm Beach, *A. H. Curtiss 5395* (G). Pasco Co.: St. Leo, Mar. 24, 1927, *O'Neill* (M). Pinellas Co.: near St. Petersburg, *Deam 2762* (F, G). Seminole Co.: Sanford, Oct. 8, 1892, *Leeds* (F). ALABAMA. Mobile Co.: Mobile, *Dukes 6* (G); Mobile, Sept., 1878, *Mohr* (G). ARIZONA. Cochise Co.: near Fort Huachuca, Huachuca Mts., *J. G. Lemmon 2875* (F, G). Santa Cruz Co.: Tumacacori, *Harrison & Kearney 6022* (G, US);

base of Patagonia Mts., *Peebles, Harrison & Kearney 4653* (US); Nogales, *Harrison & Kearney 6026* (US); near Patagonia, *Kearney & Peebles 10172* (US).

16b. E. HIRTA L. var. PROCUMBENS (DC.) N. E. Brown in Thiselton-Dyer, Fl. Trop. Afr. **6 (1):** 497. 1911; L. C. Wheeler, Contr. Gray Herb. **127:** 69, Pl. IV, C, fig. 2. 1939; based on *E. procumbens* DC., Cat. Pl. Hort. Monsp., 111. 1813, not Miller, Gard. Dict. ed. 8, *Euphorbia* 12. 1768. TYPE: probably a plant from the garden at Montpellier, France, (Geneva?, not seen).—*E. pilulifera* L. var. *procumbens* (DC.) Boiss. in DC. Prod. **15 (2):** 21. 1862.—*Chamaesyce pilulifera* (L.) Small var. *procumbens* (DC.) Small, Fl. Se. U. S., 714, 1334. 1903. Since no authentic material has been seen it has been necessary to accept without confirmation the interpretation of Boiss. in DC. Prod. **15 (2):** 21. 1862.

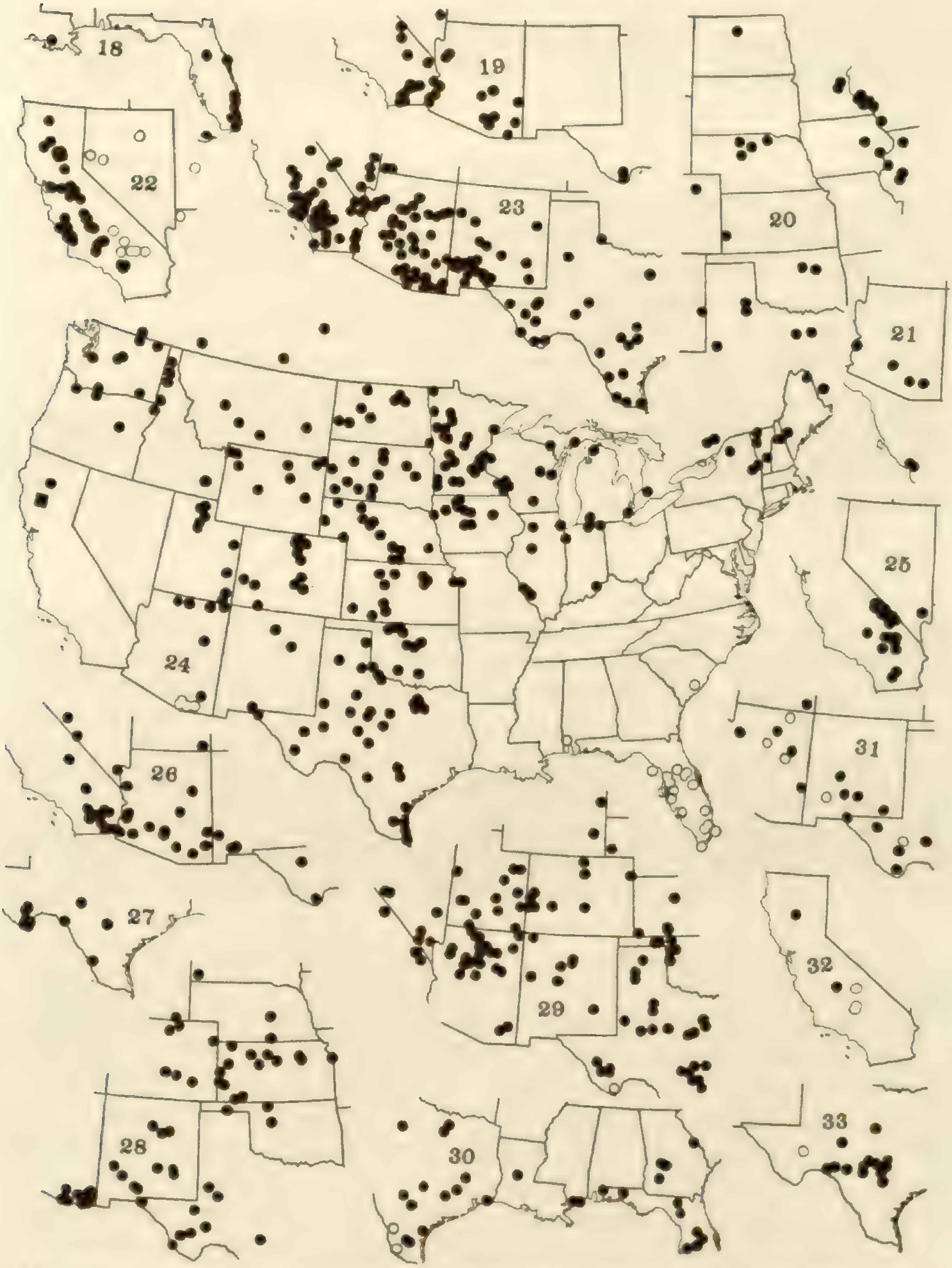
E. obliterata Jacquin, Enum. Syst. Pl. Carib., 22. 1762, & Select. Stirp. Amer. Hist., 151. 1763, at least in the sense in which it was used: *E. pilulifera* L. var. *obliterata* (Jacq.) A. S. Hitchcock, Ann. Rep. Mo. Bot. Gard. **4:** 127. 1893. No authentic material has been seen.

E. opthalmica Persoon, Syn. Pl. **2:** 13. 1807. TYPE: Rio de Janeiro, Brazil, July, 1767, *Commerson 238* (Herb. Mus. Paris, not seen; fragment F!). A small-leaved plant.

E. gemella Lag., Gen. et Sp. Nov., 17. 1816. TYPE: "Habit.[at] in N.[ova] H.[ispania]"; perhaps at Madrid judging by Alph. DC., Phytographie, 426. 1880. Supposed by Boiss. in DC. Prod. **15 (2):** 21. 1862, and others, to be the same as *E. procumbens* DC.—*Chamaesyce gemella* (Lag.) Small, Fl. Miami, 110, 200. 1913.

Florida; adventive in Pennsylvania; Louisiana; Mexico, West Indies, and South America (MAP 18). Representative specimens seen from the United States: PENNSYLVANIA. Lancaster Co.: Columbia, April, 1876, *Garber* (F). FLORIDA. Brevard Co.: Meritt's Island, Indian River, *A. H. Curtiss 2496* (F, G). Broward Co.: Pompano, *Pease 26455* (G). Dade Co.: Miami, *Tracy 9115* (G); hammocks between Miami and Cocoanut Grove, *J. K. & G. K. Small 4694* (G); Elliott's Key, *Simpson 505* (F, G); Miami, *A. H. Curtiss 5849* (F, G). Monroe Co.: Pine Crest, *Moldenke 865* (M, NY). Palm Beach Co.: Kelsey City, *Fannie R. Randolph 135* (G); Palm Beach, May 20, 1895, *A. H. Curtiss* (G). LOUISIANA. Terrebonne Co.: Houma, Sept. 6, 1912, *Wurzlow* (F).

For a review of the evidence supporting the application of the name *Euphorbia hirta* to the species described above see my discussion in Contr. Gray Herb. **127:** 71–72. 1939. Also see op. cit., 78, for reasons for applying *E. pilulifera* L., which has been applied to the concept here called *E. hirta*, to an Old World plant.



MAP 18, range of EUPHORBIA HIRTA var. PROCUMBENS in U. S. but Pennsylvanian ballast plants omitted; 19, E. SETILOBA in U. S.; 20, E. GEYERI; 21, E. TRACHYSPERMA; 22, dots E. OCELLATA var. TYPICA, circles E. OCELLATA var. ARENICOLA; 23, E. ALBOMARGINATA in U. S.; 24, dots E. GLYPTOSPERMA, circles E. HIRTA var. TYPICA in U. S. but Michigan and New York waifs omitted, square E. OCELLATA var. RATTANII; 25, E. PARISHII; 26, E. MICROMERA in U. S.; 27, E. CINERASCENS in U. S.; 28, E. STICTOSPORA in U. S.; 29, dots E. FENDLERI var. TYPICA in U. S., circle E. FENDLERI var. TRILIGULATA; 30, dots E. CORDIFOLIA, circles E. LAREDANA; 31, dots E. FENDLERI var. CHAETOCALYX, circles intergrades between E. FENDLERI vars. TYPICA and CHAETOCALYX; 32, dots E. HOOVERI, circles E. VALLIS-MORTAE; 33, dots E. ANGUSTA, circle E. ASTYLA in U. S.

17. Euphorbia capitellata Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**)**:** 188. 1859. Type: low valley at San Bernardino, Cochise County, Arizona, Oct. 3, 1851, *C. Wright 1849* (M 149810!; photographs G!, W!; isotypes G!, NY!). Rather lax and long-leaved; leaves nearly glabrous. Boissier in DC. Prod. **15** (**2**)**:** 22. 1862; L. C. Wheeler, Bull. Torr. Bot. Club **62:** 537. 1935.—*Chamaesyce capitellata* (Engelm.) Millsp., Field Mus. Pub. Bot. **2:** 408. 1916.—*E. capitellata* var. *typica* L. C. Wheeler, Bull. So. Calif. Acad. Sci. **35:** 127. 1936.

E. pycnanthema Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**)**:** 188. 1859. Type: on mountainsides near Lake Santa Maria, Chihuahua, Mexico, April 20, 1852, *C. Wright 186* (M 144666!; photographs G!, W!; isotypes G!, NY!). Compact and leaves pubescent. Boiss. in DC. Prod. **15** (**2**)**:** 22. 1862.—*Chamaesyce pycnanthema* (Engelm.) Millsp., Field Mus. Pub. Bot. **2:** 411. 1916.

E. Rusbyi Greene, Bull. Calif. Acad. Sci. **2:** 57. 1886. Type: near Prescott, Yavapai County, Arizona, June 19, 1883, *H. H. Rusby 822* (probably destroyed in 1906 when the herbarium of California Academy burned, for no specimen is in the Herbarium Greeneanum at Notre Dame according to Dr. Theodor Just in letter of Feb. 25, 1939 filed at Gray Herbarium); isotype M!; photograph of isotype G!). Pubescent, small, and erect.—*Chamaesyce Rusbyi* (Greene) Millsp., Field Mus. Pub. Bot. **2:** 411. 1916.

E. geminiloba Millsp., Proc. Calif. Acad. Sci. ser. 2, **2:** 228. 1889. Type: Pozo de Los Dolores, Lower California, Mexico, Apr. 5, 1889, *T. S. Brandegee* (F 196142!, photograph G!, W!). A specimen with the tips of the branches missing and the leaves coarsely serrate.

Euphorbia pycnanthema forma *serrata* Millsp., op. cit., 222. 1889. "Pozo de Los Dolores, April 5th" 1889, Lower California, *T. S. Brandegee* (?). The type has not been located. At least an isotype may be expected at C. The description suggests that it was based on the same minor variant and perhaps even the same specimen as *E. geminiloba.*

E. capitellata var. *laxiflora* S. Wats., Proc. Amer. Acad. Arts & Sci. **24:** 74. 1889. Type: high mountains, Guaymas, Sonora, Mexico, 1887, *Ed. Palmer 210* (G!, isotype US!). Erect with long internodes and narrow glabrous leaves.

E. Chamberlinii I. M. Johnston, Proc. Calif. Acad. Sci. ser. 4, **12:** 1066. 1924. Type: Escondido Bay, Lower California, Mexico, June 14, 1921, *I. M. Johnston 4136* (CA 1288!). Has a distinctive appearance due to an abundance of white coccids.

E. gladiosa M. E. Jones, Contr. West. Bot. **15:** 144. 1929. Type: Guaymas, Sonora, Mexico, Nov. 2, 1926, *M. E. Jones 22613* (P!). The same variant as *E. capitellata* var. *laxiflora*.

Perennial; stems few to numerous, ascending to erect, 5–40 cm. long, 0.5–1.5 mm. thick, glabrous to pubescent, internodes up to 4.5 cm. long, mostly about 1 cm. long; leaf-blades ovate-acute to linear-lanceolate, 4–25 mm. long, glabrous to pubescent, base markedly inequilateral, margin entire to coarsely and sharply serrate; petioles ca. 1 mm. long; stipules mostly distinct, triangular- to subulate-attenuate, parted into a few erect linear segments, ciliate to pubescent, 1.5–2 mm. long; cyathia congested in cymose glomerules of several to many, or a few solitary in the upper bifurcations; peduncles pubescent to glabrous, 0.5–1 or rarely to 3 mm. long; involucre campanulate to broadly obconical-campanulate, 1.3–1.7 mm. in diam., glabrous to pubescent outside, hairy on the inside of the lobes and stipes; lobes narrowly triangular, acuminate, slightly to markedly exceeding the glands; glands circular to transversely oval, 0.2–0.45 mm. in diam., on long stipes; appendages white to pink, glabrous, entire, usually conspicuous; fifth gland linear, pubescent, ½–¾ as long as the lobes; sinus U-shaped, slightly depressed; bracteoles united and forming radial partitions adnate for ca. ⅔ their length to the involucre below the gland, free portion pubescent, entire to once parted; staminate flowers 28–41 per cyathium; androphores sparsely pubescent above, or glabrous, 1.6–1.9 mm. long; ovary slightly 3-lobed, mostly pubescent, sometimes glabrous; styles ½–⅔ bifid, glabrous or sometimes with a few hairs at the base, 0.6–0.7 mm. long; capsule pubescent to glabrous, 1.3–1.9 mm. long, subacutely 3-lobed, widest at the equator or slightly below; seeds quadrangular, 1.2–1.4 mm. long, 0.6–0.8 mm. tangentially, 0.6–0.7 mm. radially, narrowly ovate to very narrowly oblong-ovate radially, apex acute, base obtuse to truncate, facets with small shallow depressions or even sub-regular faint transverse wrinkles.—PLATE 657B.

Arizona, western Texas, Chihuahua, Coahuila, Sonora, Sinaloa, Lower California (MAP 45) Representative specimens seen: TEXAS. Brewster Co.: along Blue Creek, foot-hills of Chisos Mountains, *E. J. Palmer 34199* (M, NY); near Castolon, *Cory 1907* (G). ARIZONA. Coconino Co.: Ashfork to Williams, *Kearney & Peebles 12077* (G). Yavapai Co.: Prescott, *Rusby 317* (NY, US). Gila Co.: 6 miles east of Cassadore Springs, *Maguire, Richards & Moeller 13068* (I); Roosevelt Dam, *Eastwood 8668* (G). Pinal Co.: 2 miles below Coolidge Dam, *Maguire, Richards & Moeller 10431* (G, I); Picacho Mountains, *Peebles 6493* (NY); Graham Co.: Fairview, *M. E. Jones 4097* (G, I, NY, O, US); 10 miles west of Ash Creek Ranch, San Carlos Indian Reservation, *Maguire, Richards & Moeller 10375* (G, I). Pima Co.: near Colossal Caves, Tucson, *Maguire, Richards & Moeller 11699* (G, I); east of Ranger Station, Baboquivari Mountains, *Wiegand, Maguire, Richards & Moeller 10778* (I); near Tucson, May 3, 1883, *Pringle* (NY, US), Apr. 8, 1881, *Pringle* (G, M, US), Oct. 27, 1905, *Tracy 8987* (G, M, NY, US), Oct. 29, 1905, *Tracy 8953* (G, M, NY, US). Santa Cruz Co.: Ruby to Nogales, *Peebles & Fulton 11446* (NY). Cochise Co.: near Fort Huachuca, near Huachuca Mountains, *Lemmon 3112* (G). MEXICO: Chihuahua: near Chihuahua, June 5–10, 1908, *Ed. Palmer 370* (G, US); near Chihuahua, June 5–10, 1908, *Ed. Palmer 376* (G); near Chihuahua, *Pringle 699* (G, US); 7 miles north of Charco Piedra, *Johnston 7931* (G). Coahuila: Monclova, Aug., 1880, *Ed. Palmer 1211* (G). Sonora: Guaymas, June, 1887, *Ed. Palmer 83* (G, US), Aug., 1887, *Ed. Palmer 142* (G, US), Oct., 1887, *Ed. Palmer 317* (G, US). Badebuache, *C. E. Lloyd 457* (G). Sinaloa: Culiacan, Aug. 27–Sept. 15, 1891, *Ed. Palmer 1517* (G, US). Lower California: Concepcion Bay, *Johnston 4173* (G, US); 30 miles south of Mulege, *Shreve 7096* (G).

In Bull. So. Calif. Acad. Sci. **33:** 105–6. 1934, I had provisionally accepted the data on a specimen of this species which claimed to have come from an altitude of 6000–8000 feet in the San Jacinto Mountains, Riverside County, California. In view of the fact that this is the only collection purporting to have come from California and that it is far above the life zone in which it occurs in adjacent regions I am now refusing to accept as valid the data of this collection.

This species is as polymorphic as *E.pediculifera*. Both have a linear-leaved variation centering about Guaymas, Sonora. Perhaps the linear-leaved variation in one is of as much consequence as in the other. However, with some hesitation I have concluded that *E. capitellata* var. *linearifolia* is too vague and ill-defined for recognition due to the great number of intermediates in all characters.

18. Euphorbia acuta Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 189. 1859. Boiss., Icon. Euph., t. 6. 1866. Type: "N. Mex.", 1851, *C. Wright 1839* (M 149791!; fragment F!). A good representative of the species.—*Chamaesyce acuta* (Engelm.) Millsp., Field Mus. Pub. Bot. **2:** 407. 1916.

E. acuta var. *stenophylla* Boiss. in DC. Prod. **15** (**2**): 18. 1862. Type: limestone hills in the Big Bend of Devil's River, Texas, Nov., 1852, *C. Wright 1840* (Ge!; photographs G!, W!; isotypes G!, M!, US!). A narrow-leaved extreme intergrading completely.

Perennial from a farinaceous taproot as much as 1.5 cm. thick; stems annual, erect or ascending, numerous, 10–30 cm. long, to 1.5 mm. diam., with long weak hairs partially deciduous in age, internodes 1–4 cm. long; leaves sessile or subsessile, sparingly long-villous to densely appressed-tomentose below, less so and glabrate above, mostly 1–2 cm. long, ovate-lanceolate to lanceolate, base subsymmetrical, apex long-acuminate, cartilaginous at the extreme tip, margin sometimes strongly revolute; stipules apparently wanting; peduncles stout, to 2 mm. long, sparingly to densely villous; cyathia solitary at the nodes; involucres turbinate, 1.7–2.5 mm. diam., sparsely to markedly villous without, with fine short hairs within; lobes narrowly deltoid and entire, or broader and two-toothed, equaling or slightly exceeding the glands; glands transversely elongate, slightly concave, ochroleucous, the proximal 1–1.5 mm. long, the distal shorter; appendages mostly as wide as to wider and longer than the glands, glabrous, white, margin with irregular short blunt teeth; fifth gland totally absent; sinus somewhat depressed, U-shaped; bracteoles 3–5 opposite each gland, united at the base and sometimes throughout, of various lengths, some usually nearly equaling the glands, long-hairy; staminate flowers 4–5 per fascicle, 20–25 per cyathium; androphores 2.2–2.5 mm. long, slightly exserted, with from few to numerous slender hairs throughout; gynophore hairy, exserted and reflexed at maturity; ovary densely white-hairy, styles glabrous, ca. 1 mm. long, parted to the middle, divisions somewhat flattened, recurved; capsule sharply three-lobed, 3 mm. long and in diam., short-appressed-hairy; seeds quadrangular, ovate radially, 2.2–2.5 mm. long, 1.5–1.7 mm. tangentially, 1.5 mm. radially, base oblique, coat white, microreticulate.—PLATE 659B.

Southern New Mexico, western Texas, and northern Coahuila (MAP 35). Representative specimens seen: NEW MEXICO. Sierra Co.: Lake Valley, 1915, *Beals* (US). Eddy Co.: east of Carlsbad, *Standley 40287* (US). TEXAS. Brewster Co.: Agua Fria road, *Cory 1915* (G); south of Alpine, *Cory 18593B* (G). Crockett Co.: Ozona, *M. E. Jones 26015* (M). Edwards Co.: Barksdale, *E. J. Palmer 10984a* (US). Kinney Co.: *Cory 508* (G). Pecos Co.: northeast of Fort Stockton, *Cory 1914* (G). Presidio Co.: Marfa, June 9, 1895, *Plank* (NY). Reeves Co.: Pecos City, *Neally 719* (US). Terrell Co.: Sanderson, *Orcutt 765* (US); Dryden, *Cory 2273* (G). Uvalde Co.: west of Uvalde, *M. E. Jones 28439* (M); Utopia, 1916, *E. J. Palmer 10228* (US); near Uvalde, *E. J. Palmer 33618* (NY, US). MEXICO: COAHUILA: near Diaz, *Pringle 8278* (G, M, NY, US); 100 miles north of Monclova, Sept., 1880, *Ed. Palmer* (G); 17 miles south of Allende, Aug., *Johnston 7028* (G); at foot of eastern slope of the Sierra de Puerto Santa Ana, *Wynd & Mueller 243* (M, NY, US). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 435. 1936.

There seems to have been some confusion about the collections referred to this species. Engelmann in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 189. 1859, states "Stony prairies western Texas, along the San Pedro and Pecos river, &c.; *Bigelow, Schott.* (No. 1739 and 1749, Wright.)" There are before me what are presumably all the specimens of this species from the United States in the Herbarium of Missouri Botanical Garden. Yet none of the collections cited is in the suite. However, there is *Wright 1839* which I am taking as type. The most plausible explanation which occurs to me is that someone made a mistake in numbering some of these collections. All the other *Euphorbiae* of Wright's collections of the years 1851–2 bear numbers in the eighteen hundreds. (They were numbered phylogenetically by Asa Gray.) There are sheets at G, NY, and US bearing the number 1739. At both G and US someone has queried this number and added 1839. Just how Engelmann managed to cite No. 1739 when the sheet in his herbarium bore only the number 1839 is not clear. Engelmann's citation of number 1749 is even more puzzling. He did have a number 1840 which by a combination of poor handwriting and perhaps unknown circumstances was evidently converted into 1749. However, the problem can be dealt with very simply after the obvious assumption is made that there were errors in the numbers. *Wright 1839* is taken as type since it is a good specimen and entirely representative of the species. *Wright 1840* is the type collection of *Euphorbia acuta* var. *stenophylla* Boiss. and represents a narrow-leaved extreme of the species. The usual methods of elucidating the source of Wright's collections fail completely in this case. Of the three original numbers found, all came from Western Texas. It appears very likely that the material distributed as No. 1839 (or 1739) may have been from more than one of Wright's collections.

19. Euphorbia angusta Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 189. 1859. Type: Rocky bluffs at camp in big bend of the San Pedro (now Devil's) River, probably Valverde Co., Texas, May 21, 1851, *C. Wright 1828* (M 149804!, photographs G!, W!; isotypes G!, NY!. US!). A satisfactory representative of the species. Boiss. in DC. Prod. **15** (**2**): 18. 1862, & Icon. Euph., t. 7. 1866.—*Chamaesyce angusta* (Engelm.) Small, Fl. SE U. S., 711, 1333. 1903.

Perennial; stems several to numerous, erect, 12–43 cm. tall, thinly to densely short-strigose, 1–2 mm. thick above the base, often simple below and branching only above, internodes rarely up to 8 cm. long but mostly not over 2–4 cm. long and gradually shorter upward; leaf-blades of three completely intergrading sorts, (1) the basal, ovate to elliptic-oblong, 7–15 mm. long, (2) the median, elliptic-linear to linear, acuminate, 2–4 cm. long, (3) the upper, linear, often involute on drying, 4–10 mm. long, all entire (with the exception of a few serrulate basal leaves on one plant), strigose to glabrous, especially on the upper surface; petioles 0.5–1.5 mm. long; stipules tardily deciduous, distinct, consisting of brown segments arising from interpetiolar portion of the amplexicaul petioles, bearing a few short hairs, longest segments 0.6–0.9 mm. long; peduncles 1–3 mm. long, strigose; cyathia at the upper nodes, solitary; involucres narrowly campanulate to obconical, tapering to the peduncles, 1.3–1.6 mm. in diam., strigose outside, strigose inside except on the lower half beneath the lobes; lobes short, triangular, little exceeding the glands, small and densely hairy; glands narrowly transversely oblong, 0.4–0.6 mm. long, strongly depressed in the middle, appendages ascending, white, 0.3–0.7 mm. wide, longer than the glands, with a few short appressed hairs beneath at the base, outer margin truncate, shallowly and irregularly toothed; fifth gland absent, sinus U-shaped, strongly depressed; bracteoles united at the base into a tuft adnate below to the involucre beneath the glands, densely hairy, a little shorter than the androphores; staminate flowers 16–26 per cyathium; androphores 1.3–1.4 mm. long, mostly, i. e., some in each cyathium, with sparse fine hairs; gynophore strigose, shortly exserted and usually reflexed; ovary 3-lobed, densely appressed-hairy; styles obliquely spreading to erect, 0.4–0.6 mm. long, bifid only at the stigmatic apex to ⅓ to the base, with short appressed hairs at the base; capsule strigose, 2.1–2.4 mm. long, wider than long, deeply roundly to subacutely 3-lobed, wider below the equator; seeds quadrangular, 1.6–1.9 mm. long, 1.1–1.4 mm. tangentially, 1.3–1.4 mm. radially, ovate to broadly ovate radially, base obtuse to truncate, angles blunt but definite, ventral facets plane or concave, dorsal slightly convex, both traversed by few to several low irregular transverse ridges, coat off-white to chalk-white, microreticulate, testa dark gray.—Plate 659A.

Local in the Edward's Plateau region, western Texas (Map 33). Representative specimens seen: Texas: Bandera Co.: Medina Lake Hills, *Tharp 6013* (US). Bexar Co.: on the Cibolo and Sabinas (near San Antonio), *Lindheimer 429* (G, M). Comal Co.: bed of Cibolo River, Bracken, *Groth 131* (G, NY, US). Comanche Co.: Comanche Spring, June 1849, *Lindheimer* (G, M). Edwards Co.: Ranch Expt. Station, *Cory 3188* (G). Hays Co.: San Marcos & vicinity, May, 1897, *Stanfield* (NY). Kerr Co.: Turtle Creek, *Bray 276* (US); Kerrville, *Heller 1738* (G, M, NY, US). Llano Co.: Llano, *E. J. Palmer 10287* (US). Tom

Green Co.: Knickerbocker Ranch, Dove Creek, *Tweedy 258* (US). Travis Co.: Mt. Burnell, Austin, *Hall 559* (G, M, NY, US). Valverde Co.: Devil's River, *Orcutt 6040* (M); mouth of Pecos River, *Cory 26701* (G). Wilson Co.: Sutherland Springs, Aug., 1879, *Ed. Palmer* (G).

20. Euphorbia lata Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 188. 1859; based on *E. dilatata* T. & G., Rep. Expl. & Surv. Railr. Miss. R. to Pacific Ocean **2** (**4**): 175. 1855, not Hochst. ex A. Richard, Tent. Fl. Abyss. **2:** 240. 1851.[1] (*E. dilatata* E. Meyer in Drege, Flora, Jena **26:** Besondere Beigabe 184. 1843, has been given as preoccupying but is a *nomen nudum.*) Type: a specimen bearing only the data "Pope's Expedition"; (NY!; photographs G!, W!; probable isotype at G! bears the data "Ex coll. Geo. Thurber, Texas, Pope").—*Alectoroctonum dilatatum* (T. & G.) Klotzsch and Garcke, Abh. Akad. Berlin, Phys. **1859:** 39. 1860.—*Chamaesyce lata* (Engelm.) Small, Fl. Se. U. S., 710, 1333. 1903.

E. rinconis M. E. Jones, Contr. West. Bot. **12:** 76. 1908. Type: Rincon, Doña Ana County, New Mexico, 1890, *M. E. Jones* (P!). This is in no wise different.

Perennial, herbage with short appressed hairs; stems ascending or erect, 10–15 cm. long, 0.5–1 mm. thick; internodes 0.5–2 cm. long; leaf-blades ovate-deltoid-falcate to long-deltoid or virtually linear in some cases by revolution of the margins, margin entire, more or less revolute; petioles ca. 1 mm. long; cyathia solitary at the nodes; involucres turbinate, 1.7–2 mm. in diam., with short appressed hairs without, glabrous within except above; lobes deltoid, entire, equaling or exceeding the glands; glands transversely oblong, ca. 0.5 mm. long, hairy beneath; appendages absent or very narrow, white, crenate; fifth gland minute or absent, with a tuft of hairs in its interval; sinus somewhat depressed; bracteoles united below into one radial appendage adnate below to the involucre opposite each gland, 4–7 parted above, not quite equaling the glands, with straight long slender hairs above; staminate flowers 5–7 per fascicle, 25–35 per cyathium; androphores 1.9–2.2 mm. long, equaling the glands, with numerous hairs above; gynophore hairy, shortly exserted and reflexed at maturity; ovary with short appressed hairs, three-angled; styles ca. 0.75 mm. long, parted to or below the middle, with very short hairs below; capsule sharply three-lobed, with appressed hairs, ca. 2.5 mm. long, 2.5 mm. in diam.; seeds quadrangular, 2 mm. long, 1 mm. radially and tangentially, long-deltoid radially, back rounded, raphal ridge straight in tangential silhouette, base obtuse-truncate, angles sharp, facets smooth, depressed, coat white, microreticulate.—Plate 659C.

Plains of Kansas, south to Texas, west to Colorado and New

[1] Date fide Pritzel, Thes. Lit. Bot. ed. 2, 240. 1872.

Mexico (MAP 36). Representative specimens seen: KANSAS. Morton Co.: on Cimarron River, north of Elkhart on Point Rock, *Rydberg & Imler 944* (M, NY). TEXAS. Brewster Co.: 17 miles south of Alpine, *Cory 9294* (G). Coleman Co.: Coleman, April, *Reverchon 1355* (M, NY). Coryell Co.: gravelly hills, Eagle Springs, *Bigelow* (NY). Culberson Co.: near Kent, *Earle & Tracy 381* (NY); Signal Peak, Guadalupe Mountain, *Whitehouse 502* (NY). Hudspeth Co.: *Cory 1921* (G). Jeff Davis-Brewster Co.: mountain slopes between Alpine and Fort Davis, *Small & Wherry 12047* (NY). Martin Co.: near Stanton, June 12, 1900, *Eggert* (M). Mitchell Co.: north of Colorado, June 8, 1900, *Eggert* (M). Potter Co.: prairies, Amarillo, May 28, 1902, *Reverchon* (M). Presidio Co.: *Cory 1919* (G). Randall Co.: west Canyon City, Aug. 12, 1900, *Eggert* (M). Reeves Co.: plains west of the Pecos, *Earle & Tracy 104* (Mo, NY). Taylor Co.: north Abilene, June 7, 1900, *Eggert* (M). Tom Green Co.: San Angelo, *E. J. Palmer 10310* (M). County?: near the Sabinal, May 13, 1851, *C. Wright 1841* (G, M, NY). COLORADO. Baca Co.: 19 miles north Boise City, Oklahoma in Colorado state, *Stratton 441* (M). NEW MEXICO. Chaves Co.: Rosswell, alt. ca. 3800 ft., *Earle 343* (NY). Doña Ana Co.: Organ Mountains, *Vasey* (M). Lincoln Co.: Carrizozo, *Earle 592* (NY). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 434. 1936. Formerly, l. c., I included some collections from Coahuila in this species. They are not at hand now. *Palmer 1205* in 1880 at G is *E. fruticulosa* Engelm.

Wright no. 1841 would have been preferable as type as far as locality-data are concerned. However, the collection chosen as type is accompanied by drawings and notes of diagnostic characters and the plants are in far better condition. Consequently, since the description seems to have been drawn from these plants, I have taken them as type. The specimens were very likely collected on the Pope Expedition in Texas somewhere near the thirty second parallel of north latitude.

21. EUPHORBIA GOLONDRINA L. C. Wheeler, Proc. Biol. Soc. Wash. **53:** 8. 1940. TYPE: along sandy beach at entrance to Boquillas Canyon, Chisos Mountains area, Brewster County, Texas, Aug. 5, 1937, *B. H. Warnock 998* (US 1726028!; fragments G!; photographs G!, W!).

Annual, glabrous; stems prostrate, to 15 cm. long, 0.7–1.5 mm. thick, internodes up to 2 cm. long; leaf-blades mostly 6–9 mm. long, oblong to narrowly oblong or even narrowly elliptic, entire, base inaequilateral; petioles ca. 1 mm. long, amplexicaul; stipules 0.7–1 mm. long, mostly glabrous, ventral united into a median, subulate, often bifid structure, dorsal distinct, linear; peduncles

1–1.5 mm. long; cyathia solitary at the nodes; involucres turbinate, 1.1–1.3 mm. diam., glabrous without, glabrous within except for short hairs at base of lobes, gland-stipes and a line extending half-way down below the stipes; lobes slenderly deltoid-attenuate, not quite equaling the glands; glands subcircular or a little longer than wide, deeply concave, sometimes folded together, 0.3–0.5 mm. in diam.; appendages white, glabrous, entire, forming a semi-lunate margin to the gland, 0.2–0.5 mm. wide; sinus U-shaped, slightly depressed, short-hairy; 5th gland linear, equaling the lobes and clothed like them; bracteoles more or less united together below and adnate to the involucre, free ends linear, short-hairy; staminate flowers 7–10 per fascicle, 39–50 per cyathium; androphores ca. 1.5 mm. long, glabrous; gynophore glabrous, exserted and reflexed at maturity; ovary glabrous, obtusely 3-angled; styles ca. 0.4 mm. long, glabrous, parted nearly to the base, slightly clavate; capsule broadly ovoid, glabrous, 3-angled, ca. 1.8 mm. long; seeds 1.6–1.8 mm. long, subquadrangular, narrowly ovate radially, base truncate, ca. 0.8 mm. radially and tangentially, facets slightly convex, irregularly wrinkled, dorsal and lateral angles blunt, raphe so low and blunt as to scarcely separate the front facets.—Plate 664A.

Known only from the type (Map 37).

22. Euphorbia pediculifera Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 186. 1859.

Perennial from a taproot stout in age; stems prostrate to erect, appressed-pubescent, glabrate in age, up to 2 mm. in diam. toward the base, internodes up to 5 cm. long, often very short toward the stem-tips thus congesting the cyathia; leaves closely appressed-pubescent, or sometimes closely tomentose, to subglabrous, blades 2–37 mm. long, 1–10 mm. wide, ovate with oblique base, oblong with subsymmetrical base to spathulate and even narrowly linear with symmetrical base, petioles 1–2 mm. long, amplexicaul on ventral side of stem; stipules mostly less than 0.5 mm. long, the ventral united, the upper distinct; peduncles clothed as the leaves, up to 1.5 mm. long; cyathia solitary at the nodes, sometimes congested at the branch-tips by shortening of the terminal internodes but not strictly glomerulate; involucres campanulate, 1.5–2 mm. long, closely appressed-pubescent to sub-glabrous without, more or less short-hairy within above; lobes deltoid, hairy, equaling the glands; glands transversely oblong, 0.5 mm. wide, 0.75–1.25 mm. long, dark red-purple; appendages absent or up to 2 mm. wide and 3 mm. long, entire or slightly lobed, glabrous; fifth gland very short or usually absent; sinus U-shaped, hairy, little depressed; bracteoles shorter than the androphores, usually very hairy above, in one group of 6–8 opposite each gland, united at the base and adnate to the involucre; staminate flowers 4–5 per fascicle, 22–25 per cyathium; androphores ca. 1.25 mm. long, included or shortly exserted, glabrous or with few hairs above; gynophore nearly glabrous or hairy nearly throughout, exserted and reflexed at maturity; ovary very slightly lobed, densely hairy, tapering upward; styles ca. 1 mm. long, slender, parted to the base, short-hairy on the lower side to the tip; capsule appressed-pubescent, widest below the middle, 2 mm. in diam. and long, markedly three-lobed, the lobes obtuse; seeds slenderly ovoid, 1–1.3 mm. long, 0.6–0.7 mm. diam., encircled by 4 or 5 rounded ridges with V-shaped channels between, coat white.

Key to Varieties

Leaves ovate to lanceolate with obtuse apex, rarely over 2 cm. long; bracteoles 6–8, united only at base and conspicuous. . .a. var. *typica*.
Leaves strictly linear, often over 2 cm. long, up to 3.7 cm. long; bracteoles usually inconspicuous, if conspicuous united upward . . . . .b. var. *linearifolia*.

22a. E. pediculifera Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 186. 1859, var. typica L. C. Wheeler, Bull. Torr. Bot. Club **63:** 442. 1936. Type: "On the Sonoita [Creek] near Deserted Rancho," Santa Cruz County, Arizona, Sept. 15, 1851, *C. Wright 1848* (M 144671!; photographs G!, W!; isotypes G!, NY!). A very good representative of the species with short broad leaves and medium-sized appendages.—*Chamaesyce pediculifera* (Engelm.) Rose & Standley, Contr. U. S. Nat. Herb. **16:** 12. 1912.

E. involuta Millsp., Proc. Calif. Acad. Sci., ser. 2, **2:** 227. 1889. Type: Comondu, Lower California, Apr., 1889, *T. S. Brandegee* (F 196145!; photographs G!, W!; isotype C!). A plant from which the larger leaves have fallen.—*Chamaesyce involuta* (Millsp.) Millsp., Field Mus. Pub. Bot. **2:** 410. 1916.—*E. pediculifera* Engelm. var. *involuta* (Millsp.) I. M. Johnston, Proc. Calif. Acad. Sci., ser. 4, **12:** 1070. 1924.

E. conjuncta Millsp., Proc. Calif. Acad. Sci., ser. 2, **2:** 227. 1889. Type: Purisima, Lower California, Feb. 12, 1889, *T. S. Brandegee* (F 196147!; photographs G!, W!; isotypes C!, G!). Leaves somewhat narrowed at the base, which is not unusual.—*Chamaesyce conjuncta* (Millsp.) Millsp., Field Mus. Pub. Bot. **2:** 408. 1916.

E. pediculifera Engelm. var. *inornata* T. S. Brandegee, Zoe **5:** 209. 1905. Type: Cofradia, vicinity of Culiacan, Sinaloa, Mexico, Oct. 23, 1904, *T. S. Brandegee* (C!; isotypes F!, G!). A minor variant with appendages of glands lacking and rather short internodes.

E. vermiformis M. E. Jones, Contr. West. Bot. **16:** 23. 1930. Type: Ajo, Pima County, Arizona, Sept. 18, 1929, *M. E. Jones 24856* (P!; isotypes G!, NY!). A variant with long internodes and long narrow leaves approaching *E. pediculifera* var. *linearifolia.*—Plate 664C, figs. 1–9.

Colorado Desert, California, southern Arizona, Baja California, Sonora, and Sinaloa (Map 6). Representative specimens seen: California. Imperial Co.: upper end of Painted Gorge, Carisso Mountains, *Ferris & Rossbach 9624* (G). Arizona. Yuma Co.: near Mohawk, *Peebles & Harrison 5021* (US); Dome to Castle Dome, *Peebles & Kearney 10939* (US). Yavapai Co.: Castle Creek, Bradshaw Mountains, *Toumey 260* (US). Maricopa Co.: Black Cañon Road, 23 miles north of Phoenix, *Gillespie 8665* (US); Camp Creek, *Harrison 1938* (US). Pinal Co.: sandy soil, ½ mile north of Mammoth, *Maguire, Richards & Moeller 10834* (G, I); Oracle, *Newlon 699* (J); near Maricopa, *Peebles, Harrison & Kearney 4909* (US). Pima Co.: Picture Rocks, Tucson Mountains, *Bartram 326* (US); sandy wash-bed, 26 miles east of Tucson, *Maguire, Richards & Moeller 11222* (G, I); Quitovaquito, *Mearns 2746* (US). Santa Cruz Co.: Patagonia and Nogales, *Peebles, Harrison & Kearney 5628* (US); hills between Calabasas and Nogales, *Tidestrom 802* (US). Cochise Co.: Bowie, *Lemmon 283* (G). MEXICO: Lower California: San Marcos Island, *Johnston 3641* (C, G, US); San Luis Gonzales Bay, *Johnston 3331* (C, G, US); near El Marmol, *Wiggins 4364* (G, US); Carmen Island, Nov. 1–7, 1890, *Ed. Palmer 835* (G, US); Cocopa Mountains, *MacDougal 122* (NY); Santa Rosalia, north of flying field, *Ferris 8697* (US); San Felipe, *Goldman 1162* (US); Isla Partida, *Collins, Kearney & Kempton 145* (US). Sonora: Hacienda Oquito (Cutting's Ranch) 6 miles east of Altar, *Wiggins 5967* (US); granitic hills, 5 miles east of Garumbullo, *Wiggins 6125* (US); Bacum Station near Rio Yaqui, *Pennell 20214* (US); 12 miles east of Libertad, *MacDougal & Shreve 48* (US); New Year's Mine, 20 miles south of Hermosillo, *M. E. Jones 22617* (G); 7 miles west of Mina San Jose on road to Misa, *Wiggins 6311* (US). Sinaloa: Topolobampo, *Rose, Standley & Russell 13276* (US). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 442–443. 1936.

Some of the plants of Arizona, particularly *M. E. Jones 24856*, approach the linear-leaved var. *linearifolia.* If, however, the leaf variations here included under var. *typica* were all named little but confusion would result. Some of the plants from the hottest and driest parts of the deserts have very small whitish-tomentose leaves resembling *E. melanadenia* from which the very different seeds distinguish it.

The specimen chosen here as type was left unnamed by Engelmann. Nevertheless, this is taken as type in preference to the collection of Schott which Engelmann did name, for Schott's specimen lacks seeds and has but few cyathia. Too much weight need not be given the fact that Engelmann did not name the cited sheet of *Wright 1848* in his herbarium for there is another case in which Engelmann failed to name his specimens. Of the three numbers cited by Engelmann as *E. glyptosperma* var. *tenerrima* none was named!

22b. E. PEDICULIFERA Engelm. var. LINEARIFOLIA S. Wats., Proc. Amer. Acad. Arts & Sci. **24:** 76. 1889. TYPE: high mountains, Guaymas, Sonora, Mexico, Sept., 1887, *Ed. Palmer 215* (G!; ISOTYPES C!, US!).—PLATE 664, C, FIGS. 10–11.

Local about Guaymas, Sonora. Additional specimens seen: Guaymas, 1893, *T. S. Brandegee* (C); among rocks at foot of hills, Guaymas, Nov., 1887, *Ed. Palmer 627* (C, F, G, US); San Pedro Bay, *T. Craig 671* (P).

This variety, though extralimital, is included here for completeness since some of the Arizonan plants approach it.

23. EUPHORBIA CINERASCENS Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 186. 1859. TYPE: Bishops Hill near Monterey, Nuevo Leon, Mexico, Feb. 5, 1847, *J. Gregg 215* (M 46715!; photographs G!, W!; ISOTYPE G!, NY!). A satisfactory representative of the species.—*E. melanadenia* Torrey var. *subinappendiculata* Engelm., Proc. Amer. Acad. Arts & Sci. **5:** 172. 1861.[1] Boissier in DC. Prod. **15** (**2**): 32. 1862.—*Chamaesyce cinerascens* (Engelm.) Small, Fl. Se. U. S., 710, 1333. 1903.

Perennial, forming mats up to 50 cm. in diam.; stems to 30 cm. long, prostrate or decumbent, mostly slender (1 mm. diam.), clothed with crisped, short, mostly appressed hairs, internodes up to 2.5 cm. long, average ca. 1 cm.; leaf-blades 2–9 mm. long, ovate with oblique base to oblong with slightly oblique base, usually glabrous above, closely tomentose to glabrate beneath; petioles tomentose, 1–2 mm. long; stipules hairy, ca. 0.5 mm. long, ventral united, linear, dorsal distinct, linear; peduncles less than 1 mm. long, with short appressed hairs; cyathia solitary at the nodes; involucres turbinate, 1.2–1.5 mm. diam., appressed-short-hairy without, glabrous within except below the glands; lobes narrowly deltoid, copiously hairy, equaling the glands; glands transversely oblong, dark reddish-purple; appendages narrow or usually wanting; fifth gland absent; sinus U-shaped, not depressed, densely hairy; bracteoles forming a radial appendage opposite each gland, often united only below, with 5 or 6 very slender short-hairy free segments above; staminate flowers 3–4 per fascicle, 15–20 per cyathium; androphores 1.5–2 mm.

[1] Date according to Trelease & Gray, Bot. Works Geo. Engelmann, 439. 1887.

long, glabrous; gynophore shortly appressed-hairy, exserted and reflexed at maturity; ovary copiously hoary-tomentose, roundly three-lobed; styles parted nearly to the base, 0.5–0.8 mm. long, short-hairy below, clavate; capsule 1.5–1.75 mm. long, ovoid, sharply angled, very short-tomentose; seeds quadrangular 1.2–1.5 mm. long, ca. 0.6–0.9 mm. radially, ca. 0.6–1 mm. tangentially, facets smooth or faintly wrinkled, oblong or often deltoid-oblong radially (i. e. wider below), base obtuse or truncate, apex acutish, coat white, microreticulate.—PLATE 663B.

Southwestern Texas, Chihuahua, Coahuila, Nuevo Leon, San Luis Potosi, and Tamaulipas (MAP 27). Representative specimens seen: TEXAS. Brewster Co.: Lechuguilla Flats out of Green Gulch, Chisos Mountains, *Sperry 449* (US); Chisos Mountains, *Mueller 8080* (M, NY, US). Kimble Co.: 5 miles west of Roosevelt, *Cory 21208* (G). MEXICO. CHIHUAHUA: limestone hillside, pass 19 miles east of Jimenez, *Johnston 7851* (G); silty plain 8 miles northwest of Cruces, *Johnston 7987* (G); gravelly benches, pass between Chilicote Station & Las Animas, *Johnston 7997* (G). COAHUILA: Juarez on the Sabinas River, 100 miles north of Monclova, Sept., 1880, *Ed. Palmer 1204* (F, G, US); rocky slopes of canyon, 5 miles north of Saucillo, *Johnston 7211* (G); on desert plain, 7 miles south of Hipollito, *Johnston 7240* (G); desert 41 miles west of Saltillo, *Johnston 7694* (G); Municipio de Ramos Arizpe, dry mountain slope east of Hacienda la Rosa, *Wynd & Mueller 37* (G). NUEVO LEON: Monterey, Feb. 17–26, 1880, *Ed. Palmer 1197* (G, US). SAN LUIS POTOSI: Estacion de Catorce, Sierra Madre Oriental, gravelly bed of arroyo, *Pennell 17570* (US); Charcas, *Lundell 5196* (US); rocky slopes of a hill, 11 miles south of Matehuala, *Johnston 7577* (G). TAMAULIPAS: Victoria, May 1–June 13, 1907, *Ed. Palmer 548* (US); Cerro de la Tamaulipeca, near San Miguel, Sierra de San Carlos, *Bartlett 10559* (US). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 439–440. 1936.

24. EUPHORBIA VALLIS-MORTAE (Millsp.) J. T. Howell, Madroño **2:** 19. 1931. TYPE: a few kilometers north of Indian Wells, between Mohave and Keeler, Kern County, California, June 21, 1891, *Coville & Funston 1008* (US 16203!; fragment F!)—*Chamaesyce vallis-mortae* Millsp., Field Mus. Pub. Bot. **2:** 403. 1916.

Perennial, usually forming a dense rounded plant up to 15 cm. high; herbage hoary-tomentose throughout; stems usually arising from 2–4 cm. below the surface of the ground, this portion brown and glabrous, aërial portion to 1 mm. diam., internodes mostly 1–2.5 cm. long, but much shortened toward the tip, thereby congesting the leaves and cyathia; leaf-blades suborbicular to oblong-ovate, mostly 4–8 mm. long; lower stipules united, filiform, ca. 1 mm. long, densely hairy, upper stipules distinct, filiform, ca. 0.7 mm. long, densely hairy; cyathia solitary at the nodes; peduncles stout, to 1.5 mm. long, densely hairy; involucres campanulate, ca. 2 mm. diam., densely hairy without, with long erect hairs extending halfway down within opposite glands; lobes with long ascending hairs within, equaling or slightly exceeding the glands, deltoid, entire; glands yellowish or reddish, transversely oblong, to 1 mm. long, the distal slightly shorter; appendages white, as wide as and a little longer than the glands, entire or crenulate, with numerous short hairs beneath and on the margins and a few above; fifth gland absent; sinus U-shaped, with long erect hairs at the bottom; bracteoles mostly united into one group of 6–10 bracteoles opposite each gland, more or less united below, adnate to the involucre, sometimes with shorter bracteoles outside the fascicle, all hairy above; staminate flowers 3–5 per fascicle, 17–22 per involucre; androphores ca. 2 mm. long, slightly exserted, sometimes with a few short hairs above; gynophore densely hairy, long-exserted and reflexed at maturity; ovary three-lobed, densely hairy; styles ca. 0.5 mm. long, parted to the middle, short-hairy below; capsule tomentose, three-angled, 2 mm. long and in diam.; seeds sharply quadrangular, 1.4–1.7 mm. long, ca. 0.7 mm. tangentially and radially, ovate radially, raphe straight, back rounded in tangential silhouette, base obtusely truncate, facets smooth or nearly so, ventral facets concave, dorsal facets slightly convex, coat white, microreticulate.—PLATE 663C.

Eastern base of the Sierra Nevada from northwestern Mohave Desert north to Owen's Lake, California (MAP 32). Specimens seen: CALIFORNIA. Inyo Co.: west shore of Owens Lake, *Hall & Chandler 7323* (C, M, P). Kern Co.: Indian Wells, *Hoffmann 617* (P), *Purpus 5473* (F, G, J, M, US); 6 miles north of Freeman, *Hoffmann 585* (CA, SB); Dove Springs, 1931, *Hoffmann* (SB); Red Rock Canyon, *J. T. Howell 4973* (CA, Peir).

The particular locality-data for the type collection are lacking on the label but are given by Coville, Contr. U. S. Nat. Herb. **4:** 256. 1893.

25. EUPHORBIA MELANADENIA Torrey, Rep. Expl. & Surv. Miss. R. to Pacific Ocean **4:** 135. 1857. TYPE: "Low places near San Gabriel", Los Angeles County, California, 1853–4, *J. M. Bigelow* (NY!; photographs G!, W!; ISOTYPE G!). A good representative of the species. Munz, Man. So. Calif. Bot., 289, fig. 153. 1935, good except styles should be 3.—*Anisophyllum melanadenium* (Torr.) Klotzsch & Garcke, Abh. Akad. Berlin, Phys. **1859:** 23. 1860.—*E. polycarpa* Bentham var. *vestita* S. Wats., Bot. Calif. **2:** 73. 1880.—*Chamaesyce melanadenia* (Torr.) Millsp., Field Mus. Pub. Bot. **2:** 410. 1916.

E. cinerascens Engelm. var. *appendiculata* Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 186. 1859. TYPE: San Felipe, San Diego County, California, May, 1852, *Geo. Thurber 628* (M 46715!; ISOTYPES G!, NY!). Differs in no consequential respect.—*E. polycarpa* Bentham var. *appendiculata* (Engelm.) Munz, Bull. So. Calif. Acad. Sci. **31**: 68. 1932.

Chamaesyce aureola Millsp., Field Mus. Pub. Bot. **2**: 406. 1916. TYPE: Azusa, Los Angeles County, California, alt. 800 feet, May 3, 1912, *H. H. Smith 4933* (F 389282!, photographs G!, W!). A good match for the type of *E. melanadenia*.

E. polycarpa Bentham *sensu* Thurston, Wild Flowers So. Calif., 181, fig. 274. 1936 (photograph).

Perennial from a taproot as much as 5 mm. in diam.; stems ascending or erect, to 20 cm. long, sometimes stout (1.5 mm. diam.) below, closely tomentose, glabrate; leaf-blades 2–9 mm. long, ovate to ovate-lanceolate, base oblique, closely and often hoary tomentose on both surfaces, petioles clothed, as the leaves, 1–2 mm. long; ventral stipules mostly united, linear, hairy, to 1 mm. long, dorsal stipules distinct, linear, hairy, to 1 mm. long; peduncles less than 1 mm. long, with short appressed hairs; cyathia solitary at the nodes; involucres open-campanulate, 1.2–1.5 mm. diam., appressed-short-hairy without, glabrous within except below the glands; lobes narrowly deltoid, copiously hairy, equaling the glands; glands transversely oblong, dark reddish; appendages usually conspicuous, twice as wide as and longer than the glands to rarely wanting, white, margin crenate to subentire, glabrous or rarely with a few short hairs beneath next to the gland; fifth gland absent; sinus U-shaped, not depressed, densely hairy; bracteoles more or less completely united into an upwardly broadening, densely hairy, thickish, radial appendage adnate on the lower half to the involucre opposite each gland; staminate flowers 3–4 per fascicle, 15–20 per cyathium; androphores 1.5–2 mm. long, glabrous or rarely with short hairs above; gynophore shortly appressed-hairy, exserted and reflexed at maturity; ovary copiously hoary-tomentose, roundly three-lobed; styles parted nearly to the base, 0.5–0.8 mm. long, short-hairy below, slender throughout; capsule 1.5–1.7 mm. long, ovoid, sharply angled, very short-tomentose; seeds quadrangular, 1.2–1.5 mm. long, ca. 0.6 mm. radially and tangentially, facets smooth or slightly wrinkled, apex acutish, coat white, microreticulate.—PLATE 663A.

Southern California, southern Arizona, northern Baja California including Guadalupe Island, Sonora (MAP 12). Representative specimens seen: CALIFORNIA. Los Angeles Co.: Verdugo Hills, *Abrams 1381* (NY); rocky slopes, San Gabriel Canyon, San Gabriel Mountains, *L. S. Rose 34521* (M, NY); Mt. Wilson Trail, San Gabriel Mountains, Apr. 5, 1933, *Steele & Pratt* (O);

slopes of Sierra Madre Canyon, San Gabriel Mountains, July 29, 1927, *Hastings* (NY); Lone Hill, near Glendora, *Munz & Eggleston 19622* (G). San Diego Co.: San Felipe Valley in Agave patches, *Reed 5833* (O); Yaqui Wells, Colorado Desert, *Eastwood 2773* (G, NY). Imperial Co.: 1 mile east of Mountain Springs, *Wiegand & Upton 3742* (G). ARIZONA. Yuma Co.: Mohawk Pass, *Lemmon 296* (G). Yavapai Co.: Copper Basin, *Toumey 251* (NY); on dry mesa, Big Bug, July 21, 1891, *Toumey* (US). Maricopa Co.: Agua Fria, *Coues & Ed. Palmer 264* (M); among the rocks, Canyon Lake, *A. Nelson 11216* (I); road banks along Apache Trail, west end of Canyon Lake, *A. & R. Nelson 1709* (M, NY). Pinal Co.: rocky south slopes, 5 miles west of Superior, *Maguire, Richards & Moeller 10263* (G, I); Oracle Ranger Station, Coronado Forest, *Eggleston 15967* (G, US). Pima Co.: La Osa, *Mearns 2688* (US); Canyon Diablo, Ajo Mountains, *Peebles & Kearney 10836* (US); Santa Catalina Mountains, *Shreve 5154* (G, US); Fresnal, *Thackery 83* (US). Gila Co.: Collom's camp at foot of Matzatzal Mountains, *A. & R. Nelson 1955* (G); Globe, *Kearney & Peebles 12060* (NY); rocky slopes of sandstone, Cassadore Spring Canyon, San Carlos Indian Reservation, *Maguire, Richards & Moeller 10301* (I); Collom Camp, Matzatzal Mountains, *Collom 33* (M, NY, US). Navajo Co.: Fort Apache, 1892, *Hoyt* (NY). Graham Co.: rocky soil, 12 miles east of Coolidge Dam, US Highway 180, *Maguire, Richards & Moeller 13024* (G, I). Cochise Co.: Pinery Creek, Chiricahua Mountains, Aug., 1896, *Fernow* (US). MÉXICO. BAJA CALIFORNIA: sandy wash at junction of El Marmol and San Fernando Roads, 25 miles from El Marmol, *Wiggins 4357* (G, US); Lagoon Head, Mar. 6–15, 1889, *Ed. Palmer 783* (G, NY); near San Quentin Bay, *Orcutt 2196* (M); Jacumba, *Fisher 39* (US). SONORA: granitic hills 2 miles south of Sasabe, *Wiggins 5915* (US). For citation of additional specimens see Bull. Torr. Bot. Club. **63:** 438–9. 1936.

Jepson, Man. Fl. Pl. Calif., 600. 1925[1] includes under *Euphorbia polycarpa* var. *vestita* three entities, judging by the range given: *E. melanadenia* "Santa Monica; Glendora; Cahuenga Pass"; *E. polycarpa* var. *hirtella*, at least in part, "Colorado Desert"; *E. vallis-mortae*, "Inyo Co.". However, Jepson, Fl. Calif. **2:** 429. 1936, has the entities correctly delimited and named except that the proof of the statement that *E. melanadenia* occurs in "western Nevada" has yet to be supplied. I find neither explanation nor support for it in the *Euphorbiae* of Jepson's herbarium which he so kindly loaned to the Gray Herbarium for my use.

[1] Title-page date questionable but here accepted as no question of priority is involved.

That the type of *E. melanadenia* did not come from "Low places near San Gabriel" is highly probable since this plant is confined to a narrow zone on the foot of the mountains in this region. Probably Bigelow collected it in the vicinity of Sierra Madre.

26. Euphorbia polycarpa Bentham, Bot. Voy. Sulphur, 50. 1844.

Perennial from a taproot slender or up to 6 mm. diam., prostrate or erect, sometimes forming a low rounded bush as much as 25 cm. high; stems very slender throughout or as much as 4 mm. diam. at base, sometimes zigzag, glabrous or with short spreading hairs, internodes mostly 1–2 cm. long, often much shorter upward; leaves glabrous or more or less pubescent, blades 1–10 mm. long, more or less oblique at base, orbicular to oblong-lanceolate, thin to thick, petioles clothed as the blades, 1–2 mm. long; ventral stipules united, ca. 0.5 mm. long, deltoid or rounded, ciliate or glabrous, dorsal stipules distinct, narrowly deltoid, ca. 0.5 mm. long, ciliate or sometimes glabrous; peduncles to 2 mm. long, glabrous or with short spreading hairs; involucres solitary at the nodes, distributed along the stem or more or less congested at the branch-tips, campanulate, 1–1.5 mm. in diam., glabrous or with short spreading hairs without, glabrous within except immediately below the glands, lobes narrowly deltoid to deltoid-attenuate, equaling or slightly exceeding the glands, short-hairy; glands maroon, transversely oblong, 0.5–0.75 mm. long; appendages up to three times as wide as the glands to absent, as long as or longer than the gland, white or reddish, entire or crenate, glabrous or with a few short hairs below on inner portion; fifth gland absent, its sinus U-shaped and not depressed, or V-shaped and slightly depressed; bracteoles forming a radial appendage opposite each gland, united to the involucre on lower half, linear, tapering upward, entire, or broader, with 2–5 divisions above, short-hairy above; staminate flowers 15–32 per cyathium; androphores 1–1.5 mm. long, glabrous or rarely short-hairy above; gynophore glabrous or short-hairy above, exserted and reflexed at maturity; ovary glabrous or densely pubescent, three-lobed; style bifid, 0.3–0.5 mm. long, glabrous or short-hairy below, clavate or slender above; capsule sharply 3-angled, glabrous or pubescent, spheroid, 1.1–1.3 mm. diam.; seeds quadrangular, 1–1.3 mm. long, ovate in radial outline, 0.5–0.6 mm. radially and tangentially, apex acutish, base truncate or obtuse, angles sharp, back curved, raphe straight, micropylar area slightly truncated, facets smooth or slightly wrinkled, plane or concave, the back facets lower than the angles, i. e., slightly depressed, coat micro-reticulate, white, opaque, or so thin that the brown testa shows through.

KEY TO VARIETIES

Appendages present, petioles ca. ¼ as long as leaves.
Appendages wide to narrow and herbage usually essentially glabrous...a. var. *typica*.
Appendages narrow and herbage pubescent...............b. var. *hirtella*.
Appendages absent, petioles ca. ½ as long as leaves........c. var. *simulans*.

26a. E. POLYCARPA Bentham, Bot. Voy. Sulphur, 50. 1844, var. TYPICA L. C. Wheeler, Bull. Torr. Bot. Club **63:** 408. 1936. TYPE: Bay of Magdalena, Lower California, Mexico, 1841, *Hines* (K!; photographs G!, W!; fragment F!). Boissier in DC. Prod. **15** (**2**): 44. 1862; Jepson, Man. Fl. Pl. Calif., 600, fig. 593. 1925;—*Chamaesyce polycarpa* (Benth.) Millsp. ex Parish, Cat. Pl. Salton Sink, 6. 1913 (preprint from Carn. Inst. Wash. Pub. **193:** 110. 1914.)—PLATE 657D.

California and Nevada, south to Lower California and Sonora (MAP 4). Representative specimens seen: CALIFORNIA. Los Angeles Co.: Eagle Rock foothills, *Rockwell 300* (J). San Bernardino Co.: the Needles, *M. E. Jones 5178* (I, O); Dunes, Needles, *Parish 9608* (G, M). Riverside Co.: Elsinore, Apr. 1892, *McClatchie* (NY); slopes of Box Springs Mountains, Riverside, Nov. 12, 1919, *Barrus 7* (O); between Cottonwood Mountains and Mecca, *McKelvey 5038* (G); near Desert Center, *M. E. Jones 24860* (G). San Diego Co.: San Diego, *Brandegee 615* (G, NY); Sweetwater valley, Apr. 30, 1883, *G. C. Deane* (G); Yaqui Wells, Colorado Desert, *Eastwood 2766* (G); near Sentenac Canyon, *Jepson 12475* (J); Escondido, *Meyer 230* (J); Del Mar grade from La Jolla, *Newlon 312* (J). NEVADA: 8 miles above Rioville, *M. E. Jones 5035* (M); Virgin River, *Goodding 708* (G). ARIZONA. Yavapai Co.: Castle Creek, *Toumey 263* (US). Yuma Co.: east of Blythe, *M. E. Jones 24877* (G, NY); Quartzsite, *M. E. Jones 24878* (G, NY); near Quartzsite, Sept. 20, 1934, *Kearney & Peebles* (US); Yuma, Apr. 21, 1913, *Wooton* (US). Maricopa Co.: Phoenix, June 20, 1891, *Dewey* (US); near Tempe, *Gillespie 8415* (US); Black Canyon Road, 23 miles north of Phoenix, *Gillespie 8666* (US); Hyder, *Peebles 6420* (US); near Phoenix, *Peebles, Harrison & Kearney 2461* (US); 5 miles east of Gila Bend, *Wolf 2300* (G). Pima Co.: north of mouth of Sabino Canyon, *Shreve 5354* (US); foothills of Santa Catalina Mountains, Apr. 8, 1884, *Pringle* (US). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 408. 1936.

26b. E. POLYCARPA Bentham var. HIRTELLA Boiss. in DC. Prod. **15** (**2**): 44. 1862. TYPE: California, *Emory* (Ge; fragment F!)—*Chamaesyce polycarpa* var. *hirtella* (Boiss.) Millsp. ex Parish, Cat. Pl. Salton Sink, 6. 1913 (preprint from Carn. Inst. Wash. Pub. **193:** 110. 1914)—*C. tonsita* Millsp., Field Mus. Pub. Bot. **2:** 412. 1916.

Deserts of California and southern Nevada, south to lower

California and Sonora (Map 3). Representative specimens seen: California. San Bernardino Co.: Soda Lake Mountains near Baker road station, May 30, 1931, *Beal* (J); Twenty-nine Palms, Colorado Desert, *Jepson 5964* (J). Riverside Co.: Devil's Canyon, Santa Rosa Mountains, Coachella Valley, *Clary 655* (J); Palm Canyon and return to Van Deventer's, *Jepson 1374* (J); Palm Springs, Colorado Desert, Apr. 18, 1921, *Spencer* (O); Palm Canyon, *Johnston 1050* (US); mouth of Palm Canyon, Borego Valley, *Duran 3176* (G, I, O); Signal Mountain, Colorado Desert, *Abrams 3187* (G). Imperial Co.: upper end of Painted Gorge, Carisso Mountains, *Ferris & Rossbach 9605* (G). Nevada: the Muddy Range, *Goodding 2222* (G). Yuma Co.: Yuma, Feb., 1881, *Vasey* (US); Yuma, Nov. 6, 1909, *Mowry* (US); Aztec, *Harrison 3563* (US). A collection differing in having the appendages almost twice as wide as the glands and deeply parted into several segments is possibly worth varietal recognition but is tentatively referred here until seeds, which were lacking, can be had: in rock crevices, Orocopia Mts. south of Hayfield's Reservoir, Riverside Co., California, alt. 1400 ft., Dec. 3, 1939, *Jaeger* (W).

26c. E. polycarpa Bentham var. **simulans** var. nov. Glabra; petiolus limbo ca. duplo brevior; glandulae exappendiculatae.

Type: dry hillside near the Rio Grande, mouth of Santa Helena Canyon, Big Bend State Park, Brewster County, Texas, alt. 2,100 feet, Sept. 6, 1938, *Rollins & Chambers 2770* (G!). Additional specimens seen: Texas. Brewster Co.: frequent in stream-bed 2 miles east of Castolon, Mar. 4, 1937, *Cutler 723* (G); Castolon, May 5, 1928, *Cory 1927* (G); Santa Helena Canyon, Oct. 21, 1937, *Cory 26452* (G); common, sandy soil in valleys, Boquillas, Aug. 3, 1919, *Hanson 714* (G, US); mouth of Santa Helena Canyon, Aug. 8, 1938, *Warnock C506*, in part (US); near Chisos Mountains, *Young 139* (M); between Goat and Trap Mountains, *E. J. Palmer 34207* (NY); near San Vincente, *Sperry 1358* (US); Santa Helena Canyon, June 7, 1937, *Warnock 985* (US). Presidio Co.: Presidio, Sept. 27, 1937, *Warnock T95* (US). (Map 5).

27. Euphorbia Parishii Greene, Bull. Calif. Acad. **2:** 56. 1886. Type: Warm Springs, Mohave Desert, San Bernardino County, California, May, 1882, *S. B. & W. F. Parish 1384* (probably lost when the herbarium of California Academy burned in 1906, for Dr. Theodor Just states in letter of Feb. 25, 1939, filed at Gray Herbarium, that there is only a fragment in Herbarium Greeneanum at Notre Dame University; isotypes D!, M!, NY!).—*Chamaesyce Parishii* (Greene) Millsp. ex Parish, Cat. Pl. Salton Sink, 6. 1913, preprint from Carn. Inst. Wash. Pub. **193:** 110. 1914.—*E. polycarpa* Bentham var. *Parishii* (Greene) Jepson, Fl. Calif. **2:** 429. 1936.

E. patellifera J. T. Howell, Leafl. West. Bot. **1**: 53. 1933. TYPE: Palm Wash, western Colorado Desert, San Diego County, California, *J. T. Howell 3488* (CA!; ISOTYPE F!).

Perennial, forming prostrate mats 20–50 cm. across, or a low bush 15–20 cm. high; stems slightly woody below in age, slender, glabrous, internodes 5–15 mm. long; leaf-blades mostly ovate, 2–4 mm. long, entire, glabrous, or very rarely tomentulose beneath, base oblique, apex mucronulate, midrib evident at least in lower half of blade; petioles 0.5–1 mm. long, glabrous, amplexicaul on ventral side of stem; upper stipules distinct, mostly entire, ciliate, broadly linear, 1 mm. long, lower stipules often more or less united, ciliate, linear, 1 mm. long; peduncles up to 1 mm. long, glabrous; cyathia solitary at the nodes; involucre campanulate, tapering to the peduncle, 1–1.2 mm. diam., glabrous without, with many short hairs within above; lobes broadly deltoid, mostly dentate, ciliate on inner face, equaling the glands; glands discoid, ca. 0.5 mm. diam., pale yellow or reddish, on stipes ca. half as wide as the gland; stipes ciliate on inner side; appendages absent; fifth gland ciliate on inner side, linear, mostly shorter than the lobes; sinus U-shaped, not depressed; bracteoles united for half their length, forming a membranous radial appendage ca. 1.3 mm. long, adnate for half its length to the involucre opposite each gland, glabrous below, ciliate above; staminate flowers 8–10 per fascicle, 40–50 per involucre; androphores glabrous, ca. 1.5 mm. long, slightly exserted at maturity; gynophore glabrous, long-exserted and usually reflexed at maturity; ovary glabrous, three-angled; styles ca. 0.5 mm. long, bifid to the middle, glabrous; capsule glabrous, sharply three-angled, oblate-spheroid, ca. 1.75 mm. long; seeds ca. 1.5 mm. long, ca. 0.75 mm. tangentially, ca. 0.65 mm. radially, quadrangular, long-ovate in radial outline, raphe straight, slightly truncated above, back sharply angled, facets faintly wrinkled, coat white, microreticulate.—PLATE 658B.

Deserts of Inyo, Kern, San Bernardino, Riverside, and San Diego Counties, California, east to Nevada (MAP 25). Representative specimens seen: CALIFORNIA. Inyo Co.: Furnace Creek Ranch, Death Valley, Apr. 30, 1917, alt. to 100 ft., *W. L. Jepson* (J); Stove Pipe Wells, Death Valley, *P. A. Munz & C. L. Hitchcock 11032* (P); near Triangle Spring, Death Valley, growing in dense brown mats on pebbly wash-fan, Apr. 17, 1917, *J. Grinnell* (J); Surprise Canyon, *S. B. Parish 10217* (C, J); Emigrant Canyon, Panamint Mountains, *R. S. Ferris, F. M. Scott & R. Bacigalupi 3998* (D); Emigrant Springs, *S. B. Parish 10190* (C, J); Greenwater Flat, *S. B. Parish 10138* (C). San Bernardino Co.: Baxter, Mohave Desert, *S. B. Parish 9882* (C); Ludlow, Mohave Desert, 1926, *M. E. Jones* (P). NEVADA. Lincoln Co.: Muddy Valley, alt. 1,700 ft., *Kennedy & Goodding 77* (NY, US).

For citation of additional specimens see Bull. Torr. Bot. Club **63:** 406. 1936.

28. Euphorbia micromera Boiss. ex Engelm., Proc. Amer. Acad. Arts & Sci. **5:** 171. 1861; Boiss. in DC. Prod. **15 (2):** 44. 1862. Type: bed of a creek descending to the San Pedro River, Cochise County, Arizona, Sept. 8, 1851, *C. Wright 1854* (M 149918!; photographs G!, W!, isotypes F!, G!, Ge!). Small and essentially glabrous, a good representative of the species.—*E. polycarpa* Bentham var. *micromera* Millsp. ex Orcutt, West Amer. Scientist **10:** 134. 1901; with neither basinym nor description, identity inferred from the coincidence of names.—*Chamaesyce micromera* (Boiss.) Wooton & Standley, Contr. U. S. Nat. Herb. **16:** 144. 1913.

E. pseudoserpyllifolia Millsp., Pittonia **2:** 87. 1890. Type: Bowie, Cochise County, Arizona, Sept. 15, 1884, *M. E. Jones 4223* (F 196599!; photographs G!, W!, isotypes G!, I!, P!, US!). Differing little from the type of *E. micromera* which was not considered.—*Chamaesyce pseudoserpyllifolia* (Millsp.) Millsp., Field Mus. Pub. Bot. **2:** 411. 1916.—*E. pseudoserpyllifolia* Millsp. forma *typica* J. T. Howell, Leafl. West. Bot. **1:** 52. 1933.

E. podagrica I. M. Johnston, Univ. Calif. Pub. Bot. **7:** 440. 1922. Type: washes at Gold Mountain, Esmeralda County, Nevada, 1898, *C. A. Purpus 6437* in part (C 110920!). Differing in no essential respect from the type of *E. micromera* which was not considered.

E. pseudoserpyllifolia Millsp. forma *villosa* J. T. Howell, Leafl. West. Bot. **1:** 53. 1933. Type: south of Palm Springs near Cathedral City, Riverside County, California, *J. T. Howell 6651* (CA 188849!). Differs from the type only in vestiture which is too variable to warrant recognition.

E. setiloba Engelm. var. *nodulosa* Jepson, Fl. Calif. **2:** 427. 1936. Type: between Brawley and Salton Sea, Colorado Desert, Imperial County, California, Oct. 15, 1912, 115 feet below sea level, *S. B. Parish 8301* (J!; photographs G!, W!; isotypes D!, F!, G!). This is the nodulose vestite variant local in the Colorado Desert. Some of the glands bear minute appendages. Possibly with more numerous collections this variant may prove itself worthy of recognition.

Prostrate annual: stems glabrous or pubescent, extremely variable, one extreme very straight, thick, with thickened nodes and internodes up to 1 cm. long, the other extreme flexuous or straightish, slender, nodes not thickened, internodes up to 2 cm. long; leaves glabrous or short-pubescent, blades 2–7 mm. long, ovate and base markedly oblique in the larger, oblong and base slightly oblique in the smaller, petioles ca. 0.5 mm. long; stipules ca. 0.7 mm. long, or shorter in pubescent plants, triangular, ciliate, upper distinct, lower often united toward stem-tip;

peduncles glabrous or pubescent, up to 1 mm. long; cyathia solitary in the axils; involucres ca. 0.9 mm. in diam., very short-campanulate, narrowed above, more or less cuneate to the peduncle, glabrous or pubescent without, glabrous within except the lobes, green-veined beneath the lobes; lobes deltoid, equaling or slightly exceeding the glands, hairy within; glands pink or red, strictly discoid or transversely oblong, especially the proximal, 0.1–0.15 mm. diam.; appendages absent or, in some pubescent and nodulose plants occasionally present as minute white margins; fifth gland absent; sinus broadly V-shaped, hairy, little depressed; bracteoles reduced to a solitary linear hairy appendage ca. 0.5 mm. long, adnate for most of its length to the involucre opposite the glands; staminate flowers 2–5 per involucre; androphores glabrous, included, 0.7–0.9 mm. long; gynophore glabrous throughout or short-hairy above, long-exserted and usually reflexed at maturity; ovary three-angled, glabrous to pubescent, carpels slightly grooved on the back; styles bifid, glabrous, ca. 0.2–0.3 mm. long, clavate; capsule three-angled, glabrous to pubescent, spheroid, ca. 1.3 mm. long; seeds quadrangular, 1.1–1.3 mm. long, 0.5 mm. tangentially, 0.4 mm. radially, narrowly ovate radially, angles sharp, facets smooth or with very faint wrinkles, convex, especially the front, base truncate, raphe straight or slightly concave, shortly truncate at a slight angle above, microreticulate white coat thin, with the brown of the testa showing through.—PLATE 658C.

Deserts from Inyo County south to Imperial County, California; Esmeralda and Clark Counties, Nevada; San Juan County, Utah; Arizona; Grant and Doña Ana Counties, New Mexico; Reeves and Brewster Counties, Texas; Chihuahua; and Coahuila and Peru (MAP 26). Representative specimens seen: CALIFORNIA. San Bernardino Co.: Daggett, Mohave Desert, Oct. 13, 1933, *Beal* (J). NEVADA: Clark Co.: near Boulder City, *Eastwood & Howell 6292* (G). UTAH: San Juan Co.: along San Juan River near Bluff, *Rydberg & Garrett 9896* (NY). ARIZONA: Yuma Co.: south of Quartzsite, *Kearney & Peebles 10219* (US); Mohawk, *Peebles, Harrison & Kearney 4976* (US). Pinal Co.: Sacaton, *Peebles 5000* (US). Pima Co.: Wilmot, on range reserve, *Thornber 341* (US). Gila Co.: Sierra Ancha, *Harrison & Kearney 8293* (US). Navajo Co.: Holbrook, Oct. 4, 1879, *Zuck* (NY, US in part). NEW MEXICO: Grant Co., gravel beds of the Gila River, *E. L. Greene 266* (M). Doña Ana Co.: Mesilla Valley, Oct. 5, 1899, *Wooton* (NY). TEXAS: Reeves Co.: *Cory 1959* (G). Brewster Co.: Persimmon Gap area, *Sperry 1464* (US). MEXICO: CHIHUAHUA: 3 miles north of Charco Piedra, *Johnston 7925* (G). COAHUILA: 3 miles south of Peña, *Johnston 7729* (G). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 432–433. 1936.

This species is nowhere abundant and, while wide-ranging, occupies only scattered stations. Formerly, l. c., I included *Orcutt 1331* from Socorro, northern Baja California here. That collection, the basis of the *nomen nudum, Euphorbia baja californica* Millsp. ex Orcutt, West Amer. Scientist **10:** 134. 1901, differs in having styles ca. 0.6 mm. long and scarcely clavate; involucres ca. 1.1 mm. in diam.; staminate flowers 7–8; seeds strongly and irregularly ridged and glands often appendaged. (The specimen which is the type, if nomina nuda are worth typifying, is F 197073! for this came from Millspaugh's herbarium and is labeled "E. Baja-Californica sp. nov." There was some mistake made since the plants on the sheet are *E. cordifolia;* only the fragments in the pocket are the Lower Californian plant. Probably a mixture occurred during mounting.) This entity may be only worth varietal recognition, but, being extra-limital, is excluded here. Likewise *Ed. Palmer 789* (US), Baja California, Lagoon Head, is excluded as it seems to be the same as *Orcutt 1331.*

The reason that the specimen at M rather than the specimen at Ge is taken as type is that in the loan from Ge there is included only the merest fragment which is mislabeled as "*Fendler no. 1854*" when it should have been "*Wright no. 1854*". Furthermore the label accompanying this fragment bears no name. The piece sent may be a portion of Boissier's specimen but that is not certainly known. In view of the fact that Engelmann published the species first, attributing it to Boissier, and left a good specimen with a label bearing the name of the plant, it seems justifiable to take Engelmann's specimen as type.

The following new example of common identities between North and South America is to be noted: Shale cliff above sea, alt. 0–20 m., Paita, Dept. Piura, Peru, July 4, 1925, *F. W. Pennell 14815* (G).

29. Euphorbia cordifolia Elliott, Sketch Bot. So.-Car. & Georgia **2:** 656. 1824.[1] Type: "Grows in cultivated land, common around Beaufort [South Carolina] in dry soils." (Charleston, South Carolina, Museum).—*Chamaesyce cordifolia* (Ell.) Small, Fl. Se. U. S., 709, 1333. 1903.

Annual, glabrous; stems prostrate, or occasionally ascending in small plants, 4–35 cm. long, 0.5–2 mm. thick, internodes

[1] See J. H. Barnhart, Dates of Elliott's Sketch, Bull. Torr. Bot. Club **28:** 680–688. 1901.

rarely up to 6 cm. long, mostly 2 cm. long or shorter; leaf-blades elliptic-orbicular to oblong and ovate-oblong, 4–12 mm. long, base more or less inequilateral, often cordate, margin entire; petioles ca. 1 mm. long; stipules parted to the base into few to several filiform segments up to 1.4 mm. long, mostly with short scattered hairs at least when young, dorsal distinct, ventral often united; peduncles 0.4–4 mm. long; cyathia solitary at the nodes and at the branch-tips but often congested by the marked shortening of the upper internodes; involucre broadly campanulate, 1.3–1.6 mm. in diam., glabrous outside, glabrous inside except at the base of the lobes and beneath the glands; lobes subulate, pubescent below, glabrous above, slightly exceeding the glands; glands transversely elliptical to oblong, often strongly folded, 0.5–0.9 mm. long; appendages from 1–3 times as wide as the gland, to 1.3 mm. wide, the wider radially broadly elliptical to reniform, glabrous, entire or with two or three low blunt teeth; fifth gland consisting of 1 or 2 linear filiform segments, glabrous above, equaling the lobes; sinus U-shaped, not depressed; bracteoles mostly united into a radial partition adnate for ca. half its length to the involucre, free portion parted into few to several linear pubescent segments, a few of the bracteoles entirely free; staminate flowers 9–44 per cyathium; androphores 1.2–1.6 mm. long, glabrous, or occasionally with a few short hairs above; gynophore glabrous or rarely pubescent below, exserted and reflexed; ovary glabrous, 3-angled; styles parted to the base, 0.6–0.9 mm. long; capsule glabrous, sharply 3-angled, wider below the equator, 1.7–2.1 mm. long; seeds ovoid-triangular, 1.2–1.5 mm. long, 0.7–0.9 mm. tangentially and radially, radially ovate to oblong-ovate, usually acute, or with low faint wrinkles, slightly concave to slightly convex, angles blunt, coat white, microreticulate, mostly so thin as to little obscure the pale, brown to gray testa.—PLATE 658A.

Mostly in sandy pine barrens, North Carolina to Florida, west to Texas (MAP 30). Representative specimens seen: NORTH CAROLINA. Pender Co.: Point Rock, Aug. ?, *Williamson* (NY). SOUTH CAROLINA: "Sand hills of S. C.". Oct. ?, *Ravenel* (G). GEORGIA. Richmond Co.: Augusta, Aug., 1902, *Anon.* (NY). Macon Co.: on site of Andersonville stockade, Sept. 5, 1897, *Harper* (NY). Dooly Co.: near Flint River, *Harper 574* (G, NY). Dougherty Co.: Albany, *Tracy 4710* (NY); pine barrens bordering the Altamaha River, *Curtiss 2469* (G, NY). FLORIDA. Lake Co.: near Eustis, *Nash 1070* (G, NY). Orange Co.: 1894. *Lewton* (NY). Polk Co.: Haines City, *Curtiss 5959* (G, NY). Hillsborough Co.: west coast, 1886, *Curtiss* (G). Walton Co.: summer, 1885, *Curtiss* (NY). Escambia Co., *Biltmore Herb. 5895*^{b} (NY). Suwanee Co.: 5 miles west of Live Oak, *Wiegand & Manning 1801* (G). Gilchrist Co.: Hammock along the Suwanee River east of Old Town, *J. K. Small, J. W. Small & DeWinkeler 11470* (NY). MISSISSIPPI. Jackson Co.: Horn Island, *Tracy 6370* (NY). Harrison Co.: Cat Island, *F. E. Lloyd & Tracy 208* (G, NY). LOUISIANA. Rapides Co.: Alexandria, *Hale* (NY). TEXAS. Tarrant Co.: in field, *Ruth 686* (NY). Medina Co.: 30 miles west of San Antonio, Sept., 1879, *Ed. Palmer 1212* (G). Hays Co.: San Marcos, *Stanfield* (NY). Colorado Co.: 6 miles northeast of Alleyton, *Cory 25096* (G). Walker Co.: near Huntsville, *Dixon 335* (G, NY). Waller Co.: Hempstead, *Hall 547* (G, NY). Jefferson Co.: Sabine Pass, July, 1884, *Neally* (G). Nueces Co.: near Corpus Christi, Mar., 1894, *Heller* (NY).

The type was recently examined by Professor Fernald who reports that it is identical with the usual interpretation of the species as exemplified by the two following collections from Georgia with which he compared it: *A. H. Curtiss 2469* (G); *R. M. Harper 574* (G).

There are two races of this species. This was discovered by the counts of the staminate flowers. In ten collections from west of the Mississippi River the number of staminate flowers per cyathium was 29–44; in ten collections from east of the Mississippi River the number per cyathium was 9–27. Having made this discovery a reexamination of the collections from these two areas was made in order to ascertain whether there were any more obvious differences between the two races. While there is a tendency in the eastern plants to have smaller leaves and shorter internodes there are too many exceptions to make any practical or certain division on these characters. Examination of a more ample suite of specimens would very likely produce intermediate numbers of staminate flowers. Since the species forms an acceptable unit as an undivided aggregate no attempt will be made here to further distinguish the two races.

Boissier in DC. Prod. **15 (2)**: 30. 1862 identifies *Euphorbia ludoviciana* Raf., Fl. Ludovic., 111. 1817, with *E. cordifolia*. Since Rafinesque described his species as having leaves other than entire this identification must be erroneous.

30. EUPHORBIA SERPENS HBK., Nov. Gen. et Sp. **2**: 52 (quarto), 41 (folio). 1817.[1] TYPE: Cumana, Venezuela, *Bonpland 407* (Herb. Mus. Paris; photograph G! fragment F!).

[1] See Barnhart, Bull. Torr. Bot. Club **29**: 585. 1902 as to date and for discussion of the quarto and folio editions.

Average as to habit and leaf-size, nodes rooting. Boissier in DC. Prod. **15** (**2**): 29. 1862; Millsp., Bot. Gaz. **25:** 18. 1898, fifth gland broken in figure; Thellung, Bull. Herb. Boiss. ser. 2, **7:** 755. 1907; N. E. Brown in Thiselton-Dyer, Fl. Trop. Afr. **6** (**1**): 511. 1911; Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 440–443. 1917; L. C. Wheeler, Bull. So. Calif. Acad. Sci. **33:** 108. 1934.—*Anisophyllum serpens* (HBK.) Klotzsch & Garcke, Abh. Akad. Berlin, Phys. **1859:** 23. 1860.—*E. radicans* Moricand ex Klotzsch & Garcke, op. cit., 24, as synonym of *Anisophyllum serpens.*—*Chamaesyce serpens* (HBK.) Small, Fl. Se. U. S., 709, 1333. 1903.—*E. serpens* HBK. A *genuina* Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 442. 1917.

E. herniaroides Nutt., Trans. Amer. Philos. Soc. n. s. **5:** 171. 1837. TYPE: Arkansas, probably *Nuttall* (PH!, or perhaps isotype?; photographs G!, W!).

E. flexicaulis Scheele, Linnaea **22:** 153. 1849. TYPE: "nordlich von Neubraunfels: Lindheimer. August." Comal County, Texas (?). Description places it here.—*E. serpens* HBK. var. *flexicaulis* (Scheele) Coulter, Contr. U. S. Nat. Herb. **2:** 388. 1894 (the available *E. serpens* var. *radicans* cited in synonymy). —*E. serpens* A *genuina* III *flexicaulis* (Scheele) Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 442. 1917.

E. serpens var. *radicans* Engelm. ex Boiss. in DC. Prod. **15** (**2**): 30. 1862. TYPE: Tampico, Mexico, *Berlandier 140* (Ge!; photographs G!, W!; ISOTYPE US 1169354!). Merely a vegetational phase with roots at some of the nodes.—*E. radicans* Moricand ex Boiss., l. c., as synonym of above name.—*Chamaesyce radicans* (Engelm.) Millsp., Field Mus. Pub. Bot. **2:** 411. 1916.

E. serpens var. *imbricata* Boiss. in DC. Prod. **15** (**2**): 30. 1862. TYPE: Texas, *F. Lindheimer 693* (Ge!; photographs G!, W!). Internodes short and leaves thick, presumably due to a dry habitat. (This is the *Chamaesyce Hartwegiana* (Boiss.) Small *sensu* Small, Fl. Se. U. S. ed. 2, 1349. 1913).—*E.* "*herniaroides* Nutt. var. *imbricata*" Engelm. ex Blankinship, Ann. Rep. Mo. Bot. Gard. **18:** 149. 1907, as synonym of *E. serpens* HBK.; indexed in op. cit., **20:** 183. 1909. *E. serpens* A *genuina* II *imbricata* (Boiss.) Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 442. 1917.

E. serpens A *genuina* III *flexicaulis* b *psilocyathia* Thellung, l. c. TYPE: Illinois (Zurich?). Referred here from the description.

E. forbuserpens HBK. ex Wood & McCarthy, Journ. Elisha Mitchell Soc. **1885–6:** 119. 1886 (without description) is doubtless a *lapsus calami* for *E. serpens.*

Prostrate annual, often very leafy, herbage glabrous throughout; stems slender, up to 50 cm. long, internodes to 3 cm. long, nodes sometimes rooting; leaf-blades 2–7 mm. long, ovate-orbicular to oblong, base oblique except in the smallest, margin entire; petioles mostly less than 1 mm. long; both upper and lower stipules united into a white, membranous, glabrous scale less than 1 mm. long with more or less lacerate margin; peduncles up to 2 mm. long, expanding upward, glabrous; cyathia solitary at the nodes; involucres turbinate, 1 mm. long, 1 mm. diam., tapering to the thick upper end of the peduncle, glabrous without and within; lobes deltoid, sometimes with a few hairs on the margins below, apex acute to attenuate, equaling or slightly exceeding the glands; glands transversely oblong, ca. 0.2 mm. long, ochroleucous, concave; appendages mostly present, little wider than the glands, white, glabrous, margin mostly crenate; fifth gland linear, exceeding the glands, with a few marginal hairs at the base; sinus slightly depressed; bracteoles forming a single, linear or broader, entire or parted, slightly hairy appendage 0.6 mm. long or shorter, adnate below to the involucre opposite each gland; staminate flowers 5–10 per cyathium; androphores glabrous, 0.9–1 mm. long, equaling the glands; gynophore glabrous, exserted and mostly reflexed at maturity; ovary 3-lobed, glabrous; styles glabrous, markedly clavate, 0.2 mm. long, usually parted to below the middle, rotately spreading; capsule glabrous, 3-angled, ca. 1.2 mm. long; seeds smooth, ovoid with rounded angles or somewhat turgid-quadrangular with more prominent angles, ca. 1 mm. long, ca. 0.5 mm. radially and tangentially, coat microreticulate, white, with the brown testa showing through.—Plate 661C.

Casual introduction in New Hampshire, New Jersey, Pennsylvania and probably Georgia; Ontario, Ohio, Indiana, Tennessee, Alabama and Florida, west to Arizona and New Mexico, north to Colorado and Montana, east to North Dakota, Iowa, and Illinois; south to South America, introduced in the Old World (Map 37). Representative specimens seen from the United States and Canada: Ontario. Kent Co.: Chatham, *Macoun 5897* (NY, US). Middlesex Co.: London, June 9, 1883, *Burgess* (US). Windsor Co.: Windsor, Oct. 5, 1885, *Macoun* (G). New Hampshire: Belknap Co.: Gilmanton, 1867, *Blake* (US). New Jersey. Co.?: on ballast sand, Petty's Island, Aug. 27, 1866, *Parker* (G, M). Pennsylvania: Philadelphia Co.: Navy Yard, Philadelphia, Oct., 1865, *Burk* (PhB). Ohio. Sandusky Co.: Sandusky, Oct. 14, 1902, *Moseley* (US). Indiana. Perry Co.: 5½ miles above Cannelton on Ohio River, *Deam 33357* (Deam, G). Illinois. Fulton Co.: Canton, 1881, *Wolfe* (US). Menard Co.: Athens, Aug., 1886, *Hall* (US). St. Clair Co.: Cahokia, *Eggert* (NY). Tennessee. Davidson Co.: Nashville, Aug. 31, 1877, *Ward* (US). Georgia. Glynn Co.: waste places among rosin wharves, Brunswick, *Harper 1520* (G, NY, US). Florida. Franklin Co.: Apalachicola, *Biltmore Herb. 3848a* (G, NY, US). Alabama. Hale Co.: Rosemary, *Harper 3248* (G, NY, US).

Perry Co.: Uniontown, 1889, *Newman* (US). Mobile Co.: Mobile, July 14, 1891, *Mohr* (US). MISSISSIPPI. Lowndes Co.: Artesia, *Tracy 3125* (NY). IOWA. Webster Co.: *Somes 3841* (US). Woodbury Co.: Sioux City, *Pammel 192* (NY). MISSOURI. Jackson Co.: Courtney, *Bush 412* (NY, US). St. Clair Co.: 3½ miles north of Iconium on Osage River, *Steyermark 24316* (NY). ARKANSAS. Johnson Co.: Pine Bluff, *Demaree 8778* (NY, US). Pulaski Co.: Little Rock, *Coville 10* (US). LOUISIANA. Caddo Co.: Shreveport, *Cocks 3625* (NY). Orleans Co.: New Orleans, July, 1837, *Riddell & Carpenter* (US). Feliciana, *Carpenter* (US). NORTH DAKOTA. Morton Co.: Glen Ullin, *Bergman 2411* (M). SOUTH DAKOTA. Mellette Co.: White River, *Over 6131* (US). Cheyenne River bottom, July 16, 1896, *Wallace* (NY). Indian Creek, Aug. 1891, *Williams* (US). NEBRASKA. Knox Co.: Niobrara, *Clements 2717* (G, NY, US). Lancaster Co.: Lincoln, Aug., 1898, *Williamson* (Ph). Kearney Co.: Minden, Sept. 18, 1929, *Hapeman* (Ph). Franklin Co.: Franklin, Aug. 25, 1929, *Hapeman* (Ph). KANSAS. Ellis Co.: near Hays, *Rydberg & Imler 1193* (NY). Osborne Co.: Osborne City, *Shear 176* (G, NY, US). Riley Co.: *Norton 469* (G, NY, US). Saline Co.: Salina, *Mohr* (US). Douglas Co.: Lawrence, July, *W. C. Stevens* (US). Miami Co.: Aug. 10, 1885, *Oyster* (NY). Hamilton Co.: Syracuse, *Rose & Fitch 17011* (NY, US). Kiowa Co.: Belvidere, Sept. 26, 1897, *Ward* (US). OKLAHOMA. Woods Co.: Alva, *G. W. Stevens 1604* (G, NY, US). Kay Co.: Tonkawa, *G. W. Stevens 1863* (G, NY, US). Blaine Co.: Canton, *G. W. Stevens 834* (G, NY). Cleveland Co.: Norman, *Emig 527* (US). TEXAS. Austin Co.: Industry, 1846, *Lindheimer 300 Fasc. III* (US). Bexar Co.: near Bracken, *Groth 15* (G, US). Brazoria Co.: Columbia, *Bush 136* (NY). Cameron Co.: near Point Isabel, *Tharp 1180* (US): Dallas Co.: Dallas, *Stephenson 191* (US). Harris Co.: Hockley, *Thuron 4* (US). Howard Co.: Big Springs, *Tracy 8127* (Mo, NY, US). Jackson Co.: Carancahua Pt., *Tharp 1416* (US). Potter Co.: Amarillo, *Ball 1275* (US). Lubbock Co.: Lubbock, *Reed 3005* (US). Nueces Co.: Corpus Christi, *Heller 1463* (NY, US). Red River Co.: Clarksville, Sept. 25, 1894, *Plank* (NY). Starr Co.: 5 miles north of Rio Grande City, *Clover 1364* (NY). Tarrant Co.: Grapeland, *Tharp 881* (US). Taylor Co.: Abilene, *Tracy 7844* (Mo, NY, US). Travis Co.: near Austin, *Armer 5390* (US). Valverde Co.: bank of the Rio Grande, Del Rio, June 13, 1891, *Dewey* (US). Walker Co.: near Huntsville, *Dixon 376* (NY). Waller Co.: Hempstead, 1872, *Hall* (US). Webb Co.: Laredo, *Reverchon 3787* (G, US). Wharton Co.: Pierce, *Tracy 7435* (G, NY, US). Wilson Co.: Sutherland Springs, Aug. 22–30, 1879, *Ed. Palmer 1191* (G, US). MONTANA. Cascade Co.: Great Falls, *Williams 160* (US). COLORADO. Weld Co.: New Windsor, Aug. 8, 1901, *Osterhout 2345* (NY).

New Mexico. Valencia Co.: near McArty's Ranch, *Rusby 378½* (M, NY). Chaves Co.: 20 miles south Rosswell, *F. S. & E. S. Earle 308* (M, NY, US). Eddy Co.: Carlsbad, *Tracy 8170* (NY, US). Doña Ana Co.: west of Organ Mountains, Aug. 26, 1899, *Wooton* (US). Arizona. Santa Cruz Co.: Santa Cruz River at La Noria, *Mearns 1192* (US). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 448–9. 1936.

31. Euphorbia albomarginata T. & G., Rep. Expl. & Surv. Miss. R. to Pacific Ocean **2** (**4**)**:** 174. 1855. Type: Rio Pecos, Texas, Nov. 1850, *Thurber 98* (NY!; photographs G!, W!; isotype G!). The common late-season phase with small leaves and short internodes. L. C. Wheeler, Bull. Torr. Bot. Club **63:** 446–7. 1936.—*E. stipulacea* Engelm. ex Boiss. in DC. Prod. **15** (**2**)**:** 30. 1862, in synonymy.—*Anisophyllum albomarginatum* (T. & G.) Klotzsch & Garcke, Abh. Akad. Berlin, Phys. **1859:** 53. 1860.—*Chamaesyce albomarginata* (T. & G.) Small, Fl. Se. U. S., 710, 1333. 1903.

Glabrous prostrate perennial from a taproot woody in age; stems several to numerous, up to 40 cm. long, internodes up to 6 cm. long but usually much shorter, nodes often rooting; leaf-blades mostly 3–6 mm. long, sometimes as much as 15 mm. long, orbicular to oblong, sometimes with a red spot in the middle on the upper surface, midrib usually not prominent, lateral veins rarely evident, margin entire; petioles 0.5–1 mm. long; both upper and lower stipules united into a glabrous, white, membranous, deltoid to subulate, usually lacerate-margined scale; cyathia solitary at the nodes; peduncles slender, glabrous, mostly 2–4 mm. long; involucres 1.5–2 mm. diam., open-campanulate to broadly obconical, glabrous without and within except on the lobes; lobes short-hairy within below, exceeding the glands, narrowly deltoid-attenuate; glands 0.5–1 mm. long, transversely oblong, concave, ochroleucous or mostly maroon; appendages usually conspicuous, wider and longer than the glands, white, glabrous, entire or slightly crenate; fifth gland linear, equaling the lobes, hairy within below; sinus U-shaped, little depresssed; bracteoles forming one conspicuous, upwardly expanded, mostly 2–4-divided, hairy radial appendage two-thirds as long to as long as the androphores, adnate below to the involucre opposite each gland; staminate flowers 3–6 per fascicle, 15–30 per involucre; androphores 1–1.3 mm. long, glabrous; gynophore glabrous, long-exserted and mostly reflexed at maturity; ovary glabrous, three-lobed; styles bifid to below the middle, 0.5–0.7 mm. long, glabrous, clavate, spreading-erect; capsule sharply three-angled, glabrous, ovoid, 1.7–2.3 mm. long; seeds 1.2–1.7 mm. long, 0.7–0.8 mm. radially, 0.7–0.9 tangentially, quadrangular, narrowly oblong to oblong-ovate radially, base obtuse or truncate, facets concave or convex, smooth, angles mostly rounded, coat microreticulate in definite lines, opaque-white or so thin as to little obscure the brown testa.—PLATE 661D.

Southern San Joaquin Valley, Inyo Co., south through southern California, east to Nevada, Utah, Arizona, New Mexico, Texas and Oklahoma, south to Lower California, east to Tamaulipas (MAP 23). Representative specimens seen: CALIFORNIA. Tulare Co.: Porterville, Sept. 20, 1921, *Kelly* (CA). Kings-Tulare Co.: between Tulare and Tulare Lake, 1892, *Ed. Palmer 2721* (US). Kern Co.: Bakersfield, *Davy 1883* (C); Randsburg, Mohave Desert, Apr. 14, 1905, *Heller* (NY, Ph, US). Ventura Co.: near Frazier Borax Mine, Mt. Pinos, *Abrams & McGregor 206* (D, G, NY, US). Inyo Co.: Shepherd Canyon, Argus Mountains, *Coville & Funston 735* (G, NY). Los Angeles Co.: Santa Monica Hills, *G. B. Grant 427* (US); North Fork, San Gabriel, *Leiberg 3374* (US); San Bernardino Co.: Kessler Peak, Ivanpah Mountains, Mohave Desert, *Jepson 15829* (J); Holcomb Valley, San Bernardino Mountains, altitude 7,200 feet, *Ewan 4872* (G); Redlands, *Kuntze 23263* (NY); Hesperia, Mohave Desert, *Spencer 552* (G, NY). Riverside Co.: Paloverde, Colorado Desert, *Schellenger 78* (J); San Jacinto Valley, *Vasey 574* (US). San Diego Co.: head of Box Canyon near Mason Valley, *Duran 3205* (G, I, NY, O, US). Imperial Co.: on ditch banks, Experiment Farm, Bard, Apr. 5, 1912, *Dewey* (US); Fort Yuma, *Jepson 11734* (J). NEVADA. Nye Co.: Rhyolite, *Heller 9674* (G, US); gravel canyon-bottom, road to Beatty, east side Grapevine Mountains, Death Valley Region, *Train 676* (US). Clark Co.: Moapa, *Kennedy 1089* (NY, US); Kiernan's, Meadow Valley Wash, *Goodding 654* (NY, US); Mormon Mesa, *Eastwood & Howell 6310* (G); Las Vegas, *Goodding 2301* (G, NY). UTAH. Washington Co.: mesa northwest of Hurricane, *Maguire & Blood 1436* (I); near St. George, *Wann 27* (I). ARIZONA. Mohave Co.: plain near Oatman, April, 1916, *Creighton* (Ph); Peach Springs, April, 1893, *Wilson* (G). Coconino Co.: Turkey Tanks, *MacDougal 141* (G, US); north from San Francisco Peaks, *Leiberg 5573* (US). Navajo Co.: Winslow, 2 miles north in desert, *Stone 373* (NY); Pinedale, *Hough 126* (US). Apache Co.: between Chambers and Navajo, *Eastwood & Howell 6893* (G). Yavapai Co.: Prescott, Aug. 7, 1876, *Ed. Palmer 509* (G, US). Maricopa Co.: Hassayampa, *Newlon 584* (J). Pinal Co.: sandy river bottom, Gila River, 2 miles below Coolidge Dam, *Maguire, Richards & Moeller 10421* (G, I). Gila Co.: Roosevelt Dam, *Goodding 723* (G, NY, US). Greenlee Co.: face of conglomerate cliff above San Francisco River banks, S. Clifton, *Maguire, Richards & Moeller 11788* (G, I). Graham Co.: ¼ mile west Upper Reservoir Plat, 10 miles southwest Safford, *Maguire 10007* (I). Pima Co.: Santa Cruz Valley near Tucson, May 2, 1881, *Pringle* (G, NY, US); Tucson, Nov. 30, 1894, *Toumey* (G, NY, US). Santa Cruz Co.: vicinity of Ruby, *Mrs. A. F. Morton 88* (US). Cochise Co.: Tanner's Canyon, Huachuca Mountains, *Holzner 1573* (US); Paradise, *Blumer 1691* (G, NY, US); San Bernardino Ranch, Mex. Boundary Line, *Mearns 639* (NY, US). New Mexico: McKinley Co.: Ft. Wingate, *Rusby 380* (NY, US). Quay Co.: Tucumcari, red clay soil, *Fisher 74* (US). Socorro Co.: Magdalena to Water Canyon, *Eggleston 20227* (NY, US). Lincoln Co.: 4 miles above Tularosa, White Mountains, *Wooton & Standley 3617* (US). Chaves Co.: 20 miles south of Roswell, *F. S. & E. S. Earle 309* (NY, P, US). Sierra Co.: Lake Valley, Sept., 1914, *Beals* (US). Grant Co.: Mangas Springs, 18 miles northwest of Silver City, *Metcalfe 722* (G, NY, US); 5 miles east of junction of Mule Creek road, on Mule Creek Highway, *Maguire, Richards & Moeller 11918* (G, I). Luna Co.: Deming, *Evans 5* (NY); Carrizallilo Mountains, *Mearns 153* (US). Doña Ana Co.: mesa near Las Cruces, *Wooton 75* (NY, US). Eddy Co.: dry plains east of Carlsbad, *Standley 40295* (US). Oklahoma: Harmon Co.: field near Hollis, *G. W. Stevens 1105* (D, G, M, NY, US). Texas: Lubbock Co.: Lubbock, *Demaree 7525* (US). Hudspeth Co.: Rio Grande at Bosque Bonita Crossing, *Cory 1935* (G). Reeves Co.: Verhalen, *Cory 1926* (G). Ward Co.: Barstow, *Tracy 437* (G, Mo, NY, US). Jeff Davis Co.: Limpia Canyon, *Tharp 4427* (US). Presidio Co.: Shafter, infrequent, valleys, *Hanson 552* (NY, US). Brewster Co.: along Rio Grande near Lajitas, Chisos Mountain area, *Warnock 665* (US). Crockett Co.: Ozona, *M. E. Jones 26001* (I, W). Dallas Co.: Dallas, *Bush 650* (G, NY, US). Tom Green Co.: Knickerbocker Ranch, Dove Creek, *Tweedy 268* (US). Bexar Co.: San Antonio, dry rocky ground, *E. J. Palmer 33786* (NY, US). Wilson Co.: Sutherland Springs, Aug. 1879, *Ed. Palmer 1207* (G). Zavala Co.: Crystal City, *Hanson 685* (G, US). Duval Co.: San Diego, *Croft 202* (US). Starr Co.: Rio Grande City, *Neally 221* (US). Hidalgo Co.: Abrams, June 9, 1928, *Bogusch & Molby* (O). Cameron Co.: Kingsville, *Tracy 9125* (G, NY, US). Rio Hondo, *Chandler 7026* (G, NY, US). MEXICO: Baja California: between Ojos Negros and Neji Rancho, *Wiggins & Gillespie 4141* (G, NY, O, US); Gardner's Laguna, *Schoenfeldt 2896* (US). Sonora: dry reservoir, Alamo, west Magdalena, *Kennedy 7076* (US); 5 miles south of Nacori, *Lloyd 458* (G); Arroyo de Cocoragua south of Velderrain, *Pennell 19477* (US); Alamos, arroyo, *Rose, Standley & Russell 12935* (US); Magdalena, *Rose, Standley & Russell 15074* (NY, US). Sinaloa: Culiacan, *Rose, Standley & Russell 14934* (NY, US). Chihuahua: Rio Santa Maria, *Thurber 749* (G, NY); 6 miles west of Piloncillo, *Johnston 7862* (G); Casas Grandes, *Goldman 406* (G, US); near Chihuahua, Apr. 8–27, 1908, *Ed. Palmer 15* (G, NY, US); Llano de Chilicote, 7 miles east of Chilocote Station, *Johnston 7991* (G); Santo

Tomas on railroad northwest of San Isidro, Sierra Madre Occidental, *Pennell 18991* (US). DURANGO: Durango and vicinity, June, 1896, *Ed. Palmer 296* (C, F, G); Santiago Papasquiaro, Apr., 1896, *Ed. Palmer 42* (C, F, G, US). COAHUILA: Municipio de Muzquiz, Hacienda Mariposa, open brush land near Puerto Santa Ana, *Wynd & Mueller 274* (G, NY, US). NUEVO LEON: Monterey, *Dodge 83* (US). TAMAULIPAS: Victoria, Feb. 1 to Apr. 9, 1907, *Ed. Palmer 92* (US). For citation of additional collections see Bull. Torr. Bot. Club **63:** 446–447. 1936.

The Thurber specimen here taken as type is from Torrey's herbarium and is labeled "*Euphorbia albomarginata* Torr. & Gray" presumably in Torrey's hand. This specimen is accompanied by diagnostic drawings. This choice of type preserves the customary interpretation of this well known species. The original diagnosis would not distinguish *E. Fendleri* nor *E. polycarpa* from *E. albomarginata*. However, in spite of that and the fact that some specimens of *E. Fendleri* were labeled as *E. albomarginata* and the description of the seeds was probably drawn from them, the majority of specimens originally referred to *E. albomarginata* were that, and *E. Fendleri* was described on the next page. One specimen of *E. polycarpa* was included in the concept and part of the original diagnosis may have been based upon it. Nevertheless, about three-fourths of the specimens originally referred to *E. albomarginata* were specifically identical with the specimen here chosen as type.

Jepson's statement, Fl. Calif. **2**: 428. 1936: "type loc. 'headwaters of the Colorado,' that is, western Texas, *Diffenderfer;*" is based on the statement in the publication of *E. albomarginata* that it grew "with the preceding" (*E. Wrightii* T. & G.) which is reported from "Headwaters of the Colorado". This, combined with the statement on page 3 of the same volume that all the collections of plants of the expedition were made by Dr. W. L. Diffenderfer leads logically to Jepson's bibliographical conclusion. My selection is based on actual examination of the specimens from which the original diagnosis was drawn.

EUPHORBIA SUBGENUS CHAMAESYCE IN CANADA AND THE UNITED STATES EXCLUSIVE OF SOUTHERN FLORIDA

Louis Cutter Wheeler

(*Continued from page 205*)

32. Euphorbia Fendleri T. & G., Rep. Expl. & Surv. Miss. R. to Pacific Ocean **2** (**4**): 175. 1855.

Glabrous perennial from a taproot woody in age; stems several to numerous from the base, decumbent to erect, up to 15 cm. long, slender, internodes up to 2 cm. long; leaf-blades entire, 3–11 mm. long, ovate-orbicular with oblique base, to lanceolate; petioles mostly ca. 1 mm. long; stipules up to 1 mm. long, distinct, narrowly linear, mostly entire, rarely with a few hairs; peduncles up to 4 mm. long, glabrous; cyathia solitary at the nodes; involucres glabrous, 1.25–1.75 mm. diam., campanulate to turbinate, glabrous without, with short hairs within above opposite the glands; lobes deltoid, shortly-attenuate, hairy within below, equaling the glands; glands reddish, 1.5–4 times as long as wide, concave or convex, up to 1 mm. long; appendages white, glabrous, 0.5–1 mm. long, as wide as the gland at least at the base, obtuse-crenate to entire and narrowly deltoid, or parted into 2–4 narrow segments; fifth gland shorter than the lobes, linear; sinus very broad and little depressed; bracteoles forming a single appendage adnate below to the involucre opposite each gland, 3–5-parted and hairy above; staminate flowers 5–7 per fascicle, 25–35 per involucre; androphores 1.25 mm. long, glabrous; gynophore glabrous, exserted and reflexed at maturity; ovary glabrous, three-lobed; styles glabrous, ca. 0.4 mm. long, bifid to the middle, curved upward, thickened at the base; capsule glabrous, three-angled, wider below, ca. 2.25–2.5 mm. long; seeds quadrangular, 2–2.25 mm. long, ca. 1 mm. radially, 1–1.2 mm. tangentially, ovate-acute radially, angles prominent, front facets concave, mostly smooth, back facets slightly wrinkled, coat white, microreticulate.

Key to Varieties

Plants decumbent to erect; leaves ovate-orbicular to ovate-lanceolate; appendages obtuse, crenate . . . . a. var. *typica*.
Plants erect and leaves lanceolate.
  Appendages narrowly deltoid, entire . . . . b. var. *chaetocalyx*.
  Appendages parted into 3–4 narrowly linear segments; roots very thick . . . . c. var. *triligulata*.

32a. E. Fendleri T. & G., Rep. Expl. & Surv. Miss. R. to Pacific Ocean **2** (**4**): 175. 1855, var. typica L. C. Wheeler, Bull. Torr. Bot. Club **63**: 444. 1936. Type: Santa Fe, New Mexico, May 4–July 18, 1847, *Fendler 800* (NY!; isotype G!, atypical).

See Plantae Exsiccatae Grayanae 726, cited below, for bibliography.—*Anisophyllum Fendleri* (T. & G.) Klotzsch & Garcke, Abh. Akad. Berlin, Phys. **1859:** 26. 1860.—*Chamaesyce Fendleri* (T. & G.) Small, Fl. Se. U. S., 710, 1333. 1903.

E. rupicola Scheele, Linnaea **22:** 153. 1849, not Boiss., Elench., 81. 1838. TYPE: "südlich von Neubraunfels: Lindheimer. Juli." (?). (*Lindheimer 290*, (M!) New Braunfels, Texas, July, 1846, designated as type collection by Blankinship, Ann. Rep. Mo. Bot. Gard. **18:** 149. 1907).

E. Fendleri T. & G. var. *dissimilis* Payson, Bot. Gaz. **60:** 379. 1915. TYPE: dry sandy hills, Naturita, Montrose County, Colorado, alt. 5,400 feet, June 27, 1913, *Payson 119* (Herb. University of Wyoming, Laramie; fragment W!; ISOTYPE G!, M!). Some of the plants unusually large-leaved and some of the appendages approaching those of var. *chaetocalyx*.

Chamaesyce Gooddingii Millsp., Field Mus. Pub. Bot. **2:** 405. 1916. TYPE: Lee Canyon, Spring (Charleston) Mountains, Clark County, Nevada, altitude 8,000 feet, Aug. 4, 1913, *A. A. Heller 11058* (F 411087!; photographs G!, W!; ISOTYPES C!, G!, Ph!). A good representative of var. *typica*.

Chamaesyce Greenei (Millsp.) Rydberg *sensu* Rydberg, Fl. Rocky Mts., 544. 1917, and Fl. Pr. Plains, 517, fig. 350. 1932. The second includes some plants rather intermediate between var. *typica* and var. *chaetocalyx*. PLATE 666C.

Inyo and San Bernardino Counties, California, east to western Nebraska and Oklahoma, south to Sonora (?), and Texas (MAP 29). Representative specimens seen: KANSAS. Ellis Co.: stony hills, *A. S. Hitchcock 475* (G). OKLAHOMA. Ellis Co.: near Shattuck, *Clifton 3183* (G). Woodward Co.: 8 miles southwest of Woodward, *Goodman 2179* (G). Roger Mills Co.: Antelope Hills, *Goodman 2612* (G). Harper Co.: near Buffalo, *G. W. Stevens 308* (G). Beaver Co.: 15 miles southwest of Beaver City, *G. W. Stevens 350* (G). TEXAS. Bexar Co.: 8 miles south of Bulverde, *Cory 6020* (G). Comal Co.: New Braunfels, *Lindheimer 104* (G). Wilson Co.: Sutherland Springs, 1879, *Ed. Palmer 1203* (G). Howard Co.: Big Springs, *Tracy 7852* (G, Mo). Hood Co.: rocky bluffs, June–Sept., ?, *Reverchon* (G). Taylor Co.: Buffalo Gap Hills, *Cory 8729* (G). Jeff Davis Co.: Davis Mountains, *Tracy 154* (G, Mo). Brewster Co.: 55.4 miles south of Alpine, *Cory 18595* (G). Presidio Co.: 15½ miles southwest of Marfa, *Cory 26319* (G). Kendall Co.: Spanish Pass, *Cory 19308* (G). WYOMING. Weston Co.: Newcastle, June 13, 1896, *Bates* (G). COLORADO. Larimer Co.: *Cowen 126* (G). Weld Co.: Grassland, *Muir 82* (G). Mesa Co.: Grand Junction, *Macbride & Payson 694* (G). Montrose Co.: West Paradox, *Payson 2320* (G). UTAH. Uintah Co.: 8 miles south of Ouray, Uinta Basin, *Rollins 1699* (G). Grand Co.: near Wilson Mesa, *Rydberg &*

Garrett 8382 (G). Emery Co.: Muddy River, 1877, *Ed. Palmer 443* (G). Nevada. Clark Co.: Las Vegas, *Goodding 2282* (G). Arizona. Coconino Co.: Cosnino, *M. E. Jones 4036* (I, NY, O); desert near Tuba, *Clute 91* (G); Williams, July 12–14, 1886, *Bunker* (G); near Flagstaff, *MacDougal 209* (G, US). Yavapai Co.: near Montezuma Castle National Monument, *A. & R. Nelson 2048* (NY). Navajo Co.: Kayenta, *Clute 9* (G); Marsh Pass, *Eastwood & Howell 6616* (G). Cochise Co.: 5 miles northeast of Dragoon, *Maguire 11191* (G, I). For citation of additional specimens and discussion of intergrades see Bull. Torr. Bot. Club **63:** 445. 1936; Bull. So. Calif. Acad. **33:** 106. 1934; Bull. So. Calif. Acad. Sci. **35:** 128. 1936.

Certain plants of this species exhibit a rare tendency. They have occasionally three, four, or even five leaves at a node. The collection showing this tendency most strongly was one infected with rust: below Wheeler Well, rocky hillside, Juniper belt, Clark County, Nevada, May 31, 1936, *I. W. Clokey 7183* (Cl, G). These plants showed as many as five leaves per whorl. Another collection made at the same place and time which was not infected with rust had only opposite leaves: *Clokey 7184* (Cl). This suggested that the abnormality might have been induced by the pathogen. However another perfectly healthy collection from the same general region showed some whorled leaves: gravelly slope with *Juniperus* and *Cercocarpus,* Harris Springs Road, Spring (Charleston) Mountains, Clark Co., Nevada, July 16, 1937, *Clokey 7578, Pl. Exs. Gray. 726* (G). *MacDougal 209* (US) from Arizona also shows three leaves in a whorl in one rusty plant. That this variation is not confined to this region is shown by a collection which bears not only one whorl of four leaves but also one unpaired leaf. The collection bears only the data "*Rio Grande, Wright 1848*" (G).

Previously, Bull. Torr. Bot. Club **63:** 444. 1936, I made the error of combining the locality for Pope's collection from Big Springs of the Colorado River, Texas, with New Mexico, the state from which *Fendler 800* came.

32b. E. Fendleri T. & G. var. chaetocalyx Boiss. in DC. Prod. **15 (2):** 39. 1862. Type: mountain sides near Frontera, El Paso County, Texas, Apr. 3, 1852, *C. Wright 1847* (Ge!; photographs G!, W!; isotype G!). Not the extreme of the variety but rather closer to *typica* but nevertheless acceptable in var. *chaetocalyx.—Chamaesyce chaetocalyx* (Boiss.) Wooton & Standley, Contr. U. S. Nat. Herb. **16:** 144. 1916.—*E. chaetocalyx* (Boiss.) Tidestrom, Proc. Biol. Soc. Wash. **48:** 40. 1935. Plate 666D.

Map 34, dots range of Euphorbia supina; 35, E. acuta; 36, E. lata; 37, dots E. serpens in Canada & U. S., circle E. Golondrina; 38, E. hyssopifolia in U. S.; 39, E. ammannioides in U. S.; 40, E. humistrata (Virginian stations omitted).

Arizona, New Mexico, and western Texas (MAP 31). Representative specimens seen: TEXAS. Culberson Co.: *Cory 1964* (G). Crockett Co.: 11.9 miles southwest of Leon Powell, *Cory 3191* (G). Brewster Co.: Chisos Mountains, *Mueller 8077* (M). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 445. 1936.

Frontera seems to be missing on the modern maps. It is located on the Rio Grande a few miles above El Paso. It is shown on the general map, which is first, in the part entitled "Topographical Maps, Profiles, and Sketches", in Rep. Expl. & Surv. Miss. R. to Pacific Ocean. **11:**—1859.

32c. E. FENDLERI T. & G. var. TRILIGULATA L. C. Wheeler, Bull. Torr. Bot. Club **63:** 445. 1936. TYPE: cliffs above Boquillas Canyon, Boquillas, Brewster County, Texas, July 12, 1931, *Moore & Steyermark 3444* (G!; ISOTYPES CA!, D!, Ph!). A very distinctive variant known only from the type collection (MAP 29). PLATE 666E.

33. EUPHORBIA ASTYLA Engelm. ex Boiss. in DC. Prod. **15 (2):** 40. 1862. TYPE: "Valley of the Nazas River" [Coahuila or Durango], Mexico, Apr. 15, 1847, *J. Gregg 457* (M 149805!; fragment F!; photographs G!, W!; probable isotype G!). A small but otherwise typical plant.—*Chamaesyce astyla* (Engelm.) Millsp., Field Mus. Pub. Bot. **2:** 408. 1916.

Glabrous, perennial from a root up to 6 mm. thick; stems several to numerous, 4–23 cm. long, prostrate to erect, 0.6–2 mm. thick, internodes up to 2 cm. long but predominantly 3–6 mm. long; leaves sessile, 2–8 mm. long, orbicular-reniform to ovate-acute, base oblique, often clasping, margin entire: stipules united to form a scale ca. 0.5 mm. wide and mostly only ca. 0.2 mm. high, minutely lacerate and bearing a fringe of very short hairs on the inner margin; cyathia solitary at the nodes, mostly toward or at the stem-tips where often much congested by the very short internodes; peduncles 0.5–1.4 mm. long, stout; involucres glabrous outside, densely short-hairy inside especially at summit and somewhat downward beneath the glands, broadly campanulate to obconical-campanulate, 1.4–1.6 mm. in diam.; lobes narrowly triangular, equaling the glands; glands transversely oval to oblong, generally slightly depressed in the middle, 0.4–0.6 mm. long; appendages white, glabrous, ½–1½ times as wide as gland, entire or crenulate; 5th gland absent or present as a mere papilla; sinus U-shaped, not depressed, densely hairy; bracteoles numerous, glabrous below, pubescent above, ca. ⅔ as long as the androphores, some united below and often adnate to the involucre beneath the glands; staminate flowers 3–6 per fascicle, 22–26 per cyathium; androphores glabrous, 1.4–1.6

mm. long; gynophore glabrous, soon exserted and usually reflexed; ovary glabrous, 3-angled; styles 0.3–0.4 mm. long, entire, sometimes medianly creased, stigmas thickly round-capitate; capsule glabrous, subacutely 3-lobed, slightly wider below the equator, 1.9–2.6 mm. long, one carpel often sterile and shriveled; seeds sharply quadrangular, 1.5–1.7 mm. long, 0.9–1 mm. tangentially, 0.8–1 mm. radially, ovate radially, ventral facets plane to slightly convex, all traversed by irregular low rounded frequently anastamosing ridges separated by narrow grooves, angles often notched, gelatinous coat sordid to chalky white, very thick, microreticulate.—PLATE 666A.

Rare and local in Coahuila and Durango (?), and in Pecos County, Texas (MAP 33). Additional specimens seen: TEXAS: Pecos Co.: *Cory 1960* (G). MEXICO: COAHUILA: 1 mile south of Hermanas, prostrate on heavy alkaline soil, *Johnston 7060* (G); 4 miles west of Cuatro Cienagas, middle of saline flats in very alkaline soil (with *Dondia, Allenrolfea, Atriplex,* etc.) prostrate, succulent, brittle, *Johnston 7135* (G); Sierra del Rey, *Purpus 4512* (F, G, M, US).

The collector's number on the type bears some illegible suffix and the notation that it was mixed with 457a.

34. EUPHORBIA HOOVERI L. C. Wheeler, Proc. Biol. Soc. Wash. **53:** 9. 1940. TYPE: Yettem, Tulare County, California, June 30, 1937, *R. F. Hoover 2583* (G!; ISOTYPE W!).

Annual; stems prostrate or decumbent, to 20 cm. long, glabrous, from 1 mm. in diam. near the tips to as much as 3.5 mm. in diam. at the base, internodes as much as 1.5 cm. long, shorter toward the stem-tips; petioles ca. 0.5 mm. long; blades 2–5 mm. long, orbicular-cordate to orbicular-reniform, glabrous, papillate, margin with sharp white teeth; stipules united, white, deeply lacerate; peduncles ca. 0.5 mm. long; cyathia solitary in the axils; involucres 1.7–2 mm. in diam., campanulate, glabrous without and within except beneath the glands; lobes much exceeding the glands, narrowly deltoid, laciniate; glands transversely oval, ca. 0.5 mm. long, slightly cupped, at first red, then olive; appendages white, glabrous, parted into 3–5 ligules ca. 1 mm. long; 5th gland of 1 or 2 filiform segments equaling the lobes; sinus narrowly V-shaped, not depressed; bracteoles united only at the base, filiform, sparsely hairy, ca. ⅔ as long as the androphores, forming a radial row opposite each gland; staminate flowers 30–35 per cyathium, 6–7 per fascicle; androphores 2–2.1 mm. long, glabrous; gynophore glabrous, long-exserted and reflexed at maturity; ovary glabrous, 3-lobed; styles 1.7–2 mm. long, entire; capsule spheroid with flattened base, roundly 3-lobed, glabrous, 1.6–1.9 mm. long; seeds ovoid-quadrangular, rotund-ovate radially, raphe slightly curved, back semi-circular, facets covered with low irregular, smooth ridges, 1.4–1.6 mm. long, 1–1.1 mm. tangentially and radially, coat white and microreticulate.—PLATE 664B.

Central Valley of California (MAP 32). Other collections seen: CALIFORNIA. Tulare Co.: Yettem, *R. F. Hoover 1277* (G). Tehama Co.: 4 miles southeast of Vina, *R. F. Hoover 3722* (G).

35. EUPHORBIA SERPYLLIFOLIA Pers., Syn. Pl. **2:** 14. 1806 (as *serpillifolia*).

Annual; stems glabrous to sparsely villous, prostrate to erect, 5–35 cm. long; leaf-blades 3–14 mm. long, ovate, oblong, oblong-cuneate, obovate, to narrowly oblong, linear-oblong, or oblong-lanceolate, often falcate, glabrous to sparsely villous, usually serrulate at least toward the apex; stipules distinct, linear, entire or few-parted, mostly glabrous; cyathia solitary; involucres glabrous to villous, 0.8–1.2 mm. in diam., obconical-campanulate to campanulate; glands transversely oblong, 0.2–0.5 mm. long; appendages narrow, white, glabrous, entire to crenulate or even subdentate; sinus U-shaped, slightly depressed; staminate flowers 5–18 per cyathium; androphores glabrous, 1–1.2 mm. long; gynophore glabrous, soon exserted and reflexed; capsule sharply 3-angled, 1.5–1.9 mm. long, wider below the equator, mostly glabrous; seeds quadrangular but often turgid, angles rounded to sharp, 1–1.4 mm. long, broadly ovate to narrowly ovate radially, facets smooth to slightly punctate or even rugulose, coat clay white to brown.

KEY TO VARIETIES

Glabrous throughout; leaves 3–14 mm. long . . . . a. var. *genuina*.
More or less villous; leaves 3–7 mm. long . . . . b. var. *hirtula*.

35a. E. SERPYLLIFOLIA Pers., Syn. Pl. **2:** 14. 1806, var. GENUINA Boiss. in DC. Prod. **15 (2):** 43. 1862; Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 444. 1917. TYPE: "Hab. in Amer. calidiore" (Ge?, not seen; fragment M!; photographs of fragment G!, W!). An average member of the species, stems slightly winged. Millspaugh, Pittonia 2: 82, Pl. 1, figs. 1–4. 1890, poor.—*Chamaesyce serpyllifolia* (Pers.) Small, Fl. Se. U. S., 712, 1333. 1903.

E. inaequilatera Sonder *sensu* Engelm. in Emory, U. S. & Mex. Bound. Surv. **2 (1):** 187. 1859.

Anisophyllum novomexicanum Klotzsch & Garcke, Abh. Akad. Berlin, Phys. **1859:** 31. 1860. TYPE: "25th May–3rd Octbr. 1846–7. Rio del Norte, sandy soil, low river bank between rocks. Also: Santa Fe and Poñi Creek".[1] New Mexico, *Fendler 795* (B!; photographs G! W!). Stems very slightly winged; seeds slender, slightly punctately pitted. (This is not the extreme represented by *E. albicaulis.*)—*E. novomexicana* (Klotzsch & Garcke) L. C. Wheeler, Bull. So. Calif. Acad. Sci. **35:** 129. 1936.

[1] From Fendler's field notes (or copy?) at Gray Herbarium.

E. serpyllifolia Pers. β *consanguinea* Boiss. in DC. Prod. **15** (2): 43. 1862. Type: Nebraska, 1853–4, *F. V. Hayden* (Ge!; photographs G!, W!). Stems slightly winged; seeds slender, punctately pitted; leaves mostly broad. While the seeds and capsules approach those of *E. albicaulis* the leaves are broader. Jepson, Fl. W. Middle Calif., 262. 1901.—*E. consanguinea*, *E. subserrata*, and *E. notata* Engelm. ex Boiss., l. c. in synonymy.—*Chamaesyce consanguinea* (Engelm.) Lunell, Amer. Midl. Nat. **1:** 205. 1910, with parenthetical author but without basinym; description given. Millsp., Field Mus. Pub. Bot. **2:** 408. 1916, basinym given as "*Euphorbia consanguinea* Engelm. Mex. Bound. 187". In that place no such name appeared. The name was first published by Boissier in synonymy; see above.

E. neomexicana Greene, Bull. Calif. Acad. Sci. **2:** 56. 1886. Type: plains toward the Gila, New Mexico, Aug., 1880, *E. L. Greene* (Herb. Greeneanum 13713, not seen; photograph G!). Narrow-leaved, other characters not certain from picture.—*E. serpyllifolia* var. *neomexicana* (Greene) Millsp., Pittonia **2:** 84, Pl. 1, figs. 16–18. 1890.—*Chamaesyce neomexicana* (Greene) Lunell, Amer. Midl. Nat. **1:** 205. 1910 (June), with parenthetical author but without basinym; description given. Standley, Contr. U. S. Nat. Herb. **13:** 199, 227. 1910 (Oct.), with basinym.

E. sanguinea Hochst. & Steud. *sensu* Greene, Bull. Calif. Acad. **2:** 56. 1886.

E. occidentalis Drew, Bull. Torr. Bot. Club **16:** 152. 1889. Type: Hy-Am-Pum, Trinity County, California, July 23, 1888, *Chestnut & Drew* (C!; isotype J!).—*E. serpyllifolia* var. *occidentalis* (Drew) Jepson, Fl. W. Middle Calif., 262. 1901.—*Chamaesyce occidentalis* (Drew) Millsp., Field Mus. Pub. Bot. **2:** 410. 1916.

E. serpyllifolia var. *rugulosa* Engelm. ex Millsp., Pittonia **2:** 85, Pl. 1, fig. 19. 1890. Type: San Bernardino Valley, Aug., 1881, *S. B. & W. F. Parish 672* (F 99060!; photographs G!, W!; isotype M!). Jepson, Fl. W. Middle Calif., 262. 1901.—*E. rugulosa* (Engelm.) Greene, Fl. Franciscana, 92. 1891.—*Chamaesyce rugulosa* (Engelm.) Rydb., Bull. Torr. Bot. Club **33:** 145. 1906.

E. albicaulis Rydb., Mem. N. Y. Bot. Gard. **1:** 266. 1900. Type: cultivated place south of Potter, Cheyenne County, Nebraska, July 13, 1891, *P. A. Rydberg 356* (NY!; photographs G!, W!). Stems terete; leaves very narrow; seeds long and slender.—*Chamaesyce albicaulis* (Rydb.) Rydb., Bull. Torr. Bot. Club **33:** 145. 1906.

Chamaesyce aequata Lunell, Amer. Midl. Nat. **1:** 204. 1910. Type: on a railroad bank, Leeds, Benson County, North Dakota, July 12, 1909, *J. Lunell 694* (Mi 251952!; photographs G!, W!).

Chamaesyce aequata var. *claudicans* Lunell, op. cit., 205. Type: on a railroad bank, Leeds, Benson County, North Dakota, July 27, 1909, *J. Lunell 695* (Mi 251953!; photographs G!, W!).

Chamaesyce erecta Lunell, op. cit., 206. TYPE: on the margin of a slough, Leeds, Benson County, North Dakota, Aug. 19, 1909, *J. Lunell 696* (Mi 251955!; photographs G! W!). Erect, as is often the case with plants of this species in wet situations.—*C. aequata* var. *erecta* (Lunell) Lunell, op. cit., **4**: 471. 1916.—PLATE 657C.

Southern British Columbia and Alberta, south to Mexico, east to western Texas, Colorado, Nebraska, Iowa, Minnesota, and northwestern Michigan (MAP 15). Said to be introduced into Europe. Representative specimens seen: ALBERTA: Rosebud Creek Valley, *Moodie 1199* in part (NY); Milk River, *Macoun 13702*[b] (O). BRITISH COLUMBIA: Vancouver Island, Sproat Lake, Aug. 12, 1887, *Macoun* (NY). MICHIGAN. Keweenaw Co.: July, 1888, *O. A. Farwell 235* (NY); Phoenix, June, 1886, *Farwell* (Ph); Keweenaw Point, July 15, 1885, *Farwell* (NY). MINNESOTA. Brown Co.: Sleepy Eye, *Sheldon 917* (Mi). Clay Co.: south of Moorhead, *Ballard 2902* (Mi). Kittson Co.: Northcote, *Ballard 2682* (Mi); Kennedy, *Ballard 2734* (Mi). Lincoln Co.: Lake Benton, *Sheldon 1285* (Mi). Marshall Co.: Warren, *Ballard 2774* (Mi). Pipestone Co.: Pipestone, Aug. 11, 1925, *Peterson* (Mi). St. Louis Co.: Duluth, *Lakela 2118* (Mi). IOWA. Monona Co.: Turin, *Pammel* (F). MISSOURI. Jackson Co.: Courtney, *Bush 11824* (Mo). NORTH DAKOTA. Benson Co.: Leeds, *Lunell 639* (Mi). Cass Co.: Fargo, July, 1890, *Greene* (NY). SOUTH DAKOTA. Brookings Co.: near Brookings, June 26, 1894, *T. A. Williams* (W). Stanley Co.: Fort Pierre, June 21, 1853, *Hayden* (NY). Washington Co.: Sheep Mt., *Visher 2359* (NY). NEBRASKA. Cheyenne Co.: south of Potter, *Rydberg 356* (NY). OKLAHOMA. Cimarron Co.: 11 miles north of Boise City, *Stratton 448* (M). TEXAS. Brewster Co.: Alpine, *MacKensen 38* (F). El Paso Co.: El Paso, *M. E. Jones 4342* (I). Culberson Co.: Van Horn flats, July, 1900, *Eggert* (M). MONTANA. Lake Co.: Aug., 1924, *Swingle* (I). WYOMING. Platte Co.: Uva, *Nelson 2743* (NY). Sweetwater Co.: Granger, *Nelson 8133* (NY). COLORADO. Boulder Co.: near Boulder, *Tweedy 5057* (NY). Conejos Co.: Antomito, July 19, 1898, *Earle* (NY). Denver Co.: Denver, along the Platte River, *M. E. Jones 864* (I). Douglas Co.: Buffalo Creek, *Goodman 2004* (NY). El Paso Co.: Manitou, July 27, 1888, *Northrop* (NY). Fremont Co.: Canyon City, *T. S. Brandegee 316* (Ph). Gunnison Co.: Parlin, *B. H. Smith 81* (NY). Jefferson Co.: Golden City, July, 1879, *Gaillardon* (F). La Plata Co.: Durango, *Baker, Earle & Tracy 608* (NY). Larimer Co.: Ft. Collins, July 10, 1896, *Baker* (NY). Otero Co.: 15 miles northeast of La Junta, *Rollins 1874* (M, NY, W). Ouray Co.: Box Cañon west of Ouray, *Underwood & Selby 156* (NY). Pueblo Co.: Pueblo, *Coulter* (F). NEW MEXICO. Chaves Co.: 20 miles south of Roswell, *Earle 273* (NY). Doña Ana Co.: Organ Mts., *Wooton 425* (NY). Grant Co.: Fort

Bayard, *Blumer 27* (NY). Lincoln Co.: near Gray, *Skehan 71* (NY); White Mts., *Wooton 608* (NY). Otera Co.: Cloudcroft, *Schulz 301* (NY). Sandoval Co.: 4 miles north of Bernalillo, *Arsène 18987* (F, US). San Miguel Co.: near Pecos, *Standley 5054* (NY). Santa Fe Co.: Santa Fe Canyon, 9 miles east of Santa Fe, *Heller 3845* (NY, O). Sierra Co.: 2 miles south of Hillsboro, *Metcalfe 1298* (NY). Idaho. Ada Co.: Boise, *Clark 144* (F). Bonner Co.: Lake Pend d'Oreille, Aug. 1, 1889, *Greene* (F). Shoshone Co.: Coeur d'Alene Mts., *Leiberg 1317* (NY). Canyon Co.: Falk's Store, *Macbride 724* (NY). Kootenai Co.: Lake Coeur d'Alene, *Epling & Hauch 10008* (M). Gem Co.: Sweet, *Macbride 1629* (NY). Utah. Juab Co.: Troutcreek, *Becraft & Starr 385* (I); 6 miles south of Callao, *Maguire & Richards 2685* (I). Beaver Co.: Beaver Canyon, *Garrett R2708* (NY). Carbon Co.: Price, *M. E. Jones 5467* (NY). Nevada. Elko Co.: near Blaine postoffice, *Heller 11118* (NY, Ph); near Fort Halleck, *Heller 9275* (NY). Ormsby Co.: Eagle Valley, *Baker 1274* (NY). Washoe Co.: Spanish Springs Valley, *Kennedy 1945* (F, NY). Arizona. Mohave Co.: Peach Spring, *Lemmon 39* (NY). Coconino Co.: Walker Lake, San Francisco Mts., *Knowlton 159* (F, US); Flagstaff, *M. E. Jones 3998* (I, O, US). Yavapai Co.: Clarksdale, *W. W. Jones 288* (G); 4 miles west of Prescott, *Wolf 2321* (G). Navajo Co.: Lakeside, White Mts., *Harrison 5517* (US). Apache Co.: north end of the Carrizo Mts., Navajo Indian Reservation, *Standley 7499* (US). Graham Co.: Solomonville, *Goodding 519* (G, NY, US). Gila Co.: Tonto Basin, *Toumey 266* (US). Cochise Co.: near Fort Huachuca, *Wilcox 328* (US); Portal, *Eggleston 10274* (US). Santa Cruz Co.: near Nogales, *Peebles, Harrison & Kearney 5565* (US). Washington. Klickitat Co.: North Dalles, *Thompson 11122* (NY). Okanogan Co.: Loomiston, *Elmer 602* (NY). Whitman Co.: Pullman, *Elmer 200* (NY). Oregon. Curry Co.: Rogue River bar at ferry, *Peck 13656* (Ph). Klamath Co.: Fort Klamath, *Peck 9562* (NY). Multnomah Co.: University Park, *Sheldon S.11309* (NY). Wallowa Co.: Hurricane Creek, *Sheldon 8630* (NY); Wallowa Mts., *Constance & Jacobs 1418* (NY). Wasco Co.: The Dalles, *Thompson 11891* (NY, W). Washington Co.: Forest Grove, July 2, 1894, *Lloyd* (NY). California. Humboldt Co.: Trinity River Valley near the South Fork, *Tracy 6555* (J). Mendocino Co.: Covelo Ranger Station, *Cronemiller 663* (J). Lake Co.: near Clear Lake, *J. Torrey 478* (NY). Sonoma Co.: Santa Rosa Creek east of Santa Rosa, *Heller 5802* (M, NY, Ph). Napa Co.: Napa River near St. Helena, *Jepson 13934* (J). Solano Co.: northeast of Elmira, *Jepson 12379* (J). San Francisco Co.: San Francisco, *Bolander 186* (NY). San Mateo Co.: Crystal Lake, *Abrams 2990* (NY). Santa Clara Co.: Stanford University, *Baker 195* (NY). Monterey Co.: Carmel, 1905, *Clemens* (NY). Siskiyou Co.: Mt. Shasta, *Brown 541* (NY). Shasta Co.: near Ash Creek, Shasta Forest, *Dayton 486* (NY). Butte Co.: 5 miles east of Chico, *Heller 13815* (F, NY). Colusa Co.: Indian Creek about 7 miles north of Leesville, *Bracelin 564* (I, NY). Sacramento Co.: Sacramento, *M. E. Jones 2855* (I). San Joaquin Co.: Lathrop, *Walker 910* (J). Alameda Co.: Berkeley, *Michener & Bioletti 6189* (M, NY). Modoc Co.: Egg Lake, July 25, 1893, *Baker* (J, NY). Lassen Co.: Beckwith Pass, *Jepson 7762* (J). Plumas Co.: Bucks Valley, *Jepson 10643* (J). Nevada Co.: lower end of Donner Lake, *Heller 6935* (NY). Placer Co.: Yuba River below Cisco, *Heller 13303* (NY, Ph). El Dorado Co.: near Echo Camp on Lincoln Highway, *Heller 12524* (NY, Ph, W). Amador Co.: Ione, *Braunton 1178* (NY). Calaveras Co.: Dorrington, *Jepson 10112* (J). Tuolumne Co.: Deadman Creek, *Jepson 6559* (J). Mariposa Co.: Yosemite Valley, *Abrams 4652* (NY). Madera Co.: Fresno Big Trees, *Jepson 15985* (J). Fresno Co.: Pine Ridge, *Hall & Chandler 345* (NY). Los Angeles Co.: Los Angeles, *Abrams 4178* (M, NY); Mescal Creek, San Antonio Mts., *Munz 7697* (NY); Canyon south of Avalon, Santa Catalina Island, *Pendleton 1398* (J). Orange Co.: Newport, May, 1908, *King* (J). San Bernardino Co.: Cucamonga, *Abrams 2661* (M, NY, Ph); Mill Creek, San Bernardino Mts., *Munz 7577* (NY); 5 miles south of Barnwell, eastern Mohave Desert, *Munz 13836* (W). San Diego Co.: San Diego, *Spencer 964* (NY). MEXICO: BAJA CALIFORNIA: northwest of La Encantada, Sierra San Pedro Mártir, *Wiggins & Demaree 5020* (US). CHIHUAHUA: plains near Chihuahua, *Pringle 286* (Ph, US). COAHUILA: Jimulco, *Pringle 81* (US). DURANGO: Durango, Apr.–Nov., 1896, *Ed. Palmer 899* (US). QUERÉTARO: near San Juan del Rio, *Rose, Painter & Rose 9611* (US).

Bush's collection of this species from Missouri is not necessarily to be taken as evidence that the species grows there naturally. From this and several other collections of *Euphorbia* made by Bush at Courtney, his home town, I have been led to wonder if he were not careless with the sweepings from his herbarium and consequently found many waifs in his backyard.

Euphorbia minuta Philippi appears doubtfully distinct from *E. serpyllifolia*.

It is quite possible that the plants here called *E. serpyllifolia* var. *genuina* could be divided into three varieties: (1) The typical with broad leaves and seeds; (2) slender-seeded, narrow-leaved, ranging from Nebraska to New Mexico and perhaps westward in arid regions; (3) elliptic-leaved and with numerous staminate flowers and subdentate appendages, in the Central Valley of California.

35b. E. SERPYLLIFOLIA Pers. var. HIRTULA (Engelm.) L. C. Wheeler, Proc. Biol. Soc. Wash. **53:** 11. 1940; based on *E. hirtula* Engelm. ex S. Wats., Bot. Calif. **2:** 74. 1880. TYPE: Talley's, Cuyamaca Mountains, San Diego County, California, 1875, *Ed. Palmer 451* (G!; ISOTYPE M!). Jepson, Man. Fl. Pl. Calif., 599. 1925; Munz, Man. So. Calif. Bot., 287. 1935.—*Chamaesyce hirtula* (Engelm.) Millsp., Field Mus. Pub. Bot. **2:** 409. 1916; Davidson & Moxley, Fl. So. Calif., 219. 1923.

Mostly in the pine belt, central Sierra Nevada, south Coast Ranges, San Bernardino, San Jacinto, and Cuyamaca Mountains, California, south to northern Lower California (MAP 14). Representative specimens seen: CALIFORNIA. Nevada Co.: Bear Valley, *Jepson 13924* (J). Mariposa Co.: Cedar Brook, Sierra Nevada, *Jepson 15964* (J); Agua Fria, Mariposa, *Congdon 75* (G). Monterey Co.: Santa Lucia Mountains, *Vasey 576* (G); along San Antonio River between Jolon and Santa Lucia Ranger Stations, *Mason 5789* (G); bridge over Salinas River at Bradley, *Mason 5506* (G); San Miguelito Rancho, Jolon, Santa Lucia Mountains, *Jepson 1650* (G); Jolon, Sept. 22, 1894, *Eastwood* (G); Jolon, Aug., 1885, *T. S. Brandegee* (G). San Bernardino Co.: Bear Valley, margins of Pine Lake, *Abrams 2952* (G); San Bernardino Mountains, 1880, *Nevin* (G). Riverside Co.: Idyllwild, San Jacinto Mountains, June 16, 1921, *Spencer* (O); Idyllwild, San Jacinto Mountains, June 26, 1920, *Spencer* (O); San Jacinto Mountains, *Spencer 970* (G). San Diego Co.: Pine Valley, June 10, 1917, *Spencer* (O); Julian, *Cleveland 904* (G); San Diego, 1874, *Cleveland* (G, M); near Julian, *Abrams 3789* (G). MEXICO: LOWER CALIFORNIA, San Vincente Rancho, July 8, 1896, *T. S. Brandegee* (J).

The designation of the specimen at Gray Herbarium as type seems necessary in view of the following evidence: Two collections are cited, "Near San Diego (*Cleveland*); at Talley's in the Cuyamaca Mountains, *Palmer.*" Engelmann, on the sheet in his herbarium, questioned the reference of the Cleveland collection to *E. hirtula.* That means that Engelmann considered the name associated permanently with the Palmer collection. No sheet has been found at Missouri Botanical Garden which can appropriately be taken as type. The isotype at M was acquired after Engelmann's death by purchase of a private herbarium. Engelmann's Latin diagnosis was sent to Watson and now reposes in the folder of *E. hirtula.* Watson translated the description into English and published it for Engelmann.

Jepson, Fl. Calif. **2:** 426. 1936, took the Cleveland collection as type but that was done without examining the actual specimens. Jepson has confused certain specimens of *E. supina* (as *E. maculata*) with this species, e. g., *Jepson 10,042*.

At US there is a collection by *Ed. Palmer* in 1869 bearing only the locality "Sonora". The label is copied. In view of the curiously restricted range of this species it is fairly certain that this locality is erroneous.

36. Euphorbia glyptosperma Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 187. 1859. Type: Fort Kearney on the Platte River, Kearney County, Nebraska, July, 1856, *H. Engelmann* (M 144635!; photographs G!, W!; isotype? G!). (See Rhodora **39:** 496. 1937 for discussion of this choice.) An average member of the entity. Boiss., Icon. Euph., t. 18. 1866, poor.—*Chamaesyce glyptosperma* (Engelm.) Small. Fl. Se. U. S., 712, 1333. 1903.

E. glyptosperma Engelm. var. *tenerrima* Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 187. 1859. Type: pebbly bars of the Nueces River, Texas, May 25, 1851, *C. Wright 1853* (M 144673!; photographs G!, W!; isotypes G!, NY!). A plant with small leaves, a character which shows no geographical correlation, completely intergrades and is probably more ecological than genetical.

E. glyptosperma Engelm. var. *pubescens* Boiss. in DC. Prod. **15** (**2**): 48. 1862. Type: bord du Mississippi, Illinois, *Riehl 472* (Ge, not seen; fragment F!). A mixture of typical *E. glyptosperma* with *E. humistrata*. The first element is taken as type.—*Chamaesyce glyptosperma pubescens* (Boiss.) Millsp., West Va. Geol. Surv. **5** (A): 294. 1913 (Living Fl. W. Va.).

E. Greenii Millsp., Pittonia **2:** 88. 1890. Type: Beaver Canyon, Idaho, July 30, 1889, *E. L. Greene* (F 196395!, photographs G!, W!). Entirely typical and later abandoned by its author.—*Chamaesyce Greenei* (Millsp.) Rydb., Fl. Rocky Mts., 544, 1063. 1917.

Chamaesyce glyptosperma Engelm. var. *integrata* Lunell, Amer. Midl. Nat. **3:** 142. 1913. Type: Leeds, Benson County, North Dakota, Aug. 20, 1906, *J. Lunell 693* (Mi 251964!, photographs G!, W!). Entire leaves are by no means unusual in this species and the character is too variable to warrant recognition.

Annual, glabrous; stems mostly prostrate, sometimes ascending or erect, 5–33 cm. long, 0.5–1.5 mm. thick, internodes up to 3 cm. long, average ca. 1 cm.; leaf-blades prevailingly oblong to narrowly oblong, often subfalcate, but varying to ovate and ovate-oblong in the lower, 3–15 mm. long, base strongly inequilateral, margin often serrulate especially at the apex and on the lower margin; petioles ca. 1 mm. long; stipules subulate, long-attenuate into a filiform tip, up to 2 mm. long, glabrous, with a few linear, erect lateral divisions below; peduncles 0.5–2 mm. long; cyathia solitary at the nodes; involucre obconical, tapering to the peduncle, 0.6–0.9 mm. in diam., glabrous outside, glabrous inside except on lower margin of lobes; lobes triangular, shortly attenuate, slightly exceeding the glands; glands transversely elliptical to oblong, 0.15–0.4 mm. long, mostly depressed in the middle; appendages white, glabrous, 1–1½ times as wide as the glands, bluntly crenulate-dentate to subentire; fifth gland nearly glabrous, of 1 or sometimes 2 filiform segments, equaling or slightly exceeding the lobes; sinus narrowly U-shaped, slightly depressed; bracteoles reduced to one filiform segment adnate below to the involucre opposite each gland, free portion entire to deeply parted, about equaling the androphores, bearing a few minute hairs above, or glabrous; staminate flowers 1–5, but most commonly 4, per cyathium; androphores 0.9–1 mm. long, glabrous; gynophore glabrous, soon exserted and usually reflexed; ovary glabrous, subacutely 3-lobed; styles spreading, becoming erect only in age, the tips erect and slightly clavate, ca. 0.3 mm. long; ca. ⅓ bifid; capsule glabrous, sharply 3-angled, wider below the equator, 1.4–1.7 mm. long; seeds sharply quadrangular, 1–1.3 mm. long, 0.7–0.9 mm. tangentially and radially, radially ovate, base truncate, ventral facets concave, dorsal convex, both traversed by 3 to 4 rounded transverse ridges passing more or less through the angles, or sometimes the ridges very faint, coat microreticulate, white to tan.—Plate 660B.

New Brunswick and Quebec, west to British Columbia, south to Indiana, Missouri, and Texas, northwest from New Mexico to northern California and Oregon (Map 24). Representative specimens seen: New Brunswick: Carleton Co.: yard of the Canadian Pacific railroad, Hartland, *Fernald 1981* (G). Quebec: Pontiac Co.: Chichester, Vallée de l'Ottawa, *Marie-Victorin, Rolland-Germain & Meilleur 44015* (G). Lake Deschênes above Aylmer, *Macoun 87830* (G). Ontario: east of London, Sept. 23, 1911, *Dearness* (G, NY); Stilleville, *Macoun 87829* (G); Amherstburg, *Macoun 88092* (G); Thunder Bay District, near Jack Fish, *Pease & Bean 23435* (G). Saskatchewan: along railroad near Saskatoon, *Macoun & Herriot 76824* (NY); Carlton House, *Richardson* (M). Alberta: Fort Saskatchewan, *Turner 66* (W); Calgary, *Macoun 24720* (NY); Rosedale, Rosebud Creek Valley, *Moodie 1199* (G, M). British Columbia: Lake Osoyyos, *Macoun 79546* (NY); flood plain of Columbia at Beavermouth, *Shaw 1146* (G, NY); Vancouver Island, Aug. 15, 1921, *Carter* (G). Maine. Aroostook Co.: Fort Fairfield, *Fernald 1980* (G, NE). Oxford Co.: Rumford, Aug. 1, 1890, *Parlin* (NE). New Hampshire. Coös Co.: Randolph, *Pease 18138* (NE); Carroll at

Carroll Station, *Pease 16591* (NE). VERMONT. Franklin Co.: Swanton, *Blake 3158* (NE). Chittenden Co.: Burlington, Aug. 7, 1921, *Knowlton* (G). Windsor Co.: Mt. Tom, Woodstock, Aug. 3, 1933, *Kittredge* (G). NEW YORK. Washington Co.: northeast of Tripoli, Sept. 19, 1915, *Burnham* (G, NY). Albany Co.: Albany, *House 25024* (NY). Suffolk Co.: Fishers Island, Aug. 11, 1895, *Graves* (NY). MICHIGAN. Schoolcraft Co.: near Manistique, *Dodge 201* (NY). Emmet Co.: Pellston, *Deam 28949A* (Deam). Dickinson Co.: south of Iron Mountain, *Fernald & Pease 3407* (G). Kalamazoo Co.: 6 miles west of Schoolcraft, *Hanes 1886* (G). INDIANA. Steuben Co.: Bass Lake, 5 miles west of Angola, *Deam 55400* (Deam, G). Elkhart Co.: 3 miles northeast of Bristol, *Deam 57370* (Deam, G). Newton Co.: Beaver Lake bed, 3 miles south of Lake Village, *Deam 56707* (Deam). WISCONSIN. Brown Co.: Green Bay, Aug. 4, 1887, *Schuette* (NY). Waupaca Co.: Lake Mendota, Marion, Aug. 21, 1893, *Sudworth* (NY). Trempealeau Co.: Brady Peak, 1 mile west of Trempealeau, *Hermann 8944* (NY). La Crosse Co.: La Crosse, *Pammel 620* (G). Dane Co.: Madison, Aug. 13, 1889, *Trelease* (M). Polk Co.: Osceola, Aug. 8, 1900, *Baker* (G). Pierce Co.: Prescott, *Fassett 10258* (G). ILLINOIS. Cook Co.: on ballast, West Chicago, *Umbach 2313* (G). Lee Co.: Dixon, *Vasey* (G). Peoria Co.: Peoria, July, 1891, *McDonald* (G). St. Clair Co.: St. Louis, Sept., 1886, *Eggert* (NY). MINNESOTA. Anoka Co.: *Cooper 111* (Mi). Becker Co.: Detroit Lakes, *O. A. Stevens 290* (G). Brown Co.: Sleepy Eye, *Sheldon 5966* (Mi). Carver Co.: Chaska, *Ballard 161* (Mi). Chisago Co.: Center City, *Taylor 1568* (Mi). Clay Co.: Muskoda, *Ballard 3051* (Mi). Chippewa Co.: Montevideo, Aug. 28, 1893, *Moyer* (Mi). Clearwater Co.: near Squaw Lake, *Moyle 850* (Deam, NY). Crow Co.: Brainerd, *Mell 249* (M, NY). Houston Co.: Jefferson, *W. A. Wheeler 434* (Mi). Hennepin Co.: Minneapolis, *Sheldon 1658* (Mi). Kandiyohi Co.: Spicer, *Frost 347* (Mi). Kittson Co.: Humboldt, *Ballard 2604* (Mi). Lincoln Co.: Lake Benton, *Sheldon 1557* (Mi). Morrison Co.: *Sandberg 888* (Mi). Ottertail Co.: Clitherall, July, 1897, *Campbell* (Mi). Pipestone Co.: Pipestone City, 1892, *Menzel* (Mi). Pope Co.: Glenwood, *Taylor 784* (Mi). St. Louis Co.: tree nursery bed, Duluth, *Lakela 1563* (NY). Scott Co.: Cleary's Lake, *Ballard 527* (Mi). Winona Co.: July, 1886, *Holzinger* (Mi). IOWA. Boone Co.: Ledges, *Pammel & Ball 191* (G, NY). Black Hawk Co.: *Burk 904* (M). Green Co.: Rippey, July 31, 1867, *Allen* (G). Woodbury Co.: Sioux City, *Pammel 193* (G, NY). Humboldt Co.: Dakota City, *Pammel 190* (G, NY). MISSOURI. Jackson Co.: Courtney, *Bush 500* (NY). NORTH DAKOTA. Renville Co.: Pleasant, July 28, 1912, *Lunell* (NY). Towner Co.: Maza, May 10, 1900, *Kildahl* (Mi). Ramsey Co.: Devil's Lake, *Lunell 692* (Mi). Oliver Co.:

Ft. Clark, upper river valley on old Indian Lodge site, *O. A. Stevens 384* (F, G). Billings Co.: Medora, Aug. 12, 1896, *Brannon* (Mi). Stark Co.: Dickinson, *Bergman 690* (O). Richland Co.: Swan Lake, Hankinson, *Metcalf 156* (NY). South Dakota. Walworth Co.: Mobridge, Missouri River bottom, *Moyer 687* (NY). Potter Co.: Forest City, June 9, 1892, *Griffith & Schlosser* (O). Spink Co.: near Redfield, *Ricksecker 81* (O). Kingsbury Co.: Iroquois, Aug., 1892, *Thornber* (G). Meade Co.: Faith, *Moyer 205* (NY). Lawrence Co.: Deadwood, *Rydberg 77* (G, NY). Fall River Co.: Hot Springs, Black Hills, *Rydberg 992* (G, NY). Washabaugh Co.: Bear Creek, *Visher 2022* (NY). Mellette Co.: White River, July 5, 1896, *Wallace* (NY). Pennington Co.: 5 miles south of Scenic, *Hayward 569* (NY). Todd Co.: Rosebud Creek, *Wallace 121* (NY). Nebraska. Cherry Co.: Snake River Hardlands, *Tolstead 621* (G). Hooker Co.: on Middle Loup River, near Mullen, *Rydberg 1373* (G, NY). Thomas Co.: on Middle Loup River, *Rydberg 1742* (G, NY). Scott's Bluff Co.: Kuoa Valley, *Rydberg 355* (NY). Custer Co.: Broken Bow, *Webber 7* (NY). Deuel Co.: sand-draws, *Rydberg 197* (NY). Lancaster Co.: Lancaster, *Clements 2587* (NY). Dawes Co.: 10 miles south of Chadron, *Tolstead 806* (G). Franklin Co.: Franklin, *Laybourn 48* (M). Kearney Co.: Minden, July 29, 1930, *Hapeman* (O). Webster Co.: Red Cloud, *Bates 2988* (G). Kansas. Comanche Co.: west of Protection, *E. J. Palmer 41860* (NY). Ellis Co.: near Hays, *Rydberg & Imler 1252* (NY). Geary Co.: Ft. Riley, *Gayle 576* (NY). Graham Co.: Bogue, *Imler 65* (NY). Grant Co.: Ulysses, *Thompson 2* (G, NY). Kiowa Co.: Belvidere, Sept. 5, 1898, *White* (NY). Osborne Co.: south Fork Solomon River, 5 miles of Osborne City, *Shear 183* (G). Riley Co.: Prairie, *Norton 470* (G, NY). Wyandotte Co.: Quindaro, Aug. 30, 1896, *Mackenzie* (NY). Oklahoma. Alfalfa Co.: near Cherokee, *G. W. Stevens 1779* (G, M). Comanche Co.: Fort Sill, July 20, 1891, *Sheldon* (M). Harmon Co.: Hollis, *G. W. Stevens 1055* (G, M). Kingfisher Co.: Huntsville, May 26, 1896, *L. A. Blankinship* (G, O). Logan Co.: near Guthrie, *G. W. Stevens 3277* (G). Murray Co.: Davis, Arbuckle Mountains, *Demaree 12827* (NY). Muskogee Co.: Arkansas Junction, *Bush 533* (G, NY). Woods Co.: near Fairvalley, *G. W. Stevens 1641* (G, M, NY). Texas. Brown Co.: *Reverchon 765* (G). Crane Co.: 11 miles east of Grand Falls, *Cory 27315* (G). Dallas Co.: Dallas, June, 1874, *Reverchon* (G). El Paso Co.: El Paso, *M. E. Jones 4195* (NY). Hall Co.: Estelline, *Reverchon 3789* (G). Menard Co.: Menard, *Cory 24700* (G). Nueces Co.: near Corpus Christi, Mar., 1894, *Heller* (NY). Presidio Co.: Marfa, *Havard 16* (M). Randall Co.: Palo Duro Canyon, *Ball 1257* (NY). Reeves Co.: Verhalen, *Cory 1956* (G). Tarrant Co.: low woods, *Ruth 304* (NY). Taylor Co.: Abilene, *Tracy 7861* (G, NY). Tom Green Co.: 3 miles east of San Angelo, *Cory 4879* (G). Victoria Co.: Guadalupe, 105 miles southwest of San Antonio, 1879, *Ed. Palmer 1201* (G). Wilbarger Co.: Chillicothe, *Ball 959* (NY). Wilson Co.: Sutherland Springs, 1879, *Ed. Palmer 2047* (G). MONTANA. Lewis and Clark Co.: near Helena, Aug. 12, 1892, *Kelsey* (NY). Park Co.: Suksdorf Gulch, 9 miles west of Wilsall, *Suksdorf 86* (G). Yellowstone Co.: Custer, *J. W. Blankinship 116* (M). WYOMING. Teton Co.: Spread Creek, *Tweedy 368* (NY). Crook Co.: Devil's Tower, Little Missouri Butte, Aug. 17, 1897, *Griffiths & Carter* (NY). Johnson Co.: South Fork of Powder River, *Goodding 257* (G, NY). Converse Co.: Orin Junction, *Nelson 2573* (G, NY). Yellowstone National Park, *G. N. Jones 5285* (NY). COLORADO. Weld Co.: New Windsor, *Osterhout 2369* (NY). Larimer Co.: Ft. Collins, July 9, 1896, *Baker* (M, NY). Boulder Co.: near Boulder, *Tweedy 5058* (NY). Denver Co.: near Denver, Sept. 25, 1916, *Rehder* (G). El Paso Co.: Manitou, *F. E. & E. S. Clements 25* (M, NY). Fremont Co.: Canyon City, *Clements 276* (NY). Pueblo Co.: Pueblo, *Baker, Earle & Tracy 5* (G, NY, O). Montrose Co.: Naturita, *Payson 510* (G, Ph). Ouray Co.: near Ouray, *Underwood & Selby 240* (NY). Archuleta Co.: Arboles, *Baker 453* (G). UTAH. Box Elder Co.: Brigham, *Zundel 242* (NY). Cache Co.: 3 miles northeast of Logan, *Maguire 208* (I). Morgan Co.: Peterson, Weber River, Devil's Gate, *Pammel & Blackwood 3911* (G, M). Salt Lake Co.: Salt Lake City, *M. E. Jones 1024* (I, NY). Grand Co.: Moab, *Christinsen 10039* (NY). Uintah Co.: near Jensen, *Peirson 12599* (G). San Juan Co.: near Bluff, along San Juan River, *Rydberg & Garrett 9897* (NY). NEVADA, 1872, *Wheeler* (NY). NEW MEXICO. Rio Arriba Co.: Española on the Rio Grande above Santa Fe, Sept. 7, 1881, *Engelmann* (M). Guadalupe-San Miguel Co.: between Anton Chico & Las Vegas, *Rose & Fitch 17620* (NY). Doña Ana Co.: Doña Ana, *C. Wright 1855* (G, NY). ARIZONA. Apache Co.: Navajo Indian Reservation, north end of Carrizo Mountains, *Standley 7371* (US). Navajo Co.: Holbrook, Oct. 4, 1897, *Zuck* (US). Coconino Co.: Houserock, *Eastwood & Howell 6473* (G). IDAHO. Nez Perces Co.: Lake Waha, *Heller 3343* (NY). OREGON. Multnomah Co: Hayden Island, *Thompson 3749* (M). Wasco Co.: The Dalles of the Columbia, Aug. 2, 1880, *G. Engelmann* (M). Wallowa Co.: Horse Creek Canyon, *Sheldon 8114* (NY). Grant Co.: 4 miles east of John Day, *Peck 18612* (NY). WASHINGTON. Okanogan Co.: Palmer Lake, Loomiston, *Elmer 602* (M). Chelan Co.: Peshastin, Wenatchee Valley, *Sandberg & Leiberg 472* (G, NY). Stevens Co.: Marcus, *Kreager 461* (G, NY). Pierce Co.: Murray, American Lake, *Muenscher 5103* (G). Walla Walla Co.: Waitsburg, *Horner 1161* (G). Klickitat Co.: White Salmon, *Suksdorf 489* (G).

This species ranges the farthest north of any species of *Euphorbia* in North America. It nearly reaches 54° north latitude at Fort Saskatchewan, Alberta. On the other extreme it ranges south to the Gulf of Mexico in Texas.

I was under the impression that I had seen specimens from California in some of the herbaria in that state. None of my notes confirm this and only one Californian specimen has been found in the more than three hundred collections examined and that had atypical seeds and foliage: Shasta Co., along the Sacramento River, but in dry ground, near Redding, Sept. 4, 1889, *Greene* (F). Plants nearly intermediate between *E. glyptosperma* and *E. serpyllifolia* occur on the southern slopes of Mt. Shasta.

The plants referred to *E. glyptosperma* by Jepson, Man. Fl. Pl. Calif., 599. 1925, were probably *E. Abramsiana.* The fact that *E. glyptosperma* does not appear in Jepson, Fl. Calif. **2:** —. 1936, supports this supposition.

There are two other collections sufficiently different to merit comment. *Eastwood & Howell 6473* from Arizona has unusually narrow seeds, thus approaching *E. Abramsiana. Suksdorf 86* from Montana has unusually large seeds.

37. Euphorbia Abramsiana L. C. Wheeler, Bull. So. Calif. Acad. Sci. **33:** 109. 1934. Type: Heber, Imperial Valley, Imperial County, California, June, 1904, *LeRoy Abrams 4097* (D33555!; isotypes G!, M!, Ph!). *E. pediculifera* Engelm. var. *Abramsiana* (L. C. Wh.) Ewan in Jepson, Fl. Calif. **2:** 427. 1936.

Chamaesyce saltonensis Millsp. in Parish, Cat. Pl. Salton Sink, 6. 1913 (preprint from Carn. Inst. Wash. Pub. **193:** 110. 1914); nomen nudum based on *Parish 8302 & 8305 q. v. infra.*

Annual; stems prostrate or rarely ascending, few to several, finely pubescent to rarely completely glabrous, slender (mostly not over 1 mm. thick), to 25 cm. long, internodes to 3 cm. long but mostly much shorter, gradually shortening upward; leaf-blades shortly puberulent to glabrous, 2–12 mm. long, ovate-oblong, oblong, elliptic-oblong, or the uppermost sometimes elliptic-lanceolate, base inequilateral, apex obtuse, margin often strongly revolute at least on drying, sometimes some of the larger serrulate at the apex and on the lower margin; petioles ca. 1 mm. long; stipules distinct, less than 0.5 mm. long, the upper usually 2–3-parted, the lower several-parted, with a few cilia or glabrous; peduncles to 1 mm. long, glabrous; cyathia solitary at the nodes but mostly congested in groups of 5 to 10 on very short leafy lateral branches; involucres 0.6–0.7 mm. in diam., glabrous outside, glabrous inside except on the lobes, obconical, tapering to the peduncle; proximal lobes greatly exceeding the glands, each deeply parted into 2–4 slender glabrous segments, the distal lobes exceeding the glands, mostly parted into 2 slender glabrous segments, all the lobes with a few hairs inside at the base; fifth gland equaling the glands, filiform, glabrous; sinus narrowly V-shaped, little depressed, making the fifth gland appear somewhat as one of the divisions of the lobes; glands transversely elliptic to subcircular, 0.15–0.2 mm. long; appendages mostly wider than the glands, white, glabrous, entire or slightly two-lobed; bracteoles reduced to one slender segment opposite each gland, adnate to the involucre below, free portion of one or two slenderly filiform segments about equaling the androphores, with a few short hairs; staminate flowers 3–5 per cyathium; androphores glabrous, 0.7–0.9 mm. long; gynophore glabrous, exserted but often not reflexed; ovary glabrous, 3-lobed; styles bifid ca. halfway, glabrous, clavate, ca. 0.3 mm. long, rotately spreading but the tips slightly ascending; capsule glabrous, rotundly ellipsoid-oblong, 1.3–1.7 mm. long, subacutely 3-angled; seeds sharply quadrangular, 1–1.4 mm. long, 0.6–0.7 mm. tangentially, ca. 0.6 mm. radially, narrowly ovate to oblong-ovate radially, base truncate, ventral facets slightly concave, dorsal facets plane or slightly convex, all with 4–6 irregular transverse rounded ridges slightly including the angles, coat white, microreticulate.—Plate 660D.

Colorado Desert, California, southern Arizona, south to northern Sinaloa (Map 1). Representative specimens seen: California. Imperial Co.: streets of Brawley, about 15 feet below sea-level, *Parish 8305* (F, G, J); old beach east of Calexico, about 2 feet below sea-level, *Parish 8302* (G, J, NY). Arizona. Yavapai Co.: Fort Verde, *MacDougal 511* (US); Fort Verde, *Mearns 155* (NY). Maricopa Co.: 20 miles south of Gila Bend, *Harrison, Kearney & Fulton 7991* (A, US). Pinal Co.: Sacaton, *Peebles, Harrison & Kearney 83* (US), *Peebles 10595* (US); weed in greenhouse, experiment farm, Sacaton, *Peebles 5834* (A). Pima Co.: on range reserve, Wilmot, *Thornber 342* (M, US); among rocks, Papago Reservation, *Harrison & Kearney 7993* (A, US). Co.?: "Mesas," June 23, 1881, *Pringle* (NY, US). MEXICO: Sonora: Guaymas, low sandy places, Sept., 1887, *Ed. Palmer 186* (G, US); Guaymas, high gravelly ridges, Sept., 1887, *Ed. Palmer 187* in part (G, US). Sinaloa: dry hills, Fuerte, *Rose, Standley & Russell 13541* (US). For citation of additional specimens see Bull. So. Calif. Acad. **33:** 110. 1934.

The specimens from Fort Verde are atypical in that they have coarser stems with coarser pubescence, and seeds approaching those of *E. glyptosperma* which is the closest relative of this species.

38. Euphorbia **theriaca** sp. nov. Annua, glabra; caulibus prostratis vel suberectis; laminis foliorum ovatis, obovatis, vel ovato-orbicularibus, 3–5 mm. longis, integris; petiolis 0.7–1 mm. longis; cyathiis solitariis; involucris turbinato-campanulatis, diametro 1.3–1.4 mm.; glandulis transverse ovalibus vel oblongis, 0.6–0.8 mm. longis; appendiculis nullis vel rudimentis tantum; floribus masculis 30–36 per cyathium; stylis bifidis, 0.3–0.4 mm. longis; capsulis glabris, subacute 3-angulatis, 1.4–1.6 mm. longis; seminibus acute quadrangularibus, 1–1.2 mm. longis, in quoque latere 2–3 rugis transversis praeditis, radialiter ovato-acutis, basi truncatis.

Glabrous annual; stems prostrate to suberect, 0.5–1.4 mm. thick, internodes up to 2 cm. long but mostly about 1 cm. long; leaf-blades ovate or obovate to ovate-orbicular, 3–5 mm. long, margin entire, apex rounded or sometimes emarginate; petioles 0.7–1 mm. long; stipules 0.7–1 mm. long, ventral mostly united, dorsal sometimes united, linear-subulate, mostly entire, margin sparsely ciliate; cyathia solitary at the nodes; peduncles 0.3–0.7 mm. long; involucre turbinate-campanulate, 1.3–1.4 mm. in diam., 1.7–2 mm. long, glabrous outside, with short hairs at the summit and beneath the glands inside; lobes triangular, acuminate to obtuse, slightly exceeding the glands, with short hairs on the margin and inner face; glands 0.6–0.7 mm. long, transversely oval to oblong; appendages absent or a mere linear swelling beneath gland; fifth gland ca. ⅔ as long as the lobes, linear; sinus U-shaped, not depressed; bracteoles forming a radial partition adnate halfway up the involucre below each gland, parted into few to several shortly hairy linear segments above; staminate flowers 6–8 per fascicle, 31–36 per cyathium; androphores 1.4–1.7 mm. long, glabrous or very rarely with a few short hairs; gynophore glabrous, soon exserted and reflexed; ovary glabrous, strongly but roundly 3-lobed; styles 0.3–0.4 mm. long, slightly clavate, bifid to the middle or below; capsule glabrous, 1.4–1.6 mm. long, slightly broader than long, strongly and subacutely 3-lobed; broader below the equator, base truncate; seeds tetragonal, 1–1.2 mm. long, 0.7–0.8 mm. tangentially and radially, ovate-acute radially, base truncate, facets with mostly 3, sometimes 2, high rounded ridges passing but slightly through the sharp angles, coat white, microreticulate.—Plate 660A.

Type: Blue Creek, Chisos Mountains, Brewster County, Texas, Aug. 1, 1931, *C. H. Mueller 8080* (G!).

This same number at M, NY, and US consists wholly of *E. cinerascens*. There was a little bit of this mixed with the collection at G. This number at F contains a few fragments of *E. theriaca*, the rest is *E. cinerascens*. Known only from the type. (Map 7).

39. Euphorbia arizonica Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 186. 1859. Type: Arizona (without further locality) Nov., 1856, *A. Schott* (M 46906!, fragment F!, photographs F!, G!, W!). A young erect plant with large leaves.—*Chamaesyce arizonica* (Engelm.) Arthur, Torreya **11**: 260. 1911.

E. versicolor Greene, Bot. Gaz. **6**: 184. 1881. Type: San Francisco Mountains near Clifton, Greenlee County, Arizona, Sept. 3, 1880, *E. L. Greene* (Herb. Greeneanum, Notre Dame; photograph G!; isotype NY!). About an average member of the species.—*Chamaesyce versicolor* (Greene) Norton, Contr. U. S. Nat. Herb. **25**: 345. 1925.

E. portulana S. Watson, Proc. Amer. Acad. Arts & Sci. **24**: 73. 1889. Type: island in harbor, Guaymas, Sonora, Mexico, Oct., 1887, *Ed. Palmer 321* (G!; isotype C!).—Stems unusually rigid and numerous.—*Chamaesyce portulana* (S. Wats.) Millsp., Field Mus. Pub. Bot. **2**: 411. 1916.

E. purisimana Millsp., Proc. Calif. Acad. Sci., ser. 2, **2**: 225. 1889. Type: Purisima, Lower California, Mexico, Feb. 12, 1889, *T. S. Brandegee* (F 196127!; photographs G! W!; isotype C!). Unusual in that the glands on most, but not all, of the involucres lack appendages.—*Chamaesyce purisimana* (Millsp.) Millsp., Field Mus. Pub. Bot. **2**: 411. 1916.

E. collina T. S. Brandegee, Univ. Calif. Pub. Bot. **4**: 184. 1911 (not Philippi, Linnaea **29**: 41. 1857–8). Type: Cerro de San Ignacio, Durango, Mexico, July, 1910, *C. A. Purpus 4599* (C 144767!; fragment F!; isotypes F!, G!, M!). An entirely typical member of the species.

Perennial from a woody taproot, erect or prostrate, sometimes forming mats; stems up to 30 cm. long, slender, with fine, spreading, mostly clavate, microscopically smooth hairs, internodes up to 3 cm. long, generally shorter, often very short towards the ends of the branches; leaf-blades reddish, 1–10 mm. long, deltoid-ovate, ovate, ovate-oblong with oblique base, or the upper very small and oval-cuneate, mostly with fine spreading hairs at least on the lower surface, margin entire, petioles 1–2 mm. long, clothed as the leaves; stipules minute and often not visible, lower united, upper distinct; peduncles filiform, with fine spreading hairs, 1–4 mm. long, mostly 1–2 mm. long; cyathia solitary at the nodes but often congested by the shortening of the upper internodes; involucres long-turbinate, constricted above, ca. 1.5 mm. long, 0.8 mm. diam., with sparse short spreading hairs without, glabrous within; lobes subulate, equaling the glands, entire, ciliate on the margins; glands 1.5–2 times as long as wide, 0.3–0.4 mm. long, concave, red; appendages glabrous, oval, up to 1 mm. long, white but rubescent; fifth gland absent, its sinus narrowly V-shaped and depressed halfway to base of the involucre; bracteoles reduced to one sparsely hairy filiform appendage adnate below to the involucre opposite each gland, two-thirds as long as the involucre or shorter; staminate flowers 5–10 (or rarely 12), mostly 6–7; androphores glabrous, equaling the glands, 1.5 mm. long; gynophore glabrous, long-exserted and reflexed at maturity; ovary three-lobed, densely pubescent, styles parted to the middle, slender, glabrous, ca. 0.6 mm. long; capsule with spreading hairs, spheroid with flattened base, ca. 1.5 mm. long and in diam., obtusely three-angled; seeds quadrangular, 1–1.2 mm. long, ca. 0.6 mm. radially and tangentially, base truncate, outline narrowly ovate radially, raphe obliquely truncated by the micropylar region, facets with low, often anastomosing, ridges which slightly include the angles, white coat very thin, the brown testa showing through.—PLATE 661B.

Colorado Desert, California, south to Lower California, east to Texas, Chihuahua, and northern Durango (MAP 43). Representative specimens seen: CALIFORNIA. San Diego Co.: Palm Canyon, Borrego Valley, *Templeton 1632* (Lam, P). Riverside Co.: Andreas Canyon, Palm Spring region, *Peirson 4256* (Peir). ARIZONA. Yuma Co.: near Quartzsite, *Kearney & Peebles 10215* (US); Palm Canyon, S. H. Mountains, *Peebles & Loomis 6755* (US). Coconino Co.: Phantom Ranch, Bright Angel Creek, Grand Canyon, Nov. 16, 1935, *Collom* (US); Shinumo Creek, Grand Canyon, Oct. 21–26, 1906, *Pilsbry* (Ph). Maricopa Co.: Cave Creek, north of Phoenix, *Peebles, Harrison & Kearney 3685* (US). Pinal Co.: near Superior, *Kearney & Peebles 9213* (US). Pima Co.: Sierra Tucson, April 27, 1884, *Pringle* (NY); Baboquivari Mountains, *Kearney & Peebles 10395* (US); rocky south slopes, north of Ranger Station, Baboquivari Mountains, *Wiegand, Maguire, Richards & Moeller 10761* (G, I). Santa Cruz Co.: Tumacacori, *Harrison & Kearney 6021* (G, US). Greenlee Co.: disturbed soil at side of Highway 81 on Smelter Hill, south of Clifton, west exposure, *Maguire, Richards & Moeller 11780* (G, I). Graham Co.: east exposed slopes, Upper Creosote Zone, Peloncillo Mountains, 20 miles east of Safford, *Maguire, Richards & Moeller 10642* (I); Coolidge Dam, *Kearney & Smith 9029* (US). NEW MEXICO. Doña Ana Co.: Peña Blanca, 1903, *Wooton* (P). TEXAS. El Paso Co.: El Paso, Sept. 11, 1885, *M. E. Jones* (I, O, US). Brewster Co.: Persimmon Gap, Santiago Mountains, *Cory 6906* (G); frequent on talus, 14 miles east of Castolon, *Cutler 664* (G); frequent along creek-bed at base of Lone Mountain, Chisos Mountain area, *Warnock 657* (US). MEXICO: BAJA CALIFORNIA: in wash north of flying field, near Santa Rosalia, *Ferris 8699* (NY, US); head of Concepcion Bay, *J. N. Rose 16696* (G, NY, US). CHIHUAHUA: Candelaria, *E. Stearns 245* (US); 11 miles northeast of Camargo, crevices on face of lava cliff, *Johnston 7917* (G). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 416. 1936.

My previous statement, l. c., as to type locality and type collection was based on confusion resulting mainly from the fact that I had not seen Engelmann's specimens. Now it is clear that the specimen taken as type here is the one which should be and has been taken as type by Millspaugh. There is a specimen of this species purporting to have as its origin Warm Springs, Mohave Desert, San Bernardino County, California, May, 1882, *S. B. & W. F. Parish 1384* (M 144655). But this is the type collection of *E. Parishii*. Another sheet of the same collection (M 144654) is *E. Parishii*. Since 144655 is the only specimen of *E. arizonica* claiming to have come from Mohave Desert and since it appears that a mixture may have occurred in the mounting, I question the source of 144655.

40. EUPHORBIA SETILOBA Engelm. ex Torrey, Rep. Expl. & Surv. Miss. R. to Pacific Ocean **5** (**2**): 364. 1857. TYPE: Fort Yuma, Imperial County, California, *Major G. H. Thomas* (NY!; ISOTYPE M!). A biologically typical member of the species.—*Chamaesyce setiloba* (Engelm.) Millsp. ex Parish, Cat. Pl. Salton Sink, 6. 1913 (preprint from Carn. Inst. Wash. Pub. **193:** 110. 1914).

E. floccosiuscula M. E. Jones, Contr. West. Bot. **15:** 145. 1929. TYPE: Hermosillo, Sonora, Mexico, Oct. 27, 1926, *M. E. Jones 22739* (P!; ISOTYPE M!). A plant with unusually long internodes, apparently from a shady situation.

Annual, with microscopically smooth tapering hairs throughout; stems slender, prostrate or perhaps rarely erect, rarely forming mats, internodes up to 2 cm. long, often much shortened toward the stem-tips congesting the leaves and involucres into dense small "heads"; leaf-blades 2–7 mm. long, oblong or oblong-ovate, base slightly oblique, petioles up to 1 mm. long; stipules not apparent; peduncles up to 1.5 mm. long, clothed as the herbage, filiform; cyathia solitary at the nodes; involucres very shortly hairy without, glabrous within, long-turbinate, constricted above, ca. 1.2 mm. long, ca. 1 mm. in diam.; lobes narrowly deltoid, entire, ciliate, equaling the glands; glands red, transversely oblong or the distal sometimes discoid, concave, 0.1–0.2 mm. long; appendages white, glabrous, ca. 1 mm. long and wide, parted into 3–5 narrow attenuate segments; fifth gland totally absent, its sinus depressed halfway to base of the involucre; bracteoles reduced to one filiform appendage adnate below to the involucre opposite each gland, with few or no hairs, free portion only ca. 0.2 mm. long; staminate flowers 3–7 per cyathium; androphores glabrous, ca. 1.2 mm. long, ca. equaling the glands; gynophore glabrous or with a few hairs above; ovary three-lobed, long-white-hairy, styles glabrous, 0.4–0.5 mm. long, parted to the base, clavate, slender; capsule long-hairy, spheroid, ca. 1.1 mm. long, sharply angled, seeds 0.9–1 mm. long, ca. 0.6 mm. radially and tangentially, quadrangular, sharply angled, facets with low irregular wrinkles, base truncate, ovate-acutish radially, coat microreticulate, white but the brown testa showing through. —Plate 661A.

Deserts of California from Inyo County south to San Diego and Imperial Counties, southern Nevada, western and southern Arizona, Gila River Valley in New Mexico, east to western Texas, south to Baja California and Sinaloa (Map 19). Representative specimens seen: California. Inyo Co.: Funeral Mountains, *Coville & Funston 333* (US). San Diego Co.: sandy soil, upper end of San Felipe Wash, *J. T. Howell 3255* (M). Arizona. Yuma Co.: near Quartzsite, *Kearney & Peebles 10213* (US). Pima Co.: fenced area, Santa Rita Forest Reserve, *Griffiths 6080* (M, US). Cochise Co.: sandy washes, Fort Lowell, *Thornber 180* (M, NY). New Mexico. Grant Co.: gravel beds along the Gila, *E. L. Greene 265* (M). Texas. Brewster Co.: frequent on flats between Nugent Mountain and Lone Mountains, *Warnock T562C* (US); infrequent at Persimmon Gap, *Warnock T553* (US). MEXICO: Baja California: Agua Verde, *J. N. Rose 16574* (US). Sonora: in sand on river bank, Chorijoa, Rio Mayo, *Gentry 1609* (F, G, US): hillside 9 miles north Magdalena, *Wiggins 6194* (US). Sinaloa: Fuerte, *Rose, Standley & Russell 13540* (US). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 429–430. 1936.

The specimen at M, which it would seem might well be taken as type, is too fragmentary.

41. Euphorbia villifera Scheele, Linnaea **22:** 153. 1849. Annual, or definitely perennial in some Mexican specimens: stems erect, 6–45 cm. tall, pilose with long white tapering hairs, or rarely glabrous, epidermis papillate, papillae disappearing in age, internodes mostly 1–2 cm. long, ultimate branchlets often subcapillary; leaf-blades ovate to triangular-ovate-acute, often falcate, 3–10 mm. long, uppermost often much reduced and narrower, mostly glabrate above, usually pilose beneath, epidermis papillate beneath, base usually strongly inequilateral, margin entire to coarsely serrate; petioles ca. 1 mm. long, strongly amplexicaul; stipules 0.5–1 mm. long, distinct to wholly united, mostly attenuate and often with erect linear divisions, mostly glabrous; peduncles mostly glabrous, 1–2 mm. long; cyathia solitary at the nodes and terminal; involucre campanulate, 0.9–1 mm. in diam., glabrous or occasionally with sparse short spreading hairs outside, pubescent at the summit inside; lobes triangular, acuminate, hairy inside, about equaling the

glands; glands transversely elliptical to oblong, 0.3–0.5 mm. long, depressed or slightly folded in the middle; appendages 1–3 times as wide as and mostly a little longer than the glands, white, glabrous, margin entire to crenulate; fifth gland linear, ½–⅔ as long as the lobes; sinus small, U-shaped, little depressed; bracteoles partly free and partly united into a radial partition adnate for ca. ⅔ its length to involucre, somewhat shallowly divided above, pubescent above, nearly equaling the androphores; staminate flowers 9–25 per cyathium; androphores glabrous, ca. 0.9 mm. long; gynophore glabrous, exserted and mostly reflexed; ovary glabrous, sharply 3-angled; styles glabrous, ca. 0.4 mm. long, ⅓–½ bifid; capsule glabrous, sharply 3-angled, the angles often produced beyond the seed into an empty carina, 1.3–1.9 mm. long, 2.6–3.2 mm. in diam.; seeds ovoid-quadrangular, 1–1.1 mm. long, 0.7–0.9 mm. tangentially and radially, radially ovate, subacute, back and lateral angles sharp, facets convex, smooth to faintly and broadly wrinkled, coat light brown to white, subfarinose and microreticulate.

Key to Varieties

Herbage more or less pilose . . . . a. var. *typica*.
Herbage glabrous . . . . b. var. *nuda*.

41a. E. villifera Scheele, Linnaea **22:** 153. 1849, var. **typica.** Type: New Braunfels, Comal County, Texas, Aug.–Sept., 1846, *F. Lindheimer 293* (?; isotype M 200497!). (This collection designated as type by Blankinship, Ann. Rep. Mo. Bot. Gard. **18:** 149. 1907.) A good representative of the species, some of the leaves slightly toothed.—*Chamaesyce villifera* (Scheele) Small, Fl. Se. U. S., 712, 1333. 1903.

Chamaesyce Stanfieldii Small, l. c. Type: San Marcos and vicinity, Hays County, Texas, summer, 1898, *S. W. Stanfield* (NY!; photographs G!, W!). Leaves mostly entire, good match for isotype of *E. villifera.*—*E. Stanfieldii* (Small) Cory, Rhodora **38:** 407. 1936.—Plate 659D.

Texas, south to Oaxaca, Yucatan, and Guatemala (Map 16). Representative specimens from the United States: Texas. Hays Co.: San Marcos and vicinity, summer, 1898, *Stanfield* (NY); San Marcos, spring, 1897, *Stanfield* (NY). Travis Co.: Mt. Bonell, Austin, *Hall 550* (M, NY); Mt. Bonell, near Austin, *Young 50* (G, M); southwest of Austin, *Rose & Russell 24111* (NY). Comal Co.: near New Braunfels, *Plateau 5447* (NY); New Braunfels, 1846–1851, *Lindheimer 294* (M), *308* (G, M), *508* (G, M), *1148* (G, NY), *1149* (G, NY); New Braunfels, 1850, *C. Wright* (M, NY). Kerr Co.: 5.8 miles southeast of Mountain Home, *Cory 19310* (G); 13¾ miles southwest of Kerrville, *Cory 23954* (G). Real Co.: 16 miles north of Bandera, *Cory 8898* (G);

16¼ miles north of Leakey, *Cory 24387* (G); 14.7 miles north of Leakey, *Cory 27404* (G). Brewster Co.: Blue Creek, Chisos Mountains, *Cory 7006* (G); Blue Creek Trail, Chisos Mountains, *Cory 7329* (G); Chisos Mountains, *Mueller 8081* (G, NY); in basin of Chisos Mountains, *Warnock C646* (US); Glass Mountain, *Warnock T202* (US).

This species is exceedingly variable in habit and margin of the leaf. The distinction attempted by Small when he separated this species into two, one with leaves entire or essentially so and the other with leaves serrate, is useless since it would divide the species in such a way that there would be more intermediates than members of the two extremes. Furthermore, Small's type was far from typical of the supposed entity he attempted to define.

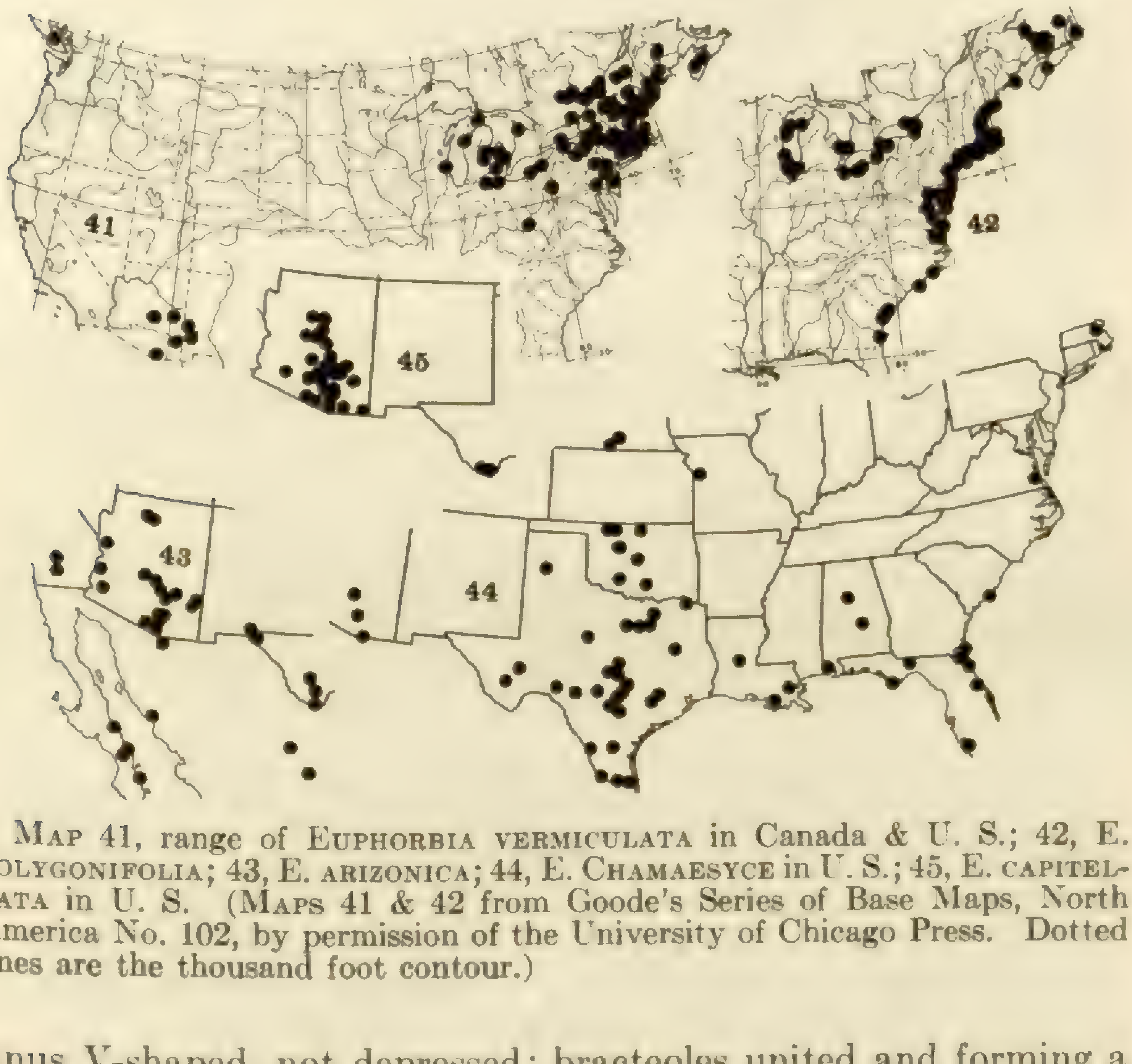
Lindheimer 293 is one of the numbers combined and distributed as Fasc. III 530. *Warnock T202* is atypical in having styles ca. 0.7 mm. long, 33–34 staminate flowers, and a woody perennial root.

41b. E. villifera Scheele var. nuda Engelm. ex Boiss. in DC. Prod. **15** (**2**): 45. 1862. Type: Growing in the bed of a mountain torrent near New Braunfels, Comal County, Texas, Nov., 1850, *C. Wright* (M 200505!; photographs G!, W!; isotypes G!, Ge!, NY!). Known only from the type collection.

This rather trifling variant is striking for being a glabrous member of an otherwise more or less pilose species.

42. Euphorbia serrula Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 188. 1859. Type: Guadalupe Pass on mountains (between San Bernardino and Sierra de las Animas), Sonora?, Oct. 4, 1851, *C. Wright 1843* (M 144668!; photographs G!, W!; isotypes G!, NY!).—*Chamaesyce serrula* (Engelm.) Wooton & Standley, Contr. U. S. Nat. Herb. **16:** 144. 1913.

Annual; stems few to several, mostly prostrate, 5–22 cm. long, 0.5–1 mm. thick, pilose, internodes up to 2.5 cm. long, average ca. 1 cm. long; leaf-blades 3–11 mm. long, glabrous to sparsely pilose above, more or less pilose beneath, broadly elliptic, oblong-lanceolate, oblong, or obovate-oblong, but most commonly oblong, often falcate, base markedly inequilateral, margin sharply serrate on the larger leaves to subentire on some of the smaller; petioles 0.5–1 mm. long; stipules distinct, glabrous to rarely ciliate, deltoid, attenuate, central lobe much exceeding the lateral and up to 1.7 mm. long; peduncles ca. 1 mm. long, glabrous to rarely sparsely pilose; cyathia at the upper nodes, solitary, but often crowded toward the branch-tips by the short upper internodes; involucre 1–1.1 mm. in diam., shortly obconical-campanulate, glabrous to rarely sparsely pilose outside, sparsely short-hairy at the summit inside; lobes triangular, exceeding the glands, often 2–3-parted above; glands transversely elliptical to oblong, or rarely subcircular, slightly depressed in the middle, 0.2–0.6 mm. long; appendages white, glabrous, ca. as wide as to twice as wide as the glands, rounded, subentire to crenulate; fifth gland absent to nearly as long as lobes, linear;



Map 41, range of Euphorbia vermiculata in Canada & U. S.; 42, E. polygonifolia; 43, E. arizonica; 44, E. Chamaesyce in U. S.; 45, E. capitellata in U. S. (Maps 41 & 42 from Goode's Series of Base Maps, North America No. 102, by permission of the University of Chicago Press. Dotted lines are the thousand foot contour.)

sinus V-shaped, not depressed; bracteoles united and forming a radial appendage adnate to the involucre for ca. half its length, glabrous below, entire to 3-parted, sparsely pubescent above, about equaling the androphores; staminate flowers 7–13 per cyathium; androphores 1–1.1 mm. long, glabrous; gynophore long-exserted and usually reflexed, glabrous or rarely very sparsely pilose; ovary 3-lobed, glabrous; styles 0.3–0.4 mm. long, bifid halfway to nearly to the base, subclavate; capsule glabrous, 2.1–2.6 mm. long, broader than long, turgidly triangular in cross-section, broader below the equator, base truncate; seeds quadrangular, 1.5–2 mm. long, 1.1–1.5 mm. tangentially, 1.1–1.3 mm. radially, ovate to rotund-ovate radially, dorsal and lateral angles subalate, ventral blunt, ventral facets plane to slightly concave, dorsal facets plane to slightly convex, surface essentially smooth, coat chalk-white to occasionally sordid.—Plate 658D.

Arizona, New Mexico, western Texas, Chihuahua, Coahuila, Durango, and Zacatecas (Map 7). Representative specimens seen: Arizona. Mohave Co.: 4 miles east of Peach Springs, *Kearney & Peebles 12767* (US). Pima Co.: Tucson, *Toumey 261* (US); common on mesas, Tucson, *Thornber 47* (M, NY, T, US). Cochise Co.: between Tombstone and Bisbee, *Harrison & Kearney 6085* (US); Mexican boundary line, south of Bisbee, *Mearns 902* (US). New Mexico. San Juan Co.: vicinity of Farmington, *Standley 7053* (US). Santa Fe Co.: valleys between the dry gravelly hills, Santa Fe, *Fendler 796* (G, M); near Tesuque, Aug. 20, 1904, *Wooton* (US). Socorro Co.: foothills east of Doyle Rentfrow's "desert claim", *Eggleston 19370* (US). Chaves Co.: 20 miles south of Rosswell, *F. S. & E. S. Earle 285* (US). Doña Ana Co.: beside the white sands, Aug. 24, 1899, *Wooton* (US); mesa near Las Cruces, Aug. 12, 1895, *Wooton* (NY). Eddy Co.: dry hillside near Carlsbad Cavern, *Standley 40397* (US). Co.? 1852, *C. Wright 1844* (G, M, NY). Texas. Hudspeth Co.: Eight Mile Well, *Cory 1942* (G). Culberson Co.: Van Horn, *Tharp 3557* (US); Walker Ranch, *Cory 1941* (G). Jeff Davis Co.: north edge of Davis Mountains, 5 miles east of Kent, *Rollins & Chambers 2761* (G). Terrell Co.: 25 miles northeast of Dryden, Holdeman Ranch, *Cory 3201* (G). "Collected in Expedition from western Texas to El Paso, New Mexico", May–Oct., 1849, *C. Wright 658* (G, NY). MEXICO: Chihuahua: volcanic mesa near Horcasitas, *Pringle 799* (G, M, US); pass between Las Animas and Chilicote Station, *I. M. Johnston 7995* (G); 8 miles northwest of Cruces, silty plain, *Johnston 7981* (G); 2 miles south of San Fernando, silty soil on plain, *Johnston 7940* (G); 3 miles north of Charco Piedra (21 miles northeast of Camargo), *Johnston 7928* (G). Coahuila: 12 miles north of Monclova, *Johnston 7196* (G); 2 miles northwest of Frontera (road from Monclova westward to beyond Cuatro Cienagas), *Johnston 7183* (G); 24 miles west of Saltillo, silty benches at base of hills, *Johnston 7673* (G); desert 41 miles west of Saltillo, *Johnston 7691* (G); Torreon, Oct. 13–20, 1898, *Ed. Palmer 501* (G, US). Durango: 19 miles north of Zaragoza, *Shreve 8820* (G); Mapimi, Oct. 21–23, 1898, *Ed. Palmer 532* (G, US). Zacatecas: Conception de Oro, Aug. 11–14, 1904, *Ed. Palmer 320* (G, US); Hacienda de Cedros, *Lloyd 209* (US); 5 miles south of Majoma, *Johnston 7393* (G).

43. Euphorbia indivisa (Engelm.) Tidestrom, Proc. Biol. Soc. Wash. **48**: 40. 1935.—*E. dioeca* HBK. var. ? *indivisa* Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 187. 1859. Type:

"Stony hills near the Coppermines, Aug. 20, 1851", Grant County, New Mexico, *C. Wright 1845*, (G!; ISOTYPES M!, US!). Engelmann's specimen of this number was unnamed and also mounted in such a way that the relation of specimens and labels on the sheet is uncertain. Millsp., Field Mus. Pub. Bot. **2:** 387. 1914, designated as type the specimen at G.—*E. adenoptera* Bertol. var. *indivisa* (Engelm.) Boiss. in DC. Prod. **15** (**2**)**:** 49. 1862.—*Chamaesyce indivisa* (Engelm.) Millsp., Field Mus. Pub. Bot. **2:** 387. 1914.

Annual; stems few to several, prostrate, 6–25 cm. long, mostly 0.5–1 mm. thick, crisply pilose, the young tips densely so, internodes up to 2.5 mm. long, median ca. 1 cm., shortened to but 1 or 2 mm. at the branch tips; leaf-blades broadly ovate-deltoid-falcate and strongly asymmetrical (butterfly-wing-shaped) to oblong or even linear-oblong, 5–8 mm. long, mostly serrulate, mostly glabrous above, sparsely crisp-pilose beneath, often glabrate; petioles crisp-pilose, ca. 1 mm. long; stipules distinct, linear-subulate, 1–1.4 mm. long, usually entire, with short crisped hairs; cyathia subsessile, solitary at the nodes but clustered at the branch-tips by extreme shortening of the internodes; involucre cylindrical-campanulate, 0.9–1 mm. in diam., pubescent outside especially above, short-hairy within on the lobes; lobes subulate, proximal shorter than the glands, distal slightly exceeding the glands; glands transversely oval to oblong, usually folded, 0.25–0.6 mm. long, the proximal about twice as long as the distal; appendages white, rubescent, glabrous, irregularly wavy-margined, the distal fan-shaped, symmetrical, 0.2–0.3 mm. long, the proximal oblong to oblong-spatulate or obliquely elliptical, greatly prolonged parallel to the columella, 1.1–1.6 mm. long; fifth gland linear, half as long as the lobes; sinus U-shaped, depressed halfway to base of involucre; bracteoles about half as long as the androphores, of 1–3 linear segments opposite each gland, adnate below to the involucre, pubescent above; staminate flowers 5–15 per cyathium; androphores glabrous, 1.1–1.5 mm. long; gynophore crisply hairy above, reflexed into the sinus but scarcely exserted; ovary 3-lobed, densely strigose; styles glabrous, shortly united below, entire or sometimes bifid ⅓ to base, 0.7–1.3 mm. long; capsule strigose, 1.4–1.6 mm. long, subpyriform, strongly 3-lobed, base truncate; seeds quadrangular, 0.9–1.2 mm. long, 0.5–0.6 mm. tangentially, 0.4–0.5 mm. radially, narrowly ovate-acute radially, base truncate, facets with 3–5 rounded transverse ridges passing slightly through the angles, separated by sharp deep grooves, coat white, microreticulate, often but little obscuring the pale brown testa.—PLATE 663D.

Southern Arizona, southern New Mexico, western Texas, Sonora, Chihuahua, Durango, Coahuila, and San Luis Potosi

(Map 11). Representative specimens seen: Arizona. Pinal Co.: Oracle, *Eggleston 15951* (Ph). Pima Co.: Range Reserve near Tucson, Sept. 13, 1911, *Wooton* (US). Santa Cruz Co.: Patagonia Mountains, *Kearney & Peebles 10145* (US); Nogales, *Harrison & Kearney 6028* (G, US). Cochise Co.: Mescal, *Griffiths 1817* (NY); Bisbee, *C. E. Lloyd 459* (G); Rucker Valley, 1881, *Lemmon 454* (F, G). New Mexico. Sierra Co.: 2 miles south of Hillsboro, *Metcalfe 1292* (G, NY). Texas. Brewster Co.: Alpine, Sept. 1, 1909, *Mackensen* (M); 13 miles south of Alpine, *Cory 9264* (G); Limpia Canyon, Davis Mountains, *Hanson 744* (G). MEXICO: Sonora: gravelly arroyo, *Thurber* 963 (G); Rio Magdalena on road to Cananea and Remedios, *Wiggins 7073* (W). Chihuahua: hills and plains near Chihuahua, *Pringle 326* (G); 5 miles north of Mesteñas, *Johnston 7954* (G). Durango: 26 miles west of Mapimi, *Johnston 7780* (G). Coahuila: Soledad, Sept., 1880, *Ed. Palmer 1206* (G). San Luis Potosi: in arenosis, Morales, *Schaffner 855* (G).

This entity is very closely related to *E. dioeca* HBK. Since the other members of the group to which *E. indivisa* belongs are all extra-limital, the specific lines drawn by Millspaugh, Field Mus. Pub. Bot. **2:** 383–392. 1914, in his paper, "'Euphorbia adenoptera' in North America", are accepted, with some hesitation, until the group can be carefully studied.

The collection made in Texas in 1855 by *Dr. Antisell* (NY), reported by Engelmann in Emory, U. S. & Mex. Bound. Surv. **2 (1):** 187. 1859, as *E. dioeca* HBK., is here included under *E. indivisa*, as are also the plants described by Coulter, Contr. U. S. Nat. Herb. **2:** 389. 1894 as *E. adenoptera* Bertol.

44. Euphorbia thymifolia L., Sp. Pl. **1:** 454. 1753. Type: (?)—*Anisophyllum thymifolium* (L.) Haw., Syn. Pl. Succ., 160. 1812.—"**E.[uphorbia] maculata** L. (var. *thymifolia* L.)" Griseb., Fl. Brit. W. Ind. Isl., 53. 1859, basinym not stated but reference made to *E. maculata* δ. Pl. Carib. (not located).—*Chamaesyce thymifolia* (L.) Millsp., Field Mus. Pub. Bot. **2:** 412. 1916.

Additional synonyms listed by Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 438–439. 1917.

Annual (or short-lived perennial?); stems prostrate, mostly 0.5–1 mm. thick, strigose to strigose-tomentulose, sometimes glabrate at maturity, 15–30 cm. long, internodes on the main stems from a maximum of 2 cm. long to only ca. 1 mm. long on some of the lateral branchlets; petioles 0.5–1 mm. long; blades broadly elliptic to oblong (often narrowly so) and ovate-lanceolate, 3–10 mm. long, base inequilateral, apex blunt to acute, nearly glabrous above, sparsely tomentulose to subglabrous beneath; stipules ca. 1 mm. long, linear-subulate, distinct or slightly united, entire or slightly parted, with erect hairs; cyathia subsessile, mostly in small cymes of 2-several on short lateral branchlets, involucres broadly obconical, soon distended and distorted by the base of the partially included capsule, upwardly strigose outside, subglabrous inside; lobes triangular, distal equaling the glands, proximal much shorter, upwardly strigose; glands red, subcircular to very broadly transversely oval, the distal the more nearly circular, 0.2–0.25 mm. in diam., slightly depressed in the center; appendages on distal glands symmetrical, margining the glands and 1½ times as wide, to rudimentary, on proximal glands up to twice as long as glands, asymmetrical, elongated toward the sinus, glabrous, white to pink, entire to crenulate; 5th gland absent; sinus broadly U-shaped, depressed nearly to base of involucre; bracteoles few, linear, sparsely pubescent; staminate flowers 3–5 per cyathium; androphores glabrous, 0.9–1.2 mm. long; gynophore very short (ca. 0.5 mm. long), strigose above; ovary densely hairy; styles bifid about halfway, glabrous, 0.4–0.5 mm. long, tips usually clavate; capsule upwardly strigose, sharply 3-angled, widest near the base, 1.1–1.5 mm. long; seeds sharply quadrangular, with low subregular transverse ridges often slightly including the angles, ovate to narrowly ovate radially, 0.8–0.9 mm. long, 0.45–0.55 mm. tangentially and radially.—PLATE 655A

Mexico, West Indies, South America, Old World tropics. This species is not known from the United States but is included here because of its close relationship with *Euphorbia supina*. The description given above is based on the following specimens: MEXICO: Tamaulipas: Tampico, June 3–6, 1910, *Ed. Palmer 572* (M). Sinaloa: Comedero, Jan. 27, 1940, *Gentry 5395* (W); Cofradia, Nov. 25, 1939, *Gentry 5062* (W).

The application of the name *E. thymifolia* here made is the traditional one. Whether the type in the Linnaean Herbarium is identical with the plants included here is uncertain. According to his notes, A. Gray considered the specimen of *E. thymifolia* in Linnaeus' herbarium identical with the entity called *E. supina* in this paper. That interpretation may be correct but Gray might easily have overlooked the small differences between these two entities. The customary application will be continued until definite evidence to the contrary is submitted by someone particularly acquainted with the plants concerned.

I am applying the name *E. thymifolia* in the sense in which it was used by Boissier in DC. Prod. **15** (**2**): 47. 1862. Thellung, in his discussion of his application of this name in Ascherson &

Graebner, Syn. Mitteleur. Fl. **7:** 475. 1917, states: "Linné's Herbarexemplar gehört nach Boissier (a. a. O. 1862), wie auch dasjenige des jüngeren Burmann, zu *E. thymifolia* in unserem Sinne." It is not at all certain that Boissier ever saw Linnaeus' specimen. Boissier merely stated: "157. E. thymifolia (Burmann fl. Ind. pag. 2, et herb.)." There is no definite evidence to indicate that the herbarium referred to is Linnaeus'.

45. Euphorbia supina Raf., Amer. Monthly Mag. **2:** 119. 1817 (Dec.). Type: doubtless not extant. "Very common on the downs and seashores of Long-Island, north and south, also in New-Jersey, Sandy-Hook, &c."—*Xamesike supina* (Raf.) Raf., Aut. Bot., 87. 1840.—*Chamaesyce supina* (Raf.) Moldenke, An annotated and classified list of H. N. Moldenke collection numbers from No. 1 to No. 11,277 inclusive, 135. 1939.

E. littoralis Raf., Amer. Mo. Mag. **2:** 119. 1817 (Dec.), not *E. litoralis* HBK., Nov. Gen. et Sp. **2:** 54 (quarto), 43 (folio). 1817 (Apr.).[1] Type: doubtless not extant. " . . . it grows on the sandy and gravelly shores of the Hudson from New York to the falls".—*Xamesike littoralis* (Raf.) Raf., Aut. Bot., 97. 1840.

E. depressa Torrey, Cat. Pl. N. Y., 45. 1819, by reference to *E. maculata* L. *sensu* W. P. Barton, Comp. Fl. Phila. **2:** 185. 1818. Type: sandy fields and cultivated grounds, common near New York, probably *Torrey* (NY!; photographs G!, W!). Elliott, Sketch Bot. So.-Car. & Georgia **2:** 655. 1824; Sprengel, Syst. Veg. **3:** 794. 1826.—*Xamesike depressa* (Torr.) Raf., Aut. Bot., 97. 1840.

E. thymifolia Michaux, Fl. Bor.-Amer. **2:** 212. 1803. Type: Ohio and Mississippi Rivers and Illinois. *Michaux* (Herb. Mus. Paris; photograph G!).

E. thymifolia L. *sensu* Pursh, Fl. Amer. Sept., 606. 1814.

E. maculata L. *sensu* Torrey, Fl. State N. Y. **2:** 176. 1843, and virtually all subsequent American authors; Boissier in DC. Prod. **15** (2): 46. 1862; Small in Britton & Brown, Ill. Fl. No. U. S. & Can. **2:** 373. 1897; Robinson & Fernald, Gray's New Man. Bot. ed. 7, 547. 1908; Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 465. 1917; Jepson, Man. Fl. Pl. Calif., 600. 1925. Not L.

E. meganaesos Featherman, Ann. Rep. Geol. Surv. Louisiana **2:** 71. 1871. Type: Grand Isle, Louisiana, *Featherman?* (Louisiana State University?; isotype G!). A narrow-leaved, apparently erect maritime ecotype representing an almost indefinable tendency.

Chamaesyce Tracyi Small, Fl. Se. U. S., 713, 1333. 1903. Type: Biloxi, Harrison County, Mississippi, July 15, 1894 (NY!; photographs G! W!). The same ecotype as *E. meganaesos.*

[1] Date according to Barnhart, Bull. Torr. Bot. Club **29:** 597. 1902.

Chamaesyce Mathewsii Small, Man. Se. Fl. 797, 1505. 1933. TYPE: sand dunes opposite Miami, Dade County, Florida, Nov. 26–Dec. 20, 1913, *J. K. & G. K. Small 4556* (NY!; photographs G!, W!). A robust maritime ecotype intergrading too generally for recognition.

Annual; stems prostrate to erect, sparsely villous or the young stems subtomentose, sometimes glabrate but stem-tips always vestite, 10–45 cm. long; leaf-blades 4–17 mm. long, elliptic-ovate, oblong-ovate to linear-oblong, the larger with inequilateral base, sparsely villous, often glabrate especially above, serrulate to subentire; petioles 1–1.5 mm. long, 2–3-parted, villous; cyathia solitary at the nodes but mostly borne on short congested lateral branches; involucres obconical, ca. 0.8 mm. in diam., villous; glands 0.15–0.25 mm. long, transversely elongate; fifth gland filiform, ½ as long to ca. equaling the lobes; sinus U-shaped, depressed, ¼ to ⅓ to base of involucre, long-hairy; appendages narrow, white, glabrous, irregularly crenulate; staminate flowers 4–5 (sometimes 2–3) per cyathium; androphores glabrous, 0.9–1.2 mm. long; gynophore crisply hairy, barely exserted and mostly reflexed; ovary densely strigose; styles ca. 0.4 mm. (rarely to 0.6 mm.) long, ¼–⅓ bifid, clavate, capsule sharply 3-angled. strigose, often partially glabrate, wider below the equator, ca, 1.4 mm. long; seeds quadrangular, ca. 1 mm. long, ovate radially, facets with subregular low transverse ridges often slightly including the angles, coat whitish-brown.—PLATE 662D.

Quebec and Ontario; general in eastern United States, west to North Dakota and Texas; introduced in Oregon, California, and Arizona; introduced in Europe (MAP 34). Representative specimens seen: QUEBEC. Wright Co.: Chelsea, *Macoun 87833* (G). Pontiac Co.: Chichester, *Marie-Victorin, Rolland-Germain & Meilleur 44016* (G). ONTARIO. Ottawa, Broad St. Station, *Macoun 87834* (G); Amherstburgh, *Macoun 88081* (G); Chatham, *Macoun 88088* (G); Niagara Falls, *Macoun 88083* (G); Owen Sound, *Macoun 88086* (G); Port Colborne, *Macoun 88082* (G); Southampton, *Macoun 88087* (G); Windsor, *Macoun 88085* (G); Wooler, *Macoun 88084* (G). MAINE. Androscoggin Co.: Auburn, *E. D. Merrill 1649* (NE). Aroostook Co.: Island Falls, *Fernald 2739* (NE). Cumberland Co.: Portland, *Fernald, Long & Norton 13999* (NE, Ph); Brunswick, Aug. 23, 1910, *Furbish* (NE). Hancock Co.: Schooner Head Road, Bar Harbor, Mount Desert Island, Sept. 18, 1896, *Rand* (NE). Kennebec Co.: Winslow, *Fernald 2736* (NE); Clinton, July 20, 1907, *Bean* (NE). Franklin Co.: Farmington, Sept. 2, 1904, *Knowlton* (NE). Penobscot Co.: Lagrange, *Fernald & Long 13997* (NE, Ph). Piscataquis Co.: Abbot Village, *Fernald & Long 13998* (NE, Ph). Sagadahoc Co.: Bath, July 12, 1912, *Furbish* (NE). Washington Co.: Valley of the St. Croix River, Sept. 1, 1908, *Fernald* (NE). York Co.: Old

Orchard, *Chamberlain 228* (NE); York, Mt. Agamenticus, Aug. 17, 1905, *Chamberlain* (NE). New Hampshire. Cheshire Co.: East Swanzey, *Robinson 539* (G, NE). Coös Co.: Whitefield, *Pease 11616* (NE); Berlin, *Moore 4329* (G). Grafton Co.: Plymouth, Aug. 24, 1916, *Knowlton* (Ph). Hillsboro Co.: Pelham, Sept. 13, 1902, *Knowlton* (G). Merrimack Co.: Aug. 24, 1925, *Batchelder* (NE). Rockingham Co.: Hampton Falls, Sept. 8, 1916, *Batchelder* (NE). Vermont. Chittenden Co.: Burlington, July 6, 1919, *Knowlton* (Ph). Windham Co.: Bellows Falls, July 18, 1896, *Deane* (NE). Windsor Co.: Windsor, Aug. 22, 1880, *Leland* (NE). Massachusetts. Barnstable Co.: Harwich, *Fernald & Long 18687* (NE, Ph); Brewster, *Collins 1176* (NE); Yarmouth, *Collins 981* (NE). Berkshire Co.: Stockbridge, July 20, 1919, *Hoffmann* (NE). Bristol Co.: New Bedford, Aug. 5, 1904, *Hervey* (NE). Dukes Co.: Elizabeth Islands, *Fogg 2869* (NE). Essex Co.: Salem, *Forbes 2315* (NE). Hampshire Co.: West Chesterfield, *Robinson 489* (G). Hampden Co.: Springfield, July 15, 1915, *Andrews* (NE). Middlesex Co.: Arlington, *Pease 4704* (NE); Winchester, *L. B. Smith 2496* (NE). Norfolk Co.: Norfolk, *Ware 4138* (NE). Plymouth Co.: Hull, *Rothrock* (NE). Suffolk Co.: Savin Hill Beach, Boston, Aug. 28, 1853, *W. Boott* (G); Revere, Oak Island, July 9, 1882, *Young* (NE). Rhode Island. Newport Co.: Clay Head, Block Island, *Fernald, Long & Torrey 9822* (G, NE, Ph). Providence Co.: Providence, Aug. 20, 1907, *Hope* (G). Washington Co.: Hopkinton, Aug. 30, 1919, *Ware, Woodward & Harger* (NE). Connecticut. Fairfield Co.: Stratford, Fresh Pond, Aug. 15, 1897, *Eames* (NE). Middlesex Co.: Killingworth, Sept. 3, 1874, *Hall* (NE). New Haven Co.: Naugatuck, *Harger 5519* (Ph); South End, New Haven, Long Island Sound, *Castle 104* (NE). New London Co.: Franklin, Oct. 1, 1910, *Woodward* (NE). Tolland Co.: Bolton, *Weatherby 5104* (NE). Windham Co.: Central Village, *Sheldon 514* (NE). New York. Albany Co.: Albany, Sept. 2, 1908, *Burnham* (G). Bronx Co.: Thorn's Dock, Oct. 2, 1891, *Bicknell* (Ph). Richmond Co.: Port Richmond, Staten Island, *Dowell 6735* (M). St. Lawrence Co.: Canton, *Phelps 636* (G). Tompkins Co.: Ithaca, *Bechtel 8409* (G). Washington Co.: Vaughns, north of Hudson Falls, Aug. 28, 1891, *Burnham* (G). New Jersey. Atlantic Co.: within 1 mile south along Great Egg Harbor River, Catawba, *Long 51184* (G). Burlington Co.: Delanco, *Hermann 3631* (PhB). Camden Co.: Lawnside, *Stone 1077A* (PhB). Cape May Co.: Cape May City, Aug. 2, 1917, *Stone* (PhB). Cumberland Co.: Cumberland, *Long 38946* (PhB). Essex Co.: Watchung Mt., *Pennell 7459* (Ph). Middlesex Co.: Stelton, *Halsted's* American Weeds 88 (G, Mo). Ocean Co.: Lakewood, *Hunnewell 8081* (G). Somerset Co.: Watchung, *Moldenke 1303* (Ph). Pennsylvania. Berks Co.: Fleetwood, *Leibelsperger 52* (PhB). Bucks Co.: Grenoble, *Long 4601* (PhB). Chester Co.: Honey Brook, *Benner 5418* (PhB). Columbia Co.: west branch Fishing Creek, 25 miles above Central, *Fosberg 15968* (G). Lebanon Co.: in South Mountain, Penryn, *Heller 669* (G). Lehigh Co.: near Allentown, *Pretz 4842* (PhB). Montgomery Co.: Souderton, *Long 26754* (PhB). Northampton Co.: Northampton, Aug. 17, 1923, *Churchill* (G). Philadelphia Co.: Holmesburg, *Benner 7335* (G, PhB). DELAWARE. New Castle Co.: Newark, Oct. 18, 1923, *Otis* (PhB). Sussex Co.: Rehoboth, Aug. 15, 1895, *Commons* (Ph). DISTRICT OF COLUMBIA: Brookland, Oct. 13, 1915, *Holm* (G); Washington, Aug. 18, 1888, *Holm* (G). VIRGINIA. Amherst Co.: Monroe, Aug. 16, 1899, *Pieters* (US). Arlington Co.: near Ballston, Sept. 20, 1935, *Blake* (W). Bedford Co.: Sept. 25, 1871, *A. H. Curtiss* (G). WEST VIRGINIA. Cabell Co.: Roland Park, *Gilbert 493* (Mo, Ph). Grant Co.: Bayard, *Moore 1950* (G). Greenbrier Co.: White Sulphur Springs, *Hunnewell 2827* (G). Mineral Co.: Keyser, *Moore 1948* (G). Tucker Co.: along Shavers Fork near Parsons, *Greenman 408* (G). NORTH CAROLINA. Buncombe Co.: Biltmore, *Biltmore Herbarium 407b* (G). Cartaret Co.: shore of North River, *Randolph 827* (G). Pender Co.: Hampstead, *Randolph 989* (G). SOUTH CAROLINA. Berkeley Co.: Santee Canal, *Ravenel* (G). Charleston Co.: Charleston, *Fernald & Long 9748* (G). Lancaster Co.: Elgin, *House 2583* (M). Marion Co.: Marion, *Wiegand & Manning 1814* (G). GEORGIA. Whitfield Co.: Dalton, Chickamauga, *Harper 380* (G). FLORIDA. Bradford Co.: Hampton, *Wiegand & Manning 1816* (G). Dade Co.: sand-dunes opposite Miami, *J. K. & G. K. Small 4580* (NY). Duval Co.: *Fredholm 5138* (G). Escambia Co.: Pensacola, 1886, "*A. W. Curtiss*" (G). Gulf Co.: Apalachicola, *Chapman* (G). Hillsborough Co.: *Fredholm 6469* (G). Lake Co.: near Eustis, *Nash 1058* (G). Lee Co.: Alva, *A. S. Hitchcock 328* (G). Palm Beach Co.: Palm Beach, *Hunnewell 7365* (G). Pinellas Co.: St. Petersburg, *Deam 2797* (G). MICHIGAN. Allegan Co.: *Dohmen 61* (F). St. Joseph Co.: Sturgis, Aug., 1898, *Daniels* (Mo). Washtenaw Co.: Ann Arbor, *Hermann 9115* (G). OHIO. Portage Co.: Garrettsville, *Webb 469* (G). Scioto Co.: Moore's Lane, Friendship, *Demaree 10788* (G). INDIANA. Cass Co.: 2 miles west of Hoover, *Deam 34640* (Ph); 2 miles west of Royal Center, *Deam 29566* (Deam). Clay Co.: six miles east of Brazil, *Deam 37789* (Deam). Elkhart Co.: 4 miles north of Elkhart on Simonton Lake, *Deam 52954* (Deam). Jasper Co.: 5 miles east of Wheatfield, *Deam 26533* (Deam). Lake Co.: north side of Cedar Lake, *Deam 21389* (Deam). Marion Co.: Pine, *Umbach 2315* (G). Morgan Co.: north of Martinsville, along Traction Line, *Deam 13935* (Deam). Noble Co.: north side of Waldron Lake on Orange Township, Aug. 9, 1905, *Deam* (Deam). Parke Co.: ½ mile west of Bloomingdale, *Deam 41921* (Deam). Pike Co.: 1 mile west of Cato, *Deam 52655* (Deam). Porter Co.: northwest of Porter, *Lansing 1636* (Ph). Pulaski Co.: 2½ miles southeast of Denham, *Deam 29862* (Deam). St. Joseph Co.: South Bend, *Nieuwland 11736* (M). Starke Co.: 3 miles west of North Judson, *Deam 32212* (Deam). Sullivan Co.: 5 miles southeast of Sullivan, *Deam 25691* (Deam). Tippecanoe Co.: 2 miles south of Battle Ground, *Deam 49615* (Deam). Warren Co.: 7 miles west of Williamsport, *Deam 37890* (Ph). Washington Co.: 6 miles west of Pekin, *Deam 18980* (Deam). White Co.: bank of Tippecanoe River, 2 miles northeast of Monticello, *Deam 32671* (Deam, G). Kentucky. Harlan Co.: near Poor Fork Post Office, *Kearney 156* (G). Kenton Co.: Banklich Creek, Sept. 25, 1838 (Ph). Tennessee. Davidson Co.: campus of Peabody College, Nashville, *Svenson 137* (G). Alabama. Jefferson Co.: west side of Library, Birmingham, *H. E. Wheeler 140* (G). Lee Co.: Auburn, *Earle 35* (G). Tuscaloosa Co.: Tuscaloosa, Sept., 1898, *Mohr* (US). Mississippi. Harrison Co.: Biloxi, *Pollard 1155* (G). Panola Co.: Sept. 17, 1896, *Eggert* (M). Wisconsin. Iowa Co.: Wyoming, *Fassett 12574* (M). Milwaukee Co.: Milwaukee, *Ogden 7* (F). Pierce Co.: Prescott, *Fassett 10287* (Deam); Bay City, *Fassett & Wilson 10281* (G). Illinois. Champaign Co.: Champaign, *Gleason 1932* (G). Cook Co.: Stony Island, *H. H. Smith 5979* (G, M, Ph). Hancock Co.: Augusta, Aug., 1859, *Mead* (G); Augusta, Sept. 21, 1860, *Mead* (G). Henry Co.: Atkinson, Aug., 1921, *Ledman* (M). Kankakee Co.: Altorf Island in Kankakee River, *Lansing & Sherff 5* (G). La Salle Co.: Ottawa, *Juett* (G). Peoria Co.: Peoria, Aug., 1903, *McDonald* (G). Richland Co.: Olney, *Ridgway 3133* (Ph). Stark Co.: Wady Petra, *V. H. Chase 696* (Ph). Vermilion Co.: Muncie, *Pease 14104* (G). Winnebago Co.: South Beloit, *Wadmond 2943* (G). Minnesota. Chisago Co.: Taylors Falls, Sept., 1893, *Ballard* (Mi). Goodhue Co.: Burntside, *Anderson 777* (Mi). Hennepin Co.: Fort Snelling Reservation, *Rosendahl 2332* (Mi). Houston Co.: Jefferson, *W. A. Wheeler 430* (Mi). Hubbard Co.: Itasca Park, *Moyle 762* (Mi). Lincoln Co.: Lake Benton, *Sheldon 1560* (Mi). Pipestone Co.: Pipestone, Aug. 11, 1925, *Peterson* (Mi). Scott Co.: Cleary's Lake, *Ballard 526* (Mi). Wabasha Co.: Brook Lodge, Aug. 15, 1904, *Roberts* (Mi). Washington Co.: Afton, Sept., 1919, *Butters* (Mi). Winona Co.: Latsch Island, Winona, *Fassett 3413* (G). Iowa. Dallas Co.: Aug. 2, 1867, *Allen* (G). Fayette Co.: Fayette, July, 1894, *Fink* (G). Story Co.: Ames, Sept., *Pammel 34* (G). Missouri. Barry Co.: White River at Cutner Ford 2 miles northwest of Golden, *Steyermark 19543* (M, Mo). Boone Co.: Columbia, *Drouet 1012* (Mo). Cole Co.: Jefferson City, Aug., 1871, *Krause* (M). Cooper Co.: *Bush 15125* (Mo). Dunklin Co.: Campbell, Oct. 23, 1893, *Bush* (M). Franklin Co.:

Gray Summit, *Kellogg 1845* (M). Henry Co.: July 3, 1892, *Link* (Mo). Jackson Co.: Courtney, *Bush 7068* (G). Jefferson Co.: 4 miles southwest of Pevely, *Steyermark 506* (M). Laclede Co.: Fork of Gasconade River 1 mile west of Dry Knob, *Steyermark 13925* (Mo). Marion Co.: Hannibal, *Davis 1419* (M). Saint Clair Co.: 1 mile north of Collins, Oct. 4, 1930, *Drouet* (Mo). St. Louis Co.: Jefferson Barracks, *Bartram 3053* (Ph). Saline Co.: below Glasgow Bridge on Highway 20, *Drouet 1607* (Mo). ARKANSAS. Crawford Co.: Van Buren, *Demaree 15278* (W). Drew Co.: Monticello, *Demaree 13521* (W). Garland Co.: 8 miles east of Hot Springs, *Scully 284* (G). Grant Co.: Saline River, Poyen, *Demaree 16331* (W). Hempstead Co.: Tokio, *Demaree 9931* (G, M). Hot Springs Co.: Malvern, *Demaree 16298* (Mo, W). Jefferson Co.: Pine Bluff, *Demaree 15407* (W). Montgomery Co.: Caddo Gap, Small Creek, *Demaree 9582* (M, Ph). Polk Co.: Mena, *Demaree 16057* (W). Pope Co.: Russellville, *Demaree 15334* (W). Prairie Co.: White River Ridges, de Valls Bluff, *Demaree 15736* (W). Pulaski Co.: Little Rock, *Demaree 8202* (M). Scott Co.: Mansfield, *Demaree 18180* (W). LOUISIANA. Boissier Co.: Alden Bridge, 1898, *Trelease* (M). Caddo Co.: Shreveport, Sept. 20, 1847, *Gregg* (Ph). Plaquemines Co.: Port Eads, *Tracy & Lloyd 209* (G, Ph). Terrebonne Co.: Houma, on Little Temple, *Wurzlow* (F). NORTH DAKOTA. Cass Co.: Fargo, Oct. 16, 1911, *Waldron* (G, Ph). NEBRASKA. Kearney Co.: Minden, Aug. 27, 1929, *Hapeman* (Ph). Nemaha Co.: Peru, *Michels 419* (O). Otoe Co.: Nebraska City, Aug., 1898, *Thornber* (M). Webster Co.: Blue Hill, *Bates 5025* (G). KANSAS. McPherson Co.: Lindsborg, June, 1884, *Bodin* (F). Riley Co.: *Norton 471* (G). OKLAHOMA. Alfalfa Co.: near Goltry, *G. W. Stevens 1334.1* (G). Creek Co.: Sapulpa, *Bush 536* (M). Harmon Co.: Hollis, *G. W. Stevens 1054* (G). Le Flore Co.: Stapp, *Demaree 16041* (W). Mayes Co.: near Mazie, *G. W. Stevens 2584* (G). Oklahoma Co.: near Oklahoma City, *White 1145* (G). Osage Co.: near Copan on Coon Creek, *G. W. Stevens 2170* (G). Ottawa Co.: near Miami, *G. W. Stevens 2307* (G). Pawnee Co.: Pawnee, Aug. 31, 1933, *Coffman* (Mo). Woods Co.: near Alva, *G. W. Stevens 1603* (G). TEXAS. Anderson Co.: Palestine, Oct. 21, 1884, *Joor* (M). Aransas Co.: 5 miles east of Rockport, *Cory 20383* (G). Burnet Co.: Bluffton, 1879, *Ed. Palmer 1198* (G). Chambers Co.: 5¾ miles south of Anahuac, *Cory 22451* (G). Fayette Co.: ¾ miles south of Monument Hill, *Cory 10046* (G). Gillespie Co.: Bear Mt., *Cory 24574* (G). Grayson Co.: Denison, Sept. 30, 1933, *Rotchslein* (M). Harris Co.: Houston, *Hall 569* (G); Houston, 1842, *Lindheimer* (G). Kerr Co.: Kerrville, *Heller 1921* (Ph). Matagorda Co.: 2½ miles west of Gulf, *Cory 11547* (G). Nueces Co.: Corpus Christi, *Heller 1804* (G, Ph). Parker Co.: Weatherford, *Tracy 7858* (Mo).

Uvalde Co.: Uvalde, 90 miles northwest of San Antonio, 1879, *Ed. Palmer 1202* (G). Valverde Co.: Devils River, *Orcutt 6074* (M). Walker Co.: 14 miles southwest of Huntsville, *Cory 10224* (G). Wharton Co.: Pierce, *Tracy 7436* (G). Williamson Co.: Georgetown, 1879, *Ed. Palmer 1202* (Ph). Wilson Co.: 5 miles east of Floresville, *Cory 11812* (G). Arizona. Greenlee Co.: 6 miles north of Metcalf, *Maguire, Richards & Moeller 11808* (G, I). Pima Co.: Tucson, July 19, 1934, *Thornber* (T). Oregon. Jackson Co.: Ashland, *T. Howell 720* (G). Josephine Co.: Grants Pass, *J. Howell & T. J. Howell 787* (G). California. Siskiyou Co.: Yreka, *L. C. Wheeler 3652* (G, W). Shasta Co.: below Redding, *Heller 14802* (NY). Calaveras Co.: South Fork Calaveras River, Kentucky House, Sierra Nevada, *Jepson 10042* (J). Butte Co.: Chico, *W. H. Wheeler 296* (W). Alameda Co.: West Berkeley, July, 1891, *Michener & Bioletti* (J). Ventura Co.: Ventura, *Abrams 4132* (G, Ph). Los Angeles Co.: Pasadena, *Grant 427* (J). Riverside Co.: Santa Ana River at Chino Creek, *L. C. Wheeler 1330* (W). San Bernardino Co.: Colton, *M. E. Jones 3201* (I). San Diego Co.: San Diego, *Spencer 970* (G).

E. thymifolia β *disticha* Nutt., Trans. Amer. Philos. Soc., n. s. **5**: 171. 1837. Type: "Hab. Banks of the Mississippi and Arkansas" (Ph? or British Mus.?), not located. This variety may well belong here but no authentic material has been located.

E. maculata L. β *detonsa* Engelm. ex. Boiss. in DC. Prod. **15** (**2**): 47. 1862. Type: "In civitatibus australioribus Amer. bor. (Engelm.)" (M? or Ge?), not located. This variety probably belongs here but no authentic material found.

There is one glabrous collection of *E. supina:* Cameron, Cameron Co., Louisiana, July 4, 1903, *Tracy 8477a* (G, M).

It may be that authentic material of *E. supina* Raf. exists at Geneva. Boissier in DC. Prod. **15** (**2**): 47. 1862, appears to have taken the name from exsiccatae rather than from the article in the American Monthly Magazine, for no page is cited and Boissier does not mention the other two *Euphorbiae* that appeared in the same article. Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7**: 471. 1917, cites "*E. supina* Rafin.!" which makes it appear that he has examined the Rafinesquean specimen at Geneva.

For discussion of the history of the misapplication of the name *E. maculata* L. see Contr. Gray Herb. **127**: 74–76. 1939.

The identity of the Linnaean specimen of *E. thymifolia* L. has not been investigated. In view of the very close relationship between the entity to which that name has been applied and *E.*

supina it is entirely possible that *E. thymifolia* might be applicable to the entity here called *E. supina.*

The identity of *E. supina* seems beyond question. It is the only prostrate pilose *Euphorbia* with opposite leaves and vestite capsules occurring in the area mentioned by Rafinesque.

46. Euphorbia humistrata Engelm. ex Gray, Man. Bot. No. U. S., ed. 2, 386. 1856. Type: banks of the Mississippi, St. Louis, Missouri, July, 1833, *Geo. Engelmann 1139* (M 149873!; photographs G! W!). Boiss. in DC. Prod. **15 (2):** 44. 1862.—*Anisophyllum humistratum* (Engelm.) Klotzsch & Garke, Abh. Akad. Berlin, Phys. **1859:** 26. 1860.—*Chamaesyce humistrata* (Engelm.) Small, Fl. Se. U. S., 713, 1333. 1903.

Annual; stems prostrate to ascending, crisply and sparsely villous, sometimes glabrate below, to 35 cm. long, internodes mostly 1–3 cm. long; leaf-blades oval to oblong-ovate on the main stems, often narrower and much reduced on the branchlets, 4–14 mm. long, mostly glabrous above, sparsely crisply villous but glabrate below, margin entire to remotely serrulate, base strongly inequilateral; petioles 1–1.5 mm. long; stipules distinct to united, triangular, attenuate, 1–1.5 mm. long, mostly with linear divisions, ciliate; peduncles ca. 1 mm. long, crisply hairy to glabrate; cyathia solitary at the nodes or, more commonly, in dense clusters on short lateral branches; involucre obconical, 0.6–0.8 mm. in diam., villous outside, essentially glabrous inside; lobes triangular, attenuate, slightly exceeding the glands; glands mostly transversely oblong to elliptical, sometimes subcircular, 0.15–0.3 mm. long; appendages narrow, white to pink, crenulate to entire; fifth gland linear, ca. ½ as long as the lobes; sinus U-shaped, wide, depressed fully halfway to base of involucre; bracteoles minute, linear; staminate flowers 3–5 per cyathium; androphores glabrous, ca. 1.3 mm. long; gynophore slightly vestite above, barely exserted, mostly reflexed; ovary 3-lobed, densely strigose; styles glabrous, ca. 0.7 mm. long, ca. ½ bifid, slender; capsule strigose, sometimes partially glabrate, sharply 3-angled; 1.3–1.4 mm. long, wider below the equator; seeds quadrangular, 0.9–1 mm. long, 0.7–0.8 mm. tangentially, 0.6–0.7 mm. radially, radially broadly ovate, facets nearly smooth, coat brown, granular.—Plate 662C.

Ohio west to Illinois and Kansas, south to Alabama, west to extreme northeastern Texas; adventive in Virginia (Map 40). Representative specimens seen: Virginia. Henrico Co.: railroad ballast, Richmond, Fredericksburg and Potomac Railroad, Richmond, *Fernald & Long 12708* (W); waste places and railroad ballast, South Richmond, *Fernald & Long 12709* (W). Ohio. Champaign Co.: Sept. 10, 1892, *Werner* (NY, Ph).

Hamilton Co.: near Cincinnati, *Lloyd 2485* (Ph). Indiana: Crawford Co.: bank of Ohio River in Leavenworth, *Deam 48035* (Deam). Dearborn Co.: bank of Ohio River in Aurora, *Deam 41122* (Deam). Dubois Co.: Hunnely bottom, 2 miles east of Huntingburg, *Deam 42635* (Deam). Gibson Co.: swamp 3 miles south of Mt. Carmel, Ill., *Deam 24230* (Deam). Greene Co.: swamp 1 mile north of Newberry, *Deam 24101* (Deam). Harrison Co.: bank of Ohio River 4 miles southeast of Laconia, *Deam 41514* (Deam). Jackson Co.: 6 miles north of Crothersville, *Deam 38092* (Deam). Jefferson Co.: bank of Ohio River 4 miles east of Madison, *Deam 40038* (Deam). Knox Co.: bank of White River near its mouth, *Deam 26597* (Deam, NY). Ohio Co.: bank of the Ohio River at the ferry in Rising Sun, *Deam 50800* (Deam). Perry Co.: bank of Ohio River 6 miles east of Cannelton, *Deam 26745* (Deam). Posey Co.: bank of Wabash River 2 miles below New Harmony, *Deam 24270* (Deam, NY). Sullivan Co.: bank of ditch 6 miles northwest of Carlisle, *Deam 51438* (Deam). Switzerland Co.: bank of Ohio River in Vevay, *Deam 50817* (Deam). Vermillion Co.: bank of creek 1½ miles northwest of Eugene, *Deam 51351* (Deam). Vigo Co.: Greenfield Bayou 9 miles west of Pimento, *Deam 23989* (Deam). Warrick Co.: bank of Big Pigeon Creek 6 miles west of Boonville, *Deam 24344* (Deam). Illinois. Menard Co.: Athens, 1863, *Hall* (M). Peoria Co.: Illinois River bottomlands near Peoria, Aug., 1903, *McDonald* (NY). Rock Island Co.: Rock Island, Aug. 10, 1866, *Engelmann* (M). St. Clair Co.: Sept. 10, 1886, *Eggert* (G, M, NY). Kentucky: Lyon Co.: Kuttawa, *Eggleston 5246* (M, NY). Kenton Co.: Banklick Creek, Aug. 30, 1834, *T. G. Lea Herb.* (Ph). Tennessee. Davidson Co.: along Cumberland River, near Nashville, *Gattinger 2485* (G, M, Ph). Alabama: Autauga Co.: bank of Alabama River at House Bluff, *Harper 40* (G, NY, Ph). Mississippi. Warren Co.: Vicksburg, *Demaree 14111* (W). Missouri. Barry Co.: White River, Sept. 22, 1896, *K. K. Mackenzie* (NY). Bates Co.: Osage River at bridge south of Amoret, *Steyermark 20281* (M). Clark Co.: 2 miles west of Gregory Landing, Sept. 6, 1934, *Drouet* (G, M, Mo). Cole Co.: Osage River lock, *Rickett 1134* (Mo). Cooper Co.: 10 miles southwest of Boonville & south of Lanvine, *Steyermark 15910* (M, Mo). Jackson Co.: Sheffield, *Bush 12324* (M, NY). Jefferson Co.: Kimmswick, Sept., 1868, *Engelmann* (M). Laclede Co.: Osage Fork of Gasconade River, *Steyermark 13931* (M, Mo). New Madrid Co.: near La Forge, *Steyermark 8843* (M). Perry Co.: Mississippi River, 1½ miles north of Wittenburg, *Steyermark 14085* (M, Mo). Pulaski Co.: along Gasconade River between Laquey and Richland, *Steyermark 19867* (M). St. Clair Co.: 3½ miles north of Iconium at Wagon Ford, *Steyermark 24317* (NY). St. Louis Co.: junction of Missouri and Mississippi

Rivers on island, *Steyermark 19716* (M). ARKANSAS. Chicot Co.: Eudora, near La Fourche Lake, *Demaree 18575* (W). Drew Co.: Monticello, *Demaree 18410* (W). Lincoln Co.: Bayou Bartholomew, York Town, *Demaree 13729* (M, NY). Prairie Co.: De Valls Bluff on White River bottoms, *Demaree 15521* (NY). Pulaski Co.: along Arkansas River at Little Rock, *Demaree 8328* (G, NY). LOUISIANA. Terrebonne Co.: Houma, Aug. 21, 1912, *Wurzlow* (NY). KANSAS. Miami Co.: Paola, Sept. 19, 1885, *Oyster* (NY). OKLAHOMA. Nowata Co.: Lenapah, *G. W. Stevens 2182* (G, NY). Ottawa Co.: bar by Neosleo River, near Miami, *G. W. Stevens 2309* (G, M, NY). Rogers Co.: Verdigris, *Bush 537* (G, M, NY). TEXAS. Bowie Co.: Texarkana, May 9, 1891, *Plank* (NY).

This species seems to grow usually on river flats, judging by the meager habitat-data given by collectors on their labels. Some specimens are difficult to place definitely in *E. humistrata* for it approaches *E. supina* very closely. Reports of *E. humistrata* from states other than those from which specimens are cited above are probably based on misidentifications of *E. supina*.

47. EUPHORBIA STICTOSPORA Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 187. 1859. TYPE: steep bank of the Pawnee River ("fork"), in loose soil, Kansas, Sept. 8, 1847, *A. Fendler 798* (M 200482!; photographs G!, W!). (Type designated by Millspaugh, Bot. Gaz. **26**: 266. 1898.) Boiss. in DC. Prod. **15** (**2**): 41. 1862.—*Chamaesyce stictospora* (Engelm.) Small, Fl. Se. U. S., 714, 1334. 1903.

Anisophyllum senile Klotzsch & Garcke, Abh. Akad. Berlin, Phys. **1859**: 28. 1860. TYPE: Los Baños, Mexico, *C. Ehrenberg* (B!; photographs G!, W!; ISOTYPE M!).

Annual; stems prostrate to ascending, crisply villous, 5–25 cm. long, internodes mostly 1–2 cm. long on the main stems; leaf-blades suborbicular, ovate, oblong-acute to oblong-linear and obovate, 3–10 mm. long, sparsely crisply hairy and glabrate above, similarly but more densely and permanently vestite beneath, margin sharply serrate, base oblique; petioles ca. 1 mm. long; stipules triangular, often attenuate, distinct or united, sometimes divided, ca. 1 mm. long, sparsely hairy; cyathia solitary at the nodes but mostly on congested short densely leafy lateral branches; peduncles mostly 1–2 mm. long, pubescent; involucre obconical, tapering to the peduncle, 0.7–1 mm. in diam., pubescent outside, essentially glabrous inside; lobes triangular, ciliate, about equaling the glands; glands transversely oblong to elliptical or even subcircular, 0.15–0.3 mm. long; appendages narrow, glabrous, white, entire to crenulate or even sharply toothed; fifth gland from a mere apiculation to a linear segment half as long as the lobes; sinus narrowly U-shaped, depressed ca. ⅓ to base of involucre; bracteoles minute, linear; staminate flowers 3–7 per cyathium; androphores glabrous, 0.9–1 mm. long; gynophore glabrous below, crisply hairy above, exserted and mostly reflexed; ovary 3-lobed, densely strigose; styles ca. 0.2 mm. long, expanded at the apex, entire to deeply emarginate; capsule 1.4–1.9 mm. long, 3-angled, widest near the base, strigose, the basal angles with spreading hairs; seeds sharply quadrangular, 1.2–1.4 mm. long, 0.7–0.8 mm. tangentially, ca. 0.6 mm. radially, radially narrowly ovate to oblong-ovate, base truncate, apex acute, facets with shallow irregular pits to subregular low transverse ridges, coat mottled whitish brown and brown, the bottom of the pits darker colored than the ridges.—Plate 662B.

South Dakota and Wyoming, south to Chihuahua, Coahuila, Durango, and Zacatecas, west to Arizona (Map 28). Representative specimens seen: South Dakota. Fall River Co.: Hot Springs, Aug. 27, 1909, *Petersen* (NY). Stanley Co.: Missouri Valley near Fort Pierre, June 19, 1839, *Geyer* in part (US). Black Hills, Aug., 1893, *Thornber* (M). Nebraska. Dawes Co.: Whitney, Aug., 1890, *Bates* (G). Webster Co.: Red Cloud, July 22, 1904, *Bates* (G). Kansas: Ellis Co.: near Hays, *Rydberg & Imler 1244* (NY). Graham Co.: Bogue, *Imler 5* (NY). Greeley Co.: near Tribune, *Rose & Fitch 17086* (NY). Hamilton Co.: 5 miles east of Kendall, *Rydberg & Imler 1065* (M, NY). Lincoln Co.: *A. S. Hitchcock 472a* (G, M, NY). Logan Co.: on Turkey Creek, east of McCallaster, *Rydberg & Imler 1153* (NY). Meade Co.: Meade, Aug., 1892, *A. S. Hitchcock* (NY). Osborne Co.: Osborne City, *Shear 119* (G). Riley Co.: hills, *Norton 472* (G, M, NY). Rooks Co.: Rockport, July 20, 1889, *Bartholomew* (M). Seward Co.: Liberal, July, 1892, *A. S. Hitchcock* (NY). Wyandotte Co.: Wyandotte, Aug. 16, 1896, *Mackenzie* (NY). Oklahoma. Blaine Co.: near Canton, *G. W. Stevens 835* (G). Texas Co.: 25 miles southeast of Guymon, *Stratton 459* (M). Woods Co.: Alva, *G. W. Stevens 1602* (G, NY). Texas: Brewster Co.: frequent on Sul Ross Campus, Alpine, *Warnock T589* (US). Culberson Co.: Walker Ranch, *Cory 1941* (G). El Paso Co.: El Paso, *M. E. Jones 4195* (G, I, NY in part, O). Gaines Co.: 3.9 miles south of Seminole, *Cory 16617* (W). Hudspeth Co.: Eight Mile Well, *Cory 1946* (G). Kerr Co.: 5.8 miles southeast of Mountain Home, *Cory 19317* (G). Martin Co.: Stanton, June 14, 1900, *Eggert* (M). Pecos Co.: 5¼ miles southeast of Fort Stockton, *Cory 15295* (W). Reeves Co.: *Cory 1949* (G). Ward Co.: Barstow, *Tracy 8169* (G, M, Mo, NY). Wyoming: Laramie Co.: Cheyenne, *Nelson 2727* (G, M, NY). Colorado. Fremont Co.: below Canyon City, *M. E. Jones 786* (I, M, NY). Larimer Co.: Fort Collins, *Anonymous 4020* (NY). Otero Co.: 15 miles northeast of La Junta, *Rollins 1876* (M, NY, W). Pueblo Co.: Pueblo, *Baker, Earle & Tracy 6* (G, M, NY). Weld Co.: Sec. 18, T.10 N, R.65 W, *Muir 149* (G). Yuma Co.: Wray, 1907, *Shantz* (NY). New Mexico. Catron Co.: Beaverhead, Datil Forest, *Eggleston 20424* (G). Chaves Co.: south of Rosswell, *Earle 290* (M). Doña Ana Co.: Mesilla Valley, *Wooton & Standley 3273* (M). Lincoln Co.: Gray, *Skehan 51* (G, NY). Santa Fe Co.: Santa Fe at base of hills, *Fendler 797* (G, M). San Miguel Co.: near Pecos, *Standley 4939* (G, M, NY). Sierra Co.: Kingston, *Metcalfe 1006* (M). Arizona: Cochise Co.: Douglas, *Thornber 7111* (T); near Douglas, *Harrison & Kearney 6114* (US); Paradise, Chiricahua Mts., *Blumer 1690* (G, M, NY, US); Benson, *Harrison 8224* (US); Bisbee, Aug. 28–30, 1910, *Pilsbry* (Ph). Pima Co.: Rosemont, Santa Rita Mts., *Thornber 9055* (T). Santa Cruz Co.: near Nogales, *Peebles, Harrison, & Kearney 5564* (US); Patagonia Mts., *Kearney & Peebles 10140* (US). MEXICO: Chihuahua: near Chihuahua, *Pringle 327* (G, US); southwest of El Paso, near Comalitos, *Thurber 731* (G, M). Coahuila: 1 mile south of Hermanas, *Johnston 7061* (G); 4 miles east of Cuatro Cienegas, *Johnston 7123* (G); Saltillo, Nov. 2–5, 1898, *Ed. Palmer 567* (G, US); Torreon, Oct. 13–20, 1898, *Ed. Palmer 489* (G, US); Jimulco, *Pringle 80* (G, US); Ramos Arizpe between Hipolito and Sacramento, *Wynd & Mueller 77* (G, M, US). San Luis Potosi: near San Luis Potosi, *Parry & Ed. Palmer 817½* (G, M). Zacatecas: 5 miles south of Majoma, *Johnston 7387* (G); near Conception del Oro, Aug. 11–14, 1904, *Ed. Palmer 319* (G). Durango: 26 miles west of Mapimi, *Johnston 7779* (G); Santiago Papasquiaro, Apr. & Aug., 1896, *Ed. Palmer 43* (G, M, US); Tepehuanes, June 4–25, 1906, *Ed. Palmer 299* (US).

48. Euphorbia Chamaesyce L., Sp. Pl. **1:** 455. 1753. Type: Jamaica, *P. Browne* (Linnaean Herb., not seen; photograph F!, W!; fragment F!, the right-hand specimen). An average member of the species.—*Tithymalus Chamaesyce* (L.) Moench, Meth. Pl., 666. 1794.—*Anisophyllum Chamaesyce* (L.) Haw., Syn. Pl. Succ., 160. 1812.—*E. Chamaesyce* L. A. *eu-chamaesyce* Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 454. 1917.

E. prostrata Aiton, Hort. Kew. **2:** 139. 1789. Type: "*Nat*[*ive*] of the West Indies. *Cult.* 1758, by Mr. Philip Miller" (British Museum if extant.) Boissier in DC. Prod. **15 (2):** 47. 1862; Boissier, Icon. Euph., t. 17. 1866, poor; Fiori & Paoletti, Fl. Ital. Illustr., 303, t. 2572. 1901[1]; Thellung, Bull. Herb. Boiss., ser. 2, **7:** 768–770. 1907; Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 476–479. 1917.—*E. serpillacea* Willd. ex Klotzsch & Garcke, Abh. Akad. Berlin, Phys. **1859:** 26. 1860, as

[1] Date fide Thellung, Bull. Herb. Boiss., ser. 2, 7: 769. 1907.

synonym of *Anisophyllum prostratum*, and Baillon, Adansonia **1:** 116. 1860–1861 as synonym of *E. prostrata.*—*Anisophyllum prostratum* (Aiton) Klotzsch & Garcke, Abh. Akad. Berlin, Phys. **1859:** 26. 1860.—*Tithymalus prostratus* (Aiton) Bubani, Fl. Pyren. (ed. Penzig) **1:** 116. 1897.—*Chamaesyce prostrata* (Aiton) Small, Fl. Se. U. S., 713, 1333. 1903.

E. callitrichoides HBK., Nov. Gen. et Sp. **2:** 52 (quarto). 1817. TYPE: Vera Cruz, Mexico (Herb. Mus. Paris, not seen; photograph G!). Referred here, apparently correctly, by Boiss. in DC. Prod. **15** (**2**): 47. 1862.

E. tenella HBK., Nov. Gen. et Sp. **2:** 53(quarto). 1817. TYPE: ad Ripas Orinoci prope Maypures et Carichana, Venezuela (Herb. Mus. Paris, not seen; photograph G!; fragment of ISOTYPE from Berlin at M!).

E. prostrata β *vestita* Engelm. ex Boiss. in DC. Prod. **15** (**2**): 47. 1862. TYPE: New Orleans, Louisiana, *Hale* (Ge!; photographs G!, W!). Scarcely more vestite than usual and of no consequence.

E. stictospora Engelm. var. *texensis* Millsp., Bot. Gaz. **26:** 266. 1898. TYPE: southern Texas, 1894, *Heller 1913* (F 196483!).—*Chamaesyce stictospora guadalupensis* Small, Fl. Se. U. S., 714, 1334. 1903.—*C. stictospora* var. *texensis* (Millsp.) Fedde in Just, Bot. Jahrb. **32** (**1**): 368. 1905.

Chamaesyce malaca Small, Fl. Se. U. S., 713, 1333. 1903. TYPE: Kerrville, Kerr County, Texas, June 26–30, 1894, *A. A. Heller 1918* (NY!; photographs G!, W!; ISOTYPES F!, G!, M!).—*E. malaca* (Small) Little in Jeffs & Little, Univ. Okla. Biol. Surv. Pub. **2** (**2**): 70. 1930 (Prelim. List Ferns & Seed Pl. Okla.).

Boiss. in DC. Prod. **15** (**2**): 47. 1862, lists two additional extralimital synonyms which have not been confirmed.

Annual; stems prostrate to decumbent, few to several, mostly 1–1.5 mm. thick, crisped-hairy to glabrate, at least the young tips vestite and often subtomentose, internodes rarely up to 4 cm. long, average on main stems about 1 cm. long, on short lateral branchlets shortened to as little as 2 mm.; leaf-blades broadly elliptical to elliptic-oblong, obovate-spatulate or even ovate, 3–11 mm. long, mostly 4–8 mm. long, margin often serrulate, base mostly inequilateral, upper surface mostly glabrous, lower surface finely and crisply hairy, often glabrate; petioles ca. 1 mm. long; stipules with short hairs, triangular-subulate, often lacerate above, 0.5–1 mm. long, dorsal usually distinct, ventral often united; peduncles 1–2 mm. long, with short hairs or sometimes glabrous; cyathia solitary at the nodes but mostly on short-noded lateral branchlets; involucres 0.6–0.9 mm. in diam., obconical, tapering to the peduncle, with scattered crisped hairs or glabrous outside, glabrous inside except on the lobes and stipes; lobes rounded-triangular, about equaling the glands, hairy; glands transversely oval to oblong, 0.15–0.3 mm. long, usually depressed in the middle; appendages white, glabrous, from about as wide as to twice as wide as the gland; sinus U-shaped, somewhat depressed, glabrous in the lower half; fifth gland filiform, ¼–⅔ as long as the lobes; bracteoles nearly wanting, reduced to 2–3, glabrous, filiform; staminate flowers 4 per cyathium; androphores glabrous, 0.9–1.1 mm. long; gynophore hairy above or glabrous, exserted and usually reflexed; ovary roundly 3-lobed, densely white-hairy; styles bifid nearly to the base, 0.2–0.3 mm. long, glabrous, slightly clavate; capsule sharply 3-angled, 1–1.4 mm. long, wider below the equator, with crisped hairs persistent on the backs of the carpels but more or less deciduous on the sides; seeds sharply quadrangular, 0.9–1 mm. long, 0.6–0.7 mm. tangentially and radially, radially ovate, facets traversed by low narrow slightly irregular ridges which scarcely pass through the angles, ventral facets concave, dorsal plane to convex, coat white, microreticulate, often little concealing the brown to gray testa.—PLATES 660C and 668A.

Introduced in Massachusetts and Virginia; South Carolina, Florida, Alabama, Louisiana, Missouri, Nebraska, Oklahoma, Texas, and Arizona; introduced in the Old World (MAP 44). Representative specimens seen: MASSACHUSETTS. Middlesex Co.: Malden, on cotton waste, Sept. 20, 1890, *Collins* (NE). VIRGINIA. James City Co.: Williamsburg, stone steps of old house, *Grimes 4640* (G, NY). SOUTH CAROLINA. Charleston Co.: Charleston, *B. L. Robinson 237* (G). FLORIDA. Nassau Co.: Fernandina, Oct. 29, 1890, *A. S. Hitchcock* (M). Duval Co.: Jacksonville, 1880, *Curtiss* (M). St. Johns Co.: streets in St. Augustine, *Curtiss 6426* (G, M, NY). Volusia Co.: Green Mound (shell-midden) 5 miles south of Daytona Beach, *J. K. Small, J. W. Small & DeWinkeler 10568* (NY). Monroe Co.: Garden Key, Dry Tortugas, *Lansing 2502* (NY). Lee Co.: shell mounds, Marco, *A. S. Hitchcock 318* (G, M, NY). Leon Co.: sidewalk on Tennessee St., Tallahassee, July 13, 1926, *Harper* (NY). Gulf Co.: Apalachicola, "Herb. Chapman" (M, NY). ALABAMA. Jefferson Co.: Birmingham, in garden on 7th St. S., *H. E. Wheeler 1209* (G, NY). Montgomery Co.: on slag ballast on L. & N. Railroad about 2 miles southwest of Montgomery, *Harper 30* (G, NY, Ph). Mobile Co.: Mobile, *Dukes 11* (G). MISSOURI. Jackson Co.: Courtney, *Bush 8630* (NY). LOUISIANA. Rapides Co.: near Alexandria in cultivated ground, not common, *Ball 637* (G, M, NY). Orleans Co.: streets of New Orleans, *Hale* (M). Terrebonne Co.: Houma, July, 1912, *Wurzlow* (NY). NEBRASKA. Kearney Co.: Minden, Sept. 1, 1933, *Hapeman* (NY). Harlan Co.: Orleans, *Bates 3633* (NY). OKLAHOMA: Kay Co.: Tonkawa, *G. W. Stevens 1864* (G). Woods Co.: near Fairvalley, *G. W. Stevens 1640* (G). Blaine

Co.: near Canton, *G. W. Stevens 833* (G, M). Rogers Co.: Verdigris, *Bush 537* (G, NY). Oklahoma Co.: Oklahoma City, north Canadian River bottom, *Demaree 13252* (G, NY). Murray Co.: Turner Falls, Arbuckle Mountains, *Demaree 13204* (NY). Comanche Co.: near Fort Sill, *J. Clemens 11674* (G, M). TEXAS. Anderson Co.: Palestine, *Cory 25414* (G). Austin Co.: in clayey soil near Industry, July, 1844, *Lindheimer* (G, M). Bexar Co.: San Antonio, *Wilkinson 52* (M). Calhoun-Matagorda Co.: Matagorda Bay, *Robbins 10* (M). Cameron Co.: Harlingen, *Tracy 9123* (G, M, NY). Colorado Co.: Columbus, common along river, *Bush 431* (G, M, NY). Comal Co.: New Braunfels, 1846, June, *Lindheimer III, 533* (G, M). Dallas Co.: Dallas, June, 1874, *Reverchon* (G). Duval Co.: San Diego, *Croft 168* (NY). Edwards Co.: Substation no. 14, yard, *Cory 6763* (G); 22 miles south of Rocksprings, *Cory 3197* (G). Hays Co.: San Marcos, *E. J. Palmer 12096* (M). Hidalgo Co.: Donna, *Tracy 9124* (G, M, NY). Lampasas Co.: Lampasas, Sept. 21, 1892, *Plank* (NY). Llano Co.: Llano, Aug., 1848, *Lindheimer* (M). Parker Co.: Weatherford, *Tracy 7858* (G, M, Mo, NY). Randall Co.: north of Canyon City, Aug. 13, 1900, *Eggert* (M). Red River Co.: Clarksville, Sept. 25, 1894, *Plank* (NY). Starr Co.: Rio Grande City, *Neally 222* (US). Tarrant Co.: Fort Worth, *Tracy 8167* (G, M, Mo, NY). Taylor Co.: Buffalo Gap Hills, Sayles Ranch, *Cory 1966* (G). Travis Co.: Austin, *Bogusch & Molby 5508* (O). Valverde Co.: 48 miles south of Ozona on Comstock Road, *Ferris & Duncan 3013* (M, NY). Webb Co.: Laredo, July 26, 1882, *Letterman* (M). Wilson Co.: Sutherland Springs, 25 miles southeast of San Antonio, *Ed. Palmer 1196* (G, M). ARIZONA. Pinal Co.: 8 miles west of Florence, *Peebles & Kearney 264* (A). Pima Co.: Tucson, Sept. 30, 1892, *Toumey* (C). Santa Cruz Co.: Santa Cruz River at La Noria, *Mearns 1168* (US).

This species is native in the New World where it is widely distributed. It is introduced generally in the Old World.

Several additional synonyms are cited by Boissier and Thellung. All these are, of course, later than *Euphorbia Chamaesyce* and are extra-limital. Since no authentic material of any of these supposed synonyms has been available no opinion as to their identity will be offered.

Small separated *Chamaesyce malaca* from *C. prostrata* as follows:

"Capsules pubescent along the angles .... 35. *C. prostrata*
Capsules pubescent all over but mainly so below the middle. . 36. *C. malaca*"

The capsules of *C. prostrata* are glabrate on the sides of the carpels. Those with slightly more persistent hairs on the sides of the carpels constitute *C. malaca.* The character does not hold. Small described the leaves of *C. malaca* as "1–1.5 cm. long", and those of *C. prostrata* as "4–6 mm. long". The leaf-length given for *C. malaca* was evidently taken from a juvenile specimen of *Euphorbia humistrata* collected at Verdigris, Oklahoma (Indian Territory), *B. F. Bush 537* (NY) which has the leaves as long as ca. 1.5 cm. But even the type of *Chamaesyce malaca* has leaves of mostly average size for what Small called *C. prostrata.*

The placing in this paper of *E. prostrata* Aiton in the synonymy of *E. Chamaesyce* needs comment. There has been no opportunity to examine any authentic material of the former. Aiton's description is so vague as to be applicable to more than one species. As a consequence of these circumstances there is no assurance that *E. prostrata* is here correctly interpreted. In absence of any basic evidence, it has seemed wise to continue the customary application of the name *E. prostrata.*

Customarily the name *E. Chamaesyce* is applied to an entity native in the Mediterranean region and eastward into Asia. Consequently it had not occurred to me to consider the possibility that the name might properly belong to a plant native in the New World. There seems to be only one author, Swartz, Obs. Bot. Pl. Ind. Occ., 196. 1791, who has applied the name to any New World plant and this was ignored as a mere casual misapplication. However, while browsing through the specimens at Field Museum, Chicago, in Sept., 1939, I came upon a photograph of the specimen in the Linnaean herbarium and fragments from the same specimen. The photograph shows that the sheet upon which the specimen is mounted bears the customary abbreviation used by Linnaeus to indicate specimens collected by Patrick Browne, hence the specimen was collected in Jamaica. Jackson's Index to the Linnean Herbarium shows that the specimen was in Linnaeus' herbarium in 1753. The photograph and fragments had been filed at Field Museum in their proper place under Ind. Occ. in the folder of *E. prostrata* Aiton! There is no doubt that *E. Chamaesyce,* as represented in the Linnaean herbarium, is identical with *E. prostrata* as usually interpreted. This is not a new discovery, for, as I discovered in January, 1940, Thellung, in Ascherson & Graebner, Syn.

Mitteleur. Fl. **7:** 477. 1917, notes in the synonymy of *E. prostrata*: "*E. Chamaesyce* P. Browne in Linné's Herbar (von Jamaica) nach B. Daydon Jackson briefl." Thellung then enumerates a few authors who have applied the name *E. Chamaesyce* in the sense of Linnaeus' herbarium to the plant naturalized in the Mediterranean region.

One of the fundamental rules to be followed in the typification of a Linnaean species is that the Linnaean specimen is to be taken as type, except in extraordinary cases, if he had it in his herbarium at the time the species in question was published and if it conforms to his diagnosis. Exceptional cases are rare and require a full and elaborate explanation to establish acceptable grounds for refusing to accept the Linnaean specimen as type. The force of custom is shown by the careful and extended explanation deemed necessary by Merrill, Bull. Torr. Bot. Club **60:** 633–638. 1933, to justify his rejection of the Linnaean specimen as type of *Poa malabarica* L. In order to determine whether there were any possibility that Linnaeus casually applied the name *E. Chamaesyce* to a plant received perhaps long after the concept had been formulated, his Hortus Cliffortianus was examined, since it was among the earlier references cited in the Species Plantarum. In Hort. Cliff., 198. 1737, the species appears as follows:

> "12. Euphorbia inermis, foliis oppositis oblique cordatis serrulatis uniformibus, ramis alternis, floribus solitariis."
> Several synonyms were cited, then:
> "*Crescit in agris & vineis aridis & arenosis* Siciliae, Italiae, Galliae Narbonensis & Jamaicae. *Corymbus in hac nullus; folia omnia uniformia, aequalia; flores ex alis ubique, albi, tetrapetali; caules alternatim ramosissimi. Folia in Europaea magis orbiculata, in Americana oblonga & saepius macula fusca in medio notata; caulis quam arctissime terrae appressus.*"

Since Jamaica and the plant of America are specifically mentioned in 1737, it was no casual chance whereby the name was applied to a New World plant in Linnaeus' herbarium. Consequently *Euphorbia Chamaesyce* must be typified by the Linnaean specimen. This is the plant commonly known as *E. prostrata* Aiton, which is native of the New World but now widely introduced in tropical regions. The numerous specimens in various herbaria which I have named *E. prostrata* Aiton must now be called *E. Chamaesyce* L.

Thellung, in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 455 footnote 2, 1917, stated "Das Original der *E. Chamaesyce* (vielleicht von Loefling aus Spanien stammend?) gehört gleichfalls zur Abart *canescens* [of *E. Chamaesyce*] (B. Daydon Jackson briefl.)". I do not understand what Jackson could have been taking as type unless there were two specimens in the Linnaean Herbarium.

49. Euphorbia laredana Millsp., Pittonia **2:** 88. 1890. Type: Sandy plains, Laredo, Webb County, Texas, July 28, 1888, *C. G. Pringle 2074* (F 197395!; photographs G!, W!; isotype NY!).—*Chamaesyce laredana* (Millsp.) Small, Fl. Se. U. S., 709, 1333. 1903.

Annual, more or less pilose-tomentose throughout; stems several to many, 10–20 cm. long, stout (1.5 mm. diam.) toward the base, internodes to 1 cm. long; leaf-blades extremely oblique even to the small upper ones, ovate to elliptic-oblong (distorted by the obliquity) 3–5 mm. long, margin entire or the large juvenile leaves with a few low discrete teeth, petioles less than 1 mm. long; stipules minute and obscured by the tomentum; peduncles ca. 0.5 mm. long; cyathia solitary at the nodes; involucres tomentose without, glabrous within except above, short-campanulate, cuneate to the peduncle, 1 mm. or less in diam., green-veined opposite the lobes; lobes deltoid, equaling or slightly exceeding glands, hairy; glands transversely oblong, 0.2–0.3 mm. long, yellowish; appendages absent to slightly wider than the glands; fifth gland a minute papilla; sinus slightly depressed and with long hairs; bracteoles reduced to one radial appendage opposite each gland, adnate to the involucre for half its length, entire to one- or two-parted to the base, hairy above; staminate flowers 3–5; androphores glabrous, 1 mm. long, included; gynophore tomentose above, glabrous below, exserted and reflexed at maturity; ovary sharply three-angled, tomentose, styles bifid, less than 0.2 mm. long; capsule glabrate on the sides of the carpels, the backs usually persistently tomentose, sharply three-angled, 1.3–1.5 mm. long, 1.5 mm. diam.; seeds sharply quadrangular, 1.1–1.2 mm. long, 0.6 mm. radially and tangentially, ovate to narrowly ovate radially, base concave-truncate, facets concave, with subregular, round, transverse ridges including the angles, tops of ridges and angles frosted white, brown between.—Plate 662A.

Sandy sites in Webb, Starr and Hidalgo Counties, Texas (Map 30). Representative specimens seen: Texas. Webb Co.: Laredo, *Pringle 3747* (C, F, G, NY, O, P). Starr Co.: 5 miles north of Rio Grande City, *Clover 1363* (NY). Webb Co.: Laredo, Aug., 1899, *Mackenzie 50* (NY). Hidalgo Co.: Sullivan City, *Runyon 2541* (W). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 431. 1936.

This species is very closely related to *E. Chamaesyce.* The following specimen, though rather intermediate, is referred to *E. Chamaesyce:* Laredo, Webb Co., Texas, July 26, 1882, *Geo. W. Lettermann* (M).

Excluded and Doubtful Species

Anisophyllum dentatum (Michaux) Haw., Syn. Pl. Succ., 162. 1812, is a member of *Euphorbia* subgenus *Poinsettia.*

Aplarina prostrata Raf., New Fl. N. Amer. **4:** 99. 1838, proposed without reference to *Euphorbia prostrata* Aiton. Not recognizable. Said to grow in Pennsylvania.

Aplarina? microphyla Raf., op. cit., 100. Not recognized from the description. From Louisiana and Texas.

Chamaesyce exstipulata (Engelm.) Rydb., Bull. Torr. Bot. Club **40:** 53. 1913, is a member of *Euphorbia* subgenus *Agaloma* (including section *Zygophyllidium*).

Chamaesyce oregonensis Millsp. ex Arthur, N. Amer. Fl. **7:** 766. 1926; Man. Rusts U. S. & Canada, 309. 1934. Merely listed as the host of a rust.

Euphorbia grisea Engelm. ex Boiss. in DC. Prod. **15** (2): 41. 1862. Reported from Texas by Cory, Bull. Texas Agr. Exper. Sta. **550:** 65. 1938.[1] I have seen no material to support this report which may be based on the supposition of Coulter, Contr. U. S. Nat. Herb. **2:** 388. 1894 (Bot. West. Texas) that this species occurred in Texas.

Euphorbia humifusa Engelm. ex Wiegand, Bot. Gaz. **24:** 51. 1897, in key, *lapsus* for *E. humistrata* Engelm.

Euphorbia hypericifolia L. var. *prostrata,* var. *multiflora,* and var. *simplex* Raf., Med. Fl. U. S. **1:** 183. 1828, *nomina nuda.*

Euphorbia ludoviciana Featherman, Ann. Rep. Geol. Surv. Louisiana **2:** 71. 1871, not Raf., Fl. Ludovic., 111. 1817. An isotype, at Gray Herbarium, of this species, shows it to be *Phyllanthus caroliniensis* Walter.

Euphorbia oregonensis Millsp. ex Seymour, Host Index Fungi N. Amer., 462. 1929. Merely listed as the host of a rust.

Euphorbia Peplis L., Sp. Pl. **1:** 455. 1753, has been found on ballast but has not become established and hence is excluded.—*Tithymalus Peplis* (L.) Scop., Fl. Carn. ed. 2, **1:** 340. 1772.—*Anisophyllum Peplis* (L.) Haw., Syn. Pl. Succ., 159. 1812.—*Chamaesyce Peplis* (L.) Prokhanov, Consp. Syst. Tithym. Asiae Mediae, 15, 1933.

Euphorbia setigerus [sic] Benth. ex Frick, Euphorbia Review **2:** 10. 1936, with brief description, is evidently a garbled account of some weedy species of *Euphorbia* inadvertently associated with the irrelevant name *Eremocarpus setigerus* Bentham. According to Frick in a letter, the account was drawn from a newspaper report.

Xamesike deltifolia Raf., Aut. Bot., 98. 1840; not recognized. Florida. Specimen at Paris according to his notes shown me by Croizat.

Xamesike glauca Raf., op. cit., 97. Perhaps a prostrate individual of *Euphorbia maculata.* Kentucky, Virginia.

[1] Published Jan. 18, 1938 according to Cory in letter filed at Gray Herbarium.

Xamesike gracilis (Elliott) Raf., op. cit. 98; based on *Euphorbia gracilis* Elliott. Belongs to *E.* subgenus *Agaloma* (including section *Tithymalopsis*).

Xamesike hypericifolia Raf. var. *sanguinolenta* Raf., l. c. Probably equals *Euphorbia maculata* L. Pennsylvania.

Xamesike hypericifolia Raf. var. *parviflora* Raf., l. c. Identity uncertain. Alabama.

Xamesike micranthes Raf., l. c. Identity uncertain. Louisiana to Alabama.

Xamesike microphyla (Raf.) Raf., l. c.; based on *Aplarina? microphyla* Raf.

Xamesike prostrata (Raf.) Raf., op. cit., 99; based on *Aplarina prostrata* Raf.

Gandoger, Fl. Europae 20: 142. 1890 has described and given binomials under *Euphorbia* sect. *Anisophyllum* to three supposedly new entities from the United States (Pennsylvania, Nebraska, and Missouri). In addition he has named (as binominals) and described a total of 10 segregates of 2 species native in the United States but introduced into Europe. It seems best to continue the custom of ignoring all names published in this work of Gandoger's. The technical nomenclatural justification for this action at least in the case of *Euphorbia* is that the first members of Gandoger's binomials under this genus were the names of the various subdivisions, in the case pertinent here, *Anisophyllum.* Also, the structure of the work indicates that the new binomials were subdivisions of species which form of nomenclature is inadmissible according to the International Rules of Botanical Nomenclature, Article 28.

List of Exsiccatae

The collectors' numbers are printed in *italics;* unnumbered collections are indicated by a dash. The numbers in parentheses are those of species and varieties treated in this revision.

Abrams, LeRoy. *1381* (25); *2661* (35a); *2952* (35b); *2990* (35a); *3187* (26b); *3789* (35b); *4097* (37); *4132* (45); *4178*, *4652* (35a); *5341* (3a).
Abrams, LeRoy, and E. A. McGregor. *206* (31).
Allen, J. A. — (36, 45).
Allison, A. *148* (13).
Anderson, A. P. *777* (45); *1537* (13).
Anderson, L. E. *4479* (13).
Andrews, L. — (14, 45).
Antisell, T. — (43).
Armer, Annie A. *5390* (30).
Arsène, G. *18987* (35a).
Arthur, J. C. *79* (13).
Ashcroft, G. B. — (13).

Baker, C. F. — (35a, 36); *195* (35a); *453* (36); *1274* (35a).
Baker, C. F., F. S. Earle & S. M. Tracy. *5* (36); *6* (47); *608* (35a).
Baker, H. P. — (7b).

Clover, E. U. *356* (5); *783* (15); *1363* (49); *1364* (30); *1475*, *1524*, *1537* (15).
Clute, W. N. *9* (32); *91* (32a); *257* (1).
Cocks, R. S. *3625* (30).
Coffman, Coral Fleenor. — (45).
Collins, F. S. — (1, 48); *981*, *1176* (45); *2872* (1).
Collins, G. N., T. H. Kearney & J. H. Kempton. *145* (22a).
Collins, J. F., & M. L. Fernald. — (14).
Collom, Mrs. Rose E. — (39); *33* (25); *314* (10).
Commerson. *238* (16b).
Commons, A. — (13, 45).
Congdon, J. W. *75* (35b).
Conklin, J. — (7b).
Constance, L., & C. D. Jacobs. *1418* (35a).
Cook, H. C. — (13).
Cooper, H. L. *111* (36).
Cory, V. L. *508* (18); *1907* (17); *1914*, *1915* (18); *1919*, *1921* (20); *1922* (4); *1926* (31); *1927* (26c); *1935* (31); *1941* (42, 47); *1942* (42); *1946*, *1949* (47); *1956* (36); *1959* (28); *1960* (33); *1964* (32b); *1966* (48); *2273* (18); *3188* (19); *3191* (32b); *3197* (48); *3201* (42); *4879* (36); *6020* (32a); *6763* (48); *6906* (39); *7005* (12); *7006*, *7329* (41a); *8729* (32a); *8898* (41a); *9264* (43); *9294* (20); *10046*, *10224*, *11547*, *11812* (45); *13130* (7b); *15295* (47); *15617* (7a); *16037*, *16313* (7b); *16617* (47); *18593B* (18); *18595*, *19308* (32a); *19310* (41a); *19317* (47); *20383* (45); *21208* (23); *22451* (45); *23954*, *24387* (41a); *24574* (45); *24700* (36); *25096* (29); *25414* (48); *25547* (30); *26319* (32a); *26452* (26c); *26701* (19); *27315* (36); *27404* (41a).
Coues, Elliott, & Ed. Palmer. *264* (25); *531* (10).
Coulter, J. M. — (35a).
Coville, F. V. *10* (30).
Coville, F. V., & F. Funston. *735* (31); *1008* (24); *1081* (3a).
Cowen, J. H. *126* (32a).
Creighton, H. B. — (31).
Croft, Mary B. *168* (48); *202* (31).
Cronemiller, F. P. *663* (35a).
Curtiss, A. H. — (16b, 29, 45, 48); *2469* (29); *2486* (15); *2496* (16a); *2496* (16b); *5395* (16a); *5849* (16b); *5959* (29); *6426* (48); *6670* (12).
Curtiss, A. W. — (45).
Cushman, J. A. — (1).
Cuthbert, A. — (13); *707* (1).
Cutler, H. C. *664* (39); *723* (26c); *2286* (4).

Daniels, F. P. — (45).
Darlington, Wm. — (13).
Davis, J. J. — (1).
Davis, John. *955* (13); *1419* (45).
Davy, J. B. *1883* (31).
Day, M. A. *42*, *87*, *376* (14).
Dayton, W. A. *486* (35a).
Deam, C. C. — (45); *5206* (1); *13935*, *18980*, *21389* (45); *23989*, *24101*, *24230*, *24270*, *24344* (46); *25691*, *26533* (45); *26597*, *26745* (46); *26793* (13); *29566*, *29862* (45); *32083* (13); *32212* (45); *32533* (14); *32671* (45); *33357* (30); *34640* (45); *37495*, *37598* (13); *37789*, *37890* (45); *38092*, *40038*, *41122*, *41514* (46); *41921* (45); *42635*, *48035* (46); *49615* (45); *50800*, *50817*, *51351*, *51438* (46); *52655*, *52954* (45); *55400*, *56707*, *57370* (36).
Deam, Mrs. Charles C. *2758* (12); *2762* (16a); *2797* (45); *28949A* (36).
Deane, G. C. — (26a).
Deane, Walter. — (1, 45).
Dearness, J. — (36).
Demaree, Delzie. *7525* (31); *8202* (45); *8239* (13); *8328* (46); *8778* (30); *9430* (13); *9582* (45); *9736* (13); *9931* (45); *10214* (12); *10788* (45); *10809*, *11097* (13); *12827* (36); *13204*, *13252* (48); *13470* (13); *13521* (45); *13729* (46); *13972*, *14104* (13); *14111* (46); *14116* (13); *15278*, *15334*, *15407* (45); *15521* (46); *15736*, *16041*, *16057*, *16298*, *16331*, *18180* (45); *18410*, *18575* (46).
Dewey, L. H. — (13, 26a, 30, 31); *40* (13).
Dick, W. M. — (1).
Dixon, R. A. *335* (29); *376* (30).
Dodge, C. K. — (1, 14); *7* (13); *83* (31); *201* (36).
Dohmen, W. A. *61* (45).
Dowell, P. *6735* (45).
Dreisbach, R. R. —, *6025* (13).
Drouet, F. — (45); *1012*, *1607* (45); *1699* (46).
Drushel, J. A. *9470* (13).
Dukes, W. C. *6* (16a); *11* (48).
Duran, Victor. *3176* (26b); *3205* (31).
Dutton, D. L. — (13).

Eames, E. H. — (1, 13, 45); *45* (1); *54* (14).
Earle, F. S. — (35a); *290* (47); *592* (20).
Earle, F. S., & E. S. Earle. *35* (45); *36* (13); *273* (35a); *279* (7b); *308* (30); *309* (31); *343* (20).
Earle, F. S., & S. M. Tracy. *104, 381* (20).
Eastwood, Alice. — (35b); *137* (4); *2766* (26a); *2773* (25); *8668* (17).
Eastwood, A., & J. T. Howell. *6292* (28); *6310* (31); *6473* (36); *6616* (32a); *6893* (31).
Eggert, H. — (7b, 20, 30, 35a, 36, 45, 46, 47, 48).
Eggleston, W. W. *1565* (14); *5246* (46); *10274* (35a); *10725* (12); *15951* (43); *15967* (25); *17352* (47); *19370* (42); *20227* (31); *20424* (47).
Ehrenberg, C. — (47).
Ellis, Charlotte C. *335* (9).
Elmer, A. D. E. *200* (35a); *602* (35a, 36).
Emig, W. H. *525* (7b); *527* (30).
Engelmann, Geo. — (36, 46); *1139* (46).
Engelmann, Henry. — (36, 7b).
Epling, C. C. & Hauch. *10008* (35a).
Evans, Walter H. *5* (31).
Evermann, B. W. *1021* (13).
Ewan, J. *4872* (31).

Farwell, Oliver A. — (35a); *235* (35a); *8756* (16a).
Fassett, N. C. *3413* (45); *10258* (36); *10287, 12574* (45); *18156* (1).
Fassett, N. C., & L. R. Wilson. *10281* (45); *14674* (1).
Fendler, A. *789* (9); *795* (35a); *796* (42); *797, 798* (47).
Fernald, M. L. — (1, 14, 45); *69* (1); *1980, 1981* (36); *1983* (14); *2733* (1); *2736* (45); *2737* (14); *2739* (45).
Fernald, M. L., E. B. Bartram & B. Long. *24085* (14).
Fernald, M. L., C. H. Bissell, C. B. Graves, B. Long & D. H. Linder. *21756* (14).
Fernald, M. L., F. K. Butters & H. St. John. *15261* (1).
Fernald, M. L., F. W. Hunnewell & B. Long. *9818* (1).
Fernald, M. L., & H. B. Jackson. *12118* (14).
Fernald, M. L., & B. Long. *5350* (1); *7510* (5); *9747* (16a); *9748* (45); *9817, 9821, 12703, 12704, 12705, 12706* (5); *12708, 12709* (46); *13994* (1); *13996* (14); *13997, 13998* (45); *17038, 18684* (1); *18687* (45).
Fernald, M. L., B. Long & A. H. Norton. *13995* (14); *13999* (45).
Fernald, M. L., B. Long & H. St. John. *7719, 7720, 7721, 7722* (1).
Fernald, M. L., B. Long & G. S. Torrey. *9822* (45).
Fernald, M. L., & A. S. Pease. *3407* (36).
Fernald, M. L., & H. St. John. *11114* (1).
Fernow, B. E. — (25).
Ferris, R. S. *8697* (22a); *8699* (39).
Ferris, R. S., & C. D. Duncan, *2698* (12); *3012* (13); *3013* (48); *3129* (15); *3353, 3422* (7b).
Ferris, R. S., & R. P. Rossbach. *9605* (26b); *9624* (22a).
Ferris, R. S., F. M. Scott & R. Bacigalupi. *3998* (27).
Fink, B. — (45); *451* (13).
Fisher, G. L. *39* (25); *74* (31); *607* (13); *37217* (7a).
Flynn, Nellie F. — (13).
Fogg, J. M., Jr. *2869* (45); *2870* (1); *5934* (13); *7753* (1); *11208* (1).
Forbes, F. F. *2315* (45).
Fosberg, F. R. *S3785* (4); *15754* (14); *15968* (45).
Fowler, J. — (1, 14).
Fredholm, A. *5138* (45); *5429, 5517* (16a); *6014* (13); *6280* (12); *6348* (16a); *6469* (45).
Frost, W. D. *347* (36).
Fuller, T. O. — (1).
Furbish, Kate. — (1, 14, 45).

Gaillardon, Anna. — (35a).
Garber, A. P. — (1, 16b).
Garrett, A. O. *R2708* (35a).
Gates, F. C. *18947* (13).
Gattinger, A. *2485* (46).
Gayle, E. E. *576* (36).
Gentry, H. S. *1119, 1148* (10); *1608* (8); *5062, 5395* (44).
Geyer, C. A. — (47).
Gilbert, F. A. *493* (45).
Gillespie, J. W. *8415* (26a); *8665* (22a); *8666* (26a).
Gillman, Henry. — (1).
Gleason, H. Allan. *1932* (45).
Gleason, H. A., & F. D. Shobe. *336* (1).
Godfrey, R. K. *6490* (1).
Goldman, E. A. *406* (31); *1162* (22a).
Goodding, L. N. *161* (7b); *257* (36); *519* (35a); *654* (31); *708* (26a); *723*

Jaeger, E. C. — (4, 26b).
Jepson, W. L. *577* (3a); *1374* (26b); *1650* (35b); *5964* (26b); *6159* (3a); *6559* (35a); *6879* (27); 7144 (3c); *7762* (35a); *10042* (45); *10112*, *10643* (35a); *11734* (31); *12379* (35a); *12475* (26a); *13924* (35b); *13925*, *13926* (3a); *13934* (35a); *15279a* (3a); *15829* (31); *15964* (35b); *15985* (35a).
Jermy, G. — (7a, 13).
Johnson, Frank W. *1132* (1).
Johnston, I. M. *1050* (26b); *3331*, *3641* (22a); *4136*, *4173* (17); *7028* (18); *7060* (33); *7061*, *7123* (47); *7135* (33); *7183*, *7196* (42); *7211*, *7240* (23); *7387* (47); *7393* (42); *7577* (23); *7673*, *7691* (42); *7694* (23); *7729* (28); *7779* (47); *7780* (43); *7851* (23); *7862* (31); *7874* (9); *7917* (39); *7925* (28); *7928* (42); *7931* (17); *7940* (42); *7954* (43); *7981* (42); *7987* (23); *7991* (31); *7995* (42); *7997* (23).
Jones, G. N. *5285* (36).
Jones, M. E. — (4, 27, 39); *292* (7b); *786* (47); *864* (35a); *1024* (36); *2855* (35a); *3201* (45); *3998* (35a); *4036* (32a); *4097* (17); *4174* (13); *4195* in part (47); *4195* in part (36); *4223* (28); *4247* (12); *4263* (10); *4342* (35a); *4720* (4); *5035*, *5178* (26a); *5467* (35a); *6044* (4); *22604* (8); *22613* (17); *22617*, *24856* (22a); *24859* (12); *24860* (26a); *24862* (10); *24877*, *24878* (26a); *26001* (31); *26013*, *26015*, *28439* (18).
Jones, W. W. *C287* (9); *288* (35a).
Joor, J. F. — (45).
Juett, J. W. — (45).

Kearney, T. H. *156* (45); *1812* (1); *2108* (13).
Kearney, T. H., & R. H. Peebles. — (26a); *9213* (39); *10140* (47); *10145* (43); *10172* (16a); *10215* (39); *10219* (28); *10395* (39); *12060* (25); *12077* (17); *12767* (42).
Kearney, T. H. & E. G. Smith. *9029* (39).
Kellogg, John H. *1845* (45).
Kelly, Junea. — (31).
Kelsey, F. D. — (36).
Kennedy, G. G. — (1, 13, 14); *9*, *10* (14).
Kennedy, P. B. *918* (3c); *1089* (31); *1945* (35a); *7076* (31).
Kennedy, P. B., & L. N. Goodding. *77* (27).
Kildahl, N. J. — (36).
Killian, O. L. *6873* (13).
Killip, E. P. *7343* (1); *31582* (15); *32209* (1).
King, Alice. — (35a).
Kittredge, Elsie M. — (36).
Knight, Elizabeth G., — (1).
Knowlton, C. H. — (1, 14, 36, 45).
Knowlton, F. H. — (13); *159* (35a).
Kramer, Joseph. *152* (7b).
Krause, O. — (45).
Kreager, F. O. *461* (36).
Kuntze, Otto. *23263* (31).

Lakela, Olga. *1563* (36); *2118* (35a).
Lansing, O. E., Jr. *1636* (45); *2502* (48); *2780*, *3339* (13); *3359* (1); *3494*, *4020*, *4028* (13).
Lansing, O. E., Jr. & E. E. Sherff. *5* (45).
Lapham, I. A. — (1).
Larsen, E. L. *425*, *1044* (1).
Laybourn, W. A. *48* (36).
Lea, T. G. — (13).
Ledman, O. S. — (45).
Leeds, B. — (16a).
Leiberg, J. B. *1317* (35a); *3374*, *5573* (31); *5969* (9).
Leibelsperger, W. H. *52* (45).
Leland, George H. — (45).
Lemmon, J. G. *39* (35a); *283* (22a); *454* (43); *469* (10); *2875* (16a); *3112* (17).
Leo, Thomas G. — (46).
Letterman, G. W. — (13).
Lewis, I. F. *164* (5).
Lewton, F. L. — (5, 29).
Lighthipe, L. H. — (13); *427* (5).
Lillis, S. C. — (3a).
Lindheimer, F. — (7a, 19, 45, 48); *104* (32a); *186* (7a); *293*, *294* (41a); *300 Fasc. III* (30); *308* (41a); *429* (19); *508* (41a); *533 Fasc. III* (48); *693* (30); *1148*, *1149* (41a).
Link, E. L. — (45).
Lippincott, C. D. *98* (13).
Lloyd, C. E. — (9); *457* (17); *458* (31); *459* (43); *463* (10).
Lloyd, C. G. *2485* (46).
Lloyd, F. E. — (13, 35a); *209* (42).
Lloyd, F. E., & S. M. Tracy. *207* (5); *208* (29); *213* (12); *214* (5).
Long, B. *4601* (45); *15194*, *17121*, *19622* (13); *26754* (45); *32522* (13); *38946*, *51184*, *51420* (45); *51421* (14).
Long, C. A. E. *74* (1).

(12); *1058* (45); *1070* (29); *2448* (5); *2519* (13).
Neally, G. C. — (29); *221* (31); *222* (48); *719* (18).
Nelson, Aven. *2573* (36); *2727* (47); *2743, 8133* (35a); *11216* (25).
Nelson, A. & R. *1709, 1955* (25); *2048* (32a).
Nelson, E. W. *6455* (4).
Nevin, J. C. — (35b).
Newlon, L. M. *312* (26a); *584* (31); *699* (22a).
Newman, W. H. — (30).
Nieuwland, J. A. *11736* (45).
Northrop, Alice R. — (1).
Northrop, J. I. — (35a).
Norton, J. B. S. — (13); *467, 468* (7a); *469* (30); *470* (36); *471* (45); *472* (47); *473* (13).
Nuttall, T. — (1, 7a).
Nye, H. A. — (14).

Ogden, H. V. *7* (45).
O'Neill, Hugh. — (16a); *458* (12).
Oosting, H. J. *34403* (13).
Orcutt, C. R. *765* (18); *2196* (25); *6040* (19); *6074* (45).
Osterhout, Geo. E. *2345* (30); *2369* (36).
Otis, J. P. — (45).
Over, W. H. *6131* (30).
Owens, J. G. — (4).
Ownbey, Marion. *1350* (7b).
Oyster, J. H. — (46); *2469* (30); *7306* (7a).

Painter, J. H. *1027* (13).
Palmer, Ed. — (12, 18, 19, 35b); *15* (31); *20* (11); *42* (31); *43* (47); *68* (8); *83* (17); *92* (31); *142* (17); *183* (11); *186, 187* (37); *209* (10); *210* (17); *215* (22b); *237* (10); *296* (31); *299* (47); *317* (17); *319* in 1887 (11); *319* in 1904 (47); *320* (42); *321* (39); *370, 376* (17); *443* (32a); *489* (47); *499* (1); *451* (35b); *501* (42); *509* (31); *532* (42); *548* (23); *567* (47); *627* (22b); *640* (10); *783* (25); *835* (22a); *899* (35a); *1191* (30); *1196* (48); *1197* (23); *1198* (45); *1201* (36); *1202* (45); *1204* (23); *1206* (43); *1207* (31); *1211* (17); *1212* (29); *1517* (17); *2047* (36); *2721* (31).
Palmer, E. J. *1203* (32a); *4261* (13); *6333, 6379, 6426* (7a); *8729* (13); *10228* (18); *10285* (7b); *10287* (19); *10310* (20); *10406* (7a); *10984a* (18); *12096* (48); *12832* (7a); *14542* (7b); *33618* (18); *33786* (31); *34199* (17); *34207* (26c); *41860* (36); *41887* (7b).
Pammel, L. H. — (35a); *190* (36); *192* (30); *193, 620* (36).
Pammel, L. H., & C. R. Ball. *191* (36).
Pammel, L. H., & R. E. Blackwood. *3911* (36).
Pammel, L. H. & Violet. *34* (45).
Parish, S. B. *8301* (28); *8302, 8305* (37); *9608* (26a); *9882, 10138, 10190, 10217* (27); *10375* (3c).
Parish, S. B. & W. F. *672* (35a); *1370* (3c); *1384* (39).
Parker, C. F. — (30).
Parlin, J. C. — (36); *52* (14).
Parry, C. C., & Ed. Palmer. *817½* (47).
Parry, C. C., J. M. Bigelow, Charles Wright & A. Schott. — (18, 31).
Payson, E. B. *119* (32a); *510* (36); *2320* (32a).
Pease, A. S. *2716* (1); *4704* (45); *9858* (1); *11616, 14104* (45); *14469* (14); *16591, 18138* (36); *19128, 23971, 25316, 25345* (14); *26455* (16b).
Pease, A. S., & R. C. Bean. *23435* (36).
Pease, A. S., & M. Hopkins. *24006* (14).
Peck, M. E. *9562, 13656* (35a); *18612* (36).
Peebles, R. H. *5000* (28); *5834* (37); *6420* (26a); *6493* (17); *9599* (4); *10595* (37).
Peebles, R. H., & H. J. Fulton. *11446* (17).
Peebles, R. H., & G. J. Harrison. *4692* (12); *5021* (22a).
Peebles, R. H., G. J. Harrison & T. H. Kearney. *83* (37); *224* (12); *2461* (26a); *2773* (10); *3685* (39); 4576 (28); *4589* (9); *4590* (12); *4653* (16a); *4909* (22a); *4976* (28); *5564* (47); *5565* (35a); *5628* (22a).
Peebles, R. H., & T. H. Kearney. *264* (48); *10836* (25); *10939* (22a).
Peebles, R. H., & F. H. Loomis. *6755* (39).
Penard, E. *301* (7b).
Pendleton, R. L. *1398* (35a).
Pennell, F. W. *2214* (1); *4042* (13); *7459* (45); *8282* (13); *14815* (28); *17570* (23); *18991, 19477* (31); *19730* (8); *20214* (22a).
Perkins, C. E. — (14)
Perry, R. C. — (13)

Peirson, F. W. *4256* (39); *12599* (36).
Peterson, Alfred. — (35a, 45).
Petersen, N. F. — (47).
Phelps, O. P. *635* (14); *636* (45).
Pieters, A. J. — (13, 45).
Pilsbry, H. A. — (39, 47).
Pitard, C. J. — (1).
Plank, E. N. — (18, 30, 46, 48).
Plateau, E. *5447* (41a).
Plitt, C. C. *857* (1).
Pollard, C. L. — (13); *92* (7b); *648* (13); *1155* (45).
Pollard, C. L., G. N. Collins & E. L. Morris. *126* (15).
Pollock, W. M. — (13).
Porter, T. C. — (1, 13).
Pretz, H. W. *4842* (45); *11116* (13).
Pringle, C. G. — (3a, 8, 9, 10, 12, 17, 26a, 31, 37, 39); *80* (47); *81*, *286* (35a); *326* (43); *327* (47); *699* (17); *799* (42); *999* (9); *2074*, *3747* (49); *8278* (18).
Purpus, C. A. *4512* (33); *4599* (39); *5473* (24); *6187* (3c); *6437* (28).

Ramaley, F. & J. Ewan. *16325* (7b).
Rand, Ed. L. — (45).
Randolph, Fannie R. *135* (16b).
Randolph, L. F. & Fannie R. *827*, *989* (45).
Rattan, Volney. *57* (3b).
Raup, H. M., & C. A. Weatherby. *565* (14).
Ravenel, H. W. — (13, 29, 45).
Reed, E. L. *3005* (30).
Reed, F. M. — (25)
Rehder, A. — (36).
Reverchon, J. — (20, 36, 48); *Curtiss North Amer. Pl. 2478** (32a); *Curtiss North Amer. Pl. 2498** (13); *135* (18); *765* (36); *1345*, *1353* (18); *1355* (20); *3787* (30); *3789* (36); *3797*, *3799* (7b).
Rich, W. P. — (1).
Richardson. — (36).
Rickett. *1134* (46).
Ricksecker, Alfred E. — (13); *81* (36).
Riddell & Carpenter. — (30).
Ridgway, R. *3133* (45); *3260* (13).
Riehl. *472* (36).
Roberts, T. S. — (45).
Robbins. *10* (48).
Robinson, B. L. *97* (14); *229* (13); *237* (48); *489*, *539* (45); *578*, *616*, *851* (14).
Robinson, C. B. *187* (1).
Rockwell, Ethel. *300* (26a).
Rollins, R. C. *1699* (32a); *1874* (35a); *1876* (47).
Rollins, R. C., & T. S. Chambers. *2761* (42); *2770* (26c).
Rose, J. N. *16696* (39).
Rose, J. N., & Wm. R. Fitch. *17011* (30); *17086* (47); *17099* (7b); *17620* (36); *17638*, *17699* (9).
Rose, J. N., J. H. Painter & J. S. Rose. *9611* (35a).
Rose, J. N., & P. G. Russell. *24111* (41a).
Rose, J. N., P. C. Standley & P. G. Russell. *12728* (16a); *12935* (31); *13276* (22a); *13541* (37); *14934*, *15074* (31).
Rose, L. N. *34521* (25).
Rosendahl, C. O. *2332* (45); *4177* (7b).
Rotchslein, David. — (45).
Rothrock, J. T. — (45); *339* (4); *672* (14).
Runyon, Robert. *1495* (13); *2541* (49).
Rusby, H. H. — (4); *317* (17); *378½* (30); *380* (31); *822* (17); *827* (4).
Ruth, Albert. *686* (29); *2498* (13).
Rydberg, P. A. — (7b); *77*, *197* (36); *353* (7b); *355* (36); *356* (35a); *992* (36); *1372* (7b); *1373*, *1742* (36); *8223* (13).
Rydberg, P. A., & A. O. Garrett. *8382* (32a); *9896* (28); *9897* (36)
Rydberg, P. A., & R. Imler. *662* (7); *747*, *919* (7b); *944* (20); *1065*, *1153* (47); *1193* (30); *1244* (47); *1252* (36).

Safford, W. E. *233* (1); *1247* (23).
St. John, H. *787*, *2787*, *2788* (1).
Sandberg, J. H. — (13); *888* (36).
Sandberg, J. H., J. B. Leiberg. *472* (36).
Sanford, S. N. F. *10384* (1).
Schaffner, J. G. *855* (43).
Schellenger, E. E. *78* (31).
Schoenfeldt, L. *2896* (31).
Schott, A. — (11, 39).
Schuette, J. H. — (36).
Schulz, E. D. *301* (35a); *720* (13).
Scully, F. J. *284* (45).
Seymour, F. C. *2009* (14).
Shantz, H. L. — (47).
Shaw, C. H. *1146* (36).
Shear, C. L. — (13); *119* (47); *126* (7b); *176* (30); *183* (36).
Sheldon, Chas. S. — (7a, 36).
Sheldon, E. P. *917*, *1285* (35a); *1557*

(36); *1560* (45); *1658*, *5966*, *8114* (36); *8630*, *S11309* (35a).
Sheldon, J. L. *514* (45).
Sherff, Earle E. — (1).
Short, C. W. — (1).
Shrevə, F. — (4); *5154* (25); *5354* (26a); *6320*, *6375* (8); *7096* (17); *7922* (4); *8820* (42).
Skehan, J. *51* (47); *71* (35a); *118* (9).
Simpson, J. H. — (16a); *310*, *388* (15); *505* (16b).
Singer, J. W. *353* (13).
Singleton, J. R. *213* (13).
Small, J. K. *2113* (5); *4036* (15).
Small, J. K., & J. J. Carter. *644*, *3209* (15).
Small, J. K., J. J. Carter & G. K. Small. *3627* (15).
Small, J. K., & C. A. Mosier. *5699* (15).
Small, J. K., C. A. Mosier & G. K. Small. *6800* (12).
Small, J. K. & E. W. *5869* (5).
Small, J. K. & G. K. *4556*, *4580* (45); *4619* (15); *4694* (16b).
Small, J. K., J. W. Small & J. B. DeWinkeler. *10568* (48); *11470* (29).
Small, J. K., & E. T. Wherry. *12047* (20).
Smart. — (11).
Smith, B. H. *81* (35a).
Smith, H. H. *5979* (45).
Smith, J. D. — (13).
Smith, L. B. *2496* (45).
Smith, Uselma C. — (13).
Smyth, B. B. *45* (7b).
Somes, M. P. *3569* (13); *3841* (30).
Spencer, Mary F. — (26b, 35b); *552* (31); *964* (35a); *970* (35b); *970* (45).
Sperry, Omer E. *T243* (13); *T244* (12); *449* (23); *450* (12); *1358* (26c); *1464* (28).
Stabler, L. M. — (1).
Standley, Jeannette P. *307* (12).
Standley, P. C. *4939* (47); *5054* (35a); *7053* (42); *7371* (36); *7499* (35a); *12656* (12); *40287* (18); *40295* (31); *40362* (7b); *40397* (42).
Standley, P. C., & H. C. Bollman. *12243* (13).
Stanfield, S. W. — (7a, 19, 29, 41a).
Stearns, Elmer. — (4); *245* (39).
Steele, E. S. & Mrs. *37* (13).
Steele, E. S., & H. S. Pratt. — (25).
Stephenson, Mary R. *191* (30).
Stevens, G. W. *308*, *350* (32a); *622* (7b); *833* (48); *834* (30); *835* (47); *1054* (45); *1055* (36); *1105* (31); *1334.1* (45); *1602* (47); *1603* (45); *1604* (30); *1640* (48); *1641*, *1779* (36); *1798* (13); *1863* (30); *1864* (48); *1917½* (13); *2170* (45); *2182* (46); *2307* (45); *2309* (46); *2344* (7a); *2584* (45); *2960* (7a); *3277* (36).
Stevens, O. A. *290*, *384* (36).
Stevens, W. C. — (13, 30).
Steyermark, J. A. *506* (45); *8843* (46); *13925* (45); *13931*, *14085*, *15910* (46); *15972* (7a); *19543* (45); *19642* (7a); *19716*, *19867*, *20281* (46); *24316* (30); *24317* (46).
Stone, Mrs. Frederick M. *373* (31).
Stone, Witmer. — (45, 13); *1077A* (45).
Stratton, R. *206* (7a); *441* (20); *448* (35a); *459* (47); *656* (7b).
Stuart, Robbie. *147* (7b).
Sudworth, G. B. — (36).
Suksdorf, W. N. *86* (36); *489* (36); *12327* (13).
Sullivant, W. S. — (1).
Svenson, H. K. *137* (45); *139* (13).
Swingle, D. B. — (35a).

Taylor, B. C. *784*, *1568* (36).
Templeton, B. *1632* (39).
Thackery, F. A. *83* (25).
Tharp, B. C. *881*, *1180*, *1416* (30); *2854* (7a); *3557* (42); *4427* (31); *6013* (19).
Thompson, C. H. *2* (36); *60* (7b).
Thompson, J. W. *3749* (36); *11122*, *11891* (35a).
Thornber, J. J. — (13, 36, 45, 47); *47* (42); *136* (10); *209* (12); *341* (28); *342* (37); *7111*, *9055* (47); *9141* (11).
Thurber, Geo. — (18, 20); *98* (31); *731* (47); *749* (31); *963* (43).
Thuron, F. W. *4* (30).
Tidestrom, I. *802* (22a); *6902* (13); *7028* (12); *7460* (13).
Tolstead, W. L. — (7b); *621*, *806* (36).
Torrey, J. *478* (35a).
Toumey, J. W. — (12, 31, 48); *260* (22a); *261* (42); *263* (26a); *266* (35a).
Townsend, C. H., & C. M. Barber. *284* (9).
Tracy, Joseph P. *6555* (35a).
Tracy, S. M. *154* (32a); *437* (31); *2913* (45); *3125* (30); *4710* (29); *4717* (5); *6370* (29); *6376* (5);

7429, *7432* (13); *7435* (30); *7436* (45); *7842* (13); *7844* (30); *7852* (32a); *7858* (45, 48); *7861* (36); *8119* (13); *8121* (7b); *8124* (7a); *8127* (30); *8167* (48); *8168* (7a); *8169* (47); *8170* (30); *8477a* (45); *8953*, *8987* (17); *9018* (13); *9115* (16b); *9123*, *9124* (48); *9125* (31); *9127* (15).
Tracy, S. M., & Earle. *2882* (5).
Tracy & Lloyd. *209* (45).
Train, Percy. *676* (31); *1875* (4).
Trelease, William. — (36, 45); *873*, *874*, *877*, *878*, *880*, *1178* (13).
Trueman, H. — (1).
Turner, G. H. *66* (36).
Tweedy, Frank. *258* (19); *268* (31); *368* (36); *5057* (35a); *5058* (36).

Umbach, L. M. —, *1917* (1); *2313* (36); *2315* (45).
Underwood, L. M., & A. D. Selby. *156* (35a); *240* (36).

Vasey, Geo. R. — (1, 13, 20, 26b, 36); *574* (31); *576* (35b); *577* (3a).
Visher, S. S. *2022* (36); *2359* (35a); *4103* (13).

Wadmond, S. C. *2943* (45).
Waldron, C. H. — (45).
Walker, Harriet A. *910* (35a).
Wallace, E. J. — (7b, 30, 36); *121* (36).
Wann, F. B. *27* (31).
Ward, L. F. — (13, 30).
Ware, Robt. A. *4138* (45).
Ware, R. A., R. W. Woodward & E. B. Harger. — (45).
Warner, S. R. — (13).
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Weatherby, C. A. & U. F. *5700* (1).
Weatherby, C. A., & J. F. Collins. — (1).
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Webber, H. J. *2* (7b); *7* (36); *11* (7b); *26* (12).
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Wheeler, L. C. *1330*, *3652* (45); *4041* (3b).
Wheeler, W. A. *336* (13); *430* (45); *434* (36).
Wheeler, W. H. *296* (45).
Whetzel, H. M. *12388* (14).
White, D. *296* (1).
White, Mark. — (7, 36).
White, Stephen. *1145* (45).
Whitehouse, Eula. *502* (20).
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Wiegand, K. M., B. Maguire, B. L. Richards, Jr. & T. Moeller. *10761* (39); *10778* (17).
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Wiegand, K. M., & G. B. Upton. *3748* (25).
Wiggins, I. L. *4357* (25); *4364* (22a); *5915* (25); *5967* (22a); *6124* (10); *6125*, *6311* (22a).
Wiggins, I. L., & D. Demaree. *5020* (35a).
Wiggins, I. L., & J. W. Gillespie. *4141* (31).
Wilcox, T. E. *320* (12); *328* (35a).
Wilkinson, E. H. *52* (48); *56* (13).
Williams, E. F. — (1).
Williams, R. S. *160* (30).
Williams, T. A. — (7b, 13, 30, 35a).
Williamson, C. S. — (29, 30, 1); *2418* (1).
Williamson, Mrs. W. J. *242* (13).
Wilson, Guy. *27* (13).
Wislizenus, A. *464* (7b).
Wislizenus, F. *377* (13).
Wolf, C. B. *2300* (26a); 2321 (35a).
Wolf, J. — (30).
Woodward, R. W. — (13, 14, 1, 45).
Wooton, E. O. — (9, 12, 13, 14, 26a, 28, 30, 39, 42, 43); *75* (31); *346* (9); *349* (4); *425*, *608* (35a); *609* (12).
Wooton, E. O., & P. C. Standley. — (9); *3273* (47); *3617* (31).
Wright, C. — (7a, 18, 41a, 41b); *186* (17); *652*, *657* (18); *658* (42); *1739* (18); *1828* (19); *1829* (10); *1832* (11); *1839*, *1840* (18); *1841* (20); *1842* (16a); *1842* (13); *1843*, *1844* (42); *1845* (43); *1848* (32a, 22a); *1849* (17); *1853* (36); *1854* (28); *1855* (36).
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Wyatt, S., & M. Franklin. — (1).
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Young, Mary S. *139* (26c); *50* (41a).
Young, H. A. — (45).
Zuck, Myrtle. — (28, 36).
Zundel, G. L. *242* (36).

Explanation of Plates 654–668

Note: In plates 654–655A, 656–663 and 667 the various structures are arranged under the following uniform system of numbers for each species: 1, habit of branch; 2, cyathium with mature capsule; 3, capsule viewed from the stylar end; 4, glands, and appendages if present, viewed from above; 5, styles; 6, basal view of seed, raphe up; 7, lateral view of seed, micropyle up, raphe on left; 8, "radial" view of seed with raphe toward the observer and micropyle up; 9, leaf; 10, node showing stipules.

Plate 654. A. Euphorbia polygonifolia L., from Massachusetts, *G. G. Kennedy*, Aug. 24, 1904 (G). B. E. ammannioides HBK., from Florida, *J. A. Harris C17205* (G). C. E. Geyeri Engelm., from Illinois, *Gleason*, Aug. 18, 1904 (G). D. E. Parryi Engelm., from Utah, *Maguire & Redd 1958* (I).

Plate 655. A. Euphorbia thymifolia L., from Tamaulipas, Mexico, *Ed. Palmer 572* in 1910 (M 778646). Figures in same order as in first ten plates. B. 1, diagram of type of habit usual in Euphorbia subgenus Esula and sometimes occurring in subgenus Agaloma; 2, diagram of apparent habit of growth of E. gracillima and revoluta; 3, diagram of branch of E. maculata; 4, diagram of species such as E. supina; 5, diagram of cross-section of cyathium cut just below the intervals between the glands and the lobes: a, interval of reduced 5th gland; b, silhouette of gland to show its position; c, silhouette of appendage; 4, pedicels of staminate flowers (androphores); e, pedicel of pistillate flower (gynophore); f, bracteoles; g, involucre; 6, diagram of involucre spread out flat: a, 5th gland; b, sinus; c, gland; d, lobe; 7, diagrammatic cross-section of capsule; a, carpel; b, testa.

Plate 656. A. Euphorbia vermiculata Raf., from New York, *Stewart H. Burnham*, Aug. 3, 1914 (G). B. E. maculata L., from Indiana, *Deam 32083* (G). C. E. glomerifera (Millsp.) L. C. Wheeler, from British Honduras, *Lundell 1841* (G). D. E. hyssopifolia L., from Arizona, *M. E. Jones 28751* (M 1013009).

Plate 657. A. Euphorbia hirta L. var. typica, from Tamaulipas, Mexico, *Ed. Palmer 6* in 1910 (G). B. E. capitellata Engelm., from Arizona, *Maguire, Richards & Moeller 11699* (G). C. E. serpyllifolia Pers. var. genuina, fig. 1 from "authentic specimen", apparently from herb. Thibaut (M 200327); figs. 2–9 from New Mexico, *A. Nelson 11638* (G). D. E. polycarpa Benth. var. typica, from California, *G. C. Deane*, Apr. 30, 1883 (G.).

Plate 658. A. Euphorbia cordifolia Ell., from Texas, *Ed. Palmer 1212* in 1879 (G). B. E. Parishii Greene, from California, *Parish 10217* (J). C. E. micromera Boiss., from Arizona, *Peebles, Harrison & Kearney 4576* (US). D. E. serrula Engelm., from Coahuila, *I. M. Johnson 7673* (G).

Plate 659. A. Euphorbia angusta Engelm., from Texas, *Cory 3188* (G). B. E. acuta Engelm., from Texas, *Cory 508* (G). C. E. lata Engelm., from Texas, *Cory 1919* (G). D. E. villifera Scheele var. typica (vesture omitted), from Texas, *Cory 7006* (G).

PLATE 660. A. EUPHORBIA THERIACA sp. nov., from the TYPE from Texas, *Mueller 8080* (G). B. E. GLYPTOSPERMA Engelm., from Nebraska, *Tolstead 621* (G). C. E. CHAMAESYCE L., from Texas, *Cory 6763* (G). D. E. ABRAMSIANA L. C. Wheeler, from the TYPE collection from California, *Abrams 4097*, fig. 1 (G), figs. 2–9 (Ph).

PLATE 661. A. EUPHORBIA SETILOBA Engelm., from Arizona, *M. E. Jones 24880* (G). B. E. ARIZONICA Engelm., from Arizona, *Maguire, Richards & Moeller 11780* (G). C. E. SERPENS HBK., from Texas, *Cory 25547* (G). D. E. ALBOMARGINATA T. & G., from Nevada, *Eastwood & Howell 6310* (G.)

PLATE 662. A. EUPHORBIA LAREDANA Millsp., from Texas, *Pringle 3747* (G). B. E. STICTOSPORA Engelm. from Nebraska, *Bates*, July 22, 1904 (G). C. E. HUMISTRATA Engelm. from Kentucky, *Eggleston 5246* (M 149855). D. E. SUPINA Raf. from New York, *Phelps 636* (G).

PLATE 663. A. EUPHORBIA MELANADENIA Torr., from California, *M. E. Jones*, Mar. 16, 1926 (G). B. E. CINERASCENS Engelm., from Texas, *Moore & Steyermark 3266* (G). C. E. VALLIS-MORTAE (Millsp.) Howell, from California, *Purpus 5473* (G). D. E. INDIVISA (Engelm.) Tidestrom, from Arizona, *Harrison & Kearney 6028* (G).

PLATE 664. A. EUPHORBIA GOLONDRINA L. C. Wheeler, from photograph and fragments of the TYPE from Texas, *Warnock 998* (G): 1, branch; 2, cyathium with mature capsule; 3, glands and appendages from above; 4, capsule viewed from stylar end; 5, basal view of seed, raphe up; 6, lateral view of seed, micropyle up, raphe on right; 7, raphal side of seed, micropyle up; 8, young pistillate flower. B. E. HOOVERI L. C. Wheeler, from California, *Hoover 2583* (G): 1, branch; 2, cyathium with mature capsule; 3, cyathium viewed from above, capsule omitted; 4, capsule viewed from stylar end; 5, seed, basal view, raphe up; 6, lateral view of seed, raphe on right, micropyle up; 7, raphal view of seed, micropyle up; 8, node showing stipules and leaf; 9, involucre opened, inside view. C. E. PEDICULIFERA Engelm. figs. 1–9 var. TYPICA, from Arizona, *Maguire, Richards & Moeller 10834* (G); figs. 10–11 var. LINEARIFOLIA S. Wats., from the TYPE, Sonora, Mexico, *Ed. Palmer 215* in 1887 (G): 1, branch; 2, cyathium with mature capsule; 3, glands and appendages from above; 4, capsule viewed from stylar end; 5, seed, basal view, raphe up; 6, lateral view of seed, raphe on right, micropyle up; 7, raphal view of seed, micropyle up; 8, styles; 9, leaf; 10, branch; 11, leaf.

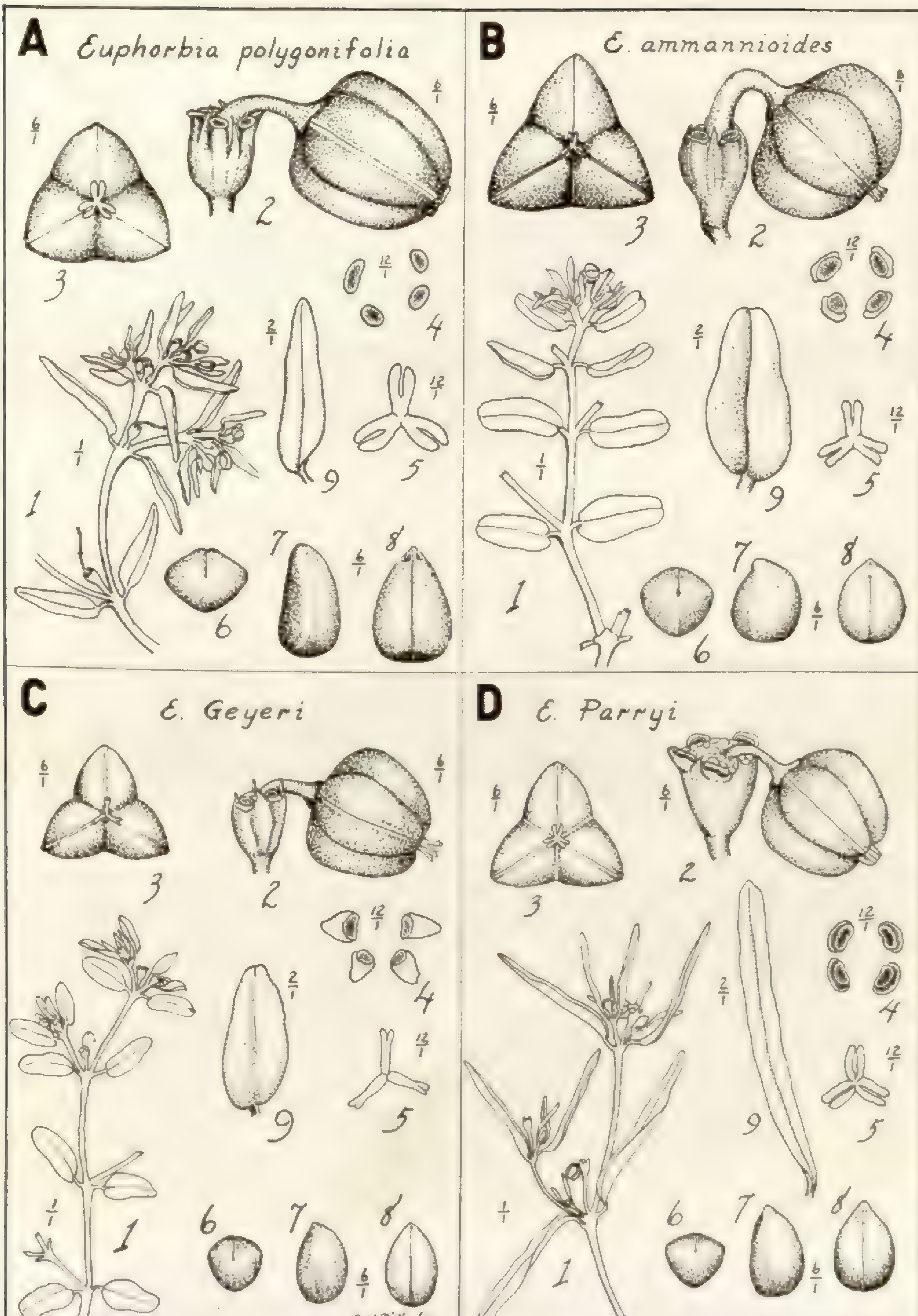
PLATE 665. A. EUPHORBIA OCELLATA D. & H. var. TYPICA, from California, fig. 1 from "C. E. J." (G); figs. 2–7 from *J. T. Howell 8168* (G): 1, branch with typical large leaves; 2, branch with narrow late-season (Nov.) leaves; 3, capsule, stylar view; 4, glands from above; 5, cyathium with mature capsule; 6, seed, raphal view, micropyle up; 7, seed, lateral view, raphe on left, micropyle up; 8, diagram of cross-section of seed. B. E. OCELLATA D. & H. var. RATTANII (S. Wats.) L. C. Wheeler, from the TYPE from California, *Rattan 57* (G): 1, branch; 2, glands and appendages from above. C. E. OCELLATA D. & H. var. ARENICOLA (Parish) Jepson, from ISOTYPE from California, *Parish 1370* (G): 1, branch. D. E. PLATYSPERMA Engelm., from TYPE collection from Arizona, *Ed. Palmer* in 1869, figs. 1–4 (US 58628), figs. 5–7 (G): 1, branch; 2, cyathium with half-grown capsule; 3, cyathium from above, capsule omitted; 4, styles; 5, diagram of cross-section of seed; 6, seed, lateral view, raphe on left, micropyle up; 7, seed, raphal view, micropyle up.

E. E. incerta *T. S. Brandegee*, from Revillagigedo Islands, Baja California, Mexico, *Anthony 399* (G): 1, branch; 2, styles; 3, capsule viewed from stylar end; 4, cyathium with mature capsule; 5, cyathium from above, capsule omitted; 6, seed, lateral view, raphe on left, micropyle up; 7, seed, raphal view, micropyle up; 8, diagram of cross-section of seed. (This extra-limital species included because of its close relation to *E. ammannioides* and *polygonifolia*).

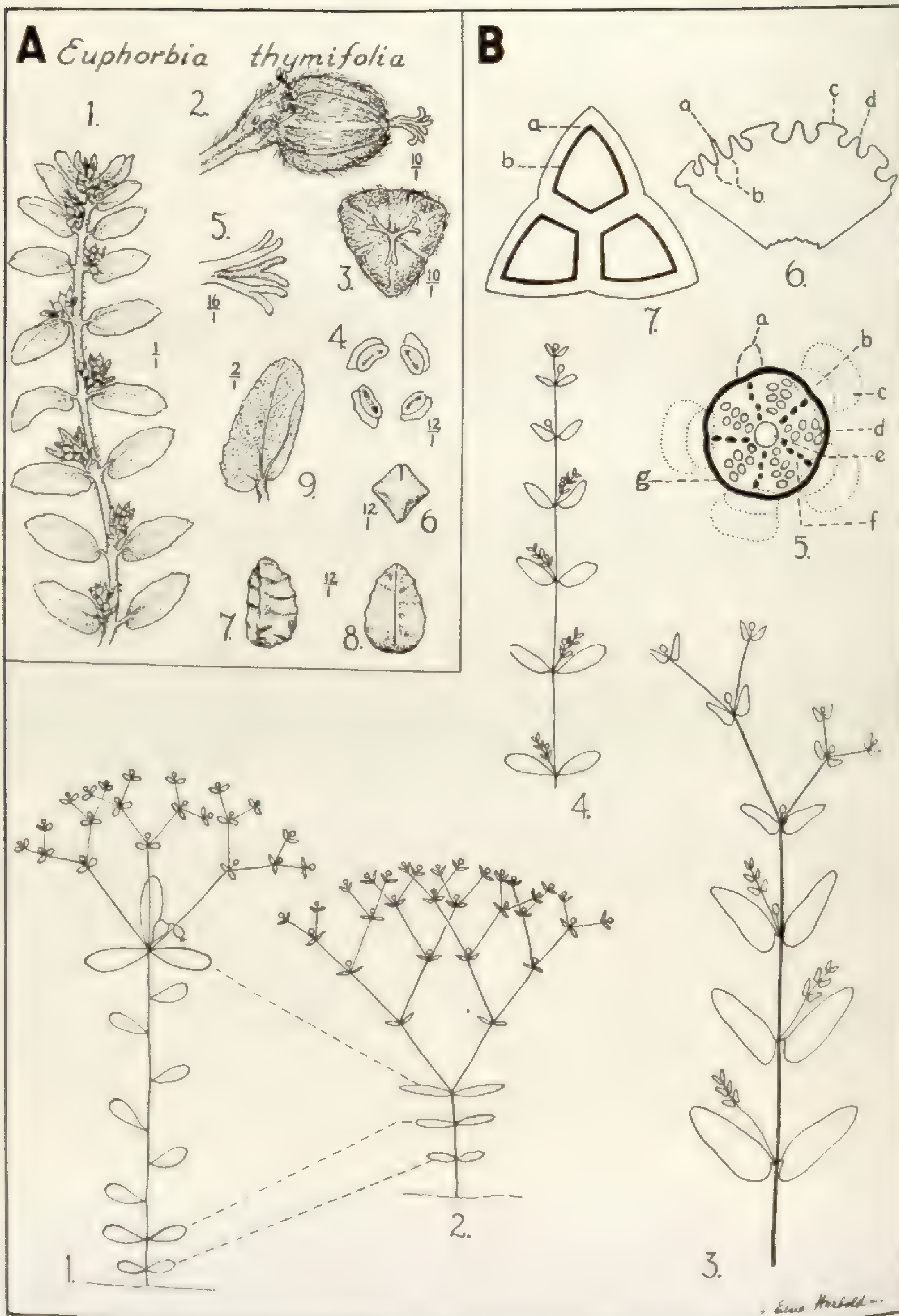
Plate 666. A. Euphorbia astyla Engelm., from Texas, *Cory 1960* (G): 1, branch; 2, node with leaves; 3, young pistillate flower; 4, cyathium with mature capsule; 5, glands and appendages from above; 6, diagram of cross-section of seed, raphe up; 7, seed, lateral view, raphe on left, micropyle up; 8, raphal view of seed, micropyle up; 9, capsule, stylar view showing entire styles. B. E. missurica Raf. var. typica, from Missouri, *Bush 737A* (G): figures in standard order as in first ten plates. C. E. Fendleri T. & G. var. typica, figs. 1–7 from Texas, *Cory 8729* (G); fig. 8 from Nevada, *Clokey 7578* (G); fig. 9 from Nevada, *Clokey 7183* (G): 1, branch; 2, glands and appendages from above; 3, cyathium with mature capsule; 4, seed, lateral view, raphe on left, micropyle up; 5, raphal view of seed, micropyle up; 6, diagram of cross section of seed, raphe down; 7, stylar view of capsule; 8, node with whorl of 3 leaves; 9, node with whorl of 5 leaves. D. E. Fendleri T. & G. var. chaetocalyx Boiss., from Texas, *Cory 1964* (G): 1, branch; 2, glands and appendages from above. E. E. Fendleri T. & G. var. triligulata L. C. Wheeler, from Texas, *Moore & Steyermark 3444* (G): 1, branch; 2, glands and appendages from above.

Plate 667. A. Euphorbia gracillima S. Wats., from Arizona, *Harrison 8142* (US 1530966). B. E. revoluta Engelm., from Chihuahua, *I. M. Johnston 7874* (G). C. E. florida Engelm., from Arizona, *Harrison & Kearney 8943* (US 1566544). D. E. trachysperma Engelm., figs. 1–4 from Arizona, *Ed. Palmer 20* in 1869 (US 58604); figs. 6–8 from Arizona, *Wright 1832* (G).

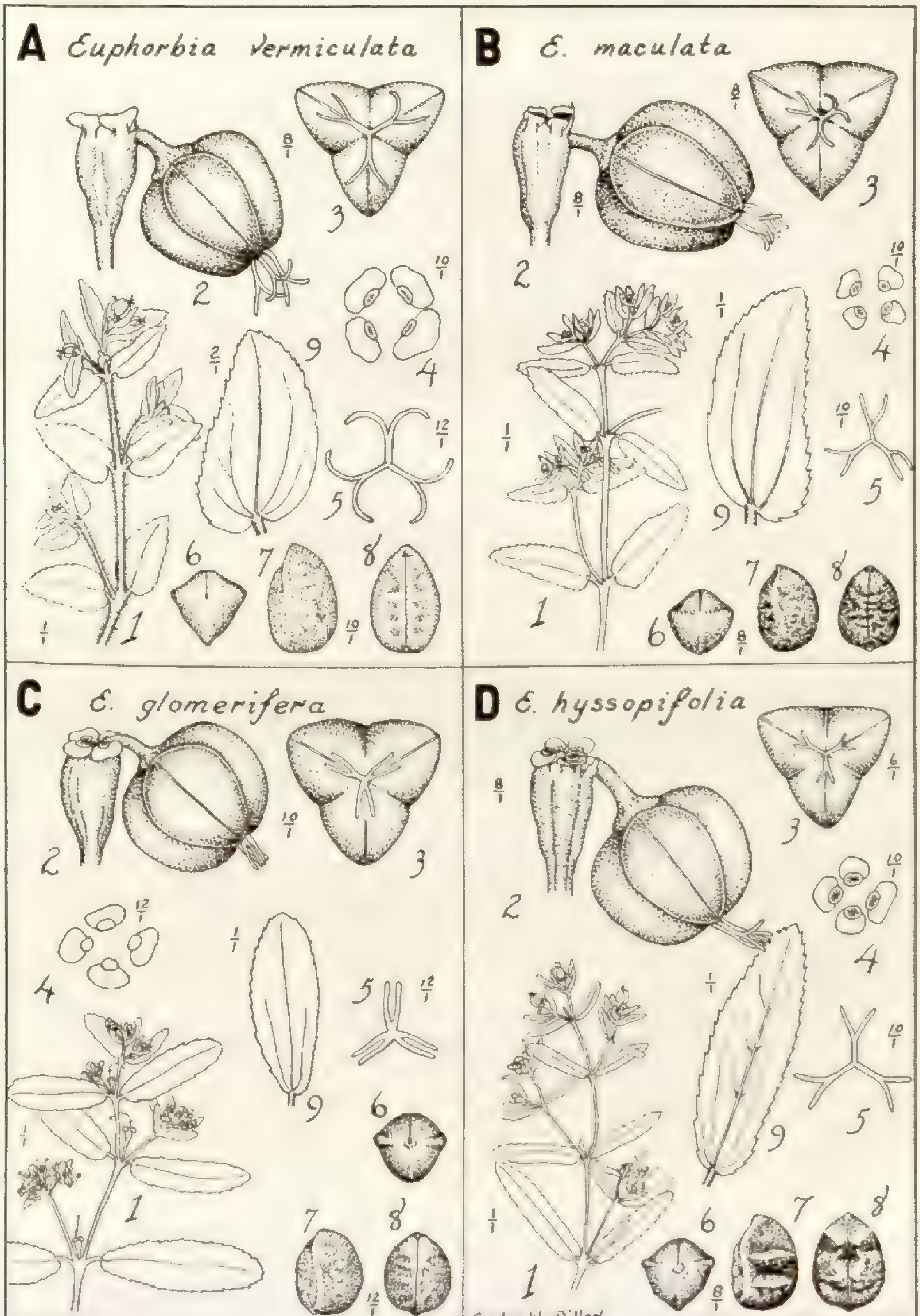
Plate 668. A. Euphorbia Chamaesyce L. Photograph of type from Jamaica, *P. Browne* (Linnaean Herb.). B. E. maculata L. Photograph of type, source and collector unknown (Linnaean Herb.)—Photographs courtesy of Section of Photography, Field Museum of Natural History.



Wheeler on Euphorbia



WHEELER on EUPHORBIA



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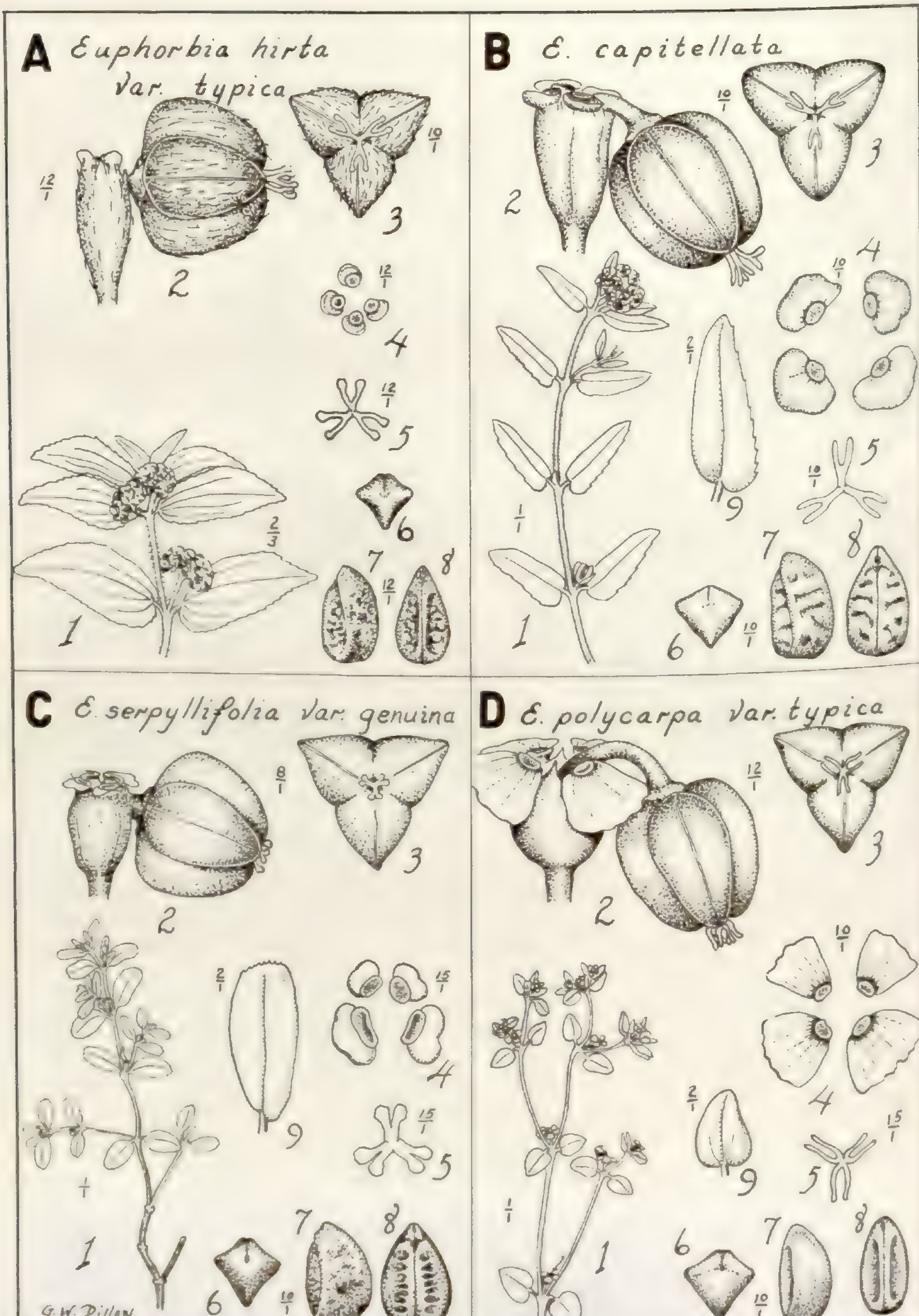

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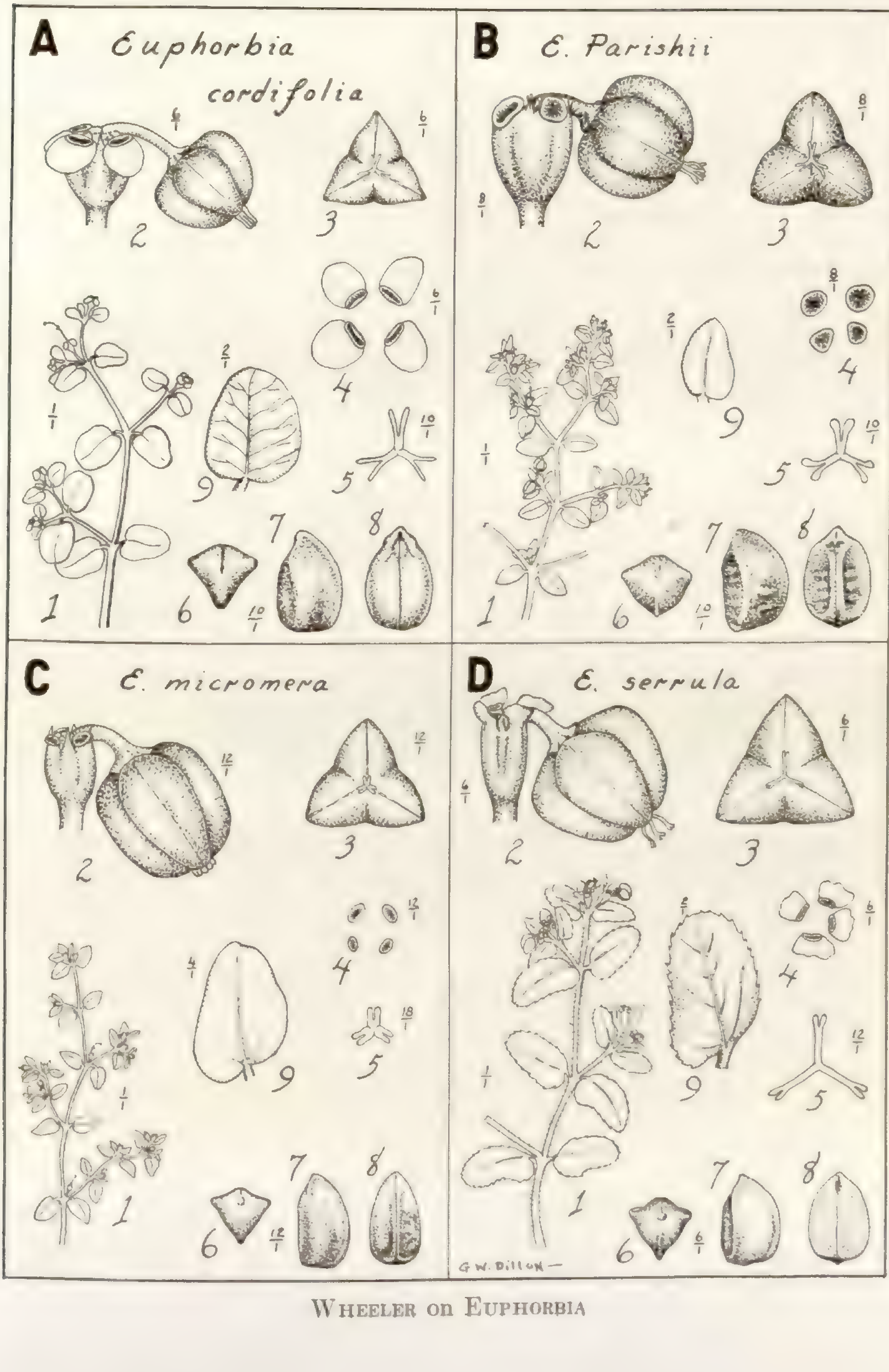

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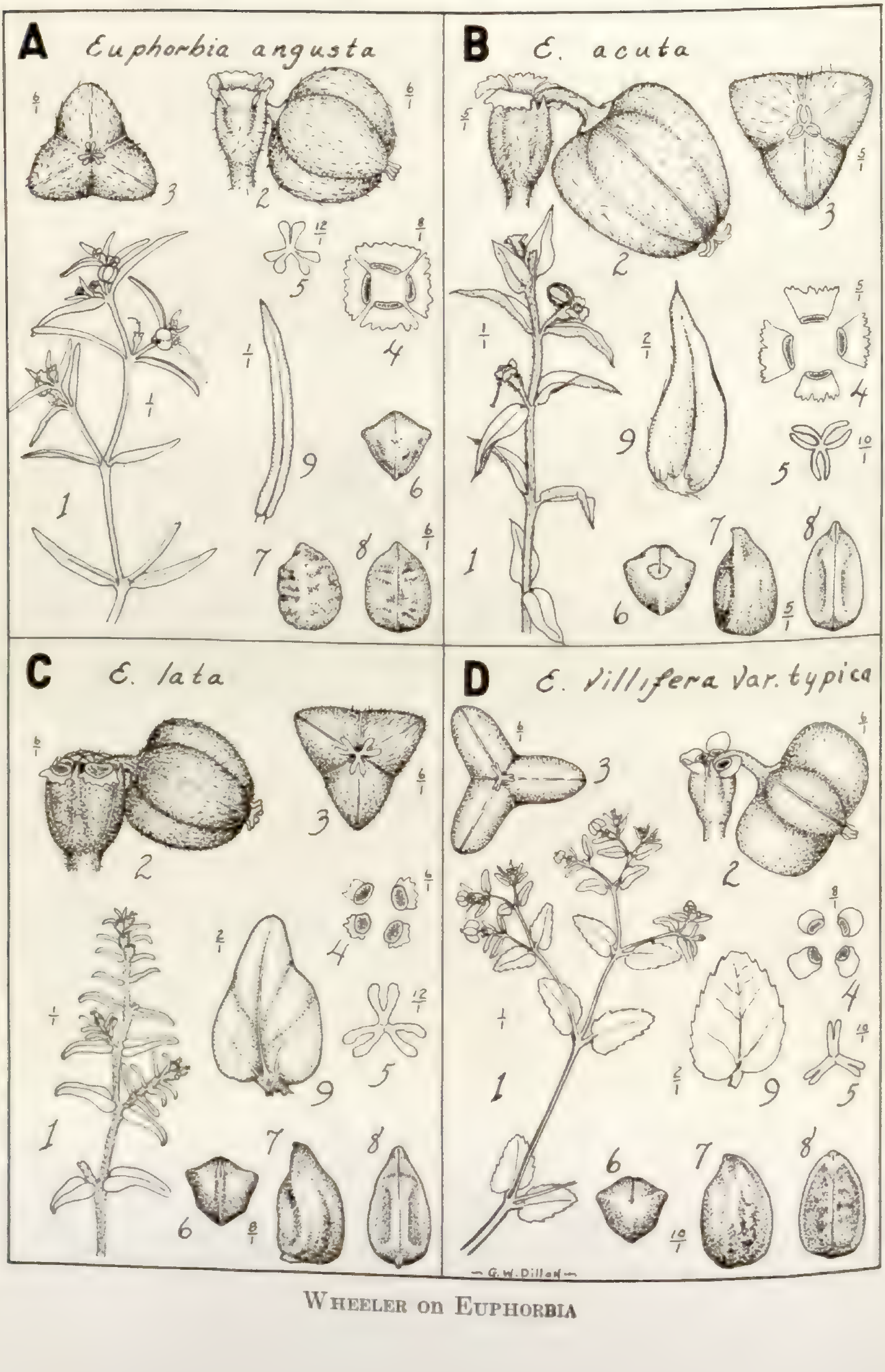

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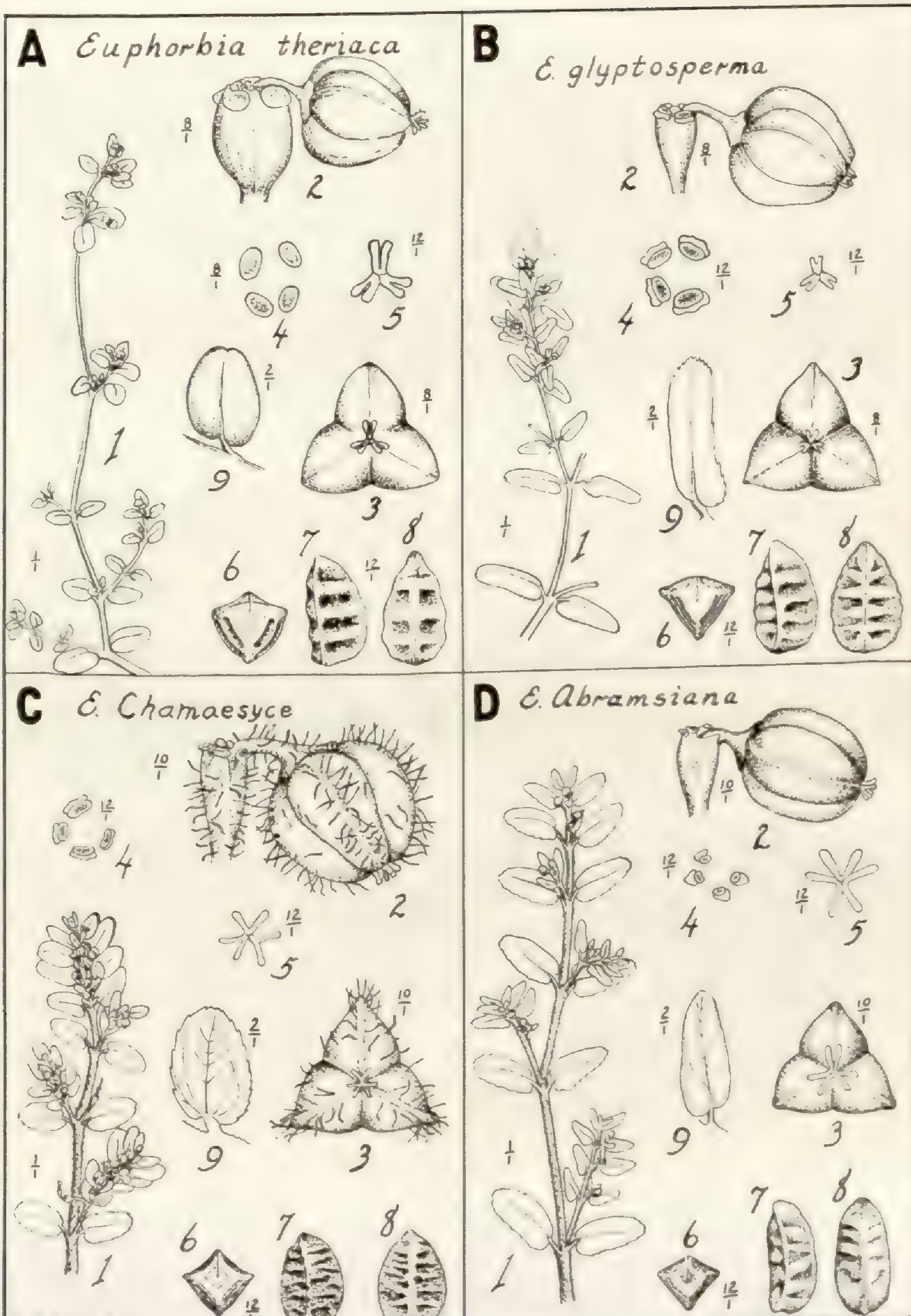

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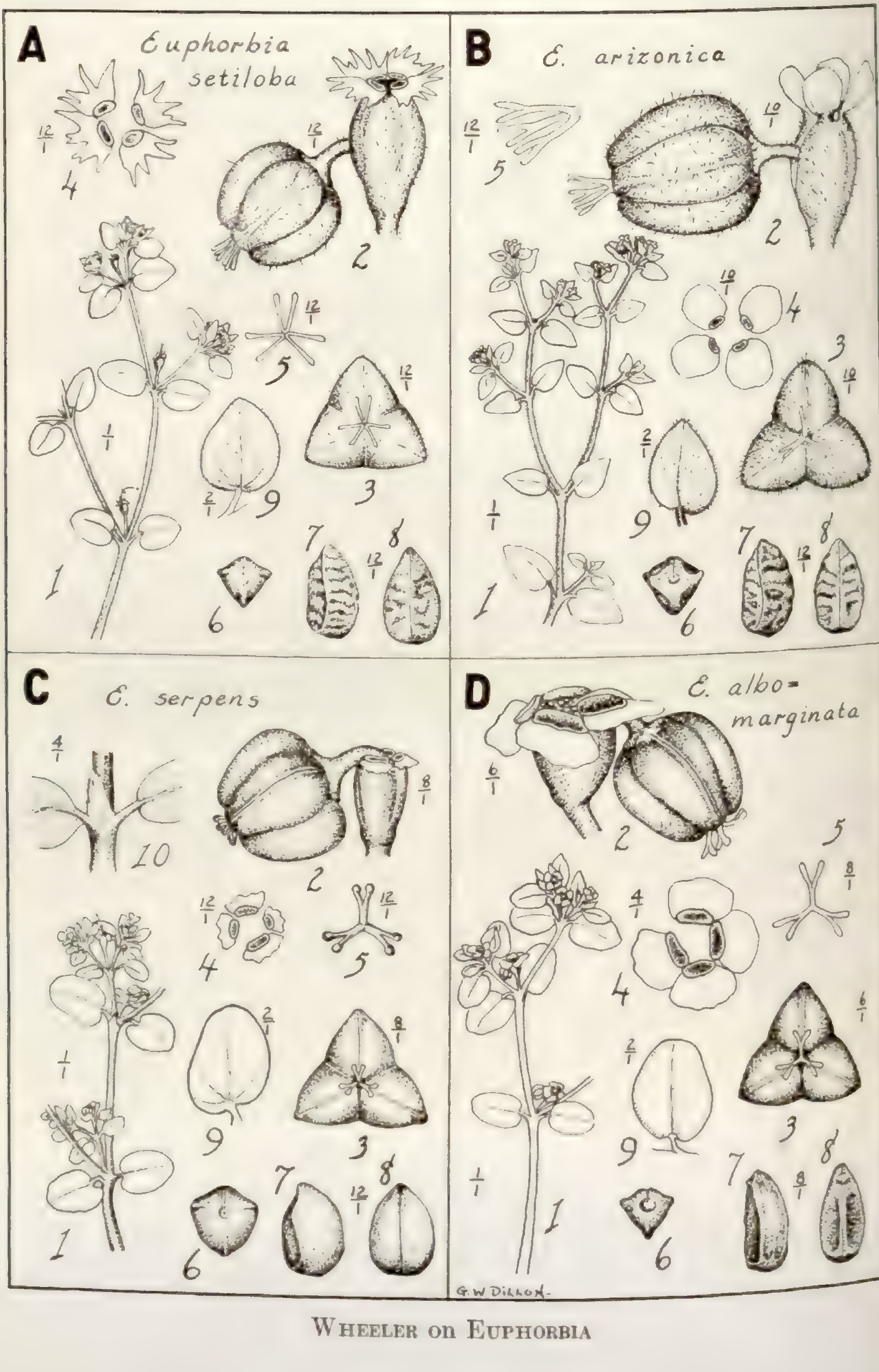

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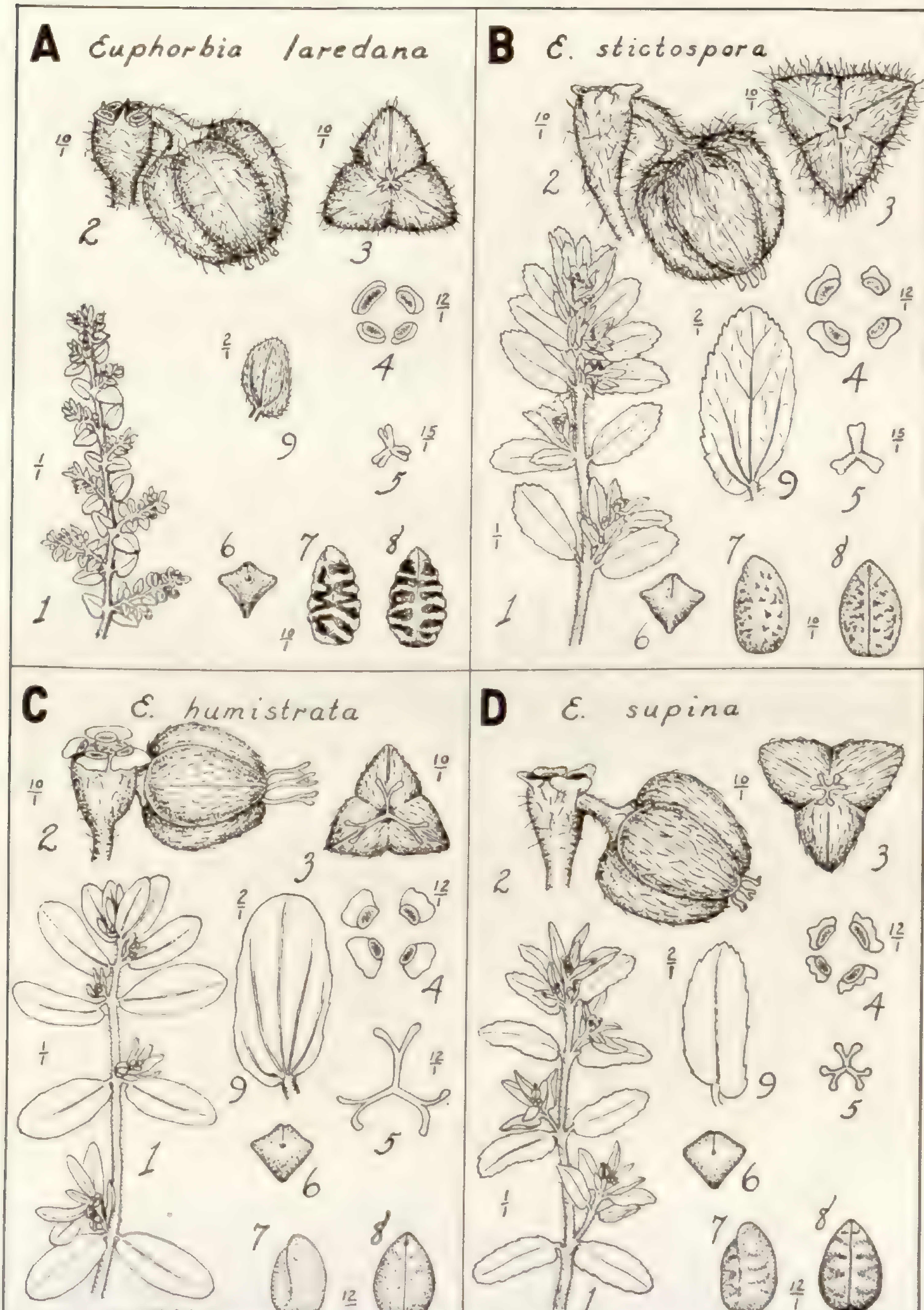

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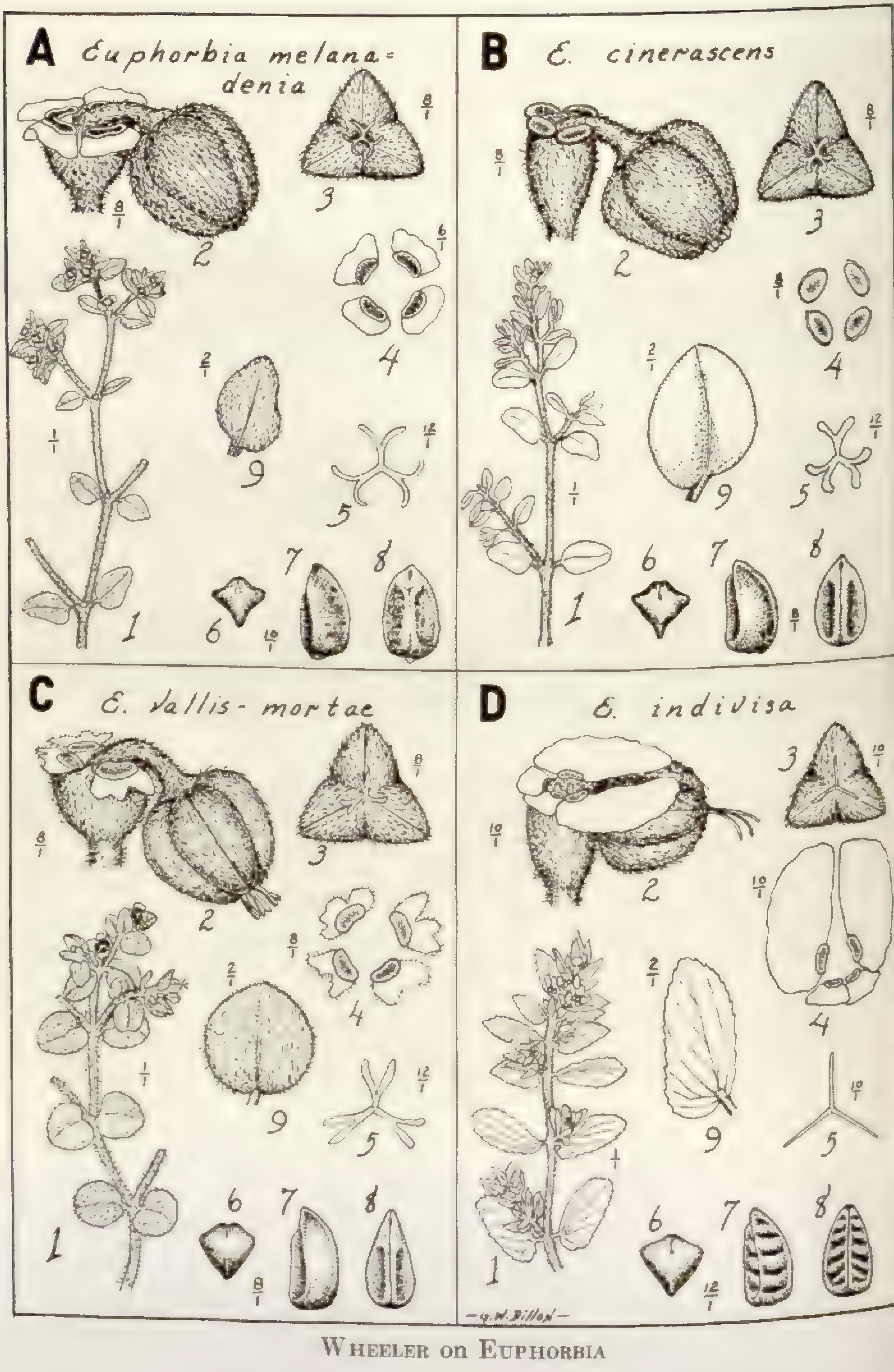

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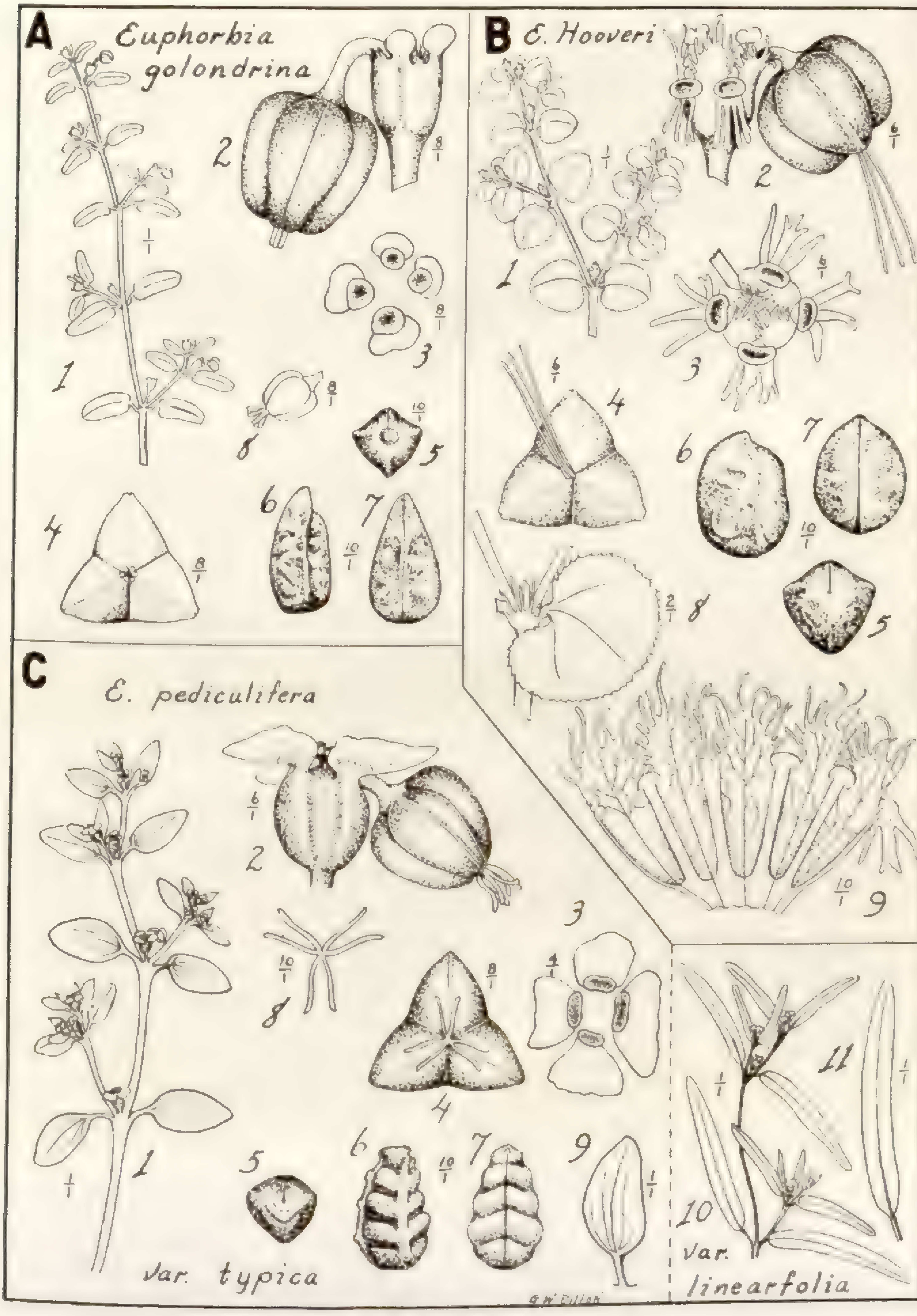

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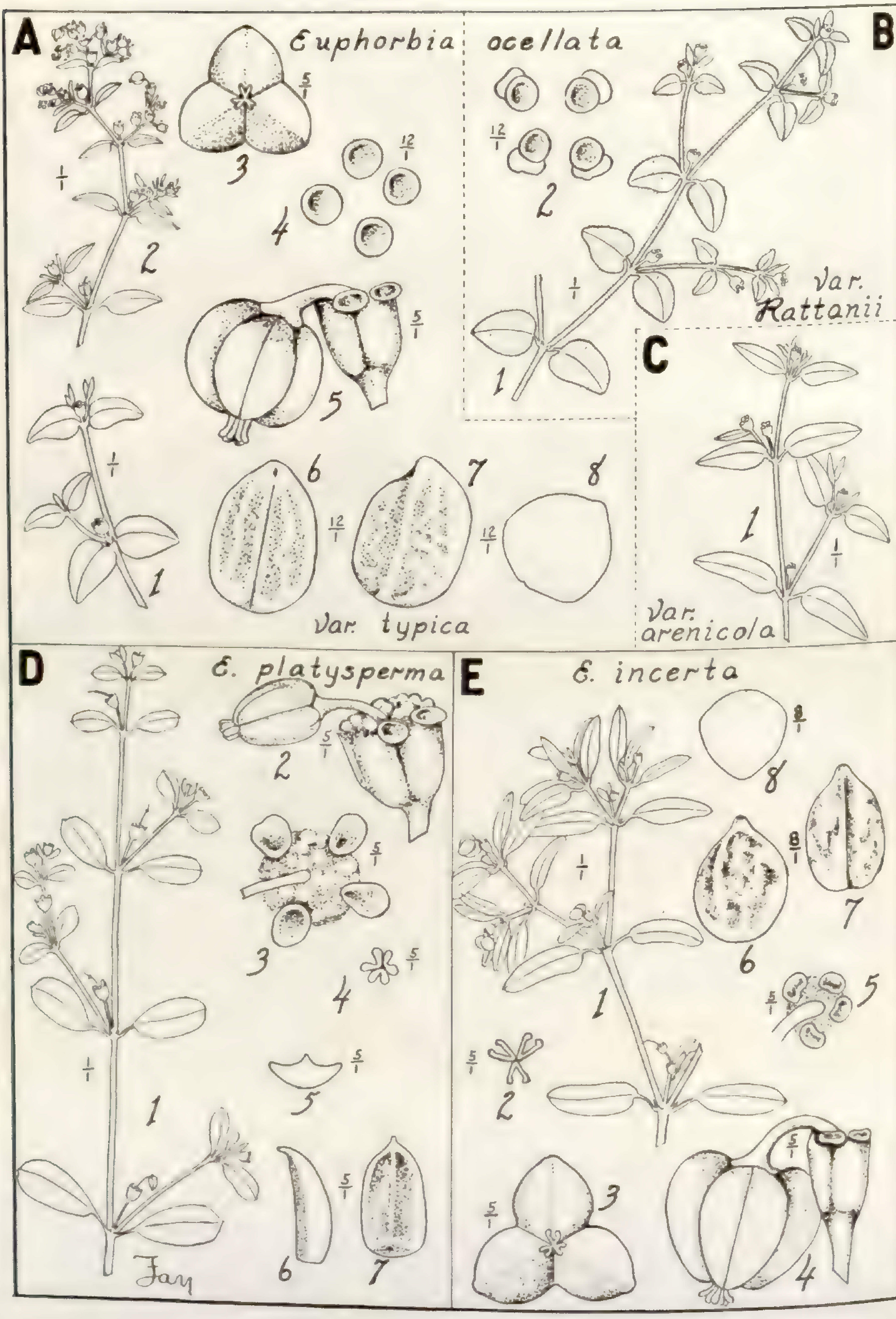

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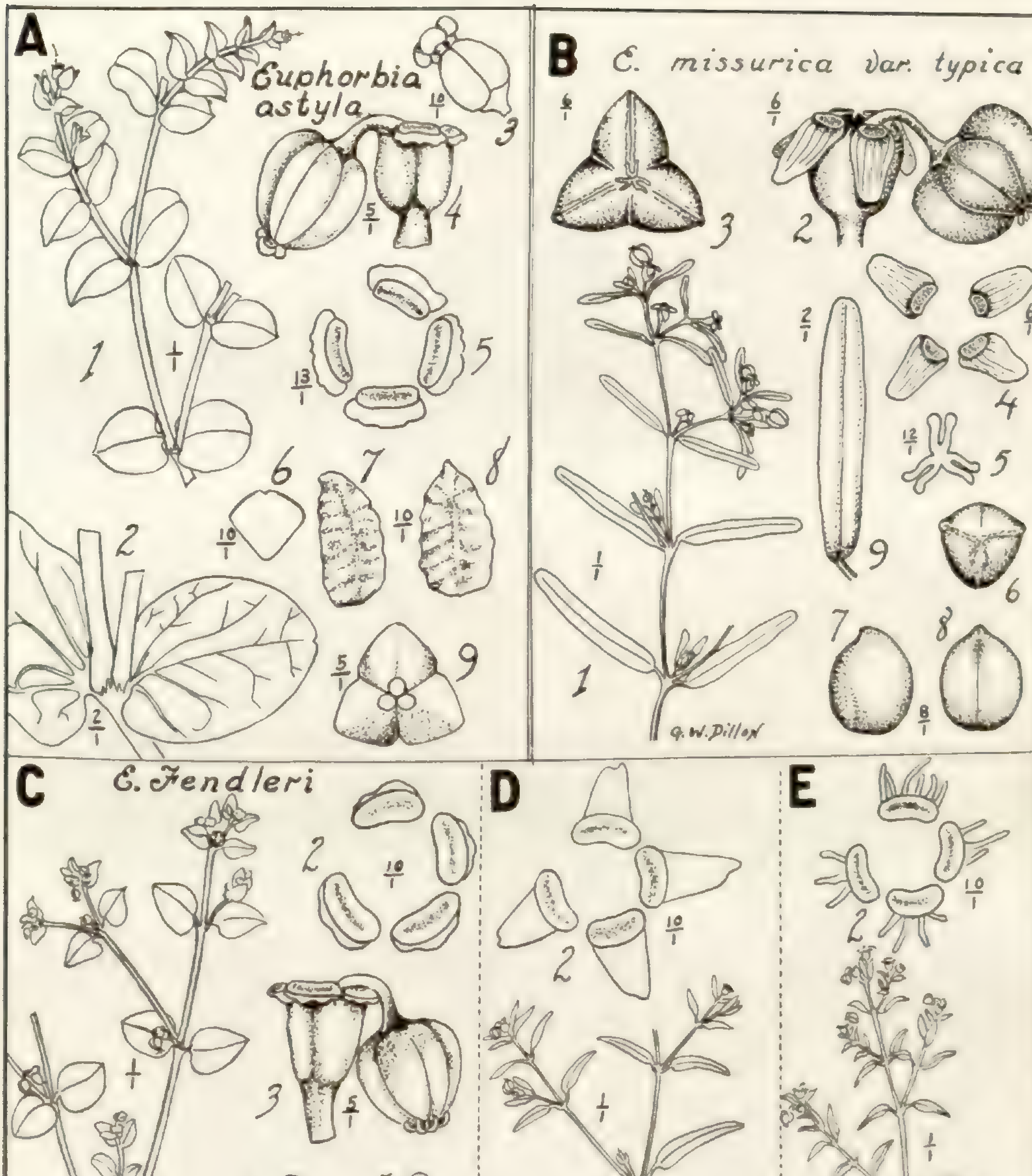

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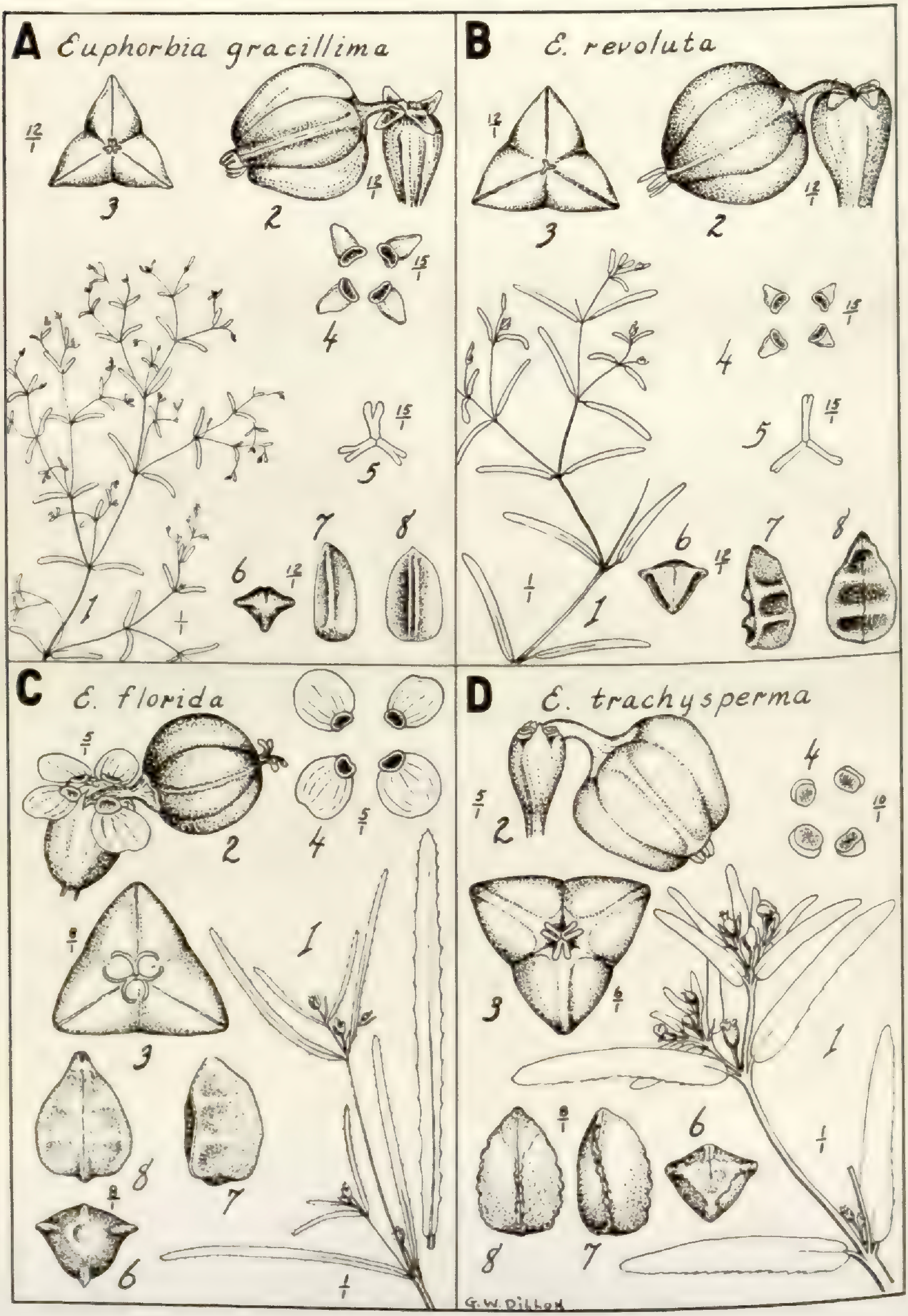
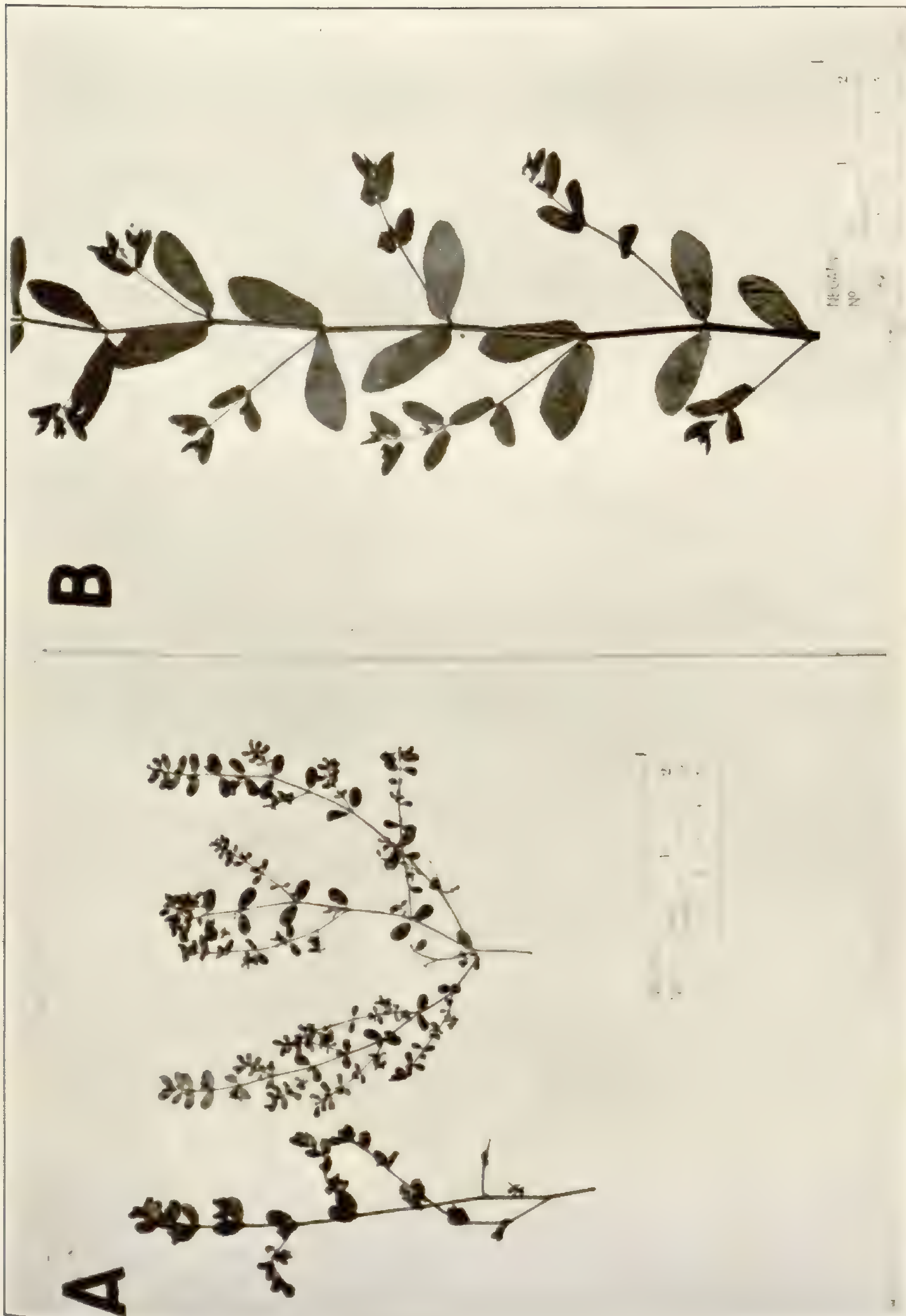


Wheeler on Euphorbia



A. Euphorbia Chamaesyce L. Photograph of type from Jamaica, *P. Browne* (Linnaean Herb.). B. Euphorbia maculata L. Photograph of type, source and collector unknown (Linnaean Herb.). Photographs by courtesy of Section of Photography, Field Museum of Natural History.

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STUDIES IN THE BROMELIACEAE — XII

By LYMAN B. SMITH

RESUMEN

Estudios en Bromeliáceas. XII. — En la parte preliminar el autor publica las novedades : *Hohenbergia guatemalensis* L. B. Smith, *Pitcairnia heterophylla* (Lindl.) Beer forma *albiflora* Standley et L. B. Smith, *P. Tuerckheimii* Donn. Smith var. *macrolepis* L. B. Smith, *Tillandsia ionantha* Planch. var. *scaposa* L. B. Smith, *T. Penlandii* L. B. Smith y su var. *pedunculata* L. B. Smith, *T. polita* L. B. Smith, *Vriesia lancifolia* (Baker) L. B. Smith, *V. pectinata* L. B. Smith y *V. Racinae* L. B. Smith.

En la segunda parte el autor continúa sus sinopsis de la Tribu *Tillandsieae* (ahora subfamilia *Tillandsioideae* de acuerdo a Harms). En esta parte estudia las especies con inflorescencias simples y flores que se dirigen todas hacia un lado, con un total de 26 del género *Vriesia*. La primera parte de las sinopsis ha sido publicada en los números LXXXVI y CVI de *Contributions from the Gray Herbarium of Harvard University*.

1. PRELIMINARY RECORDS

In preparing the present paper the author has been especially fortunate in receiving recent collections of *Bromeliaceae* from several regions still not very well represented in American herbaria. Dr. C. W. Penland's specimens from Ecuador beside furnishing one new species of *Tillandsia* also provided new and beautifully prepared material of poorly known species of André and others. Dr. P. C. Standley in his intensive collec-

[1] *Contributions from the Gray Herbarium of Harvard University*, Nº CXXXVII.

ting preparatory to a flora of Guatemala has uncovered a number of novelties and much enlarged our knowledge of other species. Mr. and Mrs. Mulford B. Foster of Orlando, Florida, have botanized extensively in Brazil in 1939 and again in 1940 and have discovered many new species of *Bromeliaceae.* However, only one of these has direct application here, the remainder being intended for publication in Brazil.

Since this is the first appearance of this series in *Lilloa* it seems well to list again the explanation of abbreviations of herbaria as follows: the Gray Herbarium of Harvard University (G) the United States National Museum (US) the New York Botanical Garden (NY), the Field Museum of Natural History (FM), the Missouri Botanical Garden (Mo), the University of Michigan (Mich), the Royal Botanic Gardens at Kew (K), the British Museum of Natural History (BM), the Riks Museum at Stockholm (S), the Botanical Museum of Copenhagen (Ko), the Herbarium of the Botanical Museum at Berlin-Dahlem (B), the Botanical Museum of Munich (Mun), the Muséum National d'Histoire Naturelle at Paris (P), the Barbey-Boissier Herbarium (Boiss) now with the Conservatory of Botany at Geneva, the Departamento de Botânico do Estado, São Paulo (SP) formerly the Instituto Biologico, the private collection of Dr. Carl Mez (Mez) now at Berlin-Dahlem, the Herbarium of the Botanic Garden of the University of Liége (Liége), the Herbarium of the Natural History Museum of Vienna (Hb. Mus. Vienna), the Jenman Herbarium at Georgetown, British Guiana (Jenman), the Colegio de La Salle of Havana-Vedado, Cuba (La Salle) and the Estación Experimental Agronómica of Santiago de Las Vegas, Cuba (Las Vegas). The material from Berlin-Dahlem has been studied by means of photographs taken by Mr. J. Francis Macbride under the Rockefeller Foundation Fund.

Hohenbergia guatemalensis, spec. nov., *florifera 5-6 dm. alta; laminis foliorum lingulatis, 8 cm. latis, planis, late acutis et apiculo involuto gracili ad 1 cm. longo auctis, utrinque lepidibus parvis albidis adpressis obsitis, margine spinis latis ad 1.5 mm. longis subdense armatis; scapo erecto, valido, dense flocculoso;*

scapi bracteis erectis, dense imbricatis, ample ellipticis, acuminatis pungentibusque, obscure punctulato-lepidotis ; inflorescentia bipinnatim paniculata, dense cylindrica, 2 dm. longa ; rhachi valida, alato-angulata, badio-flocculosa ; bracteis primariis eis scapi similibus sed multo minoribus, infimis spicas longe superantibus ; spicis crasse ellipsoideis, per anthesin ad 3 cm. longis, multifloris, perdense strobiliformibus ; bracteis florigeris e suborbicularibus longe acuminatis, 18 mm. longis, 12 mm. latis, subtenuibus, obscure nervatis, brunneis, mox glabris, ad apicem versus paulo carinatis ; floribus sessilibus ; sepalis ovatis, valde mucronatis, 8 mm. longis ; petalis staminibusque ignotis ; ovario obconico, parvo, bacca ex ovario multo incrassato, tubo epigyno nullo, placentis apicalibus, ovulis longe caudatis. Tab. I, figs. 1-4.

GUATEMALA : ALTA VERAPAZ : on tree in dense wet forest, mountains east of Tactic, on road to Tamahú, alt. 1500-1650 m., April 9, 1939, *Standley 71169* (FM, type ; phot. G), *71364* (FM, cotype ; phot. G).

The above constitutes the first record for the genus *Hohenbergia* on the mainland of North America. *H. guatemalensis* shows no strong resemblance to any other species and its caudate ovules would relate it to the Brazilian rather than to the West Indian series of species.

Pitcairnia heterophylla (Lindl.) Beer forma **albiflora** Standley et L. B. Smith, forma nov., petalis omnino albis.

GUATEMALA : SACATEPÉQUEZ : near Las Lajas, alt. ca. 1200 m., Nov. 28, 1938, *Standley 58302* (FM, type ; G).

Pitcairnia Tuerckheimii Donn. Smith var. **macrolepis**, var. nov., foliis ad 22 mm. latis ; axi inflorescentiae valido, dense albido-flocoso ; bracteis florigeris pedicellos multo superantibus ; sepalis ad 33 mm. longis, basi alato-carinatis. Tab. I, fig. 5-6.

GUATEMALA : HUEHUETENANGO : sunny cliff, San Miguel Acatán, alt. 2080 m., Aug. 18, 1934, *Skutch 995* (G, type).

This variety is a more robust more differentiated development from the typical. Its leaves are broader, setting a new mark for the deciduous type, and the tendency toward a dorsal wing on the sepals has become pronounced where it is scarcely noticeable in the typical form. The varietal name refers to the relatively larger floral bracts.

Tillandsia ionantha Planch. in Fl. des Serres, x. 101, t. 1006 (1855). *T. erubescens* Schlecht. sensu Mez in Engl. Pflanzenreich, iv. Fam. 32, 496, fig. 98 (1935).

In his treatment of *Tillandsia erubescens* in the Pflanzenreich, Mez nowhere cites any Schiede material which was the basis of the original description. Schlechtendal's description contains the following phrases: «Eine nur 1/2 Fuss hohe Art,»... «etwa 3/4 Zoll dicken Aehre»... «Die Blumen erscheinen getrocknet gelb»; and none of these are easily reconciled with *Tillandsia ionantha*. Yet Mez reduces *T. ionantha* to the synonymy of the *T. erubescens*.

It is probably best for the present to place *T. erubescens* on the dubious list and hope for the appearance of the type later. Judging from the description there is some possibility that *T. erubescens* is the same as *T. Benthamiana*.

Tillandsia ionantha Planch. var. **scaposa**, var. nov., inflorescentia scapo brevi sed distincto elata. Tab. I, fig. 7.

GUATEMALA: SACATEPÉQUEZ: near Antigua, alt. 1500-1600 m., Nov. 1938-Feb. 1939, *Standley 63065* (FM, G, type); *58817* (FM, G); hills of Finca Carmona, southeast of Antigua, alt. 1590-1800 m., Jan. 27, 1939, *Standley 63751* (FM, G); barranca above Dueñas, alt. 1590-1800 m., Jan. 21, 1939, *Standley 63185* (FM); near Pastores, 1560-1650 m., Dec. 14, 1938, *Standley 59956* (FM); ESCUINTLA: above Palín, alt. 1500 m., Dec. 16, 1938, *Standley 60107* (FM, G).

Tillandsia (subgen. *Pseudo-Catopsis)* **Penlandii**, spec. nov. *acaulis, ca. 6 dm. alta; foliis 3 dm. longis, extimis valde reductis, vaginis ellipticis, ventricosis, pseudobulbum ellipsoideum magnum efformantibus, densissime minuteque adpresso-lepidotis, basi atro-castaneis, ad apicem versus viridibus et violaceo-maculatis, laminis angustissime triangularibus, involutis contortisque, utrinque lepidibus minutis albidis adpressis dense obsitis; scapo erecto, gracili, albido-lepidoto; scapi bracteis late ellipticis, cum laminis linearibus elongatis contortis internodia superantibus; inflorescentia laxe quadripinnatim paniculata, subcylindrica, ca. 3 dm.*

longa, 8 cm. diametro, albido flocculoso; bracteis primariis bases steriles ramorum aequantibus vel superantibus, infimis eis scapi similibus, reliquis apiculatis; ramis spicas ad 10 laxe gerentibus; spicis dense paucifloris, 10-15 mm. longis; rhachi gracili, geniculata; bracteis florigeris late ovatis, obtusis, quam sepala paulo brevioribus, rhachin nullo modo obtegentibus; floribus subpatentibus; sepalis asymmetricis, 5 mm. longis, dissite lepidotis; petalis paulo exsertis, pallide flavis; staminibus styloque inclusis. Tab. I, figs. 14-15.

ECUADOR: LOJA: epiphytic, near Loja, alt. 2300 m., July 28, 1939, *Penland & Summers 1138* (G, type).

This species is closely related to *Tillandsia ropalocarpa* but differs by its ventricose spotted leaf-sheaths and long-laminate scape-bracts.

Tillandsia Penlandii L. B. Smith var. **pedunculata**, var. nov., *a typo differt basibus sterilibus ramorum elongatis, quam bracteas primarias multo longioribus; bracteis florigeris triangularibus, acutis, quam sepala multo brevioribus.* Tab. I, figs. 16-17.

COLOMBIA: ANTIOQUIA: San Pedro, Dec. 1937, *Bro. Daniel & Bro. Tomás 1558* (US, type: phot. G).

Tillandsia polita, spec. nov., *acaulis, ad 45 cm. alta; foliis multis, dense rosulatis, 3 dm. longis, vaginis anguste ovatis, atrobrunneis, densissime minuteque adpresso-lepidotis, laminis angustissime triangularibus, acuminatis, subpungentibus, basi ca. 15 mm. latis, lepidibus minutis cinereis subpruinosis utrinque densissime indutis; scapo erecto, 6 mm. diametro, glabro; scapi vaginis erectis, dense imbricatis, infimis foliaceis, supremis late ovatis, acuminatis, dissite punctulato-lepidotis, laevibus, lucidis; inflorescentia densissime bipinnatim paniculata, crasse fusiformi, in specimine typico 11 cm. longa; bracteis primariis supremis scapi similibus, quam spicas axillares multo brevioribus; spicis suberectis, anguste lanceolatis, acutis, valde complanatis, basi bracteis sterilibus reductis gerentibus, ad 55 mm. longis et 15 mm. latis, dense 5-floris; bracteis florigeris erectis, distichis, dense imbricatis, 20-25 mm. longis, quam sepala bene brevioribus, carinatis, apice minute incurvatis, glabris lucidisque, coriaceis, ad apicem versus obscure* *punctulato-lepidotis, fulgide rubris (! Standley); floribus subsessilibus; sepalis anguste lanceolatis, acutis, fere 3 cm. longis, ad apicem versus dissite punctulato-lepidotis, posticis alte connatis; petalis violaceis; staminibus maturis ignotis sed verisimiliter exertis.* Tab. I, fig. 8-9.

GUATEMALA : QUICHÉ : on tree, dry rolling hills with pine and oak forest, between Quiché and San Pedro Jocopilas, alt. 1800-2100 m., Jan. 12, 1939, *Standley 62465* (FM, type : phot. G).

The dense spikes and exserted sepals of *Tillandsia polita* give it a combination of characters found in very few North American species. Except for the exserted sepals it looks like a reduced form of *T. fasciculata*, but these place it with *T. lineatispica*. The latter, however, is tripinnate with long-laminate primary bracts.

Vriesia lancifolia (Bak.), comb. nov. *Tillandsia lancifolia* Bak. Brom. 202 (1889). *Vriesea Platzmanni* Mez in Mart. Fl. Bras. iii. pt. 3, 546 (1894) in part, not as to type.

In view of the shortness of Baker's original description the following enlarged one may be helpful :

Planta ad 7 dm. alta; foliis multis, erectis, densissime rosulatis, ad 25 cm. longis, vaginis maximis, late ellipticis, laminis anguste subtriangularibus, acuminatis, basi 35 mm. latis, subglabris; scapo gracillimo sed verisimiliter erecto; scapi vaginis erectis, quam internodia multo brevioribus, ellipticis, infimis anguste laminatis, supremis apiculatis; inflorescentia simplicissima, laxa, nullo modo secundiflora, ultra 8 cm. longa, 8-flora; axi flexuoso, gracili; bracteis florigeris subpatentibus, late ovatis, obtusis, 8-12 mm. longis, quam sepala multo brevioribus; floribus divergentibus; pedicellis brevibus; sepalis ellipticis, obtusis, 18 mm. longis; petalis delapsis solum cognitis, ultra 25 mm. longis; staminibus ignotis. Tab. II, figs. 3-4.

BRAZIL : BAHIA : near Igreja Velha, 1841, *Blanchet 3458* (BM, type; phot. G).

Since the flowers of *Vriesia lancifolia* are not secund and its stamens are unknown, the chances are about even of its belonging to Section *Psittacinae* or to Section *Xiphion*. In Section

Psittacinae it would fall next to *V. amethystina*, from which it differs in the form of its leaves, and in Section *Xiphion* next to *V. brassicoides* from which it differs in not having its flowers secund.

Vriesia pectinata, spec. nov., *e fragmentis solum cognita, sed sine dubia ultra metralis; foliis ca. 5 dm. longis, laminis ligulatis, acuminatis, ultra 3 cm. latis, concoloribus, utrinque sparse brunneo-punctulato-lepidotis; scapo erecto, 8 mm. diametro, glabro; scapi bracteis omnibus quam internodia brevioribus, late ovatis, acutis, scapum arcte involventibus, brunneo-punctulatis, laevibus; inflorescentia simplicissima, dense multiflora, 6 dm. longa; rhachi flexuosa, leviter angulata, glabra; bracteis florigeris cum floribus secunde versis, late ovatis, acutis, minute cucullatis, ad 32 mm. longis, internodia plus quam duplo superantibus, obtuse carinatis, coriaceis, ex sicco leviter nervatis, viridibus, brunneo-punctulatis; floribus secunde patentibus; pedicellis crassis, ca. 1 cm. longis; sepalis late ellipticis, acutis, 23 mm. longis, ecarinatis, coriaceis; petalis anguste ellipticis, obtusis vel emarginatis, 28 mm. longis, basi ligulis binis magnis acutis auctis, ex sicco flavo-virentibus; staminibus inclusis, filamentis ad apicem versus paulo incrassatis.* Tab. I, figs. 10-13.

GUATEMALA : ALTA VERAPAZ : terrestrial in wet thicket near Cobán, alt. 1260-1440 m., March-April, 1939, *Standley 69055* (FM, type; phot. G).

Vriesia pectinata closely resembles the West Indian *V. Tuerckheimii* in its flowers and elongate axis, but differs in its much larger bracts and simple dense inflorescence.

Vriesia Racinae, spec. nov., *florifera infra 3 dm. alta; foliis multis, dense rosulatis, 10-11 cm. longis, vaginis late ellipticis, nonnunquam cum laminis aequilongis et omnibus quam eas multo latioribus, brunneo-punctulato-lepidotis, prope basin atro-castaneis, ad apicem versus brunneo-maculatis, laminis ligulatis, late acutis apiculatisque, 15-20 mm. latis, planis et spiraliter recurvatis, supra glabris, subtus obscure punctulato-lepidotis et dense atro-maculatis: scapo erecto, gracili, glabro; scapi bracteis erectis, imbricatis, scapum arcte amplectentibus, ellipticis, acutis; inflorescentia simplicissima, laxa, in specimine typico 5-flora, glabra; rhachi fere* *recta, ca. 6 cm. longa; bracteis florigeris alteris erectis alteris cum floribus secunde versis, late ovatis, acutis, ad 18 mm. longis, internodia aequantibus vel paulo superantibus, convexis, nullo modo carinatis, laevibus; pedicellis graciliter obconicis, 1 cm. longis; floribus secundis, patentibus; sepalis anguste ellipticis, 18 mm. longis, bracteas longe superantibus, convexis, ecarinatis; petalis staminibus styloque ignotis.* Tab. III, figs. 5, 6.

BRAZIL : ESPIRITO SANTO : epiphytic, Santa Teresa, alt. 775 m., July 26, 1939, *M. B. & R. Foster 270* (G, type).

Vriesia Racinae is unusual for the Brazilian species of the genus in its combination of variegated leaves and simple secund-flowered inflorescence.

The specific name is in honor of Mrs. Mulford B. Foster, able partner in her husband's Bromeliad collecting enterprise.

2. Synopsis of the Tribe Tillandsieae. Part 3

This installment of the synopsis treats twenty-six species of *Vriesia* characterized by an acaulescent habit and a simple inflorescence of secund flowers. At present no species of *Tillandsia* with such characters are known and secund flowers are generally much rarer in the genus than in *Vriesia*.

The paper has a further unity because so far as is known all the species treated belong to the Section *Xiphion*. It must be admitted, however, that the petals and stamens of several species have not been seen.

Technically speaking some species of the Section *Euvriesia* like *Vriesia erythrodactylon* can be called secund-flowered because their petals all emerge on one side of the inflorescence. But this character is not evident in fruiting material and since the object of this synopsis is the determination of fruiting material such species are excluded from the present part. In flowering condition they may be determined from the natural keys of standard monographs.

KEY TO SPECIES

1. Spikes with the flowers distichous or secund, or else the inflorescence reduced to a single flower.
  2. Sepals asymmetric, free, oblong or broadest near the apex, not over 10 mm. long. *Tillandsia* § *Pseudo-Catopsis.* [1]
  2. Sepals symmetric, or if slightly asymmetric, ovate or lanceolate, broadest near the base.
    3. Inflorescence of a single spike or reduced to a single flower, either terminal or pseudoaxillary.
      4. Plant caulescent : leaf-blades linear or triangular. *Tillandsia* in part. [2]
      4. Plant acaulescent : leaves often ligulate.
        5. Flowers becoming secund at anthesis.
          6. Floral bracts acute or obtuse or rarely the lowest ones acuminate : axis of the inflorescence smooth or ridged but never verrucose.
            7. Inflorescence dense, the floral bracts at least twice as long as the internodes.
              8. Scape-bracts shorter than the internodes.
                9. Floral bracts acute, green : leaves acuminate. Guatemala. 1. *V. pectinata.*
                9. Floral bracts obtuse, castaneous : leaves broadly rounded or subtruncate. Brazil. 2. *V. Clausseniana.*
              8. Scape-bracts exceeding the internodes.
                10. Floral bracts rugulose throughout when dry, thick, coriaceous.
                  11. Floral bracts with a triangular apex : sepals acute. Panama. 3. *V. Woodsoniana.*
                  11. Floral bracts broadly subacute or obtuse : sepals broadly obtuse.
                    12. Floral bracts becoming secund with the flowers : sepals twice as long as broad. British Guiana. 4. *V. pachychlamys.*
                    12. Floral bracts remaining erect : sepals much less than twice as long as broad.
                      13. Leaves broadly obtuse or acute, apiculate : floral bracts three to four times as long as the internodes. Guatemala to Colombia. 5. *V. gladioliflora.*

[1] *Contrib. Gray. Herb.* lxxxix. 15 (1930).

[2] *Proc. Am. Acad,* lxx. (*Contrib. Gray Herb.* cvi.) 156 (1935).

13. Leaves acuminate : floral bracts slightly more than twice as long as the internodes. Costa Rica. 6. *V. Tonduziana.*

10. Floral bracts not rugulose when dry, or only near their apices.

14. Floral bracts each with its apical third rugulose and much paler and softer than the castaneous coriaceous remainder. Brazil. 7. *V. longicaulis.*

14. Floral bracts essentially uniform in texture (verrucose toward apex in *V. viridiflora).*

15. Floral bracts not becoming secund with the flowers.

16. Floral bracts ecarinate, barely more than twice as long as the internodes. Brazil. 23. *V. unilateralis.*

16. Floral bracts obtusely carinate toward the apex, much more than twice as long as the internodes.

17. Leaves acuminate : floral bracts up to 5 cm. long, much exceeding the sepals. Lesser Antilles. 8. *V. guadelupensis*

17. Leaves rounded and apiculate : floral bracts up to 35 mm. long, often exceeded by the sepals. Brazil. 9. *V. longiscapa.*

15. Floral bracts becoming secund with the flowers.

18. Rhachis subalate, up to 10 mm. in diameter, dark, its internodes narrowly obconical : leaves mostly red-spotted : plant 1-2 m. high. Costa Rica to Colombia, Cuba, Jamaica, Hispaniola. 10. *V. sanguinolenta.*

18. Rhachis terete or angled with its internodes subcylindrical, rarely more than 5 mm. in diameter.

19. Leaf-blades less than 2 cm. wide, acuminate : plants not over 5 dm. high : inflorescence few-flowered. Costa Rica, Panama. 11. *V. subsecunda.*

19. Leaf-blades 3-10 cm. wide : plants

5-20 dm. high: inflorescence usually many-flowered.

20. Floral bracts drying dark castaneous with a narrow pale margin, even, lustrous. Costa Rica. 12. *V. Pittieri.*

20. Floral bracts green or dull buff.

21. Floral bracts evenly convex without any keel.

22. Sepals 15-20 mm. long: leaf-blades 3-4 cm. wide. Costa Rica, British Guiana. 13. *V. viridiflora.*

22. Sepals 35 mm. long: leaf-blades 6 cm. wide. Cuba. 14. *V. haplostachya.*

21. Floral bracts obtusely carinate: leaves broadly acute or rounded and apiculate.

23. Sepals up to 34 mm. long: floral bracts barely twice as long as the internodes: plant usually 2 m. high or more. Brazil. 15. *V. Hoehneana.*

23. Sepals 20-27 mm. long: floral bracts two and a half to three and a half times as long as the internodes: plant 6-12 dm. high. Brazil. 9. *V. longiscapa.*

7 Inflorescence lax, the floral bracts distinctly less than twice as long as the internodes.

24. Leaf-blades linear, 4 dm. long and not over 5 mm. wide: inflorescence typically 3-flowered: floral bracts membranaceous. Costa Rica. 16. *V. graminifolia.*

24. Leaf-blades narrowly triangular or ligulate, 15-80 mm. wide: inflorescence normally much more than 3-flowered: floral bracts firmer.

25. Scape-bracts, or at least the upper ones, shorter than the internodes: sepals much exceeding the floral bracts.

26. Leaf-blades narrowly triangular, acuminate: floral bracts obtuse, ecarinate. Brazil. 17. *V. brassicoides.*

26. Leaf-blades ligulate, broadly rounded and apiculate : floral bracts acute, carinate. Brazil. 18. *V. Platzmannii.*

25. Scape-bracts all imbricate.

27. Floral bracts exceeding the sepals.

28. Floral bracts acute or acuminate : sepals 17 mm. long. British Honduras. 19. *V. Schippii.*

28. Floral bracts obtuse : sepals 26 mm. long. Costa Rica. 20. *V. macrochlamys.*

27. Floral bracts distinctly exceeded by the sepals.

29. Leaf-blades narrowly triangular, long-acuminate, not over 3 cm. wide.

30. Floral bracts fleshy-coriaceous, coarsely lepidote except in age : flowers divergent : sepals oblong, 27-30 mm. long. Brazil. 21. *V. oligantha.*

30. Floral bracts subchartaceous, sparsely and minutely lepidote : flowers spreading : sepals broadly elliptic, 18 mm. long. Trinidad. 22. *V. Broadwayi.*

29. Leaf-blades ligulate, acute or rounded and apiculate or sometimes the apex acuminate for a short distance, 15-80 mm. wide.

31. Plants less than 1 m. high : scape slender : floral bracts ecarinate.

32. Floral bracts about twice as long as the internodes : leaf-blades concolorous. Brazil. 23. *V. unilateralis.*

32. Floral bracts little more than once as long as the internodes : leaf-blades densely maroon-spotted. Brazil. 24. *V. Racinae.*

31. Plants 1-2 m. high or more : scape stout : floral bracts obtusely carinate toward apex.

33. Sepals narrowly elliptic : floral bracts about twice as long as the internodes. Brazil. 15. *V. Hoehneana.*

33. Sepals very broadly elliptic : floral bracts about as long as the internodes. Brazil. 25. *V. amazonica.*

6. Floral bracts all acuminate, sharply carinate toward

the apex: axis of the inflorescence verrucose just below the nodes. Costa Rica, Panama, West Indies, Colombia. 26. *V. ringens*.

1. **Vriesia pectinata** L. B. Smith (see p. 387). Known only from fragments, but the flowering plant certainly over 1 m. high; leaves ca. 5 dm. long, the blades ligulate, acuminate, over 3 cm. broad, concolorous, sparsely brown-punctulate-lepidote on both sides; scape erect, 8 mm. in diameter, glabrous; scape-bracts all shorter than the internodes, broadly ovate, acute, closely enfolding the scape, brown-punctulate, even; inflorescence simple, densely many-flowered, 6 dm. long; rhachis flexuous, faintly angled, glabrous; floral bracts becoming secund with the flowers, broadly ovate, acute, minutely cucullate, up to 32 mm. long, more than twice as long as the internodes, obtusely carinate, coriaceous, faintly nerved when dry, green, brown-punctulate; flowers secund-spreading; pedicels stout, ca. 1 cm. long; sepals broadly elliptic, acute, 23 mm. long, ecarinate, coriaceous; petals narrowly elliptic, obtuse or emarginate, 28 mm. long, bearing 2 large acute scales at base, greenish yellow when dry; stamens included, filaments slightly thickened toward apex. — Terrestrial; Guatemala. — Pl. I, figs. 10-13.

GUATEMALA: ALTA VERAPAZ: terrestrial in wet thicket near Cobán, alt. 1260-1440 m., March-April, 1939, *Standley 69055* (FM, type; phot. G).

2. **Vriesia Clausseniana** (Bak.) Mez. Flowering plant up to 16 dm. high; leaves erect, 25-48 cm. long, wholly suffused or spotted with blue-violet or only toward base, finely and rather densely appressed-lepidote throughout, sheaths large, blades suboblong, tapering, broadly rounded or subtruncate, apiculate, 40-65 mm. wide, flat; scape erect, stout; scape-bracts erect, enfolding the scape, shorter than the internodes, broadly ovate, broadly rounded and apiculate; inflorescence simple, densely many-flowered, 35-40 cm. long, glabrous; axis stout, sulcate on drying; floral bracts remaining erect, $2\frac{1}{2}$-3 times as long as the internodes, broadly elliptic, obtuse, ca. 35 mm. long and 45 mm. wide, exceeded by the sepals, strongly convex, obtusely or not at all carinate, coriaceous, rigid, even or some-

what nerved, castaneous with a narrow magenta margin when fresh, sublustrous; flowers suberect, secund, 5 cm. long; pedicels very stout, up to 1 cm. long; sepals elliptic, obtuse, ca. 30 mm. long and 17 mm. wide, pale green, drying stramineous; petals elliptic, pale yellow, bearing 2 large triangular scales at base; stamens included, filaments thickened toward apex; pistil exserted. — Terrestrial; Brazil. — Mez in Mart. Fl. Bras. iii. pt. 3, 545 (1894); in DC. Mon. Phan. ix. 593 (1896); and in Engler, Pflanzenreich, iv. Fam. 32, 386 (1935). *Tillandsia Clausseniana* Bak. Brom. 213 (1889). — Pl. I, fig. 22.

BRAZIL : MINAS GERAES : Serra de Caraça, *Claussen s. n.* (P, type; phot. G); most common *Vriesia* in the region, on rocks in full sun, Caraça, Municipio Santa Barbara, alt. 1500 m., July 22, 1940, *M. B. & R. Foster 688* (G).

3. **Vriesia Woodsoniana** L. B. Smith. Leaves rosulate, up to 5 dm. long, sheaths elliptic, castaneous toward base, densely punctate-lepidote, blades ligulate, 3 cm. broad, flat, rounded at apex and apiculate, concolorous, densely and minutely lepidote beneath, glabrous above; scape erect, glabrous, its bracts foliaceous, densely imbricate; inflorescence simple, curved, subdensely few-flowered, ca. 15 cm. long; floral bracts imbricate, slightly secund, very broadly ovate, triangular-acute, up to 45 mm. long and 33 mm. wide, exceeding the sepals, glabrous, strongly rugose when dry, not at all carinate, dark castaneous toward base; flowers strongly secund; pedicels 1 cm. long, very thick; sepals broadly ovate, acute, 35-40 mm. long, rather thin, impressed-punctulate, rugulose when dry; petals imperfectly known, at base bearing 2 scales 1 cm. long, stamens apparently included. — Panamá. — L. B. Smith in Woodson & Seibert, Fl. Panamá, III, in Ann. Missouri Bot. Gard. xxvi. 275, t. 20 (1939).

PANAMA : CHIRIQUÍ : Bajo Mona, mouth of Quebrada Chiquero, along Río Caldera, alt. ca. 1500-2000 m., July 3, 1938, *Woodson, Allen & Seibert 1029* (Mo, type; phot. G).

4. **Vriesia pachychlamys** Mez. Known only from fragments, flowering plant at least 7 dm. high; leaves 5-8 dm. long, sheaths large, broadly elliptic, blades ligulate, broadly acute or round-

ed, apiculate, 6 cm. wide, green, concolorous, appearing glabrous at maturity; scape erect, stout; scape-bracts erect, imbricate, very broadly elliptic, apiculate; inflorescence simple, densely 14-17-flowered, ca. 3 dm. long, 35 mm. wide; axis stout, thickened at the nodes; floral bracts distichous, becoming secund with the flowers, very broadly elliptic, obtuse, 5 cm. long, ecarinate, very thick, coriaceous, rugulose and pale brown when dry; flowers suberect, secund; sepals elliptic, obtuse, 35 mm. long, 17 mm. wide, ecarinate, glabrous, even. — British Guiana. — Mez in DC. Mon. Phan. ix. 594 (1896); in Engler, Pflanzenreich, iv. Fam. 32, 386 (1935); L. B. Smith in Contrib. Gray Herb. lxxxix. 69 (1930). *Tillandsia pachychlamys* Bak. ex Mez in DC. Mon. Phan. ix. 594 (1896), nomen in synon. — Pl. I, figs. 18-19.

BRITISH GUIANA: Camounie Creek, April 1883, *Jenman 2044* (K, type; hb. Jenman, phot. G).

5. **Vriesia gladioliflora** (Wendl.) Ant. Plant up to 1 m. high; leaves rosulate, 6 dm. long, purplish when young (! Antoine), becoming deep green especially above; sheaths elliptic, inconspicuous, densely lepidote with brown punctiform scales; blades ligulate, broadly acute or obtuse, apiculate, 6-8 cm. wide, unmarked, glabrous above, obscurely punctulate-lepidote beneath; scape erect, very stout; scape-bracts exceeding the internodes, elliptic, abruptly acute; inflorescence simple, densely many-flowered, subcylindric at anthesis, acute, 2-4 dm. long, up to 5 cm. wide; floral bracts distichous, erect, imbricate, very broadly ovate, obtuse or broadly subacute, 45-55 mm. long, ecarinate, equaling to much exceeding the sepals, three to four times as long as the internodes, coriaceous, glabrous, green, purplish toward the apex, becoming buff and finely rugulose when dry; flowers suberect, slightly or not at all secund; pedicels very short and stout; sepals broadly elliptic, obtuse, 20-45 mm. long, coriaceous; petals ligulate with suborbicular blade, 4-7 cm. long, greenish white, bearing 2 obovate subincised scales at the base; stamens and pistil shorter than the petals. — Terrestrial and epiphytic; Guatemala to Colombia. — Ant. in Wiener Ill. Gart.-Zeit. v. 97 (1880);

Phyto-Iconogr. 23, t. 15 (1884); E. Morr. in Belg. Hort. xxx. 87, 216 (1880); Wittm. in Engler & Prantl, Nat. Pflanzenfam. ii. Abt. 4, 59 (1888); Mez in DC. Mon. Phan. ix. 594 (1896); in Engler, Pflanzenr., iv. Fam. 32, 386 (1935); Harms in Engler & Prantl, Nat. Pflanzenfam. ed. 2, xv a. 125 (1930); L. B. Smith & Standley in Standley, Fl. Costa Rica in Bot. Ser. Field Mus. xviii. 161 (1937); in Mus. Nac. Costa Rica, Ser. Bot. i. 173 (1940); L. B. Smith in North American Flora, xix. 161 (1938); L. B. Smith & Lundell, Bromel. Yucatán Penin. in Carnegie Inst. Washington Publ. nº 522, 122 (1940). *Tillandsia gladioliflora* H. Wendl. in Hamb. Gartenz. xix. 31 (1863); Bak. Brom. 214 (1889). *Vriesia gladioliflora purpurascens* Ant. in Wiener Ill. Gart.-Zeit. v. 97, t. 1 (1880). *V. gladioliflora* var. *purpurascens* Ant. Phyto-Iconogr. 23 (1884), in synon. *V. princeps* Hort. Linden ex Batal. in Gartenfl. xxvi. 158 (1877); cf. E. Morr. in Belg. Hort. xxx. 216 (1880). — Pl. II, figs. 1-2.

BRITISH HONDURAS: STANN CREEK DISTRICT: swampy forest, Mullins River Road, alt. 30 m., Jan. 4, 1932, *Schipp S-189* (FM); BELIZE DISTRICT: Gracie Rock, Sibun River, Jan. 30, 1936, *Gentle 1782* (Mich).

GUATEMALA: PETEN: Yaloch road from Dos Arroyas, May 2, 1931. *Bartlett 12851* (Mich); Chicbul, La Libertad, April 8, 1933, *Lundell 2631* (G, Mich); IZABAL: terrestrial and epiphytic, lowland jungle at Punta Palma, across bay from Puerto Barrios, April 23, 1940, *Steyermark 39859* (FM).

COSTA RICA: CARTAGO: vicinity of Cartago, alt. 1200-1600 m., 1901, *Wercklé 16205* (US); INDEFINITE: cultivated in Liége, Belgium, from Costa Rican material, 1881, *E. Morren* (Liége).

PANAMA: CANAL ZONE: Zetek Trail, Barro Colorado Island, Dec. 4, 1931, *O. Shattuck 524* (FM); westerly arm of Quebrada Salamanca, alt. 70 m., Dec. 16, 1934, *Dodge, Steyermark & Allen 17037* (Mo, G).

COLOMBIA: EL VALLE: epiphyte, coastal thickets, Punta Arenas, Buenaventura Bay, Feb. 3, 1939, *Killip 33018* (G); epiphyte, dense forest, Córdoba, alt. 50-100 m., Feb. 17, 1939, *Killip & García 33455* (US).

Wendland described *Vriesia gladioliflora* from material which he had brought from northern Costa Rica to Hamburg and cultivated. It is not known whether an actual herbarium specimen of the type exists but the progeny of his plants appear to have been widely distributed in European gardens. He gave the size of the sepals as 30-35 mm., dimensions which have been considerably extended in both directions by subsequent collections.

In the Pflanzenfamilien, Wittmack gives «Caracas» as a locality for this species but so far it has not been possible to find proof for any Venezuelan stations for the species. Possibly it is an error for *V. macrostachya* which has a somewhat similar habit.

6. **Vriesia Tonduziana** L. B. Smith. About 8 dm. high; leaf-blades ligulate, acuminate, over 8 dm. long, 4 cm. wide, green, concolorous, very obscurely punctulate-lepidote; scape stout; scape-bracts erect, densely imbricate, broadly elliptic, apiculate; inflorescence simple, 15-flowered, 3 dm. long; floral bracts remaining erect, barely imbricate, very broadly ovate with a short triangular obtuse cucullate apex, 45 mm. long, about equaling the sepals, ecarinate, thick, coriaceous, rugulose when dry, obscurely punctulate; flowers secund, divergent; pedicels stout; sepals broadly ovate, obtuse, 40 mm. long, 28 mm. wide, coriaceous; petals elliptic-oblong, each bearing 2 large scales at the base. — Epiphytic; Costa Rica. — L. B. Smith in North American Flora, xix. 166 (1938). — Pl. II, figs. 18, 19.

COSTA RICA: San José: epiphytic, La Palma, alt. 1520 m., May 22, 1898, *Tonduz. in hb. inst. phys.-geogr. costar. 12349* (US, type; phot. G).

7. **Vriesia longicaulis** (Bak.) Mez. Flowering plant 6-12 dm. high; leaves 4-9 dm. long, sheaths large, elliptic, minutely brown-appressed-lepidote, deep castaneous toward base, blade ligulate, broadly rounded and apiculate, flat, 30-45 mm. wide, concolorous, green, glabrous above, very obscurely punctulate-lepidote beneath; scape erect, elongate, rather stout, glabrous; scape-bracts erect, densely imbricate, the lower ones foliaceous, the upper ones ovate and acute; inflorescence simple or rarely with a small lateral branch and short primary bract similar to the scape-bracts, densely many-flowered, 14-42 cm. long; rhachis stout, angled, geniculate, glabrous; floral bracts suberect and densely imbricate, then often more or less secund with the flowers, broadly ovate, acute, 3-8 cm. long, usually much exceeding the sepals, convex, obtusely and faintly carinate, glabrous, pale brown and slightly rugulose near their apices, elsewhere deep castaneous and even; pedicels stout, obconic, 8

mm. long; flowers often secund at anthesis, subspreading; sepals lance-ovate, acute, 20-35 mm. long, obtusely carinate toward base, coriaceous, even, glabrous; petals elliptic, about one and a half times as long as the sepals, all yellow or with a brown margin, bearing 2 large subtriangular acuminate scales at base; stamens included. — Epiphytic; Brazil. — Mez in Mart. Fl. Bras. iii. pt. 3, 542 (1894); in DC. Mon. Phan. ix. 592 (1896); in Engler, Pflanzenr. iv. Fam. 32, 386 (1935). *V. Jonghei* E. Morr. sensu Wawra in Oesterr. Bot. Zeitschr. xxx. 220 (1880); It. Sax.-Cob. 167 (1883). *V. Jonghei* « fm. capsulis secundis » Wawra, op. c. 168. *Tillandsia longicaulis* Bak. in Journ. Bot. xxvi. 80 (1888); Brom. 214 (1889). *V. longicaulis* var. *secunda* Mez. in Mart. Fl. Bras. iii. pt. 3, 543 (1894); in DC. Mon. Phan. ix. 593 (1896), incorrectly attributed to Wawra. — Pl. I, figs. 20, 21.

BRAZIL: MINAS GERAES: in deepest jungle, Vaccaria, Serra do Cipo. north of Bello Horizonte, alt. 1400 m., July 12, 13, 1940, *M. B. & R. Foster 604* (G); ESPIRITO SANTO: Santa Teresa, alt. 780 m., July 27, 1939, *M. B. & R. Foster 111 A* (G); Santa Teresa, Aug. 7, 1940, *M. B. & R. Foster 833* (G); RÍO DE JANEIRO: forests, Organ Mountains, 1879, *Wawra II 359* (Hb. Mus. Vienna, phot. FM; type of *V. longicaulis* var. *secunda* Mez); by Morro do Retiro near Petropolis, *Glaziou 8988* (K, type; phot. G); in shade, Itatiaya, alt. 750-1000 m., June 29, 1939, *M. B. & R. Foster 111* (G); Petropolis, Aug. 10, 1939, *M. B. & R. Foster 506* (G); Therezopolis, Aug. 21, 1940, *M. B. & R. Foster 978, 1026* (G).

The fine series of *Vriesia longicaulis* collected by Mr. and Mrs. Foster in 1939 and 1940 demonstrates that it is a quite variable species and that no importance can be attached to the secund flowers occurring in some specimens. Most of their material has the flowers definitely secund or not, but their n° 833 shows a few mature flowers secund but most of them not. This also is the only collection with a branched inflorescence.

The type of the species is so young that it is impossible to say whether the flowers would be secund eventually, so that it is preferable not to divide the species along these lines.

The other line of variation is that of size, and it may at times be very striking. Mr. Foster notes that his n° 1026 was about half the size of his n° 978 and that it grew at higher altitudes than did any of the larger plants. Yet the shape and color of the parts of the two numbers are very uniform and other collections of his lie between the two in size so that there seems to be no satisfactory basis for division on the line of size either.

8. **Vriesia guadelupensis** (Bak.) Mez. Flowering plant about 1 m. high; leaves 5-8 dm. long; sheaths elliptic-oblong, inconspicuous, densely and minutely brown-lepidote; blades ligulate, acuminate, 5 cm. wide, concolorous, glabrous or nearly so above, very inconspicuously punctulate-lepidote beneath; scape erect, very stout; scape-bracts densely imbricate, rigidly coriaceous, the very lowest foliaceous, the rest ovate and abruptly acute; inflorescence simple, dense, up to 30-flowered, 3-4 dm. long, about 6 cm. wide; floral bracts erect or suberect, not becoming secund with the flowers, very broadly ovate, subacute, 5 cm. long, much exceeding the sepals, obtusely carinate toward the apex and not incurved, stiffly coriaceous, even, glabrous, concolorous or spotted with dark brown; flowers suberect, becoming secund; pedicels very short and stout; sepals broadly ovate, acute, up to 30 mm. long and 15 mm. wide; petals obtuse, 36 mm. long, bearing 2 large acute scales near the base; ovules conspicuously caudate; coma flavescent. — Epiphytic; Lesser Antilles. — Mez in DC. Mon. Phan. ix. 596 (1896), as « Guadeloupensis » ; in Engler, Pflanzenr. iv. Fam. 32, 389 (1935); Duss. Fl. Phan. Antill. Françaises, in Ann. Inst. Colon. Marseille, iii. 575 (1897); Boldingh, Fl. Dutch West Ind. Is. i. 34 (1909); Fl. Ned. West-Ind. Eilanden, 144 (1913); L. B. Smith in N. Am. Fl. xix. 165 (1938). *Tillandsia guadelupensis* Bak. Brom. 213 (1889). *Neovriesia guadalupensis* Britton ex Stehlé, Fl. Guadeloupe, i. 212 (1936), nomen. — Pl. II, figs. 9, 10.

LESSER ANTILLES : ANTIGUA : very rare on exposed rocky precipices on summits of the highest hills in the southwest, Macarthy Hills, alt. ca. 380 m., Dec. 19, 1937, *H. E. Box 1327* (US) ; MONTSERRAT : on tree, foot of Fergus Mt., Jan. 30, 1907, *Shafer 353* (NY, US, FM) ; GUADELOUPE : epiphytic in woods, Plateau des Palmistes, 1895, *Duss 3321* (US, NY, isotype ; phot. G) ; DOMINICA : epiphytic, rainforest bordering Campbell Track, Sylvania, alt. 549 m., Feb. 13, 1940, *W. H. & B. T. Hodge 1128* (G) ; common epiphyte, Lisdara, alt. 457 m., Mar. 27, 1940, *W. H. & B. T. Hodge 2468* (G).

9. **Vriesia longiscapa** Ule. Flowering plant 6-12 dm. high: leaves 35-67 cm. long, sheaths elliptic, not much wider than the blades, densely dark-punctulate-lepidote, blades ligulate, broadly rounded and apiculate, flat, 35-40 mm. wide, pale or dark green and glabrous above, dark green or maroon, glaucous and obscurely punctulate-lepidote beneath; scape erect, rather stout, glabrous; scape-bracts erect, imbricate, the lower ones foliaceous, the upper elliptic, acute; inflorescence simple or rarely with 1-3 lateral racemes, the principal or only raceme 17-28 cm. long, densely many-flowered; rhachis geniculate, angled, stout, glabrous; floral bracts subspreading at anthesis and more or less secund, two and one half to three and one half times as long as the internodes, broadly ovate, broadly acute, up to 35 mm. long, obtusely carinate, slightly incurved at apex, faintly nerved, obscurely punctulate-lepidote, pale greenish brown at anthesis becoming darker with age; flowers secund-spreading; pedicels obconic, stout, 5-8 mm. long; sepals elliptic, subacute, 20-27 mm. long, about equaling or somewhat exceeding the bracts, fleshy-coriaceous; petals narrowly obovate or elliptic, ca. 3 cm. long, yellow, bearing 2 acute scales 8 mm. long at the base; stamens included, equaling the pistil, filaments much dilated toward apex. — Epiphytic; Brazil. — Ule in Bericht. Deutsch. Bot. Gesellsch. xviii. 323 (1900); Mez in Engler, Pflanzenr., iv. Fam. 32, 393 (1935). — Pl. II, figs. 11-13.

BRAZIL: ESPIRITO SANTO: Santa Teresa, alt. 775 m., July 26, 1939, *M. B. & R. Foster 259* (G); RÍO DE JANEIRO: Serra do Macahé, Nova Friburgo, alt. 900-1400 m., Jan. 1900, *Ule 4956* (Berlín, type; phot. G); near Meio da Serra, alt. ca. 500 m., April 7, 1929, *L. B. Smith & A. C. Brade 2293* (G); Petropolis, alt. 760 m., Aug. 9, 1939, *M. B. & R. Foster 338* (G); Therezopolis, alt. 900-1000 m., Aug. 21, 1940, *M. B. & R. Foster 979* (G); FEDERAL DISTRICT: Río de Janeiro, 1838, *Wilkes Expedition s. n.* (G).

Ule gives rather larger measurements for this species than the photograph of his type bears out. Of course there may be other and larger material of the type number than that which was photographed, but it seems unlikely and none of the above collections reach Ule's measurements although they agree closely with the type in all details of form.

10. **Vriesia sanguinolenta** Cogn. et Marchal. Flowering plant 1-2 m. high; leaves about 10 in a dense rosette, suberect, 6-7 dm. long, green, usually with large irregular spots of deep red especially near the base, obscurely punctulate-lepidote; sheaths ovate-elliptic, the same color as the blades and but slightly broader; blades ligulate, acute or subrounded with a long apiculus, 8-10 cm. wide; scape erect, greatly exceeding the leaves. well over 1 cm. in diameter at the summit, glabrous; scape-bracts erect, imbricate, very broadly ovate, acute or the lower ones triangular-laminate, glabrous, even, thick, coriaceous; inflorescence simple or few-branched, up to 4 dm. long; primary bracts suberect, like the upper scape-bracts, covering only the sterile bases of the branches; branches suberect, secundly 11-15-flowered, the lateral ones 25 cm. long with 1 or 2 sterile bracts at the base, the terminal one nearly 4 dm. long with a sterile base as long as the fertile part and appearing like a continuation of the scape; rhachis up to 10 mm. in diameter, flexuous, strongly 4 angled, glabrous, dark, its internodes narrowly obconical; floral bracts becoming secund with the flowers. broadly elliptic to suborbicular, abruptly acute, up to 5 cm. long, some and usually all more than twice as long as the internodes, glabrous, even, rigid, coriaceous, green, drying to light brown, incurved and carinate toward the apex; flowers spreading and downwardly secund; pedicels very stout, up to 12 mm. long; sepals very broadly elliptic or ovate, obtuse or broadly acute, 30-45 mm. long, rigid, coriaceous, even and glabrous outside, striate and punctulate-lepidote within; petals white, slightly exceeding the sepals, bearing 2 scales at base. — Terrestrial and epiphytic; Costa Rica to Colombia, Cuba, Jamaica, Hispaniola. — Pl. Ornem. t. 52 (1874); André in Ill. Hort. xxii. 44, t. 200 (1875); Mez in DC. Mon. ix. 609 (1896); in Engler, Pflanzenr. iv. Fam. 32, 400 (1935); L. B. Smith & Standley in Standley, Fl. Costa Rica in Bot. Ser. Field. Mus. xviii. 162 (1937); in Mus. Nac. Costa Rica, Ser. Bot. i. 174 (1940); L. B. Smith in N. Am. Fl. xix. 166 (1938). *Tillandsia sanguinolenta* (Cogn. et Marchal) Bak. Brom. 226 (1889). *Vriesea Alfarovii* Mez in Fedde, Rep. Spec. Nov. xiv. 247 (1916); in Engler, Pflanzenr. iv. Fam. 32, 387 (1935); L. B. Smith in

Proc. Am. Acad. (Contrib. Gray Herb. cii.) lxviii. 149 (1933). *Tillandsia ingens* Mez. in Urb. Symb. Ant. ii. 256 (1900); in Engler, Pflanzenr. iv. Fam. 32, 458 (1935). *Vriesea Urbaniana* Harms in Notizbl. xii. 532 (1935). — Pl. II, figs. 14, 15.

COSTA RICA: PUNTARENAS: on *Hippomane Mancinella* on the beach, Santo Domingo de Golfo Dulce, Mar. 1896, *Tonduz in hb. Nat. Costar. 9883* and *in hb. J. D. Smith 7184* (G, US, Boiss; isotype of *Vriesea Alfarorii* Mez).

PANAMA: COCLE: vicinity of Penonome, Feb.-Mar., 1908, *R. S. Williams 621* (NY); PANAMÁ: top of peak among rocks, hills northeast of Hacienda La Joya, alt. 50-300 m., Dec. 9, 1934, *C. W. Dodge, Hunter, Steyermark & Allen 16907* (Mo, G); CANAL ZONE: westerly arm of Quebrada Salamanca, alt. 70 m., Dec. 16, 1934, *C. W. Dodge, Steyermark & Allen 17038* (Mo, G).

CUBA: ORIENTE: on trees in large clumps, Alto Cedro, Mar., 1903, *Underwood & Earle 1614* (NY); on trees in dense woods along railroad, Alto Cedro to Paso Estancia, Apr. 28, 1909, *Shafer 1627* (NY, G); Vista Alegre, alt. 1000 m., 1940, *Carabia 2192* (phot. G).

JAMAICA: MIDDLESEX: on banks and trees between Lancaster and Moody's Gap, alt. 750 m., Mar. 8, 1895, *W. Harris 5565* (Hb. Hope Gardens, Jamaica, and sketch NY, Las Vegas, G; isotype of *Tillandsia ingens* Mez); SURREY: on Bank, Mansfield, Parish of St. Thomas, Sept. 15-19, 1908, *N. L. Britton 3608* (NY).

COLOMBIA: EL VALLE: epiphytic, coastal thickets, Buenaventura, alt. 0-10 m., Oct. 5-10, 1922, *Killip 11736* (G); Indefinite: cultivated, Jan. 1880, *F. Massange* Liége, phot. G); cultivated, May 14, 1885, *E. Morren* (Liège, phot. G).

Judging from Harms' description of his *Vriesia Urbaniana* and his reference to *Shafer 1627*, the species is equivalent to *V. sanguinolenta*.

The exsiccatae of cultivated plants at Liége are probably the nearest thing we have for a type of *Vriesia sanguinolenta*. They are almost certainly lineal descendants of the type.

This Liége material closely resembles Mez's *V. Alfarorii* which he separates on the basis of its having a simple inflorescence. However, isotype material of *V. Alfarorii* at Washington with Tonduz's own label shows an indubitable lateral branch. With this not too good distinction removed, I find nothing left to separate the two species.

Some of the West Indian material has the floral bracts narrower than is typical but this character does not appear to be constant enough to be worth even varietal rank.

11. **Vriesia subsecunda** Wittm. Flowering plant 5 dm. high or less, very slender; leaves 20-35 cm. long, chartaceous, densely appressed-lepidote, brownish green, sometimes tinged with red or violet; blades linear, acuminate, 13-18 mm. wide; scape slender, erect, usually exceeding the leaves; scape-bracts imbricate, ovate or elliptic, acuminate or the upper ones acute, brown, submembranaceous, not foliaceous; inflorescence simple, densely 4-9-flowered, 4-9 cm. long; rhachis slender, flexuous, slightly angled; floral bracts becoming secund with the flowers, broadly ovate, about 26 mm. long, equaling the sepals at anthesis, convex and not carinate, strongly incurved toward the apex, even, chartaceous, light brown, slightly lustrous; flowers suberect, 28 mm. long; pedicels very stout, 4 mm. long; sepals elliptic, rounded and apiculate, 22 mm. long, 10 mm. wide, thin, even, glabrous outside, dark-punctulate-lepidote inside; petals yellow, each bearing 2 lanceolate acute or bicuspidate scales near the base; stamens and pistil included; ovules with a short stout protuberance, not truly caudate. — Epiphytic; Costa Rica, Panamá. — Wittm. in Engler, Bot. Jahrb. xi. 69 (1889); Mez in DC. Mon. Phan. ix. 595 (1896); in Engler. Pflanzenr. iv. Fam. 32, 389 (1935); L. B. Smith & Standley in Standley, Fl. Costa Rica in Bot. Ser. Field. Mus. xviii. 162 (1937); in. Mus. Nac. Costa Rica, Ser. Bot. i. 174 (1940); L. B. Smith in North American Flora, xix. 167 (1938). *Tillandsia subsecunda* (Wittm.) Bak. Brom. 217 (1889). *Vriesea diminuta* Mez et Wercklé in Bull. Herb. Boiss. ser. 2, iv. 869 (1904); Mez in Engler, Pflanzenr. iv. Fam. 32, 387 (1935); L. B. Smith & Standley in Standley, Fl. Costa Rica in Bot. Ser. Field Mus. xviii. 161 (1937); in Mus. Nac. Costa Rica, Ser. Bot. i. 173 (1940); L. B. Smith in North American Flora, xix. 167 (1938). — **Pl. II, figs. 6-8.**

COSTA RICA: HEREDIA: on trees near Río Sucio, alt. 400 m., Mar. 17, 1884, *Lehmann 1775* (Boiss, type; phot. G); ALAJUELA: on tree, vicinity of Fraijanes, alt. 1500-1700 m., Feb. 12-13, 1926, *Standley & Torres 47677* (US) and *47701* (US, phot. G); CARTAGO: on tree, Cerro de La Carpintera, alt. 1500-1850 m., Feb. 1924, *Standley 34440* (US); SAN JOSÉ: on tree, Cerro de Piedra Blanca. above Escasú, Jan. 31, 1924, *Standley 32601* (US, phot. G); on tree, Zurqui, alt. 2000-2500 m., Feb. 13, 1926, *Standley & Valerio 48332* (US) and *48336* (US); Cerro de Escasú, alt. 1800 m., Aug. 2, 1933, *F. Solis 278* (FM).

PANAMA: CHIRIQUI: valley of the upper Río Chiriqui Viejo, vicinity of Monte Lirio, alt. 1300-1900 m., June-July, 1935, *Seibert 229* (Mo, phot. G).

Since I have seen no authentic material of *Vriesia diminuta* Mez I am forced to judge solely by its description. From this it appears to be young material of *V. subsecunda* like *Standley 32601.* The floral bracts develop first and consequently they exceed the sepals in young material, but only equal them by anthesis.

12. **Vriesia Pittieri** Mez. Stemless, 5-10 dm. high; leaves 4-6 dm. long; sheaths elliptic, densely brown-punctulate-lepidote; blades ligulate, broadly acute and apiculate to acuminate, 3-4 cm. wide, flat, soon glabrous above, very obscurely punctulate-lepidote beneath; scape erect or ascending, stout; scape-bracts erect, exceeding the internodes, the lower foliaceous, the upper elliptic, acute or apiculate, rigidly coriaceous, subinflated; inflorescence simple, secundly 12-20-flowered, dense, 15-20 cm. long; rhachis stout, angled, geniculate; floral bracts secund with the flowers, very broadly ovate, obtuse and minutely cucullate, usually appearing acute by the inrolling of the margins, 30-35 mm. long, exceeding the sepals, 2-3 times as long as the internodes, coriaceous, even, bronze-green when fresh, drying to deep castaneous with a narrow pale margin, glabrous, lustrous; flowers subspreading; pedicels stout, 7-10 mm. long; sepals broadly elliptic, obtuse, 17-27 mm. long, coriaceous, dark brown, glabrous; petals broadly ligulate, 25-40 mm. long, pale green; stamens and pistil included; capsule stout, short-beaked, 3 cm. long, seeds with a usually reddish coma. — Epiphytic; Costa Rica. — Mez in Bull. Herb. Boiss. ser. 2, iii. 135 (1903); in Engler, Pflanzenr. iv. Fam. 32, 387 (1935); L. B. Smith & Standley in Standley, Fl. Costa Rica in Bot. Ser. Field Mus. xviii. 162 (1937); in Mus. Nac. Costa Rica, Ser. Bot. i. 174 (1940); L. B. Smith in North American Flora, xix. 166 (1938). Pl. II, figs. 16, 17.

COSTA RICA: Alajuela: Volcán Poás, alt. 2100 m., Mar. 1896, *J. D. Smith 6794* (US); epiphytic in subtropical zone, Palmira, Cantón Alfaro Ruiz, alt. 2000 m., June 21, 1938, *A. Smith nº H 789* (FM); subtropical zone, Palmira, near Zarcero, alt. 1900 m., Dec. 22, 1937, *A. Smith nº A 745* (FM, G); Cartago: on tree, Cerro de La Carpintera, alt. 1500-1850 m., Feb. 1924, *Standley 34364* (US, phot. G); San José: forests, Santa Rosa de Copey, alt. 2600-2700 m., April 1898, *Tonduz in hb. Inst. Nat. Costaric. 12229* (US, isotype; phot. G); on tree in dense oak and bamboo forest near Laguna de la Escuadra, northeast of El Copey, alt. 2000-2200 m., Dec. 16, 1925, *Standley 42082* (US); on tree in wet forest, Laguna de la Chonta, northeast of Santa María de Dota, alt. 2000-2100 m., Dec. 18, 1925, *Standley 42146* (US); common, on tree in wet forest, near Finca La Cima, above Los Lotes, north of El Copey, alt. 2100-2400 m., Dec. 21-22, 1925, *Standley 42651, 42731* (US).

13. **Vriesia viridiflora** (Regel) Wittm. ex Mez. Flowering plant barely 1 m. high, slender; leaves densely rosulate, up to 55 cm. long; blades ligulate, acuminate, 3-4 cm. wide, green, concolorous, glabrous above, obscurely punctulate beneath; scape erect, 4 mm. in diameter, elongate; scape-bracts erect and tubular-involute, slightly exceeding the internodes, broadly elliptic, acute, stramineous; inflorescence simple, densely distichous-flowered, 15-18 cm. long; floral bracts becoming secund with the flowers, very broadly ovate, obtuse, equaling the sepals, ecarinate, thin-coriaceous, minutely verrucose near the apex, green with brownish tips; flowers suberect; pedicels stout, 4-5 mm. long; sepals elliptic, obtuse, 15-20 mm. long; petals oblong, subtruncate and emarginate, about 4 cm. long, white, spreading above the sepals, each bearing 2 acute serrulate scales at the base; stamens slightly shorter than the petals; capsule fusiform, 4 cm. long; coma white. — Epiphytic; Costa Rica, British Guiana. — Wittm. ex Mez in Engler, Pflanzenr. iv. Fam. 32, 387 (1935); L. B. Smith & Standley in Standley, Fl. Costa Rica in Bot. Ser. Field Mus. xviii. 162 (1937); in Mus. Nac. Costa Rica, Ser. Bot. i. 175 (1940); L. B. Smith in North American Flora, xix. 167 (1938). *Pitcairnia viridiflora* Regel in Ind. Sem. Hort. Petrop. 1866. 81 (1867). *Tillandsia viridiflora* Regel, l. c., nomen in synon. *Vriesia viminalis* E. Morr. in Belg. Hort. xxviii. 257, t. 14-15 (1878); Ant. Phyto-Iconogr. 21, t. 14 (1884); Mez in DC. Mon. Phan. ix. 595 (1896); Harms in Engler & Prantl, Nat. Pflanzenfam. ed. 2, xv a. 125 (1930). *Tillandsia viminalis*

(E. Morr.) Hemsl. Biol. Centr.-Am. Bot. iii. 323 (1884); Bak. Brom. 214 (1889). — Pl. II, fig. 5.

COSTA RICA : GUANACASTE : on tree in moist forest, Naranjos Agrios, alt. 600-700 m., Jan. 29, 1926, *Standley & Valerio 46512* (US); CARTAGO: cultivated in the botanic garden at Liége from material originally collected by *Wendland* on Volcán Irazu near Cartago (hb. Liége, phot. G).

BRITISH GUIANA : NORTH WESTERN DISTRICT : on tree trunk in forest, portage between Aruau and Yarikita Rivers, lat. 8° N., long. 59°55′ W., Jan. 17, 1920, *Hitchcock 17593* (G).

The Liége material is undoubtedly from the same stock as *Vriesia viminalis* and quite possibly as *V. viridiflora* also.

The British Guiana material is so old and shattered that its identification is not certain, but what remains certainly accords better with *V. viridiflora* than with any other known species.

14. **Vriesia haplostachya** (C. Wright ex Sauv.) L. B. Smith. Leaves 4-6 dm. long, very obscurely punctulate-lepidote; sheaths elliptic, ample, nearly half as long as the blade; blades ligulate, acuminate, flat, 6 cm. wide; scape erect, 7-8 mm. in diameter, glabrous; scape-bracts densely imbricate, subfoliaceous, elliptic, acuminate, densely punctulate toward the apex and rugulose in drying; inflorescence simple, secundly 12-22-flowered, 20-35 cm. long; rhachis stout, flexous to geniculate, faintly angled; floral bracts secund with the flowers, very broadly ovate, obtuse, ecarinate, cucullate, equaling the sepals, thin-coriaceous, faintly many-nerved, obscurely punctulate; flowers stoutly short-pedicellate; sepals elliptic-oblong, obtuse, 35 mm. long, coriaceous; petals ligulate, probably obtuse, 5 cm. long, green, bearing 2 large scales at the base; stamens included; capsule 45 mm. long, acuminate. — Cuba. — L. B. Smith in Contrib. Gray Herb. cxiv. 9, t. 2, fig. 6 (1936); in North American Flora, xix. 168 (1938). *Tillandsia haplostachya* C. Wright ex Sauv. in Anal. Acad. Ci. Habana, viii. 73 (1871).

CUBA : ORIENTE : near the village of Monte Verde, 1859, *C. Wright* (G, isotype); Serra de Nipe on the border of Rio Piloto, 1914, *Ekman 3363* (S).

15. **Vriesia Hoehneana** L. B. Smith. Usually 2 m. or more high; leaves numerous in a spreading rosette, 3.5-5 dm. long;

sheaths large, broadly elliptic, dark castaneous, very densely and minutely appressed-lepidote; blades ligulate, broadly acute or obtuse and apiculate, flat, 6-8 cm. broad, pale green, concolorous, very finely reticulate with irregular cross-veins, obscurely punctulate-lepidote beneath, glabrous above; scape erect, elongate, 14 mm. in diameter at base, glabrous; scape-bracts erect, the lower foliaceous and densely imbricate, the upper broadly lanceolate and about equaling the internodes; inflorescence simple and bent obliquely from the summit of the scape or more often laxly few-branched; primary bracts like the upper scape-bracts, mostly shorter than the sterile bases of the racemes; racemes up to 28 cm. long, 8-16-flowered, the lateral ones divergent, slenderly stipitate, eprophyllate or with a single sterile bract in the same inflorescence, the terminal raceme long-stipitate with many sterile bracts like the upper scape-bracts; floral bracts becoming secund with the flowers at anthesis, up to 32 mm. long, about twice as long as the internodes, suborbicular, very broadly acute or apiculate, obtusely carinate toward the apex and slightly incurved, flavous, nearly or quite even, obscurely and very minutely brown-lepidote; flowers downwardly secund at anthesis, spreading; pedicels rather slender, up to 10 mm. long; sepals narrowly elliptic, obtuse, up to 34 mm. long, exceeding the floral bracts, minutely brown-lepidote especially inside; petals oblanceolate, obtuse, up to 5 cm. long, lemon-yellow, bearing 2 large acute scales at base; stamens included, filaments much thickened toward apex. — Terrestrial; Brazil. — L. B. Smith in Proc. Am. Acad. Arts & Sci. (Contrib. Gray Herb. cii.), lxviii. 150, t. 1, figs. 11-13 (1933); Mez in Engler, Pflanzenr. iv. Fam. 32, 398 (1935). *V. tessellata* E. Morr. sensu Hoehne, Album da Secção de Botanica do Museu Paulista, 97, c. fig. (1925).

BRAZIL: SÃO PAULO: in campo, Alto da Serra, Estrada do Vergueiro, Dec. 23, 1920, *Hoehne 4724* (G, SP); Campo Grande, Jan. 12, 1924, *Hoehne 9478* (G, SP); in campo, Estação Biologica, Alto da Serra, alt. 800-900 m., Feb. 17, 1929, *L. B. Smith 1945* (G, type); Oct. 28, 1936, *Hoehne & Gehrt 36647* (SP); Alto da Serra, Aug. 19, 1939, *M. B. & R. Foster 369* (G).

In my original publication of *Vriesia Hoehneana*, I referred to its relation to *V. Tweedieana* as interpreted by Mez in De

Candolle's Monographiae. Mez, evidently, read no further, for in the Pflanzenreich he treated *V. Hoehneana* as a dubious segregate of *V. Tweedieana* and took no account of my demonstration that true *V. Tweedieana* does not even belong in the same section of the genus as *V. Hoehneana.* However, the fact remains that *V. Hoehneana* has included stamens and belongs in the Section *Xiphion,* while true *V. Tweedieana* has exserted stamens, as shown in the type and noted in the original description, and thus belongs in the Section *Euvriesia.* In fact *V. Tweedieanae* an not be distinguished from *V. Rodigasiana* and must be considered a synonym of that species.

Actually *V. Hoehneana* shows no very strong relations with any other species, though habitally its greatest resemblance is doubtless to *V. sanguinolenta.*

16. **Vriesia graminifolia** Mez et Wercklé. Flowering plant barely 4 dm. high, very slender; leaves up to 4 dm. long, 5 mm. wide, linear and grass-like, acuminate, appressed-pale-lepidote, chartaceous when dry; sheaths violet-tinged; blades green, concolorous; scape erect, very slender, terete, glabrous; scape-bracts lax, very narrow, reddish with foliaceous blades; inflorescence simple, 3-flowered in the type, exceeded by the leaves, lax, 7 cm. long; axis slightly angled and undulate; floral bracts secund with the flowers and enfolding their bases on one side, membranaceous, striate, the lowest produced into a long acuminate blade, the others acute, 17 mm. long and about equaling the sepals; flowers suberect; pedicels stout, 5 mm. long; sepals elliptic, narrowly obtuse, 15 mm. long, 7 mm. wide, castaneous with a pale membranaceous border when dry, even and shiny; capsule acuminate, gray-black, opaque. — Costa Rica. — Mez & Wercklé in Bull. Herb. Boiss. ser. 2, iv. 868 (1904); Harms in Engler & Prantl, Nat. Pflanzenfam. ed. 2, xv a. 125 (1930); Mez in Engler, Pflanzenr. iv. Fam. 32, 390 (1935); L. B. Smith & Standley in Standley, Fl. Costa Rica in Bot. Ser. Field Mus. xviii. 161 (1937); in Mus. Nac. Costa Rica, Ser. Bot. i. 173 (1940); L. B. Smith in N. Am. Fl., xix. 163 (1938).

COSTA RICA: CARTAGO: near Cartago, *Wercklé 92* and *in Herb. Inst. Phys.-Geogr. Costaric. 17438* (hb. Mez, type).

In the original description no locality was given beyond «Costa Rica». Mez's collection of *Bromeliaceae* is now in the Berlin-Dahlem herbarium.

17. **Vriesia brassicoides** (Bak.) Mez. Flowering plant slightly over 4 dm. high; leaves numerous, 2-3 dm. long, densely ferruginous-lepidote throughout; sheaths suborbicular, more than half as long as the blades; blades narrowly triangular, 28 mm. broad at base, uncinnate-recurved at apex; scape erect, rather stout; scape-bracts erect, broadly elliptic with decurrent auricles, acute, 25 mm. long, distinctly shorter than the internodes, coriaceous; inflorescence simple, laxly 6-8-flowered, ca. 13 cm. long; rhachis stout, flexuous; floral bracts erect or secund with the flowers, suborbicular, obtuse, ecarinate, 23 mm. long, about equaling the internodes, much exceeded by the sepals, thick, coriaceous; flowers suberect to spreading, strongly secund; pedicels stout, 8 mm. long; sepals elliptic, obtuse, 27 mm. long, very thick and coriaceous; petals and stamens unknown. — Terrestrial; Brazil. — Mez in DC. Mon. Phan. ix. 598 (1896); in Engler, Pflanzenr. iv. Fam. 32, 391 (1935). *Tillandsia brassicoides* Bak. in Journ. Bot. xxvi. 12 (1888); Brom. 189 (1889); Mez in Mart. Fl. Bras. iii. pt. 3, 615 (1894). — Pl. III, fig. 1.

BRAZIL: FEDERAL DISTRICT: on cliffs near the summit of the Corcovado, Rio de Janeiro, 1826, *Burchell 1393* (K, type; phot. G).

18. **Vriesia Platzmannii** E. Morr. Plant 9-12 dm. high; leaves numerous in a dense crateriforme rosette, 1-5 dm. long, sheaths elliptic, 10-15 cm. long, dark brownish purple toward base, densely brown-punctulate-lepidote on both sides, blades ligulate, broadly rounded and apiculate, ca. 25 mm. wide at base, more or less blotched with red, glabrous above, obscurely punctulate-lepidote beneath; scape erect, slender, glabrous; scape-bracts erect, the lowest subfoliaceous and imbricate, the others elliptic, apiculate, much shorter than the internodes; inflorescence erect, simple, laxly 8-11-flowered, 1-2 dm. long, glabrous; axis slender, slightly geniculate, angled; floral bracts remaining erect, broadly ovate, acute, ca. 25 mm. long, barely exceeding the internodes, much exceeded by the sepals, convex, obtusely carinate, subcoriaceous, faintly nerved, dark purple; flowers

strongly secund, spreading; pedicels thick-cylindric, 1 cm. long; sepals elliptic, obtuse, 25-28 mm. long, ecarinate, even, yellow except for the brownish base; petals oblong, obtuse, over 4 cm. long, bearing 2 lobed scales at base; stamens included, filaments thickened toward apex, conglutinated; capsule cylindric, acute, 5 cm. long, seeds with a reddish brown coma. — Epiphytic; Brazil. — E. Morr. in Belg. Hort. xxv. 349, t. 23 (1875); Mez in Mart. Fl. Bras. iii. pt. 3, 546 (1894), as to type; in DC. Mon. Phan. ix. 599 (1896), as to type; in Engler, Pflanzenr. iv. Fam. 32, 392 (1935), as to name only. *Tillandsia Platzmannii* (E. Morr.) Bak. in Journ. Bot. xxvi. 104 (1888); Brom. 218 (1889). Pl. III, figs. 9-10.

BRAZIL : PARANÁ : in swamp at sea level, near Paranaguá on the road to Curityba, Sept. 1, 1939, *M. B. & R. Foster 445* (G); same, *M. Kuhlmann 41604* (SP).

Two previously unnoted species were involved in the original description of *Vriesia Platzmannii.* It seems best to preserve as the type the species discovered by Platzmann rather than the Blanchet specimen added by Morren. Mez proceeded rather uncertainly in the other direction and wound up in the Pflanzenreich by excluding the original plate by Platzmann and including the Blanchet material. However, he dropped the citation of *Tillandsia lancifolia* Baker based on that same Blanchet collection, where he had included it in his earlier monograph.

19. **Vriesia Schippii** L. B. Smith. About 4 dm. high; leaves rosulate, up to 3 dm. long, minutely punctulate-lepidote, marked below with transverse dark brown bands; sheaths large, elliptic; blades ligulate, acute, 3 cm. wide or slightly wider at the base; scape erect, slender, glabrous; scape-bracts imbricate, acuminate from an ovate base, inflated, pale brown, lepidote toward the apex but elsewhere glabrous, nearly even; inflorescence simple, laxly few-flowered; floral bracts broadly ovate, the lower ones acuminate, up to 43 mm. long, exceeding the sepals, not at all carinate nor imbricate, becoming secund with the flowers; rhachis slender, flexuous; flowers secund; pedicels 5 mm. long; sepals broadly elliptic, obtuse, 17 mm. long, glabrous, faintly nerved; capsule slenderly ellipsoid, 3 cm. long. —

Epiphytic; British Honduras. — L. B. Smith in Contrib. Gray Herb. xcviii. 18, t. 5, figs. 5-6 (1932); in North American Flora, xix. 164 (1938); Mez in Engler, Pflanzenr. iv. Fam. 32, 390 1935); L. B. Smith & Lundell, Bromel. Yucatan Penin. in Car-(negie Inst. Washington Publ. no 522, 123 (1940).

BRITISH HONDURAS : STANN CREEK : epiphytic in mountain forest near Middlesex, alt. 600 m., *W. A. Schipp no. S 82* (FM, type; phot. G).

20. **Vriesia macrochlamys** Mez et Wercklé. Flowering up to 7 dm. high, very stout; leaves 45 cm. long, 35 mm. wide, abruptly acute, green with irregular violet spots, rigid, subglabrous at maturity; scape erect, stout, glabrous, slightly exceeding the leaves; scape-bracts imbricate, elliptic, abruptly acute, rigid, shiny; inflorescence simple, laxly about 10-flowered, 18 cm. long; floral bracts becoming secund with the flowers, very broadly ovate, obtuse, 42 mm. long, inflated-convex, not at all carinate, very thick and rigid, punctulate-lepidote with immersed scales; flower-pedicels very stout; sepals very broadly elliptic, obtuse, 26 mm. long, 20 mm. wide, very thick, even except for the finely striate apex. — Costa Rica. — Mez & Wercklé in Bull. Herb. Boiss. ser. 2, iv. 865 (1904); Mez in Engler, Pflanzenr. iv. Fam. 32, 391 (1935); L. B. Smith & Standley in Standley, Fl. Costa Rica in Bot. Ser. Field Mus. xviii. 162 (1937); in Mus. Nac. Costa Rica, Ser. Bot. i. 174 (1940); L. B. Smith in North American Flora, xix. 164 (1938).

COSTA RICA : without further locality, *Wercklé 115* (Hb. Mez).

21. **Vriesia oligantha** (Bak.) Mez. Flowering plant 5-9 dm. high; leaves forming a slenderly crateriform rosette, 3 dm. long, sheaths elliptic, large, densely and minutely brown-appressed-lepidote, blades narrowly triangular, long-acuminate, nearly flat, ca. 3 cm. broad at base, densely cinereous-lepidote, not at all spotted, suffused with violet especially toward apex; scape erect, rather slender; scape-bracts erect, the lower foliaceous and much exceeding the internodes, the upper ovate apiculate and about equaling the internodes; inflorescence simple, laxly few-flowered, 12-19 cm. long; rhachis flexuous; floral bracts more or less secund with the flowers, ovate, acute, only slightly carinate

toward apex, 24 mm. long, somewhat longer than the internodes. distinctly shorter than the sepals, fleshy-coriaceous, coarsely lepidote or rarely becoming glabrous; flowers divergent-secund; pedicels 6 mm. long, stout; sepals oblong, obtuse, 30 mm. long, 8.5 mm. wide; petals and stamens unknown; capsule slenderly cylindric, acute, 7 cm. long, seeds with a pale ferrugineous or white coma. — Epiphytic; Brazil. — Mez in Mart. Fl. Bras. iii. pt. 3, 544 (1894); in DC. Mon. Phan. ix. 596 (1896); in Engler. Pflanzenreich, iv. Fam. 32, 390 (1935). *Tillandsia oligantha* Bak. in Journ. Bot. xxv. 345 (1887); Brom. 215 (1889). Pl. III, fig. 7.

BRAZIL: MINAS GERAES: epiphytic, Serra d'Ouro Preto, 1883-4, *Glaziou 15472* (K, type, phot. G; Ko, phot. G; B, fide Mez); on rocks and dwarf trees in extremely exposed situations, Vaccaria north of Bello Horizonte, Serra do Cipo, Minas Geraes, alt. 1400 m., July 12, 13, 1940. *M. B. & R. Foster 621* (G).

Mez also cites *Schenck 3507* from the same locality as the Glaziou material, and *Schwacke 9315* from Serra de Capanema. He gives the Glaziou locality as « Ouro Branco » while the Kew label reads « Ouro Preto ». Judging from Urban's account in the introductory volume of the Flora Brasiliensis, these are two different but not widely separated localities.

22. **Vriesia Broadwayi** L. B. Smith. Plant 5 dm. tall; leaves 3 dm. long, sheaths elliptic, densely and minutely ferrugineous-lepidote on both sides, blades narrowly triangular, acuminate. 2 cm. wide at base, glabrous above, sparsely and obscurely punctulate-lepidote beneath; scape erect, slender, glabrous: scape-bracts erect, densely imbricate, sparsely punctulate-lepidote, the lower ones foliaceous, the upper broadly elliptic, apiculate, pale brown; inflorescence simple, racemose, 7-9 cm. long. laxly 5-7-flowered, minutely ferrugineous-lepidote; rhachis slender, flexous; floral bracts becoming secund with the flowers. broadly ovate, abruptly acute, brown, up to 22 mm. long, exceeded by the sepals and distinctly less than twice as long as the internodes, subchartaceous, brown, sparsely appressed-ferrugineous-lepidote toward the base; flowers spreading-secund: pedicels rather stout, 7-8 mm. long.; sepals broadly elliptic. obtuse, 18 mm. long, subcoriaceous, faintly nerved, dark brown

except for the pale margin; petals unknown; capsule subcylindric, 35 mm. long. — Epiphytic; Trinidad. — L. B. Smith in Proc. Am. Acad. Arts & Sci. (Contrib. Gray Herb. cii.) lxviii. 149, t. 1, figs. 9, 10 (1933); Broadway & Smith, op. c. 172; Mez in Engler, Pflanzenr. iv. Fam. 32, 390 (1935).

TRINIDAD: Heights of Aripo, Jan. 10-26, 1922, *Broadway 9916* (Trin, type; phot. G; K, NY); Mt. Tucuche, April 3-5, 1920, *N. L. Britton, Hazen & Mendelson 1258 in part* (G, NY); in large patches on tree-trunks, 11-12 mile posts, Tucuche, April 19, 1929, *Broadway 7096* (K).

23. **Vriesia unilateralis** (Bak.) Mez. Plant 55-95 cm. high; leaves many in a dense crateriform rosette, 35-50 cm. long, sheaths broadly elliptic, much wider than the blades, blades ligulate, broadly rounded and apiculate, 3-4 cm. wide, concolorous, yellow-green, glabrous above, obscurely punctulate-lepidote beneath; scape erect, 5-8 mm. in diameter; scape-bracts erect, imbricate and closely enfolding the scape, broadly ovate, apiculate, submembranaceous; inflorescence erect, simple, 6-20-flowered, 10-15 cm. long; axis slender, flexuous; floral bracts remaining erect or nearly so, broadly ovate, acute, up to 35 mm. long, about twice as long as the internodes, broadly convex, ecarinate, greenish; flowers strongly secund, spreading; pedicels subcylindric, stout, 1 cm. long; sepals narrowly elliptic, obtuse, 24 mm. long, exceeding the floral bracts, ecarinate; petals ligulate, 3 cm. long; stamens included. — Epiphytic; Brazil. — Mez in Mart. Fl. Bras. iii. pt. 3, 545 (1894); in DC. Mon. Phan. ix. 598 (1896); in Engler, Pflanzenr. iv. Fam. 32, 391 (1935). *Tillandsia unilateralis* Bak. in Journ. Bot. xxvi. 105 (1888); Brom. 218 (1889). — Pl. III, figs. 2-4.

BRAZIL: ESPIRITO SANTO: Vargem Alta, Morro do Sal, Aug. 16, 1940, *M. B. & R. Foster 950* (G); SÃO PAULO: São Bento near Santos, Oct. 25, 1826, *Burchell 3347* (K, type; phot. G); PARANÁ: on tree-trunks in virgin forest, Porto de Cima, Serra do Mar, alt. 200 m., Feb. 18, 1915, *Dusén 16663* (US, S, phot. G); SANTA CATHARINA: near Blumenau, *Fritz Mueller* (Mez !).

24. **Vriesia Racinae** L. B. Smith (see p. 387). Flowering plant less than 3 dm. high; leaves numerous in a dense rosette, 10-11 cm. long, sheaths broadly elliptic, sometimes as long as the

blade and always much wider, brown-punctulate-lepidote, deep castaneous near base, brown-spotted near apex, blades ligulate, broadly acute and apiculate, 15-20 mm. wide, flat and coiled-recurving, glabrous above, beneath obscurely punctulate-lepidote and coarsely and densely maroon-spotted; scape erect, slender, glabrous; scape-bracts erect, imbricate, closely enfolding the scape, elliptic, acute; inflorescence simple, lax, 5-flowered in the type, glabrous; rhachis nearly straight, ca. 6 cm. long; floral bracts partly erect, partly secund with the flowers, broadly ovate, acute, up to 18 mm. long, equalling or slightly exceeding the internodes, convex, ecarinate, even; flowers secund, spreading; pedicels slenderly obconic, 1 cm. long; sepals narrowly elliptic, 18 mm. long, much exceeding the floral bracts, convex, ecarinate; petals, stamens and pistil not known. — Epiphytic; Brazil. — Pl. III, figs. 5, 6.

BRAZIL: ESPIRITO SANTO: epiphytic, Santa Teresa, alt. 775 m., July 26, 1939, *M. B. & R. Foster 270* (G, type).

25. **Vriesia amazonica** (Bak.) Mez. Flowering plant 1 m. or more high; leaves at least 5 dm. long; blades ligulate, broadly acute then long-apiculate and pungent, over 8 cm. wide, green, concolorous, glabrous at maturity; scape erect, 15-20 mm. in diameter; scape-bracts straight, erect, densely imbricate, very broadly ovate with a narrowly triangular elongate blade; inflorescence few-branched or simple; primary bracts like the upper scape-bracts, much shorter than the sterile bases of the branches; racemes divergent, 2-4 dm. long, laxly 6-20-flowered, bearing 2 sterile bracts at base; floral bracts secund with the flowers, very broadly ovate, acute, ca. 25 mm. long, much shorter than the sepals, about equaling the internodes, obtusely carinate, inflated-convex, coriaceous, even, glabrous; flowers spreading, downwardly secund; pedicels stout, up to 1 cm. long; sepals very broadly elliptic, 20-25 mm. long, broadly obtuse, ecarinate, coriaceous; petals and stamens not known; capsule subellipsoid, acute, 40-45 mm. long, nearly black. — Epiphytic and terrestrial; French Guiana, Brazil. — Mez in Mart. Fl. Bras. iii. pt. 3, 554 (1894); L. B. Smith in Contrib. Gray Herb. cxxiv. 11 (1939). *Tillandsia gigantea* Mart. ex R. et S. Syst.

vii. 1224 (1830); Bak. Brom. 222 (1889). *Tillandsia amazonica* Bak. in Jour. Bot. xxvi. 108 (1888); Brom. 220 (1889). *Vriesia gigantea* (Mart. ex R. et S.) Mez in Mart. Fl. Bras. iii. pt. 3, 566 (1894); in DC Mon. Phan. ix. 612 (1896); in Engler, Pflanzenr. iv. Fam. 32, 402 (1935), non Gaud. (1846). — Pl. III, fig. 8.

FRENCH GUIANA: without further locality, *Melinon* (Mez !).
BRAZIL: PARÁ: near Belem (Pará), 1829, *Burchell 9440* (K, type; phot. G); AMAZONAS: on banks and trees, Río Negro, *Martius s. n.* (Mun, type of *Tillandsia gigantea* Mart. ex R. et S.; phot. G); MATTO GROSSO: on large branches in virgin forest, Serra do Itapirapuan, Cascata do Angelim, April 26, 1894, *Lindman nº A 3517* (S, phot. G).

The inflorescence is simple in the type specimen and for that reason I have included the description of the species in this treatment although I believe it is more usual for the inflorescence to be compound.

The general habit is much like that of *Vriesia sanguinolenta* but the leaves are concolorous so far as known and the racemes much more laxly flowered.

26. **Vriesia ringens** (Griseb.) Harms. Flowering plant very variable in size; leaves up to 9 dm. long; sheaths ovate-elliptic, mostly indistinct, brown-punctulate-lepidote; blades ligulate, acute or acuminate, 6 cm. wide, green or occasionally with a faint purplish tinge, concolorous or obscurely banded, obscurely punctulate-lepidote beneath; scape erect, stout; scape-bracts erect, densely imbricate, elliptic-lanceolate, acute, pale green; inflorescence laxly compound or rarely simple, up to 5 dm. long; primary bracts like the scape-bracts but thinner, much shorter than the axillary branches; branches suberect, secundly few-flowered, bearing several imbricate sterile bracts at the base; rhachis usually slender, verrucose just below the nodes; floral bracts very broadly ovate, acuminate, 30-65 mm. long, enfolding the flowers, exceeding the sepals of at least the lower flowers, straight, carinate toward the apex, green or brownish; flowers erect, up to 8 cm. long, glabrous; sepals elliptic, acuminate, 25-35 mm. long, 13 mm. wide, subcoriaceous, lustrous; petals white or yellow (Duss !), coiling-recurved, shorter than the stamens, flaccid, bearing 2 large spatu-

late acute scales at the base. — Epiphytic; Costa Rica, Panamá, West Indies, Colombia. — Harms in Notizbl. x. 801 (1929); in Engler, Nat. Pflanzenfam. ed. 2, xv a. 124 (1930); Mez in Engler, Pflanzenr. iv. Fam. 32, 403 (1935); L. B. Smith in North American Flora, xix. 163 (1938). *Tillandsia ringens* Griseb. Cat. Pl. Cub. 255 (1866); Wright & Sauvalle, Fl. Cub. 168 (1873); Bak. Brom. 222 (1889). *T. chagresiana* Bak. in Jour. Bot. xxvi. 109 (1888); Brom. 222 (1889). *T. Veitchii* Bak. Brom. 223 (1889). *Vriesia Veitchii* E. Morr. ex Bak. l. c., nomen in synon. *V. paniculata* Mez in DC. Mon. Phan. ix. 614 (1896), as *V. panniculata,* quoad *Tillandsia ringens* Griseb., non quoad *T. paniculata* L.; Urb. Fl. Doming. in Symb. Ant. viii. 87 (1920); Broadway & L. B. Smith in Proc. Am. Acad. (Contrib. Gray Herb. cii.) lxviii. 173 (1933); Standley, Fl. Panama Canal Zone in Contrib. U. S. Nat. Herb. xxvii. 108 (1928); Fl. Barro Colorado Is. in Contrib. Arnold Arboretum, v. 43 (1933). — Pl. III, figs. 11-14.

COSTA RICA : Carillo, *Wercklé 73, 143, 147,* in hb. Inst. Phys.-Geogr. Costaric. *17442, 17462* (fide Mez).

PANAMA : COLÓN : Chagres, Feb. 11, 1850, *Fendler 448* (K, type of *Tillandsia chagresiana* Bak., phot. G); CANAL ZONE : on trees, common, Mount Hope Cemetery, Dec. 28, 1923, *Standley 28812* (US); westerly arm of Quebrada Salamanca, alt. 70 m., Dec. 16, 1934, *C. W. Dodge, Steyermark & Allen s. n.* (Mo, G); DARIEN : Chepigana District, rain forest, Cana-Cuasi Trail, alt. 1370 m., Mar. 12, 1940, *M. E. & R. A. Terry 1527* (FM).

CUBA : ORIENTE : near Monte Verde, Jan.-July, 1859, *C. Wright 1518* (G, isotype, Mo), *1520a* (G); deciduous woods and thickets, Serra Nipe, near Woodfred, alt. 450-550 m., Dec. 16, 1909, *Shafer 3193* (NY); same Jan. 10, 1910, *Shafer 3499, 3499a* (NY); vicinity of Loma del Gato, Cobre Range of Sierra Maestra, July-Aug., 1921, *Leon, Clement & Roca 10408* (NY); slope near Rio Sabanilla, Sabaneta, Baracoa, July 23, 1938, *Leon 18379* (Inst. La Salle); SANTA CLARA : betwen El Porvenir and Aguacate, Trinidad Mountains, alt. 700-900 m., Mar. 10, 1910, *N. L. Britton & Wilson 5362* (NY, phot. G); Pico Potrerillo, April 9, 1940, *Acuña 11125* (Est. Las Vegas).

JAMAICA : SURREY : on tree, Parish of St. Thomas, alt. 800 m., Sept. 15-19, 1908, *N. L. Britton 3546* (NY, phot. G); on trees, eastern slopes, John Crow Mountains, alt. 520 m., Mar. 9-11, 1909, *N. L. Britton 4147* (NY); MIDDLESEX : near Moody's Gap, alt. 750 m., Mar. 8, 1895, *W. Harris 5217* (G); on log in woods, Union Hill near Moneague, Parish of St.

Ann's, alt. 700 m., April 6-7, 1908, *N. L. Britton & Hollick 2800* (NY); on tree, between Lancaster and Moody's Gap, Sept. 10, 1908, *N. L. Britton 3357* (NY); CORNWALL : woods, summit of Dolphin Head, Mar. 17, 1908, *N. L. Britton & Hollick 2854* (NY).

HAITI : on trees, between Petit Brogne and Mt. Casse, alt. ca. 150 m., Aug. 16, 1903, *Nash 560* (NY. phot. G); epiphytic valley of Rivière de Barre, St. Louis du Nord, Massif du Nord, alt. ca. 50 m., April 14, 1925, *Ekman no. H 3796* (US); road to M. Baron at Vital, St. Louis du Nord, alt. 250 m., April 23, 1925, *Ekman no. H 3896* (US).

LESSER ANTILLES : GUADELOUPE : 1896, *Duss 3725* (G, NY, Mo); DOMINICA : Feb. 2, 1933, *Cooper « orchid 6 »* (G); epiphytic, cleared lands and forest borders, Sylvania, Feb. 16, 1940, *W. H. & B. T. Hodge 1167* (G); common epiphyte on *Citharexylum*, Lisdara, alt. 457 m., Mar. 30, 1940, *Hodge 2346* (G); epiphytic, border of high-stem rainforests, Syndicate Plantations, close to northwest slopes of Morne Diablotin, alt. 600 m., Apr. 8, 1940, *Hodge 2628* (G); same, Apr. 10, 1940, *Hodge 2911* (G); very common epiphyte throughout moist forests bordering Pegoua River in vicinity of Deux Branches, Concorde Valley, May 6-7, 1940, *Hodge 3465* (G). MARTINIQUE : epiphytic, heights of Trois-Flets, 1879, *Duss 274* (US, NY, phot. G). TRINIDAD : *Broadway 3235* (Mez !).

COLOMBIA : BOLÍVAR : epiphytic, coastal thickets, Cartagena, Oct. 5-10, 1922, *Pennell 11736* (G); EL VALLE : epiphyte, coastal thickets, Punta Arenas, Feb. 3, 1939, *Killip 33019* (G).

At first it seemed as if it might be possible to separate the specimens of *Vriesia ringens* from the Lesser Antilles as a variety. But as more and more material has been studied, supposed distinctions have broken down. Figures 11 and 12 of plate III illustrate the typical form with large firm floral bracts and firm sepals, while figures 13 and 14 show the other extreme with smaller thinner floral bracts and thinner but equally large sepals.

Plate 1

Fig. 1. Hohenbergia guatemalensis L. B. Smith *(Standley 71169)*, leaf and inflorescence × 1/5.

2. Same, floral bract × 1.
3. Same, sepal × 2.
4. Same, longitudinal section of ovary × 2.
5. Pitcairnia Tuerckheimii Donn. Smith var. macrolepis L. B. Smith *(Skutch 995)*, flower and bract × 1/2.
6. Same, sepal × 1.
7. Tillandsia ionantha Planch. var. scaposa L. B. Smith *(Standley 63065)*, plant × 1/2.
8. Tillandsia polita L. B. Smith *(Standley 62465)*, leaf and inflorescence × 1/5.
9. Same, young flower and bract × 1.
10. Vriesia pectinata L. B. Smith *(Standley 69055)*, section of scape × 1/2.
11. Same, section of inflorescence and leaf × 1/2.
12. Same, sepal × 1.
13. Same, petal × 1.
14. Tillandsia Penlandii L. B. Smith *(Penland & Summers 1138)*, branch of inflorescence × 1/2.
15. Same, flower × 2.
16. Tillandsia Penlandii L. B. Smith var. pedunculata L. B. Smith *(Daniel & Tomás 1558)*, branch of inflorescence × 1/2.
17. Same, flower and bract × 2.
18. Vriesia pachychlamys (Bak.) Mez *(Jenman 2044)*, leaf and inflorescence × 1/5.
19. Same, sepal × 1.
20. Vriesia longicaulis (Bak.) Mez *(Foster 111)*, leaf and inflorescence × 1/5.
21. Same, sepal × 1.
22. Vriesia Claussenana Mez *(Claussen s. n.)*, inflorescence and leaf × 1/8.

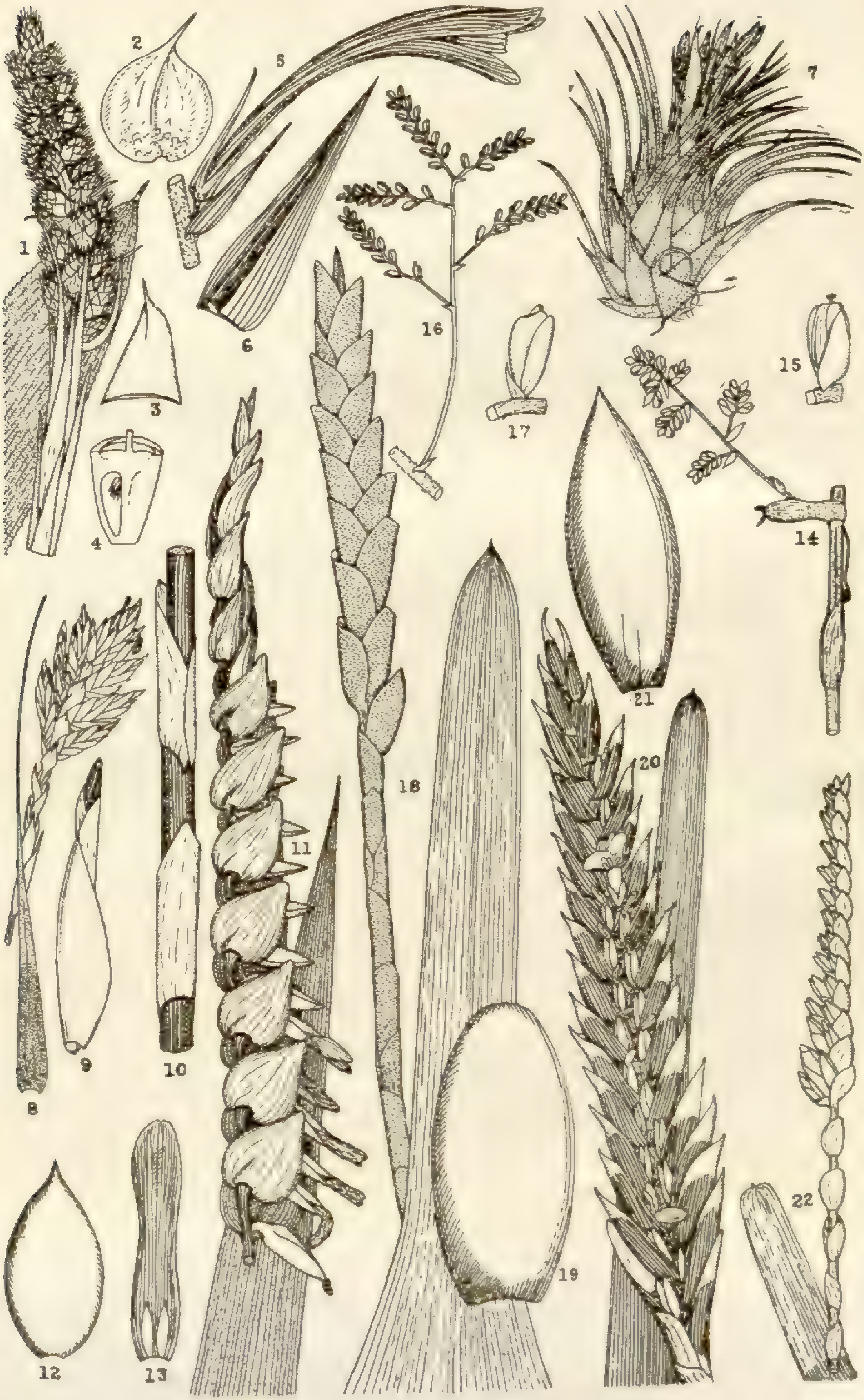
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PLATE II

Fig. 1. VRIESIA GLADIOLIFLORA (Wendl.) Ant. (after Antoine), leaf-blade and inflorescence × 1/5.

2. Same, flower × 1/2.
3. VRIESIA LANCIFOLIA (Bak.) L. B. Smith *(Blanchet 3458)*, scape and inflorescence × 1/5.
4. Same, leaf × 1/5.
5. VRIESIA VIRIDIFLORA (Regel) Wittm. ex Mez (after Antoine), leaf-blade and inflorescence × 1/5.
6. VRIESIA SUBSECUNDA Wittm. *(Lehmann 1775)*, apex of leaf-blade and inflorescence × 1/2.
7. Same, sepal × 1.
8. Same, petal × 1.
9. VRIESIA GUADELUPENSIS (Bak.) Mez *(Duss 3321)*, apex of leaf-blade and inflorescence × 1/5.
10. Same, sepal × 1.
11. VRIESIA LONGISCAPA Ule *(Smith & Brade 2293)*, leaf and inflorescence × 1/5.
12. Same, sepal × 1.
13. Same, petal × 1.
14. VRIESIA SANGUINOLENTA Cogn. & March. *(Dodge, Hunter & Steyermark 16907)*, apex of leaf-blade and lateral spike × 1/5.
15. Same, sepal × 1.
16. VRIESIA PITTIERI Mez *(Tonduz 12229)*, apex of leaf-blade and inflorescence × 1/5.
17. Same, sepal × 1.
18. VRIESIA TONDUZIANA L. B. Smith *(Tonduz 12349)*, apex of leaf-blade and inflorescence × 1/5.
19. Same, sepal × 1.


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Plate III

Fig. 1. Vriesia brassicoides (Bak.) Mez *(Burchell 1393)*, leaf and inflorescence × 1/5.

2. Vriesia unilateralis (Bak.) Mez *(Burchell 3347)*, leaf × 1/5.
3. Same (Dusén 16663), scape and inflorescence × 1/5.
4. Same, sepal × 1.
5. Vriesia Racinae L. B. Smith *(M. B. & R. Foster 270)*, leaf × 1/2.
6. Same, scape and inflorescence × 1/2.
7. Vriesia oligantha (Bak.) Mez *(Glaziou 15472)*, plant × 1/5.
8. Vriesia amazonica (Bak.) Mez *(Martius s. n.)*, branch of inflorescence × 1/2.
9. Vriesia Platzmannii E. Morr. (after Morren), inflorescence × 1/2.
10. Same, petal × 1.
11. Vriesia ringens (Gris.) Harms *(Wright 1518)*, plant × 1/5.
12. Same *(Wright 1520a)*, sepal × 1.
13. Same *(Duss 3725)*, inflorescence × 1/5.
14. Same, sepal × 1.


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CXXXVIII

MONOGRAPHIC STUDY OF ARABIS IN WESTERN NORTH AMERICA

REED C. ROLLINS

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A MONOGRAPHIC STUDY OF ARABIS IN WESTERN NORTH AMERICA

Reed C. Rollins

In *Arabis,* one of the larger genera of the *Cruciferae,* the excessive variability of certain species and the lack of sharply defined diagnostic characters throughout have given it a reputation of being exceedingly complex. The speciation is especially complicated in the Cordilleran region of western North America which is one of the principal centers of distribution for the genus. Elsewhere, *Arabis* is represented mostly in the north-temperate regions of the world with special areas of species-concentration in Europe and Asia. An inadequate appreciation of the importance of *Arabis* in North America is evident in all general systematic treatments of the *Cruciferae.* Even in the late pretentious work of O. E. Schulz,[1] the American species were not sufficiently considered in setting up the sixteen sectional divisions. As a result, many of our species are not properly referable to any section.

Perhaps one reason why American species have been largely ignored by the creators of world-wide systems of plant-classification is the lack of an inclusive, detailed study of *Arabis* in which the species and their relationships have been carefully and accurately evaluated. Recently, Hopkins[2] has partly met

[1] Engler & Harms, Pflanzenf. **17b**: 542–547 (1936).

[2] Rhodora **39**: 63–98, 106–148, 155–186 (1937).

the need by giving us a treatment covering eastern and central North America, but the larger task of dealing with the species of the western portion of the North American Continent has not been accomplished. The central object of the present study has been the preparation of a systematic account of *Arabis* to fill this gap, but natural variation and the phylogenetic relationships of the species have also received attention.

Unlike many genera of plants with endless modifications of flower-parts, the flowers of *Arabis* are monotonously uniform. Even the fruits and foliage are alike in some species so that in many instances trivial structures must be elevated to a position of prominence in treating the species and their relationships. Fortunately there are a number of clearly discrete species in *Arabis* which have been available as points of reference in their respective circles of affinity. These species are guide-posts to limits of variation and definitive characters and afford a general basis for interpreting species of a less clearly defined nature. The practice of constantly referring to natural, clearly defined species for aid in clarifying those of some obscurity has been such a standard procedure in the present investigation that it is expedient to list some of the species used. These are *A. blepharophylla, A. cobrensis, A. Crandallii, A. crucisetosa, A. Cusickii, A. dispar, A. furcata, A. glaucovalvula, A. Koehleri, A. Parishii, A. perennans, A. platysperma, A. rectissima, A. Shockleyi* and *A. suffrutescens.*

The taxonomic history of *Arabis* has been carefully worked out and presented by Hopkins.[1] A further discussion of the subject is unnecessary. Except for one species, *A. petiolaris*, not included by Hopkins, this study is concerned with the native species of *Arabis* occurring west of the one hundredth meridian in North America. It is expected that the present paper will be used in conjunction with that of Hopkins so that wherever possible duplication of his work has been avoided.

The present work cannot be considered to be final. *Arabis* is too complex for that. However, as much data and experience as it has been possible to assemble over a period of half-a-dozen years have been directed toward a solution of the problems involved. Some species are inadequately known because the re-

[1] Op. cit. pp. 63–66.

gions inhabited by them have not been botanically explored. Others should be studied genetically and cytologically to elucidate certain problems concerning them. Still others should be cultivated in various ecological situations in order to test their presumed plasticity. These methods of approach are beyond the possible scope of this investigation, but it is hoped they will eventually be utilized. Eighteen of the fifty-three species included in the present work have been grown continuously for two or three years. All flowered except *A. hirsuta* and *A. glabra* which grew vigorously for three years without producing flowering stems. The plant-cultures were grown from seed collected in the wild and have been used for observations on the ontogeny of the species and a certain amount of cytological investigation.

Relationships with other Genera

The question as to how far usual or well understood generic limits may be stretched without causing a complete breakdown in established concepts is particularly pertinent in the *Cruciferae*. In this family, the genera as often constituted are not wholly natural. This is true because of the tendency to include species which claim one or perhaps a few characteristics in common with those obviously belonging with the generic type, but which differ sufficiently to be definitely discordant. Large genera often receive many species in which the relationships are dubious and thus over a period of years may become so heterogeneous as to be almost an absurdity. It is the business of the monographer to evaluate and place anomolous species. In studying *Arabis*, it has been my policy to check carefully the generic character of each species under consideration before placing it unequivocally in the genus. While doing so, as one might expect in a genus dating from Linnaeus, several species have been found to be quite out of place.

In America, the nearest related genus to *Arabis* is *Sibara*. In 1896, Greene[1] proposed the anagram *Sibara* as a generic name for a number of species with common characters previously placed by various authors in *Arabis*, *Cardamine*, *Sisymbrium* and *Nasturtium*. These species seemingly are more closely re-

[1] Pittonia 3: 10 (1896).

lated to *Arabis* than to any other genus and, indeed, they have a number of characters in common with it. Greene failed to point out reliable differences between *Sibara* and *Arabis* and as a result many subsequent writers have not recognized his genus as a valid one. *Arabis* is related to *Sibara* through such species as *A. lyrata* and *A. arenosa* which belong to the so-called section *Cardaminopsis.* At least two recent students of the *Cruciferae,* von Hayek[1] and O. E. Schulz,[2] have given generic recognition to *Cardaminopsis.* I do not concur with them in the opinion that *Cardaminopsis* is a genus distinct from *Arabis,* but it must be admitted that *A. lyrata* and its relatives are not next door to *A. alpina,* the type of the genus. To add species to *Arabis* which are only remotely related, if at all, to *A. lyrata,* the latter being somewhere near the outer boundary of the generic limits, simply overruns the natural definitive lines of the genus. Such a practice carried to its logical conclusion in a family like the *Cruciferae* would only lead to the establishment of another absurd *Crucifera* as conceived by Krause.[3]

Sibara as a genus rests on the following characters which do not belong or belong only in part to *Arabis:* pectinate to pinnatifid, somewhat glaucous foliage; similar basal and cauline leaves; petiolate cauline leaves; annual or at very most biennial habit; absence of glandular tissue adjacent to the paired stamens; and the lack of an expanded pedicel-summit. The foliage of all the species of *Sibara* is highly dissected, varying from runcinate-pinnatifid to pectinate with many narrow divisions. This type of foliage is common in *Cardamine* and *Sisymbrium,* but is unknown in *Arabis* proper. The basal rosette is caducous or entirely absent in *Sibara,* but always the first formed leaves are similar to the cauline ones. In *Arabis,* a basal rosette is usually developed and in all cases the basal leaves are differentiated from the cauline. Such recent authors as von Hayek[4] and Villani,[5] among others, have stressed the configuration of the nectar-glands on the receptacle as being of fundamental importance in classifying the *Cruciferae.* It is undoubtedly

[1] Fl. Steiermark **1**: 477 (1908).
[2] Op. cit. p. 541.
[3] Sturm's Fl. Deutsch. **6**: 31–169 (1902).
[4] Beiheft Bot. Centralb. **27**: 127–335 (1911).
[5] Annali di Botanica **16**: 71–121 (1923).

true that they have overemphasized this character, since more variation in natural genera occurs than they have taken account of, but when used in conjunction with other characteristics, this feature is a useful tool to aid in clarification of generic lines. In *Arabis*, the glandular tissue of the nectaries is well-developed and surrounds the base of the single stamens, subtends or surrounds the base of the paired stamens, except in one small group, and often subtends or partially surrounds the base of each petal. *Sibara*, on the other hand, has poorly developed nectaries. The glandular tissue subtends or rarely almost surrounds the base of the single stamens in a thin mold, but is absent or obsolete elsewhere on the receptacle. The most noticeable difference between *Arabis* and *Sibara*, aside from the foliage, is the lack of an expanded pedicel-summit in the latter genus. *Arabis* always has the pedicel-summit expanded in such a way as to create an enlarged support for the receptacle and nectaries. On mature fruits, a rather abrupt narrowing from pedicel-summit to replum-base is evident. In *Sibara*, there is practically no change in diameter or only a slight gradual expansion between pedicel and replum-base. An obscure ring of sepal-, petal-, and stamen-scars and shriveled nectaries alone mark the outer part of the receptacle after mature siliques have been developed. Very small flowers and a branching habit give *Sibara* a habital symmetry which is distinctive in itself. Only one or two species of *Arabis* have flowers even approaching the small size of the largest flowers of *Sibara* and only a few species have a similar habital aspect.

The essential characters setting *Arabis* off from other genera possessing linear siliques are its accumbent cotyledons and siliques flattened parallel to the septum. One possible exception to the flattened siliques is found in *A. glabra*, but here the siliques are often somewhat flattened and are never more than semiterete. The nature of the siliques together with the distinctive creamy-yellow petals in *A. glabra* are used by some botanists, especially the European, to separate this species from *Arabis* as *Turritis glabra*. There can be no doubt but that *A. glabra* is somewhat related to *A. hirsuta* which it nearly parallels in distribution, and it seems preferable to retain it in *Arabis*.

In the related *Halimolobos*, the siliques are terete and the seeds have incumbent cotyledons. These points, together with the general habit, seem to place *Halimolobos* nearer to *Sysimbrium* than to *Arabis*. Several species, such as *A. Whitedii* and *A. Hookeri*, with terete siliques and incumbent cotyledons are now more naturally placed with *Halimolobos*.

Arabis is sometimes placed near *Cardamine*, but it is not believed that these genera are at all closely related. The peculiar elastic valves, opening with a relatively wide band of replum-tissue remaining on each side, is a distinctive feature of *Cardamine* and *Dentaria*. It should be stressed that the stamens of *Arabis* are always tetradynamous. This aids in distinguishing it from genera like *Thelypodium* where the single and paired stamens are of equal length.

Relationships of the Species

The systematic classifications of *Arabis* presented by DeCandolle,[1] Meyer,[2] Prantl,[3] Watson,[4] v. Hayek,[5] N. Busch,[6] and O. E. Schulz,[7] though almost successively more complicated in the chronological order given, do not satisfactorily allow for the inclusion of the North American plants without separating obviously related species into different sections. The weaknesses of these attempts to arrange systematically the species of *Arabis* into sections result from the fact that there are no clearly defined groups within the genus. Furthermore, many of the workers did not have sufficient material to insure an inclusive treatment. In the older works the lack of representative species was the penalty imposed by the immaturity of the science itself, but the recent students have been more fortunate in this respect. However, even with a quantity of material available for study, the difficulty resulting from the lack of clearly defined subgenera or sections cannot be overcome. It is my conviction that among the western American species of *Arabis* truly natural subdivisions of the genus other than the species themselves are nonexistent. For this reason I have arranged these species in

[1] Syst. Nat. **2**: 214 (1821) and Prod. **1**: 142–148 (1824).
[2] Ledeb., Fl. Alt. **3**: 18–20 (1831).
[3] Engler & Prantl, Pflanzenf. **3**: 2 Abt. 192–193 (1891).
[4] Gray, Syn. Fl. N. Am. **1**: 159–167 (1895).
[5] Beih. Bot. Central. **27**: 204 (1911).
[6] Fl. Sib. et Orient. Ext. **4**, fam. **25**: 428–475 (1926).
[7] Engler and Harms, Pflanzenf. **17b**: 2 Aufl. 542–547 (1936).

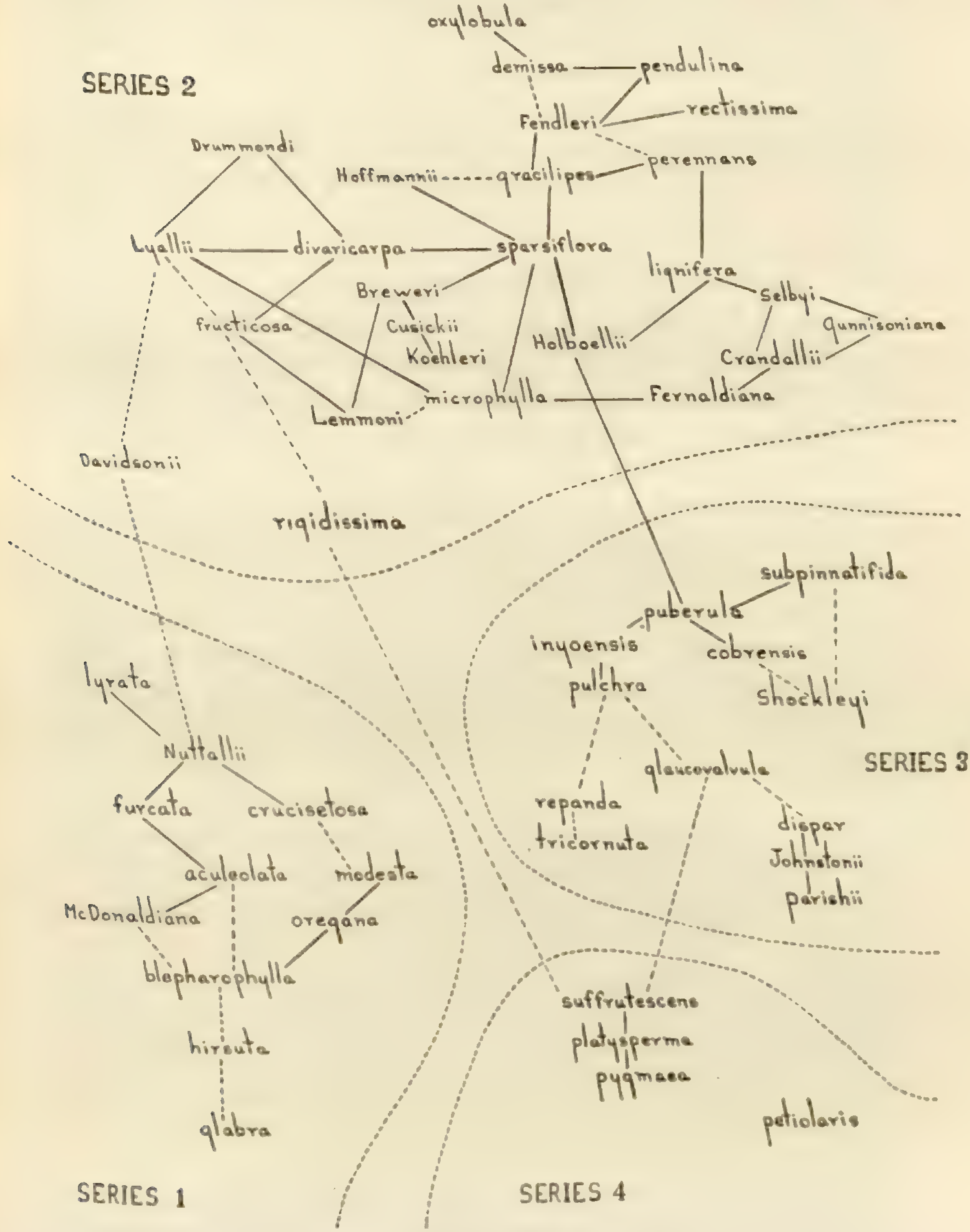

Fig. 1. Relationships in Arabis

four more or less interrelated series of no specified taxonomic rank. It should be understood that these divisions do not correspond to previously published sections of *Arabis*, and are used primarily for the purpose of indicating probable circles of affinity. The four series are presented in chart form as FIG. 1. Solid lines between species indicate a rather close relationship, broken lines indicate a probable distant relationship.

Species-Criteria

No single character, although it may appear to be very fundamental, can be solely relied upon positively to indicate relationships between species or to separate interrelated groups of species in *Arabis*. One group is likely to have the same or a similar interplay of characters as that found in another. A simple illustration of the point may be taken from the cases of *A. platysperma* and *A. suffrutescens*, whose close relationship to each other is obvious, and of *A. puberula* and *A. Shockleyi*, another related pair. The pedicel-position in one species of each pair is directly opposite that of the other. Thus, *A. platysperma* and *A. Shockleyi* have ascending pedicels, whereas *A. suffrutescens* and *A. puberula* have the pedicels reflexed. Taking pedicel-position as a criterion it is impossible to show that *A. platysperma* and *A. suffrutescens* are related but, when several characters are taken into account, the relationship is unmistakable. Numerous similar instances of parallel development in unrelated species and unrelated groups of species could be pointed out. This fact makes evident the necessity for great care in the evaluation of diagnostic characters. Furthermore, it is clear that a successful classification of *Arabis* must rest on a series of characters whose pattern has been carefully determined. In general, qualitative rather than quantitative differences are most reliable and should be given first importance in the characterization of the species.

Habit.—Most species of *Arabis* are strictly herbaceous, but many possess a woody caudex. In perennial species the caudex and root persist in a dormant state throughout any period inimical to growth, and leaves arise from the apex of the caudex or caudex-branches with the return of favorable growing conditions. The caudex shows special development in such desert species as

A. pulchra and *A. perennans* in which it is much elongated. Using desert shrubs for support, the leaves and flowering stems of these plants are often held from one to several decimeters off the ground. A number of tufted perennials have a highly branched caudex which may or may not be subterranean. In such cases many of the caudex-branches bear only leaves, while others bear both leaves and a fertile stem. Usually some remnants of shed leaves are to be found upon the caudex. Sometimes these are of a characteristic nature, as in *A. Koehleri*, in which the leaf-bases resemble the peg-like pulvini found on old twigs of *Picea*.

The stems may be either simple or branched even within a given species. Certain species show a marked constancy in possessing simple fertile stems, while others constantly possess branched stems. Plants which have been grazed are usually branched even though a simple stem is the normal habit of growth. Whether the stems are branched near the base or toward the top markedly affects the general symmetry of the plant. Thus, the position of the branching is sometimes of importance in distinguishing between entities, but this feature is usually not constant and must be used with caution.

The tap-root system is characteristic of *Arabis*, but that alone does not indicate that all species are either biennial or perennial as Hopkins[1] seems to have presumed. The plant which he treated as *Arabis virginica* (it is here transferred to *Sibara*) was said to be biennial.[2] Two lots of this plant have been grown from seed to the flowering stage in less than three months at the Harvard greenhouses. This would seem to indicate that it is usually annual in spite of its having a tap-root. All species of *Arabis* included in the present paper are either biennial or perennial.

Foliage.—Two sorts of leaves are found in *Arabis*. Those of the flowering stems are differentiated from those at the base of these stems or those terminating sterile branches of the caudex. The term "basal leaves" used throughout this paper refers to the leaves found at the base of fertile stems, those terminating caudex-branches or on the root-crown. The term "radical

[1] Rhodora 39: 67 (1937).
[2] Ibid. p. 80.

leaves" has often been applied here but usually only the first year's rosette is truly radical. Leaves subsequently produced are not near the root in many cases but, strictly speaking, are stem-leaves, though different from the leaves of the fertile stem. The term "cauline leaves" is restricted to the leaves borne on the fertile stems.

The size and shape of the leaves are variable, but extremes in either may be characteristic of certain species and are useful in their delimitation. The leaves are entire, dentate or rarely more highly dissected. These features, though variable, are useful when only extremes are considered. The strongly perennial species usually have entire or nearly entire leaves. Many species have cauline leaves with auricled bases, while in others no auricles are present. This feature has been widely used as a species-criterion but it is unstable and may be relied upon only in some cases.

The basal leaves are always petiolate, while the cauline leaves are only rarely so. In western America only four species with petiolate cauline leaves are known. The cauline leaves usually diminish in size from base toward apex of the flowering stem. The basal leaves are often caducous, hence they may not be present on mature plants, as in *A. canadensis* and *A. tricornuta*. However, most of the species in our area have the basal leaves present even in old plants.

Vestiture.—The trichomes of *Arabis* are single-celled and never glandular. They may be simple, bifurcate with branches appressed (malphigiaceous) or variously branched. The term stellate has usually been applied to trichomes of the *Cruciferae* with several to many branches. Most of the highly branched types are actually not stellate, if by that term is meant a centrally attached hair with branches radiating from the middle after the manner of a star. The severally branched trichomes commonly found in *Arabis* are nearly all of a dendritic type, i. e., with a central trunk and irregularly placed, elevated branches. These branches themselves often fork, giving rise to new branches, thus forming a tree-like configuration. The fact that truly stellate trichomes are common in the *Cruciferae* and other plant families has made it desirable to distinguish the tree-like hairs by applying to them the term dendritic.

The type of trichome, whether simple, malphigiaceous, stellate, dendritic, swollen at base, terete or flattened, is of considerable importance in characterizing many species. A few species have two kinds of pubescence, but the association is usually fairly stable. The significance of the size of trichomes is not fully understood. Large differences in size may be safely used in support of other characters, but within at least a few species the trichomes vary considerably in size. An unsuccessful attempt was made to correlate trichome-size with polyploidy in *A. divaricarpa.* Further data are needed to determine whether polyploidy has the same effect on trichome-size as on the size of cells and stomata.

The density and extent of the pubescence on plants of *Arabis* are ecologically plastic and vary seasonally. Though often used with a great deal of assurance, the mere presence or absence of pubescence is a weak criterion. Specific observations on this point are discussed in some detail under *A. Drummondi.*

Flowers.—In general the flowers are similar throughout *Arabis.* They are always tetradynymous. Large differences in size may be utilized in differentiating some species, while in others there is considerable variation and size-differences are not reliable. Measurements to be useful comparatively must include the limits of variation in the size of any given part or organ. When accurately determined and based on a sufficient sample of the total population of a species they may be highly reliable. Unfortunately, it is only in some cases that such a procedure can be followed by a taxonomist because of lack of material.

The inner sepal-pair of the *Arabis* flower is never saccate at base. However, the outer pair is sometimes slightly saccate and in a few instances markedly so. The character is only limitedly usable. Petal-color varies from a deep purple to white in *Arabis. A. glabra* alone has a slightly yellowish petal.

The nectar-glands in the *Cruciferae* have been shown to be diversely specialized and it has been contended that their form, position and extent of development are of importance in the classification of the family. Beginning with Hildebrand in 1879 and Velenovsky in 1883 the nectar-glands have received increased attention. They formed the chief basis for a system of the *Cruciferae* by Bayer[1] and were heavily relied upon by von Hayek[2] in his inclusive treatment of the family. In view of these facts, the glandular pattern in all species of *Arabis* included in the present paper has been carefully determined and diagrammed to see if this feature might be used as an aid in the characterization of species or species-groups. Contrary to the finding of Günthart,[3] where several types were found among European species, only two patterns were found. One type, in which the glandular tissue surrounds the base of the single stamen and is obsolete or entirely absent elsewhere on the receptacle, is confined to series one. In the rest of the species, the glandular tissue forms a continuous mold beneath all stamens and often has short projections flanking the petal-base. Thus it is clear that the glandular pattern is of no particular importance in any attempt to distinguish between the species themselves, although it may be used to some extent in separating groups of species.

Siliques.—The mature silique, as in other *Cruciferae*, is of paramount significance. The shape is, in general, narrowly linear with the valves strongly flattened parallel to the septum. An exception is the semi-terete capsule of *A. glabra*. Although the size of the silique is variable, there are recognizable limits to the variation and, if accurately determined, size becomes a useful tool in characterizing certain species. The central nerve of the valves is variously developed in different species, and a limited use may be made of this feature if it is carefully applied in conjunction with other characters. The cellular pattern of the septum is distinctive in a few species but, on the whole, it is so uniform and difficult of determination that little use has been made of it. The siliques of most species of *Arabis* are glabrous but in some they are always pubescent, while in a few species they may be either pubescent or glabrous.

Silique-position is constant in most species and the usefulness of this feature in determining species of *Arabis* is well known. However, in a few instances the siliques vary considerably in their position with respect to the rachis within a given entity. Among different species the siliques vary all the way from a

[1] Beih. Bot. Central. **18**: 119–180 (1905).
[2] Op. Cit.
[3] Reprint from Bibl. Bot. **77**: 1–36 (1912).

strictly erect position to a closely reflexed one. The siliques may be straight, curved or even strongly bow-shaped. The presence or absence of an elongated style upon the mature silique is a character which may be trusted within certain groups. An unusual development of the style is found in *A. Parishii* and it is only slightly less prominent in *A. Johnstonii.*

Seeds.—The shape and size of the seeds and the absence or extent of development of wings are significant. Whether the seeds are in one or two rows in each locule has frequently been the basis for the segregation of species. Considering the point of attachment, the seeds are always in two rows, the attachment being at the point of replum-junction on both sides of the locule. In certain species the seeds do not enlarge to the full width of the locule, hence the seeds themselves appear to be in two rows. In other species, the seeds entirely occupy the locule-width and are then said to be in one row. The difference is not a morphological one and is more apparent than real in so far as the actual number of rows of seeds in each locule is concerned. It is clear, then, that it might be possible for the seeds to be in neither one row nor two, but half-way between. This is precisely what happens in some species. In others the character is very constant. It will be seen that the real significance is to be attached to the relationship between seed-size and silique-width. My use of the terms uniseriate and biseriate refers to the position of the seed rather than to the actual number of rows as determined by seed-attachment. The cotyledons are accumbent in all the species presented in the present paper.

Geographical Distribution

The geographical area occupied by each species dealt with has been carefully determined and mapped. Maps showing the distribution of all species and varieties not extremely localized, except the widespread *A. glabra* and *A. hirsuta*, are presented on several pages appropriately placed in the general treatment. Many more specimens than could be cited were included in the data assembled for the maps. These geographical data have been of considerable value in determining natural boundaries of the species and varieties. Where a question as to the distinctness or relationship of a variety or species has arisen, a comparison of the areas occupied by the related forms has usually been decisive. In addition to the horizontal area occupied by the species, the altitudinal zone in which they normally grow has been considered. The habitat and soil-preferences have also received attention whenever the data have been available. *Arabis* is indigenous to all the general habitats represented in the area, including high alpine and desert situations.

No one limited area in western America is conspicuous because of the number of endemic species of *Arabis* contained within it. The endemic species are quite generally distributed among the Rocky Mountains, Sierra Nevada Mountains, northern Coast Ranges in California, Siskiyou Mountains, Cascade Mountains and the deserts or lesser mountain systems in the intervening region. One species, *A. Hoffmannii,* is exclusively insular, being found only on Santa Cruz Island. Plants of the genus extend from Alaska on the north to northern Baja California on the south. Throughout the paper, where geographical distribution has been of special importance, it has been discussed under the species concerned. Many of the accompanying maps were based on Goode *Base Map* no. 102; by permission of the University of Chicago Press.

Cytology

In addition to the usual techniques employed in Systematic Botany, some species have been examined cytologically. As a result of these studies it has become clear that certain species usually considered to be highly complex taxonomically are apt to contain a polyploid series. *A. hirsuta* in America, *A. Holboellii, A. Fendleri* and *A. divaricarpa* are species of this type. Far more work is necessary before the variations and complexities of these species will be fully understood, but it is now definitely known that there are polyploid plants in all of them.

Results of the cytological examination of thirty-four collections of *Arabis* are presented in the table following, which contains chromosome-numbers for eighteen species and varieties. All but four are reported for the first time. The counts were made from material gathered directly at the locality given or from plants grown from seed collected at these stations. Except for one or two instances, specimens have been preserved and may be consulted at the Gray Herbarium under the number cited. Counts were made from pollen mother-cells, using aceto-carmine smears, or from root-tips, using a modification of Fuelgen's technique. Unfortunately, it has been impossible to obtain sufficient data to make more than one or two general statements concerning the cytology of *Arabis*. Although several interesting problems have arisen, their solution has not been attempted, but it is hoped they will be mastered during future work in the genus.

On the basis of Jaretzky's[1] report of the chromosome-numbers for ten species of *Arabis*, Manton[2] gave the number eight as the fundamental one for the genus. Recently, Frank H. Smith,[3] after finding six pairs of chromosomes in *A. dentata* and seven in *A. laevigata*, doubted whether eight was necessarily the basic number for the genus. A glance at the table below will show that a haploid number of seven is by far the commonest among the species investigated. Undoubtedly seven is to be considered one of the fundamental chromosome-numbers of *Arabis*.

Chromosome-Numbers in Arabis

Species	Place of Collection	Collector and Number	N	2N
A. alpina	Harvard Botanic Garden, Cambridge	Rollins s. n.	8	16
A. alpina	Gaspé Co., Quebec	Knowlton s. n.		16
A. cobrensis	Uinta Co., Wyoming	Rollins 1656	7	
A. Crandallii	Gunnison Co., Colorado	Rollins 2093	7	
A. Crandallii	Gunnison Co., Colorado	Rollins 2084	7	
A. divaricarpa	Uintah Co., Utah	Rollins 1767	15	
A. divaricarpa	Larimer Co., Colorado	Rollins 2400	8	
A. Drummondi	Uintah Co., Utah	Rollins 1764	7	
A. Drummondi	Hinsdale Co., Colorado	Rollins 1506	7	14
A. Fendleri				
var. typica	Gunnison Co., Colorado	Rollins 2098	7	14?
var. typica	Costilla Co., Colorado	Rollins 1288	21	
var. spatifolia	Fremont Co., Colorado	Rollins 2069	7	14
var. spatifolia	Chaffee Co., Colorado	Rollins 2077	7	
var. spatifolia	San Juan Co., Colorado	Rollins 1511	14	
A. Gunnisoniana	Gunnison Co., Colorado	Rollins 2090	7	
A. hirsuta				
var. pycnocarpa	Windham Co., Connecticut	Weatherby and Rollins s. n.	16	

[1] Jahrb. Wiss. Bot. **68**: 1–45 (1928).
[2] Annals Bot. **46**: 516 and 543 (1932).
[3] Am. Journ. Bot. **25**: 220 (1938).

Chromosome-Numbers in Arabis—(*Continued*)

Species	Place of Collection	Collector and Number	N	2N
var. pycnocarpa	Daggett Co., Utah	Rollins 2267	32	
var. pycnocarpa	Gunnison Co., Colorado	Rollins 1427	16	32
A. Holboellii				
var. retrofracta	Sublette Co., Wyoming	Ownbey 1008	7	
var. retrofracta	Albany Co., Wyoming	Rollins 1070	7	
var. retrofracta	Larimer Co., Colorado	Rollins and Chambers 2401	7	
var. retrofracta	Mesa Co., Colorado	Rollins 2188	7	
var. retrofracta	Uintah Co., Utah	Rollins 1765	14	
var. retrofracta	Humboldt Co., Calif.	Harris et al. 3417	7	14
var. pinetorum	Lake Co., Colorado	Rollins 1349	21	
var. pinetorum	Gunnison Co., Colorado	Rollins 1426	14	
A. laevigata	Litchfield Co., Connecticut	Weatherby s. n.	7	
A. lignifera	Uinta Co., Wyoming	Rollins 2308	7?	14
A. lignifera	Montrose Co., Colorado	Rollins 2129	7	
A. lyrata	Litchfield Co., Connecticut	Weatherby s. n.	8	
A. microphylla				
var. typica	Wallowa Co., Oregon	Constance 1274	7	
var. saximontana	Big Horn Co., Wyoming	Williams 3264	14	
A. perennans	Mesa Co., Colorado	Rollins 2128	7	14
A. repanda	Madera Co., California	Constance 2386	7	

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Palo Alto (DS); herbarium of the Field Museum, Chicago (F); herbarium of the U. S. Forest Service, Washington, D. C. (FS); Gray Herbarium of Harvard University, Cambridge (G); the herbarium of Dr. Eric Hultén, Lund, Sweden (L); herbarium of the Missouri Botanical Garden, St. Louis (M); herbarium of the National Arboretum, Washington, D. C. (NA); herbarium of the University of Notre Dame, Notre Dame (ND); herbarium of the New York Botanical Garden, New York (NY); herbarium of the University of Oregon, Eugene (O); herbarium of Oregon State College, Corvallis (OS); Pomona College Herbarium, Claremont (P); the herbarium of Mr. Frank W. Peirson, Altadena, Calif. (Peirs); herbarium of the Academy of Natural Sciences of Philadelphia, Philadelphia (Ph); the Rocky Mountain Herbarium of the University of Wyoming, Laramie (RM); herbarium of the U. S. Field Station at Sacaton, Arizona (Sac); the herbarium of Mr. J. W. Thompson, Seattle (T); the Intermountain Herbarium of the Utah Agricultural College, Logan (UAC); herbarium of the University of California, Berkeley (UC); herbarium of the University of California at Los Angeles, Los Angeles (UCLA); herbarium of the University of Idaho, Southern Branch, Pocatello (UIP); herbarium of the U. S. National Museum, Washington, D. C. (US); herbarium of the University of Washington, Seattle (UW); Vegetation Type Map Herbarium, U. S. Forest Service, located at the University of California, Berkeley (VTM); herbarium of Willamette University, Salem, Oregon (W); herbarium of the State College of Washington, Pullman (WSC). The symbols in parenthesis are those used to indicate the herbarium where the specimens cited throughout the text were seen. Collections marked (R) are in my own herbarium.

Synopsis of the Genus Arabis L. in Western North America

Arabis L. Biennial or perennial herbs, often with a ligneous base, glabrous to sparsely or densely pubescent with simple, bifurcate, stellate or dendritic trichomes; caudex simple or branched; stems terete, leafy, simple or branched; basal leaves petiolate, entire, dentate or rarely somewhat dissected, persistent or caducous; cauline leaves sessile or rarely petiolate, often auricled, approximate to remote, entire or dentate; inflorescence racemose, ebracteate, greatly elongating as the flowers successively expand; flowers erect to reflexed at anthesis, tetradynymous; sepals erect, oblong to nearly ovate, uniform, or the outer pair infrequently saccate, bounded on the sides and apex by a narrow non-chlorophyllous margin; petals spatulate to oblong, less frequently narrowly obovate, white to deeply purple, rarely stramineous; filaments linear to narrowly subulate, entire, erect, straight or the single ones rarely curved upwards from their base; anthers oblong; nectar-glands in a continuous mold beneath all stamens to merely subtending the base of the single stamens; siliques linear, straight or curved, erect to reflexed, sessile or very rarely with a short gynophore, flattened parallel to partition, rarely semi-terete, two-valved; valves prominently one-nerved to completely nerveless in rare instances, sometimes minutely net-veined; style prominent or none; stigma entire to rarely somewhat bilobed; septum nerveless or with a variable central band of differentiated tissue; seeds numerous, pendulous, orbicular to nearly oblong, flattened or plump, winged or wingless, uniseriate to biseriate, funiculus free or nearly so, cotyledons accumbent.—L., Sp. Pl. **2:** 664 (1753); Gen. Pl., ed. 5, 298 (1754); DC., Syst. **2:** 213–244 (1821) and Prod. **1:** 142–149 (1824); Hooker, Fl. Bor.-Am. **1:** 41–43 (1829); Torrey & Gray, Fl. N. Am. **1:** 79–83 (1838); Gray, Gen. Illustr. **1:** 141, pl. 58 (1848); Watson in Gray, Syn. Fl. **1:** 159–167 (1895); Howell, Fl. Northw. Am. **1:** 42–46 (1897); Piper in Contrib. U. S. Nat. Herb. **11:** 291–295 (1906); Coulter & Nelson, New Man. Bot. Rky. Mts. 225–229 (1909); Wooton & Standley in Contrib. U. S. Nat. Herb. **19:** 279–280 (1915); Henry, Fl. So. Brit. Columb. 149–150 (1915); Rydberg, Fl. Rky. Mts. 356–363 (1918); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 241–245 (1925); Jepson, Man. Fl. Pl. Calif. 427–433 (1925) and Fl. Calif. **2:** 59–73 (1936); Munz, Man. So. Calif. Bot. 202–205 (1935); Rollins in Res. Stud. State Coll. Wash. **4:** 1–52 (1936); O. E. Schulz in Engler, Pflanzenf. 2 Aufl., **17b:** 542 (1936); Hopkins in Rhodora **39:** 63–98, 106–148, 156–186 (1937). *Turritis* L., Sp. Pl. **2:** 666 (1753); Gen. Pl. ed. 5, 298 (1754); DC., Syst. **2:** 211–13 (1821) and Prod. **1:** 139–140 (1824); Hooker, Fl. Bor.-Am. **1:** 40–41 (1829); Torrey & Gray, Fl. N. Am. **1:** 78 (1838); Gray, Gen. Illustr. **1:** 143, pl. 59 (1848). Lectotype species—*A. alpina*, L.

Artificial Key to the Species

A. Seed-wing 1–3 mm. wide or, if slightly less, then cauline leaves petiolate; seeds (including wings) 2.5–5 mm. long; siliques 3–8 mm. wide (rarely slightly narrower) ......B.

B. Cauline leaves petiolate, the lower dissected to the midrib; petiole not winged; basal leaves 10–15 cm. long; Texas ....53. *A. petiolaris.*

B. Cauline leaves sessile, or if petiolate, then the petiole winged, entire or merely dentate; basal leaves less than 8 cm. long....................................C.

C. Siliques and pedicels erect or ascend.ng............D.

D. Lower cauline leaves petiolate; petiole winged; basal leaves oblanceolate to broadly spatulate, 1–3 cm. wide; petals equaling or only slightly exceeding sepals; Nevada and California ....45. *A. repanda.*

D. All cauline leaves sessile; basal leaves linear to oblanceolate, less than 8 mm. wide; petals definitely exceeding the petals..........................E.

E. Leaves and lower stems hoary with a minute pubescence; pedicels pubescent; California ....47. *A. dispar.*

E. Leaves and stems green, glabrous or pubescent, but never hoary; pedicels glabrous...............F.

F. Basal leaves linear, about 2 mm. wide, densely hirsute with very coarse trichomes, persistent and forming successive hemispherical rosettes on the elongated crown; California ....52. *A. pygmaea.*

F. Basal leaves oblanceolate to spatulate, 3–8 mm. wide, glabrous or pubescent with much finer trichomes than the above, deciduous, not forming successive rosettes on the crown; Nevada, California and Oregon................51. *A. platysperma.*

C. Siliques and pedicels reflexed (horizontal in *A. suffrutescens,* var. *horizontalis*)....................G.

G. Leaves and stems green, glabrous or pubescent below only; siliques attenuate at apex; seeds uniseriate; Idaho to California and Washington........50. *A. suffrutescens.*

G. Leaves and stems hoary with a minute pubescence; siliques obtuse at apex; seeds biseriate; California and Nevada...........................46. *A. glaucovalvula.*

A. Seed-wing less than 1 mm. wide or seeds wingless; seeds (including wings) less than 2 mm. long; siliques usually less than 3 mm. wide, very rarely up to 3.5 mm. wide. .H.

H. Basal leaves obovate to broadly oblanceolate, obtuse and rounded at apex, often forming a flat rosette at base of stems, usually rather thin, blade nearly as broad as long, glabrous or hirsute with simple or forked trichomes except in *A. crucisetosa, A. modesta* and var. *furcatipilis* of *A. glabra;* siliques erect or ascending; styles often evident; stems often hirsute with simple or forked trichomes near base; glandular tissue subtending single stamens only, or disrupted and poorly developed near paired stamens; outer sepals saccate except in *A. glabra*...I.

I. Seeds biseriate; siliques semi-terete; flowers creamy-yellow (rarely lilac); cauline leaves ample, ovate to ovate-lanceolate, usually glaucous; widely distributed from Quebec to California...........................1. *A. glabra.*

I. Seeds uniseriate; siliques flattened parallel to septum; flowers white to purple; cauline leaves much smaller except occasionally in *A. hirsuta,* obovate to oblong, rarely if ever glaucous...............................J.

J. Seeds definitely winged at least at the distal end; flowers purple to white.........................K.

K. Plants completely glabrous...................L.

L. Basal leaves 3–8 cm. long, broadly oblanceolate, entire or rarely few-toothed; California to Oregon....12. *A. Davidsonii.*
L. Basal leaves less than 2.5 cm. long, ovate to spatulate, dentate to rarely entire....M.
M. Flowers purple; petals truncate at apex; plants of California....6. *A. McDonaldiana.*
M. Flowers white; petals rounded at apex; plants of Washington and northern Oregon....8. *A. furcata.*
K. Plants pubescent at least on lower stems and basal leaves....N.
N. Flowers purple, showy; petals 9–20 mm. long; pedicels pubescent....O.
O. Petals 4–8 mm. broad, rounded at apex or retuse; plants pubescent at least on lower stems and basal leaf-margins....P.
P. Plants more than 2 dm. high; siliques acute, 3.5–6.5 cm. long; style slender or obsolete; southern Oregon and extreme northern California....Q.
Q. Lower stems appressed-pubescent; basal leaves not ciliate; pubescence of uniform, small dendritic trichomes....5. *A. modesta.*
Q. Lower stems hirsute; basal leaves ciliate, pubescence of large simple, forked or dendritic trichomes.
Caudex multicipitally branched; basal leaves 1–4 cm. long, hirsute and ciliate with large white simple or rarely forked trichomes; cauline leaves 5–15 mm. long....7. *A. aculeolata.*
Caudex simple or rarely closely branched; basal leaves 3–8 cm. long, pubescent with large dendritic or forked trichomes with bulbous bases; cauline leaves 2–5 cm. long....4. *A. oregana.*
P. Plants less than 2 dm. high; siliques 2–4 cm. long, obtuse, usually with a stoutish style; south from Sonoma Co., California
3. *A. blepharophylla.*
O. Petals 2.5–3 mm. broad, usually truncate at apex; plants usually glabrous, but rarely with a few marginal trichomes on the basal leaves
6. *A. McDonaldiana.*
N. Flowers white, rarely pinkish; petals less than 11 mm. long; pedicels glabrous or very rarely sparsely hirsute in *A. hirsuta.*
Stems glabrous; pedicels divaricately ascending; siliques 2–4 cm. long; cauline leaves not auriculate; Oregon and Washington..8. *A. furcata.*
Stems hirsute at least below; pedicels erect, rarely divaricately ascending; siliques 3–6 cm. long; cauline leaves auriculate; widely distributed....2. *A. hirsuta.*
J. Seeds wingless; flowers white....R.
R. Basal leaves hirsute with large simple or rarely forked trichomes to glabrous; lower stems hirsute with spreading trichomes or glabrous.

Basal leaves entire; lower cauline leaves sessile; styles 1 mm. or more long; Montana to Utah and Washington....................9. *A. Nuttallii.*

Basal leaves lyrate-pinnatifid to dentate; lower cauline leaves usually petiolate; styles less than 1 mm. long or absent; Washington to Saskatchewan and Alaska. .11. *A. lyrata,* var. *kamchatica.*

R. Basal leaves rather densely pubescent on both surfaces with dendritic trichomes, never ciliate; lower stems appressed-pubescent to glabrous; Idaho and Washington....................10. *A. crucisetosa.*

H. Basal leaves linear to linear-oblanceolate (if broader, then minutely pubescent or the siliques reflexed or both), acute or rarely obtuse, usually thick, rarely rounded at apex, ascending, not forming a flat rosette at base of stems; pubescence varied or absent; siliques erect to reflexed; glandular tissue continuous beneath all stamens; outer sepals non-saccate or only slightly so..S.

S. Leaves, stems and pedicels hoary with a very minute pubescence; mostly desert plants or plants from mountain ranges bordering the deserts............T.

T. Siliques erect or ascending to widely spreading; pedicels erect to spreading at right angles to rachis...U.

U. Styles less than 1 mm. long or the stigma sessile; basal leaves narrowly oblanceolate............V.

V. Seeds uniseriate, winged, flattened, 1.5–2.5 mm. broad.

Seed-wing over 0.5 mm. wide; siliques 2.5–3.5 mm. wide, divaricately ascending; California.................................47. *A. dispar.*

Seed-wing less than 0.5 mm. wide; siliques about 2 mm. wide, spreading at right angles; California....................42. *A. inyoensis.*

V. Seeds biseriate, essentially wingless, plump, about 1 mm. broad; Utah to California..........41. *A. Shockleyi.*

U. Styles 1–8 mm. long; basal leaves linear.

Styles 4–8 mm. long; seeds narrowly winged; siliques 1–2 cm. long; California............49. *A. Parishii.*

Styles 1–3 mm. long; seeds broadly winged; siliques 3–5 cm. long; California..........48. *A. Johnstonii.*

T. Siliques reflexed; pedicels strongly reflexed to pendulous..............................W.

W. Seeds biseriate; cauline leaves linear, not crowded, entire; Colorado to California ....43. *A. pulchra.*

W. Seeds uniseriate; cauline leaves oblong to broadly lanceolate, crowded, often subpinnatifid.

Siliques blunt at apex; style wanting; petals 7–10 mm. long; Idaho to California and Washington...........................38. *A. puberula.*

Siliques acuminate at apex; style about 1 mm. long; petals 10–14 mm. long; California and Oregon ....39. *A. subpinnatifida.*

S. Cauline leaves, stems and pedicels greenish, densely pubescent to glabrous, never hoary; basal leaves sometimes hoary-pubescent, but usually greenish, densely pubescent to glabrous..................X.

X. Mature fruiting pedicels erect to ascending, never diverging at right angles to rachis or descending; siliques erect, ascending or more rarely arcuate. . Y.

Y. Basal leaves narrowly oblanceolate to spatulate or rarely almost linear, pubescent to glabrous, but not hirsute with large spreading simple or forked trichomes; lower cauline leaves variously pubescent or glabrous, but not hirsute, auriculate to non-auriculate . . . . Z.

Z. Lower fruiting pedicels 2–4 cm. long, glabrous; siliques arcuate or at least somewhat curved; seeds biseriate.

Lower stems densely hirsute; siliques nerved below, not coriaceous; lower cauline leaves pubescent on both surfaces; Arizona. . 25. *A. gracilipes.*

Lower stems glabrous to very sparsely pubescent with appressed trichomes; siliques nerveless, thick and coriaceous; lower cauline leaves glabrous above; Santa Cruz Island, California. . . . . 27. *A. Hoffmannii.*

Z. Lower fruiting pedicels less than 2 cm. long, pubescent or glabrous; siliques straight to arcuate, if arcuate, then the seeds uniseriate. . a.

a. Basal leaves and lower cauline leaves densely pubescent with dendritic trichomes, gray, often pannose or appearing so; siliques straight to somewhat curved or arcuate; stems usually numerous from a much-branched caudex. . . . . b.

b. Basal leaves linear to linear-oblanceolate, usually less than 5 mm. broad; siliques straight except in *A. Koehleri* and *A. sparsiflora*. . . . . c.

c. Petals less than 7 mm. long; stigmas mostly sessile; styles rarely up to 1 mm. long. . . . . d.

d. Basal leaves pannose, very finely pubescent; cauline leaves oblong to narrowly ovate, crowded near base; pedicels pubescent; lower stems finely pubescent. . . . . e.

e. Siliques about 1 mm. wide, erect, valves constricted between seeds; seeds wingless to very narrowly winged; Colorado. . . . . 33. *A. Crandallii.*

e. Siliques 1.5–2 mm. wide, divaricately ascending, valves not constricted between seeds; seeds definitely winged.

Siliques acuminate at apex; style about 1 mm. long; cauline leaves non-auriculate; Nevada
32b. *A. Fernaldiana* var. *stylosa.*

Siliques blunt at apex; stigma sessile, cauline leaves auriculate; Nevada and California
18d. *A. Lemmoni* var. *depauperata.*

d. Basal leaves not pannose, though often appearing so to the naked eye; cauline leaves narrowly lanceolate, remote; pedicels glabrous; lower stems hirsute to glabrous; Wyoming to Nevada and Washington ....31. *A. microphylla.*

c. Petals 7–14 mm. long; styles about 1 mm. long or stigmas sessile ....f.

f. Basal leaves linear, rather coarsely pubescent, not pannose, acute; siliques usually curved; caudex-branches elongated.

Plants 3–9 dm. high; pedicels pubescent or glabrous; lower stems pubescent or rarely glabrous; caudex without numerous peg-like leaf-bases; widely distributed from the Rocky Mountains to California and Yukon ....26. *A. sparsiflora.*

Plants mostly less than 3 dm. high; pedicels glabrous; lower stem glabrous or rarely sparsely pubescent; caudex covered with numerous peg-like leaf-bases; southern Oregon 30. *A. Koehleri.*

f. Basal leaves linear-oblanceolate, minutely pubescent, pannose, obtuse; siliques straight; caudex-branches not elongated.

Style absent, stigma sessile; pedicels and siliques divaricate; California ....42. *A. inyoensis.*

Style about 1 mm. long; pedicels and siliques erect; Nevada ......32. *A. Fernaldiana.*

b. Basal leaves oblanceolate, often broadly so, 6–15 mm. wide; siliques somewhat curved ....g.

g. Stems and pedicels hirsute with spreading trichomes; cauline leaves ovate to broadly oblong, mostly approximate; California and southern Oregon......28. *A. Breweri.*

g. Stems and pedicels pubescent with minute appressed trichomes to glabrous; cauline leaves lanceolate, remote; Colorado....35. *A. Selbyi.*

a. Basal leaves pubescent to glabrous, greenish, never pannose; lower leaves and stems glabrous to sparsely pubescent; siliques straight; stems one to several or many; caudex usually simple except in *A. Lyallii* and *A. fructicosa* ....h.

h. Siliques 1.5–3.5 mm. wide; seeds orbicular to oblong, 1–2 mm. broad; stems glabrous to appressed-pubescent below, never hirsute with spreading trichomes ....i.

i. Seeds biseriate, oblong, winged on one side and the distal end; siliques and pedicels erect; siliques usually blunt; basal leaves strigose with malphigiaceous hairs or glabrous; flowers white, very rarely pinkish; widely distributed .....14. *A. Drummondi.*

i. Seeds uniseriate or rarely imperfectly biseriate, orbicular, winged all around; siliques and pedicels divaricately ascending to erect, siliques usually acute; basal leaves pubescent with three- to several-branched trichomes or glabrous; flowers pink to purple ....j.

j. Plants less than 3 dm. high; stems several to numerous from a branching caudex; siliques and pedicels erect to slightly divergent; widely distributed ......13. *A. Lyallii.*

j. Plants 3–9 dm. high; stems usually single, rarely two or three from a simple caudex; siliques and pedicels divaricately ascending to more widely spreading..k.

k. Siliques 1.5–2.5 mm. wide, margin straight; seeds 1–1.5 mm. broad.

Basal leaves sparsely pubescent with minute dendritic trichomes; cauline leaves glaucous, ovate; siliques glaucous, nerved only at very base or nerveless; Wyoming (rare) ....16. *A. fructicosa.*

Basal leaves sparsely pubescent with appressed several-branched, rather coarse trichomes or glabrous; siliques not glaucous, nerved at least to the middle; caudex simple; widely distributed. ....15. *A. divaricarpa.*

k. Siliques 2.5–3.5 mm. wide, margin undulate; seeds 2–2.5 mm. broad; California ....17. *A. rigidissima.*

h. Siliques less than 1.5 mm. wide; seeds orbicular, about 1 mm. broad; stems sparsely hirsute at base; Wyoming to California and British Columbia ....31. *A. microphylla.*

Y. Basal leaves narrowly linear, densely hirsute with large simple or forked trichomes; lower cauline leaves hirsute, linear, non-auriculate; Idaho to Oregon and Washington ....29. *A. Cusickii.*

X. Mature fruiting pedicels diverging at right angles to strictly reflexed; siliques straight to arcuate, diverging at right angles to rachis to strictly reflexed ....l.

l. Basal leaves definitely ciliate with large acerose simple or forked trichomes, rarely glabrous, blades hirsute with simple or forked hairs to glabrous; pedicels glabrous, gently curving downward except in *A. rectissima* where they are geniculately reflexed ....m.

m. Siliques pendulous on gently curving pedicels, never appressed to rachis; basal leaves linear to broadly oblanceolate ....n.

n. Plants 2.5–6 dm. high; stems few to several, fairly robust; seeds biseriate; lower cauline leaves crowded to slightly overlapping or remote; pedicels 1–2 cm. long.

Siliques 2–4 cm. long; cauline leaves small, mostly remote; basal leaves hirsute with simple trichomes to glabrous; Utah and Nevada ....21. *A. pendulina.*

Siliques 4–6 cm. long; cauline leaves fairly ample, lower imbricated; basal leaves hirsute on the blade-surfaces with forked trichomes, ciliate with simple or forked trichomes; Wyoming to Texas, Mexico and Nevada..........................23. *A. Fendleri.*

n. Plants caespitose, 1–3 dm. high, usually less than 2 dm. high; stems slender; seeds uniseriate except in *A. pendulina;* cauline leaves remote; pedicels 3–10 mm. long ....o.

o. Seeds biseriate; siliques blunt, 2–3 mm. wide ....21. *A. pendulina.*

o. Seeds uniseriate; siliques slightly tapering at apex; 1.5–2 mm. wide.

Siliques definitely pendulous, acute to obtuse; at least some of the basal leaves densely hirsute; Wyoming, Colorado and Utah ....20. *A. demissa.*

Siliques almost oblique to widely pendulous, acuminate; basal leaves glabrous, thin; Colorado (rare) ....19. *A. oxylobula.*

m. Siliques strictly reflexed, appressed to rachis; pedicels geniculate; basal leaves oblanceolate to slightly broader; California and Oregon 22. *A. rectissima.*

l. Basal leaves densely pubescent with fine to coarse dendritic trichomes, blades always pubescent, never merely hirsute with simple or forked hairs; pedicels pubescent to glabrous, spreading at right angles to strictly reflexed ....p.

p. Cauline leaves sessile, never petiolate; filaments of single stamens straight, erect; petals at least one-third longer than the sepals .....q.

q. Seeds uniseriate; cauline leaves lanceolate to oblong or ovate, rarely linear; petals less than 12 mm. long, their limbs not spreading; siliques glabrous except occasionally in *A. Holboellii,* var. *retrofracta* ....r.

r. Basal leaves spatulate to oblanceolate, never linear; seed-wing less than 0.3 mm. wide; cauline leaves not pannose; stems rigid; siliques widely spreading to strictly reflexed ....s.

s. Pedicels 2–4 (–6) mm. long; siliques spreading at right angles to rachis; cauline leaves ovate, mostly glabrous; widely distributed ....18. *A. Lemmoni.*

s. Pedicels 6–20 mm. long; siliques spreading to reflexed; cauline leaves oblong to lanceolate, mostly pubescent ....t.

t. Mature fruiting pedicels spreading at right angles to rachis, straight or arched downward, not strongly descending or strictly reflexed; siliques straight and spreading at right angles or arcuate. .u.

u. Plants 1–2 (–3) dm. high, caespitose; stems numerous, filiform; cauline leaves few, small and remote.
   - Cauline leaves linear-lanceolate, 1–2 cm. long; pedicels glabrous; stems hirsute below, usually branched; Wyoming to California and British Columbia ....31. *A. microphylla.*
   - Cauline leaves oblong, 5–8 mm. long; pedicels pubescent; stems simple, densely pubescent, but not hirsute with spreading trichomes; Colorado ....34. *A. Gunnisoniana.*

u. Plants 3–9 dm. high, rarely caespitose; stems one to several, fairly stout; cauline leaves usually numerous, crowded and overlapping near base of stem, except in *A. perennans* ..v.

v. Basal leaves entire, finely and densely pubescent with minute dendritic trichomes; stems densely appressed-pubescent at least below; pedicels sparsely pubescent to glabrous; stems several to few.
   - Pedicels and siliques rigidly spreading at right angles to rachis, straight; seed-wing 0.2–0.3 mm. wide; California ....42. *A. inyoensis.*
   - Pedicels and siliques curved downward; siliques usually curved; seed-wing very narrow (less than 0.2 mm. wide); Wyoming to Arizona and Nevada ....36. *A. lignifera.*

v. At least the outer basal leaves dentate, densely pubescent with coarse dendritic trichomes; stems mostly hirsute with spreading hairs below, rarely appressed-pubescent; pedicels often hirsute; stems one to several or many.
   - Outer basal leaves broadly oblanceolate, obtuse; pedicels slender, 1–2 cm. long, glabrous; petals 6–9 mm. long, 1.5–2.5 mm. wide; Colorado to Mexico and California ....24. *A. perennans.*
   - Outer basal leaves narrowly oblanceolate, acute; pedicels stout, 5–12 mm. long, hirsute or appressed-pubescent in var. *californica;* petals 8–12 mm. long, 2–4 mm. wide; widely distributed ....26. *A. sparsiflora.*

t. Mature fruiting pedicels definitely descending to strictly reflexed, straight, not widely spreading with tips descending; siliques mostly straight, pendulous to strictly appressed against the rachis ....w.

w. Pedicels strictly reflexed, appressed to the rachis; widely distributed..37. *A. Holboellii.*
w. Pedicels strongly descending, but not appressed to the rachis ....x.
x. Stems hirsute with spreading trichomes below; siliques straight or nearly so ....37. *A. Holboellii.*
x. Stems finely appressed-pubescent below; siliques often slightly curved and usually widely pendulous; Wyoming to Arizona and Nevada..36. *A. lignifera.*
r. Basal leaves linear, minutely pubescent, usually pannose; seed-wing about 0.5 mm. wide; cauline leaves pannose; stems weak; siliques pendulous on widely spreading slender pedicels; Wyoming to Nevada and Oregon ....40. *A. cobrensis.*
q. Seeds definitely biseriate; cauline leaves linear; petals 8–20 mm. long, usually showy, petal-limb spreading at right angles; siliques densely pubescent except in var. *gracilis;* Colorado to California and Mexico......43. *A. pulchra.*
p. Cauline leaves petiolate; filaments of single stamens arising at right angles to receptacle and curved upward; petals barely exceeding the sepals; Arizona ....44. *A. tricornuta.*

1. A. GLABRA (L.) Bernhardi. Biennial or rarely perennial; stems one or few from a tap-root, simple or rarely branched above, stout, glabrous and glaucous above, pubescent (usually hirsute) below, 4–12 dm. high; basal leaves broadly oblanceolate to oblong or spatulate, petiolate, repand, dentate or sometimes rather deeply divided, rarely entire, coarsely pubescent with forked or dendritic trichomes, rarely almost glabrous, 6–15 cm. long, 1–3 cm. wide, petiole usually hirsute; cauline leaves lanceolate to ovate, entire or the lower toothed, sessile, auricled, sagittate, glabrous or the lower sparsely pubescent, 4–15 cm. long, 1–4 cm. wide; sepals oblong, non-saccate, obtuse, yellowish to rarely purplish, 3–5 mm. long; petals linear to narrowly spatulate, slender-clawed, yellowish-white or very rarely purplish, 5–7 mm. long; glandular tissue subtending single stamens, absent or nearly obsolete near paired stamens; siliques strictly erect, semi-terete to slightly more flattened, glabrous, 4–10 cm. long, slightly more than 1 mm. wide, valves nerved to the middle or often to the tip; style short and stout; stigma expanded; seeds oblong to nearly orbicular, wingless to very narrowly winged, biseriate or nearly so.

Pubescence of the stem simple or rarely forked, spreading..1a. Var. *typica.*
Pubescence of the stem several-branched, appressed....1b. Var. *furcatipilis.*

1a. Var. TYPICA Hopkins in RHODORA **39:** 106 (1937). *A. glabra* (L.) Bernh., Syst. Verz. Erf. 195 (1800). *Turritis glabra*

L., Sp. Pl. **2:** 666 (1753). *Arabis perfoliata* Lam., Dict. **1:** 219 (1793). *Turritis macrocarpa* Nuttall in T. & G., Fl. N. Am. **1:** 78 (1838). *Arabis macrocarpa* (Nutt.) Torrey in Bot. Mex. Boundary pt. 1: 32 (1858). *Turritis glabra,* var. *lilacina* O. E. Schulz in Fedde, Repert. Sp. Nov. **33:** 191 (1933).—Quebec to North Carolina, California and British Columbia. Only the leading synonyms have been given above. For full synonymy, references, and citations of specimens see Hopkins, l. c.

1b. Var. FURCATIPILIS Hopkins. Stems pubescent below with appressed, several-branched trichomes. Pubescence smaller than in var. *typica.*—RHODORA **39:** 109 (1937).—Utah and California. UTAH: Logan City Camp, Logan Canyon, Cache Co., *Maguire 3437* (G, TYPE). CALIFORNIA: without locality, *T. Bridges 15* (G); Santa Lucia Mts., Monterey Co., March, 1898, *Plaskett 53* (G).

A. glabra is abundant and widely distributed in the mountains of our area where it is usually found in habitats ranging from moist shady places to open dry disturbed soils. The total distribution is very wide in temperate Asia and Europe as well as in North America. This species is often removed from *Arabis* and placed in the genus *Turritis,* but the characters used to make the separation are not convincing. The distinctive characters supposedly include yellowish petals as opposed to white or purple ones, semi-terete instead of definitely flattened siliques and biseriate instead of uniseriate seeds. As shown above, the seed-position in the silique may be untenable even as a species-criterion in *Arabis,* therefore it is of even less value as a generic character. Furthermore, a number of undoubted species of *Arabis* have biseriate seeds. The siliques of *A. glabra* are only semi-terete and in many cases they are flattened as much as those of *A. hirsuta.* As for petal-color, *A. glabra* does not have exclusively yellowish petals. Sometimes the petals are pink or even purplish. Other minor characters such as the angular nature of the silique or the complete nervation of the valves are sometimes pointed to as being distinctive, but these are variable in *A. glabra* and cannot be satisfactorily used to bolster generic segregation.

Two varieties of *A. glabra* have been distinguished in America. O. E. Schulz in 1933 described *Turritis glabra,* var. *lilacina*,[1] basing it upon the lilac color of the petals and sepal-margins.

[1] Fedde, Repert. Sp. Nov. **33:** 191 (1933).

An isotype of this variety does not show the characters described by Schulz, but specimens from widely separated stations (Wyoming, *Rollins no. 991;* Idaho, *Rollins & Constance no. 1109* and Utah, *Garrett no. 2236*) have purplish to lilac-colored buds and newly expanded petals. The supposedly distinctive color fades to the usual straw-yellow as the flower fully expands. I do not consider plants with such dubious ephemeral characters to be worthy of any nomenclatorial recognition. In the case of Hopkins's var. *furcatipilis*,[1] a more fundamental character, that of pubescence-type, is used as a distinguishing character. The distribution of this variety, including as it does only isolated stations in northeastern Utah and western California, is peculiar. Perhaps the variety is not a natural one, but until more information is available on its distribution this cannot be determined.

2. A. hirsuta (L.) Scop. Biennial or perennial; stems erect, one to several from a simple or branching caudex, simple or branched above, hirsute with coarse, spreading, simple or forked trichomes (strigose with appressed malphigiaceous trichomes in var. *adpressipilis*), often glabrous above, 2–7 dm. high; basal leaves oblong to oblanceolate or broadly spatulate, short-petioled, obtuse to rarely acutish, entire, dentate or repand, hirsute on both surfaces with coarse simple or forked trichomes or rarely almost glabrous, 2–8 cm. long, 1–3 cm. wide; cauline leaves lanceolate to oblanceolate or nearly spatulate, acute or obtuse, sessile, auriculate, entire to coarsely dentate, hirsute on both surfaces or the upper glabrous, 1–5 (–7) cm. long, 0.5–2.5 cm. wide, approximate to remote; pedicels erect to divaricately ascending, glabrous or rarely sparsely hirsute, 0.5–1.5 cm. long; sepals oblong, glabrous or rarely with a few trichomes, 2.5–4.5 mm. long, about 1 mm. wide; petals white to rarely pinkish, oblong to spatulate, 3–9 mm. long; siliques erect, strict to divaricately ascending, glabrous, nerved below or nearly the entire length, 3–6 cm. long, 1–2 mm. wide; style 0.5–1 mm. long, stigma entire to slightly divided; seeds brown to blackish, suborbicular to nearly rectangular, prominently winged on the distal end to narrowly winged or wingless, 1–1.5 mm. long, about 1 mm. wide, uniseriate, cotyledons accumbent. The above description was drawn from American material.

[1] Rhodora 39: 109 (1937).

KEY TO THE AMERICAN VARIETIES OF A. HIRSUTA

a. Flowers small; petals 3–5 mm. long, white to yellowish-white; cauline leaves approximate to subremote, siliques strictly erect; outer sepals moderately saccate........b.
  b. Stem-pubescence spreading, mostly simple.......2a. Var. *pycnocarpa.*
  b. Stem-pubescence appressed, mostly malphigiaceous 2b. Var. *adpressipilis.*

a. Flowers larger; petals 5–9 mm. long, white to pinkish; cauline leaves mostly remote; siliques often somewhat divergent; outer sepals markedly saccate............c.
  c. Siliques about 1 mm. wide; stigma nearly entire; cauline leaves usually entire; upper stem glabrous; inland in the mountains from California to British Columbia...............................2c. Var. *glabrata.*
  c. Siliques 1.5–2 mm. wide; stigma noticeably bifid; cauline leaves usually dentate; upper stem hirsute; chiefly near the Pacific Coast-line from Alaska to Oregon.............................2d. Var. *Eschscholtziana.*

2a. Var. **pycnocarpa** (Hopkins), comb. nov. Cauline leaves approximate to subremote; stems hirsute with simple or forked trichomes; siliques strictly erect, 3–5 cm. long; seeds winged on the sides and distal end.—*A. pycnocarpa* Hopkins in RHODORA **39:** 112 (1937); Deam, Fl. Indiana 505 (1940). *Turritis ovata* Pursh, Fl. Am. Sept. **2:** 438 (1816)? *T. oblongata* Raf. in Am. Mo. Mag. **2:** 44 (1817)? *Arabis* "(turritis ovata)" (Pursh) Poir. in Lam. Encycl. Suppl. **5:** 557 (1817)? *A. sagittata, γ ovata* (Pursh) DC., Prod. **1:** 144 (1824)? *A. hirsuta, γ ovata* (Pursh) T. & G., Fl. N. Am. **1:** 80 (1838)? *A. hirsuta* sensu Hooker, Fl. Bor.-Am. **1:** 42 (1829) in part; T. & G., Fl. N. Am. **1:** 80 (1838); Gray, Man. 36 (1848); Watson in Gray, Syn. Fl. N. Am. **1:** 162 (1895) in part; Britton & Brown, Ill. Fl. **2:** 149 (1897); Small, Fl. Se. U. S. 484 (1903); Piper in Contrib. U. S. Nat. Herb. **11:** 293 (1906) in part; Robinson & Fernald in Gray, Man. ed. 7, 438 (1908); Coulter & Nelson, New Man. Bot. Rky. Mts. 227 (1909); Rollins in Res. Stud. State Coll. Wash. **4:** 14 (1936) in part. *A. ovata* (Pursh) Poir. sensu Rydb., Fl. Colo. 165 (1906); Fl. Rky. Mts. 359 (1918) in part; Fl. Pr. Pl. N. Am. 381 (1932); Wooton & Standley in Contrib. U. S. Nat. Herb. **19:** 280 (1915); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 244 (1925); Small, Man. Se. Flora 571 (1933), wrongly attributed to Michx. *A. hirsuta,* f. *banffica* Tuzson in Bericht Frei. Ver. Syst. Bot. for 1919: 41 (1921). *A. hirsuta,* f. *constrictoides* Tuzson, ibid. *A. hirsuta,* f. *cordata* sensu Tuzson, ibid. *A. hirsuta,* f. *crepidifolia* Tuzson, ibid. *A. hirsuta,* f. *gracilis* Tuzson, ibid., p. 42. *A. hirsuta,* f. *iowensis* Tuzson, ibid. *A. hirsuta,* f. *laevis* Tuzson, ibid. p. 43. *A. hirsuta,* f. *novomexicana* Tuzson, ibid. *A. hirsuta,* f. *sagittata* sensu Tuzson, ibid. *A. pycnocarpa,* var. *reducta* Hopkins in RHODORA **39:** 117 (1937), based upon a pathological monstrosity.—Widespread from Quebec to Missouri, Arizona, British Columbia and Yukon.

A detailed discussion of leading characters, geographical distribution, and citations of specimens is given by Hopkins, l. c. under *A. pycnocarpa,* var. *typica* and need not be repeated in the present paper.

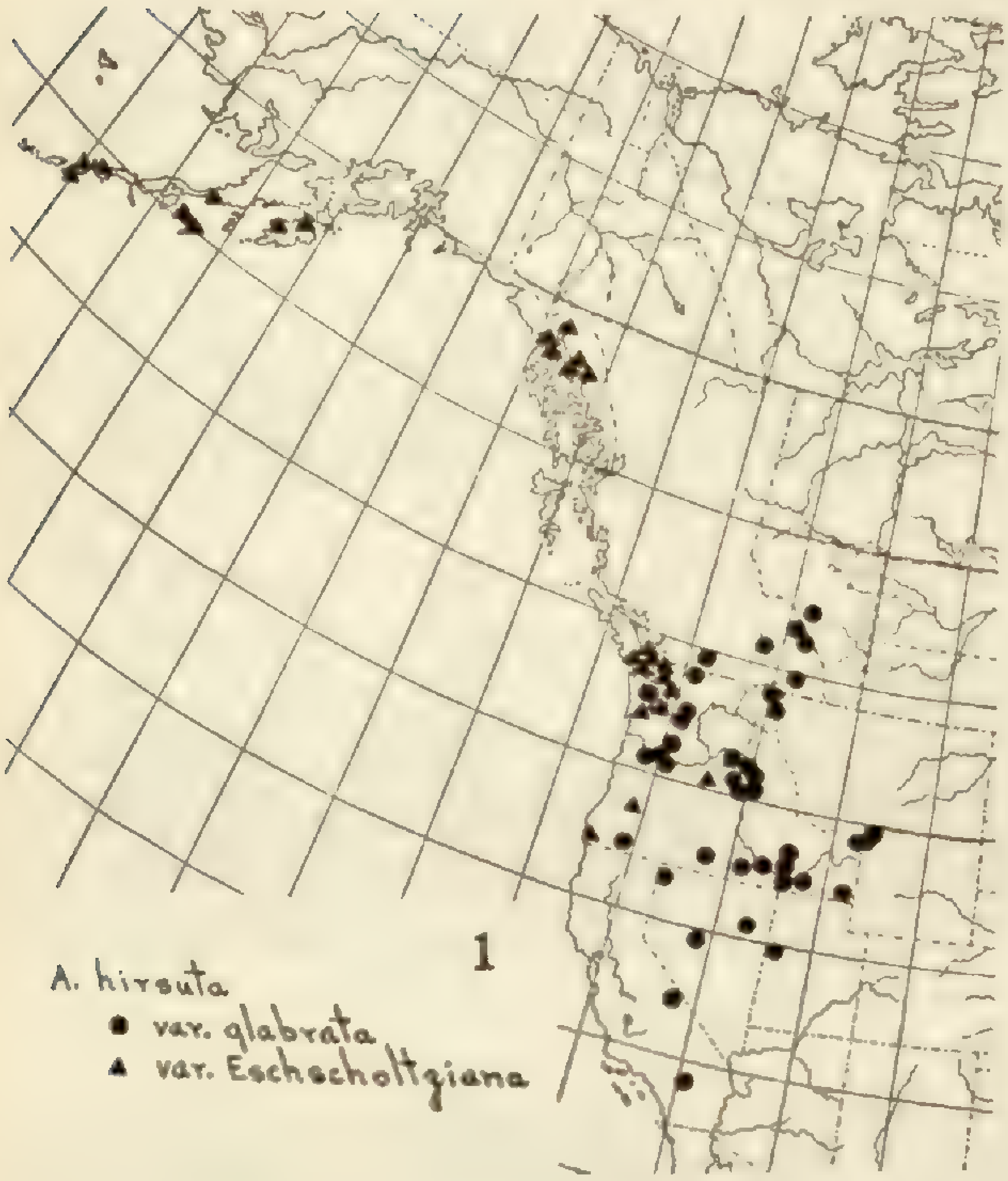
2b. Var. **adpressipilis** (Hopkins), comb. nov. *A. pycnocarpa* Hopkins, var. *adpressipilis* Hopkins in RHODORA **39:** 117 (1937); Deam, Fl. Indiana 506 (1940).

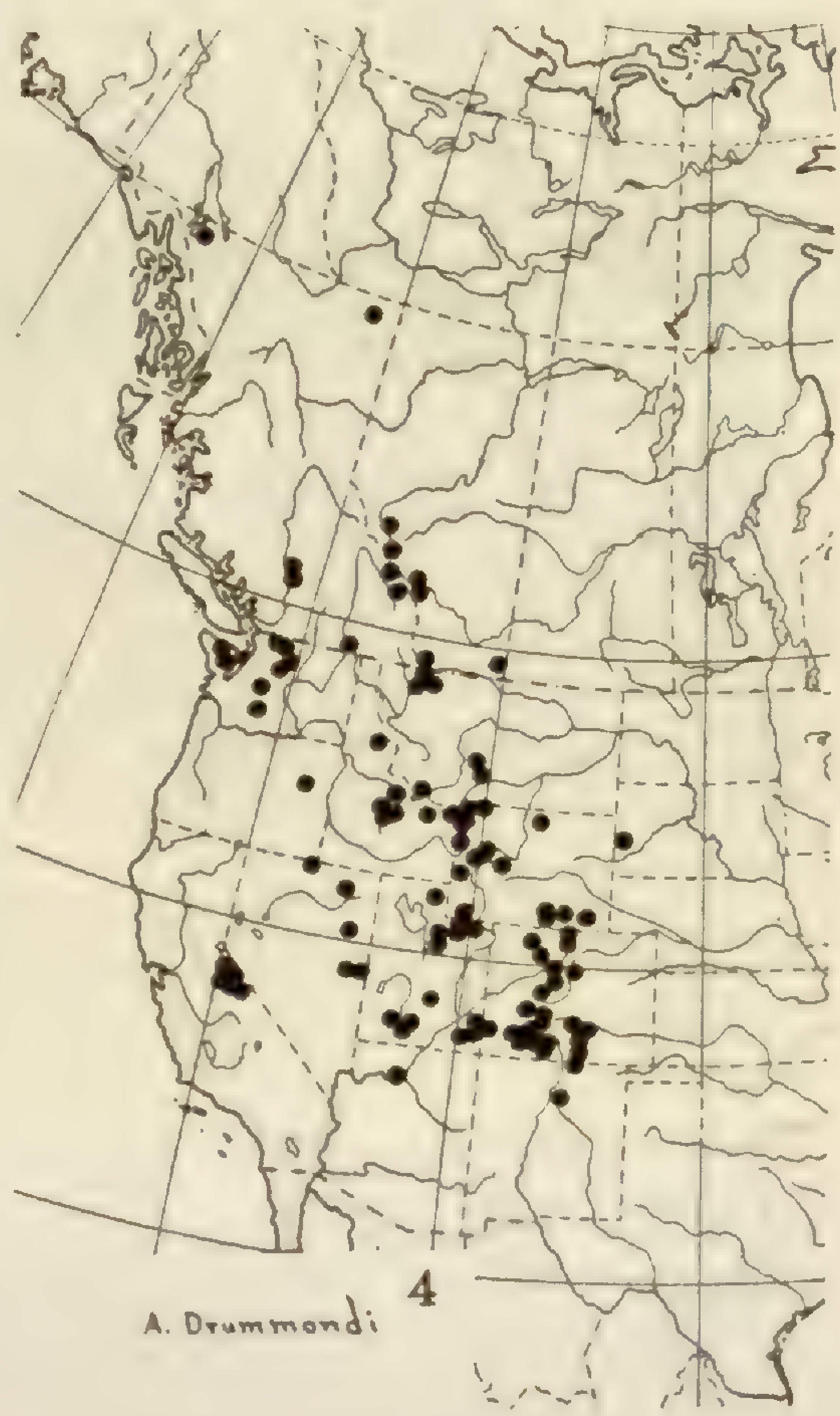
This variety is outside the area included in the present study, but its status has been verified, hence it is transferred to its proper place under *A. hirsuta.* A map showing the distribution of var. *adpressipilis* in the central United States may be seen in Hopkins paper cited above.

2c. Var. GLABRATA T. & G. Stems hirsute below, glabrous above; basal leaves obovate to oblanceolate, entire or rarely few-toothed, obtuse, sparsely hirsute to nearly glabrous, 3–7 cm. long, 1–2.5 cm. wide; cauline leaves obovate to oblong, rarely ovate, entire to rarely few-toothed; pedicels usually divaricately ascending; petals white, spatulate, 5–9 mm. long; siliques erect to slightly divaricate, usually not appressed, about 1 mm. wide.—*A. hirsuta, β glabrata* T. & G., Fl. N. Am. **1:** 80 (1838), not *A. hirsuta,* var. *glabrata* Döll (1862). *A. rupestris* Nuttall in T. & G., op. cit. p. 81; Rydberg, Fl. Rky. Mts. 359 (1917) in part; Tidestrom in Contrib. U. S. Nat. Herb. **25:** 244 (1925) in part. *Turritis spathulata* Nuttall in T. & G., op. cit. p. 78. *Arabis hirsuta* sensu Watson in Gray, Syn. Fl. N. Am. **1:** 162 (1895) in part; Howell, Fl. Northw. Am. **1:** 42 (1897) in part; Piper in Contrib. U. S. Nat. Herb. **11:** 293 (1906) in part; Coulter & Nelson, New Man. Bot. Rky. Mts. 227 (1909) in part; Jepson, Man. Fl. Pl. Calif. 428 (1925) and Fl. Calif. **2:** 61 (1936); Munz, Man. So. Calif. Bot. 204 (1935); Rollins in Res. Stud. State Coll. Wash. **4:** 14 (1936) in part. *A. hirsuta,* f. *americana* Tuzson in Bericht. Frei. Ver. Syst. Bot. for 1919, 41 (1921). *A. hirsuta,* f. *integra* Tuzson, ibid. p. 42. *A. pycnocarpa* Hopkins, var. *glabrata* (T. & G.) Hopkins in RHODORA **39:** 116 (1937) in part.—Alberta and British Columbia to Wyoming, Utah and California. MAP 1. ALBERTA: Kootenai Plains, north branch Saskatchewan River, June, 1908, *Brown 951* (G); June, 1908, *Brown 940* (G). WYOMING: Silver Gate, Yellowstone Nat. Park, June, 1885, *Tweedy 556* (US). IDAHO: near Hatwai Cr., Nez Perce Co., April, 1892, *Sandberg et al. 41* (G, isotype of *A. hirsuta,* f. *americana*); near Pollock, Idaho Co., May, 1937, *Constance 1856* (R); Silver City, Owyhee Co., June, 1911, *Macbride 991* (Cl, G, RM); near St. Anthony, June, 1919, *Quayle 58* (Cl, RM); Preston, May, 1909, *M. P. Henderson 48* (RM);

Hope, May, 1914, *Dunkle 412* (RM); Twin Falls-Shoshone Falls, July, 1911, *Nelson & Macbride 1352* (RM). Utah: Deep Creek Mts., June, 1933, *Maguire & Becraft 2627* (R, RM, UAC); Troutcreek, Juab Co., June, 1933, *Maguire & Becraft 2628a* (G, RM, UAC). Nevada: Lamoille Canyon, Ruby Mts., Elko Co., July, 1938, *Rollins & Chambers 2564* (G, R); about 10 miles south of Austin, Lander Co., June, 1937, *Goodner & Henning 117* (NA, R); 2 miles west of Uya, Washoe Co., May, 1939, *Train 2834* (NA, R). California: Cottonwood Creek, White Mts., Mono Co., July, 1891, *Coville & Funston 1807* (G, US); Santa Ana River, San Bernardino Mts., Aug., 1922, *Munz 6324* (G, RM); July, 1926, *Munz 10797* (G); Bear Valley, San Bernardino Mts., June, 1922, *Munz 5728* (RM); Mill Creek Falls, San Bernardino Mts., June, 1901, *S. B. Parish 5069* (G). Oregon: near Cornucopia, Baker Co., July, 1936, *Thompson 13313* (G); Multnomah Falls Trail, Multnomah Co., May, 1940, *Beetle & Constance 2623* (R); Willamette River, *Nuttall s.n.* (G, isotype of *A. rupestris*); Elk Rock, June, 1917, *J. C. Nelson 1269* (G); Ashland-Klamath Falls, July, 1920, *Peck 9228* (G, NY); Ice Lake Trail, Wallowa Mts., June, 1936, *Eastwood & Howell 3310* (R); Steens Mts., July, 1896, *Leiberg 2469* (US). Washington: Winchester Mt., Whatcom Co., July, 1937, *Muencher 7879* (G); upper valley of Nisqually Glacier, Mount Rainier, June, 1894, *Allen 313a* (G); White River, Mt. Rainier, June, 1937, *G. N. Jones 9957* (G); Swauk River, Kittitas Co., 1913, *Sharples 87, 88 & 93* (G); Waitsburg, May, 1897, *R. M. Horner s.n.* (G); Cape Horn, Skamania Co., Aug., 1894, *Suksdorf 2355* (G); Constance Ridge, Olympic Mts., May, 1931, *Thompson 6560* (G). British Columbia: Avalanche Patti, June, 1904, *Shaw 37* (G, isotype of *A. hirsuta*, f. *integra*); Emerald Lake, June, 1931, *Pease 22383* (G); Ainsworth near Kootanie Lake, July, 1890, *J. Macoun s.n.* (G); Glacier, June, 1906, *Brown 291* (G); Lower Frazer River, 1859, *Lyall s.n.* (G); near Lake Bootahnie, Marble Mts., June, 1938, *J. W. & E. Thompson 134* (G).

2d. Var. **Eschscholtziana** (Andrz.), comb. nov. Stems hirsute from base to the inflorescence with spreading simple or forked trichomes; basal leaves obovate to oblanceolate, repand to coarsely dentate, rarely entire, pubescent on both surfaces with coarse trichomes, 3–8 cm. long, 1.5–3 cm. wide; cauline leaves ovate to oblong, auriculate, acute or rarely obtuse, dentate, 1.5–5 (–7) cm. long, pubescent; petals white to pinkish, 5–10 mm. long; mature siliques erect to slightly spreading, 1.5–2.5 mm. wide; stigma usually noticeably bifid.—*A. Eschscholtziana* Andrz. in Ledeb., Fl. Alt. **3:** 25 (1831). *A. hirsuta* sensu Cham. & Schlecht. in Linnaea **1:** 15 (1826); Hooker, Fl. Bor.-Am. **1:** 42





ROLLINS ON ARABIS

(1829) in part; Ledeb., Fl. Ross. **3:** 118 (1842); Howell, Fl. Northw. Am. **1:** 42 (1897) in part; Piper in Contrib. U. S. Nat. Herb. **11:** 293 (1906) in part; Piper & Beattie, Fl. Northw. Coast 170 (1915) in part; Henry, Fl. So. Brit. Columb. 150 (1918) in part; Rollins in Res. Stud. State Coll. Wash. **4:** 14 (1936) in part. *A. hirsuta*, f. *Eschscholtziana* (Andrz.) Tuzson in Bericht. Frei. Ver. Syst. Bot. for 1919. 42 (1921). *A. hirsuta*, f. *grandiflora* Tuzson, ibid. *A. hirsuta*, f. *Krausei* Tuzson, ibid. p. 43. *A. hirsuta*, f. *lilacina* Tuzson, ibid. *A. hirsuta*, f. *subsetosa* Tuzson, ibid. p. 44. *A. Stelleri*, var. *Eschscholtziana* (Andrz.) Busch, Fl. Sib. & Orient. Ext. **4:** fam. 25. 438 (1926). *A. rupestris* sensu Hultén, Fl. Aleut. Is. 203 (1937).—Oregon to Alaska. Map 1. Oregon: without locality, 1871, *E. Hall 33* (G); Harbor, Curry Co., June, 1919, *Peck 8737* (G, M); Kamela, Union Co., July, 1915, *Peck 2715* (G); Pauline Lake, July, 1894, *Leiberg 580* (G). Washington: near Fairhaven, Whatcom Co., July, 1890, *Suksdorf 1907* (G, R); Brown Island, near Friday Harbor, May, 1936, *Blanchard 29* (R, UC); near Dewatto, Kitsap Co., May, 1936, *Eicher 78* (G, R, WSC); Colonial Bob Mt., Grays Harbor Co., July, 1934, *Hodgdon & Rossbach 1 & 2* (G); mouth of Skagit River, Skagit Co., May, 1927, *Lucile Roush s.n.* (R); Semiahmoo Bay, 1858, *Lyall* (G). British Columbia: Vancouver Island: San Juan Harbor, Aug., 1907, *Rosendahl 2061* (G); District of Renfrew, 1901, *Rosendahl & Brand 12* (G, RM); Cameron Lake, May, 1917, *W. R. Carter s.n.* (G); Manoose Bay, May, 1916, *W. R. Carter s.n.* (G). Alaska: Taku Harbor, June, 1899, *Coville & Kearney 485* (G); near Skagway, June, 1906, *G. C. Deane, s.n.* (G); mouth of Yes Bay, *T. Howell 1608* (NY); Khantaak Island near Yakutat Bay, June, 1892, *Funston 15* (G); Admiralty Island, June, 1915, *Walker 723* (G); near Karluk, Kodiak Is., June, 1903, *Rutter 28* (G); Larson Bay, Kodiak Is., 1933, *Geist s.n.* (L); Olga Bay, Kodiak Is., June, 1938, *E. H. & H. B. Looff 647 & 648* (G, R); Dutch Harbor, Unalaska, 1907, *Van Dyke 12 & 113* (G), *Hultén 7651 & 5500* (L); Shumagin Islands, Popoff Is., June, 1892, *Harrington s.n.* (G), *Hultén 7708* (L); Chiachi Islands, June, 1874, *Dall s.n.* (G).

The studies of Tuzson[1] on the geographical distribution of *A. hirsuta* significantly show that the species with its multiplicity of forms extends interruptedly around the globe in the northern hemisphere. He gives the limits of occurrence as 38° to 65° north latitude, but the southern limit must be modified in North America to 35°, since the species has been found at about that

[1] Bericht. Frei. Ver. Syst. Bot. for 1919.

latitude in Arizona and New Mexico. In all, according to Tuzson, over 25 species with numerous varieties have been described which really belong in *A. hirsuta.* Accordingly he has relegated many previously described variants to the rank of form and described a number of new forms, particularly from North America. Authentic material of twelve of the sixteen forms attributed to this continent has been studied, with the conclusion that too little material was taken into account when these forms were erected. Tuzson did not set up natural entities, consequently his names have been placed in synonymy under the three varieties of *A. hirsuta* in which they seem to belong.

In treating *A. hirsuta* for North America, it appears that phylogeny is best served by the maintenance of the principal natural entities as varieties rather than as species, since treating them as species tends to obscure the very close relationship which exists between them. Actually there is a certain amount of intergrading between these entities and if they could not be correlated with geographic areas, their continuation even as varieties might be seriously challenged. Hopkins[1] has described the American plants as a new species, separating them from the Eurasian *A. hirsuta.* In doing so he has emphasized the strongest divergences detectable without, it seems to me, giving adequate consideration to the entire natural variation occurring in plants of either Eurasia or America. Unfortunately, each character emphasized as distinguishing *A. pycnocarpa* from *A. hirsuta* is found to be variable and breaks down as a valid point of distinction when systematically tested on a large series of either American or European plants. This is particularly true when vars. *Eschscholtziana* and *glabrata* are taken into consideration, but was freely found to be the case with populations of var. *pycnocarpa* studied in the field in the Rocky Mountain area.

The distribution of *A. hirsuta* in a general way parallels that of *A. glabra* and it is not disturbing from the geographical point of view to find it widely distributed in both the eastern and western hemispheres. It is true that the American plants show certain tendencies away from the characteristics found in plants of Eurasia, but the resulting differences are by no means

[1] Rhodora 39: 112 (1937).

of a specific nature. It appears that two alternative courses are open to one treating *A. hirsuta* for North America. The species may be divided into ten or a dozen "microspecies" which do not parallel in the slightest other species of the genus or it may be kept intact as a wide-spread species with the principal variants designated as varieties. Using the more clearly defined species of *Arabis* as a guide as to where specific lines should be drawn in those where complexity often obscures natural boundaries, it is clear that the latter course is preferable.

The application of the name *Turritis ovata* Pursh to an American species of *Arabis*, as shown by Hopkins, l. c., remains unsolved. DeCandolle, l. c., indirectly, and Torrey and Gray, l. c., directly used Pursh's name in a varietal category and this name should have priority over var. *pycnocarpa* if its suspected application could be proved. Under the circumstances it seems best to base the varietal name on plants which are adequately described and represented by a known type. Variety *pycnocarpa* is well illustrated and mapped by Hopkins, l. c., under *A. pycnocarpa*, var. *typica*. A few minor range extensions could be given for the Rocky Mountain region, but this seems hardly necessary since the variety is known to occur widely in the area. Plants of var. *pycnocarpa* have been grown in the greenhouse for three consecutive years without their having flowered. This would seem to indicate that it is often a perennial instead of a strict biennial as formerly supposed.

Var. *Eschscholtziana* was described from specimens collected on the island of Unalaska by Chamisso. The type has not been examined, but there is little doubt as to the identity of the plants. The only other *Arabis* reported from Unalaska is the very different *A. lyrata*, var. *kamchatica*. Var. *Eschscholtziana* is apparently abundant on lower mountain slopes and cliffs at a number of stations from the Aleutian Islands of Alaska to southern Oregon, chiefly near the ocean. The basal leaves of this variety are often large, thick and purplish on the under surface. It intergrades to some extent with var. *glabrata*, but in general the two are distinguishable and occupy separate geographical areas.

Var. *glabrata* was based on a specimen collected in Oregon by Dr. Scouler, but the actual type has either been misplaced or lost. The application of the name to the nearly glabrous-leaved plants from Oregon, Washington, Idaho, British Columbia and nearby areas seems to be sound. Our interpretation differs from that of Hopkins in that we limit var. *glabrata* to the large-flowered plants with diverging pedicels and somewhat saccate outer sepals from the northwestern United States and adjacent Canada. The nearly glabrous types from the Rocky Mountains and farther east do not differ enough from typical var. *pycnocarpa* to be set off from it.

In accounting for *A. pycnocarpa*, var. *reducta*, it may be pointed out that this is the fifth entity described in *Arabis* from North America based on specimens with sterile, semi-sterile or diseased siliques. Partial or complete sterility is a fairly common phenomenon in *Arabis* and has been repeatedly observed in the field in widely separated places. The distinctive characteristics claimed for var. *reducta* are attributable in a large part, particularly in the type specimen, to the diseased siliques, which have only a powdery brown mass in place of normal seeds. The name is considered to have been based on a monstrosity, hence it does not have valid priority over var. *pycnocarpa*.

A MONOGRAPHIC STUDY OF ARABIS IN WESTERN NORTH AMERICA

Reed C. Rollins

(*Continued from page 325*)

3. A. BLEPHAROPHYLLA Hooker & Arnott. Perennial; stems simple, one or few from a simple or closely branching base, pubescent with coarse, branching, appressed trichomes, rather more densely so above, rarely somewhat glabrous, 0.5–2 dm. high; basal leaves rosulate, numerous, obovate to oblanceolate, petiolate, obtuse, entire or dentate, pubescent on surfaces and margins with coarse forked or dendritic trichomes or the surfaces glabrous, 2–8 cm. long, 0.5–2 cm. broad; cauline few, ovate to oblong, entire or dentate, sessile but not auriculate, pubescent or glabrous on the surfaces, 1–2 cm. long, 4–10 mm. broad; pedicels erect, stout, pubescent, 5–10 mm. long; sepals pubescent, oblong, purplish, 6–8 mm. long, 2–3 mm. broad, outer pair saccate, inner pair non-saccate; petals rose-purple, broadly spatulate, usually retuse but sometimes merely truncate or rounded, 12–18 mm. long, 4–7 mm. broad; anthers apiculate; glands well-developed around single stamens, obsolete under paired stamens; siliques erect, glabrous, nerved to middle or above, 2–4 cm. long, 2–2.5 mm. wide; style stout when young, more slender on mature siliques, 1–2 mm. long; seeds orbicular, 1.5–2 mm. broad, narrowly winged, dark brown, uniseriate.—Bot. Beech. Voy. 321 (1840); Hooker in Bot. Mag. **33:** tab. 6087 (1874); Greene, Fl. Francis. 254 (1891); Watson in Gray, Syn. Fl. N. Am. **1:** 161 (1895); Jepson, Man. Fl. Pl. Calif. 428 (1925) and Fl. Calif. **2:** 62, fig. 136 (1936). *Erysimum blepharophyllum* (H. & A.) O. Ktze., Rev. Gen. Pl. pt. 2; 933 (1891).—Western California. MAP 2. CALIFORNIA: without locality, *Douglas s.n.* (G, isotype); Bodega Bay, Sonoma Co., March, 1902, *Heller & Brown 5178* (G, M, NY, P, US); Point Reyes, Marin Co., Feb., 1928, *Mason 4157* (R); April, 1932, *Ferris 8041* (P, UC); Sausalito, Marin Co., March, 1889, *V. K. Chesnut s.n.* (US); June, 1917, *Walker*

3393 (UC); near San Francisco, April, 1903, *Baker 1881* (G, M, NY, P, UC); April, 1903, *Heller 6591* (G, M, NY, P, UC, US); San Mateo County, April, 1903, *Elmer 4736* (M); Monterey, *Andrews s.n.* (G).

There is some variation in the distribution of the indument on the leaves of this species. The blade-surfaces may be relatively glabrous with the margins supporting a fringe of trichomes, as in the isotype specimen cited above, or the entire leaf may be pubescent. *A. blepharophylla* is a species of lower stature, shorter and more obtuse siliques and thicker styles than its relatives from southern Oregon and the extreme northern portion of California. Its flowers are relatively large and colorful. These traits have been responsible for its having been cultivated as an ornamental, both in Europe and America.

Jepson[1] has raised the question as to whether *A. blepharophylla* occurs on the Monterey Peninsula. A fragmentary specimen in the Gray Herbarium marked "Monterey, *Andrews*" in the handwriting of Asa Gray is the only evidence I have seen of its occurrence there, except published reports which were doubtless based on the same evidence. The identity of the specimen is unquestionable, but the actual location of its collection may be only an approximation as was the data preserved on many of the earlier collections sent to Gray from the West for determination. The locality, Monterey, for *A. blepharophylla* represents a considerable southward extension from recent stations, but it is deemed wise to include it as part of the range of the species, since only negative "evidence" against its occurrence on the peninsula is available. So far as I am aware, no systematic search of the entire area has been made.

4. A. **oregana** nom. nov. Perennial; stems one or few from a simple or closely branched caudex, simple or branched above, coarsely pubescent with a mixture of forked and dendritic trichomes, 3–5 dm. high; basal leaves repand to nearly entire, obovate to oblanceolate, obtuse, abruptly narrowed to a distinct petiole, 4–8 cm. long, 1–2 cm. broad, coarsely pubescent with large forked and smaller dendritic trichomes; cauline leaves oblong to ovate, entire or dentate, pubescent to nearly glabrous, sessile but not auriculate, 2–5 cm. long, 5–20 mm. broad; pedicels ascending to divaricate, pubescent, 1–2 cm. long; sepals oblong, purple, pubescent, 5–7 mm. long, 1.5–2 mm. broad, outer pair

[1] Fl. Calif. 2: 62 (1936).

saccate, inner pair non-saccate; petals spatulate, purple, rounded at apex, tapering to a narrow claw, 4–6 mm. broad, 10–15 mm. long; glands well developed and nearly surrounding single stamens, obsolete under paired stamens; siliques erect to somewhat divaricate, straight, glabrous, nerved nearly to the tip, 4–5 cm. long, about 2 mm. wide; style less than 2 mm. long; seeds dark brown, oblong, narrowly winged on sides, distal portion of wing elongated.—*A. purpurascens* Howell ex Greene in Pitt. **1:** 161 (1888), not *A. purpurascens* Presl, Fl. Sicula **1:** 50 (1826). *A. purpurascens* Howell, Fl. Northw. Am. **1:** 43 (1897) in part. *A. furcata* Wats., var. *purpurascens* (Howell) Watson in Gray, Syn. Fl. N. Am. **1:** 161 (1895), as to name only; Rollins in Res. Stud. State Coll. Wash. **4:** 18 (1936) in part.—Rogue River drainage of southwestern Oregon; Map 2. Oregon: rocky hillsides, Ashland, April 26, 1887, *Th. Howell s.n.* (ND, type; F, M, NY, UC, US, isotypes), May, 1887, *Henderson 1384* (G); junction of Siskiyou and Cascade Mts., Jackson Co., May, 1898, *Applegate 2272* (US); Roxy Ann, Jackson Co., March, 1925, *Brown 11* (FS); Jackson Canyon, Jackson Co., April, 1925, *Brown 26* (FS); Moore Ranch, Little Butte Creek, May, 1927, *Ingram 2348* (FS).

A study of the type of *A. purpurascens* Howell ex Greene at the University of Notre Dame and a mature fruiting specimen of the same collection at the Field Museum has made it clear that the species is unrelated to *A. furcata,* as was formerly supposed. Watson[1] in reducing "*A. purpurascens*" to a variety of the latter species, cited only a Howell specimen from Eight Dollar Mountain which belongs to *A. aculeolata,* indicating that he misunderstood "*A. purpurascens*" as originally described. His concept of *A. furcata,* var. *purpurascens,* which I followed in 1936,[2] was based upon specimens in the Gray Herbarium which are now referred to both *A. oregana* and *A. aculeolata.* With more and better material for study available, I am now convinced that there are three natural and discrete species belonging to the *blepharophylla*-group in southern Oregon and adjacent California.

5. A. **modesta,** sp. nov. Herba perennis; caulibus ramosis vel rare simplicibus stellato-pubescentibus 2.5–4.5 dm. altis; foliis radicalibus petiolatis obovatis obtusis repandis vel integris stellato-pubescentibus 2–6 cm. longis, 8–16 mm. latis; foliis caulinis sessilibus oblongis vel obovatis non auriculatis pubes-

[1] Gray's Syn. Fl. No. Am. **1:** 161 (1895).
[2] Res. Stud. State Coll. Wash. **4:** 18 (1936).

centibus; pedicellis divaricatis vel erectis pubescentibus 6–12 mm. longis; sepalis oblongis pubescentibus 5–7 mm. longis, 1.5–2 mm. latis; petalis spathulatis purpureis 12–15 mm. longis, 3.5–5.5 mm. latis; siliquis immaturis adscendentibus; stylo 1–2 mm. longo; seminibus ignotis.

Perennial; stems one to few from a simple or closely branched base, simple or usually branched above, 2.5–4.5 dm. high, pubescent throughout with small appressed stellate trichomes; basal leaves petiolate, obovate, obtuse, repand to entire, densely and evenly stellate-pubescent, often purplish beneath, 2–6 cm. long, 8–16 mm. broad; cauline leaves few (2–6), remote, oblong to obovate, obtuse, green, sessile but not auricled or clasping, densely pubescent, shallowly dentate to entire, 1–2.5 cm. long, 6–12 mm. wide; older flowering pedicels divaricate to more ascending, pubescent, 6–12 mm. long, elongating in fruit; sepals oblong, pubescent, 5–7 mm. long, 1.5–2 mm. wide, outer pair saccate, inner pair non-saccate; petals spatulate, tapering to a slender claw, purple to pinkish-purple, 12–15 mm. long, 3.5–5.5 mm. wide; nectar-glands U-shaped, subtending single stamens, obsolete beneath paired stamens; immature siliques glabrous, ascending; style 1–2 mm. long; mature siliques and seeds unknown.—*A. furcata* Wats., var. *purpurascens* sensu Rollins, Res. Stud. State Coll. Wash. **4:** 18 (1936) in part.—Southwestern Oregon and adjacent CALIFORNIA: Klamath River, near Horsecreek, Siskiyou Co., March, 1926, *Douthitt 5* (FS). OREGON: Josephine Co.: moist sub-shaded banks of the Rogue River, near Galice, April 18, 1926, *L. F. Henderson 5914* (RM, TYPE; M, isotype); Hellgate, Rogue River, Galice Road, May, 1927, *Gabrielson & Ingram 2247* (FS).

A. modesta is a relative of *A. oregana*, but differs markedly in its pubescence-type. The species has uniform four-parted, small, short-stalked trichomes covering the leaves and stems, whereas the indument of *A. oregana* is made up of large forked or dendritic trichomes of different sizes. In the latter species the basal leaves are somewhat ciliate, because of the large trichomes along their margins, and the lower stems are decidedly hirsute. In *A. modesta* the basal leaves are never ciliate, nor is the stem hirsute. Rather, the stem is covered with appressed stellate hairs. Unfortunately, mature fruiting material of this species has not been available. Immature specimens indicate that the siliques of *A. modesta* possess a style 1–2 mm. long. Ordinarily it would be deemed unwise to describe a new species in *Arabis* without seeing mature fruiting specimens, but in this case the type of pubescence and its distribution upon the plants is so distinctive that I am confident the species is undescribed.

6. A. McDonaldiana Eastwood. Perennial; stems few to many from a branching caudex, simple, glabrous, 5–20 cm. high, slender; basal leaves rosulate, spatulate, repand to somewhat toothed, glabrous or the few teeth rarely bristle-tipped, 1–2 cm. long, 4–7 mm. broad; cauline leaves small, oblong, remote, entire, sessile, 4–7 mm. long, 2–3 mm. broad; pedicels ascending, glabrous, 8–10 mm. long; sepals oblong, glabrous, 5–6 mm. long, 1.5–2 mm. broad, outer pair saccate, inner pair non-saccate; petals rose-purple, narrowly spatulate, truncate or somewhat rounded at apex, gradually tapering to a narrow claw, 9–11 mm. long, 2.5–3 mm. broad; nectar-glands U-shaped, around single stamens, obsolete beneath paired stamens; immature siliques erect or somewhat divaricate, glabrous, 3–4 cm. long; seeds unknown.—Bull. Torr. Bot. Club **30:** 488 (1903). *A. blepharophylla* H. & A., var. *macdonaldiana* (Eastw.) Jepson, Man. Fl. Pl. Calif. 429 (1925) and Fl. Calif. **2:** 62 (1936).—Map 2. California: Red Mountain, near Bell Spring, Mendocino Co., May 21–28, 1902, *Eastwood s.n.* (G, NY, UC, US, isotypes).

This entity is very closely related to *A. aculeolata* Greene, which has a restricted range in southern Oregon. However, *A. McDonaldiana* differs in being entirely glabrous, of lower stature, and in possessing slender, truncate petals. Though little is known of *A. McDonaldiana,* its inclusion as a variety of *A. blepharophylla* where it was placed by Jepson, l. c., is more open to question than would be its association with *A. aculeolata.* Until further exploration of northwestern California yields more and better material, the limits of specific variation and geographical distribution will remain in doubt. *A. McDonaldiana* has much narrower petals than any of its relatives and is the only completely glabrous member of its immediate group.

7. A. aculeolata Greene. Perennial with a branching caudex which is often invested with old leaf-bases; stems few to several, simple, few-flowered, densely hirsute with large simple or forked trichomes, often nearly glabrous above, 2–3.5 dm. high; basal leaves rosulate, obovate to oblanceolate, obtuse, entire or somewhat repand, densely hirsute or the surfaces rarely less so, 1–4 cm. long, 5–10 mm. broad; cauline sessile, not auriculate, entire to few-toothed, hirsute, remote, 5–15 mm. long, 3–6 mm. broad; pedicels erect or slightly diverging, hirsute, 1–1.5 cm. long; sepals pubescent, purple, 1.5–3 mm. wide, 6–9 mm. long, outer pair saccate, broader than the inner, inner pair non-saccate;

petals purple, spatulate, tapering rather abruptly to a narrow claw, 12–20 mm. long, 5–8 mm. broad; nectar-glands well developed at base of short stamens, obsolete beneath long stamens; siliques glabrous, erect, nerved almost to apex, prominently veined, 3.5–6.5 cm. long, about 2 mm. wide; style slender, 1–2 mm. long; seeds orbicular to somewhat oblong, narrowly winged all around, 1.5–2 mm. broad, dark brown, uniseriate.—Leaflets **2:** 69 (1910). *A. furcata* Wats., var. *purpurascens* Watson in Gray, Syn. Fl. N. Am. **1:** 161 (1895) in part; Rollins in Res. Stud. State Coll. Wash. **4:** 18 (1936) in part. *A. purpurascens* sensu Howell, Fl. Northw. Am. **1:** 43 (1897) in part.—Southwestern OREGON: JOSEPHINE CO.: Eight Dollar Mt., May, 1884, *Th. Howell 35* (G), June, 1904, *C. V. Piper 6256* (US, TYPE); near Selma, March, 1926, *Henderson 5721* (M, RM), May 1, 1924, *Savage s.n.* (UC), May, 1927, *Gabrielson & Ingram 2230* (FS); near O'Brien, April, 1934, *Thompson 10239* (M, NY, US, UW, W); Waldo, April, 1924, *Eastwood & Howell 1404* (G), June, 1884, *Th. Howell s.n.* (G, NY, O, UC, US, WSC); Rough & Ready Creek, April, 1930, *Applegate 6140* (G), May, 1933, *Tracy 12521* (UC).

A. aculeolata is another singular endemic of the "Klamath Region" of southwestern Oregon. The species is related to *A. furcata* on the one hand and to *A. oregana* on the other. From *A. furcata*, with which it agrees in general habit, *A. aculeolata* differs in having much larger purple instead of white flowers, hirsute instead of glabrous upper stems, pedicels and sepals; also the seeds are winged all around rather than merely on the distal end. Actually, *A. aculeolata* is more closely related to all the purple-flowered species of the group than to *A. furcata*, where it has often been included in var. *purpurascens*.

A. aculeolata is distinguished from *A. oregana*, its nearest relative, by its multicipitally branching caudex, smaller basal leaves, shorter stems, uniformly simple or at most forked pubescence, erect pedicels and prominent style 1–2 mm. long. In *A. oregana*, the caudex is usually simple, but may have one or two close branches; the pubescence is made up of a mixture of large forked trichomes with bulbous bases and smaller dendritically branched ones; the pedicels are divaricate, and the siliques have sessile or nearly sessile stigmas.

8. A. FURCATA Watson. Perennial; stems one or usually several from a simple or branching caudex, slender, simple, erect or ascending, glabrous to sparsely pubescent near the

base, 1–4 dm. high; basal leaves numerous, obovate to spatulate, tapering to a narrow petiole, glabrous to sparsely hirsute, ciliate with forked or simple trichomes along the margins to rarely glabrous, entire to repand or remotely dentate, 2–5 cm. long, blade 5–20 mm. wide; cauline leaves smaller, sessile, entire or rarely dentate, obovate to oblong-lanceolate, mostly glabrous, 1–2 cm. long; sepals oblong, glabrous, 2–4 mm. long, outer pair saccate, inner pair non-saccate; petals white, spatulate, 5–10 mm. long, 2–4 mm. wide, conspicuously veined; nectar-glands surrounding base of single stamen, poorly developed below paired stamens; pedicels ascending, straight, glabrous, 0.5–1.5 cm. long; siliques erect, straight or nearly so, glabrous, 2–4 cm. long, about 2 mm. wide, valves constricted between the seeds, conspicuously one-nerved from base to apex; style about 1 mm. long; seeds oblong-elliptical to nearly orbicular, winged at the distal end only, 1.5–2 mm. long, uniseriate; funiculus nearly equaling the seeds in length.

8a. Var. **typica.** *A. furcata* Watson in Proc. Am. Acad. **17:** 362 (1882) and in Gray, Syn. Fl. N. Am. **1:** 161 (1895); Howell, Fl. Northw. Am. **1:** 43 (1897); Piper in Contrib. U. S. Nat. Herb. **11:** 293 (1906); Piper & Beattie, Fl. Northw. Coast 171 (1915); Rollins in Res. Stud. State Coll. Wash. **4:** 17, fig. 5 (1936); G. N. Jones in Univ. Wash. Pub. Biol. **7:** 91 (1939). *A. Suksdorfii* Howell, Fl. Northw. Am. **1:** 43 (1897).—Washington and Oregon. Map 6. Oregon: bluffs of the Columbia, near mouth of Hood River, May 18, 1882, *J. & T. J. Howell s.n.* (G, type); Mitchell Point, May & June, 1909, *Suksdorf 1368* (G, R, UC, US, WSC); Hood River, June, 1879, *J. Howell s.n.* (G); Mt. Hood, July, 1895, *Langile 67* (US), July, 1926, *English 282* (WSC); Elk Cove, Hood River Co., Aug., 1927, *English 837* (WSC); Olallie Mt., near Mt. Jefferson, July, 1928, *Leach & Leach 1974* (O). Washington: Three Brothers Peak, June, 1934, *Thompson 10743* (T, UW), Aug. 1935, *Thompson 12641* (G); Mt. Stuart region, Chelan Co., Aug., 1930, *Thompson 5797* (G); Mt. Stuart, July, 1898, *Elmer 1223* (US, WSC); Earl Ridge, Wenatchee Mts., July, 1933, *Thompson 9549* (G, T); head of Beverly Creek, Kittitas Co., July, 1932, *Thompson 8718* (G); Owyhigh, Mt. Rainier, Aug., 1919, *Flett 3161* (WSC); King Mt., Aug., 1899, *Suksdorf s.n.* (R); upper Ahtanum River, Yakima Co., Aug., 1892, *Henderson 58* (UW, WSC); Flat Top Mt., June, 1923, *Pearson 371* (WSC); Mt. Adams (Paddo), Aug. 10, 1882, *T. Howell s.n.* (O, type; G, isotype of *A. Suksdorfii*), Oct. 1892, *Suksdorf 2472* (G); Chiquash Mts., Skamania Co., Aug., 1895, *Suksdorf 2431* (G).

8b. Var. olympica (Piper) Rollins. Stems simple, slender, hirsute with branched trichomes; inflorescence subcorymbose;

siliques erect, narrowly linear, 18–24 mm. long.—Res. Stud. State Coll. Wash. **4:** 19 (1936). *A. olympica* Piper in Contrib. U. S. Nat. Herb. **16:** 208 (1913); Piper & Beattie, Fl. Northw. Coast 170 (1915); G. N. Jones in Univ. Wash. Pub. Biol. **5:** 158 (1936).—WASHINGTON: near Humes Glacier, base of Mt., Olympus, Jefferson Co., Aug. 12, 1907, *Flett s.n.* (US, TYPE; WSC, isotype).

The alpine or high mountain phase of *A. furcata* tends to be more nearly glabrous, thicker-leaved, and slightly dwarfed as compared with plants from the type station in the gorge of the Columbia River. However, there is no good evidence that the alpine plants really represent a discrete taxonomic entity. The distinctive characteristics of *A. furcata* run through the entire series, leaving no doubt as to the continuity of form and structure. Without experimental evidence, it is impossible to know whether the superficial differences between the "Columbia Gorge" phase and the high altitude phase from the adjacent Cascade Ranges are constant, but on the basis of their morphology and geographical distribution, it seems most satisfactory to treat them as a single species. Therefore, *A. Suksdorfii* is considered to be an unequivocal synonym of *A. furcata*.

The type of var. *olympica* has been re-examined since my former treatment, op. cit., and the disposition given there seems valid. There is a slight possibility that the specimens upon which var. *olympica* was established will eventually be considered to be a depauperate form of *A. hirsuta*. More material together with accurate field observations in the type region are needed before the disposition of var. *olympica* can become more conclusive.

9. A. NUTTALLII Robinson. Perennial; stems several to numerous from a branching caudex, simple, slender, erect to slightly decumbent at base, glabrous above, hirsute with rather long simple or often forked trichomes below, 6–35 cm. high; basal leaves spatulate-oblanceolate to obovate, obtuse, rosulate, entire, petiolate, ciliate and hirsute on both surfaces to glabrous, thin and membranaceous or sometimes coriaceous, 1–4 cm. long, 4–10 mm. wide; cauline leaves oblong to somewhat elliptical, sessile, not auriculate, hirsute on both surfaces to glabrous, 5–15 mm. long; nectar-gland surrounding base of single stamens, very small or obsolete beneath paired stamens; sepals oblong, sparsely pubescent or glabrous, 2–4 mm. long, outer pair saccate, inner pair non-saccate; petals white, spatulate, 5–8 mm. long, 2–4 mm.

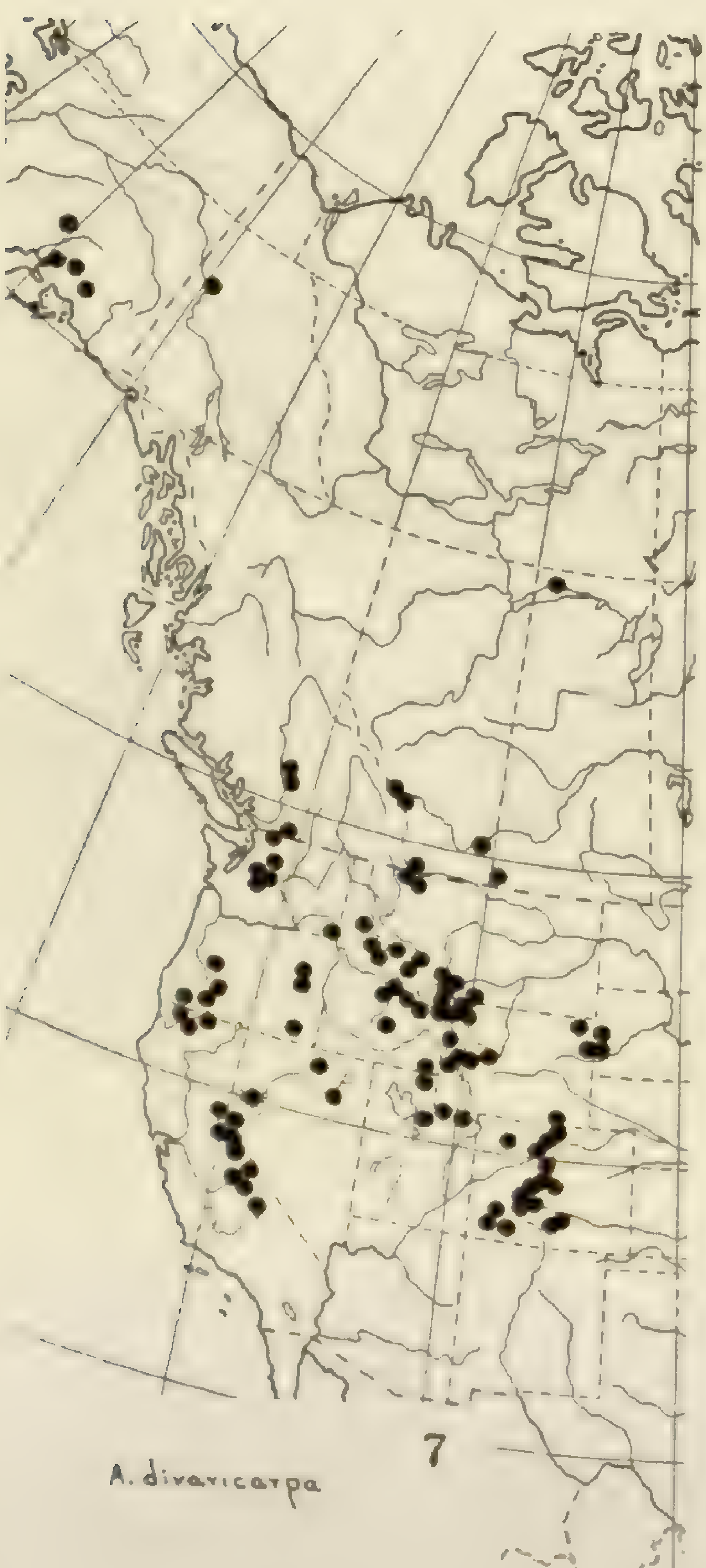
wide; pedicels glabrous, slender, divaricately ascending, 5–20 mm. long; siliques erect to slightly spreading, straight, glabrous, inconspicuously 1-nerved or the nerve obsolete, 1–3 cm. long, 0.8–1.5 mm. wide; style slender, about 1 mm. long; seeds small, less than 1 mm. broad, oblong, wingless, uniseriate; cotyledons accumbent.—In Gray, Syn. Fl. N. Am. **1:** 160 (1895); Howell, Fl. Northw. Am. **1:** 42 (1897); Piper in Contrib. U. S. Nat. Herb. **11:** 292 (1906); Coulter & Nelson, New Man. Bot. Rky. Mts. 227 (1909); Rydberg, Fl. Rky. Mts. 358 (1918); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 243 (1925); Rollins in Res. Stud. State Coll. Wash. **4:** 12, fig. 4 (1936). *A. spathulata* Nuttall in T. & G., Fl. N. Am. **1:** 81 (1838), not *A. spathulata* DC., Syst. **2:** 227 (1821). *Erysimum Nuttallii* O. Ktze., Rev. Gen. Pl. pt. **2:** 933 (1891). *A. bridgeri* M. E. Jones, Contrib. West. Bot. **14:** 38 (1912). *A. macella* Piper in Proc. Biol. Soc. Wash. **33:** 103 (1920).—Alberta to Wyoming, Nevada? and Washington. Map 6. Without definite locality (probably Wyoming): Platte River, Rocky Mountains, *Nuttall s.n.* (G, isotype). Alberta: Crow Nest Pass, Aug., 1897, *J. Macoun 18162* (G, ND, NY). Montana: Logan Pass, Glacier Co., June, 1934, *Maguire et al. 1503* (R, UAC); Upper Marias Pass, Aug., 1883, *Canby 17* (G); Columbia Falls, June, 1893, *R. S. Williams 167* (RM, US); Helena, Clark Co., May, 1889, *F. D. Kelsey s.n.* (UC); Bridger Mts., June, 1897, *Rydberg & Bessey 4230* (G, NY, RM, US, WSC); Mt. Bridger, Gallatin Co., Aug. 10, 1905, *M. E. Jones s.n.* (P, type of *A. bridgeri*); Red Rock Lake, Madison Co., June, 1899, *A. & E. Nelson 5479* (G, RM, US); Rock Creek Canyon, Carbon Co., July, 1937, *L. O. & R. Williams 3590* (G, R). Wyoming: near Medicine Mt., Big Horn Co., July, 1936, *L. O. & R. Williams 3346* (R); 15 miles east of Kane, June, 1936, *L. O. & R. Williams 3025* (G, M, R); Soda Butte, Yellowstone Nat. Park, July, 1899, *A. & E. Nelson 5833* (RM); 15 miles northeast of Bondurant, Sublette Co., Aug., 1922, *E. B. & L. B. Payson 3024* (G, RM, UC, US); Sheep Mt., near Alpine, Lincoln Co., July, 1923, *Payson & Armstrong 3461* (G, RM); hills east of Afton, June, 1923, *Payson & Armstrong 3273* (G, RM); Evanston, Uinta Co., May, 1897, *A. Nelson 2961* (RM, WSC). Idaho: high mts., Kootenai Co., Aug., 1892, *Sandberg s.n.* (UW, WSC); Wiessners Peak, Kootenai Co., July, 1892, *Sandberg et al. 601* (G, UC, US); divide between St. Joe and Clearwater Rivers, Shoshone Co., July, 1895, *Leiberg 1239* (G, RM, UC, US); Bear-skull Mt., July, 1929, *Epling s.n.* (UCLA); Camas Meadows, Clark Co., June, 1938, *Davis 337* (G, R); Henry Lake, Fremont Co., July, 1920, *E. B. & L. B. Payson 1985* (G, RM); near Soda Springs, Caribou Co. (formerly Bannock Co.), June, 1920, *E. B. & L. B. Payson 1722* (G, RM), May, 1939, *Davis 826* (R).

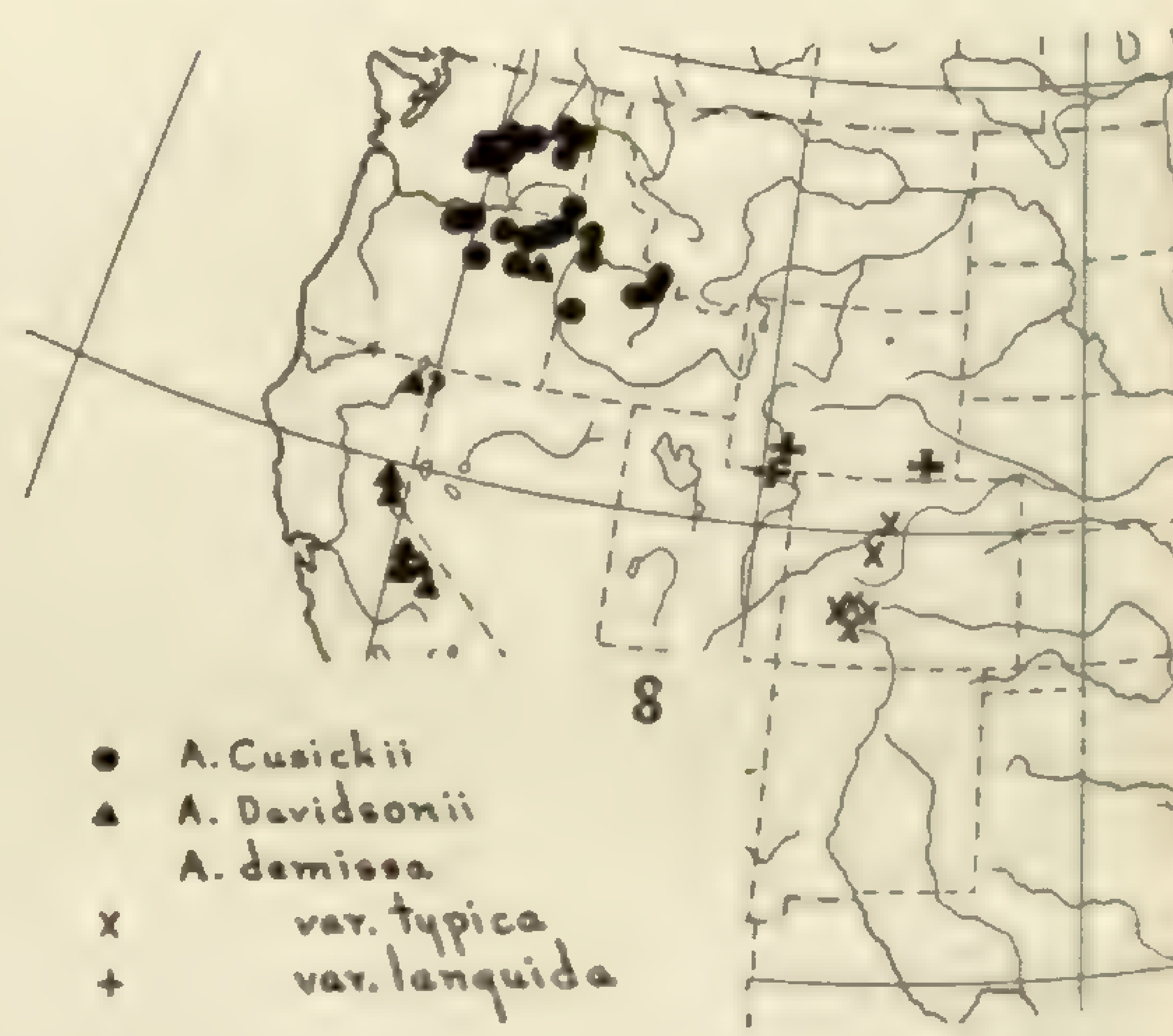
UTAH: Cache Co.: Lewiston, May, 1911, *C. P. Smith 2367* (NY, RM); Logan Canyon, *Muenscher & Maguire 2347* (UAC), May, 1909, *C. P. Smith 1572* (RM); 3 miles west of Logan, May, 1932, *Maguire 3452* (G, M, UAC); Mt. Magog, July, 1936, *Maguire et al. 14066* (G, R, UAC). NEVADA: Sonoma Range (Havallah Mts.), Humboldt-Pershing Cos., June, 1868, *S. Watson 67* (G). WASHINGTON: Columbia River Valley, May, 1911, *Gabby 65* (WSC); Spokane, May, 1899, *Piper 2950* (WSC); Medical Lake, Spokane Co., May, 1893, *Sandberg & Leiberg 50* (Cl, G, O, UC, US, WSC); Crab Creek, Lincoln Co., June, 1884, *Suksdorf 238* (G, WSC); Sprague, Lincoln Co., June, 1893, *Sandberg & Leiberg 202* (G, UC, WSC); near Rock Lake, Whitman Co., May, 1936, *Rollins & Constance 1096* (G, R, WSC); Ritzville, Adams Co., June 11, 1893, *Sandberg & Leiberg 202* (US, TYPE; O, isotype of *A. macella*).

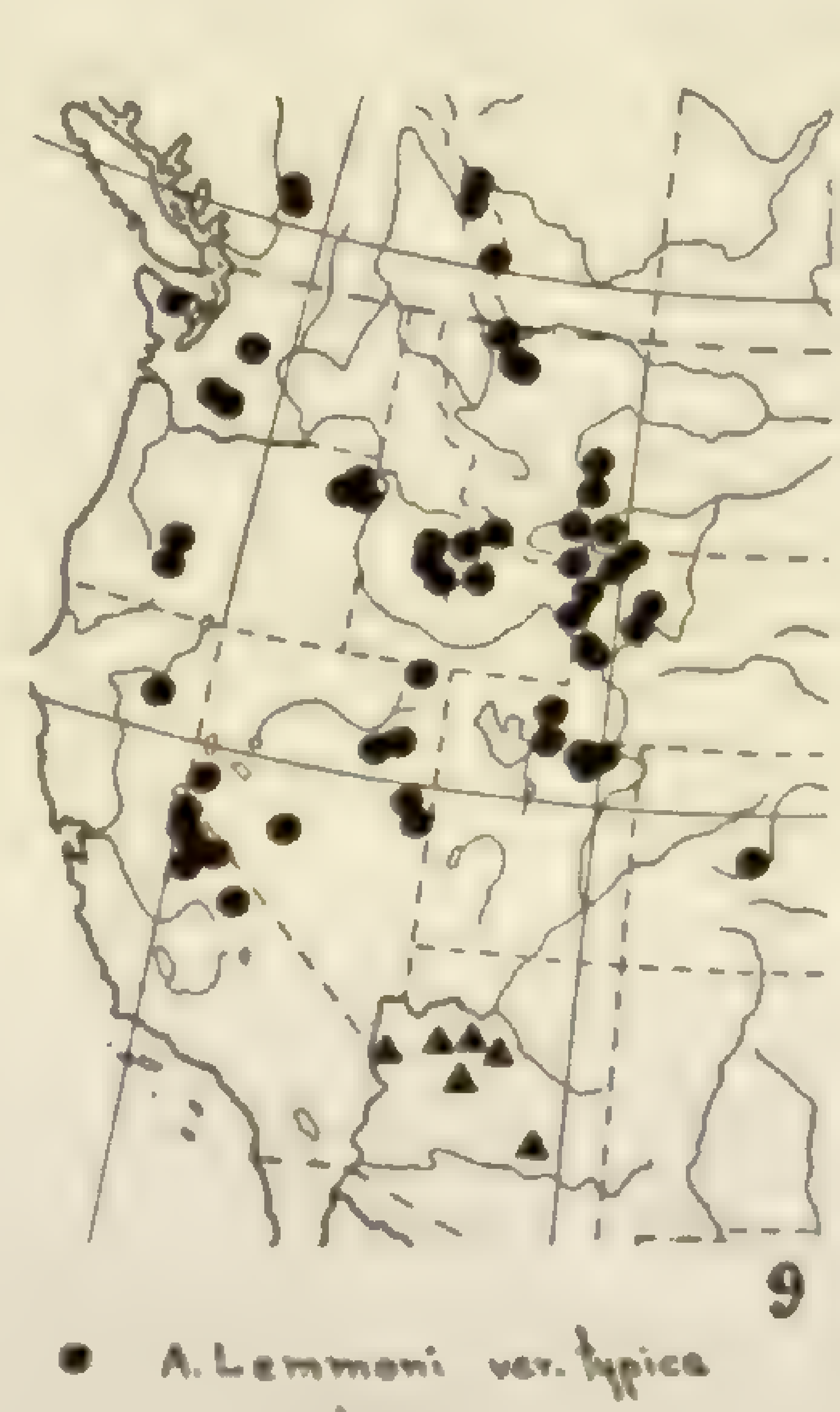
Since my former treatment of this species,[1] a number of new collections have been studied, particularly from Utah where both the high-altitude and lowland phases have been collected in abundance by Dr. Bassett Maguire. It was previously concluded that *A. Nuttallii* showed recognizable tendencies in a lowland phase named *A. macella* by Piper and a sub-alpine phase named *A. bridgeri* by Jones. The lowland phase of *A. Nuttallii* is recognizable because of its taller habit, weak, slender stems and long, slender pedicels. Plants of this phase have been collected in Montana, Idaho, Utah and Washington or at local stations roughly approximating the range of the species.

The high-altitude phase of *A. Nuttallii* is nearly or wholly glabrous, the leaves are thickish and the pedicels tend to be reduced. Plants of this phase are apt to be a trifle more robust with a more highly branched caudex than the usual phase of the species. These nearly glabrous plants have been collected at mountain stations in Montana, Idaho, Wyoming and Utah. It has been pointed out elsewhere that many species of *Arabis* which have a rather wide altitudinal occurrence are likely to develop a glabrous phase at high elevations. In some instances, for example in *A. platysperma*, the glabrous condition is accompanied by correlated minor morphological differences and a distinctive geographical range. In such cases, it seems worth while formally to recognize these correlated divergences from the typical pattern by applying a varietal epithet to the plants

[1] Res. Stud. State Coll. Wash. 4: 14 (1936).







Rollins on Arabis

which fall into this category. On the other hand, if glabrous plants appear here and there throughout the range of a species, probably in response to ecological rather than genetical factors; if these plants do not have significant correlated characters or a distinctive geographical range; and particularly, if there is intergradation with the usual phase of the species, it seems hardly necessary to designate them nomenclaturally. *A. Nuttallii* is a species of the latter type in which a transitional series from a rather lax, pubescent lowland type to a compact, glabrous, high-altitude type might be encountered almost anywhere in its range where the plants are abundant and suitable habitats are to be found.

I have seen a single collection of undoubted *A. Nuttallii* which supposedly came from Nevada. The specimen is Watson's number 67 labeled, "Arabis hirsuta Scop., Havallah Mts. [now known as the Sonoma Range], N. Nevada, June, 1868". The data on this specimen may be perfectly accurate, but one's suspicion is aroused by two items. (1) Watson reported this collection under *Arabis hirsuta* in the Botany of King's Expedition[1] as being from the "Wahsatch and Uinta Mountains, Utah". (2) The station is several hundred miles from the nearest known locality for the species and is outside the expected range. Undoubtedly this collection was the basis for Robinson's inclusion of "N. Nevada" in the range of *A. Nuttallii* in the Synoptical Flora, l. c.

10. A. CRUCISETOSA Constance & Rollins. Perennial; caudex simple or branched; stems several to numerous, rarely single, simple or sometimes branched above, slender, glabrous to sparsely pubescent below, 1–4 dm. high; basal leaves numerous, spatulate to obovate, obtuse, petiolate, entire to sparsely dentate, harshly pubescent with dendritic cross-shaped or three-pronged trichomes, rarely almost glabrous, dark green above, paler to purplish below, 2–6 cm. long, 6–15 mm. wide, petiole nearly equalling the blade in length; cauline leaves few, sessile, not auriculate, entire or rarely few-toothed, linear-oblong, obtuse, 1–3 cm. long, 2–6 mm. wide, pubescent to glabrous on the surfaces, margins always pubescent; sepals oblong, yellowish, rarely purple-tipped, scarious-margined, glabrous, 3–4.5 mm. long, outer pair saccate, inner pair non-saccate; petals lingulate, white, 6–9 mm. long, 2.5–3 mm. wide; pedicels slender, glabrous, di-

[1] King, Geol. Expl. Fortieth Parallel 5: 16 (1871).

varicate, 1–2 cm. long; stamens very unequal, filaments projecting into a small apiculate tip above the anthers; nectar-glands surrounding single stamens, very poorly developed beneath paired stamens; siliques erect, glabrous, straight or nearly so, nerved below, 2–4 cm. long, 1–1.5 mm. wide; style about 1 mm. long; seeds oblong, about 1 mm. broad, wingless, uniseriate.—Proc. Biol. Soc. Wash. **49:** 147 (1936); St. John, Fl. Southeastern Wash. Adj. Idaho 164 (1937).—Western Idaho and adjacent Washington. Map 6. Idaho: Nez Perce Co.: 19 miles east of Spalding, June, 1937, *Constance, Hedrick & Peters 1886* (G, R, WSC); near the Clearwater River, 27 miles east of Lewiston, April, 1936, *Beinke 83* (G); 10 miles east of Lewiston, April, 1930, *Maxfield 46* (G, R). Idaho Co.: between Steep Creek and Willow Creek, Snake River Canyon, May 16, 1936, *Rollins, Constance & Dillon 1107* (WSC, type; G, M, NY, R, isotypes); between Lightning Creek and middle fork of Sheep Creek, May, 1936, *Baubier, Fosberg & Hardt 74* (G, R, WSC); Little Granite Creek, 1 mile above its mouth, May, 1937, *Packard, Moore & Katznelson 207* (G, R). Washington: Lime Point, Asotin Co., April, 1928, *St. John 9294* (R, WSC).

Arabis crucisetosa is nearest related to *A. Nuttallii* which it resembles in general habit and many important morphological features. The foliage, seeds, disposition of siliques, style-length and color and size of flowers are all similar in the two species. However, there is no difficulty in distinguishing between them because of the great difference in type of pubescence. In *A. crucisetosa* the trichomes are dendritic with four (rarely three) prongs raised on a central stalk, but in *A. Nuttallii* the trichomes are very much coarser and simple or at most merely forked. Besides this marked difference, *A. crucisetosa* is a taller species with longer pedicels and siliques and narrower cauline leaves which tend to become dentate. *A. crucisetosa* is rather common in the Transition and Lower Canadian Life-zones on high hills and in the mountains bordering the Snake River drainage in western Idaho and adjacent Washington. The known distribution is limited, but an extension is to be expected at least to the Oregon side of the Snake River.

11. A. lyrata L., var. kamchatica Fischer ex DC. Stems simple or branched, often flexuose, 1–4 dm. high; basal leaves pinnatifid to coarsely dentate or nearly entire, lyrate, spatulate or obovate, petiolate, pubescent with simple or forked trichomes or usually glabrous, 2–6 cm. long; cauline leaves sessile, not auriculate, oblong to broadly spatulate, entire to coarsely dentate.

1

2

3

Fig. 1. A. aculeolata drawn from *T. Howell* s. n. collected in 1884; Fig. 2. A. rigidissima drawn from *Tracy 14469* (type); Fig. 3. A. Fernaldiana drawn from *Rollins & Chambers 2520*. All figures about one-half natural size.

glabrous; petals white to pinkish, 4–8 mm. long; outer sepals saccate, inner non-saccate; siliques erect to divaricately ascending, glabrous, 1–1.5 mm. wide, 1.5–4 cm. long; style very short or absent, rarely up to 1 mm. long; seeds wingless, oblong, uniseriate, about 1 mm. broad, cotyledons accumbent.—*A. lyrata*, var. *kamchatica* Fischer ex DC., Syst. **2:** 231 (1821); Nakai in Tok. Bot. Mag. **32:** 239 (1918); Hultén, Fl. Kamtchatka **2:** 165 (1928); Hopkins in Rhodora **39:** 92 (1937). *A. ambigua*, var. *glabra* DC., l. c. *A. ambigua*, var. *intermedia* DC., l. c. *A. arenosa* sensu Cham. & Schlecht. in Linnaea **1:** 17 (1826). *A. ambigua* sensu Hooker, Fl. Bor.-Am. **1:** 42 (1829). *A. kamchatica* (Fisch.) Ledeb., Fl. Ross. **1:** 121 (1842); Busch in Notul. Syst. Hort. Bot. Petrop. **3:** 11 (1922), Fl. Sib. Orient. Ext. **4:** fam. 25. 466 (1926) and in Komarov, Fl. U.R.S.S. **8:** 192 (1939) as *kamtschatica*. *A. lyrata*, var. *occidentalis* Watson in Gray, Syn. Fl. N. Am. **1:** 159 (1895); Piper in Contrib. U. S. Nat. Herb. **11:** 292 (1906); Rollins in Res. Stud. State Coll. Wash. **4:** 9 (1936). *A. media* var. *glabra* (DC.) Busch, Fl. Sib. Orient. Est. **4:** fam. 25. 465 (1926). *A. media*, var. *intermedia* (DC.) Busch, ibid. *A. kamtschatica*, var. *glabra* (DC.) Busch, ibid. p. 468. *A. kamtschatica*, var. *intermedia* (DC.) Busch, ibid. *A. lyrata*, var. *glabra* (DC.) Hopkins, op. cit. p. 93. *A. lyrata*, subsp. *kamtschatica* (Fisch.) Hultén, Fl. Aleut. Is. 202 (1937). *A. occidentalis* (Wats.) A. Nelson in Univ. Wyoming Pub. **3:** 111 (1937). *Cardaminopsis kamtschatica* (Fisch.) O. E. Schulz in Engler, Pflanzenf. Aufl. 541 **17b:** 2 (1936).—Saskatchewan to Washington, Alaska and the Aleutian Islands; eastern Asia. Map 5. Saskatchewan: 5 miles east of Poplar Pt., Lake Athabaska, July, 1935, *Raup 6684* (G); vicinity of Wolverine Pt., Lake Athabaska, July, 1935, *Raup 6706* (G); Charlot Pt., Lake Athabaska, June, 1935, *Raup 6132* (G). Alberta: Maligne Lake, July, 1908, *Brown 1169* (G); Independence Branch, Pobocton Creek, July, 1908, *Brown 1355* (G); Mt. Temple, Laggan, Aug., 1904, *Butters & Holway a8* (G); vicinity of Lake Louise, July, 1916, *Hunnewell 4356* (G). Washington: Heliotrope Ridge, Mt. Baker, Whatcom Co., Aug., 1934, *Thompson 11239* (G, RM, T, UW); Nooksack River, near Mt. Baker, 1890, *Suksdorf 1999* (G, WSC), specimen cultivated at Bingen, Wash. British Columbia: Lower Allokagnik Lake, 1882, *McKay s.n.* (G); Bishop Range, Selkirk Mts., Aug., 1908, *Butters & Holway 447* (G); Fraser River Valley, May, 1875, *Macoun 132* (G); Carbon River about 4 miles above the Peace River, Aug., 1932, *Raup & Abbe 4267* (G); Mt. Selwyn, July, 1932, *Raup & Abbe 3797, 4096 & 4153* (G). Yukon: Lake Lindeman, head of Yukon R., June, 1883, *Schwatka 19* (G); Klondyke Bottom, Dawson, June, 1914, *Eastwood 191* (Cl, G); Carcross, July, 1914, *Eastwood 708* (Cl, G). Alaska: Sitka, *Bongard s.n.* (G); Admirality

Is., June, 1915, *Walker 716* (G); Juneau, *Hultén 8112* (L); Skagway, 1910, *Kusche s.n.* (G); Yakutat, June, 1916, *Walker 1055* (G); Seward, June, 1937, *Scamman 525* (G, L); Tutka Bay, Kenai Pen., *Hultén 7776* (L); Rapids Lodge, 138 miles south of Fairbanks, Aug., 1937, *Scamman 1001* (G, L); Mt. McKinley Nat. Park, June, 1937, *Scamman 630* (G, L); vicinity of Karluk, Kodiak Is., June, 1903, *Rutter 29* (G); Olga Bay, Kodiak Is., June, 1936, *E. H. & H. B. Looff 642* (G, R); St. Paul Is., Aug., 1891, *Macoun s.n.* (G); Tanunak, Nelson Is., 1933, *Geist s.n.* (L); Dutch Harbor, Unalaska, June, 1907, *Van Dyke 61* (G); Schumagin Is., July, 1899, *Kincaid s.n.* (L); Nikolski, Umnak Is., *Hultén 5688* (L); Atka Is., *Eyerdam 1144a* (L).

Two varieties of *A. lyrata* were recognized by Hopkins[1] as occurring in northwestern North America, var. *kamchatica* and var. *glabra*. The essential points used to separate them were flower-size and presence or absence of pubescence on the stem and basal leaves. An attempt was made to follow this interpretation, but the study of a large series of specimens has shown that there is considerable variation in flower-size among glabrous plants and that presence in quantity or scantiness of pubescence is not correlated with or confined to either large- or small-flowered forms. Admittedly there is great variation in the characters mentioned, but this variation is not restricted to any given set of characters. The plants as a whole as well as their parts vary tremendously in size. These variations seem to occur in all possible combinations so that it is impossible satisfactorily to split var. *kamchatica* without making innumerable micro-entities. In this case it is preferable to place these plants in a single variety. Hultén[2] reached the same conclusion after a serious study of the variety in Kamtchatka, even though the same forms occur there.

Var. *kamchatica* tends to have broader, usually longer, siliques, coarser stems, shorter styles and less divided basal leaves than var. *typica*. The plants are usually glabrous or very nearly so, which is seldom the case in var. *typica*. The type of var. *kamchatica* has not been seen and it is not known whether one is actually in existence. There is more than a chance that both var. *glabra* and var. *kamchatica* were based on the same collection, since DeCandolle's var. *glabra* (as shown by a photo-

[1] Rhodora **39**: 88–98 (1937).
[2] Fl. Kamtchatka and Adj. Islands **2**: 167 (1928).

graph of the type in the Gray Herbarium) was based on specimens from the herbarium of Pallas communicated to DeCandolle by Fischer in 1819. Var. *kamchatica* was credited to Fischer "in litt" (as a species) by DeCandolle. A summary of the facts shows that there is but a single variety of *A. lyrata* in northwestern North America and Kamtchatka and that var. *kamchatica* is the oldest varietal epithet available for it under this species. The differences between var. *kamchatica* and var. *typica* are not striking nor invariable, and for this reason I do not consider var. *kamchatica* to be a particularly strong variety.

12. A. Davidsonii Greene. Perennial with a deep, simple or branched caudex; stems several, slender, glabrous, simple, 5–15 cm. high; basal leaves oblanceolate-cuneate to spatulate, obtuse, entire or with a few teeth near apex, glabrous, thickish, 3–8 cm. long, 4–12 mm. wide; cauline leaves oblong to cuneiform, entire, few, glabrous, sessile, not auriculate, 6–15 mm. long, 3–6 mm. wide; sepals glabrous, oblong, 4–5 mm. long, 1–1.5 mm. wide; petals spatulate, rounded at apex, white to pinkish, 8–10 mm. long, 2–3.5 mm. wide; glands well developed below single stamens, poorly developed below paired stamens; pedicels divaricate, glabrous, 1–1.5 cm. long; siliques divaricate, glabrous, straight to somewhat falcate, nerved to the middle or above, 3–5 cm. long, 1.5–2 mm. broad; style evident but very short; seeds orbicular, narrowly winged all around, 1.5 mm. broad, uniseriate.—Leaflets **2:** 159 (1911); Jepson, Fl. Calif. **2:** 65 (1936). *A. Lyallii* Watson, var. *Davidsonii* (Greene) Smiley in Univ. Calif. Pub. Bot. **9:** 205 (1921). *A. Brucae* M. E. Jones, Contrib. West. Bot. **14:** 37 (1912). *A. cognata* Jepson, Man. Fl. Pl. Calif. 429 (1925) and Fl. Calif. **2:** 64 (1936).—California and Oregon. Map 8. California: below Sabrina Lake, Bishop Creek, Inyo Co., July 11 (no year given), *A. Davidson 2728* (ND, type; UC, isotype); South Lake, Inyo Co., July, 1913, *A. Davidson 2935* (G); Ledge Trail, Yosemite, *Chandler & Babcock 1033* (UC); Yosemite Valley, July, 1902, *Hall & Babcock 3436* (UC); Little Kern River, Tulare Co., June, 1896, *Purpus 1795* (UC); Mt. Elwell, Plumas Co., July 11, 1912, *Mrs. C. M. Wilder s.n.* (UC, type; US, isotype of *A. cognata*); Slate Creek, Plumas Co., May, 1877, *Mrs. R. M. Austin s.n.* (M, NY, US); Summit, Nevada Co., July, 1902, *M. E. Jones s.n.* (P); Donner Pass, Nevada Co., Aug., 1903, *Heller 7121* (G, M, ND, NY, US); Salmon Lake—Gold Lake, Sierra Co., July, 1921, *H. M. Evans s.n.* (F); Hills near Davis Creek, June, 1898, *Mrs. Austin & Mrs. Bruce 2251* in part (P, type of *A. Brucae*); Redwood Creek, near affluence of the south and middle forks of Kings River, Fresno Co., April,

1939, *Belshaw 5029* (R, UC). OREGON: Baker County, July, 1887, *Cusick 949* (G).

Arabis Davidsonii is distantly related to *A. Lyallii* with which it has been confused and which it resembles in a general way. However, the species is easily distinct and if the caudex-crowns are present, no difficulty should be experienced in determining specimens. The basal leaves and flowers are much larger in *A. Davidsonii* than in *A. Lyallii* and the caudex-crowns differ in being very thick as a result of the old leaf-bases which invest them. The remarkable caudex-branches of this species sometimes penetrate the soil more than a decimeter before they are joined to the principal root. These underground caudex-branches retain the persistent leaf-bases along their entire length, but at the summit of each branch a definite crown from 1 to 3 centimeters across is formed.

The Cusick specimen cited above is apparently typical of the species. It is of interest because of its complete isolation from the known stations for *A. Davidsonii* in California. Perhaps subsequent exploration in the mountains of the intervening area will bring to light new localities for the plant, but the present known distribution for it is unusual.

13. A. LYALLII Watson. Perennial, caespitose; caudex usually branched; stems few to numerous, dwarfed at high altitudes, glabrous, 4–25 cm. high; basal leaves oblanceolate to narrowly linear-oblanceolate, acute to obtuse, entire, narrowly petioled, thin, entirely glabrous or pubescent with small dendritic trichomes, 1–3 cm. long, 3–6 mm. wide (1–2.5 mm. wide in var. *nubigena*); cauline leaves few, remote, lanceolate to oblong, acute, sessile, non-auriculate or sometimes slightly auricled, glabrous or the lower rarely pubescent, 1–2 cm. long, 3–6 mm. wide; sepals oblong, glabrous, non-saccate, green or sometimes purplish, 3.5–4.5 mm. long, about 1.5 mm. wide; petals spatulate, long and narrowly clawed, rose to purplish, (5–) 7–10 mm. long, (1.5–) 2–3 mm. wide; glandular tissue continuous beneath all stamens, moderately developed; siliques erect to slightly divergent, narrowed to a very short style or sessile stigma, one-nerved to the middle, glabrous, 3–5 cm. long, 2–3 mm. wide; seeds orbicular, winged, 1–2 mm. broad, uniseriate to imperfectly biseriate.

13a. Var. **typica.** *A. Lyallii* Watson in Proc. Am. Acad. **11:** 122 (1875) and in Gray, Syn. Fl. N. Am. **1:** 166 (1895); Brewer & Watson, Bot. Calif. **1:** 32 (1876); Greene, Fl. Francisc. 254

(1891); Howell, Fl. Northw. Am. **1:** 44 (1897); Piper in Contrib. U. S. Nat. Herb. **11:** 295 (1906); Coulter & Nelson, New Man. Bot. Rky. Mts. 226 (1909); Rydberg, Fl. Rky. Mts. 359 (1917); Smiley in Univ. Calif. Pub. Bot. **9:** 205 (1921); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 244 (1925); Rollins in Res. Stud. State Coll. Wash. **4:** 40, fig. 12 (1936). *A. Drummondi* Gray, var. *alpina* Watson in King, Geol. Expl. Fortieth Parallel **5:** 18 (1871); Jepson, Fl. Calif. **2:** 64 (1936); Hopkins in Rhodora **39:** 140 (1937) excl. syn. *A. albertina*. *A. oreophila* Rydberg in Bull. Torr. Bot. Club **34:** 437 (1907) and Fl. Rky. Mts. 359 (1918). *A. armerifolia* Greene, Leaflets **2:** 75 (1910). *A. densa* Greene, ibid. p. 76. *A. multiceps* Greene, ibid. *A. Drummondi* Gray, var. *Lyallii* (Wats.) Jepson, Man. Fl. Pl. Calif. 429 (1925). *A. Drummondi* Gray, var. *oreophila* (Rydb.) Hopkins in Rhodora **39:** 141 (1937).—Alberta and Wyoming to California and British Columbia. Map 3. Alberta: head of Ptarmigan Valley, July, 1906, *Brown 385* (G); Mt. Temple, Laggan, Aug., 1904, *Butters, Holway & Rosendahl a7* (G); Lake O'Hara, Rky. Mt. Park, Aug., 1904, *Macoun 64509* (G); Lake Louise, Rky. Mt. Park, July, 1904, *Macoun 64510* (G, US). Montana: vicinity of Sexton Glacier, Glacier Park, Aug., 1919, *Standley 17224* (US); Logan Pass, Flathead Co., Aug., 1934, *Hodgdon & Rossbach 12 & 13* (G); Glacier Nat. Park, June, 1934, *Maguire et al. 15042* (UAC); MacDougal Peak, Mission Range, July, 1908, *Clemens s.n.* (G); Gallatin Peak, Aug., 1928, *Swingle s.n.* (RM). Wyoming: Union Peak, Aug., 1894, *Nelson 3154* (RM); near Yellowstone Lake, Aug., 1871, *Adams s.n.* (US); mts. near Cottonwood Lake, Lincoln Co., Aug., 1923, *Payson & Armstrong 3788* (G, RM); Teton Mts., Aug., 1894, *Nelson 1007* (US), July, 1901, *Merrill & Wilcox 1253* (US). Idaho: ridge south from Wiessners Peak, July, 1895, *Leiberg 1362* (G, O, RM, US); Packsaddle Peak, Kootenai Co., Aug., 1892, *Sandberg et al. 852* (US); junction of the Selway and Lochsa Rivers, Idaho Co., July, 1937, *Constance & Pennell 1991* (G, R); high ridge west of Cascade, Valley Co., July, 1937, *Thompson 13853* (G, R); Salmon River Mts., near Bonanza, Custer Co., July, 1916, *Macbride & Payson 3393* (G, RM, US); head of Boulder Cr., Sawtooth Mts., Blaine Co., Aug., 1937, *Thompson 14086* in part (R); Twin Lakes, about 11 miles southwest of Obsidian, Blaine Co., Aug., 1939, *Hitchcock & Martin 5727* (R). Utah: Henry's Fork Basin, Summit Co., Aug., 1936, *Maguire et al. 14711* (UAC); La Motte Peak, Uinta Mts., June, 1926, *E. B. & L. B. Payson 5043* (G, RM, US); divide between Big Cottonwood Cañon and Heber Valley, 1905, *Rydberg & Carlton 6678* (NY, type of *A. oreophila*); Twin Lakes, Salt Lake Co., Aug., 1906, *Garrett 1913* (US); Strawberry Valley, Wasatch Mts., Aug., 1883, *M. E. Jones s.n.* (US); White Pine Lake, Mt. Naomi

Region, Cache Co., July, 1936, *Maguire et al. 14091 & 14023* (UAC). NEVADA: East Humbolt Mts. (Clover Mts.), Elko Co., Sept., 1868, *Watson 75* (G, TYPE of *A. Drummondi*, var. *alpina*), Sept., 1910, *Heller 10231* (G); head of Lamoille Creek, about 15 miles southeast of Lamoille, Ruby Mts., Elko Co., July, 1938, *Rollins & Chambers 2547* (G, R). CALIFORNIA: north side of Black Mt., near Kings Castle, Siskiyou Co., July, 1939, *Hitchcock & Martin 5303* (R); Susie Lake, Aug., 1909, *McGregor 132* (US); Gabbot Meadow, Alpine Co., June-July, 1913, *Eggleston 9419* (US); Mt. Dana, Tuolumne Co., July, 1935, *Sharsmith 2077* (UC); Rock Creek Lake Basin, Inyo Co., July, 1934, *Peirson 11295* in part (Peirs), Aug., 1933, *Peirson 10767* (Peirs). OREGON: Wallowa Mts., Wallowa Co., Aug., 1909, *Cusick 3381* (O, WSC); Eagle Cap, Union Co., Sept., 1907, *Sampson & Pearson 206* (US, TYPE of *A. densa*); Blue Mts., head of Anthony Creek, July & Sept., 1899, *Cusick 2245* (G, UC, WSC); Gunsight Peak, near Anthony Lake, Baker Co., July, 1938, *Rollins & Chambers 2633* (G, R); Strawberry Mts., Grant Co., July, 1925, *Henderson 5579* (O); Mount Hood, July-Aug., 1886, *Howell 590* (G, O); middle peak of Three Sisters, July, 1914, *Peck 2723* (O); Mt. Thielson, Aug., 1897, *Coville & Applegate 435* (US, TYPE; RM, isotype of *A. multiceps*); Crater Lake Nat. Park, Sept., 1902, *Coville 1504* (US, TYPE of *A. armerifolia*); Johnson Prairie, Jackson Co., June, 1898, *Applegate 2458* (US). WASHINGTON: Fort Coville to the Rocky Mts., 1861, *Lyall s.n.* (G, TYPE); Ashtnola, Cascade Mts., 1860, *Lyall s.n.* (G); Sheep Mt., Okanogan Co., July-Aug., 1916, *Eggleston 13299* (US); Indian Head Peak, Chelan Co., July, 1921, *St. John 4847* (WSC); Mount Baker, Whatcom Co., Aug., 1923, *St. John 5125* (WSC); Iron Mt., Kittitas Co., June, 1931, *Thompson 6645* (T); Mt. Rainier, Aug., 1897, *Allen 299* (G, UC, UW, WSC); Mt. Adams, Aug., 1882, *T. Howell 557* (G, marked "typical" by Watson); Olympic Mts., Aug., 1895, *Piper 2180* (G, WSC); Hurricane Ridge, Clallam Co., Sept., 1933, *Thompson 14183* (G, R). BRITISH COLUMBIA: Green Mt., near Haylmore, July, 1938, *Thompson 677* (G); between Mt. Wapta and Mt. Field, 1919, *Walcott s.n.* (US).

13b. Var. **nubigena** (Macbride & Payson) comb. nov. Densely caespitose perennial with few to numerous filiform stems, 4–12 cm. high; basal leaves narrowly linear-oblanceolate, 1–1.5 cm. long, 1–2.5 mm. wide, acute, densely pubescent with fine dendritic trichomes to rarely glabrous; cauline narrowly linear; petals pink to purplish, 5–7 mm. long, 1.5–2.5 mm. broad; siliques acute.—*A. nubigena* Macbride & Payson in Contrib. Gray Herb. **49:** 62 (1917). *A. paupercula* Greene, Leaflets **2:** 77 (1910). *A. microphylla* Nutt., var. *nubigena* (Macbride & Payson) Rollins in Res. Stud. State Coll. Wash. **4:** 40 (1936).—California and IDAHO: Smoky Mts., Blaine Co., Aug., 1916, *Macbride*

& Payson 3772 (G, type; RM, UC, US, isotypes); Josephus Lakes, Custer Co., Aug., 1916, *Macbride & Payson 3552* (G, RM); near Sawtooth, July, 1895, *Henderson 3535* (RM, US), July, 1896, *Evermann 656* (US); near Stanley Lake, Custer Co., July, 1937, *Thompson 13997* (T, R). California: Farewell Gap, April-Sept., 1897, *Purpus 5229½* (US, type; G, isotype of *A. paupercula*); Dana Plateau, Mono Co., July, 1936, *Mason 11417 & 11401B* (UC), Sept., 1936, *C. W. Sharsmith 2413* (G); White Mt., Tuolumne Co., July, 1936, *Mason 11351* (G); Mt. Dana, Tuolumne Co., July, 1933, *C. W. Sharsmith 133B* (UC), July, 1936, *C. W. Sharsmith 2206* (G); Folger Peak, Alpine Co., July, 1913, *Eggleston 9618 & 9641a* (US).

Jepson[1] and Hopkins[2] have recently treated *A. Lyallii* as a variety or varieties (var. *alpina* and var. *oreophila*) of *A. Drummondi.* Since the publications by these authors, I have had the opportunity of examining and comparing this species with *A. Drummondi* both in the field and from greenhouse cultures. At 9,500 feet in the Ruby Mountains of northern Nevada, *A. Lyallii* and *A. Drummondi* were found sharing the same shallow soil covering a granite outcrop. Plants of both species were about the same height (1–2 dm.), but could be readily distinguished when certain characters were carefully noted. In *A. Lyallii* the siliques were somewhat divergent, the seeds in a single row equaled the silique-width and the pubescence, if present, was of a multiple-branching type. *A. Drummondi* had strictly erect siliques, the seeds in two rows were only about half the silique-width and the pubescence, if present, was closely appressed and bifurcate (malpighiaceous). Specimens of *A. Lyallii* (*Rollins & Chambers 2547*) and of *A. Drummondi* (*Rollins & Chambers 2547a*) were collected to demonstrate these points. In the same locality in a more favorable habitat, taller plants of *A. Drummondi* were found (*Rollins & Chambers 2454*). These observations and others, along with a study of the whole question in the laboratory, have convinced me that *A. Lyallii* is not merely an alpine variety of *A. Drummondi* as sometimes supposed, but that it is a discrete biological entity which usually maintains its distinctive characters even when growing side by side with the latter species. In some localities, for example the Olympic Mts. and northern Cascade Mts. of western Washington, there is ap-

[1] Fl. Calif. 2: 64 (1936).
[2] l. c. p. 140.

parently some crossing where the two species grow in the neighborhood of each other. An occasional plant from either of these areas shows intermediate characteristics between *A. Lyallii* and *A. Drummondi,* but determinations can ordinarily be decisive. In these areas, *A. Holboellii* seems also to cross occasionally with *A. Drummondi* giving a product not so different from a tall plant of *A. Lyallii.*

The pubescent phase of *A. Lyallii* was named *A. oreophila* by Rydberg and reduced to varietal rank under *A. Drummondi* by Hopkins. That the presence of pubescence alone in a supposedly glabrous species is not always taxonomically significant has been demonstrated in other species. In both places where I have collected *A. Lyallii* (northern Nevada and eastern Oregon), pubescent and glabrous plants grew together indiscriminately. That this is true nearly throughout the range of the species is shown by the constant occurrence of both pubescent and glabrous plants on the same sheet in a large percentage of the specimens examined, hence I can see no reason for separating the two nomenclaturally.

The type of *A. paupercula* Greene very well matches the type of *A. nubigena* of Macbride and Payson except that the latter has narrower and shorter leaves. However, other specimens from Idaho are identical in all details with the Sierra Nevada plants. Greene's name has priority as a specific epithet, but *A. nubigena* was first placed in a varietal category, hence the plants must be known as *A. Lyallii,* var. *nubigena.* This variety is also closely related to *A. microphylla* which it resembles in its basal leaves and pubescence. But the broadly winged seeds, nerved siliques and large flowers indicate its real homology to be with *A. Lyallii.* The large gap between central Idaho and the high Sierra Nevada of California makes the distribution of var. *nubigena* rather unusual. However, the range of the very distinctive crucifer, *Anelsonia eurycarpa* is almost identical and there are doubtless other plants with a similar disrupted range.

14 A. Drummondi Gray. Biennial or perennial; stems one to several from a simple caudex, simple or branched above, glabrous to very sparingly appressed-pubescent at base, 3–9 dm. high; basal leaves narrowly oblanceolate to somewhat broader, entire to dentate, petiolate, usually acute, glabrous to pubescent with malpighiaceous trichomes, 2–8 cm. long; cauline leaves oblong to oblong-

lanceolate, acute, sessile, auriculate, usually clasping, glabrous, crowded toward base, fewer above, entire to sparingly dentate, 2–7 cm. long; flowers erect; sepals narrowly oblong, obtuse, glabrous, 3–5 mm. long; petals white to pinkish, 7–10 mm. long; stamens barely exceeding the calyx; pedicels erect, glabrous, 1–2 cm. long; siliques erect, often strict, straight, usually numerous and crowded, glabrous, 4–10 cm. long, 1.5–3 mm. wide, obtuse or rarely subacute; valves 1-nerved to the top or at least above middle; style short or lacking; seeds oblong to slightly broader, prominently winged on distal end and on one side, narrowly winged or wingless on the other side, about 1 mm. wide, 1.5–2 mm. long, biseriate.—Proc. Am. Acad. **6:** 187 (1866) and Man. ed. 5. 69 (1869); Watson in King, Geol. Expl. Fortieth Parallel **5:** 17 (1871) in part; Watson in Gray, Syn. Fl. N. Am. **1:** 166 (1895) in part; Britton & Brown, Ill. Fl. **2:** 150 (1897) in part; Fernald in Rhodora **5:** 230 (1903); Piper in Contrib. U. S. Nat. Herb. **11:** 295 (1906); Robinson & Fernald in Gray, Man. ed. 7. 437 (1908); Coulter & Nelson, New Man. Bot. Rky. Mts. 226 (1909); Henry, Fl. So. Brit. Columb. 150 (1918); Rydberg, Fl. Rky. Mts. 359 (1918) and Fl. Pr. Pl. Cent. N. Am. 381 (1932); Jepson, Man. Fl. Pl. Calif. 429 (1925) in part, and Fl. Calif. **2:** 63 (1936) in part; Tidestrom in Contrib. U. S. Nat. Herb. **25:** 244 (1925); Rollins in Res. Stud. State Coll. Wash. **4:** 43, fig. 13 (1936); G. N. Jones in Univ. Wash. Pub. Biol. **7:** 90 (1939). *A. Drummondi* Gray, var. *typica* Hopkins in Rhodora **39:** 136 (1937). *Turritis stricta* Graham in Edinb. New Phil. Journ. 350 (1829); Hooker, Fl. Bor.-Am. **1:** 40 (1829); Torrey & Gray, Fl. N. Am. **1:** 79 (1838); Gray, Man. 36 (1848) and Gen. Illustr. **1:** 144, t. 59 (1848), not *Arabis stricta* Hudson. Fl. Angl. **1:** 292 (1777). *Streptanthus angustifolius* Nuttall in T. & G., Fl. N. Am. **1:** 76 (1838), not *Arabis angustifolia* Lam., Encycl. **1:** 220 (1883). *Arabis confinis* Watson in Proc. Am. Acad. **22:** 466 (1887) in part and in Gray, Syn. Fl. N. Am. **1:** 163 (1895) in part; Rydberg, Fl. Pr. Pl. Cent. N. Am. 381 (1932). *Erysimum Drummondi* (Gray) O. Ktze., Rev. Gen. Pl. pt. 2: 933 (1891). *A. connexa* Greene in Pitt. **4:** 197 (1900); Rydberg, Fl. Rky. Mts. 359 (1918) and Fl. Pr. Pl. Cent. N. Am. 381 (1932). *A. Drummondi* Gray, var. *connexa* (Greene) Fernald in Rhodora **5:** 231 (1903); Robinson & Fernald in Gray, Man. ed. 7. 437 (1908); Hopkins in Rhodora **39:** 144 (1937). *A. oxyphylla* Greene in Pitt. **4:** 196 (1900). *A. Drummondi* Gray, var. *oxyphylla* (Greene) Hopkins, op. cit. p. 143. *A. albertina* Greene in Pitt. **4:** 196 (1900). *A. philonipha* Nelson ex Rydberg, Fl. Colorado 165 (1906), *nomen nudum*. *Turritis Drummondi* (Gray) Lunell in Am. Midl. Natur. **5:** 236 (1918).—Southern Labrador, Newfoundland and adjacent Quebec south to Delaware and west through the Great Lakes Region to California, Washington and British Columbia.[1] MAP 4. WITHOUT DEFINITE LOCALITY: Rocky Mts., *Nuttall s.n.* (G, NY, isotypes of *Streptanthus angustifolius*); Rocky Mts., 1858, *Bourgeau s.n.* (G). ALBERTA: Elbow River, Rocky Mts., June–July, 1897, *J. Macoun 18101* (ND, TYPE of *A. albertina;* photo at Gray Herb.); Waterton Lake, July, 1895, *Macoun A1002* (G); Cypress Hills, June, 1894, *Macoun 3071* (G); Maligne Lake, July, 1908, *Brown 1257* (G); base of Mt. Wilson, June, 1908, *Brown 999* (G). SOUTH DAKOTA: near Savoy, Black Hills National Forest, June, 1910, *Murdoch 4117* (G). MONTANA: Logan Pass, Glacier Park, Aug., 1934, *Hodgdon & Rossbach 3* (G); 12 miles northwest of Wilsall, July, 1921, *Suksdorf 1053* (G, WSC); Bridger Mts., July, 1897, *Rydberg & Bessey 4209* (G); near Melrose, Beaverhead Co., *Bradley 29* (T). WYOMING: base of Beartooth Peak, Park Co., July, 1939, *Rollins & Muñoz 2849* (G, R); Medicine Mt., Big Horn Co., *L. O. & R. Williams 3249* (G, R); Soda Butte Cr., Yellowstone National Park, July, 1899, *A. & E. Nelson 5827* (G, RM); 8 miles west of Wind River, Fremont Co., June, 1936, *Costello & Rollins 2065* (G, R); near Continental Divide, west of Encampment, Sierra Madre, Carbon Co., July, 1936, *Ownbey 1077* (R); Telephone Mines, Albany Co., Aug., 1900, *Nelson 7913* (G, isotype of *A. philonipha*); University of Wyoming Summer Camp, Medicine Bow Mts., Albany Co., July, 1935, *Rollins 1050* (G, R); Vedawoo Glenn, Laramie Hills, July, 1935, *Rollins 991a* (G, R); 15 miles south of Mountain View, Uinta Co., June, 1938, *Rollins & Gates 2372* (G, R). COLORADO: 20 miles north of Rifle, Rio Blanco Co., May, 1938, *Rollins 2204* (G, R); Denver Camp, Willow Creek Pass, Grand Co., July, 1935, *Rollins 1028* (G, R); Beaver Creek, Larimer Co., July, 1903, *Goodding 1446* (G); Empire ?, Clear Creek Co., 1875, *E. L. Greene s.n.* (ND, TYPE of *A. oxyphylla;* photo in Gray Herb.); 4 miles north of Como, Park Co., Aug., 1937, *Beetle 2214* (R); 5 miles south of Tincup, Gunnison Co., July, 1936, *Rollins 1439* (G, R); 6 miles northwest of Rio Grande Reservoir, Hinsdale Co., Aug., 1936, *Rollins 1506* (G, R); 30 miles southwest of Montrose, Montrose Co., Aug., 1937, *Rollins 1979* (G, R); near Pagosa Peak, Mineral Co., Aug., 1899, *Baker 341* (ND, TYPE; G, isotype of *A. connexa*). NEW MEXICO: Costilla Park, Taos Co., Sept., 1895, *Mrs. O. St. John 58* (G); Grass Mt., Pecos River Nat. Forest (now the Santa Fe Nat. Forest), June, 1908, *Standley 4069* (G). IDAHO: divide between St. Joe and Clearwater River, July, 1895, *Leiberg 1212* (G, RM); near Bonanza, Custer Co., July, 1916, *Macbride & Payson 3426* (G, M, UC, US); above Redfish Lake, Aug., 1916, *Macbride & Payson 3659* (G, M, RM); Cherry Creek Divide,

[1] For citations of specimens from east of the one-hundredth meridian see Hopkins, op. cit. pp. 137–139.

Custer Co., July, 1939, *Davis 1554* (G, R); Wild Horse Creek, Custer Co., July, 1939, *Davis 1207* (R); Frazier Dam, Clark Co., June, 1938, *Davis 338* (G, R); Galena Pass, Blaine Co., June, 1938, *Davis 448* in part (R). Utah: Big Cottonwood Canyon, Salt Lake Co., July, 1905, *Garrett s.n.* (G); Alta, Wasatch Mts., Aug., 1879, *M. E. Jones 1177* (G); Stillwater Fork, Uinta Mts., Summit Co., July, 1926, *E. B. & L. B. Payson 4980* (G); 30 miles south of Manila, Uintah Co., June, 1937, *Rollins 1764* (G); above White Pine Lake, Bear River Range, Cache Co., *Maguire & Hobson 14221* (G); near Delano, Beaver Co., July, 1934, *Hodgdon & Rossbach 71* (G); La Sal Mts., Grand Co., July, 1924, *E. B. & L. B. Payson 3945* (G); West Mt., Abajo Mts., San Juan Co., June, 1932, *Maguire & Redd 1853* (UAC); Blue Spring Ranger Station, Sevier Forest, Garfield Co., July, 1912, *Eggleston 8389* (NA). Arizona: North Rim, Grand Canyon of the Colorado, June, 1933, *Eastwood & Howell 967* (G). Nevada: Hinkey Summit, Santa Rosa Range, Humboldt Co., July, 1937, *Train 281* (R); base of Mt. Wheeler, White Pine Co., July, 1938, *Rollins & Chambers 2486* (G, R); 3 miles south of Preston, White Pine Co., June, 1937, *Moore & Franklin 716* (NA, R); head of Lamoille Creek, Ruby Mts., Elko Co., July, 1938, *Rollins & Chambers 2545* (G, R); 8 miles west of North Fork, Elko Co., July, 1937, *Nichols & Lund 301* (R). California: Eagle Meadow, Tuolumne Co., July, 1936, *Hoover 1476* (R); Mono Pass, Tuolumne River, 1863, *Brewer s.n.* (G); Tioga Crest, Sierra Nevada, Mono Co., July, 1936, *Mason 11464* (UC); Virginia Lakes Basin, Mono Co., July, 1934, *Peirson 11233* (Peirs); South Lake, Bishop Creek, Inyo Co., July, 1929, *Peirson 8517* (Peirs). Oregon: Elk Horn Mts., west of North Powder, Baker Co., Aug., 1915, *Peck 2710* (W); base of Gunsight Peak, Blue Mts., Baker Co., July, 1938, *Rollins & Chambers 2630* (G, R). Washington: Angels Pass, Okanogan Co., June, 1931, *Thompson 7044* (G); Heliotrope Ridge, Mt. Baker, Aug., 1937, *Muenscher 7883* (G); Sourdough Mt., Whatcom Co., Aug., 1937, *Muenscher 7884* (G); Stevens Pass, Aug., 1893, *Sandberg & Leiberg 764* (WSC); White River, Mount Rainier Park, June, 1937, *G. N. Jones 10002* (G); north of Mt. Adams, Aug., 1892, *Henderson 2397* (G, UW); Mt. Angeles, Clallam Co., July, 1931, *Thompson 7427* (G), July, 1931, *J. T. Howell 7471* (G); Mount Constance, Jefferson Co., Aug., 1938, *Rollins & Chambers 2652* (G, R, DS). British Columbia: Bluster Mt., Marble Mts., July, 1938, *J. & E. Thompson 404* (G); Cornwall Hills, July, 1894, *McEvoy 5097* (G); Emerald Lake, June, 1929, *Peterson 52* (G); Mount St. Thomas, Aug., 1902, *Macoun 63499* (G); Lake Atlin, July, 1914, *Eastwood 638* (Cl, G); Mt. Selwyn, July, 1932, *Raup & Abbe 4081* (G).

The unreliability of the presence or absence of pubescence as a criterion for the separation of certain species and varieties of *Arabis* has been stressed above, but this point must be particularly emphasized in the case of *A. Drummondi.* This wide-ranging species tends toward a glabrous condition in the eastern portion of its range, while the dominant form along the Rocky Mountain axis has strigose basal leaves. However, it is significant that one finds specimens possessing strigose trichomes from scattered stations in Massachusetts, Connecticut, Vermont, New York, Michigan and Ontario in the eastern half of North America. Westward, where the strigose form prevails, glabrous plants are also abundant and may be found throughout most of the Rocky Mountain region. The sporadic occurrence of pubescent forms nearly throughout the range of *A. Drummondi* is not, in my opinion, taxonomically significant. This character appears to be dependent upon the age of the plant and the environmental circumstances under which it grew. These two points were studied in several greenhouse- and two field-cultures obtained from seeds of *A. Drummondi* gathered in Colorado (*Rollins 1506*). The young leaves under both greenhouse and field conditions were evenly strigose on both surfaces. On greenhouse-grown plants the trichomes remained evenly spaced over the leaf-surfaces on fully matured or even old basal leaves, although the distance between trichomes was considerably greater than on young leaves. The mature basal leaves of field-cultures behaved differently with respect to vestiture. Here, the older basal leaves became completely glabrous or a few hairs remained along the leaf-margins. The pubescence had evidently been shed. Assuming that the same thing takes place in nature and in view of the fact that the pubescent form of *A. Drummondi* has no distinctive geographic range of its own, I find it desirable to discontinue *A. oxyphylla* Greene as a taxonomic entity even in varietal rank as Hopkins, op. cit. p. 143, placed it.

A broad-podded form of *A. Drummondi* was segregated as *A. connexa* by Greene and has more recently been maintained in varietal rank. This form occurs at widely separated locations in the range of the species and is doubtfully a natural biological entity. The broad-podded form of *A. Drummondi* represents the one extreme in pod-width and should be more naturally included as an integral part of the species proper rather than as a variety of it. My collection, number 1439 from Gunnison County, Colorado, was purposely selected from a colony of broad-podded plants to illustrate this form. In the dry meadow from which these plants came nearly the complete range of pod-width found in *A. Drummondi* might have been collected from the various colonies present. Field observations indicate that the broad-podded forms and the noticeably narrow-podded forms tend to grow in colonies, hence, pod-size appears to be genetically controlled. This does not mean that the factors controlling all degrees of pod-size are lacking in plants with one extreme or the other. Plants with extreme pod-width, since they are of random occurrence, may be due to some type of genetical segregation.

The great variation in the size of the gross morphological structures in *A. Drummondi* is partially due to its aggressive nature, at least in western America. The species is quick to inhabit disturbed soils, where it becomes abnormally large and vigorous. In western America the flowers are usually white, but may be tinged with pink. Flowering specimens with pink or purple flowers which seem to belong to *A. Drummondi* are apt to prove to be *A. Lyallii* or *A. divaricarpa* upon closer examination.

15. A. divaricarpa A. Nelson. Biennial or rarely perennial; stems one or few from a simple or branching caudex, simple or branched above, pubescent below with appressed trichomes or glabrous throughout (except in var. *interposita* which is pubescent both above and below), 3–9 dm. high; basal leaves broadly oblanceolate to narrowly spatulate, usually acute, dentate to subentire, loosely pubescent with three- to several-rayed trichomes, pubescence usually appressed, 2–6 cm. long, 4–8 mm. wide; cauline leaves narrowly oblong to lanceolate, entire or the lower sometimes dentate, glabrous or the lower sparsely pubescent (except in var. *interposita* which often has all the leaves sparsely pubescent), auriculate and often sagittate; sepals oblong, glabrous to sparsely pubescent, scarious-margined, 3–5 mm. long; petals spatulate, pink to purplish, 6–10 mm. long; pedicels divaricate to loosely descending, slender, glabrous (pubescent in var. *interposita*), 6–12 mm. long; siliques straight or rarely very slightly curved, loosely ascending, divaricate or less frequently nearly pendulous, glabrous, nerved to middle or nearly entire length, 2–8 cm. long, 1.5–2.5 mm. wide; style very short or absent; seeds broadly oblong to nearly orbicular, narrowly winged, about 1 mm. wide, uniseriate or imperfectly biseriate.

Pedicels and upper stems glabrous, lower stems glabrous to sparsely pubescent with malpighiaceous trichomes.......15a. Var. *typica.*
Pedicels and upper stems usually pubescent with three- to four-parted trichomes, lower stems pubescent with several-branched trichomes..............................15b. Var. *interposita.*

15a. Var. TYPICA Hopkins in RHODORA **39:** 130 (1937). *A. divaricarpa* A. Nelson in Bot. Gaz. **30:** 193 (1900); Coulter & Nelson, New Man. Bot. Rky. Mts. 226 (1909); Rydberg, Fl. Rky. Mts. 362 (1918); Tidestrom in Contrib. U. S. Nat. Herb. (Fl. Utah and Nevada) **25:** 244 (1925); Rollins in Res. Stud. State Coll. Wash. **4:** 45 (1936). *Turritis brachycarpa* T. & G., Fl. N. Am. **1:** 79 (1838); Walpers, Rep. **1:** 130 (1842); Gray, Man. 37 (1848). *Arabis Drummondi,* var. *brachycarpa* (T. & G.) Gray, Man. ed. 5. 69 (1867). *A. confinis* Watson in Proc. Am. Acad. **22:** 466 (1887) in part and in Gray, Syn. Fl. N. Am. **1:** 163 (1895) in part. *A. confinis,* var. *brachycarpa* (T. & G.) Watson & Coulter in Gray, Man. ed. 6. 67 (1889); Watson in Gray, Syn. Fl. N. Am. **1:** 163 (1895). *A. brachycarpa* (T. & G.) Britton in Mem. Torr. Bot. Club **5:** 174 (1894); Fernald in RHODORA **5:** 231 (1903); Robinson & Fernald in Gray, Man. ed. 7. 437 (1908); Rydberg, Fl. Rky. Mts. 361 (1918) and Fl. Pr. Pl. Cent. N. Am. 381 (1932); Marie-Victorin, Fl. Laurent. 261 (1935); not *A. brachycarpa* Ruprecht, Fl. Cauc, 73 (1869). *A. oblanceolata* Rydberg in Bull. Torr. Bot. Club **31:** 557 (1904); Coulter & Nelson, New Man. Bot. Rky. Mts. 228 (1909); Rydberg, Fl. Rky. Mts. 359 (1918). *A. pratincola* Greene in Fedde, Repert. Nov. Sp. **5:** 344 (1908). *A. Drummondi,* var. *pratincola* (Greene) Hopkins in RHODORA **39:** 142 (1937). *A. nemophila* Greene, Leaflets **2:** 78 (1910). *A. dacotica* Greene, ibid. p. 80. *A. brevisiliqua* Rydberg, Bull. Torr. Bot. Club **39:** 326 (1912). *A. Stokesiae* Rydberg, Fl. Rky. Mts. 361 (1918).—Quebec[1] to northern New York, Great Lakes region, interruptedly westward to the Rocky Mountains and California, north to Yukon and Alaska. MAP 7. SASKATCHEWAN: without locality, 1858, *E. Bourgeau s.n.* (G); vicinity of Charlot Point, Lake Athabaska, June, 1935, *Raup 6111* (G); Cypress Hills, June, 1894, *J. Macoun 3072* (G). ALBERTA: vicinity of Fort Chipewyan, June, 1935, *Raup 6068* (G), *Raup 6067* (G); Rosebud Valley, May, 1915, *Moodie 855* (G); discharge of Lake Louise, July, 1904, *J. Macoun 64514* (G, M, NY); below Wapta Lake, Rky. Mt. Park, Aug., 1904, *J. Macoun 64513* (G, NY); Laggan, Rky. Mt. Park, June, 1904, *J. Macoun 64518* (G); shore of Waterton Lake, July, 1895, *J. Macoun A1004* (G); opposite Cataract Pass, headwaters of the Saskatchewan and Athabasca Rivers, June, 1908, *Brown 1044* (G). SOUTH DAKOTA: near Deadwood, Lawrence Co.,

[1] For citations of specimens from east of the one-hundredth meridian see Hopkins. op. cit. pp. 130–132.

June, 1929, *Palmer 37164* (G); Custer Peak, Black Hills, 1927, *Hayward 1749* (F); Fort Meade, May, 1887, *Forwood 28* (US, TYPE; G, isotype of *A. dacotica* Greene). MONTANA: Glacier Park, July, 1931, *Pease 22328* (G); about 13 miles west of Browning, Glacier Co., Aug., 1934, *Hodgdon & Rossbach 72* (G); Daly Creek, Granite Co., Aug., 1933, *C. L. Hitchcock 2067* (G); Missoula, May, 1921, *Kirkwood 1130* (Cl); Bozeman, June, 1900, *Blankinship s.n.* (M); near Wilsall, Park Co., July, 1921, *Suksdorf 531* (G, R); West Yellowstone, Gallatin Co., July, 1920, *E. B. & L. B. Payson 1925* (G, RM); 10 miles southwest of Red Lodge, Carbon Co., July, 1939, *Rollins & Muñoz 2819* (G, R). WYOMING: Yellowstone Lake, Yellowstone National Park, Aug. 6, 1899, *A. & E. Nelson 6332* (RM, TYPE), Aug 23, 1899, *A. & E. Nelson 6622* (G); 5 miles west of Beartooth Lake, Park Co., July, 1939, *Rollins & Muñoz 2858* (G, R); Jackson's Hole, Lincoln Co., Aug., 1920, *E. B. & L. B. Payson 2194* (G, RM); near Afton, Lincoln Co., July, 1923, *Payson & Armstrong 3367* (G); Newcastle, Weston Co., June, 1893, *Bates s.n.* (G); 7 miles northwest of Hulett, Crook Co., June, 1935, *Ownbey 551a* (G); Centennial, Albany Co., July, 1902, *Nelson 8735* (G). COLORADO: Spicer, Larimer Co., July, 1903, *Goodding 1513* (G); eastern slope of Fall River Pass, Rocky Mountain National Park, Aug., 1937, *Rollins 1884* (G, R); East Tennessee Cr., about 10 miles north of Leadville, Lake Co., July, 1936, *Rollins 1401* (G, R); western slope of Monarch Pass, 1 mile from summit, Chaffee Co., July, 1936, *Rollins 1343* (G, R); 2 miles south of Pitkin, Gunnison Co., July, 1936, *Rollins 1426a* (G); near the Alvrado Ranger Station, Custer Co., June, 1936, *Rollins 1245* (G, R); lower slope of Mt. Carbonate, 20 miles west of Gardner, Huerfano Co., June, 1936, *Rollins 1258* (DS, G, R); mountains above Silverton, San Juan Co., July, 1934, *Hodgdon & Rossbach 7* (G); Valley Spur, Sept., 1901, *Underwood & Selby 454* (NY, TYPE of *A. oblanceolata*); Ridgway, Ouray Co., June, 1924, *E. B. & L. B. Payson 3850* (G, M). IDAHO: ridges south from Wiessners Peak, Kootenai Co., July, 1895, *Leiberg 1374* (G, M); Lookout, Priest River Experiment Station, July, 1923, *Epling 5872* (UCLA); Lolo Trail, Idaho Co., July, 1937, *Constance & Pennell 2020* (G, R); Birch Creek, Lemhi Co., June, 1939, *Davis 1098* (R); Frazer Dam, Clark Co., June, 1938, *Davis 340* (R); Henry Lake, Fremont Co., July, 1920, *E. B. & L. B. Payson 1984* (G); near Clayton, Custer Co., July, 1916, *Macbride & Payson 3386* (G, RM, UC); near Clyde, Blaine Co., July, 1916, *Macbride & Payson 3136* (G, RM, US); Meadow Creek Ranger Station, Bear Lake Co., June, 1936, *Davis 395* (R). UTAH: inlet to White Pine Lake, Mt. Naomi region, Cache Co., July, 1936, *Hoyt 15267* (G, R); Stillwater Fork, Uinta Mts., Summit Co., July, 1926, *E. B. & L. B. Payson 4967* (G); 25 miles south of

Manila, Uintah Co., June, 1937, *Rollins 1767* (DS, G, R); 18 miles north of Vernal, Uinta Mts., Uintah Co., June, 1937, *Rollins 1760a* (DS, G, R); Parley's Canyon, Wasatch Mts., June, 1901, *S. G. Stokes s.n.* (NY, TYPE of *A. Stokesiae*). NEVADA: West Humboldt Mts., June, 1886, *Watson 74 ?* in part (G); head of Lamoille Creek, about 15 miles southeast of Lamoille, Ruby Mts., Elko Co., July, 1938, *Rollins & Chambers 2546* (G, R); Jack Creek, 70 miles northwest of Elko, Elko Co., June, 1937, *Nichols & Lund 213* (R); 1 mile south of Marlette Lake, Sierra Nevada Range, Ormsby Co., July, 1939, *Train 3213* (G); Spooner, Douglas Co., June, 1902, *Baker 1149* (G, M, isotypes of *A. pratincola*). CALIFORNIA: rocky gulch off Jaynes Canyon, Siskiyou Mts., Siskiyou Co., Aug., 1934, *Wheeler 3053* (G); south fork of Salmon River, near Big Flat, Siskiyou Co., July, 1937, *J. T. Howell 13205* (G, R); near Castle Peak, Nevada Co., July, 1903, *Heller 7069* (G, M, NY, US); White's Creek Lake, Trinity Co., Aug., 1935, *Tracy 14692½* (UC); Donner Pass, Placer Co., July, 1919, *Heller 13319* (G); near Lake Alpine, Alpine Co., July, 1935, *Peirson 11573* (Peirs); Wheats Meadow Ranger Station, Stanislaus Forest, Tuolumne Co., June, 1918, *Eggleston 9282* (NA); east slope of Sonora Pass, July, 1932, *Peirson 10380* (Peirs); Rock Creek Lake Basin, Inyo Co., July, 1932, *Peirson 9456* (Peirs); Farewell Gap, Tulare Co., Aug., 1904, *Culbertson 4523* (G, M); near Mineral King, Tulare Co., Aug., 1891, *Coville & Funston 1450* (G); Sequoia National Forest, July, 1908, *A. Davidson 1847* (US, TYPE of *A. nemophila*). OREGON: Powder River Mts., Aug., 1896, *Piper 2507* (G, WSC); Strawberry Mt., Grant Co., July, 1925, *Henderson 5579* (G); Pine Creek, Baker Co., Aug., 1915, *Peck 2706* (W); head of Divine Creek, Steens Mts., June, 1901, *Cusick 2570* (G); 10 miles south of McKenzie Bridge, Lane Co., July, 1914, *Peck 2708* (G); Sparks Lake, Deschutes Co., July, 1931, *J. T. Howell 7139* (G); Ashland Butte, July, 1886, *Henderson 13* (G); near Lake-of-the-woods, Klamath Co., July, 1936, *Thompson 13138* (R). WASHINGTON: Godman Springs, Columbia Co., July, 1935, *Constance et al. 1178* (G, R, WSC); above Slate Creek, Barron, Whatcom Co., June, 1939, *Muenscher 10089* (G); Chiwaukum Cr., Chelan Co., Aug., 1916, *Eggleston 13534* (US); Table Mt., Kittitas Co., Aug., 1933, *Thompson 9778* (NY); Wenas Cattle Camp, Kittitas Co., July, 1937, *Caples & Spence 74* (FS); American River Canyon, above Union Creek, Yakima Co., June, 1936, *Eastwood & Howell 2983* (R); Cowlitz Ridge, Mt. Rainier, Pierce Co., Aug., 1919, *Flett 3162* (WSC). BRITISH COLUMBIA: Skagit Valley, July, 1905, *Macoun 70824* (G); July 6, 1905, *Macoun 70825* (NY, TYPE of *A. brevisiliqua*); near Lake Bootahnie, Marble Mts., June, 1938, *J. W. & E. M. Thompson 65* (G); Carson Mt., Marble Mts., June, 1938, *J. W. & E. M.*

Thompson 330 in part (G). Yukon: Dawson, June, 1914, *Eastwood 246* (G); Fort Selkirk, June, 1899, *Gorman 1008* (Can). Alaska: Mt. McKinley National Park, June, 1937, *Scamman 633* (G, L, R); between Anchorage and Curry, June, 1937, *Scamman 568* (G); between miles 52 and 65, Richardson Highway, *Anderson 1972* (L); Matanuska, *Anderson 1105* (L); Robertson River, June, 1921, *Murie 101* (L).

15b. Var. **interposita** (Greene), comb. nov. Stems usually simple, single, pubescent to the inflorescence; pedicels sparsely pubescent; siliques nerveless or nearly so.—*A. interposita* Greene, Leaflets **2:** 78 (1910). *A. acutina* Greene, ibid. p. 82. *A. Drummondi* Gray, var. *interposita* (Greene) Rollins in Res. Stud. State Coll. Wash. **4:** 45 (1936).—Southwestern Oregon and northern California. California: Spirit Lake, Marble Mts., Siskiyou Co., Aug., 1939, *J. T. Howell 14952* (G, R); Marble Mt., Siskiyou Co., June, 1901, *Chandler 1630* (UC); Log Lake, Siskiyou Co., June, 1910, *Butler 1537* (P); Caribou Basin, Siskiyou Co., July, 1937, *J. T. Howell 13551* (G, R); Trinity Summit, Humboldt Co., July, 1932, *Tracy 10396* (G, P). Oregon: Diamond Lake, Douglas Co., June, 1931, *J. T. Howell 6857* (G); Ashland Butte, Siskiyou Mts., and Crater Lake, Cascade Mts., July 14, Aug. 22, 1902, *Cusick 2970* (US, type as to plant in center of sheet; G, isotype as to plant on left of sheet); Crater Lake National Park, Aug., 1916, *Heller 12630* (G); Mt. Thielson, Aug. 6, 1897, *Coville & Leiberg 343* (US, type; RM, isotype of *A. acutina*); near Oregon Caves, July, 1918, *Peck 8276* (G, W).

The distribution of *A. divaricarpa* parallels in a general way that of *A. Drummondi* and these two species are very closely related. In fact, the relationship is so close that some natural hybridization apparently occurs. In the main, each species has a characteristic type of pubescence, but on occasional specimens a mixture of malpighiaceous and more highly branched hairs is found. These specimens usually resemble *A. divaricarpa* and are often so determined. However, other traces of "*Drummondi*" besides pubescence are frequently found, such as broader and more erect siliques and a tendency to have the seeds in two rows instead of the usual single row. *A. divaricarpa* is extremely variable as regards the position of the mature silique. Ordinarily the siliques diverge upward from the rachis at an angle of about 45°, but variations from nearly erect to a widely pendulous position are frequent. Different plants of *A. divaricarpa* possess trichomes of different sizes and specimens may be arranged in two series on the basis of coarseness or fineness of the pubescence. This difference in trichome-size, together with the knowledge that polyploidy is found in the species, led to the investigation of size of pollen-grains in the two series, but no appreciable differences could be detected. No attempt was made to correlate stoma-size or -distribution with trichome-size in this species, although the accumulation of such data together with chromosome-counts on a selected series of plants would probably be profitable.

Two collections from Michigan, *Fernald & Pease 3334* and *Pease & Ogden 25181*, are notable because the silique-position is similar to that of *A. Holboellii* in being loosely descending and often secund. The superficial resemblance of these plants to *A. Holboellii* led Hopkins, op. cit. pp. 171 and 174, to attribute this species to the Keweenaw Peninsula of Michigan. A careful examination of the two collections shows that the pubescence is exactly the same as on other specimens of *A. divaricarpa* from the same area and is quite different from that of *A. Holboellii.* Pubescence-type is far more significant than pedicel- or silique-orientation in *Arabis* generally, hence one must conclude that the plants in question are actually *A. divaricarpa* instead of *A. Holboellii* as determined by Hopkins.

In another paper on *Arabis,* op. cit. p. 45, I treated certain plants of southern Oregon as *A. Drummondi,* var. *interposita.* These plants were later partly included by Hopkins, op. cit. p. 142, in *A. Drummondi,* var. *pratincola.* This separation from typical *A. Drummondi* was made because the stems and leaves were pubescent with several-branched hairs instead of being glabrous or pubescent with appressed bifurcate trichomes. In reconsidering the plants, I find that while they are somewhat intermediate between *A. Drummondi* and *A. divaricarpa*, they are really more closely related to the latter species and constitute a variety with more pubescent stems, pubescent pedicels and more erect siliques. *A. pratincola* is too near typical *A. divaricarpa* to be included in the variety.

16. A. FRUCTICOSA A. Nelson. Perennial; stems numerous from a branching base, glabrous and glaucous, abundantly branched, 4–6 dm. high; basal leaves oblanceolate to spatulate, obtuse to acute, not rounded at apex, rather sharply dentate to rarely entire, about 2 cm. long, 4–7 mm. wide, sparsely pubescent with

minute dendritic trichomes; cauline leaves glaucous, ovate to broadly oblong, sessile, auriculate, remote, 10–15 mm. long, 4–7 mm. wide, lower sparsely pubescent, dentate, upper entire and glabrous; sepals oblong, sparsely pubescent to glabrous, 2–3 mm. long; petals pink to purplish, spatulate, 5–7 mm. long; pedicels divaricately descending, glabrous, 6–10 mm. long; siliques glabrous and glaucous, divaricately spreading, straight to slightly curved, nerveless to slightly nerved near base, 4–6 cm. long, 1.5–2 mm. wide; seeds orbicular, narrowly winged, uniseriate, about 1.5 mm. broad.—Bot. Gaz. **30:** 190 (1900); Coulter & Nelson, New Man. Bot. Rky. Mts. 227 (1909); Rydberg, Fl. Rky. Mts. 362 (1918).—Wyoming: Undine Falls, Yellowstone National Park, July 6, 1899, *A. & E. Nelson 5681* (RM, type; G, NY, isotypes).

A. fructicosa is known only from the type collection, hence the normal range of variation cannot be determined. The species is apparently related to *A. divaricarpa* from which it is distinguished by having ovate instead of oblong cauline leaves, a much-branched caudex in place of a simple base and minute dendritic trichomes on the basal leaves instead of having them coarse and few-branched. *A. fructicosa* has some of the features of *A. Lemmoni,* var. *drepanoloba,* but the two are apparently not closely related. In the summer of 1939, attempts were made to re-collect *A. fructicosa* in Yellowstone National Park, but the species could not be found. However, the exact type station was not visited.

17. A. **rigidissima,** sp. nov. Herba perennis basi suffruticosa; caulibus glabris vel inferne sparse pubescentibus, 2–4 dm. altis; foliis radicalibus glabris vel sparse pubescentibus spathulatis integris obtusis 1.5–3 cm. longis, 4–8 mm. latis; foliis caulinis ovatis vel oblongis sessilibus auriculatis integris glabris 1–2 cm. longis, 4–8 mm. latis; sepalis glabris oblongis 4–5 mm. longis 1.5–2 mm. latis; petalis spathulatis roseis 7–9 mm. longis; pedicellis glabris divaricato-adscendentibus 5–10 mm. longis; siliquis divaricato-adscendentibus glabris acuminatis 5–7 cm. longis, 2.5–3.5 mm. latis; seminibus oblongis vel orbicularibus alatis 2–2.5 mm. latis, uniseriatis.

Perennial; stems one to several from a naked simple or branching suffruticose caudex, sparingly pubescent below or glabrous throughout, simple or branched below, 2–4 dm. high; basal leaves spatulate, entire, obtuse, short-petioled, sparsely pubescent with rather fine dendritic or forked, spreading trichomes or usually glabrous, 1.5–3 cm. long, 4–8 mm. wide; cauline leaves ovate to oblong, sessile, auriculate, entire, coriaceous, usually remote, glabrous or the lower rarely sparsely pubescent, 1–2 cm. long, 4–8 mm. wide; sepals glabrous, oblong, scarious-margined, 4–5 mm. long, 1.5–2 mm. broad, outer pair very slightly saccate; petals spatulate, tapering gradually to a fairly broad claw, pink, 7–9 mm. long, 2.5–3.5 mm. broad; glands well developed, continuous beneath all stamens; pedicels glabrous, divaricately ascending, 5–10 mm. long; siliques straight, divaricately ascending, glabrous, strongly nerved to the middle or slightly above, acuminate, 5–7 cm. long, 2.5–3.5 mm. wide; style less than 1 mm. long; seeds slightly oblong to orbicular, narrowly winged, 2–2.5 mm. broad, uniseriate.—Northwestern California: Mary Blaine Mt., Trinity Co., Aug. 3, 1935, *J. P. Tracy 14469* (G, type; UC, isotype); head of White's Creek, Devils Canyon Mts., Trinity Co., Aug., 1935, *Tracy 14536* (R, UC); White's Creek Lake, Devils Canyon Mts., Trinity Co., Aug., 1935, *Tracy 14668½* (UC); Trinity Summit, head of Devils Hole, Humboldt Co., July, 1935, *Tracy 14319½* (UC).

The siliques of *A. rigidissima* resemble those of *A. suffrutescens* in being broad with an uneven, somewhat undulate margin and acuminate apex. The disposition and shape of the leaves and the general habit of growth are also very similar in the two species. *A. rigidissima* is distinct from *A. suffrutescens* on the basis of its narrower ascending instead of reflexed siliques and narrowly instead of broadly winged seeds. The latter character is fundamental and immediately sets the two species apart. The siliques are borne in a divaricately ascending position in *A. rigidissima* similar to the silique-position in *A. divaricarpa* which it superficially resembles. However, these two species are not particularly related and differ in the form of silique, size of seeds, size of flower parts and shape and disposition of the leaves. In many ways *A. rigidissima* represents a transitional type between that group of species with broad siliques and widely winged seeds of which *A. suffrutescens* and *A. platysperma* are representative, and the more abundant group in *Arabis* with narrow siliques and narrowly winged seeds. The silique-position is also that of *A. platysperma*, but our plant does not have the very broadly winged seeds characteristic of the latter species.

18. A. Lemmoni Watson. Deep-rooted perennial; stems several to numerous from a branching caudex, slender, simple, pubescent throughout or usually glabrous above, 6–20 (–40) cm. high; basal leaves broadly spatulate-oblanceolate (much nar-

rower in var. *depauperata*), entire to few-toothed, usually obtuse, densely pubescent with minute dendritic trichomes, pannose (except in var. *paddoensis*), 1–2 cm. long; cauline leaves sessile, oblong-lanceolate to somewhat ovate, auriculate and slightly clasping, glabrous or the lower pubescent (all pubescent in var. *depauperata*), 4–10 (–15) mm. long; sepals oblong, obtuse, nonsaccate, glabrous to sparsely pubescent, often purplish, 2–3 mm. long; petals pink to purple, spatulate, 4–6 mm. long; glandular tissue moderately developed, continuous beneath all stamens; pedicels glabrous or rarely pubescent, 2–5 mm. long; siliques usually horizontal, sometimes slightly ascending or somewhat pendent (divaricately ascending in var. *depauperata*), straight to slightly curved, glabrous, nerved to the middle, 2–4 (–5) cm. long, 2–3.5 mm. wide; stigma sessile or the style very short; seeds orbicular, narrowly winged, slightly more than 1 mm. broad, uniseriate.

Key to the Varieties of A. Lemmoni

Siliques divaricately ascending; basal leaves narrowly oblanceolate to lanceolate; fruiting raceme not secund. .18d. Var. *depauperata*.
Siliques horizontal or slightly descending; basal leaves spatulate; fruiting raceme usually somewhat secund.
  Basal leaves sparsely pubescent to glabrous........18b. Var. *paddoensis*.
  Basal leaves densely pubescent, usually pannose.
    Siliques 2–2.5 mm. broad, 2–4 cm. long; stems numerous, less than 2 dm. high.............................18a. Var. *typica*.
    Siliques 2.5–3.5 mm. broad, 3–5 cm. long; stems few, 2–4 dm. high.................................18c. Var. *drepanoloba*.

18a. Var. **typica.** *A. Lemmoni* Watson in Proc. Am. Acad. **22:** 467 (1887) and in Gray, Syn. Fl. N. Am. **1:** 166 (1895); Howell, Fl. Northw. Am. **1:** 44 (1897); Coulter & Nelson, New Man. Bot. Rky. Mts. 227 (1909); Rydberg, Fl. Rky. Mts. 360 (1918); Henry, Fl. So. Brit. Columb. 149 (1918); Jepson, Man. Fl. Pl. Calif. 430 (1925) in part and Fl. Calif. **2:** 65 (1936) in part; Tidestrom in Contrib. U. S. Nat. Herb. **25:** 244 (1925); Rollins in Res. Stud. State Coll. Wash. **4:** 36, fig. 10 (1936). *A. canescens* Nuttall, var. *latifolia* Watson in King, Geol. Expl. Fortieth Parallel **5:** 17 (1871). *A. latifolia* (Watson) Piper in Contrib. U. S. Nat. Herb. **11:** 295 (1906). *A. bracteolata* Greene, Leaflets **2:** 73 (1910). *A. Kennedyi* Greene, ibid. p. 71. *A. oreocallis* Greene, ibid. p. 73. *A. polyclada* Greene, ibid. p. 75. *A. semisepulta* Greene, ibid. p. 74. *A. Egglestonii* Rydberg, Fl. Rky. Mts. 361 (1918).—Montana to Colorado, California and British Columbia. Map 9. Montana: Glacier Park, Aug., 1919, *Standley 17737* (US), July, 1933, *C. L. Hitchcock 2043* (P); Black Butte, Tobacco Root Range, Aug., 1902, *Blankinship s.n.* (G); Blackfoot Glacier, Aug., 1909, *M. E. Jones s.n.* (P); Bridger Mts., June, 1897, *Rydberg & Bessey 4223* (G);

Lone Mt., Gallatin Co., Aug., 1906, *Roadhous & Chestnut 29* (UC), June, 1901, *W. W. Jones s.n.* (G, RM, UC); Crazy Mts., Park Co., July, 1902, *Blankinship s.n.* (RM). WYOMING: Fremont Peak, Aug., 1878, *C. Richardson s.n.* (G); Beartooth Butte, Park Co., July, 1939, *Rollins & Muñoz 2838* (G, R), Aug., 1937, *L. O. & R. P. Williams 3760* (R); northwestern Wyoming, Aug., 1893, *Rose 399a* (US, TYPE of *A. bracteolata*); Mt. Washburn, July, 1932, *B. & R. Maguire 1169* (UAC); Piney Mt., July, 1922, *E. B. & L. B. Payson 2674* (G, US); Teton Pass Mts., July, 1920, *E. B. & L. B. Payson 2135* (G). COLORADO: Clover Mt., above Garfield, July, 1910, *Eggleston 6013* (NY, TYPE; US, isotype of *A. Egglestonii*). IDAHO: Brazil's, Birch Creek, Lemhi Co., June, 1939, *Davis 1046* (R); Mt. Hyndman, Blaine Co., July, 1936, *Thompson 13637* (G, R, T); near Clyde, Blaine Co., July, 1916, *Macbride & Payson 3137* (G, RM, US); Parker Mt., Custer Co., July, 1916, *Macbride & Payson 3257* (G); 7 miles north of Dickey, Custer Co., June, 1938, *Hitchcock 3796* (R); Caribou Mt., Bonneville Co., July, 1923, *Payson & Armstrong 3565* (G, P). UTAH: Henry's Fork Basin, Summit Co., Aug., 1936, *Maguire et al. 14688* (G, R, UAC); Gunsight Pass, Summit Co., *Maguire et al. 14564* (G, R, UAC); La Motte Peak, Uinta Mountains, July, 1926, *E. B. & L. B. Payson 5091* (M, RM); Mt. Agassiz, Duchesne Co., Aug., 1933, *Maguire et al. 4144* (UAC); Black Mt., near Salt Lake City, May, 1903, *Mrs. Joseph Clemens s.n.* (G); Cottonwood Canyon, May, 1932, *Burke 2977* (UAC). NEVADA: alpine peak east of Mt. Wheeler, Snake Range, White Pine Co., July, 1938, *Rollins & Chambers 2477* (G, R); Jarbidge, July, 1912, *Nelson & Macbride 1971* (G); above Liberty Pass, Ruby Mts., about 16 miles southeast of Lamoille, Elko Co., July, 1938, *Rollins & Chambers 2554* (G, R); Duck Creek near Ely, Aug., 1913, *A. E. Hitchcock 1411* (US); Clover Mts., Sept., 1868, *S. Watson 71* (G, TYPE of *A. canescens*, var. *latifolia*); Toiyabe Dome, Toiyabe Mts., Aug., 1939, *Hitchcock & Martin 5623* (R); Galena Creek, Washoe Co., Aug., 1906, *Kennedy 1248* (US, TYPE; NY, isotype of *A. Kennedyi* Greene); Mt. Rose, Washoe Co., Aug., 1938, *J. T. Howell 14215* (G, R). CALIFORNIA: Lassen Peak, Sept., 1872, *J. G. Lemmon 23* (G, TYPE), Aug., 1882, *Mrs. R. M. Austin s.n.* (G, UC); White Mt., Conness Range, Tuolumne Co., July, 1936, *Mason 11326* (G, UC); Kaiser Peak, Fresno Co., July, 1914, *Smiley 644* (G); Mt. Warren Pass, Mono Co., Aug., 1894, *Congdon 613* (G, UC); Virginia Lakes Basin, Mono Co., July, 1934, *Peirson 11331* (Peirs); Rock Creek Lake Basin, Inyo Co., July, 1934, *Peirson 11296* (Peirs); Farewell Gap, Tulare Co., 1897, *C. A. Purpus 5229* (US, TYPE; G, UC, isotypes of *A. polyclada*), Aug., 1891, *Coville & Funston 1747* (G). OREGON: Wallowa Mts., Baker Co., July, 1936, *Thompson 13399* (R, T), July, 1899, *Cusick 2264* (G, UC, US, WSC); near Wallowa Lake, Wallowa Co., July, 1936, *L. S. Rose 36610* (R); Mt. Thielson, Klamath Co., Aug., 1897, *Coville & Applegate 454* (US, type; RM, isotype of *A. semisepulta*); Mt. Scott, Crater Lake, July, 1935, *Thompson 12280* (T, UW), Sept., 1902, *Coville 1489* (US). Washington: Mt. Stuart, Chelan Co., July, 1931, *Thompson 7700* in part (G, UC); Three Brothers Peak, Chelan Co., June, 1934, *Thompson 10582* (T); Mt. Adams, Aug., 1906, *Suksdorf 1920* (G, R, UC, US, WSC), Aug., 1885, *Suksdorf 510* (G); Mt. Angeles, Clallam Co., June, 1932, *Thompson 8393* (G), July, 1933, *Thompson 9465* (NY). British Columbia: Beaverfoot Mts., Selkirk and Rky. Mts., July, 1904, *C. H. Shaw 315* (US, type; G, isotype of *A. oreocallis*); Bow River Pass, Sept., 1879, *Macoun 74* (G); Silver City, Aug., 1885, *J. Macoun s.n.* (G); summit of Rky. Mts., Aug., 1890, *J. Macoun s.n.* (G); Bluster Mt., Marble Mts., July, 1938, *J. & E. Thompson 457* (G); Chipuin Mt., Marble Mts., July, 1938, *J. & E. Thompson 627* (G).

18b. Var. **paddoensis,** var. nov. Herba glabra vel sparse pubescens; caulibus 1–2.5 dm. altis; foliis radicalibus sparse pubescentibus vel glabris spathulatis vel oblanceolatis. Map 10. Washington: Mt. Stuart region, Kittitas Co., 1931, *Thompson 7753½* (G); high alpine ridges at head of Beverly Creek, Kittitas Co., July, 1933, *Thompson 9500* (G, T); east of Mt. Adams, Aug., 1892, *Henderson 2391* (G, UW); rocks, Mt. Adams (Paddo), Aug., 1885, *Suksdorf 509* (G, type), Sept., 1905, *Suksdorf 5296* (G).

18c. Var. **drepanoloba** (Greene) comb. nov. Stems few, 1.5–4 dm. high; pubescence of basal leaves coarser and less dense than in var. *typica;* siliques 3–5 cm. long, 2.5–3.5 mm. wide.—*A. drepanoloba* Greene in Pitt. **3:** 306 (1898); Rydberg, Fl. Rky. Mts. 360 (1918).—Alberta to Wyoming. Map 11. Alberta: Crow Nest Pass, Aug., 1897, *Macoun 18114* (G); Devil's Head Lake, Banff, Aug., 1891, *Macoun 1719a* (ND, type; US, isotype; photo of type in Gray Herb.); Bertha Lake, vicinity of Waterton Lakes, July, 1938, *Hunnewell 15825* (G). Montana: Glacier Nat. Park, July, 1933, *C. L. Hitchcock 2043* (G, P), July, 1919, *Standley 15796* (US). Wyoming: Gros Ventre Mts., Sublette Co., Aug., 1922, *E. B. & L. B. Payson 3039* (G, M, P, RM, US); near Alpine, Lincoln Co., July, 1923, *Payson & Armstrong 3463* (G, M, RM); northeast of Smoot, Lincoln Co., July, 1923, *Payson & Armstrong 3637* (G, M, RM).

18d. Var. depauperata (Nelson & Kennedy) Rollins. Basal leaves narrowly oblanceolate, very finely pubescent; cauline leaves densely pubescent; pedicels and siliques divaricately ascending.—Madroño **3:** 360 (1936). *A. depauperata* Nelson & Kennedy in Proc. Biol. Soc. Wash. **19:** 36 (1906).—Nevada and California. MAP 11. NEVADA: Bunker Hill, Toiyabe Forest, July, 1913, *A. E. Hitchcock 855 & 866* (US); Toiyabe Dome, Toiyabe Mts., Nye Co., July, 1938, *Rollins & Chambers 2522* (G, R); Mt. Rose, Washoe Co., Aug., 1905, *Kennedy 1167* (RM, TYPE; UC, isotype), July, 1909, *Heller 9868* (NY, US), July, 1939, *Hitchcock & Martin 5497* (R). CALIFORNIA: Tinkers Knob, Placer Co., July, 1897, *S. F. Sonne s.n.* (P, UC); Mt. Tallac, Eldorado Co., July, 1903, *Hall & Chandler 4624* (UC); Rubicon Peak, Eldorado Co., Aug., 1913, *Smiley 405* (G); near Crest View, 19 miles south of Mono Lake, Aug., 1938, *Constance 2462* (R); Olancha Mt., Tulare Co., June, 1904, *Hall & Babcock 5229* (G).

Watson first listed plants of *A. Lemmoni* both as *A. canescens* and as *A. canescens,* var. *latifolia,* but an accumulation of specimens from the high mountains of several western states led him to separate them later as a distinct species. Of the several specimens cited with the original description, one from Lassen Peak, California, by J. G. Lemmon must be regarded as the type. *A. Lemmoni* is found on the highest peaks in many of the main ranges of western America. Its range is necessarily disrupted due to the lack of tolerable habitats between the high peaks, many of which have undoubtedly been isolated for a considerable period. This probably contributes to the fact that *A. Lemmoni* exhibits a number of minor variations in its morphology when plants from the entire geographic range are considered. As shown by the list of synonyms, a number of independent specific names have been proposed for the various phases of this species. Most of these were proposed without due regard for the usual variations found in even a single colony of *A. Lemmoni.*

Three varieties are distinctive and have been set off to indicate the directions in which particular specialization is apparently taking place in the species. These varieties share with var. *typica* only a fragment of the total range of the species and differ from each other and the typical variety in several ways. Var. *depauperata* has divaricately ascending siliques which are rarely secund instead of the horizontally spreading to slightly reflexed secund siliques of the other varieties. It is more pubescent above, has narrower, longer siliques and narrower basal leaves than var. *typica.* Var. *drepanoloba* is larger in stature with broader siliques and a more scanty, slightly coarser pubescence than is found in the typical variety. Var. *paddoensis* is restricted to the Cascade Range in central and southern Washington and differs from the typical variety in being wholly glabrous or only scantily pubescent.

19. A. oxylobula Greene. Caespitose perennial; caudex simple or branching, densely covered with old leaf-bases; stems slender, numerous, simple, glabrous, 8–12 cm. high; basal leaves linear to narrowly oblanceolate, entire, acute, glabrous or the petioles sparingly hirsute with simple trichomes, 2–3 cm. long, 3–5 mm. wide; cauline leaves few, oblong, remote, entire or minutely denticulate, glabrous, teeth and apex often cuspidate, sessile, not auriculate, 8–15 mm. long; inflorescence few-flowered, loose; sepals glabrous, oblong, 2–3 mm. long, about 1 mm. wide; petals lingulate to spatulate, pink, about 5 mm. long, 1.5–2 mm. wide; glands poorly developed; pedicels filiform, glabrous, arched or horizontal, 3–6 mm. long; siliques glabrous, widely pendulous to spreading almost at right angles, nerved to the middle or above, 1.5–2.5 cm. long, 1.5–2 mm. wide; seeds orbicular, winged all around, about 1 mm. wide, uniseriate.—Pittonia **4:** 195 (1900); Coulter & Nelson, New Man. Bot. Rky. Mts. 227 (1909) in part; Rydberg, Fl. Rky. Mts. 361 (1918).—Colorado: Glenwood Springs, Garfield Co., June, 18, 1899, *G. E. Osterhout s.n.* (ND, type; photo in Gray Herb.), June 6, 1902, *Osterhout 2575* (NY, RM).

Unfortunately too little material is available of this species. It is related to *A. demissa*, but differs in having broader cauline leaves, basal leaves with thinner texture, and more numerous filiform stems. Also the siliques of *A. oxylobula* are shorter, more acute and more widely spreading than those of *A. demissa*. The present disposition of *A. oxylobula* is frankly provisional. A larger suite of specimens may show an intergradation with *A. demissa* in which case it would be better treated as a variety.

20. A. demissa Greene. Perennial, caespitose; stems several to numerous from a simple or branching caudex, simple or rarely branched above, slender, hirsute below or glabrous throughout, 1–3 dm. high; basal leaves linear to oblanceolate, acute or the outer obtuse, entire, hirsute with large simple or forked trichomes or rarely nearly glabrous, margins usually ciliate, 1.5–3.5 cm. long, 2–5 mm. wide; cauline leaves remote, sessile, not auriculate except in var. *languida*, 5–10 mm. long, 1.5–4 mm. wide, lower usually sparsely hirsute, upper glabrous; sepals oblong, sparsely pubescent, non-saccate, 2–3.5 mm. long, about 1.5 mm. broad; petals white to pink, spatulate, 4.5–6.5 mm.

long, 1.5–2 mm. broad; nectar-glands developed around single stamens, merely subtending paired stamens; pedicels glabrous, slender, arched downward, 3–7 mm. long; siliques pendulous, nerved about to the middle, 2–4 cm. long, 1.5–2 mm. wide, valves often constricted between seeds; stigma sessile; seeds orbicular to slightly oblong, plump, narrowly winged or wingless, about 1 mm. broad, uniseriate.

Key to the Varieties of A. demissa

a. Basal leaves linear to narrowly oblanceolate; cauline leaves without auricles....................................b.

b. Trichomes on leaves and stems simple; basal portion of stems sparsely hirsute or the stems completely glabrous; valves of siliques not constricted between seeds; seeds wingless; southern Wyoming and northeastern Utah....................................20b. Var. *russeola*.

b. Trichomes on leaf-blades forked and smaller than those of the margins; basal portion of stems hirsute with forked trichomes; valves of siliques constricted between seeds; seeds narrowly winged to wingless; Colorado....................................20a. Var. *typica*.

a. Outer basal leaves oblanceolate; cauline leaves auriculate; southern Wyoming and northeastern Utah......20c. Var. *languida*.

20a. Var. **typica.** *A. demissa* Greene, Pl. Baker. **3:** 8 (1901). *A. rugocarpa* Osterhout in Bull. Torr. Bot. Club **31:** 357 (1904); Coulter & Nelson, New Man. Bot. Rky. Mts. 227 (1909); Rydberg, Fl. Rky. Mts. 361 (1918). *A. aprica* Osterhout ex Nelson in Coulter & Nelson, New Man. Bot. Rky. Mts. 228 (1909).—Map 8. Colorado: Sulphur Springs, Grand Co., June, 1907, *Osterhout 3540* (RM, type; NY, isotype of *A. aprica*); Malta Station, near Leadville, Lake Co., June, 1903, *Osterhout 2800* (RM, type; NY, isotype of *A. rugocarpa*); June, 1900, *Osterhout 2096* (NY); Phipps Ranch, Mineral Co., May, 1911, *J. Murdoch Jr. 4511* (M, NY, US); near Sargents, Saguache Co., May, 1938, *Rollins 2086* (G, R); June, 1928, *Osterhout 6920* (M); 4 miles east of Gunnison, May, 1938, *Rollins 2099* (G, R); 1 mile east of Sapinero, May, 1938, *Rollins 2113* (G, R); 5 miles south of Iola, Gunnison Co., Sept., 1937, *Rollins 2002* (G, R); in a stony river bed, Cimarron, Gunnison Co., 1901, *C. F. Baker 16* (ND, type; photo in Gray Herb.).

20b. Var. **russeola,** var. nov. Herba caespitosa; caulibus glabris vel inferne pilosis, 1–2.5 dm. altis; foliis radicalibus hirsutis; caulinis remotis non auriculatis; petalis albis; seminibus orbicularibus exalatis uniseriatis.—Wyoming and Utah. Wyoming: Laramie Hills, Albany Co., June, 1899, *E. Nelson 212* (G, NY). Utah: vicinity of Flaming Gorge, Daggett Co., June, 1938, *Rollins 2272* (G, R), May, 1932, *L. Williams 459* (G, NY, RM); 18 miles north of Vernal, Uintah Co., June, 1937, *Rollins 1757* (G, type; R, isotype).

20c. Var. **languida,** var. nov. Herba multicaulis caespitosa; caulibus simplicibus vel superne ramosis 1–3 dm. altis; foliis radicalibus hirsutis; caulinis auriculatis; pedicellis 4–7 mm. longis; seminibus orbicularibus exalatis vel anguste alatis uniseriatis 1 mm. latis.—Wyoming and Utah. Map 8. Wyoming: Albany Co., Laramie Hills, May, 1896, *A. Nelson 1885* (NY, P, US); near City Springs, east of Laramie, June 14, 1936, *Rollins 1178* (G, type; R, isotype), June, 1935, *L. Williams 2183* (G, M), June, 1937, *Rollins 1610* (G, R); 2 miles southeast of Green River, Sweetwater Co., June, 1938, *Rollins 2250* (G, R). Utah: 15 miles southeast of Manila, near Flaming Gorge, Daggett Co., June, 1938, *Rollins 2279* (G, R).

Typical *A. demissa* is very abundant on exposed stony knolls in the Gunnison Basin of western Colorado. The plants are often associated with dwarfed sagebrush and in some small areas devoid of shrubby types it becomes the dominant species. The type specimen of *A. demissa* collected in a "stony river bed", which is an unnatural habitat for the species, is nearly glabrous, only the petioles of the basal leaves being hirsute. Usually, the young basal leaves are conspicuously hirsute with large simple or forked trichomes, but much of the indument is shed as the leaves mature. Often plants are found with the outer basal leaves completely glabrous, while the inner are densely hirsute.

A. demissa is nearest related to *A. Fendleri*, var. *spatifolia*, from which it differs in being caespitose with numerous stems instead of being one- to few-stemmed, in having larger seeds which are disposed in a single row rather than a double row, and small, remote cauline leaves in place of relatively large, imbricated ones. *A. demissa*, var. *typica* has the valves markedly constricted between the seeds, but this character is not found in vars. *russeola* and *languida* in which the valves are plane. Var. *languida* has auriculate cauline leaves, whereas in vars. *typica* and *russeola* the cauline leaves lack auricles.

21. A. pendulina Greene. Perennial; stems several to numerous from a simple caudex, hirsute with simple trichomes below to glabrous throughout, simple or rarely branched above, usually slender, 1–4 dm. high; basal leaves spatulate to linear-oblanceolate, entire, hirsute with simple trichomes to glabrous, 1–4 cm. long, 3–10 mm. wide, petioles slender; cauline sessile, usually non-auriculate, lanceolate to slightly broader, acute, glabrous

or the lower hirsute, 5–10 mm. long, 2–6 mm. wide; inflorescence few-flowered, lax; pedicels slender, arched downward, glabrous, 5–10 mm. long; sepals oblong, glabrous or hirsute with a few large trichomes, usually purplish, non-saccate, 3-4 mm. long; petals pink to purplish, spatulate, 5–6 mm. long, about 2 mm. broad; glandular tissue continuous under both single and paired stamens, poorly developed; siliques glabrous, pendulous, straight to slightly curved, obtuse, nerved below, 2–4 cm. long, 2–3 mm. broad; stigma sessile; seeds biseriate, slightly oblong, wingless, about 1 mm. broad.—Leaflets **2:** 81 (1910); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 245 (1925). *A. setulosa* Greene, Leaflets **2:** 81 (1910). *A. Diehlii* M. E. Jones, Contrib. West. Bot. **14:** 38 (1912). *A. nevadensis* Tidestrom in Proc. Biol. Soc. Wash. **36:** 182 (1923).—Utah and Nevada. MAP 11. UTAH: Marysvale, June, 1894, *M. E. Jones 5330* (US, TYPE; NY, P, UC, isotypes of *A. setulosa*); Joe's Valley, Emery Co., May, 1932, *Pickford & Pechanec 139* (FS); Cedar Ridge, Sevier Co., May, 1923, *Miller 246* (FS). NEVADA: near Lehman Creek, east of Mt. Wheeler, Snake Range, White Pine Co., July, 1938, *Rollins & Chambers 2469* (G, R), June, 1927, *Gray 155* (FS); Charleston Mts., Clark Co., May–Oct., 1898, *C. A. Purpus 6104* (US, TYPE; UC, isotype); Clark Canyon, Charleston Mts., June, 1936, *Clokey 7125* (G, R); head of Lee Canyon, Charleston Mts., Aug., 1913, *Heller 11077* (US, TYPE; G, NY, UC, isotypes of *A. nevadensis*); Deer Creek, Charleston Mts., June, 1939, *Alexander 743c* (G, UC); Hidden Forest, Sheep Mts., Clark Co., May, 1940, *Alexander & Kellogg 1520* (R).

Arabis pendulina is closely related to *A. Fendleri*, but differs in having smaller, usually entire basal leaves, numerous slender stems, small, remote, usually non-clasping cauline leaves and shorter siliques. The plants are more tufted and never attain the robustness found in *A. Fendleri*. There is also a difference in the type of pubescence exhibited on the basal leaves of the two species. In *A. pendulina*, the pubescence is predominantly simple on the leaf-surfaces and margins, whereas in *A. Fendleri* the pubescence is commonly forked, especially on the leaf-surfaces.

The glabrous phase of *A. pendulina* was named *A. nevadensis* by Tidestrom, but this, as in other species of *Arabis*, is a feature often found in plants growing at high altitudes. All stages between glabrous and hirsute types have been repeatedly observed. *A. setulosa* Greene and *A. Diehlii* Jones were based on plants collected in the mountains near Marysvale, Utah.

Fig. 1. A. demissa drawn from *Rollins 2113*; Fig. 2. A. Koehleri drawn from *Cusick 2905*; Fig. 3. A. Gunnisoniana drawn from *Rollins 2090*; Fig. 4. A. crucisetosa drawn from *Rollins, Contance & Dillon 1107*.

B. Diagram of the glandular tissue on the receptacle; C. Sepal about two times natural size; D. Petal about two times natural size; E. Stamen about two times natural size. All figures about one-half natural size except figures 4B, 4C, 4D, and 4E.

It is not certain that the same species was described in each case because I have been unable to locate the type of *A. Diehlii* in Jones's herbarium at Pomona College, but the two descriptions are very similar. Certainly *A. setulosa* does not fall outside the natural specific variation found in *A. pendulina.*

22. A. RECTISSIMA Greene. Biennial; stems one to several from a simple or rarely branched caudex, often purplish, simple to branched above, sometimes rather stout, glabrous to sparsely hirsute below with coarse, simple trichomes, 2–8 dm. high; basal leaves numerous, spatulate to oblanceolate, short-petioled, entire, hirsute with coarse simple and forked trichomes, 1–3 cm. long, 4–10 mm. wide, blade-surfaces sometimes glabrous, margins always ciliate; cauline leaves crowded below, remote above, oblong to nearly lanceolate, obtuse, auriculate or the auricles nearly wanting, sessile, ciliate, sparsely hirsute or the upper glabrous, 1–2 cm. long, 3–8 mm. wide; sepals oblong, obtuse, sparsely hirsute near apex, 2–3 mm. long; petals spatulate to narrowly lingulate, white or rarely pinkish, 4–6 mm. long, 1–2 mm. wide; glandular tissue well developed in a continuous ring beneath all stamens; fruiting raceme 1–4 dm. long; pedicels glabrous, strictly reflexed, 4–12 mm. long; siliques numerous, crowded, straight, strictly reflexed, appressed to the rachis, glabrous, 1-nerved below, acute at apex, 5–8 cm. long, 1.5–2.5 mm. wide; stigma sessile or nearly so; seeds orbicular, winged all around, about 1.5 mm. broad, uniseriate.—Pittonia **4:** 191 (1900); Jepson, Fl. Calif. **2:** 68 (1936); Rollins in Madroño **3:** 362 (1936) and in Res. Stud. State Coll. Wash. **4:** 30 (1936); Applegate in Am. Midl. Natur. **22:** 269 (1939). *A. setigera* Greene, Leaflets **2:** 80 (1910). *A. Holboellii*, var. *Fendleri* sensu Jepson, Man. Fl. Pl. Calif. 429 (1925). *A. Wyndii* Henderson in RHODORA **32:** 25 (1930).—Western Nevada, California and southern Oregon. MAP 12. NEVADA: Creek at Incline, Lake Tahoe, Washoe Co., Aug., 1938, *Archer 6695* (NA). CALIFORNIA: near Black Butte, north of Sisson, Siskiyou Co., June, 1916, *Heller 12421* (Cl, G, M, Ph, US, WSC); Mt. Shasta, July, 1912, *Eastwood 1231* (G); Diamond Mt., Lassen Co., June, 1897, *M. E. Jones s.n.* in part (P); Prattville, Plumas Co., July, 1907, *Heller & Kennedy 8809* (G, P, UC, US); Jonesville, Butte Co., July, 1929, *Copeland 367* (G, NY, US); Downieville, Sierra Co., May, 1854, *J. M. Bigelow s.n.* (G); Rubicon Park, Eldorado Co., July, 1901, *Setchell & Dobie s.n.* (UC); Cascade Creek, western Yosemite Nat. Park, Tuolumne Co., July, 1934, *Hodgdon & Rossbach 5* (G); Sunrise Trail, Yosemite Nat. Park, Mariposa Co., July, 1936, *H. K. Sharsmith 3808* (R); 1 mile northwest of Ellis Meadow, Madera Co., July, 1938, *Constance 2393* (R); Dinkey

Creek, Fresno Co., June, 1900, *Hall & Chandler 346* (UC); Fresno Co., 1890, *Mrs. Peckinpah s.n.* (ND, TYPE; NY, isotype); Olancha Mt., Tulare Co., June, 1904, *Hall & Babcock 5290* (UC); north side of Bear Lake, San Bernardino Mts., June, 1922, *Munz 5729* (P); City Creek Grade, San Bernardino Mts., June, 1926, *M. E. Jones s.n.* (P). OREGON: Corral Springs, Klamath Co., Aug. 2, 1894, *Leiberg 610* (US, TYPE; G, O, UC, isotypes of *A. setigera*); Cherry Cr., Klamath Co., July, 1899, *Leiberg 4305* (O, US); 5 miles north of Fort Klamath, July, 1920, *Peck 9564* (G, M, W, WSC); Crater Lake, July, 1928, *Wynd 2322* (O, TYPE of *A. Wyndii*).

The pubescence of *A. rectissima* is similar to that of *A. Fendleri* and *A. pendulina.* Instead of the widely spreading pedicels and curved pendulous siliques found in those species, *A. rectissima* has strictly reflexed pedicels and straight siliques. A unique feature of this species is the long fruiting raceme which often occupies over half the entire length of the stem. *A. rectissima* has often been confused with varieties of *A. Holboellii,* but plants of these species are not as closely related as historical treatments would seem to indicate. The large acicular trichomes fringing the basal leaf-blades in *A. rectissima* are a quick mark of identity.

Beginning in the southern Cascade Mountains of Oregon, *A. rectissima* is found at middle elevations almost continuously along the Sierra Nevada mountain-axis to Tulare County, then, like many other plants of similar distribution, it jumps to the San Bernardino Mountains where its geographical area is relatively limited.

23. A. FENDLERI (Watson) Greene. Perennial; stems one to several from a simple caudex, simple or branched above, hirsute below with simple, spreading trichomes, glabrous above, 2.5–6 dm. high; basal leaves oblanceolate to linear-oblanceolate, entire to coarsely dentate, densely pubescent with coarse, simple or forked trichomes or the surfaces nearly glabrous, margins ciliate, 2–6 cm. long, (2–) 3–15 mm. broad; cauline leaves sessile, oblong to lanceolate, auriculate, lower pubescent and usually imbricated, upper glabrate, entire or rarely dentate, 1–4 cm. long, 2–8 mm. broad; pedicels slender, ascending at anthesis, arched downward in fruit, glabrous, 1–2 cm. long; sepals glabrous or usually with a few trichomes, oblong, 3–5 mm. long, 1.5–2 mm. broad; petals spatulate, white to pink, 5–8 mm. long, 2–3 mm. broad; nectar-glands subtending single stamens, poorly developed be-

low paired stamens; siliques glabrous, pendulous, nerved to the middle or slightly above, obtuse, 3–6 cm. long, 1.5–2.5 mm. wide; stigma sessile; seeds orbicular to slightly oblong, narrowly winged or rarely almost wingless, 1–1.5 mm. broad, biseriate.

Basal leaves dentate, oblanceolate, obtuse; petals pink....23a. Var. *typica*.
Basal leaves entire, linear-oblanceolate, acute; petals white
23b. Var. *spatifolia*.

23a. Var. **typica.** *A. Fendleri* (Watson) Greene, Pitt. **3:** 156 (1897); Rydberg, Fl. Colo. 165 (1906); Coulter & Nelson, New Man. Rky. Mts. 229 (1909); Wooton & Standley in Contrib. U. S. Nat. Herb. **19:** 280 (1915) in part; Rydberg, Fl. Rky. Mts. 362 (1918) in part. *A. Holboellii* Hornem., var. *Fendleri* Watson in Gray, Syn. Fl. N. Am. **1:** 164 (1895). *A. porphyrea* Wooton & Standley in Contrib. U. S. Nat. Herb. **16:** 123 (1913), ibid. **19:** 280 (1915).—Colorado to Texas, northern Mexico and Nevada. MAP 12.[1] COLORADO: Wolhurst, Douglas Co., May, 1920, *Clokey 3785* (Cl, G, P); La Veta Pass, Costilla Co., June, 1936, *Rollins 1288* (R); 4 miles east of Gunnison, Gunnison Co., May, 1938, *Rollins 2098* (G, R). NEW MEXICO: without locality, 1847, *A. Fendler 27* (G, TYPE; NY, isotype; a sheet of this number at the Missouri Botanical Garden is a mixture of *A. Fendleri* and *A. perennans*); near Santa Fe, May, 1897, *A. A. & E. Heller 3562* (M; other specimens of this collection are *A. perennans*); South Percha Creek, Sierra Co., May, 1905, *Metcalfe 1591* (M); Silver City, April, 1919, *Eastwood 8219* (Cl, G); Sandia Mts., near Albuquerque, June, 1926, *E. J. Palmer 31202* (M), April, 1911, *Ellis 9* (M, NY); Tierra Amarilla, Arriba Co., April-May, 1911, *Eggleston 6446* (G, M, US); at the Cueva, Organ Mts., Dona Ana Co., April, 1907, *Wooton & Standley s.n.* (US, TYPE of *A. porphyrea*). TEXAS: Hueco Mts., El Paso Co., March, 1932, *Whitehouse 8307* (F); Sierra Blanca, April, 1930, *M. E. Jones 25824* (M); Alpine, Brewster Co., April, 1919, *Hanson 640* (M, NY). UTAH: Silver Reef, May, 1894, *M. E. Jones 5176f* in part (P); Pine Valley, Washington Co., June, 1933, *Eastwood & Howell 1270* (G). NEVADA: south end of Bristol Range, 10 miles northwest of Pioche, Lincoln Co., April, 1939, *Train 2664* (NA, R); Charleston Park, Clark Co., June, 1937, *Clokey 7538* (Cl, G, R), May, 1936, *Clokey 7121* (Cl, R); Griffith's Lodge, Charleston Mts., June, 1936, *Clokey 7119* (Cl, R). ARIZONA: Grand Canyon, June, 1916, *Eastwood 5778* (G); Kaibab, June, 1929, *M. E. Jones s.n.* (P); North Rim, Grand Canyon, June, 1933, *Eastwood & Howell 961* (G); near Flagstaff, May, 1898, *MacDougal 6* (G); 6 miles east of Flagstaff, Coconino Co., July,

[1] The symbols for vars. *typica* and *spatifolia* were inadvertently reversed in the legend of this map. The triangles indicate the range of var. *typica;* the solid circles, the range of var. *spatifolia.*

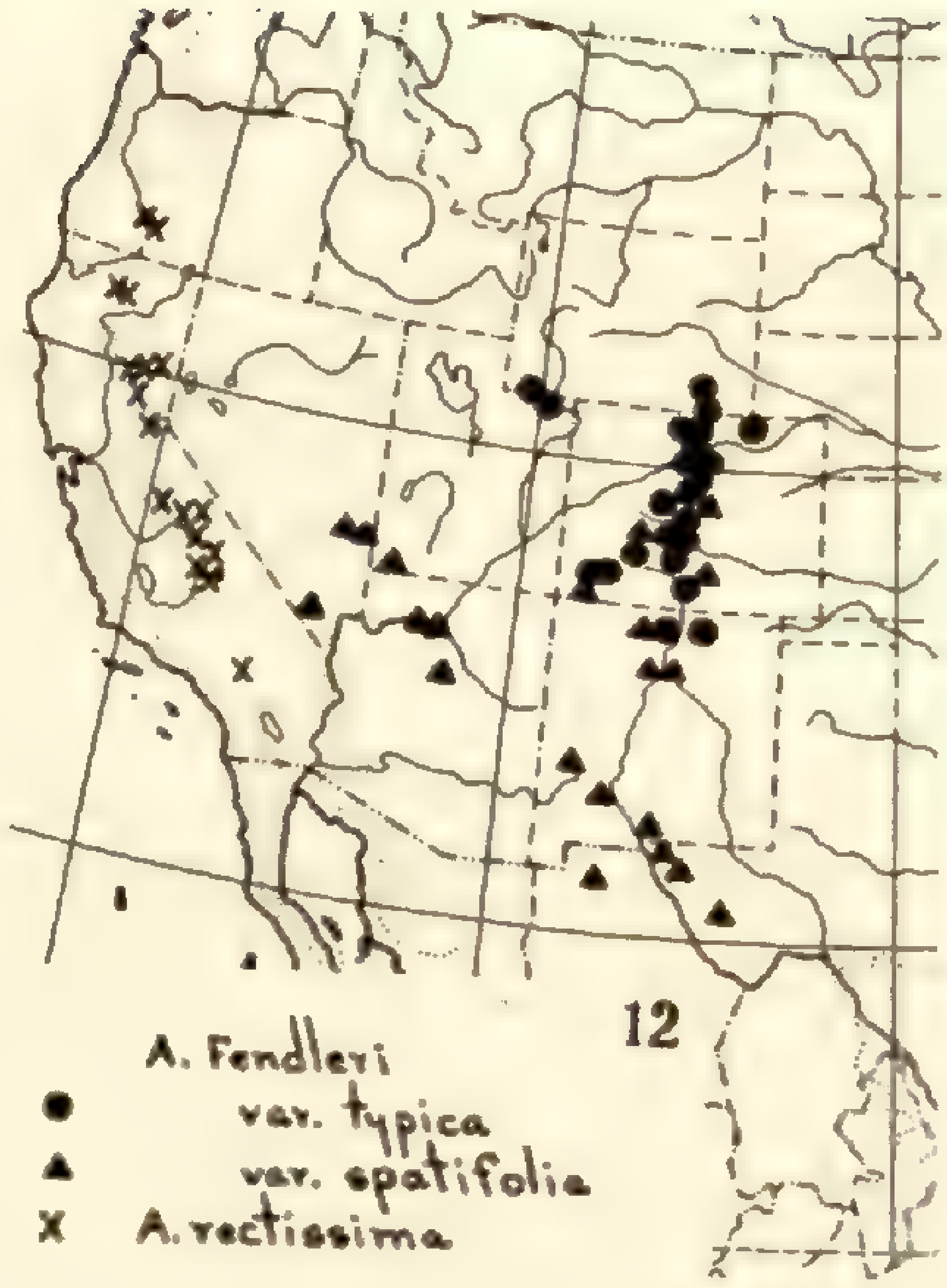
1938, *Rollins & Chambers 2811* (G). Mexico: (Lake Santa Maria) Chihuahua, 1852, *C. Wright 1313* (G).

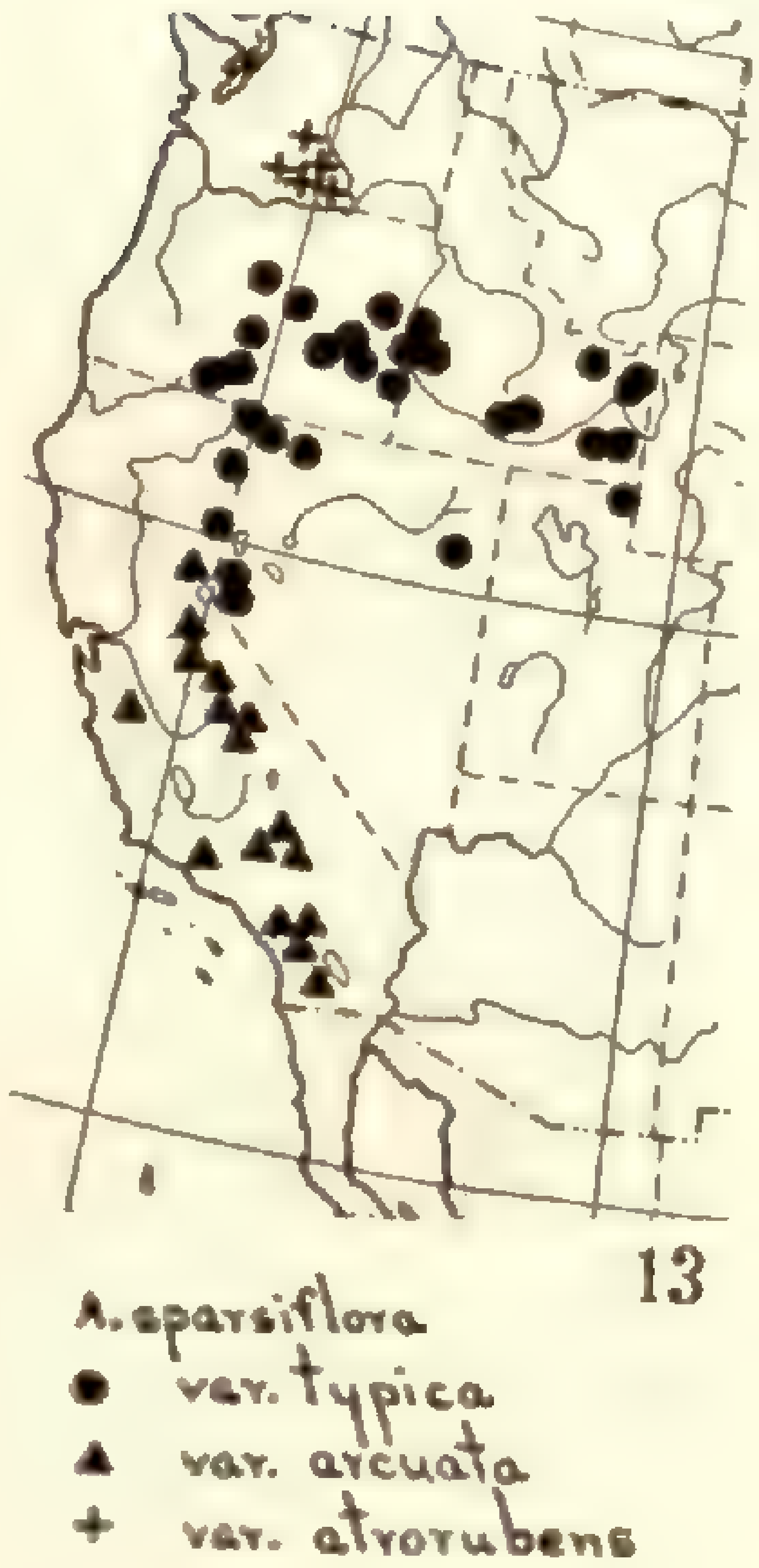
23b. Var. **spatifolia** (Rydberg), comb. nov. Stems one or few, usually branched above, 2–5 dm. high; basal leaves linear-oblanceolate, acute, 1.5–2.5 cm. long, 2–4 mm. wide; petals white, 5–6 mm. long; siliques about 2 mm. wide.—*A. spatifolia* Rydberg, Fl. Rky. Mts. 361 (1918). *A. Fendleri* sensu Rydberg, Fl. Pr. Pl. Cent. N. Am. 382 (1932) in part.—Southern Wyoming to northern New Mexico and eastern Utah. Map 12. Wyoming: Ragged Top, 25 miles north of Laramie, July, 1938, *Beetle 5591* (G, R); Dale Creek, Albany Co., June 30, 1896, *E. L. Greene s.n.* (ND); 3 miles south of Lonetree, Uinta Co., June, 1938, *Rollins 2303* (G, R). Colorado: Estes Park, Larimer Co., July, 1903, *Osterhout 2808* (NY, type; RM, isotype), June, 1916, *E. L. Johnston 90B* (G, NY, US); 4 miles west of Estes Park, Rocky Mountain National Park, June, 1938, *Rollins & Chambers 2399* (G, R); near Central City, Gilpin Co., July, 1937, *Beetle 2047* (R); Brookvale, Clear Creek Co., July, 1937, *Beetle 2065* (R); near Cripple Creek, Teller Co., Aug., 1937, *Beetle 2245* (R); Pikes Peak, June, 1935, *Ownbey 711* (R); east of Leadville, Lake Co., July, 1936, *Rollins 1349a* (R); Royal Gorge Bridge, Fremont Co., May, 1938, *Rollins 2069* (G, R); 4 miles south of Salida, Chaffee Co., May, 1938, *Rollins 2077* (G, R); Devils Hole, Huerfano Co., June, 1936, *Rollins 1254* (G, R). New Mexico: Ute Park, Colfax Co., Aug., 1916, *Standley 13619* (NY); Tres Piedras, Taos Co., June, 1930, *Talbot 1318* (NA). Utah: near Sheep Creek, 12 miles southwest of Manila, Daggett Co., June, 1938, *Rollins 2266* (G, R).

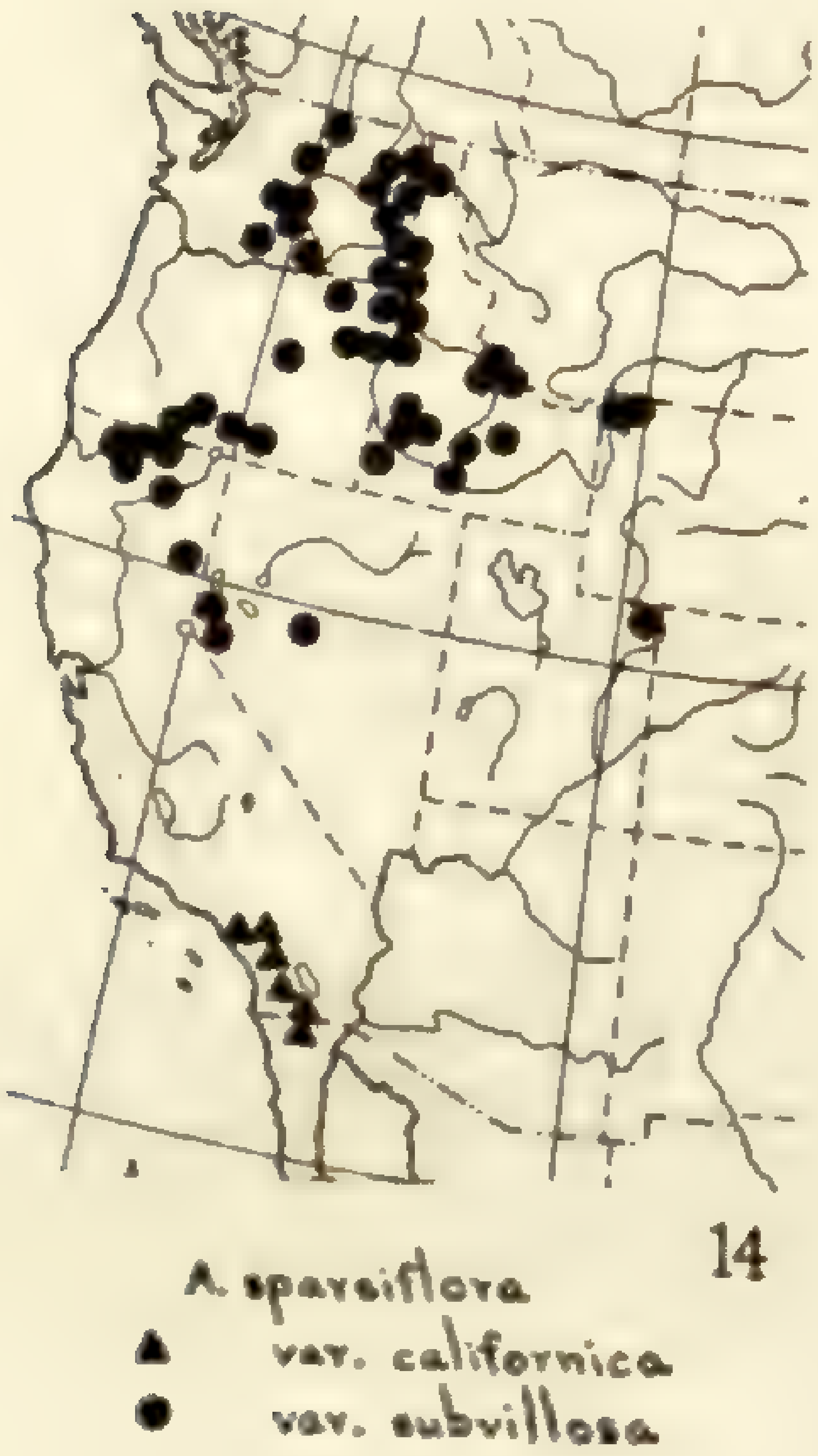
Arabis Fendleri has a very distinctive setaceous, simple or forked pubescence which makes it readily separable from the related *A. perennans*, with which it has often been confused. The latter has smaller trichomes of a dendritic type evenly covering the blade-surfaces of the basal leaves. The leaf-margins are usually ciliate in *A. Fendleri*, but this is never the case with *A. perennans*. The nearest relative of *A. Fendleri* is *A. pendulina*. This relationship has been discussed under the latter species.

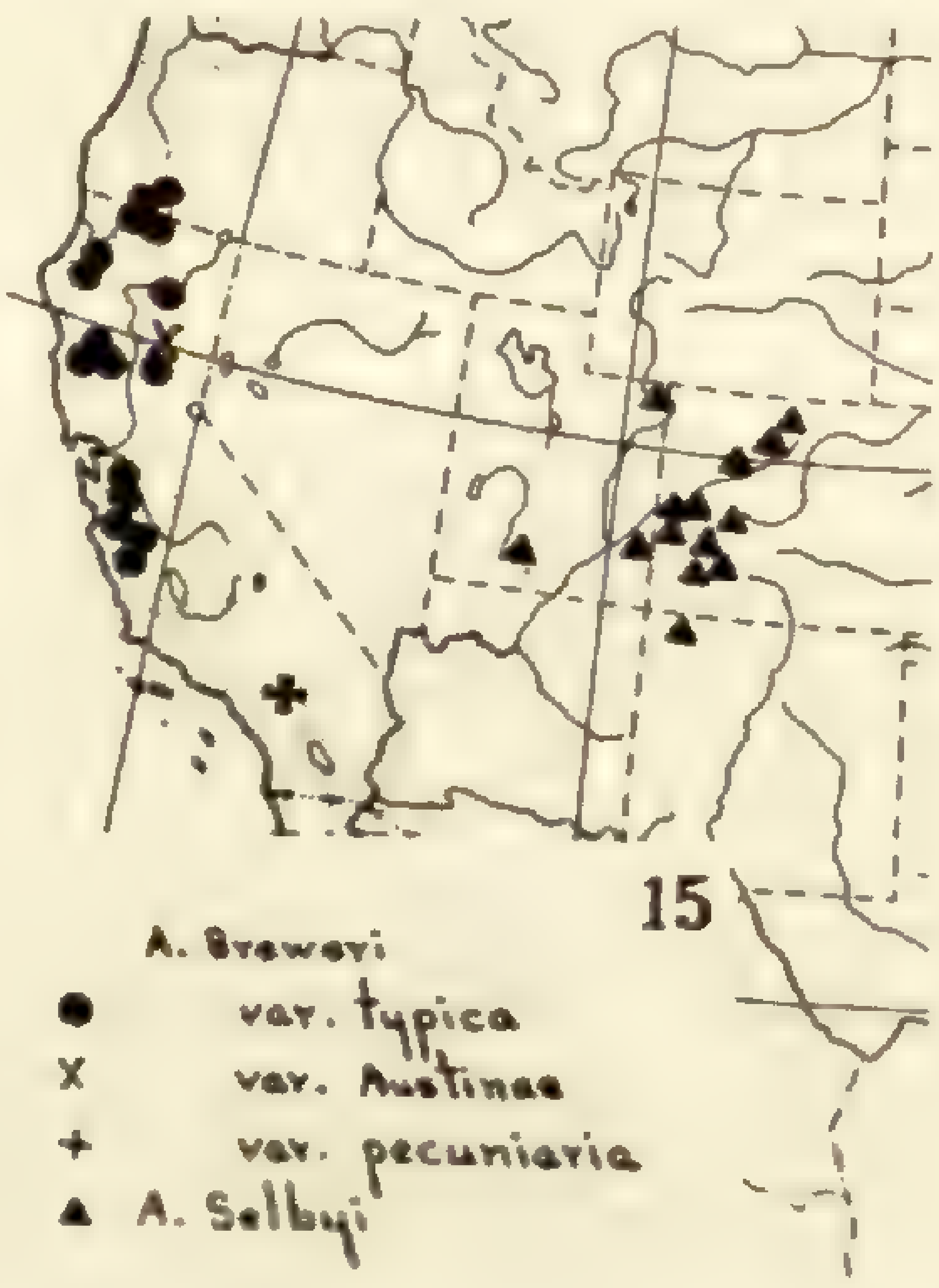
Typical *A. Fendleri* is quite variable compared to var. *spatifolia*, which shows unusual uniformity throughout its range. Perhaps some of the variability found in var. *typica* is to be associated with polyploidy which is apparently more marked here than in var. *spatifolia*. A hexaploid form of var. *typica* growing in Costilla County, Colorado, is exceedingly robust, but is not otherwise distinctive. Contrariwise, a tetraploid plant of var. *spatifolia* from Gunnison County, Colorado, did not show a similar robustness. Rather, it seemed to be the same as diploid plants of the variety collected elsewhere in Colorado.

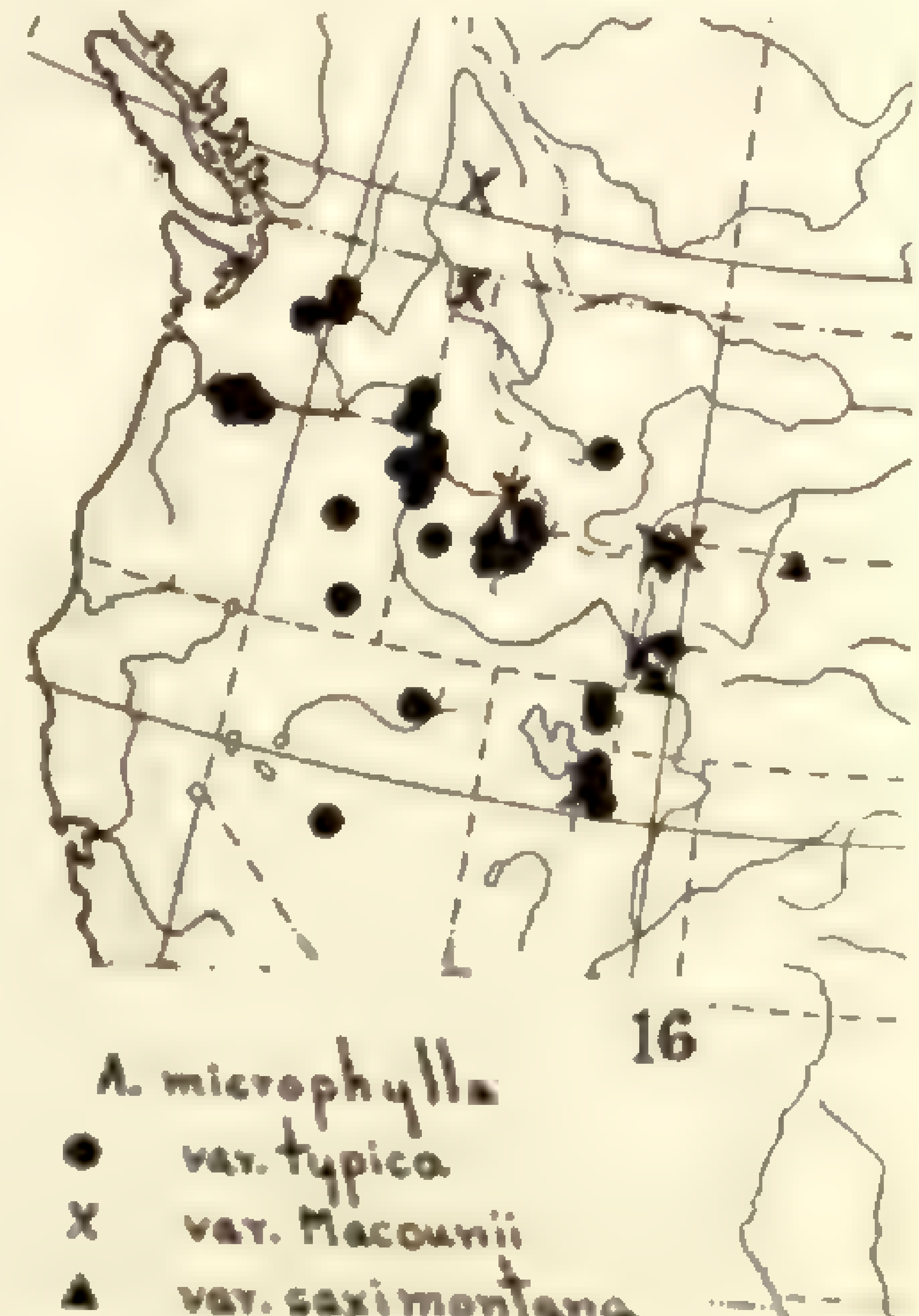
24. A. PERENNANS Watson. Perennial; stems several to numerous from a simple or branching ligneous caudex, simple or branched above, pubescent below with coarse, dendritic, usually spreading trichomes, glabrate above, 1.5–6 dm. high; caudex often elongated; basal leaves numerous, oblanceolate to broader, petiolate, dentate or rarely entire, densely pubescent with fairly coarse dendritic trichomes, 2–6 cm. long, 4–20 mm. wide; cauline leaves lanceolate, auricled and somewhat sagittate, entire or rarely sparsely dentate, 1–3 cm. long, 2–8 mm. wide, lower pubescent, upper glabrous; sepals oblong, nonsaccate, pubescent, 3.5–4.5 mm. long, 1–1.5 mm. wide; petals spatulate with a narrowed claw, purple to pinkish, 6–9 mm. long, 1.5–2.5 mm. wide; pedicels very slender, spreading and arched downward, glabrous, 1–2 cm. long; siliques widely spreading to pendulous, glabrous, curved inward, nerved at base or usually nerveless, 4–6 cm. long, 1.2–2 mm. wide; stigma sessile; seeds orbicular, winged all around, 1–1.5 mm. broad, uniseriate.—Proc. Am. Acad. **22:** 467 (1887) and in Gray, Syn. Fl. N. Am. **1:** 165 (1895); Coville in Contrib. U. S. Nat. Herb. **4:** 61 (1893); Rydberg, Fl. Rky. Mts. 360 (1918) in part; Jepson, Man. Fl. Pl. Calif. 431 (1925) and Fl. Calif. **2:** 70 (1936), excluding var. *longipes;* Tidestrom in Contrib. U. S. Nat. Herb. **25:** 244 (1925); Munz, Man. So. Calif. Bot. 204 (1935). *A. arcuata*, var. *perennans* (Watson) M. E. Jones in Proc. Calif. Acad. Sci. **5:** 621 (1895). *A. gracilenta* Greene in Pittonia **4:** 194 (1900); Rydberg, Fl. Rky. Mts. 362 (1918) in part. *A. eremophila* Greene in Pittonia **4:** 194 (1900); Coulter & Nelson, New Man. Rky. Mts. 227 (1909) in part; Rydberg, op. cit. p. 361 in part. *A. recondita* Greene in Pittonia **4:** 195 (1900). *A. angulata* Greene ex Wooton & Standley in Contrib. U. S. Nat. Herb. **16:** 123 (1913); Wooton & Standley in Contrib. U. S. Nat. Herb. **19:** 280 (1915). *A. Fendleri* sensu Wooton & Standley, ibid. in part.—Colorado and New Mexico to Nevada, California and Baja California. MAP 3. COLORADO: 2 miles west of Rifle, Garfield Co., May, 1938, *Rollins 2203* (G, R); 4 miles south of Mesa, Mesa Co., May, 1938, *Rollins 2187* (G, R); 3 miles northeast of Cedaredge, Delta Co., May, 1938, *Rollins 2148* (G, R); 10 miles south of Montrose, Montrose Co., May, 1938, *Rollins 2128* (G, R); Naturita, Montrose Co., April, 1914, *Payson 231* in part (G, RM); 10 miles northeast of Ridgeway, Ouray Co., Sept., 1937, *Rollins s.n.* (R). NEW MEXICO: Santa Fe, May, 1897, *A. A. & E. G. Heller 3562* (ND, TYPE; G, isotype of *A. gracilenta*. This number at the Missouri Botanical Garden is

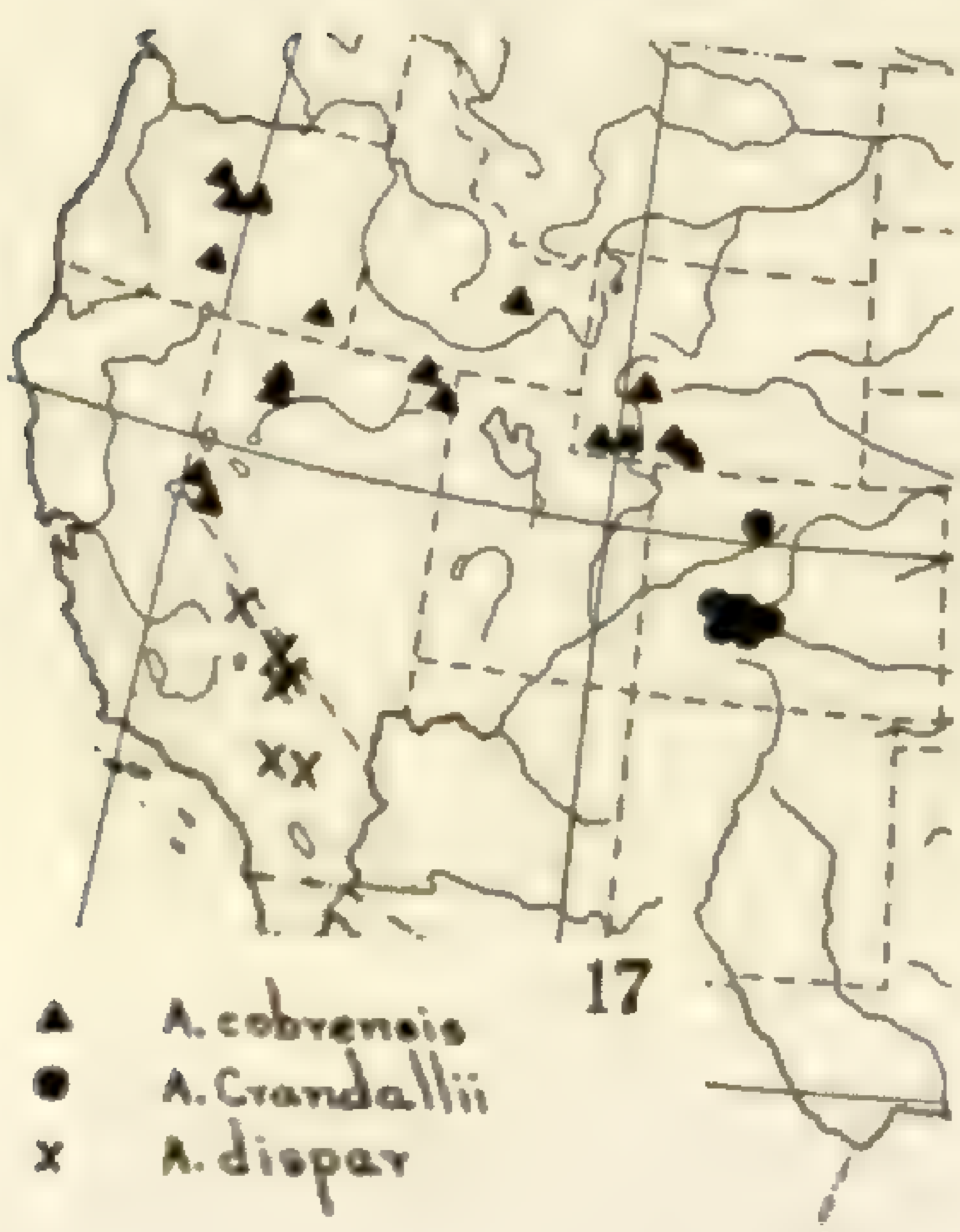












Rollins on Arabis

A. Fendleri); Mangas Springs, April, 1903, *Metcalfe 12* (US, TYPE; G, NY, isotypes of *A. angulata*); Mangas Springs, April, 1880, *Rusby 11* (M); east of Lordsburg, 1913, *M. E. Jones 25825* (P). UTAH: near Bluff, San Juan Co., April, 1936, *Maguire 15044* (G, UAC); Wah Wah Pass, west of Milford, Beaver Co., April, 1934, *Hutchings & Stahmann s.n.* (FS); Silver Reef, Washington Co., 1894, *M. E. Jones 5152* (P, RM, UC); Virgin, Washington Co., May, 1923, *C. L. Hitchcock 3027* (G); east of Hurricane, May, 1932, *Maguire & Blood 1396* (G, UAC); Zion National Park, April, 1934, *Maguire & Blood 4818* (UAC); St. George, April, 1880, *M. E. Jones 1650* (P, US). NEVADA: about 10 miles south of Austin, Lander Co., June, 1937, *Goodner & Henning 139* (NA, R); north of Nelson, Clark Co., April, 1919, *Tidestrom 8773* (G); Charleston (Spring) Mts., June, 1926, *Jaeger s.n.* (P); Deadman's Canyon, Sheep Mts., Clark Co., May, 1940, *Alexander & Kellogg 1606* (R). ARIZONA: Bright Angel Point, Grand Canyon, July, 1938, *Rollins & Chambers 2442* (G, R); south rim of the Grand Canyon, May, 1938, *A. & R. Nelson 2791* (G); Diamond Creek Canyon (probably Mohave Co.), 1893, *N. C. Wilson s.n.* (ND, TYPE of *A. recondita;* photo in Gray Herb.); Oatman-Kingman, Mohave Co., March, 1931, *Harrison & Kearney 7600* (P); Peach Springs, Mohave Co., April, 1893, *N. C. Wilson s.n.* (ND, TYPE of *A. eremophila*; photo in Gray Herb.); Mt. Ord, Apache Co., May, 1935, *Peebles & Smith 11526* (Sac); south of Safford, Graham Co., March, 1935, *Maguire et al. 10156* (R, UAC); Batatakin, Navajo Co., *Wetherill 346* (US); 1 mile south of Seneca Creek, Globe-Showlow, Gila Co., April, 1938, *Foster & Arnold 271* (G); Superstition Mts., Pinal Co., Feb., 1932, *Gillespie 8790* (G); below Coolidge Dam, Pinal Co., April, 1935, *Maguire 10441* (UAC); Sierra Estrella, Maricopa Co., March, 1935, *Peebles & Smith 10726* (G); Santa Catalina Mts., Pima Co., April, 1881, *Pringle s.n.* (G, TYPE; M, isotype), March, 1926, *Peebles, Harrison & Kearney 1435* (Sac); Tucson, Pima Co., March, 1919, *Eastwood 8120* (G). CALIFORNIA: Panamint Mts., April, 1891, *Coville & Funston 611* (G), June, 1928, *J. T. Howell 2903* (G); north slope of the San Bernardino Mts., May, 1882, *S. B. & W. F. Parish 1301* (G); near Goffs, San Bernardino Co., April, 1928, *Ferris 7263* (P); Providence Mts., May, 1920, *Munz et al. 4256* (P, Peirs, RM, UC); 4th of July Canyon, New York Mts., San Bernardino Co., May, 1940, *Alexander & Kellogg 1317* (R); Coyote Canyon, Riverside Co., April, 1902, *Hall 2869* (G); near Tahquitz Camp, east of Palm Springs, Riverside Co., April, 1919, *Peirson 660* (Peirs); Borego Valley, San Diego Co., May, 1929, *Munz & Hitchcock 11358* (P); Laguna Mts., San Diego Co., May, 1925, *Munz 9678* (P). BAJA CALIFORNIA: Tecate, May, 1925, *Munz 9591* (P); San Pedro Martir, May, 1893, *T. S. Brandegee s.n.* (G).

A. perennans is found principally in an area bordering the Colorado River drainage in the southwestern United States, but the range extends slightly in all directions. Although it has been reported from as far north as the state of Washington,[1] the species is not known from authentic material north of western Colorado. The Vasey collection (*Vasey no. 201* collected in 1889) upon which Piper based his Washington report is so nearly identical with a specimen from San Diego Co., California, made by Orcutt in 1889 that one is led to suspect them to be one and the same collection.[2] In any case, it is almost certain that the Vasey specimen did not come from Washington.

In the southern portion of its range, *A. perennans* usually has broader, more obtuse basal leaves than in the northern portion. Also, there is some variation in the degree of toothing of the basal leaves. Often the inner leaves are entire and in rare instances all the basal leaves lack any evidence of being dentate. The variation in pedicel-length is noticeable, yet all degrees between 1 and 2 cm. may be found in any sizeable collection of the species.

Several names have been proposed for variants of *A. perennans,* but in each case there are no fundamental characters by which they can be consistently separated. Of the synonyms listed, the type of *A. gracilenta* is perhaps more distinctive than any of the others because of the entire basal leaves. However, this character is not significant when a gradual transition from entire to dentate or repand basal leaves is so obvious as in *A. perennans.* The type of *A. angulata* has especially slender and long pedicels but, as in the case of the basal leaves, we are dealing with an organ which normally has a rather wide range of variation. One near relative of *A. perennans* is *A. Fendleri,* which may be distinguished by its small, nearly wingless, biseriate seeds and large acicular trichomes along the margins of the basal leaves. *A. lignifera,* a plant with a very fine, dense pubescence on the leaves and stems, short, abruptly recurved

[1] Piper in Contrib. U. S. Nat. Herb. **11**: 294 (1906).

[2] In the *Cruciferae* one other collection of this series attributed to the state of Washington (*Vasey 192* in 1889) belongs to *Caulanthus simulans* Pays., a species not known north of southern California.

pedicels and entire leaves, is also related. *A. perennans* often develops a ligneous, elongated caudex which elevates the basal leaves from the ground-surface. The plants often grow intermixed with desert shrubs from which they derive mechanical support.

25. A. GRACILIPES Greene. Perennial, usually with a single robust stem from a simple caudex; stem simple or branched above, densely hirsute below with simple or rarely forked trichomes, glabrous above, 6–9 dm. high; basal leaves oblanceolate to slightly narrower, obtuse, dentate, coarsely pubescent with forked trichomes, 4–6 cm. long, 8–15 mm. broad, cauline lanceolate with a sagittate base, 3–5 cm. long, 5–10 mm. wide, lower imbricated, pubescent and dentate, upper hardly overlapping, entire and glabrous; sepals oblong, glabrous or with a few trichomes near apex, non-saccate, 5–6 mm. long, 1.5 mm. wide; petals narrowly lingulate, pink, 8–10 mm. long, about 2 mm. wide, rounded at apex, not effectively differentiated into blade and claw; glandular tissue continuous beneath all stamens, moderately developed; pedicels very slender, glabrous, ascending but often arching downward on the outer portion, 2–4 cm. long; infructescence 3–4 dm. long; siliques pendulous, glabrous, nerved below, 4–8 cm. long, about 2 mm. wide; stigma sessile; ovules biseriate, mature seeds not seen.—Pittonia **4:** 193 (1900). *A. arcuata* (Nutt.) Gray, var. *longipes* Watson in Gray, Syn. Fl. N. Am. **1:** 164 (1895). *A. perennans* Watson, var. *longipes* (Wats.) Jepson, Fl. Calif. **2:** 70 (1936).—MAP 9. ARIZONA: Flagstaff, Coconino Co., May, 1893, *N. C. Wilson s.n.* (ND, TYPE; photo in Gray Herb.); about Mormon Lake, Coconino Co., June, 1898, *MacDougal 60* (G, US); hot, sandy canyons, Williams, Coconino Co., April, 1924, *Nelson 10244* (G, M, RM); Williams to Ashfork, Coconino Co., April, 1930, *Loomis 6928* (Sac); Fort Mohave, April, 1884, *Lemmon 4184* (G, TYPE of *A. arcuata*, var. *longipes*); rim of Pueblo Canyon, Sierra Ancha, Gila Co., May, 1931, *Harrison 7883* (Sac); near Prescott, Yavapai Co., April, 1936, *McLellan & Stitt 815* (Sac); 6 miles west of Prescott, Yavapai Co., April, 1934, *Mrs. F. M. Stone s.n.* (NY).

This species is more closely related to *A. Fendleri* than to *A. perennans,* as has been indicated by the treatments of Jepson[1] and Munz.[2] From *A. Fendleri* it may be distinguished by the numerous, large, imbricated cauline leaves, the extremely long, slender pedicels and the usually single-stemmed habit. *A. Fend-*

[1] Fl. Calif. **2:** 70 (1936).
[2] Man. So. Calif. Bot. 204 (1935).

leri, in addition to having the leaf-blades covered with trichomes similar to those of *A. gracilipes,* has the leaf-margins ciliate. In the latter species the leaf-margins are never ciliate. *A. gracilipes* has more numerous flowers and the infructescence is more elongated than that of either *A. Fendleri* or *A. perennans.*

26. A. sparsiflora Nuttall. Perennial; stems one to several from a simple or branching caudex, usually stout, simple or branched above, pubescent below with spreading or appressed trichomes (often glabrous in var. *atrorubens*) pubescent or glabrous above, (2.5–) 3–9 dm. high; basal leaves numerous, linear-oblanceolate to broader, usually acute, rarely obtuse, entire to irregularly dentate, harshly pubescent with coarse dendritic trichomes on both surfaces or the trichomes somewhat finer, 3–10 cm. long, 3–6 (–10) mm. wide; cauline leaves approximate, linear-lanceolate to broadly lanceolate, entire or the lower dentate, sagittate-auriculate, 2–8 cm. long, 3–6 (–10) mm. wide, usually obtuse, lower densely pubescent (glabrous or nearly so in var. *atrorubens*), upper pubescent or glabrous; sepals oblong, pubescent to sparsely so, 4–6 mm. long, 1.5–2 mm. wide, callose at base; petals pink to purple, spatulate (6–) 8–14 (–15) mm. long, 2–4 mm. wide; glandular tissue subtending all stamens, moderately developed; fruiting raceme elongated; pedicels divaricately ascending to spreading at right angles, often stout, pubescent with spreading or appressed trichomes or glabrous, 5–15 mm. long; siliques divaricately ascending to arcuately descending, slightly curved to strongly arcuate, glabrous, nerved below the middle, obtuse, 6–12 cm. long, 1.5–2 mm. wide; stigma sessile or nearly so; seeds orbicular, narrowly winged, uniseriate.

Key to the Varieties of A. sparsiflora

a. Pedicels hirsute with spreading trichomes or glabrous, fruiting pedicels divaricately ascending to pendulous; lower stems hirsute with spreading trichomes or rarely glabrous ....b.

b. Petals white, 6–8 mm. long; Montana to British Columbia and Yukon..............................26f. Var. *columbiana.*

b. Petals pink to purple, 8–15 mm. long; plants south of British Columbia and Montana.....................c.

c. Upper leaves and stems glabrous to very sparsely hirsute ....d.

d. Basal leaves entire, linear-oblanceolate; pedicels divaricately ascending, glabrate; stems usually branched above; Idaho and northern Utah to Oregon and northeastern California..........26a. Var. *typica.*

d. Basal leaves dentate, oblanceolate to broader; pedicels horizontal to somewhat ascending, hirsute or glabrous; stems rarely branched above...........e.

e. Pedicels horizontal, usually hirsute; siliques strongly arcuate, widely spreading, nerved; widely dis-

tributed from northern California to Washington and eastward to the Rky. Mountains. .26d. Var. *subvillosa.*
e. Pedicels ascending, glabrous; siliques only slightly arcuate, nearly nerveless; south central Washington............................26e. Var. *atrorubens.*
c. Upper leaves and stems hirsute; basal leaves linear-lanceolate, acute, coarsely pubescent; California. 26b. Var. *arcuata.*
a. Pedicels pubescent with closely appressed trichomes, fruiting pedicels usually widely pendulous; stems densely pubescent throughout with appressed trichomes; southern California to northern Baja California..........26c. Var. *californica.*

26a. Var. **typica.** Caudex often branched; stems fairly slender, simple or branched above, hirsute below, glabrate above; basal leaves long-petioled, entire; cauline leaves linear-oblong, obtuse, lower densely pubescent, upper glabrate; pedicels ascending, loosely pilose or rarely almost glabrous; siliques often only slightly arcuate but sometimes strongly so.—*A. sparsiflora* Nuttall in T. & G. Fl. N. Am. **1:** 81 (1838). *A. peramoena* Greene in Fedde, Repert. Nov. Sp. **5:** 242 (1908). *A. arcoidea* Nelson in Bot. Gaz. **53:** 220 (1912). *A. sparsiflora,* var. *peramoena* (Greene) Rollins in Res. Stud. State Coll. Wash. **4:** 25 (1936).—Idaho and northern Utah to California and Oregon. MAP 13. LOCALITY UNCERTAIN: R(ocky) Mts., *Nuttall s.n.* (Ph, isotype; photo of TYPE in Gray Herb.). IDAHO: St. Anthony, Fremont Co., May, 1919, *Quayle 19* (Cl, P, RM, US); Rexburg Butte, Madison Co., June, 1938, *Davis 308* (R); Little Lost River, Butte Co., May, 1938, *Davis 162* (R); Pocatello, Bannock Co., April, 1937, *Leiniger s.n.* (R); Picabo, Blaine Co., June, 1916, *Macbride & Payson 2979* (G, RM, US); New Plymouth, Payette Co., (formerly Canyon Co.), May, 1910, *Macbride 87* (RM, TYPE; G, M, isotypes of *A. arcoidea*). UTAH: Logan Canyon, Cache Co., May, 1932, *Maguire 3440* (UAC). NEVADA: south of Secret, base of Ruby Range, Elko Co., June, 1937, *Nichols & Lund 99* (R); summit of Slumbering Hills, Humboldt Co., June, 1937, *Train 151* (G, R); Vya Spring, Vya, Washoe Co., May, 1939, *Train 2774* (NA, R); Mt. Rose, Washoe Co., July, 1913, *Heller 10943* (G, NY); Galena Creek, Washoe Co., Aug., 1906, *Kennedy 1248* (M); 2 miles west of Reno, April, 1910, *Heller 9993* (P, UC). CALIFORNIA: near Lost Lake, Modoc Co., June, 1934, *J. T. Howell 12138* (G); Honey Lake, June, 1892, *Brandegee s.n.* (UC); Susanville, Lassen Co., June, 1897, *M. E. Jones s.n.* (P); Doyle Station, Lassen Co., May, 1911, *Eggleston 6727* (G). OREGON: Powder River, May, 1886, *Cusick 1348* (G); Forked Horn Butte, Deschutes Co., May, 1921, *Whited 22* (G, US); Camp Harney, Harney Co., May, 1885, *T. Howell 335* (G); Dry Creek, Crook Co., June, 1894, *Leiberg 340* (G, UC); Willow Creek, Malheur Co., May, 1900, *Cusick 2369* (US, TYPE; G, NY, O, RM, WSC, isotypes of *A. peramoena*); Burns, Malheur Co., June, 1912, *Peck 2703* (G, W); Beulah, Malheur Co., June, 1896, *Leiberg 2310* (G, UC, US).

26b. Var. arcuata (Nuttall) Rollins. Usually woody at base; stem pubescent throughout, lower portion hirsute with large simple or branched trichomes; basal leaves linear-oblanceolate, acute, often borne on sterile shoots, coarsely pubescent; pedicels spreading, pubescent; siliques strongly arcuate.—Res. Stud. State Coll. Wash. **4:** 26 (1936). *Streptanthus arcuatus* Nuttall in T. & G., Fl. N. Am. **1:** 77 (1838). *Arabis arcuata* (Nuttall) Gray in Proc. Am. Acad. **6:** 187 (1864); Watson in King, Geol. Expl. Fortieth Parallel **5:** 18 (1871); Brewer & Watson, Bot. Calif. **1:** 23 (1876) in part; Watson in Gray, Syn. Fl. N. Am. **1:** 164 (1895) in part; Jepson, Fl. Calif. **2:** 69 (1936) in part, not *A. arcuata* Shuttlw. (1852). *A. Holboellii*, var. *arcuata* (Nuttall) Jepson, Man. Fl. Pl. Calif. 430 (1925). *A. maxima* Greene, Pittonia **4:** 192 (1900); Munz, Man. So. Calif. Bot. 205, fig. 102 (1935) in part. *A. arcuata*, var. *rubicundula* Jepson? Fl. Calif. **2:** 69 (1936).—Map 13. California: Sierra City, Sierra Co., June, 1938, *Constance 2302* (R); near Folsom, Sacramento Co., April, 1928, *Copeland 897* (P); Yosemite Valley, June, 1911, *Abrams 4483* (P); Mather, Tuolumne Co., May, 1931, *Keck 1124* (G, M); near Tollhouse, Fresno Co., May, 1938, *Constance 2213* (R); Hobo Hot Springs, Kern Co., April, 1938, *Constance & Mason 2120* (R); Mt. Day, Santa Clara Co., April, 1938, *Heller 8935* (G); near North Fork, Madera Co., May, 1938, *Eastwood & Howell 5420* (G, R); Big Tree Canyon, Tulare Co., July, 1891, *Coville & Funston 1350* (G); San Antonio Mts., May, 1918, *Johnston 1952* (G); Santa Barbara, *Nuttall s.n.* (G, isotype); Mt. Wilson, July, 1915, *Macbride & Payson 880* (G); 5 miles west of Julian, April, 1932, *Johansen & Ewan 7159* (P).

26c. Var. **californica,** var. nov. Herba perennis; caulibus robustis pubescentibus, pilis ramosis adpressis; petalis purpureis; pedicellis pubescentibus.

Stems coarse, pubescent throughout with fine dendritic trichomes; basal leaves large, coarsely toothed, densely pubescent with moderately fine dendritic trichomes; pedicels pubescent with appressed trichomes; petals deep purple.—*A. arcuata* sensu Brewer & Watson, Bot. Calif. **1:** 23 (1876) in part; Watson in Gray, Syn. Fl. N. Am. **1:** 164 (1895) in part; Jepson, Fl. Calif. **2:** 69 (1936) in part. *A. maxima* sensu Munz, Man. So. Calif. Bot. 205 (1935) in part.—Southern California and adjacent Baja California. Map 14. California: Mt. Lowe, near Dawn Station, Los Angeles Co., May, 1918, *Peirson 62* (Peirs); San Antonio Canyon Wash between Claremont and Upland, April, 1918, *Johnston 1973* (Cl, G, UC); 18 miles from Banning, Riverside Co., May, 1924, *Munz 8136* (G); Santa Rosa Mts., Riverside Co., May, 1937, *Munz 15085* (G); Warner's Hot Springs, San Diego Co., April, 1913, *Eastwood 2821* (G); near Campo, San Diego Co., May 24, 1903, *L. R. Abrams 3563* (G, TYPE; UC, isotype). MEXICO: 9 miles southeast of Tecate, Baja California, May, 1925, *Munz 9478* (P).

26d. Var. **subvillosa** (Watson) comb. nov. Stems hirsute below with large simple or branched trichomes, glabrous above; basal leaves dentate or very rarely entire, acute, harshly pubescent; pedicels spreading at right angles to rachis, hirsute; siliques arcuate.—*A. arcuata*, var. *subvillosa* Watson in Gray, Syn. Fl. N. Am. **1:** 164 (1895). *A. sparsiflora* sensu Howell, Fl. Northw. Am. **1:** 43 (1897); Piper in Contrib. U. S. Nat. Herb. **11:** 294 (1906); Rollins in Res. Stud. State Coll. Wash. **4:** 23 (1936). *A. campyloloba* Greene, Pittonia **4:** 192 (1900). *A. elegans* Nelson in Bot. Gaz. **30:** 192 (1900). *A. perelegans* Nelson in Coulter & Nelson, New Man. Bot. Rky. Mts. 228 (1909); Rydberg, Fl. Rky. Mts. 361 (1918); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 244 (1925). *A. polytricha* Greene, Leaflets **2:** 72 (1910). *A. subserrata* Greene, Leaflets **2:** 79 (1910). *A. retrofracta* sensu Jepson, Fl. Calif. **2:** 67 (1936) in part.—Montana and Wyoming to California and Washington. MAP 14. MONTANA: Jack Creek, July, 1897, *Rydberg & Bessey 4222* (NY). WYOMING: Undine Falls, Yellowstone National Park, July, 1897, *A. & E. Nelson 5676* (G, RM), July 6, 1899, *A. & E. Nelson 6939*[1] (RM, TYPE of *A. elegans & A. perelegans*); 5 miles west of Beartooth Lake, Park Co., *Rollins & Muñoz 2856* (G, R). IDAHO: Edgemere, Bonner Co., June, 1923, *Large 54* (WSC); Albany Falls, Kootenai Co., May, 1923, *Sprague 399* (WSC); North Fork of the Salmon River, Lemhi Co., June, 1938, *Davis 428* (R); Shoup, 1919, *Kemp 60* (NY); Clearwater, *Spalding s.n.* (G); 6 miles south of Craigmont, Lewis Co., June, 1936, *Rollins 1118* (G, R); Martin, Blaine Co., July, 1916, *Macbride & Payson 3089* (G); Lake Waha, Nez Perce Co., June, 1896, *Heller & Heller 3173* (M, UC, US); near Sheep Creek, lower slopes of the Seven Devils Mts., Snake River Canyon, Idaho Co., May, 1936, *Moore 74* (G, R); Twin Springs, Elmore Co., May, 1937, *Buffat & Murdock s.n.* (G, R); Shoshone Falls, Lincoln Co., May, 1912, *Bennitt 57* (RM); Silver City, Owyhee Co., June, 1911, *Macbride 934* (RM). UTAH: 18 miles north of Vernal, Uintah Co., June, 1937, *Rollins 1760* (DS, G, R). NEVADA: San Juan Creek Canyon, Nye Co., June, 1937, *Goodner & Henning 395* (R); head of Summit Lake Creek, Humboldt Co., June, 1939, *Train 3040* (NA); Hunter Creek Canyon, Washoe Co., July, 1913, *Kennedy 3039* (G); Reno, June, 1897,

[1] No. 5680 was published as type, but the same number was cited as type of *A. densicaulis*. This number was found marked type in the Rocky Mountain Herbarium.

M. E. Jones s.n. (UAC). California: dry hills near Yreka, Siskiyou Co., May, 1908, *Butler 723* (ND, type; P, UC, isotypes of *A. polytricha*); Salmon River Canyon, Siskiyou Co., July, 1937, *Howell 13569* (G, R); Hornbrook, April, 1913, *L. E. Smith 104* (G); Igerna-Weed, June, 1905, *Heller 8083* (G); near Yreka, April & May, 1876, *Greene 695* (ND, type of *A. campyloloba;* photo in Gray Herb.); Mt. Shasta, June, 1939, *Cooke 13563* (G, R); Devils Backbone, Humboldt Co., July, 1935, *Tracy 14391* (UC); Red Clover Valley, July, 1907, *Heller & Kennedy 8713* (G). Oregon: Ice Lake Trail, Wallowa Mts., June, 1936, *Eastwood & Howell 3321* (R); head of Horse Creek, Wallowa Co., June, 1897, *Sheldon 8356* (M, RM); Pine Creek near Snake River, May, 1901, *Cusick 2518* (G, M, O, RM, UC, US); Owyhee, Mathew Divide, June, 1896, *Leiberg 2206* (G); Service Creek, Wheeler Co., May, 1925, *Henderson 5061* (G); near Lakeview, June, 1928, *Constance* (Henderson 9527) (O); Gearhart Mt., June, 1928, *Constance* (Henderson 9528) (O, WSC); Klamath Falls, Klamath Co., May, 1928, *Applegate 3506* (G, UC); rocky south slope of Siskiyou Mts., 3 miles north of Oregon-California boundary, Jackson Co., June, 1940, *Beetle & Constance 2621* (R). Washington: Bead Lakes, Pend Oreille Co., May, 1923, *Sprague 400* (WSC); Spokane, May, 1898, *Piper 2821* (G); Malden-Pine City, May, 1936, *Rollins & Constance 1093* (DS, G, R); Rock Lake, May, 1936, *Rollins & Constance 1100* (G, R, WSC); east of Coulee Dam, Grant Co., April, 1935, *Rollins 860* (G, R, RM, UC, US, WSC); Kamiak Butte, Whitman Co., June, 1936, *Constance & Clements 1800* (G, R); Pullman, Whitman Co., May 20, 1894, *Piper 1812* (G, type); above Anatone, Asotin Co., June, 1937, *Constance et al. 1875* (G, R); west of Ventura, Okanogan Co., May, 1936, *Edwards 237* (G, R); 10 miles east of Davenport, Lincoln Co., June, 1940, *Constance & Beetle 2748* (G); Ellensburg, Kittitas Co., April, 1897, *Whited 312* (US, type; WSC, isotype of *A. subserrata*); Rattlesnake Mts., Yakima Co., 1902, *Cotton 562* (G); Klickitat River, May, 1894, *Suksdorf s.n.* (G, M, WSC).

26e. Var. atrorubens (Greene) Rollins. Stems usually single, simple, glabrous to sparsely pubescent at the base; basal leaves spatulate to widely oblanceolate, irregularly dentate, thinly pubescent with dendritic trichomes; cauline leaves glabrous or the lower sparsely pubescent, somewhat dentate, the upper entire; pedicels divaricately ascending, glabrous to sparsely pilose; petals deep purple; siliques divaricately ascending to more widely spreading, nerveless.—Res. Stud. State Coll. Wash. **4:** 26 (1936). *A. atrorubens* Greene in Erythea **1:** 223 (1893); Watson in Gray, Syn. Fl. N. Am. **1:** 162 (1895); Howell, Fl. Northw. Am. **1:** 43 (1897); Piper in Contrib. U. S. Nat. Herb.

11: 294 (1906). *A. atriflora* Suksdorf in Deutsch. Bot. Monatsschr. **15:** 211 (1897.—South central Washington. MAP 13. WASHINGTON: Rattlesnake Hills, Ellensburg, Kittitas Co., May, 1932, *Thompson 8254* (G); near Virden, Kittitas Co., May, 1935, *Thompson 11469* (G, T, UW); Darling Mts., Yakima Co., June, 1899, *Flett 1137* (WSC); Yakima Indian Reservation, April, 1932, *Heidenreich 68* (WSC); high prairie near Goldendale, June, 1926, *Suksdorf 12024* (R, WSC); western Klickitat Co., May, 1892, *Suksdorf 2105* (G, UC, US, WSC, isotypes).

26f. Var. **columbiana** (Macoun) comb. nov. Stems one to several, sparsely hirsute below, glabrous above; petals white, 6–8 mm. long; pedicels hirsute with spreading trichomes; siliques arcuate.—*A. columbiana* Macoun, Cat. Canad. Pl. **2:** 304 (1890).—Montana, British Columbia and Yukon. MONTANA: Rockwall Basin, 12 miles northwest of Wilsall, Park Co., July, 1921, *Suksdorf 362* (R, WSC). BRITISH COLUMBIA: Yale, May 17, 1889, *Macoun 1677* (Can.); Fraser River Canyon, May, 1938, *J. W. & E. M. Thompson 19* (G); Vancouver Island, May 9, 1875, *Macoun s.n.* (Can). YUKON: Atlin, July, 1914, *Eastwood 638a* (G).

Arabis sparsiflora is a complex species occupying a wide geographic area and many different habitats. An attempt to organize the leading variants of the species inevitably led to the recognition of several varieties. These have been called species by some botanists, but they certainly do not parallel the other species of the genus as defined in the present work. Each variety is recognizable if carefully observed and its geographic area taken into consideration. However, there is no sharp morphological distinction which may be used as a basis for their being placed into entities of a higher order.

I have examined a photograph of the type of *A. sparsiflora* and studied an isotype at the Philadelphia Academy of Sciences. Although only the upper part (about one half) of the plants are represented in each case, the pubescence of the cauline leaves and spreading trichomes on the stem as well as the form and position of the siliques are distinctive and give clues as to their identity. These plants are matched by specimens from Idaho, Oregon and Nevada which I formerly called *A. sparsiflora*, var. *peramoena*. Thus a slight rearrangement of my former[1] interpretation of the varieties of *A. sparsiflora* is necessary. Those plants treated before as typical *A. sparsiflora* are actually var.

[1] Res. Stud. State Coll. Wash. **4:** 23–27 (1936).

subvillosa. A type for var. *subvillosa* was not designated by Watson or by Robinson who revised Watson's manuscript of *Arabis* before it was actually published in the Synoptical Flora. I have arbitrarily selected Piper's no. 1812 from Pullman, Washington, as type. The specimen answers the description of var. *subvillosa* and was undoubtedly one of those upon which the variety was based.

Variety *arcuata* and var. *californica* are very similar except for a few minor characters. The former has a very coarse, dense pubescence, and the trichomes on the pedicels and lower stems are spreading. The basal leaves are nearly linear and very often entire. In var. *californica* the pubescence is finer and appressed throughout. The basal leaves are oblanceolate to broader and usually dentate. Var. *arcuata* seems to be more or less confined to the mountains, whereas var. *californica* is usually at the base of mountain-ranges or on lower slopes nearer the desert. I have not seen the type of *A. arcuata,* var. *rubicundula* Jepson, but Heller's specimen no. 8935 from Mt. Day, its type-locality, is var. *arcuata.* Assuming the two plants to be the same, I am hesitatingly referring var. *rubicundula* to the older var. *arcuata.*

Greene in Erythea, l. c., described *A. atrorubens* attributing it to "Suksdorf in herb." Ordinarily the authorship of this epithet would be given as Suksdorf ex Greene. However, Suksdorf writing four years after the original publication disclaimed the name *atrorubens* and proposed the new *atriflora.* Since Suksdorf's action was positive, it seems wise to consider Greene as sole author of the species. With this interpretation, the specimen in Greene's Herbarium must be designated type, not the specimen at Washington State College, as I have previously indicated.

It is difficult to determine which of Macoun's specimens is the actual type of var. *columbiana.* He says the plant is "quite common on the lower slopes of the mountains bordering the Thompson and Fraser rivers from Spence's Bridge to Yale, B. C. First detected May 19, 1875". The only specimen sent from the National Herbarium of Canada answering the description of var. *columbiana* and nearly agreeing with the date of the presumed type-specimen is the one from Vancouver Island cited above. This obviously is not the type nor is Macoun's no. 1677 from Yale, B. C. The latter specimen, however, undoubtedly represents the entity Macoun had in mind, therefore I am using it temporarily as a point of reference for the variety.

27. A. Hoffmannii (Munz) Rollins. Perennial, often coarse; caudex scaly, usually invested in old leaf-bases, woody; stems one to several, branched above, glabrous or very sparsely pubescent below, 5–7 dm. high; basal leaves numerous, crowded, linear-lanceolate to slightly broader, sinuate-dentate, obtuse, glabrous or nearly so above, pubescent with dendritic trichomes below, coriaceous, 5–10 cm. long, 6–10 mm. wide, mid-rib wide and prominent; petiole widely winged to base; cauline leaves sessile, crowded, linear-oblong, obtuse, auriculate and somewhat clasping, green and glabrous above, pubescent below, 3–6 cm. long, 4–6 mm. wide; sepals oblong, obtuse, green, glabrous to very sparsely pubescent, 4–5 mm. long; petals linear-oblong, slightly narrowed toward base, white, 8–10 mm. long; fruiting raceme greatly elongated; pedicels divaricately ascending, glabrous, 1–4 cm. long; siliques divaricate, straight or usually becoming slightly arcuate, glabrous, thick and coriaceous, nerveless, obtuse, 6–10 cm. long, 2–3.5 mm. wide; style nearly obsolete or short and stout; seeds orbicular, narrowly winged, about 1 mm. broad, biseriate.—Madroño **3:** 360 (1936). *A. maxima* Greene, var. *Hoffmannii* Munz in Bull. So. Calif. Acad. Sci. **31:** 63 (1932).—Santa Cruz Island, California: without definite locality, April, 1888, *T. S. Brandegee s.n.* (UC); ledges in sea cliffs, east of Dick's Harbor, Feb., 1932, *R. Hoffmann 653* (P, type), May, 1932, *R. Hoffmann s.n.* (P).

This species is remarkable for its greatly elongated pedicels, leathery nerveless siliques and very thick basal leaves. The species is related to *A. sparsiflora*, var. *arcuata*, but seems amply distinct on the basis of a number of characters. *A. Hoffmannii*, so far as known, is completely insular.

28. A. Breweri Watson. Caespitose perennial; stems several to numerous from a much-branched, woody caudex, simple, densely hirsute below with simple or rarely forked, spreading trichomes, often glabrous above, 6–20 cm. high; basal leaves broadly spatulate, entire to remotely few-toothed, obtuse, short-petioled, pubescent on both surfaces with usually three-forked hairs, 1–3 cm. long, 4–6 mm. wide, rarely larger; cauline leaves sessile, auriculate, oblong to oblong-lanceolate, pubescent, 1–2 (–3) cm. long, 4–6 (–10) mm. wide; sepals oblong, obtuse, pubescent, often purple-margined, or -tipped, non-saccate, 4–5 mm. long, 1–2 mm. wide; petals spatulate, reddish-purple to

pink, 7–10 mm. long, 3–4 mm. wide, tapering to a very narrow claw; glandular tissue on each side of single stamens and beneath paired stamens, nearly continuous; pedicels pubescent to rarely glabrous, 3–15 mm. long; siliques divaricate, arcuate to nearly straight, 3–7 cm. long, about 2 mm. wide, 1-nerved on the lower third of the valves; stigma sessile; seeds orbicular, narrowly winged, 1 mm. or slightly broader, uniseriate.

Key to the Varieties of A. Breweri

a. Pedicels 5–15 mm. long, hirsute or rarely glabrous; siliques 4–7 cm. long. . . . b.
  b. Petals 6–9 mm. long; cauline leaves usually less than 2 cm. long; pedicels 5–9 mm. long..................28a. Var. *typica.*
  b. Petals 10–13 mm. long; cauline leaves 2–4 cm. long; pedicels 10–15 mm. long......................28b. Var. *Austinae.*
a. Pedicels 3–4 mm. long, glabrous; siliques 2–3 cm. long 28c. Var. *pecuniaria.*

28a. Var. **typica.** *A. Breweri* Watson in Proc. Am. Acad. **11:** 123 (1875); Brewer and Watson, Bot. Calif. **1:** 33 (1876); Greene, Fl. Francis. 254 (1891); Watson in Gray, Syn. Fl. N. Am. **1:** 165 (1895); Howell, Fl. Northw. Am. **1:** 44 (1897); Jepson, Man. Fl. Pl. Calif. 431 (1925) and Fl. Calif. **2:** 65 (1936); Rollins in Res. Stud. State Coll. Wash. **4:** 22 (1936). *A. epilobioides* Greene in Fedde, Rep. Nov. Spec. **5:** 242 (1908). *A. rostellata* Greene, Leaflets **2:** 71 (1910). *A. Breweri* Wats., var. *figularis* Jepson, Fl. Calif. **2:** 65 (1936).—California and southern Oregon. Map 15. California: between Big Flat and Caribou Gulch, Siskiyou Co., *J. T. Howell 13568* (G, R); near Yreka, Siskiyou Co., April, 1934, *Eastwood & Howell 1762* (G, Peirs, R); north of Cabin Creek, Trinity Co., Aug., 1935, *Tracy 14529* (R, UC); Klamath River, Siskiyou Co., May, 1910, *Butler 1379* (M, P, RM, UC, US); Plumas County, 1880, *Austin s.n.* (G); Marysville Buttes, April, 1893, *Blankinship s.n.* (G); South Butte, Sutter Co., May, 1936, *J. & N. Ewan 9648* (R); Black Butte, Colusa Co., June, 1884, *Rattan 2* (G); Mt. Sanhedrin, Lake Co., July, 1902, *Heller s.n.* (US, type; G, M, Ph, isotypes of *A. epilobioides*); Elk Ridge, Mendocino Co., 1867, *Bolander 6561* (G, UC, US); Mt. Hood, Sonoma Co., March, 1902, *Heller & Brown 5190* (G, M, P, Ph, US); Mt. Diablo, Contra Costa Co., 1860–62, *Brewer 1086* (G, type; M, UC, WSC, isotypes); April, 1938, *Constance & Morrison 2192* (R); Mt. Hamilton, Santa Clara Co., May, 1907, *Heller 8617* (G, M, Ph, US); The Pinnacles, San Benito Co., March, 1930, *Mason 5524* (R), May, 1937, *J. T. Howell 12955* (G, R); Pico Blanco, Monterey Co., May-June, 1901, *Davy 7330* (UC); Tassajara, Monterey Co., June, 1901, *Dudley s.n.* (NY, US). Oregon: near Medford, Jackson Co., April, 1934, *Thompson 10319* (G, P, RM, T, US, UW); Siskiyou Summit, Jackson Co., June, 1929, *Kildale 8314* (OS); Mt. Grayback, Josephine Co., June, 1904, *C. V. Piper 6156* (US, TYPE; G, W, isotypes of *A. rostellata*).

28b. Var. **Austinae** (Greene), comb. nov. Basal leaves entire to repand, 3–6 cm. long, 7–14 mm. broad, pubescent with large, spreading, dendritic trichomes; cauline leaves ample, 2–4 cm. long, 5–10 mm. broad, pubescent to nearly glabrous; sepals sparsely pubescent, purple, outer saccate, 5–7 mm. long; petals purple, spatulate, 10–13 mm. long, 3–4 mm. broad; pedicels 1–1.5 cm. long; siliques 5–7 cm. long, about 2 mm. broad.—*A. Austinae* Greene in Fedde, Rep. Nov. Spec. **5:** 242 (1908).—MAP 15. CALIFORNIA: Little Chico Canyon, Butte Co., March & April, 1896, *Mrs. R. M. Austin s.n.* (ND, TYPE); Little Chico Creek, March & May, 1896, *Mrs. R. M. Austin 868* (M); canyon of Chico Creek, below Ten Mile House, March, 1920, *Heller 13359* (M); rocks, Little Chico, Feb., 1897, *Mrs. C. C. Bruce 1945* (P).

28c. Var. **pecuniaria,** var. nov. Herba perennis; caulibus tenuibus 1–2 dm. altis; petalis 6–8 mm. longis; siliquis divaricatis 2–3 cm. longis, ca. 2 mm. latis; pedicellis glabris 3–4 mm. longis.—MAP 15. CALIFORNIA: rocky ledge, Dollar Lake, San Bernardino Mts., San Bernardino Co., August 24, 1922, *P. A. Munz 6238* (G, TYPE; P, Peirs, isotypes).

Plants from the northern portion of the range of *Arabis Breweri* are often taller, with straighter and more erect siliques, than those from nearer the type-station. These plants often have a perplexing mixture of the supposedly distinctive characters of both *A. Breweri* and *A. sparsiflora*, suggesting a possible hybrid origin. Plants of this sort were defined as var. *figularis* by Jepson, but I have been unable to discover characters which would consistently separate them from var. *typica*. *A. Breweri* is most closely related to *A. sparsiflora*, var. *arcuata*, with which it has many characteristics in common. For those who would consider *A. Lyallii* to be a variety of *A. Drummondi*, it would be necessary in order to be consistent, to place *A. Breweri* in a varietal category under *A. sparsiflora*.

Variety *Austinae* has larger leaves and flowers than var. *typica*, but the dimensions of the siliques and total height of the plants are similar. The very ample cauline and long basal leaves impart a distinctive growth-habit to var. *Austinae* which makes it easily recognized, even though the main points of its morphology are in agreement with the typical variety. Var. *pecuniaria* has certain traits in common with *A. Lemmoni* and may well be a remnant from a former series which linked the latter species with *A. Breweri.* Var. *pecuniaria* is isolated from typical *A. Breweri* and this isolation must have taken place very early because there is no evidence of intergrading characters between the two. That the variety should be associated with *A. Breweri,* rather than *A. Lemmoni,* there is little doubt.

29. A. Cusickii Watson. Perennial, caespitose; stems usually several, simple or rarely branched, erect to somewhat decumbent, hirsute below with large, spreading, simple trichomes, sparingly hirsute above to glabrous, 6–20 cm. high; basal leaves tufted, numerous, linear, acute, hirsute and somewhat ciliate, 1–3 cm. long, 2–3 mm. broad; cauline leaves linear to linear-lanceolate, sessile, not auriculate, 1–3 cm. long, 2–4 mm. broad; sepals oblong, hirsute, scarious-margined, non-saccate, 3.5–5 mm. long; petals spatulate, white to rose-colored, 6–10 mm. long, 2–3 mm. broad; glandular tissue weakly developed, continuous beneath all stamens; pedicels ascending, stout, glabrous to rarely sparsely hirsute, 5–15 mm. long; siliques arcuate-ascending, glabrous, nerved near the base, 4–8 cm. long, 2–3 mm. wide; stigma sessile; seeds orbicular, narrowly winged, 1–2 mm. broad, uniseriate.—In Proc. Am. Acad. **17:** 363 (1882) and in Gray, Syn. Fl. N. Am. **1:** 167 (1895); Howell, Fl. Northw. Am. **1:** 44 (1897); Piper in Contrib. U. S. Nat. Herb. **11:** 295 (1906); Piper & Beattie, Fl. Southeastern Wash. Adj. Idaho 116 (1914); Rollins in Res. Stud. State Coll. Wash. **4:** 20, fig. 6 (1936); St. John, Fl. Southeastern Wash. Adj. Idaho 164 (1937).—Idaho, Oregon and Washington. Map 8. Idaho: Salmon, Lemhi Co., June, 1920, *E. B. & L. B. Payson 1832* (Cl, G); hills near Challis, Custer Co., April, 1915, *Work 516* (FS); Garden Creek, Custer Co., April, 1915, *Work 532* (FS); Sawyer Canyon, Lewis Co., June, 1936, *Rollins 1121* (G, R); Middle Fork of Weiser River, Weiser National Forest, May, 1923, *Lommasson 158* (FS); near Joseph, Idaho Co., May, 1939, *J. H. Christ 10205* (Herb. J. H. Christ). Oregon: Union County, 1879, *Cusick 727* (G, type); 20 miles south of Ukiah, Umatilla Co., June, 1916, *Eggleston 12715* (US); near Rhea Creek, Morrow Co., May, 1894, *Leiberg 59* (G, O, UC, US); near Prairie City, Grant Co., April, 1925, *Henderson 5062* (G, M, O, US); near Maupin, May, 1928, *Thompson 4079* (T, US); Enterprise-Joseph, Wallowa Co., May, 1923, *Sherwood 20* (W). Washington: near Spangle, Spokane Co., April, 1916, *Suksdorf 8512* (G, NY, UC, US, WSC), May, 1916, *Suksdorf 8647* (G, UC, US, WSC); near Rock Lake, Whitman Co., May, 1936, *Rollins & Constance 1098, 1101, 1104* (G, R, WSC); near Pine City, Whitman Co., May, 1936, *Rollins*

& Constance 1091 (G, NY, R, WSC), May, 1898, *Piper 2828 & 2829* (G, WSC); Cleman Mt., June, 1892, *Henderson 2388* (G, UW); Ellensburg, Kittitas Co., May, 1897, *Piper 2711* (G, WSC); Johnson's Canyon, Yakima region, July, 1883, *Brandegee 624* (G, UC); Grande Ronde River, Asotin Co., May, 1922, *St. John & Brown 4198* (WSC).

This species is very distinctive and is easily separated from other members of the genus. At one point (near Pine City, Washington) in its range, there is apparently some natural crossing with *Arabis sparsiflora*, var. *subvillosa*. Piper collected specimens in the area which exhibit several-branched trichomes, hirsute pedicels and broader basal leaves than are usually found in *A. Cusickii.* These specimens are intermediate between the latter species and *A. sparsiflora*, var. *subvillosa.* Since *A. Cusickii* shows no such variations toward var. *subvillosa* in other parts of its range and since the departures from the normal toward *A. sparsiflora*, var. *subvillosa* take place in an area where both species abound, it is logical to assume that some natural hybridization has occurred. The hybrids, if indeed they are hybrids, are much closer to *A. Cusickii* than to *A. sparsiflora*, var. *subvillosa* and are provisionally placed with the former species.

Plants from the Salmon River Basin of eastern Idaho are not quite typical, in that they have but one or two stems and lack the strongly developed caudex usually found in the species. Also, the pubescence is less conspicuous, but these plants are not otherwise distinctive and seemingly do not represent a separate variety.

A MONOGRAPHIC STUDY OF ARABIS IN WESTERN NORTH AMERICA

Reed C. Rollins

(*Continued from page 411*)

30. A. Koehleri Howell. Perennial; caudex much-branched, woody, covered with peg-like leaf-bases; stems slender, simple, numerous, entirely glabrous to sparsely pubescent below, 5–30 (–40) cm. high; basal leaves numerous, linear to narrowly oblanceolate, acute, entire, stellate-pubescent, 1–2 cm. long, 2–4 mm. wide; cauline leaves sessile, lanceolate, auriculate, slightly clasping, entire, glabrous or nearly so, remote to overlapping, 1–2 cm. long; sepals oblong, often purplish, sparsely pubescent, 3.5–5 mm. long, 1.5–2 mm. wide, non-saccate; petals scarlet to deep purple, nearly oblong but with a short narrow claw, 7–10 mm. long, about 3 mm. wide; glandular tissue well developed, continuous beneath all stamens; pedicels ascending to divaricate, glabrous, 1–2 cm. long; siliques divaricately spreading, arcuate, glabrous, attenuate at apex, 5–8 cm. long, about 2 mm. wide; style short or absent; seeds orbicular, narrowly winged, about 1.5 mm. broad including wing, uniseriate.

Siliques sessile, only slightly curved; cauline leaves few, remote..30a. Var. *typica*.
Siliques shortly stipitate, strongly recurved; cauline leaves numerous, imbricated..............................30b. Var. *stipitata*.

30a. Var. **typica.** *A. Koehleri* Howell, Fl. Northw. Am. **1:** 44 (1897); Rollins in Res. Stud. State Coll. Wash. **4:** 21 (1936) in part. *A. arbuscula* Greene, Leaflets **2:** 77 (1910).—Southwestern OREGON: bluffs, Roseburg, Douglas Co., April 17, 1887, *T. Howell s. n.* (O, TYPE; G, NY, T, isotypes), April & May, 1914, *Cusick 3950* (G, R, WSC), June, 1916, *Peck 6955* (WSC), April, 1934, *Thompson 10157* (NY, T, US); Mt. Nebo, near Roseburg, May, 1924, *Ingram 1498* (FS). Eight Dollar Mt., Josephine Co., June 18, 1904, *Piper 5056* (US, TYPE; G, isotype of *A. arbuscula*).

30b. Var. **stipitata,** var. nov. Herba perennis; caulibus 1.5–4 dm. altis; foliis caulinis imbricatis auriculatis; siliquis arcuatis stipitatis 5–6 cm. longis, ca. 2 mm. latis.—Josephine County, OREGON: Camp Chicago Trail near Waldo, April 19, 1934, *Alice Eastwood & John T. Howell 1695* (G, TYPE); Redwood Highway at north fork of Illinois River, April, 1934, *Eastwood & Howell 1432* (G); Kerby, May, 1922, *Sweetser 5748* (WSC); O'Brien, April, 1934, *Thompson 10275* (M, NY, T, US, W); Eight Dollar Mt., May, 1884, *T. Howell 34* (G).

The caudex is woody, strongly developed and highly branched in *A. Koehleri*, which gives it a distinctive appearance. The caudex-branches are covered with stiff peg-like leaf-bases making them resemble naked spruce-twigs. Ordinarily, the cauline leaves are few and remote, the basal leaves linear and the sessile siliques only slightly curved. However, some of the plants from Josephine County have numerous crowded cauline leaves, broader basal leaves and rather strongly recurved, shortly stipitate siliques. The latter I have called var. *stipitata*.

A. Koehleri is perhaps most closely related to *A. Breweri*, but the pubescence of the two species is wholly unlike. *A. Koehleri* has a moderately fine, truly stellate pubescence upon the basal and lower cauline leaves and is glabrous on the upper stem and pedicels. In *A. Breweri*, the leaves are covered with forked or dendritic trichomes and the stems and pedicels are hirsute with mostly simple spreading hairs.

31. A. MICROPHYLLA Nuttall. Perennial; stems slender, several to numerous from a subterranean, branching caudex, few-flowered, simple or occasionally branched, glabrous above, somewhat hirsute with spreading simple or forked trichomes below or rarely glabrous, 1–5 (–7) dm. high; basal leaves linear to narrowly oblanceolate, entire, acute, densely pubescent with small dendritic trichomes, not pannose but appearing so to the naked eye, rarely almost glabrous, 5–20 mm. long; cauline leaves few, narrowly

lanceolate, auriculate, glabrous or the lower pubescent, 1–2 cm. long; sepals oblong, non-saccate, glabrous or rarely sparsely pubescent, green to purple-tinged, 2–3.5 mm. long; petals pale-rose to purplish, 4–6 mm. long, spatulate to cuneate; glandular tissue continuous beneath all stamens, weakly developed; pedicels slender, divaricate to more ascending, glabrous or rarely pubescent, 5–15 mm. long; siliques erect to obliquely spreading, straight to somewhat curved, narrow, blunt to slightly attenuate, glabrous, faintly nerved toward base, 2–6 cm. long, 1–1.5 mm. wide; style less than 1 mm. long or obsolete; seeds orbicular, small, narrowly winged, about 1 mm. broad, uniseriate (imperfectly biseriate in var. *saximontana*).

Key to the Varieties of A. microphylla

a. Siliques few on each stem, straight, erect to divaricate; plants usually less than 2 dm. high. . . . . *b*.
  b. Style absent or very short; pubescence fine. . . . . *c*.
    c. Siliques erect, nerveless or only faintly nerved; caudex highly branched. . . . . 31a. Var. *typica*.
    c. Siliques rigidly divaricate, nerved at base; caudex simple or branched only a few times; Wyoming and Idaho 31d. Var. *saximontana*.
  b. Style about 1 mm. long; pubescence coarser; plants of Washington. . . . . .31c. Var. *Thompsonii*.
a. Siliques numerous on each stem, slightly curved, obliquely spreading; plants usually about 3 dm. or more high. 31b. Var. *Macounii*.

31a. Var. **typica.** *A. microphylla* Nuttall ex T. & G., Fl. N. Am. **1:** 82 (1838); Watson in Gray, Syn. Fl. N. Am. **1:** 167 (1895); Howell, Fl. Northw. Am. **1:** 41 (1897); Piper in Contrib. U. S. Nat. Herb. **11:** 295 (1906); Coulter & Nelson, New Man. Bot. Rky. Mts. 227 (1909); Rydberg, Fl. Rky. Mts. 359 (1918); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 243 (1925); Rollins in Res. Stud. State Coll. Wash. **4:** 38, fig. 11 (1936). *A. tenuicula* Greene, Leaflets **2:** 82 (1910).—Montana and Wyoming to Nevada and Washington. Map 16. Locality uncertain: Rocky Mountains, *Nuttall* (photo of type in Gray Herb.). Montana: Mt. Helena, Sept. 10, 1882, *F. W. Anderson* (NY). Wyoming: Yellowstone River, near Junction Butte, Yellowstone Nat. Park, July, 1899, *A. & E. Nelson 5726* (G, M, NY, RM, US); Yellowstone Park, July, 1885, *Tweedy 554* (G, US); near Leckie, Sublette Co., June, 1901, *Merrill & Wilcox 634* (G, NY, US). Idaho: Lime Point, Nez Perce Co., May, 1926, *St. John 4374* (WSC); between Willow Cr. and Steep Cr., Idaho Co., May, 1936, *Rollins, Constance & Dillon 1106* (G, R, WSC); Granite Cr., Idaho Co., April, 1935, *Constance et al. 1014* (R, WSC); Gold Fork Lookout, Sawtooth Mts., Valley Co., July, 1937, *Thompson 13743* (G, R); near Patterson, Lemhi Co., July, 1916, *Macbride & Payson 3186* (G, M, RM, US); Bear Cr., below Parker Mt., July, 1916, *Macbride & Payson 3304* (M, RM, US); near Martin, Blaine Co., July, 1916, *Macbride & Payson 3066* (G, RM, US); Ketchum, July, 1911, *Nelson & Macbride 1193* (G, RM). UTAH: Green Canyon, Cache Co., May, 1935, *B. & C. B. Maguire 15033* (G, R, UAC), May, 1932, *Burke 3449* (G, M, UAC); Logan Canyon, Cache Co., April, 1934, *B. & R. R. Maguire 15034* (R, UAC); Farmington Canyon, Wasatch Co., May, 1903, *Stokes s.n.* (NY); Big Cottonwood Canyon, Salt Lake Co., May, 1908, *Garrett 2237* (G); Parley's Canyon, April, 1908, *Garrett 2222* (G); Thistle, Utah Co., June, 1898, *Jones 6162* (M, US). NEVADA: Thomas Falls, 34 miles west of Elko, Eureka Co., June, 1937, *Breene 481* (NA); 6 miles west of canyon mouth, South Twin River, Toiyabe Mts., July, 1938, *Rollins & Chambers 2530* (G, R). OREGON: Jim Cr., Wallowa Co., June, 1897, *Sheldon 8303* (G, NY, UC, US); mouth of the Imnaha River, Wallowa Co., March, 1935, *Constance 1000* (R, WSC); mouth of Deep Cr., Wallowa Co., May, 1936, *Rollins, Constance & Dillon 1105* (G, R, WSC); crevices of cliffs, Union Co., May, 1883, *Cusick 1124* (US, type; G, isotype of *A. tenuicula*); basaltic cliffs near Union, June, 1909, *Cusick 3340* (R, US, WSC); above Alvord, Steens Mts., June, 1927, *Henderson 8409* (O); head of Willow Cr., Steens Peak, June, 1936, *Peck 19047* (R); Canyon City, Grant Co., July, 1921, *Peck 10164* (W); Rowena, Wasco Co., April, 1902, *Sheldon S. 10168* (G, O, NY, US, WSC); Mitchell Point, Hood River Co., April, 1920, *Suksdorf 2202* (WSC). WASHINGTON: east of Bishop, Whitman Co., May, 1936, *Rollins & Constance 1090* (G, R, WSC); Table Rock, Columbia Co., July, 1935, *Constance et al. 1274* (R, WSC); Williams Ridge, Columbia Co., July, 1913, *Darlington 123* (WSC); Lime Point, Asotin Co., April, 1928, *St. John 9292 & 9293* (WSC); Angell's Pass, Okanogan Co., July, 1931, *Fiker 260* (T); near Entiat, Chelan Co., April, 1931, *Thompson 6377* (G, OS, T, UW); base of Three Brothers Peak, Chelan Co., June, 1934, *Thompson 10530* (G, NY, RM, T, UW); Bingen, Klickitat Co., April 28, 1881, *Suksdorf 11695* (WSC), March, 1886, *Suksdorf 14* (G, R, WSC); White Salmon, March, 1886, *Suksdorf s. n.* (G); Prindle, Skamania Co., May, 1924, *Suksdorf 11695* (WSC).

31b. Var. **Macounii** (Watson), comb. nov. Stems numerous, 2.5–5 (–7) dm. high; basal leaves denticulate to entire; pedicels obliquely spreading, slender; siliques numerous on each stem, slightly curved to arcuate, widely spreading.—*A. Macounii* Watson in Proc. Am. Acad. **26:** 124 (1891) and in Gray, Syn. Fl. N. Am. **1:** 163 (1895); Rydb., Fl. Rky. Mts. 360 (1918). *A. densicaulis* A. Nelson in Bot. Gaz. **30:** 190 (1900); Rydb., Fl. Rky. Mts. 362 (1918).—Montana to Utah, Idaho and British

Columbia. MAP 16. MONTANA: without locality, *F. Tweedy* (US). WYOMING: Undine Falls, Yellowstone Park, July, 1899, *A. & E. Nelson 5680*[1] (RM, TYPE; G, isotype of *A. densicaulis*); 5 miles west of Beartooth Lake, Beartooth Mts., Park Co., July, 1939, *Rollins & Muñoz 2857* (G, R); east of Afton, Lincoln Co., July, 1923, *Payson & Armstrong 3370* (RM). IDAHO: upper Priest River, June, 1925, *Epling 7255* in part (UCLA); Rapid River, Custer Co., Aug., 1916, *Macbride & Payson 3608* (G, M, NY, RM, UC, US); Wild Horse Creek, Custer Co., July, 1939, *Davis 1205* (R); near Stanley Lake, July, 1937, *Thompson 14034* (G). UTAH: Mill Creek Canyon, Salt Lake Co., June, 1905, *Garrett 1201* (G, NY, RM); Fort Douglas, July, 1918, *J. F. Brenkle s.n.* (G). BRITISH COLUMBIA: Revelstoke, May 13, 1890, *John Macoun s.n.* (G, TYPE; M, US, isotypes).

31c. Var. **Thompsonii,** var. nov. Herba multicaulis; caulibus erectis ca. 1 dm. altis; siliquis acuminatis; stylis ca. 1 mm. longis.—WASHINGTON: alpine meadows of Table Mt., Kittitas Co., July 3, 1933, *J. W. Thompson 9266* (G, TYPE; NY, T, US, isotypes).

31d. Var. **saximontana,** var. nov. Herba paucicaulis; pilis minutis ramosis; caulibus 1–2 dm. altis; siliquis divaricatis obtusis; seminibus biseriatis vel uniseriatis.—Wyoming and Idaho. MAP 16. WYOMING: granitic hillsides, Porcupine Creek, near Medicine Mt., Big Horn Mts., Big Horn Co., July 6, 1936, *L. O. & R. Williams 3264* (G, TYPE; R, isotype); Piney Mt., 25 miles west of Big Piney, *E. B. & L. B. Payson 2670* (RM). IDAHO: Challis Creek, Custer Co., July, 1916, *Macbride & Payson 3319* (G, RM); Railroad Ridge, Custer Co., July, 1938, *Davis 603* (R).

Arabis microphylla is not as variable as some species of the genus and is usually readily recognized, but there are occasional specimens which show tendencies toward other species. Some collections from the Wasatch Mountains of Utah, for example, often possess the broader basal leaves of *A. Lyallii* and, unless mature fruits are present, they are difficult to place. Another instance is that of the alpine *A. nubigena* of Macbride & Payson, which I formerly treated as a variety of *A. microphylla*. The study of more material has now led me to associate this entity with *A. Lyallii*, but in many respects it is intermediate between the two species.

The stems of *A. microphylla* are slender and may be long and flexuose or short and rather rigid, depending largely upon the habitat in which the plants are growing. Ordinarily the species

[1] This same number was cited as the type of *A. elegans*, see Bot. Gaz. **33**: 190 & 193 (1900).

may be found in crevices of basaltic rocks or on steep slopes in the vicinity of basaltic outcrops. *A. microphylla* follows rather closely the old Columbia River drainage and whenever it is found outside this drainage-area, marked minor differences are usually found. Thus, var. *saximontana* is partly outside the Columbia River drainage and is not associated with basaltic rocks; and var. *Macounii* is not wholly within this area. *A. microphylla* occurs most frequently in the Upper Sonoran Life Zone but penetrates well into the Canadian Life Zone at various points in its range.

Var. *Macounii* culminates a tendency toward numerous, curved, almost obliquely spreading siliques which is evident in plants from scattered stations in the range of var. *typica*. It does not have a markedly distinct geographic area which is separate at all points from that of var. *typica* but, in spite of this, it is a fairly well-marked entity on morphological grounds alone. The type of *A. densicaulis* is very similar to that of var. *Macounii* and it is evident that they should be included in a single category. It is with some hesitation that the plants here named var. *saximontana* are associated with *A. microphylla*. There is some evidence indicating that they represent a separate species, but a more thorough knowledge of their biology is needed to prove the point. The distinctive characters are the simple caudex, divaricate siliques and elliptical, imperfectly biseriate seeds. Var. *Thompsonii* has a coarser pubescence upon the basal leaves than is found in var. *typica*, and the acuminate siliques have a definite style which approximates a millimeter in length. Otherwise, it is very much like typical *A. microphylla*.

32. A. **Fernaldiana,** sp. nov. (p. 361, FIG. 3). Herba perennis caespitosa; caulibus erectis vel basi decumbentibus inferne pubescentibus superne glabris vel pubescentibus 1.5–4 dm. altis; foliis radicalibus canescentibus integris spathulatis vel oblanceolatis petiolatis 1–4 cm. longis, 2–5 mm. latis; caulinis sessilibus auriculatis oblongis vel lanceolatis acutis 1–2 cm. longis, 2–3 mm. latis; sepalis oblongis pubescentibus 3–6 mm. longis, 1–1.5 mm. latis; petalis roseis spathulatis vel cuneatis 10–14 (5–7) mm. longis, 2.5–4 (2–3) mm. latis; pedicellis divaricatis glabris vel pubescentibus 5–10 mm. longis; siliquis erectis acuminatis glabris substipitatis 4–6 cm. longis, 1.5–2 mm. latis; stylis ca. 1 mm. longis; seminibus oblongis anguste alatis vel exalatis uniseriatis.

Perennial, caespitose; pubescence of fine dendritic trichomes; stems several to numerous from a branching caudex, erect to somewhat decumbent at base, densely pubescent below with a mixture of very fine and large trichomes or the large ones absent, pubescent or glabrous above, 1.5–4 dm. high; basal leaves numerous, entire, often clustered in sterile soboles, spatulate to oblanceolate, narrowly petiolate, densely pubescent with minute trichomes, canescent, 1–4 cm. long, 2–5 mm. wide, petioles usually ciliate with long simple or forking trichomes; cauline leaves sessile, auriculate, oblong to lanceolate, acute, densely pubescent or the upper glabrous, 1–2 cm. long, 2–3 mm. wide; inflorescence racemose, greatly elongating in fruit; sepals oblong, scarious-margined, pubescent, 3–6 mm. long, 1–1.5 mm. wide; petals pink, spatulate to cuneate, not differentiated into blade and claw, 10–14 mm. long, 2.5–4 mm. wide (5–7 mm. long, 2–3 mm. wide in var. *stylosa*); glandular tissue poorly developed, nearly surrounding single stamens, merely subtending paired stamens; filaments of paired stamens free or very rarely united; pedicels divaricate, glabrous or pubescent, 5–10 mm. long; siliques erect, acuminate, glabrous, nerveless, 4–6 cm. long, 1.5–2 mm. wide, substipitate, straight or nearly so; style about 1 mm. long; seeds oblong, narrowly winged or wingless, uniseriate, cotyledons accumbent.

Petals 10–14 mm. long; upper stems and the pedicels glabrous; basal leaves 2–4 cm. long............................Var. *typica*.
Petals 5–7 mm. long; upper stems and the pedicels pubescent; basal leaves 1–2 cm. long............................Var. *stylosa*.

Var. **typica.** NEVADA: among rocks and around sagebrush, eastern slope of Toiyabe Dome, Toiyabe Mts., Nye Co., July 13, 1938, *Rollins & Chambers 2520* (G, TYPE; R, isotype); Sheep Camp Meadows, 1 mile north of Road Forks Pass, Delano Mts., eastern Elko Co., May, 1940, *Train 3706* (G, NA, R).

Var. **stylosa** (Watson), comb. nov. Perennial; stems 1–3 dm. high; basal leaves 1–2 cm. long, 2–3 mm. wide; pedicels pubescent; sepals pubescent; petals 5–7 mm. long.—*A. canescens*, var. *stylosa* Watson, Bot. Calif. **2:** 431 (1880).—NEVADA: granitic soil near rocks, between Lamoille Creek and Verdi Peak, Ruby Mts., about 13 miles southeast of Lamoille, Elko Co., July, 1938, *Rollins & Chambers 2570* (G, R); Sherman Ridge, south end of Ruby Range, Aug., 1939, *Hitchcock & Martin 5642 & 5643* (G); E. Humboldt Mts., Aug., 1868, *Watson 70* (G, TYPE; NY, isotype).

This species, named in honor of Professor M. L. FERNALD, is nearest related to *Arabis Crandallii* and *A. microphylla*. From *A. Crandallii*, with which it agrees in pubescence, typical *A.*

Fernaldiana is distinguished by its much broader, substipitate, attenuate instead of sessile, blunt siliques; larger flowers, glabrous upper stems and pedicels, and conspicuous style. In *A. Crandallii* the sepals and petals are only about half the length of those in typical *A. Fernaldiana* and the styles are very short or obsolete. The flower-size and pubescence-distribution of *A. Fernaldiana,* var. *stylosa* are about the same as in *A. Crandallii,* but the siliques, seeds and general habit are in accord with *A. Fernaldiana,* var. *typica.*

A. Fernaldiana (both var. *typica* and var. *stylosa*) has a very fine hoary pubescence covering its basal leaves and the lower stems are appressed-pubescent with many-branched trichomes. In *A. microphylla,* the basal leaves are not hoary, the pubescence is coarser and the lower stems are hirsute with simple trichomes or rarely glabrous. The flowers are smaller and the pedicels longer in *A. microphylla* than in *A. Fernaldiana.* Unfortunately, *A. Fernaldiana,* var. *typica* is known from only two collections and var. *stylosa* from only a few. Obviously a larger series is necessary before the relationship of this species to others in the genus can be accurately established. The type of var. *typica* was collected from plants growing abundantly near the upper limit of sagebrush on the eastern slope of the Toiyabe Mountains of central Nevada. Var. *stylosa* has been found only in the Ruby Range and adjacent East Humboldt Range of the same state.

Two specimens were cited by Watson with his original diagnosis of var. *stylosa,* "Plumas County (Mrs. Austin), and East Humboldt Mountains, Nevada, Watson, n. 70". Mrs. Austin's specimen belongs to *A. Lemmoni,* hence I have designated Watson's plant as type of var. *stylosa.* Thus restricted, it is possible to keep Watson's name going, but I do not feel justified in making it the species-name.

33. A. Crandallii Robinson. Perennial; pubescence composed of minute dendritic trichomes; stems numerous from a branching, subterranean caudex, slender, erect to slightly decumbent at base, simple or rarely branched, densely pubescent or sparsely so above, 1.5–4 dm. high; basal leaves numerous, entire to obscurely dentate, oblanceolate to somewhat spatulate, usually acute, petiolate, densely pubescent, canescent, 1.5–3 cm. long, 2–4 mm. wide; cauline leaves sessile, entire, auriculate or

the auricles rarely almost obsolete, densely pubescent, canescent, oblong to lanceolate, 8–15 mm. long, 2–4 mm. wide; inflorescence racemose, elongating in fruit; sepals oblong, pubescent, scarious-margined, 3–4 mm. long, about 1.5 mm. wide, neither pair saccate; petals white to pinkish, nearly spatulate, not differentiated into blade and claw, 5–7 mm. long, 2–3 mm. wide; nectar-glands poorly developed, merely subtending all filaments; pedicels slender, erect or slightly spreading, pubescent, 5–10 mm. long; siliques erect, slender, constricted between seeds, glabrous, nerveless or faintly nerved below, obtuse, 3–6 cm. long, about 1 mm. wide; style very short or absent; seeds orbicular to slightly oblong, less than 1 mm. broad, wingless to very narrowly winged, uniseriate.—Bot. Gaz. **28:** 135 (1899); Coulter & Nelson, New Man. Bot. Rky. Mts. 227 (1909); Rydberg, Fl. Rky. Mts. 359 (1918). *A. stenoloba* Greene, Pl. Baker. **3:** 8 (1901).—Map 17.

Colorado: Gore Canyon, Grand Co., *Osterhout 3502* (NY, RM); 3 miles north of Sargents, Gunnison Co., *Rollins 2084* (G, R); 5 miles east of Parlin, Gunnison Co., *Rollins 2091* (G, R); 6 miles east of Gunnison, *Rollins 2093* (G, R); 12 miles south of Iola, Gunnison Co., *Rollins 2019* (G, R); 1 mile east of Sapinero, *Rollins 2111* (G, R); below Sargents, Saguache Co., *Osterhout 6919* (M); Cimarron, May 18, 1898, *Crandall 6* (G, type; NY, isotype), June 6, 1901, *C. F. Baker 21* (ND, type; G, M, NY, RM, US, isotypes of *A. stenoloba*).

Arabis Crandallii is canescent with a very fine pubescence on the stem and foliage and is distinctive because of its very narrow, moniliform siliques. Its relatives are *A. Fernaldiana* and *A. Selbyi*. *A. Fernaldiana* is well isolated geographically, but the range of *A. Selbyi* is adjacent to that of *A. Crandallii* on the west and north. *A. Selbyi* differs from *A. Crandallii* in having broader, spreading instead of erect siliques, larger obovate to oblanceolate basal leaves and definitely winged, instead of wingless, seeds. Probably the nearest relative of *A. Crandallii* is *A. Fernaldiana*, but this relationship has been discussed under that species. *A. stenoloba* is in no way different from *A. Crandallii*. It was founded on plants collected from the type locality of *A. Crandallii* and may have been published without knowledge of the latter species which was described only two years earlier. *A. Crandallii* is very abundant on rocky hillsides and open sagebrush slopes in the Gunnison Basin of west central Colorado. It appears to be confined to the Transition Life Zone and is usually found in granitic soils. Osterhout's collection from

Grand County is from some distance north of the Gunnison Basin, but it is typical in every way. Doubtless intermediate stations will be found when the area is more thoroughly known botanically.

34. A. **Gunnisoniana,** sp. nov. (page 390, FIG. 3). Herba perennis caespitosa multicaulis; caulibus tenuibus simplicibus inferne pubescentibus superne glabratis 1–2 dm. altis; foliis radicalibus lineari-oblanceolatis acutis integris vel sparse dentatis pubescentibus 1–2 cm. longis, 2–4 mm. latis; foliis caulinis remotis oblongis acutis 5–8 mm. longis, ca. 2 mm. latis; sepalis pubescentibus oblongis 2–3 mm. longis, ca. 1 mm. latis; petalis roseis spathulatis 4–6 mm. longis, ca. 2 mm. latis; pedicellis gracilibus divaricatis pubescentibus vel glabris 5–8 mm. longis; siliquis glabris patentibus acutis inferne 1-nervatis 2.5–4 cm. longis, 1–1.5 mm. latis; stigmatibus sessilibus; seminibus orbicularibus alatis ca. 1 mm. latis uniseriatis.

Caespitose perennial; stems slender, numerous from a closely branching or simple caudex, densely pubescent below, glabrate above, simple, 1–2 dm. high; basal leaves numerous, linear-oblanceolate, acute, entire or rarely few-toothed 1–2 cm. long, 2–4 mm. wide, densely pubescent with medium-sized dendritic trichomes; cauline leaves few, remote, pubescent or the upper glabrate, oblong, acute, 5–8 mm. long, about 2 mm. wide, auriculate but the auricle small; sepals oblong, 2–3 mm. long, about 1 mm. wide; petals spatulate, pink to purplish, 4–6 mm. long, about 2 mm. wide; glandular tissue weakly developed, in a continuous mold under all stamens; pedicels widely spreading at right angles to rachis, straight to slightly curved downward, pubescent or rarely completely glabrous, slender, 5–8 mm. long; siliques glabrous, spreading at right angles to stem or slightly descending, straight to slightly curved, acute, nerved nearly to the middle, 2.5–4 cm. long, 1–1.5 mm. wide; stigma sessile; seeds orbicular, narrowly winged, about 1 mm. broad, uniseriate.—Colorado: Gunnison Co.: barren rocky knoll near Saguache Creek, 6 miles east of Gunnison, May 21, 1938, *Rollins 2090* (G, TYPE; R, isotype); 4 miles east of Gunnison, May, 1938, *Rollins 2096* (G, R); 4 miles south of Tomichi Creek, about 10 miles southeast of Gunnison, Sept., 1937, *Rollins 2014* (G, R); 1 mile east of Sapinero, May, 1938, *Rollins 2114* (G).

While botanizing in the Gunnison Basin in the fall season of 1937, I discovered the basal leaves and old stems of an *Arabis* which was unfamiliar to me. Returning to the same locality the following spring, I found abundant material of the plant described above. *A. Gunnisoniana* is probably most closely

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FIG. 1. A. CRANDALLII drawn from *Rollins 2091*; FIG. 2. A. LIGNIFERA drawn from *Rollins 2274*. Both figures about one-half natural size.

related to *A. Selbyi,* from which it differs in its smaller stature, smaller leaves, more numerous slender stems and narrower siliques. In habit our plant more closely resembles *A. demissa.* However, the pubescence and seeds of *A. demissa* and *A. Gunnisoniana* are entirely different. The species is named for J. W. Gunnison whose name designates the area in which it is abundant.

35. A. Selbyi Rydberg. Perennial; stems several to numerous from a simple or usually much branched caudex, usually branched above, erect or ascending, often decumbent at base, slender to fairly stout, pubescent below with dendritic or rarely forked trichomes, usually glabrous above, 2.5–5 dm. high; basal leaves numerous, oblanceolate to broadly spatulate, obtuse to nearly acute, entire or dentate, densely to sparsely pubescent with fine dendritic trichomes, grayish, 3–7 cm. long, 6–20 mm. wide; cauline leaves few, sessile, remote, linear-oblong to lanceolate, entire, auriculate, 2–5 mm. wide, 1–3 (–4) cm. long, lower pubescent, upper glabrous; sepals oblong, non-saccate, 3–4 mm. long, 1.5–2 mm. wide, pubescent; petals pink, spatulate to narrower, 6–8 mm. long, 1.5–2.5 mm. wide; glandular tissue poorly developed, continuous beneath all stamens; fruiting pedicels divaricately ascending or spreading at right angles to rachis, glabrous to sparsely pubescent, straight or nearly so, 5–12 mm. long; siliques slightly curved to straight, rarely nearly arcuate, divaricately ascending to spreading at right angles, glabrous, 3–6 cm. long, 1.5–2 mm. wide; valves faintly nerved at base to nerveless, often somewhat constricted between seeds; stigma sessile; seeds orbicular, narrowly winged, 1–1.5 mm. broad, uniseriate.—Bull. Torr. Bot. Club **31:** 557 (1904); Coulter & Nelson, New Man. Rky. Mts. 229 (1909); Rydberg, Fl. Rky. Mts. 361 (1918).—Western Colorado to Utah and northwestern New Mexico. Map 15. Colorado: 5 miles west of Walden, Jackson Co., Aug., 1937, *Beetle 2350* (R)?, only basal leaves and old stalks present; State Bridge, Eagle Co., May, 1910, *Osterhout 4215* (NY); Glenwood Springs, Garfield Co., June, 1902, *Osterhout 2576* (RM); 10 miles north of Mesa, Mesa Co., May, 1938, *Rollins 2191* (G, R); 8 miles west of Grand Junction, Mesa Co., May, 1938, *Rollins 2160 & 2170* (G, R); Grand Junction, June, 1915, *Macbride & Payson 714* (RM); tributary of Little Dolores River, 7 miles west of Glade Park, Mesa Co., Aug., 1937, *Rollins 1898* (R); 1 mile south of Gateway, Mesa Co., Aug., 1937, *Rollins 1910* (R); Paonia, Delta Co., May, 1911, *Osterhout 4513* (NY); 6 miles east of Montrose, Montrose Co., May, 1938, *Rollins 2122* (G, R); near Bostwick Park, Montrose Co., Aug., 1937, *Rollins 1984* (R); west of Ouray, Ouray Co., Sept. 9, 1901, *Underwood*

& Selby 207 (NY, TYPE); 10 miles northeast of Ridgeway, Ouray Co., Sept., 1937, *Rollins s.n.* (R). NEW MEXICO: Aztec, May, 1899, *Baker 343* (G). UTAH: 10 miles north of Vernal, Uintah Co., June, 1937, *Rollins 1753a* (DS, G); La Sal Mts., June, 1914, *M. E. Jones s.n.* (P); Red Canyon, near Bryce Canyon, Garfield Co., June, 1933, *Eastwood & Howell 667* (G).

The type of *A. Selbyi* is a slightly aberrant specimen when compared with plants from the type-locality placed in this species. The stems of the type are unusually elongated, as is the infructescence, and the pedicels diverge from the rachis at right angles, instead of being divaricately ascending as is usually the case. These peculiarities may be due to the fact that the type is a post-season plant, collected in September, instead of May or June, or perhaps it came from an unusual habitat. In August and September of 1937 and again in late May, 1938, I searched the general area where the type of *A. Selbyi* was collected, but no plants which exactly duplicate it were found. In the fall of 1937 basal leaves and old fruiting stalks were found at several stations, but these are like the plants collected in the spring of the following year. Further exploration of western Colorado may show that the type of *A. Selbyi* really represents a natural entity. If such is proved to be the case, then all the collections cited above, except the type, should be placed in a separate variety.

A. Selbyi is very closely related to *A. lignifera*. The differences between the two are pointed out in a discussion under the latter species. Obviously, the entire range of *A. Selbyi* is not known, and one cannot be certain that these two closely related plants will be kept as separate species if an intergrading series of forms is discovered. At present it seems best to treat them as distinct species.

36. A. LIGNIFERA A. Nelson. Perennial; stems one or usually few from a simple or branched caudex, erect, simple or usually branched above, densely pubescent below with appressed minute stellate trichomes, glabrous above, 2–5 dm. high; basal leaves linear-oblanceolate, acute to obtuse, entire, densely pubescent with minute dendritic trichomes, petiolate, 2–5 cm. long, 3–8 mm. wide; cauline leaves oblong, auriculate, entire, remote to subremote, 1–3 cm. long, 2–5 mm. wide, lower densely pubescent, upper sparsely pubescent to glabrous; inflorescence loosely racemose; sepals oblong, pubescent, purplish, 3–4.5 mm. long,

about 1.5 mm. wide, non-saccate; petals pink to purplish, spatulate to lingulate, 5–8 mm. long, 1.5–2 mm. wide; glandular tissue weakly developed, continuous beneath all stamens; fruiting pedicels sparsely pubescent to glabrous, arched downward, 5–12 mm. long; fruiting raceme lax; siliques laxly pendulous, not crowded, curved inward or rarely almost straight, glabrous or very rarely sparsely pubescent, 3–6 cm. long, 1.5–2 mm. wide, valves one-nerved to the middle or above; style very short or obsolete; seeds orbicular to slightly oblong, narrowly winged, 1–1.2 mm. broad, uniseriate to imperfectly biseriate, cotyledons accumbent.—Bull. Torr. Bot. Club **24:** 123 (1899); Coulter & Nelson, New Man. Bot. Rky. Mts. 229 (1909); Rydberg, Fl. Rky. Mts. 362 (1918); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 245 (1925).—Wyoming and Idaho to Arizona and Nevada. Map 2. Wyoming: 20 miles north of Baggs, Carbon Co., May, 1938, *Rollins 2211* (G, R); Green River, Sweetwater Co., June, 1898, *Nelson 4711* (RM, type; G, M, isotypes); 2 miles southeast of Green River, June, 1938, *Rollins 2246* (G, R); rocky hillside, near Lyman, Uinta Co., June, 1937, *Rollins 1614* (DS, G, R), June, 1938, *Rollins 2308* (G, R); 3 miles south of Lonetree, June, 1938, *Rollins 2304* (G, R); Flat Iron Butte, west of Cumberland, Lincoln Co., June, 1938, *Rollins 2359* (G, R). Colorado: Naturita, Montrose Co., April, 1914, *Payson 231* in part (G, M); 10 miles south of Montrose, Montrose Co., May, 1938, *Rollins 2129* (G, R); near Meeker, Rio Blanco Co., May, 1938, *Rollins 2222* (G, R); Disappointment Ranger Station, Dolores Co., May, 1914, *Wilson 711* (FS). Nevada: 7 miles northwest of Ragsdale Springs, White Pine Co., May, 1937, *Moore & Franklin 165* (R); 15 miles west of McGill, White Pine Co., May, 1937, *Moore & Franklin 229* (R); near South Twin Creek, eastern base of Toiyabe Dome, Nye Co., July, 1938, *Rollins & Chambers 2519* (G); 20 miles east of Battle Mt., June, 1933, *Eastwood & Howell 178* (G); Empire City, June, 1882, *Jones 3763* (P). Idaho: Beaver Canyon, June, 1895, *Shear 3064* (M); Shoupe, Lemhi Co., June, 1938, *Davis 417* (UIP); Big Creek, Butte Co., May, 1938, *Davis 182* (UIP). Utah: Gold Hill, Tooele Co., June, 1917, *M. E. Jones s.n.* (P); Deep Creek, Tooele Co., June, 1891, *M. E. Jones s.n.* (P); Clifton, Tooele Co., May, 1917, *M. E. Jones s.n.* (P); Alta, Salt Lake Co., July, 1910, *M. E. Jones s.n.* (P); Stansbury Island, Great Salt Lake, June, 1869, *Watson 76* (G); 15 miles southeast of Manila, Daggett Co., June, 1938, *Rollins 2274* (G, R); 10 miles north of Vernal, Uintah Co., June, 1937, *Rollins 1753* (G, R); Mammoth, Juab Co., May, 1910, *M. E. Jones s.n.* (P); Scofield, Carbon Co., June, 1904, *M. E. Jones s.n.* (P); Cedar City, Iron Co., May, 1894, *Jones 5204ad* (P). Arizona: 12 miles east of

Keams Canyon, Navajo Co., June, 1937, *Peebles & Smith 13438* (G, Sac).

Arabis lignifera is closely related to *A. Selbyi* and *A. Holboellii*, var. *retrofracta*. From the latter, it is distinguished by having loosely pendulous and curved, instead of strictly reflexed, straight siliques. Also, *A. lignifera* has smaller, more remote cauline leaves and smaller flowers than *A. Holboellii*, var. *retrofracta*. In general appearance, *A. lignifera* resembles *A. Selbyi* more than any other, but the two species differ in a number of technical points and apparently occupy separate geographical areas. The pedicels and siliques are divaricate to ascending and nearly straight in *A. Selbyi*, whereas in *A. lignifera* the pedicels arch downward with the pendulous siliques curved inward. The basal leaves of *A. Selbyi* are broadly oblanceolate to obovate and often repand or dentate, while in *A. lignifera* they are linear-oblanceolate and entire. The valves of the siliques in *A. lignifera* are strongly nerved to the middle or above, but in *A. Selbyi* the valves are plain or very faintly nerved at the extreme base. *A. lignifera* occurs in the upper Sonoran Life Zone and is usually associated with sagebrush, juniper or similar desert plants.

37. A. Holboellii Hornem. Biennial or perennial; stems one to several from a simple or branching caudex, simple or branched above, erect, pubescent throughout with appressed or spreading trichomes to glabrous above, 1–9 dm. high; basal leaves linear-oblanceolate to broadly spatulate, entire to somewhat dentate, densely pubescent with fine to coarse dendritic trichomes, often pannose, acute to obtuse, 1–5 cm. long, 1.5–6 (–8) mm. broad; cauline leaves auriculate and clasping to non-auriculate, with a narrowed base, entire, oblong to lanceolate, 1–4 cm. long, 1.5–6 mm. wide, lower densely pubescent, upper pubescent to glabrous; inflorescence loosely racemose; sepals oblong, scarious-margined, pubescent or glabrous, 2–4 (–5) mm. long, 1–2 mm. wide; petals spatulate with a narrow claw, purplish pink to whitish, (5–) 6–10 mm. long, 2–3.5 mm. wide; fruiting pedicels straight to somewhat curved, often geniculate, strictly reflexed to loosely descending, pubescent or glabrous, slender, 6–16 mm. long; siliques glabrous (sometimes pubescent in var. *retrofracta*), straight to slightly curved, strictly reflexed to loosely pendulous, nerved below or to slightly above middle, obtuse to acute, 3–7 cm. long, 1–2.5 mm. wide; seeds orbicular, narrowly winged all around, about 1 mm. broad, uniseriate or imperfectly biseriate.

KEY TO THE VARIETIES OF A. HOLBOELLII

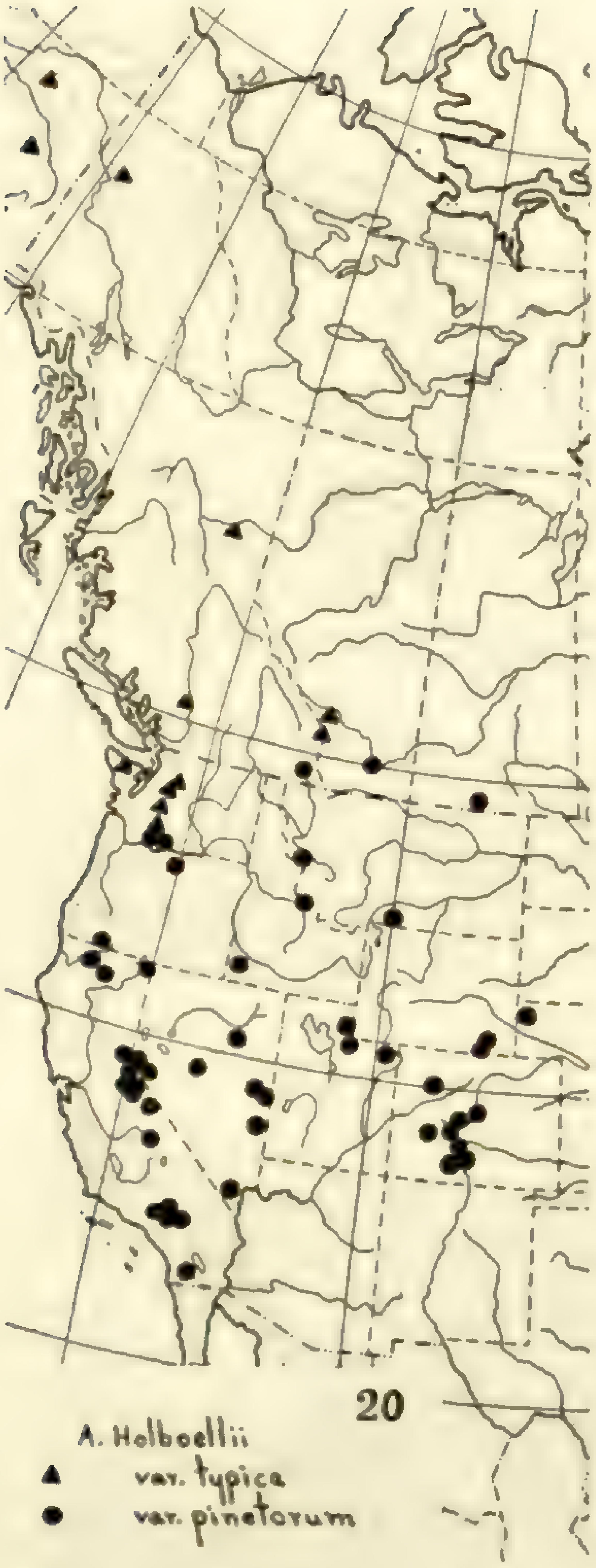
a. Cauline leaves auriculate; plants usually more than 2 dm. high; basal leaves mostly more than 3 mm. broad. . . . b.
  b. Pedicels geniculate near base, usually straight or at least not uniformly curved; siliques strictly reflexed to somewhat spreading, but not loosely pendulous, straight or nearly so; pubescence of basal leaves fine............*c*.
    c. Lower stem hirsutulous with large spreading hairs; petals 5–7 mm. long..........................37c. var. *Collinsii*.
    c. Lower stem appressed-pubescent with small or minute hairs; petals 7–10 mm. long.......................*d*.
      d. Cauline leaves usually flat, upper glabrous; siliques 2–2.5 mm. wide; mature basal leaves evenly pubescent with spaced trichomes...................37a. var. *typica*.
      d. Cauline leaves usually revolute, upper finely pubescent; siliques 1–2 mm. wide; basal leaves densely pubescent, very often pannose.....37b. var. *retrofracta*.
  b. Pedicels gently curved downward; pods pendulous, usually somewhat curved inward; pubescence of basal leaves coarse...............................37e. var. *pinetorum*.
a. Cauline leaves lacking auricles; plants usually less than 2 dm. high; basal leaves less than 3 mm. broad..37d. var. *pendulocarpa*.

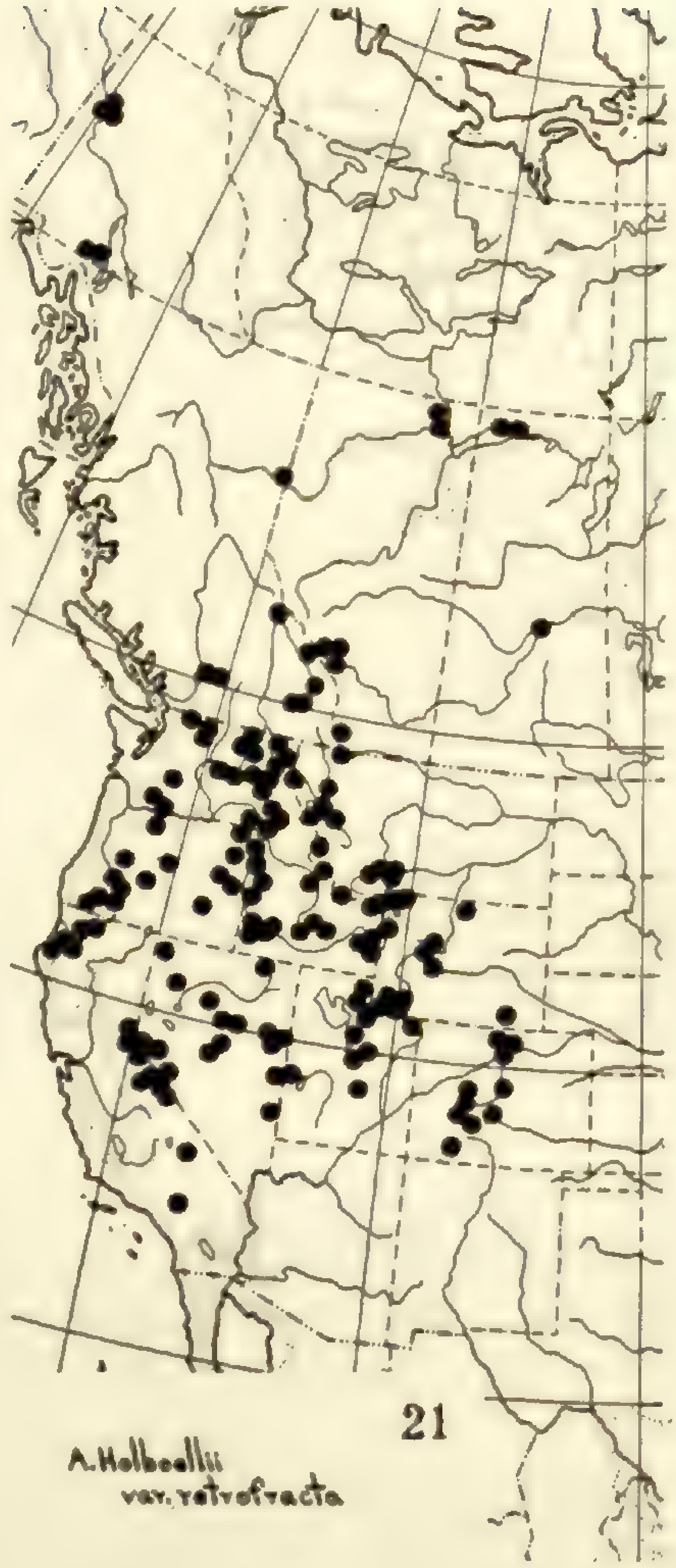
37a. Var. **typica.** *A. Holboellii* Hornem., Fl. Dan. **11:** 5, t. 1879 (1827); Lange, Consp. Fl. Groenl. 49 (1880); Watson in Gray, Syn. Fl. N. Am. **1:** 164 (1895) in part; Henry, Fl. So. Brit. Columb. 149 (1918) in part; Rollins in Res. Stud. State Coll. Wash. **4:** 27 (1936); Hopkins in RHODORA **39:** 170 (1937) in large part. *Erysimum Holboellii* (Hornem.) O. Ktze., Rev. Gen. Pl. pt. 2: 933 (1891), as "Hollboellii". *A. holboellii patula* sensu Piper in Contrib. U. S. Nat. Herb. (Fl. Washington) **11:** 293 (1906). *A. retrofracta* sensu G. N. Jones in Univ. Wash. Pub. Biol. **7:** 91 (1939).—Greenland,[1] Quebec, Alberta, Yukon, British Columbia and Washington. MAP 20. ALBERTA: Banff, June, 1906, *S. Brown 111* (G). WASHINGTON: Nisqually River, Mt. Rainier Nat. Park, July, 1937, *G. N. Jones 10274* (G); Nisqually Checking Station, Mt. Rainier Nat. Park, July, 1922, *Abrams 9215* (M, P, RM); moraine of Emmons Glacier, Mt. Rainier, June, 1937, *G. N. Jones 9997* (G); Mt. Rainier Nat. Park, June, 1936, *L. S. Rose 36378* (R); Green River Hot Springs, July, 1888, *Piper 544* (G, WSC); Mt. Angeles, Clallam Co., July, 1931, *Thompson 7427* (M, NY), June, 1934, *Thompson 10603* (M), July, 1931, *J. T. Howell 7454* (G); on low ground in valleys, Skamania Co., July, 1894, *Suksdorf 2354* (G, WSC); headwaters of Robinson Cr., Okanogan Co., July, 1916, *Eggleston 13203* (US); Barnard Trail, Tiffany Mt., July, 1932, *Fiker 1002* (T, WSC). BRITISH COLUMBIA: Lake Bootahnie, Marble Mts., June, 1938, *J. W. & E. M. Thompson 87* (G); Mt. Selwyn, July,

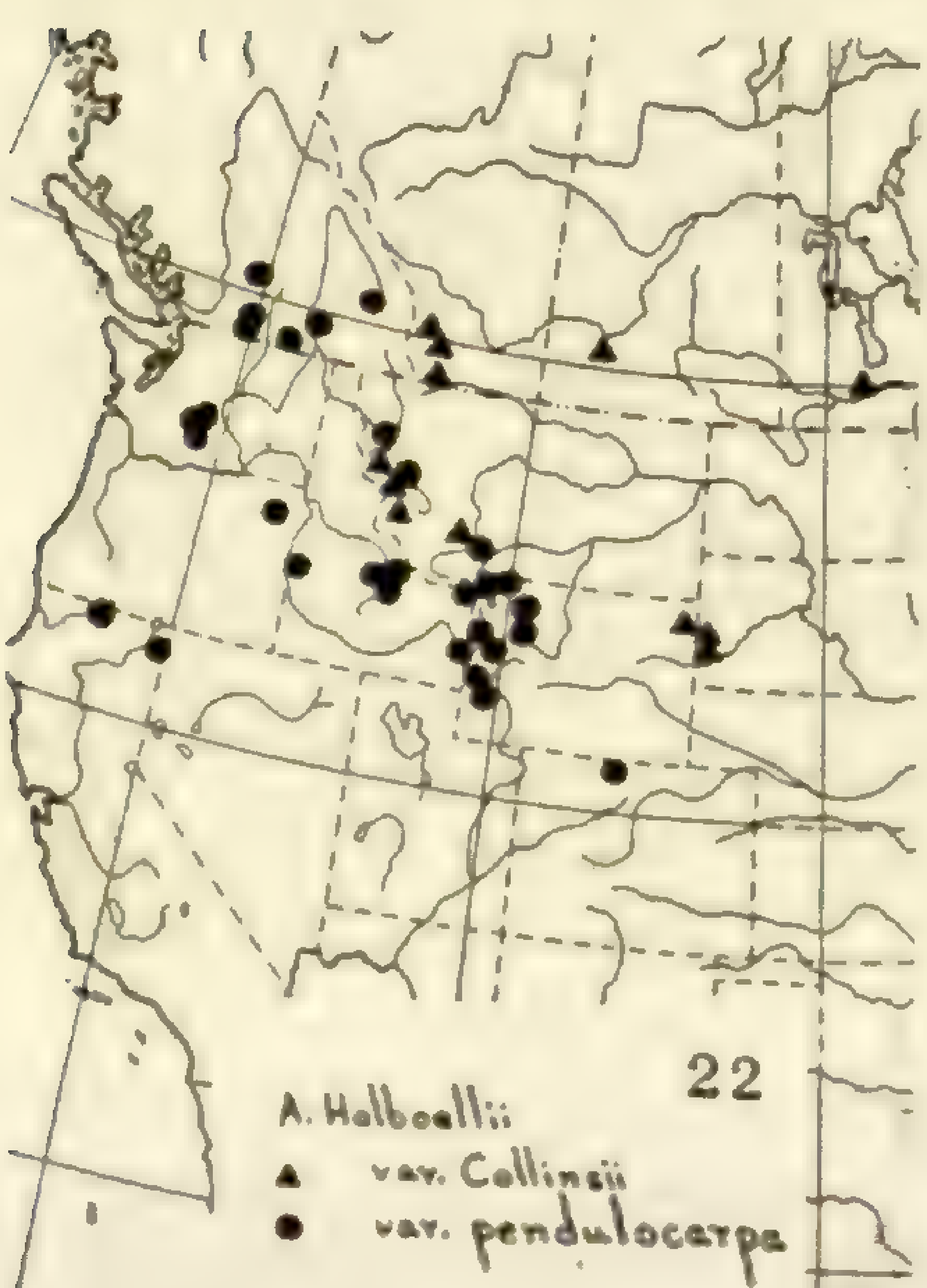
[1] For specimens cited from east of the one hundredth meridian, see Hopkins, op. cit. p. 171. These are *A. Holboellii*, var. *typica* with the exception of *Stebbins 798* from Quebec, which is var. *retrofracta*, and the Michigan specimens which are *A. divaricarpa* A. Nels.

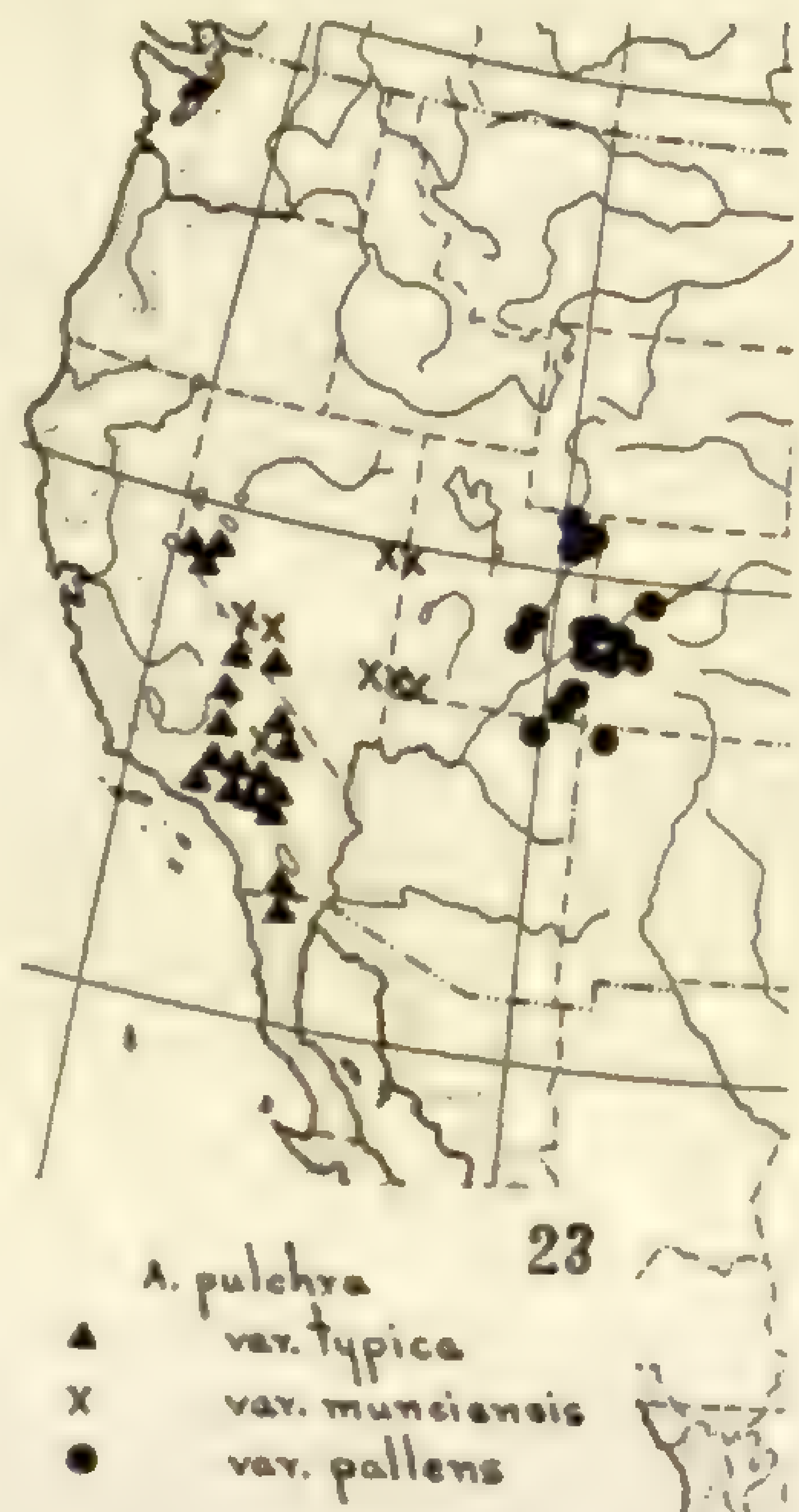
1932, *Raup & Abbe 3958* (G). YUKON: Dawson, June, 1914, *Eastwood 134* (Cl, G, in part). ALASKA: Lower Tanana River, May 27, 1936, *Murie s.n.* (L).

37b. Var. RETROFRACTA (Graham) Rydberg. Stems densely pubescent with fine appressed dendritic trichomes to glabrous above; basal leaves pannose to subpannose, usually entire; cauline leaves revolute-margined; pedicels pubescent, strongly reflexed, usually geniculate; petals usually whitish, but often pink; siliques glabrous or sometimes finely pubescent, strongly reflexed, usually appressed to rachis, straight or nearly so, 3.5–8 cm. long, 1–1.5 mm. wide.—Contrib. U. S. Nat. Herb. **3:** 484 (1896); Jepson, Man. Fl. Pl. Calif. 429 (1925) in part. *A. retrofracta* Graham in Edinb. New Phil. Journ. 344 (1829); Watson in King, Geol. Expl. Fortieth Parallel **5:** 18 (1871) in part; Greene, Pitt. **4:** 188 (1900); Rydberg, Fl. Rky. Mts. 362 (1918) in part, and Fl. Pr. Pl. Cent. N. Am. 382 (1932) in part; Jepson, Flora Calif. **2:** 67 (1936) in part; Hopkins in RHODORA **39:** 179 (1937). *Streptanthus virgatus* Nuttall in T. & G., Fl. N. Am., **1:** 76 (1838). *A. Holboellii* sensu Brewer & Wats., Bot. Calif. **1:** 33 (1876); Watson in Gray, Syn. Fl. N. Am. **1:** 164 (1895) in part; Piper in Contrib. U. S. Nat. Herb. (Fl. Washington) **11:** 293 (1906). *A. secunda* Howell in Erythea **3:** 33 (1895); Jepson, Flora Calif. **2:** 66 (1936). *A. arcuata* Gray, var. *secunda* (Howell) Robinson in Gray, Syn. Fl. N. Am. **1:** 164 (1895). *A. sparsiflora secunda* (Howell) Piper, op. cit. p. 294. *A. Holboellii* Hornem., var. *secunda* (Howell) Jepson, Man. Fl. Pl. Calif. 430 (1925). *A. rhodantha* Greene, Pitt. **3:** 155 (1897); Rydberg, Fl. Colo. 165 (1906) and Fl. Rky. Mts. 362 (1918); Coulter & Nelson, New Man. Bot. Rky. Mts. 228 (1909). *A. exilis* A. Nelson in Bull. Torr. Bot. Club **26:** 123 (1899); Coulter & Nelson, l. c.; Rydberg, Fl. Rky. Mts. 363 (1918). *A. tenuis* Greene, Pitt. **4:** 189 (1900). *A. lignipes* A. Nelson in Bot. Gaz. **30:** 191 (1900); Coulter & Nelson, op. cit. p. 229; Rydberg, Fl. Rky. Mts. 362 (1918). *A. consanguinea* Greene, Pitt. **4:** 190 (1900); Rydberg, Fl. Colo. 165 (1906) and Fl. Rky. Mts. 362 (1918). *A. Kochii* Blankinship in Mont. Agri. Coll. Sci. Stud. **1:** 57 (1904), not Jordan, Diag. **1:** 112 (1864). *A. caduca* A. Nelson in Coulter & Nelson, New Man. Bot. Rky. Mts. 229 (1909); Rydberg, Fl. Rky. Mts. 363 (1918). *A. polyantha* Greene, Leaflets **2:** 80 (1910). *A. MacDougalii* Rydberg in Bull. Torr. Bot. Club **39:** 326 (1912). *Turritis retrofracta* (Grah.) Hooker, Fl. Bor.-Am. **1:** 41 (1829). *Sisymbrium pauciflorum* Nuttall ex T. & G., Fl. N. Am. **1:** 93 (1838).—Locally in Quebec and Michigan, more abundant westward from Saskatchewan and Alberta to Colorado, California, Washington, British Columbia and north to Yukon. MAP 21. PRECISE









Rollins on Arabis

LOCALITY UNKNOWN: Rocky Mountains (of Canada), Palliser's Brit. N. Am. Expl. Exped., 1858, *E. Bourgeau s.n.* (G, PROVISIONAL TYPE). SASKATCHEWAN: junction of north fork and north branch of the Saskatchewan River, June, 1908, *Brown 924* (G); vicinity of Cornwall Bay, Lake Athabaska, July, 1935, *Raup 6446* (G); Charlot Point, Lake Athabaska, June, 1935, *Raup 6081* (G). ALBERTA: Bow River Valley, vicinity of Banff, June, 1906, *Brown 50* (G); Laggan, Rky. Mt. Park, June, 1904, *Macoun s.n.* (G); Banff, July, 1907, *Butters & Holway 52* (G); Crow Nest Pass, Aug., 1897, *Macoun 18109* (G); Pine Lake district, Wood Buffalo Park, July, 1928, *Raup 2491* (G, Can); Peace Point, Wood Buffalo Park, July, 1928, *Raup 2490* (G). MONTANA: Bozeman, June, 1906, *Blankinship 554a* (P); Cache Creek, Mineral Co., July, 1933, *C. L. Hitchcock 1754* (G); Wild Horse Island, Flathead Lake, Aug., 1908, *M. E. Jones 8026* (P); near Missoula, June, 1901, *MacDougal 191* (NY, TYPE; US, isotype of *A. MacDougalii* Rydb.; May, 1933, *C. L. Hitchcock 1632* (G); Mud Lake, Ravali Co., Aug., 1933, *C. L. Hitchcock 2075* (G); near Pony, Madison Co., July, 1897, *Rydberg & Bessey 4227* (G, NY). WYOMING: on high hills, sources of the Sweetwater, *Nuttall s.n.* (photo of the type of *Streptanthus virgatus* in Gray Herb.); 5 miles west of Beartooth Lake, Beartooth Mts., Park Co., July, 1939, *Rollins & Muñoz 2859* (G, R); Madison River, Yellowstone Nat. Park, June, 1899, *A. & E. Nelson 5505* (RM, TYPE; G, isotype of *A. lignipes*); 10–15 miles east of Kane, Big Horn Co., June, 1936, *L. O. & R. Williams 3013* (R); near Fremont Lake, Sublette Co., Sept., 1935, *Ownbey 1008* (R); Alpine, Lincoln Co., July, 1923, *Payson & Armstrong 3401* (G, RM); Evanston, June, 1898, *A. Nelson 4523* (RM, TYPE; G, isotype of *A. exilis*); Wind River Mts., Fremont Co., June, 1936, *Costello & Rollins 2067* (G, R); 3 miles north of Lyman, Uinta Co., June, 1937, *Rollins 1657* (G, R); Medicine Bow Mts., Albany Co., July, 1935, *Rollins 1070* (DS, G, R); Woods Creek, Aug. 11, 1896, *A. Nelson 2584* (RM, TYPE of *A. caduca*). COLORADO: 4 miles south of Mesa, Mesa Co., May, 1938, *Rollins 2188* (G, R); 2 miles northeast of Cedaredge, Delta Co., May, 1938, *Rollins 2146* (G, R); 5 miles north of Grand Lake, Grand Co., July, 1935, *Rollins 1018* (DS, G, R); 3 miles south of Milner's Pass, Rky. Mt. Nat. Park, June, 1938, *Rollins & Chambers 2402* (G, R); 2 miles south of Pitkin, Gunnison Co., July, 1936, *Rollins 1425* (DS, G, R); near Empire, 1875, *E. L. Greene s.n.* (ND, TYPE of *A. rhodantha;* photo in Gray Herb.); Los Pinos (Bayfield), May 18, 1899, *Baker s.n.* (ND, TYPE; RM, UC, isotypes of *A. consanguinea;* photo in Gray Herb.); near Sargent's, Saguache Co., May, 1938, *Rollins 2087* (G, R). IDAHO: forks of St. Marys River, July, 1895, *Leiberg 1161* (G); ridges south from Weissners Peak, July, 1895, *Leiberg 1404* (G, M, O, P); east of Laird Park, Latah Co., May, 1936, *Rollins & Constance 1108* (G, R, WSC); near Pollock, Idaho Co., May, 1937, *Constance 1854* (G, R); Cuddy Mts., Washington Co., July, 1899, *M. E. Jones* (M, P); Idaho Falls, May, 1924, *Nelson 10051* (RM, UAC); Parker Mt., Custer Co., July, 1916, *Macbride & Payson 3271* (G, P); Elgin, Fremont Co., May, 1919, *Quayle 38* (P); Thunderboldt Mt., Valley Co., July, 1937, *Thompson 13920* (R); Silver City, Owyhee Co., June, 1911, *Macbride 1011* (RM, US). UTAH: Tony Grove Canyon, Cache Co., July, 1936, *Maguire et al. 13959* (UAC); Providence Bench and Providence Canyon, Cache Co., May, 1932, *Maguire 3444 & 3443* (UAC); Salina Canyon, June, 1894, *M. E. Jones s.n.* (P); Lake Point, May, 1880, *M. E. Jones s.n.* (P); Salt Lake Co., June, 1905, *Garrett 1094* (G); Coalville, May, 1889, *M. E. Jones s.n.* (P); 25 miles south of Manila, Uintah Co., June, 1937, *Rollins 1765* (DS, G, R); 12 miles south of Manila, Daggett Co., June, 1938, *Rollins 2268* (G, R); Trout Creek, Juab Co., *Maguire & Becraft 2626* (UAC). NEVADA: Jarbidge, July, 1912, *Nelson & Macbride 1920* (G); July, 1938, *Rollins & Chambers 2579* (G, R); Star Peak, Pershing Co., July, 1901, *M. E. Jones s.n.* (P); about 15 miles southeast of Lamoille, Ruby Mts., Elko Co., July, 1938, *Rollins & Chambers 2548* (G, R); Coleman Pass Canyon, northwestern Washoe Co., June, 1939, *Train 2983* (NA, R); Palisade, June, 1882, *M. E. Jones s.n.* (P); King's Canyon, Ormsby Co., June, 1902, *Baker 891* (G); Sweetwater Mts., near Sweetwater, Mineral Co., July, 1919, *Tidestrom 10204* (G); near Lehman Cr., east of Mt. Wheeler, White Pine Co., July, 1938, *Rollins & Chambers 2470* (G, R). CALIFORNIA: near Big Flat, Siskiyou Co., July, 1937, *J. T. Howell 13203* (G, R); Loy Lake, Siskiyou Co., July, 1910, *Butler 1663 & 1763* (P); Salmon Summit, Humboldt Co., July, 1935, *Tracy 14379* (UC); Rae Lake, Fresno Co., July, 1910, *Mrs. Joseph Clements s.n.* (P); Rock Creek Lake Basin, Inyo Co., Aug., 1937, *Peirson 12183* (Peirs); above Lake Sabrina at the head of Bishop Creek, Aug., 1938, *Constance 2463* (R, UC); Sierra City, Sierra Co., June, 1938, *Constance 2296* (R, UC); lower end of Donner Lake, Nevada Co., July, 1903, *Heller s.n.* (G); Deer Park, Lake Tahoe region, June, 1912, *Eastwood 368* (Cl, G); Baldwin Lake, San Bernardino Co., May, 1932, *Peirson 9966* (Peirs). OREGON: McKenzie Highway, Lane Co., April, 1934, *Eastwood & Howell 1625* (G); Swan Valley, Klamath Co., June, 1896, *Applegate 29* (G); Abbott Butte, Jackson Co., July, 1936, *Thompson 13055* (G, R); Wallowa Lake, Wallowa Co., Aug., 1935, *Constance & Jacobs 1315* (UC, US, WSC); near Anthony Lake, Blue Mts., Baker Co., July, 1938, *Rollins & Chambers 2599* (G); Powder River Mts., Aug., 1896, *Piper 2504* (G, WSC); Blue Mts., Grant Co., June, 1925, *Henderson 5290* (US). WASHINGTON: Malden-Pine City, Whitman Co., May, 1936, *Rollins & Constance 1092* (G, R); near Spokane Bridge, Spokane Co., May and July, 1916, *Suksdorf 8567* (G, R, UC, US, WSC); near Caisy, Stevens Co., May, 1937, *Constance 1841* (G, R); Kettle Falls, Ferry Co., May, 1937, *Constance 1842* (G, R); Metaline, Pend Oreille Co., June, 1933, *Thompson 9224* (G); Godman Springs, Columbia Co., July, 1935, *Constance et al. 1191* (WSC); Barron, Whatcom Co., Aug., 1937, *Muenscher 7882* (G); Mt. Adams, Aug., 1882, *Howell 1487* (O, TYPE; NY, UC, US, WSC, isotypes of *A. secunda* Howell); Rock Island, Chelan Co., April, 1899, *Whited 1043* (US, TYPE; OS, WSC, isotypes of *A. polyantha* Greene); on mountains, w. Klickitat Co., May, 1884, and July, 1885, *Suksdorf 15* (ND, TYPE; G, R, isotypes of *A. tenuis* Greene). BRITISH COLUMBIA: Peace River at Taylor Flat, June, 1932, *Raup & Abbe 3573* (G); shore of Howser Lake, June, 1905, *Shaw 711* (G); Kicking Horse Valley, vicinity of Field, June, 1906, *Brown 351* (G); five miles north of Birch Island, North Thompson River, May, 1935, *McCabe 1891* (G); Carson Mt., Marble Mts., June, 1938, *J. W. & E. M. Thompson 319* (G); south of Kamloops, May, 1938, *J. W. & E. M. Thompson 41* (G); Cranbrook, May, 1930, *Grove s.n.* (G). YUKON: White Horse, Sept. 2, 1902, *Macoun* (Can. 54359); Hunker Creek, July 31, 1902, *Macoun* (Can. 58357); Lake Bennett, July 8, 1902, *Macoun* (Can. 58356); White Horse Rapids, *Tarleton 30* (NY); Klondike-Dawson, July 11, 1902, *Macoun* (Can. 58355).

37c. Var. **Collinsii** (Fernald), comb. nov. Stems 2–6 dm. high, hirsutulous below with coarse spreading simple or branched trichomes, glabrous above; cauline leaves auriculate at base, lower finely pubescent, upper glabrate; pedicels strongly reflexed, geniculate, sparsely pubescent to glabrous; petals white to pinkish, 6–8 mm. long, 2–3 mm. broad; siliques glabrous, straight, nerved to middle or slightly beyond, usually strictly reflexed.—*A. Collinsii* Fernald in RHODORA **7:** 32 (1905); Britton & Brown, Ill. Fl. **2:** ed. 2, 183, fig. 2082 (1913); Marie-Victorin, Fl. Laurent. 261 (1935). *A. pendulocarpa* sensu Hopkins in RHODORA **39:** 183 (1937) in part.—Rimouski County, Quebec;[1] Manitoba, Alberta, South Dakota, Montana and Wyoming. MAP 22. MANITOBA: north of Carberry, June, 1906, *Macoun & Herriot 69860* (G). ALBERTA: vicinity of Rosedale, April, 1915, *Moodie 823* (G, NY); near Banff, July, 1931, *Pease 22441* (G). SOUTH DAKOTA: Custer Peak, Lawrence Co., June, 1929, *Palmer 37545* (G); near Savoy, June, 1910, *J. Murdoch, Jr. 4116* (G). MONTANA: near Missoula, June, 1918, *Collins s.n.* (G),

[1] For citations of specimens from Quebec, see Hopkins, op. cit. p. 184 under *A. pendulocarpa* A. Nels.

July, 1933, *C. L. Hitchcock 1839* (G, R); above Bonner, Missoula Co., July, 1933, *C. L. Hitchcock 1686* (G); 30 miles south of Missoula, Ravali Co., May, 1933, *C. L. Hitchcock 1569* (G) in part; Spanish Creek, Gallatin Co., May, 1901, *J. Vogel s.n.* (G) in part; Bridger Pass, Gallatin Co., Aug., 1916, *Suksdorf 53* (G); Westby, Sheridan Co., June, 1927, *Esther Larsen 21* (G); 17 miles southwest of Red Lodge, Carbon Co., July, 1939, *Rollins & Muñoz 2830* (G, R). Wyoming: near Hulett, Crook Co., May & June, 1935, *Ownbey 532, 532a, 545*, in flower; *545a, 532b* in fruit (R), May, 1935, *Ownbey 551a* (G); Yellowstone River, near Junction Butte, Yellowstone Nat. Park, July, 1899, *A. & E. Nelson 5728* (RM).

37d. Var. **pendulocarpa** (A. Nels.), comb. nov. Stems slender, usually simple, pubescent below with coarse simple or branched, often spreading trichomes, glabrous above, 1–2.5 dm. high; cauline leaves acute, not auriculate at base; basal leaves entire; pedicels arched downward, not strictly reflexed nor straight; siliques pendulous, straight or very slightly curved inward.—*A. pendulocarpa* A. Nelson in Bot. Gaz. **30:** 192 (1900); Rydberg, Fl. Rky. Mts. 363 (1918); Hopkins in Rhodora **39:** 183 (1937) in part. *A. canescens* sensu Rollins in Res. Stud. State Coll. Wash. **4:** 35, fig. 9 (1936).—Montana to Colorado, California and British Columbia. Map 22. Montana: Missoula, April, 1921, *Kirkwood 1133* (Cl, NY), March and April, 1915, *Kittredge s.n.* (G), May, 1933, *C. L. Hitchcock 1592* (G, P, RM); 5 miles east of Perma, May, 1933, *C. L. Hitchcock 1551* (G, P, R, RM); 12 miles west of Wilsall, Park Co., July, 1921, *Suksdorf 352* (R). Wyoming: Yellowstone Nat. Park, Aug. 1922, *E. B. & L. B. Payson 3105* (RM), May, 1902, *Mearns 753* (US); Madison River, Y. N. Park, June, 1899, *A. & E. Nelson 5504* (RM, type; G, NY, US, isotypes); Piney Mt., Sublette Co., July, 1922, *E. B. & L. B. Payson 2678* (G, NY, RM, US); Gros Ventre Fork (Snake R.) June, 1860, *Heyden 71* (M); Sheep Mt., Lincoln Co., July, 1923, *Payson & Armstrong 3446* in part (G, RM); Wind River Mts., Fremont Co., June, 1936, *Costello & Rollins 2047* (G, R); 6 miles west of Jackson, Teton Co., June, 1936, *L. O. & R. Williams 3008b* (R). Colorado: near Kings Canyon, Jackson Co., June, 1925, *E. B. & L. B. Payson 4252* (RM). Idaho: Henry Lake, July, 1920, *E. B. & L. B. Payson 1971* (G, NY, RM); Mt. Borah, near Chilly, Custer Co., June, 1939, *Christ & Ward 10643* (Herb. J. H. Christ); forks of Big Creek, Custer Co., May, 1932, *A. M. Cusick 163* (FS); Gallagher Canyon, Lemhi Forest, May, 1928, *Schulze 47* (FS); south end of Soldier Mts., Blaine Co., June, 1916, *Macbride & Payson 2898* in part (G, RM, UC, US). California: Warren Peak, head of Parker Creek, Modoc Co., July, 1917, *Smith 55* (FS); one-half mile southeast of King's Castle, Siskiyou Co., July, 1939, *Hitchcock & Martin 5322* (G, R). OREGON: Strawberry Butte, Blue Mts., July, 1896, *Coville 552* (US). WASHINGTON: Beehive-Cashmere Trail, Wenatchee Forest, May, 1925, *Ingram 1956* and *1960* (FS, OS); Summit of Bald Mt., Valley of Nile Creek, Rainier Nat. Forest, Yakima Co., July, 1923, *St. John 7856* (WSC); Mt. Adams, July, 1906, *Suksdorf 5751* (WSC); Hurricane Ridge, Clallam Co., July, 1933, *G. N. Jones 4017* (UW), July, 1931, *G. N. Jones 3406* and *3201* (UW); Mt. Angeles, July, 1931, *G. N. Jones 3322* (UW). BRITISH COLUMBIA: Midway, April, 1905, *Spreadborough 70817* (G, NY); Yale, May, 1889, *J. Macoun s.n.* (G); Carbonate Draw, July, 1904, *Hescock 3091* (G); Penticton, April, 1903, *Spreadborough 59558* (G, NY); near Lake Boothanie, Marble Mts., June, 1938, *J. W. & E. Thompson 155* (G).

37e. Var. **pinetorum** (Tidestrom), comb. nov. Stems hirsutulous below with simple, branched or dendritic trichomes, glabrous above, 3–9 dm. high; basal leaves broadly oblanceolate to more narrowly so, densely pubescent with coarse dendritic trichomes; pedicels usually slightly arched downward, rarely geniculate, usually glabrous; siliques slightly curved inward, sometimes straight, glabrous, 4–7 cm. long, 1.5–2 mm. wide.—*A. pinetorum* Tidestrom in Proc. Biol. Soc. Wash. **36:** 182 (1923) and Contrib. U. S. Nat. Herb. (Fl. Utah and Nevada) **25:** 245 (1925). *A. Holboellii*, var. *retrofracta* sensu Munz, Man. So. Calif. Bot. 205 (1935). *A. retrofracta* sensu Jepson, Fl. Calif. **2:** 67 (1936) in part.—Southern Saskatchewan, Nebraska and Colorado to California and British Columbia. MAP 20. SASKATCHEWAN: Wood Mountain Post, June, 1895, *Macoun 5933* (P). NEBRASKA: Ft. Robinson, June, 1890, *J. M. Bates s.n.* (G). WYOMING: Plumbago Canyon, Albany Co., June, 1930, *Nelson 11307* (G, RM); Laramie Hills, May, 1896, *Nelson 1885* (G). COLORADO: South Park, 1873, *Wolf & Rothrock 655* (G); Alvarado Ranger Station, Custer Co., June, 1936, *Rollins 1246* (G, R); La Veta Pass, Costella Co., June, 1936, *Rollins 1288a* (G, R); 10 miles east of Leadville, Lake Co., July, 1936, *Rollins 1349* (G, R); Monarch Pass, Chaffee Co., July, 1936, *Rollins 1343a* (R); 2 miles south of Pitkin, Gunnison Co., July, 1936, *Rollins 1426* (DS, G, R); 6 miles east of Gunnison, Gunnison Co., May, 1938, *Rollins 2095* (G, R). IDAHO: Salmon, Lemhi Co., June, 1920, *E. B. & L. B. Payson 1788* (G); Silver City, Owyhee Co., June, 1911, *Macbride 934* (G). UTAH: Providence Canyon, Cache Co., May, 1933, *Muenscher & Maguire 2346* (UAC); Wasatch Mts., May, 1867, *Bailey 76* (G); Summit Springs Ranger Station, Daggett Co., June, 1932, *L. O. Williams 567* (G); Fish Lake, Aug., 1894, *Jones 5770a* (P); Marysvale, June, 1894, *Jones 5353* (P). Nevada: Duck Creek, Shell Creek Mts., July, 1924, *Jones s.n.* (P), Aug., 1880, *Jones s.n.* (P); 2 miles south of Lehman Creek, near base of Mt. Wheeler, White Pine Co., July, 1938, *Rollins & Chambers 2485* (G, R); west slope of Pioche Mt., Lincoln Co., April, 1939, *Train 2666* (NA, R); 12 miles north of Pioche, Lincoln Co., May, 1939, *Train 2676* (G); Glenbrook, Lake Tahoe, July 7, 1919, *Tidestrom 10387* (US, type), July 6, 1919, *Tidestrom 10279* (G). California: near Etna, Siskiyou Co., June, 1937, *Eastwood & Howell 5031* (R); One Thousand Lake Basin, Shasta Co., July, 1932, *Peirson 10152* (Peirs); Lake Tahoe, Eldorado Co., June, 1932, *Maguire et al. 15046* (UAC); Cave Rock, Lake Tahoe region, 1909, *Eastwood 157* (Cl); 4 miles west of Sonora Pass, Alpine Co., Aug., 1938, *Constance 2405* (R); Glen Alpine Canyon, July, 1937, *Abrams 13412* (G, P); Tuolumne Meadows, Aug., 1916, *Smiley 758* (G); Mineral King, July, 1891, *Coville & Funston 1388* (G); Yosemite Valley, June, 1911, *Abrams 4452* (G); San Bernardino Mts., June, 1926, *Munz 10474* (P), July, 1924, *Munz & Johnston 8481* (P), July, 1902, *Abrams 2830* (G); Laguna Mts., San Diego Co., June, 1924, *Munz 8362* (P), May, 1925, *Peirson 5922* (Peirs). Oregon: Hoover Creek, Lillian Co., June, 1894, *Leiberg 132* (G); Ashland-Klamath Falls, July, 1920, *Peck 9232* (G). Washington: base of Mt. Adams, June, 1883, *Suksdorf 97* and *1915* (G); North Yakima, May, 1892, *Henderson 2393* (G); upper Yakima (River), Wash. Terr., 1860, *Lyall* (G); Swauk River, Kittitas Co., May-Sept., 1913, *Sharples 83* (G).

Critical students have often toiled with the numerous and seemingly unpredictable variations of *Arabis Holboellii* which occur in various parts of its natural geographical range. Some, including two recent authors,[1] have taken the stand that two or several species are represented by the plants which are here included under the single species with its varieties. However, there is no clear hiatus between the varieties as they are presented above, nor are there significant morphological differences between them. Hopkins l. c. who treated most of the "*Holboellii* complex", did not detect var. *typica* from western Washington or British Columbia. By thus limiting the distribution of typical *A. Holboellii* to Greenland and a few isolated stations in eastern America, it is admittedly easier to argue that "*A. retrofracta*" and "*A. pendulocarpa*", which are found chiefly in the Cordillera of western North America, are distinct species.

[1] Jepson, Flora Calif. **2**: 66–68 (1936) and Hopkins in Rhodora **39**: 170–186 (1937).

The facts are, as I see them, that the gradation of characters throughout the varietal series is too complete to allow the admission of even the leading varieties to specific rank. The varieties here recognized, as shown by the key, are based on trivial characters of pubescence and habit. They may not be entirely natural in every case, but the arrangement is orderly and the recognizable entities are easily determined as part of the species as a whole.

Such criteria as petal-size and the coarseness or fineness of stem-pubescence must be used with extreme care in the delimitation of *Arabis*-species. In measuring petal-width in the entity treated as *A. pendulocarpa* by Hopkins, for example, the measurement was found to vary from less than 1 mm. to more than 3 mm. Petal-length is equally variable, depending both on the stage of development and to a small extent on the position of the flower in the inflorescence. The last flowers to develop near the apex of the raceme often fail to attain the size of the lower ones which mature much earlier.

As regards pubescence in this immediate group, one must be equally wary. The young leaves in *A. Holboellii*, var. *typica* tend to be pannose, but as the leaf fully expands, the density of the pubescence decreases and one observes a spaced relationship between the dendritic trichomes. Var. *pendulocarpa*, var. *Collinsii* and var. *pinetorum* possess a coarse, spreading, almost hirsutulous type of pubescence on the lower stem and in general this character serves well to distinguish them from var. *retrofracta* and var. *typica*, but here again one finds a perplexing gradation from a coarse to a fine type of indument. The stem-pubescence of typical *A. Holboellii* is, in fact, about half-way between that of var. *retrofracta* and var. *pendulocarpa*. It is also significant that many of these gradations occur in specimens gathered at a single station; for example, the four sheets of the type-collection of var. *pendulocarpa* are quite variable with respect to the coarseness of stem-pubescence and two plants mounted on the same sheet at the Gray Herbarium, representing C. L. Hitchcock's no. 1569 from Ravali County, Montana, have the extremes in coarseness and fineness of stem-pubescence, but are otherwise nearly identical. The proximity or remoteness of cauline leaves in this species is correlated with the stage of development of the plant. Young plants nearly always have the cauline leaves closely imbricated, but as the stem lengthens these leaves may become separated by a centimeter or more.

A photograph of the type of *Streptanthus virgatus* Nuttall shows clearly that the specimen is an *Arabis*, but the accurate determination of the species cannot be made from the photograph alone. The single plant which constitutes the type is in flower only and resembles closely flowering specimens of *A. Holboellii*, var. *retrofracta*. However, a direct examination of the plant may show that it is really the same as the species which bears the name *A. lignifera* in the present work.

The complex nature of *A. Holboellii* is, in part at least, to be associated with the existence of polyploidy in the species. The common, wide-spread var. *retrofracta* is usually diploid, as shown by the cytological examination of six collections from California, Wyoming and Colorado, but a single collection from Utah was found to be tetraploid. Two collections of var. *pinetorum* from Colorado have proved to be polyploids, one tetraploid, the other hexaploid. Böcher[1] has reported the chromosome number of var. *typica* as $n = 22$. This count is not compatible with those I have made from other varieties of the species nor with other counts in the genus. The significance of such a number in this group is not at present understood. The effect of polyploidy in widening the range of variation within a given species seems to be borne out by such data as are available on *A. Holboellii*, but considerably more work on the cytology, genetics and geographical distribution of this species will be necessary before the complete story will be known.

38. A. puberula Nuttall. Biennial or perennial; stems often stout, single or few from a simple caudex, simple or branched above, hoary throughout with a dense, dendritic pubescence, rarely becoming glabrous above, 1.5–5 dm. high; basal leaves dimorphic, oblanceolate to linear-oblanceolate, entire or few-toothed, acute, hoary with a minute dendritic pubescence, petiolate, 1–2 (–3) cm. long, 3–6 mm. wide; cauline leaves numerous, crowded, lanceolate to oblong, acute, entire or the lower irregularly toothed, sessile, densely pubescent, 1–3 cm. long, auricles small or absent; sepals oblong, densely pubescent, 4–6 mm. long, about 1.5 mm. wide, non-saccate; petals rose to

[1] Reprint from Meddelelser om Grønland **106**: 100 (1938).

purple, rarely white, spatulate to narrower, 7–11 mm. long, 1.5–2.5 mm. wide; glandular tissue rather poorly developed, continuous beneath all stamens; fruiting pedicels curved downward, often strictly reflexed, densely pubescent, 4–8 mm. long; siliques numerous, pendulous to rather strictly reflexed, straight, usually blunt at apex, one-nerved below the middle, densely pubescent or less so in age, 3–6 cm. long, 2–3 mm. wide; stigma sessile; seeds orbicular, plump, narrowly winged, slightly less than 2 mm. broad, uniseriate.—In T. & G., Fl. N. Am. **1:** 82 (1838); Piper in Contrib. U. S. Nat. Herb. **11:** 294 (1906) in part. *A. canescens* sensu Watson in Gray, Syn. Fl. N. Am. **1:** 165 (1895) in part; Rydb., Fl. Rky. Mts. 363 (1918) in part; Tidestrom in Contrib. U. S. Nat. Herb. **25:** 245 (1925) in part; Jepson, Fl. Calif. **2:** 67 (1936) in part. *A. Beckwithii* Watson in Proc. Am. Acad. **22:** 467 (1887) in part, and in Gray, Syn. Fl. N. Am. **1:** 165 (1895) in part; Tidestrom l. c. in part. *Erysimum puberulum* (Nutt.) O. Ktze., Rev. Gen. Pl. pt. 2: 933 (1891). *A. subpinnatifida,* var. *Beckwithii* (Wats.) Jepson, Man. Fl. Pl. Calif. 431 (1925). *A. arida* Greene, Pittonia **4:** 190 (1900). *A. lignipes,* var. *impar* A. Nelson in Bot. Gaz. **54:** 139 (1912). *A. subpinnatifida,* var. *impar* (A. Nels.) Rollins in Res. Stud. State Coll. Wash. **4:** 32, fig. 8 (1936). *A. sabulosa* Jones, Contrib. West. Bot. **14:** 40 (1912). *A. sabulosa,* var. *frigida* Jones, ibid. p. 41. *A. sabulosa,* var. *colorata* Jones, ibid.—Idaho to Nevada, California and Washington. MAP 18. WITHOUT DEFINITE LOCALITY: Blue Mts., Columbia (probably Washington or Oregon), *Nuttall s.n.* (Ph, isotype; photo of TYPE in Gray). IDAHO: 2 miles from Salmon, Lemhi Co., May, 1924, *Romano 8* (FS); Middle Valley (Midvale), Washington Co., April, 1900, *Jones 6167* (UC, US); Squaw Creek (Sweet), May, 1911, *Macbride 828* (RM, TYPE; C, UC, US, isotypes of *A. lignipes,* var. *impar*); Rattlesnake Creek near Dixie, Elmore Co., June, 1916, *Macbride & Payson 2855* (G, NY, RM, US); Picabo, Blaine Co., July, 1916, *Macbride & Payson 2996* (G, NY, RM, UC, US); Kingport Peak, near Pocatello, Bannock Co., May, 1925, *Soth 539* (NY). NEVADA: near Owyhee, June, 1937, *Murphy 210* (R); Wendover, Elko Co., June, 1934, *Maguire et al. 5806* (UAC); Moor's Station, Elko Co., May, 1896, *E. L. Greene s.n.* (ND, TYPE of *A. arida;* photo in Gray); Palisade, Eureka Co., June, 1882, *Jones 3761* (P, TYPE; Cl, NY, UAC, UC, US, isotypes of *A. sabulosa*); 15 miles west of Round Mountain, Toiyabe Mts., Nye Co., July, 1938, *Rollins & Chambers 2509* (G, R); Paradise Valley, Humboldt Co., April, 1905, *Kennedy 1065* (RM); Swan Lake, northern Washoe Co., June, 1939, *Train 3008* (G, NA, R); (West) Humboldt Mts., Pershing Co., June, 1868, *Watson 76* (G); July, 1894, *Greene s.n.* (ND); Lower Rochester, Pershing

Co., June, 1937, *Train 38* (R); Carson City, Ormsby Co., April, 1868, *Watson 76* (G); Kings Canyon, Ormsby Co., June, 1902, *Baker 985* (G, ND, NY); Nevada?, Quartz Mts.?, west of Great Salt Lake! *Lieut. Beckwith* (G, TYPE of *A. Beckwithii*). CALIFORNIA: Mt. Eddy, Siskiyou Co., July, 1920, *Heller 13434* (DS, P, US); Fort Bidwell, Modoc Co., July, 1903, *Manning 100b* (UC); Goose Lake Valley, May, 1894, *Austin 30* (ND, UC); above Parker Creek, Modoc Co., June, 1919, *Ferris & Duthie 65* (DS); Bieber Range, Lassen Co., June, 1920, *Smith 1200* (FS); Dixey Mts., Lassen Co., July, 1894, *Baker & Nutting s.n.* (UC); Diamond Mt., near Susanville, June 28, 1897, *M. E. Jones s.n.* (P, TYPE of *A. sabulosa*, var. *frigida*); vicinity of Doyles Station, Lassen Co., May, 1911, *Eggleston 6702* (US); Summit, Sierra Co., 1873, *Bolander 338* (M); Summit, Owens Valley, May 19 & 20, 1897, *M. E. Jones s.n.* (P, TYPE? of *A. sabulosa*, var. *colorata*). OREGON: Juniper Springs, Malheur Co., June, 1896, *Leiberg 2261* (G, NY, UC, US); Harper Ranch, Malheur Co., May, 1896, *Leiberg 2092* (G, O, UC, US); Camp Harney, Harney Co., May, 1885, *T. Howell s.n.* (G, O, US); near Prairie City, Grant Co., June, 1925, *Henderson 5289* (O); Forked Horn Butte, near Laidlaw, Crook Co., June, 1919, *Whited 99* (G, US, WSC); Deschutes Co., Aug., 1920, *Peck 9762* (W); Hart Mt., Lake Co., July, 1933, *L. Constance* (Henderson no. 15758) (O); Ingram Butte, Lake Co., July, 1929, *Ingram 3070* (FS); Pelican City, Klamath Co., May, 1923, *Applegate 3510* in part (DS, O); Brookside Ranch, Swan Lake Valley, Klamath Co., June, 1923, *Applegate 3586* (DS). WASHINGTON: Ellensburg, Kittitas Co., May, 1897, *Piper 2707* (WSC); Tampico, Yakima Co., May, 1899, *Flett 1125* (WSC); Cleman Mt., Yakima Co., June, 1892, *Henderson 2389* (G, UW); near Bickleton, Klickitat Co., April, 1934, *Pickett et al. 1463* (WSC).

Arabis puberula is related to *A. subpinnatifida* and to *A. Holboellii*, var. *retrofracta*. As pointed out elsewhere, more abundant and accurate information on the life-histories of these plants may show that *A. subpinnatifida* should be given only subordinate rank under *A. puberula*. In habit and disposition of siliques, *A. puberula* resembles *A. Holboellii*, var. *retrofracta*, but ordinarily it can be distinguished by the fact that the siliques are densely pubescent, instead of being glabrous or only sparsely pubescent. The basal leaves of *A. puberula* tend to be dimorphic as in *A. subpinnatifida*. The leaves of the sterile shoots and first-year rosettes are much longer, narrower and more acuminate than the basal leaves of the fruiting stems.

The pubescence of *A. puberula* is hoary, being extremely dense on the stems, leaves and usually on the siliques. The seeds and siliques are broader and the flowers somewhat larger than any found in *A. Holboellii*, var. *retrofracta*.

In a former paper[1] *A. puberula* was treated and illustrated as *A. subpinnatifida*, var. *impar*. At that time the application of *A. puberula* was not properly known to me. Observing that plate 359 in Hooker's Icones Plantarum,[2] labeled *Arabis puberula*, was "taken from a specimen obligingly sent to us—by Mr. Nuttall", I had supposed the illustration to have been taken from an isotype or at least authentic material. Now that photographs of Nuttall's types of *A. canescens* and *A. puberula* in the British Museum have been obtained and isotype material of both has been examined at the Academy of Natural Sciences of Philadelphia, it is clear that Hooker illustrated Nuttall's *A. canescens*, but gave the description and locality of *A. puberula*. This mix-up has been the source of a seemingly perpetual misinterpretation of both *A. puberula* and *A. canescens*. Hooker's illustration is actually *A. cobrensis* Jones under which *A. canescens* Nuttall, being a later homonym, must now be placed.

The synonyms of *A. puberula* listed above are clear, except perhaps *A. Beckwithii*. When Watson described the latter species he cited four collections, without designating a type, as follows: "Nevada (Quartz Mountains, *Beckwith;* near Carson City, *Watson;* Candelaria, *Shockley*); San Bernardino Mountains, California (*Parish Brothers*, 1302)". The Beckwith and Watson specimens, though only in flower, appear to be merely *A. puberula*. The other two obviously belong to a different species and have been named *A. Shockleyi* by Munz. If, as seems reasonable, we are to associate the name *A. Beckwithii* with the Beckwith specimen as type, then the name must fall into the discard as a synonym of the older *A. puberula*.

39. A. SUBPINNATIFIDA Watson. Perennial; stems one to few from a simple or branched caudex, simple or branched above, densely pubescent with fine dendritic trichomes throughout or glabrous above, 1.5–4 dm. high; basal leaves dimorphic, leaves at base of flowering stems linear to linear-oblanceolate, acute, petiolate, dentate to somewhat incised, rarely entire, hoary with

[1] Res. Stud. State Coll. Wash. 4: 32 (1936).
[2] Icones Plant. 4: tab. 359 (1841).

a fine, dense, dendritic pubescence, 1–3 cm. long, 2–4 mm. wide, leaves of the sterile shoots narrowly linear-oblanceolate, acuminate, usually entire, 2–5 cm. long, densely pubescent; cauline leaves lanceolate to linear-lanceolate, acute, revolute, sessile or the lower having the suggestion of a petiole, subpinnatifid to irregularly dentate, rarely almost entire, hoary, 1–3 cm. long, 2–6 mm. wide, auricles small or absent; sepals oblong, scarious-margined, densely pubescent, often purplish, 5–7 mm. long; petals spatulate to lingulate, purple to lavender, 10–14 mm. long, 2–3 mm. wide; glandular tissue weakly developed, continuous under all stamens; flowering pedicels erect to divaricate; fruiting pedicels arched downward, pubescent, rather stout, 6–12 mm. long; siliques pendent, straight to slightly curved inward, glabrous to sparsely pubescent, 5–7 cm. long, 2–3.5 mm. wide, apex acuminate; style about 1 mm. long; seeds orbicular to slightly oblong, winged on the sides or sometimes all around, 1.5–2.5 mm. broad including wings, uniseriate.—Proc. Am. Acad. **20:** 353 (1885) and in Gray, Syn. Fl. N. Am. **1:** 165 (1895) in part; Howell, Fl. Northw. Am. **1:** 46 (1897); Jepson, Man. Fl. Pl. Calif. 431 (1925) and Fl. Calif. **2:** 65 (1936); Rollins in Res. Stud. State Coll. Wash. **4:** 30, fig. 7 (1936).—Oregon and CALIFORNIA; Siskiyou Co.: Callahan, *Eastwood & Howell 5024* (R); east of Etna, April, 1938, *Horn 28* (G); Scott Valley, April and June, 1876, *Greene 711* (G, ND); Yreka, April, 1914, *L. E. Smith 636* (G). Trinity Co.: Mary Blaine Mt., Aug., 1935, *Tracy 14442* (UC); Trinity River Canyon, *Eastwood & Howell 4975* (R). Humboldt Co.: Grouse Mt., July, 1933, *Tracy 12878* (UC). OREGON: Jackson Co.: above Inns, July, 1930, *Henderson 12863* (O); Anderson's Camp east of Abbott Butte, July, 1899, *Leiberg 4279* (O, US); Abbott Butte, July, 1936, *Thompson 13057* (R, T). Josephine Co.: Waldo, June, 1884, *T. Howell s.n.* (G, TYPE; NY, T, US, isotypes); Kerby, April, 1926, *Henderson 5918* (M, O, RM); Rogue River near Galice, April, 1926, *Henderson 5917* (M, O, RM); Sexton Mt., April, 1934, *Thompson 10248* (T, US, W); near Merlin, March, 1927, *Peck 14775* (NY, W); Takilma, June, 1918, *Peck 8422* (G, W).

There is some question as to whether *A. subpinnatifida* should be kept up as a species now that the identity of Nuttall's *A. puberula* is clear. The plants formerly treated[1] as *A. subpinnatifida*, var. *impar* undoubtedly should be referred to *A. puberula*. In order to place these two entities in the same relationship nomenclaturally, it would be necessary to place *A. sub-*

[1] Res. Stud. State Coll. Wash. **4:** 32 (1936).

pinnatifida in varietal rank under *A. puberula.* This I should hesitate to do unless further investigation should indicate a closer affinity between the two than is now apparent. Ordinarily the two species will not be confused except, perhaps, in an area where they come together in western Nevada and northeastern California. *A. subpinnatifida* differs from *A. puberula* in having larger flowers and broader siliques. The siliques are acuminate at the apex, the style is about 1 mm. long and the cauline leaves are usually subpinnatifid in the former species. In *A. puberula* the cauline leaves are usually entire and the smaller, blunt siliques lack a definite style, the stigma being quite sessile.

Of the three specimens cited in the original publication of *A. subpinnatifida,* the specimen from the "West Humboldt Mts., Nev.", is *A. puberula.* The other two represent the species as here interpreted.

40. A. COBRENSIS M. E. Jones. Perennial; stems slender, several to many from a branched caudex, simple or usually branched above, softly pubescent with minute dendritic trichomes below, glabrate above, 2–5 dm. high; basal leaves numerous, entire, linear, acute, densely and finely pubescent with minute dendritic trichomes, hoary, 2–5 cm. long, 1–3 mm. wide; cauline leaves few, narrowly linear, entire, sessile, inconspicuously auriculate, often subtending a flower or branch, densely pubescent, 1–3.5 cm. long, 1–3 mm. wide; flowers small; sepals oblong, obtuse, non-saccate, sparsely pubescent, scarious-margined, 2–3 mm. long; petals white, narrowly clawed, about 4 mm. long, 1 mm. wide; glandular tissue continuous beneath all stamens; stamens nearly equal; fruiting raceme open; siliques straight or nearly so, pendulous or widely descending, sparsely pubescent pedicels, one-nerved below the middle, glabrous, obtuse, 3–5 cm. long, about 2 mm. wide; style very short or absent; seeds slightly oblong to nearly orbicular, about 2 mm. long, uniseriate, rather widely winged, wing about 0.5 mm. wide.—Contrib. West. Bot. **12:** 1 (1908). *A. canescens* Nuttall ex T. & G., Fl. N. Am. **1:** 83 (1838); Watson in Gray, Syn. Fl. N. Am. **1:** 165 (1895) in part; Coulter & Nelson, New Man. Bot. Rky. Mts. 228 (1909) in part; Rydberg, Fl. Rky. Mts. 363 (1918) in part; Tidestrom in Contrib. U. S. Nat. Herb. **25:** 245 (1925) in part, not *A. canescens* Brocchi in Bibleot. Ital. **29:** 90 (1823). *A. puberula* sensu Hooker, Icon. Pl. **4:** t. 359 (1841); Rollins in Res. Stud. State Coll. Wash. **4:** 34 (1936). *A. crypta* A. Nelson in Bot. Gaz. **56:** 473 (1913); Tidestrom, op. cit. p. 244.—Wyoming to Nevada and Oregon. MAP 17. LOCALITY UNCER-

tain: R.(ocky) Mts., *Nuttall s.n.* (G, Ph, isotypes of *A. canescens* Nutt.; photo of type from Herb. Brit. Mus. in Gray Herb.). Wyoming: Orenda Butte, Red Desert, Sweetwater Co., June, 1900, *Nelson 7131* (RM); Point of Rocks, Sweetwater Co., June, 1897, *Nelson 3077* (G, M, RM, US); between Eden and Big Piney, Sublette Co., July, 1922, *E. B. & L. B. Payson 2569* (G, M, RM, UC, US); 3 miles north of Lyman, Uinta Co., June, 1937, *Rollins 1656* (G, R), June, 1938, *Rollins 2287* (G, R); Granger, Uinta Co., June, 1898, *Nelson 4700* (RM). Idaho: desert near Big Butte, Butte Co., *R. J. Davis 167* (UIP). Nevada: Cobre, Elko Co., June 16, 1906, *M. E. Jones s.n.* (P, type; M, UC, US, isotypes); Jarbidge, Elko Co., July 4, 1912, *Nelson & Macbride s.n.* (RM, type of *A. crypta*); Paradise Valley, Humboldt Co., April, 1905, *Kennedy 1055* (RM); Winnemucca, May, 1917, *Wooton s.n.* (US); 5 miles north of Poeville, Washoe Co., June, 1938, *Tollotson 101* (R, VTM); Empire City, June, 1882, *Jones 3762* (Cl, M, US). Oregon: near Gateway, Jefferson Co., June, 1925, *Peck 13808* (W); between Prineville and Button Springs, Crook Co., June, 1894, *Leiberg 342* (US); camp at Dry Creek, Crook Co., July, 1894, *Leiberg 342* (G, O, UC); Fort Rock, Lake Co., June, 1911, *Eggleston 6835* (NY, US); base of Steens Mts., Harney Co., June, 1901, *Cusick 2567* (G, M, O, RM, UC, US, WSC).

This species was treated as *A. puberula* in a former paper.[1] The misapplication of the name was made as a result of my having followed the plate in Hooker's Icones Plantarum.[2] In the latter work, Nuttall's *A. canescens* is figured, but the plate is given as *A. puberula* Nutt., which is actually an entirely different species. An explanation of this error is given more fully under *A. puberula*.

A. cobrensis is found in the semi-arid to arid desert regions of the Great Basin area of western America. The stems are weak and often depend upon sagebrush or similar shrubby plants for support and protection. Its nearest relative is *A. puberula*, from which it differs in having remote instead of imbricated cauline leaves, glabrous instead of pubescent siliques and long linear basal leaves in place of short narrowly oblanceolate ones. *A. crypta* is based on an aberrant specimen of *A. cobrensis*. The type of *A. crypta* has abnormally short siliques caused by a high percentage of aborted ovules.

[1] Res. Stud. State Coll. Wash. **4**: 34 (1936).
[2] Hook. Icon. Pl. **4**: t. 359 (1841).

Otherwise the distinctive characters of *A. cobrensis* are unmistakably present. *A. cobrensis* is relatively homogeneous compared to many species of *Arabis*.

41. A. Shockleyi Munz. Perennial, hoary with a fine dendritic pubescence; caudex simple, invested by old leaves and leaf-bases; stems one to few, simple to branched above, stout, densely pubescent throughout with minute dendritic trichomes, 1.5–3 dm. high; basal leaves crowded, spatulate, entire, short-petioled, hoary, 1–2 cm. long, 4–6 mm. broad; cauline leaves broadly lanceolate, acute, auricled but not clasping the stem, approximate, 1–1.5 cm. long, 3–6 mm. wide; sepals linear-oblong, pubescent, non-saccate, 5–7 mm. long, 1–1.5 mm. wide; petals linear-lanceolate, obtuse, pink, 8–11 mm. long, gradually tapering from blade to claw; glandular tissue continuous beneath all stamens, not highly developed; pedicels ascending, densely pubescent, 8–12 mm. long; siliques divaricate, crowded at apex of stem, straight to slightly curved, sparsely pubescent or glabrous, nerved at base only, often purplish, 5–8 cm. long, about 2 mm. wide; stigma sessile or nearly so; seeds oblong, plump, essentially wingless, 1 mm. broad, biseriate.—Bull. So. Calif. Acad. Sci. **31:** 62 (1932) and Man. So. Calif. Bot. 203 (1935).—Utah, Nevada and California. Utah: Dutch Mountain, Tooele Co., June, 1900, *Jones 6169* (P). Nevada: Millin Mt., Esmeralda Co., May, 1884, *W. H. Shockley 366* (G, type; ND, US, isotypes). California: dry canyon, north slope of the San Bernardino Mts., May, 1882, *S. B. & W. E. Parish 1302* (G, DS).

The type of *A. Shockleyi* was cited by Watson[1] under *A. Beckwithii* when that species was originally published. However, he had included two distinct species in *A. Beckwithii* and it remained for Munz to separate them correctly and give one a new name. The three cited collections of *A. Shockleyi* come from widely separated points in the Great Basin and Mohave Desert region. In spite of this, the plants are remarkably uniform and undoubtedly belong to the same species. The paucity of material of *A. Shockleyi* emphasizes the fact that many of the desert mountain-ranges where it presumably occurs have not been adequately explored. In many cases they have not even been visited by a botanist.

42. A. **inyoensis,** sp. nov. Herba perennis; caulibus paucis erectis robustis rigidis inferne pubescentibus superne glabratis 2–5 dm. altis; foliis radicalibus numerosis lineari-oblanceolatis

[1] Proc. Am. Acad. **22:** 467 (1887).

vel spathulatis integris canescentibus 2–3 cm. longis, 2–5 mm. latis; foliis caulinis sessilibus oblongis auriculatis pubescentibus 1–2.5 cm. longis, 1.5–3 mm. latis; sepalis lineari-oblongis non saccatis pubescentibus 3.5–4.5 mm. longis; petalis roseis vel purpureis lingulatis vel spathulatis 7–9 mm. longis, ca. 2 mm. latis; pedicellis fructiferis divaricatis sparse pubescentibus vel glabris 6–12 mm. longis; siliquis glabris divaricatis 4–6 cm. longis, ca. 2 mm. latis; seminibus orbicularibus alatis ca. 1.5 mm. latis uniseriatis; cotyledonibus accumbentibus.

Deep-rooted perennial; stems several from an enlarged branching caudex, erect, rigid, densely pubescent below, glabrate above, 2–5 dm. high; basal leaves numerous, linear-oblanceolate to spatulate, acute, entire, densely pubescent with dendritic trichomes, gray, 2–3 cm. long, 2–5 mm. wide, petiolate; cauline leaves sessile, oblong, auriculate, densely pubescent, gray, only slightly overlapping, 1–2.5 cm. long, 1.5–3 mm. wide; flowering pedicels ascending, sparsely pubescent; sepals linear-oblong, non-saccate, pubescent, 3.5–4.5 mm. long; petals pink to purplish, lingulate to spatulate, 7–9 mm. long, about 2 mm. wide; glandular tissue weakly developed, continuous beneath all stamens; fruiting pedicels spreading at right angles to rachis, glabrous to sparsely pubescent, 6–12 mm. long; siliques glabrous, spreading at right angles to rachis or slightly descending, nerved at base or up to the middle, straight or nearly so, 4–6 cm. long, about 2 mm. broad; seeds orbicular, winged, about 1.5 mm. broad, uniseriate, wing about 0.3 mm. wide; cotyledons accumbent.—California: hills west of Big Pine, Inyo Co., May 15, 1906, *Heller 8259* (G, type; M, NY, UC, US, isotypes); Darwin, April 28, 1897, *M. E. Jones s.n.* (P); Ralston, Sierra Nevada, July 22, 1920, *H. M. Evans s.n.* in part (P); mountain slope west of Heart Lake, Rock Creek Lake Basin, Inyo Co., Aug., 1940, *Peirson 12975* (G, R); Shepherd Canyon, April 30, 1897, *M. E. Jones s.n.* (P); Hanaupah Canyon, Panamint Mts., Inyo Co., May, 1932, *Munz 12559* (P); Keeler, Inyo Co., April 14—, *T. S. Brandegee s.n.* (G).

Arabis inyoensis is somewhat related to *A. lignifera,* but differs, among other ways, in having broader, straight instead of curved siliques, more rigid stems and more widely winged seeds. Our species also bears some relation to *A. pulchra* with which it agrees in type of pubescence. *A. inyoensis* may be distinguished from the latter species by its auriculate cauline leaves, uniseriate seeds and widely spreading, glabrous siliques. In habit, *A. inyoensis* somewhat resembles *A. dispar,* but the seeds, siliques and type of pubescence are wholly different in the two. *A. inyoensis* borders the Mohave Desert in east-central California.

43. A. PULCHRA M. E. Jones ex Watson. Perennial with a sub-shrubby base; caudex simple or branching, usually elevated above ground; stems one to several, simple or branched, densely pubescent with minute appressed dendritic trichomes throughout to glabrous above, 2–6 dm. high; basal leaves linear, entire or rarely slightly dentate, obtuse, densely pubescent with minute dendritic trichomes, petiolate, 4–8 cm. long, 3–6 mm. broad; cauline leaves linear, sessile, densely pubescent, non-auriculate, 2–6 cm. long, 3–4 mm. broad; pedicels erect or divergent at anthesis, sharply recurved to pendulous in fruit, densely pubescent (glabrous or nearly so in var. *gracilis*), 8–20 mm. long; sepals oblong, densely pubescent, often purplish, 5–8 mm. long, 1.5–2.5 mm. wide, outer pair very slightly saccate; petals purple to reddish or white, broadly spatulate, 8–20 mm. long, 3–5 mm. wide; glands well developed, continuous beneath all stamens; siliques strictly reflexed to pendulous, straight, densely pubescent (glabrous or nearly so in var. *gracilis*), hoary when young, 4–7 cm. long, 2.5–3.5 mm. wide; valves thick, nerved to the middle or above; stigma sessile or the style very short; seeds nearly orbicular, rather prominently winged, 1.5–2 mm. broad, biseriate.

KEY TO THE VARIETIES OF A. PULCHRA

a. Mature siliques strictly appressed on geniculately reflexed pedicels, densely pubescent; petals purple........... 43a. var. *typica*.
a. Mature siliques pendulous on arched pedicels, densely pubescent to glabrous; petals purple to white........... *b*.
  b. Siliques and upper stems glabrous or nearly so; pedicels glabrous to very sparsely pubescent, slender, 1–2 cm. long.. 43d. var. *gracilis*.
  b. Siliques and upper stems densely pubescent; pedicels densely pubescent, stouter, 5–15 mm. long........... *c*.
    c. Petals purple, less than 1 cm. long. Western Utah, Nevada and California..................... 43b. var. *munciensis*.
    c. Petals white or rarely purple, 12–20 cm. long. Colorado and eastern Utah, southward.................... 43c. var. *pallens*.

43a. Var. **typica.** *A. pulchra* M. E. Jones ex Watson in Proc. Am. Acad. **22:** 468 (1887); Coville in Contrib. U. S. Nat. Herb. **4:** 61 (1893); Watson in Gray, Syn. Fl. N. Am. **1:** 167 (1895); M. E. Jones, Contrib. West. Bot. **14:** 41 (1912); Rydberg, Fl. Rky. Mts. 360 (1918); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 244 (1925); Jepson, Man. Fl. Pl. Calif. 431 (1925) and Fl. Calif. **2:** 69 (1936); Munz, Man. So. Calif. Bot. 205 (1935); Jaeger, Desert Wild Fls. 79, fig. 167 (1940).—Nevada and California to Baja California, Mexico. MAP 23. NEVADA: Empire City, Ormsby Co., June 19, 1882, *M. E. Jones 3765* (G, type; Cl, NY, P, US, isotypes); Carson City, Ormsby Co., June, 1897, *M. E. Jones s.n.* (P); Reno, Washoe Co., June 12, 1894, *Hillman s.n.* (P); 1 mile east of Virginia City, May, 1937, *Moore & Franklin 26* (R); pass west of Lida, Esmeralda Co., June, 1919, *Tidestrom 9846* (US). California: above Lake Sabrina at head of Bishop Creek, Inyo Co., Aug., 1938, *Constance 2465* (R); Lone Pine, Inyo Co., May, 1897 & May, 1927, *M. E. Jones s.n.* (P); 18 miles south of Ryan, Inyo Co., April, 1928, *Peirson 7807* in part (Peirs); Willow Springs, Kern Co., April, 1926, *Munz 10033* (P); Frazier Borax Mine, Ventura Co., June, 1908, *Abrams & McGregor 202* (G, NY, US); 4 miles southwest of Fairmont, Los Angeles Co., April, 1932, *Wheeler 569* (G); near Palmdale, Los Angeles Co., April, 1937, *Eastwood & Howell 3968* (G); Whitewater, Riverside Co., April, 1880, *Parish Bros. 97* (G); Hesperia, San Bernardino Co., April, 1917, *Spencer 391* (G, P, US); near Jacumba, San Diego Co., May, 1903, *Abrams 3643* (G, NY, P). Mexico: 50 miles southeast of Tecate, Baja California, May, 1925, *Munz 9560* (P).

43b. Var. munciensis M. E. Jones. Pedicels gently spreading downward, never geniculately reflexed; siliques pendulous.—Contrib. West. Bot. **14:** 42 (1912).—Western Utah to eastern California. Map 23. Utah: between St. George and Beaver Dam Mts., May, 1919, *Tidestrom 9319* (US); Milford, May, 1903, *S. G. Stokes s.n.* (US). Nevada: Muncy, White Pine Co., May 19, 1906, *M. E. Jones s.n.* (P, type), June 25, 1906, *M. E. Jones s.n.* (P); Ferguson Spring, White Pine Co., June, 1900, *M. E. Jones s.n.* (P); Tonopah, April, 1907, *M. E. Jones s.n.* (P); Candelaria, Mineral Co., May—, *Shockley 218* (G); first canyon north of Pioche, Ely Range, Lincoln Co., April, 1939, *Train 2653* (G, NA, R). California: Darwin, April, 1897, *M. E. Jones s.n.* (P).

43c. Var. pallens M. E. Jones. Petals white or rarely purple, 1.2–2 cm. long, 4–5 mm. wide at apex; pedicels arching downward or rarely more strictly reflexed; siliques pendulous.—Contrib. West. Bot. **14:** 42 (1912). *A. formosa* Greene, Pitt. **4:** 198 (1900); Coulter & Nelson, New Man. Bot. Rky. Mts. 228 (1909); Wooton & Standley in Contrib. U. S. Nat. Herb. **19:** 280 (1915); Rydberg, Fl. Rky. Mts. 360 (1918).—Western Colorado, eastern Utah and adjacent Arizona and New Mexico. Map 23. Colorado: 2 miles west of Rifle, Garfield Co., May, 1938, *Rollins 2201* (G, R); 8 miles west of Grand Junction, May, 1938, *Rollins 2169* (G, R); Grand Junction, May, 1892, *Eastwood s.n.* (G, US); near Westwater, Utah, but in Mesa Co., Colo., May 6, 1891, *M. E. Jones s.n.* (P, type; G, NY, US, isotypes); Naturita, April, 1914, *Payson 245* (G, Ph, RM); 6 miles east of Montrose, Montrose Co., May, 1938, *Rollins 2120*

(G, R). New Mexico: Aztec, April, 1899, *C. F. Baker 345* (US, type; G, NY, RM, isotypes of *A. formosa*). Utah: 8 miles south of Manila, Daggett Co., June, 1938, *Rollins 2281* (G, R); 14 miles west of Vernal, Uintah Co., June, 1937, *Rollins 1748* (G, R); San Rafael Swell, Emery Co., May, 1914, *M. E. Jones s.n.* (P); Lower Crossing (Woodside), Emery Co., July, 1898, *M. E. Jones s.n.* (P); La Sal Mts., June, 1913, *M. E. Jones s.n.* (P); Cisco, May, 1890, *M. E. Jones s.n.* (P, US); near Bluff, San Juan Co., April, 1936, *Maguire 13518* (R). Arizona: vicinity of Kayenta, 1922, *Wetherill s.n.* (NY).

43d. Var. gracilis M. E. Jones. Pubescence coarser and less dense than in var. *typica;* stems glabrous above; pedicels arched downward, never geniculately reflexed, slender, 1–2 cm. long; siliques pendulous, glabrous or nearly so.—Contrib. West. Bot. **8:** 41 (1898); Munz, Man. So. Calif. Bot. 205 (1935). *A. trichopoda* Greene in Fedde, Rep. Nov. Sp. **5:** 242 (1908), not *A. trichopoda* Turcz. in Bull. Mosc. **8:** 63 (1840). *A. pulchra* Jones, var. *glabrescens* Wiggins in Contrib. Dudl. Herb. **1:** 100 (1929). *A. pulchra* Jones, var. *viridis* Jepson, Fl. Calif. **2:** 70 (1936).—Nevada and California. Map 19. Nevada: Calientes, Lincoln Co., April, 1904, *M. E. Jones s.n.* (NY, P); Meadow Valley Wash, April, 1904, *M. E. Jones s.n.* (P); Goodsprings, Clark Co., May, 1905, *M. E. Jones s.n.* (P). California: Silver Canyon, east of Laws, Inyo Co., May, 1906, *Heller 8191* (G); Dantes Point, Inyo Co., April, 1928, *Munz & Hitchcock 11014* (P); Shepherd Canyon, Argus Mts., May 1, 1897, *M. E. Jones s.n.* (P, type; US, isotype; also type and isotype of *A. trichopoda*); Granite Well, above Cooper City, May, 1922, *Johnston 6552* (P, RM); Providence Mts., May, 1920, *Munz et al. 4263* (P); Cactus Flat, San Bernardino Mts., May, 1926, *M. E. Jones s.n.* (P); Cima Road, 10 miles south of Las Vegas Road, April, 1930, *Peirson 8733* (Peirs); Jacumba-Mountain Springs, April, 1920, *Eastwood 9541* (G); Jacumba, April, 1924, *Eggleston 19773* (G, P); Julian-Banner, March, 1926, *Wiggins 2015* (G, P, US, isotypes of *A. pulchra*, var. *glabrescens*).

That *A. pulchra* is made up of a series of several varieties was first recognized by Jones, l. c., who studied the species as he explored much of the arid area it occupies. His three varieties, which have a measure of geographical discreteness, are accepted as probably representing natural subdivisions of the species. The very densely pubescent siliques and biseriate seeds will easily identify all plants of *A. pulchra*, except var. *gracilis*, which has nearly glabrous siliques and pedicels. *A. pulchra* is a weak-stemmed plant with a sub-shrubby base. It is very often found tangled among desert shrubs from which it derives support. The very large-flowered var. *pallens* usually has white flowers, but sometimes purple flowers are also found. The latter variety was named *A. formosa* by Greene, but the plants certainly do not represent a distinct species.

Jepson[1] states that Jones "first recognized and named this species and indicated (in herb.) as the type his specimens (Jones 3764) from Empire City, Ormsby Co., Nev. June 19, 1882". These data are correct except that the type is *Jones, no. 3765* in the Gray Herbarium, the specimen from which the original description was drafted by Watson. Two sheets of this number are in the Jones Herbarium at Pomona College. Fortunately, *Jones 3764* is not the type because three of the four sheets bearing that number which I have examined are *A. sparsiflora*, var. *typica*, the fourth is a mixture of the latter plant and *A. pulchra.*

44. A. tricornuta Rollins. Perennial; stems single, branched above, pubescent below with simple or branched trichomes, glabrous above, 3–6 dm. high; basal leaves caducous, unknown; lower cauline leaves petiolate, oblanceolate, pubescent with harsh 2- or usually 3-pronged trichomes, 3–5 cm. long, about 1 cm. wide; upper cauline leaves linear to narrowly lanceolate, glabrous; inflorescence lax, slender, greatly elongated; sepals glabrous, nearly ovate to broadly oblong, 3–4 mm. long, 2–3 mm. wide, unequal, non-saccate, inner pair tapering at base; petals white, narrowly spatulate, thickened toward base with edges rolled outward, erose to entire along upper margin, not strongly differentiated into blade and claw, 4–5 mm. long, about 1.5 mm. wide; stamens slightly shorter than petals, filaments of single stamens curved, filaments of paired stamens straight; glandular tissue surrounding base of single stamens, continuous beneath paired stamens, well developed; pedicels slender, gently curved downward, glabrous, 1–1.5 cm. long; siliques glabrous, 1-nerved to middle or above, spreading at right angles to widely pendulous, often secund, 3–7 cm. long, about 2 mm. wide; style about 1 mm. long; stigma entire; seeds flat, orbicular, conspicuously winged all around, about 1.5 mm. broad, uniseriate; cotyledons obliquely accumbent.—In Kearney and Peebles in Journ. Wash. Acad. Sci. **29:** 478 (1939).—Arizona: Eastview, Rincon Mts., Oct. 13, 1909, *J. C. Blumer 3478* (G, type); Rincon Mts., 1891, *Neally 120* in part (US); Santa Rita Mts., Aug. 23, 1936, *Darrow & Arnold s.n.* (G).

[1] Fl. Calif. **2:** 70 (1936).

Arabis tricornuta is particularly interesting because at anthesis it is very difficult to distinguish from *Thelypodium micranthum.* In habit, inflorescence, flower and type of pubescence they are almost identical. One minor feature of flower-similarity is particularly striking. In both species the short stamens arise at right angles to the ovary and then curve upward. This particular characteristic has not been observed in other species of *Arabis*, but it is not of major importance as a diagnostic character, since there is considerable variation in stamen-insertion throughout the genus. The definitely winged seeds, accumbent cotyledons and markedly flattened siliques of *A. tricornuta* leave little doubt about its being properly placed in *Arabis*, in spite of the striking similarity it shows to another species of a different genus. *A. tricornuta* is not closely related to any North American species of *Arabis,* but the flower, inflorescence, and upper parts of the plant are similar to *A. laevigata.* It is somewhat like *A. repanda,* particularly as regards the petiolate cauline leaves, but the similarity is only superficial. *A. tricornuta* is apparently restricted to the mountains of southern Arizona where it has been collected at elevations of between seven and nine thousand feet.

45. A. REPANDA Watson. P e r e n n i a l ; caudex simple or branched; pubescence of forked or dendritic trichomes; stems one to few, branched above, densely pubescent below, sparsely pubescent to glabrous above, green to purplish, (1–) 2–7 dm. high; basal leaves rosulate, petiolate, deeply toothed, repand or entire, densely pubescent, oblanceolate to broadly spatulate, obtuse, 3–7 cm. long, 1–3 cm. wide, petiole winged; cauline leaves petiolate or the upper sessile, broadly oblanceolate to nearly linear, densely pubescent, often subtending the somewhat flexuous branches, 1–6 cm. long, 0.5–2 cm. wide, entire to repand; inflorescences rather lax, terminating the stem-branches; pedicels stout, straight, divaricately ascending to erect, pubescent to rarely glabrous, 3–6 (–10) mm. long; sepals pubescent, linear-oblong, 4–5 (–6) mm. long, 1–2 mm. wide, non-saccate, outer pair slightly longer than the inner; petals white to pinkish, nearly linear, narrow at base, 4–6 mm. long, about 1 mm. wide; all stamens nearly equal in length; nectar-glands weakly developed, nearly surrounding all stamens; siliques divaricately ascending, straight or often falcate, pubescent to glabrous, linear, coriaceous, nerved to the middle or usually nerveless, 4–10 cm.

long, 2–4 mm. wide; style slender, 1 mm. or less long; seeds orbicular to slightly elliptical, widely winged, 2–4 mm. broad including wings; cotyledons accumbent.

45a. Var. **typica.** *A. repanda* Watson in Proc. Am. Acad. **11:** 122 (1875); Brewer & Watson, Bot. Calif. **1:** 32 (1876); Coville in Contrib. U. S. Nat. Herb. **4:** 61 (1893); Watson in Gray, Syn. Fl. N. Am. **1:** 161 (1895); Jepson, Man. Fl. Pl. Calif. 429 (1925) and Fl. Calif. **2:** 63 (1936).—Nevada and California. Map 10. Nevada: 8 miles southwest of Reno, Sierra Nevada, Washoe Co., June, 1938, *Archer 6111* (G, NA, R), July, 1938, *Archer 6259* (NA, R); 10 miles southwest of Carson City, Douglas Co., June, 1938, *Archer 6032* (NA). California: west of Alder Springs, Glenn Co., July, 1917, *Heller 12799*) Cl, G, M, NY, US); near Floriston, Nevada Co., June, 1934, *J. T. Howell 11836* (G); Stanislaus Forest, Alpine Co., July, 1913, *Eggleston 9573* (US); Bridgeport Quadrangle, Eagle Creek, Mono Co., July, 1937, *Hendrix 329* (VTM); Yosemite Valley, Mariposa Co., 1866, *H. N. Bolander 4881* (G, type); above Whiskey Creek, 1 mile below Ellis Meadow, Madera Co., July, 1938, *Constance 2386* (R); Giant Forest, Tulare Co., July, 1905, *T. S. Brandegee s.n.* (NY); near Mineral King, Tulare Co., July, 1891, *Coville & Funston 1389* (G, US); Tehachapi, Kern Co., June, 1889, *E. L. Greene s.n.* (US); Frazier Mt., Ventura Co., July, 1905, *Hall 6614* (UC); North Baldy Mt., Los Angeles Co., July, 1908, *Abrams & McGregor 589* (G, US); Bear Valley, San Bernardino Mts., San Bernardino Co., June, 1895, *S. B. Parish 3752* (G, UC, US), Aug., 1902, *Abrams 2863* (G, NY, P, US); North Fork Tahquitz Creek, San Jacinto Mts., Riverside Co., Sept., 1922, *Munz 6386* (P).

45b. Var. Greenei Jepson. Stems 1–3.5 dm. high; leaves entire to slightly dentate; pedicels sparsely pubescent, 5–10 mm. long; siliques glabrous, 2–2.5 mm. wide, nerved at least to the middle; style about 1 mm. long; seeds about 2 mm. broad including wings.—Fl. Calif. **2:** 63 (1936). *A. inamoena* Greene, Leaflets **2:** 158 (1911), not *A. inamoena* Greene in Fedde, Repert. Nov. Sp. **5:** 243 (1908).—Map 10. California: 19 miles south of Mono Lake, Mono Co., Aug., 1938, *Constance 2461* (R); South Lake, Inyo Co., July, 1913, *Davidson 2956* (G); Lake Sabrina, Bishop Creek, Inyo Co., July 11—, *Davidson 2729* (ND, type); Rock Creek Lake Basin, west of Heart Lake, Inyo Co., Aug., 1933, *Peirson 10768* (P, Peirs).

Plants of *A. repanda* have been collected at various altitudes ranging from 5,000 to 11,500 ft., but they appear to be most abundant in the pine belt. A dwarfed variety of the species was named *A. inamoena* by Greene, l. c., the name being a homonym of his own earlier *A. inamoena* which in turn is synonymous with *A. platysperma.* Jepson, l. c., renamed the later *A. inamoena* of Greene as *A. repanda*, var. *Greenei*, stating that it "is at most of varietal value". The variety *Greenei* is based on its small size, entire or nearly entire leaves and usually longer style than that found in var. *typica.* None of these features is completely consistent in the four collections examined. The siliques of var. *Greenei* are nerved below, glabrous, and the seeds are less widely winged than those of var. *typica.*

There is some variation in the amount of vestiture on different plants of var. *typica.* The type, together with a number of other collections, has pubescent siliques, but in the majority of specimens of *A. repanda* studied the siliques are glabrous. There is evidence that mature siliques are sometimes glabrous only because the indument has been shed. Other species of *Arabis*, such as *A. pulchra* and *A. puberula*, are known to shed the indument from their siliques and the phenomenon is in line with the general evidence regarding the unreliability of the presence or absence of vestiture as a criterion in the genus.

46. A. GLAUCOVALVULA M. E. Jones. Perennial; stems one or several from a ligneous, branching caudex, fairly robust, simple or branching above, hoary throughout, 1.5–4 dm. high; basal leaves linear to slightly broader, entire, obtuse, densely pubescent with dendritic trichomes, hoary, 2–5 cm. long, 2–5 mm. wide; cauline leaves lanceolate to linear-lanceolate, sessile, non-auriculate, densely pubescent throughout, 1–4 cm. long, 2–5 mm. broad; sepals oblong, reddish, non-saccate, pubescent, 4–5 mm. long, 2 mm. broad; petals with an oblong blade which is narrowed to a slender claw, pink to whitish, 6–8 mm. long, about 2 mm. wide; nectar-glands developed under single stamens, nearly obsolete under the paired stamens; pedicels stout, strongly recurved, densely pubescent; siliques reflexed, oblong, obtuse at both ends, glabrous and glaucous, one-nerved to the middle or often the entire length, 2–4.5 cm. long, 5–8 mm. wide; style evident, less than 1 mm. long; seeds orbicular, very widely winged, 5–6 mm. broad including the wings, biseriate.—Contrib. West. Bot. **8:** 40 (1898); Jepson, Man. Fl. Pl. Calif. 432, fig. 419 (1925) and Fl. Calif. **2:** 71 (1936); Munz, Man. So. Calif. Bot. 205 (1935); Jaeger, Desert Wild Fls. 82, fig. 170 (1940).—California and Nevada. MAP 18. CALIFORNIA: Keane Spring, Inyo Co., May, 1932, *Munz 12577* (P); Darwin Mesa, Argus Mts., May 8, 1897, *M. E. Jones s.n.* (P, TYPE; M, NY, Ph, RM,

UAC, UC, US, isotypes); 2 miles west of Darwin, May, 1932, *Munz 12489* (M, P, UC); Black Mts., Death Valley, May 2, 1927, *E. C. Jaeger s.n.* (P); Bishop Creek, Inyo Co., May, 1906, *Hall & Chandler 7246* (M, UC); 10 miles southeast of Windmill Tank, April, 1932, *C. L. Hitchcock 12241* (P); 3 miles east of Warren's Well, San Bernardino Co., May, 1922, *Munz & Johnston 5179* (Cl, G, NY, RM); Lanfair Valley, eastern San Bernardino Co., May, 1935, *Munz 13704* (P); Cottonwood Springs, Riverside Co., May, 1905, *Hall 6019* (UC), April, 1932, *C. L. Hitchcock 12241* (P); White Tanks, eastern Riverside Co., April, 1932, *Munz & Hitchcock 12231* (M, P); Keyes Ranch, Little San Bernardino Mts., May, 1922, *Munz & Johnston 5251* (Cl, UC, US).

Arabis glaucovalvula is one of the most distinctive species in the genus and has a very restricted range, bordering the Mohave Desert in California and Nevada. I have not seen specimens from Nevada, but a single collection is reported from that state by Jepson, l. c. The linear basal leaves, moderately fine dendritic pubescence, non-auriculate cauline leaves and biseriate seeds seem to relate this species to *A. pulchra*, while the broad siliques and large and widely winged seeds indicate something of an affinity with *A. platysperma* and *A. suffrutescens.* Actually, *A. glaucovalvula* is not closely allied to any other known species.

47. A. DISPAR M. E. Jones. Perennial; stems several from a branching, lignescent caudex, simple or branched above the base, densely pubescent below, less so above, 1–2.5 dm. high; basal leaves numerous, entire, erect, spatulate to linear-oblanceolate, slender-petioled, hoary with a dense, fine, dendritic pubescence, 1.5–2.5 cm. long, 2–4 mm. broad; cauline leaves sessile, broadly linear, reduced upwards, hoary, 1–2 cm. long, 1.5–2 mm. broad; sepals oblong, pubescent, purplish with scarious margins, about 4 mm. long, 1.5 mm. wide; petals obovate, purplish, not differentiated into blade and claw, 5–6 mm. long, about 2 mm. wide at apex; pedicels nearly erect to divaricate, pubescent, 1–2 cm. long; siliques divaricate to more ascending, glabrous, acute, 5–7 cm. long, 2.5–3.5 mm. wide, mid-nerve prominent below, absent above the middle; stigma sessile to subsessile; seeds nearly orbicular, widely winged, about 2 mm. broad, imperfectly uniseriate.—Contrib. West. Bot. **8:** 41 (1898); Munz, Man. So. Calif. Bot. 203 (1935); Jepson, Fl. Calif. **2:** 71 (1936). *A. nardina* Greene, Leaflets **2:** 70 (1910); Jepson, l. c. *A. salubris* Jones, Contrib. West. Bot. **14:** 37 (1912). *A. juniperina* Jones,

Contrib. West. Bot. **15:** 68 (1929).—MAP 17. CALIFORNIA: Pleasant Canyon, Panamint Mts., Inyo Co., May 6, 1897, *M. E. Jones s.n.* (P, TYPE; M, UAC, US, isotypes); north fork of Hanaupah Canyon, Panamint Mts., May, 1932, *Munz 12569* (P); Mill Canyon, Panamint Mts., May, 1891, *Coville & Funston 776* (US, TYPE; G, isotype of *A. nardina*); near Bishop, Inyo Co., May 13, 1927, *M. E. Jones s.n.* (P); Cactus Flat in Cushenbury Canyon, May 13, 1927, *M. E. Jones s.n.* (P, TYPE of *A. juniperina*); north slope of the San Bernardino Mts., San Bernardino Co., May, 1892, *S. B. & W. F. Parish 1300* (G); Quail Springs, Little San Bernardino Mts., May, 1922, *Munz & Johnston 5214* (Cl, G, P, RM).

The types of *A. dispar* and *A. nardina* are almost identical in every way except for the slightly narrower siliques on that of *A. nardina*. This difference is certainly not of sufficient definitive importance to warrant the maintenance of two names for an otherwise homogeneous entity. The type of *A. juniperina* is a slightly larger plant than the average and the siliques are a trifle more ascending than is usually found in *A. dispar*, but these are only minor variations to be expected as a response to local environmental conditions. *A. dispar* is most closely related to *A. Johnstonii*, but is separated from it on a number of fundamental points stressed in a discussion under that species.

I was not able to find a type for *A. salubris* at the Pomona College Herbarium. Jones's citation of the type-specimen is nearly identical with that for the type of *A. dispar*. From the descriptions it seems almost certain that he described the same collection under two different names, *A. dispar* in 1898 and *A. salubris* in 1912.

48. A. JOHNSTONII Munz. Perennial, densely pubescent with fine dendritic trichomes; stems several from a ligneous, branching caudex, erect or ascending, simple to branched, pubescent throughout, 1–2 dm. high; basal leaves entire, linear-oblanceolate to narrowly spatulate, petioled, 1–2 cm. long, 1.5–3.5 mm. wide, hoary with a fine dense dendritic pubescence; cauline leaves entire, sessile, not auriculate, lanceolate to linear-oblong, hoary, 1–1.5 cm. long, 2–5 mm. wide; sepals purplish, oblong, pubescent, 4.5–6 mm. long, about 1.5 mm. wide, outer pair slightly saccate at base; petals purple, spatulate, 8–10 mm. long, 2–3 mm. wide; ovary glabrous; pedicels ascending, pubescent, 6–10 mm. long; siliques very shortly stipitate, erect, glabrous, one-nerved to the middle or above, 3–5 cm. long, 2–3 mm. wide,

apex acuminate; style slender, persistent, 1–2 mm. long; seeds nearly orbicular, widely winged, about 1.5 mm. broad, uniseriate.—In Bull. So. Calif. Acad. Sci. **31:** 63 (1932) and Man. So. Calif. Bot. 204 (1935).—Southern California: Riverside Co.: Kenworthy, San Jacinto Mts., May 19, 1922, *Munz & Johnston 5485* (P, type; G, isotype), May, 1937, *Munz 15123* (G, P); near Toro Mt., San Jacinto Reserve, March, 1898, *Leiberg 3173* (US); Hemet Valley, San Jacinto Mts., *Peirson 3030* (Peirs).

A. Johnstonii is related to *A. dispar,* but is readily distinguished by its more ascending, shorter siliques, short gynophore, slender persistent style, larger purple petals and slightly saccate outer sepals. In general appearance, specimens of *A. Johnstonii* look like "grown-up" plants of *A. Parishii.* These species are related, but are easily separated on a number of characters. The flower is smaller and the style much shorter, yet the siliques are much larger in *A. Johnstonii* than in *A. Parishii.* The latter species has small, very narrowly winged seeds instead of the large, broad-winged seed which is characteristic of *A. Johnstonii.* At present the known range of *A. Johnstonii* is limited to a single mountain-system, the San Jacinto Mts. of southern California.

49. A. Parishii Watson. Perennial; stems several to numerous and tufted from a subterranean branching caudex, slender, simple, densely pubescent with dendritic trichomes below, less so upward, 3–14 cm. high; basal leaves numerous, entire, narrowly linear-oblanceolate, tapering to a short petiole, acute, hoary with a fine dendritic pubescence, 5–15 mm. long, 1–2 mm. wide; cauline leaves few, sessile, entire, not petioled nor auricled, hoary, linear, 5–10 mm. long, 1–2 mm. wide; sepals oblong, green or purplish, pubescent, 3–4 mm. long; petals purple, bluish or rarely almost white, spatulate, tapering to a very narrow claw, 8–13 mm. long; pedicels erect to slightly spreading, rather stout, pubescent, 3–7 mm. long; siliques ascending, glabrous, nerved to the middle or above, 1–2 cm. long, 2–3 mm. wide, acuminate; style filiform, 4–8 mm. long; seeds elliptical to nearly orbicular, narrowly winged, 1–1.5 mm. broad, imperfectly uniseriate.—Proc. Am. Acad. **22:** 468 (1887) and in Gray, Syn. Fl. **1:** 167 (1895); Jepson, Man. Fl. Pl. Calif. 433 (1925) and Fl. Calif. **2:** 72 (1936); Munz, Man. So. Calif. Bot. 203, fig. 101 (1935).—San Bernardino County, California: Bear Valley, San Bernardino Mts., June, 1886, *Parish 1793* (G, type; UC, isotype), June, 1895, *Parish 3751* (G, UC, US), June, 1922, *Munz 5751* (G); near Baldwin Lake, San Bernardino Mts., June,

1924, *Munz 8179* (G, NY); Sugarloaf Mt., San Bernardino Mts., July, 1906, *Hall 7537* (M, RM, UC); June, 1922, *Peirson 3101* (G, Peirs, RM).

Arabis Parishii is distinctive in habit, character of the style and localization of range. The specific circumscription is clear, yet its relationship to *A. Johnstonii* and *A. dispar* is unmistakable. It is found, chiefly in exposed places, from the upper canyon-slopes to the higher peaks and ridges of the San Bernardino Mountains in southern California. The species could be usefully introduced into cultivation as a rock-garden plant of exquisite beauty.

50. A. SUFFRUTESCENS Watson. Suffruticose perennial; stems several to many from a widely branching caudex, simple or rarely branched above, glabrous (pubescent below in var. *horizontalis*), (1–) 2–5 dm. high; basal leaves linear to oblanceolate or sometimes nearly spatulate, acute to obtuse, glabrous or rarely sparsely pubescent (densely pubescent in var. *horizontalis*), 1–4 cm. long, 2–6 mm. wide; cauline leaves few, sessile, auriculate (non-auriculate in var. *perstylosa*), lanceolate to narrowly obovate, acute or the lower obtuse, glabrous or rarely with a few marginal trichomes, 1–3 cm. long, 2–6 mm. wide; flowers few; sepals oblong to slightly broader, glabrous, 3.5–4.5 mm. long; petals spatulate, rose to purplish, 6–8 mm. long, 2.5–3 mm. wide; pedicels slender, glabrous, horizontal to strictly reflexed, 4–10 mm. long; siliques pendulous to strictly reflexed (horizontal in var. *horizontalis*), glabrous, one-nerved from base to above middle or often to the tip, acuminate, 4–7 cm. long, 3–6 mm. wide, venation evident; style less than 1 mm. long or absent (2–3.5 mm. long in var. *perstylosa*); seeds orbicular, widely winged, 2–3.5 mm. wide including wings, imperfectly uniseriate, papery wings about 1 mm. wide; cotyledons accumbent.

KEY TO THE VARIETIES OF A. SUFFRUTESCENS

Styles less than 1 mm. long or absent; cauline leaves auriculate; siliques horizontal to strictly reflexed.
  Siliques pendulous to strictly reflexed; plants 2–5 dm. high; basal leaves and lower stems glabrous or nearly so....50a. var. *typica*.
  Siliques horizontally spreading; plants 1–2 dm. high; basal leaves and lower stems densely pubescent.......50b. var. *horizontalis*.
Styles 2–3.5 mm. long; cauline leaves non-auriculate; siliques strictly reflexed............................50c. var. *perstylosa*.

50a. Var. **typica.** *A. suffrutescens* Watson in Proc. Am. Acad. **17:** 362 (1882) and in Gray, Syn. Fl. N. Am. **1:** 166 (1895); Howell, Fl. Northw. Am. **1:** 45 (1897); Piper in Contrib. U. S.

Nat. Herb. **11:** 295 (1906); Rydberg, Fl. Rky. Mts. 360 (1918); Jepson, Man. Fl. Pl. Calif. 432 (1925) and Fl. Calif. **2:** 70 (1936); Rollins in Res. Stud. State Coll. Wash. **4:** 48, fig. 15 (1936). *A. duriuscula* Greene, Pitt. **4:** 191 (1900). *A. dianthifolia* Greene, Leaflets **2:** 76 (1910).—Idaho to California and Washington. MAP 19. IDAHO: ridge west of Cascade, Valley Co., July, 1937, *Thompson 13852* (G, R); Payette National Forest, Aug., 1912, *Martineau & Sparhawk 59* (FS); Rush Creek, Washington Co., July, 1899, *Jones 6164* (NY, RM, UC, US); near Bonanza, Custer Co., July, 1916, *Macbride & Payson 3481* (G, NY, RM); near Martin, Blaine Co., July, 1916, *Macbride & Payson 3070* (G, NY, RM, US), June, 1938, *C. L. Hitchcock 3826* (R); above Galena, Blaine Co., July, 1895, *Henderson 3537* (US). CALIFORNIA: Medicine Lake, Siskiyou Co., July, 1921, *Eastwood 10885* (G, US); Shackleford Creek, Siskiyou Co., July, 1910, *Butler 1705* (RM, UC, US); Salmon-Trinity Alps, Caribou Basin, Siskiyou Co., July, 1937, *J. T. Howell 13379* (G, R); Lassen Forest, Lassen Co., July, 1933, *Fischer & Johnson F273* (UC); 1000 Lake Basin, Shasta Co., July, 1932, *Peirson 10151* (Peirs, UC); Donner Lake, Nevada Co., July, 1893, *Michener s.n.* (ND, TYPE of *A. duriuscula;* photo in Gray Herb.); Truckee, Nevada Co., June, 1892, *Sonne 9* (NY, UC); Mt. Lola, Nevada Co., July, 1903, *Hall & Babcock 4539* (UC); Kaiser Crest, Fresno Co., July, 1914, *Smiley 621* (G). OREGON: mouth of Battle Cr., Wallowa Co., July, 1933, *Peck 17616* (NY, W); bluffs of Snake River and vicinity, Baker Co., 1881, *W. C. Cusick 919* (G, TYPE); stony hills near Snake River, Baker Co.?, May, 1898, *Cusick 1898* (G, UC, US, WSC); Steens Mts., Harney Co., July, 1896, *Leiberg 2514* (G, NY, O, US); Santiam Nat. Forest, Linn Co., 1920, *Ingram 1360* (OS); near Paulina Lake, Deschutes Co., June, 1931, *J. T. Howell 7097* (G), July, 1920, *Peck 9685* (G, NY, T, W); Crater Lake, Klamath Co., Sept. 14, 1902, *Coville 1511* (US, TYPE of *A. dianthifolia*), July, 1928, *Wynd 2250* (O); near Buck Lake, Jackson Co., July, 1936, *Thompson 13121* (T). WASHINGTON: Wenaha River Trail, Columbia Co., July, 1913, *Darlington s.n.* (WSC); Cleman Mt., Yakima Co., June, 1892, *Henderson 2398* (UW); Mt. Adams, probably Yakima Co., Aug., 1885, *Suksdorf 511* (G), May, 1884, *Suksdorf 633* (UC, US, WSC), Aug. 15, 1882, *T. Howell s.n.* (O, T, US).

50b. Var. HORIZONTALIS (Greene) Rollins. Stems numerous, slender, 1–2 dm. high, pubescent below; basal leaves pubescent with dendritic trichomes; cauline leaves nearly ovate to oblong, pubescent or the upper glabrous; pedicels 4–8 mm. long, glabrous, horizontally spreading; siliques horizontal, 2–4 cm. long, 2.5–4 mm. wide.—Res. Stud. State Coll. Wash. **4:** 50 (1936);

Applegate in Am. Midl. Natur. **22:** 269 (1939). *A. horizontalis* Greene, Leaflets **2:** 74 (1910).—Southern OREGON: Crater Lake, Klamath Co., Aug. 1, 1897, *Coville & Applegate 334* (US, TYPE; RM, isotype), July, 1929, *Wynd 1545 & 1547* (O); Llao Rock, Crater Lake, July, 1924, *Hall 11972* (DS); Mt. Garfield, July, 1918, *Heller 13040* (G, NY, US).

50c. Var. **perstylosa,** var. nov. Herba glabra; foliis caulinis sessilibus, non auriculatis; stylis filiformibus 2–3.5 mm. longis. Plants glabrous or very rarely with a few trichomes along the margins of the basal leaves; stems one to several or many; cauline leaves remote, sessile, non-auriculate; siliques strongly nerved; style persistent, slender, 2–3.5 mm. long.—MAP 19. CALIFORNIA: open bare serpentine slope, above Middle Fork of the Feather River, 7.3 miles southeast of Quincy, Plumas County, June 9, 1938, *Lincoln Constance 2309* (G, TYPE; R, isotype).

There is considerable variation in the width of the siliques in *A. suffrutescens.* On the average, plants from Washington, eastern Oregon and Idaho seem to have slightly broader siliques than those from southern Oregon and California, but this is only a tendency and the species could not be divided, using silique-width as a basis. Var. *typica* is usually glabrous throughout, but specimens with branched trichomes along the basal leaf-margins or even on the blade-surfaces are occasionally found. The leaves are ordinarily fairly narrow and acute, although plants in which the lower cauline and basal leaves are broad and obtuse are sometimes collected. Neither *A. dianthifolia* Greene nor *A. duriuscula* Greene have characteristics which serve to separate them from *A. suffrutescens.* They do not even represent end points of normal trends in specific variation.

Variety *horizontalis* is distinguished from var. *typica* by its lower stature, more numerous, slender stems, shorter pedicels, horizontally spreading, smaller siliques and rather densely pubescent basal leaves. The plants are quite distinctive in appearance. However, they possess the basic characteristics of *A. suffrutescens* and must be included in the species as a whole. The variety is known from several stations, all within Crater Lake National Park.

Known only from the single collection cited, var. *perstylosa* is distinguished from var. *typica* by its long style and non-auriculate cauline leaves. Var. *typica* often has a sessile stigma or the style may reach a millimeter in length, but in var.

perstylosa, the style is never less than 2 mm. long and is usually about 3 mm. in length. Ordinarily, species of *Arabis* vary in the length of the style, and, were it not for the fact that this character is associated with the lack of auricles on the cauline leaves, one might suggest that var. *perstylosa* is only a marked variant of var. *typica.* These rather marked characteristics associated together are sufficient, it seems to me, to warrant making the separation.

51. A. PLATYSPERMA Gray. Perennial, pubescence dendritic; stems several to numerous from a simple or branching caudex, erect to somewhat decumbent, simple or often branched above, pubescent to glabrous, (0.5–) 1–4 dm. high; basal leaves numerous, oblanceolate or narrower, acute to obtuse, rather densely pubescent to glabrous, entire, 2–5 cm. long, 3–8 mm. wide; cauline leaves few, remote, oblong to linear-lanceolate, sessile, not auriculate (except occasionally in var. *Howellii*), pubescent or glabrous, 1–1.5 cm. long, 2–5 mm. wide; sepals oblong, non-saccate, pubescent or glabrous, 3–4 (–5) mm. long; petals pink to white, spatulate, 4–6 (–7) mm. long, 2–3 mm. wide; glandular tissue continuous beneath all stamens, often surrounding single stamens; pedicels divaricately ascending, straight, pubescent or glabrous, 5–15 mm. long; siliques erect to divaricately ascending, straight, broad, flat, acuminate, 3–7 cm. long, 3–5 mm. wide; valves distinctly veined, nerved toward the base; style less than 1 mm. long or absent; seeds orbicular, widely winged, 3–4 mm. broad including the wings, uniseriate; cotyledons accumbent.

51a. Var. **typica.** Basal leaves, lower stems and sepals pubescent; stems 1–4 dm. high; cauline leaves never auriculate; sepals 3–4 mm. long; petals 4–6 mm. long; stems very often branching above.—*A. platysperma* Gray in Proc. Am. Acad. **6:** 519 (1865); Watson in King, Geol. Expl. Fortieth Parallel **5:** 16 (1871); Brewer & Watson, Bot. Calif. **1:** 32 (1876); Coville in Contrib. U. S. Nat. Herb. **4:** 61 (1893); Watson in Gray, Syn. Fl. N. Am. **1:** 163 (1895); Howell, Fl. Northw. Am. **1:** 45 (1897) in part; Tidestrom in Contrib. U. S. Nat. Herb. **25:** 243 (1925); Jepson, Man. Fl. Pl. Calif. 432, fig. 420 (1925) and Fl. Calif. **2:** 71, fig. 138 (1936) in part; Munz, Man. So. Calif. Bot. 204 (1935); Rollins in Res. Stud. State Coll. Wash. **4:** 47, fig. 14 (1936) in part. *Erysimum platyspermum* (Gray) O. Ktze., Rev. Gen. Pl. pt. 2: 933 (1891). *A. inamoena* Greene in Fedde, Rep. Nov. Sp. **5:** 243 (1908), not *A. inamoena* Greene, Leaflets **2:** 158 (1911). *A. oligantha* Greene in Fedde, Rep. Nov. Sp. **5:** 243 (1908).—Nevada, California and Oregon.—MAP 25. NEVADA: Sierra Nevada above Virginia City, Ormsby Co., July, 1939, *Train 3251* (NA, R); near Mt. Rose, Aug., 1938, *J. T. Howell 14060* (G); 20 miles southwest of Reno, June, 1937, *Henrichs s.n.* (G); along Galena Creek, 7 miles west of Reno Hot Springs, Washoe Co., July, 1937, *Archer 5667* (R); divide south of Slide Mt., Washoe Co., July, 1913, *Heller 10932a* (G, NY, UC, US); East Humboldt Mts., Sept., 1868, *Watson 69* (G, NY, US). CALIFORNIA: Half Moon Meadow, Marble Mt. Primitive Area, Siskiyou Co., Aug., 1939, *S. K. & C. C. Harris 6039* (G, R); Mt. Shasta, Siskiyou Co., Sept., 1897, *Canby 16* (G), 1860–62, *Brewer 1393* (G, US); headwaters of Hat Creek, Shasta Co., July–Aug., 1911, *Eggleston 7433* (G, NY, US); Diamond Mt., Lassen Co., June, 1897, *M. E. Jones s.n.* (NY, UC); near Jonesville, Butte Co., July, 1917, *Heller 12859* (G, US), June, 1931, *Copeland 643* (NY, RM, UC); Soda Springs, Nevada Co., July, 1881, *M. E. Jones 2512* (NY, UAC, UC, US); Donner Pass, Placer Co., July, 1903, *Heller 6975* (G, NY, RM, UC, US); Echo Camp, Eldorado Co., Aug., 1915, *Heller 12176* (G, NY); Ebbetts Pass, Alpine Co., 1863, *Brewer 1989* (G, TYPE; UC, US, isotypes); Cloud's Rest-Moraine Dome, Yosemite National Park, July, 1936, *Helen Sharsmith 3809* (G, R); Belle Meadow, Tuolumne Co., July, 1934, *Wiggins 6898* (G); near Devil's Postpile, Madera Co., Aug., 1938, *J. T. Howell 14469* (G, R); Long Meadow, Tulare Co., June 7–12, 1888, *E. Palmer 192* (US, TYPE; NY, isotype of *A. inamoena*); 0.2 mile east of Sonora Pass, Mono Co., Aug., 1938, *Constance 2449* (R); region of Dinkey Creek, Fresno Co., June–July, 1900, *Hall & Chandler 354* (US, TYPE; NY, UC, isotypes of *A. oligantha*); Baldy Mt. (Mt. San Antonio), San Bernardino Co., Aug., 1880, *Parish Bros. 498* (G); Dollar Lake, San Bernardino Mts., Aug., 1922, *Munz 6241* (G, RM); San Jacinto Mts., San Bernardino Co., June, 1921, *Jaeger 577* (US); Tahquitz Ridge, San Jacinto Mts., July, 1908, *Reed 2527* (UC). OREGON: Mt. Scott, Klamath Co., *Thompson 12290* (G, NY).

51b. Var. HOWELLII (Watson) Jepson. Entire plant glabrous or rarely with a few trichomes along the petiole of the basal leaves, often dwarfed at high altitudes; stems 0.5–3 dm. high; sepals glabrous, 3–5 mm. long; petals obtuse, 5–7 mm. long; cauline leaves sometimes auriculate.—Man. Fl. Pl. Calif. 432 (1925). *A. Howellii* Watson in Proc. Am. Acad. **25:** 124 (1889) and in Gray, Syn. Fl. N. Am. **1:** 167 (1895); Howell, Fl. Northw. Am. **1:** 45 (1897). *A. platyloba* Greene in Pitt. **4:** 198 (1900); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 243 (1925). *A. platysperma* sensu Howell, Fl. Northw. Am. **1:** 45 (1897) in part; Rollins in Res. Stud. State Coll. Wash. **4:** 46 (1936) in part. *A. chionophila* Greene ex C. F. Baker, West Am. Pl. [1] 16 (1902). *A. conferta* Greene in Fedde, Rep. Nov. Sp. **5:** 243

(1908). *A. Covillei* Greene, ibid. *A. Leibergii* Greene, ibid. *A. platysperma* Gray, var. *imparata* Jepson, Fl. Calif. **2:** 72 (1936). *A. inamoena* Greene, var. *acutata* Jepson, ibid.—Nevada, California and Oregon. MAP 24. NEVADA: divide south of Slide Mt., Washoe Co., July, 1913, *Heller 10932* (G, NY, UC, US); Marlette Lake, Washoe Co., July, 1902, *Baker 1389* (G, UC, US); Mt. Rose, Washoe Co., July, 1937, *Breene 523* (NA, R); Snow Valley, Ormsby Co., June, 1912, *Baker 1157* (ND; photo in Gray Herb. This specimen was labeled *A. chionophila* by Greene and is the basis for *A. chionophila* Greene ex Baker, West. Am. Pl. [1] 16 (1902), nomen nudum). CALIFORNIA: Caribou Basin, Salmon-Trinity Alps, Siskiyou Co., July, 1937, *J. T. Howell 13444* (G, R); Devil's Canyon Mts., Trinity Co., *Tracy 14712* (R, UC); Mt. Shasta, Aug., 1882, *Pringle 18* (G); Lake Solfatara, Lassens Peak, Shasta Co., 1896, *Mrs. R. M. Austin s.n.* (ND, TYPE; US, isotype of *A. platyloba;* photo of type in Gray Herb. This collection is also the basis for *A. platysperma* Gray, var. *imparata* Jepson); Benson Pass, northern part of Yosemite Nat. Park, Aug., 1936, *Helen Sharsmith 3810* (G, R); Conness Trail, near Young's Lake, Tuolumne Co., July, 1937, *Peirson 7610* (Peirs, TYPE of *A. inamoena*, var. *acutata*); Ragged Peak, Tuolumne Co., July, 1936, *Mason 11264* (G); terminal moraine of Conness Glacier, Mono Co., July, 1936, *Mason 11425* (G); Taboose Pass, Inyo Co., *Peirson 2535* (Peirs); near Mineral King, Tulare Co., Aug., 1891, *Coville & Funston 1492* (US, TYPE; G, NY, isotypes of *A. Covillei*); mountain near Little Kern River, April–Sept., 1897, *Purpus 5231* (US, TYPE; G, UC, isotypes of *A. conferta*). OREGON: Mt. Hood, Hood River Co., Sept., 1880, *J. & T. J. Howell 309* (G, US); Mt. Jefferson, Jefferson Co., Aug., 1919, *J. C. Nelson 2881* (G); west slope of Middle Sister, Lane Co., July, 1914, *Peck 2720* (G); Paulina Peak, Deschutes Co., June, 1931, *J. T. Howell 7053* (G); north of Mt. Bachelor, Deschutes Co., July, 1931, *J. T. Howell 7129* (G); Crater Lake, Klamath Co., Aug., 1916, *Heller 12633* (G, NY, OS, US); Mt. Thielson, Klamath Co., Aug., 1897, *Coville & Applegate 436* (US); Gayhart Buttes (Gearhart Mt.) Aug., 1896, *Coville & Leiberg 262* (US, TYPE of *A. Leibergii*); Ashland Butte, Jackson Co., July 19, 1887, *T. Howell 664* (G, TYPE; OS, Ph, T, US, isotypes), July, 1935, *Thompson 12333* (G); near Oregon Caves, Josephine Co., July, 1918, *Peck 8330* (G, W).

Arabis platysperma varies rather widely in height and in the size and shape of its foliar organs. At high altitudes the plants are apt to be considerably dwarfed, with numerous stems less than 1 dm. high. Conversely, at lower altitudes, particularly in favorable sites, the stems may reach 4 dm. in height. These variations apparently accompany differing conditions of habitat and are only rarely correlated with slight dimensional differences observable in such conservative organs as the flower. In spite of the variation in habit, the flowers and fruits remain fairly constant throughout.

The two points noted by Greene as justifying the segregation of *A. inamoena*, "pubescent sepals and very short colorless petals", are both perfectly characteristic of typical *A. platysperma.* The very short colorless petals are found when the flower first opens, later the petals elongate and often become pink- or purplish-tipped. I cannot see anything in the type-specimen of *A. oligantha* which differs particularly from the type of *A. platysperma.*

It has been with some hesitation that the pubescent and glabrous phases of *A. platysperma* have been separated. I do not believe the two varieties are natural, even though var. *Howellii* does have a more northerly range and is usually found at higher altitudes than var. *typica.* So far as I have been able to determine, the glabrous condition is not correlated with any constant character such as width or shape of the siliques, as suggested by Jepson, l. c. At the very highest altitudes, var. *Howellii* becomes exceedingly dwarfed and in the northern part of its range the flowers tend to be slightly larger than in the southern. In general the same series of variations run through var. *Howellii* as are found in var. *typica.*

An interesting repetition occurred when Jepson, l. c., proposed var. *imparata* for the glabrous, broad-podded phase of *A. platysperma.* This variety was based on a collection by Mrs. R. M. Austin from Lake Solfatara, Lassens Peak, California, which Greene, l. c., earlier used as the basis for his *A. platyloba.* The plants of this collection are glabrous and the siliques are very wide, but there is nothing fundamentally distinctive about them. In the present treatment they are placed with the glabrous, usually more dwarfed var. *Howellii. A. inamoena,* var. *acutata* is an extremely dwarfed form of var. *Howellii* with rather narrow basal leaves. The siliques are markedly acute, due largely to their immaturity, but this is not a singular character in the species.

52. A. **pygmaea,** sp. nov. Herba perennis; caudicibus simplicibus vel ramosis foliis emortuis persistentibus tectis; caulibus tenuibus erectis simplicibus inferne pubescentibus superne glabratis vel pubescentibus 5–10 cm. altis; foliis radicalibus integris linearibus hispidulis 1–2 cm. longis, 1–2 mm. latis, pilis furcatis vel simplicibus; foliis caulinis paucis remotis linearibus sessilibus non auriculatis hispidulis 5–10 mm. longis, 1–2 mm. latis; sepalis pubescentibus ca. 2 mm. longis; petalis albis?; pedicellis adscendentibus sparse pubescentibus 5–8 mm. longis; siliquis erectis acuminatis glabris 2–4 cm. longis, 4–5 mm. latis; stigmatibus sessilibus; seminibus orbicularibus alatis 2.5–3.5 mm. latis; cotyledonibus accumbentibus.

Perennial, caudex simple or branched, usually covered with a series of hemispherical clusters of dead leaves; stems several, slender, erect to slightly decumbent, simple, rather densely pubescent below with forked trichomes, sparsely pubescent above or glabrate, 5–10 cm. high; basal leaves tufted, entire, narrowly linear, hispid with coarse forked trichomes, marginal trichomes often simple and larger than those on the blade surfaces, 1–2 cm. long, 1–2 mm. wide; cauline leaves few, remote, sessile, nonauriculate, linear, loosely hispid, 5–10 mm. long, 1–2 mm. wide; sepals pubescent, about 2 mm. long; petals white?; pedicels ascending, sparingly pubescent, 5–8 mm. long; siliques erect, straight, somewhat acuminate, mid-nerve rather obscure, netted venation evident, glabrous, 2–4 cm. long, 4–5 mm. wide; stigma sessile; seeds orbicular, broadly winged, 2.5–3.5 mm. broad including wings; funiculi free, slender, 2–3 mm. long; cotyledons accumbent.—California: Basin of the Upper Kern River, Volcano Meadows (originally known as Whitney Meadows), Tulare Co., July 21, 1904, *H. M. Hall & H. D. Babcock 5465* (G, type; M, NY, OS, US, isotypes); Olancha Mt., Tulare Co., June, 1904, *Hall & Babcock 5465* (RM; the collection bears the same number as the above, but it is marked with a different locality and date); Moraine Lake to Big Arroyo, headwaters of the Kern River, July, 1916, *M. L. Campbell s.n.* (Calif. Acad. Sci.).

This species is evidently the one described under *A. inamoena* Greene by Jepson,[1] though I have not seen any of the collections cited. *A. inamoena,* var. *acutata* of the same publication is *A. platysperma,* var. *Howellii.* As shown by the type-specimen, *A. inamoena* Greene (1908) is nothing more than typical *A. platysperma.* The statement in Greene's description, "caulibus tenuibus 1–1.5 cm. altis", has possibly been responsible for the misapplication of the name *A. inamoena* to the plants here

[1] Fl. Calif. 2: 72 (1936).

A. PYGMAEA drawn from *Hall & Chandler 5465.* About one and one-half times natural size.

named *A. pygmaea.* It is probable that "cm." in the above quotation is a misprint for "dm.", since both the type at the U. S. National Herbarium and an isotype at the New York Botanical Garden show the stems to be 1–2 dm. high. *A. pygmaea* is related to *A. platysperma,* the siliques and seeds of each being almost identical. The significant differences between the two are found in the foliage, pubescence and habit of growth. Definitive statements concerning these characters are given in the key.

53. A. PETIOLARIS Gray. Annual or biennial ?; single stem simple below, robust, usually branched above, pilose at base, becoming glabrous upward, 4–10 dm. high; basal leaves long-petioled, lyrate to pinnately lobed, pilose on both surfaces, 1–1.5 dm. long, 2–6 cm. wide; cauline leaves long-petioled, lower similar to the basal, pilose to glabrate; upper reduced, entire to rarely dissected, lanceolate, glabrous; sepals oblong, glabrous, 3–5 mm. long, 1–1.5 mm. wide; petals pink, spatulate, 6–8 mm. long, 1.5–2 mm. wide; filaments often attached to petals at base; glandular tissue weakly developed, continuous under all stamens; pedicels glabrous, divaricately ascending, straight, 8–12 mm. long; siliques flattened, broad, acuminate, straight, divaricately ascending, 4–8 cm. long, 3–4 mm. wide; style slender, 1–2 mm. long; seeds orbicular, widely winged all around, 3–4 mm. broad including the wings, uniseriate.—Proc. Am. Acad. **6:** 187 (1863); Coulter in Contrib. U. S. Nat. Herb. **2:** 19 (1891); Watson in Gray, Syn. Fl. N. Am. **1:** 161 (1895); Cory & Parks in Texas Agric. Exp. Sta. Bull. **550:** 48 (1938). *Streptanthus petiolaris* Gray in Mem. Am. Acad. **4:** 7 (1849). *S. brazoensis* Buckley in Proc. Acad. Sci. Phila. 448 (1861). *Erysimum petiolare* (Gray) O. Ktze., Rev. Gen. Pl. pt. 2: 933 (1891).—Central TEXAS: rocky hill, Austin, Travis Co., May, 1872, *E. Hall 17* (G, NY, US); Barton Creek Valley, near Austin, April, 1918, *Young 24* (G); San Marcos Spring, Hays Co.?, 1847, *C. Wright s.n.* (G, TYPE); San Marcos, Hays Co., April, 1917, *Palmer 11562* (RM); Coleman County, April, 1882, *Reverchon 4* (G); Makewater Creek, Coleman Co., April, 1882, *Reverchon 1246* (US); Bear Mountain, Gillespie Co., May, 1935, *Cory 12875* (G); San Saba, San Saba Co., May, 1917, *Palmer 11797* (RM); New Braunfels, Comal Co., May, 1851, *Lindheimer 517 & 674* (G), May, 1850, *Lindheimer 675* (G, NY); western Texas to El Paso, May–October, 1849, *Wright 5* (G); San Antonio, Bexar Co., *M. E. Jones 798* (P); Bexar County, June, 1904, *Jermy s.n.* (NY).

Arabis petiolaris is different from all other American species of *Arabis* in having strongly petiolate, somewhat dissected cauline leaves. *A. tricornuta* and *A. repanda* have petiolate cauline leaves, but they are not dissected, nor is the petiole strongly developed. In some respects *A. petiolaris* resembles certain members of the genus *Sibara*, but in the aggregate its characters are those of an *Arabis*. O. E. Schulz[1] has placed this species in a separate section of *Arabis* § *Oxytria*. That *A. petiolaris* is a very distinctive species of *Arabis* is unquestioned, but I cannot agree with Schulz that it is the only *Arabis*-species which has apiculate anthers. A number of American species, including *A. crucisetosa, A. furcata, A. blepharophylla, A. aculeolata* and several others, have this character very plainly marked.

Species Excluded from Arabis or with Names of Uncertain Application

1. *A. Bolanderi* Watson in Proc. Am. Acad. **22:** 467 (1887)[2] was based upon plants with sterile siliques.

2. *A. Brebneriana* A. Nelson in Bull. Torr. Bot. Club **25:** 373 (1898) = *Halimolobos virgatus* (Nuttall) O. E. Schulz in Engler, Pflanzenr. **4:** fam. 105, 290 (1924).

3. *A. Bourgovii* Rydberg in Mem. N. Y. Bot. Gard. **1:** 186 (1900), based on *Turritis patula* Graham. See footnote under *Arabis patula* (Graham) Torrey below.

4. *A. elata* Piper in Proc. Biol. Soc. Wash. **37:** 91–92 (1924). The type of this species in the U. S. National Herbarium has sterile siliques and is otherwise deformed. It is believed that normal plants would be referable to one of the varieties of *A. sparsiflora* Nuttall.

5. *A. Endlichii* O. E. Schulz in Notizbl. **11:** 390 (1932) = *Sibara Viereckii* (Schulz) Rollins, var. **Endlichii** (Schulz), comb. nov.

6. *A. filifolia* Greene in Bull. Calif. Acad. Sci. **2:** 390 (1887) = *Sibara filifolia* Greene in Pittonia **3:** 11 (1896).

[1] Engler's Bot. Jahrb. **66:** 94 (1933).

[2] When Watson described *A. Bolanderi*, he cited three specimens as follows, "Yosemite or Mono Pass (Bolander); mountains of Washington Territory (Brandegee); also collected by Dr. Torrey, a more glabrous form, probably in the mountains of California, but ticketed in his herbarium as from Colorado." These specimens have one thing in common. They all bear sterile siliques. Otherwise, they probably belong to three separate species, but the presence of nothing but aborted ovules, sterile siliques and the attendant effects of sterility on the plants, makes their identification difficult. I have not been able to place confidently Bolander's specimen, the type of *A. Bolanderi*, with any California species of *Arabis*, but it appears to belong with one of the varieties of *A. Holboellii*. The Brandegee specimen from Washington is almost certainly a variety of *A. sparsiflora* Nuttall, but the Torrey specimen is too fragmentary to be placed at all. I suggest the name *A. Bolanderi* be discarded on the grounds that it is of uncertain application to living plants; it was based on three discordant elements (the specimens probably belong to three separate species), and its type is a near-monstrosity.

7. *A. hastatula* Greene, Leaflets **2**: 79 (1910). The type in the U. S. National Herbarium is a flowering specimen not certainly determinable, but I believe it should be referred to *A. Holboellii*, var. *retrofracta* (Grah.) Rydb.

8. *A. Holboellii* Hornem., var. *patula* (Grah.) Watson in Gray, Syn. Fl. N. Am. **1**: 164 (1895), based on *Turritis patula* Graham. See footnote below under *Arabis patula* (Graham) Torrey.

9. *A. Hookeri* Lange, Consp. Fl. Groen. **3**: 50 (1880) = *Halimolobos* **mollis**[1] (Hooker) comb. nov., based on *Turritis mollis* Hooker, Fl. Bor.-Am. **1**: 40 (1829).

10. *A. longirostris* Watson in King, Geol. Expl. Fortieth Parallel **5**: 17, pl. 1 (1871) = *Streptanthella longirostris* (Watson) Rydberg, Fl. Rky. Mts. 364 (1918).

11. *A. Menziesii* (Hook.) A. Nelson in Proc. Biol. Soc. Wash. **18**: 187 (1905) = *Phoenicaulis cheiranthoides* Nuttall in T. & G. Fl. N. Am. **1**: 89 (1838).

12. *A. Menziesii lanuginosa* Nelson & Macbride in Bot. Gaz. **55**: 374 (1913) = *Phoenicaulis cheiranthoides*, var. **lanuginosa** (Watson), comb. nov., based on *Parrya Menziesii*, var. *lanuginosa* Wats. in Gray, Syn. Fl. N. Am. **1**: 152 (1895).

13. *A. Menziesii*, var. *lata* Nelson & Macbride, l. c. = *Phoenicaulis cheiranthoides* Nutt.

14. *A. mexicana* Watson in Proc. Am. Acad. **17**: 319 (1882) = *Sibara* **mexicana,** comb. nov.

15. *A. patula* (Graham) Torrey, Bot. U. S. & Mex. Bound. Surv. **1**: 32 (1859), based on *Turritis patula*[2] Graham in Edinb. New Phil. Journ. 350 (1829); not *Arabis patula* Host, Fl. Austr. 271 (1831).

16. *A. pectinata* Greene, Pittonia **1**: 287 (1889) = *Sibara pectinata* Greene, Pittonia **3**: 11 (1896).

[1] This species is very closely related to *Halimolobos virgatus* of the Rocky Mountain area. It is interesting to note that Hooker originally compared it to the Mexican and South American *Turritis hispidula* which is now also included in *Halimolobos*.

[2] *Turritis patula* has not been identified with any modern species of *Arabis*, although the description is full and it is certain that the plant described is an *Arabis*. Apparently no type was preserved at Edinburgh (see Hopkins in RHODORA **39**: 134) and it has been impossible to determine which of several Rocky Mountain species of *Arabis* should bear the name. I am inclined to think the name should be associated with one of the varieties of *A. sparsiflora*, but Hopkins, l. c., thought the description could be applied to plants of *A. divaricarpa*. My own notion on the matter is supported to some extent by a specimen of *A. sparsiflora*, var.? in the Torrey Herbarium of the New York Botanical Garden marked "Franklin's Journey Dr. Hooker" with the fruiting portion marked "cultivated." Both annotations are presumably in the handwriting of Asa Gray. Does this specimen represent part of the garden material from which Graham drew his description of *Turritis patula?* In so far as the specific name *patula* is concerned, the identity of Graham's plant is not important because the same specific epithet was used in *Arabis* several times before Torrey made the transfer based on Graham's name. However, two species have been proposed using *Turritis patula* Graham as their basinym, and it is with them that we must deal. *Turritis Grahamii* Lehmann in Litt.-Bericht zur Linnaea für das Jahr 1831, p. 74, is the oldest substitute name I know about and it antedates the names in current use. Also *Arabis Bourgovii* Rydberg in Mem. N. Y. Bot. Gard. **1**: 186 (1900) is a substitute name for *Turritis patula* Graham, therefore resting on the same type. At present it is impossible to assign the names based on Graham's description to any species of *Arabis*. If a type is discovered, then this will be possible.

17. *A. pedicellata* A. Nelson in Proc. Biol. Soc. Wash. **17:** 91 (1904) = *Phoenicaulis cheiranthoides,* var. *lanuginosa* (Watson) Rollins.

18. *A. runcinata* Watson in Proc. Am. Acad. **17:** 319 (1882) = *Sibara* **runcinata,** comb. nov. (Not *A. runcinata* Lam., Encycl. **1:** 222 (1783).

19. *A. Viereckii* O. E. Schulz in Notizbl. **11:** 389 (1932) = *Sibara* **Viereckii** (Schulz), comb. nov.

20. *A. virginica* (L.) Poir. Encycl. Suppl. **1:** 413 (1810) = *Sibara* **virginica** (L.), comb. nov., based on *Cardamine virginica* L., Sp. Pl. **2:** 656 (1753).

21. *A. Whitedii* Piper in Bull. Torr. Bot. Club **28:** 39 (1901) = *Halimolobos* **Whitedii** (Piper), comb. nov.

Stanford University.

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New scientific names are printed in full-face type