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A NEW GENUS OF ANACARDIACEAE[1]

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The poorly understood species on which this genus is based seems to have been collected orginally by Sessé and Moçiño in Mexico. The first published description was by A. P. de Candolle (Prodromus **2**: 67. 1825) under the name *Rhus Filicina.* Following the brief description he says, "dicitur *Tetlazian* sed non est Tetlacian Hern. mex. 153." In 1858, Turczaninow, working over the plants of Galeotti, published *Galeotti 4006A* as *Rhus potentillaefolia.* Sessé and Moçiño described a plant under the name *Rhus Tetlatziam* in 1887. From the descriptions given, these three elements, *Rhus Filicina* DC., *Rhus potentillaefolia* Turcz., and *Rhus Tetlatziam* Sessé & Moç., appear to be conspecific.

This plant resembles *Rhus glabra* L. in its staghorn-like stems and deciduous leaves which are imparipinnately compound with many leaflets, but the leaves are more densely clustered near the apex and the leaflets are peculiarly rugose and crenate-lobed. The inflorescence is axillary, composing an open compound leafy panicle, unlike that of *Rhus Coriaria* L. and its immediate allies, in which it is a dense terminal thyrsus. The situation of the ovary on a column is vaguely suggestive of the condition in *Anacardium,* and is found in no member of the genus *Rhus.* The *Cotinus, Metopium, Malosma,* and *Toxicodendron* elements, which are often included in *Rhus,*

[1] Issued March 20, 1937.

have essentially glabrous fruits, while in the other members of *Rhus,* such as *Rhus virens* Lindh., the fruit is covered with short simple hairs intermixed with club-shaped acid-secreting ones, never long and silky hairs as in the plant under discussion. Considering these peculiarities—the staghorn-like stems, the rugose crenate-lobed leaflets, the axillary panicles, the presence of a torus, and the long, silky pubescence on the fruit—it seems best to treat this species as constituting a monotypic genus:

ACTINOCHEITA Barkley, n. gen.

Arbuscula. Folia imparipinnata; foliolae multae sessiles. Flores in panicula patula foliosa dispositi cum foliis apparentes. Petala et sepala quinque plusminusve patula. Ovarium uniloculare in gynobase; stylus tripartitus. Drupa subaequalis; villae praelongae molles subrutiles.

Shrubs or small trees. Leaves compound, odd-pinnate; leaflets many, sessile. Flowers disposed in open, leafy, compound, axillary panicles, appearing with the leaves. Petals and sepals five, somewhat spreading. Ovary upon a column formed by the disk and partly adherent to the disk, one-celled; style three-branched. Drupe almost symmetrical, clothed with long, soft, reddish hairs.

The generic name is from ἀκτίνος = ray, and χιτών = garment, referring to the ray-like pilosity of the fruit-coat. Similar to *Rhus,* but differs in having axillary panicles, the ovary on a gynobase, long-villous fruit, and in other characters.

Actinocheita filicina (DC.) Barkley, n. comb.

Rhus Filicina DC.[1] Prodr. **2**: 67. 1825.

Rhus filicina DC. in A. DC. Calq. Dess. Fl. Mex. Moç. & Sessé, *t. 189.* 1874; Hemsl. Biol. Cent.-Am. Bot. **1**: 217. 1880.

[1] The citations, "Rhus filicina [Moç & Sesse,] ex DC. Prod. ii. 67 . . . " in Index Kewensis **2**: 714. 1895, and "Rhus filicina Moc. & Sessé. A. De Candolle, Calq. Dess. Fl. Mex. Moc. & Sessé, t. 189 (1874)." in Index Londonensis **5**: 415. 1931, are probably due to the inclusion of "(fl. mex. ic. ined.)" and "Ex fl. mex. mss. dicitur *Tetlazian* . . . " in the original description by De Candolle (Prodromus **2**: 67. 1825), a manuscript which apparently has been interpreted as being by Moçiño and Sessé.

Rhus potentillaefolia Turcz. in Bull. Soc. Nat. Mosc. **31**: 469. 1858; Hemsl. Biol. Cent.-Am. Bot. **1**: 218. 1880, and **4**: 21. 1886, *in nota;* Engl. in DC. Monogr. Phaner. **4**: 383, *pl. 14, figs. 11–12.* 1883; Standl. in Contr. U. S. Nat. Herb. **23**: 669. 1923.

Rhus Tetlatziam Sessé & Moç. Pl. Nov. Esp. p. 47. 1887 [La Naturaleza II. **1**, App: 47], and ed. 2, p. 44. 1893.

Rhus tetlatziam Sessé & Moç. Pl. Nov. Esp. ed. 2, p. xi. 1893.

Bursera bipinnata (Schlecht.) Engl. in DC. Monogr. Phaner. **4**: 49. 1883, in part, as to *Rhus filicina* in synonymy[2]; Hemsl. Biol. Cent.-Am. Bot. **4**: 19. 1886, in part, as to *Rhus filicina* in synonymy.[2]

Toxicodendron potentillifolium Kuntze, Rev. Gen. Pl. **1**: 154. 1891.

Shrubs and small trees with few staghorn-like branches covered with tuberculate leaf scars; branches ash-gray, glabrous below and densely pubescent at the apex, nude at base and clothed heavily near the summit with leaves; leaves alternate, rugose, imparipinnate, 9–33 cm. long, deciduous; leaflets 13 to 29, sessile, broadly linear, to 6 cm. long, sometimes as small as .5 cm., hoary-tomentose, lighter below, with revolute margins, crenate-lobed, lobes usually cristate-pointed, apex more or less acute, base truncate; rachis naked, densely pubescent; flowers polygamo-dioecious, disposed in ascending panicles

[2] While there is some room for doubt in the interpretation of *plate 189* of A. De Candolle's 'Calques des Dessins, Flora du Mexique, de Moçiño et Sessé' (pl. 1), the depiction of the leaves, with basal, central and terminal pinnae alike, does not seem to fit the leaves of *Bursera bipinnata* Engl., which are bipinnate except at the base of some of the central pinnae where they are tripinnate. On the other hand, my interpretation is that the leaves depicted are once-pinnate, with the veins running from the lobes and sinuses, as in the specimens of *Actinocheita filicina* examined. Of the many leaflets shown there are only three which might be considered bipinnate, and this I construe to be due to artist's "license" during the (assumedly) hurried drawing of this figure. The staghorn-like branch, smooth below except for the leaf scars, tomentose at the apex, leaves in a dense apical cluster, the pubescence on the petiole and rachis, all are characters of *Actinocheita filicina* and lend further credence to the interpretation of the figure as such.

The original description of *Rhus filicina* DC., as "*Fructus pilis violaceis hirtus,*" leaves little doubt that this is the plant referred to rather than *Bursera bipinnata* which has glabrous fruits.

half as long as the subtending leaves and appearing with them; bracts linear to subrotund, persistent, pilose-hirsute; sepals 5, deltoid-lanceolate, densely pubescent; stamens with thickened filaments longer than the ovoid anthers; pistil with 3-short styles, ovary on a torus formed by the disk, 1-celled, ovule anatropous; drupe almost symmetrical, villous, clothed with long, soft, violet-red hairs (pl. 2).

In the mountains of southwest Mexico (fig. 1).

Fig. 1. Known area of distribution of *Actinocheita filicina* (DC.) Barkley. (Base map from Goode's series, courtesy of University of Chicago Press.)

TYPE: In all probability the original material on which this species was founded no longer exists; but the species is based primarily on *plate 189* of 'Calque des Dessins de la Flora du Mexique, de Moçiño et Sessé,' 1874, and is typified by *Pringle 4752* (pl. 3), which is represented in the larger herbaria of America and Europe.

MEXICO: coll. of 1791, *Thaddaeus Haenke 1503* (Field Mus. 834658); GUERRERO: Acuitlapan, 1900 m., Oct. 1935, *Mrs. Gordon Abbot 11* (Gray Herb.); shrub 10 to 15 feet, mountains above Iguala, Oct. 4, 1900, *C. G. Pringle 9164* (Mo. Bot. Gard., Field Mus. 120458, U. S. Nat. Herb. 381912, Gray Herb.); OAXACA: Cañon del Tomellin, Estacion de Almoloyas, Sept. 29, 1907, *C. Conzatti 2019* (Field Mus. 225784, N. Y. Bot. Gard.); District of Nochixtlan, Cuesta de Henaudilla, *C. Conzatti 4247* (U. S. Nat. Herb. 1082288); Cuesta de Nochixtlan, 2000 m., May, 1899, *V. Gonzalez & C. Conzatti 937* (Gray Herb.); six miles above Dominguillo, Oct. 3, 1893, *E. W. Nelson 1593* (U. S. Nat. Herb., two sheets); six miles above Dominguillo, Oct. 20, 1894, *E. W. Nelson 1825* (N. Y. Bot. Gard., U. S. Nat. Herb., Gray Herb.); limestone ledges, Tomellin Cañon, July 31, 1894, *C. G. Pringle 4752* (Mo. Bot. Gard., Field Mus. 106356, N. Y. Bot. Gard., Brooklyn Bot. Gard., Philadelphia Acad. Nat. Sci., U. S. Nat. Herb. no number, 1418075, 989910, Univ. Cal. 109836, Gray Herb.); Nov. 27, 1895, *Caec. & Ed. Seler 1419* (N. Y. Bot. Gard., Gray Herb.); Rio Seco, Necaltepec, alt. 3100 ft., "Poison to the touch," September 21, 1895, *Rev. Lucius C. Smith 777* (Gray Herb.); PUEBLA: Tehuacan, June, 1905, *C. A. Purpus 1236* (Mo. Bot. Gard., Field Mus. 192813, N. Y. Bot. Gard., Univ. Cal. 138091, Gray Herb.); Tlacuiloltepec, May, 1909, *C. A. Purpus 4065 (in part)* (Mo. Bot. Gard., N. Y. Bot. Gard., Field Mus. 276600, Gray Herb.); Tehuacan, Sept., 1911, *C. A. Purpus 5702* (Mo. Bot. Gard., Univ. Cal. 162034); Tehuacan, Aug., 1905, *J. N. Rose, Walter Hough & J. H. Painter 9967* (N. Y. Bot. Gard., U. S. Nat. Herb. 453462, Gray Herb.).

EXPLANATION OF PLATE

PLATE 1

Actinocheita filicina (DC.) Barkley

Reproduction natural size from *plate 189* of A. DeCandolle's 'Calques des Dessins, Flora du Mexique, de Moçiño et Sessé.' The original is a blueprint of the duplicate copy of *plate 189* of Moçiño and Sessé given to Dr. Asa Gray by DeCandolle, and is listed in the "Enumeration d'après l'ordre des numéros" as "*Rhus filicina* 2. p. 67." As it is probable that the original material on which the species was founded no longer exists, ***Actinocheita filicina*** must rest on the Moçiño and Sessé plate.


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Explanation of Plate

PLATE 2

Actinocheita filicina (DC.) Barkley

Fig. 1. Flower, X 14, from *Purpus 1236.*

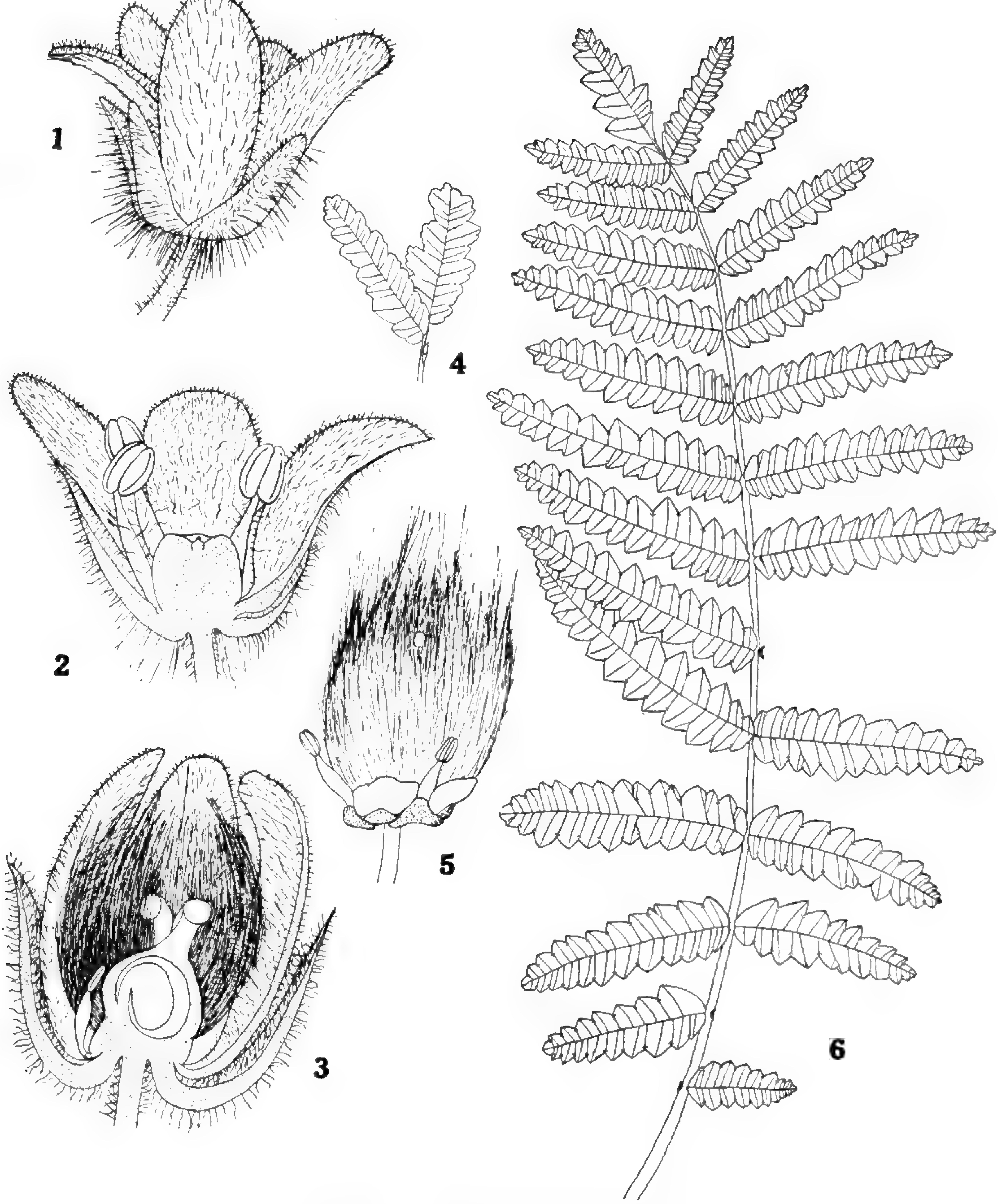
Fig. 2. Longitudinal section through a staminate flower, X 14, from *Purpus 1236.*

Fig. 3. Longitudinal section through pistillate flower, X 14, from *Pringle 4752.*

Fig. 4. Terminal portion of a leaf, X .7, from *Pringle 4752.*

Fig. 5. Pistillate flower with petals and sepals removed, X 14, from *Pringle 4752.*

Fig. 6. Leaf, X .7, from *Pringle 9164.*



BARKLEY—ACTINOCHEITA FILICINA

Explanation of Plate

PLATE 3

Actinocheita filicina (DC.) Barkley

From specimen collected by *C. G. Pringle, 4752,* on limestone ledges, in Tomellin Canyon, Oaxaca, Mexico, altitude 2,500 ft., July 31, 1894. This specimen is typical of the species.

BARKLEY—ACTINOCHEITA FILICINA

NEW OR OTHERWISE NOTEWORTHY APOCYNACEAE OF TROPICAL AMERICA. V[1]

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Plumeriopsis Rusby & Woodson, gen. nov. Apocynacearum (Plumerioideae-Plumerieae-Cerberinae). Calyx 5-partitus intus multisquamelligerus, laciniis subaequalibus foliaceis. Corolla salverformis majuscula, tubo cylindrico faucibus paulo inflato ibique squamas 5 dentiformes villosulas gerente, limbi lobis late obliqueque obovatis patentibus. Antherae haud conniventes exappendiculatae parvae apice minute appendiculatae. Ovarium 2-carpellatum apocarpum 2–4-ovulatum, nectario annulari multifido. Fructus baccatus.—Arbusculae, foliis alternatis, inflorescentiis racemosis plurifloris aut terminalibus aut lateralibus.

Type species: *P. Ahouai* (L.) Rusby & Woodson.

Plumeriopsis Ahouai (L.) Rusby & Woodson, comb. nov.
Cerbera Ahouai L. Sp. Pl. ed. 2. 303. 1762.
Cerbera nitida HBK. Nov. Gen. **3**: 225. 1819.
Thevetia Ahouai (L.) A. DC. in DC. Prodr. **8**: 344. 1844.
Thevetia nitida (HBK.) A. DC. loc. cit. 345. 1844.

Plumeriopsis is undoubtedly closely associated phylogenetically with *Thevetia,* but the relatively few points of divergence are of considerable morphological importance. Chief of these is found in the nature of the fruit, that of *Thevetia* being definitely drupaceous, with a thick, woody endocarp, while that of *Plumeriopsis* is essentially baccate, with only a thin, membranaceous endocarp. The mesocarp of both genera is very fleshy and brilliant red in color, as well as highly toxic. The second important criterion is found in the structure of the corolla, that of *Thevetia* being infundibuliform, with slightly spreading lobes of about equal length to the tube, whereas that of *Plumeriopsis* is typically salverform, with proportionally

[1] Issued March 20, 1937.

shorter, sharply reflexed lobes. *Plumeriopsis* is evidently a monotypic genus.

Tonduzia macrantha Woodson, spec. nov., arborescens ca. 8 m. alta; ramulis gracilibus inconspicue lenticellatis; foliis ternatis superne oppositis longiuscule petiolatis oblongo-ellipticis apice longiuscule acuteque acuminatis basi cuneatis in petiolis decurrentibus 10–18 cm. longis 2–4 cm. latis firme membranaceis supra aliquid nitidulis subtus opacis omnino glaberrimis; petiolis 1–2 cm. longis glabris; inflorescentiis terminalibus irregulariter cymosis plurifloris foliis multo brevioribus; pedicellis 0.5–0.7 cm. longis glabris; bracteis ovato-deltoideis minimis; calycis laciniis ovato-deltoideis rotundatis margine undulatis 0.1–0.125 cm. longis subfoliaceis glaberrimis intus eglandulosis; corollae salverformis colore albidae tubo 0.7 cm. longo basi ca. 0.125 cm. diametro metiente extus glabro intus puberulo, lobis late oblongo-dolabriformibus apice rotundatis 0.9–1.0 cm. longis patulis extus glabris intus basi puberulis caeterumque glabriusculis; staminibus valde inclusis, antheris 0.175 cm. longis glabris; ovariis ovoideis ca. 0.08 cm. longis glaberrimis nectarium annulare ca. ter superantibus; stigmate 0.15 cm. longo; folliculis crassiusculis falcatis 10–12 cm. longis; seminibus ignotis. — GUATEMALA: QUEZALTENANGO: second-growth woodland, Volcan Zunil, alt. 5500 ft., July 30, 1934, *A. F. Skutch 871* (Herb. Missouri Bot. Garden, TYPE, Herb. Arnold Arboretum, ISOTYPE).

This species is distinguished by the magnitude of the flowers which are two to three times larger than those of the previously described species of the genus, recalling certain representatives of *Tabernaemontana*.

Rauwolfia indecora Woodson, spec. nov., fruticosa altitudine ignota; ramis ramulisque teretibus juventate minutissime puberulis mox glabratis maturitate bene lenticellatis; foliis ternatis subsessilibus ovatis apice acute acuminatis subcaudato-acuminatisve basi obtusis 0.9–2.5 cm. longis 0.5–1.2 cm. latis in verticillo subaequalibus membranaceis supra glabris opacisque subtus minutissime puberulis; petiolo vix 0.05 cm. longo glanduligero; inflorescentiis 1–3-floris folia subaequantibus; pedicellis 0.1–0.3 cm. longis; calycis laciniis ovato-lanceolatis anguste acuminatis 0.1–0.15 cm. longis puberulo-papillatis; corolla haud visa; drupis subgloboso-subreniformibus inconspicue emarginatis 0.6–0.8 cm. longis 0.7–0.9 cm. latis.—Costa Rica: Catalina, alt. 2000 ft., June 29, 1928, *H. E. Stork 2800* (Herb. Field Museum, type).

Very closely related to *R. Alphonsiana* Muell.-Arg., of Cuba, but distinguished by its nearly isophyllous, subsessile leaves, which are minutely puberulent beneath, and its larger drupes.

Vallesia antillana Woodson, spec. nov., fruticosa glaberrima 3 m. plus minusve alta; foliis alternatis petiolatis ovato- vel obovato-ellipticis basi obtusis vel late cuneatis apice acuminatis vel acutis rariusve obtusiusculis 2.5–8.0 cm. longis 1–3 cm. latis subcoriaceis; petiolis 0.4–0.7 cm. longis; appendicibus stipulaceis minute dentiformibus deciduis; inflorescentiis irregulariter dichasialibus lateralibus folia ca. dimidio aequantibus flores parvos albidos 3–12 gerentibus; pedicellis 0.4–0.5 cm. longis; bracteis minute ovato-deltoideis deciduis; calycis laciniis ovato-trigonalibus acuminatis 0.07–0.1 cm. longis; corollae tubo 0.6–0.7 cm. longo basi ca. 0.125 cm. diametro metiente deinde paulo angustato faucibus paulo ampliato ibique staminigero extus glaberrimo, limbi lobis oblongo-ellipticis obtusis 0.45–0.5 cm. longis patulis, alabastro anguste ovoideo-cylindrico; antheris subsessilibus ovoideis ca. 0.1 cm. longis omnino inclusis; ovariis ovoideis ca. 0.1 cm. longis glabris, stylo 0.3–0.35 cm. longo; stigmate capitato apice breviter 2-lobo 0.05 cm. longo; drupis oblique angusteque obovoideis, semine cum endocarpo duro ca. 1 cm. longo.—Florida: thickets on Key West, April 13, 1896, *A. H. Curtiss 5620* (Herb. Missouri Bot. Garden, type).

Vallesia antillana is widely distributed in southern peninsular Florida, the Bahama Islands, Cuba, Hispaniola, and perhaps others of the Antilles. It has long been confused with *V. glabra* (Cav.) Link, which is distinguished from our species by a much smaller corolla (0.5–0.7 cm. long), the proportionally shorter lobes of which are broadly conical in convolution, and narrower, usually elliptic-lanceolate leaves.

Vallesia flexuosa Woodson, spec. nov., arborescens glaberrima; foliis alternatis petiolatis obovato-oblongis apice acute acuminatis basi late obtusis subtruncatis 6–14 cm. longis 2.5–4.0 cm. latis membranaceis; petiolis 0.5–0.7 cm. longis; appendicibus stipulaceis minute dentiformibus persistentibus; inflorescentiis irregulariter scorpioideis, pedunculis secondariis brevibus sed valde manifestis multo brevioribus quam foliis flores parvos albidos 8–14 gerentibus; pedicellis 0.3–0.4 cm. longis; bracteis parvis ovatis deciduis; calycis laciniis anguste ovatis anguste acuminatis 0.1–0.15 cm. longis; corollae tubo 0.8–0.9 cm. longo basi ca. 0.1 cm. diametro metiente deinde paulo angustato faucibus ampliato ibique staminigero, limbi alabastro anguste ovoideo-cylindrico, lobis oblongo-ovatis anguste obtusis 0.3–0.4 cm. longis patulis; antheris subsessilibus ovoideis ca. 0.1 cm. longis omnino inclusis; ovariis ovoideis ca. 0.1 cm. longis glabris; stigmate capitato apice brevissime 2-lobo ca. 0.05 cm. longo; fructibus ignotis.—Costa Rica: bois des collines de Zarcera, alt. 1550 m., Dec. 21, 1924, *A. Brenes 4156* (Herb. Field Museum, type).

Apparently most closely related to *V. Baileyana,* of central Mexico, but differing strikingly in the much larger leaves and smaller flowers.

Vallesia Baileyana Woodson, spec. nov., fruticosa glaberrima altitudine ignota; foliis alternatis petiolatis oblongo-lanceolatis apice acutis basi obtusis 6–9 cm. longis 1.2–2.0 cm. latis firmiter membranaceis; petiolis 0.7–0.9 cm. longis; appendicibus stipulaceis minute dentatis persistentibus; inflorescentiis subumbellatis plerisque dichotomis multo brevioribus quam foliis flores mediocres albidos 8–20 gerentibus; pedicellis 0.3–0.4 cm. longis; bracteis minute ovato-lanceolatis deciduis; calycis laciniis anguste ovatis acutis 0.08–0.1 cm. longis; corollae salverformis tubo 0.9–1.0 cm. longo basi ca. 0.1 cm. diametro metiente, faucibus paulo inflatis ibique staminigeris, lobis oblongo-ovatis rotundatis 0.5–0.6 cm. longis patulis; antheris ovoideis ca. 0.1 cm. longis omnino inclusis; ovario ovoideo ca. 0.1 cm. longo; stigmate subcapitato obscure 2-lobo ca. 0.06 cm. longo; fructibus ignotis.—Mexico: sonora: Nacapule Canyon, near Guaymas, March 30, 1934, *L. H. Bailey s. n.* (Herb. Missouri Bot. Garden, TYPE).

The affinities of this species with *V. flexuosa* have already been indicated. Both are closely allied to *V. montana* Urb., of Hispaniola, which is distinguished chiefly by corolla-lobes nearly equalling the tube.

Allomarkgrafia Brenesiana Woodson, spec. nov., fruticosa volubilis alte scandens omnino glaberrima; ramulis crassiusculis teretibus bene lenticellatis; foliis oppositis superne rarius ternatis petiolatis oblongo-ellipticis apice breviter subcaudato-acuminatis basi late obtusis rotundatisve 8–12 cm. longis 2.0–3.5 cm. latis subcoriaceis supra, nervo medio basi inconspicue glanduligero, petiolis 0.8–1.0 cm. longis; inflorescentiis lateralibus aut subterminalibus cymoso-compositis flores majusculos aut gilvos aut albidos 6–12 gerentibus; pedicellis 1.2–1.5 cm. longis; bracteis minute ovatis caducis; calycis laciniis ovatis vel ovato-lanceolatis acutis 0.2–0.25 cm. longis intus multisquamelligeris; corollae infundibuliformis tubo proprio 1.3–1.5 cm. longo basi ca. 0.15 cm. diametro metiente, faucibus conicis 2 cm. longis, ostio ca. 0.8 cm. diametro metiente, limbi lobis oblique obovatis 2.0–2.5 cm. longis patulis; antheris omnino inclusis oblongo-ellipticis basi obtuse 2-lobatis glabris; ovariis oblongoideo-ovoideis ca. 0.25 cm. longis glabris; nectariis 5 compresse oblongoideis ca. dimidio brevioribus quam ovariis; folliculis ignotis.—COSTA RICA: ALAJUELA : bosque entre La Balsa y Cataractas de San Ramon, alt. 850 m., Oct. 12, 1925, *A. Brenes 4509* (Herb. Field Museum, TYPE).

This species is very closely related indeed to *A. ovalis* (Mgf.) Woods., which may be distinguished by its broader foliage with more abrupt acumination, and particularly by the corolla throat, which is essentially campanulate, and broader than the conical throat of *A. Brenesiana.* The same species has been found by Brenes at two additional localities in the environs of San Ramon: "Entre La Balsa y Los Angeles, près La Paz ca. de San Ramon," alt. 980 m., July 30, 1926, *Brenes 4912* (Herb. Field Museum); Los Angeles de San Ramon (Finca Johansson), April 14, 1928, *Brenes 6127* (Herb. Field Museum).

Allomarkgrafia subtubulosa Woodson, spec. nov., fruticosa volubilis 10–15 m. altitudine attingens omnino glaberrima; ramulis crassiusculis bene lenticellatis; foliis oppositis petiolatis late ovalibus apice late obtusis vel brevissime lateque acuminatis basi late obtusis 8–12 cm. longis 3–5 cm. latis coriaceis, supra nervo medio basi multiglanduloso; petiolis 0.8–1.2 cm. longis; inflorescentiis aut lateralibus aut subterminalibus ut videtur simplicibus (pro genere raro) flores 8–12 speciosos gilvos gerentibus; pedicellis 1.0–1.2 cm. longis; bracteis minute ovatis scariaceis persistentibus; calycis laciniis ovatis late acutis rotundatisve 0.2–0.25 cm. longis minute papillatis squamellis subquadratis multis; corollae subtubulosae tubo 2.0–2.5 cm. longo basi ca. 0.2 cm. diametro metiente ca. medio staminigero deinde paululo ampliato, ostio ca. 0.25 cm. diametro metiente lobis oblique obovatis 1.7–2.0 cm. longis patulis; antheris oblongo-ellipticis basi obtuse 2-lobatis 0.6–0.65 cm. longis glabris; ovariis oblongoideis 0.35–0.4 cm. longis minutissime papillatis; nectariis 5 compresse oblongoideis ovario ca. dimidio brevioribus; folliculis ignotis.—Costa Rica: alajuela: bosquets, collines près de San Ramon, alt. 975–1000 m., April 21, 1927, *A. Brenes 5457* (Herb. Field Museum, type).

The type specimen is somewhat fragmentary, as far as the inflorescence is concerned, and it is not possible to prove conclusively that the inflorescence is simple, but should such be the case it would be an anomaly for the genus. The subtubular corolla is not strictly conformable with the original characters of *Allomarkgrafia* as well, although the affinity of *A. subtubulosa* with such species as *A. Brenesiana* Woods., *A. plumeriaeflora* Woods., and *A. ovalis* (Mgf.) Woods. is quite obvious.

A MONOGRAPH OF THE GENUS MERTENSIA IN NORTH AMERICA[1]

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Introduction

The present study was made with at least two objects in view: to work on a problem which would yield results of a practical taxonomic value, and to straighten out one of the many puzzling genera concerned particularly with the flora of the Rocky Mountains and the West. *Mertensia* is a genus in which the entities have been much confused, particularly by the earlier authors on the flora of the West. Since the time of Gray's 'Synoptical Flora' numerous species have been described with too little attention given to the tremendous variation which may occur within a single colony in the field. Further, the genus is one which does not lend itself to a straightforward enumeration of characters by which entities may be differentiated. Characters, which may seem fairly definite in the laboratory, may often be broken down or minimized by study of plants in the field, or variations often found within a single colony which will help to solve puzzling relationships. Conversely, a study of a mass of material in the field may show that certain species or varieties seem to be quite distinct. Even with study in the field and of a large suite of herbarium specimens in the laboratory entities within the group, to no small extent, must be left to the judgment of the student of the group.

An attempt has been made to delimit the entities involved so that their distribution would coincide with that of similar entities in other groups, where such procedure could be logically followed. The publication of a monograph of this genus does not mean finality or that with it interest in the group ceases.

[1] An investigation carried out at the Missouri Botanical Garden in the Graduate Laboratory of the Henry Shaw School of Botany of Washington University and submitted as a thesis in partial fulfillment of the requirements for the degree of doctor of philosophy in the Henry Shaw School of Botany of Washington University.

Issued March 20, 1937.

There are still several imperfectly known and unsatisfactory entities which need further study both in the field and in the laboratory.

Manuals, floras, or other works in which species or varieties of *Mertensia* are given, often without synonymy or bibliography, are not cited in the text of this paper unless such citations are necessary for bibliographical reasons. It is felt that such citations would indicate acceptance of the various entities as delimited in those works, which is generally not the case. The more important publications are to be found in the generic synonymy.

The key to the species and varieties, as herein defined, is in no way an attempt to present a phylogenetic synopsis of the genus; but it is mainly an artificial key, which it is hoped will aid in the ready identification of the several taxonomic entities recognized. Some specific and varietal names will key out in different places, thus covering individual variations. Geographical lines have been used quite frequently; it is believed that these, as delimited, will be found to be sound.

History

The first species belonging to the genus *Mertensia* to be described were *M. maritima, M. virginica,* and *M. sibirica.* They were, however, treated by Linnaeus under the generic name *Pulmonaria.* Hill was the first to question the generic relationship of these three species and erected the genus *Pneumaria,* in 1764, to contain them. This generic name has been rejected. Roth, in 1797, described *Mertensia* and assigned to it one species, *M. pulmonarioides (= M. virginica).* This generic name has been conserved over the earlier one.

The next work of importance in which species of this genus were treated was that of Lehmann in 1818. He treated the previously mentioned species, as well as three others which had been described in the meantime, as *Lithospermum.* Between the time of Lehmann's work and that of G. Don in 'The General History of Dichlamydeous Plants,' in 1838, several more species were described by Pursh, Nuttall, Torrey, and James, all assigned to the genus *Pulmonaria.* In addition, three more generic names were proposed or mentioned. Don, in 1838 for the first time, treated most of the previously described species under *Mertensia.* A. DeCandolle in the "Prodromus," in 1846, continued the use of the name *Mertensia,* accrediting to the genus nineteen species, ten of which were North American. In the period between DeCandolle's treatment in the 'Prodromus' and that of Gray in the 'Synoptical Flora,' in 1878, two more genera were described to contain species of *Mertensia.* Only a few more species, based on North American material, were added. Two short papers by Gray appeared between 1840 and 1878, and for American species are the most important for the period. In the 'Synoptical Flora,' Gray maintained seven species and three varieties. This treatment well illustrates the difficulty that was had with the genus at that time.

Since the time of the 'Synoptical Flora' a great deal of collecting, exploration, and floristic work has been done in the West where the genus is most abundant. This has brought together a great mass of material and with it has come the descriptions of numerous species and varieties. Greene, Nelson, Rydberg, Piper, Heller, and Macbride have accounted for the majority of the increase; a few entities have been described by other botanists. With the exception of Macbride, these authors have, for the greater part, described the plants in connection with studies on the western flora. One of the most recent contributions to the literature of the genus is a paper by Macbride entitled "The True Mertensias of Western North America." This was the first attempt at a comprehensive review of the western species since Gray revised them for the 'Synoptical Flora.' In so far as Macbride was conversant with the difficulties to be encountered with the American borages his revision is of interest and is the best treatment of the genus up to that time. It is further of interest that Macbride knew many of the plants of which he wrote from field experience. The main disadvantage of the work is that he did not see enough material nor did he work that which was available to him carefully or critically. To these faults errors are due which might well have been avoided.

Since the publication of Macbride's paper, not a great deal has been done with the North American species except for a few descriptions of new material and a short paper by Johnston (Contr. Arnold Arb. No. 3, pp. 83–87. 1932) in which several entities are critically discussed.

Morphology

Calyx.—A few valuable characters are offered in the calyx. The structure, whether divided almost to the base or campanulate, will separate a few species from the others, but this character is not always consistent. The shape and size of the lobes are of value in a general way and are specific in a few entities, even though they show much variation within species.

Corolla.—The differences to be found in the corolla are of a good deal of value. The relative lengths of the tube and the limb[1] provide a convenient method of separating groups in both the low and the tall species of the section Eumertensia. This character probably also indicates close relationship among species. In species which are di- or possibly trimorphic both conditions may prevail. Size of the corolla can be used to some extent but it is often subject to much variation. Some species which have large flowers early in the season may produce very much smaller ones later on in the season. In some entities the flowers continue to increase in size through the period of anthesis. The presence or absence of fornices is of value in the separation of a few species. The lack of fornices may indicate a fairly recent species. The presence or absence of a ring of hairs or of scattered hairs in the tube of the corolla is of some use in a general way but of little or no use in a specific way. As a character it is to be warily used because both conditions sometimes occur in the same inflorescence. Campanulate corollas seem to be constant and where found are of value. Coloration is of no value; it is usually blue, but flowers lacking the blue color are not uncommon.

Nutlets.—Unfortunately the nutlets do not seem to present the specific characters so often found in other members of the

[1] For convenience the "limb" is used throughout this monograph to signify that portion of the corolla above the fornices although, technically, this is divided into throat and limb.

Boraginaceae. A few tendencies are manifest, but in only a few species do the nutlets show characters of unique value. Evidently in many species they are shed before they are completely ripe for mature fruit is rarely seen. Many of the smaller western species are inconspicuous after the flowers have fallen and consequently are seldom collected in the fruiting stage. The nutlets of specimens taken in immature fruit usually lose their shape or are crushed in drying.

Inflorescence.—The characters of the inflorescence are difficult of precise description and definition. In some species the branches of the inflorescence elongate with age to a marked degree; in others there is very little or no elongation.

Stamens.—Size and shape of anthers are of diagnostic value in a few species; in most species the size is fairly constant. The filaments are of some little value. A few species are set off from the others by having the stamens included in the corolla-tube.

Style.—The style presents little of specific value. In some species it is di- or possibly trimorphic.

Gynobase.—The gynobase is difficult of examination but seems to present little of specific value.

Indument.—The pubescence furnishes easily examined and obvious characters for diagnosis. It is not a fundamental character even though it has been widely used as a specific difference. The position, type, and abundance of the pubescence seem to be fairly constant and can be used to advantage in some species; in other species and varieties, notably those allied to *M. paniculata,* the pubescence presents a character which must be warily used. In entities where position and character of the indument seem to be constant, within limits, full advantage has been taken of it.

Leaves.—The shape and size of leaves are of some diagnostic value, but in some species are subject to a large range of variation. A tendency for the leaves to broaden with age is manifest in most species. A fairly constant character, but again one which is not absolute, is found in the venation of the leaves which will divide the species roughly into two groups.

Venation.—Whether or not the cauline leaves have lateral veins visible is a general character of value in the separation of the genus into two groups. The tall species (see below) usually have distinct lateral veins in the cauline leaves while the low species do not. There is intergradation in this character, so it is not absolute or constant. The character of the venation is concomitant with the time of flowering and the habitat.

Time of flowering and habitat.—The tall species, which usually have lateral veins in the cauline leaves, generally flower in the late spring or in the summer and are usually found in moist and fairly well-shaded situations. The low species, which usually do not exhibit lateral veins in the cauline leaves, generally flower in the early spring and are to be found in drier more open habitats unless they occur at high altitudes when they of necessity flower later and are often found in moist situations. Some species may be somewhat limited in altitudinal range, others are quite cosmopolitan.

Stems.—Two groups of the Eumertensia may be set apart by the height of the stems: one group, having tall stems and lateral veins in the leaves; the other, having low stems and usually without apparent lateral veins in the cauline leaves. The character is empirical and intergradation between the two types is complete.

Roots.—The roots are usually large and fleshy, with numerous small fibrous roots. In some species the underground parts seem to be essentially rhizomes. In a few species the root is very much shortened and may be almost round.

Phylogeny

The phylogeny of the genus *Mertensia* in North America is apparently very complex. Among some species it might be possible to trace a fairly logical course of their evolution, but in the greater number of the species no such course can be traced with any degree of accuracy. Speculation on their phylogeny, while it would probably be interesting, would be of no great value. It is fairly safe to say, however, that the relationship between the entities is probably reticulate and not lineal or dendroid. Relationships and some probable phylogeny will be found in the discussion of some of the entities.

While it is not always possible to bring into juxtaposition those species which seem to be closely related, an attempt has been made to group species according to their affinities, thus having closely related groups together. This is true particularly of the section Eumertensia which contains most of the species, the sections Steenhammera and Neuranthia each containing a single species.

Generic Relationship

Mertensia, so far as the author is aware, has no very close generic allies. *Pulmonaria,* to which certain species of *Mertensia* were referred for a long time, is near *Mertensia* in facies. No species of that genus are known from the New World. Johnston, in his treatment of "The Old World Genera of the Boraginoideae," states of *Anoplocaryum* that it "appears to be a close ally of *Mertensia.*" That monotype is not known to the author.

In its tribal relationship *Mertensia* has been treated in essentially two ways. Bentham and Hooker, in the 'Genera Plantarum,' placed it in the subtribe Lithospermeae of the tribe Borageae. Gürke, in Engler and Prantl's 'Natürlichen Pflanzenfamilien,' included it in the tribe Lithospermeae of the subfamily Borraginoideae. Johnston, both in his treatment of "The Old World Genera of the Boraginoideae" and in his "Synopsis of the American Native and Immigrant Borages of the Subfamily Boraginoideae," placed *Mertensia* in the tribe Eritrichieae. The author is inclined to accept the latter disposition of the genus as more nearly correct.

Specific Concept

In the present study an attempt has been made to delimit the entities in such a way that they would be most logical and useful, although it is recognized that the species are not of uniform value. The course followed, it is thought, is a conservative one. The line of demarcation is, in many instances, difficult enough to draw and becomes increasingly so with further division. The differences between certain species, while not clearly and sharply definable, are most evident when their often distinct but intangible facies are taken in conjunction with morphological characters. The species, as here delimited, will in most cases be found to have ranges similar to those of species in other genera which have developed in the same region and under similar conditions. Among the varieties here maintained are many which, biologically, would seem not to belong in the same category. Some of them may have a natural range of their own, either distinct or within that of the species, and be distinguishable from the species on minutae of morphology. Others are sporadic, having no natural or limited range of their own, and are distinguishable by sporadic characters.

Geographical Distribution

In North America *Mertensia* has its greatest concentration in the western half of Colorado. Some twenty entities occur there, many of which are also found in the floristically related Uinta and La Sal Mountains in Utah. From Colorado the general range of greatest density extends west and northward. A second and smaller center of distribution occurs in northern Idaho and adjacent areas of Montana, Wyoming, Washington, and Oregon.

The majority of the entities are found in or not very far removed from the mountains, in the low hills. A few are typically plains plants but extend into the lower elevations of the mountains. The break in the continuity of the mountains, which occurs across Wyoming and north of the Uinta and south of the Wasatch Mountains in Utah, marks the boundary line across which some northern species have not crossed and also the northern limit of some southern species. In that region, and in other similar regions, some entities are found to be inconstant in their characters, even more so than elsewhere.

Species and varieties occurring in the high mountains of Colorado are often found across the plains region in the high mountains of Wyoming and Montana. Such distribution is well known in other genera.

Our knowledge of the Siberian species of *Mertensia* is still too fragmentary to permit discussion of their relationship or comparisons of the distribution areas with those of America.

Illustrations

Line drawings have been prepared illustrating the more difficult or interesting of the species. The drawings were made natural size and reduced in reproduction. Species vary greatly in size and consequently the amount of reduction varies. The drawings were all prepared by Dorothy D. Wynd.

Acknowledgments

This study has been carried out at the Missouri Botanical Garden where the splendid library and herbarium were at all times placed at the disposal of the author. For these privileges and many others he is indebted to the Director, Dr. George T. Moore. Above all the author wishes to express his sincere appreciation and thanks to Dr. J. M. Greenman, Curator of the Herbarium of the Missouri Botanical Garden, for his invaluable assistance, encouragement, helpful criticism, and time, which were given without stint. To Dr. Ivan M. Johnston, the author is much indebted for many critical suggestions. To those in charge of the many herbaria, who have so freely loaned of the material in their charge, the author wishes to express his gratitude. Much assistance in many ways was rendered by the author's wife.

Abbreviations

The herbaria from which material has been available for study and from which specimens are cited in this monograph are indicated by the following abbreviations:

Herbarium of the New Mexico College of Agriculture and Mechanical Arts (AM); Herbarium of the Academy of Natural Sciences, Philadelphia (ANS); Herbarium of the University of Arizona (Ariz); Herbarium of Brigham Young University (BYU); Herbarium of the University of Colorado (C); Herbarium of the Carnegie Museum (Carnegie); Herbarium of the California Academy of Sciences (CAS); Herbarium of Cornell University (Cl); Ira W. Clokey, his personal herbarium (Clokey); Dudley Herbarium of Stanford University (Dudley Herb); Herbarium of the Field Museum of Natural History (F); Herbarium of the Colorado Agricultural College, Fort Collins (FC); Gray Herbarium of Harvard University (G); Herbarium of Kansas State College (K); Herbarium of the Royal Botanical Gardens, Kew (Kew); Herbarium of the Missouri Botanical Garden (M); Herbarium of the University of Nebraska (N); Herbarium Greeneanum at the University of Notre Dame (ND); Herbarium of the New York Botanical Garden, the Torrey Herbarium, and the Britton Herbarium (NY); George E. Osterhout, his personal herbarium (O); Herbarium of the University of Oregon (Ore); Herbarium of the State College of Washington, Pullman (P); Herbarium of Pomona College (Pom); Rocky Mountain Herbarium at the University of Wyoming (Ry); Intermountain Herbarium at the Utah State Agricultural College (U); Herbarium of the University of California (UCal); Herbarium of the University of Idaho (UIdaho); Herbarium of the University of Montana (UM); Herbarium of the University of New Mexico (NMex); United States National Herbarium (US); Louis O. Williams, personal collection (W); Herbarium of Willamette University (Willm); Herbarium of the Botanical Garden and Academy of Science, Leningrad (USSR), types of Siberian species, not cited.

Taxonomy

GENERIC SYNONYMY AND DESCRIPTION

Mertensia Roth, Cat. Bot. **1**: 34. 1797, *conserved name;* G. Don, Gen. Hist. Dich. Pl. **4**: 318–320, 372. 1838; A. DC. in DC., Prodr. **10**: 87–93. 1846; Gray in Proc. Am. Jour. Sci. and Arts, II. **34**: 339–341. 1862; Porter & Coulter, Syn. Fl. Colo. 101. 1874; Gray in Proc. Am. Acad. N. S. **10**: 52–53. 1875; Bentham & Hooker, Gen. Pl. **2**: 857–858. 1876; Gray, Syn. Fl. N. Am. **2**^{1}: 199–201. 1878; Macoun, Cat. Can. Pl. pt. 2: 338–339. 1884; Coulter, Man. Bot. Ry. Mt. Reg. 262–263. 1885; Gürke in Engler & Prantl, Nat. Pflanzenf. **4**^{3a}: 119–121. 1893;

Britton & Brown, Ill. Fl. N. States and Canada **3**: 59–60. 1898; Rydberg in Mem. N. Y. Bot. Gard. **1**: 335–337. 1900; Howell, Fl. N. W. Am. 490–491. 1901; Britton, Man. Fl. N. States and Canada, 771–772. 1901, and ed. 2. 1905; Rydberg in Colo. Agr. Exp. Sta. Bull. [Fl. Colo.] 100: 289–292. 1906; Piper in Contr. U. S. Nat. Herb. [Fl. Wash.] **11**: 476–480. 1906; Robinson & Fernald in Gray's Man. Bot. ed. 7, 685. 1908; Nelson in Coult. & Nels., Man. Ry. Mt. Bot. 420–423. 1909; Piper & Beattie, Fl. N. W. Coast, 301–302. 1915; Wooton & Standley in Contr. U. S. Nat. Herb. [Fl. N. Mex.] **19**: 541–542. 1915; Macbride in Contr. Gray Herb. N. S. No. 48: 1–20. 1916; Rydberg, Fl. Ry. Mts. and Adj. Plains, 730–736. 1918, and ed. 2, 730–736, 1131–1132. 1923; Johnston in Contr. Gray Herb. N. S. No. 70: 46. 1924, and No. 73: 66–67. 1924; Tidestrom in Contr. U. S. Nat. Herb. [Fl. Utah and Nev.] **25**: 465–467. 1925; Skutch, Ann. N. Y. Acad. Sci. **32**: 1–52. 1930; Rydberg, Fl. Pr. and Pl. Cent. N. Am. 671–673. 1932; Victorin, Fl. Laurent. 456–457. 1935.

Pulmonaria L., Sp. Pl. 135–136. 1753, in part; Michaux, Fl. Bor.-Am. **1**: 131–132. 1803; Pursh, Fl. Am. Sept. **1**: 130–131. 1814, and ed. 2. 1816; Nuttall, Gen. N. Am. Pl. 115. 1818; Eaton, Man. Bot. N. Am., ed. 7, 467–468. 1836.

Lithospermum of authors, not L., Lehmann, Asperif. pars 2: 289–297. 1818; Pug. **1**: 26–27. 1828; in Hooker, Fl. Bor.-Am. **2**: 86–87. 1838.

Pneumaria Hill, Veg. Syst. **7**: 40, *pl. 37, fig. 1, a–b.* 1764, and new ed. 1824; Britton & Brown, Ill. Fl. N. States and Canada **3**: 59. 1898; Howell, Fl. N.W. Am. 491. 1901; Britton, Man. Fl. N. States and Canada, 771. 1901, and ed. 2. 1905.

Casselia Dumortier, Com. Bot. 21. 1822.

Steenhammera Reichb., Fl. Germ. Excurs. 337. 1831; Turczaninow in Bull. Soc. Nat. Moscow **14**: 241–251. 1840.

Platynema Schrad., Ind. Sem. Hort. Götting. 1835; Linnaea **11**: Litt.-Ber. 89. 1837.

Winkleria Reichb., Nom. Gen. 236. 1841.

Hippoglossum Hartm. ex Lilja in Linnaea **17**: 111. 1843.

Cerinthodes Ludwig, Defin. Gen. 5. 1737, ex O. Kuntze, Rev. Gen. Pl. pt. 2: 436. 1891.

Glabrous or pubescent caulescent perennial herbs with fleshy, fusiform, rhizome-like or corm-like roots. Leaves entire, linear to cordate, sessile or petiolate, alternate. Stems one to many from each root, decumbent to erect, usually unbranched below the inflorescence, 0.3–17 dm. tall. Inflorescence a lax or congested, ebracteate, unilateral, modified scorpioid cyme, or with the lowest flowers often single and subtended by leaves, often becoming panicled in age. Calyx 5-parted, occasionally campanulate, often accrescent. Corolla tubular, infundibuliform or campanulate, the expanded limb[1] exceeding or exceeded by the tube, with or rarely without fornices in the throat alternating with the stamens, blue, occasionally white or pink. Filaments attached below the throat, the anthers exserted or included. Style shorter or longer than the corolla, in some di- or trimorphic, the base often dilated slightly; the stigma entire or obscurely lobed. Ovary 2-celled, each cell 2-lobed. Nutlets 4, or by abortion fewer, attached laterally to the gynobase from one-fourth to one-half the distance above the base to the apex of the nutlet, the point of attachment usually elevated and twisted to one side, open or closed, usually rugose or pectinately rugose, coriaceous or in *M. maritima* smooth and shining, utricle-like. Gynobase[2] subtending the nutlets of 2 unequal pairs of lobes alternate with the nutlets and often intruding between them.

Type species: **Mertensia virginica** (L.) Pers. *(Mertensia pulmonarioides* Roth, Cat. Bot. **1**: 34. 1797).

KEY TO THE SECTIONS

A. Nutlets smooth, utricle-like; procumbent plants of the sea-shore and salt marshes....................................Section 1. STEENHAMMERA.

AA. Nutlets rugose, not utricle-like; mostly erect or ascending inland plants.

B. Corolla not divided into a tube and a limb, campanulate, 10 mm. or less long..Section 2. NEURANTHIA.

BB. Corolla divided into a tube and a limb, not campanulate, usually 10 mm. or more long or if shorter then the division into tube and limb well pronounced.....................................Section 3. EUMERTENSIA.

Section 1. STEENHAMMERA (Reichb.) Gray in Proc. Am. Acad. N. S. **2**: [whole series **10**:] 52. 1874, as section. (Changed to *Stenhammaria.)*

[1] See footnote on p. 20.

[2] cf. Moore, J. A. Morphology of the gynobase in *Mertensia*. Am. Midl. Nat. **17**: 749–752. 1936.

Steenhammera Reichb., Fl. Germ. Excurs. p. 337. 1831, as genus.

Nutlets smooth, utricle-like; leaves thick and fleshy; procumbent plants of the sea-shore and salt marshes.

A single species..*1. M. maritima*

Section 2. NEURANTHIA, n. sec.[1]

Nutlets rugose; corolla not divided into a tube and a limb, campanulate, 10 mm. long or less; roots corm-like, usually rounded, small; cauline leaves with lateral veins.

A single species..*2. M. bella*

Section 3. EUMERTENSIA Gray, *l.c.*

Nutlets rugose; corolla divided into a tube and limb, not campanulate, usually more than 10 mm. long, if less then definitely divided into a tube and limb; cauline leaves with or without lateral veins.

KEY TO SPECIES AND VARIETIES OF SECTION EUMERTENSIA

X. Plants usually with prominent lateral veins in the cauline leaves; stems usually 4 dm. or more tall (1–17 dm.); normally flowering in late spring and in the summer; mostly occurring in moist shaded situations. (XX on page 31.)

A. Limb of the corolla longer than the tube; leaves usually acuminate. (AA on page 31.)

P. Anthers 3.7–5 mm. long, usually curved.

e. Calyx-lobes 5–7 mm. long, acute; plants of western Washington ....*6. M. platyphylla*

ee. Calyx-lobes 2.5–4 mm. long, obtuse; plants of western Oregon. ....*6a. M. platyphylla* var. *subcordata*

PP. Anthers rarely exceeding 3 mm. in length, usually straight.

B. Nutlets *with* long subspinose processes; pubescence of both leaf-surfaces appressed; calyx-lobes glabrous.........*3. M. Eastwoodiae*

BB. Nutlets *without* long subspinose processes; pubescence of the lower surface of the leaves spreading or none, that of the upper surface appressed or none, rarely spreading; calyx-lobes glabrous to densely pubescent.

Y. Leaves pubescent at least on one surface.

C. Leaves pubescent on both surfaces.

D. Pubescence of lower surface appressed......*3. M. Eastwoodiae*

[1] **Neuranthia**, n. sec., nucellis rugosis; corolla in tubo et limbo non divisa, usque ad 10 mm. longa, campanulata; radice parva orbiculata subtuberosa; foliis caulinis cum nervis lateralibus.

DD. Pubescence of the lower surface spreading or none.
E. Plants occurring only north of the 42nd parallel, not in Colorado, New Mexico, Utah, Arizona, or Nevada.
F. Cauline leaves lanceolate or ovate; calyx pubescent or glabrous on the back; plants from Quebec and Iowa to Alaska, south to Montana and Washington...... .... *4. M. paniculata*
FF. Cauline leaves linear to narrowly elliptic; calyx glabrous on the back; plants of Alaska and Yukon.... .... *4a. M. paniculata* var. *alaskana*
EE. Plants occurring only south of the 42nd parallel in Colorado, New Mexico, Utah, Arizona, and Nevada.
G. Pubescence of both surfaces of the leaves and of the pedicels spreading; leaves oblong-lanceolate to elliptical.............................. *7. M. toyabensis*
GG. Pubescence of both surfaces of the leaves not spreading; leaves not oblong-lanceolate to elliptic.
H. Calyx not accrescent, margins densely ciliate, backs pubescent or glabrous.............. *5. M. franciscana*
HH. Calyx accrescent, margins not densely ciliate, backs glabrous............... *8c. M. arizonica* var. *subnuda*
CC. Leaves pubescent only on one surface.
I. Leaves glabrous above.
J. Calyx-lobes acute, accrescent... *4b. M. paniculata* var. *borealis*
JJ. Calyx-lobes obtuse, not accrescent..................... .... *12a. M. ciliata* var. *subpubescens*
II. Leaves glabrous below.
K. Calyx not accrescent, margins of the lobes densely ciliate .... *5. M. franciscana*
KK. Calyx accrescent, margins of lobes not densely ciliate.
L. Plants from south of the 42nd parallel............... .... *8c. M. arizonica* var. *subnuda*
LL. Plants from north of the 42nd parallel............. .... *4b. M. paniculata* var. *borealis*
YY. Leaves glabrous on both surfaces.
a. Calyx campanulate, lobes shorter than the tube.
b. Cauline leaves rapidly reduced upward; fornices none or inconspicuous; plants of Idaho............ *10. M. campanulata*
bb. Cauline leaves not rapidly reduced upward; fornices conspicuous; plants of Colorado, Utah, and possibly Arizona.
‡. Corolla 13–20 mm. long; base of anthers higher than the fornices; plants of Utah and possibly Arizona........ .... *8. M. arizonica*
‡‡. Corolla 9–13 mm. long; base of anthers opposite the fornices; plants known only from Colorado.............. .... *8b. M. arizonica* var. *Grahami*
aa. Calyx not campanulate, lobes longer than the tube.
c. Plants occurring only south of the 42nd parallel.

y. Plants of Mexico............................*9. M. mexicana*
yy. Plants of Wyoming, Colorado, or Utah.
d. Base of the anthers opposite the fornices; corolla 9–13 mm. long; plants of Colorado...*8b. M. arizonica* var. *Grahami*
dd. Base of the anthers higher than the fornices; corolla 13–20 mm. long; plants of Wyoming and Utah............................*8a. M. arizonica* var. *Leonardi*
cc. Plants occurring only north of the 42nd parallel...*4b. M. paniculata* var. *borealis*
AA. Limb of the corolla shorter than the tube or the two about subequal; leaves usually not acuminate.
f. Leaves pubescent at least on one surface.
g. Leaves pubescent only below; calyx-lobes obtuse...*12a. M. ciliata* var. *subpubescens*
gg. Leaves pubescent above or on both sides; calyx-lobes 2.5–7 mm. long, usually acute.
h. Pubescence of both surfaces of the leaves and of the pedicels spreading.......................................*7. M. toyabensis*
hh. Pubescence of the upper surface of the leaves and of the pedicels appressed....................................*5. M. franciscana*
ff. Leaves glabrous on both surfaces, sometimes the upper surface papillate.
i. Corolla-tube 11–21 mm. long, very narrow; plants east of the 95th parallel...*11. M. virginica*
ii. Corolla-tube 12 mm. or less long, not very narrow; plants west of the 95th parallel.
j. Calyx not campanulate, the lobes longer than the tube; fornices conspicuous.
k. Calyx-lobes obtuse or acutish, ovate or oblong, 1.5–6 mm. long.
l. Calyx-lobes 1.5–3 mm. long, sinus usually open; style usually not exceeding the corolla; plants not of California and closely adjacent Nevada........................*12. M. ciliata*
ll. Calyx 2.5–6 mm. long, sinus usually closed; style usually exceeding the corolla; plants of California and closely adjacent Nevada.............*12c. M. ciliata* var. *stomatechoides*
kk. Calyx-lobes acute, lanceolate to triangular, 3.7–7 mm. long.
m. Anthers 1–1.5 mm. long; corolla 10–14 mm. long; plants of Idaho.........................*12b. M. ciliata* var. *latiloba*
mm. Anthers 1.5–2.5 mm. long; corolla 15–21 mm. long; plants of Washington and Oregon................*13 M. umbratilis*
jj. Calyx campanulate, the lobes shorter than the tube; fornices inconspicuous; plants of Idaho.................*10. M. campanulata*
XX. Plants usually *without* lateral veins in the cauline leaves, some specimens of *M. oblongifolia* var. *nevadensis* excepted; stems usually less than 4 dm. tall; normally flowering in early spring, later when growing in the mountains, but commonly as soon as the snow and temperature permit; mostly occurring in fairly dry open habitats or if in the mountains often in moist or wet situations.

A. Filaments attached in the corolla-tube, the anthers not projecting beyond the throat, *i. e.* contained within the tube.
  B. Leaves pubescent on the upper surface, glabrous below.
    C. Backs of the calyx-lobes and the stems pubescent; plants not alpine or subalpine....................................*16. M. brevistyla*
    CC. Backs of the calyx-lobes and the stems glabrous; plants alpine or subalpine..*18. M. alpina*
  BB. Leaves glabrous on both surfaces.......................*17. M. humilis*
AA. Filaments attached near the throat of the corolla-tube, anthers projecting beyond the throat, *i. e.* not contained in the tube.
    C. Limb of the corolla longer than or subequal to the tube.
      D. Leaves strigose only above or glabrous on both surfaces.
        E. Filaments shorter than the anthers; calyx divided quite to the base; style usually not reaching the anthers; anthers straight; leaves strigose above; plants usually alpine or subalpine, sometimes of lower altitudes and then more densely strigose.
          F. Cauline leaves not unilateral....................*19. M. viridis*
          FF. Cauline leaves unilateral........ *19d. M. viridis* var. *parvifolia*
        EE. Filaments longer than the anthers; calyx not divided quite to the base; style usually reaching or surpassing the anthers; anthers usually curved; leaves strigose above or glabrous; plants usually not alpine or subalpine.
          G. Calyx divided about two-thirds or more the way to the base.
            H. Roots fusiform; calyx pubescent on the back; leaves usually densely strigose above, the hairs directed toward the nearest margin of the leaf..*15. M. fusiformis*
            HH. Roots not fusiform; calyx glabrous on the back; leaves glabrous to rather densely strigose on the upper surface, the hairs usually directed toward the apex of the leaf......................*14. M. lanceolata*
          GG. Calyx divided less than halfway to the base, usually forming a campanulate cup.
            I. Plant entirely glabrous on the surface; plants of Larimer Co., Colorado....*14b. M. lanceolata* var. *brachyloba*
            II. Plants with the leaves densely pubescent on the upper surface, usually on the calyx and often on the stem; plants of southern Colorado and adjacent New Mexico...............*14c. M. lanceolata* var. *Fendleri*
      DD. Leaves pubescent on both surfaces.
        J. Calyx divided one-half or less the way to the base; plants of New Mexico and adjacent Colorado......................
        ....*14d. M. lanceolata* var. *pubens*
        JJ. Calyx divided two-thirds or more the way to the base; not of New Mexico.
          K. Cauline leaves linear to broadly lanceolate; plants of the plains, Wyoming and Colorado......................
          ....*14a. M. lanceolata* var. *secundorum*

KK. Cauline leaves linear to narrowly ovate; plants of the high mountains, Colorado and probably Utah.. *19e. M. viridis* var. *cana*

CC. Limb of the corolla shorter than the tube.

L. Nutlets with the margins elevated, forming a tumid ring toward the inner surface; plants of Arizona..........*21. M. MacDougalii*

LL. Nutlets without the margins elevated and without a tumid ring; plants not of Arizona.

M. Tube of the mature corolla only slightly longer than the limb; plants mostly south of the 42nd parallel and in the mountains, or if north of it to be found at high elevations in the mountains of Montana and Wyoming. (If corollas immature see also MM.)

N. Leaves pubescent only above, or glabrous on both surfaces.

O. Leaves strigose above.

P. Plants usually erect; leaves not unilateral, usually quite glaucous.

Z. Pubescence of pedicels appressed..........*19. M. viridis*

ZZ. Pubescence of pedicels spreading. ....*19c. M. viridis* var. *cynoglossoides*

PP. Plants usually ascending; leaves usually unilateral, not glaucous................*19d. M. viridis* var. *parvifolia*

OO. Leaves glabrous on both surfaces.

R. Calyx mostly 4–5 mm. long; plants of southeastern Wyoming, adjacent Colorado, and Uinta Mountains, Utah.....................*19a. M. viridis* var. *dilatata*

RR. Calyx mostly 6–7 mm. long; plants of northern New Mexico..................*19b. M. viridis* var. *caelestina*

NN. Leaves pubescent on both surfaces.

S. Leaves usually unilateral, 1.5–3 cm. long; stems ascending; plants of north-central Colorado, probably also in Utah..........................*19e. M. viridis* var. *cana*

SS. Leaves not unilateral, usually larger than above; stems more erect; plants of the mountains of Colorado, adjacent Utah, and adjacent New Mexico.

T. Calyx usually densely pubescent on the back and margins; pubescence of the upper surface of the leaves appressed; plants usually drying sordid brown, the corollas drying purple. (Plants in the Uinta Mountains, Utah, are often much less pubescent than typical forms).........................*20. M. Bakeri*

TT. Calyx usually glabrous on the back; pubescence on both surfaces of leaves spreading; plants usually drying green and the corollas drying blue.......................................*20a. M. Bakeri* var. *Osterhoutii*

MM. Tube of mature corolla usually much longer than the limb; plants mostly north of the 42nd parallel, or if south of it then on the plains or low hills.

U. Roots shallow-seated, tuberous; leaves usually obtuse and not more than three times longer than broad, glabrous to densely strigose........................*24. M. longiflora*

UU. Roots not as above; leaves usually acute and more than three times longer than broad, except in *M. oreophila* obtuse and usually less than three times longer than broad.

V. Leaves pubescent, at least on one surface.

W. Leaves pubescent above, glabrous below...*22. M. oblongifolia*

WW. Leaves pubescent on both surfaces....................................*22b. M. oblongifolia* var. *amoena*

VV. Leaves glabrous on both surfaces.

a. Leaves commonly more than three times longer than broad, acute, usually thin; plants of the plains or low foothills, widespread..*22a. M. oblongifolia* var. *nevadensis*

aa. Leaves usually less than three times longer than broad, obtuse, subcoriaceous; plants of the Big Horn Mountains, Wyoming........................*23. M. oreophila*

1. **Mertensia maritima** (L.) S. F. Gray, Nat. Arr. Brit. Pl. **2**: 354. 1821.

M. parviflora G. Don, Gen. Hist. Dich. Pl. **4**: 320. 1838.

M. maritima forma *albiflora* Fernald in Rhodora **23**: 288. 1922.

Pulmonaria maritima L., Sp. Pl. 136. 1753, and ed. 2, 195. 1762.

P. parviflora Michx., Fl. Bor.-Am. **1**: 131. 1803.

Pneumaria maritima Hill, Veg. Syst. **7**: 40, *pl. 37, f. 3.* 1764, and new ed. 1824.

Lithospermum maritimum Lehm., Asperif. pars 2: 291. 1818.

? *L. pumilum* Lehm., *l.c.* 319.[1]

Casselia maritima Dumort., Com. Bot. 25. 1822.

C. parviflora Dumort., *l.c.*

Steenhammera maritima Reichb., Fl. Germ. Excurs. 337. 1831.

[1] *L. pumilum* Lehm.—A photograph, in U. S. Nat. Herb. and in the Gray Herb., purporting to be one of a fragment of the type of this species contained in the herbarium at Berlin, taken by E. P. Killip in 1925, is doubtless *M. maritima*. However, Lehmann's description does not fit this species. It is probable that he had some other species at hand, or more probable some genus other than *Mertensia*. Lehmann no doubt knew *M. maritima* rather well, and the possibility that he would redescribe it is not very great.

Hippoglossum maritimum Hartm., Handb. Scand. Fl. (ed. 2. 1832 ?), ed. 4. 66. 1843.

Cerinthodes maritimum O. Kuntze, Rev. Gen. Pl. pt. 2: 436. 1891.

Spreading or decumbent, the stem 0.5–10 dm. long; leaves more or less fleshy, ovate, spatulate or ovate-obtuse to acuminate, 2–10 cm. long including the petiole, 0.3–5 cm. broad, sparingly to densely papillose above, glaucous or eglaucous; pedicels 2–30 mm. long; calyx 2–6 mm. long, 1–4 mm. broad at the base, becoming enlarged in fruit, the lobes oblong to triangular, acute; corolla-tube short, 2–5 mm. long, scarcely exceeding the calyx-lobes; corolla-limb 1.5–4 mm. long, slightly broader

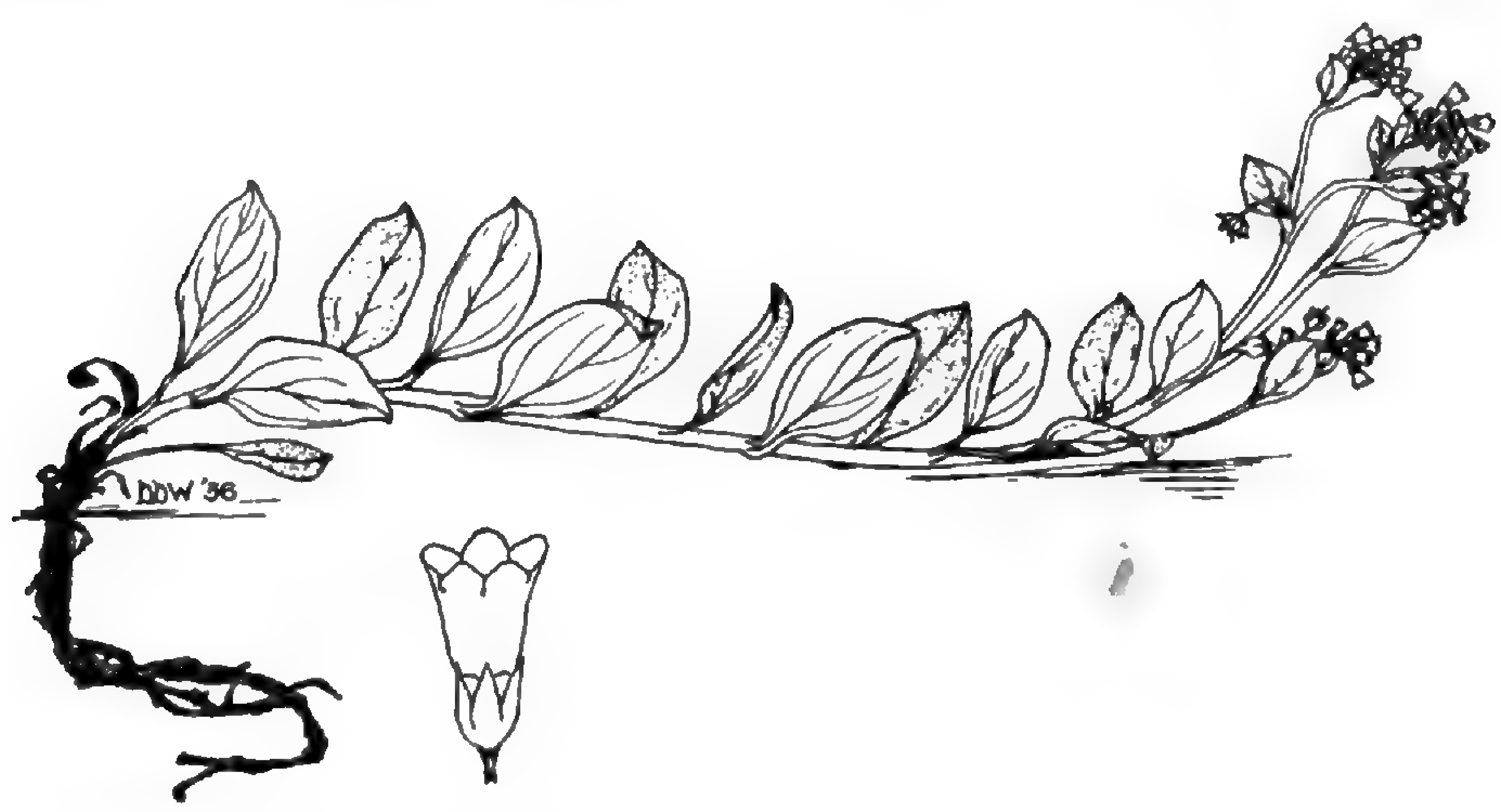

Fig. 1. *M. maritima.* Habit sketch × ⅓; enlarged flower × 1⅔.

than the tube; filaments inserted on the tube and exceeding the fornices, longer and narrower than the stamens; style 2–5 mm. long, shorter than the corolla-tube, slightly exceeding the nutlets in fruit; stamens 0.75–1 mm. long, about 0.25 mm. broad; fornices small or nearly absent; nutlets smooth, carinose, acute at the apex, raphe small, orbicular, near base of nutlet.

Distribution: Massachusetts to Alaska and adjacent islands, possibly south to Vancouver Island, along the sea-shore and in salt marshes; Greenland, Baffin Island, Disco Island; Eurasia.

Greenland: Godhavn, 1870, *Andersson* (G); Disco Island, 1891, *Burk 48* (M, US); Disco Island, Aug. 2, 1896, *Cornell Party* (Cl, US, M); delta at mouth of gorge near Igloos, Sonntag Bay, region of Etah, Aug. 24–29, 1914, *Ekblaw 616* (M, US, G, CAS); Pingoarsuk, July 3, 1888, *Hansen* (M); sandy beach, Godhavn, July

16, 1925, *Koelz 60* (US); Disco Island, 1877–8, *Krumlein* (G); Saduarak, July 8, 1883, *Lylow* (G); Disco and Gothaab, July 14, 1892, *Meehan 53* (G, US); Godhavn, Disco, Sept. 10–20, 1922, *Porsild* (G); Disco, 1924, *Porsild 417* (US, G, M); Disco, Kutolisat, Aug. 7, 1902, *Porsild* (US, G); Disco, 1918, *Porsild* (G); Ingnerit Fjord, Nordsiden, Disco, July 9, 1934, *Porsild* (UCal, M); Godhavn, Disco, Aug. 1, 1898, *Simmons 92* (G); Disco, *Vahl* (G); not very abundant, Cape York, northwest Greenland, July 23, 1894, *Wetherill 59* (G).

FRANKLIN DISTRICT: north side of White Island, Frozen Straits, Aug. 9, 1933, *Angel 33* (US); sandy shores, Cape Prince of Wales, Hudson Strait, Aug. 21, 1884, *Bell* (US); Hudson Strait, 1885, *Bell* (G); Bernard Harbour, Aug. 1915, *Johansen 370* (G); sandy sea-shore, Pangnirtung, Cumberland Gulf, Baffin Island, Aug. 21–22, 1927, *Malte* (G); Lake Harbour, Baffin Island, Aug. 25–26, 1927, *Malte* (G); in sand on sea-shore, Cape Dorset, Baffin Island, Aug. 4, 1928, *Malte* (G); Bowdoin Harbor, Baffin Land, June 10, 1922, *Robinson 16* (G); Signuia near Cape Haven, Aug. 1–2, 1897, *White & Schuchert 100* (US).

LABRADOR: northern Labrador, coll. of 1873, *Anspach* (M); Sumavik, July 18, 1925, *Bartlett 13* (US); sea beach, Percoliak Island, Nain Bay, Aug. 3, 1928, *Bishop 522* (G); Red Bay, July 12, 1891, *Bowdoin College 43* (G); Chateau Bay, July 14, 1891, *Bowdoin College 73* (G); Webeck Harbor, Aug. 4, 1891, *Bowdoin College 210* (G); Battle Island, July 24, 1913, *Ekblaw* (G); Winter Harbour, 20 miles north of Hopedale, July 19–24, 1933, *Gardner 129* (G); Nain, July, 1927, *Sewall 161* (US, G); Anatolak, June, July, Aug., 1928, *Sewall 356* (G, US, CAS, M); sandy beach, Hopedale, Aug. 4–6, 1897, *Sornborger 51* (US, M, Ry, G); Rama, July–Aug., 1899, *Stecker 330* (US, G, Ry, M); sea beach, east of Wodeise, Aug. 12, 1894, *Waghorne* (M, US); on granitic rock, north shore of Duck Bight, 1 km. north of Ryan's Bay, Aug. 24, 1926, *Woodworth 358* (G); on granitic rock, at head of main arm of Ekortiarsuk Bay, Aug. 20, 1926, *Woodworth 359* (G).

NEWFOUNDLAND: Funk Island off the east coast of Newfoundland, July 2–12, 1906, *Bryant* (G); Ward's Harbor, Notre Dame Bay, Sept. 1, 1906, *Bryant* (G); upper border of limestone shore, Flower Cove, Straits of Belle Isle, Aug. 2, 1924, *Fernald, Long & Dunbar 26994* (G); upper border of gravelly strand, Woody Island, Bay of Islands, Sept. 3, 1926, *Fernald, Long & Fogg 387* (G); cobbly barrier-beach, Great Barachois (or Barasway Bay), District of Burgeo and La Poile, Sept. 11, 1926, *Fernald, Long & Fogg 388* (G); conglomerate limestone and calcareous sandstone cliffs and ledges, Cow Head, Silurian Coastal Region north of St. Paul's Bay, July 23, 1910, *Fernald & Wiegand 3923* (Cl, G); gravelly strand of Ingornachoix Bay, Aug. 2, 1910, *Fernald & Wiegand 3924* (G); pebbly beach, Little Bell Island, near Topsail, Conception Bay, Aug. 12–19, 1901, *Howe & Lang 1257* (G); Funk Island, July 23, 1887, *Palmer* (US); among the rocks by the seashore, Flowers' Cove, July 12, 1920, *Priest* (G); Barred Islands, Aug. 12–13, 1903, *Sornborger* (G, US).

NOVA SCOTIA: sandy beach, Signey Mines, Cape Breton Co., Aug. 28, 1920, *Bissell & Linder 22345* (G); rocky barrier beach, Markland (Cape Forchu), Yarmouth Co., July 13, 1921, *Fernald, Bartram, Long & Fassett 24411* (G); gravelly beach of Great Bras d'Or, Kidstone Island, Victoria Co., Aug. 28, 1920, *Fernald & Long 22347* (G); abundant and uniform on crest of barrier, East Jordan, Shelburne Co., Aug. 4, 1921, *Fernald & Long 24412* (G); gravelly beach of Bras d'Or Lake, Grand Narrows, Cape Breton Co., July 20, 1914, *Fernald & St. John 11165* (G); Canso, Aug. 5, 1901, *Fowler* (US); pebbly upper beach, Yarmouth, June

22–29, 1901, *Howe & Lang 23* (G, Ry); near mouth of the Barrasois River, Cape Breton Island, July–Aug., 1915, *Nichols 1254* (G); sand-beach beyond West Landing, St. Paul Island, Aug. 8, 1929, *Perry & Roscoe 332* (US, G); Cape Anns Bay, Cape Breton, Aug. 26, 1928, *von Schrenk* (M).

New Brunswick: sandy shore of Nepisiguit Bay, Bathurst, Gloucester Co., Aug. 13, 1913, *Blake 5394* (G, Cl, US); Point Lepreaux, Sept. 1885, *Brewster* (G); Cranberry Road, Mt. Desert, Sept., 1905, *Crocker* (G); salt marsh, Salisbury Bay, Harvey, Albert Co., Aug. 22, 1924, *Fassett 2262* (G); salt marsh, Quaco, St. John Co., Aug. 21, 1924, *Fassett 2263* (G); Bathurst, July 23, 1873, *Fowler* (M); Eel River, Aug. 3, 1873, *Fowler* (M); Eel River, Restigouche, Aug. 4, 1873, *Fowler* (M); St. Andrew's, July 28, 1900, *Fowler* (G); Campobello Island, July 17–Aug. 20, 1888, *Smith* (US, UCal); The Wolves near Campobello Island, Sept. 1898, *Sturgis* (US, G); top of beach, Castalia, Grand Menan, Charlotte Co., Aug. 7, 1926, *Weatherby & Weatherby 5533* (Cl, G, US); sand dunes, Bathurst, Gloucester Co., July 24, 1902, *Williams & Fernald* (G).

Quebec: Middle Island, St. Mary's Island, Aug. 5, 1929, *Abbe 1247* (G); east coast of Hudson's Bay, coll. of 1879, *Bell 133* (G); on moist beach, north shore, Matamek River District, Aug. 3, 1927, *Bowman 288* (G); gravelly beach, Carleton Point, Carleton, Bonaventure Co., July 21, 1904, *Collins & Fernald* (G); gravelly beach, Tracadigash Point, Carleton, Bonaventure Co., July 25, 1904, *Collins & Pease 4474, 4475* (G); dry gravelly beach near the Lobster Hatchery, Grindstone, Grindstone Island, Magdalen Islands, July 22, 1912, *Fernald, Bartram, Long & St. John 7958* (G); sand beach near the wharf, Seven Islands, Saguenay Co., Sept. 9, 1925, *Fernald & Long 28954* (G); beach at base of dry talus of slaty cliffs, northern face of Mt. St. Pierre, at mouth of Rivière à Pierre, Gaspé Co., Aug. 14, 1923, *Fernald & Smith 25992* (G); shore of the St. Lawrence, Rivière Blanche, Gaspé Co., Aug. 3–8, 1904, *Forbes* (G, Ry); Little Metis, July 12, 1906, *Fowler* (G); Anticosti, 1861, *Hyatt, Shaler & Verrill* (G); Entry Islands, Magdalen Islands, Aug. 16, 1917, *Johansen* (G); Tadoussac, Saguenay, Aug. 5, 1892, *Kennedy* (G, Cl); gravelly seashore, Wakeham Bay, Hudson Strait, July 24, 1933, *Malte 157* (G); sandy seashore, Wolstenholme, Hudson Strait, Aug. 26, 1928, *Malte 1110* (G); St. Lawrence R., Rivière du Loup, July 10, 1903, *Pease 2482* (G); sandy beaches of the St. Lawrence, Temiscouata, Aug. 7, 1879, *Pringle* (Ry, M, US); Seven Islands, Aug. 4, 1907, *Robinson 730* (G); rocky beach, Point au Maurier, Charnay, Saguenay Co., Aug. 23, 1915, *St. John 90690* (G); Mingan, Saguenay Co., June 1909, *Townsend* (G); Rivages de Cacouna, juillet, 1913, *Victorin 7* (G); Isle-aux-Coudres, juin, 1917, *Victorin 4203* (US, G); sur les rivages calcaires, Ile à Bouleau, Archipel de Mingan, du Golfe Saint-Laurent, 4 aout, 1924, *Victorin & Germain 18 443* (G); sur les dunes à l'est du village, Pointe-aux-Esquimaux, du Golfe Saint-Laurent, 14 juillet, 1924, *Victorin & Germain 18 444* (G); sur les rivages calcaires, une colonie etendue, Ile Niapisca, Archipel de Mingan, du Golfe Saint-Laurent, 30 juillet, 1924, *Victorin & Germain 18 610* (NY, G); sur les sables du littoral, la Peninsule, Baie de Gaspé, 17 juillet, 1923, *Victorin, Germain, Brunel, & Rousseau 17 315* (G); Double Mer, south shore, about 10 miles above the mouth, Hamilton Inlet, Aug. 17, 1921, *Wetmore 103040* (G); gravelly sea-beach, Metis to Matane, Matane Co., Aug. 27, 1924, *Wiegand & Wiegand 287* (Cl).

Ontario: sandy beach, bay west of Point Comfort, July 21, 1929, *Potter 695* (G).

Maine: beach, York, July 23, 1863, *Blake* (M); Machias, Aug. 20, 1888, *Chick-*

ering (US); York Beach, York, Sept. 5, 1887, *Deane* (US, G); sea wall, Mt. Desert, July 9, 1896, *Faxon* (G); Great Cranberry Island, July 10, 1894, *Faxon & Faxon* (G); Wells Beach, 1879, *Furbish* (G); Bay of Fundy, Sept. 1885, *Gilbert* (UCal); on border of sandy grassland, coast of Maine, Aug., 1896, *Harvey & Harvey* (US); Cutler, Washington Co., July 3, 1902, *Kennedy, Williams, Collins & Fernald* (G); sea-beach in gravel, Roque Bluff, Washington Co., July 12, 1908, *Knowlton* (UCal); along shore, Prospect Harbor, July 8, 1898, *Larabee 687* (US); Matinicus Island, Nov. 2, 1915, *McAtee* (US); growing amid rocks on coast, Pemaquid Point, Lincoln Co., Aug. 1930, *McMullen* (Cl); Owl's Head, Aug. 20, 1902, *Moore 330* (UCal); near Southwest Harbor, Mount Desert, Hannock Co., July 2, 1928, *Perkins* (Cl); beaches, Seal Harbor, Mt. Desert Island, July 21, 1882, *Redfield* (M); Grand Menan, *Rothrock* (Cl); on gravelly shore, near Owl's Head, Knox Co., July 8, 1930, *Steyermark 994* (M); Vinal Haven, Aug. 1, 1891, *Watson* (G); Little Cranberry Island, July 24, 1899, *Williams 1* (G).

New Hampshire: Gilmanton, 1867, *Blake* (US); Isles of Shoals, Aug., 1864, *Canby* (US); Isles of Shoals, Aug., 1866, *Canby* (Cl); Rye, July 1, 1888, *Davis* (UCal, M).

Massachusetts: sandy sea-shore, Surf Side, Nantucket, July 13, 1884, *Deane* (G); south shore inland, July 13, 1884, *Deane* (G); on beach near Horsebeach Pond, east coast, Wellfleet, Barnstable Co., Sept. 3, 1935, *Johnston* (G).

Keewatin District: Depot Island, northwest coast, Hudson Bay, Sept. 1893, *Comer* (Ry, G); Whale Point, northwest coast, Hudson Bay, July 1894, *Comer* (G); près de la Mission, Chesterfield, 13 aout, 1933, *Gardner 374* (G); Roes Welcome, Whale Point, N. W. Terr., Hudson Bay area, July 2, 1923, *Preuchier 670b* (US).

Mackenzie District: Cape Bathurst, July 26, 1916, *Johansen 513* (US).

Alaska: Ft. St. Michaels, Norton Sound, 1865–66, *Bannister* (US, Cl, G); Sitka, 1865–66, *Bischoff* (Cl, G); sandy soil, Gambell, St. Lawrence Island, July 2, 1902, *Campbell* (US); St. Lawrence Island, Aug. 2, 1902, *Campbell* (M, US); west of Martin Point, July 1914, *Canadian Arctic Expedition 146* (US); beach beyond Gold Creek, Juneau, July 31, 1891, *Cooley* (G, US); Glacier Bay, Aug. 23, 1921, *Cooper 97* (US); Egg Island, Disenchantment Bay, June 21–22, 1899, *Coville & Kearney 1056* (US); Kukak Bay, Alaska Peninsula, July 1–5, 1899, *Coville & Kearney 1683* (US); Sturgeon River, "Kadiak Island," July 19, 1899, *Coville & Kearney 2239* (US); beach, Skagway, July 29, 1907, *Cowles 851* (M, US); Amchitka, July 25, 1873, *Dall* (G); along beach, Skagway, July 21, 1914, *Eastwood 741* (CAS, G); Muir Glacier moraine, June 29, 1897, *Evans 160* (US); Homer, Cook's Inlet, July 11, 1897, *Evans 307, 308* (US); sandy places near beach, Kussiloff, July 1898; *Evans 700* (US); Unalaska, June 9–14, 1892, *Evermann 18* (US); "Kadiak Island," July 2–4, 1899, *Fernow* (Cl); west of the bay, 10 kilometers north of Point Manby, June 28, 1892, *Funston 50* (Cl, G, M, P, UCal, US); Nelson's Lagoon, June 28, 1900, *Golder 63* (US); Lake Iliamna region, 1902, *Gorman 102* (CAS, NY, G, US); on shingly sea-beach at Cottonwood Bay, Lake Iliamna region, Aug. 26, 1902, *Gorman 277* (US); on the strand, Homer, Cook Inlet, June 5, 1913, *Griggs* (US); Katmai Region, Kasuik Bay Strand, July 6, 1917, *Hagelbarger 112* (US); Tolstoi sand dunes, Pribilof Islands, St. Paul, Sept. 4, 1910, *Hahn 44* (US); North East Point near "Salt Horse," St. Paul, Pribilofs, July 6, 1925, *Haley* (UCal); Nome, June 23–27, 1926, *Haley* (CAS); St. Paul Island, 1919, *Haley & Haley* (CAS); St. Matthew Island, July 8–13, 1916, *Hanna* (NY, US); St. Paul

Island, Aug. 1–15, 1920, *Hanna* (CAS, Clokey); on beach, Goodnews Bay, July 10, 1919, *Harrington 36* (US); St. Michael, July 30, 1917, *Harrington 88* (US); Unalaska, 1871-72, *Harrington* (M, US); beach, Ungad, Shemagin, July 15, 1872, *Harrington* (G); Dalls Survey, 1873, *Harrington* (US); Nunivak Island, July 1927, *Harrold* (CAS); salt beach, Karluk Spit, June 1901, *Horne* (NY); Iluilink, Aleutian Islands, June 26, 1899, *Jepson 230* (G, US); west of Martin Point, July 1914, *Johansen 146* (G); vicinity of Unalakleet, Norton Sound, Aug. 1920, *Johnston & Palmer 15* (G, US); Kodiak, 1867, *Kellogg* (M); Kodiak, 1867, *Kellogg 270* (NY, US); "Russian America," coll. of 1866, *Ketchum* (NY); Yukon River Country, "Russian America," 1867, *Ketchum* (G); St. Paul Island, Behring Sea, July 19, 1897, *Macoun* (Cl); Pt. Barrow, July 11, 1898, *McIlhenny 96* (Ry); St. Paul Island, Pribilof Islands, Bering Sea, July 30, 1891, *Merriam* (US, NY); Unalasachka, *Mertens* (G); head of Kotzebue Sound, 1881, *Muir 60* (G); Pt. Barrow, Coglamie, arctic shore of Alaska, *Murdock* (M); Homer, Aug. 16, 1904, *Piper 4441* (US); vicinity of Karluk, "Kadiak Island," July, 1903, *Rutter 212* (CAS, US, M, G); Alaskan Peninsula, July 5, 1899, *Saunders 4809* (M); sandy shores, Popoff Island, Shumagin Islands, July 15, 1899, *Saunders 4810* (M); Pitchfork Falls above Skagway, July 14, 1930, *Setchell & Parks* (UCal); Salmon Creek, July 31, 1891, *Shumway* (G); beach, Bering Island, *Stejneger 48* (US); Coppermine Cove, Glacier Bay, July 19, 1907, *Stephens 1* (UCal); vicinity of Nome, July 31, 1919, *Thornton 411* (US); Akun Island, Aug. 31, 1893, *Townsend* (US); beach, Muir Glacier, Glacier Bay, June 9, 1899, *Trelease 4806* (M); Sturgeon River Bay, "Kadiak Island," July 19, 1899, *Trelease 4807, 4807a* (M); Kodiak, "Kadiak Island," July 20, 1899, *Trelease 4808* (M); in sand just back of sea beach, Dutch Harbor, Unalaska, June 29, 1907, *Van Dyke 69* (G); seashore, Nazan Bay, Atka, Aleutian Islands, July 26, 1907, *Van Dyke 243* (G); meadows at east end of Grantley Harbor, vicinity of Port Clarence, July 30, 1901, *Walpole 1602* (US); prostrate on gravel, often along road, Seward, Aug. 5, 1934, *Went 279* (UCal); near Tyoneck, 1907, *Woolsey 35* (US); Arakamtchetchene Island, Behring Straits, 1853-56, *Wright* (NY).

BRITISH COLUMBIA: Nutka, 1791, *Haenke e.2370* (P).

Mertensia maritima is the most unusual species of the North American members of the genus, by reason of the peculiar fruit. It has been maintained by some authors as distinct from *Mertensia* and given generic rank as *Pneumaria*. Dr. I. M. Johnston, prolific and careful student of the borages, was of the opinion (Contr. Gray Herb. N.S. No. 73: 67. 1924) that its recognition as a genus would set generic values too low. The author has found no reason to recognize it as a separate genus and believes that it should be considered to be a *Mertensia*. Although the species is often subject to reduction in size, proceeding from south to north in its range, it presents little difficulty taxonomically when compared to other species of the genus.

2. Mertensia bella Piper in Proc. Biol. Soc. Wash. **31:** 76. 1918.

M. siskiyouensis Applegate in Contr. Dudley Herb. **1:** 154. 1930.

Roots cormose, 2 cm. or less in diameter, bearing many small fibrous roots; stems erect, 1–4 dm. tall, pubescent above, glabrous below; basal leaves reduced to scarious, sheathing phyllodes; lowest stem-leaves broadly ovate or slightly subcordate, 1–5 cm. long, 0.5–3 cm. broad, on narrowly winged petioles about as long as the blade; middle cauline leaves largest, ovate, obtuse or acute, glabrous below or nearly so, strigillose above, 3–7 cm. long, 1.5–5 cm. broad, distinctly 3–6 parallel-veined, petiole shorter than the blade; upper leaves ovate-lanceolate to lanceolate, the uppermost leaves smallest, occasionally bract-like, 1–5 cm. long, 0.5–3 cm. broad, often strigillose below as well as above, sessile or nearly so, opposite; pedicels 0.3–1 cm. long, slender, strigillose; inflorescence borne on long stipes from the axil of the leaves which they surpass, at least at maturity, flowers laxly to densely scorpioid or apparently umbellate; corolla blue, campanulate, 5–10 mm. long, not divided into tube and limb, the lobes about 2 mm. long, obtuse, fornices reduced to a slight thickening in the corolla tissue just above and alternate with the point of insertion of the filaments; anthers 1.2 mm. long, oval; filaments very slender, not expanded, free portion about 1.5 mm. long, inserted about 1 mm. above the base of the corolla; style 4–5 mm. long, reaching or exceeding the anthers; calyx-lobes 1.5–3 mm. long, linear-lanceolate, acute or obtuse, densely strigillose on both sides; nutlets about 1.5 mm. long, slightly rugose-rough-

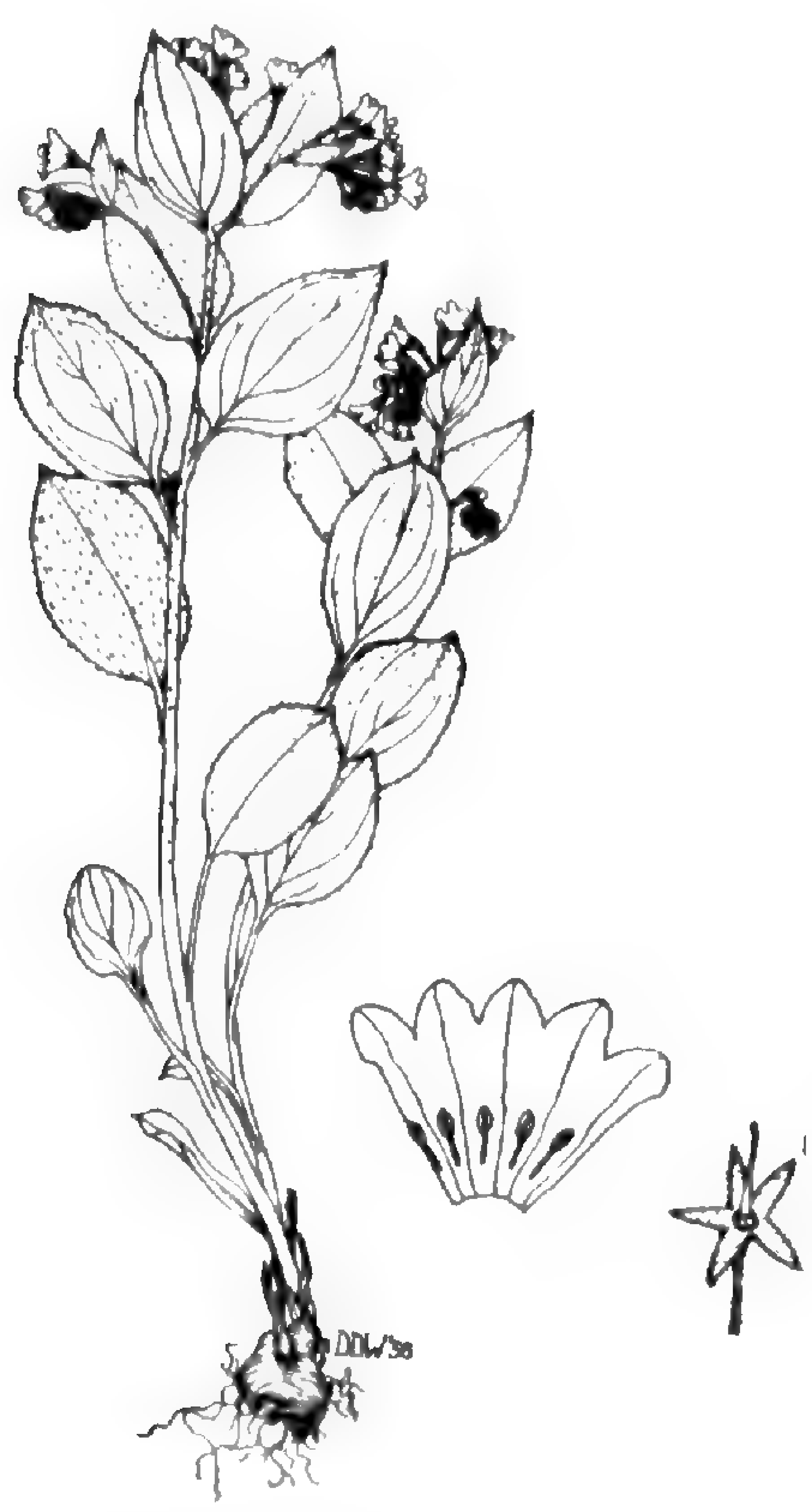

Fig. 2. *M. bella.* Habit sketch × ⅓; enlarged flower × 1⅔.

ened dorsally, scar small, about 0.25 mm. long, near base; intrusion of gynobase high.

Distribution: west-central and southwestern Oregon.

OREGON: Horse Pasture Trail, Horse Pasture Mountain, Lane Co., June 11, 1934, *Andrews 339* (Ore); easterly slope of Grayback Mountain, Siskiyou Mountains, Applegate River watershed, Josephine Co., June 13, 1927, *Applegate 5061* (Dudley Herb. TYPE *M. siskiyouensis*, G); north slope of Grayback Mountain, headwaters of Grayback Creek, Siskiyou Mountains, alt. about 6500 ft., Josephine Co., July 17, 1933, *Applegate 8751* (UCal, F, G); north slope of Mt. Grayback, headwaters of Grayback Creek, alt. about 6500 ft., Josephine Co., July 17, 1933, *Applegate 8767* (Willm, F, G); wet margins of streams in coniferous forests, Oregon Caves National Monument, Josephine Co., June 20, 1935, *Applegate 9696* (W); near Oregon Caves, Josephine Co., May 28, 1928, *Leach* (Willm); along a ravine in open Douglas fir woods on Lake Mountain about 1.5 miles above Oregon Caves, Josephine Co., May 28, 1923, *Leach & Leach 1507* (G); Horse Pasture Mountain, 10 miles southwest of McKenzie Bridge, Lane Co., July 2, 1914, *Peck 5811* (P TYPE); moist slopes 1 mile south of Oregon Caves, July 15, 1918, *Peck 8253* (Willm, G); damp thickets along Cave Lake, 4 miles southeast of Oregon Caves, July 16, 1918, *Peck 8343* (Willm); moist slope, Whiskey Peak, Jackson Co., June 18, 1931, *Peck 16462* (Willm); alpine meadows above Oregon Caves, Siskiyou Mountains, alt. 5000 ft., Josephine Co., July 31, 1935, *Thompson 12441* (G, CAS).

A most striking species which in aspect is much like *Trigonotis*. The characters of the corolla resemble those of *M. maritima* more than any of the true Mertensias. The cormose root, which has its nearest approach in *M. longiflora,* and the opposite upper leaves, as well as the type of inflorescence, are distinctive.

3. **Mertensia Eastwoodiae** Macbr. in Contr. Gray Herb. N.S. No. 49: 18. 1917.

M. alaskana Eastw. in Bot. Gaz. **33**: 287. 1902, non Britt., 1901.

Stems erect, 2–6 dm. tall, one to several from each fleshy root; basal leaves not seen; cauline leaves lanceolate to elliptic, 2–10 cm. long, 1–3 cm. broad, acuminate, usually sessile or the lowermost short-petiolate, both sides strigose, the hairs pointing toward the apex of the leaf, rarely the upper surface almost glabrous, the conspicuous lateral veins tending to converge at the apex of the leaf; pedicels 2–10 mm. long, strigose; inflorescence an ebracteate, modified scorpioid cyme, elongating with age; corolla blue, the tube 5–6 mm. long, usually sparsely pubescent within, the moderately expanded limb 6–7 mm. long (rarely up to 10 mm.); fornices conspicuous, glabrous; anthers 2–2.5 mm. long; filaments about as long as the anthers or slightly shorter; style usually slightly shorter than the corolla or exceeding it; calyx 2–6 mm. long (mostly about 4–5 mm.), the lobes 0.5–1 mm. shorter than the entire calyx, lanceolate to linear-lanceolate, acute, glabrous on the back, ciliate on the margins; nutlets 3–5 mm. long, weakly spinose-rugose on the backs and to a less extent on the sides.

Distribution: Alaska.

ALASKA: Nome, marshy tundra, July 11, 1927, *Ames 41* (F); Nome, 1900, *Blaisdell 94(139)* (UCal); Cape Nome, summer of 1900, *Blaisdell* (CAS TYPE, M, NY, US); without locality, *Bryant* (UCal); Seward Peninsula, near coast on west side of Golofin's Bay, July 1, 1900, *Collier* (US); in shade of alder, grassy places 5 miles north of Nome City, July 8, 1900, *Flett 1536* (US); Lake Iliamna region, on sandy shore at foot of Lake Clark, July 22, 1902, *Gorman 170* (US); foot of hillsides, Nome, June 10, 1914, *Hill 10* (P, US); on Anvil Ridge, Nome, June 23, 1929, *Miller 114-c* (US); Kokrinus, 1925, *Palmer 1599* (US); Nome, coll. of 1916, *Thornton 27* (US); Copper Gulch, Nome, July 17, 1917, *Thornton 136* (US); without locality, coll. of 1901, *Walpole 1614, 1954* (US).

Mertensia Eastwoodiae is more closely related to *M. rivularis* (Turcz.) A. DC., apparently so common on the other side of the Behring Sea, than it is to *M. paniculata*. *Mertensia rivularis* has a smaller flower with a comparatively more expanded limb. The anthers are smaller than in our species. The fruit of *M. rivularis* shows the same markings as our species. The type of pubescence on the leaves is the same and the lateral veins are similar.

There is a possibility that *Lithospermum denticulatum* Lehm. may apply to the plant here called *M. Eastwoodiae* but the exact application of that name remains in doubt. The type could not be located.

4. **Mertensia paniculata** (Ait.) G. Don, Gen. Hist. **4**: 318. 1838.

M. membranacea Rydb. in Bull. Torr. Bot. Club **28**: 33. 1901.

M. paniculata var. *longisepala* Macbr. in Contr. Gray Herb. N.S. No. 48: 6. 1916.

M. Palmeri Nels. & Macbr.[1] in Bot. Gaz. **62**: 146. 1916.

Pulmonaria paniculata Ait.,[2] Hort. Kew. **1**: 181. 1789, including α *floribus caeruleis,* and β *floribus albis.*

Pulmonaria elegans Hort. ex Roem. & Schult., Syst. **4**: 745. 1819.

Lithospermum paniculatum Lehm., Asperif. pars 2: 289. 1818.

Casselia paniculata Dumort., Com. Bot. 22. 1822.

Platynema paniculata Schrad., Ind. Sem. Hort. Götting. 1835, fide Index Kewensis; cf. Linnaea **11**: 89. 1837.

Cerinthodes paniculatum O. Kuntze, Rev. Gen. Pl. pt. 2: 436. 1891.

Stems erect, 1–7.5 dm. tall, one to several from each root; basal leaves 5–20 cm. long, 2.5–14 cm. broad, elliptic-lanceolate to ovate-subcordate, acute to acuminate, the upper surface scabrous with short appressed hairs, the lower surface with rough spreading hairs, the petiole 10–25 cm. long; cauline leaves 5–18 cm. long, 1–8 cm. broad, ovate-acuminate to lanceolate-acuminate, short-petiolate or sessile, pubescence as of basal leaves, all leaves pinnately veined; inflorescence a modified scorpioid cyme, congested at first, elongating with age; peduncles 1–30 mm. long, strigose or with spreading hairs, usually reflexed in fruit; corolla blue, occasionally white, often pinkish when young, the tube shorter than the moderately to much-expanded limb; corolla-tube 4.5–7 mm. long (mostly 5–6 mm.), pubescent or glabrous within; corolla-limb 6–9 mm.

[1] This is supposed to have been collected in Arizona. It is identical with material of the species coming from British Columbia. It is no doubt a case of mislabel or transferred label, as this particular phase of the species is not known south of the international boundary. See footnote on page 62.

[2] The authority for this species should probably be Solander instead of Aiton. There is little doubt that the name is the work of Solander and not of Aiton, as pointed out by Britten, Jour. Bot. N.S. **11**: 108. 1882. However, Solander's name does not appear in connection with the work and, as indicated by Gray, Jour. Bot. N.S. **11**: 173–174. 1882, "there seems no proper ground for recognizing this in citations."

There is a specimen in the Gray Herbarium, derived from the British Museum of Natural History and collected by Thomas Hutchins in 1773 at Hudson's Bay, which bears the annotation "Pulmonaria paniculata, Sol. Msc." This specimen is here designated as typical.

long (mostly about 7 mm.); fornices conspicuous, glabrous or very rarely with a few hairs; anthers 2.2–3.3 mm. long (mostly about 3 mm.), usually the base higher than the fornices; filaments 1.5–3 mm. long (mostly 2–3 mm.); style about as long as or slightly exceeding the corolla, exceeding the anthers; calyx 2–7 mm. long (mostly about 4 mm.), hairy or glabrous, the lobes about 1 mm. shorter than the entire calyx, strigose with spreading hairs on the back, or glabrous, ciliate, narrowly lanceolate to triangular, acute; nutlets rugose on all sides as well as minutely papillate, falling as soon as mature or possibly just before maturity.

Fig. 3. *M. paniculata.* Habit sketch × 1/6; enlarged flower × 1⅔.

Distribution: eastern Quebec, Ontario, Michigan, Wisconsin, Minnesota, and Iowa, thence across Canada to British Columbia and north through Alaska. Montana, Idaho, and Washington.

Quebec: clay river bank, Rupert House, east coast James Bay, July 8, 1929, *Potter 686* (G); soggy woods, East Main, east coast James Bay, July 11, 1929, *Potter 689* (G); gravel beach, Brushy Island, east coast James Bay, July 12, 1929, *Potter 694* (G); Amos (Abitibi), July 10, 1918, *Victorin 8376* (NY, G, US, M).

Ontario: rich soil, north shore of Lake Superior, June, 1890, *Aiton* (F); Moose River Basin, coll. of 1903, *Bell* (G); Hudson's Bay, *Burke* (G, NY); Hudson's Bay, coll. of 1773, *Hutchins* (G designated as TYPE); L. Superior, coll. of 1869, *Macoun 73* (US); Nipigon, north shore of Lake Superior, Sept. 12, 1896, *Miller* (G); in thin mold on mossy rock, Township of Deloro, Porcupine Mining District, June–July, 1911, *Nichols 8, 14, 26, 62* (F); bank by Algoma Central R. R., Tatnall Station, near Oba Lake, June 23, 1921, *Pease 17944* (G); clearing, Hearst, June 23, 1921, *Pease 18032* (G); damp grassy or shaded places, Jack Fish, Thunder Bay District, July 5, 1933, *Pease & Bean 23472* (G); clay river bank, Saw Pit Island, Moose River, James Bay, July 1, 1929, *Potter 680* (G); wooded bank along Blacksmith Rapids, Abitibi River, James Bay, June 29, 1929, *Potter 687* (G); Gravel Island, near mouth of Nipigon River, coll. of 1912, *Pulling* (G); clay soil, Onoman River, Thunder Bay Dist., coll. of 1912, *Pulling* (G); Howard Fall, near L. Nipigon, coll. of 1912, *Pulling* (G); banks of Kaministikwa River, Fort William, July 25, 1912, *Williamson 1788* (ANS); north shore of Lake Superior, July, 1897, *Van Brunt & Van Brunt 170* (NY).

MICHIGAN: near Houghton, June 12, 1883, *Britton* (ANS); Phoenix and Lac LaBelle, Keweenaw Co., July 8, 1888, *Farwell 282* (G); Phoenix, June 1885, *Farwell 2111* (ANS); brook side in woods south of L'Anse, Baraga Co., July 3, 1934, *Fernald & Pease 3493* (G); open woods, June, 1884, *Wood* (US, AM); 1885, *Wood* (Ariz).

WISCONSIN: Siskiwit Bay, June 26, 1897, *Cheney 6516* (G); moist grounds at the Central Mine, L. S., coll. of 1863, *Robbins 146* (G); Solon Springs, June 30, 1915, *Stone* (ANS); south shore Lake Superior, coll. of 1849, *Whitney* (G).

MINNESOTA: moist soil, Two Harbors, June, 1896, *Aiton* (NY); Duluth, July 4, 1935, *Baehni 668* (F); Duluth and vicinity, June 10–12, 1911, *Rydberg 8310* (NY); rich soil, Two Harbors, June 1890, *Sandberg* (F, G, US, M, ANS, Ariz, NY); moist places, Two Harbors, June 1891, *Sandberg* (NY, Ry, N); Two Harbors, May 1891, *Sandberg 104* (P, N); Two Harbors, Lake Co., June 1893, *Sheldon* (Ry, G, US, P); July, 1889, *Wood* (US); Fond du Lac, June 1891, *Wood* (Ariz, Cl, US, K, Ry).

IOWA: Decorah, June 1882, *Holway* (NY, US); Decorah, June 10, 1882, *Holway* (F); Decorah, June 13, 1887, *Holway* (F, M).

MANITOBA: Winnipeg Valley, coll. of 1859, *Bourgeau* (G); The Pas, route of Hudson Bay Railway, July 1, 1917, *Emerton* (G); Kettle Rapids, route of Hudson Bay Railway, July 15, 1917, *Emerton* (G); low woods, Observation Pt., Lake Winnipeg, July 22, 1884, *Macoun* (ANS).

MACKENZIE DISTRICT: Mackenzie River, coll. of 1861–62, *Onion, Kennicott & Hardesty* (NY); Hay River, June 30, 1903, *Preble & Cary 24* (US).

SASKATCHEWAN: coll. of 1858, *Bourgeau* (G); near Prince Albert, July 1896, *Macoun 14132* (F).

ALBERTA: wet woods near Bow River, *Barber 198* (G); Clive, coll. of 1918, *Bickle* (CAS); small draw in brush clearing, Red Deer River, Content, Stettler District, June 20, 1926, *Brinkman 2214* (US); low spot in forest, Highwood River Forest Stn., Highwood River District, June 6, 1928, *Brinkman 3139* (Cl, NY); Choba Lake, headwaters of the Saskatchewan and Athabasca Rivers, July 8, 1908, *Brown 1174* (ANS); Red Deer, Alta, 1910, *George 863* (P); Sarceo Reserve, June 15–Aug. 15, 1905, *Goddard 448* (UCal); Athabasca Landing, July 28, 1914, *Hitchcock 12075, 12097* (US); Prairie Creek, July 3, 1911, *Hollister 69* (US); near Banff, July 14, 1891, *Macoun* (G); moist ground, wooded hills and thickets, Shaganappi, vicinity of Calgary, alt. 3400–3600 ft., June 21, 1913, *Moodie 4* (NY, US, F); coal woods, Elbow River Valley, vicinity of Calgary, alt. 3400–3600 ft., July 7, 1915, *Moodie 1053* (G, US, NY, Clokey, F); in woody swamp near Athabasca River, June 23, 1927, *Ostheimer 10B* (G); foothill of Banff, July, 1893, *Schaffer* (ANS); on the Miette, headwaters of the Saskatchewan and Athabasca Rivers, Aug. 12, 1908, *Schaffer 1568* (ANS).

MONTANA: moist stream bank, Fish Creek near mouth of Cache Creek, Mineral Co., alt. 3500 ft., July 11, 1933, *Hitchcock 1761* (UM, CAS, G); creek bottoms, woods, Lolo Valley, alt. 3600 ft., July 16, 1921, *Kirkwood 1258* (G, M, UM); Lolo Creek Canyon, Aug. 19, 1880, *Watson 290* (G).

"ARIZONA": coll. of 1869, *Palmer 2* (US, TYPE of *M. Palmeri*).

IDAHO: Boulder Creek, Shoshone Co., July, 1900, *Abrams 804* (NY); Boville, June 17, 1911, *Beattie 4104* (P); Collins, June 17, 1911, *Beattie 4131* (P); near Lake Chatcolet, June 23, 1929, *Colvin* (UIdaho); along streams on shaded banks, Cedar Mountains, May 1897, *Elmer 793* (P, M, NY, US, Ry); Cedar Mountain, near Moscow, Latah Co., June 17, 1892, *Heller 420* (ANS); moist, sunny brook sides, Mt. Moscow, July 7, 1894, *Henderson 2813* (G, Cl, US); moist woods, along Alder Creek, Benewah Co., June 19, 1927, *Jones 727* (ANS, P); Moscow Mountain, Latah Co., May 22, 1926, *Jones 1673* (G); Indian Grave Camp, Clearwater Forest, alt. 6000 ft., Aug. 26, 1924, *Kirkwood 2005* (Ry); Kootenai Co., July, 1886, *Leiberg* (F); forks of St. Mary's River, Shoshone Co., alt. 950 m., July 1, 1895, *Leiberg 1136* (UCal, US, F, M, Ry, G, NY); Moscow, May 18, 1906, *Lewis* (UIdaho); MacAbee's Ranch, Priest River Valley, alt. 600 m., July 23, 1900, *MacDougal 3* (NY TYPE *M. membranacea*, P photo, G photo); Cedar Mountains, Latah Co., June 17, 1892, *MacDougal 428* (F); moist shady woods along Paradise Creek, Thatuna Hills, May 31, 1913, *Muenscher 352* (Cl); moist woodland, Grizzly Camp, on Palouse River, Latah Co., July 2, 1922, *Parker 493* (P); dense woodland, north side Cedar Mountains, Latah Co., July 4, 1922, *Parker 683* (P); Cedar Mountains, Latah Co., July 7, 1893, *Piper 1691* (P); grassy and brushy river flat, one-fourth mile north of Clarkia railroad station, St. Maries River, St. Joe National Forest, July 19, 1933, *Quick 1157* (UCal); along shady banks of streams, Hayden Creek, Coeur d' Alene, Aug. 1, 1912, *Rust 155* (US); moist places, Kootenai Co., May, 1862, *Sandberg* (P); along streams, Kootenai Co., June, 1892, *Sandberg* (UCal); moist places, Latah Co., June 1892, *Sandberg* (P, NY); moist places, Cedar Mountain, Latah Co., alt. 1050 m., June 17, 1892, *Sandberg, MacDougal & Heller 420* (G, US, NY, CAS); on wet shady creek bank near Zaza in the Craig Mountains, Nez Perce Co., alt. 4800 ft., Oct. 9, 1927, *St. John 9087* (P); Cedar Mountain, June–July, 1914, *Weaver* (N); deep moist woods, Sanders, Benewah Co., June 22, 1927, *Weitman 337* (P).

ALASKA: Matanuska, July 4, 1931, *Anderson 797* (US); Fairbanks, July 10, 1922, *Anderson 1892a* (NY); Ft. St. Michaels, Norton Sound, coll. of 1865-66, *Bannister* (Cl, G, US, F); mouth of the Tananah River, coll. of 1881, *Bates* (ND TYPE of *M. strigosa*, UCal); along the Delta River, June, 1907, *Black 17, 36* (US); grassy hillside in gravelly soil, St. Michaels, June 25, 1902, *Brooks* (G); between Tyonok, on Cook Inlet, and Rampart City, Yukon River, June 1, 1902, *Brooks & Pringle* (US); Mission Premises, Anvik, June, July, and Aug. 16, 1905, *Chapman 6* (G); Anvik, near the Mission, July 8, 1924, *Chapman 69* (NY); along Ninklink River, Seward Peninsula, July, 1900, *Collier* (US); near Council City, July 24, 1902, *Coulter* (F); springy slopes, Bennet, July 30, 1907, *Cowles 985* (US, M, F); Kaminsichtuh River, May 30, 1867, *Dall* (F); Savage River, Mt. McKinley District, June 17, 1926, *Dickson* (UCal); McKinley Park Station, Mount McKinley National Park, June 4, 1932, *Dixon 11* (US, UCal); Igloo Creek, Mt. McKinley National Park, June 13, 1932, *Dixon 24* (US, CAS, UCal); White River Valley, near the boundary, coll. of 1909, *Eaton* (US); Chitina Valley, north of Mt. St. Elias, coll. of 1913, *Eaton* (US); Tyoonock, July 31, 1897, *Evans 476* (US); near old cannery on high ground, Kussiloff, July 1898, *Evans 737* (US); Johnson River, between Cook Inlet and the Tanana River, June 27, 1899, *Glenn* (US); damp open woods, foot of Lake Lebarge, June 7, 1916, *Harrington 13* (US); Holy Cross, July 24, 1917, *Harrington 72* (US); swamp near Tunulik River, Goodnews Bay, July 16, 1919, *Harrington 74* (US); open places, on high banks, common throughout the Yukon and Tanana Valley, Ft. Gibbon, July 4, 1905, *Heideman 51* (US); vicinity of Copper Center, 1908, *Heideman 74* (US); Koyukuk, June, 1905, *Hilsman* (US); vicinity of Unalakleet, Norton Sound, Aug. 18, 1920, *Johnston & Palmer 24* (NY, US); very common, Rampart, June 16, 1901, *Jones 25* (US); St. Michaels, Aug., 1915, *Kusche* (CAS); Nushagak, June 25, 1881, *McKay* (US); abundant, in birch woods, Dall River, 35 miles above mouth, June 21, 1901, *Mendenhall* (US); between Yukon River, Nation River, and International Boundary, coll. of 1930, *Mertie 99* (US); open spaces in spruce forest, flat north of Savage River, alt. 900 m., July 5, 1928, *Mexia 2079* (ANS, M, G, US, NY, UCal, CAS); Jennie Creek, McKinley Park, July 10, 1922, *Murie* (US); McDonald Creek, Salcha Slough, June 20, 1922, *Murie* (US); very common in open woods where no moss covers the ground, Kenai, June 9, 1901, *Nielsen 14* (US); on mountain side, head of Seward Creek, near Eagle, alt. 5000–6000 ft., Aug. 8, 1903, *Osgood* (US); Kuskokwin River, July 22, 1922, *Palmer 400* (US); Fairbanks, *Patton* (UCal); Dall River, June, 1904, *Piper* (US); opposite Fort Hamlin, June 23, 1904, *Piper* (US); Kenai, Aug. 18–20, 1904, *Piper 4440* (US); St. Michaels, July 10, 1889, *Russell* (US); on the banks of the Yukon and Porcupine Rivers, near Fort Yukon, Aug. 8–12, 1889, *Russell* (US); headwaters of the Copper and Tanana Rivers, Batzulnetas Village, June 19, 1902, *Schrader & Hartman 3* (US); St. Michael, June 30, 1899, *Setchell* (UCal); swampy country, Talushulitna Valley, July 1, 1903, *Shainwald* (NY); luxuriantly green slope, headwaters of Chulitna River, alt. 2500 ft., Sept. 11, 1903, *Shainwald* (NY, ANS); valley of Putnam River, July 1, 1885, *Stoney* (US); Camp Retreat, June 28, 1886, *Stoney* (US); on the Porcupine River, coll. of 1891, *Turner* (UCal); 1884, *Weinmann* (US); Fort Gibbon, coll, of 1899–1901, *Weirick* (US); Alaska range near Paxon's July–Aug. 1934, *Went* (UCal); near Tyoneck, 1907, *Woolsey 2* (US).

YUKON: Labarge, summer of 1932, *Bayne Beauchamp Expedition 110* (UCal); Dominion Creek, 1900, *Bolton* (US); on island 20 miles below Dawson, June 16, 1902, *Collier 10* (US); Carcross, July 16, 1914, *Eastwood* (CAS, G); 24-mile House, Dawson, June 25, 1914, *Eastwood* (CAS); common, Dawson, June 3, 1914, *Eastwood 137* (G, NY, Clokey, US, UCal, F, CAS); White Pass, July 23, 1914, *Eastwood 903* (CAS); Ladue Valley, Alaska-Canada Boundary, June 15–Aug. 15, 1910, *Eaton* (US); dry gravelly soil, open woods, Fort Selkirk, May 31, 1899, *Gorman 999* (US); moist meadows, Ranch Valley, July 5, 1899, *Gorman 1076* (NY, US); Fort Selkirk, June 14, 1903, *Hollick* (NY); woods and meadows, Dawson, alt. 1500 ft., June 16, 1933, *Hutchinson 2, 4* (G, UCal); King Point, June 24, 1906, *Lindstrom* (NY); Mosquito Gulch, coll. of 1898–1901, *MacLean* (UCal); Little Dawson River, coll. of 1898–1901, *MacLean* (UCal); Lake Bennett, July 8, 1902, *Macoun 78739* (UCal); hillsides at Hunkes Creek, July 31, 1902, *Macoun 78741* (UCal); Moosehead Mountain, Dawson, alt. 2300 ft., July 14, 1902, *Macoun 78742* (UCal); flats above Rink Rapids, Yukon River, July 9, 1902, *Macoun 78743* (UCal); Colorado Creek, July 28, 1902, *Macoun 78744* (UCal); Bear Creek (near Lake Desert D'Asch), Aug. 6, 1920, *Muller* (ANS, G, US); Lake Kulane to Don Jek River, Aug. 11–27, 1920, *Muller* (US, ANS, G); Lake Linderman, Upper Yukon, June 12, 1883, *Schwatka 13, 42* (G); Lake Bennett, Upper Yukon River, June 10, 1883, *Schwatka 57* (G); Upper Yukon River above Fort Selkirk, July 12, 1883, *Schwatka 95* (G);

Five Finger Rapids, July 5, 1899, *Tarleton 77* (NY, US); Labarge, June 15, 1898, *Williams* (NY).

BRITISH COLUMBIA: Bennett, Aug. 5, 1917, *Anderson 1112* (NY); Fort George, Yale & Caribou Districts, Aug. 9, 1918, *Anderson 799* (P); Atlin, Lake Atlin, July 14, 1914, *Eastwood* (CAS, G, US); west of Prince George, June 4, 1935, *Murie 1317* (M, W); in gulley, in shade of willow thickets, 150 Mile House, Caribou Road, June 28, 1935, *Murie 1318* (M, Willm, W); mountains near head Iskut River, Cassiar District, July 30, 1910, *Preble & Mixter 622* (US); in poplar thicket along creek, vicinity of Dawson Creek, June 8, 1932, *Raup & Abbe 3511* (G); poplar woods, south slopes of Peace River Valley, vicinity of Hudson Hope, June 21, 1932, *Raup & Abbe 3633* (F, NY, G); rich woods along Wicked River, near the Peace River, July 18, 1932, *Raup & Abbe 3871* (NY, G); above timber line, west and northwest slopes of Mt. Selwyn, July 19, 1932, *Raup & Abbe 3940* (G); dry ground, Lake Tatleb, July–Aug., coll. of 1865–66, *Rothrock 52* (Cl, G, F); Glacier, Aug. 1895, *Schaffer* (ANS); Atlin, July 9, 1930, *Setchell & Parks* (UCal); Mt. Atlin, Aug. 15, 1929, *Swarth 180* (CAS); Burgess Pass, July 16, 1919, *Walcott* (US); Telegraph Creek, June 1918, *Walker 1186* (CAS, Ry, M, Cl, US, G).

WASHINGTON: stream bank in deep woods, Mt. Spokane, Spokane Co., alt. 5200 ft., June 22, 1935, *Clarke* (W); in thickets along banks of Omak Creek above Disautel, east of Omak, June 19, 1932, *Fiker 862* (NY, P, M); along stream, Blue Mountains, Asotin Co., May 24, 1930, *Jones 2869* (G); Mt. Carlton, Spokane Co., July 16, 1902, *Kreager 190* (US, G, P, Clokey, NY); Davis Ranch, July 18, *Kreager 202* (P, US); Davis Ranch, July 18, 1902, *Kreager 216* (P); in woods in moist places, east of Usk, Pend Oreille Co., May 16, 1923, *Lackey* (P); in damp woods on Mt. Spokane road 12 miles northeast of Mead, Spokane Co., July 16, 1923, *Lackey* (P); shady, wet ground, slopes of Mt. Spokane, alt. 3500 ft., June 20, 1932, *Milburge 499* (G); wet bottom, Old Mill, Asotin Co., June 26, 1927, *Onstot* (P); 7 miles northeast of Wellpinit, Stevens Co., June 13, 1923, *Spiegelberg 526* (P); along creek, 5 miles north of Chewelah, Stevens Co., June 6, 1923, *Sprague 702* (P); Hangman (Latah) Creek, Spokane Co., May 20, 1889, *Suksdorf* (P); Rock Creek, near Mica Peak, June 5, 1889, *Suksdorf* (P); Newman Lake, Spokane Co., July 9, 1916, *Suksdorf 8801* (P, W); base of talus slope, south of Republic, toward Keller, June 29, 1931, *Thompson 7158* (G, UCal, US, NY, M); Newman Lake, Spokane Co., June 8, 1913, *Turesson* (Ry).

LOCALITY LACKING: "herb. Lehm. sub. nom. Lithospermum paniculatum, Pulmonaria, Hffl. collect." (ANS); Arctic America, *Richardson* (ANS).

4a. Mertensia paniculata var. **alaskana** (Britt.), comb. nov.

M. alaskana Britt. in Bull. N. Y. Bot. Gard. **2**: 181. 1901.

Leaves linear to narrowly elliptical, strigose above, glabrous to sparsely spreading pubescent below; the calyx-lobes glabrous on the back, otherwise as the species.

Distribution: Alaska and the Yukon.

ALASKA: Sheenjek Valley, coll. of 1926, *Mertie* (US); valley of Chandalar River, June 10–July 4, 1927, *Mertie* (F); valley of Chandalar River, alt. 800–2000 ft., June 10–July 4, 1927, *Mertie 35* (US); Fort Yukon, June 9, 1926, *Murie* (CAS);

Fort Yukon, June 21, 1899, *Shrader* (US); Fort Yukon, coll. of 1865, *Soule* (NY TYPE, F).

YUKON: Dawson Slide, June 16, 1914, *Eastwood* (CAS); Coffee Creek, July 9, 1914, *Eastwood* (CAS); Dawson Slide, May 23, 1914, *Eastwood 94* (Clokey, UCal, F, NY, G, US, CAS); Forty Mile Creek, Yukon River, May 31, 1893, *Funston 53* (US, NY, G); between the boundary and Forty Mile Creek, May 27, 1890, *McGrath* (US); between the boundary and Forty Mile Creek, Yukon River, June 5, 1890, *McGrath* (US); Dawson, June 6, 1899, *Williams* (NY).

"SUBARCTIC AMERICA": "Exploration in subarctic America, 1861–62," *Onion, Kennicott & Hardisty* (NY).

4b. Mertensia paniculata var. **borealis** (Macbr.), comb. nov.

M. laevigata Piper in Contr. U. S. Nat. Herb. [Fl. Wash.] **11**: 477. 1906; Macbr. in Contr. Gray Herb. N.S. No. 48: 10. 1916.

M. pratensis var. *borealis* Macbr., *l.c.* 8.

M. brachycalyx Piper, *l.c.*

M. leptophylla Piper, *l.c.* 478.

M. paniculata var. *subcordata* f. *leptophylla* Macbr. *l.c.* 7.

M. laevigata var. *brachycalyx* Macbr., *l.c.* 10.

M. paniculata var. *laevigata* G. N. Jones in Univ. Wash. Publ. Biol. **5**: 219. 1936.

This variety differs from the species in having the leaves glabrous on both sides or pubescent below, or minutely strigillose above.

Distribution: northern Idaho, adjacent Montana, southern British Columbia, Washington, and Oregon.

MONTANA: small pocket, near summit of east side of Continental Divide, between Irish and Cache Creeks, Lolo National Forest, Mineral Co., Aug. 13, 1933, *Hitchcock 2109* (G); springy place, canyon west of St. Regis, Missoula Co., alt. 4000 ft., July 22, 1921, *Wiegand 2081* (Cl).

IDAHO: northeast ridge, Cedar Mountain, Latah Co., July 2, 1911, *Beattie 4304* (P); Three Devils Creek at Middle Fork Clearwater River, 4 miles below Lowell, Clearwater National Forest, Idaho Co., June 2, 1935, *Constance, Dimond, Rollins & Worley 1105* (W); Priest River Exp. Station, alt. 2700 ft., July, 1923, *Epling 6002* (F, M); Upper Priest River, alt. 3000 ft., July 15, 1925, *Epling 7308* (M); Hughes meadow, Upper Priest River, alt. 3000 ft., July 15, 1925, *Epling 7391* (F, M) and *7396* (M); rich bottom, Upper Priest River, alt. 3000 ft., July 20, 1925, *Epling 7494* (M); Orogrande Creek, alt. 3000–4000 ft., July 12, 1926, *Epling & Hauch* [*Houck*] *9355* (M, US); Fish Lake Creek, alt. 5000 ft., July 20, 1926, *Epling & Hauch* [*Houck*] *9496* (US, M); Fish Lake, alt. 5600–6800 ft., July 21, 1926, *Epling & Hauch* [*Houck*] *9541* (M); Fish Lake, alt. 6000 ft., July 21, 1926, *Epling & Hauch* [*Houck*] *9608* (M); near Boise, 1916, *Gageby* (Ry); moist, shaded ravine, near Fish Lake, Clearwater National Forest, alt. 6200 ft., Aug. 15, 1933, *Hitchcock*

2169 (G); Black Lake to Bear (P.O.), Seven Devils Mountains, Adams Co., alt. 4500–8000 ft., July 20, 1931, *Johnston* (CAS); burn near Elk summit, Selway Forest, alt. 6000 ft., Aug. 25, 1923, *Kirkwood 1611* (G); Cyr's cabin on Fish Lake Creek, Clearwater Forest, alt. 5000 ft., Aug. 20, 1924, *Kirkwood 1881* (UM, G); Indian grave camp, Clearwater Forest, alt. about 6000 ft., Aug. 26, 1924, *Kirkwood 2005* (G, UM); on trail from Big Sand Creek to Elk Summit, Selway Forest, alt. 6000 ft., Aug. 26, 1923, *Kirkwood & Severy 1611* (UM); divide between St. Joe and Clearwater River, alt. 1540 m., July 9, 1895, *Leiberg 1217* (Ariz, G TYPE of *M. pratensis* var. *borealis*, M, NY, Ry, UCal, US, F); West Fork of Priest River, alt. 1200 m., Aug. 4, 1897, *Leiberg 2834* (US); rocky soil, Hornet Creek, Weiser Forest, alt. 4000 ft., June 4, 1915, *Mangun 147* (N); Quartzburg, July 24, 1892, *Mulford* (NY, M); Latah Co., July 7, 1893, *Piper 1691* (G); along streams, Kootenai Co., July, 1887, *Sandberg* (UCal); summit of Cedar Mountain, Latah Co., July 5, 1923, *Shaw* (P); Clearwater, *Spalding* (G); Wallace, Shoshone Co., July 10, 1924, *Stillinger 10* (P); Upper Priest River, Boundary Co., July 10, 1924, *Stillinger 12* (P); meadow land, Idaho National Forest, alt. 6000 ft., July 12, 1913, *Varner 2* (Ry); moist soil, Hughes Fork, trail fr. Seine Creek, Boundary Co., Aug. 1, 1924, *Warren 304* (P).

BRITISH COLUMBIA: woods near creek, road between Reno Mill and Kootenay Belle Mine, Salmo, July 15, 1935, *MacFadden 13853* (NY).

WASHINGTON: Narada Falls, Mt. Rainier National Park, July 17–23, 1922, *Abrams 9177* (M, NY, Ry); Mt. Rainier, alt. 7000 ft., July 20, 1892, *Allen 2* (G); Goat Mountains, near the Upper Valley of the Nesqually, July 22, 1896, *Allen 231* (M, P, NY, UCal, G, US TYPE); near Narada Falls, July 29, 1924, *Baker 729b* (CAS); Yakima Region, coll. of 1882, *Brandegee* (UCal); Yakima Region, coll. of 1882, *Brandegee 472* (M); coll. of 1883, *Brandegee 999* (UCal); Scenic Washington, July 1916, *Clegg* (CAS); shade of coniferous woods, Godman Springs, Blue Mountains, Columbia Co., alt. 5740 ft., July 21, 1935, *Constance & Clarke 1280* (W); dry ground in brush, edge of woods, Godman Springs, Blue Mountains, Columbia Co., alt. 5740 ft., July 19, 1935, *Constance, Clarke, Staats & Van Vleet 1166, 1170* (W); Paradise River, Mt. Rainier, July 17, 1907, *Cowles 677* (F); Columbia Co., July, 1913, *Darlington* (P); Alder Spring, Columbia Co., July, 1913, *Darlington 49* (P); Poverty Flat, Columbia Co., Wenaha Forest Reserve, July 16, 1913, *Darlington 383* (P); Chiwawa River basin near Wenatchee River, Wenatchee Forest, Chelan Co., alt. 600 m., July 7, 1916, *Eggleston 12970* (US); Chiwaukum Creek, Wenatchee Forest, Chelan Co., alt. 1150 m., Aug. 18–20, 1916, *Eggleston 13535* (US); Mt. Stuart, Cascades, Aug., 1898, *Elmer 1195* (P, US); Olympic Mountains, Clallam Co., July, 1900, *Elmer 2826* (NY, P, M, US TYPE of *M. leptophylla*); in moist grounds on tributary creeks to the Pend Oreille River, June, 1905, *Fallcott* (M); hills along Klickitat River, June 27, 1899, *Flett 1199* (P); Marysville, *Grant* (M); Cascade Mountains, Aug. 1925, *Grant* (F, CAS); Glacier Basin, alt. 6000 ft., Aug., 1925, *Grant* (ANS, CAS); Rainier National Park, Aug., 1925, *Grant* (Ry); Steven's Pass, foothills Cascade Mountains, June, 1928, *Grant* (Ry); in the forest along Van Trump Creek, on the Van Trump Park trail, Rainier National Park, Aug. 12, 1928, *Heller 14794* (M, US); moist ground, along streams, Cascade Mountains, Aug. 2, 1892, *Henderson 2259* (P, G); Blue Mountains, June 11, 1897, *Horner 367* (US); moist ravines, Blue Mountains, Columbia Co., June 11, 1897, *Horner B367* (G); Simcoe Mountains, June 6, 1879, *Howell*

(US); rock slide, Melakwa Lake Trail, King Co., July, 1925, *Jones 189* (P); Davenport, Lincoln Co., alt. 2500 ft., May 20, 1905, *Jones* (G); Mt. Rainier, July, 1917, *Kelley* (CAS); Mt. Rainier, July 1914, *King* (CAS); Blue Mountains, July 4, 1892, *Lake & Hull* (M); Tukanon River, July 5, 1892, *Lake & Hull 639* (P, NY); "Cob Bob" Peak, Chehalis Co., alt. 3000 ft., Aug. 4, 1897, *Lamb 1383* (F, P), and *1383a* (NY, M, ANS); in path of snow slide, north side of mountain, Lake Crescent, on Mt. Storm King, Clallam Co., alt. 600–4300 ft., July 23, 1904, *Lawrence 359* (P); Mt. Adams, Cascade Mountains, Aug. 9, 1894, *Lloyd* (NY); Simcoe Mountain, 1860, *Lyall in part* (G); Seattle, Aug. 24, 1892, *Mosier* (US); along stream in Cascade Mountains, Tye, King Co., Aug. 23, 1913, *Muenscher 1037* (Cl); mountain side below Embro, alt. 2300 ft., June 7, 1918, *Otis 699* (CAS); Paradise Valley, Aug. 5, 1928, *Parks & Parks 21049* (M, F, UCal, US); along streams in woods, Blue Mountains, Walla Walla Co., July 17, 1896, *Piper* (P); Olympic Mountains, Sept. 27, 1890, *Piper 919* (G); rich meadows, Mt. Rainier, alt. 6500 ft., Aug. 1–15, 1895, *Piper 2116* (P, US); Nason City, alt. 6000 ft., July, 1863, *Sandberg & Leiberg* (P); Nason Creek, alt. 3500–6000 ft., Aug. 4, 1893, *Sandberg & Leiberg 678* (P, M, ANS, F, UCal, NY, G, CAS, US TYPE of *M. brachycalyx);* Wellington, Snohomish Co., July, 1898, *Savage, Cameron & Lenocker* (M, F); moist slopes by trail to Snow Lakes, near Leavenworth, Wenatchee Mountains, alt. 3500 ft., May 28, 1931, *Seely 2* (M); Glacier Basin, Mt. Rainier, alt. 5935 ft., Aug. 19, 1919, *Shaw* (P); Cowlitz Valley and vicinity of Mt. Rainier, July–Aug., 1911, *Sherman 391* (Cl); moist ground, Dalkena, Pend Oreille Co., May 10, 1923, *Spiegelberg 524* (P); north side of Pend Oreille River, Dalkena-Newport, Pend Oreille Co., May 11, 1923, *Spiegelberg 525* (P); Ranch of Many Waters, Dalkena-Newport, Pend Oreille River, Pend Oreille Co., May 11, 1923, *Sprague 700* (P); on mountain creek, three miles south of Pork Rapids, Stevens Co., May 28, 1923, *Sprague 701* (P); moist, along creek, 5 miles north of Chewelah, Stevens Co., June 6, 1923, *Sprague 702 in part* (P); moist rich soil, Hoverland Meadows, Stevens Co., June 16, 1923, *Sprague 703* (P); mountain bog at head of creek, Mt. Calispal, Stevens Co., alt. 4500 ft., June 8, 1923, *Sprague 704* (P); Pork Rapids, Stevens Co., May 28, 1923, *Sprague 705* (P); moist creek bottom, 6 miles west of Camden, Pend Oreille Co., May 7, 1923, *Sprague 708* (P); rocky banks of Canyon Creek, Clallam Co., alt. 3000 ft., Aug. 25, 1921, *St. John 4788* (P); rock slide, Bald Mountain, head of Nile Creek, Rainier National Forest, Yakima Co., alt. 6050 ft., July 22, 1923, *St. John 7855* (G, F); thicket, base of peridotite slide, 2 miles below Chiwaukum, Chelan Co., May 19, 1928, *St. John, Eggleston, Beals & Warren 9450* (P); wet shaded woods, Chiwaukum, Chelan Co., May 19, 1928, *St. John, Eggleston, Beals & Warren 9458* (P); creek in woods, Anatone, Asotin Co., alt. 3000 ft., May 30, 1928, *St. John & Palmer 9563* (P, NY); mossy edge of creek, Agnes Creek, Chelan Co., July 17, 1923, *St. John & Ridout 3643* (P); stream bank, Stayawhile Springs, Columbia Co., alt. 5300 ft., July 6, 1927, *St. John & Smith 8333* (W, P); Quartz Valley, Olympic Mountains, Aug. 11, 1913, *Streator 6* (P); moist grounds, Mt. Paddo (Adams), alt. 5000–6000 ft., Aug. 10, 1882, *Suksdorf* (UCal, ANS, F, P); Mt. Paddo (Adams), July 12, 1886, *Suksdorf* (P); Hangman (Latah) Creek, Spangle, Spokane Co., May 20, and June 17, 1889, *Suksdorf* (P); Trout Valley, Klickitat Co., June 20, 1890, *Suksdorf* (P); Cascade Mountains, Skamania Co., Aug. 26, 1890, *Suksdorf* (P); Wodan Valley, Mt. Adams, Skamania Co., Sept. 2, 1891, *Suksdorf* (P); Wodan Valley, Mt. Adams, Skamania Co., Sept. 25, 1896, *Suksdorf* (P);

"Rolthal"—a small valley a few miles west of Trout Lake, Klickitat Co., Aug. 5, 1899, *Suksdorf* (P, W); among rocks, Mt. Paddo, alt. 2200 m., Aug. 1907, *Suksdorf* (NY); Wodan Valley, Mt. Adams, Skamania Co., Aug. 26, 1907, *Suksdorf 6090* (P, W); Indian Henry Park, Sept., 1901, *Tarleton 3* (F); rocky banks of Carbon River, Mt. Rainier, Pierce Co., July 27, 1930, *Thompson 5461* (G); wet rocky soil 15 miles east of Stevens Pass, Chelan Co., alt. 3500 ft., May 23, 1931, *Thompson 6436* (G, M); open alpine slopes in Yakima Park, Mt. Rainier, Pierce Co., alt. 6200 ft., July 5, 1931, *Thompson 7225* (M, G, UCal); rocky talus slopes by trail to Col. Bob Lookout, Grays Harbor Co., alt. 4000 ft., July 9, 1931, *Thompson 7278* (G, M, UCal); along alpine streams on Mt. Spokane, Spokane Co., alt. 5000 ft., June 24, 1933, *Thompson 9193* (M); lower meadows on Mt. Stuart, Chelan Co., alt. 5000 ft., July 23, 1933, *Thompson 9581* (M, NY, G, UCal); moist meadows on Tumwater Mountain, Chelan Co., alt. 4000 ft., May 12, 1934, *Thompson 10441* (NY, M); alpine slopes of Stuart Ridge, Chelan Co., alt. 5000 ft., June 19, 1935, *Thompson 11735* (G, CAS); canyons of Cascades, Wellington, Aug. 31, 1901, *Umbach* (F, ANS); creek bank, Cascade Mountains, Wellington, Aug. 31, 1901, *Umbach 519* (NY); coll. of 1889, *Vasey 402* (P); moist rocky soil, 1 mile above camp-ground, White River, Pierce Co., June 16, 1931, *Warren 1493* (W); rocky places at foot of Mt. Stuart, July 29, 1898, *Whited 796* (US, G); Stevens Pass, Chelan Co., Aug. 27, 1901, *Whited 1444* (P, US); Chewaukum, June 16, 1904, *Whited 2513* (P); turfy bank, Paradise River, Mt. Rainier Park, Pierce Co., alt. 6000 ft., Aug. 9, 1921, *Wiegand 2080* (Cl); Mt. Elinor, Olympic Mountains, Aug. 1910, *Zeller* (M).

OREGON: springy place in fir woods, west side of Abbot's Butte on boundary between Jackson & Douglas Counties, alt. about 5200 ft., June 29, 1898, *Applegate 2578* (NY, US); lodgepole pine forest, east base of Bailey Mountain, Diamond Lake, Douglas Co., July 16, 1924, *Applegate 4127* (G); moist coniferous woods, near Rabbit Ears, Upper Rogue River region, Jackson Co., July 13, 1929, *Applegate 5999* (G); edge of brook, Mt. Hood, Cascade Mountains, Hood River Co., alt. 3500 ft., July 31, 1930, *Benson 2492* (US, M, NY); moist ground, Crescent Lake, Cascade Mountains, Klamath Co., July 18, 1928, *Constance 9413* (UM, UCal); moist soil between granite boulders, west end of Lee Lake, lake basin, Wallowa Mountains, Wallowa Co., alt. 7000 ft., Aug. 4, 1935, *Constance & Jacobs 1385* (W); along Union Creek, Huckleberry Mountain, northeast Jackson Co., Aug. 3, 1897, *Coville & Applegate 404* (G, US); Union Co., 1877, *Cusick* (G); subalpine stream bank, Aug. 1896, *Cusick* (UCal); along mountain streamlets, alt. 4000–8000 ft., summer of 1881, *Cusick 211* (F); coll. of 1898, *Cusick 1911a* (G); common, granitic soil, Wallowa Mountains, alt. 2000 m., July 28, 1908, *Cusick 3292* (G, NY, F, US, P, Ry, M, UCal); wet, granite cliffs on peak one mile south of "China Cap," summit of Wallowa Mountains, alt. 2330 m., July 30, 1908, *Cusick 3296* (G, NY, F, P, US, M, UCal, Ry); very common, Wallowa Mountains, alt. 6500 ft., July 28, 1908, *Cusick 3392* (US); near Coman Springs, Blue Mountains, Umatilla Co., alt. 4500 ft., June 24, 1910, *Cusick 3474* (P); moist woods, near highway, east side of Mt. Hood, Hood River Co., July 4, 1926, *English 134* (P); moist rich ground, Mirror Lake, Mt. Hood, Clakamas Co., alt. 4000 ft., Aug. 5, 1927, *English 800* (P, ANS); Wallowa Mountains, near Aneroid Lake, Aug., 1912, *Finley 8766* (G); Boise National Forest, coll. of 1912, *Grandjean 84* (US); rather open rich woods, Loop Highway east of Mt. Hood, June 2 and June 10, 1924, *Henderson 647* (G, M); Diamond Lake, Douglas Co., June 21, 1931, *Howell 6881* (CAS); Wallowa Lake, July, 1930, *Jones 25016* (M, CAS, P); Cornucopia, July 27, 1931, *Jones 28914*

(CAS, M, UCal); Wenaha National Forest, alt. 4100 ft., July 31, 1916, *Lawrence 81* (US); rocky summit of Bald Mountain, near Detroit, Marion Co., alt. 7500 ft., Aug. 14, 1917, *Nelson 1910* (G); low thicket, east end of Parmelia Lake, alt. 4000 ft., Aug. 13, 1919, *Nelson 2786* (G); swamp along railroad, west end of Odell Lake, Klamath Co., July 29, 1928, *Nelson 5091* (G); wet ground, head of Parmelia Lake, foot of Mt. Jefferson, Aug. 14, 1919, *Peck 9233* (Willm, M, F, NY); moist thicket, 3 miles west of Whitney, Baker Co., July 22, 1921, *Peck 10356* (Willm, NY); damp ground, Clackamas Lake, July 23, 1927, *Peck 15817* (Willm); moist thicket, 4 miles east of Pendelton, Umatilla Co., July 1, 1933, *Peck 17464* (Willm); stream bank, Aneroid Lake, Wallowa Co., July 28, 1933, *Peck 17915* (Willm); in gravelly places along streams, Duck Lake Fork, Whitman National Forest, alt. 4500 ft., July 20, 1912, *Peterson 125* (US); Bald Knob, alt. 6500 ft., June 23, 1907, *Sampson & Pearson 26* (US); along Griffith's Creek, alt. 4650 ft., July 15, 1897, *Sheldon 8577* (NY), and *Sheldon 8577b* (US); slopes of Bluegrass Ridge, Aug. 5, 1927, *Thompson 3466* (ANS); dry ground above Mirror Lake, alt. 4500 ft., Aug. 17, 1927, *Thompson 3566* (ANS); moist woods at head of Wallowa Lake, Wallowa Co., June 15, 1928, *Thompson 4804* (US, G, ANS, M); damp draws on road to Elk Meadows, Mt. Hood, July 22, 1928, *Thompson 5077* (G, ANS, US, M).

WITHOUT EXACT LOCALITY: Columbia River, *Nuttall* (ANS).

Mertensia paniculata is the most widely distributed of the North American inland species of the genus. It occurs, as far as specimens indicate, from the region of James Bay in Quebec south to the Great Lakes, thence sparingly westward to Alberta and British Columbia where it is again rather abundant; from there it extends through Alaska. South of the international boundary, in the eastern part of its range, it is found in Michigan, Wisconsin, Minnesota, and at one known station in Iowa. In the western part of its range, it has been collected in the panhandle of Idaho and adjacent Montana and Washington. Whether or not it occurs in Siberia is not known, no specimens having been seen.

Mertensia paniculata, with its two varieties, is the most difficult of definition of the taller species of *Mertensia.* Variation is found in a most bewildering degree. In the eastern part of its range, the species is fairly constant, although the degree of pubescence varies to a small extent. From Alaska down through Alberta and British Columbia it is again fairly constant except as to degree of pubescence. The degree of variation is relatively greater than in the eastern plants, some plants being densely pilose, some sparsely pubescent. In those of Montana, Idaho, and Washington, and in some of the adjacent region of Canada, the normal aspect of the species is changed by the spreading character of the pubescence, especially on the pedicels and the calyx. In addition to the character of the pubescence the corollas are, on the average, slightly smaller. The calyces on many plants are smaller and of no consistent shape. This minor variation has been separated as *M. membranacea;* however, there seems not to be sufficient reason to separate it. The presence or absence of pubescence on the backs of the calyx-lobes is subject to variation. Typically the backs of the calyx-lobes are strigose; this shades into a phase in which they are quite glabrous. This variation has been found both in plants of eastern North America, where it is uncommon, and in western North America where it is common. Both phases have been found in the same collection and even on flowers in the same inflorescence.

M. paniculata var. *borealis.*—In Montana, Idaho, southern British Columbia, Washington, and Oregon, there is a group of plants in which the minor deviations from the species are most puzzling. Several of these phases have received names, and others have escaped attention. From a variation hardly to be distinguished from the species, one finds various phases, differing one from another only slightly, ranging to glabrous plants. This latter is the basis of Piper's *M. laevigata.* In the attempt to find lines of cleavage between the various phases by which they might be separated, it was soon discovered that while many of the specimens could be placed with one or another phase, an equal amount could not be placed with any particular one. If a restricted view were to be taken of the various phases, a large number of them would have to be given subspecific rank. Such a course would serve no good purpose but rather would cause greater confusion than already exists. To be consistent, if a restricted view were taken of the several phases according to their pubescence, still further segregation would be in order based on inconstant calyx and corolla characters.

Mertensia paniculata var. *alaskana* is a relatively unimportant variation, and again one in which there is no clear or sharp morphological line distinguishing it from the species occurring in Alaska and the Yukon. From its more perplexing ally further to the south, *M. paniculata* var. *borealis,* it is separated by a large hiatus in range.

5. **Mertensia franciscana** Heller in Bull. Torr. Bot. Club **26**: 549. 1899.

M. pratensis Heller, *l.c.* 550.

M. alba Rydb. in Bull. Torr. Bot. Club **31**: 638. 1904.

M. grandis Wooton & Standley in Contr. U. S. Nat. Herb. **16**: 165. 1913.

M. pratensis f. *alba* Macbride in Contr. Gray Herb. N.S. No. 48: 8. 1916.

Stems erect or ascending, 1–10 dm. tall (rarely up to 16.5 dm.), usually with several from each rootstalk; basal leaves oblong-elliptic to elliptic, 6–20 cm. long, 5–9 cm. broad, base subcordate to obtuse, apex acuminate, acute, or obtuse, upper surface short-strigillose, lower surface glabrous or with spreading pubescence, petioles longer or shorter than the blade; cauline leaves elliptical to narrowly ovate, 4–14 cm. long, 1–5 cm. broad, obtuse to acuminate, the lowermost petiolate, becoming sessile toward the inflorescence, strigillose on the upper surface, glabrous to densely pubescent with spreading hairs below; flowers of the inflorescence paniculately disposed in an ebracteate modified scorpioid cyme, the branches of the inflorescence elongating in age; pedicels strigose, 1–20 mm. long; calyx 2.5–5 mm. long, divided almost to the base, the lobes linear to lanceolate, 1–2 mm. wide at the base, acute, rarely obtuse, glabrous or pubescent on the back, strongly ciliate; corolla-tube 5–9 mm. long (mostly about 6 mm.), glabrous or pubescent within; corolla limb 4–9 mm. long (mostly about 6 mm.), subequal to or slightly shorter or longer than the corolla-tube, moderately expanded; anthers 2.5–3 mm. long, longer than the filaments; filaments 2–2.5 mm. long, glabrous or with spreading hairs; fornices prominent, usually pubescent; style 9–20 mm. long, usually shorter than the corolla, sometimes exceeding it; nutlets rugose and papilliferous.

Distribution: southern Colorado, New Mexico, Arizona, southern Utah, eastern Nevada, and possibly California.

COLORADO: Van Boxde's Ranch, above Cimarron, 8500 ft., July 10, 1901, *Baker 391* (US, P, M, G, ND, UCal, O, Ry); common along river bottom, Mancos, alt.

7500 ft., June 22, 1898, *Baker, Earle & Tracy 42* (ND, M, US, Cl, N, NY, O, F); Bob Creek, West La Plata Mountains, alt. 10,000 ft., June 29, 1898, *Baker, Earle & Tracy 234* (Cl, ND, AM, US, M, N, NY, O, G, F, UCal, Ry, Clokey); common on dry rocky summits, above timber line, Mt. Hesperus, June 30, 1898, *Baker, Earle & Tracy 252* (US, NY, O, Ry, ND, M, N, Cl, F); La Plata River, 10,500 ft., July 13, 1898, *Baker, Earle & Tracy 825* (NY TYPE of *M. alba*, F, ND, M, N, Cl, NY, US); Trinidad, July, 1915, *Beckwith 154* (CAS); Keating, Fremont Co., June 25, 1916, *Comstock 15* (Cl); Needle Mountains quadrangle at Camp Creek, alt. 10,500 ft., July 10, 1901, *Cross 6* (US); short distance west of summit of Wolf Creek Pass, San Juan Mountains, alt. 10,600 ft., June 7, 1934, *Ferguson & Ottley 5381* (G); La Veta Pass, June 11, 1901, *Ferril* (Clokey, C); Granite Peaks, west side of Los Piños River, La Plata Co., May 26, 1934, *McKelvey 4666* (G); between Pagosa Springs and Wolf Creek Pass, Mineral Co., alt. about 7500 ft., May 28, 1934, *McKelvey 4722 in part* (G); Goose Creek, Rio Grande National Forest, Mineral Co., June 18, 1911, *Murdoch 4610* (US, M, F, UCal, Clokey); Park, Rio Grande National Forest, Mineral Co., July 4, 1911, *Murdoch 4669* (F, M); Rico, Dolores Co., June 15, 1899, *Osterhout 1870* (O, NY); shady aspen grove, Tabegauche Basin, alt. 8000 ft., July 29, 1914, *Payson 552* (Ry, G); in shade near Sheep Creek, western Montrose Co., alt. 7000 ft., July 6, 1924, *Payson & Payson 3905* (Ry, G); Beulah, June 5–9, 1908, *Robbins 4936* (C, Ry); West Spanish Peak, alt. 3000–3800 m., July 9, 1900, *Rydberg & Vreeland 5683* (NY); Cuchara River, above La Veta, alt. 2100 m., May 31, 1900, *Rydberg & Vreeland 5685* (NY, Ry, N, O, ND); Granite Peaks Ranch, north of Bayfield on Pine River, alt. 8500 ft., May 26, 1934, *Stone 511* (NY); Culebra Cañon, Costilla Co., 9000 ft., July 7, 1912, *Warren* (Ry); along a creek in moist humid soil, 14 miles south of Trinidad toward Raton Pass, Las Animas Co., June 24, 1935, *Williams 2273* (W, M, ND, P).

NEW MEXICO: vicinity of Las Vegas, San Miguel Co., July, 1920, *Anect 51* (US); vicinity of Las Vegas, Solitario, July 9, 1926, *Arsène 17902* (G); Lake Peak, alt. 3780 m., Aug. 26, 1928, *Arsène 20756* (G); vicinity of Santa Fe, canyon east, alt. 2400 m., July 20, 1926, *Arsène & Benedict 15728* (US, F); Pecos Baldy, alt. 11,000 ft., July 30, 1903, *Bailey 575* (US); Taos Mountains, Taos Co., alt. 11,400 ft., July 28, 1904, *Bailey 881* (US); along creeks, Santa Fe Mountains, June 15, 1925, *Benedict 112* (US); Holy Ghost Canyon, July 5, 1929, *Castetter 73* (Ry); Panchuela Creek above Cowles, July 5, 1931, *Castetter 1071* (Ry); Las Vegas Mountains, coll. of 1901, *Cockerell* (CAS); Beulah, alt. 8000 ft., 1903, *Cockerell* (AM); top of Las Vegas Range, alt. 11,000 ft., coll. of 1901, *Cockerell 17* (NY), and *20* (Ry); Pecos River, July 17, 1898, *Coghill 67* (M); Chama, Rio Arriba Co., alt. 2380 m., May 26, 1911, *Eggleston 6652* (US); between Mogollon Ranger Station and Willow Creek (Silver-Willow Creek divide), Gila Forest, Socorro Co., alt. 2100–2900 m., July 29, 1920, *Eggleston 16845* (US, NY); lower Forest Service Cabin, Sierra Blanca, Sacramento Mountains, Lincoln Forest, Lincoln Co., alt. 3100 m., July 29, 1923, *Eggleston 18835* (US, NY); at junction of Rio Junita and Rio Martinez above Tres Ritos, Carson Forest, Taos Co., Aug. 27, 1923, *Eggleston 19332* (US); Ritos de los Frijoles, Bandelier National Monument, Sandoval Co., alt. 2000–2200 m., June 5–6, 1924, *Eggleston 20021* (US, NY); Santa Fe Creek bottom, banks of stream, June and July, 1847, *Fendler 626* (M, ANS, US, F, G, NY); in Santa Fe Cañon, 9 miles east of Santa Fe, alt. 8000 ft., June 2, 1897, *Heller & Heller 3641* (M, ND, N, G, NY TYPE of *M. pratensis*, US, P, Cl); sandy soil, Rio Monito, May, *Henry* (ANS); upper Pecos River, July 17, 1898, *Maltby & Coghill 67* (US, AM); cañon in Chusca Mountains, July 3, 1883, *Marsh 177* (US); in the Mogollon Mountains, on Mogollon Creek, Socorro Co., alt. 7500 ft., July 23, 1903 *Metcalfe 302* (US, NY, G, Ariz, Ry, M, ND, AM); in and around the south end of the Black Range, Hillsboro Peak, Grant Co., alt. 8500 ft., Sept. 11, 1904, *Metcalfe 1319* (G, US TYPE of *M. grandis*, M, AM); Redstone, Aug. 13, 1895, *Mulford 850* (NY, M); near Kingston, Black Range, Sierra Co., Aug. 1915, *Pilsbry* (ANS, US); Mogollon Mountains, July, 1881, *Rusby* (M); Mogollon Mountains, Aug., 1881, *Rusby 291* (ND, US, F, UCal, NY, Cl, M); Winsor's Ranch, Pecos River National Forest, alt. 8400 ft., June 29, 1908, *Standley 4020* (AM, M, US, NY, F, G); Pecos Baldy, Pecos River National Forest, alt. 12,000 ft., July 11, 1908, *Standley 4307* (M, AM, US, NY); Spirit Lake, Pecos River National Forest, alt. 10,000 ft., July 18, 1908, *Standley 4388* (AM, M, US, NY); Harvey's upper ranch, Pecos River National Forest, alt. 9600 ft., Aug. 1, 1908, *Standley 4709* (AM); Truchas Peak, Pecos National Forest, alt. 12,000 ft., Aug. 8, 1908, *Standley 4786* (AM); along the river, vicinity of Chama, Rio Arriba Co., alt. 2380–2850 m., July 8, 1911, *Standley 6524* (US); bogs, Navajo Indian Reservation, in the Tunitcha Mountains, Aug. 8, 1911, *Standley 7665* (US); edge of brook, vicinity of Ute Park, Colfax Co., alt. 2200–2900 m., Aug. 21, 1916, *Standley 13476* (US); open hillside, vicinity of Ute Park, Colfax Co., alt. 2200–2900 m., Aug. 31, 1916, *Standley 14109* (US); along brook under aspens, vicinity of Ute Park, Colfax Co., alt. 2900 m., Aug. 31, 1916, *Standley 14130* (US); edge of brook, vicinity of Brazos Canyon, Rio Arriba Co., Aug. 21, 1914, *Standley & Bollman 10699* (US); Comanche Valley, Colfax Co., alt. 8500 ft., July, 1896, *St. John 22* (G); rich moist soil, Raton road, 19 miles east of Taos, Colfax Co., alt. 8800 ft., June 5, 1922, *Wiegand & Upton 4134* (Cl); Sierra Blanca Peak, Mescalero Indian Reservation, Otero Co., alt. 9300 ft., July 20, 1928, *Wolf 2834* (CAS, G); 3 miles north of Chama, Rio Arriba Co., alt. 8000 ft., July 25, 1928, *Wolf 2977* (G, CAS); White Mountains, alt. 7800 ft., July 6, 1895, *Wooton* (AM); Silver Spring Canyon, Sacramento Mountains, July 28, 1899, *Wooton* (US); east of Holt's Ranch, alt. 6000 ft., July 20, 1900, *Wooton* (AM); near Holt's Ranch, Mogollon Mountains, Socorro Co., July 20, 1900, *Wooton* (US); Eagle Peak, Aug. 2, 1900, *Wooton* (AM); White Mountain Peak, Aug. 1, 1901, *Wooton* (US, NY, AM); Costilla Valley, alt. 10,000 ft., Sept. 6, 1913, *Wooton* (US); White Mountains, Lincoln Co., alt. 10,000–11,000 ft., Aug. 16, 1897, *Wooton 649* (ND, US, NY, M).

ARIZONA: narrow space between 2 high granite walls, 1 mile south of Fly Peak, Chiricahua Mountains, alt. 9000 ft., *Blumer Pr37* (Ariz, US); Pinchot Ranger Station, Mogollon Mountains, Coconino Co., alt. 1950–2280 m., *Collom* (NY); Pinchot Ranger Station, Mogollon Mountains, Coconino Co., alt. 1950–2280 m., *Collom 237* (M); San Francisco Mountains, alt. 10,000 ft., July 16, 1927, *Foster & Osborn 4810* (US); Coronado Trail, Sept. 7, 1931, *Fulton 8209* (F); in aspen groves, Miller's Peak and slope, Huachuca Mountains, July 12, 1909, *Goodding 178* (G, Ariz, NY, Ry); among rocks of lava heap, Thompson's Ranch, Black River, White Mountains, July 12, 1910, *Goodding 540* (NY, US, Ariz, Ry, G); below cliffs, Black River, Thompson's Ranch, White Mountains, July 14, 1910, *Goodding 594* (NY, US, Ariz, Ry, G); in meadows, Sheep Crossing, Little Colorado River, July 13, 1912, *Goodding 1173* (NY, Ariz, US, Ry); Mt. San Francisco, July 9, 1889, *Greene* (ND); White Mountains, Aug. 11–15, 1903, *Griffiths 5345* (US); open slopes, near Flagstaff, alt. 8500 ft., July 28, 1922, *Hanson 145* (Ry); in spruces, San Francisco Mountains, alt. 10,000 ft., June 30, 1923, *Hanson & Hanson A605* (Ry, N, F, M); San Francisco Peak, Aug. 30, 1884, *Jones 4106* (Ry, CAS, F, US, Ariz, U); Mt. Graham, alt. 9500 ft., Aug. 12, 1934, *Kearney & Peebles 9960* (US); Mt. Humphrey, alt. 8600–10,500 ft., July 30, 1897, *Kuntze* (NY); Chiricahua Mountains, alt. 9000-9500 ft., July 15–20, 1927, *Kusche* (F, CAS, NY); western slopes of San Francisco Peaks, alt. 2600 m., June 25, 1901, *Leiberg 5582* (US); upper Smith Creek, alt. 3000 m., July 27, 1901, *Leiberg 5765* (US, Clokey); San Francisco Mountains, Aug., 1884, *Lemmon* (UCal); Sitgreaves Mountain, Aug., 1884, *Lemmon & Lemmon* (US); San Francisco Mountains, Aug., 1884, *Lemmon & Lemmon* (UCal, N); vicinity of Flagstaff, alt. 7000 ft., July 5, 1898, *MacDougal 232* (F, UCal, Ariz, US, NY TYPE, Cl, Ry, ANS, G); level plateau, San Francisco Mountains, alt. 8000 ft., June 16, 1891, *MacDougal 251* (US); Schultze Pass, San Francisco Mountains, June 6, 1929, *McKelvey* (CAS); cañon of Clear Creek, 50 miles from confluence with Rio Verde, July 25, 1887, *Mearns 162* (NY); between Fort Huachuca and San Pedro River, July 27, 1893, *Mearns 1547* (US, NY, G); Willow Spring, July 5–6, 1890, *Palmer 619* (US, G); near Flagstaff, May–Oct., 1899, *Purpus* (UCal); San Francisco Mountains, May–Oct., 1900, *Purpus* (M); Willow Spring, alt. 7400 ft., July, 1874, *Rothrock 246* (F, G, US); San Francisco Mountains, Summit Ranch, Aug. 18, 1907, *Thornber 2843, 2862, 2876* (Ariz); Greer, June 13–15, 1917, *Thornber 8925* (Ariz); Graham, *Thornber & Shreve 7931, 7951* (Ariz); San Francisco Mountains, July 20, 1894, *Toumey* (UCal, NY); San Francisco Mountains, July 14, 1892, *Toumey 352* (Ariz, US); San Francisco Mountains, Coconino Co., alt. 13,000 ft., Aug. 2, 1928, *Wolf 3116* (CAS, G); Hart's Little Spring, July 14, 1892, *Wooton* (US).

UTAH: Gooseberry Ranger Station, Fishlake National Forest, Wasatch Mountains, Sevier Co., alt. 2400 m., June 24, 1914, *Eggleston 10164, 10168* (US); headwaters of the south forks of Salina Creek, Wasatch Mountains, Fishlake National Forest, Sevier Co., alt. 3100 m., July 28–30, 1914, *Eggleston 10302* (US); Mt. Hilgard, Wasatch Mountains, Fishlake National Forest, Sevier Co., alt. 3000 m., Aug. 1, 1914, *Eggleston 10344* (US); in moist meadow, north slope of Abajo Mountains, alt. 8500–11,000 ft., July 1–2, 1930, *Goodman & Hitchcock 1387* (G, NY, UCal, O, CAS, M); north slope Abajo Mountains, alt. 8500–11,000 ft., July 1–2, 1930, *Goodman & Hitchcock 1443* (CAS, UCal, NY, O, G, M, ANS, UM); Fish Lake, Aug. 10, 1894, *Jones* (UCal); Silver Lake, American Fork Cañon, alt. 10,000 ft., July 20, 1895, *Jones* (U); Silver Lake, American Fork Cañon, alt. 10,000 ft., July 23, 1895, *Jones* (G); Ireland's Ranch, head of Salina Cañon, alt. 8000 ft., June 15, 1894, *Jones 5441aa* (US, NY, UCal); mesa south of Devil's Canyon, 10 miles north of Blanding, July 1, 1932, *Maguire & Redd 2109* (U); Abajo Peak, alt. 11,000 ft., July 1, 1932, *Maguire & Redd 2110* (U); about spring below cabin, and along grassy stream bank, Abajo Mountains, alt. 9500 ft., June 24, 1932, *Maguire & Redd 2111* (U); in damp woodland, Dream Mine, San Juan Co., alt. 9000 ft., June 28, 1932, *Maguire & Redd 2112* (U); West Mountain, Abajo Mountains, alt. 10,000 ft. to summit, June 29, 1932, *Maguire & Redd 2113* (U); in older thicket along stream, vicinity La Sal Ranger Station, San Juan Co., alt. 7000 ft., July 2, 1932, *Maguire & Redd 2115* (U); under *Ribes*, in meadow, Burro Pass, Grand Co., alt. 11,400 ft., July 18, 1933, *Maguire, Richards, Maguire & Hammond 5118* (U, G); spruce woods, head of Horse Canyon, San Juan Co., alt. 9500 ft., July 26, 1933, *Maguire, Richards, Maguire & Hammond 5121* (G); spruce forest, La Sal Mountains, Grand Co., alt. 10,500 ft., July 22, 1924, *Payson & Payson 3949* (UCal, G, M, Ry); western slope of La Sal Mountains, alt. 2200–3000 m., July 6, 1911, *Ryd-*

berg & Garrett 8597, 8598 (Ry, US, NY); Elk Mountains, near Scorup's Camp, alt. 2500 m., Aug. 8, 1911, *Rydberg & Garrett 9531* (US, NY); Abajo Mountains (eastern range), alt. 3000–3300 m., Aug. 17, 1911, *Rydberg & Garrett 9775, 9776* (Ry, NY); Abajo Mountains, near Spring Creek, alt. 2700–3000 m., Aug. 17–20, 1911, *Rydberg & Garrett 9814* (US, NY); wet canyon bottoms, Geyser Canyon, San Juan Co., alt. 8700 ft., July 11, 1912, *Walker 256* (Ry, M, US, NY, G).

NEVADA: along stream, Baker-Lehman Creek, White Pass Co., alt. 7500 ft., June 20, 1928, *Cottam 3283* (F).

CALIFORNIA: Sierra Valley to the high valleys of the Warner Mountains, June 1879, *Lemmon* (NY, UCal).[1]

6. Mertensia platyphylla Heller in Bull. Torr. Bot. Club **26**: 548. 1899.

M. paniculata var. *platyphylla* G. N. Jones in Univ. Wash. Publ. Biol. **5**: 220. 1936.

Stems erect, 3–9 dm. tall, one or few stems from the root; basal leaves ovate-subcordate, 12 cm. more or less long, 10 cm. more or less broad, acute or acuminate, minutely strigillose above, sparingly hirsute below, the basal portion often nearly glabrous, petiole much longer than the blade (25 cm. more or less); cauline leaves usually petiolate, the uppermost sessile, lanceolate-acuminate to ovate-acuminate, 4–14 cm. long, 2–7 cm. broad, pinnately veined, pubescence as of basal leaves; inflorescence a modified scorpioid cyme, congested at first, becoming elongated in age; pedicels 2–40 mm. long, strigose; corolla blue probably also occasionally white, the tube 4.5–6 mm. long, glabrous or very rarely with a few hairs within, the moderately expanded limb 6–9 mm. long, always longer than the tube, fornices conspicuous, glabrous or rarely with extremely short hairs; anthers 3.7–5 mm. long (usually 4 mm.), their bases about even with the fornices or not more than 1 mm. above them; filaments 1.5–2.5 mm. long, about as broad as the anthers; style as long as or usually exceeding the corolla; calyx 5–7 mm. long at anthesis, up to 12 mm. long at fruiting stage, the lobes 0.5–1 mm. shorter than the calyx, linear to lanceolate, acute, densely ciliate, usually glabrous on the back, rarely sparingly strigose; nutlets large, 5–7 mm. long, rugose dorsally and smooth on the inner faces or rugose on all faces, rarely all developing.

[1] This collection is probably mislabeled. It may be the same collection as *Lemmon 2831*, from Arizona.

Distribution: western Washington.

WASHINGTON: Puyallup, Puget Sound, July 17, 1880, *Engelmann* (M); stream banks, Montesano, June 1917, *Grant* (NY, C, US); river bottom, Montesano, July, 1919, *Grant* (M, NY); fields, Montesano, *Grant 831* (P); near Montesano, alt. 200 ft., June 3, 1898, *Heller & Heller 3872* (US, M, Ry, ANS, P, UCal, F TYPE, G, N, Cl, NY); Skokomish River, Mason Co., May 16, 1892, *Kincaid* (P); New London, Grays Harbor Co., June 10, 1897, *Lamb 1168* (F, P, ANS, NY, M); moist river bottoms near Aberdeen, Grays Harbor Co., May 4, 1935, *Thompson 11433* (G); Nisqually, Puget Sound, *Wilkes* (NY); Palace Camp, coll. of 1883, *Willis* (NY).

6a. M. platyphylla var. **subcordata** (Greene), comb. nov.

M. subcordata Greene, Pittonia **4**: 89. 1899.

M. paniculata var. *subcordata* Macbr. in Contr. Gray Herb. N.S. No. 48: 7. 1916.

As the species except: calyx 2.5–4 mm. long, broadly lanceolate, triangular or oblong, usually obtuse, occasionally acute; cauline leaves occasionally slightly subcordate, old specimens sometimes almost entirely glabrous.

Distribution: western Oregon.

OREGON: Coquille River, midway between Bridge and Myrtle Point, Coos Co., May 13, 1924, *Abrams & Benson 10540* (Ry, Willm); Umpqua River, Douglas Co., 1914, *Cusick 3875* (P); in small clumps in thickets, bank of Umpqua River, Roseburg Quadrangle, Douglas Co., April 17, 1914, *Cusick 3895* (P); Willamette River banks, Milwaukie, Clackamas Co., May, 1886, *Drake & Dickson* (F); Corvallis, Benton Co., May, 1922, *Epling 5578* (M); Silver Creek, coll. of 1871, *Hall 405* (M, G, F); Milwaukie, Clackamas Co., Aug., 1880, *Howell* (P); Roseburg, Umpqua Valley, Douglas Co., May 3, 1887, *Howell* (ND TYPE, UCal, NY, M, F); Cascade Mountains, June 25, 1895, *Lloyd* (NY); low woods along Willamette River, West Salem, Polk Co., May 25, 1916, *Nelson 607* (P); wet ledges on side of Silver Creek Falls, Marion Co., June 8, 1916, *Nelson 669* (P); low woods near river, West Salem, Polk Co., May 8, 1917, *Nelson 1111* (G, NY); low woods near river, West Salem, Polk Co., May 12, 1918, *Nelson 2137* (G); rocky shore of stream, Silver Creek Falls, Marion Co., June 19, 1918, *Nelson 2255* (G); low woods along Willamette River, West Salem, Polk Co., April 16, 1921, *Nelson 3495* (ANS); rocky ravine, Silver Creek Falls, Marion Co., June 9, 1921, *Nelson 3794* (ANS); Columbia woods, *Nuttall* (ANS); Port Oxford, Curry Co., May 5, 1931, *Osbanie* (Willm); damp woods along river, Salem, May 27, 1911, *Peck 5349* (Willm); damp woods along river, Salem, April 23, 1910, *Peck 5350* (Willm); damp woods, Cottage Grove, June 15, 1916, *Peck 7443* (Willm); moist shade along Willamette River, near Salem, May 15, 1935, *Peck 18654* (Willm); west of Corvallis, Benton (?) Co., May 1, 1933, *Rounds* (M); on hills, Yamhill Co., June 29, 1893, *Spillman 131* (P, F); Independence, Polk Co., May 20, 1893, *Stanton 72* (P); banks of Clatskanie River, 5 miles above Clatskanie, Columbia Co., May 15, 1927, *Thompson 2425* (M); rocky banks of Clatskanie River, 5 miles above Clatskanie, Columbia Co., May 15, 1927, *Thompson 2430* (ANS); near Astoria, Clatsop Co., June, 1927, *Van Dyke* (CAS).

The most outstanding character of this species and variety is the very large anthers, almost always 4 mm. long, in comparison to those of closely related *M. paniculata* and its varieties in which the anthers rarely exceed 3 mm. The corolla is broad in comparison to that of the related plants and gives a distinctive appearance to the species and variety.

The pubescence on the lower surface of the leaves is always sparse, that of the upper surface is inconspicuous and closely appressed. In older specimens it may nearly all have broken off, but the surface remains scabrid to the touch because of the remaining pustulate bases.

Various interpretations have been given to the plants here concerned. Piper maintained both of them in his flora of Washington (although the variety is not known from Washington). Macbride, in his revision of the western species of the genus, maintained *M. platyphylla* as a species but assigned *M. subcordata* to *M. paniculata* as a variety. Johnston (Contr. Arnold Arb. No. 3: 85–86. 1932) used *M. paniculata* var. *subcordata* as a convenient name to assign to the complex assemblage of species and varieties allied to *M. paniculata* which Piper had described or used in his flora of Washington, as well as one more name published by Macbride in his revision. *Mertensia platyphylla* and a more distantly related species were thus included. Later Piper came to the conclusion that *M. platyphylla* was the same as *Lithospermum denticulatum,* probably from the statement of locality in Hooker, Fl. Bor.-Am. **2**: 87. 1838.

The characters here used to separate the species and the variety are minor, but they do not seem to overlap and their ranges apparently do not come together.

7. Mertensia toyabensis Macbr. in Contr. Gray Herb. N.S. No. 48: 7. 1916.

Stems erect, few, 3–5 dm. tall; roots and basal leaves unknown; cauline leaves oblong-lanceolate to elliptic, 3–14 cm. broad, the lower ones petiolate, the petiole somewhat shorter than the blade, the upper ones becoming sessile and smaller in size, densely pubescent on both surfaces with short spreading hairs, lateral venation inconspicuous; pedicels 2–10 mm. long, pubescent with spreading hairs; inflorescence a modified scorpioid cyme, congested at first, becoming panicled; corolla-tube 5–8 mm. long (mostly 5–6 mm.), hairy within toward the base; corolla-limb 6–8 mm. long (mostly 6–7 mm.), moderately expanded; fornices conspicuous, pubescent; anthers 2–2.5 mm. long; filaments 2.5–3 mm. long; style equalling or shorter than the corolla; calyx 4–7 mm. long, divided almost to the base, lobes linear-lanceolate to lanceolate, acute, pubescent with more or less spreading hairs; nutlets rugose, 3–4 mm. long.

Distribution: known only from Lander Co., Nevada.

NEVADA: Austin, June 16, 1882, *Jones 4007* (US, M, U, Clokey, Pom, G, NY, CAS); Toyabe Mountains, alt. 7000 ft., July, 1868, *Watson 843* (G, NY).

Mertensia toyabensis is closely allied to *Mertensia arizonica* and its varieties. More collections are desired for a better understanding of the species.

8. Mertensia arizonica Greene, Pittonia **3**: 197. 1897.[1]

Erect or ascending, 3–8 dm. or more tall, stems 1–several from each rootstalk; basal leaf (only one seen) narrowly ovate, acute, 15 cm. long, 6 cm. broad, slightly decurrent on the petiole, petiole as long as the blade, glabrous but slightly papillate, margin ciliate; lower cauline leaves from spatulate to elliptical, usually petiolate, the petiole winged, upper cauline leaves usually sessile, elliptical to narrowly ovate, acute, 3–12 cm. long, 1–5 cm. broad, glabrous or papillate, ciliate on the margins, not becoming abruptly smaller upward; pedicels 2–30 mm. long, glabrous, papillose or sometimes the papillae developing short hairs; inflorescence usually branched, the peduncles bearing a several-flowered elongated scorpioid cyme; calyx 4–8 mm. long, campanulate, glabrous on the back, hairy within, the lobes one-half or less the entire length of the calyx, 2–4 mm.

[1] Doubtful that *M. arizonica* and more particularly *M. Palmeri*, were collected in Arizona by Dr. Palmer, I wrote to Dr. F. V. Coville concerning them. A part of Dr. Coville's answer follows: "I have looked up Dr. Palmer's itinerary for 1869, and I find that most of his collections from Arizona, including all of his Arizona plants of that year except a few from the southern part of the state, were shipped by steamer from Ehrenberg down the Colorado River and by way of the Gulf of California to San Francisco. They were then reshipped in a steamer for the Isthmus of Panama and the steamer carrying the collection was lost. I am confident that the specimens labeled . . . 'as collected by Dr. Edward Palmer in Arizona in 1869' are erroneously labeled."

long, acute or obtuse, ciliate; corolla-tube 6–9 mm. long, with a definite ring of hairs at the base within; corolla-limb 7–11 mm. long, always longer than the tube, moderately expanded; anthers 2.5–3.5 mm. long, as long as or shorter and narrower than the filaments, filaments 3–4 mm. long; fornices conspicuous, pubescent; style 10–15 mm. long, usually shorter than the corolla; nutlets rugose, shorter than the calyx.

Distribution: central to southwestern Utah, probably also in adjacent Arizona.

Fig. 4. *M. arizonica.* Habit sketch × ⅛; enlarged corolla × 1⅔; variation in calyx × ⅔.

"ARIZONA": without definite locality, coll. of 1869, *Palmer* (US TYPE).

UTAH: Tushar Ranger Station, headwaters of Beaver Creek, Fillmore National Forest, Tushar Mountains, Beaver Co., Aug. 8–9, 1914, *Eggleston 10399* (US); creek banks, Pine Valley Mountain, May 17, 1902, *Goodding 855* (Ry, Cl, M); Cienega, 6 miles west of Panguitch Lake, alt. 9000 ft., July 17, 1930, *Goodman & Hitchcock 1578* (UCal, O, G, F, ANS, NY, CAS, UM, M); gravel, Marysvale, alt. 8900 ft., 1894, *Jones 5375W* (US); Brigham Peak, Mt. Ellen, Henry Mountains, alt. 10,500 ft., Aug. 29, 1894, *Jones 5957a* (US); in meadows at Cedar Breaks, Iron Co., Aug. 6, 1934, *Maguire 12995* (M, G, U); meadows above the Breaks, Cedar Breaks, alt. 10,000–11,000 ft., July 19, 1929, *Mathias 686* (G, M); St. George, coll. of 1875, *Palmer* (NY); Beaver Valley, coll. of 1877, *Palmer 347* (NY, M); mountains north of Bullion Creek, near Marysvale, July 23, 1905, *Rydberg & Carlton 7061* (NY); mountains north of Bullion Creek, near Marysvale, July 23, 1905, *Rydberg & Carlton 7077* (NY, G); Bullion Cañon, in and near the Gorge, July 27, 1905, *Rydberg & Carlton 7285* (NY, US, Ry); Zion National Park, June 6, 1929, *Woodbury 29* (US).

8a. Mertensia arizonica var. **Leonardi** (Rydb.) Johnston in Contr. Arnold Arb. No. 3: 83. 1932.

M. Leonardi Rydb. in Bull. Torr. Bot. Club **36**: 680. 1909.

M. Sampsonii Tidestrom in Proc. Biol. Soc. Wash. **26**: 122. 1913.

M. arizonica var. *umbratalis* Macbr., acc. to Macbride in Contr. Gray Herb. N. S. No. 48: 9. 1916, as to synonyms *M. Leonardi* and *M. Sampsonii,* and specimens cited from Utah except *Pammell & Blackwood 3820.*

Very similar to the species; calyx 4–8 mm. long, divided almost to the base, the lobes 3–7 mm. (rarely 2 mm.) long, lanceolate, acute, ciliate; anthers and filaments averaging slightly shorter than in the species.

Distribution: central to north-central Utah and southwestern Wyoming.

Wyoming: moist valley, Aspen Station, Union Pacific Railway, July 9, 1896, *Cleburne* (N); damp underbrush, Darlington Gulch, June 3, 1909, *Willits 67* (Ry).

Utah: Uinta National Forest, alt. 7000–9000 ft., July 14, 1913, *Barnett 114* (US); north slope, Uinta National Forest, alt. 7800 ft., July 14, 1913, *Bowen 1* (US); low moist ground, Alta, summit of Parley's Cañon, alt. 7600 ft., June 27, 1892, *Cleburne* (N); moist ravine, near Alta Summit, Utah Central Railway, Parley's Cañon, alt. 6600 ft., June 27, 1896, *Cleburne* (N); Weber Cañon, July 31, 1875, *Cleburne 1020* (N); Red Butte, Salt Lake City and vicinity, June 26, 1908, *Clemens* (G); Wasatch Mountains, 1908, *Clos 122* (US); stream-side, Puffers Lake, Beaver Co., alt. 10,000 ft., June 26, 1928, *Cottam 3490* (F); stream-side, Summit Co., alt. 9000 ft., July 12, 1928, *Cottam 3754* (CAS); Cottonwood Canyon, Salt Lake, June 27, 1918, *Eastwood 7764* (CAS); Mt. Timpanogos, Wasatch Range, June 15, 1933, *Eastwood & Howell 481* (G, CAS, NY); Pioneer Ranger Station, Fillmore Forest, Sevier Co., alt. 2700 m., July 12, 1917, *Eggleston 13883* (US); Big Cottonwood Canyon, Salt Lake Co., July 22, 1905, *Garrett 1516* (NY); Red Butte Canyon, Salt Lake Co., July 2, 1907, *Garrett 2145* (NY); Emigration Canyon, Salt Lake Co., June 14, 1913, *Garrett 2717* (F, G, NY); Big Cottonwood Canyon, Salt Lake Co., June 8, 1920, *Garrett 2909* (F, NY); City Creek Canyon, Salt Lake Co., June 20, 1923, *Garrett 3035* (G, NY); Hidden Lake Meadow, Utah Co., Aug. 13, 1925, *Garrett 3473* (Ry); Mt. Timpanogos, Utah Co., Aug. 2, 1925, *Garrett 3967* (F); Mt. Timpanogos, Wasatch Mountains, Utah Co., June 12, 1932, *Garrett 6187* (F); Lamb's Canyon, Wasatch Mountains, Salt Lake Co., June 28, 1933, *Garrett 6355* (F); Lamb's Canyon, Salt Lake Co., May 12, 1934, *Garrett 6561* (F); Lamb's Canyon, Salt Lake Co., June 19, 1934, *Garrett 6578* (F); wet places, Mt. Nebo, June 13, 1902, *Goodding 1145* (Ry); in aspen grove, near Bear River, Summit

Co., alt. 2460 m., June 20, 1931, *Goodman 1883* (NY, G, US, M); on aspen slope, east side of Wolf Creek Pass, alt. 9000 ft., June 16, 1933, *Graham 8141* (W, M, Carnegie); under aspens, head of Horse Creek, southwest of Strawberry Reservoir, alt. 7800 ft., June 17, 1935, *Graham 9228* (W, M, Carnegie); dry slopes aspen grove, Timpanogos Canyon, Utah Co., alt. 6800 ft., Sept. 16, 1932, *Harrison 5805* (M); Marysvale, Piute Co., alt. 9000 ft., June 15, 1899, *Jones* (G); Alta, alt. 8500 ft., July 7, 1910, *Jones* (G); Provo, alt. 8000 ft., July 3, 1894, *Jones 5585* (UCal, M, G, US, Ry, NY); Parley's Cañon, alt. 8000 ft., July 1, 1898, *Jones 6471* (US, M); Mill Creek Canyon, July 31, 1884, *Leonard* (K, NY, UCal); on rocks by clear creek, between Cove Fort and Sevier, Sevier Co., alt. 6500 ft., May 9, 1934, *McKelvey 4243* (G); pasture, Moroni Ranger Station, Uinta National Forest, alt. 8950 ft., July 16, 1913, *Ollerton 200* (US); aspen groves, Goodman Ranch, Summit Co., alt. 7900 ft., June 30, 1926, *Payson & Payson 4830* (UCal, Ry, ANS, P, G, US, NY, M); common on somewhat dry slopes near West Fork of Bear River, Uinta Mountains, Summit Co., alt. 9700 ft., July 8, 1920, *Payson & Payson 4927* (UCal, P, M, G, US, Ry, ANS, NY); Uinta Forest Reserve, June 28, 1905, *Potter* (US); Red Rock Cañon, near Salt Lake City, June 11, 1905, *Rydberg 6098* (NY); around and below Twin Lakes, Big Cottonwood Cañon, July 7, 1905, *Rydberg 6743* (NY); headwaters of Little Cottonwood Creek, above Alta, July 10, 1905, *Rydberg 6863* (NY, G); Big Cottonwood Cañon, below Silver Lake, June 27, 1905, *Rydberg & Carlton 6347* (NY); Big Cottonwood Cañon, below Silver Lake, June 29, 1905, *Rydberg & Carlton 6442* (US, NY, Ry); Big Cottonwood Cañon, below Silver Lake, June 29, 1905, *Rydberg & Carlton 6480* (NY); Big Cottonwood Cañon, around Lake Solitude, June 30, 1905, *Rydberg & Carlton 6516* (US, Ry, NY); Manti Forest, alt. 9500 ft., *Sampson* (US); Emigration Cañon, Salt Lake Co., July 17, 1909, *Smith 1846* (Ry, U); aspen thicket, Spring Hollow, Logan Canyon, Cache Co., alt. 7500 ft., June 28, 1910, *Smith 2216* (G, NY, U, Ry); limestone, crossing mountain from Cove Fort east on Clear Brook Stream, Fish Lake National Forest, alt. 6500 ft., May 9, 1934, *Stone 204 in part* (NY); spruce zone, Ephraim Cañon, Wasatch Mountains, alt. 2700 m., Aug. 27, 1907, *Tidestrom 343* (US); abundant in spruce zone, Twelve Mile Cañon, Wasatch Mountains, July 10, 1908, *Tidestrom 1482* (US); cañon south of Glenwood, alt. 7000 ft., June 12, 1875, *Ward 202* (M, F, G, US, ANS); slope of Aquarius Plateau, alt. 8800 ft., Aug. 22, 1875, *Ward 716* (US, M, F, ANS); Parley's Park, alt. 7000 ft., June 1869, *Watson 843* (US); damp sandy loam, aspen area, north slope Fish Creek, Manti Forest, alt. 8850 ft., July 20, 1912, *Willey 179* (U).

8b. Mertensia arizonica var. Grahami, var. nov.[1]

Corolla smaller than in the species, tube 4–6 mm. long, glabrous at the base, limb 5–7 mm. long; insertion of filaments lower in the tube, about 1.5 mm. long; anthers about 3 mm.

[1] **Mertensia arizonica** var. **Grahami**, var. nov., *M. arizonicae* similis; corollae tubo 4–6 mm. longo, basi glabro; corollae limbo 5–7 mm. longo; antheris ca. 3 mm. longis; calyce 3–4 mm. longo, in fructu usque ad 10 mm. longo, triangulari-acuto; nuculeis 4–5 mm. longis, rugosis.

long, base reaching down to the fornices; calyx 3–4 mm. long in anthesis, the triangular acute lobes half as long, becoming much enlarged in fruit, up to 10 mm. long, the lobes longer than the tube; nutlets 4–5 mm. long, slightly rugose.

Distribution: Garfield and probably Rio Blanco Co., Colorado.

COLORADO: at head of Ute Trail, Roan Mountains, July 8, 1922, *Cockerell* (US); canyon at head of west fork of Douglas Creek, Garfield Co., alt. 7700 ft., July 16, 1935, *Graham 9667* (M TYPE, Carnegie, W).

8c. Mertensia arizonica var. **subnuda** (Macbr.), comb. nov.

M. toyabensis var. *subnuda* Macbr. in Contr. Gray Herb. N. S. No. 48: 7. 1916.

Leaves short-strigose on the upper surface, glabrous or sparingly hairy on the lower surface; calyx-lobes divided almost to the base, glabrous on the back or sparingly pubescent, ciliate; anthers 2–2.5 mm. long.

Distribution: Sevier Co., Utah, to White Pine Co., Nevada.

UTAH: Deer Creek, July 29, 1880, *Jones* (G); gravel, Fish Lake, Aug. 10, 1894, *Jones 5801* (M, US, P); Fish Lake Forest, crossing mountain from Cove Fort east on Clear Brook stream, May 9, 1934, *Stone 204 in part* (NY); Fish Lake Mountain, July 8, 1875, *Ward 329* (M, G TYPE, US); Fish Lake Mountain, July 8, 1875, *Ward 338* (US, F).

NEVADA: Snake Creek, Snake Mountains, July 6, 1928, *Jaeger* (G).

The type of *Mertensia arizonica* bears the label "Arizona," but the specimens were collected probably in southwestern Utah.

Mertensia arizonica and its var. *Leonardi* are easily separated in their typical form but a few intermediate forms are hard to place. The var. *Grahami* is closely related to the species and to var. *Leonardi,* but by reason of the smaller flowers, attachment and position of the stamens, and structure of the calyx, is distinct. It is also disjunct in range.

The specimens referred to var. *subnuda* are quite variable as to character of pubescence, but show close affinity to *Mertensia arizonica* var. *Leonardi,* differing mainly in the pubescence. The specimen from Nevada has the calyx less deeply divided than the others.

9. Mertensia mexicana, sp. nov.[1]

Erect (?), probably 8 dm. or more tall; basal leaves unknown; cauline leaves elliptical, 4–12 cm. long, 1.5–4 cm. broad, acute or obtuse, the lowermost petiolate, the upper sessile, glabrous, papillate below, pustulate above, obscurely ciliate; inflorescence axillary, diffuse and multiflorous, the peduncles much elongated (at least in age), bearing many flowers in a modified scorpioid cyme; pedicels 5–20 mm. long, glabrous to sparsely scabrous; calyx 3–4 mm. long in flower, becoming much enlarged in fruit, up to 9 mm. long, divided almost to the base, the lobes lanceolate, obtuse or acutish, short-ciliate, glabrous outside, strigose within; corolla-tube 6–7 mm. long, the glands at the base well developed and sparsely pubescent; corolla-limb 8–9 mm. long, longer than the tube, only moderately expanded; anthers 2–2.5 mm. long, shorter and about as broad as the filaments; filaments 3–3.5 mm. long; fornices prominent, glabrous; style 13–15 mm. long, about as long as the corolla; nutlets 3–4 mm. long, rugose dorsally.

Distribution: known only from the type locality.

MEXICO: road to Porral, near San Julian, State of Chihuahua, alt. 7000–8000 ft., Sept. 8, 1898, *Nelson 4931* (US TYPE, G).

Notwithstanding the remoteness of this species from *M. arizonica* var. *Leonardi* and *M. arizonica* it is closely related to them. The first thing to which attention is called on seeing the plant is the tremendous number of flowers in comparison to the above-mentioned entities. The calyx is similar to that of var. *Leonardi* in form but it is smaller, with the lobes inclined to be more obtuse. The ring of hair which is usually present at the base of the corolla-tube in *M. arizonica* and var. *Leonardi* is represented by some rather inconspicuous hairs on the basal glands. The fornices also lack pubescence. The anthers are

[1] **M. mexicana** sp. nov., erecta, 8 dm. vel plus alta; foliis caulinis ellipticis, 4–12 cm. longis, 1.5–4 cm. latis, acutis vel obtusis, glabris, obscure ciliatis; inflorescentiis axillaribus, diffusis et multifloris; pedicellis 5–20 mm. longis, glabris vel scabris; calyce 3–4 mm. longo, in fructu usque ad 9 mm. longo; calycis lobis lanceolatis, obtusis vel acutis, breviter ciliatis, glabris; corollae tubo 6–7 mm. longo; corollae limbo 8–9 mm. longo, tubum superanto; antheris 2–2.5 mm. longis; filamentis 3–3.5 mm. longis; nuculeis 3–4 mm. longis, rugosis.

slightly shorter than in *arizonica* and about the same as in var. *Leonardi.*

This species is based on but one collection, the specimens of which are not complete and past the best stage of development. More material may disclose other differences.

10. Mertensia campanulata A. Nels. in Bot. Gaz. **54**: 150. 1912.

Erect, 3–8 dm. tall, stems from each rootstalk 1 to few; basal leaves very large in contrast to the cauline leaves, 10–20 cm. long, 2–8 cm. broad, ovate-oblong to oblong-lanceolate, acute or possibly somewhat acuminate, the base decurrent on the petiole, glabrous except the margins sparingly short-strigose, upper surface papillate, petiole 10–20 cm. long; cauline leaves diminishing rapidly in size from base to top of plant, 2–20 cm. long, 0.7–5 cm. broad, ovate to narrowly oblong-lanceolate, acute, acuminate, or obtuse, the lowest petiolate, the rest sessile, glabrous, the upper surface pustulate, the margins rarely developing hairs, more or less glaucous; pedicels 1–10 mm. long, glabrous, glaucous, stout; inflorescence usually much branched, the peduncles bearing a more or less elongated scorpioid cyme; calyx campanulate, 5–7 mm. long, glabrous, lobes short-obtuse, 1–2 mm. long, margins merely pustulate, inner surface of calyx with a few short hairs; corolla-tube 7–10 mm. long, glabrous within; corolla-limb 7–8 mm. long, only moderately expanded, subequal to the tube; anthers 2.5–3.5 mm. long, about as long as or longer than and as wide as or wider than the filaments; fornices inconspicuous, merely a thickening in the tissue; style about the length of the corolla or a little longer; nutlets rugose, about 5 mm. long.

Distribution: Blaine and Camas Counties, Idaho.

IDAHO: near Ketchem, Custer Co. [now Blaine Co.], June 19, 1930, *Applegate 6326* (G); prairie and dry places along roads, Corral, Blaine Co., alt. 5700 ft., June 27, 1916, *Macbride & Payson 2907* (NY, G, Ry, US, M, CAS, UCal); edge of meadow, Alturas Lake, Blaine Co., alt. 6400 ft., Aug. 11, 1916, *Macbride & Payson 3724* (NY, G, Ry, US, M); on moist flat near Alturas Lake, July 12, 1910, *M'Cain* (Ry); Sawtooth National Forest, coll. of 1910, *Woods 230* (Ry); moderately moist meadows, Hailey, Blaine Co., July, 1911, *Woods 328* (G, Ry TYPE).

A conspicuously and well-marked species by reason of the calyx and the stem-leaves which become rapidly reduced upward. A note by the collector attached to one of the type sheets indicated that this species does not grow in such rank stands as does *M. ciliata* nor is it so leafy. The peculiar cam-

Fig. 5. *M. campanulata.* Habit sketch × 1/6; enlarged flower × 2/3.

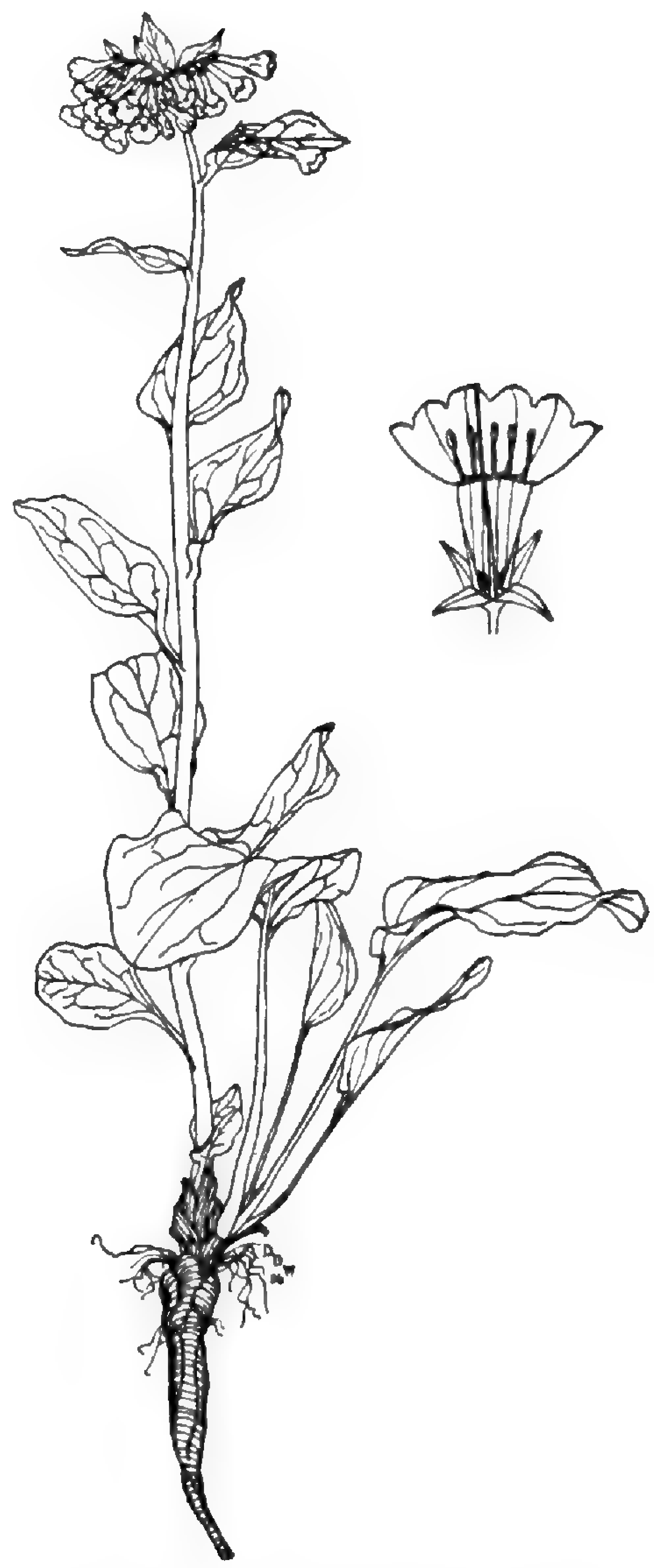

Fig. 6. *M. virginica.* Habit sketch × 1/6; flower × 2/3.

panulate calyx finds its nearest approach in *M. arizonica* among the American species. In Siberia it has a close counterpart in *M. serrulata* (Turcz.) DC., as to calyx development. By a typographical error the number of the type was given as *Woods 325* in the original publication. It should have read *Woods 328*.

11. Mertensia virginica (L.) Pers. ex Link, Handb. **1**: 580. 1829.

M. pulmonarioides Roth, Cat. Bot. **1**: 34. 1797.
Pulmonaria virginica L., Sp. Pl. 135. 1753.
? *P. canadensis* Yong, Cat. 44. 1783, *nomen subnudum.*
? *P. glabra* Stokes, Bot. Mat. Med. **1**: 282. 1812.
Pneumaria virginica Hill, Veg. Syst. **7**: 40. 1764.
Lithospermum pulchrum Lehm., Asperif. pars 2: 290. 1818.
Casselia virginica Dumort., Com. Bot. 24. 1822.
Steenhamera virginica Kosteletzky, Allg. Med. Pharm. Fl. **3**: 838. 1834.
Steenhammera virginica Turcz. in Bull. Soc. Nat. Moscow **14**: 244. 1840.
Hippoglossum virginicum Lilja in Linnaea **17**: 111. 1843.
Cerinthodes virginicum O. Kuntze, Rev. Gen. Pl. pt. 2: 436. 1891.

Stems erect, 1–7 dm. tall, one to several from a thick ligneous root; basal leaves of flowering stems relatively small, the surculose leaves larger, 4–20 cm. long, 2–12 cm. broad, broadly ovate to elliptic, glabrous or usually slightly papillate above, long-petiolate; middle cauline leaves broadly ovate to elliptic-oblong, 4–12 cm. long, 2–9 cm. broad, short-petiolate to sessile, glabrous, the upper leaves reduced, sessile and semiamplexicaul, all leaves pinnately veined; inflorescence borne on peduncles, usually from the axils of leaves, flowers in unilateral or scorpioid cymes, congested at first, much elongated in age; pedicels 3–10 mm. long; calyx 2–10 mm. long (mostly about 3 mm. long), divided almost to the base, the lanceolate to oblong-lanceolate lobes obtuse or acute, accrescent; corolla blue, occasionally white or pinkish, tube 11–21 mm. long (mostly 13–16 mm. long), with a dense ring of hairs at the base within, the limb 7–13 mm. long (mostly 8–10 mm. long), abruptly expanded, campanulate; fornices present but usually inconspicuous; anthers linear-oblong, 1.2–1.7 mm. long; filaments slender, not expanded, 4–8 mm. long; style usually reaching or surpassing the anthers; nutlets about 3 mm. long, rugose on all sides at maturity; gynobase separating the two pairs of nutlets well intruded.

Distribution: New York, Ontario, Wisconsin, and Iowa south, on the east to New Jersey, Delaware, Virginia, Tennessee; on the west to eastern Kansas (Miami Co.), Missouri, and Alabama (Tuscaloosa Co.).

ONTARIO: St. Thomas, May 29, 1904, *Fisher* (ANS); Glen Elgin, Lincoln Co., May 13, 1897, *McCalla 445* (Cl).

NEW YORK: Port Dickinson, Broome Co., coll. of 1895, *Clute* (NY); rich alluvial soil, Negundo Woods, Ithaca, May 8, 1884, *Coville* (US); in alluvium along Enfield Creek below gorge, Ithaca, Tompkins Co., May 10, 1914, *Davis 3058* (Cl, G); flats of stream, near Honeoye Junction, Caledonia, Livingston Co., June 2, 1917, *Eames 8677* (Cl); on banks of Oneida Creek, Durhamville, Oneida Co., May 24, 1920, *House 6920* (Ry, Clokey); East Aurora, May 15, 1926, *Johnson* (NY); along the Chemung River, Chemung Co., fl. May 12, 1897, fr. June 10, 1897, *Lucy 1202* (Ry, F); Genesee River flats, May 14, 1922, *Matthews 2085* (UM); in alluvial soil, along creek bank, Oneida, May 2, 1896, *Maxon* (US, NY); alluvial soil, Ellis Hollow, Ithaca, May 30, 1920, *Muenscher & Bechtel 339* (US, Clokey); alluvial soil south of Chenango River, Chenango Co., June 18, 1924, *Muenscher, Wilson & Foster 15899* (Cl); Ellis Hollow, May 6, 1889, *Norris* (M); Collins, Erie Co., April 15, 1921, and May 16, 1921, *Perkins* (G); in sandy soil along the inlet northwest of Buttermilk Creek, Ithaca, May 8, 1914, *Rodman & Metcalfe 3057* (G); Taughannock Ravine, Ithaca, May 14, 1892, *von Schrenk* (M); Negundo Woods, Ithaca, April 25, 1878, *Trelease* (M); alluvial soil along Cascadilla Creek, Ellis Hollow, Dryden, Tompkins Co., April 25, 1915, *Wiegand 4865* (Cl).

NEW JERSEY: Raritan, May 6, 1886, *Apgar* (NY); Burnt Mills, May, 1889, *Perry* (M).

PENNSYLVANIA: pasture, Sayre, May 4, 1899, *Barbour 613* (Ry); along creek, Millersville, April 30, 1894, *Bitner 2213* (Ry); Peach Bottom, Lancaster Co., April 9, 1910, *Carter* (NY); Corry, May 7, 1896, *Churchill* (US, G, M); Little Conestoga, May 17, 1895, *Eisenhower* (M); low, moist ground, east bank of Schuylkill River, Perkiomen Junction, Montgomery Co., May 4, 1930, *Fogg 4056* (G); banks of Little Conestoga, Lancaster Co., April 28, 1890, *Heller* (US); between York Furnace and Tucquan, Lancaster Co., May 11, 1901, *Heller* (US, G, F); Safe Harbor, Lancaster Co., April 29, 1893, *Heller & Halbach 1325* (US, G, M, NY); foot of moist, wooded slopes, Perkiomen Creek above Graters Ford, Perkiomen Township, Montgomery Co., April 21, 1915, *Long & St. John 2448* (G); Westown Farm, Butternut Island, Chester Co., April 25, 1905, *Moon 25* (US); Union Co., *Noll* (US); banks of the Schuylkill near Conshohoken, April 23–26, 1865, *Parker* (M, F); meadow, near West Chester, May 9, 1882, *Redfield* (M); Moore Township in Stoops Ferry, Allegheny Co., May 7, 1901, *Shafer 314* (Cl); 2 miles north of Wrightsville, York Co., May 2, 1891, *Small* (F); vicinity of Lancaster, May, 1892, *Small* (NY); meadow, Brandywine Creek, Shaw's Bridge, Chester Co., April 26, 1930, *Stone* (G); Williamsport, Lycoming Co., May 25, 1920, *Young* (Cl).

DELAWARE: Mount Cuba, May 10, 1896, *Albrecht* (NY); meadows near Wilmington, May, 1893, *Canby* (P); Centerville, fl. April 20, 1866, fr. June 2, 1866, *Commons* (NY); alluvial soil along Red Clay Creek, Mount Cuba, fl. April 29, 1897, fr. May 8, 1897, *Commons* (NY); meadows, Mount Cuba, May 7, 1893, *MacElwee 1361* (F); Grand Tower, May 1, 1910, *Williamson* (ANS); Mount Cuba, May 1, 1910, *Williamson* (ANS).

MARYLAND: open rocky woods, near Washington D. C., April 10, 1914, *Batchelder* (NY); Lock Raven, April 6, 1906, *Conard 552* (AM); a full acre of this plant on Cayuta Creek, April 10, 1888, *Millspaugh* (US); river bank, Montgomery Co., April, 1897, *Morris* (F); Cumberland, April, 1906, *Perdew* (AM); High Island, Potomac River, April 28, 1881, *Smith* (US, G); flats at upper end, Plummer's Island, in the Potomac River, near Cabin John, Montgomery Co., April 15, 1915, *Standley 11268* (G); Great Falls, Montgomery Co., April 30, 1889, *Sudworth* (M); Plummer's Island, in the Potomac River, near Cabin John, Montgomery Co., April 15, 1915, *Van Eseltine 265* (G); rich soil near a stream, Gunpowder River, May 13, 1894, *Waters* (US).

DISTRICT OF COLUMBIA: High Island, April 24, 1881, *Comstock* (Cl); vicinity of Washington D. C., April 11, 1897, *Kearney* (NY); Plummer's Island, April 23, 1897, *Kearney* (Cl); low grounds, banks of the Potomac, May 10, 1877, *Morong* (M, NY); banks of canal, April 21, 1895, *Pollard 78* (UCal); Rock Creek, April 18, 1897, *Williams* (Ry); banks of Potomac above Washington D. C., April 21, 1908, *Williamson* (ANS).

VIRGINIA: Richmond, April 24, 1924, *Benke 3699* (F); Bedford Co., April 30, 1871, *Curtiss* (G); near Miller School, Alb Co., April 20, 1888, *Finsley* (AM); Battlefield Winchester, April 29, 1896, *Gray 364* (G); alluvial bottoms, near Dead River, Virginia shore of Potomac River, April 19, 1902, *Morris 1463* (AM); woods, Front Royal, Warren Co., April 20, 1912, *Wiegand* (Cl).

ALABAMA: alluvial banks of Rock Creek, in southwestern part of Colbert Co., March 29, 1935, *Harper 3313* (M); moist rocky ground, along small creek, near Black Warrior River, Tuscaloosa Co., April 15, 1929, *Palmer 35376* (M).

OHIO: Columbus, May 8, 1897, *Clevenger* (US); Granville, coll. of 1903, *Condit* (UCal); O. S. U. Island, Franklin Co., May, 1889, *Craig 6014* (Cl); Oberlin, Lorain Co., May 13, 1894, *Dick* (G); swampy ground, banks of Grand River near Soda Ash Plant, Painesville, Lake Co., May 8, 1916, *Douglas* (Cl); wet ground, bank of Kellogg Creek, Painesville, Lake Co., May 19, 1916, *Douglas* (Cl); damp grounds, Bennett's Woods, Carlisle, Lorain Co., May 3, 1902, *Grover & Booth* (UM); Granville, April 18, 1890, *Jones 1323* (Ry); river bottoms, Oberlin, Lorain Co., May 8, 1891, *Kofoid* (Cl); Big Darby, May, 1909, *Mayferth* (UM); Oberlin, Lorain Co., April 28, 1894, *Ricksecker* (US); Fernbank, "North Bend," coll. of 1854, *Short* (UCal); moist woods, Stoney Point, Sedansville, May 5, 1931, *Stephenson* (Ry); Chillicothe, May, 1885, *Wallace 744* (US); Berea, Cuyahoga Co., May, 1897, *Watson* (F); alluvial soil, Garrettsville, Portage Co., April 26, 1908, *Webb* (G).

WEST VIRGINIA: moist hillside near Guyandotte River, Cabell Co., April 6, 1928, *Gilbert 38* (G); Wheeling, April 13, 1878, *Mertz* (NY); rich woods, Morgantown, Monongalia Co., April 11, 1890, *Millspaugh* (NY); near Hampton, Upshur County, April 21, 1895, *Pollock* (P).

MICHIGAN: Ross, Kent Co., May 7, 1889, *Sones* (P).

INDIANA: Honey Creek, Terre Haute, April 17, 1889, *Evermann* (US); Knox

Co., April 23, and May, 1890, *Spillman 360* (P); Crawfordsville, May, 1896, *Thompson* (F); Happy Valley, Hanover, March 20, *Williams 114* (G); Mattsville, May 5, 1892, *Wilson* (NY).

KENTUCKY: Elklick, Fayette Co., March 26, 1927, *Anderson 392* (G); Shelbyville, coll. of 1917, *Flint* (G); rich damp banks in woods, Burgin, Mercer Co., *King 29* (F); moist woods, Bowling Green, April, 1892, *Price* (M); Elkhorn Cliff, farm W. Carlton, Stamping Ground, March 10, 1930, *Singer 16* (US); coll. of 1842, *Short* (US).

TENNESSEE: Sherwood, coll. of 1886-87, *Bridgman* (UCal); rich, wooded banks, Emory River, April 23, 1893, *Kearney 133* (US); to French Broad River above Dandridge, March, 1842, *Rugel* (NY, M); very wet grounds, near Knoxville, April, 1896, *Ruth* (M); low, damp grounds, Harriman, May 1, 1896, *Ruth 147* (G); low wet grounds, Dante, April, 1897, *Ruth 3236* (NY).

WISCONSIN: Kickapoo River bottoms, Ontario, Vernon Co., May 9, 1931, *Fassett & Truman 13034* (M); May 22, 1888, *Scoville* (Ry).

ILLINOIS: alluvial river banks, Dekalb Co., May, *Abbott* (CAS); Riverside, May 10, 1911, *Babcock* (NY); Utica, May 16, 1916, *Benke 1775* (CAS, US); rich woods near Wady Petra, May 4, 1898, *Chase* (US, AM); moist clearing, near Monica, Peoria Co., April 28, 1907, *Chase 1282* (US); Macon Co., April, 1896, *Clokey 227* (Clokey); Rossville, May 2, 1885, *DeForest 364G* (Cl); 3 miles south of Columbia, April 22, 1922, *Drushel 1904* (M); French Village, April 24, 1877, *Eggert* (UCal, M, NY, Ry); Vermilion River, south of Hillery, Vermilion Co., April 27, 1907, *Gates 1407* (US); Decatur, May 8, 1897, *Gleason* (G); rich mesophytic hillsides, Grand Tower, May 5, 1902, *Gleason 2579* (G); in clearing, Starved Rock, La Salle Co., June 1–7, 1909, *Greenman, Lansing & Dixon 100* (NY, G); Peoria, May, 1884, *Heading 2109* (UCal); woods along Des Plaines River, north of Thatcher's Park, May 14, and 26, 1900, *Hill 1280, 1312* (ANS, M); low open woods along stream near Hickory Creek, New Lenox, May 8, 1915, *Johnson 1639* (NY); rich woods, Peoria, May, 1900, *McDonald* (Ry); Augusta, *Mead* (ANS, G); low rich ground, Johnson Co., April 28, 1919, *Palmer 14987* (M); rich woods, 1¼ miles north of "Cottonwood" Station, Urbana, April 24, 1909, *Pease 11835* (G); Kinkade's Woods, Richland Co., May 2, 1926, *Ridgway 2485, 2486, 2487* (M); moist woods, Evanston, coll. of 1879, *Shipman* (ANS); rich woods, Wheatland, April 19, 1896, *Umbach* (US, ANS).

IOWA: 4 miles west of Grinnell, Sugar Creek, May 11, 1907, *Conard 626* (AM); Indianola, May 20, 1885, *Elrod* (UM); Fayette Co., May 28, 1894, *Fink 100* (US, G); Johnston Co., April 28, 1895, *Fitzpatrick & Fitzpatrick* (M, G); rich open woods, Johnston Co., May 11, 1900, *Fitzpatrick & Fitzpatrick* (Cl); rich ground in shade, vicinity of Bentonsport, April, 1930, *Graves 1740* (CAS, M); Iowa City, coll. of 1889, *Hitchcock* (M); Grinnell, coll. of 1876, *Jones* (G); wet woods, Poweshiek Co., June, 1876, *Jones* (CAS); Grinnell, May 7, 1877, *Jones* (NY, Ry); near Grinnell, coll. of 1886, *Norris* (M); rich woods along base of river bluff, near Farmington, Van Buren Co., May 19, 1929, *Palmer 35851* (G); Ames, May 25, 1890, *Raymond* (M); rich woods, Davenport, May 10, 1891, *Ross* (UCal); Iowa City, May 13, 1883, *Shimek* (US); Cou Falls, May 15, 1909, *Somes 3023* (US); Ames, *Stewart 293* (Cl); Scott Co., May 18, 1873, *Suksdorf* (P).

MISSOURI: low grounds, Cass Co., April 30, 1864, *Broadhead* (M); Independence, April 10, 1895, *Bush 365* (M); common in rich woods, Adams Station, April 25, 1897, *Bush 398* (US); along streams, Swan, April 21, 1907, *Bush 4238* (M);

rich bottoms, Monteer, April 28, 1907, *Bush 4374* (M); bottoms, Morgan Co., April 13, 1935, *Bush 14544* (M); banks of streams, Eolia, Pike Co., April 23, 1917, *Davis* (Clokey, Cl); dry open woods, Davis farm, near Whiteside, Lincoln Co., May 19, 1917, *Davis 7296* (M); Jerome, April 22, 1923, *Drushel 1705* (M); near Mincke, April 21, 1918, *Drushel 4065* (M); bridge across Big River, near junction with Flat River, St. Francois Co., April 7, 1929, *Greenman* (M); rich woods, local, Jackson Co., April 25, 1897, *Mackenzie* (M); low rich woods, Galena, Stone Co., May 20, 1914, *Palmer 5656* (M, Cl); wet rocky ground along Stout's Creek, near Arcadia, Iron Co., May 27, 1926, *Palmer 30239* (M); rich shaded ground at foot of bluff, Mine La Motte, Madison Co., April 29, 1931, *Palmer 39154* (G, M); shaded woods, alluvial soil, Irondale, Washington Co., April 15, 1898, *Russell* (M); in shaded ground at base of limestone hill along Big River, 5 miles north of House Springs, Jefferson Co., April 18, 1931, *Steyermark 550* (M); Glencoe, April 27, 1888, *Trelease* (M); moist alluvial bank of a small creek 15 miles southwest of St. Louis, St. Louis Co., April 21, 1934, *Williams 1500* (M, W); Hillsboro, May 24, 1885, *Wislizenus 315* (M).

KANSAS: Miami Co., April, 1885, *Oyster* (CAS); woods, Miami Co., May, 1883, *Oyster 5856* (P).

Mertensia virginica is possibly one of the oldest species of the genus found on our continent. Within its range are the oldest available land areas of the continent. The distinction of occurring on these old land masses is not shared with any other species. Neither does it share with most other species of the genus the complex variations which make the definition of entities so difficult. No close specific relationship between this species and any other is readily suggested. If it were necessary to show relationship, *M. ciliata* and its varieties probably are more closely allied than any other.

The author is indebted to Mr. J. Ramsbottom and Mr. A. H. G. Alston, of the British Museum of Natural History, who kindly have made a comparison of material sent them *(Williams 1500)* with Linnaeus' specimen in the Linnean Herbarium. The type is marked "virginica" and "K" (i.e. Kalm) in Linnaeus' hand. Kalm collected in Pennsylvania, New York, New Jersey, and Canada.

12. Mertensia ciliata (James) G. Don, Gen. Hist. **4**: 372. 1838.

M. polyphylla Greene, Pittonia **4**: 87. 1899.

M. punctata Greene, *l.c.* 88.

M. ciliata var. *longipedunculata* A. Nels. in Bull. Torr. Bot. Club **29**: 402. 1902.

M. picta Rydb. in Bull. Torr. Bot. Club **31**: 638. 1904.

M. ciliata polyphylla A. Nels. in Coult. & Nels., Man. Ry. Mt. Bot. 421. 1909.

M. ciliata punctata A. Nels., *l.c.*

M. pallida Rydb. in Bull. Torr. Bot. Club **36**: 680. 1909.

M. incongruens Macbr. & Payson in Contr. Gray Herb. N. S. No. 49: 66. 1917.

Pulmonaria ciliata James in Trans. Am. Phil. Soc. II. **2**: 176. 1825, name only; Torr. in Ann. Lyc. N. Y. **2**: 224. 1828.

Fig. 7. *M. ciliata.* Habit sketch × ⅛; enlarged flower × 1.

Erect or ascending, 1–12 dm. tall, usually with many stems from each rootstalk; basal leaves variable, oblong- to ovate- or lanceolate-subcordate, 4–15 cm. long, 3–10 cm. broad, ciliate on the margins, often papillate on the upper surface, petioles longer or shorter than the blades; cauline leaves lanceolate to ovate, acute, acuminate or obtuse at the apex, attenuate to subcordate at the base, the lowermost short-petiolate, the uppermost sessile, ciliate on the margins, often papillate on the upper surface (the papillae often mucronate on the uppermost leaves), often quite glaucous, thin in texture; pedicels 1–10 mm. long, glabrous, papillose or rarely with a few short strigose hairs; inflorescence from the axils of leaves, the peduncles elongated in mature or well-developed plants, in young plants the flowers aggregated at the top of the plant, each peduncle terminated in a modified ebracteate scorpioid cyme, or occasionally subumbellate; calyx-lobes 1.5–3 mm. long, glabrous on the back, ciliate to papillate on the margins, more or less strigose within, obtuse or rarely somewhat acute, divided almost or quite to the base, rarely enlarged in fruit; corolla-tube 6–8 mm. long (mostly about 7 mm.), glabrous or with crisped hairs within; corolla-limb 4–10 mm. long (mostly about 6 mm.), sometimes longer than the tube, moderately expanded; anthers 1–2.5 mm. long (mostly about 2 mm.), as long as or shorter, and narrower, than the expanded part of the filament; fornices prominent, glabrous, papillate or pubescent; style about as long as the corolla or exceeding it; nutlets rugose or mammillate.

Distribution: cosmopolitan in moist hills and foothills and up to about 12,000 feet elevation in the mountains from Montana, Colorado, and Wyoming, to eastern Oregon, south to northern New Mexico.

MONTANA: along streams, Mt. Bridger, alt. 6000 ft., July 17, 1905, *Blankinship 376* (US, UM, M, ANS); Helena, June 25, 1908, *Butler 751* (NY); Deer Lodge National Forest, Aug. 13, 1911, *Fleming 91* (US); Spanish Basin, Madison Range, July 11, 1896, alt. 6000 ft., *Flodman 751* (NY); Stillwater Co., alt. 1600–2400 m., July, 1920, *Kemp 41* (NY); Lima, June 28, 1895, *Rydberg 2777* (NY TYPE *M. pallida);* Spanish Basin, Gallatin Co., alt. 6500 ft., June 23, 1897, *Rydberg & Bessey 4876* (G); mountains, Lima, June 30, 1895, *Shear 3395* (US, NY); Hellroaring Plateau, Beartooth Forest, Rock Creek District, July 25, 1921, *Simms & Zeh 683* (UM); moist open hillside upper Hyalite Trail, Middle Creek Canyon, Gallatin Co., Aug. 3, 1927, *Swingle* (Ry); Belt Mountains, July 25, 1888, *Williams 130* (US).

WYOMING: Horse Creek, July 11, 1892, *Buffum 646* (Ry); moist hillside, Mt. Washburn, Yellowstone Park, alt. 9000 ft., July 3, 1931, *Condon 5766* (M); headwaters, Cliff Creek, alt. 9000 ft., Aug. 9–18, 1900, *Curtis* (NY); Heather Creek Ranger Station, Hayden Forest, Carbon Co., alt. 2300 m., July 4, 1915, *Eggleston 11260* (US); along streams, Clark's Fork and Big Horn Mountains, 1881–1882, *Forwood* (US); moist places, Wind River Mountains, July 24, 1881–1882, *Forwood* (US); wet hillside, Ten Sleep Lakes, Big Horn Co., July 30, 1901, *Goodding 409* (UCal, M, Cl); Coal Creek, Teton Mountains, alt. 8200 ft., on stony creek bank, Aug. 15, 1921, *Hall 11447* (G); Gros Ventre Pass, head of Pierre's Hole, alt. 7000 ft. (also on Madison River), June 18, 1860, *Hayden* (M); Lake Fork, alt. 5000 ft., June 22, 1860, *Hayden* (M); near head Bear Creek, Gray's River drainage, Wyoming Forest, July 10, 1914, *Jewell & Woods 69* (Ry); Sherman, alt. 8000 ft., Aug. 1, 1905, *Johnson 123* (NY); head of Swan Lake Valley, Yellowstone National Park, July 11, 1888, *Knowlton* (US); Uinta Mountains, Aug. 1872, *Leidy* (ANS); Uinta Mountains, Aug., 1873, *Leidy* (US); Sherman, alt. 8235 ft., July 27, 1884, *Letterman* (M); Apollinaris Spring, Yellowstone National Park, July 17, 1902, *Mearns 1939, 1940* (NY); Teton Mountains near Leigh Lake, July 26, 1901, *Merrill & Wilcox 1129* (NY, US, G, Ry);

North Chugwater, July 7, 1894, *Nelson 313* (Ry); Sybille Creek, July 8, 1894, *Nelson 408* (US, G, Ry, M, NY); Garfield Peak, July 29, 1894, *Nelson 689* (Ry); Union Pass, Aug. 13, 1894, *Nelson 1028* (US, Ry, Cl, M, G, NY); Union Peak, Aug. 13, 1894, *Nelson 1031* (Ry); Table Mountain, June, 1895, *Nelson 1392* (Ry); stream banks, Chug Creek, Albany Co., June 30, 1900, *Nelson 7321* (US, G, NY, O, Ry TYPE *M. ciliata* var. *longipedunculata,* M, C); on shaded creek banks, Nash's Fork, Albany Co., July 28, 1900, *Nelson 7752* (NY, US, G, M, Ry); wet banks, Little Goose Cañon, Sheridan Co., July 28, 1901, *Nelson 8531* (Ry); banks of streams, Centennial, Albany Co., July 27, 1902, *Nelson 8695* (US, NY, UCal, G, M, Ry, Cl); subalpine creek banks, Centennial, Albany Co., July 31, 1902, *Nelson 8723* (US, G, Ry, Cl, M); stream banks, Birds Eye, June 22, 1910, *Nelson 9422* (M, US, G, NY, Ry); Horse Creek, July 10, 1897, *Nelson 76* (NY); about clumps of willows on a creek bank, Mammoth Hot Springs, July 4, 1890, *Nelson & Nelson 5669 in part* (NY, G, AM, US, Ry, Cl); wet wooded copses, Soda Butte, July 14, 1899, *Nelson & Nelson 5835* (P); Mammoth Hot Springs, July 13, 1905, *Oleson* (Ry); Dome Lake, Elk Mountain, Sheridan Co., alt. 10,500 ft., June 28, 1897, *Pammel & Stanton* (M); dry stony slopes, mountains 5 miles east of Afton, Lincoln Co., alt. 10,000 ft., July 3, 1923, *Payson & Armstrong 3354* (Ry, M); Sheep Mountain (Ferry Peak), Snake River Range, near Alpine, Lincoln Co., moist banks, middle elevations, July 11, 1923, *Payson & Armstrong 3442* (Ry, Cl, M, ANS, G); cliffs, mountains near Cottonwood Lake, east of Smoot, Lincoln Co., alt. 10,000 ft., July 21, 1923, *Payson & Armstrong 3668* (G, M, ANS, Ry, Cl); limestone cliffs, Teton Pass Mountains, east of Victor, Idaho, alt. 9800 ft., July 25, 1920, *Payson & Payson 2140* (CAS, M, Ry, G, NY); Horse Creek, 7 miles west of Merna, Sublette Co., creek bank, July 16, 1922, *Payson & Payson 2726* (G, Ry, UCal, M, ANS); alpine rock slides, Wind River Mountains, 10 miles northeast of Fremont Lake, Sublette Co., July 30, 1922, *Payson & Payson 2886a* (Ry); moist ledges at summit, Saltlick Mountain, northeast of Kendall, Sublette Co., Aug. 7, 1922, *Payson & Payson 2971* (UCal, G, O, US, NY, Ry, M, ANS); small brook and hillsides on Deer Creek, north side of Laramie Mountains, Aug. 17, 1899, *Schuchert* (US); Little Medicine River, near the John Burnett Ranch, Aug. 18, 1899, *Schuchert* (US); Plumbago Cañon, Aug. 26–27, 1899, *Schuchert* (US); stream banks, Little Goose Canyon, Sheridan Co., June 22, 1913, *Sharp 365* (Ry); head of Big Goose Creek, Big Horn Mountains, July 15–24, 1893, *Tweedy 33* (US); headwaters of Tongue River, Big Horn Mountains, July, 1898, *Tweedy 118* (NY); Spread Creek, Teton Forest Reserve, alt. 6500 ft., Aug., 1897, *Tweedy 164* (NY); Big Horn, Sheridan Co., alt. 6000 ft., July, 1899, *Tweedy 2599, 2600* (NY); eastern slope of the Big Horn Mountains, headwaters of Clear Creek and Crazy Woman River, alt. 7000–9000 ft., July 20–Aug. 15, 1900, *Tweedy 3573, 3574* (NY, P, Ry); foothills, rolling plains between Sheridan and Buffalo, alt. 6000 ft., June 15–July 15, 1900, *Tweedy 3575* (NY); Copperton, Carbon Co., alt. 8700 ft., Aug. 5, 1901, *Tweedy 4265* (US, NY); Battle, Carbon Co., Continental Divide, alt. 10,000–11,000 ft., Aug. 1, 1901, *Tweedy 4266* (NY); river bottoms, Encampment, Carbon Co., alt. 7200 ft., June 15, 1901, *Tweedy 4267* (US, NY); bank of stream, 20 miles northwest of Lost Cabin, alt. 6000 ft., Fremont Co., July 5, 1921, *Wiegand, Castle, Dann & Douglas 2078* (Cl); banks of Trail Creek, vicinity of Teton Pass, Teton Co., alt. 7500 ft., July 1, 1932, *Williams 791* (NY, Ry, U, O, CAS, M); banks of Trail Creek, vicinity of Teton Pass, Teton Co., July 3, 1932, *Williams 797* (NY, M, O, Ry); hillsides and cliffs, Glacier Canyon, Grand Teton National Park, July 23, 1932, *Williams 926* (NY, M, O, Ry); spring bank, Roosevelt Meadows, headwater of the Hoback River, Lincoln Co., July 11, 1933, *Williams 1250* (W, M); moist hillside, Two Ocean Mountain, Continental Divide, Aug. 1, 1933, *Williams 1370* (M, W); in willows along Lizard Creek, Teton Co., June 20, 1934, *Williams 1622* (M, W); in willows along Pacific Creek, dense shade, Teton Co., June 29, 1934, *Williams 1640* (W, M); in tremendous masses along a creek below Lake Solitude, Aug. 9, 1934, *Williams 1700* (W, M); creek bank in moist woods, Happy Jack Canyon, Albany Co., June 6, 1934, *Williams 1712* (M, W); creek-bank near Powder River Pass, Big Horn Mountains, Johnson Co., July 4, 1935, *Williams 2335* (W, M, ND, P); rocky dry creek-bank near Libbey Creek, Medicine Bow Mountains, Albany Co., July 13, 1935, *Williams 2385* (W, M, ND, P); rocky roadside, Medicine Bow Mountains, Albany Co., along Libbey Creek, July 14, 1935, *Williams 2401* (W, M, ND); Bradley Lake, moist situation, June 24, 1931, *Williams & Pierson 209* (M, O, W); among willows, moist places, Black Rock Meadows, Teton Co., June 11, 1934, *Williams & Williams 1600* (M, W).

COLORADO: Chambers Lake, July 13, 1896, *Baker* (UCal, M, NY); Black Cañon, June 20, 1901, *Baker 189* (UCal, US, Ry, M, O, NY, G); Van Boxle's Ranch, above Cimarron, July 10, 1901, *Baker 403* (UCal, US, NY, G, Ry, O, M); Marshall Pass, alt. 10,000 ft., July 19, 1901, *Baker 486* (US, G, NY, P); near Pagosa Peak, alt. 12,000 ft., Aug., 1899, *Baker 559* (UCal, G, O, NY, US, Ry, AM, ND, TYPE *M. polyphylla*, M); near Pagosa Peak, alt. 10,000 ft., Aug., 1899, *Baker 560* (M, US, UCal, Ry, G, NY, O, AM, TYPE *M. punctata* not in ND, not seen); hills, Larimer Co., alt. 9500 ft., July 18, 1895, *Baker 7599* (US, Ry); along trail up cliff near Glass Lake, alt. 11,000 ft., Rocky Mountain National Park, Aug. 23–30, *Baker 4718b* (UCal); abundant along streams, Bob Creek, West LaPlata Mountains, June 26, 1898, *Baker, Earle, & Tracy 180* (Ry, M, N, G, US, NY, O, F, Cl); vicinity of Bald Pate, July 14, 1923, *Bebb 3204* (M); Breckenridge, *Bereman 769* (M); Green Mountain Falls, alt. 7500 ft., July 13, 1895, *Bessey* (NY); Cochetopa National Forest, July 20, 1911, *Bliss* (US); Middle Beaver Creek, alt. 11,000 ft., July 24, 1903, *Blumer* (G); Breckenridge, coll. of 1871, *Brandegee* (M); vicinity of Cañon City, near snow line, May, 1871, *Brandegee* (ANS); Fremont Co., 1873, *Brandegee 650* (ANS); Breckenridge, coll. of 1871, *Brandegee 277* (ANS); Ophir waterfall at the end of pipe-line, near Suffolk Mill, *Brewster* (C); Brookvale, Clear Creek Co., June 15, 1918, *Churchill* (M); Mt. Baldy, alt. 3500 m., July 15, 1901, *Clements & Clements 288* (US, NY, G, Cl, M, Ry); Peak Valley, alt. 3800 m., Aug. 21, 1901, *Clements & Clements 367* (US, NY, G, Ry, M, Cl); Dark Cañon, alt. 2800 m., Pike's Peak Region, July 15, 1901, *Clements & Clements 376* (G, US, NY, Ry, Cl, M); Turquoise Lake, Lake Co., damp shore, alt. 10,200 ft., July 3, 1915, *Clokey 2746* (Clokey); wet soil, Tolland, alt. 8800 ft., July 19, 1917, *Clokey 2851* (CAS, US, Clokey, Ry, Ariz, G, NY); moist soil, Lake Eldora, Boulder Co., alt. 9250 ft., July 18, 1918, *Clokey 3157* (Clokey); open ground, Everett, Lake Co., alt. 10,200 ft., July 6, 1919, *Clokey 3519* (Clokey, O); along wooded stream, Twin Lakes, 9400 ft., July 14, 1919, *Clokey 3553* (CAS, US, Clokey, NY, G); Estes Park, Aug. 10, 1904, alt. 8000 ft., *Cooper 284* (Ry); moist ground in shade, Hotchkiss, June 22, 1892, *Cowen* (NY); mountains above Boreas, alt. 12,000 ft., July 24, 1897, *Crandall* (UCal, NY, Ry); swamp, above Beaver Creek, alt. 9500–12,000 ft., July 7, 1896, *Crandall 1644* (US, G, UM, P); near Ironton, San Juan Co., July 21–31, 1899, *Curtis* (Ry, NY); near snow, Broomerville, alt. 10,000 ft., July 7, 1906, *Daniels 320* (M); Trapper's Lake, alt. 10,000 ft., Aug. 31, 1910, *Dirce 7481* (C); Gray's Peak, July, 1888, *Eastwood* (C); Columbia Mine, Telluride, May 18, 1896, *Eby* (M); vicinity of Mt. Carbon, Gunnison Co., alt. 2730 m., July 6, 1910, *Eggleston 5881* (US); western slope of Mt. Massive, Leadville Forest, Lake Co., alt. 3100–4000 m., Sept. 10, 1915, *Eggleston 11883* (US); along Spring Creek, above Idaho, July 31, 1874, *Engelmann* (M); banks of mountain streams, below Berthoud Pass, alt. 10,000–11,000 ft., Aug. 10, 1874, *Engelmann* (M); wet rocks, Georgetown, Aug. 17, 1874, *Engelmann* (M); Palmer Lake, July 13, 1901, *Ferril* (C); Hancock, Aug. 17, 1905, *Ferril* (C); divide between Arkansas River and South Park, coll. of 1845, *Fremont's Expedition to Rocky Mts.* (US, NY); Crystal Park, near Manitou, Aug. 14, 1885, *Fritchey* (M); Berthoud Pass, Aug. 5, 1930, *Fuller* (M); marshes, summit of North Park Range, Larimer Co., Aug. 11, 1903, *Goodding 1855* (US, Ry, Cl, UCal, M, G, NY, C, ANS); near Golden City, coll. of 1870, *Greene* (G); Ruxton Creek, Pike's Peak, July 22, 1919, *Hall* (UCal); moist soil on edge of stream near Lake Common, Trappers Lake, Garfield Co., Aug. 3, 1933, *Hanna 1344* (M); along creek near Ward, alt. 9400 ft., June 25, 1931, *Hanson C294* (M); Cameron Pass, Sept. 2, 1890, *Herb. State Agric. Coll. 1639* (NY); rocky bank of White River, one-fourth mile north of Trappers Lake, alt. 9450 ft., July 29, 1933, *Hermann 5441* (G); Red Mountain, Aug. 6, 1904, *Huestis 2117* (C); crevices of rocks along the streams within the Rocky Mountains, *James* (NY TYPE); on Long's Peak, July, 1905, *Johnston 80* (Ry); along stream, Allens Park, July 17, 1917, *Johnston & Hedgcock 542* (G); Manitou, July, 1878, *Jones* (US); Gray's Peak, alt. 11,500 ft., Aug. 28, 1878, *Jones 693* (NY, G, U); above Vallecito, alt. 12,000 ft., Sept. 4, 1903, *Knowlton 56* (US); near Breckenridge, Summit Co., alt. 12,000 ft., Aug., 1901, *Mackenzie 321* (M, Ry); near a stream, Wagon Wheel Gap Exp. Station, Mineral Co., June 25, 1911, *Murdoch 4639* (CAS, US, Clokey, M); Cameron Pass, Larimer Co., Aug. 5, 1893, *Osterhout* (O); Estes Park, Larimer Co., July 17, 1897, *Osterhout* (UCal); moraine, Estes Park, Larimer Co., June 23, 1894, *Osterhout 308* (O); Dale Creek, Larimer Co., July 19, 1899, *Osterhout 1869* (O); Red Cliff, Eagle Co., June 26, 1900, *Osterhout 2165* (O); Ward, Boulder Co., July 17, 1901, *Osterhout 2449* (O, NY); Moraine Park, Larimer Co., July 20, 1903, *Osterhout 2823* (O, NY TYPE *M. picta*); above Arrow, Grand Co., July 20, 1906, *Osterhout 3284* (O); Chambers Lake, Larimer Co., July 3, and Aug. 12, 1908, *Osterhout 3728, 3780* (O); Buckhorn Creek, Larimer Co., June 3, 1916, *Osterhout 5499* (O); Long's Peak Inn, Larimer Co., July 13, 1917, *Osterhout 5651* (O); wet rocky ground, near Tolland, Gilpin Co., June 24, 1926, *Palmer 31264* (M); Baldwin Cañon, Alpine Co., July 2, 1876, *Papineau 65* (US); Colorado Territory, coll. of 1872, *Parry* (G, NY, ANS, M); from the head-waters of Clear Creek, and the alpine ridges lying east of "Middle Park," Colorado Territory, coll. of 1861, *Parry 285* (NY, M, G); Colorado Territory, lat. 39–41°, coll. of 1862, *Parry 442* (US); brookside, Uncompahgre Divide, alt. 9000 ft., July 27, 1914, *Payson 538* (M, C, G, Ry); subalpine basin, Pike's Peak, Aug. 2, 1919, *Payson 1568* (Ry, M); Silver Lake, Aug., 1914, *Phelps* (CAS); Gray's Peak, Aug. 10, 1871, *Porter* (US); North Boulder Creek, alt. 2700 m., June 30, 1905, *Ramaley 1176* (C); Ward, July 18, 1907, *Ramaley 3179, 3220* (UCal); South Boulder Canyon, Boulder Park, Tolland, alt. 6800 ft., Aug. 24, 1907, *Ramaley 3817* (UCal, Ry, AM, C); stream-side, Mammoth Gulch, July 4, 1908, *Ramaley 5349* (C); in shade of willows, Corona Lake, Aug. 28, 1908, *Ramaley 6085* (C); Jenny Lake, July 8, 1909, *Ramaley 6613* (C); Stuart Lake, near Tolland, July 31, 1918, *Ramaley 11438* (C); near 4th July Mine, July 29, 1906, *Ramaley & Robbins 2466* (Ry) and *2566* (C); North Boxelder, alt. 7000 ft., June 8–11, 1907, *Ramaley & Robbins 2806* (C); Rollins Pass, Corona, alt. 11,000–11,700 ft., Aug. 7–8, 1907, *Ramaley & Robbins 3327* (Ry, C); near Hot Sulphur Springs, alt. about 7600 ft., Aug. 3–8, 1907, *Ramaley & Robbins 3651* (C, Ry); shrub zone around lake, Tolland, July 4, 1908, *Ramaley & Robbins 5177, 5687* (C); Tolland, July 4, 1908, *Ramaley & Robbins 5222* (Ry); Redrock Lake about 4 miles west of Ward, Boulder Co., alt. about 10,000 ft., Aug. 18, 1908, *Ramaley & Robbins 6031* (C); flank of Snowy Range, Wet Mountain Valley, July 24, 1872, *Redfield* (M); Sugar Loaf Mountain, July 21, 1906, *Robbins 2177, 2208* (Ry, C); Eldora, July 27, 1906, *Robbins 2308* (C, Ry); near Beulah, June 5–9, 1908, *Robbins 4969* (C, Ry); Mt. Audubon, July 19, 1908, *Robbins 5842* (C); Duck Lake, July 20, 1908, *Robbins 5924* (C); East Lake, Tolland, June 22, 1910, *Robbins 7700* (C); Forest Lakes, June 26, 1910, *Robbins 7740* (C); Georgetown, Aug. 19, 1895, *Rydberg* (NY); West Indian Creek, June 14–15, 1900, *Rydberg & Vreeland 5692* (NY, Ry); headwaters of Pass Creek, June 30, 1900, *Rydberg & Vreeland 5693* (NY); Halfway House, Pike's Peak, May 3, 1896, *Shear 3716* (NY, US); Georgetown, Aug. 20, 1895, *Shear 4711, 4712* (NY); Ouray, July 26, 1897, *Shear 4923* (NY); swamp-borders, North Park near Teller, alt. 8000 ft., July 30, 1884, *Sheldon 144* (US); shady moist places, Buena Vista, alt. 8000 ft., July 5, 1892, *Sheldon 533* (US); Gray's Peak, at timberline, Aug. 31, 1884, *Smith* (ANS); Rollins Pass, alt. 11,660 ft., Aug. 17, 1905, *Smith* (ANS, M); South Park, Aug., 1874, *Smith 15* (NY); Farnham, July 10, 1891, *Smith* (M, P); 15 miles from Pagosa Springs, on Wolf Creek Pass Road, alt. 7000–7500 ft., May 28, 1934, *Stone 568* (NY); common at head of West Miller Creek, White River Region, Aug. 7, 1908, *Tidestrom 1676* (US); vicinity of Mt. Carbon, abundant in moist draws and along streamlets, July 11, 1910, *Tidestrom 3740* (US); Argentine Pass, July 15, 1886, *Trelease* (M); La Plata Mountains, alt. 11,500 ft., July 20, 1896, *Tweedy 551* (US); Eldora to Baltimore, alt. 8500–9500 ft., June 20–July 10, 1903, *Tweedy 5666* (NY, Ry); Uncompahgre Forest, alt. 11,500 ft., July 10, 1913, *Watkins 132* (US); moist meadows, Rabbit Ears Pass, Jackson Co., July 20, 1935, *Williams 2426* (M, ND, P, W); summit Wolf Creek Pass, San Juan Mountains, Mineral Co., July 28, 1928, *Wolf 2998* (CAS, G); June, 1873, *Wolf 709* (US); slopes of Mt. Chapin, Larimer Co., Aug. 14, 1927, *Woodson 1862* (M); Pike's Peak, June 27, 1907, *Wooton* (AM); Estabrook, Park Co., July 15, 1919, *Young* (Cl); Duck Lake, July 18, 1935, *Zobel* (CAS).

NEW MEXICO: low wet banks along Costilla Creek, Costilla Park, Taos Co., alt. 9600 ft., Sept., 1894, *St. John 6* (G).

ARIZONA: without definite locality, coll. of 1869, *Palmer* (US); without definite locality, coll. of 1876, *Palmer 378* (US, ANS, F).

IDAHO: "Thornburg's Ravine" of Nuttall, Wildhorse Creek, head of Big Lost River, Lemhi Forest, Custer Co., alt. 2400 m., Aug. 4, 1917, *Eggleston 14075* (US, G); along creek from Meadow Lake, Lemhi Range, alt. 9000 ft., Aug. 23, 1921, *Hall 11531* (G); Soldier Mountains, alt. 8000 ft., July 16, 1895, *Henderson 3193* (US); loamy stream-sides, shade, Silver City, Owyhee Co., July 18, 1910, *Macbride 416* (US, G, NY, UCal, Ry, P, M); stream bank, Trinity Lake region, Elmore Co., alt. 8000 ft., Aug. 30, 1910, *Macbride 693* (Ry); edge of meadow near creek, Corral, Blaine Co., alt. 5700 ft., June 28, 1916, *Macbride & Payson 2926* (G, NY, US, UCal, CAS, Ry, M); wet creek bank, Bear Creek below Parker Mountain, Custer Co., alt. 6000 ft., July 18, 1916, *Macbride & Payson 3282 in part* (UCal, NY); creek bank, Bonanza, Custer Co., alt. 6500 ft., July 28, 1916, *Macbride & Payson 3491* (M, Ry, G); moist gorge near stream, Smoky Mountains, Blaine Co., alt. 9000 ft., Aug. 13, 1916, *Macbride & Payson 3742* (US, G, Ry, M); moist brook bank, Smoky Mountains, Blaine Co., alt. 9500 ft., Aug. 13, 1916, *Macbride & Payson 3759* (US, CAS, NY, UCal, G TYPE *M. incongruens*, M, Ry); Owyhee Mountains, July, 1892, *Mulford* (M); stream edge, Deer Creek, Owyhee Co., July 1, 1912, *Nelson & Macbride 1854* (Ry); swampy ground, Caribou Mountain, Bonneville Co., July 19, 1923, *Payson & Armstrong 3582* (G, Ry, M); protected calcareous cliffs, base to summit of mountains northeast of lake, Henry Lake, Fremont Co., alt. 9200 ft., July 11, 1920, *Payson & Payson 1956* (M, NY, Ry, G) and *1957* (NY, CAS, G, M, Ry); shady banks, Henry Lake, Fremont Co., alt. 6000 ft., July 12, 1920, *Payson & Payson 1999* (NY, G, M, Clokey, CAS, Ry); cliffs on north side of peak, base to summit of mountains northeast of lake, Henry Lake, Fremont Co., alt. 9200 ft., July 17, 1920, *Payson & Payson 2050* (G, CAS, NY, Ry, M); Palisade National Forest, St. Anthony, June 28, 1915, *Pickett 100* (Ry); moist situations in good soil, Sawtooth National Forest, Hailey, coll. of 1910, *Woods 325* (Ry); Poison Creek, Sawtooth Mountains, July 31, 1909, *Woods & Tidestrom 2627* (US).

UTAH: Silver Lake, Big Cottonwood Cañon, Sept. 30, 1909, *Clemens* (NY, Clokey); Silver Lake, Big Cottonwood Cañon, Sept. 14, 1910, *Clemens* (Clokey); June–July, 1869, *Eaton 247* (CAS); Uinta Mountains, Aug. 23, 1859, *Engelmann* (M); Big Cottonwood Canyon, Salt Lake Co., July 22, 1905, *Garrett 1510, 1513* (NY); in wet places in rich soil, Big Cottonwood Canyon, Salt Lake Co., Aug. 1, 1906, *Garrett 1888* (NY); Mt. Timpanogos, Wasatch Mountains, Utah Co., July 25, 1927, *Garrett 3696a* (CAS); Mt. Timpanogos, Wasatch Mountains, Utah Co., Aug. 6–15, 1930, *Garrett 5674, 5725* (G) and *5760* (UCal); Bald Mountain, Uintah Co., Aug. 7, 1930, *Garrett 5685* (F); along creeks, Dyer Mine, Uinta Mountains, June 30, 1902, *Goodding 1200* (US, G, NY, Cl, Ry, M); damp grassland near willows, Uinta Mountains, Summit Co., alt. 2600 m., June 23, 1931, *Goodman 1837* (US, M, NY, G); damp soil in willows, near Bear River, Summit Co., alt. 2460 m., June 28, 1931, *Goodman 1842* (US, UM, M, NY, G); alpine in the Uinta Mountains, Summit Co., alt. 3600 m., Aug. 4, 1931, *Goodman 1899* (US, G, NY, M); along stream, East Fork of Bear River, Uinta Mountains, Summit Co., alt. 8900 ft., July 9–13, 1930, *Goodman & Hitchcock 1492* (CAS, M, UCal, NY, O, G); near snow banks, divide between East Fork of Bear River and Black's Fork, Uinta Mountains, Summit Co., alt. 11,000 ft., July 9–13, 1930, *Goodman & Hitchcock 1513* (UCal, CAS, NY, O, G, M); along creek north of Moon Lake, Duchesne Co., alt. 8200 ft., July 1, 1931, *Graham 6552* (W, Carnegie, M); Blanchard Park, head of Dry Fork Creek, Uintah Co., alt. 10,000 ft., July 5, 1933, *Graham 8393* (W, Carnegie, M); meadow above trees, north of Chain Lakes, southeast slope of Mt. Emmons, Duchesne Co., alt. 11,400 ft., July 20, 1933, *Graham 8569* (W, Carnegie, M); along stream, in lodgepole spruce woods between Paradise Park and Chepeta Lake, Uinta Mountains, Uintah Co., alt. 10,000 ft., Aug. 20, 1935, *Graham 10086* (W, Carnegie, M); damp sandy creek bank, Moon Lake, Ashly Forest, Duchesne Co., alt. 8100 ft., June 16, 1934, *Harrison & Larsen 7741, 7742* (M); grassy savannah, bordered by willows, Carter Creek, Daggett Co., alt. 8200 ft., June 19, 1934, *Harrison & Larsen 7885* (M); rocky alpine meadow, ground moraine at timber line, Krebs Basin, southeast slope, Mt. Emmons, Duchesne Co., alt. 11,300 ft., July 18, 1933, *Hermann 4934, 4934½* (G); edge of timber line, northwest slope, Lamotte Peak, Summit Co., alt. 11,200 ft., Aug. 15, 1933, *Hermann 5959* (G); crevices in loose rock, barren northwestern slope, Lamotte Peak, Summit Co., alt. 11,800 ft., Aug. 15, 1933, *Hermann 5967* (G); American Fork, July 6, 1895, *Jones* (UCal, NY); Alta, Wahsatch Mountains, Bald Mountain, alt. 11,000 ft., Aug. 13, 1879, *Jones 1256* (NY, U); along stream in aspen, Tony Grove, Logan Canyon, Cache Co., Sept. 22, 1932, *Maguire & Maguire 3726* (U); about spring in meadow, spruce belt, saddle between Mt. Peale and Mt. Tukunikivatz, San Juan Co., alt. 10,500 ft., July 5, 1932, *Maguire & Redd 2116* (U); wet place under cliffs, Stillwater Basin, head Bear River, Summit Co., alt. 11,500 ft., Aug. 18, 1933, *Maguire, Richards & Maguire 4241* (U, G); in Krumholtz, southeastern slopes of saddle west of Mt. Agassiz, Duchesne Co., alt. 11,200 ft., Aug. 16, 1933, *Maguire, Richards & Maguire 4244* (M, G, U); along stream, north base of Haystack Mountain, Grand Co., alt. 9200 ft., July 9, 1933, *Maguire, Richards, Maguire & Hammond 5115* (UCal, G, U); in spruce, grassy north slopes of Greene Mountain, Grand Co., alt. 10,750 ft., July 13, 1933, *Maguire, Richards, Maguire & Hammond 5116* (G); in moist ravines, marsh, Peterson Canyon, Peterson, alt. 8000–10,000 ft., July 19, 1902, *Pammel & Blackwood 3820* (G, M); Stillwater Cañon, Bear River, alt. 9000–10,500 ft., Aug. 1, 1902, *Pammel & Blackwood 4234* (G, M); along streams, La Sal Mountains, Grand Co., alt. 10,500 ft., July 22, 1924, *Payson & Payson 3950* (M, UCal, Ry, G); along streams, west fork of Bear River, Uinta Mountains, Summit Co., alt. 9700 ft., July 8, 1926, *Payson & Payson 4929* (US, G, M, Ry); Mirror Lake, Duchesne Co., Aug. 2, 1932, *Richards 4242* (G, U); Mt. Lofty, divide between Weber and Bear River, Summit Co., alt. 11,300 ft., Aug. 3, 1932, *Richards 4243* (U); Big Cottonwood Cañon, below Silver Lake, June 29, 1905, *Rydberg & Carlton 6436* (NY), *6438* (NY, Ry) and *6470* (US, NY); La Sal Mountains, alt. 3000–3300 m., July 7, 1911, *Rydberg & Garrett 8721* (NY); Gold Basin, La Sal Mountains, alt. 3000–3300 m., July 11, 1911, *Rydberg & Garrett 8848* (NY); Horse Gulch and vicinity, La Sal Mountains, alt. 3000–3300 m., July 15, 1911, *Rydberg & Garrett 8960* (US, Ry, NY); La Sal Mountains, near Mt. Peal, alt. 3300–3700 m., July 17, 1911, *Rydberg & Garrett 8999* (NY, Ry, US); Provo Canyon, Wasatch Mountains, alt. 7000 ft., June 11, 1930, *Van Dyke* (CAS); Uintas, alt. 7000 ft., July, 1869, *Watson 842* (NY).

NEVADA: Clover Valley, Humboldt Mountains, July 14, 1902, *Deehl* (US); Star Canyon of Deeth, Elko Co., alt. 5600 ft., July 10, 1912, *Heller* (US, NY); Clover Mountain Range, near Deeth, East Humboldt or Ruby Mountains, Elko Co., alt. 9000 ft., July 24, 1908, *Heller 9236* (US, G, NY); Lamoille Canyon east of Lamoille, East Humboldt or Ruby Mountains, Elko Co., alt. 7050 ft., Aug. 6, 1908, *Heller 9327* (NY); ridge on the north side of Lamoille Canyon, East Humboldt or Ruby Mountains, Elko Co., alt. 8950 ft., Aug. 8, 1908, *Heller 9373* (NY); moist ground, vicinity of Gold Creek, Pine Mountain, Aug. 7, 1913, *Hitchcock 1107* (US); moist ravine, Duck Creek Cañon 4 miles southeast of Paine's Ranch, Aug. 17, 1913, *Hitchcock 1388* (US); Martin Creek, Humboldt Reserve, Elko Co., *Kennedy 4266* (ANS); stream flat, Jarbidge, alt. 7000 ft., July 8, 1912, *Nelson & Macbride 1994* (US, G, NY, Clokey, Ry); East Humboldt Mountains, alt. 7000 ft., Aug. 1868, *Watson 842* (US, NY, G).

OREGON: moist ground, Fish Lake, Stein's Mountains, Harney Co., July 20, 1927, *Henderson 8312* (CAS); bank of Wild Horse Creek, east slope of Stein Mountains, June 28, 1925, *Peck 14128* (Willm); moist ground 16–17 miles east of Prairie City, Grant Co., July 18, 1928, *Peck 16040* (Willm, M); Athena, coll. of 1917, *Stewart* (Willm).

12a. Mertensia ciliata var. **subpubescens** (Rydb.) Macbr. & Payson in Contr. Gray Herb. N. S. No. 49: 67. 1917.

M. subpubescens Rydb. in Bull. Torr. Bot. Club **30**: 261. 1903.

M. ciliata var. *subpubescens* forma *candida* Macbr. & Payson, *l.c.*

Leaves with spreading or appressed pubescence on the lower surface; pedicels usually strigose; otherwise as the species.

Distribution: western Montana, north-central and northwestern Wyoming, and adjacent Idaho.

MONTANA: common, mountain cañons, Bozeman, June 18, 1900, *Blankinship* (M, G, Ry); Helena, June 25, 1908, *Butler 750, 751* (NY); Tobacco Mountans, July 13, 1909, *Butler* (UCal, NY); Tobacco Mountains, July 15, 1909, *Butler 4230* (NY); Flathead Ranger Station, Gallatin Forest, alt. 6500 ft., July 20, 1921, *Cringer 237* (UM); in moist, stony stream-ways, near timber line, Mt. Tiny, alt. 9000 ft., Aug. 29, 1921, *Hall 11599* (G); drying hillside, just above stream, Daly Creek, on Skalkaho Road, Ravalli Co., alt. 7000 ft., Aug. 9, 1933, *Hitchcock 2061* (CAS, G, UM); along streams in shady places high in the mountains, Aug. 18, *Howard 304* (G); Alta, alt. 5000 ft., July 23, 1909, *Jones* (G, UM); near Helena, 1889, *Kelsey* (NY); above Cooke City, alt. 9750 ft., Aug. 29, 1887, *Knowlton* (US); Hulse's Cabin, Crevasse Mountain, Park Co., alt. 8000 ft., July 20, 1902, *Mearns 2046* (NY); along banks of small mountain stream, near Elk Park, Jefferson Co., July 10, 1930, *Palmer 36987* (US, G, M); black loam, Crock Lake Pasture, Madison Forest, alt. 8000 ft., July 10, 1922, *Riggle 12* (UM); mountains near Indian Creek, alt. 8000 ft., July 21, 1897, *Rydberg & Bessey 4872* (US, NY); Bridger Mountains, alt. 7000 ft., June 18, 1897, *Rydberg & Bessey 4875* (NY); Spanish Basin, Gallatin Co., alt. 6500 ft., June 23, 1897, *Rydberg & Bessey 4876 in part* (NY TYPE, US, Ry, F, UM); Deer Lodge Co., 1901, *Scheuber 42* (NY); rich open woods, West Gallatin River, June 9, 1883, *Scribner 175* (US, ANS, G); Helena, Aug., 1892, *Starz* (M); Mystic Lake, July 25, 1895, *Shear 3076* (US, NY); bank of stream, Leverich Canyon, Gallatin Co., June 25, 1929, *Swingle* (Ry); near East Entrance, Glacier National Park, June 30, 1930, *Van Dyke* (CAS).

WYOMING: Lower Falls of the Yellowstone, July 26, 1871, *Adams* (US); Sylvan Pass, Yellowstone National Park, July 19, 1924, *Ballou* (Ry); wet shaded places near Mammoth Hot Springs, alt. 6200 ft., July, 1893, *Burglehaus* (US); wet hillside, Ten Sleep Lakes, Big Horn Co., July 30, 1901, *Goodding 409 in part* (NY, US, Ry, G); Tower Falls, Aug. 7–12, 1922, *Hawkins 633* (US); Yellowstone Park, summer of 1904, *McDonald* (CAS); from stream under the bridge at Lookout Point, Lower Falls of the Yellowstone, July 30, 1889, *Mearns* (US); Yellowstone National Park, June 15, 1902, *Mearns 1126* (US); about clumps of willows on a creek bank, Mammoth Hot Springs, July 4, 1899, *Nelson & Nelson 5669 in part* (M); in open, dry, stony draws, Dunraven Peak, Aug. 27, 1899, *Nelson & Nelson 6704 in part* (Ry); Norris, Yellowstone Park, *Oleson in part* (Ry); Mammoth Hot Springs, Yellowstone Park, July, 1905, *Oleson in part* (Ry); west branch Big Goose, Sheridan Co., June 30, 1897, *Pammel & Stanton* (M); moist loam, Little Rocky, Clark's

Fork Valley, alt. 5500 ft., June 22, 1924, *Pearson & Pearson 36* (Ry); Electric Peak, alt. 9000–11,000 ft., Aug. 18, 1897, *Rydberg & Bessey 4864* (US, NY); Yellowstone Park, 1865, *Tweedy* (US); Mirror Lake plateau, alt. 8900 ft., Aug. 1885, *Tweedy 811* (US); Grand Teton National Park, June 22, 1930, *Van Dyke* (CAS); Yellowstone Park Canyon, June 30, 1919, *Young* (Cl).

IDAHO: Morgan Creek, Challis Forest, Custer Co., July 29–30, 1917, *Eggleston 13960* (US); heavy black soil, moist location on bottom of canyon, Lemhi Forest, July 31, 1911, *Huddle 27* (Ry); damp sunny places in woods, along creeks, Salmon, Aug. 2, 1896, *Kirtley* (Cl); along creek, Clyde, Blaine Co., alt. 5600 ft., July 10, 1916, *Macbride & Payson 3119* (US, UCal, Ry, NY, M, CAS, G); along creek in open forest, Parker Mountain, Custer Co., alt. 7000 ft., July 17, 1916, *Macbride & Payson 3272* (G TYPE *M. ciliata* var. *subpubescens* f. *candida*); near brook, Parker Mountain, Custer Co., alt. 7000 ft., July 17, 1916, *Macbride & Payson 3279* (US, G, CAS, M, UCal, NY, Ry); wet creek bank, Bear Creek below Parker Mountain, Custer Co., July 18, 1916, *Macbride & Payson 3282 in part* (UCal, US, CAS, G, Ry, M); creek bank, Bonanza, Custer Co., alt. 6500 ft., July 28, 1916, *Macbride & Payson 3492* (NY, US, CAS, G, M, UCal, Ry); lake margins, Craters of the Moon, July, 1926, *Rhodenbaugh 18* (Ry).

12b. M. ciliata var. **latiloba,** var. nov.[1]

Similar to the species; calyx 3.5–4.5 mm. long, divided almost to the base, the lobes 1.25–1.5 mm. broad at the base, lanceolate to triangular-lanceolate, acute or obtuse, ciliate, glabrous on the back, short-strigose within.

Distribution: known only from the type locality.

IDAHO: Bear River Range, Franklin Basin above Gibson Lake, Oneida Co., July 25, 1910, alt. 9100 ft., *Smith 2291* (NY TYPE, U).

12c. M. ciliata var. **stomatechoides** (Kellogg) Jepson, Man. Fl. Pl. Cal. 842. 1925.

M. stomatechoides Kellogg in Proc. Cal. Acad. Sci. **2**: 148. 1863.

M. californica Eastw. ex C. F. Baker, West. Am. Pl. **3**: 8. 1904, name only.

Calyx-lobes 2.5–6 mm. long, usually obtuse but occasionally acute or acutish; style usually much exceeding the corolla.

Distribution: in the Sierras, California and adjacent Nevada.

NEVADA: Snow Valley, Ormsby Co., alt. 2460–2615 m., June 24, 1902, *Baker 1154* (P, M, NY, G, US, UCal); about Marlette Lake, Washoe Co., alt. 2460 m.,

[1] **M. ciliata** var. **latiloba** var. nov., *M. ciliatae* simulans; calyce 3.5–4.5 mm. longo, fere ad basem diviso, lobis basi 1.25–1.5 mm. latis, lanceolatis vel triangulari-lanceolatis, acutis vel obtusis, glabris, ciliatis.

July 10, 1902, *Baker 1302* (CAS, Ry, M, NY, US, G, UCal); Chiatovitsh Creek, White Mountains, Esmeralda Co., alt. 2450 m., June 7, 1931, *Duran 3071* (M, CAS, Cl, U, Ry, NY, UCal); West Humboldt Mountains, alt. 8000 ft., June, 1868, *Watson 842* (G, NY, US).

CALIFORNIA: Light's Cañon, Plumas Co., coll. of 1872, *Ames* (ANS, NY); Plumas Co., *Austin* (P); Indian Valley, Plumas Co., coll. of 1877, *Austin* (UCal); Colby, Butte Co., July, 1896, *Austin 91* (M, US); Lassen Creek, July, 1894, *Austin 276* (UCal); summit grade, between Prattville and Brices, coll. of 1883, *Austin 442* (UCal); Colby, Butte Co., June 20, 1897, *Austin 1193* (US); springy places, Modoc Co., June, 1898, *Austin & Bruce 2372* (UCal, NY); moist ground about Mineral King, July 1, 1930, *Baker 4213* (Ry); Jones, Butte Co., June 16, 1923, *Bassett* (CAS); granite soil, Aspen Valley, Sierra Nevada Mountain Range, alt. 6400 ft., July 3, 1932, *Benson 3855* (US, NY); without locality, *Bolander* (US); "Southern Sierras," *Bolander 2487* (G); Mt. Gilliman, *Brandegee* (UCal); Woolverton Creek, Tulare Co., Aug., 1905, *Brandegee* (UCal); Giant Forest, Tulare Co., Aug. 12, 1905, *Brandegee* (UCal); Kit Carson Pass, Alpine Co., summer of 1930, *Branson* (CAS); Sierras east of Visalia, Tulare Co., June 17–18, 1864, *Brewer 2787* (US); Coyote Peak, July 8, 1916, *Campbell* (CAS); Yosemite Creek, Yosemite National Park, Aug. 8, 1919, *Clemens* (CAS); Crystal Lake, Plumas Co., June 23, 1920, *Clemens* (CAS); beside Butte Creek, Jonesville, Butte Co., July 11, 1920, *Copeland 379* (UCal); occasional in low woods, Jonesville, Butte Co., alt. 1500 m., June 23, 1930, *Copeland 450* (Ariz, CAS, UCal, G, US, NY, M, Ry, U, Cl); in clumps and masses, Kirby Meadows, Jonesville, Butte Co., June 11, 1931, *Copeland 1529* (UCal); Mineral King, Sierra Nevada, alt. 2750 m., July 31, 1891, *Coville & Funston 1398* (US); Hockett's Meadow, Tulare Co., July 16, 1904, *Culbertson 4375* (UCal, M, CAS TYPE *M. californica*, NY, G); mountain meadow, Sequoia National Park, Tulare Co., alt. 6700 ft., July 3, 1928, *Derby* (CAS); Kaweah Creek, Sequoia National Park, Tulare Co., alt. 6700 ft., July 4, 1928, *Derby* (CAS); Ebbett Pass, Alpine Co., June 3, 1934, *Derby* (CAS); near Harden Lake, Aug. 9, 1907, *Eastwood 189* (US, CAS, G); trail to Angora Lake, Glen Alpine Region, July 21–Sept. 5, 1906, *Eastwood 1318* (CAS); Wheats Meadow Ranger Station, Stanislaus Forest, Tuolumne Co., alt. 2000 m., June 11–17, 1913, *Eggleston 9321* (US); near White Wolf, alt. 8000 ft., July, 1901, *Evans* (UCal); meadow opposite Phillips, alt. 7000 ft., July 23, 1918, *Evans* (UCal); Mineral King, Tulare Co., July, 1923, *Fox* (CAS); head of Carson River, *Gibbs* (CAS TYPE); Crescent Meadow, Sierra Nevada Mountains, alt. 7000 ft., July, 1902, *Grant 776* (US, Ariz); swamp, Crescent Meadow, July 7, 1902, *Grant 1239* (US); rather dry, exposed places, Jonesville, Butte Co., alt. 5100 ft., July 25, 1914, *Hall 9784* (UCal, US, NY); Collins Meadow, Sierra Nevada Mountains, Fresno Co., alt. 7500 ft., July, 1900, *Hall & Chandler 456* (UCal, M, ANS, NY, US); Sequoia Region, Alpine Co., alt. 8500 ft., July, 1892, *Hansen 424* (M); Yosemite National Park, July 21–22, 1915, *Hitchcock* (US); Alta Meadows, Kaweah River Basin, Aug. 24, 1901, *Hopping 65* (UCal); moist meadow, Buck Camp Trail, Yosemite Park, Mariposa Co., Aug. 1, 1923, *Howell 209* (CAS); Sierra Valley, June, 1932, *Jackson* (CAS, UM); meadow near Camp Baxter, North Fork of the Stanislaus River, alt. 6000–7000 ft., July 8, 1930, *Jussel* (UM, CAS); Sierra Valley, May 20, 1889, *Lemmon* (UCal); Sierra Co., coll. of 1874, *Lemmon 164* (ANS) and *473* (G); Big Creek region, Fresno Co., July, 1915, *McDonald* (G, US, CAS); meadows, Eagle Peak, Yosemite, July 4, 1922, *Michaels* (CAS); Yosemite Valley, *Moore*

546 (CAS); Silver Lake, Amador Co., alt. 7200 ft., July 27–Aug. 5, 1904, *Mulliken 143* (UCal); common in shaded wet meadows, trail from Tioga Road to Yosemite Falls, alt. 7800 ft., July 25, 1923, *Munz 7502* (NY, Ry); Potter Valley, Mendocino Co., April, 1898, *Purpus* (UCal); brooks, in Farwell Gap, alt. 10,200 ft., Sept., 1897, *Purpus 5233* (US, UCal); Soda Spring, Kern River, alt. 8500 ft., Oct., 1875, *Rothrock 421* (G); Pyramid Peak, Sierra Nevada Mountains, alt. 9500 ft., July 16, 1913, *Smiley 121* (G); cañon near Sardine Valley, Nevada Co., June, 1887, *Sonne* (UCal); Sardine Valley, Nevada Co., July, 1891, *Sonne* (NY); along streams, Sardine Valley, Nevada Co., July, 1891 *Sonne* (NY); Sardine Valley, Sierra Co., July, 1891, *Sonne* (M); Sardine Valley, Nevada Co., June, 1887, *Sonne 442* (ANS, M); Salt Spring Reservoir, Calaveras Co., June, 1923, *Steinbeck* (CAS); Camp Sacramento, Eldorado Co., July, 1925, *Vortreide* (CAS).

Mertensia ciliata is the commonest and most widely distributed of the tall, aestival species within the Rocky Mountains. Although easily recognized it is found to vary considerably in diverse parts of its range. The tube of the corolla is usually longer than the limb but the reverse condition is not uncommon, particularly in the southern part of its range. The corolla is also quite variable in size, and extreme sizes on different clumps within the same colony are not unusual. The altitudinal range of the species is rather great, as are the habitats in which it occurs. It has been followed from 6,000 to 10,500 feet altitude in northwestern Wyoming. There is a constant reduction in size from similar habitats as one follows it upward. A reduced form found in a high altitude is the basis of the name *M. incongruens*. Situations in relation to moisture are equally diverse. The species has been observed growing in a spring in dense shade and on open hillsides which soon become dry. Leaves are extremely variable in shape and size, as also is their abundance on the stem; these characters have been used specifically. The normal glabrous condition of the leaves in the species is occasionally varied by having the upper surface papillose, especially toward the apex; these papillae may be rarely mucronate on the uppermost leaves.

Mertensia ciliata var. *subpubescens* is an unimportant variation, having the lower surface of the leaves pubescent, which takes the place of the species to a large extent in the northern part of the range. The species and the variety occur together.

Mertensia ciliata var. *latiloba* is a little-known variation which differs from the species mainly in the structure of the calyx.

Mertensia ciliata var. *stomatechoides* completely takes the place of the species in the Sierras of California and in adjacent Nevada. The structure of the calyx is the principal character by which it may be separated from the species, a character which is extremely variable. In its extreme form the character of the calyx, along with minor characters which are to be found in the corolla and the fairly disjunct range, might well argue for its distinctness as a species. However, the entity contains forms which can scarcely be distinguished from *M. ciliata* on a criterion other than range. The two extremes within the variety are connected by all stages of intergrading forms.

13. Mertensia umbratilis Greenm. in Erythea **7:** 118. 1899.
M. infirma Piper in Contr. U. S. Nat. Herb. [Fl. Wash.] **11:** 476. 1906.
M. ambigua Piper, *l.c.* 477.

Stems erect or ascending, 1.5–6 dm. tall, one to many from each rootstalk; blade of the basal leaves ovate to ovate-oblong, 6–11 cm. long, 3–6 cm. broad, obtuse, glabrous or rarely sparsely strigose on the upper surface, base decurrent on the petiole, petiole 5–8 cm. long; cauline leaves oblong-ovate to oblong-lanceolate, 4–10 cm. long, 1–5 cm. broad, obtuse or acute at the apex, sessile or the lowermost short-petiolate, upper surface glabrous to hirsute, lower surface glabrous or very rarely pubescent, ciliate, glaucous; inflorescence axial, the peduncles only slightly elongated at maturity, each peduncle terminated by a modified scorpioid cyme; pedicels 1–10 mm. long, glabrous or papillate; calyx 3–8 mm. long, slightly accrescent, glabrous, ciliate, divided almost to the base, lobes lanceolate to lanceolate-triangular, acute; corolla-tube 7–14 mm. long, glabrous within, the basal glands usually well developed; corolla-limb 5–9 mm. long, moderately expanded; anthers 1.5–2.5 mm. long, shorter and narrower than the filaments which are 4–5 mm. long; fornices prominent, glabrous or short-pubescent; style about as long as or exceeding the corolla; nutlets about 4 mm. long, rugose.

Distribution: central Washington to eastern and south-central Oregon.

WASHINGTON: below Blewett Pass on the west side, near Cle Elum, May 24, 1933, *Nelson & Nelson 667* (M); open flat, Teanaway River Valley, 10–15 miles north of Cle Elum, June 10, 1933, *Quick 1030* (UCal, CAS); dry open hillsides, 2 miles south of Lauderdale Auto Camp, April 18, 1931, *Thompson 6027* (US, G, NY, M); open rimrock near Lauderdale Auto Camp, May 2, 1931, *Thompson 6207* (M, G); moist shade of trees north of Ellensburg, May 2, 1931, *Thompson 6211* (M, G, US, F); open ground along the Teanaway Valley, alt. 2500 ft., May 16, 1931, *Thompson 6345* (G, M, NY); sage-brush slopes near Ellensburg, April 23, 1932, *Thompson 8220* (M, NY, G, UCal); moist open meadows on Tumwater Mountain, alt. 3500 ft., May 12, 1934, *Thompson 10441* (Pom, G, CAS); moist sage-brush slopes between Ellensburg and Cle Elum, April 27, 1935, *Thompson 11422* (G, CAS); in and near the Cascade Mountains of Kittitas, Chelan and King Counties, coll. of 1889, *Vasey 402* (P, US TYPE *M. ambigua*); on wet land, along Caribou Creek, east of Ellensburg, May 5, 1896, *Whited 4* (US); April 25, 1897, *Whited 52* (N); damp thicket at Ellensburg, April 25, 1897, *Whited 307* (P, US TYPE *M. infirma*).

OREGON: Couger Peak, alt. 1900 m., Aug. 3, 1896, *Coville & Leiberg 207* (US); around the little mining town of Sparta, coll. of 1880, *Cusick 856* (ANS, G, F, US); dry mountains, especially among low brush at Sparta, near Snake River, May 23, June 3, 1898, *Cusick 1886* (Cl, F, Pom, G TYPE, M, P. US, ND, UCal); wet banks of Ochoco Creek near the source in Blue Mountains, Crook Co., June 10, 1902, *Cusick 2807* (P, F, UCal, Cl, Pom, G, M); rocky slope, Williams Ridge, Blue Mountains, Wenaha Forest Reserve, Columbia Co., July 9, 1913, *Darlington 2* (P); high moist slope of Crane Mountain, 12 miles southeast of Lakeview, alt. 2500 m., July 11, 1927, *Peck 15578* (Willm).

The material referred to this species, although not abundant, shows several minor variations. When more material is available one of these may be found to be deserving of varietal recognition. Johnston referred *M. ambigua* to the inclusive "*M. paniculata* var. *subcordata*" as a synonym. However, it belongs with *M. umbratilis*.

This species should possibly be placed closer to *M. oblongifolia* var. *nevadensis* than is here done. Its affinity seems to be more with that variety than any of the tall species. It seems to form a link between the tall and the low species.

14. Mertensia lanceolata (Pursh) A. DC. in DC., Prodr. **10**: 88. 1846.

M. marginata G. Don, Gen. Hist. **4**: 319. 1838.
M. linearis Greene, Pittonia **3**: 197. 1897.
M. papillosa Greene, *l.c.* 261. 1898.
M. lanceolata var. *aptera* Ckll. in Macbr., Contr. Gray Herb. N. S. No. 48: 16. 1916.
Pulmonaria lanceolata Pursh, Fl. Am. Sept. **2**: 729. 1814.
P. marginata Nutt., Gen. **1**: 115. 1818.

Casselia lanceolata Dumort., Com. Bot. 24. 1822.
Lithospermum marginatum Spreng., Syst. **1**: 547. 1825.
Cerinthodes lanceolatum O. Kuntze, Rev. Gen. Pl. pt. 2: 436. 1891.

Stems erect or ascending, usually several from each rootstalk, 1–4.5 dm. tall; basal leaves usually ovate-lanceolate, 3.5–14 cm. long, 1.3–4 cm. broad, short-strigillose, pustulate or glabrous above, glabrous below, 1–7 parallel-veined, petiole longer or shorter than the blade; cauline leaves linear to broadly lanceolate or oblong-elliptical, acute or obtuse, 1.5–10 cm. long, 0.2–3 cm. broad, pubescence as of basal leaves, parallel nerves very obscure or not at all apparent, sessile, often semiamplexicaul, becoming smaller toward the inflorescence; pedicels glabrous to strigose, 1–20 mm. long; inflorescence a modified scorpioid cyme, usually congested at first but becoming panicled in age; calyx 2–9 mm. long, the lobes 1–6 mm. long, lanceolate to triangular, ciliate, glabrous on the back or rarely with a few hairs, acute or obtuse, accrescent, a definite tube usually present; corolla-tube 3–6.5 mm. long (mostly 4.5–5.5 mm.), usually with a dense ring of hairs near the base within; corolla-limb 2.5–9 mm. long (mostly 5–6 mm.), subequal to or usually slightly longer than the tube, usually campanulate and much expanded; anthers 1.5–2 mm. long, usually curved, shorter and narrower than the expanded portion of the filaments which are 2–4 mm. long; fornices more or less conspicuous, glabrous to

Fig. 8. *M. lanceolata.* Habit sketch × ⅓; variation in leaves and flowers × ⅓; enlarged corolla × 1.

pubescent; style shorter or longer than the corolla; nutlets 2.5–3 mm. long, mostly evenly rugose on the backs and laterally; scar and raised attachment twisted to one side, black at maturity.

Distribution: North Dakota, southern Saskatchewan, and Montana, south to northern New Mexico.

North Dakota: moist lumber yard, Portal, June 13, 1903, *Barber 333* (G); on shaded bank in ravine, Medora, June 1, 1912, *Bergman* (M); in deep loam, Williston, May 2, 1906, *Lunell* (Ry); Minot, Ward Co., June 5, 1909, *Lunell* (Ry, ND, O); ravines and plains, Medora, May 29, 1904, *Waldron 2318* (Ry).

South Dakota: "Louisiana,"[1] *Bradbury* (ANS, M photograph); hillsides, Whitewood, Lawrence Co., May 25, 1921, *Brigham 13753* (US); eight miles north of Bellefourche, Butte Co., 900 m., June 11, 1916, *Eggleston 12523* (US); near Ft. Meade, Black Hills, coll. of 1887, *Forwood 267* (US); along Spring Creek near Quashnich farm, Artas, June 8, 1929, *Hanna 148* (M); Ft. Pierre, May 7, 1892, *Harper & Harper* (F); common on high prairies from Ft. Pierre to Bad Lands, June 28, 1853, *Hayden* (M); east facing, red foothills, Rapid City, June 12, 1927, *Hayward 746* (Ry); wooded ridges, Custer State Park, Black Hills, June 14, 1927, *Hayward 901* (Ry); red foothills, Hermosa, June 14, 1927, *Hayward 940* (Ry); open park, 6 miles east of Deadwood, June 17, 1927, *Hayward 995* (Ry); red foothills, Sturgis, June 17, 1927, *Hayward 1038* (Ry); south facing slope, meso-canyon, Whitewood, June 21, 1927, *Hayward 1252* (Ry); west facing slope, Spearfish Canyon (Lower), June 23, 1927, *Hayward 1369* (Ry); limestone plateau, 1 mile from Hardy Station, June 25, 1927, *Hayward 1423* (Ry); meso-canyon, Spearfish Canyon (Upper), June 25, 1927, *Hayward 1435* (Ry); mountain slopes, Custer Peak, Black Hills, July 1, 1927, *Hayward 1763* (Ry); mountain slopes, Terry Peak above Trojan, July 4, 1927, *Hayward 1878* (Ry); mountain slopes, Needles Trail, Harney Peak region, July 8, 1927, *Hayward 1934* (Ry); hillside, Rapid City, April 19, 1925, *Lee 526* (Ry); grassy hillside near Rapid City, April 24, 1925, *Lee 530* (Ry); hillside, Rapid City, April 25, 1925, *Lee 538* (Ry); prairie, Chamberlain, Brule Co., May 30, 1925, *Lee 557* (Ry); along Squaw Creek, State Game Lodge, June 27, 1924, *McIntosh No. V* (Ry); in shade, along stream, Erskine, June 1, 1924, *McIntosh 148* (Ry); abundant in moist humus, on north side of boulder, Castle Creek valley, 1 mile west of Deerfield, June 26, 1925, *McIntosh 690* (Ry); slate, park at head of Willow Creek, Black Hills National Forest, alt. 5200 ft., May 16, 1908, *Murdoch 3023* (F, G); meadow, North Rapid Ranger Station, Black Hills National Forest, alt. 5600 ft., July 12, 1908, *Murdoch 3069* (F); "Upper Louisana," *Nuttall* (ANS); hillsides near Whitewood, Lawrence Co., May, 1922, *Over 14372* (US); high altitude, Lawrence Co., June 29, 1928, *Over 17613* (Ry); Silver City, Pennington Co., July 16, 1929, *Over 18092* (Ry); rocky shaded ground, in canyon, near Sturgis, Lawrence Co., June 8, 1929, *Palmer 37035* (NY, G, M); rocky ground along Boulder Creek, near Deadwood, Lawrence Co., June 11, 1929, *Palmer 37158* (G);

[1] Collected "opposite the Aricara Village" which would be about opposite Campbell, Campbell Co., South Dakota. Bradbury was at that locality from June 12 to June 18, 1811. This specimen, which bears the name "*Pulmonaria lanceolata*" in Pursh's handwriting, is possibly the historical type.

moist ground along small stream, near Pactolla, Pennington Co., June 17, 1929, *Palmer 37355* (G, M); Piedmont, June, 1895, *Pratt* (Ry); prairie, Newell, May 12, 1913, *Rydberg 11* (F, M, Ry, G); Rockford, Black Hills, alt. 5500–6000 ft., July 11, 1892, *Rydberg 897* (US); Custer, Black Hills, alt. 5500 ft., May 30, 1892, *Rydberg 899* (US, N); Sylvan Lake, Black Hills, alt. 7000 ft., July 19, 1892, *Rydberg 900* (US, N); Short Pines, Harding Co., June 10, 1911, *Visher 473* (Ry); Perkins Co., June 10, 1912, *Visher 565* (Ry); Rockerville, Black Hills, June, 1909, *White* (ND, M).

NEBRASKA: Teton River, April 20, 1853–4, *Hayden* (M); Lawrence Fork, Banner Co., July 8, 1891, *Rydberg 257* (US); War Bonnet Canyon, alt. 5000 ft., June, 1890, *Williams* (M).

SASKATCHEWAN: Wood Mountain, Assiniboia, June 6, 1895, *Macoun 11838* (US, G); Estevan, June 22, 1907, *Cowles 16* (F).

MONTANA: Westby, June 16, 1927, *Larsen 12* (G, M, ANS).

WYOMING: Newcastle, June 19, 1896, *Bates* (N); Cheyenne, May 18–24, 1916, *Bates & Eastman 183, 202* (N); Laramie Hills, May 22, 1892, *Buffum 645* (Ry); east of Laramie, Laramie Mountains, alt. 8000 ft., June 18, 1909, *Cary 308* (US); Cheyenne, May 20, 1874, *Cleburne 25* (N); in *Rhus trilobata* thicket, north slope of Casper Mountain, 5 miles south of Casper, alt. 7000 ft., July 8, 1933, *Hermann 4615* (G); Corlett, June 24, 1907, *Johnson 128* (M); south slope of Ferris Mountain, July, 1928, *Morgan* (Ry); hillside, Hanna, May 20, 1922, *Morgan* (Ry); Laramie Hills, May 16, 1894, *Nelson 34* (ANS, G, Ry, US, ND designated TYPE of *M. linearis*, M, Cl); Laramie Hills, May 18, 1895, *Nelson 1234* (O, Ry); Laramie Hills, June 6, 1896, *Nelson 1904* (F, O, M); Telephone Canyon, May 29, 1897, *Nelson 2936* (F, UCal); Laramie Hills, June 16, 1897, *Nelson 3174* (Ry); stony slopes, Chug Creek, Albany Co., June 30, 1900, *Nelson 7332* (G, US, Ry, M, N); creek bottoms, Camel Rock, Albany Co., July 4, 1924, *Nelson 10623* (UCal, Ry); moist hillsides, Plumbago Canyon, Albany Co., June 5, 1930, *Nelson 11306* (G, UCal, M, Ry); Lusk, June, 1914, *Overton* (Ry); sandy soil in open woods, 5 miles northwest of Hulett, Crook Co., alt. 4500 ft., May 16, 1935, *Ownbey 555* (M); moist sandy soil in open pine woods, 5 miles northwest of Hulett, Crook Co., alt. 4000 ft., May 24, 1935, *Ownbey 555a* (M, W.); Happy Jack Canyon, Laramie Mountains, Albany Co., June 6, 1930, *Porter 514* (M, W); common on open hillsides, Happy Jack Canyon, Laramie Mountains, Albany Co., June 2, 1932, *Porter 1036* (M, W); open sagebrush hillsides, Happy Jack Canyon, Laramie Mountains, Albany Co., June 8, 1933, *Porter 1292* (W); foot of Telephone Canyon, Laramie Mountains, Albany Co., alt. 7500 ft., May 23, 1934, *Porter 1460* (W, M); Happy Jack Canyon at Tie City Camp Ground, Albany Co., May 23, 1934, *Porter 1461* (W, Willm, M); Cheyenne, May, 1870, *Porter* (F); Box Canyon, upper Wagon Hound Creek, Converse Co., June 6, 1931, *Rollins 25 in part* (W); in rocky gulch east of Laramie, June 7, 1902, *Sellon 42* (Ry); Floral Canyon, 4 miles east of Laramie, Albany Co., alt. 7500 ft., May 21, 1931, *Williams 122* (W); grassy hillside, Middle Crow Creek, Albany Co., May 25, 1931, *Williams 155* (W); granitic hillside, Happy Jack Canyon, Albany Co., alt. 8000 ft., June 6, 1934, *Williams 1717* (W, ND, P, M); granitic hillside in shade, Happy Jack Canyon, Albany Co., alt. 8500 ft., June 6, 1934, *Williams 1731* (W, ND, P, M); dry hillside, Roger's Canyon, 8 miles northeast of Laramie, Albany Co., alt. 7500 ft., June 13, 1935, *Williams 2181* (M, ND, P, W); limestone hillside near city spring, Laramie, Albany Co., alt. 7000 ft., June 13, 1935, *Williams 2187* (M, ND, P, W); granitic hillside among sage, Happy Jack Canyon, Laramie Hills, Albany Co., alt. 8500 ft., June 14, 1935, *Williams 2202* (M, ND, P, W); base of a ledge, Telephone Canyon, east of Laramie, Albany Co., alt. 7500 ft., June 18, 1935, *Williams 2220* (M, W); among sagebrush, Happy Jack Canyon, Laramie Hills, Albany Co., alt. 8500 ft., June 18, 1935, *Williams 2221* (M, ND, P, W); plains 5 miles south of Cheyenne, Laramie Co., alt. 6500 ft., June 21, 1935, *Williams 2239* (M, ND, P, W).

COLORADO: mesas, Boulder, alt. 5600 ft., coll. of 1904, *Andrews 26* (Ry); foothills west of Ft. Collins, alt. 5500 ft., April 28, 1896, *Baker* (M); coll. of 1867, *Barthoud* (US); Manitou, Aug. 17, 1916, *Bates 6518½* (N); Boulder, May 18, 1916, *Bates & Eastman 163* (N); Clear Creek, June 14, 1916, *Bethel 25* (CAS); moist open ravine facing northwest on bluff of Clear Creek, 44th Street and Clear Creek, Denver, June 11, 1921, *Bethel, Clokey & Schmoll 258* (C); west Mt. Valley, Fremont Co., Aug., 1873, *Brandegee 651* (UCal, M); alpine, Sangre de Cristo Range, Aug., 1873, *Brandegee 654* (M); region of Pike's Peak, July–Aug., 1912, *Brumback & Davies 123* (F); slopes of Cheyenne Mountain, Colorado Springs, June 20, 1912, *Churchill* (M); rocky hill, Brookvale, Clear Creek Co., June 11, 1918, *Churchill* (G, M); dry soil, Eldorado Springs, alt. 5300 ft., June 24, 1917, *Clokey 2774* (Ariz, F, CAS, Clokey, O, G, Ry); hillsides, Idaho Springs, alt. 8000 ft., July 6, 1917, *Clokey 2785* (F, CAS, G, NY, Ariz, Clokey, O, M, Ry); dry soil, Bear Creek Canyon, alt. 5500 ft., May 19, 1918, *Clokey 3044* (UM, M, Ry, Clokey, CAS, G); dry soil, Bear Creek Canyon, alt. 5500 ft., May 19, 1918, *Clokey 3045* (CAS, US, O, Clokey); prairie, Mymon, Jefferson Co., alt. 5500 ft., May 25, 1918, *Clokey 3078* (Ry, M, G, UM, CAS, Clokey); woods, Lake Eldora, Boulder Co., alt. 9300 ft., July 17, 1918, *Clokey 3160* (CAS, NY, G, Ry, O, Clokey, M); dry open hills, Victor, Teller Co., alt. 3200 m., July 3, 1920, alt. 2750 m., fruit, July 30, 1920, *Clokey 3852* (F, CAS, G, UCal, M, Clokey, ANS, Ry, UM, P, NY); open pine woods, Tolland, Gilpin Co., alt. 2715 m., July 15, 1920, *Clokey 3853* (F, CAS, G, P, US, Clokey, Ry, ANS, M, UM); Boulder, May 18, 1909, *Cockerell 6256* (C); in gravel, Clear Creek Canyon, alt. 9000 ft., June 15, 1873, *Coulter* (NY); Horse Shoe Mountain, July 13, 1873, *Coulter* (US); Howe's Gulch, April 17, 1890, *Crandall 155* (FC); bank of stream, Platte Canyon, alt. 6500 ft., May 9, 1894, *Crandall 360* (US); hills, north of La Porte, May 7, 1898, *Crandall 1635* (N, UM, Ry, F, P, FC); gulch west of Soldier Canyon, May 27, 1898, *Crandall 1636* (FC); plains, Boulder, alt. 5600 ft., June 16, 1906, *Daniels 14* (M); Rocky Mountain National Park, July, 1926, *DeFrance* (Cl); St. Vrain Creek, June 9, 1906, *Dodds 1851* (C); Mesa-Fossil Creek, June 15, 1906, *Dodds 1925* (C); in woods, Valverde, Denver, May, 1887, *Eastwood* (C); Steamboat Springs, July, 1891, *Eastwood* (C); Boulder, June 7, 1916, *Eastwood 5488* (CAS); Trinidad, June 13, 1916, *Eastwood 5543* (CAS); Buena Vista, June 18, 1918, *Eastwood 7082* (US, CAS); rocky valley of Spring Creek above Idaho, July 31, 1874, *Engelmann* (M); grassy places, Empire, Aug. 21, 1874, *Engelmann* (M); grassy dry places, Empire City, Aug. 18, 1881, *Engelmann* (M); Palmer Lake, May 16, 1901, *Ferril* (C); Webster, June 5, 1902, *Ferril* (C, Clokey); La Veta Pass, June 21, 1902, *Ferril* (C); Berkeley Hills and Clear Creek, Denver, May 14, 1903, *Ferril* (C); dry brush, Palmer Lake, May 28, 1903, *Ferril* (C); moist soil, Boulder Canyon, June 8, 1903, *Ferril* (C); moist soil, Castle Rock, June 20, 1903, *Ferril* (C, Clokey); hillsides on the Platte and Clear Creek to the middle mountains, April 20, 1870, *Greene 303* (G); in forest of lodge-pole pine but at base of solitary relict of Douglas fir, Boulder Park, alt. 9000 ft., July 2, 1917, *Hall 10387* (G, UCal); coll. of 1862, *Hall & Harbour 445* (G, M); infrequent, slopes, Gregory Canyon near

Boulder, alt. 5600 ft., May 9, 1920, *Hanson C293* (M); Buena Vista, alt. 7500 ft., June, 1886, *Harper* (F); Manitou, El Paso Co., alt. 6900 ft., May 8, 1897, *Heller & Heller 3501* (M, US); Rist Canyon, May 11, 1923, *Hendricks* (FC); Howe's Gulch, May 25, 1899, *Herb. Colo. State Agric. Coll. 4157* (UM, P, N, Ry); Clear Creek near 44th Avenue, Denver, June 14, 1916, *Huestis* (C); near Estabrook, in Platte Canyon, 52 miles from Denver, on the South Park Line of the Union Pacific Railway, alt. 7500 ft., June 10, 1896, *Holzinger* (FC); bluffs, South Park, flowers May 28–fruit July 12, 1892, *Hughes 1* (G); central Colorado, coll. of 1907, *Johnson 460* (Ry); bluffs, Grover, May 24, 1926, *Johnston 83, 197* (M, Ry); Lyons, Boulder Co., May 24, 1916, *Johnston 374B* (M, UCal); ravine near gap, Stonewall, June 17, 1917, *Johnston 534* (M); hillsides, Trinidad, June 14, 1917, *Johnston 535* (M); Munro road, Lynn, July 14, 1917, *Johnston 541* (M); on dry grassy opening in brush, Ute Pass Trail near Manitou, alt. 6600 ft., June 17, 1920, *Johnston 2814* (G); hills in Coal Creek Canyon, 10 miles northwest of Golden, July 7, 1917, *Johnston & Hedgcock 529a* (G); in Coal Creek Canyon, 14 miles northwest of Golden, July 7, 1917, *Johnston & Hedgcock 530* (G); hillsides east, Morley, June 16, 1917, *Johnston & Hedgcock 531* (G); ravine near "Stonewall Gap," Stonewall, June 17, 1917, *Johnston & Hedgcock 533a, 543* (G); hills west, Trinidad, June 14, 1917, *Johnston & Hedgcock 535* (G); Cuchara Camps, La Veta, Las Animas and Huerfano Co., June 21, 1917, *Johnston & Hedgcock 539* (G); Miner's Ranch, North Fork of St. Vrain River, Lyons, July 14, 1917, *Johnston & Hedgcock 540, 541* (G); Colorado Springs, May, 1878, *Jones* (US); plains, Colorado Springs, May 3, 1878, *Jones 15* (U); Manitou, Aug. 16, 1884, *Letterman 155* (M, US); top of Raton Pass and Trinidad, May 29, 1931, *McKelvey 2444* (G); east of Fort Garland, before starting to climb La Veta Pass, Costilla Co., alt. 8200 ft., May 30, 1934, *McKelvey 4776* (G); Rocky Mountains, Aug., coll. of 1871, *Meehan* (ANS); borders of copses, Palmer Lake, May 20, 1925, *Nelson 10515* (M, UCal); Estes Park, Larimer Co., July 10, 1917, *Osterhout* (Clokey); foothills, Horsetooth, Larimer Co., April 25, 1895, *Osterhout 631* (O); moraine, Estes Park, Larimer Co., July 20, 1900, *Osterhout 2211* (O); near Livermore, Larimer Co., May 29, 1901, *Osterhout 2396* (O); Malta Station, Lake Co., June 20, 1903, *Osterhout 2797* (O); Sulphur Springs, Grand Co., June 9, 1906, *Osterhout 3249* (O, Ry, G, AM) and *3249B* (O); Moraine Park, Larimer Co., July 10–11, 1917, *Osterhout 5627, 5634, 5635* (O); Long's Peak Inn, Larimer Co., July 12, 1917, *Osterhout 5647* (O, Clokey), and *5648* (O); Palmer Lake, El Paso Co., June 5, 1918, *Osterhout 5723, 5878, 5879* (O); west of Buena Vista, Chaffee Co., June 16, 1926, *Osterhout 6530* (O); moist woods on hillsides, Tolland, alt. 9000 ft., June 23, 1913, *Overholts* (M); rocky ground along small creek, near Colorado Springs, El Paso Co., June 23, 1926, *Palmer 31243* (M); rocky ground, near Tolland, Gilpin Co., June 25, 1926, *Palmer 31395* (M); on gravelly banks, common in the valley of Clear Creek, May–June, 1861, *Parry 284* (M, US); Rocky Mountains, near Georgetown, July, 1873, *Patterson 103* (F); in damp shaded places, near Empire, alt. 8500 ft., July 10, 1885, *Patterson 115* (F, ANS, M); Broomfield, May, 1915, *Phelps* (CAS); Boulder, April 27, 1916, *Philipps* (G, TYPE *M. lanceolata* var. *aptera*); La Veta, coll. of 1907, *Pool* (N); near Boulder, June, 1899, *Ramaley* (C); near Florissant, alt. 2400 m., Aug. 1–8, 1905, *Ramaley 1392½* (C); Pine Cliff, July 14, 1909, *Ramaley 6671* (C); Eldora, Aug. 14, 1912, *Ramaley 9355* (Ry, C); among rocks and on dry grassland, Boulder, June 22, 1913, *Ramaley 9573, 9574* (C); dry grassland, Crescent, July 13, 1914, *Ramaley 9974* (C); dry grassland, Paetolus, Aug. 1, 1914, *Ramaley 10298* (C); dry grassland, Sulphide, June 12, 1915, *Ramaley 10370* (Ry, C); Pine Cliff, June 18, 1915, *Ramaley 10412* (C); Rose Hill, Boulder, May 15, 1916, *Ramaley 10607* (C); Box Elder, June 14, 1907, *Ramaley & Robbins 2717* (C); north Box Elder, alt. 7000 ft., June 8–11, 1907, *Ramaley & Robbins 2828* (C); Wet Mountain Valley, July 23, 1872, *Redfield* (M); open rocky prairie, east of Morrison, May 10, 1923, *Ritter & Schmoll 633* (C); open rocky prairie, east of Morrison, May 10, 1923, *Ritter & Schmoll 634* (C); near Boulder, May 5, 1909, *Robbins 6228* (C); Miramonte, July 2, 1909, *Robbins & Prosser 6394, 6438* (C); plains near Denver, alt. 1500 m., May 8, 1900, *Rydberg & Vreeland 5686* (O, P); Cuchara Valley, near La Veta, alt. 2100 m., May 17, 1900, *Rydberg & Vreeland 5687* (ND, N, O, Ry, P); hills, southeast of La Veta, alt. 2200–2300 m., May 18, 1900, *Rydberg & Vreeland 5695* (Ry, N); Calhan, alt. 7000 ft., July, 1893, *Saunders* (N); alpine, James Peak, Tolland, Aug. 7, 1919, *Schmoll 157* (C); Gullus North Mesa, Colorado Springs, May 28, 1904, *Shantz 31* (N); Clear Creek Canyon, June 5, 1893, *Schneck* (M); base of Cheyenne Mountain, May 3, 1891, *Smith* (M); Lyons, May 23, 1891, *Smith* (M); Berkeley, May 9, 1901, *Smith* (C); near brook in loam, 50 miles east of Montevista, toward La Veta Pass, alt. 8200 ft., May 30, 1934, *Stone 598* (NY); dry prairie, Colorado Springs, El Paso Co., May 14, 1903, *Sturgis* (G); Wet Mountain Valley, Canyon City, Fremont Co., July, 1873, *Tuthill 651* (F); Rico, alt. 10,000 ft., June 15, 1895, *Tweedy 117* (US); Eldora to Baltimore, alt. 8500–9500 ft., June 20–July 10, 1903, *Tweedy 5660, 5662* (Ry); plains and foothills near Boulder, alt. 5000–6000 ft., June, 1903, *Tweedy 5663* (Ry); Rocky Mountains, coll. of 1868, *Vasey 437 in part*[1] (G); Rocky Mountains, coll. of 1868, *Vasey 437B* (M, US); brickyard mesa, Boulder, Boulder Co., May 23, 1913, *Vestal* (M); Gregory Canyon, Boulder, Boulder Co., May 21, 1912, *Vestal 368* (M); Castle Rock, coll. of 1889, *Walker* (F); Rollinsville, alt. 2700 m., July, 1900, *Wheeler 360* (C); borders of *Quercus* copses, 10 miles north of Castle Rock, Douglas Co., June 22, 1935, *Williams 2244* (M, W); moist draw 1 mile south of Palmer Lake, El Paso Co., alt. 6900 ft., June 22, 1935, *Williams 2249* (W, M); moist draw along Highway 71, 15 miles north of Limon, Lincoln Co., June 28, 1935, *Williams 2297* (M, W); dry hillside along Colorado River, Hot Sulphur Springs, Grand Co., July 19, 1935, *Williams 2418* (M, W); north fork of Cache La Poudre River at base of red sandstone cliffs among *Cercocarpus*, Larimer Co., May 21, 1935, *Williams & Williams 2114* (M, W); mouth of Big Thompson Canyon in brush, Larimer Co., May 22, 1935, *Williams & Williams 2131* (M, W); among brush, hillside, Dale Creek, Larimer Co., alt. 7000 ft., May 22, 1935, *Williams & Williams 2132* (M, ND, P, W); granitic open soil near Colo.-Wyo. line, Highway 285, Larimer Co., alt. 7500 ft., May 22, 1935, *Williams & Williams 2141* (M, ND, P, W); Apex, coll. of 1873, *Wolfe 709a* (Cl, F); Littleton, May 28, 1935, *Zobel* (CAS).

NEW MEXICO: summit of grade on Palofleckalo Hill, Sangre de Cristo Range, Taos Co., alt. 9080 ft., June 4, 1934, *Ferguson & Ottley 5303* (G); near top of Palofleckalo Hill in Sangre de Cristo Mountains, alt. 9000 ft., May 28, 1931, *McKelvey 2403* (G); in the Cimarron Mountains, Taos-Cimarron, May 31, 1931, *Nelson 11497* (UCal, Ry).

LOCALITY NOT STATED: "ex regione media montium," alt. 7000–9000 ft., July,

[1] This collection by Vasey, or the following one, may be type collection of *M. papillosa*. The type could not be located.

1884, *Ball* (G); on prairie, soil dry, upper Missouri, May, 1856, *Culbertson (4)* (G); abundant on the prairie, not confined to hillsides, soil very dry, upper Missouri, May, 1856, *Culbertson (3)* (ANS); Rocky Mountains, Missouri and Oregon, coll. of 1845, *Geyer 24* (Kew); "Missouri," *Nuttall* (ANS TYPE of *M. marginata*, M photo).

14a. Mertensia lanceolata var. **secundorum** Ckll. in Torreya **18**: 180. 1918.

M. secundorum Ckll. in Muhlenbergia **3**: 68. 1907.

M. micrantha A. Nels. in Proc. Biol. Soc. Wash. **20**: 37. 1907.

M. media Osterh. in Torreya **17**: 175. 1917.

M. Clokeyi Osterh. in Bull. Torr. Bot. Club **46**: 55. 1919.

Leaves strigose above, strigose to densely hispid below; calyx glabrous to strigose; otherwise as the species.

Distribution: Wyoming and Colorado, often with the species.

WYOMING: Box Canyon, upper Wagon Hound Creek, Converse Co., June 6, 1931, *Rollins 25 in part* (W).

COLORADO: Green Mountain, Estes Park, alt. 8500 ft., Aug. 9, 1933, *Allen 147* (M); dry hillsides, Boulder, coll. of 1904, *Andrews 32* (Ry); open hills, Divide, Teller Co., June 17, 1933, *Applegate 8551* (G); Boulder, May, 1900, *Archibald A156* (C); Pike's Peak, alt. 7000–9000 ft., July, 1884, *Ball* (G); Manitou, Aug. 8, 1916, *Bates 6442* (N); in yard, Manitou, Aug. 18, 1916, *Bates 6534* (N); mountains of Colorado, Aug., 1871, *Canby* (F); summit Genesee Mountain, near Denver, June 8, 1918, *Churchill* (G); Cross Ruxton, alt. 2600 m., June 16, 1901, *Clements & Clements 124* (N, Ry, US, G, M, Cl); hillsides, Idaho Springs, alt. 8000 ft., July 6, 1917, *Clokey 3033* (O, F, G, NY, Clokey, Ry, CAS); dry soil, Bear Creek Canyon, alt. 5500 ft., May 19, 1918, *Clokey 3043* (Clokey, O); hillsides, Apex Canyon, Jefferson Co., alt. 6000 ft., May 25, 1918, *Clokey 3062* (CAS, O, G, M, Ry, NY, Clokey); woods, Lake Eldora, Boulder Co., alt. 9300 ft., July 16, 1918, *Clokey 3161* (CAS, Ry, NY, C, Clokey, O TYPE *M. Clokeyi*, G); openings in pine forest, Jefferson Co., alt. 2280 m., June 12, 1920, *Clokey 3847* (CAS, P, Ry, UM, ANS, M, NY, Clokey, F); Morrison, Jefferson Co., June 22, 1918, *Clokey 5746* (O); dry hillside, Golden-Central City, Jefferson Co., alt. 2440 m., June 9, 1920, *Clokey & Duthie 3846* (P, Clokey); in dry open woods under *Pinus scopulorum*, Florissant, alt. 8000 ft., June 26, 1908, *Cockerell* (Ry); Boulder, May 18, 1908, *Cockerell 6256* (G); Boulder, May 18, 1909, *Cockerell 6257* (C); Estes Park, alt. 9000 ft., July 15, 1904, *Cooper* (AM); Estes Park, alt. 9000 ft., July 15, 1904, *Cooper 110* (Ry); in gravel, Clear Creek Canyon, alt. 9000 ft., June 15, 1873, *Coulter* (US); Palmer Lake, July, 1887, *Eastwood* (C); Golden, May 27, 1916, *Eastwood 5402* (CAS); vicinity of Colorado Springs, El Paso Co., alt. 1800 m., June 19, 1915, *Eggleston 11175* (US); grassy places, Clear Creek Valley, Empire, Aug. 27, 1874, *Engelmann* (M); mouth of Boulder Canyon, May '16, 1907, *Euler* (Ry TYPE); Forks Creek, June 3, 1901, *Ferril* (C, Clokey); Palmer Lake, June 17, 1902, *Ferril* (C); Palmer

Lake, May 28, 1903, *Ferril* (C, Clokey); Boulder Canyon, Boulder, June 8, 1903, *Ferril* (C, O, Clokey); Castle Rock, June 20, 1903, *Ferril* (C, O); open, moist places, Veta Pass, July 4, 1904, *Ferril* (C, Clokey); Sunshine, Boulder Co., coll. of 1885, *Gardner* (G); coll. of 1871, *Greene* (M); Golden City, coll. of 1871, *Greene 613* (G); Rocky Mountains, coll. of 1864, *Hall* (M); Rocky Mountains, coll. of 1862, *Hall & Harbour 134* (G); Rocky Mountains, coll. of 1862, *Hall & Harbour 445* (F); frequent, dry slopes, Ward, alt. 9500 ft., June 25, 1921, *Hanson C295* (M); hills in Coal Creek Canyon, 10 miles northwest of Golden, July 7, 1917, *Johnston & Hedgcock 529* (G); plains, Colorado Springs, May 3, 1878, *Jones 14* (G); Twin Sisters, Larimer Co., alt. 11,000 ft., June 20, 1932, *Kiener* (W); on the Fern Lake Trail, Estes Park, June 20, 1929, *Mathias 396* (Pom); aspen grove in gulch, Rocky Mountain National Park, alt. 8000 ft., July 28, 1931, *Nelson & Ashton 324* (Ry); Moraine, Estes Park, Larimer Co., June 23, 1894, *Osterhout 309* (O); Moraine, Estes Park, Larimer Co., July 20, 1900, *Osterhout 2210* (O); Moraine Park, Larimer Co., July 20, 1903, *Osterhout 2824* (Ry); Palmer Lake, El Paso Co., May 24, 1913, *Osterhout 4882* (NY, O TYPE *M. media*); Moraine Park, Larimer Co., July 10, 1917, *Osterhout 5629* (O, Clokey); Long's Peak Inn, Larimer Co., July 13, 1917, *Osterhout 5652* (O); Palmer Lake, El Paso Co., June 5, 1918, *Osterhout 5722* (Pom, O, C, Ry); Palmer Lake, El Paso Co., June 5, 1918, *Osterhout 5724* (G, O); Palmer Lake, El Paso Co., June 5, 1918, *Osterhout 5725* (C, Ry, NY); from the headwaters of Clear Creek, and the alpine ridges lying east of "Middle Park," coll. of 1861, *Parry 285* (ANS); dry ridges, Empire, June 28–Aug. 7, 1875, *Patterson* (F); vicinity of Georgetown, July 11–Aug. 11, 1876, *Patterson* (F); dry places in Clear Creek Canyon, Georgetown, alt. 8500 ft., July 8 and 27, 1885 *Patterson 115* (M, G, F, UCal); Rocky Mountains, *Peck* (US); Bear Creek Canyon, June 23, 1929, *Phelps* (CAS); dry soil, high ground, north of Nederland, alt. 2500 m., July 1, 1905, *Ramaley 1131* (C); mesa south of Boulder, May 31, 1908, *Ramaley 4826* (C); dry grassland, Smartweed Lake, June 21, 1909, *Ramaley 6309* (C); near Ward, July 19, 1912, *Ramaley 9131* (Ry); Tolland, alt. 9000 ft., July 1, 1916, *Ramaley 10649* (Ry); gulch, near La Veta Pass, June 14, 1928, *Ramaley 12013* (Ry); Sugar Loaf Mountain, July 14, 1906, *Ramaley & Robbins 1750* (C, Ry TYPE *M. micrantha*); at Redrock Lake, about 4 miles west of Ward, alt. 10,000 ft., July 30–31, 1907, *Ramaley & Robbins 3110* (C, Ry); dry grassland, Smartweed Lake, June 15, 1910, *Robbins 7632* (C); Marshall, May, 1909, *Rusk* (US); Veta Mountain, alt. 2400–2700 m., June 4, 1900, *Rydberg & Vreeland 5688* (N, Ry); Ojo, alt. 2400–2500 m., May 26, 1900, *Rydberg & Vreeland 6615* (Ry); Pike's Peak, June 5, 1904, *Schedin & Schedin 315* (Ry); Ute Pass, July, 1904, *Taylor* (ANS); Ute Pass, July 21, 1886, *Trelease* (M); Eldora to Baltimore, Gilpin Co., alt. 8500–9500 ft., June 20–July 10, 1903, *Tweedy 5659* (Ry); plains and foothills near Boulder, Boulder Co., alt. 5000–6000 ft., June, 1903, *Tweedy 5661* (Ry); Douglas Co., coll. of 1892, *Walker* (F); Rollinsville, July, 1901, *Wheeler 358* (C); Pike's Peak auto road, El Paso Co., alt. 7600 ft., June 9, 1922, *Wiegand & Upton 4129* (Cl); moist draw one mile south of Palmer Lake, El Paso Co., alt. 6900 ft., June 22, 1935, *Williams 2249a* (W, M); rocky open hillsides toward base of Pike's Peak, El Paso Co., alt. 7000 ft., June 22, 1935, *Williams 2253* (W, ND, P, M); Clear Creek Canyon, coll. of 1873, *Wolf & Rothrock 709* (ANS); Pike's Peak Trail, alt. 7000 ft., coll. of 1883, *Woodward* (G); Pike's Peak, June 22, 1907, *Wooton* (AM); rocky south slope, near mouth, Boulder Canyon, May 22, 1903, *Young* (F).

14b. Mertensia lanceolata var. **brachyloba** (Greene) A. Nels. in Coult. & Nels., Man. Ry. Mt. Bot. 422. 1909.

M. brachyloba Greene, Pittonia **4**: 90. 1899.

Stems several from each rootstalk, up to 5 dm. tall; leaves glabrous on both surfaces; calyx campanulate, the lobes shorter than the tube, triangular or ovate, obtuse or acute.

Distribution: Larimer Co., Colorado.

COLORADO: foothills near Ft. Collins, Larimer Co., May 24, 1896, *Baker* (Pom, M, AM, F, ND TYPE, Clokey); Log Cañon and Rist Cañon, reached from Ft. Collins, 74 miles north of Denver, on the Union Pacific Railway, alt. 6000–7000 ft., May 31, 1896, *Baker & Holzinger 86* (FC); open meadows, Rocky Mountain National Park, July 4, 1923, *Bebb 3172* (M); North Fork of Big Thompson River, Cliff Crest Cabin, near Estes Park, Larimer Co., July 4, 1935, *Christ 700* (G); Moraine Park, Larimer Co., July 20, 1900, *Osterhout 2211* (Ry); Buckhorn Creek, Larimer Co., June 3, 1916, *Osterhout 5498* (Ry, O, Pom); hillside among brush, mouth of Big Thompson Canyon, 8 miles west of Loveland, Larimer Co., July 17, 1935, *Williams 2409* (W, ND, P, G, NY, O, P, M); in brush, mouth of Big Thompson Canyon, Larimer Co., May 22, 1935, *Williams & Williams 2130* (W, ND, P, G, NY, O, P, M); hillside, Big Thompson Canyon near the mouth, Larimer Co., May 22, 1935, *Williams & Williams 2133* (W, P, ND, M).

14c. Mertensia lanceolata var. **Fendleri** Gray in Proc. Am. Acad. **10**: 53. 1875.

M. Fendleri Gray in Am. Jour. Arts and Sci. II. **34**: 339. 1862.

Calyx usually divided to the middle or less, usually densely strigose but sometimes nearly glabrous; the upper surface of the leaves densely short-strigose, the lower surface glabrous.

Distribution: southern Colorado and northern New Mexico.

COLORADO: Dillon Canyon, Trinidad, June 25, 1897, *Herb. Colo. State Agric. Coll.* (NY); Raton Pass, 13 miles south of Trinidad, Las Animas Co., alt. 8000 ft., June 27, 1922, *Wiegand & Upton 4135* (Cl); hillside among oak in Raton Pass, 14 miles south of Trinidad, Las Animas Co., June 24, 1935, *Williams 2272* (M, ND, P, G, NY, O, P, W).

NEW MEXICO: Santa Fe Canyon, May, 1904, *Bartlett* (AM); Dillon Canyon, June 25, 1897, *Berg 4792* (FC); near Las Vegas, *Cockerell* (US); Trout Spring, Gallinas Canyon, May 24, 1902, *Cockerell 57* (NY); Trout Spring, Gallinas Canyon, May 24, 1902, *Cockerell & Cockerell 82* (Ry); among bushes, Balsam Park, Sandia Mountains, alt. 8200 ft., April 11, 1914, *Ellis 12* (M); foot of hills at some distance from water, Santa Fe Creek bottom, April 26–June 3, 1847, *Fendler 625* (ANS, M, G TYPE); Santa Fe Canyon, 9 miles east of Santa Fe, alt. 8000 ft., June 2, 1897, *Heller & Heller 3640* (Pom, ND, M, G, P, Cl); Bear Canyon, June, 1898, *Herrick 200* (AM); Bear Canyon, May, 1898, *Herrick 260 in part* (AM).

14d. Mertensia lanceolata var. **pubens** (Macbr.), comb. nov.

M. amplifolia Woot. & Standl. in Contr. U. S. Nat. Herb. **16**: 165. 1913.

M. Fendleri var. *pubens* Macbr. in Contr. Gray Herb., N. S. No. 48: 14. 1916.

Similar to the var. *Fendleri* except the leaves pubescent on the lower surface.

Distribution: northern New Mexico and adjacent Colorado.

COLORADO: Veta Pass, *Hicks* (G); top of La Veta Pass, alt. 9382 ft., May 30, 1934, *McKelvey 4820* (G); on sandstone gravel, 61 miles east of Montevista, La Veta Pass, alt. 9100 ft., May 30, 1934, *Stone 607* (NY).

NEW MEXICO: Santa Fe, June, 1921, *Anect 23* (US); Holy Ghost Canyon, below Cowles, July 5, 1931, *Castetter 1075* (Ry); Pecos River, June 16, 1898, *Coghill 4* (M); Bear Canyon, May, 1898, *Herrick 260 in part* (AM); Santa Fe Mountains, June 16, 1898, *Maltby & Coghill 4* (AM); Winsor's Ranch, Pecos River National Forest, alt. 8400 ft., June 29, 1908, *Standley 4023* (AM, NY, G TYPE, M, CAS); damp meadow along Winsor Creek, Pecos River National Forest, alt. 8400 ft., *Standley 4135* (AM); 5 miles above Mora, Rio de la Casa, Mora Co., alt. 2135 m., May 30, 1902, *Sturgis* (G); Glorietta, June, 1881, *Vasey* (G, ND, US TYPE *M. amplifolia*); rich soil, Raton road, 19 miles east of Taos, Colfax Co., alt. 8000 ft., June 5, 1922, *Wiegand & Upton 4128* (Cl).

Mertensia lanceolata and its varieties well demonstrate the difficulty that has been had with the western members of the genus. No less than thirteen names have been used for this plant and its variations. Essentially, as here understood, the plants concerned are five phases of the same species. Two of these, the var. *Fendleri* and var. *brachyloba,* seem to be fairly good varieties on sound morphological ground.

Mertensia lanceolata was first collected by Bradbury and, possibly at the same time, by Nuttall. These collections were made near the northern limit of its range. The specimen collected by Bradbury, and later described by Pursh as *Pulmonaria lanceolata,* is the phase of the species with the upper surface of the leaf strigillose. Nuttall renamed the plant a few years later, stating that Pursh's name was not appropriate, calling it *Pulmonaria marginata.* He gave a good description of it based on a plant collected by himself. The specimen which he "starred," thus indicating it to be a new species, is the phase of the species lacking the strigillose pubescence of the specimen on which Pursh's name is based. The plant, as

Nuttall described it, is the one which most authors have taken to represent typical *M. lanceolata.* The intergradation of these two phases is so complete through most of the range of the species that there seems no reason for separating them.

Mertensia lanceolata var. *secundorum* is a phase of the species in which both surfaces of the leaf are pubescent. This pubescence may either be scant and appressed or very dense and spreading. The stem and calyx may also be pubescent, or they may be essentially glabrous. The biological status of the variety is doubtful. It was found growing intermingled with the species in the field several times and, judging from the number of herbarium sheets on which the two are mixed, their growing together must be of common occurrence.

Mertensia lanceolata var. *brachyloba* is rather limited in its range and in the field is a rather striking variation. It was found growing intermixed with the species. When the hillside where the two grew together was first visited the species was in full flower and the variety was just in bud. At a later date the species was starting to fruit and the variety was in full flower. About a month later the variety was just shedding its seeds while the species had died down and no trace of it could be found. The variety is noticeably more robust and has slightly larger flowers in addition to the campanulate shape of the calyx on which it is separated.

Mertensia lanceolata var. *Fendleri* might be considered as a fairly distinct species if it were not for the fact that intergrades can be found in the same patch which tend to close the "gap" between the species and variety. Abundant herbarium material affords all stages of intergradation.

Mertensia lanceolata var. *pubens* is a further phase of var. *Fendleri* with the leaves pubescent on both sides. It apparently has the same relation to var. *Fendleri* as var. *secundorum* does to the species.

A word need be said concerning the variation in size of flowers and size and shape of leaves in the species and its varieties. Flowers of extreme sizes seem to be due in the main to at least two conditions. First, flowers which come out first tend to be of normal size, but if the plant continues to flower for an abnormally long period the flowers tend to be much smaller. It is also noticed that specimens bearing these small flowers usually have the majority of the inflorescences well along in fruit. Second, position in the inflorescence may account for some variation in size. Plants in the northern part of the range have the flowers averaging slightly larger than those further south. Variation in shape of leaves is rather great but of little or no diagnostic value. Leaves continue to widen through the active life of the plant and may be twice as wide at time of fruiting as they were at flowering time.

15. **Mertensia fusiformis** Greene, Pittonia **4**: 89. 1899.
M. congesta Greene, Pl. Baker. **3**: 17. 1901.
M. papillosa fusiformis A. Nels. in Coult. and Nels., Man. Ry. Mt. Bot. 421. 1909.

Stems erect or nearly so, 1–3 dm. high, glabrous or sparingly pubescent, 1–few from each rootstalk which is usually rather large and fusiform; basal leaves elliptic to oblong-ovate, 4–12 cm. long, 1.5–3 cm. broad, usually densely strigose above, glabrous below, petiole (so far as known) 7–12 cm. long; cauline leaves linear-oblong to ovate-oblong, 1.5–10 cm. long, 0.4–3 cm. broad, sessile or the lowermost short-petiolate, more or less densely strigose above, glabrous below, usually quite obtuse, rarely somewhat acute; inflorescence usually congested, sometimes slightly panicled; pedicels 1–15 mm. long, densely strigose; calyx 3–6 mm. long (mostly 4–5 mm.), slightly accrescent, the lobes lanceolate to lanceolate-ovate, 2–5 mm. long, acute, ciliate, usually pubescent on the backs, occasionally nearly glabrous, not divided to the base; corolla-tube 4–7 mm. long, with a ring of crisp hairs within at the base; corolla-limb 5–7 mm. long, moderately expanded, usually subequal to or shorter than the limb, but sometimes longer; anthers 1.5–2.5 mm. long; filaments 1–3 mm. long, longer or shorter than the anthers; fornices present but usually not conspicuous, glabrous or nearly so; style usually surpassing the anthers, sometimes shorter; nutlets rugose, about 3 mm. long.

Distribution: Wyoming, Colorado, and Utah, in the mountains.

WYOMING: along small stream, 20 miles west of Big Piney, Sublette Co., July 9, 1922, *Payson & Payson 2612* (Ry, M, G, US); dry slopes, Wyoming Range, 15 miles west of Merna, Sublette Co., July 18, 1922, *Payson & Payson 2749* (Pom, F, UCal, ANS, M, O, Ry, US).

COLORADO: Poverty Ridge, above Cimarron, alt. 8500 ft., June 13, 1901, *Baker 129* (US, Ry, G, P, M, UCal, ND TYPE *M. congesta*, Pom); Graham's Peak, alt. 8000 ft., May, 1899, *Baker 558* (M, Ry, US, G, UCal, ND, Pom); open glades, Bob Creek, West La Plata Mountains, alt. 10,000 ft., June 28, 1898, *Baker, Earle & Tracy 206* (G, M, N, ND TYPE, AM, Ry, Cl, US, M, UCal, F, Pom); Cimarron, alt. 7000 ft., May 19, 1898, *Crandall 1637* (FC); Durango, May 23, 1916, *Eastwood 5365a* (CAS); vicinity of Mt. Carbon, Gunnison Co., alt. 2750 m., June 11, 1910, *Eggleston 5669* (US); Durango, May 11, 1906, *Ferril* (C); Rico, May 15, 1906, *Ferril* (C); among sage, juniper, and pinyon, head of Deep Channel Creek, alt. 6400 ft., June 4, 1935 *Graham 9114* (Carnegie, M, W); top of Wolf Creek Pass at Continental Divide, alt. 10,800 ft., May 28, 1934, *McKelvey 4764* (G); warm sandy soils, entrance of Mesa Verde Park, May 12, 1925, *Nelson 10427* (M, G, Ry, UCal); in open pine woods, Durango, May 13, 1925, *Nelson 10444* (Ry, G, M, UCal); sandy soils, among junipers, Mesa Verde Park, May 12, 1925, *Nelson 10429* (M, G, Ry, UCal); steep brushy slopes, Cumbres Pass, May 16, 1925, *Nelson 10474* (UCal); open slopes, Tebaguache Basin, alt. 8000 ft., June 3, 1914, *Payson 376* (F, Ry, C, G, M); southern foothills on a mountain, on Tongue Creek, Mesa Grande, alt. 7000–8000 ft., May, 1892, *Purpus 139* (F); on mountain meadows, vicinity of Mt. Carbon, alt. 2700 m., May 26, 1910, *Tidestrom 3426* (US); Cripple Creek, alt. 10,500 ft., May 15, 1895, *Tweedy 118* (US); near Crawford, Delta Co., alt. 6500 ft., April 26, 1902, *Warren 999* (US); Montezuma Forest Reserve, coll. of 1907, *Wheeler 4793* (C).

UTAH: La Sal, San Juan Co., June 17, 1927, *Cottam 002270* (F); Elk Ridge, 20 miles west of Blanding, San Juan Co., May 7, 1933, *Harrison 5895* (M); sandy creek bottom, four miles south of Moon Lake, Ashley Forest, Duchesne Co., alt. 7600 ft., June 13, 1934, *Harrison & Larsen 7618* (M); moist hillsides, Dyer Mine, Uinta Mountains, June 30, 1902, *Goodding 1222* (F, Pom, UCal, G, N, M, Ry, Cl); Taylor Mountain, 15 miles north of Vernal, Uinta Basin, Uintah Co., alt. 8500 ft., June 24, 1931, *Graham 6303* (M, Carnegie); in sagebrush flat under cottonwoods along river, White Rocks Canyon, Uinta Basin, Uintah Co., alt. 7300 ft., May 23, 1933, *Graham 7806* (W, Carnegie, M); in aspen-pine meadow, Uinta River Canyon, Uinta Basin, Duchesne Co., alt. 7500 ft., June 2, 1933, *Graham 8067* (W, Carnegie, M); summit, Grouse Creek Canyon, north slope of north rim of Uinta Basin, Daggett Co., alt. 7000 ft., June 6, 1933, *Graham 8099* (W, Carnegie, M); Counting Corral, Pot Creek road, northeast of Little Brush Creek Knob, 20 miles northeast of Vernal, Uinta Basin, Uintah Co., alt. 9500 ft., June 7, 1933, *Graham 8120* (W, M, Carnegie); meadow at Trout Creek Ranger Station, 10 miles northeast of Marsh Peak, Uinta Basin, Uintah Co., alt. 9300 ft., June 20, 1933, *Graham 8198* (W, M, Carnegie); Wilson Mesa near Moab, May 29, 1915, *Jones* (CAS, UCal); open hillsides, Summit Springs Ranger Station, Uinta Mountains, Daggett Co., alt. 9000 ft., June 8, 1932, *Williams 564* (CAS, W, Ry, M, U).

Mertensia fusiformis seems to be most closely allied to *M. lanceolata* var. *Fendleri* and may possibly have originated at about the same place in the series. Some specimens are difficult to distinguish from that variety, but on the whole the species *fusiformis* is fairly distinct. If it is to be considered a member of this small series, comprising *lanceolata* and its varieties, which it probably is, it is the most western of the group and the only one which crosses the Rockies. As noted under the discussion of *M. brevistyla,* this species may have given rise to *M. brevistyla* and even though *M. brevistyla* and *M. alpina* are very similar in flower structure they probably represent parallel developments from two distinct ancestral groups. *M. fusiformis,* like *M. lanceolata* (including its varieties), tends to become less pubescent from south to north in its range. Although this species is not known from southern Wyoming it may be expected probably on the west slope of the Medicine Bow Mountains as well as in southwestern Wyoming.

16. Mertensia brevistyla S. Wats. in U. S. Geol. Expl. 40th Par. [Bot. King's Exped.] **5:** 239, *pl. 23, f. 1–2.* 1871.

M. alpina var. *brevistyla* Jones, Contr. West. Bot. No. 12: 56. 1908.

Stems erect or ascending, 1–many from each fusiform rootstalk, more or less pubescent, 1–4 dm. tall; basal leaves (so far as known) broadly lanceolate to oblong, acute or otherwise, strigillose above, glabrous below, 5–13 cm. long, 2–4 cm. broad, petioles longer than the blade; cauline leaves obovate-oblong to narrowly elliptic, obtuse to acute, densely strigillose above, glabrous below, 2–6 cm. long, 0.5–3 cm. broad; inflorescence congested at first, becoming panicled in age; pedicels strigose, 1–14 mm. long; calyx 2–5 mm. long, divided almost to the base, strigose, the lobes narrowly triangular to linear, acute, 1.5–4 mm. long, 0.5–1 mm. broad at the base; corolla-tube 2–4 mm. long, slightly shorter to a little longer than the calyx-lobes, with or without a ring of scattered hairs toward the base within; corolla-limb rotate, 4–6 mm. long; anthers 1–1.3 mm. long, longer than the filaments, inserted on the tube and not exceeding the throat; fornices more or less prominent; style shorter than the calyx-lobes; nutlets rugose 2–3.5 mm. long.

Distribution: southern Wyoming, west-central Colorado, Utah in and adjacent to the Wasatch and Uinta Mountains, southeastern Idaho.

WYOMING: Bridge Peak, Sierra Madre Mountains, alt. 9000 ft., June 17, 1911, *Anthony 47* (US); Hayden Forest, alt. 8000 ft., July 24, 1912 *Eams* (ND); moist shrub-covered slopes, Hayden National Forest, June 5, 1930, *Nelson 11364* (UM, G, M, Ry, UCal, Pom).

COLORADO: Tennessee Pass, June 22, 1901, *Ferril* (C); Baxter Pass, alt. 8000 ft., May 27, 1908, *Jones* (Pom); Minturn, Eagle Co., June 5, 1902, *Osterhout 2561* (Ry); Sapinero, May, 1898, *Wheeler 448* (Ry, C).

Fig. 9. *M. brevistyla.* Habit sketch × ⅓; enlarged flower × 1⅔.

IDAHO: usually deep black soil, high elevations, mountains east of Preston, coll. of 1909, *Henderson 17* (Ry); damp black soil high up on the mountain, east of Preston, May 13, 1909, *Henderson 18* (Ry).

UTAH: aspen woods, east slope of Mt. Timpanogos, Wasatch Mountains, Utah Co., June 12, 1933, *Applegate 8431* (G); Parley's Canyon, May 23, 1908, *Clemens* (M); Red Butte Canyon, May 25, 1908, *Clemens* (ANS); Parley's Canyon, May 29, 1908, *Clemens* (G); Ft. Douglas, May 3, 1909, *Clemens* (M); Red Butte Canyon, May 8, 1909, *Clemens* (G); Ft. Douglas, March 29, 1910, *Clemens* (CAS, Clokey); Salt Lake City, coll. of 1872, *Engelmann* (M); Salt Lake City, April, 1872, *Engelmann* (M); moist rich soil, Red Butte Canyon, April 22, 1905, *Garrett 1075* (Ry, ANS, G); Emigration Canyon, June 14, 1913, *Garrett 2716* (G); Gogorza, Salt Lake Co., May 27, 1922, *Garrett 2958* (Pom); Parley's Canyon, Salt Lake Co., June 16, 1923, *Garrett 3030* (G, Pom); locally common in open dry ground, near Bear River, Uinta Mountains, Summit Co., alt. 2500 m., June 7, 1931, *Goodman 1830* (G, M); uncommon among sagebrush, Horse Creek, Strawberry Reservoir, Uinta Basin, Wasatch Co., alt. 7700 ft., June 18, 1935, *Graham 9248* (M, W, Carnegie); hillside near road, 1 mile east of Soldier Summit, Wasatch, alt. 7000 ft., April 4, 1934, *Harrison 7323* (M); dry rocky slope, Rock Canyon, Provo, Utah Co., alt. 6000 ft., May 4, 1934, *Harrison 7550* (M); Salt Lake City, April 28, 1890, *Jones* (M, UCal); Ft. Douglas, April 28, 1890, *Jones* (Pom); Ft. Douglas, April 30, 1890, *Jones* (UCal, CAS, NY, ND, Ry, G); Parley's Canyon, alt. 8000 ft., July 1, 1898, *Jones* (Pom); Ft. Douglas, May 10, 1909, *Jones* (NY, CAS); Ft. Douglas, May 18, 1909, *Jones in part* (Pom, M, ND, G); Ft. Douglas, alt. 6000 ft., April 24, 1911, *Jones* (G, UCal, Pom); Ft. Douglas, alt. 6000 ft., May 7, 1881, *Jones 2148* (U, G, Ry, AM, Pom); Milburn, alt. 6500 ft., June 2, 1898, *Jones 6472* (M, Pom); under maple, entrance to Sardine Canyon, alt. 5000 ft., June 7, 1933, *Maguire 2438* (G, U); in deep rich soil, in sagebrush, northeast slopes, entrance Sardine Canyon, April 20, 1934, *Maguire 13105* (G); in dry sagebrush, hillside, summit of Sardine Canyon, Cache Co., alt. 5700 ft., May 26, 1933, *Muenscher & Maguire 2435* (U, G); among spruce trees, near West Fork of Bear River, Uinta Mountains, Summit Co., alt. 10,000 ft., July 7, 1926, *Payson & Payson 4918* (ANS, UCal, Ry, G, P, M, Pom); hillside, Cache Junction, Cache Co., May 2, 1909, *Smith 1544* (U, ND, Ry); hillsides, Cache Junction, Cache Co., May 1, 1911, *Smith 2341* (CAS); damp cliffs, Red Butte Canyon, near Salt Lake City, May 10, 1900, *Stokes* (UCal); Wasatch Mountains, alt. 5000 ft., May, 1869, *Watson* (G TYPE); among *Artemisia*, 4 miles north of Park City, Summit Co., May 25, 1935, *Williams & Williams 2143* (M, ND, P, W); hillside among scrub oak, canyon above Ft. Douglas, Salt Lake Co., May 26, 1935, *Williams & Williams 2146* (M, P, ND, W).

In the structure of the corolla *M. brevistyla* shows close relationship to *M. alpina* and *M. humilis.* However, its true relationship may be with *M. fusiformis* with which it shows a great similarity in structure of leaves and of roots as well as indument. Further evidence is found in the corolla of some terminal forms of *M. fusiformis* which approach *M. brevistyla* very closely. Greene's *M. congesta* is such a form of *M. fusiformis. Mertensia brevistyla,* as it is now understood, is thought to be possibly a parallel development to *M. alpina* and not necessarily contiguous with it, even though it simulates it very closely. The Colorado specimens cited are slightly at variance with the material from Utah, but are better referred here than to the allied species *M. fusiformis.* Professor Nelson's collection (No. 11364, which was, according to conversation with Professor Nelson, collected near the Sandstone Ranger Station in what is now Medicine Bow National Forest) taken not far to the north, is quite typical.

17. Mertensia humilis Rydb. in Bull. Torr. Bot. Club **36**: 681. 1909.

M. alpina var. *humilis* Macbr. in Contr. Gray Herb. N. S. No. 48: 20. 1916.

Stems ascending or erect, 4–20 cm. tall; basal leaves oblong-ovate to oblong-lanceolate, glabrous, subcoriaceous, 1–6 cm. long, 0.7–1.6 cm. broad, winged petiole longer or shorter than the blade; cauline leaves linear-oblong to lanceolate-oblong,

Fig. 10. *M. humilis.* Habit sketch × ⅔; enlarged flower × 1⅔.

glabrous or at most pustulate, sessile or nearly so, subcoriaceous, 1.5–6 cm. long, 0.5–1.5 cm. broad; inflorescence congested; pedicels glabrous or pustulate, 0–5 mm. long, calyx glabrous on the back, 2.5–5 mm. long, the lobes broadly to narrowly lanceolate, acute, ciliate, slightly accrescent in fruit, 2–4 mm. long, 0.75–1 mm. broad at the base; corolla-tube exceeding the calyx, glabrous within, 3–6 mm. long; corolla-limb subrotate, 3–6 mm. long; anthers longer than the filaments, 1–1.8 mm. long, included within the tube; fornices prominent, glabrous or slightly hairy, often nearly closing the throat (in fresh material); style 2–3.5 mm. long, about as long as the calyx; nutlets rugose, 2.5–3.5 mm. long.

Distribution: (possibly north-central to) southeastern Wyoming and adjacent Colorado on the high plains and hills.

WYOMING: Laramie, May 1, 1892, *Buffum 644* (Ry); Deer Creek, west of Ft. Laramie, April 10, 1860, *Hayden* (M); Deer Creek, above Ft. Laramie, April 15, 1860, *Hayden* (M); head of Muddy Creek, May 4, 1860, *Hayden* (M); sandy valley, rather dry, near Pilot Knob, *Hobbs 7* (ANS); mediumly moist, sandy soil, Centennial, May 26, 1913, *Hobbs 50 in part* (ANS); Buffalo, May, 1903, *Lothian* (Ry); loamy stream lands, Rock River, alt. 7000 ft., May 24, 1914, *Macbride 2252* (Ry); Laramie Hills, May 16, 1894, *Nelson 33* (Cl, ND, NY, Ry, G, M); Laramie Hills, May 18, 1895, *Nelson 1222* (Pom, Ry, NY); Laramie Hills, May 23, 1894, *Nelson 1234* (P); Laramie Hills, May 30, 1898, *Nelson 4326* (Ry); stony slopes, Sand Creek, Albany Co., June 2, 1900, *Nelson 7043* (Pom, NY TYPE, Ry, M, G); moist open slopes, Sherman, July 7, 1916, *Nelson 9735* (M); Laramie Hills, May 14, 1900, *Nelson 184* (NY); Laramie Plains, May 28, 1897, *Osterhout* (C, Ry); common on moist slopes, south end of Bates Hole, May 16, 1926, *Payson & Payson 4737* (M, Ry); granitic flats, Lake Creek, Medicine Bow Mountains, Albany Co., June 7, 1934, *Williams 1730* (M); barren sandstone knoll one mile east of Laramie, Albany Co., alt. 7200 ft., May 19, 1935, *Williams 2113* (M, W); rocky sandstone hill, 1 mile east of Laramie, Albany Co., alt. 7200 ft., May 21, 1935, *Williams 2120* (M, W); barren limestone hill, 1 mile east of Laramie, Albany Co., alt. 7000 ft., June 13, 1935, *Williams 2193* (W, M); granitic summits on Sherman Hill, Laramie Mountains, alt. 8500 ft., May 25, 1931, *Williams & Solheim 162* (W).

COLORADO: infrequent among sage, Cowdrey, North Park, June 19, 1920, *Ramaley 11773* (C).

Mertensia humilis seems to be most closely allied to *M. alpina.* Field study of both species shows them to be amply distinct. With the exception of a specimen from "Buffalo" Wyoming, which may bear a false label, this species seems to be limited to southeastern Wyoming and adjacent Colorado on the high plains and hills. This distribution is not distinctive for this plant since other species show the same restricted range, *Phlox glabrata* (E. Nels.) Brand., for instance. Although *M. humilis* seems to be restricted in range, within that area it is extremely common. The truncated summit of the Laramie Mountains between Cheyenne and Laramie is literally blue with the plant when it is in flower.

18. **Mertensia alpina** (Torr.) G. Don, Gen. Hist. **4**: 372. 1838.
M. Tweedyi Rydb. in Mem. N. Y. Bot. Gard. **1**: 336. 1900.
M. obtusiloba Rydb. in Bull. Torr. Bot. Club **28**: 32. 1901.

M. brevistyla obtusiloba A. Nels. in Coult. & Nels., Man. Ry. Mt. Bot. 421. 1909.
Pulmonaria alpina Torr. in Ann. Lyc. N. Y. **2**: 224. 1828.
Cerinthodes alpinum O. Kuntze, Rev. Gen. Pl. pt. 2: 436. 1891.

Stems glabrous, erect or ascending, 1–many from each rootstalk, 2–30 cm. tall; basal leaves oblong to linear-lanceolate, short-strigillose above, glabrous below, blade 1–7 cm. long, 0.5–3 cm. broad, winged petiole usually shorter than the blade; cauline leaves sessile or nearly so, broadly to narrowly lanceolate or elliptical, 1–6 cm. long, 0.3–1.8 cm. broad, short-strigillose above, glabrous below; inflorescence sometimes slightly panicled in age; pedicels strigose or glabrous, 1–10 mm. long;

Fig. 11. *M. alpina.* Habit sketch × 1/3; enlarged flower × 1 2/3.

calyx divided almost to the base, 2–5 mm. long, often slightly accrescent, lobes linear-lanceolate to oblong, obtuse or acute, glabrous on the back, ciliate; corolla-tube glabrous within, as long as or usually exceeding the calyx-lobes, 3–6 mm. long; corolla-limb much expanded, 2–6 mm. long; anthers about 1 mm. long, about as long as or longer than the filaments, inserted in the tube and not projecting beyond it; fornices prominent, often almost closing the throat; style short, about equalling the calyx; nutlets about 2 mm. long, rugose.

Distribution: southwestern Montana, adjacent Wyoming and Idaho, south to northern New Mexico. Alpine or subalpine in the high mountains.

MONTANA: Middle Creek Canyon, Mt. Hyalite, alt. 10,000 ft., Aug. 1, 1902, *Blankinship* (FC); Grasshopper Glacier, near Cook City, alt. 10,500 ft., Aug. 6, 1926, *Conard 1896* (Ry); Lake Plateau, alt. 9000 ft., Aug., 1899, *Koch* (NY); Lake Plateau, alt. 10,000 ft., Aug. 1, 1897, *Koch 34* (G); mountains near Indian Creek, alt. 8000 ft., July 21, 1897, *Rydberg & Bessey 4866* (NY, ND, F); Old Hollowtop, near Pony, alt. 9000 ft., July 7 and 9, 1897, *Rydberg & Bessey 4867* (G, NY TYPE *M. Tweedyi*, P, UM, ND, F, Ry); moist mountain side, Gallatin Peak, Gallatin Co., Aug. 23, 1928, *Swingle* (Ry, FC); Spanish Peaks, July 10, 1901, *Vogel* (G).

WYOMING: without definite locality, July 18, 1891, *Buffum 643* (Ry); summit, Mt. Washburn, Aug. 6, 1924, *Conard 1573* (Ry); Mt. Washburn, alt. 10,300 ft., July 10, 1931, *Condon 5753* (M); upper Buffalo Fork to head of Du Noir River, Aug. 15–Sept. 8, 1899, *Curtis* (NY); receding snow, Ten Sleep Lakes, Big Horn Co., July 31, 1901, *Goodding 447* (Ry); summit of mountain, Big Horn Mountains, alt. 10,000 ft., July 27, 1900, *Jack* (G); alpine meadow, near top of Mt. Washburn, alt. 10,600 ft., July 14, 1932, *Maguire & Maguire 1211* (U, UCal, Pom); Dome Lake, Big Horn Mountains, July 18, 1896, *Nelson 2430* (Ry) and *2434* (G, Cl, M, Ry); among the rocks of the cliffs, Laramie Peak, Albany Co., July 12, 1900, *Nelson 7549 in part* (C); on moist, craggy summit, The Thunderer, July 13, 1899, *Nelson & Nelson 5811* (G, M, Pom, AM, Cl, NY, O, ND, Ry); Dome Lake, Elk Mountain, Sheridan Co., alt. 10,500 ft., June 28, 1897, *Pammel & Stanton* (NY, M); alpine rock-gravel slopes, Saltlick Mountain, northeast of Kendall, Sublette Co., Aug. 7, 1922, *Payson & Payson 2977* (Pom, G, UCal, F, M, NY, ANS, Ry); in the vicinity of Green River lakes, Sheep Mountain, Sublette Co., alt. 10,700–11,600 ft., Aug. 1, 1925, *Payson & Payson 4467* (Ry, M, G); dry to moist gravel slopes, Mt. Washburn, alt. 10,200 ft., July 25, 1928, *Smith 28* (P); Black Rock Creek, Teton Forest Reserve, alt. 11,000 ft., Aug. 1897, *Tweedy 166* (NY); Mt. Holmes, Yellowstone Park, alt. 9400 ft., Aug., 1884, *Tweedy 192* (NY, ND); Big Horn Mountains, Sheridan Co., alt. 11,000 ft., Aug., 1899, *Tweedy 2602* (NY); dry gravelly soil, Mt. Washburn, Yellowstone Park, alt. 10,000 ft., July 11, 1921, *Wiegand 2082* (Cl).

COLORADO: Pike's Peak, Aug. 6, 1916, *Bates 6410 in part* (Cl); Pike's Peak, July 21, 1894, *Bessey* (NY); Garden of the Gods, Pike's Peak, July 24, 1894, *Bessey* (NY); Pike's Peak, alt. 13,000 ft., July 27, 1895, *Bessey* (NY); Pike's Peak, alt. 12,500 ft., Aug. 6, 1895, *Bessey* (NY); Pike's Peak, alt. 13,000 ft., July 25, 1896, *Bessey* (NY); Pike's Peak, alt. 13,000 ft., June 25, 1896, *Biltmore Herbarium 2700a* (G); alpine, Pike's Peak, Aug. 27, 1895, *Canby* (G); Pike's Peak, coll. of 1900, *Clements* (NY TYPE *M. obtusiloba*); Saddle Cliffs, alt. 4000 m., July 6, 1901, *Clements & Clements 405* (G, M, Ry, Cl, NY); moist hillsides, Pike's Peak, alt. 13,000 ft., Sept. 3, 1919, *Clokey 3309* (Clokey); moist soil along stream, Pike's Peak, El Paso Co., alt. 3965 m., Aug. 30, 1920, *Clokey 3849* (Clokey, CAS, G, NY, UM, F, P); among rocks above Wood's reservoir, Cripple Creek, Teller Co., alt. 3570 m., July 31, 1920, *Clokey 3856* (Clokey, CAS, P); above timberline, Pike's Peak, Aug. 11, 1884, *Crocker* (ANS); Pike's Peak, alt. 14,000 ft., Aug. 19, 1915, *Drushel* (M); coll. of 1862, *Hall & Harbour 443* (Cl, F); The Saddle, Pike's Peak Trail, Aug., 1900, *Harper & Harper* (M); Pike's Peak, Aug. 13, 1888, *Holway 30* (NY); Pike's Peak, Aug. 2, 1904, *Huestis* (Clokey, C); Rocky Mountains, *James* (NY TYPE); on Long's Peak, July, 1905, *Johnston 18* (Ry); very common on cool north-facing alpine slope, The Saddle, Pike's Peak Region, July 9, 1920, *Johnston 2811* (UCal); very common on a grassy slope just below timberline, between Seven Lakes and Lake Moraine, Pike's Peak, alt. 11,200 ft., July 14, 1920, *Johnston 2812* (G); at timberline, on grassy subalpine slope, Windy Point, Pike's Peak, alt. 11,600 ft., Aug. 3, 1920, *Johnston 2813* (G); Argentine Pass, alt. 12,000 ft., July 10, 1878, *Jones 54 in part* (NY); Pike's Peak, Aug., 1885, *Leconte* (ANS); Pike's Peak, alt. 13,000 ft., Aug. 13, 1884, *Letterman 339* (M); Pike's Peak, El Paso Co., alt. 14,000 ft., Aug. 26, 1915, *Munz 118* (Cl); Pike's Peak, Aug. 26, 1915, *Osterhout 5389* (O, Ry); Pike's Peak, alt. 9000 ft., June, 1891, *Penard 474* (NY); Arapahoe Mountain, alt. 11,000 ft., July, 1891, *Penard 529* (NY); Pike's Peak, alt. 13,000 ft., July 8, 1893, *Saunders* (NY); near summit, Pike's Peak, Aug., *Schedin & Schedin 314, 323* (Ry); Pike's Peak, alt. 14,000 ft., Aug. 16, 1892, *Sheldon 5823* (NY); Pike's Peak, alt. 13,000 ft., Aug., 1914, *Walker* (C); Pike's Peak, July, 1888, *Wentworth* (NY); near a stream above Glen Cove, north side of Pike's Peak, El Paso Co., alt. 12,000 ft., Aug. 10, 1935, *Williams 2464* (W, M); Colorado Springs, Park Co., alt. 13,000 ft., July, *Williamson* (ANS); above timber-line, Pike's Peak, July 10, 1901, *Williamson* (ANS); Pike's Peak, June, 1894, *Woodruff* (NY).

NEW MEXICO: mountain, head of Red River, Franklin, July 26, 1897, *Berg 1632* (FC, NY).

IDAHO: base to summit of mountains northeast of lake, north side of peak, Henry Lake, Fremont Co., alt. 9000 ft., July 17, 1920, *Payson & Payson 2043* (G, Clokey, CAS, NY, Ry, M); Mt. Chauvet, alt. 10,000 ft., July 29, 1897, *Rydberg & Bessey 4865* (NY, US).

Mertensia alpina has been a convenient name for any *Mertensia* of high altitudes in the West and has been applied to most of them. In the main it is easily distinguished by the included anthers. Superficially, *M. alpina* is closely allied to *M. brevistyla* and *M. humilis,* but it may be, and probably is, more closely related to *M. viridis,* which it approaches in habit, leaves, pubescence, and is approached by *M. viridis* in the structure of the corolla in some unusual specimens. The greater part of the material examined is from Colorado, and all but a few specimens are from Pike's Peak. More localities are known for Wyoming, although that state is much less perfectly known botanically than Colorado. The discontinuous distribution of *M. alpina* is of interest. Several other of the plants limited to the high mountains of the Rocky Mountain area show a similar distribution, and more will no doubt be found when the flora is better understood.

19. Mertensia viridis A. Nels. in Bull. Torr. Bot. Club **26**: 244. 1899.

M. lanceolata var. *viridis* A. Nels., First Rept. Fl. Wyo., 158. 1896.

M. ovata Rydb. in Bull. Torr. Bot. Club **28**: 32. 1901.

M. lineariloba Rydb., *l.c.*

M. Parryi Rydb. in Bull. Torr. Bot. Club **31**: 639. 1904.

M. perplexa Rydb., *l.c.*

M. viridula Rydb., *l.c.*

M. papillosa lineariloba A. Nels. in Coult. & Nels., Man. Ry. Mt. Bot. 421. 1909.

M. lanceolata var. *lineariloba* Macbr. in Contr. Gray Herb. N. S. No. 48: 15. 1916.

M. alpina var. *perplexa* Macbr., *l. c.* 20.

Stems erect or ascending, 5–35 cm. tall, 1–several from each rootstalk; basal leaves lanceolate to ovate, 2–10 cm. long, 1–4 cm. broad, strigillose above, glabrous below, lateral veins sometimes apparent, petioles longer or shorter than the blade; cauline leaves sessile or nearly so, lanceolate to broadly ovate, 2–7 cm. long, 0.7–2.5 cm. broad, strigillose above, glabrous below, lateral veins rarely visible; inflorescence a crowded, modified, scorpioid cyme; pedicels strigose or glabrous, 1–10 mm. long; calyx 2–6 mm. long (mostly 4–5 mm.), the lobes divided almost to the base, linear-lanceolate to narrowly ovate-lanceolate, acute or obtuse, glabrous on the backs, ciliate, somewhat accrescent in fruit; corolla-tube 3–9 mm. long (mostly about 6 mm.), usually with a ring of crisped hairs near the base within, occasionally also with scattered hairs; corolla-limb 4–9 mm. long (mostly about 5 mm.), moderately expanded, usually a little shorter than the tube in flowers having a long style and filaments longer than the anthers, in flowers having a short style and filaments about the same length as or shorter than the anthers the tube may be much shorter than the limb; anthers 1–2.5 mm. long (usually about 1.5–2 mm.); filaments 1–3.5 mm. long, longer or shorter than the anthers; fornices conspicuous, glabrous to densely pubescent; style various, exceeding the anthers and about as long as the corolla to shorter than the tube of the corolla; nutlets 2–3 mm. long, rugose.

Distribution: Montana (Deer Lodge Co.), south through Colorado and Utah, in the mountains.

MONTANA: alpine meadows, Mt. Baldy, Anaconda, alt. 9300 ft., July 21, 1909, *Blankinship* (UCal, Ry); Mt. Powell, Deer Lodge Co., alt. 10,000 ft., June 30, 1918, *Blankinship* (Pom, UCal, Ry).

WYOMING: Laramie Peak, Aug. 6–7, 1895, *Nelson 1608* (G, Ry TYPE); among the rocks of the cliffs, Laramie Peak, Albany Co., July 12, 1900, *Nelson 7549* (Pom, O, G, Ry, M); alpine rock crevices, Wind River Mountains, 10 miles northeast of Fremont Lake, Sublette Co., July 30, 1922, *Payson & Payson 2886* (UCal, F, G, Pom); rocks near summit, Saltlick Mountain, northeast of Kendall, Sublette Co., Aug. 7, 1922, *Payson & Payson 2979* (US, M).

COLORADO: Continental Divide, Estes Park, alt. 10,000 ft., Aug. 7, 1933, *Allen 105* (M); timberline, Arapahoe Pass, coll. of 1904, *Andrews 9* (Ry); trail, Pike's Peak, July, 1895, *Atkinson* (Cl); Cameron Pass, alt. 11,500 ft., July 14, 1896, *Baker* (M, NY, ND, Pom); north Cheyenne Canyon, from the neighborhood of Pike's Peak, July 16, 1894, *Bessey* (NY TYPE *M. viridula*); Cascade Cañon, alt. 8000 ft., July 11, 1895, *Bessey* (NY); Breckenridge, coll. of 1871, *Brandegee* (ANS); Breckenridge, Summit Co., coll. of 1871, *Brandegee 256* (UCal); alpine, Sierra Sangre de Cristo, Aug., 1873, *Brandegee 652* (UCal, M); Chasm Lake, Long's Peak, Aug. 14, 1907, *Clements* (NY); Jack Brook, June 25, 1901, *Clements & Clements 232* (Ry, US, NY, G, Cl, M); mountain side, Ida Bell Mine, Summit Co., alt. 11,500 ft., Aug. 8, 1917, *Clokey 2902* (Ariz, CAS, Ry, NY, G, Clokey, F); mountain side, Arapahoe Peak, Boulder Co., alt. 12,000 ft., July 29, 1918, *Clokey 3187* (Clokey, CAS, G, Ry, NY, M); open hillsides, Caribou Mine, Boulder Co., alt. 10,200 ft., June 12, 1919, *Clokey 3293, 3294* (Clokey); among rocks, above timber, Manassas Creek, Chaffee Co., alt. 10,000 ft., July 27, 1919, *Clokey 3560* (Clokey, CAS, P, NY, UM, G, Ry, M, Pom); cold soil below cliff, near snow, Lach Vale, Estes Park, Larimer Co., alt. 3126 m., Sept. 16, 1920, *Clokey 3850* (Clokey, UM, CAS, NY, P); moist soil, Mt. McClellan, Clear Creek Co., alt. 3935 m., Aug. 14, 1920, *Clokey 3851* (F, CAS, UCal, Clokey, ANS, Ry, UM, G, M, NY, Pom); dry hillside, Waldorf Mine, Clear Creek Co., alt. 11,900 ft., Aug. 15, 1920, *Clokey 3854* (Clokey); dry hillside, Fall River Pass, Grand Co., alt. 3485 m., Aug. 11, 1921, *Clokey, Bruderlin & Clokey 4256* (F, CAS, Clokey, ANS, M, Ry, C, UM, NY, Pom); Long's Peak, alt. 11,000–11,500 ft., Aug. 3–5, 1904, *Cooper 74, 169* (Ry); Estes Park, alt. 12,000 ft., Aug. 13, 1906, *Cooper 119* (Ry); among large boulders on north-facing slope, James Peak, alt. 11,500 ft., July 14, 1929, *Cox 371* (F); Front Range, alt. 12,000 ft., July 6, 1896, *Crandall* (M); trail, Gray's Peak, alt. 12,000 ft., July 18, 1892, *Crandall 739, 1819* (FC); Rocky Mountain National Park, July, 1926, *DeFrance* (Cl); Mt. Audubon, July 19, 1908, *Dodds & Robbins 5819* (Ry); moist soil near water, Cascade, July 1, 1903, *Ferril* (Clokey, C); Graymont, July 16, 1891, *Fritchey* (M); rocky north slopes, Anita Peak, Routt Co., Aug. 3, 1903, *Goodding 1777* (UCal, G, C, Cl, NY, M, Ry); moist places below snow, summit of North Park Range, Larimer Co., Aug. 10, 1903, *Goodding 1827 in part* (Ry, ANS, Cl, G, UCal); among boulders on summit, Ethel Peak, Larimer Co., Aug. 14, 1903, *Goodding 1889* (NY, Ry); on north slope of burned-over area, 2 miles southeast of mouth of Wolf Creek, south side of White River, Uinta Basin, Rio Blanco Co., alt. 6500 ft., June 1, 1935, *Graham 9070 in part* (W, M, Carnegie); Colorado mountains, coll. of 1872, *Gray* (G); Corona Crest, alt. 11,700 ft., June 30, 1914, *Hall* (UCal); St. Elmo, June, 1886, *Harper* (F); Beaver Creek, alt. 12,000 ft., July 19, 1898, *Herb. Colo. State Agric. Coll. 4189* (NY, FC, P, Ry); James' Peak, alt. 13,000 ft., July 26, 1899, *Holm* (F); Torrey's Peak, coll. of 1877, *Hooker & Gray* (M, G); Gray's and Torrey's Peaks, coll. of 1877, *Hooker & Gray* (G); Sierra Blanca, coll. of 1877, *Hooker & Gray* (G); Rollins Pass, July 20, 1895, *Huestis* (C); Rollins Pass, July 18, 1903, *Huestis* (C); up Bear Creek, Colorado Springs, June 12, 1917, *Johnston & Hedgcock 536* (G); Colorado Springs, alt. 6000 ft., May 3, 1878, *Jones 916* (NY); on roof of Lake Isabel cabin, Boulder Co., alt. 10,800 ft., June 29, 1934, *Kiener 1045* (W); subalpine meadow below Lacy Lake, Boulder Co., alt. 10,400 ft., July 7, 1934, *Kiener 1046* (W); Gray's Peak, July 22, 1886, *Letterman* (M); Pike's Peak, alt. 13,000 ft., Aug. 13, 1884, *Letterman 339* (F); near Breckenridge, Summit Co., alt. 12,500 ft., Aug., 1901, *Mackenzie 220* (Ry, M); Pingree Park, Aug. 2, 1924, *McCarty 36* (UCal); Glen Eyrie to Garden of the Gods, June, 1895, *Meredith* (ANS); Long's Peak, Aug. 1896, *Mosely* (C); Boulder Co., coll. of 1896, *Mosely A316* (C, Ry); mountain meadow, Corona, Aug. 6, 1919, *Munz 2967* (Pom); moist alpine at James Peak, alt. 13,000 ft., Aug. 7, 1919, *Munz 3046* (Pom); mountains of Estes Park, July 22, 1897, *Osterhout* (F); mountains south of Ward, Boulder Co., July 18, 1901, *Osterhout 2439* (UCal, O, NY TYPE *M. perplexa)*; mountains of Estes Park, Larimer Co., July 22, 1903, *Osterhout 2848* (NY, Ry, UCal); range beyond Windy Gulch, mountains of Estes Park, Larimer Co., Aug. 19, 1905, *Osterhout 3116b* (O); Gray's Peak, Clear Creek Co., July 20, 1910, *Osterhout 4353* (O); range beyond Windy Gulch, Moraine Park, Larimer Co., Aug. 4, 1922, *Osterhout 6281* (O); Rocky Mountains, coll. of 1862, *Parry* (US); Rocky Mountains, coll. of 1872, *Parry* (NY, G, ANS, M); from the headwaters of Clear Creek, and the alpine ridges lying east of "Middle Park," coll. of 1861, *Parry 286* (G, NY TYPE *M. Parryi)*; from the headwaters of Clear Creek, and the alpine ridges lying east of "Middle Park," Rocky Mountains, coll. of 1861, *Parry 287* (F); high mountains, Gray's Peak and vicinity, alt. 11,000–14,000 ft., July, Aug. 28, 1885, *Patterson 113* (F, M, UCal); Gray's Peak, Aug., 1882, *Patterson & Beaty* (F); Silver Lake, Aug., 1914, *Phelps* (CAS); vicinity of Colorado Springs, *Pierce* (NY); Long's Peak, July 24, 1920, *Preston* (FC); Rollins Pass, Corona, Aug. 7–8, 1907, *Ramaley 3325, 3326* (AM); shade, Tolland, July 1, 1916, *Ramaley 10649* (C); Bryan Mountain, alt. 11,000 ft., July 12, 1916, *Ramaley 10690* (Ry, C); Upper Stuart Lake, near Tolland, July 31, 1918, *Ramaley 11446* (C); damp knoll, Tolland, alt. 2800 m., July 14, 1920, *Ramaley & Clokey 3855* (US, P, CAS, Clokey); damp knoll, Tolland, Gilpin Co., alt. 2800 m., July 14, 1920, *Ramaley & Clokey 3976* (P, Clokey, CAS); at timberline and above on Bald Mountain, Boulder Co., alt. 11,500 ft., July 20, 1907, *Ramaley, Dodds & Robbins 3247* (Ry, C); above timber, Arapahoe Mountain, July 29, 1906, *Ramaley & Robbins 2411* (Ry, C); Rollins Pass, Corona, alt. 11,000–11,700 ft., Aug. 7–8, 1907, *Ramaley & Robbins 3325, 3326* (Ry, C); Tolland, July 4, 1908, *Ramaley & Robbins 5217* (C); Gray's Peak, alt. 12,000 ft., July 30, 1872, *Redfield* (M); Mt. Audubon, July 19, 1908, *Robbins 5819* (C); West Spanish Peak, alt. 2800–3000 m., July 6, 1900, *Rydberg & Vreeland 5690* (FC, O, Ry, NY TYPE *M. ovata)*; West Spanish Peak, alt. 3000–3800 m., July 9, 1900, *Rydberg & Vreeland 5690a* (NY); West Indian Creek, alt. 2500–2700 m., June 14–15, 1900, *Rydberg & Vreeland 5691* (NY TYPE *M. leariloba)*; wet woods between Brainard and Mitchell Lakes west of Ward, July 17, 1919, *Schmoll 4* (C); near Lake Isabelle, Ward, June 24, 1922, *Schmoll 558, 559* (C); Alpine Tunnel, alt. 11,000 ft., July

17, 1897, *Shear 3853* (NY); above timber, Gray's Peak, Aug. 31, 1884, *Smith* (ANS); Rocky Mountains, coll. of 1868, *Vasey 437* (G, M); Sapinero, May 29, 1898, *Wheeler 454* (Ry, C); Pike's Peak auto road, El Paso Co., alt. 8500 ft., June 9, 1922, *Wiegand & Upton 4133* (Cl); moist hillsides in aspen, toward the base of Pike's Peak, 17 miles east of Colorado Springs, El Paso Co., alt. 8000 ft., June 22, 1935, *Williams 2251* (M, ND, W); moist mountain side, Trail Ridge, Rocky Mountan National Park, alt. 11,000 ft., July 19, 1935, *Williams 2411* (M, ND, W); rocky, grassy summit of a mountain east of Cameron Pass, Jackson Co., alt. 12,000 ft., July 21, 1935, *Williams 2446* (M, W); moist grassy slope of a mountain east of Cameron Pass, alt. 11,500 ft., July 21, 1935, *Williams 2448* (M, W); rocky, grassy summit of a mountain west of Cameron Pass, Jackson Co., alt. 12,000 ft., July 21, 1935, *Williams 2450* (M, W); slopes of Mt. Chapin, Larimer Co., Aug. 14, 1927, *Woodson 1848* (M); July 29, 1903, *Young* (F).

UTAH: gravel, Mt. Ellen, Henry Mountains, alt. 10,000 ft., July 27, 1894, *Jones 5688* (Pom, M); among rocks, alpine belt, west slope of Mt. Peale, La Sal Mountains, San Juan Co., alt. 12,000 ft., July 5, 1932, *Maguire & Redd 2117* (U); saddle, south of Mellenthin, La Sal Mountains, San Juan Co., alt. 11,800 ft., July 26, 1933, *Maguire, Richards, Maguire & Hammond 5109* (U, G); in cirque on east side of Mt. Mellenthin above timberline, La Sal Mountains, San Juan Co., alt. 11,800 ft., July 26, 1933, *Maguire, Richards, Maguire & Hammond 5110* (G); west slope of Mt. Hobbs, 2000 ft. above timberline, La Sal Mountains, Grand Co., alt. 11,800 ft., July 18, 1933, *Maguire, Richards, Maguire & Hammond 5111* (UCal, U, O); meadows in saddle between Castle and Waas Mountains, La Sal Mountains, Grand Co., alt. 11,500 ft., July 13, 1933, *Maguire, Richards, Maguire & Hammond 5112* (M, U, G); rocky slope on north side of Gold Mountain, La Sal Mountains, Grand Co., July 11, 1933, *Maguire, Richards, Maguire & Hammond 5113* (M, UCal, U, G); summit of Mt. Tuk, La Sal Mountains, San Juan Co., July 29, 1933, *Maguire, Richards, Maguire & Hammond 5114* (G); rock slides, La Sal Mountains, Grand Co., alt. 11,000–11,500 ft., July 23, 1924, *Payson & Payson 3983* (UCal, G, M, Ry); slide rock, La Sal Mountains, Grand Co., alt. 11,500 ft., July 27, 1924, *Payson & Payson 4032* (G, Ry); rocky soil, Mt. Tomasaki, La Sal Mountains, alt. 11,000–12,000 ft., Aug., 1897, *Purpus 6675* (M, UCal); La Sal Mountains, alt. 3300–3600 m., July 7, 1911, *Rydberg & Garrett 8653* (Ry, NY); Horse Gulch and vicinity, La Sal Mountains, alt. 3000–3200 m., July 15, 1911, *Rydberg & Garrett 8957* (NY, O), *8958* (Ry, NY), and *8959* (NY); La Sal Mountains, near Mt. Peal, alt. 3300–3700 m., July 17, 1911, *Rydberg & Garrett 8998* (NY); dry hillsides, vicinity of Flaming Gorge, Daggett Co., alt. 6000 ft., June 2, 1932, *Williams 488* (W, U, Ry, M, CAS, Pom).

WITHOUT LOCALITY: a specimen marked "ex herb. Hooker, *Lithospermum Drummondii,* Fl. Bor.-Am." and "Nov. 1874. I say it is *M. sibirica* Don var. *Drummondii.* Large flowered form." A. Gr. [ay]. The specimen probably came from Colorado. (NY). See footnote on p. 140.

19a. Mertensia viridis var. **dilatata** (A. Nels.), comb. nov.

M. coriacea A. Nels. in Bull. Torr. Bot. Club **29**: 402. 1902.

M. coriacea var. *dilatata* A. Nels., *l.c.* 403.

Similar to the species except the leaves glabrous on both sides.

Distribution: in the mountains of southeastern Wyoming, adjacent Colorado, and Uinta Mountains, Utah.

WYOMING: Medicine Bow Mountains, Aug., 1856, *Engelmann* (M); Medicine Bow Peak, Medicine Bow Mountains, Albany Co., alt. 11,500 ft., Aug. 3, 1929, *Greenman & Greenman 6196* (M); alpine rocky heights, Medicine Bow Mountains, July 17, 1925, *Hanna 100* (M); shores of alpestrine lakes, Medicine Bow Mountains, Albany Co., Aug. 1, 1900, *Nelson 7844* (Pom, C, M, G, Ry TYPE); in alpine rock slides, Medicine Bow Mountains, Albany Co., Aug. 1, 1900, *Nelson 7870* (Pom, C, G, Ry TYPE *M. coriacea*, M); in alpine rock slides, Medicine Bow Mountains, Aug. 15, 1908, *Nelson 9149* (G, M, Ry, Cl); alpine, among rocks, Medicine Bow Mountains, Aug. 14, 1914, *Nelson 9683* (M) and *9686* (Ry); wet stony ridges, University Camp, Medicine Bow Mountains, June 29, 1925, *Nelson 10554* (Ry, UM); alpine, among quartzite rock, Medicine Bow Mountains, July 15, 1925, *Nelson 10574* (G, M, Ry, UCal); La Plata Mines, Aug. 29, 1898, *Nelson 5182* (Ry); among large rocks on Medicine Bow Peak, Medicine Bow Mountains, alt. 11,500 ft., Aug. 4, 1926, *Payson & Payson 5156* (UCal, ANS, M, P, Ry, G, Pom); dry plains and rocky hills, Mt. Steele, Carbon Co., alt. 6500 ft., May 25–June 10, 1901, *Tweedy 4268* (NY); moist rocky hillside, upper Libbey Creek, Medicine Bow Mountains, Albany Co., July 13, 1935, *Williams 2386* (M, ND, O, P, NY, G, W).

COLORADO: moist places below snow, summit of North Park Range, Larimer Co., Aug. 10, 1903, *Goodding 1827* (C, M).

UTAH: grassy slopes, Uinta Mountains, Daggett Co., alt. 10,000 ft., June 11, 1932, *Williams 599* (W, U, Ry, CAS).

19b. Mertensia viridis var. **caelestina** (Nels. & Ckll.), comb. nov.

M. caelestina Nels. & Ckll. in Proc. Biol. Soc. Wash. **16**: 46. 1903.

Cauline leaves lanceolate to ovate, glabrous on both surfaces; calyx 6–7 mm. long, the lobes linear-lanceolate to oblong, acute or obtuse, ciliate; corolla-tube 7–9 mm. long, glabrous or pubescent within; corolla-limb 5.5–8 mm. long.

Distribution: northern New Mexico.

NEW MEXICO: Lake Peak, vicinity of Santa Fe, Aug. 12, 1926, *Arsène & Benedict 16131* (F); mountain tops, head of Red River, Franklin, July 26, 1897, *Berg* (NY, FC); near timberline, Santa Barbara Divide, July 25, 1931, *Castetter 726* (NMex, Ry); above timberline, Truchas Peak, coll. of 1902, *Cockerell 40* (Ry TYPE); top of Pecos Baldy, alt. 12,500 ft., July 11, 1908, *Standley 4269* (AM); Truchas Peak, alt. 12,500 ft., Aug. 8, 1908, *Standley 4784* (M, NY, AM); above timberline, Baldy Peak, Colfax Co., alt. 3600 m., Sept. 4, 1916, *Standley 14329* (US).

19c. Mertensia viridis var. **cynoglossoides** (Greene) Macbr. in Contr. Gray Herb. N. S. No. 48: 13. 1916.

M. cynoglossoides Greene, Pl. Baker. **3**: 19. 1901.

M. muriculata Greene, *l.c.*

Stems 3–5.5 dm. tall; basal leaves elliptic-oblong to ovate, 11–15 cm. long, 4–6 cm. broad, scabrous above, the bases of the hairs pustulate; cauline leaves oblong to ovate, 4–13 cm. long, 3–5 cm. broad, pubescence as of basal leaves; pubescence of pedicels spreading, hispid.

Distribution: known only from the type locality.

COLORADO: Black Canyon, June, 1901, *Baker* (Pom); Black Canyon, June 20, 1901, *Baker 191* (Pom, ND TYPE, UCal, Ry, P, M, G); Black Canyon, June 20, 1901, *Baker 193* (M, ND TYPE *M. muriculata*, Ry, G, US, Pom).

19d. Mertensia viridis var. **parvifolia,** var. nov.[1]

Stems ascending; basal leaves lanceolate 1.5–3 cm. long, 0.5–1 cm. broad, glabrous below, strigose above, petiole longer than the blade; cauline leaves linear-lanceolate to lanceolate, 1–5 cm. long, 0.2–1 cm. broad, glabrous below, strigose above, usually directed upward and hence appearing unilateral on the stems.

Distribution: north-central Colorado.

COLORADO: open hillside, Caribou Mine, Boulder Co., alt. 10,200 ft., June 12, 1919, *Clokey 3293* (UM, G, M, P, CAS, Pom, NY, Ry); open hillside, Caribou, Boulder Co., alt. 10,200 ft., June 12, 1919, *Clokey 3294* (CAS, NY, M, Ry, G); above timber, Cameron Pass, alt. 12,500 ft., July 5, 1894, *Crandall* (P); vicinity of Gray's Peak, Aug., 1882, *Patterson & Beaty* (F); Silver Lake, alt. 3200 m., July 1, 1905, *Ramaley 1178* (Ry, C); rocky, grassy summit of a mountain east of Cameron Pass, Jackson Co., alt. 12,000 ft., July 21, 1935, *Williams 2444* (M TYPE, W, O, NY, G, ND, P); Estabrook, Park Co., July 26, 1919, *Young* (Cl).

19e. Mertensia viridis var. **cana** (Rydb.), comb. nov.

M. canescens Rydb. in Bull. Torr. Bot. Club **31**: 640. 1904, not Kauff., 1824.

M. cana Rydb. in Bull. Torr. Bot. Club **36**: 698. 1909.

Similar to var. *parvifolia;* cauline leaves linear to narrowly ovate, more or less densely canescent on both surfaces; calyx-lobes usually glabrous on the backs but sometimes slightly pubescent.

Distribution: north-central Colorado and Bald Mountain, Utah.

[1] **Mertensia viridis** A. Nels., var. **parvifolia,** var. nov., foliis basalibus lanceolatis, 1.5–3 cm. longis, 0.5–1 cm. latis, subtus glabris, supra strigosis; foliis caulinis lineari-lanceolatis vel lanceolatis, 1–5 cm. longis, 0.2–1 cm. latis, subtus glabris, supra strigosis.

Colorado: open hillsides, Caribou Mine, Boulder Co., alt. 10,200 ft., June 12, 1919, *Clokey 3292* (US, Ry, G, M, CAS, Clokey); dry hillside, Waldorf, Clear Creek, alt. 3660 m., Aug. 13, 1920, *Clokey 3848* (F, NY, G, P, M, UM, ANS, CAS, Ry, Pom, Clokey); Rocky Mountain National Park, July, 1926, *DeFrance* (Cl); Colorado Springs, July, 1880, *Gardner* (ANS); Rollins Pass, July 18, 1905, *Huestis* (C); coll. of 1906, *Johnston 354a* (Ry); Argentine Pass, alt. 12,000 ft., July 10, 1878, *Jones 54 in part* (C, G, NY, U); Milner Pass, Grand Co., alt. 10,500 ft., June 15, 1930, *Kiener* (W); Fall River Pass, Grand Co., alt. 11,500 ft., June, 1932, *Kiener* (W); alpine meadows near Milner Pass, near Estes Park, alt. 10,000–11,000 ft., June 21, 1932, *Mathias 419* (M); mountains of Estes Park, Larimer Co., July 22, 1903, *Osterhout 2847* (Ry); rocky slopes of mountains, between Tolland and Corona, Gilpin Co., alt. 3000 m., June 24, 1926, *Palmer 31281a, 31282a* (M); top Griffith Mountain, June 28–Aug. 7, 1875, *Patterson* (F); vicinity of Georgetown, June 28–Aug. 7, 1875, *Patterson* (F); high mountains, Gray's Peak and vicinity, alt. 11,-000–14,000 ft., July, Aug. 28, 1885, *Patterson 113 in part* (G, NY); high mountains, Gray's Peak and vicinity, alt. 11,000–14,000 ft., July, Aug. 28, 1885, *Patterson 114* (ANS, UCal, G, M, F); Jenny Lake, June 29, 1909, *Ramaley 6366* (C); Corona, July 12 and 29, 1909, *Ramaley 6618, 6737* (Ry, C); Corona Lake, near Tolland, July 8, 1916, *Ramaley 10666* (C); Corona, July 18, 1918, *Ramaley 11387* (C); Redrock Lake about 4 miles west of Ward, Boulder Co., alt. 10,000 ft., July 19, 1912, *Ramaley & Robbins 9131* (C); Farnham, July 11, 1891, *Smith* (M); Berthoud Pass, Grand Co., alt. 11,000–12,000 ft., July, 1903, *Tweedy 5664* (Ry, NY type *M. canescens* and *M. cana)*; rocky, grassy summit of a mountain east of Cameron Pass, Jackson Co., alt. 12,000 ft., July 21, 1935, *Williams 2445* (M, ND, O, P, NY, G, W); slopes of Mt. Chapin, Larimer Co., Aug. 14, 1927, *Woodson 1848a* (M); July 30, 1903, *Young* (F).

Utah: Bald Mountain, Aug. 11, 1911, *Clemens* (Pom).

Mertensia viridis and its varieties and the closely allied species *M. Bakeri* and its variety present one of the most difficult problems of the smaller species of *Mertensia.*

The species *M. viridis* is extremely variable both as to size and shape of foliage and flower structure. There is apparently a trimorphic or at least a dimorphic condition of the stamens and style, with variations. The greater part of the material has the filaments longer than the anthers, hence the base of the stamens is much above the fornices, and the style exceeding the anthers. When this condition prevails the corolla-tube is longer than the limb. The other extreme has the filaments shorter than or equal to the anthers, hence the base of the anthers is about equal to the fornices, the style not reaching to the anthers. When this condition prevails the flowers are not only smaller, generally, but the corolla-tube is shorter than the corolla-limb. Between these two extremes is an intermediate condition in which the filaments are shorter than or equal to the anthers and the stigma may reach or surpass the stamens (rarely shorter). In this case the corolla-tube may be longer or shorter than the corolla-limb.

Mertensia viridis probably has been derived from or has given rise to *M. alpina;* in some few cases they nearly intergrade.

The synonyms listed above are nearly all various phases of the species, based either on leaf characters or on the corolla structure.

Mertensia viridis var. *dilatata* is an unimportant variation which takes the place of the species in the Medicine Bow Mountains of Wyoming and adjacent Colorado.

Mertensia viridis var. *caelestina* takes the place of the species in New Mexico. It differs in having the leaves glabrous, the calyx longer, and the flowers larger.

Mertensia viridis var. *cynoglossoides* is a peculiar robust variation which seems not to have been found since the original collections on which Greene based the two species, in synonymy under this variety.

Mertensia viridis var. *parvifolia* is an interesting variation of the species. It might be taken as an extreme variation of *M. viridis* from a study of herbarium material alone. In the field growing in close proximity, they seem amply distinct species, but a consideration of herbarium material shows intergradation between the two; further, the differences by which they may be separated are rather evasive, and the author is not certain that they can always be "spotted" in herbarium material.

Mertensia viridis var. *cana* is a further phase of var. *parvifolia* and has been found growing with that variety. The occurrence of the two varieties intermixed is apparently not uncommon. The relationship of the variety *cana* may be significant. It is possible that *M. viridis* and *M. Bakeri* may be related through var. *cana* and its close ally var. *parvifolia*. *Mertensia viridis* and both varieties *parvifolia* and *cana* were observed growing in close proximity on a mountain near Cameron Pass, Colorado. The species was just at anthesis while both varieties were well past this stage.

20. **Mertensia Bakeri** Greene, Pittonia **4**: 90. 1899.

M. paniculata var. *nivalis* S. Wats. in U. S. Geol. Expl. 40th Par. [Bot. King's Exped.] **5**: 239. 1871.

M. nivalis Rydb. in Mem. N. Y. Bot. Gard. **1**: 336. 1900.

M. lateriflora Greene, Pl. Baker. **3**: 18. 1901.

M. Bakeri lateriflora A. Nels. in Coult. & Nels., Man. Ry. Mt. Bot. 423. 1909.

Fig. 12. *M. Bakeri.* Habit sketch × 1/3; enlarged flower × 1⅔.

M. myosotifolia Heller[1] in Rydb., Colo. Agr. Exp. Sta. Bull. [Fl. Colo.] 100: 292. 1906, *nomen subnudum;* Rydb., Fl. Ry. Mts. and Adj. Plains, 734. 1918, and ed. 2, 1923, description.

M. refracta A. Nels. in Bot. Gaz. **56**: 69. 1913.

M. lanceolata var. *myosotifolia* Macbr. in Contr. Gray Herb. N. S. No. 48: 15. 1916.

Stems erect or ascending, 1–several from each rootstalk, 0.8–4 dm. tall, simple or rarely branched, pubescent with soft hairs; basal leaves linear-lanceolate to ovate-elliptic, more or less densely canescent on both surfaces, 2–11 cm. long (mostly 4–6 cm.), 0.5–3.5 cm. broad (mostly 1–1.5 cm.), petiole longer or shorter than the blade; cauline leaves linear-lanceolate to ovate, usually more or less densely canescent on both surfaces, some plants

[1] This name appears in Rydberg's 'Flora of Colorado,' giving only a locality, and only incidental description in the keys. A collection made by Mr. Geo. E. Osterhout No. 2164, bears the data given by Rydberg, and Heller's name as "sp. nov." The specimen of this collection in Mr. Osterhout's herbarium is designated as type.

(from the Uinta Mountains, Utah) sparsely so, sessile or nearly so, semiamplexicaul, 1.5–8 cm. long (mostly 3–4 cm.), 0.5–2.5 cm. broad; inflorescence congested to loosely panicled; pedicels usually canescent, often reflexed in fruit, 1.5 cm. or less long; calyx 2.5–5 mm. long (mostly 3–3.5 mm.), divided almost to the base, sparsely to usually densely pubescent on the back and margins of lobes, lobes linear-lanceolate to lanceolate, acute, about 0.5 mm. shorter than the entire calyx; flowers di-, possibly trimorphic, the tube typically longer than the limb; corolla-tube with a more or less definite ring of hairs toward the base within, 3.5–9 mm. long; corolla-limb moderately expanded, 4–6 mm. long; anthers 1.2–2 mm. long (mostly 1.5 mm.), shorter and narrower than the normal phase, longer and broader in dimorphic phases; fornices usually prominent, glabrous, papillose or pubescent; style reaching or surpassing the anthers; nutlets rugose, 2.5–3.5 mm. long.

Distribution: mountains of Colorado and Uinta Mountains, Utah, south to northern New Mexico.

COLORADO: Carson, region of the Gunnison Watershed, alt. 11,500–12,000 ft., July 2, 1901, *Baker 293* (G, US, ND, M, Pom); same locality and date, *Baker 334* (US, O, ND, Pom, P, G, M, Ry, UCal); Marshall Pass, region of the Gunnison Watershed, alt. 12,000 ft., July 19, 1901, *Baker 497* (O, ND, M, P, US, G, Ry, UCal, Pom); mountains above Ouray, region of the Gunnison Watershed, alt. 12,000 ft., Aug. 10, 1901, *Baker 773* (M, ND, Ry, US, NY, UCal, G, Pom); on bare summits, Hayden Peak, alt. 13,000 ft., July 14, 1898, *Baker, Earle & Tracy 576* (ND TYPE, G, O, M, Cl, Ry, Clokey, US, AM, UCal, Pom, F); Palsgrove Cañon, alt. 2800 m., June 27, 1901, *Clements & Clements 324* (N, M, G, Ry, Cl, US); dry open soil, Pitkin, alt. 9200 ft., Sept. 12, 1917, *Clokey 2999* (Clokey); meadow, Grizzly Peak, alt. 10,800 ft., July 5, 1918, *Clokey 3522* (Pom, O, UM, M, Ry, G, Clokey, CAS, P, US); mountain northwest of Como, alt. 12,000 ft., July 31, 1895, *Cowen 1808* (FC); fairly common, dry alpine meadow, stony soil, James Peak, alt. 11,500 ft., July 2, 1928, *Cox 11* (F); plateau above timber, mountain northwest of Como, alt. 12,000 ft., July 31, 1895, *Crandall & Cowen 359* (US); Clover Mountain, above Garfield, alt. 3900 m., July 31, 1910, *Eggleston 6059* (US); alpine, rocky heights, "The Bluffs," Spicer, Larimer Co., July 10, 1903, *Goodding 1519 in part* (O, ANS, C, US); meadows, moist east slopes, Wagon-wheel Gap, alt. 9000 ft., July 28, 1912, *Griffin 139* (Ry, G); St. Elmo, alt. 10,000 ft., June, 1886, *Harper in part* (CAS); Boreas, July 11, 1904, *Huestis* (C); rocky hill near Wagon-wheel Gap, Mineral Co., alt. 8700 ft., June 6, 1911, *Murdoch 4547* (Pom); Monarch Pass, between Salida and Gunnison, Aug. 5, 1920, *Nelson* (Ry, G, M, UCal); Horse Thief Trail, timberline, Ouray, Aug. 10, 1920, *Nelson 9828* (Ry, M, G, UCal); Horse Thief Trail, Ouray, Aug. 10, 1923, *Nelson 9859* (Ry); Red Cliff, Eagle Co., June 26, 1900, *Osterhout 2164* (UCal, O, M, C, Ry, G); Horse Thief Trail, Ouray, Ouray Co., June

29, 1927, *Osterhout 5355* (O); Monarch Pass, Saguache Co., June 29, 1927, *Osterhout 6828* (O); among rocks, near Trout Lake, San Miguel Co., alt. 12,000 ft., Aug. 21, 1924, *Payson & Payson 4185* (UCal, O, M, Ry, G); Mt. Corduroy, July 2, 1876, *Popenoe* (K); side of mountain, Bear Creek, Uncompahgre River, alt. 11,000–13,000 ft., July–Aug., 1893, *Purpus 548* (F); La Plata Mountains, alt. 11,500 ft., July 20, 1896, *Tweedy 552* (US).

NEW MEXICO: among rocks on summit, on and near the Sierra Grande, Union Co., alt. 2100–2925 m., June 19, 1911, *Standley 6151* (US atypical).

UTAH: rocky summit, Mt. Agassiz, Duchesne Co., alt. 12,500 ft., July 10, 1928, *Cottam 3713* (F); Bald Mountain, Uinta Mountains, Duchesne Co., alt. 11,000 ft., Aug. 7, 1930, *Garrett 5698* (F); among moraines, Fish Lake, Uinta Mountains, July 17, 1902, *Goodding 1386* (Cl, US, G, M, Ry, Pom); grassy eastern slopes among rocks, above East Fork of Bear River, Uinta Mountains, Summit Co., alt. 11,700 ft., Aug. 18, 1932, *Goodman 1971* (M); along divide between East Fork of Bear River and Black's Fork, Uinta Mountains, Summit Co., alt. 10,000 ft., July 9–13, 1930, *Goodman & Hitchcock 1523* (M, O, UCal, F); ridge north-northwest of Paradise Park, 6 miles west of Marsh Peak, Uinta Basin, Uintah Co., alt. 11,300 ft., July 8, 1933, *Graham 8424* (M, Carnegie, W); above trees in meadow, north of Chain Lakes, southeast of Mt. Emmons, Uinta Basin, Duchesne Co., alt. 11,400 ft., July 20, 1933, *Graham 8565* (M, Carnegie, W); barren, rocky southeast slope, Mt. Emmons, Duchesne Co., alt. 12,300 ft., July 20, 1933, *Hermann 5150* (G); barren rock slide, southeast cirque, Mt. Emmons, Duchesne Co., alt. 12,200 ft., July 22, 1933, *Hermann 5208* (G); crevices in loose rock, barren northwest slope, Lamotte Peak, Summit Co., alt. 11,800 ft., Aug. 15, 1933, *Hermann 5978* (G); above timber, southwest slopes of Bald Mountain, Summit Co., alt. 11,500 ft., Aug. 14, 1935, *Maguire, Richards & Maguire 4237* (U, G, UCal); Mt. Lofty, Divide-Weber and Bear River, Summit Co., alt. 11,300 ft., Aug. 3, 1932, *Maguire, Richards & Maguire 4238* (U, G); above timber, southwest slopes of Bald Mountain, Summit Co., alt. 11,500 ft., Aug. 14, 1933, *Maguire, Richards & Maguire 4239* (U, G); rocky west slopes Mt. Agassiz, Duchesne Co., alt. 11,600 ft., Aug. 16, 1933, *Maguire, Richards & Maguire 4240* (G, U, UCal); common among rocks on upper part of peak, West Fork of Bear River, Uinta Mountains, Summit Co., alt. 10,700 ft., July 7, 1926, *Payson & Payson 4913* (Pom, G, US, M, ANS, P, Ry, UCal); among rocks, Lamotte Peak, Uinta Mountains, Summit Co., alt. 12,000 ft., July 19, 1926, *Payson & Payson 5025* (Pom, P, ANS, M, Ry, US, UCal); among rocks, Lamotte Peak, alt. 12,000 ft., July 24, 1926, *Payson & Payson 5086* (Ry); slide rock, basin west of Lamotte Peak, Uinta Mountains, Summit Co., alt. 10,000 ft., July 27, 1926, *Payson & Payson 5137* (Ry); Bear River Cañon, alt. 11,500 ft., Aug., 1869, *Watson 844* (US, G TYPE *M. paniculata* var. *nivalis*, NY).

20a. Mertensia Bakeri var. Osterhoutii, var. nov.[1]

Similar to the species; pubescence of both surfaces of leaves spreading, almost absent on lower surfaces in a few specimens; calyx-lobes glabrous to sparingly pubescent on the back.

Distribution: Colorado.

[1] **Mertensia Bakeri** Greene, var. **Osterhoutii**, var. nov., speciei similis sed pubescentia foliorum utrinque divergente; calycis laciniis glabris vel sparse pubescentibus.

COLORADO: Breckenridge, coll. of 1887, *Bereman 770* (M); alpine, rocky heights, "The Bluffs," Spicer, Larimer Co., July 10, 1903, *Goodding 1519 in part* (ANS, C, US, G, Cl, M, Ry, UCal); Rocky Mountains, coll. of 1862, *Hall & Harbour 444* (F, M, ANS, Cl); near Breckenridge, 110 miles from Denver, on the South Park Line of the Union Pacific Railway, alt. 10,000 ft., May 27–28, 1896, *Holzinger 47* (FC); Sulphur Springs, Grand Co., June 8, 1906, *Osterhout 3225* (O, Ry TYPE, AM, G); Wolcott, Eagle Co., May 25, 1910, *Osterhout 4240* (O); Granby, Grand Co., June 21, 1906, *Osterhout 6066* (O); dry grassland, Tolland, June 16, 1909, *Ramaley 6266* (C); Park Lake, Tolland, May 31, 1911, *Ramaley 8681* (C); dry grassland, Park Lake, Tolland, May 11, 1911, *Ramaley 8689* (C, US); dry grassland, Tolland, June 14, 1913, *Ramaley 9530* (C); dry grassland, at a small lake one-fourth mile below Tolland, alt. 8800 ft., June 7, 1908, *Ramaley & Robbins 4628* (C); East Lake, Tolland, May 29, 1910, *Robbins 7554* (C); alpine, Fall River cirque, Rocky Mountain National Park, June 18, 1932, *Sperry* (N); Eldora to Baltimore, alt. 8500–9500 ft., June 20–July 10, 1903, *Tweedy 5665* (Ry); Boulder Park, alt. 3000 m., July, 1901, *Wheeler 347* (C, Ry); Rollinsville, alt. 2800 m., July, 1901, *Wheeler 363* (C); Montezuma, June, 1873, *Wolfe 710* (Cl, US, F).

Mertensia Bakeri var. *Osterhoutii* differs from the species in the rather poor characters given above which, however, seem to be constant. In addition, the variety dries a clear green color while the species almost invariably dries to a sordid brown. The corolla dries blue while that of the species dries a much darker blue or purple.

Mertensia Bakeri and its variety and *M. viridis* and its varieties form a most complex assemblage, the entities of which are not always clear cut and easily defined. In *M. Bakeri* there is a tendency toward dimorphic flowers which, however, is not so great as in *M. viridis.* The specimens of *M. Bakeri* from the Uinta Mountains, Utah, are, on the whole, less pubescent than most of the material from Colorado. The collection which is typical of *M. myosotifolia* is in part not typical of *M. Bakeri,* but it is only a minor variation.

21. **Mertensia MacDougalii** Heller in Bull. Torr. Bot. Club **26:** 550. 1899.

Stems ascending, 8–25 cm. tall, one to few from each indurated root; basal leaves petiolate, oblong-oval to oval, glabrous, usually pustulate above, the blade 2–5 cm. long, 1–4 cm. broad; cauline leaves sessile, oblong-lanceolate to ovate, 2–6 cm. long, 0.5–2 cm. broad, glabrous or usually pustulate above, lateral veins inconspicuous or none; pedicels 1–10 mm. long, glabrous; inflorescence a modified scorpioid cyme, not much elongated in fruit; corolla blue, the tube 8–9 mm. long, glabrous within, the moderately expanded limb 5–6 mm. long; fornices conspicuous, glabrous; anthers 2.5–3 mm. long; filaments 2.5–3 mm. long, about as broad as the anthers; style as long as or usually exceeding the corolla; calyx 5–6 mm. long, (up to 10 mm. in fruit), the lobes narrowly ovate to lanceolate, obtuse or acute, ciliate, otherwise glabrous, 3–4 mm. long, in-

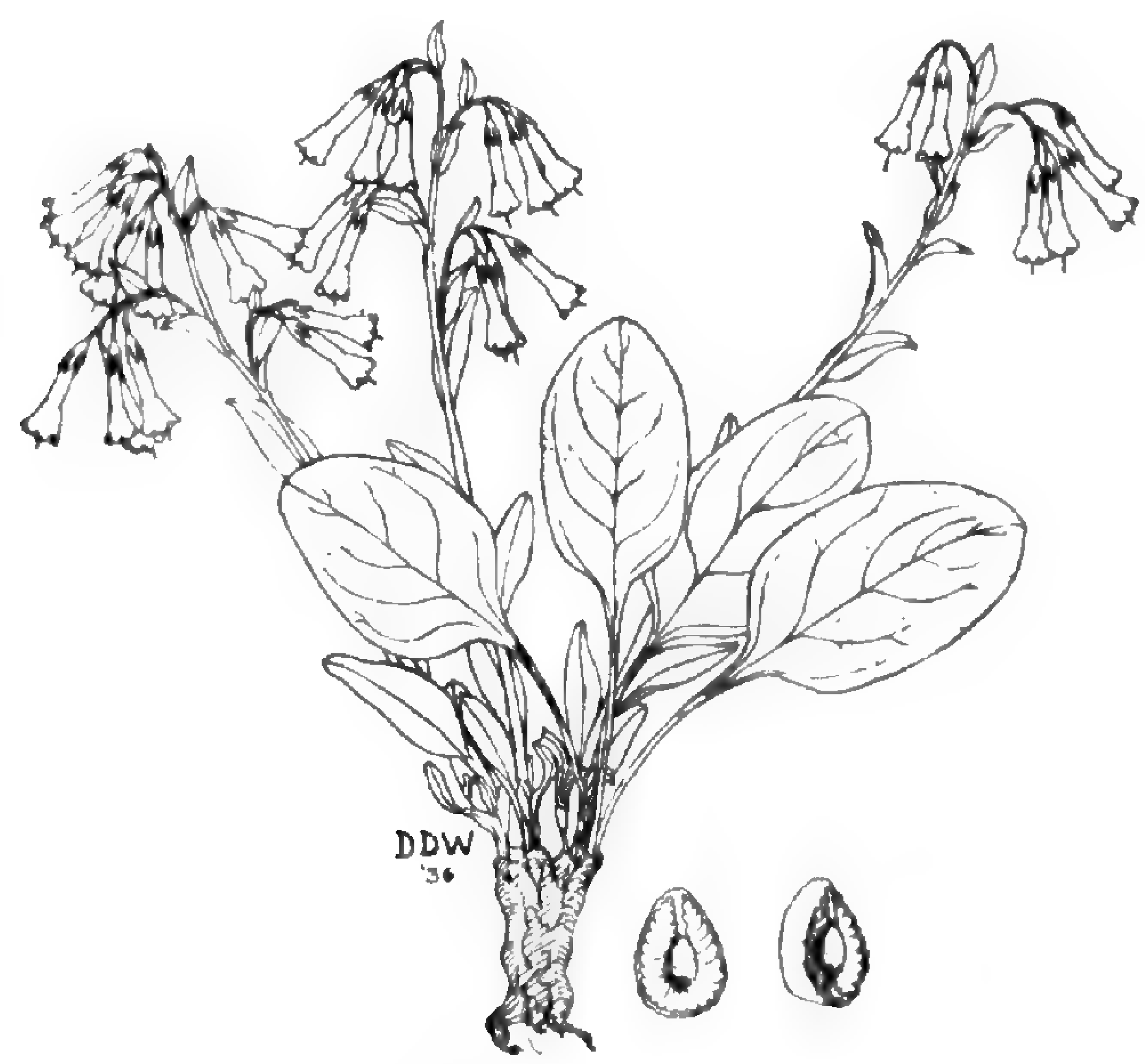

Fig. 13. *M. MacDougalii.* Habit sketch × 1/3; nutlets × 1 2/3.

creasing in size with age; nutlets rugose on the back, inner surface slightly concave, the margins forming a collar.

Distribution: Coconino and Yavapai Counties, Arizona.

ARIZONA: Ft. Whipple, April 26, 1865, *Coues & Palmer 299* (M, G); rich soil near Grand Canyon, alt. 9000 ft., June 12, 1891, *MacDougal* (NY); about Mormon Lake, alt. 6000 ft., June 12, 1898, *MacDougal 95* (NY TYPE, UCal, F, Cl); Oak Creek Canyon near Flagstaff, June 4, 1929, *McKelvey* (CAS); forest between Grand View and Desert View, Grand Canyon, 7400 ft., Coconino Co., May 12, 1922, *Wiegand & Upton 4130* (Cl).

This species has been rarely collected and from the few specimens seen it must be quite restricted in its range. The nutlets show a departure in structure which readily sets the species off from the rest in the genus. In a genus where the characters of the nutlets vary so little this departure is of interest.

22. Mertensia oblongifolia (Nutt.) G. Don, Gen. Hist. **4:** 372. 1838.

M. nutans subsp. *subcalva* Piper in Contr. U. S. Nat. Herb. [Fl. Wash.] **11:** 479. 1906.

M. foliosa var. *subcalva* Macbr. in Contr. Gray Herb. N. S. No. 48: 18. 1916.

M. Nelsonii Macbr., *l.c.* 19, in part.

M. Bakeri var. *subglabra* Macbr. & Payson in Contr. Gray Herb. N. S. No. 49: 66. 1917.

M. foliosa var. *subcalva* f. *Macbridei* Johnston in Contr. Arnold Arb. No. 3: 84. 1932.

Pulmonaria oblongifolia Nutt. in Jour. Acad. Nat. Sci. Phila. **7:** 43. 1834.

Cerinthodes oblongifolium O. Kuntze, Rev. Gen. Pl. pt. 2: 436. 1891.

Fig. 14. *M. oblongifolia.* Habit sketch × ⅓; enlarged flower × 1⅓.

Stems erect or ascending, 1–3 dm. tall, one to many from each elongated rootstalk; blade of basal leaves 3–8 cm. long, 0.5–2 cm. broad, oblong or spatulate to narrowly oblong-ovate, usually obtuse, strigose on the upper surface, glabrous below, petiole longer or shorter than the blade; cauline leaves sessile or the lowermost short-petiolate, linear to oblong-elliptical, 2–8 cm. long, 0.3–1.5 cm. broad, pubescence as of basal leaves; inflorescence congested, becoming panicled with age; pedicels strigose to essentially glabrous, 1–10 mm. long; calyx 3–7 mm. long, divided to within about 1 mm. of the base, the lobes linear to lanceolate-triangular, acute, ciliate, glabrous dorsally or rarely with a few hairs; corolla-tube 5–12 mm. long, usually quite glabrous within, occasionally with a few scattered hairs;

corolla-limb 4–7 mm. long; anthers 1.2–2 mm. long, oblong and straight; filaments 2–4 mm. long, usually longer and broader than the anthers; style exceeding the anthers; fornices prominent, glabrous or occasionally sparsely hairy; immature nutlets 3–4 mm. long, rugose; mature nutlets not seen.

Distribution: western Montana, Wyoming, and Utah to Washington and northern California.

MONTANA: foothills, Bozeman, May 23, 1899, *Blankinship in part* (G, M); hillside thickets, Bozeman, May 27, 1899, *Blankinship* (Ry, M); plains, Bozeman, May 11, 1900, *Blankinship* (G); Leveridge Canyon, Bozeman, May 20, 1900, *Blankinship* (U); Bozeman, May 10, 1901, *Blankinship* (FC, Ry); uplands, Bozeman, May 4, 1905, *Blankinship 374* (UM); upland plains, Bozeman, May 4, 1905, *Blankinship 374a in part* (ANS, F); upland plains, Bozeman, alt. 5000 ft., May 5–8, 1906, *Blankinship 374b in part* (M, Ry, F, UCal, N); foot of south slope of Bridger Mountain, May 14, 1900, *Chesnut & Jones 110* (US); Blackfoot River Canyon, 20–30 miles east of Missoula, June 6, 1918, *Collins* (G); Sedan, May 5, 1901, *Jones* (G); Bozeman, May 10, 1900, *Jones* (UCal); Bozeman, May 5, 1901, *Jones* (UCal); Bozeman, May 11, 1905, *Jones* (UCal); Bozeman, May 13, 1905, *Jones in part* (UCal); Camp Creek, Gallatin Co., June 12, 1905, *Jones* (UCal); Helena, May, 1889, *Kelsey 62 in part* (UM); Bozeman, May 5, *Kenney* (G); Bozeman, May 26, 1903, *Kimpton in part* (CAS); Mt. Sentinel, Missoula, April 25, *Maclay 41* (UM); Mt. Sentinel, May 14, 1925, *Merryfield* (UM); Bear Canyon, Gallatin Co., May 25, 1900, *Moore in part* (UCal); Bridger Canyon, Gallatin Co., May 15, 1901, *Moore in part* (UCal); Monida, June 16, 1899, *Nelson 5413a* (M, US); Livingston, May 25, 1901, *Scheuber* (US); Bozeman Pass, May 28, 1883, *Scribner 176* (US); Helena, May, 1893, *Starz* (M); Spanish Creek, May 12, 1901, *Vogel* (G); near Billings, May, 1890, *Wright* (UCal); Montana Territory, without collector's name (G); a fragment marked in Dr. Gray's hand, "*M. oblongifolia* Nutt.!, ex sp. Wyeth, misit Durand 1861" is probably from the TYPE specimen, *Wyeth* (G); Flathead River, *Wyeth* (?) (M photograph of specimen in ANS).

WYOMING: dry soil, Leucite Hills, June 17, 1901, *Merrill & Wilcox 698* (Ry, G); on the broken cliffs, Steamboat Mountain, Sweetwater Co., June 9, 1900, *Nelson 7072* (Pom, M, Ry, N); moist banks, Hoback Canyon, May 20, 1924, *Nelson 10082* (M, UM, G, Ry); Yellowstone Park, coll. of 1885, *Tweedy* (US); Swan Lake, Yellowstone Park, June, 1885, *Tweedy 813* (US); sagebrush slope in Hoback Canyon, near the "East Rim," Sublette Co., alt. 8000 ft., May 29, 1935, *Williams & Williams 2156* (Cl, W, M); Hoback Canyon, Sublette Co., April 29, 1934, *Williams 20* (W).

IDAHO: in coniferous forest, Sawtooth Mountains, Payette River, Boise Co., June 18, 1930, *Applegate 6303 in part* (G); Bannock Co., May, 1932, *Davis D23–32* (F); deep, loamy soils on hillsides, Lost River Mountains, Blaine Co., July 10, 1916, *Macbride & Payson 3143 in part* (CAS, Ry, Pom, M, G, UCal); open hillsides, Josephus Lakes, Custer Co., Aug. 3, 1916, *Macbride & Payson 3544* (M, UCal, CAS, Pom, G TYPE *M. Bakeri* var. *subglabra*, Ry, US); Juniper Hills, 10 miles west of St. Anthony, May 3, 1919, *Quayle 15* (Pom); Sawtooth National Forest, coll. of 1910, *Woods 34a, 35a* (Ry).

UTAH: Canyon, west of Steptoe Valley, May 15, 1859, *Engelmann* (M); head of South Fork of Humboldt River, May 19, 1859, *Engelmann* (M).

NEVADA: Victory Highway, Emigrant Pass, Eureka Co., June 10, 1933, *Eastwood & Howell 209 in part* (G, CAS, W); Clover Mountain Range near Deeth, East Humboldt or Ruby Mountains, Elko Co., alt. 9300 ft., July 24, 1908, *Heller 9181* (G, M); south side of Star Canyon near Deeth, Ruby Mountains, alt. 9100 ft., July 8, 1912, *Heller 10541* (G, CAS, UCal, F, Pom); south side of Star Canyon near Deeth, Ruby Mountains, alt. 8500 ft., July 8, 1912, *Heller 10546* (M); Aurum, July 9, 1891, *Jones* (Pom); East Humboldt Mountains, alt. 9000 ft., July 14, 1902, *Jones* (Pom); Aurum, alt. 7300 ft., May 30, 1893, *Jones* (Pom); Little Lakes Canyon, West Stampede, Elko Co., June 13, 1902, *Kennedy 511* (Ry); slopes above snow banks, Jarbidge, alt. 8000 ft., July 6, 1912, *Nelson & Macbride 1938 in part* (G); shaded cliffs, Jarbidge, July 9, 1912, *Nelson & Macbride 1995 in part* (Ry TYPE *M. Nelsonii);* East Humboldt Mountains, alt. 7000 ft., July, 1865, *Watson 841* (G, US).

WASHINGTON: Rattlesnake Mountains, Yakima Region, April 29, 1901, *Cotton 328* (Ry, US TYPE *M. nutans* subsp. *subcalva*, M, G, P); dry hillside, near Dutch John's, April 23, 1899, *Whited 1034 in part* (G).

OREGON: along Silvies River, near mouth of Emigrant Creek, Harney Co., June 24, 1912, *Peck 5588* (G).

CALIFORNIA: Goose Lake Valley, July, 1895, *Austin 511* (US, Pom); Goose Lake Valley, June, 1898, *Austin & Bruce 2260 in part* (UCal); canyons, Modoc Co., June, 1898, *Austin & Bruce 2261* (UCal); sunny open slopes, thickets in meadows, Fort Bidwell, Modoc Co., April 19, 1903, *Manning 83 in part* (US).

22a. Mertensia oblongifolia var. **nevadensis** (A. Nels.), comb. nov.

M. foliosa A. Nels. in Bull. Torr. Bot. Club **26**: 243. 1899.

M. tubiflora Rydb. in Bull. Torr. Bot. Club **26**: 544. 1899.

M. intermedia Rydb. in Mem. N. Y. Bot. Gard. **1**: 335. 1900.

M. nutans Howell, Fl. N. W. Am. 491. 1901.

M. stenoloba Greene, Pl. Baker. **3**: 20. 1901.

M. symphytoides Greene, *l.c.*, non Fisch., 1872.

M. coronata A. Nels. in Bull. Torr. Bot. Club **29**: 403. 1902, as to type specimen mainly.

M. nevadensis A. Nels. in Proc. Biol. Soc. Wash. **17**: 96. 1904.

M. praecox Smiley ex Macbr. in Contr. Gray Herb. N. S. No. 48: 10. 1916.

M. foliosa var. *nevadensis* Macbr., *l.c.* 19.

M. Nelsonii Macbr., *l.c.*, in part as to type specimen.

Similar to the species but often more robust; cauline leaves 2–10 cm. long, 0.8–6 cm. broad, lanceolate-oblong to ovate, glabrous or the upper surface pustulate, sometimes the pustules toward the apex of the leaves developing mucros, some specimens, particularly from northeastern Utah, with lateral veins in the well-developed cauline leaves; corolla extremely variable as to size in different localities and at different stages of anthesis.

Distribution: western Montana and Wyoming west to Washington and northern California.

MONTANA: Pleasant Valley, June 25–30, 1871, *Allen in part* (US); Mt. Sentinel, Missoula, alt. 3200 ft., April 28, 1927, *Anderson 7* (UM); Belt Creek, June, 1883, *Anderson* (UM); coll. of 1895, *Anderson 252* (UCal); Belt Mountains, June 29, 1885, *Anderson 305* (UM); Belt Mountains, July 8, 1886, *Anderson 5855* (NY); Missoula, coll. of 1903, *Blankinship* (UM); Anaconda, May 25, 1906, *Blankinship* (UCal, Ry); wooded slopes, Mt. Bridger, alt. 8000 ft., July 5, 1905, *Blankinship 375* (M, ANS, UM, F); near springs, Tobacco Mountains, alt. 5000–6000 ft., July 13, 1909, *Butler 4186* (NY, CAS); northern slope, foot of Mt. Sentinel, alt. 3320 ft., May 14, 1924, *Cramer* (UM); Mt. Sentinel, April 28, 1927, *Darlington 4* (UM); 4 miles northwest of Red Lodge, Carbon Co., May 14, 1905, *Draper* (UCal); Greycliff, Sweet Grass Co., alt. 1200 m., May 6–12, 1913, *Eggleston 9007* (US); grassy slopes, Missoula, May, *Elrod* (Clokey); Missoula and vicinity, *Elrod 9* (UM); Bridger Mountains, near the Pass, alt. 8000 ft., July 28, 1896, *Flodman 752* (M, ND TYPE *M. stenoloba);* dry, grassy, gravelly soil, Mt. Sentinel, southeast of Missoula, alt. 3600 ft., May 4, 1933, *Hitchcock 1530* (G, UM, CAS, Pom); prairies, Missoula, alt. 3200 ft., May, 1917, *Hughes 1261* (G, UM, M); Monida, alt. 7000 ft., July 8, 1909, *Jones* (Pom); Lima, July 14, 1908, *Jones 8658* (UM, G); Lima, July 14, 1908, *Jones 8858* (Pom); Bridger Mountains, May 25, 1900, *Jones* (UCal); Old Baldy, Bozeman, May 26, 1900 *Jones* (UCal); Bridger Mountains, June 27, 1901, *Jones* (M, Ry, UCal); Bridger Mountains, June 1, 1905, *Jones* (UCal); Helena, May, 1891, *Kelsey* (F); Miller Canyon, near Missoula, alt. 3600 ft., May 20, 1922, *Kirkwood 1259* (G, UM, M); forest, Bonner, alt. 4000 ft., May 28, 1921, *Kirkwood 1260* (G, UM, M); grassy slopes, Missoula, alt. 3300 ft., May 9, 1923, *Kirkwood 1362* (G, UM, CAS, F); foot of Mt. Sentinel, Missoula, alt. 3200 ft., May 14, 1922, *Kirkwood 1731* (Ry, G, UM, CAS, F); Hellgate Canyon, 2 miles east of Missoula, alt. 3500 ft., May 5, 1925, *Kirkwood 2057* (Ry, G, UM); 2½ miles up Blackfoot, Bonner, alt. 3800 ft., May 25, 1926, *Kirkwood 2514* (G, UM, Ry); dry gravelly open south slope, Missoula, alt. 4000 ft., April 8, 1915, *Kittredge* (G); campus, Missoula, alt. 3200 ft., May 12, 1924, *Larsen* (UM); Old Sentinel, mountain near Missoula, alt. 3500 ft., June 12, 1901, *MacDougal 187* (UM); among sagebrush on a moist slope, Monida, Madison Co., June 16, 1899, *Nelson & Nelson 5413 in part* (M); Monida, June 16, 1899, *Nelson 5413a in part* (Ry); Missoula, June, 1902, *Ronan 74* (UM); Old Hollowtop, near Pony, alt. 9000 ft., July 9, 1897, *Rydberg & Bessey 4869* (US); Bridger Mountains, alt. 7000 ft., June 15, 1897, *Rydberg & Bessey 4870* (G, P, Ry, N, US, UM, F); Cedar Mountain, alt. 10,000 ft., July 16, 1897, *Rydberg & Bessey 4871* (US); Bridger Mountains, alt. 7000 ft., June 18, 1897, *Rydberg & Bessey 4873 in part* (NY TYPE *M. intermedia);* Bridger Mountains, alt. 7000 ft., June 17, 1897, *Rydberg & Bessey 4874* (NY); Bozeman Pass, May 28, 1883, *Scribner 176* (G, ANS); foothills, Deerlodge, April 27, 1888, *Stapleton 53 in part* (UM); west slope of Mt. Sentinel, near Missoula, alt. 3300 ft., April 16, 1921, *Steward 366* (UM); Blackfoot Valley, near Missoula, alt. 3500 ft., May 28, 1921, *Steward 480* (UM); Missoula meadow, April 16, 1912, *Trask* (N); hills, Midvale, June 24, 1903, *Umbach 151* (NY, AM, F); mountain sides, Midvale, June 28, 1903, *Umbach 190* (AM); plains, Midvale, July 4, 1903, *Umbach 190a* (F); moist slope, Mt. Sentinel, alt. 3200 ft., May, 1924, *Williams* (UM).

WYOMING: moist ground above Trapper Canyon near Brush Butte, Big Horn Co., May 2, 1926, *Finley 5* (Ry); western slope of Wind River Mountains, alt. 7800 ft., June 3, 1860, *Hayden* (M); Gros Ventres Fork, alt. 7800 ft., June 5, 1860, *Hayden* (M); Jackson, May 22, 1928, *Murie 124* (Ry); Evanston, May 28, 1897, *Nelson 2951* (M, Ry TYPE *M. foliosa,* Cl, G, N); North Vermillion Creek, July 24, 1897, *Nelson 3593* (Ry); among the great rocks, often in shade, Leucite Hills, Sweetwater Co., June 9, 1900, *Nelson 7071* (Ry TYPE *M. coronata,* C, G); moist sagebrush slopes, Cumberland, Uintah Co., May 31, 1907, *Nelson 9007* (UCal, Ry, G); moist draws, Kemmerer, Uintah Co., June 1, 1907, *Nelson 9016* (UCal, Cl, Ry, G, M); moist banks, Hoback Canyon, May 20, 1924, *Nelson 10082* (UCal); among sagebrush, dry hillside, 5 miles west of Kemmerer, June 20, 1923, *Payson & Armstrong 3232A* (Ry, M); up the Red Grade from Big Horn, Big Horn Mountains, Sheridan Co., May 25, 1934, *Rollins 478* (W); Evanston, May 15, 1883, *Sanford* (UCal); headwaters of Tongue River, Big Horn Mountains, July, 1898, *Tweedy 119* (NY TYPE *M. tubiflora);* Big Horn, Sheridan Co., alt. 6000 ft., July, 1899, *Tweedy 2601* (NY, Ry); among sagebrush, 15 miles east of Kane, hillside, western slope, Big Horn Mountains, Big Horn Co., alt. 9000 ft., July 5, 1935, *Williams 2353* (M, W); rocky ridges, Bryan Flats, alt. 7000 ft., April 30, 1933, *Williams & Pierson 1071* (M, W); rocky knoll among sagebrush, or in open, 3 miles east of Evanston, Uintah Co., May 24, 1935, *Williams & Williams 2142* (M, W); northern slope, sagebrush hill, about 5 miles north of Kemmerer, Lincoln Co., May 28, 1935, *Williams & Williams 2155* (M, Cl, W); sagebrush slope in Hoback Canyon near the "East Rim," Sublette Co., alt. 8000 ft., May 29, 1935, *Williams & Williams 2156* (Cl, W); among sage and pine just below V-V Ranch in Hoback Canyon, Sublette Co., alt. 6500 ft., May 29, 1935, *Williams & Williams 2159, 2160* (M, W); in quaking aspen grove near mouth of Hoback River, Teton Co., alt. 6000 ft., June 3, 1935, *Williams & Williams 2166* (M, W).

IDAHO: open places on hillsides, Twin Falls, May 5, 1912, *Bennitt 20* (Ry); Ketchum, *Broadhead* (Pom); near Caldwell, Canyon Co., April 15, 1934, *Christ 6238* (G); moist hillside above old university farm, alt. 5000 ft., April 18, 1932, *Davis* (W); Pocatello, coll. of 1926, *Donaghe* (CAS); Iverson Brothers Ranch, Minidoka Forest, Cassia Co., alt. 2000 m., June 19, 1917, *Eggleston 13841* (US); near Boise, coll. of 1916, *Gageby* (Ry); east of Preston, April 30, 1909, *Henderson 19* (Ry); in sage grass, Lemhi Forest, alt. 7200 ft., May 17, 1927, *Johnson* (UIdaho); Oxford, southeast Idaho, Bannock Co., April 3, 1885, *Leonard* (G); Oxford, April 10, 1885, *Leonard* (K); southeastern Idaho, May 7, 1885, *Leonard 32* (NY); slopes along streams, Silver City, Owyhee Co., alt. 7000 ft., June 20, 1911, *Macbride 942* (F, P, M, UCal, Pom, Ry, G); sagebrush slopes, south end of Soldier Mountain, Blaine Co., alt. 7500 ft., June 26, 1916, *Macbride & Payson 2890* (UCal, G, Ry, M, Pom, CAS); sheltered moist places, Martin, Blaine Co., alt. 7000 ft., July 6, 1916, *Macbride & Payson 3065* (Ry); on rocky hillsides, Martin, Blaine Co., alt. 6400 ft., July 7, 1916, *Macbride & Payson 3092* (UCal, Ry, M, G, Pom, CAS); moist, protected slope, Lemhi Mountains, near Patterson, Lemhi Co., alt. 6400 ft., July 13, 1916, *Macbride & Payson 3191* (Ry, G, M); shady rock slides in canyon, Challis Creek, Custer Co., alt. 6000 ft., July 19, 1916, *Macbride & Payson 3335* (G, M, Ry); near Pocatello, May 17, 1893, *Palmer 34* (US); open hillside, Salmon, Lemhi Co., alt. 5000 ft., June 27, 1920, *Payson & Payson 1797* (G, M, Ry); Juniper Hills 10 miles west of St. Anthony, May 3, 1919, *Quayle 15* (Clokey, NY, Ry, US); hills and plains, Pocatello, May 17, 1909, *Slaughter 9* (Ry); damp northern slopes, Pocatello, coll. of 1921, *Soth P–7* (Ry); Shoshone Falls, Jerome Co., May 27, 1899, *Trelease 4805* (M); Sawtooth National Forest, coll. of 1910, *Woods 8a, 14a, 15* (Ry); Sawtooth National Forest, Hailey, coll. of 1910, *Woods 354* (Ry).

UTAH: southwest exposure, Brush Canyon, Wellsville Mountains, Cache Co., alt. 7650 ft., May 10, 1932, *Burke 3117* (U); above cottonwood grove in cliffs, west exposure, Wellsville Mountains, Box Elder Co., alt. 5200 ft., May 4, 1932, *Burke 3118* (U); south exposure, Brush Canyon, Wellsville Mountains, Cache Co., alt. 5650 ft., May 10, 1932, *Burke 3120* (G, U); north exposure, Greene Canyon, Cache Co., alt. 5150 ft., May 12, 1932, *Burke 3721* (W, U, G, Pom); west exposure, Logan Canyon, Cache Co., alt. 5400 ft., May 18, 1932, *Burke 3725* (G, U); Wasatch, May 10, 1874, *Cleburne* (N); red sandstone ridge east of Ft. Douglas, alt. 5500 ft., June 6, 1896, *Cleburne* (N); Wasatch, May 10, 1874, *Cleburne 24* (N); Red Butte, April 24, 1908, *Clemens* (F, G, ANS); Red Butte, Salt Lake City and vicinity, April 27, 1908, *Clemens* (G); Red Butte, Salt Lake City and vicinity, May 6, 1909, *Clemens* (M, F, ANS); alpine meadow, Rosevere, Box Elder Co., alt. 10,000 ft., June 4, 1928, *Cottam 2847* (F); moist places, top of mesa, Rosevere, Box Elder Co., alt. 10,000 ft., June 4, 1928, *Cottam 2908* (F); Sheba Mine, Tooele Co., alt. 9500 ft., June 16, 1928, *Cottam 3176* (F); mountains near Ogden, coll. of 1872, *Coulter* (US); ridge of Red Butte, Salt Lake Co., April 22, 1905, *Garrett 1074* (G); shaded, rocky soil near stream, intervale of Canyon, Cache Co., alt. 4700 ft., May 6, 1932, *Gerber 3720* (U); Ft. Douglas, May 7, 1881, *Jones* (Pom, Ry, AM, Ariz, US); Ft. Douglas, April 28, 1890, *Jones* (Pom, M, UCal, US); Ft. Douglas, April 30, 1890, *Jones* (F, CAS, G, NY, Ry, US, UCal); Mt. Ibapah, June 20, 1891, *Jones* (Pom); Provo Canyon, Utah Co., alt. 5500 ft., June 8, 1896, *Jones* (US, U, M, G); Mt. Ibapah, July 17, 1903, *Jones* (Pom); Ft. Douglas, May 18, 1909, *Jones* (F, US, G); Mammoth, alt. 7000 ft., May 10, 1910, *Jones* (Pom); Ft. Douglas, alt. 6000 ft., May 16, 1911, *Jones* (UCal, Pom); Mammoth, alt. 5500 ft., May 27, 1911, *Jones* (UCal, Pom); Lake Point, alt. 4700 ft., May 29, 1880, *Jones 2038* (F, US, U, CAS, Pom); Ft. Douglas, alt. 6000 ft., May 7, 1881, *Jones 2148* (F); City Creek Canyon, April 21, 1884, *Leonard* (UCal); under sage, Providence Canyon, Cache Co., alt. 5000 ft., May 15, 1932, *Maguire 3719* (U, G, UCal); under brush up Logan Canyon, south of Boy Scout Camp, Cache Co., alt. 6000 ft., May 14, 1932, *Maguire 3722* (U, G, W, M, UCal, Pom); in cliffs along stream, Logan Canyon, Cache Co., alt. 6000 ft., May 29, 1932, *Maguire 3724* (U, G); shade, Mt. Mahogany, Granite Canyon, Deep Creek Mountains, Juab Co., alt. 7800 ft., June 20, 1933, *Maguire & Becraft 2784* (Pom, G, U); sagebrush, Granite Canyon, Deep Creek Mountains, Juab Co., June 20, 1933, *Maguire & Becraft 2785* (U); in crevass on cliff, south exposure, Cottonwood Canyon, Box Elder Co., alt. 6000 ft., April 22, 1932, *Maguire, Burke & Gerber 3119* (U); under sagebrush, 2 miles south, Tony Grove Ranger Station, Logan Canyon, Cache Co., May 27, 1932, *Maguire & Maguire 3723* (UCal, U, G); exposed rocky slopes, 2 miles south of Tony Grove, Logan, Cache Co., alt. 6200 ft., April 29, 1934, *Maguire & Maguire 13103* (G, U); hillside, sun exposure, 1 mile above Board of Trade Camp, Logan Canyon, Cache Co., May 28, 1933, *Muenscher & Maguire 2436* (U, M, Pom); under brush 1 mile up Logan Canyon, Cache Co., alt. 4800 ft., May 28, 1933, *Muenscher & Maguire 2437* (U, G); "above the Forks," Logan Canyon, Cache Co., May 10, 1909, *Smith 1571* (F, Ry, U); Spring Hollow, Logan Canyon, Cache Co., May 28, 1910, *Smith 2160* (U, NY, G TYPE *M. praecox);* Wasatch Mountains, alt. 5500 ft., May, 1869, *Watson 843* (US); rocky brush-covered hillside, Spring Hollow about 5 miles up Logan Canyon, east of Logan, Cache Co., May 27, 1935, *Williams & Williams 2150* (M, W); among sagebrush near summit of Logan Canyon Pass, Cache Co., alt. 8000 ft., May 28, 1935, *Williams & Williams 2151* W, M); Logan Canyon, Cache Co., April 29, 1934, *Williams 21* (W).

NEVADA: sage plains, near head of Thousand Creek, west edge of Humboldt Co., June 6, 1933, *Applegate 8328* (G); Victory Highway, Emigrant Pass, Eureka Co., June 10, 1933, *Eastwood & Howell 209 in part* (W, CAS, G); Victory Highway, Emigrant Pass, Eureka Co., June 10, 1933, *Eastwood & Howell 223* (CAS); Victory Highway, between Elko and Wells, June 11, 1933, *Eastwood & Howell 299* (CAS); Fish Lake, above Marmol Station, alt. 5500 ft., April 30, 1910, *Heller 10003* (F, ANS); Ruby Mountains, south side of Star Canyon near Deeth, alt. 8500 ft., July 8, 1912, *Heller 10546* (F, G, CAS); Palisade, June 14, 1882, *Jones* (Pom); Austin, June 16, 1882, *Jones* (Pom); Star Peak, alt. 8000 ft., July 30, 1901, *Jones* (G, Pom); Hunter Creek, Washoe Co., May 17, 1907, *Kennedy 1661* (Cl, UCal, Ariz, M, AM); Hunter Creek Canyon, 5 miles west of Reno, May 16, 1903, *Kennedy & True 711* (Ry TYPE *M. nevadensis*, UCal); Warm Springs, White Pine Co., May, 1918, *King* (CAS); slopes above snow banks, Jarbidge, alt. 8000 ft., July 6, 1912, *Nelson & Macbride 1938 in part* (G, Ry); shaded cliffs, Jarbidge, July 9, 1912, *Nelson & Macbride 1995 in part* (Ry TYPE *M. Nelsonii*, G); Trinity Mountains, alt. 6500 ft., May, 1865, *Watson 840* (US, G); west Humboldt Mountains, alt. 7000 ft., June, 1865, *Watson 840* (G).

WASHINGTON: near First Creek, near southeast end of Lake Chelan, Chelan Co., May 5, 1935, *Fiker 1652* (P); Grandalles, April 20–22, 1895, *Gorman* (US); ridge, Klickitat, May 12, 1880, *Howell* (P); high hills, eastern Washington, May, 1880, *Howell* (US); north side of high hills near the Columbia River, Klickitat Co., April 1882, *Howell* (UCal); Ahtanum Ridge, Yakima Co., April 15, 1923, *Nelson 1213* (Ry); loose, rocky soil near Mabton, April 6, 1934, *Pickett, McMurray & Dillon 1456* (P); upper Nacher River, May 6, 1923, *Streeter 1449* (Ry); wet bank 10 miles north of Entiat, sagebrush slopes, April 18, *Thompson 5981* (G, M); among sagebrush slopes near Vantage, May 11, 1935, *Thompson 11461* (G); Ellensburg, April 18, 1897, *Whited* (P); dry hillside, near Dutch John's, near Wenatchee, April 23, 1899, *Whited 1034* (P, US).

OREGON: dry open hillside and along small streams, foothills east of Lakeview, Lake Co., May 29, 1902, *Applegate 3070, 3071* (G); in sagebrush near snow, side canyon of Wildhorse Creek, east wall of Steens Mountains, Harney Co., alt. 7000 ft., June 22, 1929, *Applegate 5671* (G, F); among sagebrush and mountain mahogany, edge of snow drifts, summit of Steens Mountains, at south base of highest ridge, alt. 7000 ft., May 5, 1922, *Applegate 5675* (G, F, UCal); dry yellow pine woods, Ochoco Creek near Ochoco Ranger Station, Crook Co., June 9, 1930, *Applegate 6181* (G); yellow pine woods, head of Deep Creek, eastern base of Crane Mountain, Warner Mountains, Lake Co., July 6, 1932, *Applegate 7444* (G); North Fork Sprague River, Gearhart Mountain region, Lake Co., July 21, 1932, *Applegate 7928* (G); Quartz Valley, Lake Co., July, 1893, *Austin* (UCal); near mouth of Burnt River Canyon, April 13, 1884, *Cleburne* (N); northern slope of Castle Mountain, Malheur Co., June 15, 1897, *Cusick 1629 in part* (UCal, Cl, US, P, M, G); dry mountain sides of Juniper Mountain, Malheur Co., May 7, 1900, *Cusick*

2376 (US, P, Cl, M, G, UCal, F, Ry, Pom); Bullard Canyon, Lakeview, Lake Co., alt. 1540 m., June 12, 1911, *Eggleston 6926* (US); edge of snow bank, summit of Crane Creek Mountain, Lake Co., alt. 8400 ft., June 17, 1919, *Ferris & Duthie 252* (Ry); between Merrill and Cottonwood, June, 1901, *Furlong, Greeley, Wilson & Alexander* (UCal); near John Day, Grant Co., May 10, 1928, *Gale 145 in part* (M); Hereford Valley, Baker Co., May 10, 1928, *Gale 177* (M, ANS, Kew); 40 miles south of Arlington, Gilliam Co., May 10, 1928, *Gale 180* (M, US); along Mill Creek, in moist meadows, Burns-Izee Road, Harney Co., May 15, 1927, *Henderson 8313* (CAS); high hills, eastern Oregon, May, 1880, *Howell* (F); on high hills, near Goldendale, April, 1878 (April 20, 1882), *Howell* (Ore TYPE *M. nutans);* Camp Harney, May 26, 1885, *Howell* (US, UCal, P, F); rocks and dirt, east flank of Steen Mountains, above Alvard Ranch, Harney Co., alt. 6000 ft., June 8, 1927, *Leach 8317* (CAS); Mathew Divide, Owyhee, alt. 1520 m., May 30, 1896, *Leiberg 2166* (F, UCal, Pom, Clokey, G, US); dry top of Steen Mountains above Alberson, alt. 2800 m., July 5, 1925, *Peck 14256* (Willm); damp ground, Forest Camp on Dairy Creek, 35 miles northwest of Lakeview, July 1, 1927, *Peck 15403* (Willm, M).

CALIFORNIA: near Emigrant Springs, lava beds, June, 1894, *Austin* (ANS, UCal, ND TYPE *M. symphytoides*, NY); Goose Lake Valley, June, 1898, *Austin & Bruce 2260 in part* (UCal); wet rich soil, in tamarack swamp, Modoc Co., Aug. 5, 1893, *Baker* (UCal); near Lassen's Peak, Sept., *Lemmon* (UCal); near Ft. Bidwell, April–May, 1903, *Manning 83* (UCal).

22b. Mertensia oblongifolia var. **amoena** (A. Nels.), comb. nov.

M. amoena A. Nels. in Bot. Gaz. **30**: 195. 1900.

M. Cusickii Piper in Bull. Torr. Bot. Club **29**: 643. 1902.

M. pubescens Piper in Contr. U. S. Nat. Herb. [Fl. Wash.] **11**: 479. 1906, non Willd., nec H. & B., nec Schultes.

M. Bakeri amoena A. Nels. in Coult. & Nels., Man. Ry. Mt. Bot. 422. 1909.

M. foliosa var. *pubescens* Macbr. in Contr. Gray Herb. N. S. No. 48: 19. 1916.

M. oblongifolia var. *nimbata* Macbr. in Contr. Gray Herb. N. S. No. 53: 18. 1918.

M. Cooperae Peck in Torreya **32**: 151. 1932.

M. foliosa var. *amoena* Johnston in Contr. Arnold Arb. No. 3: 85. 1932.

M. foliosa var. *amoena* f. *Cusickii* Johnston, *l. c.*

Similar to the species, often more robust; leaves more or less densely pubescent on both surfaces.

Distribution: sporadic with the preceding variety and the species; most abundant in western Montana and adjacent Wyoming and Idaho.

MONTANA: Pleasant Valley, June 25–30, 1871, *Allen in part* (US); foothill thickets, Bozeman, May 23, 1899, *Blankinship in part* (M); upland plains, Bozeman, May 4, 1905, *Blankinship 374a in part* (F); upland plains, Bozeman, alt. 5000 ft., May 5–8, 1906, *Blankinship 374b in part* (Pom, N, UCal); Bozeman, May 18, 1893, *Gottschalch* (G TYPE *M. oblongifolia* var. *nimbata*); Bozeman, May 13, 1905, *Jones in part* (UCal); Deer Lodge, June, 1890, *Kelsey* (F); Helena, May, 1889, *Kelsey 62 in part* (CAS); Bear Canyon, May 25, 1900, *Moore in part* (UCal); Bridger Canyon, May 15, 1901, *Moore in part* (UCal); Monida, June 16, 1899, *Nelson 5413a in part* (M, Ry, US); among sagebrush on a moist slope, Monida, Madison Co., June 16, 1899, *Nelson & Nelson 5413 in part* (M, Ry TYPE *M. amoena*, P, G, N, Pom, K, AM, Cl); foothills, Deer Lodge, April 27, 1888, *Stapleton 53 in part* (UM); near Mullen Tunnel, April 28, 1889, *Suksdorf* (P).

WYOMING: above junction of Mt. Washburn, Camp Roosevelt, July 1, 1924, *Conard 1289* (Ry); Mammoth Hot Springs, alt. 5800 ft., April, 1889, *Dewart* (M, G, Cl, K, UCal, N); on open grassy slopes, Glen Creek, Yellowstone National Park, June 29, 1899, *Nelson & Nelson 5556* (Ry).

IDAHO: in coniferous forest, Sawtooth Mountains, Payette River, Boise Co., June 18, 1930, *Applegate 6303 in part* (G); headwaters of the Middle Fork of Salmon River, Bear Valley, Sawtooth Mountains region, Custer Co., June 18, 1930, *Applegate 6312* (G); near Reservoir, Modoc Creek, Targhee Forest, Fremont Co., alt. 2400 m., June 4, 1928, *Eggleston 22017* (G); clumps, moist open slopes, Dry Buck, Boise Co., alt. 5500 ft., May 10, 1911, *Macbride 856* (UCal, F, Ry, US, Pom, M, G); deep, loamy soils on hillsides, Lost River Mountains, Blaine Co., alt. 8000 ft., July 10, 1916, *Macbride & Payson 3143 in part* (CAS, Ry, Pom, UCal); dry exposed hillside, Cape Horn, Custer Co., July 30, 1916, *Macbride & Payson 3522* (Ry); open hillsides, Josephus Lakes, Custer Co., alt. 7500 ft., Aug. 3, 1916, *Macbride & Payson 3557* (CAS, Pom, US, G, M, Ry); open hillside, Josephus Lakes, Custer Co., alt. 7500 ft., Aug. 3, 1916, *Macbride & Payson 3846* (G); Owyhee Mountains, July, 1892, *Mulford in part* (N); Payette Forest Reserve, coll. of 1912, *Nelson D–9* (Ry); moist north slope, Squaw Creek, Sweetwater Co., alt. 3500 ft., May 9, 1911, *Nelson & Macbride 837* (Ry); Beaver Canyon, June 27, 1895, *Shear 4407* (US); Beaver Canyon, July 13, 1880, *Watson 249* (G).

UTAH: among sagebrush, north slope of a small canyon about 3 miles east of Laketown, Rich Co., May 28, 1935, *Williams & Williams 2152* (W, ND, P, O, NY, G, Cl, M).

NEVADA: Little Lakes Canyon, West Stampede, Elko Co., June 13, 1902, *Kennedy 512* (Ry).

WASHINGTON: Browns Mountain, 5 miles southeast of Spokane, Spokane Co., April 7, 1925, *Davison* (P); top of Browns Mountain, 5 miles southeast of Spokane, Spokane Co., April 11, 1925, *Davison* (P); 6 miles west of Ephrata, Grant Co., April 8, 1926, *Jones 4126* (G); basalt scab land, east of Pearl, Douglas Co., May 20, 1928, *St. John, Eggleston, Beals & Warren 9387* (P); hillside near Lanz, Adams Co., April 10, 1924, *St. John, Pickett, Cary & Warren 3459* (M, G, P); Waterville, Douglas Co., April 23, 1900, *Whited 1214* (P, US TYPE *M. pubescens).*

OREGON: side canyon of Wildhorse Creek, east slope of Steens Mountains, alt. 7000 ft., May 22, 1929, *Applegate 5668* (G); Riley, Harney Co., June, 1922, *Cooper* (Willm TYPE *M. Cooperae);* Warner Range, Lake Co., alt. 1800 m., July 25, 1896, *Coville & Leiberg 25* (US); dry soil, Steens Mountains, alt. 7000 ft., June 18, 1901, *Cusick 2582* (UCal, US TYPE *M. Cusickii,* Cl, Pom, F, M, G, Ry, P); moist, rich, sunny banks of Silver Creek, near commencement of yellow pine, Harney Co., May 29, 1927, *Henderson 8315* (UCal, CAS); moist meadows, Spring Creek, road, Burns-Izee, Harney Co., May 15, 1927, *Henderson 8316* (CAS, UCal); top of Steens Mountains, divide near Wildhorse Creek and Huffman's Ranch, Harney Co., June 10, 1927, *Henderson 8318* (CAS); Owyhee-Malburn Divide, alt. 1300 m., May 31, 1896, *Leiberg 2178* (US, Pom, F, UCal, G, Kew); moist ground, Silvies River, Harney Co., June 26, 1912, *Peck 2914* (Willm); damp ground, upper Myrtle Creek, Harney Co., July 14, 1912, *Peck 2920* (Willm); moist ground, Emigrant Creek, Harney Co., June 23, 1912, *Peck 3236* (Willm); near the top of Pueblo Mountains, Harney Co., alt. 8000 ft., July 3, 1927, *Rogers 8319* (CAS).

CALIFORNIA: in sagebrush near spring, north slope of Ridwell Mountain, Warner Mountains, July 9, 1932, *Applegate 7615* (G); Lassen Creek, Modoc Co., Aug., 1894, *Austin* (UCal); Lake City Canyon, June, 1898, *Bruce A* (UCal); Parker Creek, Warner Mountains, Modoc Co., alt. 6000–7000 ft., June 13, 1919, *Ferris & Duthie 125* (Ry); Pine Creek Basin, Warner Mountains, Modoc Co., alt. 7600 ft., July 7, 1929, *Payne 57* (CAS).

The typical phase of *M. oblongifolia* occurs in western Montana, adjacent Wyoming, northern Idaho, and eastern Washington, and usually has larger corollas than those found in other localities. Elsewhere the occurrence is usually sporadic with the variety *nevadensis* which is probably the basic phase of this group. As can be seen above in the synonymy this species has been variously treated. Piper's *M. nutans* subsp. *subcalva* is identical with the typical phase but based on young specimens. Macbride and Payson's *M. Bakeri* var. *subglabra* is a robust phase, which shows all intergradations to the typical phase.

Mertensia oblongifolia var. *nevadensis* is again much described and is an extremely variable plant. The type would be difficult to distinguish from the species except that the leaves are completely glabrous or nearly so. The known phases are numerous; part of them are probably due to the time of collection of specimens. *Mertensia nutans* and *M. coronata* are nearly typical; *M. stenoloba, M. tubiflora,* and *M. intermedia* are robust phases; *M. symphytoides* is a tall phase; *M. nevadensis* is a small phase but quite typical; *M. praecox* is an extremely robust, broad-leaved phase, which in early growth stages is indistinguishable from var. *nevadensis; M. Nelsonii* is a fairly robust, probably shade, phase.

Mertensia oblongifolia var. *amoena* is the phase in which the leaves are pubescent on both sides, a character in which extremes occur. *Mertensia Cusickii* is an extreme pubescent and robust phase, and *M. Cooperae* is similar to it but smaller; *M. pubescens* is slightly more pubescent than the type of the variety; *M. eplicata* is a phase similar to *M. Cusickii* but slightly less pubescent; *M. oblongifolia* var. *nimbata* is slightly less pubescent than typical and with the pubescence mostly appressed.

The rather numerous names which have been applied to this small but widely distributed group give an idea of the variations found within it.

Phases of the three entities here considered to comprise the group have been studied in the field. It is felt that they represent only three phases of one entity which is widely distributed and variable, some phases being much more vigorous than others. Apparently any of the three entities may be expected at any part of the range of the group even though they are not now known. Material of *M. foliosa* and of nearly typical *M. oblongifolia* was known from southwestern Wyoming. It was thought that var. *amoena* should be found in that general region even though it was known only from Yellowstone Park as nearest locality. Consequently a large number of "patches" in that region, where it is extremely common, were carefully gone over and it was found not a great distance away in adjacent Utah, queerly enough in a patch which contained only that variety. That the species and one or even both varieties occur together seems not to be unusual. The type collection of *M. amoena* contains all three varieties; the type specimen itself is fortunately all the very pubescent plant. *Mertensia oblongifolia* and the var. *nevadensis* occur together quite commonly in northwestern Wyoming, and a search through any large patch will almost always disclose them both.

These plants change their aspect considerably from the time they first come in flower until a mature flowering stage is reached. To this characteristic may be attributed part of the excess describing of plants belonging to the group.

Although this group is fairly distinct, attention should be called to the fact that they closely simulate, in some phases, *M. viridis* and its var. *dilatata*.

It is interesting to note that the treatment accorded this group by Johnston, Contr. Arnold Arb. No. 3: 84–85. 1932, is similar to the one here presented. The main difference is that *M. foliosa* var. *subcalva* is here considered to be the same as *M. oblongifolia,* and that the other two names he used, *M. foliosa* and *M. foliosa* var. *amoena,* are given varietal rank under *M. oblongifolia,* the former as var. *nevadensis* for bibliographical reasons. Both treatments are decidedly at variance with the one presented by Macbride in Contr. Gray Herb. N. S. No. 48. 1916.

It is unfortunate that Macbride has used *M. nevadensis* in a varietal category. Except for that, the more appropriate and older name *M. foliosa* would be taken up as a variety of *M. oblongifolia,* but evidently *nevadensis* must be perpetuated according to the international rules. The types of *M. foliosa* and *M. nevadensis* are as much alike as the proverbial peas and are at almost the same stage of anthesis.

23. Mertensia oreophila, sp. nov.[1]

Stems procumbent or ascending, 4–15 cm. tall, 1–several from each rootstalk; basal leaves orbicular to oblong-ovate, obtuse, 2–5 cm. long, 1–2 cm. broad, glabrous or the upper surface pustulate, subcoriaceous, obscurely ciliate; cauline leaves elliptic-oblong to broadly ovate, obtuse, 1–5 cm. long, 0.7–2.5 cm. broad, glabrous or the upper surface pustulate, subcoriaceous; inflorescence terminal, crowded, not elongated in fruit; pedicels 1–6 mm. long, glabrous; calyx 3–6 mm. long, the lobes lanceolate-oblong to oblong-ovate, subacute, 2–4 mm. long, glabrous, obscurely ciliate, slightly accrescent; corolla-tube 5–10 mm. long, glabrous within; corolla-limb moderately expanded, 3–6 mm. long; anthers 1.2–2 mm. long; filaments 1–

[1] **Mertensia oreophila,** sp. nov., caulibus procumbentibus vel ascendentibus, 4–15 cm. altis, 1-plura ex eadam radice; foliis basalibus orbicularibus vel oblongo-ovatis, obtusis, 2–5 cm. longis, 1–2 cm. latis, glabris vel supra pustulosis, subcoriaceis, obscure ciliatis; foliis caulinis elliptico-oblongis vel late ovatis, obtusis, 1–5 cm. longis, 0.7–2.5 cm. latis, glabris vel supra pustulosis, subcoriaceis; inflorescentia conferta, maturitate non elongata; pedicellis 1–6 mm. longis, glabris; calyce 3–6 mm. longo, lobis lanceolato-oblongis vel oblongo-ovatis, subacutis, 2–4 mm. longis, glabris, obscure ciliatis, paulo accrescentibus; corollae tubo 5–10 mm. longo, infra glabro; corollae limbo 3–6 mm. longo; antheris 1.2–2 mm. longis; filamentis 1–2.5 mm. longis, latioribus quam antheris; fornicibus conspicuis, glabris; nucellis ca. 3 mm. longis, rugosis.

2.5 mm. long, broader than the anthers; fornices conspicuous, glabrous; style reaching or surpassing the anthers; nutlets about 3 mm. long, rugose.

Distribution: Big Horn Mountains, Wyoming.

WYOMING: Big Horn Mountains, May 8, 1896, *Moore* (Ry); moist meadows near Powder River Pass, south end of the Big Horn Mountains, alt. 9600 ft., July 4, 1935, *Ownbey 811* (Ry, W); wind-swept ridges near Little Baldy, Big Horn Mountains, alt. 9500 ft., July 5, 1935, *Ownbey 841* (Ry, W); protected hillsides near Buffalo, Johnson Co., April 18, 1934, *Rollins 404* (W); among sagebrush, upper Ten Sleep Canyon, Big Horn Mountains, Washakie Co., alt. 9000 ft., July 3, 1935, *Williams 2325* (M, W); rocky open ridges near head of North Fork of Powder

Fig. 15. *M. oreophila.* Habit sketch × ⅓; enlarged flower × 1⅔.

River, Big Horn Mountains, Johnson Co., alt. 9000 ft., July 4, 1935, *Williams 2331* (M TYPE, P, ND, G, NY, Cl, Dudley Herb, W); rocky ridges, Little Baldy, Big Horn Mountains, Big Horn Co., alt. 9500 ft., July 5, 1935, *Williams 2360* (M, ND, Cl, P, W); Hurlbut Creek, Sheridan Co., May 4, 1909, *Willits 6* (Ry).

Mertensia oreophila, in the field, has much of the aspect of *M. humilis* as to size and habit of growth. The relationship of this species, however, is to *M. oblongifolia* var. *nevadensis.* From this it is distinct mainly in shape and texture of the leaves, the habit of growth, and facies. Furthermore, *M. oreophila* shows the same characteristic elongation of the corolla as do *M. longiflora* and *M. oblongifolia* and its varieties. The size of the corolla is about doubled from the time it opens until the time that it is ready to fall.

The localized distribution of this species is of interest. The

Big Horn Mountains are isolated by about 100 miles of plains from the nearest mountains of like magnitude. Much of the mountain flora there is similar to that of the mountains to the west, in Wyoming, but some of it is made up of species from the mountains of Colorado, not known elsewhere from Wyoming. The present species is probably endemic in those mountains.

24. Mertensia longiflora Greene, Pittonia **3**: 261. 1898.

M. pulchella Piper in Contr. U. S. Nat. Herb. [Fl. Wash.] **11**: 478. 1906.

M. pulchella subsp. *glauca* Piper, *l.c.* 479.

M. Horneri Piper, *l.c.* 479.

M. longiflora var. *pulchella* Macbr. in Contr. Gray Herb. N. S. No. 48: 17. 1916.

M. longiflora var. *Horneri* Macbr. *l.c.*

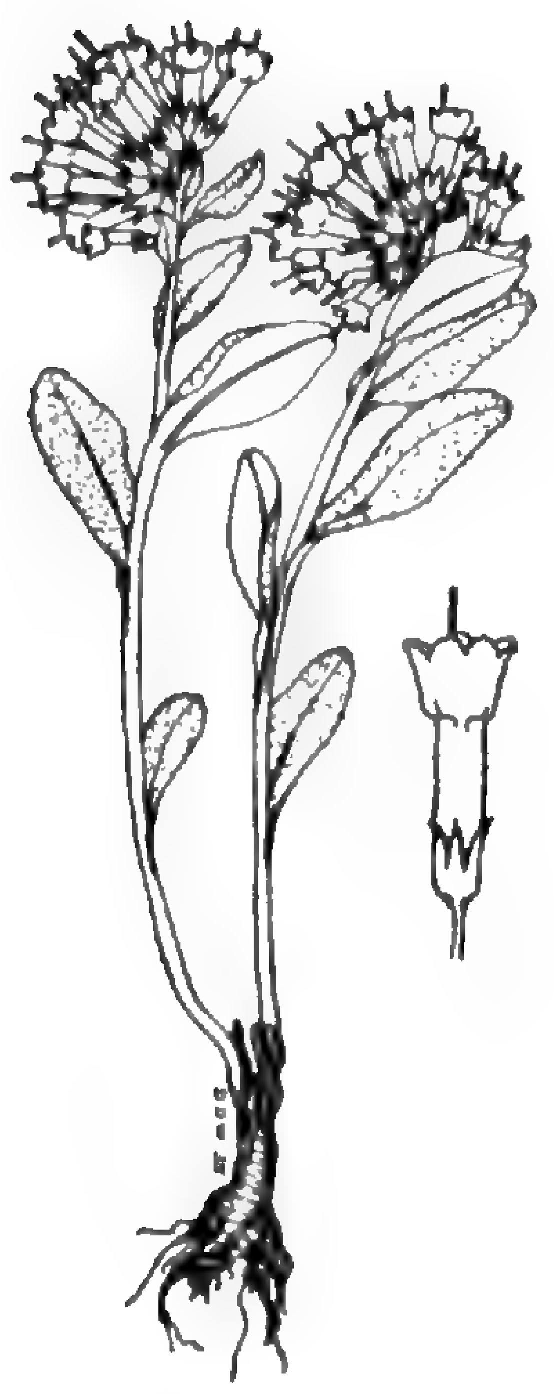

Fig. 16. *M. longiflora.* Habit sketch × ⅓; enlarged flower × ⅔.

Stems erect, 0.6–3.5 dm. tall, one to few from each shallow-seated, short, tuberous root, easily detached; basal leaves rarely from roots producing flowering stems, oval to spatulate, 2–5 cm. long, 1.2–2.5 cm. broad, winged petiole longer or shorter than the blade, or vestigial and often scarious, glabrous to hirsute above, glabrous below; cauline leaves oblong-lanceolate to broadly ovate, 2–8 cm. long, 0.4–4.5 cm. broad, obtuse, mostly less than three times longer than broad, glabrous to hirsute or strigose on the upper surface, glabrous below (very rarely pubescent on the lower surface as well); inflorescence usually congested, short; pedicels glabrous or pubescent, 0.5–6 mm. long; calyx 3–6 mm. long, the lobes lanceolate to linear-lanceolate, acute, 2.5–4.5 mm. long, glabrous, ciliate; corolla-tube 8–15 mm. long, glabrous or with a few hairs confined to the basal portion within; corolla-limb 4–7 mm. long, usually much shorter than the tube, moderately expanded; anthers 1–1.7 mm. long; filaments 1–2 mm. long, about as wide as or wider than the anthers; style about as long as or longer than the corolla;

fornices conspicuous, usually glabrous; nutlets 3–4 mm. long, rugose.

Distribution: western Montana, northern Idaho, southern British Columbia, Washington, and Oregon to northern California, mostly in the low hills or on the prairies.

MONTANA: Monida, June, 19, 1922, *Jones* (Pom); Columbia Falls, May 22, 1893, *Williams* (G, M); Columbia Falls, May 20, 1894, *Williams* (Ry, US, UM).

IDAHO: Paradise Hills, Latah Co., April, 1900, *Abrams 545* (Pom, UCal); coll. of 1874, *Ainslie* (US); south slope, summit of Cedar Peak, Thatuna Hills, Latah Co., alt. 4900 ft., May 18, 1935, *Constance, Clements & Rollins 1066* (W, M); shrubby, rocky hillside, Hope, April 7, 1914, *Dunkle* (UIdaho); along the Clearwater River, east of Lewiston, on Nez Perce Reservation, April 23–May 18, 1892, *Heller 75* (ANS); about Lake Waha, Nez Perce Co., alt. 2000–3500 ft., June 2, 1896, *Heller & Heller* (US); moist hills, Juliaetta, April 21, 1894, *Henderson* (Cl); warm, moist, open or wooded hills, about Moscow, April 21, 1894, *Henderson* (Ry); common on open hills or in light pine woods, April 21, 1894, *Henderson* (US); steep north hillside, Lewiston, March 3, 1900, *Hunter 11* (P); Middle Valley, alt. 2300 ft., April 20, 1900, *Jones* (Pom); mountains, Kootenai Co., July, 1890, *Leiberg* (F, M); moist hillsides, Kootenai Co., May, 1892, *Leiberg* (F); hills near Fort Coville, coll. of 1861, *Lyall* (G); Albion, coll. of 1893, *Lyles* (UM); Porphyry Peak, Bitter Root Mountains, alt. 6000 ft., June 28, *Marcy* (G); loam, Bear Basin, Idaho Forest, alt. 5500 ft., coll. of 1915, *Maris 45* (N); loose sandy loam, Payette Forest, alt. 5000 ft., May 31, 1911, *Moore 96* (Ry); Wallace, June, 1909, *O'Neal 8* (Ry); dry gravelly bluff along Lewiston grade, Nez Perce Co., alt. 1400 ft., April 6, 1922, *Parker 327* (P); wooded slopes, Mt. Baldy, Salmon, Lemhi Co., alt. 8000 ft., July 1, 1920, *Payson & Payson 1863* (G, Ry, M); dry slopes in yellow pine, Priest River Experiment Station, Kaniksu National Forest, May 26, 1913, *E. C. R. & J. A. L. 119* (US); Latah Co., coll. of 1900, *Ried 4* (P); dry soil, Bitter Root Mountains, June, 1887, *Sandberg 172* (F); frequent on slopes, valley of Clearwater River, Nez Perce Co., April 28, 1892, *Sandberg, MacDougal & Heller 75* (Pom, CAS, US, P photograph, G, US TYPE *M, pulchella);* on the lower Clearwater River, Nez Perce Co., April 30, 1892, *Sandberg, MacDougal & Heller 75a* (US); Clearwater, *Spalding* (G); hillside, Albany Falls of Pend Oreille River, Kootenai Co., May 12, 1923, *Sprague 707* (P); Carlin Bay, Lake Coeur d'Alene, Kootenai Co., April 25, 1926, *St. John, Gessell, Jones, Ridout & Woods 4240* (P); woods, Coeur d'Alene, Kootenai Co., April 25, 1926, *St. John, Gessell, Jones, Ridout & Woods 4269* (P); moist hillsides, Chatcolet, Benewah Co., May 12, 1928, *Warren 883* (P); Grangeville, coll. of 1887, *Weeks* (F); Hailey, Sawtooth National Forest, coll. of 1910, *Woods 314* (Ry).

BRITISH COLUMBIA: open, Cranbrook, April 29, 1908, *Anderson* (P); open land, Grand Forks, April 13, 1906, *Anderson 56* (P); Chare, Yale and Caribou Districts, April 20, 1919, *Anderson* (P); Waneta, Kootenay District, April 6, 1898, *Jamieson 196* (P); Trail near International Boundary between Kettle and Columbia Rivers, May 26, 1902, *Macoun 66567* (P, CAS, Pom, F, G); Midway, April 16, 1905, *Macoun 76738* (Cl, F).

WASHINGTON: dry treeless plains, Douglas, Douglas Co., April 25, 1931, *Applegate 6691* (F, G); hillside 1 mile south of Albion, Whitman Co., alt. 2250 ft., May

11, 1928, *Beals* (P); Rattlesnake Hills, Benton Co., coll. of 1926, *Bennett* (P); on moist hillside, Almota Canyon, alt. 1500 ft., April 5, 1930, *Clarke* (P); Pullman, May 14, 1896, *Climer* (P); open pine woods, foothills of Blue Mountains, 10 miles south of Pomeroy, Garfield Co., May 2, 1921, *Courtney* (P); Pullman, June, 1896, *Elmer* (Pom); on shady stream banks, Pullman, June 12, 1896, *Elmer 31* (Pom); on shady stream banks, Pullman, May 20, 1896, *Elmer 158* (Ry); Pullman, Whitman Co., June, 1899, *Elmer 1584* (M); (probably near Omak), Okanogan Co., April, 1931, *Fiker 40* (P); in thicket along Chiliwist Creek, near Olema, Okanogan Co., April 24, 1932, *Fiker 584* (P); on moist hillside, Pullman, Whitman Co., May 10, 1928, *Fontanilla 947* (ANS); Republic, Sept., 1912, *Foster* (M); Columbia River Valley, Stevens Co., April, 1911, *Gabby 8* (P); wooded slopes near Vantage, April 20, 1931, *Granstand* (M); Walla Walla, Walla Walla Co., May 15, 1911, *Hill* (P); Blue Mountains, Walla Walla Co., June 10, 1911, *Hill* (P); grassy knolls, Waitsburg, April 7 and 14, 1906, *Horner* (US); grassy knolls, Waitsburg, April 21 and 28, 1906, *Horner* (US); Waitsburg, April 3, 1897, *Horner 366* (US TYPE *M. Horneri)*; hilltops, Waitsburg, Walla Walla Co., April 3, 1897, *Horner R155B366* (G); high hills, eastern Washington, May, 1880, *Howell* (F); moist hillsides, Almota Canyon, Whitman Co., March 28, 1926, *Jones 251* (P); rocky ground, on top of Steamboat Rock, Douglas Co., April 12, 1930, *Jones 2826* (G); rocky hillside, Manashtash Ridge, Kittitas Co., April 14, 1935, *Jones 6332* (UCal); wet soil, Newman Lake, Spokane Co., alt. 2000 ft., April 21, 1926, *LaMotte 4* (ANS); hills near Spokane, coll. of 1861, *Lyall* (G); Pullman, April 22, 1906, *Miner* (P); rocky hillsides and moist places, Pullman, April 22, 1901, *Miner 86* (P); in field near edge of canyon, Snake River, April 26, 1913, *Muenscher 351* (Cl); moist hillsides, Almota, April 7, 1894, *Piper* (P); on hillsides, Pullman, April 25, 1894, *Piper* (UCal); in moist ground, Pullman, April 25, 1894, *Piper 1875* (P); at the top of the canyon, 1 mile east of the Grand Coulee Dam, Grant Co., April 21, 1935, *Rollins 861* (W); Medical Lake, alt. 1000–2000 ft., May, 1893, *Sandberg & Leiberg* (Pom, UCal, ND TYPE, M, ANS); Hangman Creek, Spokane Co., alt. 1910 ft., May 20, 1893, *Sandberg & Leiberg 48* (M, UCal, CAS, G, US, P, ANS); Pullman, April 27, 1897, *Sheldon* (P); Pullman, April 16, 1923, *Spiegelberg* (P); moist hillside, Sacheen Lake, Pend Oreille Co., May 9, 1923, *Spiegelberg 527* (P); south slope, in low shrubs, Kamiak Butte, Whitman Co., May 6, 1922, *Sprague* (Pom); rich warm soil, Sacheen Lake, Pend Oreille Co., May 9, 1923, *Sprague 706* (P); above Shell-rock Point, near Oueak, alt. 1200 ft., April, 1917, *Steward 36* (UM); north bank of Palouse River, below Colfax, Whitman Co., April 29, 1922, *St. John 3038* (P); rocky south slope, Kamiak Butte, Whitman Co., April 17, 1921, *St. John 6065* (P, M); rocky soil, Ewan, Whitman Co., April 10, 1924, *St. John, Cary, Pickett & Warren 6325* (P); rocky hillsides, Almota Canyon, Whitman Co., April 11, 1923, *St. John & Pickett 6508* (P); grassy draw, south end of Rock Lake, Whitman Co., April 9, 1925, *St. John, Pickett & Warren 6879, 6880* (P); Spangle, April, 1894, *Suksdorf* (P); Waverly, May 16, 1889, *Suksdorf* (P); Liberty Lake, May 2, 1916, *Suksdorf 8560* (P); on the hills south of Spokane Bridge, May 4, 1916, *Suksdorf 8570* (P, UCal, CAS, G, ANS, M); Hangman (Latah) Creek, near Spangle, May 12, 1916, *Suksdorf 8615* (P); open pine slopes 10 miles east of Cle Elum, April 4, 1931, *Thompson 5946* (US, CAS, G, M); rocky slope at northern base of Blewett Pass, April 18, 1931, *Thompson 5996* (M, G); moist slope 2 miles west of Cashmere, April 18, 1931, *Thompson 6004* (US, M, G); open rocky slopes on Lookout Mountain, near Leavenworth, alt. 5000 ft., May 23, 1931, *Thompson 6502* (M, G); Rimrock near Lauderdale Auto Camp, April 23, 1932, *Thompson 8227* (UCal, CAS, M, G); open summit of Tumwater Mountain, alt. 4500 ft., May 12, 1934, *Thompson 10485* (CAS, M, G); Cheney, Spokane Co., coll. of 1890, *Tucker* (G); Spokane, July 5, 1895, *Tucker* (ANS); Spokane Co., April 20, 1913, *Turesson* (Ry); Springdale, Stevens Co., April 19, 1925, *Tuttle* (P); rocky hillside, west of Ephrata, Grant Co., April 5, 1921, *Vercler* (P); Badger Mountain, Douglas Co., May 24, 1900, *Whited* (P); hills west of Wenatchee, March 31, 1899, *Whited 1010* (P, G, US TYPE *M. pulchella* subsp. *glauca).*

OREGON: on Bald Knob, Bear Creek, Wallowa Mountains, alt. 1950 m., June 4, 1907, *Coville 2376* (US); common on open hillsides, Union Co., alt. 3000–4000 ft., coll. of 1880, *Cusick 41* (F, US); stony hillsides, eastern Oregon, April 13, 1898, *Cusick 1830* (UCal, F, P, US, G, Cl, M); very common, basaltic soil, moist open hills, eastern Oregon, alt. 1130 m., April 12, 1907, *Cusick 3151* (UCal, F, P, Ry, US, G); basaltic rocks, steep north slopes where snow drifts deep, eastern Oregon, alt. 1200 m., May 6, 1907, *Cusick 3155* (UCal, F, M, P, US, G, Ry); basaltic soil, steep north slope, in partial shade of trees, eastern Oregon, alt. 1330 m., May 1, 1907, *Cusick 3159* (UCal, F, P, US, G, M, Ry); commonly growing among small rocks, basaltic soil, steep mountain sides of East Eagle Creek, Wallowa Mountains, alt. 2160 m., June 8, 1907, *Cusick 3169* (UCal, F, P, US, G, Ry, M); wet ledges on cliffs, Umatilla River, Blue Mountains, alt. 2000 ft., April 7, 1910, *Cusick 3424* (F, Willm, M, US, P, Ry, G); near North Powder, Union Co., May 10, 1928, *Gale 140a* (Kew); near John Day, Grant Co., May 10, 1928, *Gale 145* (Kew, G); near Dayville, Grant Co., May 10, 1928, *Gale 152* (M, ANS); near Austin, Grant Co., May 10, 1928, *Gale 165* (Kew) and *169* (F, Kew, M); Oregon, *Geyer 316* (G); moist soil, open pine woods, middle altitudes, Blue Mountains, 6 miles from Mt. Vernon, Grant Co., April 27, 1925, *Henderson 5008* (CAS, G, M); open grassy ground, top of Dixie Mountain, Blue Mountains, Grant Co., alt. 8000 ft., June 13, 1925, *Henderson 5216* (G, M, CAS); moist yellow pine woods, summit of Blue Mountains, Burns-Canyon City road, Grant Co., May 26, 1927, *Henderson 8314* (CAS); Blue Mountains, May 21, 1885, *Howell* (F, G, P); Blue Mountains, May 26, 1885, *Howell* (G); abundant on glade areas, Billy Meadows, Wallowa National Forest, March 4, 1908, *Jardine 186* (US); moist bank, Wallowa Falls, Wallowa Co., May 25, 1923, *Sherwood 309* (F, Willm); 3 miles south of La Grande, May 23, 1923, *Sherwood 324* (Willm); sagebrush slopes near Pondosa, April 14, 1935, *Thompson 11329* (G).

CALIFORNIA: hillsides, Modoc Co., alt. 5000 ft., April, May, *Gilman 583* (UCal).

Mertensia longiflora is evidently a close ally of *M. oblongifolia* and its varieties and some incomplete specimens might be confused with them. It seems, however, to be a natural unit and well worthy of distinct designation.

This species also shows a number of variations as to pubescence. The variation is from forms with leaves glabrous, even lacking pustules, to forms with leaves having the upper surface pustulate to short-strigose and from that to rather long-hirsute. The integradation between these phases is complete and as high as six intergrading phases have been found on the same herbarium sheet. Part of the specimens on two sheets seen (*Elmer 31* (Pom) and *Elmer 158* (Ry)) have leaves pubescent on both sides as well as pubescent stems. In view of this complete intergradation, where no line can be drawn between the variation, it is thought best to treat them all as one species. Variation is also to be found in size of corollas. This is to be expected, particularly between young and well-developed plants and to a lesser extent between plants of the same age.

DOUBTFUL AND EXCLUDED SPECIES

Mertensia pilosa (Cham.) G. Don, Gen. Hist. **4**: 320. 1838; A. DC. in DC., Prodr. **10**: 90. 1846 (*Pulmonaria pilosa* Cham. in Linnaea **4**: 449. 1829, at least in greater part). Said to have been from Eschscholz Bay (Alaska). The type not seen nor the species identified.

Mertensia denticulata (Lehm.) G. Don, Gen. Hist. **4**: 319. 1838 (*Lithospermum denticulatum* Lehm., Asperif. pars 2: 294. 1818; *Pulmonaria denticulata* R. & S., Syst. **4**: 746. 1819; *Casselia denticulata* Dumort., Com. Bot. 23. 1822). The type could not be located and the plant has not been identified. Habitat given as "America septentrionali."

Mertensia Drummondii (Lehm.) G. Don, Gen. Hist. **4**: 319. 1838 (*M. sibirica* var. *Drummondii* Gray in Proc. Am. Acad. **10**: 53. 1875; *Lithospermum Drummondii* Lehm., Pug. **2**: 26. 1828). The type has not been located. Locality or collector not given. In Hooker's 'Fl. Bor.-Am.,' to which Lehmann contributed the treatment of this group, the habitat is given as "Arctic Sea-shore." It is possible that Hooker supplied that data.[1] Dr. Gray, in the 'Synoptical Flora' gave the habitat as "Arctic Sea-shore, Richardson." The Richardson specimen bearing that data is a very pubescent phase of *M. paniculata* (Ait.) G. Don.

[1] There is a specimen in the British Museum of Natural History, London, bearing the collection data (a printed form) "British America. Dr. Richardson 1819-22," which may be the specimen cited by Hooker. The specimen is probably erroneously labeled for it seems to be one of the phases of *M. viridis* known to the author only from Colorado. There is a probable duplicate of this collection in the Herbarium of the New York Botanical Garden.

Mertensia corymbosa (Lehm.) G. Don, Gen. Hist. **4**: 319. 1838 (*Lithospermum corymbosum* Lehm., Pug. **2**: 27. 1828). The type could not be located nor the species identified with certainty. It may possibly be *M. paniculata* (Ait.) G. Don.

Pulmonaria elliptica Raf., New Fl. N. Am. pt. 4: 17. 1836, is probably a synonym of *Hackelia virginiana* (L.) Johnston, according to Johnston.

LIST OF EXSICCATAE[1]

The collector's numbers are indicated in *italics*, or if the collection is unnumbered, by a dash. The numbers in parentheses are those assigned to the species and varieties in this monograph.

Abbe, E. C. *1247* (1).
Abbott, E. K. — (11).
Abrams, L. R. *804* (4); *9177* (4b); *545* (24).
Abrams, L. R. & A. T. Benson. *10540* (6a).
Adams, Robert. — (12a).
Ainslie, R. S. — (24).
Aiton, Geo. B. — (4).
Albrecht. — (11).
Allen, G. N. — (22a); — (22b).
Allen, O. D. *2, 231* (4b).
Allen, P. *147* (14a); *105* (19).
Allen, T. F. — (12).
Ames, F. *41* (3).
Ames, M. E. — (12c).
Anderson, F. E. *7* (22a).
Anderson, F. W. —, *252, 305, 5855* (22a).
Anderson, J. P. *797, 1112, 1892a* (4); — (12).
Anderson, J. R. —, *56* (24).
Anderson, W. A. *392* (11).
Anderson, W. B. *799* (4); — (24).
Andersson, N. J. — (1).
Andrews, D. M. *26* (14); *32* (14a); *9* (19).
Andrews, R. C. *339* (2).
Anect, Bro. *51, 68* (5); *23* (14d).
Angel, J. B. *33* (1).
Anspach, G. — (1).
Anthony, H. E. *47* (16).
Apgar, A. C. — (11).
Applegate, E. I. *5061, 8751, 8767, 9696* (2); *2578, 4127, 5999* (4b); *6326* (10); *8551* (14a); *8431* (16); *6303* (22); *3070, 3071, 5671, 5675, 6181, 7444, 7928, 8328* (22a); *5668, 6303, 6312, 7615* (22b); *6691* (24).
Archibald, J. M. *A156* (14a).
Arsène, G. *17902, 20756* (5).
Arsène, G. & A. Benedict. *15728, 16129* (5); *16131* (19b).
Arsène, L. *406* (1).
Atkinson, G. F. — (19).
Austin, R. M. —, *91, 276, 442, 1193* (12c); *511* (22); — (22a); — (22b).
Austin, R. M. & Bruce, *2372* (12c); *2260, 2261* (22); *2260* (22a).

Babcock, H. H. — (11).
Baehni, C. *668* (4).
Bailey, V. *575, 881* (5).
Baker, C. F. *391* (5); *189, 403, 486, 559, 560, 7599* (12); *1154, 1302* (12c); — (14); — (14b); *129, 558* (15); — (19); *191, 193* (19c); *293, 334, 497, 773* (20).

[1] A great many specimens were seen which have not been cited in text because of space required. Many of those specimens will be found identified by the collector's numbers in this index, but will not be found in the body of the text. In annotating specimens by collector's numbers collections very often have been mixed, and in this index certain numbers are referred to under more than one name.

Baker, C. F., F. S. Earle & S. M. Tracy. *42, 234, 252, 825* (5); *180* (12); *206* (15); *576* (20).
Baker, C. F. & J. M. Holzinger. *86* (14b).
Baker, M. S. *729b* (4b); *4718b* (12); *4213* (12c); — (22a).
Baldwin, E. B. — (1).
Ball, J. — (14); — (14a).
Ballou, F. O. — (12a).
Bannister, H. M. — (1); — (4).
Barber, M. A. *198* (4); *333* (14).
Barbor, E. A. — (12).
Barbour, W. C. *613* (11).
Barker, — (16).
Barnett, J. *114* (8a).
Barthoud, E. L. — (14).
Bartlett, F. —, *155* (5); — (14c).
Bartlett, R. C. *13* (1).
Bassett, F. N. — (12c).
Batchelder, C. F. — (11).
Bates, J. M. *6410* (12); —, *6518½* (14); *6442, 6534* (14a); *6391, 6410* (18).
Bates, J. M. & F. Eastman. *163, 183, 202, 243* (14).
Bates, O. S. — (4).
Bayne Beauchamp Expedition. *110* (4).
Beals, R. — (24).
Beardslee, H. C. — (12).
Beattie, R. K. *4104, 4131* (4); *4304* (4b).
Bebb, R. *3204* (12); *3172* (14b).
Beckwith, F. *154* (5).
Bell, C. A. *133* (1).
Bell, J. M. — (4).
Bell, P. — (1).
Benedict, A. *112* (5).
Benke, H. C. *3699* (1); *1775* (11).
Bennett, R. L. — (24).
Bennitt, D. *20* (22a).
Benson, L. *2492* (4b); *3855* (12c).
Bereman, S. D. *769* (12); *770* (20a).
Berg, N. K. *4792* (14c); —, *1632* (18); — (19b).
Bergman, H. F. — (14).
Bessey, E. A. — (12); — (18); — (19).
Bethel, E. *25* (14).
Bethel, E., I. W. Clokey & H. M. Schmoll. *258* (14).
Bickle, M. E. — (4).
Biddulph, O. *5784* (18).
Biltmore Herbarium. *2700a* (18).
Bischoff, F. — (1).
Bishop, H. *522* (1).
Bissell, C. H. & D. H. Linder. *22345* (1).
Bitner, H. F. *2213* (11).
Black, F. F. *17, 36* (4).
Blaisdell, F. E. — (3).
Blake, J. — (1).
Blake, S. F. —, *5394* (1).
Blankinship, J. W. *376* (12); — (12a); — (18); — (19); —, *374, 374a, 374b* (22); —, *375* (22a); —, *374a, 374b* (22b).
Bliss, C. F. — (12).
Blumer, J. C. *Pr37* (5); — (12).
Bolander, H. N. —, *2487* (12c).
Bolton, A. L. — (4).
Bourgeau, E. — (4).
Bowdoin College Exped. to Labrador. *43, 73, 210* (1).
Bowen, W. J. *1* (8a).
Bowman, P. *288* (1).
Bradbury, J. — (14).
Brandegee, K. — (12c).
Brandegee, T. S. —, *472, 999* (4b); —, *277, 650* (12); —, *651, 654* (14); —, *256, 652* (19).
Branson, I. T. — (12c).
Brewer, W. H. *2787* (12c).
Brewster, W. — (1); — (12).
Bridgman, G. L. — (11).
Brigham, R. H. *13753* (14).
Brinkman, A. H. *2214, 3139* (4).
British Behring Sea Commission Collection. *186* (1).
Britton, N. L. — (4).
Broadhead, — (22a).
Broadhead, G. C. — (11).
Brooks, A. H. & L. M. Pringle. — (4).
Brooks, H. E. — (4).
Brown, A. — (12).
Brown, S. *1174* (4).
Bruce, C. C. *A* (22b).
Brumback, F. M. & C. A. Davies. *123* (14).

Bryant, O. — (1); — (3).
Buffum, B. C. —, *646, 647* (12); *645* (14); *644* (17); *643* (18).
Burglehaus, F. H. — (12a).
Burk, W. H. *48* (1).
Burke, — (4); — (12); — (16).
Burke, M. *3117, 3118, 3120, 3721, 3725* (22a).
Bush, B. F. — *365, 398, 4238, 4374, 14526, 14544* (11).
Butler, B. T. *751* (12); —, *750, 4230* (12a); *4186* (22a).
Butters, F. K. & C. O. Rosendahl. 4477 (4).
Byington. — (12).

Campbell, E. O. — (1).
Campbell, M. L. — (12c).
Canadian Arctic Exped. *146* (1).
Canby, W. M. — (1); — (10); —, *811*, (11); — (14a); — (18).
Cannon, W. A. & F. E. Lloyd. — (4).
Carter, J. J. — (11).
Cary, M. *577* (12); *308* (14).
Castetter, E. F. *73, 1071* (5); *1075* (14d); *762* (19b).
Chandler, H. F. — (11).
Chapman, J. W. *6, 69* (4).
Chase, V. H. —, *21, 1282, 1290* (11).
Cheney, L. S. *6516* (4).
Chesnut, U. K. & W. W. Jones. *110* (22).
Chickering, J. W. — (1).
Christ, J. H. *700* (14b); *6238* (22a).
Churchill, J. R. — (11); — (12); — (14); — (14a).
Clarke, J. F. G. — (4); — (24).
Cleburne, W. —, *1020* (8a); *25* (14); — (22a).
Clegg, C. E. — (4b).
Clemens, J. — (8a); — (12); — (12c); — (16); — (19e); — (22a).
Clemens, M. S. — (12c).
Clements, F. — (18); — (19).
Clements, F. E. & E. S. Clements. *288, 367, 376* (12); *124* (14a); *405* (18); *232* (19); *324* (20).
Clevenger, J. E. — (11).
Climer, B. L. — (24).
Clokey, I. W. *227* (11); *2746, 2851, 3157, 3519, 3553* (12); *2774, 2785, 3044, 3045, 3078, 3160, 3852, 3853* (14); *3033, 3043, 3062, 3161, 3847, 5746* (14a); *3309, 3849, 3856* (18); *2902, 3187, 3560, 3850, 3851, 3854* (19); *3293, 3294* (19d); *3292, 3848, 3992* (19e); *2999, 3522* (20).
Clokey, I. W., K. Bruderlin & C. B. Clokey. *4256* (19).
Clokey, I. W. & R. Duthie. *3846* (14a).
Clos, W. C. *122* (8a).
Clute, W. N. — (11).
Cockerell, T. D. A. —, *2, 17, 20* (5); — (8b); *6256* (14); —, *6256, 6257* (14a); *57* (14c).
Cockerell, T. D. A. & W. P. Cockerell. *82* (14c).
Cockerell, W. P. — (14c); *40* (19b).
Coffin. — (17).
Coghill, G. E. *67* (5); *4* (14d).
Collier, A. J. — (3); —, *10* (4).
Collins, J. F. — (22).
Collins, J. F. & M. L. Fernald. — (1).
Collins, J. F. & A. S. Pease. *4474, 4475* (1).
Collom, R. E. —, *237* (5).
Colvin, E. — (4).
Comer, G. — (1).
Commons, A. — (11).
Comstock, J. H. — (11).
Comstock, S. *15* (5).
Conard, H. S. *552, 626* (11); *1573, 1896* (18); *1289* (22b).
Condit, D. D. — (11).
Condon, D. D. *5766* (12); *5753, 5794* (18).
Constance, L. *9413* (4b).
Constance, L. & J. F. G. Clarke. *1280* (4b); — (18b).
Constance, L., J. F. G. Clarke, W. Staats & G. Van Vleet. *1166, 1170* (4b).
Constance, L., H. F. Clements & R. C. Rollins. *1066* (24).
Constance, L., A. Dimond, R. C. Rollins & C. Worley. *1105* (4b).
Constance, L. & C. D. Jacobs. *1385* (4b).
Cooley, G. E. — (1).
Cooper, R. D. — (22b).

Cooper, W. S. *97* (1); *100, 284* (12); —, *110* (14a); *74, 119, 169* (19).
Copeland, E. B. *450* (12c).
Copeland, H. F. —, *379, 1529* (12c).
Cornell Party on Peary Voyage, — (1).
Cottam, *3283* (5); *3490, 3754* (8a); *02270* (15); *3713* (20); *2847, 2908, 3176* (22a).
Cotton, J. S. *328* (22).
Coues, E. & E. Palmer. *299* (21).
Coulter, A. D. — (4).
Coulter, J. M. —, (14); — (14a); — (22a).
Courtney, W. D. — (24).
Coville, F. V. — (11); *2376* (24).
Coville, F. V. & E. I. Applegate. *404* (4b).
Coville, F. V. & F. Funston. *1398* (12c).
Coville, F. V. & T. H. Kearney. *1056, 1683, 2239* (1).
Coville, F. V. & J. B. Leiberg. *207* (13); *25* (22b).
Cowen, J. H. —, *817* (12); *1808* (20).
Cowles, H. C. *851* (1); *985* (4); *677* (4b); *16* (14).
Cox, C. F. *371* (19); *11* (20).
Craig, M. *6014* (11).
Cramer, M. — (22a).
Crandall, C. S. — (5); —, *1306, 1307, 1308, 1309, 1638, 1644, 1645* (12); *155, 360, 1635, 1636* (14); *1637* (15); —, *739, 1819* (19); — (19d).
Crandall, C. S. & J. H. Cowen, *359* (20).
Cringer, F. *237* (12a).
Crocker, — (1); — (18).
Cross, W. *6* (5).
Culbertson, *4375* (12c).
Culbertson, T. A. *3, 4* (14).
Curtis, C. C. — (12); — (18).
Curtiss, A. H. — (1); — (11).
Cusick, W. C. —, *211, 1911a, 3292, 3296, 3392, 3474* (4b); *3875, 3895* (6a); *856, 1886, 2807* (13); *1629, 2376* (22a); *2582* (22b); *41, 1830, 3151, 3155, 3159, 3169, 3424* (24).

Dall, W. H. — (1); — (4).
Daniels, F. *320* (12); *14* (14).
Darlington, H. T. —, *49, 383* (4b); *2* (13).
Darlington, J. *4* (22a).
Davis, C. A. — (1).
Davis, J. —, *1236, 2523, 3309, 3541, 6391, 7207, 7280, 7296* (11).
Davis, R. J. *D23–32* (22); — (22a).
Davis, T. C. *3058* (11).
Davison, R. T. — (22b).
Deane, W. — (1).
Decker & Eggertsen, — (16).
Deehl, I. E. — (12).
De Forest, H. P. *364g* (11).
De France, J. A. — (12); — (14); — (19); — (19e).
Derby, C. — (12c).
Dewart, F. W. — (22b).
Dick, W. M. — (11).
Dickson, J. — (4).
Dirce, T. *7481* (12).
Dixon, J. *11, 24* (4).
Dodds, G. S. *1851, 1925* (14).
Dodds, G. S. & W. Robbins. *5819* (19).
Donaghe, R. — (22a).
Douglas, J. E. — (11).
Drake & Dickson. — (6a).
Draper, C. H. — (22a).
Drushel, J. A. *1705, 1904, 4065, 4066* (11); — (12); — (18).
Dunkle, M. B. — (24).
Duran, V. *3071* (12c).

Eames, A. J. *8677* (11).
Eams, J. O. — (16).
Earle, S. F. — (11).
Eastwood, A. *741* (1); —, *137, 903* (4); —, *94* (4a); *7764* (8a); — (12); *189, 1318* (12c); —, *5543, 5488, 7082* (14); —, *5402* (14a); *5365a* (15).
Eastwood, A. & J. T. Howell. *481* (8a); *441* (12); *209* (22); *209, 223, 299* (22a).
Eaton, D. C. *247* (12).
Eaton, D. W. —, *36* (4).
Eby, A. F. — (12).
Edmonds, H. W. — (11).
Edwards, H. — (12c).
Eggert, H. — (11).

Eggleston, W. W. *12970, 13535* (4b); *6652, 10164, 10168, 10302, 10344, 16845, 18835, 19332, 20021* (5); *10399* (8); *13883* (8a); *5881, 11260, 11883, 14075* (12); *13960* (12a); *9321* (12c); *12523* (14); *1175* (14a); *5669* (15); *6059* (20); *6926, 9007, 13841* (22a); *22017* (22b).
Eisenhower, C. W. — (11).
Ekblaw, W. E. —, *616* (1).
Ellis, C. C. *12* (14c).
Elmer, A. D. E. *793* (4); *1195, 2826* (4b); —, *31, 158, 1584* (24).
Elrod, M. J. — (11); —, *9* (22a).
Emerton, J. H. — (4).
Engelmann, G. — (6); — (14); — (14a).
Engelmann, H. — (12); — (16); — (19a); — (22).
English, C. *134, 800* (4b).
Epling, C. *6002, 7308, 7391, 7396, 7494* (4b); *5578* (6a); *5651* (11).
Epling, C. & J. M. Hauch [Houck]. *9355, 9496, 9541, 9608* (4b).
Euler, C. — (14a).
Evans, H. M. — (12c).
Evans, W. H. *160, 307, 308, 700* (1); *476, 737* (4).
Evermann, B. W. *18* (1); — (11); — (12).

Fallcott, J. — (4b).
Farwell, O. A. *282, 2111* (4).
Fassett, N. C. *2262, 2263* (1).
Fassett, N. C. & H. V. Truman. *13034* (11).
Faxon, E. — (1).
Faxon, E. & C. E. Faxon. —(1).
Fendler, A. *626* (5); *625* (14c).
Fenno, F. E. *291* (11).
Ferguson, M. C. & A. M. Ottley. *5381* (5); *5303* (14).
Fernald, M. L., E. B. Bartram, B. Long, & N. C. Fassett. *24411* (1).
Fernald, M. L., E. B. Bartram, B. Long & H. St. John. *7958* (1).
Fernald, M. L. & D. H. Linder. *22349* (1).
Fernald, M. L. & B. Long. *22347, 24412, 28954* (1).
Fernald, M. L., B. Long & B. H. Dunbar. *26994, 26995* (1).
Fernald, M. L., B. Long & J. M. Fogg. *387, 388* (1).
Fernald, M. L., B. Long & D. H. Linder. *22348* (1).
Fernald, M. L., B. Long & H. St. John. *7959* (1).
Fernald, M. L. & A. S. Pease. *3493* (4).
Fernald, M. L. & L. B. Smith. *25992* (1).
Fernald, M. L. & H. St. John. *11165* (1).
Fernald, M. L. & K. M. Wiegand. *3923, 3924, 6101* (1).
Fernow, B. E. — (1).
Ferril, W. C. — (5); — (12); — (14); — (14a); — (15); — (16); — (19).
Ferris, R. S. & R. Duthie. *252* (22a); *125* (22b).
Fiker, C. B. *862* (4); *1652* (22a); *40, 584* (24).
Fink, B. — (11).
Finley, C. *5* (22a).
Finley, W. L. — (4b).
Finsley, J. D. — (11).
Fisher, G. L. — (11).
Fitzpatrick, T. J. & M. F. L. Fitzpatrick. — (11).
Fleming, C. E. *91* (12).
Flett, J. B. *1536* (3); — (4b).
Flint, M. B. — (11).
Flodman, J. H. *751* (12); *752* (22a).
Fogg, J. M. *1558, 4056* (11).
Fontanilla, A. E. *947* (24).
Forbes, F. F. — (1).
Forwood, W. H. —, *32* (12); *267* (14).
Foster, A. S. — (24).
Foster & Osburn, *4810* (5).
Fowler, J. — (1).
Fox, C. L. — (12c).
Fremont's Exped. to Rocky Mountains. —, *425* (12).
Fries, T. M. — (1).
Fritchey, J. Q. A. — (12); — (19).
Fuller, H. J. — (12).
Fulton, H. J. *8209* (5).

Funston, F. *50* (1); *53* (4a).
Furbish, K. — (1).
Furlong, H. W., W. B. Greeley, M. Wilson & A. Alexander. — (22a).

Gabby, M. B. *8* (24).
Gageby, S. — (4b); — (22a).
Gail, F. W. — (4); — (12).
Gale, N. P. *145, 177, 180,* (22a); *140a, 145, 152, 165, 169* (24).
Gardiner, W. — (1).
Gardner, E. — (14a); — (19e).
Gardner, G. *129, 374* (1).
Garrett, A. O. *1516, 2145, 2717, 2909, 3035, 3473, 3967, 6187, 6355, 6561, 6578* (8a); *1510, 1513, 1888, 3696a, 5674, 5685, 5725, 5760* (12); *1075, 2716, 2958, 3030* (16); *5685, 5698* (20); *1074* (22a).
Gates, F. C. *1380, 1407* (11).
Gattinger, A. — (11).
George, B. M. *863* (4).
Gerber, R. *3720* (22a).
Geyer, *316* (24).
Geyer, C. A. *24* (14).
Gibbs, C. D. — (12c).
Gilbert, E. J. C. — (1).
Gilbert, F. A. *38* (11).
Gilman, M. F. *583* (24).
Gleason, H. A. —, *359, 2579* (11).
Glenn, E. F. — (4).
Goddard, P. E. *448* (4).
Golder, F. A. *63* (1).
Goodding, L. N. *178, 540, 594, 1173* (5); *855, 1145* (8a); *409, 1200, 1855* (12); *178, 409, 594, 1173* (12a); *1222* (15); *447* (18); *1777, 1827, 1889* (19); *1827* (19a); *1386, 1519* (20a).
Goodman, G. J. *1883* (8a); *621, 1824, 1837, 1842, 1899* (12); *700* (14); *382, 1830* (16); *1971* (20).
Goodman, G. J. & C. L. Hitchcock. *1387, 1443* (5); *1578* (8); *1492, 1513* (12); *1523* (20).
Gorman, M. W. *102, 277* (1); *170* (3); *999, 1076* (4); (22a).
Gottschalch, C. — (22b).
Graham, E. H. *8141, 9228* (8a); *9667* (8b); *6552, 8393, 8569, 10086* (12); *6303, 7806, 8067, 8099, 8120, 8198, 9114* (15); *9248* (16); *9070* (19); *8424, 8565* (20).
Grandjean, E. *84* (4b).
Granstand, E. — (24).
Grant, G. B. *776, 1239* (12c).
Grant, J. M. — (4b); —, *831* (6).
Graves, E. W. *1740* (11); *2283* (12).
Gray, A. *364* (11); — (12); — (19).
Greene, E. L. — (5); — (12); *303* (14); —, *613* (14a).
Greenman, J. M. — (11).
Greenman, J. M. & M. T. Greenman. *6196* (19a).
Greenman, J. M., O. E. Lansing & R. A. Dixon. *100* (11).
Griffin, A. A. *139* (20).
Griffiths, D. *5345* (5); — (12).
Griggs, R. F. — (1).
Grover, F. O. & C. L. Booth. — (11).

Haenke, T. *2.2370* (1).
Hagelbarger, P. R. *112* (1).
Hahn, W. L. *44* (1).
Haley, G. — (1); — (3).
Haley, G. & Haley. — (1).
Hall, C. H. — (12).
Hall, E. *405* (6a); — (14a).
Hall, E. & J. P. Harbour. *442* (12); *445* (14); *134, 445* (14a); *443* (18); *444* (20a).
Hall, H. M. —, *11447, 11531* (12); *11599* (12a); *9784* (12c); *10387* (14); — (19); — (19a).
Hall, H. M. & H. P. Chandler. *456* (12c).
Hankenson, E. L. — (11).
Hanna, G. D. — (1).
Hanna, L. A. *1344* (12); *148* (14); *100* (19a).
Hansen, G. *424* (12c).
Hansen, S. — (1).
Hanson, H. C. *145* (5); *C294* (12); *C293* (14); *C295* (14a).
Hanson, H. C. & E. E. Hanson. *A605* (5).
Hapeman, H. — (11).
Harper, E. T. — (14); — (19); — (20).

Harper, E. T. & S. A. Harper. — (14); — (18).
Harper, R. M. *3313* (11).
Harrington, G. L. *36, 88* (1); *13, 72, 74* (4).
Harrington, M. W. — (1).
Harrison, A. K. & W. H. Harrison. *9* (1).
Harrison, B. F. *5805* (8a); *5895* (15); *7323, 7550* (16); *5784* (18).
Harrison, B. F. & E. Larsen. *7741, 7742, 7885* (12); *7618* (15).
Harrold, C. G. — (1).
Harvey, F. L. & L. H. Harvey. — (1).
Hawkins, P. H. *633* (12a).
Hayden, F. V. — (12); — (14); — (17); — (22a).
Hayward, H. E. *746, 901, 940, 995, 1038, 1252, 1369, 1423, 1435, 1763, 1878, 1934* (14).
Heading, A. J. *2109* (11).
Heath, H. — (1).
Hedgcock, G. G. — (11).
Heideman, C. W. H. *51, 74* (4).
Heller, A. A. *420* (4); *14794* (4b); — (11); —, *9236, 9327, 9373* (12); *9181, 10541, 10546* (22); *10003, 10546* (22a); *75* (24).
Heller, A. A. & E. G. Halbach. —, *1325* (11).
Heller, A. A. & E. G. Heller. *3641* (5); *3872* (6); *3501* (14); *3640* (14c); — (24).
Henderson, L. F. *2813* (4); *647* of 1924, *2259* (4b); *3193, 8312* (12); *8113* (22a); *8315, 8316, 8318* (22b); —, *5008, 5216, 8314* (24).
Henderson, M. P. *17, 18* (16); *19* (22a).
Hendricks, B. A. — (14).
Henry, T. C. — (5).
Herb. Colo. State Agric. College. —, *1639* (12); *633, 4157* (14); — (14c); *4189* (19).
Hermann, F. J. *4934, 4934½, 5378, 5441, 5959, 5967* (12); *4615* (14); *5150, 5208, 5978* (20).
Herrick, C. L. *200, 260* (14c); *260* (14d).
"Hffl." — (4).
Hicks, G. H. — (14d).
Hill, E. J. *1280, 1312* (11).
Hill, G. A. *10* (3); — (24).
Hilsman, A. — (4).
Hitchcock, A. E. *1107, 1388* (12).
Hitchcock, A. S. *12075, 12097* (4); — (5); — (11); — (12c).
Hitchcock, C. L. *1761* (4); *2109, 2169* (4b); *2061* (12a); *1530* (22a).
Hobbs, M. *7, 50* (17).
Hollick, A. — (4).
Hollister, N. *69* (4).
Holm, T. — (19).
Holms, M. E. — (11).
Holway, E. W. D. — (4); *30* (18).
Holzinger, J. M. *16* (12); — (14); *47* (20a).
Hooker, J. D. & A. Gray. — (19).
Hopping, R. *65* (12c).
Horne, W. T. — (1).
Horner, R. M. *367, B367* (4b); —, *366, R155B366* (24).
House, H. D. *4930* (4); —, *6920, 9211* (11).
Howard, W. J. *304* (12a).
Howe, C. D. & W. F. Lang. *23, 1275* (1).
Howell, John Thomas. *6881* (4b); *209* (12c).
Howell, Joseph. — (22a).
Howell, Thomas. — (4b); — (6a); — (22a); — (24).
Huddle, C. I. *27* (12a).
Huestis, W. *2117* (12); — (14); — (18); — (19); —, *6061* (19e); — (20).
Hughes, E. L. *1* (14).
Hughes, J. A. *1261* (22a).
Hunter, B. *11* (24).
Hutchins, T. — (4).
Hutchinson, I. W. *2, 4* (4).
Hyatt, S. V. — (1).

Jack, J. G. — (18).
Jackson, — (12c).
Jaeger, E. C. — (8c).
James, E. — (12); — (18).
Jamieson, R. H. *196* (24).
Jardine, J. T. *186* (24).

Jeffries, W. W. — (11).
Jenkins, E. H. & R. Thaxter. — (1).
Jepson, W. L. *230* (1).
Jewell & Woods. *69* (12).
Johansen, F. —, *146, 370, 513* (1).
Johnson, F. W. —, *1639* (11), *123* (12).
Johnson, R. B. — (22a).
Johnston, E. C. — (1); — (4b).
Johnston, E. L. *80, 123* (12); *83, 128, 197, 374b, 460, 534, 535, 541* (14); *18* (18); *354a* (19e).
Johnston, I. M. — (1); *2814* (14); *2811, 2812, 2813* (18).
Johnston & Hedgcock. *533, 538* (5); *542* (12); *529a, 530, 531, 533a, 535, 539, 540, 541, 543* (14); *529* (14a); *536* (19).
Johnston, H. W. & L. J. Palmer. *15* (1); *24* (4).
Jones, B. J. — (22).
Jones, G. N. *727, 1673, 2869* (4); *189* (4b); *4126* (22b); *251, 2826, 6332* (24).
Jones, H. — (12).
Jones, H. L. *1323* (11).
Jones, I. *25* (4).
Jones, M. E. —, *25016, 28914* (4b); —, *4106, 5441a, 5441aa* (5); *4007* (7); *5375W, 5957a* (8); —, *5585, 6471* (8a); —, *5801* (8c); — (11); —, *693, 1256* (12); — (12a); —, *15* (14); *14* (14); —, *2148, 6472* (16); *54* (18); *916, 5688* (19); *54* (19e); — (22); —, *2038, 2148, 8658, 8858* (22a); — (24).
Jones, W. W. — (22); — (22a); — (22b).
Jussel, M. S. — (12c).

Kearney, T. H. —, *133* (11).
Kearney, T. H. & R. H. Peebles. *9960* (5).
Kelley, G. E. — (4b).
Kellogg, A. —, *270* (1).
Kellogg, J. H. —, *485* (11).
Kelly, F. W. — (1).
Kelsey, F. D. — (12a); *62* (22); — (22a); —, *62* (22b).
Kelso, L. *1083* (12).
Kemp, J. F. *41* (12).
Kennedy, G. G. — (1).
Kennedy, G. G., E. F. Williams, J. F. Collins & M. L. Fernald. — (1).
Kennedy, P. B. *4266* (12); *511* (22); *1661* (22a); *512* (22b).
Kennedy, P. B. & G. H. True. *711* (22a).
Kenney, H. — (22).
Ketchum, F. E. — (1).
Kiener, W. — (14a); *1045, 1046* (19); — (19e).
Kilborne, F. L. — (11).
Kimpton, A. — (22); — (22b).
Kincaid, T. — (6).
King, A. *29* (11).
King, C. — (4b).
King, M. A. — (22a).
Kirkwood, J. E. *1258, 2005* (4); *1611, 1881, 2005* (4b); *1259, 1260, 1362, 1731, 2057, 2514* (22a).
Kirkwood, J. E. & J. W. Severy. *1611* (4b).
Kirtley, C. L. — (12a).
Kittredge, J. — (22a).
Knowlton, C. H. — (1).
Knowlton, F. H. *75* (5); —, *56* (12); — (12a).
Kobuski, C. E. — (11).
Koch, P. —, *34* (18).
Koelz, W. *60* (1).
Kofoid, C. A. — (11).
Kreager, F. O. *190, 202, 216* (4).
Krumlein, L. — (1).
Kuntze, R. E. — (5).
Kusche, J. A. — (1); — (4); — (5).

Lackey, C. F. — (4).
Laing, H. M. *101* (4).
Lake & Hull, —, *639* (4b).
Lamb, F. H. *1383, 1383a* (4b); *1168* (6).
La Motte, *4* (24).
Landmark, J. R. —, *285* (1).
Larabee, L. L. *687* (1).
Larsen, E. L. *12* (14); — (22a).
Lawrence, W. E. *81* (4b).
Lawrence, W. H. *359* (4b).
Leach, J. R. *8317* (22a).

Leach, J. R. & Mrs. J. R. Leach. *1507* (2).
Leach, L. — (2).
Le Conte, R. G. — (18).
Lee, H. *526, 530, 538, 557* (14).
Leedom, B. F. — (11).
Leiberg, J. B. —, *1136* (4); *1217, 2834* (4b); *5582, 5765* (5); *2166* (22a); *2178* (22b); — (24).
Leidy, J. — (12).
Lemmon, J. G. — (5); —, *164, 473* (12c); — (22a).
Lemmon, J. G. & Mrs. J. G. Lemmon. — (5).
Leonard, F. E. — (8a); —, *32* (22a).
Letterman, G. W. — (11); — (12); *155* (14); *339* (18); —, *339* (19).
Lewis, — (4).
Lindstrom, A. H. — (4).
Lloyd, F. E. — (4b); — (6a).
Lodewyks, M. C. *86* (11).
Long, B. & D. H. Linder. *22346* (1).
Long, B. & H. St. John. *2448* (11).
Lothian, M. — (17).
Lucy, T. F. *1202, 2109, 7601, 10583* (11).
Lunell, J. — (14).
Lyall. — (4b); — (24).
Lyles, C. S. — (24).
Lylow. — (1).
Lyon, M. W. — (11).

Macbride, J. F. *416, 693* (12); *2252, 2726* (17); *942*, (22a); *856* (22b).
Macbride, J. F. & E. B. Payson. *2907, 3724* (10); *2926, 3282, 3491, 3742, 3759* (12); *3119, 3272, 3279, 3282, 3492* (12a); *3143, 3544* (22); *2890, 3065, 3092, 3191, 3335* (22a); *3143, 3522, 3557, 3846* (22b).
MacDougal, D. T. *3, 428* (4); *232, 251* (5); —, *95* (21); *187* (22a).
Mac Elwee, A. *1361* (11).
MacFadden, F. A. *13853* (4b).
MacGregor, R. C. — (4).
Mackenzie, K. K. — (11); *321* (12); *220* (19).
Mackenzie, K. K. & L. Griscom. *10414* (1).
Maclay, A. *41* (22).
MacLean, J. — (4).
Macoun, J. — (1); —, *73, 14132, 78739, 78741, 78742, 78743, 78744* (4); *11838* (14); *66567, 76738* (24).
Maguire, B. *12995* (8); *2438, 13105* (16); *3719, 3722, 3724* (22a).
Maguire, B. & R. J. Becraft. *2784, 2785* (22a).
Maguire, B., M. Burke & R. Gerber. *3119* (22a).
Maguire, B. & R. Maguire. *42, 3726* (12); *1211* (18); *3723, 13103* (22a).
Maguire, B. & J. D. Redd. *2109, 2110, 2111, 2112, 2113, 2115* (5); *2116* (12); *2117* (19).
Maguire, B., B. L. Richards & R. Maguire. *4241, 4244* (12); *4237, 4238, 4239, 4240* (20).
Maguire, B., B. L. Richards, R. Maguire & R. Hammond. *5116, 5118, 5119, 5120, 5121* (5); *5115, 5116* (12); *5109, 5110, 5111, 5112, 5113, 5114* (19).
Maltby & G. E. Coghill. *67* (5); *4* (14d).
Malte, M. O. —, *157, 437, 1110* (1).
Mangun, C. M. *147* (4b).
Manning, M. H. *83* (22); *83* (22a).
Marcy, O. — (24).
Maris, H. B. *45* (24).
Marsh, C. C. *177* (5).
Marsland, — (18).
Mathias, M. E. *686* (8); *546* (11); *396* (14a); *419* (19e).
Matthews, W. A. *2085* (11).
Maxon, W. R. — (11).
Mayferth, A. W. — (11).
M'Cain. — (10).
McAtee, W. L. — (1).
McCalla, W. C. *445* (11).
McCarty, E. C. *36* (19).
McDonald, F. E. — (11).
McDonald, J. — (1); — (4); — (12a); — (12c).
McGrath, J. E. — (4a).
McIlhenny, E. A. *96* (1).
McIntosh, A. C. *No. V, 148, 690* (14).
McKay, C. L. — (4).
McKelvey, C. W. — (5); — (21).

McKelvey, S. D. *4666, 4722* (5); *4243* (8a); *2403, 2444, 4776* (14); *4820* (14d); *4764* (15).
McMullen, E. C. — (1).
Mead, S. B. — (11).
Mearns, E. A. —, *162, 1547* (5); *1818, 1939, 1940, 3713* (12); —, *1126, 2046* (12a).
Meehan, T. — (14).
Meehan, W. E. *53* (1).
Mendenhall, W. C. — (4).
Meredith, H. B. — (19).
Merriam, C. H. — (1).
Merrill, E. D. *360* (12).
Merrill, E. D. & E. N. Wilcox. *1129* (12); *698* (22).
Merryfield, L. A. — (22).
Mertens, — (1).
Mertie, J. B. *99* (4); —, *35* (4a).
Mertz, H. N. —, *65* (11).
Metcalfe, O. B. *302, 1319* (5).
Mexia, Y. *2079* (4).
Michaels, E. — (12c).
Milburge, M. *499* (4).
Miller, G. S. — (4).
Miller, W. B. *114-c* (3).
Millspaugh, C. F. —, *15* (11).
Miner, O. —, *86* (24).
Moldenke, H. N. *7197* (12).
Moodie, M. E. —, *4, 1053* (4).
Moon, M. B. *25* (11).
Moore, A. H. *330* (1).
Moore, E. J. — (22); — (22b).
Moore, F. L. *96* (24).
Moore, F. L. & C. E. Moore. — (12); — (23).
Moore, J. P. *546* (12c).
Morgan, R. E. — (14).
Morgan, S. L. — (14).
Morong, T. — (11).
Morris, E. L. —, *1463* (11).
Morris, G. H. — (1).
Moseley, F. Y. —, *A316* (19).
Mosier, C. A. — (4b).
Muenscher, W. L. C. *352* (4); *1037* (4b); *351* (24).
Muenscher, W. L. C. & A. R. Bechtel. *339* (11).
Muenscher, W. L. C. & B. Maguire. *2435* (16); *2436, 2437* (22a).
Muenscher, W. L. C., G. L. Wilson & A. S. Foster. *15899* (11).
Muir, J. *60* (1).
Mulford, A. I. — (4b); *850* (5); — (12); — (22b).
Muller, A. — (4).
Mulliken, E. *143* (12c).
Munz, P. A. *119* (12); *7502* (12c); *118* (18); *2967, 3046* (19).
Murdoch, J. *4610, 4669* (5); *4639, 4852* (12); *3023, 3069* (14); *4547* (20).
Murdock, — (1).
Murie, M. E. — (4a).
Murie, O. J. —, *1317, 1318* (4); *124* (22a).
Mylroie, R. *138* (1).

Nelsen, — (1).
Nelson, A. *188, 313, 408, 689, 1028, 1031, 1392, 7321, 7752, 8531, 8695, 8723, 9422* (12); *2430* (12a); *34, 1234, 1904, 2936, 3174, 7332, 10515, 10623, 11306, 11497* (14); *10427, 10429, 10444, 10474* (15); *11364* (16); *33, 1222, 1234, 3777, 4326, 7043, 9735* (17); *1211, 2430, 2434, 7549* (18); *1608, 7549* (19); *7844, 7870, 9149, 9683, 9686, 10554, 10574* (19a); —, *9828, 9859* (20); *5413a, 7072, 10082* (22); *2951, 3593, 5413a, 7071, 9007, 9016, 10082* (22a); *D9, 5413a, 10082* (22b).
Nelson, A. & R. E. Ashton. *324* (14a).
Nelson, A. & J. F. Macbride. *1854, 1994* (12); *1938, 1995* (22); *1938, 1995* (22a); *837* (22b).
Nelson, A. & E. Nelson. *5669, 5835* (12); *5669, 6704* (12a); *5811* (18); *5413,* (22a); *5413, 5556* (22b).
Nelson, A. & R. A. Nelson. *667* (13).
Nelson, E. *4931* (9); *76* (12); *184* (19); *5182* (19a); *1213* (22a).
Nelson, J. C. *1910, 2786, 5091* (4b); *607, 669, 1111, 2137, 2255, 3495, 3794* (6a).
Nichols, G. E. *1254* (1).
Nichols, H. W. *8, 14, 26, 62* (4).

Nielsen, H. P. *14* (4).
Noll, H. R. — (11).
Norris, H. W. — (11).
Nuttall, T. — (4b); — (6a); — (14).

Oleson, O. M. — (12); — (12a).
Ollerton, S. H. *200* (8a).
O'Neal, *8* (24).
Onion, I. S., R. Kennicott & W. L. Hardisty. — (4); — (4a).
Onstot, T. — (4).
Osbanie, P. R. — (6a).
Osgood, W. H. — (4).
Osterhout, G. E. *1870* (5); —, *308, 1713, 1869, 2156, 2163, 2449, 2823, 3284, 3728, 3780, 5499, 5651* (12); —, *631, 2211, 2396, 2797, 2825, 3222, 3249, 3249B, 5627, 5634, 5635, 5647, 5648, 5723, 5878, 5879, 6530* (14); *309, 2210, 2824, 4882, 5629, 5652, 5722, 5724, 5725* (14a); *2211, 5498* (14b); *2182, 2561* (16); — (17); *3277, 5389* (18); —, *2439, 2848, 3116b, 4353, 6281* (19); *2847* (19e); *2164, 5355, 6828* (20); *3225, 4240, 6066* (20a).
Ostheimer, A. J. *10B* (4).
Otis, *699* (4b).
Over, W. H. *14372, 17613, 18092* (14).
Overholts, L. O. — (12); — (14).
Overton, E. — (14).
Ownbey, M. *555, 555a* (14); *811, 841* (23).
Oyster, J. W. —, *5856* (11).

Palmer, E. *2* (4); —, *347* (8); —, *378* (12).
Palmer, E. J. *619* (5); *5656, 14987, 17230, 30239, 35376, 35851, 39154* (11); *31264* (12); *36987* (12a); *31243, 31395, 37035, 37135, 37158, 37355* (14); *31281a, 31282a* (19e).
Palmer, L. J. *1599* (3); *400* (4).
Palmer, W. —, *546* (1).
Pammel, L. H. — (12).
Pammel, L. H. & R. E. Blackwood. *3820, 4234* (12).
Pammel, L. H. & E. M. Stanton. — (12); — (12a); — (18).
Papineau, E. A. *65* (12).
Parker, C. F. — (11).
Parker, C. S. *493, 683* (4); *327* (24).
Parks, H. E. & S. T. Parks. *21049* (4b).
Parry, C. C. —, *285, 442* (12); *284* (14); *285* (14a); *287* (18); —, *286, 287* (19); *287* (19d).
Patterson, H. N. *103, 115* (14); —, *115* (14a); *113* (19); —, *113, 114* (19e).
Patterson, H. N. & F. Beaty. — (19); — (19d).
Patton, M. — (4).
Payne, F. *57* (22b).
Payson, E. B. *552* (5); *538, 1568, 3582* (12); *376* (15).
Payson, E. B. & G. M. Armstrong. *3354, 3442, 3582, 3668* (12); *3232A* (22a).
Payson, E. B. & L. B. Payson. *3905, 3949* (5); *4830, 4927* (8a); *1956, 1957, 1999, 2050, 2140, 2726, 2886a, 2971, 3950, 4929* (12); *2612, 2749* (15); *4918* (16); *4737* (17); *2043, 2977, 4467* (18); *2886, 2979, 3983, 4032* (19); *5156* (19a); *4185, 4913, 5025, 5086, 5137* (20); *1797* (22a); *1863* (24).
Pearce, O. E. — (11).
Pearson, D. & E. Pearson. *36* (12a).
Pease, A. S. *2482* (1); *17944, 18032* (4); *11835* (11).
Pease, A. S. & R. C. Bean. *23472* (4).
Peck, M. E. *5811, 8253, 8343, 16462* (2); *9233, 10356, 15817, 17464, 17915* (4b); *5349, 5350, 7443, 18654* (6a); *14128, 16040* (12); *15578* (13); — (14a); *5588* (22); *14256, 15403* (22a); *2914, 2920, 3236* (22b).
Penard, E. *474, 529* (18).
Perdew, S. S. — (11).
Perkins, A. E. — (1); — (11).
Perry, R. C. — (11).
Perry, L. M. & M. V. Roscoe. *332* (1).
Petersen, J. L. *125* (4b).
Phelps, K. E. — (12); — (14); — (14a); — (19).
Philipps, V. — (14).
Pickett, F. L., R. L. McMurray & L. A. Dillon. *1456* (22a).
Pickett, R. *100* (12).
Pierce, G. C. — (19).

Pilsbry, H. A. — (5).
Piper, C. V. *4441* (1); *1691, 4440* (4); —, *919, 1691, 2116* (4b); —, *1875* (24).
Piper, O. A. — (4).
Pollard, C. L. *78* (11).
Pollock, W. M. — (11).
Pool, R. — (14); — (18).
Popenoe, E. A. — (20).
Porsild, A. E. —, *417* (1).
Porsild, M. P. — (1).
Porter, C. L. *514, 1036, 1292, 1460, 1461* (14).
Porter, T. C. — (12); — (14).
Poto, W. L. *64* (4).
Potter, A. F. — (8a).
Potter, D. *695* (1); *680, 686, 687, 689, 694* (4).
Prager, A. *16993* (1).
Pratt, A. D. — (1); — (14).
Preble, A. E. & M. Cary. *24* (4).
Preble, A. E. & G. Mixter. *534, 622* (4).
Preston, C. M. — (19).
Preuchier, *670b* (1).
Price, S. F. — (11).
Priest, M. E. — (1).
Pringle, C. G. — (1).
Pulling, H. E. — (4).
Purpus, C. A. — (5); —, *5233* (12c); *139* (15); *6675* (19); *548* (20).

Quayle, E. H. *15* (22); *15* (22a).
Quick, C. R. *1157* (4); *1030* (13).

R., E. C. & J. A. L. *119* (24).
Rader, *25* (4).
Ramaley, F. *752, 1176, 3179, 3220, 3327, 3817, 5222, 5349, 5924, 6085, 6316, 6613, 11438* (12); —, *1022, 1392½, 6671, 9355, 9573, 9574, 9785, 9974, 10298, 10370, 10412, 10422, 10607* (14); *1131, 4826, 6309, 9131, 10649, 12013* (14a); *11773* (17); *3325, 3326, 10649, 10690, 11446* (19); *1178* (19d); *6366, 6618, 6737, 10666, 11387* (19e); *6266, 8681, 8689, 9530* (20a).
Ramaley, F. & I. W. Clokey. *3855, 3976* (19).
Ramaley, F., G. S. Dodds & W. W. Robbins. *3179, 3220* (12); *3247* (19).
Ramaley, F. & W. W. Robbins. *2466, 2566, 2806, 3327, 3399, 3651, 5177, 5222, 5687, 6031* (12); *2717, 2828* (14); *1750, 3110* (14a); *2411, 3325, 3326, 5217* (19); *9131* (19e); *4628* (20a).
Raup, H. M. & E. C. Abbe. *3511, 3633, 3871, 3940* (4).
Raymond, H. H. — (11).
Redfield, J. H. — (1); — (11); — (12); — (14); — (19).
Reed, M. — (11).
Renvall, A. *331* (1).
Rhodenbaugh, E. F. *18* (12a).
Richards, B. L. *4242, 4243* (12).
Richardson. — (4).
Ricksecker, A. E. — (11).
Ridgway, R. *2485, 2486, 2487* (11).
Ried, C. *4* (24).
Riehl, N. *206* (11).
Riggle, F. D. *12* (12a).
Ritter, H. L. & H. M. Schmoll. *633, 634* (14).
Robbins, W. W. *146* (4); *4936* (5); *2177, 2208, 2308, 4969, 5806, 5842, 5924, 7700, 7740,* (12); *6228* (14); *7632* (14a); *5819* (19); *7554* (20a).
Robbins, W. W. & D. Prosser. *6394, 6438* (14).
Robinson, C. B. *730* (1).
Robinson R. *16* (1).
Rodman, R. & F. P. Metcalfe. *3057* (11).
Rogers, R. *8319* (22b).
Rollins, R. C. *25* (14); *25* (14a); *478* (22a); *404* (23); *861* (24).
Ronan, K. *74* (22a).
Ross, E. A. — (11).
Rothrock, J. T. — (1); *52* (4); *246* (5); *421* (12c).
Rounds, M. — (6a).
Rowlee, W. W. —, *628* (11).
Rugel. — (11).
Rusby, H. H. —, *291* (5).
Rusk, W. — (14a).
Russell, C. — (4); — (11).
Rust, H. J. *155* (4).
Ruth, A. —, *147, 3236* (11).

Rutter, C. *212* (1).
Rydberg, P. A. *8310* (4); *6098, 6743, 6863* (8a); —, *2777* (12); *11, 257, 897, 899, 900* (14).
Rydberg, P. A. & E. A. Bessey. *4876* (12); *4864, 4872, 4875, 4876* (12a); *4865, 4866, 4867* (18); *4869, 4870, 4871, 4873, 4874* (22a).
Rydberg, P. A. & M. A. Carlton. *7061, 7077, 7285* (8); *6347, 6442, 6480, 6516* (8a); *6436, 6438, 6470* (12).
Rydberg, P. A. & O. A. Garrett. *8597, 8598, 9531, 9775, 9776, 9814* (5); *8721, 8848, 8960, 8999* (12); *8653, 8957, 8958, 8959, 8998* (19).
Rydberg, P. A. & F. K. Vreeland. *5683, 5685* (5); *5692, 5693* (12); *5686, 5687, 5695* (14); *5688, 6615* (14a); *5690, 5690a, 5691* (19).

Sampson, A. W. — (8a).
Sampson, A. W. & G. A. Pearson. *26* (4b).
Sandberg, J. H. —, *104, 448* (4); — (4b); *172* (24).
Sandberg, J. H., D. T. MacDougal & A. A. Heller. *420* (4); *75, 75a* (24).
Sandberg, J. H. & J. B. Leiberg. —, *678* (4b); —, *48* (24).
Sanford, J. H. — (22a); — (24).
Sarastana, S. F. — (14).
Saunders, D. *4809, 4810* (1); — (12); — (14); — (18).
Savage, Cameron & Lenocker. — (4b).
Schaffer, C. — (4).
Schaffer, Mrs. C. *1568* (4).
Schedin, L. M. & N. T. Schedin. *315* (14a); *314, 323* (18).
Scheuber, E. W. *42* (12a); — (22).
Schmoll, H. M. *1152* (5); *157* (14); *4, 558, 559* (19).
Schneck, Y. — (14).
Schrader, F. C. & G. H. Hartman. *3* (4).
Schrenk, H. von. — (1); — (11); — (12).
Schuchert, C. — (12).
Schwatka, Lt. *13, 42, 57, 95* (4).
Scoville, A. H. — (11).
Scribner, F. L. *175, 733* (12a); *176* (22); *175, 176* (22a).
Seely, C. B. *2* (4b).
Sellon, G. I. *42* (14).
Setchell, W. A. — (4).
Setchell, W. A., C. B. Setchell, H. E. Parks & S. T. Parks. — (1); — (4).
Sewall, C. S. *161, 356* (1).
Shafer, J. A. *314* (11).
Shainwald, R. L. — (4).
Shantz, H. L. — (14).
Sharp, S. S. *365* (12).
Shaw, W. T. — (4b).
Shear, C. L. *3395, 3716, 4711, 4712, 4923* (12); *3076* (12a); *3853* (19); *4407* (22b).
Sheldon, C. S. *144, 533* (12); *5823* (18).
Sheldon, E. P. *8577, 8577b* (4b); — (24).
Shepherd. — (1).
Sherman, B. *391* (4b).
Sherwood, W. *309, 324* (24).
Shimek, B. — (11).
Shipman. — (11).
Short, C. W. — (11).
Shrader, F. C. — (4a).
Shumway, E. — (1).
Simmons, H. G. *92* (1).
Simms, R. C. & W. H. Zeh. *683* (12).
Singer, F. W. *16* (11).
Slaughter, H. W. *9* (22a).
Small, J. K. — (11).
Smiley, F. J. *121* (12c).
Smith, B. H. —, *15* (12); — (19).
Smith, C. P. *1846, 2216* (8a); *3021* (11); *2291* (12b); *1544, 2341* (16); *1571, 2160* (22a).
Smith, E. C. — (12); — (14); — (19e).
Smith, F. H. *28* (18).
Smith, G. — (12).
Smith, H. G. — (14).
Smith, J. D. — (1); — (11).
Somes, M. P. *3023* (11).
Sones, G. D. — (11).
Sonne, C. F. —, *442* (12c).
Sornborger, J. D. —, *51* (1).
Soth, M. E. *P-7* (22a).

Soule, A. — (4a).
Spalding, M. — (4b); *4998* (11); — (24).
Sperry, O. E. — (20a).
Spiegelberg, C. H. *526* (4); *524, 525* (4b); —, *527* (24).
Spillman, W. J. *131* (6a); *360* (11).
Sprague, R. *702* (4); *700, 701, 703, 704, 705, 706, 708* (4b); —, *706, 707* (24).
Standley, P. C. *4020, 4307, 4388, 4709, 4786, 6524, 7665, 13476, 14109, 14130* (5); *11268* (11); *4023, 4135* (14d); *4269, 4784, 14329* (19b); *6151* (20).
Standley, P. C. & H. C. Bollman. *10699* (5).
Stansbury, J. — (16).
Stanton, F. J. *72* (6a).
Stapleton, E. *53* (22a); *53* (22b).
Starz, E. — (12a); — (22).
Stecker, A. *330* (1).
Steinbeck, W. P. — (12c).
Stejneger, L. *48* (1).
Stephens, K. *1* (1).
Stephenson, B. C. — (11).
Steward, A. N. *366, 480* (22a); *36* (24).
Stewart, F. C. *293* (11).
Stewart, R. — (12).
Steyermark, J. A. *994* (1); *329, 550, 551* (11).
Stillinger, C. R. *10, 12* (4b).
St. John, H. —, *90691* (1); *9087* (4); *4788, 7855* (4b); *3038, 6065* (24).
St. John, H., W. W. Eggleston, R. Beals & F. A. Warren. *9450, 9458* (4b); *9387* (22b).
St. John, H., V. Gessell, G. N. Jones, L. Ridout & E. W. Woods. *4240, 4269* (24).
St. John, H. & R. Palmer. *9563* (4b).
St. John, H. & F. L. Pickett. *6508* (24).
St. John, H., F. L. Pickett & F. A. Warren. *6879, 6880* (24).
St. John, H., J. A. Cary, F. L. Pickett & F. A. Warren. *3459* (22b); *6325* (24).
St. John, H. & L. Ridout. *3643* (4b).
St. John, H. & C. P. Smith. *8333* (4b).
St. John, O. *22* (5); *6* (12).
Stokes, S. G. — (16).
Stone, F. M. *511* (5); *204* (8a); *204* (8c); *568* (12); *598* (14); *607* (14d).
Stone, H. E. — (11).
Stone, W. — (4).
Stoney, G. U. — (4).
Streator, *6* (4b).
Streeter, M. *1449* (22a).
Sturgis, R. — (1).
Sturgis, W. C. — (5); — (14); — (14d).
Sudworth, G. B. — (11).
Suksdorf, A. — (24).
Suksdorf, W. N. —, *8801* (4); —, *6090* (4b); — (11); — (22b); —, *8560, 8570, 8615* (24).
Swarth, G. S. *180* (4).
Swarth, W. W. *24, 105* (4).
Swingle, D. B. — (12); — (12a); — (18).

Tarleton, J. B. *77* (4); *3* (4b).
Taylor, M. — (14a).
Thomas, C. — (12).
Thompson, H. — (11).
Thompson, J. W. *12441* (2); *7158* (4); *3456, 3566, 4804, 5077, 5461, 6436, 7225, 7278, 9193, 9581, 10441, 11735* (4b); *11433* (6); *2425, 2430* (6a); *6027, 6207, 6211, 6345, 8220, 10441, 11422* (13); *5981, 11461* (22a); *5946, 5996, 6004, 6502, 8227, 10485, 11329* (24).
Thornber, J. J. *2843, 2862, 2876, 8925* (5).
Thornber, J. J. & F. Shreve. *7931, 7951* (5).
Thornton, C. W. *411* (1); *27, 136* (3).
Tidestrom, I. *343, 1482* (8a); *1676, 3740* (12); *3426* (15).
Toumey, J. W. — *352* (5).
Townsend, C. W. — (1).
Trask, F. — (22a).
Trelease, W. *4806, 4807, 4807a, 4808* (1); —, *460* (11); — (12); — (14a); *4805* (22a).
True, F. W. & D. W. Prentiss. *60* (1).
Tucker, S. — (24).

Turesson, G. W. — (4); — (24).
Turner, — (1).
Turner, J. H. — (4).
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OBSERVATIONS ON THE DEVELOPMENT OF THE MALE GAMETOPHYTE IN CERTAIN MONOCOTS

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In view of the extensive literature dealing with the various cytological and taxonomic aspects of Angiosperms it is rather surprising that a comprehensive study of the male gametophyte has apparently never been made. Certain isolated aspects of this subject, as the structure of the chromosomes during meiosis, chronological descriptions of the meiotic process, the asymmetry of the microspore mitosis, etc., have been worked out and commented upon in detail. Consequently these are omitted in this report. But since the development of the male gametophyte has received such scattered attention it is the purpose of this paper to give a coordinated presentation in regard to such easily observed features as vacuoles, refractive granules, cell walls, nuclear shape and volume, and cell size in its development in certain monocots and particularly in *Tradescantia*.

The plants used in the present study were: *Tradescantia hirsutiflora, T. paludosa,* unnamed triploid and tetraploid *Tradescantia* hybrids, and *Aloe* sp. Correlated observations were made on species of *Rhoeo, Gasteria,* and *Sansevieria.* The plants were obtained from the Missouri Botanical Garden and grown under greenhouse conditions. Acetocarmine smear preparations of pollen mother cells, microspores, and pollen grains were used throughout the investigation. Hanging drop slides, smears being made on the cover slip and later inverted so that the material could float free in acetocarmine, were made to study tetrad shape. The work was carried on in the laboratories of the Henry Shaw School of Botany of Washington University, most of it as part of a course in cytology. We are indebted to other members of the class for various observa-

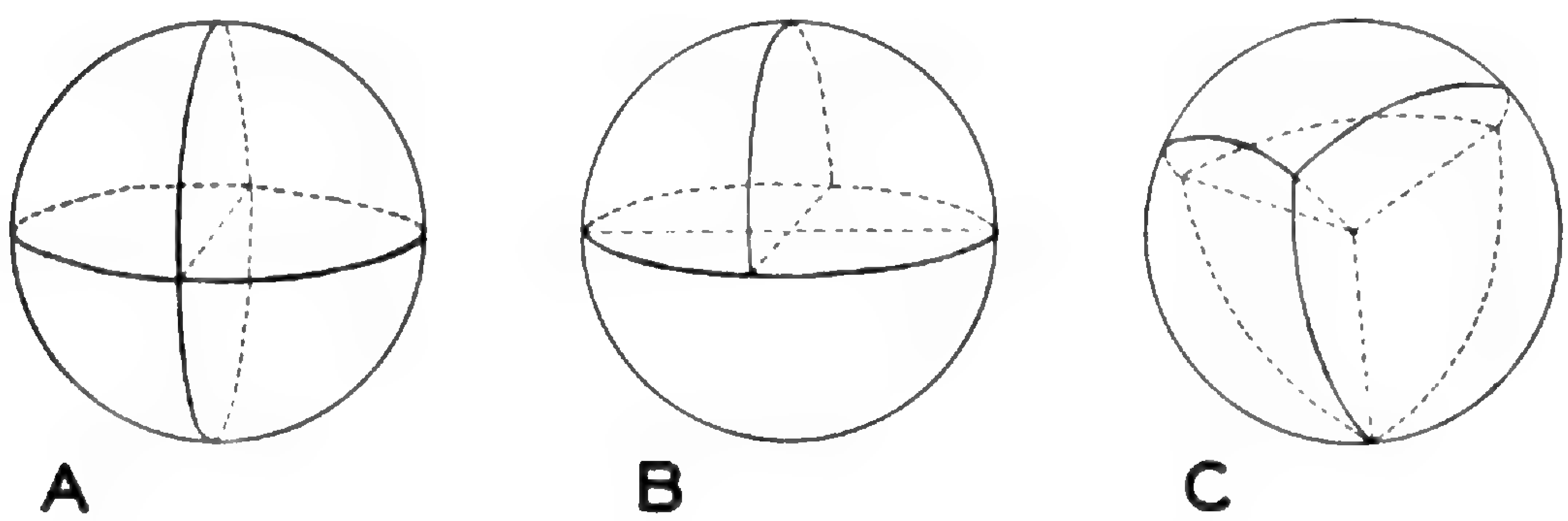

Fig. 1. (A) Tetrad in which the spindle axes of the second meiotic division were parallel; (B) in which the spindle axes of the second meiotic division were perpendicular; (C) in which the walls dividing the cells were formed after both meiotic divisions had taken place.

tions, and to Dr. Edgar Anderson for his direction in this study and his helpful suggestions.

Meiosis in *Tradescantia* shows the phenomena recorded for the various species, the nucleus of the pollen mother cell passing through two divisions and producing four daughter cells. These daughter cells are arranged in tetrads, which in *Tradescantia* are of two types. The type more often found is shown in fig. 1,A. In this case the spindle axes of the second meiotic division were parallel. Fig. 1,B shows the result of the corresponding division in which the spindle axes were perpendicular to each other. The ratio of type A to type B was found to be approximately 4:1 in *Tradescantia.* Type B is often found in groups on the slide in which none of type A are apparent. This perhaps indicates that all in the group were developed in a particular part of the anther which gave rise only to that type. The tetrads of *Rhoeo* are similar to those of *Tradescantia* but here the two types occur in about equal numbers. In *Gasteria* and *Aloe* the four cells of the tetrad are tetrahedrally arranged (fig. 1,C). The walls dividing the cells are evidently formed after both meiotic divisions have taken place.

In *Tradescantia* and *Rhoeo* the wall of the pollen mother cell about the tetrad is an ordinary spherical coat and shows no

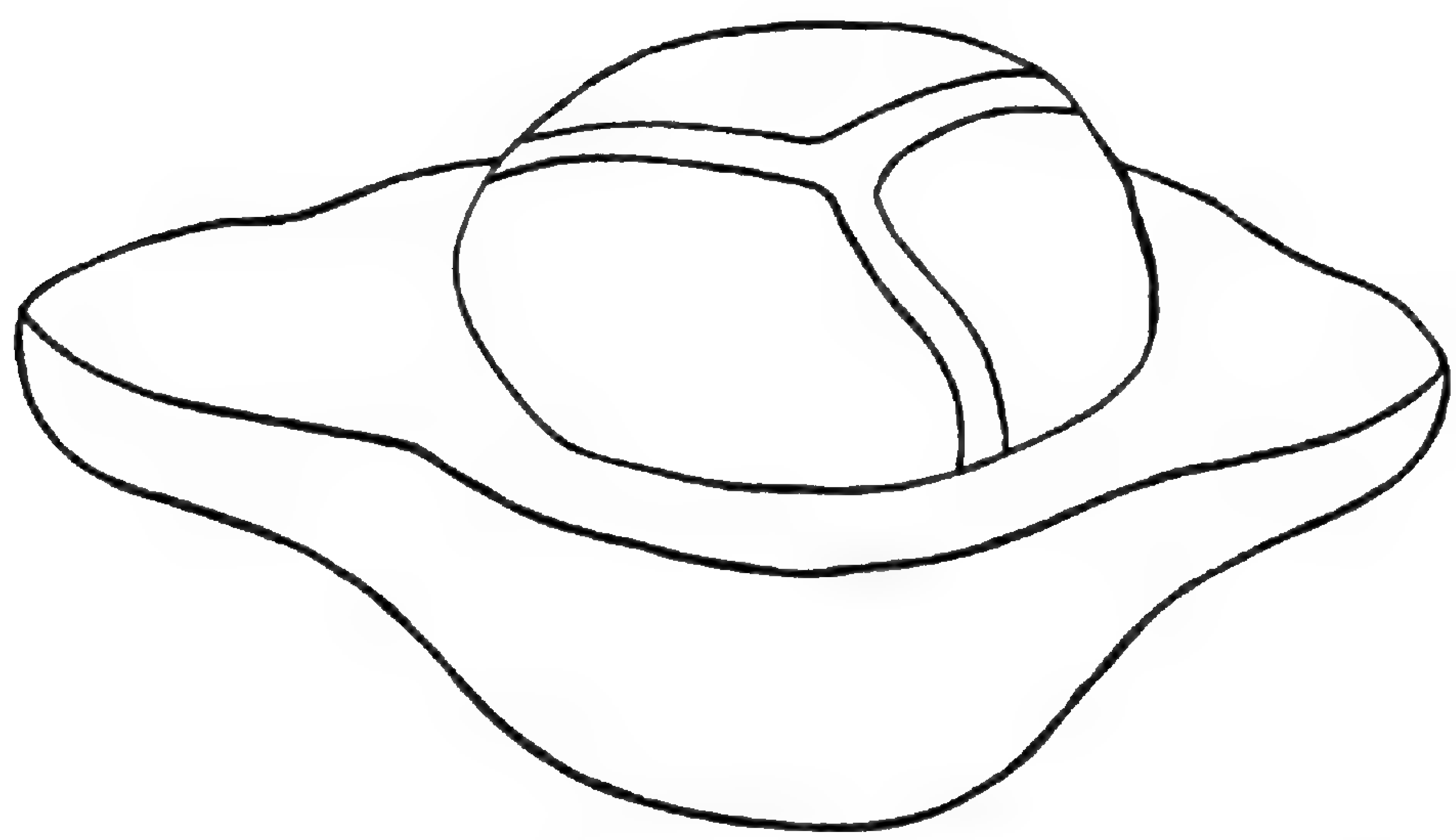

Fig. 2. Diagram of a typical tetrad of *Gasteria, Aloe,* or *Sansevieria* surrounded by the heavily flanged pollen mother cell wall, represented as if upper half of wall were removed. Figured by H. A. McQuade.

resemblance to the same structure in *Gasteria, Aloe,* and *Sansevieria,* in which two heavy flanges are at opposite ends of the cell wall (fig. 2). In *Sansevieria* and *Aloe* the flanges of adjacent pollen mother cell walls fit together and form a long chain of dyads or tetrads in the anther according to the stages examined (fig. 3). When the tetrads are freed these flanges are no longer visible on empty pollen mother cell walls or fragments of these walls; neither are they visible when the individuals of the tetrad are ready to separate. There is a gradual reduction in the size of the flanges from the first meiotic division until the tetrads are freed (fig. 4). Exactly what function these thickenings have is not known, but it is quite possible that they are gradually digested by the cells forming within the pollen mother cell. It is suggested that their function is twofold: (1) For the retention of cells within the anther, and (2) for food storage. The chemical nature of these flanges is likewise not known but they do not seem to be of cellulose. Crude microchemical tests and observations under polarized

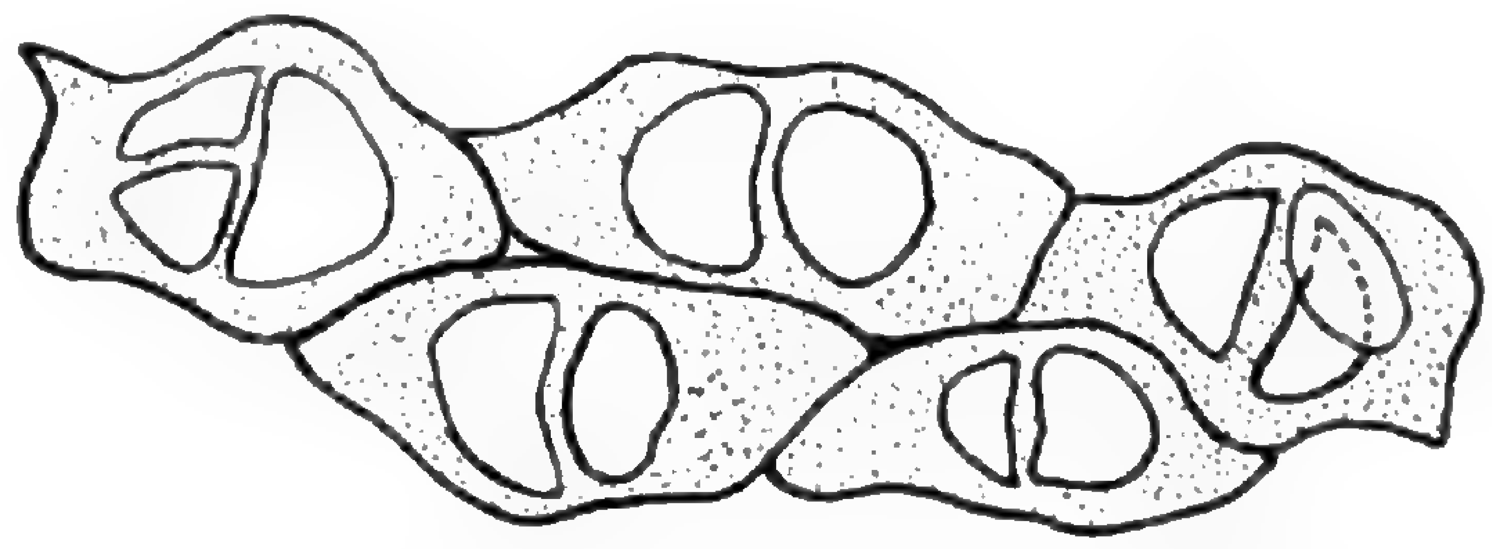

Fig. 3. Diagram of dyads and tetrads in the anther of *Sansevieria*, showing their arrangement in chains. Figured by H. A. McQuade.

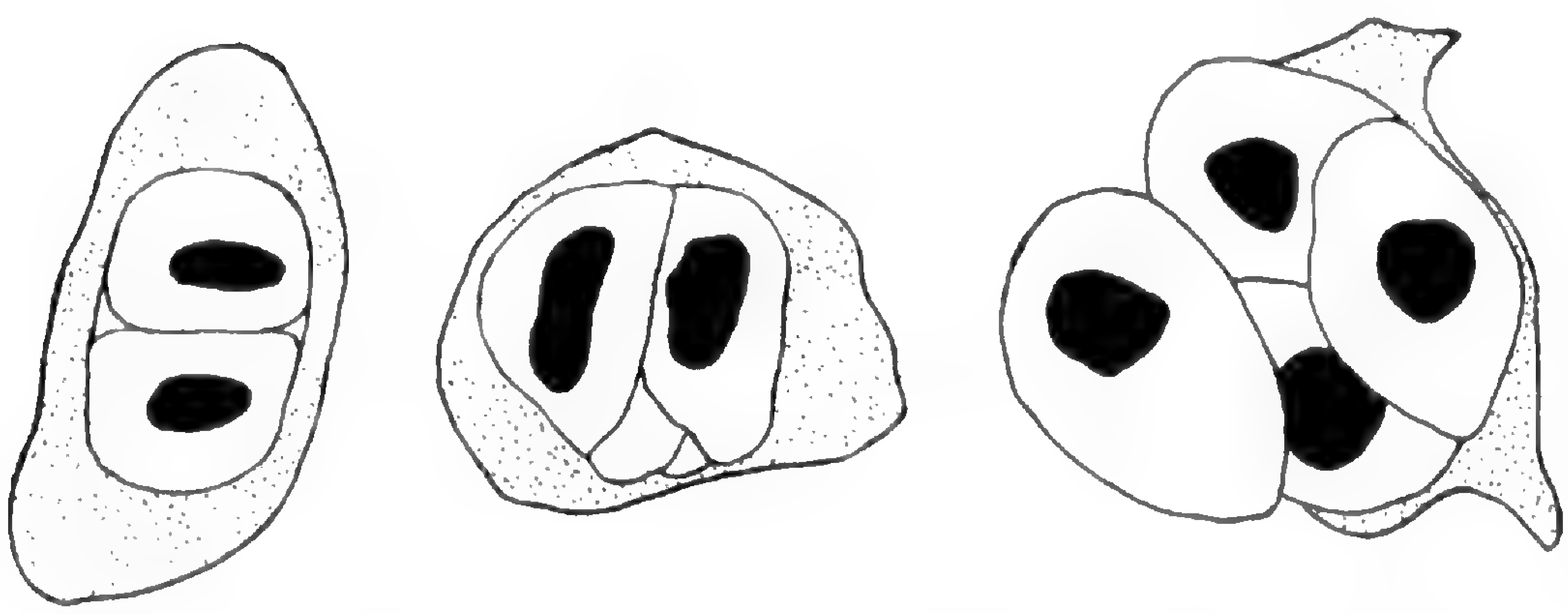

Fig. 4. Camera-lucida sketches of various stages in the formation of the tetrad of *Aloe*, showing the gradual digestion of the pollen mother cell wall. (× approx. 635.)

light with crossed Nicols fail to give positive cellulose reactions even though the epidermal cell walls of the anther do.

The microspores of *Tradescantia*, in the tetrad, regularly have the shape of the quadrisection of a sphere. While the cells are united in fours, and immediately after they separate, the nucleus is in the midde of the cell (pl. 4, fig. 1). There are no vacuoles and the cytoplasm appears clear and watery. In radial view the cell at this stage is nearly triangular with a continuous, smooth, distinct wall. As the microspore develops there is a differentiation of the wall. The wall which was innermost in the tetrad remains flattened and smooth, but the outer wall rounds out and becomes definitely sculptured. The inner wall rounds out much more gradually until the pollen grain is nearly ellipsoidal by the time it is mature. When seen in tangential view the sculptured part of the wall of the microspore shows at each end, while the long side walls are smooth.

A study was made of microspores of *Tradescantia paludosa* to determine the change in position of the nucleus between the time of the breaking up of the tetrad and the first mitotic division. Soon after the microspores become separate the nucleus moves from the middle to the end of the cell (pl. 4, fig. 2). A large vacuole usually occupies the other end and the middle region of the cell. It is during the migration of the nucleus from the middle to the end of the cell that the wall sculpturing first becomes apparent. From this time on it becomes more and more distinct.

Just before prophase of mitosis the nucleus is again in the middle of the cell, closer to the flat wall than to the curved sculptured one, when seen in radial view (pl. 4, fig. 3). In some of the cells there appeared one large vacuole, enlarged at each end of the cell with a narrower connecting portion squeezed between the nucleus and the sculptured wall. These cells probably represent a slightly earlier stage than those usually observed which contained two vacuoles, one in each end of the cell. The vacuoles usually appeared broad and blunt at the end toward the smooth flat wall of the cell and tapered off toward the curved wall.

The asymmetry of the mitotic figures in the microspore of *Tradescantia* is noticeable from the very early stages of prophase (pl. 4, fig. 4). Throughout their formation the vegetative nucleus and the generative nucleus can be distinguished by their different appearance as well as by their position in the microspore. When the chromatids begin to differentiate, the nucleus is spherical in form. As soon as the chromosomes become more definite and begin to loosen up and pull apart, the nucleus loses its regular shape and becomes more nearly obovoid. The small end is pressed close against the middle of the flat wall and the broad end reaches nearly to the other side of the cell. The asymmetric shape of the prophase nucleus is due to the fact that at the small end the chromosomes are closely massed together, with very little space between them, while at the broad end they are much more scattered and pulled apart. Apparently, even before the chromosomes line up on the division plate there is some force which holds them in this asymmetric arrangement. The chromosomes become very much shortened and thickened before metaphase.

The equatorial plate in mitosis is close to the smooth flat wall of the microspore cell and parallel to it. The six chromosomes are approximately equal in length, two of them with median, and four with sub-median attachment constrictions. At metaphase they are arranged with their attachment constrictions in a rough circle on the plate. The ends of the chromosomes may or may not lie within the plate.

In anaphase the chromosomes split to form two dissimilar groups. The group which is to form the generative nucleus is close to the smooth inner wall of the cell and is very small and compact. The other chromosomes migrate almost to the outside wall of the cell to form a much larger and much more loosely constructed group, which is to become the vegetative nucleus. The contraction of the chromosomes, begun in prophase, continues through anaphase.

In the two-nucleate stage of the microspore the compact, darkly staining generative nucleus is close to the smooth inner wall of the cell and is surrounded by a non-staining area. A smooth membrane cuts it off from the rest of the cell. The vegetative nucleus is much larger, light staining, somewhat irregular, and often rather vague in outline.

Later stages observed show that the membrane about the generative nucleus is no longer present. The generative nucleus swells somewhat and is next seen farther from the wall, larger and spherical. It seems as though the nucleus at this stage is already in the prophase of the next mitotic division. The generative nucleus in mature pollen has no definite position but may lie in any region of the cell. It elongates rapidly and curls and twists about the vegetative nucleus, which is becoming smaller. There is definite indication that separate chromosomes are arranged more or less parallel at this stage. This nucleus is often seen split from one end nearly its full length, the two halves lying parallel and close together. (Fig. 5.) A definite organization was also observed in the vegetative nucleus of pollen grains taken from flowers of *Tradescantia*

Fig. 5. Camera-lucida sketches of generative nuclei from several pollen grains of *Tradescantia paludosa:* (A) nuclei from young pollen grains; (B) nuclei at time of pollination. (× approx. 345).

paludosa which were mature and shedding pollen and also in a tetraploid *Tradescantia* hybrid (pl. 4, fig. 9). The ends of the chromosomes could be seen sticking out from the main body of the nucleus and in some cases could be distinguished entirely across the nucleus. In no case could more than twelve ends be counted (except in the tetraploid where twenty-four would be expected) and in two cases this number could be definitely seen. It seems reasonable to believe that these are separate chromosomes.

The presence of refractive granules in the cytoplasm of the pollen mother cell has been noted by several authors, but Sax and Edmonds are the only workers who make any statement as to their varying presence or as to their chemical composition. Crude microchemical tests show that in *Tradescantia* these

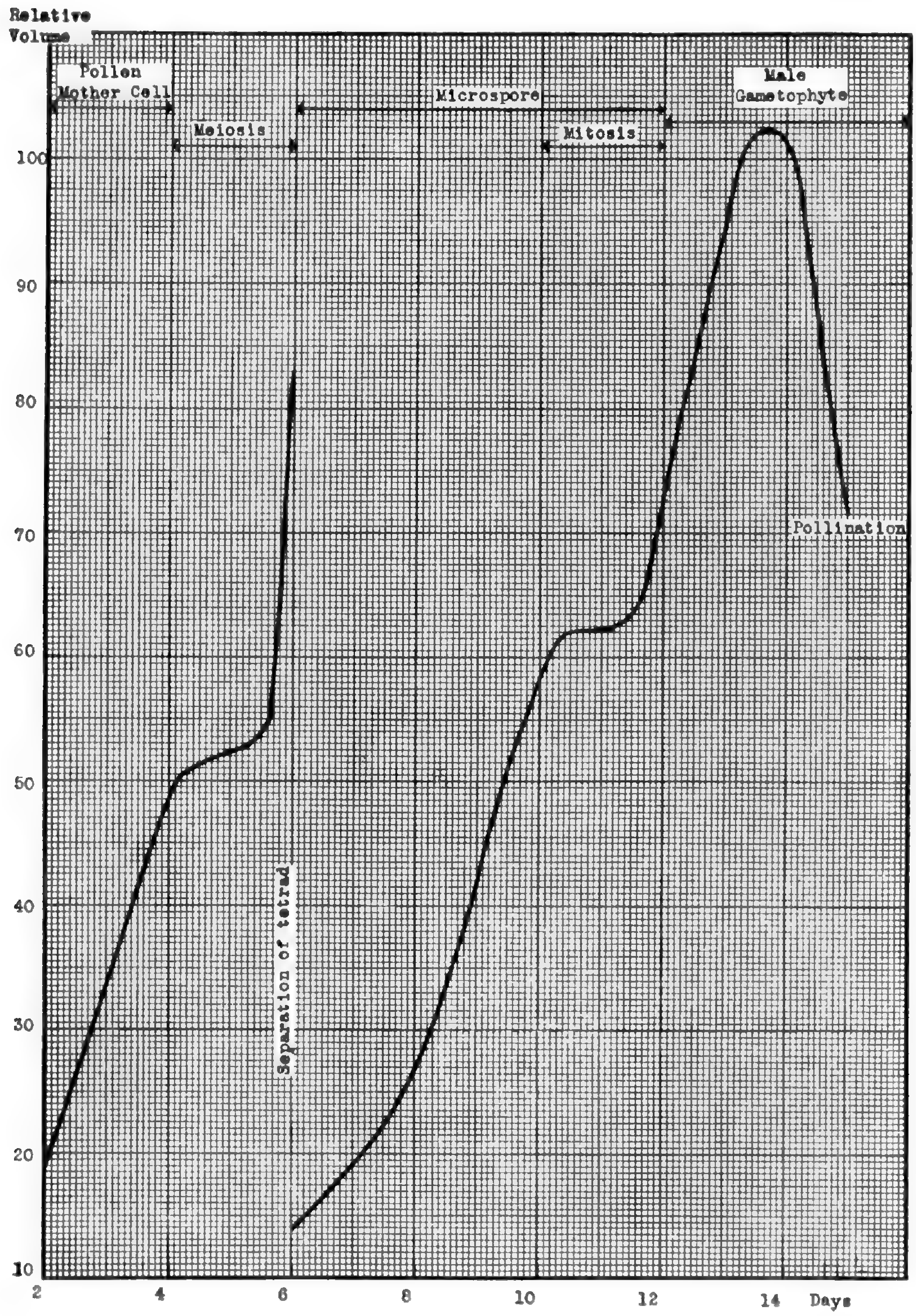

Fig. 6. Showing variation in volume in the development of the male gametophyte of *Tradescantia paludosa*. Note the great increase just before mitosis begins and after mitosis when the pollen is ripening. The decrease from its greatest volume until the time of pollination is probably due to a gradual desiccation as the anther opens. Length of time for the development of the various stages from Sax and Edmonds ('33).

granules are neither starch (Sax and Edmonds, '33) nor lipoids. In *Aloe* the granules are not as definite and distinct as in *Tradescantia* and at times they are hardly visible. Furthermore, there seem to be two types of granules in *Aloe;* one kind very clearly distinguishable and seemingly of the nature of those in *Tradescantia;* another kind rare in occurrence and not so distinct in appearance. These latter granules seem to be lipo-protein in nature, being soluble in alcohols, esters, and diethyl ether, slightly soluble in chloroform and benzene, soluble in concentrated hydrochloric acid and sodium hydroxide. They give a positive orange-red reaction with Sudan III, a brownish coloration with osmic acid, and a positive Biuret test. Reactions characteristic of other types of compounds give negative results. Granules of this type were present in few cells, but there can be no doubt that some granules, lipoprotein in nature, occasionally occur in *Aloe* and are absent in *Tradescantia.*

The relative number of refractive granules appearing in the various stages has never been estimated. Accordingly, comparative counts of every stage in the development of the male gametophyte of *Tradescantia hirsutiflora* were made, taking into account the following considerations: cells of equal age were selected for each type; counts were made from the same view in every case; and slides were kept at the same relatively low temperature during the study (below 20° C.). Since moderate heating produces better differentiation in staining between nucleus and cytoplasm, heating is often employed to produce better slides. But as granules are more or less, sometimes entirely, destroyed in this way, slides subjected and those not subjected to this treatment must not be compared.

Refractive granules are absent in the pollen mother cell and in prophase appearing between prophase and metaphase I of meiosis. From metaphase I there is a gradual decrease in the number of granules per cell throughout the entire meiotic process, the smallest number being present in the individual cells united in the tetrad (fig. 7). The cells making up the tet-

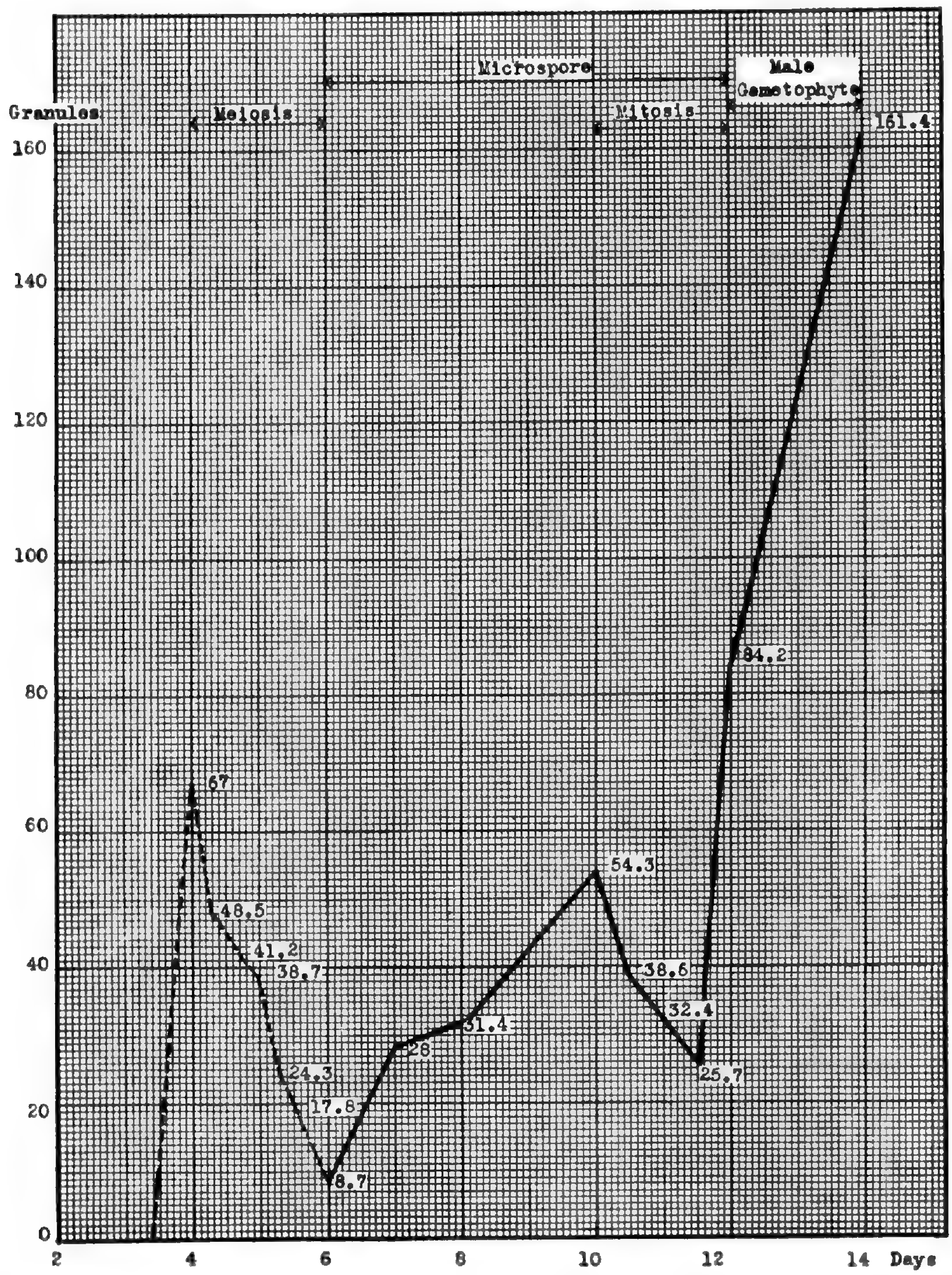

Fig. 7. Showing the average number of refractive granules found in unvacuolated cells in the development of the male gametophyte of *Tradescantia hirsutiflora.* Length of time from Sax and Edmonds ('33).

rad then split, and comparisons made with unvacuolated cells in prophase of mitosis show that an enormous increase in volume of the cell and a corresponding increase in the number of granules has taken place. In the cells united in the tetrad and in the young microspore the nucleus is seen in the center of the cell; the granules are very large and no vacuoles are present (pl. 4, fig. 1). Later the nucleus is found at the end of the cell, and at this stage the microspore characteristically has a very large vacuole (pl. 4, fig. 2) and almost no granules. Before prophase of mitosis the nucleus is again at the center of the cell and the number of granules depends upon the presence or absence of vacuoles. If a very large vacuole is present granules are usually lacking, whereas if vacuoles are absent the cytoplasm is filled with granules. Intermediate stages with small vacuoles and few granules compared to the same stage in its unvacuolated condition can be found. Thus the data show a distinct correlation between the number of granules and the presence or absence of vacuoles.

Although granules are often found in all stages of mitosis it is apparently customary for cells in this division to be greatly vacuolated and to be practically lacking in granules. Counts made during mitosis in *Tradescantia hirsutiflora* in cells in which vacuoles were absent show a steady decrease (paralleling meiosis) from prophase to telophase, a rather large number being present in telophase (fig. 7). There is an increase from telophase to matúre pollen. If the telophase stage indicated in the graph is very late there is evident in the two processes (meiosis and mitosis) a parallel decrease in the number of granules throughout both divisions, and a corresponding increase after division. At no time are more granules present than in unvacuolated mature pollen. The granules of the mature pollen grain are usually smaller and less definite than in the microspore, it is true, and they may even be different in chemical character, but there can be no doubt that they are present in abundance in the mature pollen of the specimens of *Tradescantia* and *Aloe* studied.

SUMMARY

1. A consecutive account of the development of the male gametophyte in species of *Tradescantia* is presented.

2. Appearance and disappearance of vacuoles in *Tradescantia* is correlated with the variation in number of refractive granules.

3. Wall sculpturing in *Tradescantia* begins with the sudden growth of the young microspore, just before prophase of mitosis.

4. There are two definite periods in which increase in size is apparent in the development of the male gametophyte in *Tradescantia:* (1) Just before mitosis begins, and (2) after mitosis, when the pollen is ripening.

5. It has been possible to observe separate chromosomes in vegetative nuclei of mature pollen in *Tradescantia paludosa* and in a tetraploid *Tradescantia* hybrid.

6. It is believed that the elongated generative nucleus in *Tradescantia* is composed of separate chromosomes.

7. A decrease in the number of refractive granules during the processes of meiosis and mitosis in *Tradescantia hirsutiflora* is shown by comparisons of the average number present in unvacuolated cells.

8. The flanges noted on the pollen mother cell wall of *Gasteria, Aloe,* and *Sansevieria* seem to be digested by the cells developing from the pollen mother cell.

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Explanation of Plate

PLATE 4

Diagrammatic review of the development of the male gametophyte of *Tradescantia,* showing simultaneously the changes in nucleus, vacuoles, refractive granules, cell wall, and cell size. The figures are all drawn to the same scale from aceto-carmine smears. The wall outlines are from enlargements of camera-lucida drawings. The nuclei and vacuoles are drawn to scale either from the same cell from which the size was obtained or from other typical cells of the same stage. (× approx. 985.)

Figs. 1–8. *Tradescantia hirsutiflora.*

Fig. 1. Microspore soon after separation of tetrad, nucleus in the middle, granules very large, no vacuole, cell wall not differentiated.

Fig. 2. Older microspore after nucleus has migrated to the end, granules very scanty, one large vacuole, wall sculpturing first apparent.

Fig. 3. Very early prophase of mitosis, cell and nucleus both much larger.

Fig. 4. Prophase of mitosis, chromosomes optically double. Note the asymmetry of the nucleus.

Fig. 5. Metaphase of mitosis, tangential view of the cell (polar view of the plate).

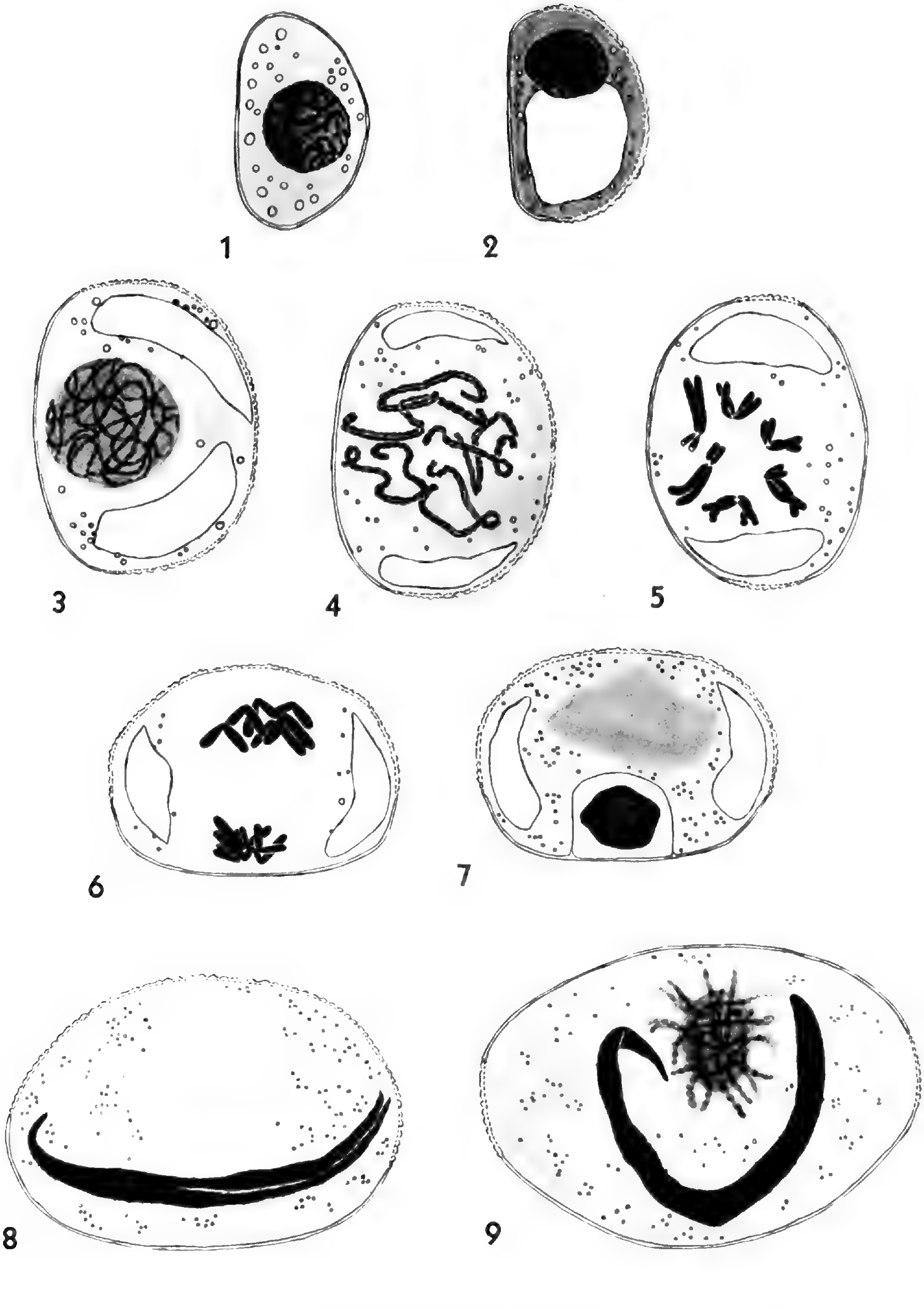
Fig. 6. Anaphase of mitosis, the two groups of chromosomes very different in compactness.

Fig. 7. Two-nucleate microspore.

Fig. 8. Mature pollen grain, some structure visible in the generative nucleus, many small granules, no vacuoles.

Fig. 9. Tangential view of the mature pollen grain of a tetraploid *Tradescantia* hybrid showing visible organization in the vegetative nucleus.

The figures are frankly diagrammatic. They are an attempt to integrate and summarize all observations.



JOHNSON AND PECK—MALE GAMETOPHYTE IN MONOCOTS

CONTRIBUTIONS TOWARD A FLORA OF PANAMA[1]

Based upon Collections by Expeditions from the Missouri Botanical Garden Tropical Station, Balboa, C. Z.

Introduction

When the Missouri Botanical Garden acquired the "orchid garden" of the late C. W. Powell of Balboa, Canal Zone, in 1926, the chief motives were to perpetuate that fine collection and eventually to add it to the already famous collection of orchids at Saint Louis. Shortly before the death of Mr. Powell, during the same year, the government of the Canal Zone provided the Garden with a favorable site located in a narrow, secluded ravine at the western base of Ancon Hill, yet very accessible to the center of Balboa itself. To this tract of land the Powell orchids were removed, and suitable landscaping undertaken. An administration building was erected to serve both as a residence for the manager and to provide laboratory space for visiting investigators from the Garden in Saint Louis. Even before these improvements had been completed, it became obvious that the Missouri Botanical Garden was not taking measures merely for the temporary care of a fine collection of orchids, but in effect was laying the foundations for a permanent Tropical Station.

Since its founding in 1926 the Tropical Station has attained a position somewhat analogous in Panama to that of the Missouri Botanical Garden proper in the United States. Its interest and accessibility have made it frequented by residents of the Canal Zone and Panama as well as by tourists. Aside from its function as the repository of the Powell collection of orchids, however, its scientific possibilities have only begun to be realized.

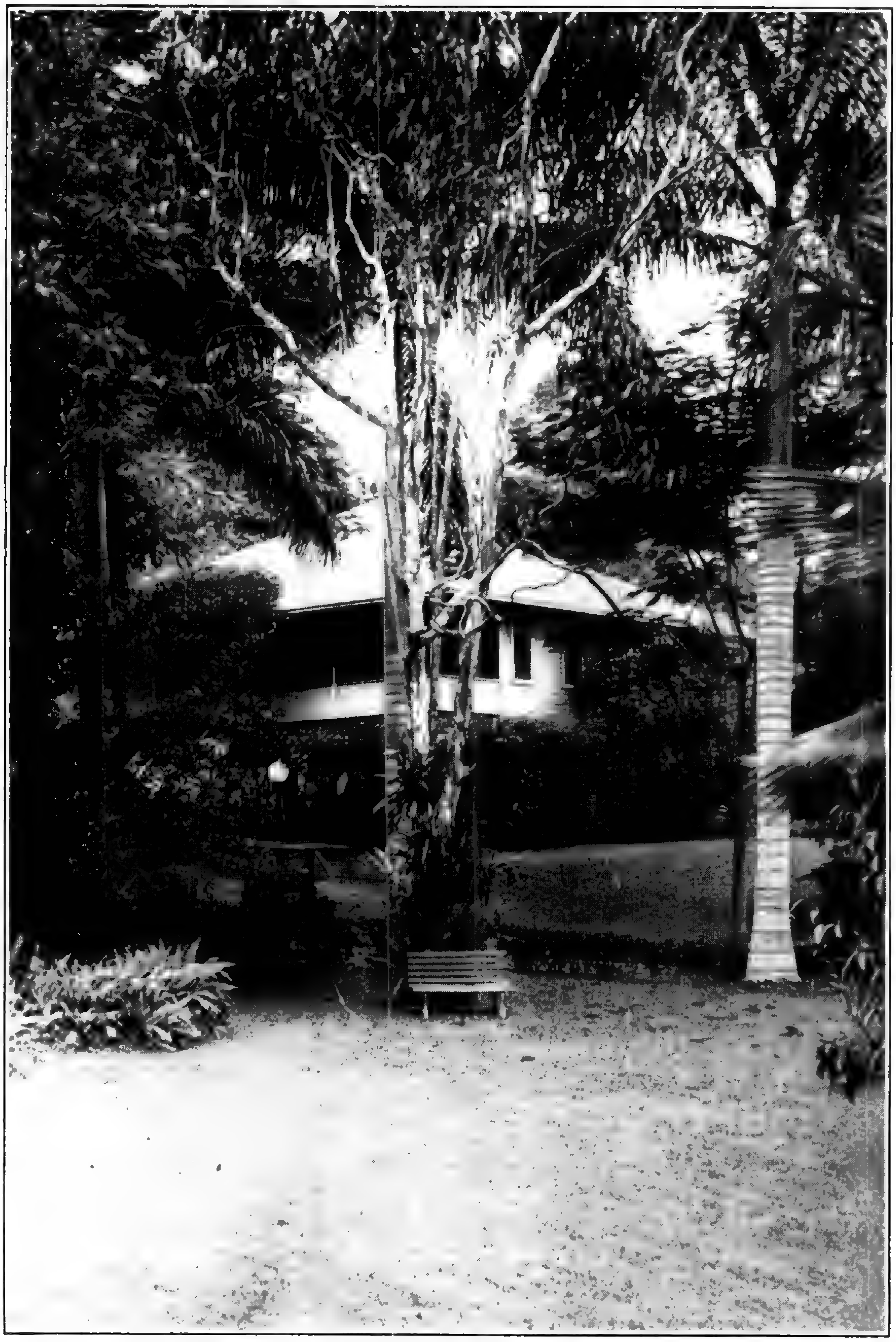
With the exception of the narrow Canal Zone, the flora of Panama can scarcely be considered as better known than that of the other Central American republics. The region from

[1] Issued April 30, 1937.

the Canal Zone eastward to the Colombian border, including virtually the whole of the territories of San Blas and Darién, is practically unexplored botanically. As a matter of fact, it is still dangerous for white travelers to penetrate this portion of the republic. Although the eastern portion of Panama is at present the least known, at the same time its vegetation is probably the richest and the most unspoiled. In this region also we may well expect to find new evidence for the historical association of the North and South American floras.

It must not be thought that one must travel far and under great difficulties in order to make valuable contributions to our knowledge of the Panamanian flora, however. Well maintained automobile highways now permit botanical collecting at a minimum of discomfort in the provinces west of the Canal Zone where a surprising number of interesting novelties await even a casual collector.

With its Tropical Station strategically located in Balboa, it is natural that the Missouri Botanical Garden should contribute to our knowledge of the Panamanian flora. Several expeditions have already been organized and sent to various promising localities in the republic for the reconnaissance of the vegetation and the preparation of herbarium specimens, and similar activities are planned for the future. It is possible that sufficient material at length may be available for a comprehensive flora of Panama in its entirety. As a preliminary to such a flora it is planned to publish a series of reports on the various expeditions which are sponsored by the Missouri Botanical Garden from time to time. These reports will embody records of vascular plants previously described but hitherto not known to occur in Panama and the descriptions of novelties to science contributed, as far as possible, by specialists of the various plant families.



Administration Building, Missouri Botanical Garden Tropical Station, Balboa, C. Z.

Fig. 1. Scene near the headwaters of the Rio Chiriquí Viejo, near Cerro Punta, Chiriquí.

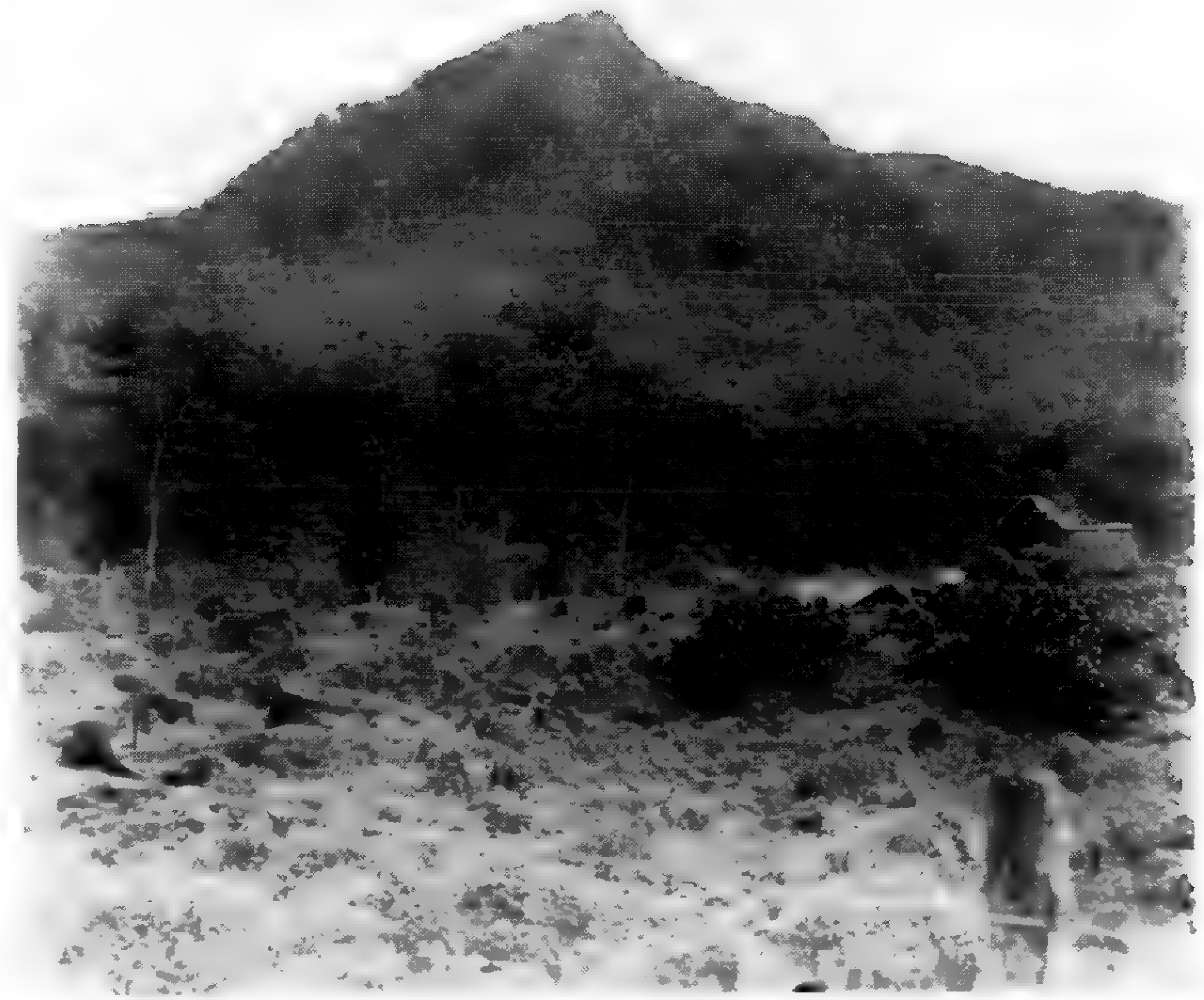


Fig. 2. Cerro Punta, Chiriquí.

I. Collections in the Provinces of Chiriquí, Coclé, and Panamá, by R. J. Seibert during the Summer of 1935

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During the months of June, July, and August, 1935, accompanied by Dr. G. W. Martin, of the State University of Iowa, we collected upon the Pacific slope of Panama at various localities in the provinces of Chiriquí, Coclé, and Panamá, and made a small collection near the mouth of the Rio Trinidád upon the Atlantic slope. While in Balboa the party made its headquarters at the Tropical Station, and to Mrs. Mary D. Hunter, then temporary manager of the Station, the members feel particularly indebted for her hospitality and the success and pleasure of their sojourn. It is also a pleasure for the party to acknowledge the many kindnesses and stimulating companionship of their friend, Mr. Adrien M. Bouché, Jr., of Pedro Miguel, C. Z., who was chiefly responsible for the summer's itinerary.

Collecting in the tropical American rain forests during the so-called "rainy season," extending on the Pacific slope of Panama roughly from May until December with short intermittent respites is a difficult matter when done at any distance from modern conveniences and for any length of time. Consequently it is not surprising that the majority of herbarium specimens from Panama is representative of the dry season rather than of the entire year. It was for this reason that the "wet" months of June, July, and August were chosen for collecting in 1935. As a matter of fact, these months proved to be the "wettest" on record upon the isthmus, approximately 60 inches of rain falling in certain localities during July and about equally during June and August.

Under such conditions the difficulties of desiccation and the dangers of molding are obvious. For these reasons and also as the consequence of misfortunes in the transportation of supplies upon two occasions in Chiriquí, the collections for the summer of 1935 were relatively few, consisting of but 552 numbers in multiplicate. In view of the small total collection, the number of novelties and new records is good evidence of our relatively meagre knowledge of the Panamanian flora even in regions of easy access.

Of the numerous trips taken during the summer of 1935, two in particular merit note since they were to localities of special interest. The more extended of these was in northwestern Chiriquí province just under the continental divide. Arriving by aeroplane upon the Llanos del Volcán, southwest of the base of the Volcán de Chiriquí, the party journeyed by foot some fifteen miles up the valley of the Rio Chiriquí Viejo to the finca of Mr. Hugh J. White, a retired employee of the Panama Canal. At Mr. White's finca, called "Monte Lirio" (alt. 1550 m.), the party made a base from which reconnaissance trips were made daily for a period of several weeks.

The province of Chiriquí has been visited by numerous botanical collectors, but chiefly in much the same territory, extending from the seaport Pedregál and the capitol city Davíd, to Boquete, an attractive settlement in the coffee-producing region between Volcán de Chiriquí and Cerro Horqueta. It is safe to assume that no botanists had visited the valley of the upper Rio Chiriquí Viejo prior to the visit of the Missouri Botanical Garden party in 1935. This valley lies north and west of the Volcan, the headwaters of the river rising toward the base of Cerro Punta (alt. 1900 m.) and Cerro Picacho (alt. 2000 m.) upon the continental divide. The region about Monte Lirio itself is provided with a very rich vegetation of rain forest nourished by the dense "baja ricas" (drenching, foggy rains) which descend from the mountain slopes with daily regularity throughout the rainy season. This flora is essentially an extension of that characteristic of the Cordillera de Talamanca in Costa Rica.

Emptying out of a narrow mountain gorge ("Paso Ancho"), the Rio Chiriquí Viejo has cut for itself a narrow, canyon-like

Fig. 1. Llanos del Volcan, Chiriquí, with the Volcan de Chiriquí seen through the gorge of the Rio Chiriquí Viejo.

Fig. 2. Llano Bonito, Coclé, looking toward the Pacific Ocean.

Fig. 1. View into El Valle de Antón from the southern rim. Note the descent of the "Baja Rica" from the mountains in the background.

Fig. 2. View across the "badlands" of the upper Llano Bonito to the Serrania de Tabasará dominated by the Cerro Valle Chiquito (left background).

valley along the western margin of the Llanos del Volcán (alt. 1330 m.), the old lava field of the extinct Volcán de Chiriquí (alt. 3374 m.). Although the llanos have been subjected to grazing by cattle and half-wild horses throughout their greater extent, they still support an interesting vegetation, including occasional novelties and numerous plants not yet recorded from Panama, many of which recall the chaparral of Mexico. At the southern margin of the llanos are found several springs and small lakes which feed such short but turbulent streams as the Rio Gariché. In the narrow upper valley of this river the party spent several days at the finca (alt. 1100 m.) of Mr. Frank Mathews.

Nearer the Canal Zone, the province of Coclé has been peculiarly neglected by botanical collectors. During the summer of 1935 the Missouri Botanical Garden party visited an interesting locality in Coclé known as El Valle de Antón, which is evidently the greatly eroded crater of an ancient volcano. Upon the floor of this "valley" many interesting bogs are found, and the precipitous walls support a rich rain forest. Overlooking El Valle to the north is the eastern end of the Serrania de Tabasará, dominated by the peculiar, "gun-sighted" Cerro Valle Chiquito. A fairly good highway now leads westward from Balboa as far as Davíd, in Chiriquí, although the western portion is practically impassible in the rainy season. From this highway a small branch turns inland a short distance west of San Carlos, leading abruptly up to the "Llano Bonito," through Las Margaritas, to El Valle de Antón.

Llano Bonito itself is an interesting place for collecting, although it has been subjected to grazing in part. It consists of an uptilted plain underlain near the surface by volcanics and greatly eroded into a maze of gullies, particularly in its upper reaches. Many interesting plants are found in the region of El Valle and Llano Bonito, outstanding of which, perhaps, are several of pronounced affinity with the flora of the Antilles, including the widespread Antillean *Polypodium dissimile* L. and *Spiranthes Scopulariae* Rchb. f., previously thought to be an endemic of Trinidad.

POLYPODIACEAE

Determined by W. R. Maxon (Washington)

Dryopteris macradenia (Sod.) C. Chr. Chiriquí: valley of the upper Rio Chiriquí Viejo; rare *(Seibert 185)*. Previously known only from Ecuador.

Polypodium astrolepis Liebm. Coclé: not uncommon upon trees, El Valle de Antón *(Seibert 421)*. A common tropical American species, but apparently not previously known from Panama.

Polypodium dissimile L. Coclé: vicinity of Llano Bonito, infrequent *(Seibert 510)*. Widespread throughout the Antilles; known on the continent from Guatemala, Venezuela, and the Guianas.

Rhipidopteris flabellulata (H. & B.) Fée. Chiriquí: on mossy logs, valley of the upper Rio Chiriquí Viejo, not infrequent *(Seibert 331)*. Previously known from Costa Rica and northern South America.

CYPERACEAE

Determined by Fr. Hugh O'Neill (Washington)

Lipocarpha Sellowiana Kunth. Chiriquí: Llanos del Volcán *(Seibert 370)*. Previously known from Brazil and Peru.

PALMAE

Determined by L. H. Bailey (Ithaca, N. Y.)

Chamaedorea costaricana Oersted. Chiriquí: valley of the upper Rio Chiriquí Viejo *(Seibert 218)*. Previously known only from the vicinity of the type locality at Mr. Turrialba, Costa Rica.

BROMELIACEAE

Determined by L. B. Smith (Cambridge, Mass.)

Catopsis nutans (Sw.) Griseb. Panamá: vicinity of Arenoso, lower Rio Trinidád *(Seibert 646)*. Recorded from Colombia and Costa Rica, but previously unknown for Panama.

Guzmania polycephala Mez & Wercklé. Chiriquí: valley of the upper Rio Chiriquí Viejo *(Seibert 208)*. Flowers cream, tinged with light cream at the base. Previously known from Costa Rica.

Vriesia subsecunda Wittm. Chiriquí: valley of the upper Rio Chiriquí Viejo *(Seibert 229).* Fruits purplish brown. Previously recorded from Costa Rica.

AMARYLLIDACEAE

Eucharis Bouchei Woodson & P. Allen, spec. nov., herbacea bulbosa; bulbis tunicatis late ovoideis ca. 6–8 cm. diametro metientibus; foliis ovato-lanceolatis apice acuminatis basi attenuatis 35–42 cm. longis 10–11 cm. latis delicate membranaceis glaberrimis; petiolis 25–30 cm. longis leviter canaliculatis basi paulo alatis glaberrimis; inflorescentiis umbellatis 4–10-floris; pedunculo crassiusculo 55–60 cm. longo glabro; bracteis subfoliaceis 1.0–1.5 cm. longis; pedicellis ca. 2.5 cm. longis glabris; perianthii lobis ovatis breviter acuminatis 3.0–3.5 cm. longis ca. 1.3–1.5 cm. latis patulis, tubo infundibuliformi usque ad 3.5 cm. longitudine ca. 0.15 cm. diametro metiente deinde 0.5 cm. longitudine tenus conico-dilatato, ostio ca. 0.6 cm. diametro metiente; staminum filamentis membranaceo-dilatatis trapezoideis basi connatis ca. 1.2 cm. longis, antheris ca. 0.3 cm. longis caducis; ovario 3-loculare subgloboso ca. 0.3 cm. diametro metiente, stylo gracilissimi, stigmate breviter 3-lobato bene exserto; fructibus ignotis.—Coclé: in woods near the base of Cerro Valle Chiquito, July 20, 1935, *R. J. Seibert 466* (Herb. Missouri Bot. Garden, type).

This is apparently the first representative of the ornamental genus *Eucharis* to be reported from north of Colombia. Abundant in the neighborhood of El Valle de Antón and the base of Cerro Valle Chiquito, it is easily distinguishable from the South American congeners by its broad staminal filaments which are roughly trapezoid, and without the rounded, lateral lobes characteristic of all the previously known species except *E. Sanderi,* in which the filaments are narrowly linear. This species is probably widely distributed in Panama. It has been cultivated at the Missouri Botanical Garden Tropical Station for several years under the name "Easter Lily."

CANNACEAE

Canna latifolia Mill. Chiriquí: valley of the upper Rio Chiriquí Viejo, not infrequent in low thickets *(Seibert 295)*. Our specimens accord well with the description of *C. latifolia* save for the obovate-trigonal capsules. If our plants are correctly identified they constitute the first record of the species from north of Colombia.

ORCHIDACEAE

Determined by C. Schweinfurth (Cambridge, Mass.)

Habenaria setifera Lindl. Chiriquí: banks of intermittent streams, Llanos del Volcán, fairly frequent *(Seibert 326)*; Coclé: Llano Bonito, north of Las Margaritas, fairly frequent *(Seibert 533)*. Previously recorded from Mexico, Guatemala, British Honduras, Honduras, Colombia, Venezuela, British Guiana, and Brazil.

Elleanthus capitatus (R. Br.) Rchb. f. Chiriquí: valley of the upper Rio Chiriquí Viejo, vicinity of Monte Lirio, rather frequent *(Seibert 140, 268)*. Widespread from Mexico to Brazil and Peru, but not previously recorded from Panama.

Spiranthes Scopulariae Rchb. f. Coclé: Llano Bonito, rare *(Seibert 528)*. Previously known only from the island of Trinidad.

Malaxis brachyrrhyncha (Rchb. f.) Ames. Chiriquí: Llanos del Volcan *(Seibert 327)*. Flowers of this species have a faint but sweet and agreeable odor. Previously recorded from Mexico, Guatemala, Honduras, and Costa Rica.

Malaxis excavata (Lindl.) O. Ktze. Chiriquí: valley of the upper Rio Chiriquí Viejo, vicinity of Monte Lirio, deep forest *(Seibert 175)*. Flowers with a rather faint but disagreeable odor of spoiled eggs. Previously unknown south of Mexico.

Malaxis macrostachya (Llave & Lex.) O. Ktze. Chiriquí: bank of an intermittent stream, Llanos del Volcán *(Seibert 128)*. Previously recorded from Arizona, New Mexico, Mexico, and Costa Rica.

Malaxis Parthonii Morr. var. denticulata (Rchb. f.) A., H. & S. Chiriquí: valley of the upper Rio Chiriquí Viejo, vicinity of Monte Lirio, relatively frequent *(Seibert 170, 221)*. Flowers with a faint odor of dried tobacco.[1] Previously known only from Costa Rica.

LIPARIS WENDLANDII Rchb. f. Chiriquí: valley of the upper Rio Chiriquí Viejo, vicinity of Monte Lirio, epiphytic, frequent *(Seibert 195, 216)*. Previously known from Costa Rica.

Pleurothallis triangulabia C. Schweinfurth, spec. nov. Herba epiphytica, caespitosa, mediocris. Caules comparate alti. Folia deflexa, late ovata, basi profunde cordata, apice abrupte acuminata. Pedunculi in sinu folii fasciculati, uniflori, bractea conduplicata celati. Sepalum dorsale suborbiculari-ovatum. Sepala lateralia in laminam paulo angustiorem connata. Petala multo minora, oblongo-lanceolata, leviter falcata, margine eroso-denticulata. Labellum carnosum, ovato-triangulare, apiculatum, basi late truncatum. Columna perbrevis, lata, cum pede crasso.

Plant epiphytic, caespitose, about 29 cm. high, erect. Roots fibrous, filiform, numerous, glabrous. Stems 8 to about 27 cm. tall, provided at the base and below the middle with a long tubular, evanescent sheath. Leaf solitary, horizontally spreading or reflexed, ovate or broadly ovate, deeply cordate at base with overlapping auricles, 5.6–10.1 cm. long including the auricles, 3.3–5.9 cm. wide, abruptly acuminate, coriaceous. Peduncles fascicled in the sinus of the auricles of the leaf, 1-flowered, concealed by a conspicuous conduplicate spathe which is about 3 cm. long. Flowers bilabiate, medium-sized. Dorsal sepal broadly ovate, about 12 mm. long and 9.8 mm. wide, 3-nerved, minutely papillose on the inner surface. Lateral sepals connate into an ovate lamina which is 10 mm. long and about 8.2 mm. wide, obtuse or shortly bidentate with acute teeth, 4-nerved (the nerves slightly carinate on the outer surface) with 2 indistinct central nerves. Petals oblong-lanceolate, slightly falcate, 6.5–7.3 mm. long, 2.2–2.5 mm. wide, erose-denticulate on the margins, acute, 1-nerved. Lip simple, fleshy, ovate-triangular, about 3.4 mm. long from the middle of

[1] Since the odors of all four species of *Malaxis* found in this part of Chiriquí are very distinctive and constant, we have taken care to note each for the benefit of future collectors and students.

the base to the apiculate apex, about 4 mm. wide across the truncate base, much thickened and papillose through the anterior portion and lateral margins toward the base, arcuate-recurved in side view due to the fleshy semilunate basal callus which is broadly sulcate next the column-foot, 3-nerved. Column very short and broad, extended into a stout papillose foot.—COSTA RICA: "Arbres des pâturages à Palmira de Alfaro Ruiz. Alt. 840 m., 4-VII-1925. Fleurs rouge-vineux foncé." *A. M. Brenes (138a) 1341* (Herb. Ames No. 43761, TYPE); PANAMA: CHIRIQUÍ: valley of the upper Rio Chiriquí Viejo, vicinity of Monte Lirio, alt. 1300–1900 m. Epiphytic on rotten logs; flowers dark reddish purple, June 27–July 13, 1935, *R. J. Seibert 269* (Herb. Missouri Bot. Garden, COTYPE).

Pleurothallis triangulabia is vegetatively similar to many species of the alliance of *P. cardiothallis* Rchb. f. and *P. phyllocardia* Rchb. f., but is distinct from all by reason of its peculiar lip. *Seibert 269* shows slight discrepancies from the type collection. One stem is about 30 cm. tall. One leaf is 11.7 cm. long from tip of auricles to tip of lamina. Dorsal sepal elliptic-ovate, 11 mm. long, 7.8 mm. wide. Lamina of lateral sepals oblong-ovate, about 10.1 mm. long, 6 mm. wide. Petals 7.5 mm. long.

PLEUROTHALLIS TUERCKHEIMII Schltr. Chiriquí: valley of the upper Rio Chiriquí Viejo, vicinity of Monte Lirio *(Seibert 142)*. Previously known from Guatemala, Honduras, and Costa Rica.

EPIDENDRUM PARKINSONIANUM Hook. Chiriquí: valley of the upper Rio Chiriquí Viejo, vicinity of Monte Lirio, frequent *(Seibert 214, 217)*. Previously known from Mexico, Guatemala, Honduras, and Costa Rica.

EPIDENDRUM PYGMAEUM Hook. Coclé: vicinity of El Valle de Antón *(Seibert 426)*. Very widely distributed from Florida and Mexico through Central America and the Antilles to Venezuela, British Guiana, Brazil, Peru, and Bolivia, but previously unrecorded in Panama.

CALANTHE MEXICANA Rchb. f. Chiriquí: valley of the upper Rio Chiriquí Viejo, vicinity of Monte Lirio *(Seibert 171)*.

Previously known from Mexico, Guatemala, Costa Rica, and the Antilles.

BLETIA CAMPANULATA Llave & Lex. Chiriquí: Llanos del Volcán, infrequent *(Seibert 328)*. Previously known from Mexico and Guatemala.

LYCASTE DOWIANA Endres & Rchb. f. Coclé: near summit of Cerro Valle Chiquito *(Seibert 644)*. Previously known from Costa Rica.

HUNTLEYA BURTII (Endres & Rchb. f.) Pfitz. Coclé: near summit of Cerro Valle Chiquito *(Seibert 643)*. Previously known from Costa Rica.

PIPERACEAE

Determined by William Trelease (Urbana, Ill.)

Peperomia antoni Trel., spec. nov. Herba epiphytica repens sat magna omnino glabra; caule graciliusculo; foliis alternatis obovatis obtuse breviterque acuminatis longe cuneatis 2.5–6.0 cm. longis 4–9 cm. latis pinnate nervatis; petiolo 3.0–3.5 cm. longo; spicis geminatis 0.2 cm. crassis 15.0 cm. longis; pedunculo 4.0 cm. longo ad apicem ramuli terminalis 1-bracteati 7.0 cm. longi conlocato; bracteis peltato-rotundatis; baccis oblongoideis anguste rostratis; stigmate anteriore sub rostro tenente.—COCLÉ: El Valle de Antón and vicinity, alt. 500–700 m., July 23–26, 1935, *R. J. Seibert 437* (Herb. Missouri Bot. Garden, TYPE).

Peperomia Seibertii Trel., spec. nov. Herba epiphytica erecta sat magna laxe ramosa glabriuscula post exsiccationem colore fulva; caule 0.2–0.3 cm. crasso anguloso nodis hirtellis; foliis aut alternatis aut oppositis late lanceolatis acuminatis basi acutis 1–2 cm. latis 2.5–5.0 cm. longis 3–5-nervatis ciliolatis; petiolo vix 0.5 cm. longo alate decurrente; spicis aut terminalibus aut lateralibus ca. 0.1 cm. crassis 4.0 cm. longis; pedunculo gracile 1 cm. longo; bracteis rotundato-peltatis; ovario ovoideo; stigmate subapicale.—CHIRIQUÍ: valley of the upper Rio Chiriquí Viejo, vicinity of Monte Lirio, District of Bugaba, alt. 1300–1900 m., June 27–July 13, 1935, *R. J. Seibert 201* (Herb. Missouri Bot. Garden, TYPE).

Peperomia valliculae Trel., spec. nov. Herba assurgens sat magna omnino glabra; caule 0.1–0.2 cm. crasso; foliis plerisque alternatis raro oppositis 3-natisve rhomboide elliptico-lanceolatis oblanceolatisve apice subacutis basi cuneatis 2.0–4.5 cm. longis 1.0–1.5 cm. latis opacis obscure 3-nervatis; petiolo 0.5–1.0 cm. longo; spicis aut terminalibus aut lateralibus filiformibus 10–15 cm. longis; pedunculo 1 cm. longo; bracteis rotundato-peltatis; baccis ovoideis; stigmate subapicale.—Coclé: western slope and summit of Cerro Valle Chiquito, alt. 700–800 m., July 25, 1935, *R. J. Seibert 503* (Herb. Missouri Bot. Garden, type).

Piper liratinerve Trel., spec. nov. Frutex *P. pseudo-lanceolato* affinis; internodiis sat gracilibus elongatisque sparse villosis tandem glabratis; foliis lanceolatis gradatim angustissime acuminatis basi gradatim inaequaliter obtusis subcordulatisve 14–15 cm. longis 4.0–4.5 cm. latis supra glabris rugosisque medium versus pinnate nervatis utroque latere, nervis 6–7, subtus molliter hirsutis venis valde prominentibus; petiolo ca. 1 cm. longo subhirsuto; spicis curvatis longe cuspidatis 8–10 cm. longis 0.2 cm. crassis; pedunculo 2 cm. longo sparse pubescente.—Chiriquí: valley of the upper Rio Chiriquí Viejo, vicinity of Monte Lirio, alt. 1300–1500 m., June 28, 1935, *R. J. Seibert 158* (Herb. Missouri Bot. Garden, type).

Piper marmoreum Trel., spec. nov. Frutex (?) glaber viridimarmoreus; internodiis florigeris gracilibus sat brevibus; foliis ovatis sat abrupte acuminatis basi rotundatis 19–20 cm. longis 10 cm. latis omnino pinnate nervatis post exsiccationem chartaceis; petiolo 2 cm. longo; spicis erectis 12.5 cm. longis 0.4 cm. crassis; pedunculo 1 cm. longo.—Panamá: vicinity of Arenoso, lower Rio Trinidád, alt. 26–50 m., Aug. 7–10, 1935, *R. J. Seibert 622* (Herb. Missouri Bot. Garden, type).

Piper rivi-vetusti Trel., spec. nov. Frutex riparius ca. 2 m. altus; internodiis florigeris sat crassis brevibusque cinereohispidis; foliis oblique ovatis elliptico-subrhomboideisve acuminatis basi acutis vel inaequilateraliter subobtusis 16–17 cm. longis 7.5–8.5 cm. latis medium versus pinnate nervatis, nervis utroque latere 6 scabridulis subtus breviter hirsutis; petiolo ca. 1.5 cm. longo subhirsuto; spicis erectis obtusis 9 cm.

longis 0.4 cm. crassis; pedunculo 1 cm. longo; bracteis rotundato-peltatis ciliolatis.—CHIRIQUÍ: valley of the upper Rio Chiriquí Viejo, vicinity of Monte Lirio, alt. 1350–1400 m., July 2, 1935, *R. J. Seibert 192* (Herb. Missouri Bot. Garden, TYPE).

Piper subrepens Trel., spec. nov. Frutex nodosus glaber; internodiis florigeris gracilibus brevibusque; foliis ovato-lanceolatis subovatisve acuminatis basi rotundatis 7.5–9.0 cm. longis 3–8 cm. latis quarto inferiore pinnate nervatis, nervis utroque latere 3–4, post exsiccationem firmis margine aliquid revolutis; petiolo 1 cm. longo; spicis 1 cm. longis 0.3 cm. crassis obtusis; pedunculo gracile 1 cm. longo.—COCLÉ: western slope and summit of Cerro Valle Chiquito, alt. 700–800 m., July 25, 1935, *R. J. Seibert 504* (Herb. Missouri Bot. Garden, TYPE).

FAGACEAE

QUERCUS INSIGNIS Mart. & Gal. Chiriquí: valley of the upper Rio Chiriquí Viejo, vicinity of Monte Lirio *(Seibert 225)*. According to Trelease's recent monograph of the American Oaks, this species has previously been known only from southern Mexico. Our specimens, taken from trees not infrequent in the valley of the upper Chiriquí Viejo, certainly accord well with the Mexican representation although the margin of the leaves is apparently quite entire in most cases, and the acorns average somewhat smaller, but not consistently so.

QUERCUS EUGENIAEFOLIA Liebm. Chiriquí: valley of the upper Rio Chiriquí Viejo, vicinity of Monte Lirio *(Seibert 226)*. This species appears to be too difficult to distinguish from *Q. Seemanni* Liebm., originally described from the region of Boquete, province of Chiriquí. If the two be maintained, however, it must be admitted that our specimens check rather more closely with the description and figures of the former, which has previously been unknown outside Costa Rica.

LORANTHACEAE

Determined by William Trelease (Urbana, Ill.)

PHORADENDRON CORYNARTHRON Eichler var. **Seibertii** Trel., var. nov., ramulis distincte ancipitalibus; foliis anguste oblongis vel falcate lanceolatis 5–7 cm. longis 0.8–1.3 cm. latis; spicis (immaturis) 2 cm. longis 0.2 cm. crassis cylindricis.—Coclé: El Valle de Antón and vicinity, alt. 500–700 m., July 23, 1935, *R. J. Seibert 411* (Herb. Missouri Bot. Garden, type).

Because of the immaturity of the inflorescence, Professor Trelease is slightly dubious of the precise affinity of these plants, which are relatively common in the vicinity of El Valle de Antón.

BALANOPHORACEAE

Helosis mexicana Liebm. Coclé: El Valle de Antón *(Seibert 469).* Previously known from southern Mexico and Colombia. The leafless stems are unbranched and 10–15 cm. tall. The inflorescence is pale buff, with the exception of the pinkish floral parts. In view of the poor understanding of the genus due to the relatively meagre collections, the determination must be regarded as provisional.

CARYOPHYLLACEAE

Stellaria ovata Willd. Chiriquí: trailing along sunny stream-banks, frequent in the upper Rio Chiriquí Viejo Valley *(Seibert 275).* Distributed from southern Mexico to the Andes, but apparently not previously reported from Panama.

RANUNCULACEAE

Thalictrum podocarpum HBK. Chiriquí: narrow gorge of the Rio Chiriquí Viejo below Monte Lirio *(Seibert 204).* Apparently the first record of this species in Central America. Previously known to extend from Venezuela to the Andes of Chile, and into Argentina.

LAURACEAE

Ocotea Whitei Woodson, spec. nov., arborescens ca. 15–20 m. alititudine attingens; ramulis glaberrimis; foliis oblanceolatis basi anguste cuneatis apice obtusiusculis 7–10 cm. longis 2–3 cm. latis coriaceis glaberrimis supra nitidulis; petiolis ca. 1 cm. longis; inflorescentiis paniculatis multifloris folia subaequantibus omnino appresse puberulis; pedicellis plus minusve glomeratis ca. 0.1 cm. longis appresse puberulis; bracteis minutissimis ovato-deltiformibus; floribus hermaphroditibus viridulis; perianthii tubo subnullo segmentis late ovatis acutis ca. 0.15 cm. longis extus minutissime appresse puberulis intus papillatis; antheris exterioribus subtrapezoideis bene stipitatis (filamentos ½ aequantibus) ca. 0.125 cm. longis introrsis mediis similibus sed extrorsis interioribus sterilibus subquadratis subsessilibusque ca. 0.05 cm. diametro metientibus omnibus eglandulosis; ovario ovoideo ca. 0.125 cm. longo glabro quam stylo dimidio breviore; baccis crasse ellipsoideis 2.5 cm. longis ca. 1 cm. diametro metientibus, cupulae incrassatae segmentis late deltoideis ca. 0.3 cm. longis patentibus.—CHIRIQUÍ: wooded hillsides near eastern banks of the Rio Chiriquí Viejo, Monte Lirio, July 11, 1935, *Seibert 307* (Herb. Missouri Bot. Garden, TYPE).

Superficially similar to *O. veraguensis* Mez, but differing in such technical characters as the stipitate stamens and peculiar staminodia. Named in honor of Mr. Hugh J. White, our host while at Monte Lirio, who has found the timber of this tree to be excellent for cabinet work. Mr. White reports the native name to be "Bambita."

CUNONIACEAE

WEINMANNIA PINNATA L. Chiriquí: epiphytic shrubs near the banks of the Rio Chiriquí Viejo, at Monte Lirio *(Seibert 288)*. Relatively rare. This is apparently the first record for this species from Panama, bringing more nearly together the range as previously known from southern Mexico to Costa Rica, and from Colombia to Brazil. Also indigenous to the Antilles.

ROSACEAE

Determined by L. H. Bailey (Ithaca, N. Y.)

RUBUS GLAUCUS Benth. Chiriquí: relatively abundant in hillside thickets about Cerro Punta *(Seibert 264)*. Apparently the first record of this species outside of Colombia from whence it was originally described. The fruits are delicious and larger than those of many cultivated raspberries; they are much prized by the inhabitants of the region about Cerro Punta.

OXALIDACEAE

Oxalis (Ionoxalis) chiriquensis Woodson, spec. nov., acaulis; bulbis 0.5–0.8 cm. diam. subglobosis, squamis ovatis acuminatis 0.4–0.7 cm. longis plerisque 3-costatis; foliis parum numerosis 3-foliolatis, foliolis obcordato-subreniformibus sinu latissimo usque ad 1/4 minusve excisis delicate membranaceis omnino viridulis supra glaberrimis subtus sparsissime pilosis 1.5–3.5 cm. longis 2.5–5.5 cm. latis; petiolis 5–30 cm. longis glaberrimis; pedunculis 12–30 cm. longis glabris apice umbellam simplicem ca. 3–10-floram gerentibus; bracteis ovato-lanceolatis acuminatis 0.2–0.3 cm. longis scariaceis sparse pilosulis apice saepe tuberculatis; pedicellis 1.5–3.0 cm. longis tenuissimis glaberrimis; sepalis oblongo-lanceolatis obtusiusculis 0.4–0.45 cm. longis glabris apice tuberculis linearibus aurantiacis 2 instructis; petalis pallide violaceis obovatis apice rotundatis integris 1.3–1.6 cm. longis; staminis filamentis minoribus glabris maioribus puberulis usque ad 1/4 parte inferiore vel infra appendiculatis; stylis manifeste pilosulis; fructibus ignotis.—Chiriquí: in rocky crevices, gorge of the upper Rio Chiriquí Viejo, about 1 mile below Monte Lirio, July 5, 1935, *Seibert 222* (Herb. Missouri Bot. Garden, type).

This species keys to the neighborhood of *O. discolor* Klotzsch in Knuth's recent revision of the genus. The latter, however, is distinguished from *O. chiriquensis* by its larger bulbs with narrower scales, its leaves which are proportionally more nearly cordate and more densely pubescent beneath, and its glabrous style, in addition to other characters. *Oxalis discolor* is at present known only from southern Mexico. *Oxalis vallicola* Rose, another Mexican species evidently closely related to *O. chiriquensis,* is distinguishable from it by means of its multicostate bulb scales, shorter corolla in proportion to the calyx, and smaller leaves which are conspicuously heavier in texture.

POLYGALACEAE

Determined by S. F. Blake (Washington)

Polygala leptocaulis T. & G. Coclé: tussocks in bogs, El Valle de Antón *(Seibert 488).* Widespread from southern

Louisiana and Texas to South America, but previously unknown from Panama.

VITACEAE

Cissus Martiniana Woodson & Seibert, spec. nov., fruticulosus humilis haud scandens; ramis ramulisque sat gracilibus juventate irregulariter ferrugineo-hispidulis mox glabratis; foliis manifeste petiolatis 3-foliolatis foliolis firmiter membranaceis opacis glabris apicem versus inconspicue inciso-denticulatis subsessilibus terminale obovato-elliptico apice obtusissimo saepius minutissime mucronulato basi aequilateraliter attenuato 3.0–4.5 cm. longo 2.0–2.5 cm. lato lateralibus oblique obovato-oblongis apice obtusissimis saepius minutissime mucronulatis basi inaequilateraliter attenuatis 2.5–4.0 cm. longis 1.0–2.5 cm. latis; petiolis 1.5–2.5 cm. longis glabris rariusve sparse ferrugineo-hispidulis; stipulis persistentibus late obovatis rotundatis subcoriaceis 0.15–0.3 cm. longis saepius sparse irregulariterque ferrugineo-hispidulis; cymis pedunculatis folio opposito multo brevioribus corymbiformibus repetite di-trichotomis, pedunculis irregulariter ferrugineo-hispidulis; pedicellis 0.2–0.25 cm. longis glabris rariusve sparsissime ferrugineo-pilosulis; calycis lobis 4 brevissime subreniformibus rotundatis patulis ca. 0.02 cm. longis glabris vel margine minutissime ciliolatis; corolla urceolata dilute viride tubo 0.08 cm. longo ca. 0.1 cm. diametro metiente extus glabro, lobis 4 ovato-triangulatis plus minusve conniventibus 0.1 cm. longis apice extus minute papillatis; baccis obovato-oliviformibus saturate viridibus (immaturis?) glaberrimis ca. 0.5–0.8 cm. diametro metientibus 1–2-spermis.—CHIRIQUÍ: wooded banks of Rio Chiriquí Viejo, near Monte Lirio, alt. about 5000 ft., July 7, 1935, *Seibert 241* (Herb. Missouri Bot. Garden, TYPE).

C. Martiniana is evidently closely related to *C. salutaris* HBK., but is immediately distinguishable by its much smaller, pale green flowers, smaller berries, and general habit. The several plants which we observed averaged about 5 dm. in height. Athough the branches tend to become somewhat lax and even procumbent, no tendrils have been found. The species commemorates our congenial and stimulating companion at Monte Lirio, Professor George W. Martin.

GUTTIFERAE

Hypericum fastigiatum HBK. Chiriquí: common upon the Llanos del Volcán *(Seibert 327)*. There appears to be no record of this species from south of Mexico. Upon the Llanos it is usually associated with *H. gnidioides* Seem. *(Seibert 349)*.

PASSIFLORACEAE

Determined by E. P. Killip (Washington)

Passiflora apetala Killip. Chiriquí: valley of the upper Rio Chiriquí Viejo, near Monte Lirio *(Seibert 160)*. Previously unknown outside Costa Rica. Flowers of this species are a pale green slightly tinged with yellow. An occasional suffrutescent vine of thickets.

THYMELAEACEAE

Determined by P. C. Standley (Chicago)

Daphnopsis Seibertii Standl., spec. nov. Arbor 7–10-metralis, ramulis crassiusculis teretibus, vetustioribus nigrescentibus rugulosis sparse minute pallido-lenticellatis, internodiis brevibus, novellis glabris; folia alterna mediocria breviter petiolata in sicco tenuiter coriacea, petiolo crassiusculo 8–12 mm. longo sparse strigoso vel glabrato; lamina anguste oblongo-lanceolata 8–11 cm. longa 2.5–3.5 cm. longa apicem versus sensim angustata et acuminata vel anguste longissime attenuata, basi acuta vel acuminata et longe in petiolum decurrens, supra in sicco fusco-viridis glabra vel glabrata, nervis venisque conspicuis sed vix prominulis, subtus fere concolor ubique sparse breviter strigosa vel glabrata, ad costam prominentem gracilem dense strigosa, nervis lateralibus utroque latere circa 10 angulo semirecto adscendentibus irregularibus obscuris vix prominulis juxta marginem conjunctis, venulis inconspicuis arcte reticulatis; flores masculi subcapitati, capitulis cymosis numerosis, cymis circa 4 cm. longis ubique dense ochraceostrigosis; calyx infundibuliformis 8 mm. longus extus dense minute tomentosus, lobis oblongo-ovatis obtusis patentibus vel subreflexis tubo fere triplo brevioribus intus tenuiter tomentosis; inflorescentia femina masculo similis dense multiflora, calyce 4 mm. tantum longo extus breviter strigoso, lobis subrotundatis intus basin versus glabris; drupae immaturae glabrae ovoideae 6 mm. longae apiculatae—COCLÉ: El Valle de Antón and vicinity, alt. 500–700 m., July 23–27, 1935, *R. J. Seibert 444* (Herb. Field Museum No. 814,030, TYPE; duplicate in Herb. Missouri Bot. Garden); also *Seibert 416* (staminate) from the same locality.

I have seen no other member of the genus from southern Central America. Each of the Mexican species differs in several details from the Panama plant, which is marked especially by its narrowly long-acuminate leaves.

MELASTOMACEAE

Determined by P. C. Standley (Chicago)

Mouriria brunneicalyx Standl., spec. nov. Arbor 7-metralis praeter inflorescentiam omnino glabra, ramulis gracilibus teretibus fere laevibus, internodiis 4.5–7.5 cm. longis; folia majuscula papyracea brevissime petiolata, petiolo crasso vix 3 mm. longo; lamina oblongo-ovalis 11–16 cm. longa 5.5–7 cm. longa apice subrotundata et breviter abrupte acuminata, acumine anguste triangulari 5 mm. longo, basi rotundata, supra sublucida in sicco olivacea, costa non elevata, nervis prominulis, subtus paullo pallidior, costa gracili elevata, nervis lateralibus utroque latere circa 11 tenerrimis angulo fere recto divergentibus juxta marginem in nervum tenuem collectivum conjunctis, nervis aliis tenuioribus irregularibus inter primarios interpositis; flores (delapsi tantum visi) albi brunneo tincti, pedicellis ad 7 mm. longis brunneo-tomentellis, calycis tubo obconico-campanulato basi acutiusculo 7 mm. longo extus dense brunneo-tomentello, sepalis aequilongis triangulari-ovatis acutis extus tomentellis intus tenuius tomentellis; petala perfecta non visa 8 mm. longa vel ultra; filamenta inaequalia gracilia glabra, antheris 5 mm. longis.—PANAMÁ: vicinity of

Arenoso, lower Rio Trinidád, 25–50 m., Aug. 7–10, 1935, *R. J. Seibert 609* (Herb. Field Museum, No. 814, 037, TYPE; duplicate in Herb. Missouri Bot. Garden).

The only other species of the region, *Mouriria parvifolia* Benth., is altogether different in its small, ovate leaves and small flowers; nor is *M. brunneicalyx* closely related to any other species of the genus known from Central America.

ONAGRACEAE

Fuchsia Hemsleyana Woodson & Seibert, spec. nov., fruticosa 2–3 m. alta; ramulis dense luteo-puberulis maturitate cortice brunneis tenuiter rimosis; foliis oppositis rariusve alternatis petiolatis rhomboideo-ellipticis apice acutis basi latiuscule cuneatis margine sinuo-dentatis 1.2–3.0 cm. longis 0.7–1.0 cm. latis firme membranaceis omnino glaberrimis; petiolis 0.3–0.6 cm. longis sparse minutissimeque pilosulis; inflorescentiis lateralibus 1–2-floris, pedunculo nullo; pedicellis ca. 0.4 cm. longis tenuissime sed valde puberulis; calycis tubo anguste subtubuloso, cum ovario globoso ca. 0.125 cm. longo, ca. 0.7 cm. longo, faucibus ca. 0.1 cm. diametro metientibus, extus tenuissime puberulo imo densius colore delicate roseo, lobis anguste ovato-trigonalibus apice attenuatis ca. 0.4 cm. longis patulis colore saturate roseis glabriusculis; petalis oblongo-obovatis apice integris rotundatis obtusiusculisve ca. 0.25 cm. longis erectis paululo patulisve dilute roseis glabris; staminibus 8 calycis faucibus biseriatim insertis omnino inclusis, filamentis brevissimis, antheris late oblongoideis ca. 0.12 cm. longis; stigmate indistincte 4-maniculato vix 0.1 cm. longo valde exserto; fructibus baccatis subglobosis ca. 0.3 cm. diametro metientibus atropurpureis glabris; seminibus numerosis gibbosis ca. 0.2 cm. longis laevibus. CHIRIQUÍ: wooded banks of Rio Chiriquí Viejo, near Monte Lirio, alt. about 5500 ft., June 28, 1935, *Seibert 162* (Herb. Missouri Bot. Garden, TYPE).

Most closely related to *F. Seleriana* Loes. of Guatemala, with pubescent foliage which is frequently ternate or quaternate and much shorter pedicels, and *F. mixta* Hemsl. of southern Mexico, with conspicuously larger, glabrous flowers. In describing *F. mixta* Hemsley (Biol. Centr.-Am. Bot. **1**: 459. 1879) cited in addition to his type from Mt. Orizaba, Mexico, a specimen from the volcano of Chiriquí (*Seemann 1226* in Hb. Kew.) with the comment "The specimens from Chiriquí are apparently of the same species, but they are destitute of flowers." It seems altogether likely that *F. Hemsleyana* is conspecific with Seemann's specimen from Chiriquí, although it has not been available for examination. If so, it is not surprising that Hemsley thought the plants from Orizaba and those from Chiriquí identical, as the foliage is closely similar. The plate in the 'Biologia,' as well as recent collections from near the type locality of *F. mixta,* however, certainly support the specificity of *F. Hemsleyana.* The flowers of the latter, as well as of *F. mixta* and *F. Seleriana,* are apparently unisexual.

Fuchsia pulchella Woodson & Seibert, spec. nov., fruticosa ca. 1.5–2.0 m. alta; ramulis teretibus gracillimis juventate minutissime puberulo-papillatis mox glabratis maturitate cortice brunneis tenuiter rimosis; foliis oppositis petiolatis obovato-rhombiformibus apice obtusiusculis basi anguste cuneatis margine remote sinuo-dentatis 1.5–3.5 cm. longis tenuiter membranaceis utrinque glabris; petiolis 0.7–1.0 cm. longis minutissime puberulo-papillatis; inflorescentiis unifloris axillaribus, pedunculo subnullo; pedicellis ca. 0.4 cm. longis minutissime puberulo-papillatis; calycis tubo anguste tubulo-campanulato cum ovario late ovoideo ca. 0.1 cm. longo sparse minutissimeque pilosulo 0.65–0.7 cm. longo, faucibus ca. 0.15 cm. diametro metientibus, colore dilute auriantiaco extus ovario excepto glaberrimo, lobis anguste ovato-trigonalibus longe acuminatis 0.45–0.5 cm. longis patulis glabris colore roseis; petalis late oblongo-obovatis apice rotundatis 0.4 cm. longis paululo patulis colore dilute roseis; staminibus 8 calycis faucibus biseriatim insertis, filamentis brevissimis, antheris ovoideis vix 0.1 cm. longis; stigmate breviter 4-maniculato ca. 0.1 cm. longo valde exserto; fructibus ignotis. CHIRIQUÍ: wooded banks of Rio Chiriquí Viejo about 1 mile below Monte Lirio, alt. about 5000 ft., June 30, 1935, *Seibert 182* (Herb. Missouri Bot. Garden, TYPE).

This species is closely related to *F. Seleriana* Loes. of Guatemala and *F. Hemsleyana* which occurs in the valley of the upper Rio Chiriquí Viejo as well *(Seibert 162)*. From the former *F. pulchella* may be distinguished by the glabrous foliage, and smaller, glabrous flowers; from the latter by the membranaceous texture of the foliage, essentially glabrous stems, and relatively more conspicuous petals. The flowering material available for collection was insufficient to determine whether the flowers are unisexual, polygamous, or polygamodioecious.

Fuchsia arborescens Sims. Chiriquí: valley of the upper Rio Chiriquí Viejo, near Monte Lirio *(Seibert 246)*. Previously known from southern Mexico, Guatemala, and Costa Rica. In the vicinity of Monte Lirio this species attains the stature of small trees as tall as 6 m., frequently forming thickets. Existing descriptions fail to note that the flowers are predominantly polygamodioecious; separate plants bearing predominantly incipient staminate or pistillate flowers, particularly noticeable in the fruiting season. Flowers capable of producing berries are characterized by somewhat larger stigmata and smaller anthers than those which are apparently incapable of fructification. Furthermore, the whole flower of the latter type is noticeably larger than that of the former, at first leading an observer to suspect the existence of two distinct species. The pollen of either type is apparently fertile and uniform.

ARALIACEAE

Determined by P. C. Standley (Chicago)

Gilibertia stenodonta Standl., spec. nov. Frutex 4-metralis omnino glaber, ramulis gracilibus ochraceis subteretibus in sicco crasse striatis, internodiis elongatis; folia mediocria longe graciliter petiolata chartacea, petiolo 2.5–5 cm. longo; lamina oblonga vel rarius oblanceolato-oblonga 14–21 cm. longa 4–6 cm. lata subabrupte longe anguste acuminata, acumine anguste attenuata, basi acuta, interdum uno latere obscure breviter lobata, remote serrata, serrationibus patentibus vel adscendentibus linearibus 2–4 mm. longis, supra in sicco obscure viridis, subtus paullo pallidior, costa gracili prominente, nervis lateralibus utroque latere circa 9 gracillimis angulo lato adscendentibus in marginem desinentibus; flores umbellati, umbellis ut videtur circa 5 multifloris racemum brevem terminalem breviter pedunculatum efformantibus, pedicellis gracillimis rectis ad 4 mm. longis; calyx 0.6 mm. longus breviter dentatus basi acutus, petalis vix ultra 1 mm. longis elliptico-ovatis subobtusis viridi-ochroleucis; filamenta petalis paullo longiora, antheris brevibus ovoideis.—Canal Zone: vicinity of Gold Creek, 4 miles northeast of Gamboa, Aug. 4, 1935, *R. J. Seibert 592* (Herb. Field Museum, No. 814,031, type; duplicate in Herb. Missouri Bot. Garden).

In the remote subulate teeth of the leaf blades this species is conspicuously different from the common *Gilibertia arborea* (L.) March. of the Canal Zone region, as well as from other Central American members of the genus.

ERICACEAE

Pernettya coriacea Klotzsch. Chiriquí: Llanos del Volcán *(Seibert 322)*. A poorly known species originally described from "the highest mountains" of Costa Rica. The plants are abundant in thickets of the lava fields between the Rio Chiriquí Viejo and the Volcán del Chiriquí.

Cavendishia Smithii Hoer. Chiriquí: gorge of the Rio Chiriquí Viejo below Paso Ancho *(Seibert 321)*. A. C. Smith cites but one specimen of this species from Panama, an unnumbered collection by Bridges, with merely the notation "Veraguas," an old name including practically all of western Panamá. We have found numerous epiphytic shrubs referable to this species about the gorge of the Rio Chiriquí Viejo as it passes through the Llanos del Volcán. The corollas are bright rose-pink; the leaves of a pale yellowish green are usually infested beneath by a species of *Haplographium,* giving the aspect of an irregular, glandular-punctate indument.

Cavendishia Wercklei Hoer. Chiriquí: valley of the upper Rio Chiriquí Viejo, vicinity of Monte Lirio *(Seibert 176)*. An epiphytic vine; corolla reddish purple, flushed with violet-blue.

A. C. Smith writes of this specimen: "This plant has been carefully compared with *Cavendishia Wercklei* Hoer. It is slightly larger as regards petiole, leaf blade, and pedicel. Flowers are identical throughout except that the corollas of our specimens are soft pilose rather than glabrous. The form of the calyx is the best specific character of this group. I believe that this specimen must be included in *C. Wercklei* but the pilose corolla has not previously been noted. It is likely that the specimens previously seen had lost such hairs. The description of this species in my paper (Contrib. U. S. Nat. Herb. **28**: 455) should be modified to include this form, and a corresponding adjustment made in the key."

MYRSINACEAE

Determined by P. C. Standley (Chicago)

Ardisia Seibertii Standl., spec. nov. Frutex vel arbuscula omnino glabra, ramis crassiusculis ochraceis striatis, internodiis brevibus vel elongatis; folia alterna mediocria brevissime petiolata subchartacea, petiolo crassissimo 4–7 mm. longo; lamina oblanceolato-oblonga vel obovato-oblonga 9.5–16 cm. longa 4–6 cm. lata acuta vel acuminata (apice perfecto non viso) basin versus sensim acute attenuata integra, supra in sicco fusco-viridis opaca, nervis inconspicuis, subtus paullo pallidior, costa gracili elevata, nervis lateralibus numerosis inconspicuis vix prominulis prope marginem arcuato-conjunctis, ubique lineis nigrescentibus inaequilongis dense notata; flores albi majusculi umbellati, umbellis cymoso-paniculatis, inflorescentia laxa sessilis 9 cm. longa 13 cm. lata, umbellis plerumque 2–4-floris, pedicellis gracilibus rectis 1.5–2 cm. longis; sepala 5–6 mm. longa ovato-oblonga obtusa lineis brevibus latiusculis nigrescentibus dense picta; petala sepalis bene longiora ovata subsparse nigro-lineata; ovarium globosum glabrum.—COCLÉ: El Valle de Antón and vicinity, 500–700 m., July 23–27, 1935, *R. J. Seibert 456* (Herb. Field Museum, No. 814,029, TYPE; duplicate in Herb. Missouri Bot. Garden).

The species is well marked by its more or less obovate leaves and large, umbellate-paniculate flowers.

ASCLEPIADACEAE

Vincetoxicum chiriquense Woodson, spec. nov., fruticosa volubilis; ramulis teretibus graciliusculis glaberrimis; foliis oppositis longe petiolatis oblongo-ellipticis apice breviter subcaudato-acuminatis basi late obtusis rotundatisve 10–14 cm. longis 3.5–6.0 cm. latis firme membranaceis omnino glaberrimis supra nervo medio basi 2-glandulosis; inflorescentiis alternato-lateralibus subumbellatis flores mediocres virides 2–5 gerentibus; pedunculo petiolo paulo breviore glaberrimo; pedicellis 2–3 cm. longis; bracteis ovato-lanceolatis minimis caducis; calycis laciniis ovato-ellipticis acutis 0.5 cm. longis glaberrimis glandulas solitarias minutas alternatas gerentibus; corollae rotatae tubo basi ca. 0.15 cm. diametro metiente intus extusque glabro, lobis late ovatis obtusis omnino viridibus 0.9–1.0 cm. longis extus glaberrimis intus minutissime papillatis; gynostegio brevissime stipitato; polliniis ovoideis cum caudiculis paulo elatis ca. 0.075 cm. longis subpendulis, corpusculo ca. 0.025 cm. longo; coronae cucullis 5 pectinatis dentem callosem intus gerentibus ca. 0.05 cm. longis; stigmate pentagone plano obscurissime 2-lobato ca. 0.2 cm. diametro metiente; ovariis ovoideis glabris; fructibus solitariis juventate late fusiformibus minute verrucosis glabris; seminibus ignotis.—CHIRIQUÍ: valley of the upper Rio Chiriquí Viejo, near Monte Lirio, twining in thickets near small stream, alt. about 5500 ft., July 5, 1935, *R. J. Seibert 231* (Herb. Missouri Bot. Garden, TYPE).

This species to some extent simulates the general aspect of *V. viridiflorum* (Meyer) Standl., which, however, is characterized by a conspicuous vegetative indument and conspicuously cordate leaves. The internal callose projections of the pectinate corona scales set apart *V. chiriquense* from other neighboring species of *Vincetoxicum.*

Funastrum Seibertii Woodson, spec. nov., fruticosa volubilis; ramulis teretibus graciliusculis juventate, minute denseque villosulis mox glabratis; foliis oppositis breviter petiolatis anguste oblongo-ellipticis apice breviter subcaudato-acuminatis basi rotundatis haud cordatis 3.0–5.5 cm. longis 0.5–1.5 cm. latis membranaceis supra glabriusculis viridibus nervo medio basi inconspicue 2-glandulosis subtus inconspicue pilosulis paululo pallidioribus; petiolis 0.2–0.5 cm. longis juventate inconspicue pilosulis tandem glabratis; inflorescentiis umbellatis alterno-lateralibus flores speciosos albidos 5–12 gerentibus; pedunculo 4–6 cm. longo juventate minute puberulo mox glabrato; pedicellis 1.0–1.1 cm. longis minute puberulis; bracteis minute ovatis scariaceis; calycis laciniis ovatis acuminatis 0.3 cm. longis extus minute puberulis intus basi glandulas minutas solitarias alternatas gerentibus; corollae rotatae tubo brevissimo basi ca. 0.1 cm. diametro metiente faucibus paulo ampliatis, lobis ovatis acutis vel breviter acuminatis 0.7 cm. longis patulis intus extusque minute papillatis margine exteriore conspicue ciliatis; gynostegio subsessile cum stigmate apiculato ca. 0.35 cm. alto; antheris ca. 0.25 cm. longis apice obtuse appendiculatis ibique inflexis; polliniis oblique oblongoideis ca. 0.1 cm. longis, caudiculis brevissimis, corpusculo ca. 0.025 cm. longo; coronae interioris segmenta inflata oblique ovoidea ca. 0.25 cm. longa; stigmate conspicue rostrato apice 2-fido; ovariis ovoideis ca. 0.25 cm. longis dense lanulosis; folliculis ignotis.—PANAMÁ: margins of the lower Rio Trinidád near its confluence with Gatún Lake, Aug. 9, 1935, *R. J. Seibert 637* (Herb. Missouri Bot. Garden, TYPE).

Standley (Contrib. U. S. Nat. Herb. **27**: 311. 1928) has reported the occurrence of *F. clausum* (Jacq.) Schltr. from the Canal Zone, but from the available material in the herbarium of the Missouri Botanical Garden, I suspect that *F. Seibertii* is the species for which it has been mistaken, as it closely approaches the latter in general habit, but may be distinguished easily by its nearly flat stigma and somewhat more nearly coriaceous foliage. *F. clausum* is abundant in localities of northern Central America, but its occurrence further south is open to question.

Metastelma glaberrimum Woodson, spec. nov., suffruticosa volubilis; ramis compressis irregulariter suberosis; ramulis teretibus gracillimis juventate inconspicuissime puberulis mox glabratis; foliis oppositis petiolatis anguste elliptico- vel ovato-lanceolatis apice acuminatis basi obtusis 2.0–4.5 cm. longis 0.4–

1.4 cm. latis membranaceis glabris supra viridibus nervo medio basi minute 2-glandulosis subtus pallidioribus paululo glaucescentibus; petiolis 0.2–0.4 cm. longis juventate minutissime puberulis tandem glabratis; inflorescentiis alterno-lateralibus quam foliis multo brevioribus flores minutos albidos 1–4 gerentibus; pedunculo 0.1–0.5 cm. longo minutissime puberulo; pedicellis ca. 0.2 cm. longis ut in pedunculo vestitis; bracteis minutissimis scariaceis vix bene visis; calycis laciniis ovatis obtusis rotundatisve ca. 0.08 cm. longis extus glabris intus cum sequentibus alternatis glandulas 2 minutas lanceolatas gerentibus; corollae campanulatae extus omnino glaberrimae tubo ca. 0.07 cm. alto basi ca. 0.02 cm. diametro metiente faucibus usque 0.1 cm. diametro ampliato, lobis ovatis late acutis vel obtusiusculis ca. 0.1 cm. longis extus glaberrimis intus minutissime papillatis fere glabris patulis; gynostegio sessile ca. 0.08 cm. alto; stigmate fere plano ca. 0.05 cm. diametro metiente; ovariis anguste ovoideis ca. 0.07 cm. longis glabris; polliniis oblique pyriformibus cum caudiculis ca. 0.01 cm. longis corpusculum angustissimum fere aequantibus; coronae segmentis ovato-oblongis anguste acutis ca. 0.09 cm. longis; folliculis ignotis.—Chiriquí: valley of the upper Rio Chiriquí Viejo, near Monte Lirio, twining in thickets near small stream, alt. about 5500 ft., July 11, 1935, *R. J. Seibert 300* (Herb. Missouri Bot. Garden, TYPE).

Simulating *M. pedunculare* Dcne. in general appearance. The latter species, however, is characterized by the corollas, which are densely villosulose within.

CONVOLVULACEAE

Ipomoea muricata Cav. Chiriquí: Llanos del Volcán *(Seibert 341)*. Although this species is described in House's monograph of *Ipomoea* as bearing only purple flowers (Ann. N. Y. Acad. Sci. **18**: 233. 1909), and emphasis laid on that character in the key to species, white flowers frequently are produced amongst the purple at Llanos del Volcán, Chiriquí. This form may be designated as:

Ipomoea muricata Cav. forma **alba** Woodson & Seibert, f.

nov. A forma genuina corollis albis differt.—Chiriquí: Llanos del Volcán, July 14, 1935, *R. J. Seibert 341a* (Herb. Missouri Bot. Garden, type).

OROBANCHACEAE

Conopholis americana Wallr. Chiriquí: valley of the upper Rio Chiriquí Viejo, near Cerro Punta *(Seibert 298)*. Previously unknown south of México. Parasitic on roots of oak trees. The bracts of our specimen are somewhat broader than those of the herbarium representation from Mexico and the United States.

GESNERIACEAE[1]

Determined by C. V. Morton (Washington)

Achimenes longiflora DC. Coclé: moist stream bank near base of Cerro Valle Chiquito *(Seibert 496)*. The plant called *Achimenes panamensis* (Seem.) Hemsl. by Standley (Contr. U. S. Nat. Herb. **27**: 345. 1928) has a wholly superior ovary, and consequently belongs in a different subfamily from the genus *Achimenes*. Seemann correctly placed his species in *Nautilocalyx*, which, as shown by Sprague (Kew Bull. 85–90. 1912), is essentially different from *Episcia* in which it was formerly included. *Nautilocalyx panamensis* will not "run down" in Standley's key because the characters given there are those of true *Achimenes*.

Diastema exiguum Morton, spec. nov. Herba tenera usque ad 17 cm. alta; caules parce pilosuli; folia opposita, aequalia, longe petiolata, petiolo usque ad 4.7 cm. longo, parce pilosulo; lamina foliorum late elliptica, membranacea, usque ad 10 cm. longa et 5.5 cm. lata, apice acuta, basi obliqua obtusa vel rotundata, fere usque ad basin perspicue dentata, supra viridis, parcissime pilosula, subtus pallida, minute et sparse substrigosa, venis primariis ca. 7-jugis, vix elevatis; inflorescentiae axillares, racemosae, basi foliiferae, usque ad 8 cm. longae sed plerumque breviores, rhachibus rubescentibus, glabris, bracteatis, bracteis variis, plerumque oblongis, saepe plus minusve

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denticulatis, pedicellis gracilibus, rubescentibus usque ad 2.4 cm. longis, glabris; calycis lobi aequales, liberi, oblongo-lanceolati, ca. 5 mm. longi, 1.5 mm. lati, apice acuti et paullo incrassati, utrinque parce pilosuli, integri, 3-nervii; corolla hypocrateriformis, externe alba (fauce intus lutea), ca. 2 cm. longa, externe parce substrigosa, intus glabra, tubo erecto, ecalcarato, non ventricoso, ca. 4 mm. diam., limbo patente, ca. 12 mm. lato, vix 2-labiato, lobis subaequalibus, rotundatis; stamina 4, didynama, filamentis liberis, non contortis, ca. 1 cm. longis, gracillimis, glabris, antheris liberis, connectivis transverse oblongis, loculis orbicularibus; discus e glandulis 5 maximis lineari-subulatis ca. 1.3 mm. longis glabris; ovarium semi-inferum, parte adnata turbinata, 1.5 mm. longa, glabra, parte libera ovoidea, sursum minute puberulenta; stylus 8.5 mm. longus, crassiusculus, glaber.—Canal Zone: vicinity of Las Cruces, alt. 26–40 m., Aug. 1, 1935, *R. J. Seibert 579* (U. S. Nat. Herb. No. 1,635,942, type).

I have seen the following additional specimens, both from the Canal Zone: near Gatún: *Standley 27223;* Barro Colorado Island, *Kenoyer 539a.* Of the numerous species of *Diastema,* the most closely related is doubtless *D. bracteosum* (Oerst.) Hanst., which has flowers not half as large, and the leaves and stems more strongly hirsute.

Diastema exiguum is the species identified and described as *Napeanthus repens* Donn. Sm. by Standley and others. *Napeanthus* has not yet been collected in the Canal Zone; furthermore *N. repens,* unknown outside Guatemala, is a typical member of the genus *Phinaea,* as has been shown clearly by Solereder (Bot. Centralbl. Beih. II. **24:** 435. 1909).

Diastema exiguum Morton var. **lilacinum** Morton, var. nov. A var. typica corolla lilacina differt.—Coclé: vicinity of El Valle de Antón, alt. 500–700 m., July 23–27, 1935, *R. J. Seibert 432* (U. S. Nat. Herb. No. 1,635,926, type).

Phinaea lacerata Morton, spec. nov. Herba tenerrima 9–13 cm. alta, propagulis linearibus, gracilibus, squamulis parvis, rubescentibus, pubescentibus; caules erecti, non ramosi, substrigosi; folia approximata, opposita, petiolata, petiolo usque ad 10 mm. longo; lamina foliorum elliptica, maxima 8 cm. longa et 3 cm. lata, apice acuminata, basi in petiolum attenuata, tenuiter membranacea, grosse et duplicate lacerato-serrata vel incisa, supra parce pilosula, viridis, subtus pallidior, strigillosa, venis primariis 7–9-jugis; flores solitarii, axillares, longe pedunculati, pedunculo ca. 2.3 cm. longo, filiformi, puberulo; calycis tubus obdeltoideus, brevissimus, pilosus, lobis liberis, lanceolatis, 3.5 mm. longis, 1.2 mm. latis, acuminatis, integris, utrinque pilosulis; corolla alba, rotata, stellata, fere actinomorpha, ca. 11 mm. lata, tubo 2 mm. longo, lobis oblongis, ca. 4 mm. longis, rotundatis, externe sparse pilosulis; stamina 4, filamentis gracilibus, ca. 2.2 mm. longis, glabris, anterioribus curvatis, antheris quam filamentis multo brevioribus, connectivo crassiusculo, loculis discretis, rima brevi dehiscentibus; discus nullus; ovarium (pars libera) subglobosum, glabrum; stylus glaber, curvatus; fructus ignotus.—CHIRIQUÍ: valley of the upper Rio Chiriquí Viejo, vicinity of Monte Lirio, alt. 1300–1900 m., June 27–July 13, 1935, *R. J. Seibert 316* (Herb. Missouri Bot. Garden, TYPE).

Phinaea is one of the least known genera of Gesneriaceae. Seven species have been described, but most of these are known from single specimens only. Perhaps the most closely related is *Phinaea caripensis* (Klotzsch) Solereder, of Venezuela, which has similar deeply cut, doubly-serrate leaves; but these are sessile, whereas those of *P. lacerata* are distinctly petiolate.

Alloplectus rubida Morton, spec. nov. Caules adscendentes, sublignosi, saepe basi radiculosi, ca. 6 mm. diam., non ramosi, apicem versus foliiferi, hornotini pilosi, annotini glabri, cortice valde irregulari, longitudinaliter striato et saepe subalato; folia opposita, subaequalia, petiolata, petiolo usque ad 1.7 cm. longo, dense piloso; lamina foliorum ovata vel subrhombea, usque ad 16 cm. longa et 7 cm. lata, utrinque rubescens, membranacea, perspicue serrato-denticulata, apice acuta vel acuminata, basi in petiolum decurrens, supra pilosa, pilis rubris, flaccidis, multiseptatis, subtus in venis pilosa, pilis multiseptatis, flaccidis, rubescentibus, in mesophyllo substrigosa, pilis rigidis, acuminatis, bicellularibus, cellula basali brevi, rubescente, cellula terminali alba, magna, venis primariis 8–9 jugis; flores solitarii, axillares, pedunculati, pedunculo petiolum superante, 2–2.5 cm. longo, piloso, ebracteato; calycis lobi liberi, aequales, erecti, rubri, lanceolati, ca. 15 mm. longi et 5 mm. basi lati, longe subulato-acuminati, externe longe pilosi, intus pilosuli, omnes perspicue serrati, dentibus utroque latere ca. 5, subulatis; corolla flava, erecta, 3.3–3.8 cm. longa, basi non calcarata, 5.5 mm. diam., sursum in medio inflata, ca. 10 mm. diam., faucem versus contracta, hic 7 mm. diam., limbo paullo obliquo, lobo inferiore erecto, semiorbiculari, apice mucronato, lobis lateralibus rotundatis, semiorbicularibus, ca. 2.5 mm. longis et 4 mm. basi latis, erectis, lobis superioribus ex toto connatis, ca. 2.5 mm. longis, 8 mm. latis, truncatis, leviter undulatis, corollae tubo et limbo externe strigoso, intus basi pilosulo, superne glabro; stamina 4, didynama, inclusa, filamentis basi in tubum 8 mm. altum postice fissum connatis, partibus liberis parce pilosulis, declinatis, antheris liberis, connectivis orbicularibus, loculis contiguis, discretis; discus ex glandulis 5 liberis crassiusculis suborbicularibus constatus; ovarium ovoideum, longe pilosum; stylus 3 cm. longus, glaber; placentae bilamellatae, intus solum ovuliferae; fructus ignotus.—Chiriquí: valley of the upper Rio Chiriquí Viejo, vicinity of Monte Lirio, alt. 1300–1900 m., June 28, 1935, *R. J. Seibert 141* (U. S. Nat. Herb. 1,635,909, TYPE).

The nearest relationship of *Alloplectus rubida* is perhaps with *A. ichthyoderma* Hanst., but that species differs in numerous points, notably in its many-flowered, congested inflorescences, in its short peduncles (shorter than the petioles), and its much smaller, differently shaped corollas.

ACANTHACEAE[1]

Determined by E. C. Leonard (Washington)

Aphelandra Seibertii Leonard, spec. nov. Herba; caulis simplex, basi procumbens, nodis infimis radicans, pilosus; folia oblongo-elliptica, apice obtusa, basi angustata, integra vel un-

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dulata, utrinque laxe pilosa; spicae terminales, pedunculatae; bracteae imbricatae, adpressae vel demum patentes, serratae, pilosulae; bracteolae lanceolatae, acuminatae, carinatae, hirsutae; calycis laciniae lanceolatae vel subulatae, subaequales, striatae; corolla minute pubescens, flava, lobis lilacinis.

Herb up to 20 cm. high, the stem simple, ascending, rooting at the lower nodes, pilose, the hairs spreading or ascending, up to 1 mm. long; petioles 1 to 1.5 cm. long, densely pilose; leaf blades oblong-elliptic, 2 to 9 cm. long, 1.5 to 5 cm. wide, obtuse at apex, narrowed at base, entire or undulate, both surfaces thinly pilose, the costa and lateral veins (6 or 7 pairs) densely so; flowers borne in one to several terminal spikes 4 to 8 cm. long, the peduncle 3 to 5 cm. long, densely pilose, the hairs yellowish, sometimes retrorse; rachis pilose; bracts purplish at tip, closely imbricate and appressed (at length spreading), bearing above the middle on each side 2 or 3 narrow erect-spreading teeth up to 1.5 mm. long, 7-nerved, pubescent without, glabrous or minutely pubescent toward tip within; bractlets lanceolate, 8 mm. long, 1.5 mm. wide, acuminate, carinate and conduplicate subhyaline, delicately nerved, the costa hirsute, the margins sparingly ciliolate with minute capitate hairs; calyx segments subhyaline, striate-nerved, the posterior segment lanceolate, 6.5 mm. long, 1.5 mm. wide, the anterior pair narrowly lanceolate, 6.6 mm. long and 1 mm. wide, the middle pair subulate, 5.5 mm. long and 0.5 mm. wide, all sparingly ciliolate with minute capitate hairs; corolla 2 cm. long, finely and sparingly pubescent, yellow, the lobes tipped with lavender, the tube slender, 1.5 cm. long, 1.5 mm. in diameter at base, about 3 mm. at mouth, the limb about 13 mm. in diameter, the lobes rounded or emarginate; stamens slightly exserted; ovary cylindric, 2.5 mm. long, glabrous below, pilose at tip; style 17 mm. long, minutely pubescent toward base, the hairs spreading; capsules about 1 cm. long, cylindric, glabrous except for the pilose tip, 4-seeded, the valves of the capsule recurved after dehiscence; retinacula 2 mm. long, cucullate at tip; seed obovoid, acute at base, light brown, 3 mm. long, 2.5 mm. wide, bearing scattered, minute, short, thick, hair-like pro-

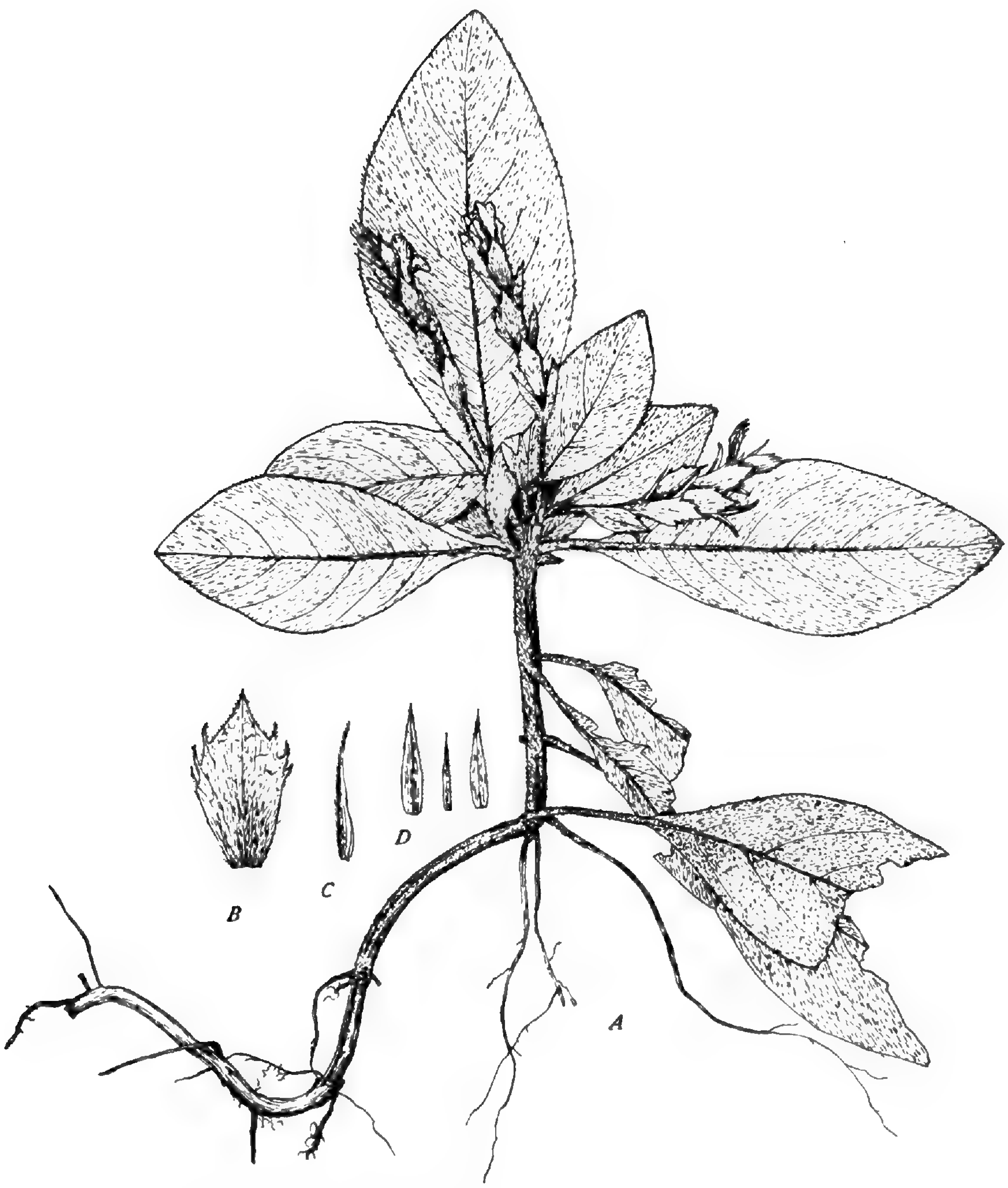

Fig. 1. *Aphelandra Seibertii* Leonard. *A*, plant, half natural size; *B*, bract; *C*, bractlet; *D*, posterior, middle, and anterior calyx segments. (*B*, *C*, *D*, twice natural size.)

jections.—Coclé: vicinity of El Valle de Antón, alt. 500–700 m., July 24, 1935, *R. J. Seibert 460* (U. S. Nat. Herb. No. 1,635,-928, TYPE).

The following additional specimens, all lacking corollas, are in the U. S. National Herbarium: Costa Rica: in wet forests, La Colombiana Farm of the United Fruit Co., alt. about 70 m., *Standley 36783, 36966;* Plaines de la Estrella, Talamanca, *Tonduz 9348.*

Although related to several South American species, *Aphelandra Seibertii* apparently has no close relatives in Central America. The shape and relationship of the corolla lobes cannot be determined satisfactorily from the scant material at hand.

RUBIACEAE

Determined by P. C. Standley (Chicago)

Appunia Seibertii Standl., spec. nov. Frutex 2-metralis ramosus, ramis gracilibus subteretibus in sicco fuscis, novellis asperulis et minutissime puberulis, internodiis 2–5.5 cm. longis; stipulae persistentes circa 7 mm. longae e basi late triangulari subulato-attenuatae adpressae; folia longiuscule petiolata firme membranacea opposita, petiolo 1–2.5 cm. longo interdum fere ad basin alato minute puberulo; lamina oblongo-lanceolata 10–15 cm. longa 2.5–5 cm. lata longe sensim attenuato-acuminata, prope basin subabrupte contracta et longe ad petiolum decurrens, supra in sicco viridis vel fusco-viridis tactu asperula et minutissime scaberula vel glabrata, costa pallida prominente, nervis manifestis sed vix elevatis, subtus paullo pallidior ubique subdense scaberulo-asperula, costa gracili elevata, nervis lateralibus utroque latere circa 9 arcuatis gracillimis angulo lato adscendentibus prope marginem arcuato-conjunctis; capitula florum in axillis supremis geminata densa pauciflora, pedunculis gracilibus 15–18 mm. longis minute scaberulis, floribus arcte sessilibus; calyx cum hypanthio 1.5 mm. longus truncatus glaber; corolla alba extus glabra circa 7 mm. longa, lobis late oblongis tubo duplo brevioribus.—Panamá: vicinity of Arenoso, lower Rio Trinidád, alt. 25–50 m., Aug. 7–10, 1935, *R. J. Seibert 624* (Herb. Field Museum, No. 814,061, TYPE; duplicate in Herb. Missouri Bot. Garden).

Of the plants collected in Panama in 1935 by Mr. R. J. Seibert only a small number were submitted to the writer for determination, but of these a high percentage consisted of very rare or otherwise interesting species. Probably the most interesting to the writer is the one here described as new, a representative of one of the smallest genera of Rubiaceae. Most of the members of the genus are natives of the Guianas and are amply distinct from the Panama plant. The only North American *Appunia* is *A. guatemalensis* Donn. Smith of Guatemala and British Honduras. Although much like *A. Seibertii* in general appearance (all the species of the genus are very similar in appearance), it is clearly different in its short-petiolate leaves, which have no trace of pubescence but instead are quite smooth to the touch.

LOBELIACEAE

Determined by F. E. Wimmer (Wien)

Centropogon diocleus E. Wimm., spec. nov. Herba erecta 2–3 m. alta. Caulis fistulosus teres inferne glaber superne hirtellus verisimiliter ramosus. Folia petiolata herbacea luteoviridia supra glabra subtus pallidiora et hirtella imprimis in nervis et venis. Nervi inferiores folii sub angulo recto superiores sub angulo fere semi-recto ascendentes. Lamina folii elliptica. interdum subovat-ovalis 8–13 cm. lg. et 5–7 cm. lt. apice subacuminata et obtusa ad basin subrotundata et in petiolum alatum acuminata margine undulato-dentata et callose denticulata. Petiolus subcrassus hirtellus cr. 1.5 cm. lg. Flores solitarii in axillis foliorum superiorum. Pedicelli hirtelli 4.0–4.5 cm. longi cr. 1.5 cm. supra basin bracteolis 2 oppositis sublinearibus 0.7 cm. longis ornati. Hypanthium depresso-globosum hirtellum. Sepala triangulari-linearis erecta 3–5-nervia subhirtella 1.4–1.6 cm. longa et basi 0.3–0.4 cm. lata; sinus inter ea acuta. Corolla rosea subhirtella 3.0–3.5 cm. lg. et ad faucem inflatam cr. 1.0 cm. in diam.; lobi corollae triangulares falcati 0.4–0.7 cm. lg. et basi 0.4 cm. lt. Filamentorum tubus glaber ad apicem parce pubescens; antherarum tubus fuscus 0.7 cm. lg. et 0.3 cm. lt. subglaber; antherae 2 inferiores cornutae. Bacca depresso-globosa cr. 1.2 cm. in diam. Semina subglobosa subcompressa cinereo-fusca vix 0.1 cm. lg. —Chiriquí: valley of Rio Chiriquí Viejo, vicinity of Monte Lirio, District of Bugaba, along stream bank, alt. 1500 m., June 27, 1936, *R. J. Seibert 166* (Herb. Naturhist. Mus. Wien, TYPE; Herb. Missouri Bot. Garden, ISOTYPE).

COMPOSITAE

Determined by S. F. Blake (Washington)

Polymnia maculata Cav. Chiriquí: in clearings, valley of the upper Rio Chiriquí Viejo *(Seibert 292)*. Previously known from southern Mexico.

A PRELIMINARY LIST OF THE LICHENS OF CENTRAL MISSOURI, WITH ECOLOGICAL NOTES

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This investigation was started at the University of Missouri as a preliminary list of the lichens of Boone County, Mo. At the Henry Shaw School of Botany it was extended to include nine other counties, and was conducted as a graduate research problem under the direction of Dr. C. W. Dodge. I am indebted to Dr. G. T. Moore for the facilities afforded by the herbarium and the excellent lichen library of the Missouri Botanical Garden. I am further indebted for the many courtesies extended by the staff; and especially to Dr. C. W. Dodge for helpful advice.

The nomenclature used in this paper is that of Fink,[1] except for the family Teloschistaceae, where that of Hillmann[2] was followed. No attempt is made to settle questions of nomenclature or to give synonymy. Permanent slides of sections through the apothecia and thalli were made, and the determinations of the species checked with authentic herbarium material when this was possible. A duplicate set of specimens has been deposited in the Herbarium of the Missouri Botanical Garden.

At the time the collections were made complete notes were taken of the ecological relation and habitat of each species. Lichens respond readily to any change in environment. The effect of sunlight on their abundance and fertility is notable. In the heavily wooded sections of the area studied, species belonging to the families Parmeliaceae, Physciaceae, Caloplacaceae, Graphidaceae, and Teloschistaceae are rare and usually

[1] Fink, Bruce. The lichen flora of the United States. Completed for publication by J. Hedrick. Ann Arbor, 1935.

[2] Hillmann, von Johannes. Teloschistaceae. In L. Rabenhorst's Kryptogamen-Flora 9: 6. Abt. Lief. 1. 1935.

Issued April 30, 1937.

sterile when they inhabit bark. The same species are very abundant and usually fertile when growing on trees of partly cleared fields or wooded pastures in the same neighborhood. Sunlight rather than moisture seems to be the chief factor in their development. The influence of sunlight on both fertility and development of the yellow pigment is definitely shown in *Xanthoria parietina* and *Caloplaca microphylina.* Where these lichens partly encircle a tree they will be bright yellow on the south side of the tree and green on the shaded side, demonstrating their inability to form the lichen-acid parietin in reduced sunlight. *Dermatocarpon miniatum, Pannaria rubiginosa* var. *lanuginosa,* and *Sticta quercizans* are species in which the amount of moisture is more nearly a limiting factor than the amount of sunlight. *Dermatocarpon miniatum* is one of the lichens occurring in each of the counties studied. It always grows attached to rocks in moist shaded places, and in a few instances it has been collected on the north face of a bluff where the light of the sun never reaches it.

The harmful effect of the gases of coal smoke on lichens is well known, but they are also injured by the gases from wood smoke even in relatively small amounts. In many of the wooded pastures, where it is the common practice to burn off the covering of leaves and dead grass during the early spring, lichens are definitely rarer and much less well developed than in adjoining areas which are not subject to burning. The injury could not be due to heat, except to lichens on the ground or on the bases of the tree trunks, for these fires are never large. Moreover, species like *Parmelia Borreri, P. rudecta,* and *Physcia astroidea* which normally form associations reaching from ten to fifteen feet above the surface of the ground, show definite injury.

The most favorable locality in this region for finding fertile species has been the wooded bluffs of the larger streams. These bluffs naturally furnish a variety of light and moisture conditions and also are little grazed by stock, and are well removed from the destructive influences of smoke. The stability of the substrate also determines to a large measure the abundance of the lichen flora. Crumbling stones, trees which shed their bark in small flakes or granules, and loose soil furnish a poor habitat. Many of the saxicolous lichens show a definite preference for certain types of rocks. There is no evidence that lichens prefer any particular species of tree. Those found on soil that has recently been disturbed are of the rapid-growing kind, like *Cladonia pyxidata.*

The principal habitats of lichens in this area, together with their associations, have been noted under the eleven groups which follow:

CHERT AND FLINT ROCKS

Boone, Cole, Gasconade, and Washington Counties have many localities where erosion has removed the less resistant materials and left chert and flint rocks exposed. These rocks furnish a substrate suitable to a few species of lichens and are the only rock substrate which is not observably penetrated or marked by the hyphae or rhizoids of the lichen. The lichens found on flint and chert are: *Acarospora citrina, Parmelia Borreri, P. hypotropa, P. saxatilis, Dermatocarpon miniatum, Rhizocarpon geographicum,* and *R. concentricum.* However, there were so few that they could hardly be referred to as an association.

SANDSTONE LEDGES AND ROCKS

In scattered localities throughout each of the counties studied sandstone appears as isolated outcrops and ledges. When the sandstone is soft and easily weathered it supports a very meager lichen flora. When the matrix cementing the quartz grains is of calcareous material, the hyphae of the lichen may penetrate the surface of the stone to a depth of two centimeters. This is particularily noticeable with *Parmelia saxatilis.* When the matrix is an iron oxide there is but little penetration of the surface of the stone, but the solid surface supports a more varied lichen growth. Associations on sandstone are: *Parmelia saxatilis, P. Borreri, P. hypotropa, P. rudecta,* and *Lecidea turgidula. Parmelia saxatilis* usually dominates the association and at times crowds out the other species.

LIMESTONE LEDGES AND ROCKS

Limestone is the most common type of rock in this region. There is hardly a locality without its appearance as bluffs, ledges, or loose rock. It supports a more varied lichen flora than any other substrate except the bark of living trees.

There are two very definite associations of lichens found on limestone: the bluffs of rivers and larger streams, and ledges in dry upland woods. The association for the bluffs is: *Lecanora muralis, L. melanophthalma, Acarospora glaucocarpa, Lecidea cinnabarina, L. auriculata,* and *L. perproxima,* with *Lecanora muralis* dominating.

The ledges in dry upland woods usually have *Parmelia saxatilis* as a dominant. The association is: *Parmelia saxatilis, P. caperata, P. rudecta, Physcia lithotodes,* and *P. hispida. Verrucaria calciseda* and *Dermatocarpon miniatum* are both to be found on limestone, but in damp shaded situations not favorable to the growth of the common associations.

SOIL OF MOIST WOODS

The soil of moist woods furnishes a habitat for the *Cladonia* association in which *Cladonia pyxidata* is usually dominant. *Peltigera canina* often appears but never in sufficient numbers to dominate. The association is: *Cladonia pyxidata, Cl. apodocarpa, Cl. cariosa, Cl. foliacea, Cl. bellidiflora,* and *Cl. fimbriata.*

SOIL OF DRY, ROCKY, WOODED HILLS

Cladonia furcata var. *racemosa* is usually the dominant species found on the dry, rocky, wooded hills. The association is: *Cladonia furcata* var. *racemosa, Cl. furcata* var. *pinnata, Cl. alpestris, Cl. cristatella,* and *Cl. pyxidata.*

SOIL OF GLADES AND ABANDONED FIELDS

The soil of glades and abandoned fields does not support a very abundant lichen flora. There was no locality in which it was possible to consider the lichens an association. *Cladonia pyxidata* is the most common species. *Dermatocarpon rufes-*

cens occurs frequently in small raised clumps. *Synechoblastus fascicularis* is also occasionally found but never in abundance.

BEDS OF SEASONAL WATER COURSES

The rocky beds of water courses which carry water only after rains furnish a habitat for an association in which *Lecidea cinnabarina* is usually dominant. The association is: *Lecidea cinnabarina, L. turgidula,* and *Verrucaria calciseda.*

TRUNKS OF TREES IN DRY SUNNY WOODS

The trunks of trees in dry, sunny woods support the most varied lichen flora of the entire region. There may be a colony of only one species or an association of as many as fourteen species on the same tree trunk. The most common association is: *Parmelia rudecta, P. Borerri, Physcia astroidea.* In the prairie sections of Boone, Cole, and Johnson Counties it is: *Parmelia rudecta, P. hypotropa, Caloplaca microphylina, Xanthoria parietina, Physcia astroidea,* and *Pertusaria marginata.*

SHADED TREE TRUNKS

The lichen flora of the shaded tree-trunks is generally meagre. The lichens associated in this habitat are: *Graphis scripta, Lecidea flexuosa, Catillaria Laureri,* and *Pannaria rubiginosa* var. *lanuginosa.* On the bark of the trees there is usually a luxuriant growth of *Protococcus viridis.*

DEAD TREES AND OLD WOOD

The lichen flora of trees that have recently died is very similar to that of the living trees in the same locality. When wood such as dead trees, fences, and buildings remains for a considerable time without decay there are usually definite associations of lichens formed. The most common of these is: *Lecidea cinnabarina, Cladonia santensis, Cl. squamosa, Cl. fimbriata* var. *subulata,* and *Cl. fimbriata* var. *coniocraea. Lecidea cinnabarina* is the dominant form, and *Parmelia rudecta* occurs occasionally.

DECAYING WOOD

Wood which is definitely rotting furnishes a habitat for a small *Cladonia* association: *Cladonia cariosa, Cl. cariosa* var. *cribrosa, Cl. delicata,* and *Cl. pyxidata.*

The species of lichens here presented are from approximately one thousand collections made in central Missouri from the ten following counties: Boone, Callaway, Cole, Franklin, Gasconade, Jefferson, Johnson, Lincoln, St. Louis, and Washington, during the years 1930 to 1937. All of these counties are on or near the northern border of the Ozark Plateau. The geological and physiographic description of this region is given by Marbut.[3]

VERRUCARIACEAE

VERRUCARIA SUBMURALIS Nyl.

Limestone ledges in open situations. Boone: Columbia, *Berry 314;* Rocheport, *Berry 335;* Johnson: Warrensburg, *Berry 359.*

VERRUCARIA SORDIDA Fink

Limestone ledges in open situations. Jefferson: Rush Tower, *Berry 437.*

VERRUCARIA NIGRESCENS Pers.

Limestone ledges in open situations. Boone: Columbia, *Berry 245, 263, 274.*

VERRUCARIA NIGRESCENTOIDEA Fink

Limestone ledges in open situations. Boone: Columbia, *Berry 246;* Rocheport, *Berry 339.*

VERRUCARIA CALCISEDA Lam. & DC.

Limestone ledges in open situations. Boone: Columbia, *Berry 291;* Jefferson: Rush Tower, *Berry 436;* Festus, *Berry 529;* De Soto, *Berry 451;* St. Louis: Creve Coeur Lake, *Berry 609;* Ranken Estate, *Berry 731;* Washington: Big River, *Berry 489.*

DERMATOCARPACEAE

DERMATOCARPON MINIATUM (L.) Mann.

Surface of limestone rocks in moist, shaded localities. Boone: Columbia, *Berry 215, 264, 311;* Ashland, *Drouet 382D;* Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 689, 714;* Port Royal, *Hubricht 795H;* Jefferson: Rush Tower, *Berry 455;* Crystal City, *Hubricht 784H;* Festus, *Berry 516;* Lincoln: Chantilly, *Hubricht 766H;* St. Louis: Creve Coeur Lake, *Berry 595.*

DERMATOCARPON MINIATUM (L.) Mann. var. COMPLICATUM (Lightf.) Th. Fries

On rocks in moist localities. Callaway: Fulton, *Bartley 319B.*

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[3] Marbut, C. F. Physical features of Missouri. Mo. Geol. Surv. 10: 11–110. *pl. 2.* 1896.

DERMATOCARPON RUFESCENS (Ach.) Th. Fries

On soil and occasionally rocks in undisturbed places. Boone: Rocheport, *Berry 321;* Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 672, 707, 757; Cutler 582C;* Jefferson: Festus, *Berry 535;* Rush Tower, *Berry 427, 458.*

PYRENULACEAE

LEPTORHAPHIS EPIDERMIDIS (Ach.) Th. Fries

Sandstone ledges in bed of seasonal water course. Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 648.*

PYRENULA NITIDA (Weig.) Ach.

Bark of trees. Boone: Columbia, *Berry 310.*

CYPHELIACEAE

CYPHELIUM TIGILLARE Ach.

On fence posts and the bark of various species of trees. Boone: Columbia, *Berry 76, 256, 267, 301.*

ARTHONIACEAE

ARTHONIA COMPLANATA Fée

Bark of trees in open woods. Lincoln: Chantilly, *Hubricht 780H.*

ARTHOTHELIUM HALLII (Tuck.) Zahlbr.

Bark of trees in open woods. St. Louis: Centaur Station, *Hubricht 815H.*

GRAPHIDACEAE

GRAPHIS EULECTRA Tuck.

Bark of trees in open woods. Boone: Rock Bridge, *Berry 224.*

GRAPHIS SCRIPTA (L.) Ach.

On trees having smooth bark and in well-lighted situations. Boone: Columbia, *Berry 297, 305;* Rocheport, *Berry 326;* Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 699;* Port Royal, *Hubricht 797H;* Jefferson: Crystal City, *Hubricht 824H;* Johnson: Warrensburg, *Berry 365;* St. Louis: Ranken Estate, *Berry 747.*

EPHEBACEAE

EPHEBE LANATA (L.) Vainio

On moist surface of limestone rocks and damp soil in shady places. Boone: Rock Bridge, *Berry 211.*

PYRENOPSIDACEAE

THYREA PULVINATA (Schaer.) Mass.

On the surface of limestone ledges in sheltered positions. Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 662, 663.*

LICHINACEAE

PTERYGIUM PETERSII (Tuck.) Nyl.

On sandstone ledges and rocks. Jefferson: Festus, *Berry 504.*

COLLEMACEAE

Synechoblastus fasciculariS (L.) A. L. Smith

On moist soil in sheltered locations. Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Cutler 640C;* Port Royal, *Hubricht 798H;* Jefferson: Festus, *Berry 549;* St. Louis: Creve Coeur Lake, *Berry 611, 613, 638.*

Collema furvum (Ach.) DC.

On moist limestone rocks. Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 664.*

Collema granosum (Schreb.) Rabh.

On rocks in shaded places. Boone: Ashland, *Drouet 388D;* Johnson: Warrensburg, *Berry 387.*

Leptogium saturninum (Dicks.) Nyl.

On moist rocks. Jefferson: Crystal City, *Hubricht 784H.*

PANNARIACEAE

Pannaria rubiginosa (Thunb.) Del. var. lanuginosa (Hoffm.) Zahlbr.

On sheltered limestone ledges and the base of trees. Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 673, 679;* Jefferson: Rush Tower, *Berry 417, 456;* St. Louis: Ranken Estate, *Berry 731.*

Pannaria lurida (Mont.) Nyl.

Bark of trees in open woods. Franklin: Gerald, *Berry 568.*

STICTACEAE

Sticta fuliginosa (Dicks.) Ach.

Stone ledges of wooded bluffs. Jefferson: Crystal City, *Hubricht 820H.*

Sticta quercizans Ach.

On moss-covered rocks and tree trunks. Boone: Columbia, *Berry 273;* Franklin: Gerald, *Berry 758;* Jefferson: Crystal City, *Hubricht 785H;* Festus, *Berry 533.*

PELTIGERACEAE

Peltigera horizontalis (Huds.) Baumg.

On moist moss-covered soil in woods. Boone: Columbia, *Berry 298;* Ashland, *Berry 234, Drouet 320D, 384D.*

Peltigera rufescens (Weis) Humb.

On moss-covered soil. Boone: Columbia, *Berry 303.*

Peltigera canina (L.) Willd.

On moss-covered soil in open woods. Boone: Silver Fork, *Berry 346;* Columbia, *Berry 301;* Ashland, *Drouet 381D;* Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 643, 718;* Gasconade: Mt. Sterling, *Berry 554;* Jefferson: Festus, *Berry 512;* Rush Tower, *Berry 428;* Lincoln: Chantilly, *Hubricht 765H.*

LECIDEACEAE

Lecidea cinnabarina Fée

On limestone rocks in full sunlight. Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 710, 758;* Jefferson: Festus, *Berry 520, 536, 540;* Rush Tower, *Berry 424;* St. Louis: Creve Coeur Lake, *Berry 601.*

LECIDEA TURGIDULA E. Fries

On sandstone ledges in open woods. Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 721.*

LECIDEA TESSELLINA Tuck.

On limestone rocks in full sunlight. Boone: Columbia, *Berry 238;* Rocheport, *Berry 329, 337.*

LECIDEA AURICULATA Th. Fries

On limestone rock in glades. Jefferson: Crystal City, *Hubricht 793H.*

LECIDEA FLEXUOSA (E. Fries) Nyl.

Bark of trees in open woods. Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 652.*

CATILLARIA LAURERI Hepp.

Bark of trees in open woods. Washington: Big River, *Berry 484.*

RHIZOCARPON CONCENTRICUM (Davies) Beltr.

On limestone and chert rocks. Boone: Columbia, *Berry 313;* Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 683.*

RHIZOCARPON GEOGRAPHICUM (L.) Lam. & DC.

On limestone rocks. Boone: Columbia, *Berry 163;* Ashland, *Drouet 373D; Henning 232H.*

CLADONIACEAE

CLADONIA ALPESTRIS (L.) Rabenh.

On soil of dry rocky hillsides. Boone: Columbia, *Berry 366;* Callaway: Fulton, *McVeigh 376M;* Montgomery: Mineola, *Rickett 225R.*

CLADONIA MACILENTA Hoffm.

On soil. Jefferson: Festus, *Berry 509.*

CLADONIA DIDYMA (Fée) Vainio

On soil in sheltered places. Jefferson: Festus, *Berry 497.*

CLADONIA BELLIDIFLORA (Ach.) Schaer.

On soil of wooded hillsides. Boone: Columbia, *Berry 266.*

CLADONIA CRISTATELLA Tuck.

On decayed wood and soil. Boone: Ashland, *Drouet 372D;* St. Louis: Ranken Estate, *Berry 749.*

CLADONIA CRISTATELLA Tuck. var. DENSISSIMA Fink

On soil on sandstone bluffs. Jefferson: Festus, *Berry 500.*

CLADONIA FURCATA (Huds.) Schrad. var. RACEMOSA (Hoffm.) Floerke

On soil of dry rocky hillsides. Boone: Columbia, *Berry 282, 307, 316;* Johnson: Warrensburg, *Berry 204.*

CLADONIA FURCATA (Huds.) Schrad. var. PINNATA (Floerke) Vainio

On soil of dry upland woods. Gasconade: Mt. Sterling, *Berry 827.*

CLADONIA SANTENSIS Tuck.

Decaying logs and soil in open woods. Jefferson: Rush Tower, *Berry 421.*

CLADONIA CRISPATA (Ach.) Flot.

Decaying wood and soil of open woods. Boone: Columbia, *Berry 248.*

CLADONIA SQUAMOSA (Scop.) Hoffm.

On soil and decaying wood. Boone: Ashland, *Drouet 251D;* Columbia, *Berry 254, 281, 287, 288, 379;* Rock Bridge, *Berry 156.*

CLADONIA SQUAMOSA (Scop.) Hoffm. var. MULTIBRACHIATA (Floerke) Vainio

On soil of dry wooded hills. St. Louis: *Berry 623.*

Cladonia squamosa (Scop.) Hoffm. var. phyllocoma (Rabenh.) Vainio

On sandy soil in open woods. Jefferson: Festus, *Berry 496.*

Cladonia delicata (Ehrh.) Floerke

On old and decaying wood. Boone: Columbia, *Berry 370.*

Cladonia apodocarpa Robbins

On soil of dry upland woods. Callaway: Fulton, *McVeigh 377M;* Franklin: Gerald, *Berry 581.*

Cladonia cariosa (Ach.) Spreng.

On soil of open woods. Jefferson: Crystal City, *Hubricht 790H.*

Cladonia cariosa (Ach.) Spreng. f. cribrosa (Wallr.) Vainio

On soil of wooded hillsides. Jefferson: Rush Tower, *Berry 430.*

Cladonia pyxidata (L.) Hoffm.

On soil of abandoned fields and open woods. Boone: Ashland, *Henning 233H;* Columbia, *Berry 7, 236, 256, 281, 287, 289, 315, 343, 368;* Jefferson: Crystal City, *Hubricht 791H;* Festus, *Berry 495, 501; Seibert 513S;* Rush Tower, *Berry 426, 432, 439;* Johnson: Warrensburg, *Berry 199, 364;* Washington: Big River, *Berry 480, 481.*

Cladonia fimbriata (L.) E. Fries

On soil and decaying wood. Boone: Ashland, *Drouet 374D.*

Cladonia fimbriata (L.) E. Fries var. subulata (L.) Vainio

On soil and decaying wood. Boone: Columbia, *Berry 242, 278, 309.*

Cladonia fimbriata (L.) E. Fries var. coniocraea (Floerke) Vainio

On soil and decaying wood. Boone: Columbia, *Berry 260, 262, 276, 280, 342.*

Cladonia pityrea (Floerke) E. Fries

On soil in open woods. Jefferson: Festus, *Berry 511.*

Cladonia pityrea (Floerke) E. Fries f. phyllophora (Mudd) Vainio

On soil of dry wooded hills. St. Louis: Valley Park, *Berry 634.*

Cladonia foliacea (Huds.) Schaer.

On soil of dry wooded hills. Jefferson: Crystal City, *Hubricht 789H;* Rush Tower, *Berry 420, 454, 457;* Lincoln: Chantilly, *Hubricht 781H;* St. Louis: Valley Park, *Berry 622, 632, 636;* Washington: Big River, *Berry 485.*

Cladonia caespiticia (Pers.) Floerke

On soil and decayed wood. Boone: Columbia, *Berry 171.*

ACAROSPORACEAE

Biatorella fossarum (Nyl.) Th. Fries

On bark at the base of trees in open woods. Cole: Jefferson City, *Berry 553.*

Acarospora citrina (Tayl.) Zahlbr.

On rock ledges in open situations. Boone: Columbia, *Berry 247.*

Acarospora glaucocarpa (Ach.) Koerb. var. verrucosa (Anzi) Magn.

On soil at the top of limestone bluffs and in undisturbed glades. St. Louis: Creve Coeur Lake, *Berry 605.*

PERTUSARIACEAE

Pertusaria multipuncta (Turn.) Nyl.

Bark of trees in well-lighted woods. Boone: Columbia, *Berry 304;* Franklin: Gerald, *Berry 563, 571;* Gasconade: Mt. Sterling, *Berry 558;* Lincoln: Chantilly, *Hubricht 774H.*

PERTUSARIA VELATA (Turn.) Nyl.
Bark of trees in open woods. Franklin: Gerald, *Berry 561.*

PERTUSARIA TETRATHALAMIA (Fée) Nyl.
Bark of trees in open woods. Johnson: Warrensburg, *Berry 832;* St. Louis: Ranken Estate, *Berry 735.*

PERTUSARIA PUSTULATA (Ach.) Duby
Bark of trees in open woods. Boone: Columbia, *Berry 312.*

PERTUSARIA LEIOPLACA (Ach.) Lam. & DC.
Bark of trees in open woods. Jefferson: Crystal City, *Hubricht 825H.*

PERTUSARIA MARGINATA Nyl.
Bark of trees in open woods. St. Louis: Centaur Station, *Hubricht 814H.*

PERTUSARIA PERTUSA (L.) Tuck.
Bark of trees in open upland woods. Washington: Big River, *Berry 486.*

LECANORACEAE

LECANORA SAMBUCI (Pers.) Nyl.
Bark of trees. Washington: Big River, *Berry 476.*

LECANORA PALLIDA (Schreb.) Rabnh.
Bark of trees. St. Louis: Centaur Station, *Hubricht 800H.*

LECANORA MELANOPHTHALMA (Lam. & DC.) Ramond
On limestone rocks in full sunlight. Jefferson: Crystal City, *Hubricht 794H.*

LECANORA THAMNOPLACA Tuck.
On limestone rocks. Boone: Rocheport, *Berry 339.*

LECANORA VERSICOLOR (Pers.) Ach.
On limestone rocks in the bed of seasonal streams. Boone: Columbia, *Berry 306.*

LECANORA MURALIS (Schreb.) Rabnh.
On limestone rocks in full sunlight. Boone: Rocheport, *Berry 331, 334.*

OCHROLECHIA TARTAREA (L.) Mass.
Bark of trees. Jefferson: Festus, *Berry 507.*

LECANIA SYRINGEA (Ach.) Th. Fries
Bark of trees. Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 688.*

LECANIA SYRINGEA (Ach.) Th. Fries var. DIMERA (Nyl.) Oliv.
Bark of trees. Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 694.*

LECANIA PERPROXIMA (Nyl.) Zahlbr.
Limestone ledges. Lincoln: Chantilly, *Hubricht 764H.*

CANDELARIELLA AURELLA (Hoffm.) Zahlbr.
Limestone ledges on open hillsides. Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 703.*

PARMELIACEAE

PARMELIA RUDECTA Ach.
Bark of trees and rarely on stones or old wood. Boone: Ashland, *Drouet 392, 394, 395;* Columbia, *Berry 3, 203, 208, 217, 218, 221, 282, 384;* Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 448, 690, 693, 698, 708, 713;*

Gerald, *Berry 570;* Jefferson: De Soto, *Berry 463;* Rush Tower, *Berry 415, 416, 434, 435, 445, 449;* Crystal City, *Hubricht 787H;* Lincoln: Chantilly, *Hubricht 772H;* St. Louis: Centaur Station, *Hubricht 818H;* Creve Coeur Lake, *Berry 586, 591, 598, 599;* Ranken Estate, *Berry 750;* Valley Park, *Berry 618, 628;* Washington: Big River, *Berry 461, 462, 465, 466.*

PARMELIA BORRERI Turn.

Bark of trees and occasionally on rocks. Boone: Ashland, *Berry 352;* Columbia, *Berry 4, 5, 101, 103, 210, 219, 222, 347;* St. Louis: Creve Coeur Lake, *Berry 583, 588;* Ranken Estate, *Berry 736;* Valley Park, *Berry 629.*

PARMELIA HYPOTROPA Nyl.

Bark of trees and on rocks. Boone: Columbia, *Berry 231, 240;* Rocheport, *Berry 322, 399.*

PARMELIA PHYSODES (L.) Ach.

Bark of trees in well-lighted woods. Boone: Columbia, *Berry 102, 169.*

PARMELIA PERTUSA (Schrank) Schaer.

Bark of trees and occasionally on rocks. Boone: Columbia, *Berry 285, 390, 391.*

PARMELIA CETRATA Ach.

Bark of trees, rarely on rocks. Boone: Columbia, *Berry 201, 227, 340.*

PARMELIA SAXATILIS (L.) Ach.

On rocks and the bark of trees, in well-lighted places. Boone: Columbia, *Berry 300;* Callaway: Fulton, *McVeigh 385M;* Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 577, 644, 649, 653.*

PARMELIA FRONDIFERA Merrill

Bark of trees. Boone: Ashland, *Drouet 396D.*

PARMELIA SUBRUGATA Nyl.

On bark of trees and rocks. Boone: Ashland, *Drouet 408D;* Columbia, *Berry 397;* Johnson: Warrensburg, *Berry 398;* Washington: Big River, *Berry 471.*

PARMELIA PERFORATA (Wulf.) Ach.

Bark of tree in open woods. Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 676, 720;* Gasconade: Mt. Sterling, *Berry 557;* Washington: Big River, *Berry 471.*

PARMELIA SUBLAEVIGATA Nyl.

On trees and rocks. Boone: Ashland, *Berry 299, Drouet 404D.*

PARMELIA QUERCINA (Willd.) Vainio

Bark of trees in upland woods. St. Louis: Ranken Estate, *Berry 739, 742;* Valley Park, *Berry 625.*

PARMELIA COLPODES (Ach.) Nyl.

Bark of trees. Franklin: Gerald, *Berry 578;* Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 691;* Gasconade: Mt. Sterling, *Berry 579.*

PARMELIA CAPERATA (L.) Ach.

On bark of trees and rocks. Franklin: Gerald, *Berry 575;* Gasconade: Mt. Sterling, *Berry 565.*

PARMELIA OLIVACEA (L.) Ach.

Limestone ledges in open woods. Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 754.*

USNEACEAE

USNEA FLORIDA (L.) Web.

On the bark of trees and rarely on rocks. Boone: Ashland, *Drouet 382D, 407D;* Columbia, *Berry 285;* Washington: Big River, *Berry 829.*

CALOPLACACEAE

CALOPLACA AURANTIACA (Lightf.) Th. Fries

Bark of trees. Boone: Columbia, *Berry 255.*

CALOPLACA MICROPHYLLINA (Tuck.) Hasse

Bark of trees in well-lighted situations. Boone: Columbia, *Berry 208;* Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 695, 722;* St. Louis: Creve Coeur Lake, *Berry 787;* Ranken Estate, *Berry 729;* Valley Park, *Berry 637;* Lincoln: Chantilly, *Hubricht 768H.*

CALOPLACA GALACTOPHYLLA (Tuck.) Zahlbr.

On limestone rocks. Boone: Ashland, *Berry 243;* Columbia, *Berry 306;* Rocheport, *Berry 330.*

TELOSCHISTACEAE

XANTHORIA PARIETINA (L.) Th. Fries

On bark of trees in well-lighted situations. Boone: Columbia, *Berry 2, 9, 45, 200, 202, 223, 231, 409.*

XANTHORIA POLYCARPA (Ehrh.) Rieber

On bark of trees. Boone: Ashland, *Berry 349;* Columbia, *Berry 105.*

BUELLIACEAE

BUELLIA PARASEMA (Ach.) De Not.

Bark of trees in sunny woods. Washington: Big River, *Berry 474.*

BUELLIA PUNCTATA (Hoffm.) Mass.

Bark of trees. Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 642;* St. Louis: Ranken Estate, *Berry 741.*

BUELLIA COLLUDENS (Nyl.) Arn.

Surface of stones in full sunlight. Jefferson: Festus, *Berry 503.*

BUELLIA PULLATA Tuck.

Surface of stones in dry, well-lighted situations. Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 658.*

RINODINA KENTUCKYENSIS Fink

Surface of sandstone rocks and ledges. Jefferson: Festus, *Berry 493, 517.*

RINODINA ATERRIMA Krempelh.

Surface of limestone rocks. Jefferson: Rush Tower, *Berry 833.*

PHYSCIACEAE

PYXINE SOREDIATA (Ach.) E. Fries

Bark of trees. Jefferson: Rush Tower, *Berry 444;* DeSoto, *Berry 450;* St. Louis: Creve Coeur Lake, *Berry 584, 589;* Valley Park, *Berry 616, 617, 626;* Washington: Big River, *Berry 468, 584, 589.*

PHYSCIA ADGLUTINATA (Floerke) Nyl.

Bark of trees in sunny woods. Boone: Ashland, *Berry 109;* Columbia, *Berry 244, 403;* Cole: Jefferson City, *Berry 552;* St. Louis: Centaur Station, *Hubricht 816H.*

PHYSCIA TERETIUSCULA (Ach.) Lynge

On rocks and occasionally on the bark of trees. Franklin: Port Royal, *Hubricht 826H;* Gasconade: Rosebud, *Berry 564.*

PHYSCIA CAESIA (Hoffm.) Hampe

On bark of trees in open woods. Boone: Ashland, *Drouet 402D;* Columbia, *Berry 400;* Rocheport, *Berry 328;* Johnson: Warrensburg, *Berry 615.*

PHYSCIA ASTROIDEA (Clem.) Nyl.

Bark of trees in well-lighted situations. Boone: Ashland, *Drouet 401, 405;* Columbia, *Berry 4, 103, 105, 203, 216, 225, 389, 410;* Rocheport, *Berry 324;* Jefferson: Rush Tower, *Berry 423;* Johnson: Warrensburg, *Berry 228;* St. Louis: Valley Park, *Berry 618;* Washington: Big River, *Berry 831.*

PHYSCIA VIRELLA (Ach.) Flagey

Bark of trees. Boone: Columbia, *Berry 220, 261;* Easley Post Office, *Berry 205;* Franklin: Port Royal, *Hubricht 802H;* Jefferson: Crystal City, *Hubricht 823H.*

PHYSCIA ENDOCHRYSEA (Hampe) Nyl.

On rocks and bark of trees. Boone: Rocheport, *Berry 341;* Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 671.*

PHYSCIA LITHOTODES Nyl.

On rocks and bark of trees in well-lighted woods. Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 665, 667, 669.*

PHYSCIA STELLARIS (L.) Nyl.

Bark of trees in well-lighted woods. Boone: Columbia, *Berry 304;* Cole: Jefferson City, *Berry 830;* Franklin: Gerald, *Berry 572, 576;* Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 668, 675;* Gasconade: Mt. Sterling, *Berry 568;* Johnson: Warrensburg, *Berry 614;* Lincoln: Chantilly, *Hubricht 776H;* St. Louis: Valley Park, *Berry 828;* Washington: Big River, *Berry 475, 477, 478.*

PHYSCIA PULVERULENTA (Schreb.) Nyl.

On limestone ledges and rocks in open well-lighted woods. Boone: Ashland, *Drouet 417D;* Columbia, *Berry 271, 275.*

PHYSCIA HISPIDA Schreb.

On the surface of sandstone ledges in open upland woods. Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 674, 728.*

PHYSCIA TRIBACIA (Ach.) Nyl.

On bark of trees. Boone: Ashland, *Berry 108;* Columbia, *Berry 1, 2, 104;* Franklin: Gray Summit, Mo. Bot. Gard. Arboretum, *Berry 706;* St. Louis: Valley Park, *Berry 620.*

ANAPTYCHIA HYPOLEUCA (Mühlb.) Mass.

On bark of trees in open woods. Washington: Big River, *Berry 473.*

STUDIES IN GRINDELIA. III[1]

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History of the Genus

In 1804 Sessé introduced seeds from Mexico to the Royal Gardens at Madrid where they were grown in 1805 under the name of *Aster spathulatus* Hort. Seeds from these plants were sent to the Montpellier Garden (Hortus Monspeliensis), and from plants grown there were distributed to various botanical gardens. Willdenow, of the Berlin Botanical Garden, received some from Professor Broussonet of Montpellier in the spring of 1806 under the name of *Aster spathularis.* When the plants flowered and matured fruit during the summer of 1807, Willdenow observed that they differed from *Inula,* under which Persoon[2] had identified them, and from *Aster* (the only genera known to him at the time with which his plants might have shown relation). Accordingly he described[3] from them a new genus, *Grindelia,* in honor of Professor Grindel of Dorpat, and named the particular plant *Grindelia inuloides.*

Previously, in 1793, Cavanilles[4] had described and illustrated an *Aster glutinosus* based upon plants he had seen in flower in the Royal Gardens at Madrid, and stated that they had come originally from Mexico. Although the ligules were yellow, a character at variance with *Aster* but in common with *Inula,* he decided that color alone should not serve as a criterion in distinguishing genera of Compositae. He regarded the nature of the base of the anther as of more fundamental impor-

[1] This, the third installment of studies in *Grindelia,* is a continuation of the monographic work which was carried on at the Henry Shaw School of Botany while the author was engaged in a comprehensive study of the genus.

[2] Persoon, C. H. Syn. Pl. **2**: 451. 1807.

[3] Willdenow, C. L. Ges. Nat. Fr. Berlin Mag. **1**: 260. 1807.

[4] Cavanilles, A. J. Ic. et Descr. Pl. Hisp. **2**: 53. *pl. 168.* 1793.

tance. The fact that the anthers were entire at the base as in *Aster* rather than bisetose as in *Inula* led him to place the species under *Aster.*

Willdenow[3] observed that Cavanilles[4] had figured the ray florets of *Aster glutinosus* without pappus bristles, although he did not mention this point in his description. No species of *Aster* (except a few with pinnate leaves) were known at that time to possess yellow flowers, and this fact, together with the absence of pappus bristles on the ray flowers, led him to place the plant in the genus *Doronicum* and to publish it as *Doronicum glutinosum.*[5] Between 1800 and 1807 seeds of *Aster glutinosus* had been grown in the various botanical gardens of Europe and Great Britain. During this time Willdenow had examined living plants and found that all the florets possessed pappus bristles. This led him to reconsider his identification, with the result that in 1807 he placed[6] the plant with *Aster* as Cavanilles originally had done. Persoon,[7] in his 'Synopsis Plantarum' in 1807, treated *Aster glutinosus* and *Grindelia inuloides* as congeneric with *Inula* and described them respectively as *Inula glutinosa* and *I. serrata.*

In 1813 Nuttall[8] published without description a generic name, *Thuraria,* which proved later to be congeneric with *Grindelia.* Robert Brown,[9] the same year, recognizing that *Doronicum glutinosum (Aster glutinosus)* had no relationship with either *Doronicum* or *Aster,* erected for it a new genus *Donia* which he based primarily on its caducous bristly pappus. This genus was adopted by Pursh,[10] and a new species *Donia squarrosa,* from the Missouri River prairies, was described.

Lagasca[11] in 1816 was the first to recognize that the *Aster spathulatus* Hort. and the *Aster glutinosus* were congeneric and constituted a new genus *Demetria,* with two species *De-*

[5] Willdenow, C. L. Sp. Pl. **6**[3]: 2115. 1800.

[6] Willd. Ges. Nat. Fr. Berlin Mag. **1**: 259. 1807.

[7] Persoon, C. H. *loc. cit.* pp. 451–452. 1807.

[8] Nuttall, T. in Fras. Cat. 1813.

[9] Brown, Robert. in Ait. Hort. Kew, ed. 2. **5**: 82. 1813.

[10] Pursh, F. Fl. Am. Sept. **2**: 559. 1814.

[11] Lagasca, M. Gen. et Sp. Pl. Nov. 30. 1816.

metria spathulata and *D. glutinosa.* A year previous, Cassini[12] had proposed a new genus, *Aurelia,* for the *Aster glutinosus* of Cavanilles *(Inula glutinosa* Persoon) to be placed next to *Grindelia* taxonomically.

Some confusion as to the generic limits of these recently proposed genera *(Grindelia, Donia, Demetria,* and *Aurelia)* existed between 1815 and 1819. In 1815 Robert Brown, on comparing flowering material of *Grindelia inuloides,* grown in the Kew Gardens, with his *Donia glutinosa,* found that the two differed principally in the number of pappus awns to the floret —there being one or two in *Grindelia inuloides* and a greater and more indefinite number in *Donia glutinosa.* Realizing that this was a variable character in *Donia* and that the two species were otherwise essentially alike, he abandoned[13] *Donia* and reunited it with *Grindelia,* since *Grindelia* was the genus first published. Dunal,[14] in 1819, showed further that *Grindelia, Donia* and *Demetria* were entirely congeneric and should constitute one genus, *Grindelia,* that being the name first published and already generally recognized. Kunth was in agreement with this treatment.

Cassini[15] tried to show that *Donia* and *Aurelia* were distinct from *Grindelia,* first, because in the former two genera the awns of the pappus were "barbellate," whereas in *Grindelia* they were "unappendaged," and second, the anthers in *Donia* and *Aurelia* did not have basal appendages, whereas *Grindelia* did. Although, according to Kunth, in the true *Grindelia* the anthers were naked at the base, Cassini stated that he had found "two basal semilanceolate or subulate appendages" on each anther. Again, in 1825, Cassini[16] insisted on the validity of retaining *Aurelia* distinct from *Grindelia,* and reported a third difference, namely, that *Grindelia* had one to three, or occasionally more, pappus awns to the floret, whereas in *Aurelia* they were numerous; moreover, although he was aware that

[12] Cassini, H. Bull. Soc. Philom. p. 175. 1815.
[13] Brown, Robert. Trans. Linn. Soc. London **12**: 102. 1818.
[14] Dunal, F. Mem. Mus. Par. **5**: 46. 1819.
[15] Cassini, H. Jour. Phys. **89**: 32. 1819.
[16] Cassini, H. Dict. Sci. Nat. **37**: 468. 1825.

Aurelia was antedated by *Donia,* he felt that *Aurelia* should be retained since Robert Brown had not only abandoned *Donia* but also was unaware of its real distinctive characters. However, later studies have shown that both few and numerous awns were found, and only one type of anther, that with short, broad, deltoid bases. Rafinesque,[17] in 1818, attempted to displace *Donia,* with the remarks: "*Donia* is rather too short, and contained in *Cladonia,* etc., it ought to be lengthened into *Doniana.*" A year previous Cornelissen[18] published a new genus, *Hoorebekia,* with one South American species, *H. chiloensis.* For some time this genus had been identified with *Aplopappus,* but recently has been shown[19] to be a *Grindelia,* congeneric with and antedating the South American species, *Grindelia speciosa, G. resinosa, G. foliosa,* and *G. Volkensii.*

Dunal,[20] in 1819, described six species of *Grindelia,* of which *G. pulchella* and *G. angustifolia* (the latter belonging to another genus) were new, and *G. glutinosa, G. inuloides, G. squarrosa* and *G. fruticosa* had been transferred from other genera. In 1825 Cassini,[21] still regarding his genus *Aurelia* as distinct from *Grindelia,* published two species, *A. amplexicaulis* and *A. decurrens.*

From 1825 on many species and varieties of *Grindelia* were published. In 1836 A. P. DeCandolle[22] treated *Grindelia* in the 'Prodromus,' describing thirteen species of which seven were new; and in 1838[23] he added four more, one, *G. stricta,* being new. In 1841 Nuttall[24] described five new species of *Grindelia,* and in 1842 Torrey and Gray[25] recognized ten species in their 'Flora of North America.'

In 1857 a new genus, *Chrysopthalmum,* with one species, *C.*

[17] Rafinesque, C. S. Am. Month. Mag. p. 268. 1818.

[18] Cornelissen, E. N., in Mussche, J. H. Hort. Gand. p. 13. 1817.

[19] Hall, H. M. Carnegie Inst. Wash. Publ. No. 389: 24. 1928.

[20] Dunal, F. *loc. cit.*

[21] Cassini, H. *loc. cit.*

[22] DeCandolle, A. P. Prodr. **5**: 314. 1836.

[23] *Ibid.* **7**: 278. 1838.

[24] Nuttall, T. Trans. Am. Phil. Soc. N. S. **7**: 314. 1841.

[25] Torrey, J. and Gray, A. Fl. N. Am. **2**: 246. 1842.

andinum, was described by Philippi[26] from the Andes of Chile, and seven years later he[27] transferred it to *Grindelia.* This species is also recognized by Cabrera under *Grindelia,* but, for the present at least, the writer prefers to regard it as generically distinct.

Gray,[28] in two editions of the 'Synoptical Flora of North America,' 1884 and 1888, recognized twelve species with several varieties, reducing a number of species to synonymy. Since 1888 approximately fifty-eight species, varieties, and forms of *Grindelia* have appeared in the literature bringing the total number of names described to nearly one hundred and forty.

Geographical Distribution

The environmental factors, past geological history, and the present distributional areas of the different species of *Grindelia* are very closely correlated. Many of the species have a remarkable capacity to pioneer and spread into new or previously unoccupied territory. Their aggressiveness is associated with their natural ability to thrive in open exposed or recently cleared or eroded habitats. They will often be the first or among the first plant forms to invade open places along roadsides, roadcuts, irrigation ditches, alluvial deposits of streams, recently eroded slopes, over-grazed pastures, railroad tracks, waste places, etc. Especially the prairie and plains species, notably *G. squarrosa, G. squarrosa* var. *serrulata,* and *G. perennis,* are among the most conspicuous examples of invaders, and are among the worst weeds, frequently being classed by agriculturists as obnoxious plants.

Associated with this weed tendency is the fact that the majority of the species form colonies. The reason is quite obvious when one considers the definite relation between colony-formation and the pappus of the genus. The few pappus bristles are awn-like and therefore not adapted for wind dispersal as in

[26] Philippi, R. A. Linnaea **29**: 9. 1857.

[27] *Ibid.* **33**: 137. 1864.

[28] Gray, A. Syn. Fl. N. Am. **1**^{2}: 116. 1884, and ed. 2. 1888.

many Astereae where the achenes have a light plumose pappus. When the achenes are ripe in *Grindelia,* the receptacle and involucre gradually open. The achenes, with the pappus mostly lacking, are much too heavy to be carried away by the wind, and when shaken out they fall to the ground close to the parent plant. Most of the seeds are viable and germinate readily. Numerous seedlings spring up around the parent plant forming compact mats by the thousands. Year by year the colony gradually increases, both in number of plants and in area. This colony formation is particularly well shown in *G. squarrosa* and var. *serrulata, G. perennis, G. lanceolata, G. nana, G. decumbens,* and *G. camporum.*

The majority of the species are found growing in strongly alkaline or saline to circumneutral soils. The apparent preference for strongly saline soils is well shown in *G. humilis, G. Blakei, G. stricta* and varieties (excluding var. *collina* and var. *Hendersoni),* and *G. aggregata,* which occur in salt or brackish marshes, tidal estuaries, and marine sand beaches. *Grindelia perennis* and *G. camporum* are often found about saline flats, salt lakes and springs, and alluvial rich soils of alkaline streams. *Grindelia texana* is mostly confined to limestone glades of the Edwards Plateau in Texas, and *G. lanceolata* to limestone and dolomite areas in Tennessee, Alabama, Missouri, Arkansas, and to a limited extent in Oklahoma and Texas. In Missouri *G. lanceolata* is limited in the Ozark region to limestone and dolomite glades of the Jefferson City (Beekmantown) and Joachim formations of Ordovician age and to the Mississippian limestones of the extreme southwest. Its absence over most of the central and southeastern Ozark region is due to the fact that either acidic rocks of Roubidoux sandstone cap the surface or the surface is underlain mostly with granite, chert, or sandstone. Similarly, *G. grandiflora* is limited in the United States to the limestone of the Devil's River and adjacent Texas region. Sometimes the soils occupied are clayey and rich in nutritive elements, rather than rocky limestone. For example, *G. camporum* var. *Davyi, G. procera, G. aphanactis,* and *G. squarrosa* follow the alluvial silts and clays of river banks, and may spread out into adjacent fields or prairies. A number of species occur in the immediate vicinity of the ocean, as *G. arenicola, G. rubricaulis* and its varieties *robusta, elata,* and *latifolia,* and *G. stricta* var. *collina* and var. *Hendersoni.* According to Cabrera,[29] the South American species tend somewhat to grow in alkaline soils.

Practically the whole range of the species of *Grindelia* may be included in the Lower and Upper Sonoran of the Austral zone and the Arid and Humid transition zones. This relatively small zonal range is remarkably correlated with the present areas occupied and the major climatic environmental factors of rainfall, temperature, and altitude.

The species are unusually adapted to xerophytic, semi-desert, or desert environments, sometimes occurring in regions which receive annually ten inches or less of rainfall. Such habitats are wind-swept plains and prairies, limestone glades, dry rocky plateaus and mesas, sands and dunes along the rivers and seashore, exposed clayey and rocky slopes, dry bluffs along river courses, etc., also salt marshes and tidal estuaries which are physiologically quite dry.

Some species have a remarkable capacity of germinating in very moist or inundated soils, and later, as the particular areas gradually become desiccated, are able to adapt themselves to the new conditions. *Grindelia squarrosa* var. *nuda* and var. *nuda* f. *angustior,* for instance, in Texas, are frequently confined to lake-beds which fill with water in times of heavy rainfall but for years at a time may remain dry and become extremely xerophytic. Also, *Grindelia procera* germinates along the San Joaquin River Valley in spring and early summer in inundated places which later become very dry and parched. The same adaptations may often be observed in the Californian *G. camporum* and *G. camporum* var. *Davyi.*

In view of the above statements, it is not surprising that *Grindelia* is more or less generally distributed over western North America. In the United States the genus has been re-

[29] Cabrera, A. L. Revision de las especies Sudamericanas del genero "*Grindelia.*" in Rev. Mus. La Plata **33**: 208. 1931, and in letter.

corded from every state except Kentucky, Mississippi, Florida, South and North Carolina, and West Virginia. It is commonly introduced east of Illinois and reaches all the New England States. North of the United States the genus penetrates to

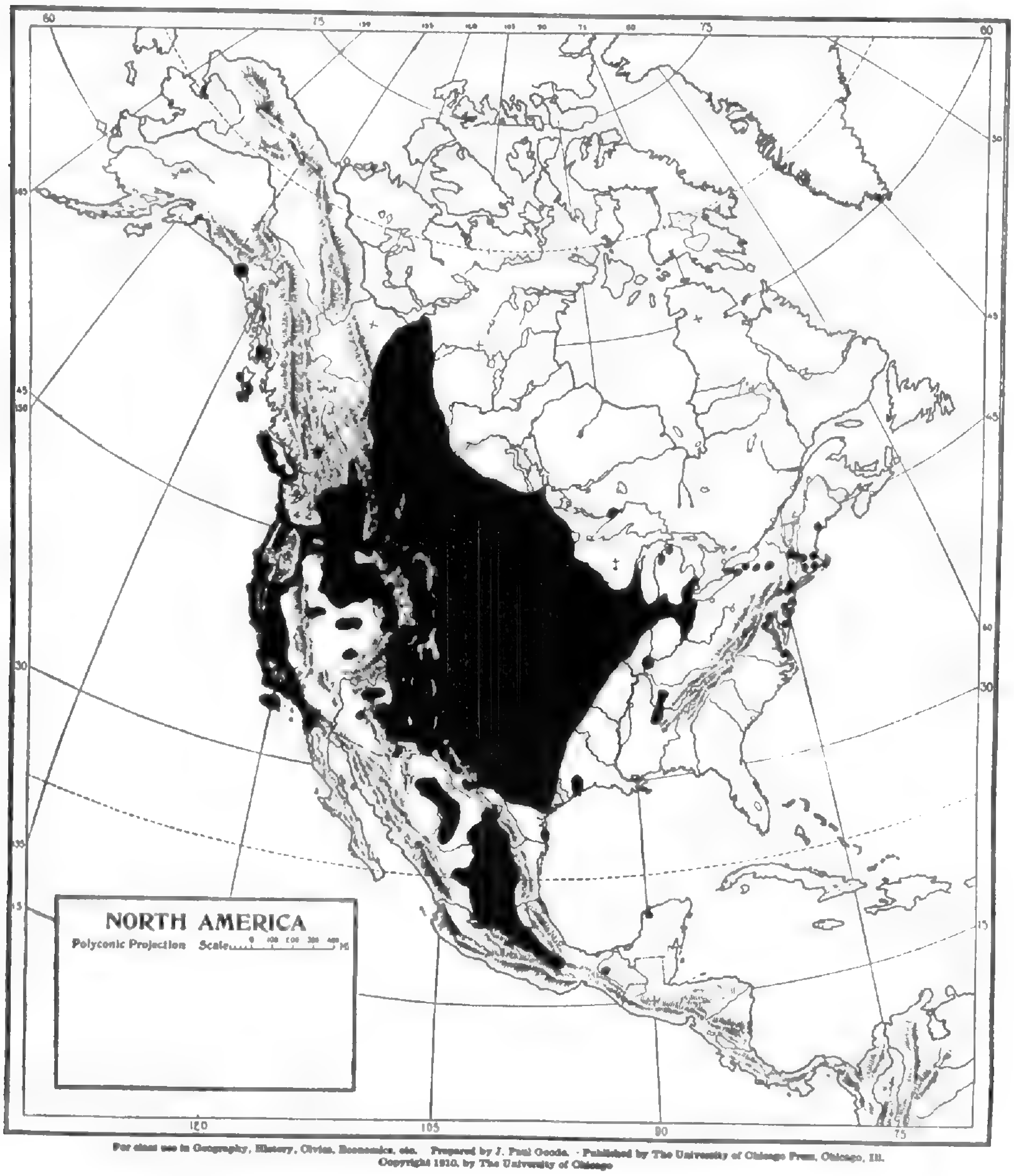

Fig. 1. Distribution of the genus *Grindelia* in North America.

59° 34′ North latitude about Port Mulgrave, Alaska, and slightly north of 60° North latitude in the vicinity of the Great Slave Lake region (Wood Buffalo Park and salt plains about Bear Spring, etc.) in Northwest Territory. It is naturally distributed in the United States west of the 86th Meridian (fig. 1).

It occurs in Mexico over the greater portion of the Plateau, but no collections have as yet been seen from the state of Sonora. One species, *G. perennis,* has been introduced in Yucatan. So far as records occur the genus skips Central America, and then reappears in South America, in Peru, Uruguay, Paraguay, southern Brazil, and in Argentina south to the Santa Cruz region. Altitudinally it ranges from sea-level to approximately 10,000 feet in the mountains of the state of Hidalgo, Mexico. The genus is predominantly one of open places and is practically absent from deep forests or wooded areas. The few species or varieties that do penetrate wooded areas are found in rather thin and semi-open tracts or near the borders of woods.

Many of the species of *Grindelia* occur on geologically very youthful territory, in most cases of Pleistocene or Post-Pleistocene age. Areas from which the sea has withdrawn or where emergence has followed submergence, places of recent sedimentation or vulcanism, glaciated areas from which recent ice-sheets have retreated, recently eroded regions, and similar youthful places have been quickly populated by species of *Grindelia,* especially if such places offered open habitats in Sonoran or Transition zones. Many of these species show rather restricted distributions which are the result of the past geological history. Notable examples are *Grindelia humilis,* which is not known outside of San Francisco and Tomales Bays of California, *G. littoralis* restricted to the Galveston Bay region, and *G. oolepis,* around Brownsville, Texas. Other coastal endemics, *G. Blakei* and *G. aggregata,* show themselves to be of at least Pleistocene or Post-Pleistocene dispersal, since the particular coastal areas occupied have all been submerged by sea water during Quaternary times and some even into the Recent epoch. The recent subsidence, which permitted the sea to encroach upon the river valleys, forming the Bay of San Francisco and other bays along the coast took place practically in modern times. Similarly, the deposits along the outermost margin of the Gulf and Atlantic Coastal Plain, including the Gulf Coastal strip of Texas, are mostly of

Recent or Quaternary origin; the bays and coastal region about Brownsville and Galveston have had the sea withdrawn from them only a matter of thousands of years.

In contrast to the coastal species of very limited distribution are those coastal types which are rather widely distributed along the Pacific Ocean and also occur on land of Recent or Quaternary origin. The extensive fiords and inlets along the coast of Alaska and British Columbia represent drowned river valleys of Recent and Quaternary submergence. Vancouver Island and the Queen Charlotte and adjacent islands are the projecting spurs of a range paralleling and even more submerged than the coast range to the East. About the close of the Pliocene there was elevation of the entire west coast[30] which continued into early Pleistocene, but toward the middle of Pleistocene the entire coast range area was sunk 1000 to 2000 feet.

Following the glacial epoch another period of subsidence occurred in the Lower and Upper San Pedro epoch, during which the shore line was carried downwards 300 to 700 feet lower than at present, drowning the mouths of streams and erosion valleys entering the ocean. Then occurred an elevation which was soon followed by another submergence, resulting in the present shore lines of Oregon and California. The northern two-thirds of the coast region in Oregon consists mostly of Miocene sandstone and shales, and the bold cliffs and promontories comprise mostly Tertiary basalt; the southern third is made up mainly of Quaternary gravel, sand, and silt.[31] In the southern coast region of Oregon the surface sands along various portions of the coast are of Pleistocene age.[32] Evidence that the coast of Oregon and Washington has recently emerged is to be seen in the narrow coastal plain one to twenty miles wide. Even more

[30] For discussion of geologic and physiographic history, see Fenneman, N. M. Physiography of western United States. pp. 479–506. 1931; Jepson, W. L. Manual of flowering plants of California. pp. 10–11. 1925; Smith, J. P. Salient events in the geologic history of California. Science N. S. **30**: 346–351. 1909.

[31] Peck, M. E. A preliminary sketch of the plant regions of Oregon. I. Western Oregon. Am. Jour. Bot. **12**: 36. 1925.

[32] Peck, *loc. cit.* pp. 45–46.

recent is a subsidence which has drowned the streams across this coastal plain and extending far inland. The Chehalis River has been drowned for 30 miles, the Columbia 140 miles, the Umpqua 25 miles, and the Coquille 30 miles.[33]

The entire coast strip of California is composed of sands, gravels, or muds, of Recent or Quaternary origin. Puget Sound constitutes the northernmost portion of a huge trough of crustal deformation; this trough includes the Great Valley of California, probably the Gulf of California, the Willamette Valley of Oregon, the Cowlitz, upper Chehalis and Puget Sound Valleys of Washington, and to the northward the sounds separating Vancouver and the Queen Charlotte Islands from the mainland of British Columbia.[34] Puget Sound was extensively glaciated in the Pleistocene, and, after the disappearance of the ice sheet, was depressed, thereby allowing the sea to advance and drown the mouths of rivers. The Puget Trough has sunk and been submerged several times since post-Cretaceous, during much of Tertiary time having been a sinking geosyncline.[35] The present deposits and topography of this region are the results chiefly of erosion in the interglacial and last glacial epochs.[36]

Since the present coastal strips of Alaska, British Columbia, Vancouver Island, Queen Charlotte and adjacent Islands, Puget Sound, Washington, Oregon, and California are all of Recent or Quaternary origin, the species of *Grindelia* occurring on these coastal strips must likewise be very recent. Also, it is in keeping with their pioneering tendencies that they should have invaded this coastal strip. Nor is it surprising that many of these species should be so very variable. The variations have not as yet had sufficient time to differentiate into distinct entities, but form an interwoven complex. For example, *G. rubricaulis,* with its numerous varieties and forms, ranges along the coast from northernmost Lower California to northern Marin County, California, assuming many variations in its extent northward: var. *latifolia,* occurring on the

[33] Fenneman, *loc. cit.* p. 461.
[34] Fenneman, *loc. cit.* pp. 442–443.
[35] Fenneman, *loc. cit.* p. 450.
[36] Fenneman, *loc. cit.* p. 451.

Santa Barbara Islands and on the adjacent mainland, which gives rise to several forms on the mainland; var. *platyphylla* around the Monterey Bay region; and var. *robusta* along the coast from Orange to Santa Cruz County. From the dunes in the region of Carmel, Monterey County, California, and ranging north along the coast to Coos County, Oregon, is the coastal species, *G. arenicola,* which is generally found on the most recent coastal dunes, mesas and beaches.

Grindelia stricta, with its varieties, is another of the rather wide-ranging coastal types, being distributed from southern Alaska in the vicinity of Port Mulgrave south to Mendocino County in northern California. It is a more or less distinct species throughout this range, but in the Puget Sound region and in the Sound to the north between Vancouver Island and the mainland of British Columbia, it gives rise to series of extremely perplexing variations. A robust form with large leaves and heads, var. *macrophylla,* occurs along the larger estuaries farthest removed from the direct ocean currents; another variation, var. *lanata,* with more or less pronounced pubescence on stem, leaves, and involucre, is found along the seashore often on rocky shores; var. *aestuarina,* with more sharply serrate, firmer, more resinous leaves and more resinous involucres, is very common in the salt marshes, estuaries, and sand beaches in the Puget Sound region; var. *Andersonii* in salt marshes around Saanich Arm, southeastern Vancouver Island, has become exceedingly foliose towards the heads; and var. *collina,* another variation of the same series, has betaken itself to dry terrestrial habitats where it has developed smaller heads and slender resinous leaves. It is interesting that the range of *G. stricta,* including all its varieties and forms, is approximately that of *Glehnia leiocarpa* Mathias,[37] but *Glehnia leiocarpa* has not differentiated into a number of variations as has *G. stricta.* The localization to certain estuaries of varieties of *Grindelia,* especially those on the Pacific Coast, is somewhat analogous to the estuarine problems of variation,

[37] Mathias, M. Studies in the Umbelliferae. I. Ann. Mo. Bot. Gard. **15**: 95–101. 1928.

isolation, and endemism in the genus *Bidens* in eastern North America.[38]

A very striking correlation exists between the present distributions of certain species of *Grindelia* and the recent geological history of the Willamette Valley, the Puget Sound, and Puget Trough regions. According to Fenneman, the Puget Trough is "a long valley enclosed on the east by the cascades and on the west by the Olympic Mountains and the Oregon Coast Range. Its northern end (within the United States) is occupied by Puget Sound. Its southern end is the Willamette Valley in Oregon."[39] While the Puget Trough was a sinking geosyncline it was receiving sediments. It was then uplifted, and the erosion which followed resulted in Willamette and Sound valleys. "These newer lowlands have since been in large part buried; in the north by glacial drift and outwash; in the south by sediments deposited when the Willamette and lower Columbia Valleys stood for some time below sea-level."[40] During the melting of the last ice sheet the Willamette Valley lay below sea-level. "The valley of the Columbia, both east and west of the Puget Trough was a strait. This was at the time when Puget Sound was last depressed, following the disappearance of the ice sheet. Over most of the Willamette Basin the soil is derived from sediments laid down in this sound."[41] In late Pleistocene the sea advanced up the Columbia River and flooded the present Willamette Valley.[42] Also during the course of the last Puget Sound submergence the higher mountain ridges were left standing as projecting islands (San Juan and others).

[38] For discussion, see Fernald, M. L. Some noteworthy varieties of *Bidens*. Rhodora **15**: 74–78. 1913; Fernald, M. L. and H. St. John. Some anomalous species and varieties of *Bidens* in eastern North America. Rhodora **17**: 20–25. 1915; Fassett, N. C. The vegetation of the estuaries of northeastern North America. Proc. Bost. Soc. Nat. Hist. **39**: 76–118. 1928.

[39] Fenneman, *loc. cit.* p. 443.

[40] Fenneman, *loc. cit.* p. 451.

[41] Fenneman, *loc. cit.* pp. 453–454.

[42] Fenneman, *loc. cit.* p. 263; and Bretz, J. H. The late pleistocene submergence in the Columbia Valley. Jour. Geol. **27**: 489–506. 1919.

Grindelia integrifolia and var. *virgata* occur only on the Quaternary gravels, sands, or silts of the Willamette Valley region north to Vancouver, Washington, and east to Hood River, Oregon (except for an isolated station of var. *virgata* on the San Juan Islands), whereas *G. stricta* var. *collina* and var. *lanata* have taken to the coastal rocky bluffs, seashore, and islands in and about the Puget Sound and the southern tip of Vancouver Island. After the flooding of the Pacific Coast, including Puget Sound and various subsidences, *G. stricta* became widely distributed in salt marshes, estuaries, sand beaches, and other coastal habitats from southern Alaska to northern California, giving rise to many variations in the Puget Sound area, *G. stricta* var. *lanata* and *G. stricta* var. *collina* being two. Upon the submergence by the Columbia of the Willamette Valley in late Pleistocene, the maritime *G. stricta* var. *lanata* intruded along the marginal beaches and shores of the Valley; then, upon the withdrawal of the sea and the later burial of the Willamette Valley by depositions of sand, gravel, and silt, its Puget Sount prototype which had penetrated this area was forced to take to the dry land of the Willamette Valley region where it has given rise to *G. integrifolia*. When the San Juan, Vancouver, and other islands were left standing in Puget Sound, *G. stricta* var. *collina* became the terrestrial phase of *G. stricta;* and at the time the Willamette Valley was depressed along with the rest of the Puget Sound, the maritime types invaded the Valley. Then, following the withdrawal of sea water and the consequent deposition, the maritime types took to the dry lands; but *G. stricta* var. *collina,* following this connection between the submergence of the Puget Sound and Willamette Valley, gave rise in the Willamette Valley region to *G. integrifolia* var. *virgata.* As a relic pointing to the former submergence of these portions of the Puget Trough we find this variety (outside of its occurrence in the Willamette Valley region) isolated on one of the projecting portions of the San Juan Islands. The Willamette Valley region, its floor covered by Quaternary and Recent deposits, has a fair number of species restricted to it. These endemics are practically all species just beginning, excellent examples of which are *Sidalcea campestris* and *S. virgata.*[43]

Grindelia camporum and its varieties are found in the Great Valley of California and southwestern Oregon, that is, the San Joaquin and Sacramento River valleys, the Tulare Basin, the western lower foothills of the Sierra Nevadas and the foothills of the northern and central Coast Range, and the river valleys of southwestern Oregon. Practically all of the floor of the Great Valley is covered with Pliocene, Pleistocene, or Recent alluvium, consisting of clay, sand, or gravel, most of it being of Recent or Quaternary origin. Several times during the Eocene and Pliocene and in the Pleistocene it was an inland sea.[44] Its successive sinking, often followed by seaward invasion, has been linked with the history of the surrounding Coast and the Sierra Nevada Ranges which have been continually warped upward. In the Lower and Upper San Pedro Epochs (Champlainian) of Quaternary time, when the surrounding ranges were much uplifted, much of the unconsolidated filling of the basin has accumulated. Even more recently (Terrace Epoch of Quaternary time) terraces were formed in the fluviatile sediments in nearly all the Coast Range Valleys.[45] Obviously, *G. camporum* and varieties, as well as many other species of the Great Valley, must have migrated into it since Quaternary or even Recent times.

Grindelia nana and its varieties and forms, most closely allied to *G. camporum* var. *Davyi,* occupy the youthful territory of the Columbia Plateau (Oregon, Washington, Idaho) and adjacent regions in northern Nevada, California, and western Montana. Most of the rocks of the Columbia Plateau are the result of great outpourings of lava of Tertiary (beginning

[43] Roush, E. M. P. A monograph of the genus *Sidalcea.* Ann. Mo. Bot. Gard. **18:** 175–179. 1931. See also Peck, M. E. Am. Jour. Bot. **12:** 39–41. 1925.

[44] Jepson, W. L. Manual of flowering plants of California. p. 10. 1925; and Anderson, W. C. Proc. Cal. Acad. Sci. IV. **3:** 6, 7, 32. 1908.

[45] For discussion, see Smith, J. P. *loc. cit;* Fenneman, N. M. *loc. cit.* pp. 472–481, especially *fig. 165.* with bibliography; Bryan, K. Geology and ground-water resources of the Sacramento Valley, California. U. S. Geol. Survey, Water Supply Paper No. 495. 1923.

with the Miocene) and Quaternary times. The Snake River Plain has been covered with great quantities of Pleistocene basalt. The lavas throughout the range of *G. nana* and varieties are generally alkaline. Most of the valleys of the mountain region of Idaho where the species occurs are covered with Quaternary deposits.[46] Many of the valleys of western Montana are filled with Tertiary and later sediments. "The upper Flathead Valley is . . . underlain in part by Miocene beds and partly filled by glacial deposits."[47]

The distribution of *G. columbiana* is definitely correlated with the late Pleistocene submergence of the area occupied. This species is practically restricted to the immediate environs of the Columbia River and some of its branches (Yakima River) in Washington and Oregon and to a limited extent the Snake River in Idaho. The Columbia River in this region flows through the Tertiary and Quaternary lava deposits. The last cycle of erosion of the cuttings of the Columbia River gorge is also Recent. Coulees are associated with the Pleistocene drainage of this river. "They represent approximately the normal drainage lines of the present-day but more accurately the lines of Pleistocene drainage. . . . These coulees and scablands result from erosion by glacial streams of great volume and steep gradient escaping from the ice-covered area to the north."[48] They are the abandoned courses of ancient rivers extending in Washington from the Snake River north to the Spokane and Columbia Rivers, and west to the Columbia River (including Douglas, Lincoln, Adams, and part of Yakima and Franklin Counties). The largest of the coulees are Grand Coulee and Moses Coulee. During the Wisconsin glacial epoch of Pleistocene time a glacial lobe of the ice sheet from the Okanogan Valley west of the Grand Coulee covered the Columbia River, crossing and blocking the Columbia Gorge, and damming back the waters until they rose to the level of the former Grand Coulee. This caused the waters to find a temporary new channel through the Grand Coulee. Following the depression in

[46] Fenneman, *loc. cit.* pp. 185–196.
[47] Fenneman, *loc. cit.* p. 208.
[48] Fenneman, *loc. cit.* pp. 258–259.

the Grand Coulee to the lower course of Crab Creek the waters of the Columbia River finally rejoined the main course of the river.[49] After the withdrawal of the glacial lobe and retreat and melting of the ice, the Columbia again followed its present course, leaving the Coulees as abandoned water courses. In late Pleistocene time the Columbia River was flooded by marine waters which submerged Yakima and Walla Walla Valleys.[50] The occurrence of *G. columbiana* at Grand Coulee above Blue Lake, Grant County, and at Wilson Creek, Whitman County, shows that it had followed the course of the Columbia River when the waters were forced to flow temporarily through the channels of the Coulees.

The distributional ranges of various species of *Grindelia* are closely correlated with the several floristic provinces maintained by Peck[51] in his preliminary study of plant regions of Oregon. These natural plant regions are the Northern Coast Region, Northern Coast Mountain Region, Willamette Valley Region, Rogue-Umpqua Region, Southern Coast Region, Southern Coast Mountain and Siskiyou Region, Cascade Region, Eastern Oregon Region (subdivided into the Columbia River Area, Yellow Pine Area, Bunch-grass Area, Lake Area, and Sagebrush Area), and the Blue Mountain Region.

The restriction of *G. integrifolia* and *G. integrifolia* var. *virgata* to the Willamette Valley region has already been discussed. Placing the Columbia River area under the Eastern Oregon Region takes care of the confinement of *G. columbiana.* The separation of the coastal flora into the Northern and Southern Coast Regions at approximately the mouth of the Coquille River is also a very natural division. At this point there is a strong break and contrast in floras, that to the south being decidedly Californian, whereas that to the north is the northern coastal flora which ranges from Alaska or British Columbia southward and sometimes penetrates into Califor-

[49] Fenneman, *loc. cit.* pp. 256–263.

[50] Bretz, J. H. The late pleistocene submergence in the Columbia Valley. Jour. Geol. **27**: 489–506. 1919; see also Fenneman, *loc. cit.* p. 263.

[51] Peck, M. E. A preliminary sketch of the plant regions of Oregon. I. Am. Jour. Bot. **12**: 33–49; II. 69–81. 1925.

nia. Applying these coastal divisions to *Grindelia* we find that *G. arenicola* with its varieties is mostly Californian, but reaches Oregon at the mouth of the Coquille River (at the sand dunes at Bandon), the division point between northern and southern floras; north of Bandon along the Oregon Coast the only coastal species encountered is *G. stricta* which is the common coastal *Grindelia* from southern Alaska south to Mendocino County, California.

Grindelia nana, with variations, is mostly confined in Oregon to the Bunch-grass Area and part of the Lake Area of the Eastern Oregon Region, although it penetrates also into the Rogue-Umpqua and Southern Coast Mountain and Siskiyou Regions. It is absent from the Willamette Valley Region (where *G. integrifolia* and var. *virgata* occur) which is more humid and which has had recent connections with the ocean water. *Grindelia nana* is most closely allied morphologically to *G. camporum,* the connection being most obvious between *G. nana* var. *altissima* and *G. camporum* var. *Davyi.* The former is found in northern California in the vicinity of the Coast and Sierra Nevada Ranges and southwestern Oregon, whereas the latter is mostly in cismontane California from approximately middle California northward, often occurring in the foothills of the Coast Ranges and the western foothills of the Sierra Nevada.

Grindelia nana, with its varieties, is dispersed mostly in the Arid Transition and Upper Sonoran zones of Oregon, Washington, Idaho, northern California, northern Nevada, and western Montana, but its relationships are with the Californian *G. camporum* complex. This Californian element in the flora of Oregon and Washington is remarkably important. Piper[52] points out that Upper Sonoran plants of the Columbian Basin have originated in part from California and in part from the Great Basin. Furthermore, the natural route of the California plants, as influenced in large part by the prevailing southwesterly winds, would be in northeastern California through the Klamath Gap made by the Klamath River and lakes. He

[52] Piper, C. V. Contr. U. S. Nat. Herb. [Fl. Wash.] **11:** 38. 1906.

also states that few of these Upper Sonoran plants have reached the Columbia Basin by way of the Willamette Valley and the Columbia River because the Rogue River Mountains of southwestern Oregon form a natural barrier. Similarly, most of the Californian element in the Humid and Arid Transition areas in Washington reached the Columbia Basin by way of the Klamath Gap.[53] These statements accord nicely with the relationship between *G. nana* and *G. camporum*. The latter, of Californian origin, has undoubtedly given rise through *G. camporum* var. *Davyi* to *G. nana* by way of *G. nana* var. *altissima*. The migration of *G. nana* and varieties from California northeastward to western Montana, Idaho, eastern Washington, and Oregon east of the Cascades has certainly taken place through the Klamath Gap. The natural barrier of the Rogue River Mountains and the Calapooia Divide has been effective against the northward migration of *G. nana* and var. *altissima* from southwestern Oregon into the Willamette Valley Region.

Grindelia squarrosa and *G. perennis,* the former of the central prairies, the latter of the high northern plains, generally occur on Tertiary or even more recent territory. Many glacial lakes were formed in the high plains of Canada in Alberta and Saskatchewan from Great Slave Lake southward into northern Montana when the region was covered and severely scoured by the great Keewatin ice-sheets of Pleistocene time. *Grindelia perennis* is found around such lakes on the plains at Calgary and Edmonton—a region not available for plant occupation until Post-Pleistocene times. Most of the remaining portion of the prairies and plains occupied by *G. perennis* and *G. squarrosa* is of similarly youthful soils, made up of glacial till or of Tertiary or Quaternary deposits.

Although the majority of the species of *Grindelia* are of Pleistocene or Post-Pleistocene dispersal, a few species occur in areas which are geologically older and which have been exposed and available for plant occupation since the end of the Paleozoic area. Such are the Ozark Plateau of Missouri, Arkansas, and eastern Oklahoma, the Edwards Plateau of Texas

[53] Piper, *loc. cit.* p. 43.

and the great Mexican Plateau. The Cretaceous seas failed to invade the Appalachian Upland or the Ozark Plateau or the Mexican Plateau. Then, at the close of the Cretaceous they were affected by a general uplift, and again, towards the close of the Tertiary period, the Appalachian Upland and Ozark Plateau were uplifted.[54] The Mexican Plateau has not been available for plant occupation since the close of the Paleozoic, but it has been free from sea invasions since Cretaceous times.[55]

Fernald has found that the plants of the most ancient dispersal occupy the land areas which have stood above sea-level since Cretaceous or in some cases since the close of the Paleozoic (although in many instances plants which now occupy the most youthful territory, that is, the Atlantic Coastal plain, were originally those of the peneplained Appalachian Upland which were compelled by invasions of mesophytic plants, following uplifts and erosion, to move out onto this new area). He finds that those groups in eastern North America which are related to similar groups in the most ancient parts of the World (mostly in Australia, New Zealand, and South Africa, also to a more limited extent in the Falkland Islands, India, Malay Archipelago, western South America, and a few other places) today are persisting on these ancient Mexican uplands, uplifted Appalachians, and a few on the Ozark Plateau.

A number of species of *Grindelia* are limited in distribution to the Ozark and Mexican Plateaus and Appalachian Upland which have (in the case of the Ozark and Appalachian areas) been available for occupation at least since the close of the Paleozoic and, in the case of the Mexican Plateau, late Cretaceous. The Edwards Plateau of Texas has been more or less available since the beginning of the Cenozoic after the withdrawal of the Cretaceous seas. This does not imply necessarily that plants have occupied these old emergent conti-

[54] Fernald, M. L. Specific segregations and identities in some floras of eastern North America and the Old World. Rhodora **33**: 25–63. 1931.

[55] Schuchert, C. A. Textbook of geology. Part II. Historical geology. *pl. 41, 42,* and *45.* 1924.

nental areas since late Cretaceous or late Paleozoic times, but that they are limited to such areas and consequently are older than those species which occur on areas generally not available until late Tertiary, Pleistocene, or even Post-Pleistocene times.

Grindelia lanceolata is confined to the southern Appalachian and Ozark Uplift region, on limestone glades and limestone prairies from central Tennessee and northern and central Alabama to the Ozark region of Missouri, Arkansas, southeastern Kansas, and eastern Oklahoma, penetrating slightly into northeastern Texas on upper Cretaceous limestone soils (*Drummond* from "San Felipe de Austin," in Gray Herbarium is of this species, but the locality may have been confused as this species has not been collected there since). Aside from the Texas collections, *G. lanceolata* lies entirely within the Southern Appalachian-Ozarkian Plateau, a region available for plant occupation since the close of the Paleozoic. It is more likely, however, that the species occupied this area about early Eocene time following the late Cretaceous uplift; nor is it unlikely that it arrived towards the close of the Tertiary period when the region was again uplifted.

Grindelia texana, which has either been derived from or given rise to *G. lanceolata,* is confined to Cretaceous strata of the Edwards Plateau and Texas Hills section of Texas[56] and the Arbuckle Mountain region of south-central Oklahoma. This area has not been submerged by the seas since the close of the Cretaceous period, and has been available for plant invasion since that time. It is very likely that *G. texana* entered there in early Eocene times or perhaps later. *Grindelia grandiflora,* confined to northeastern Mexico and the Devils River country of the Edwards Plateau in Texas, probably entered Texas at about the same time.

It is probable that the inter-migration of Mexican and South American species of *Grindelia* occurred no earlier than the close of the Cretaceous but more likely in Eocene or Miocene times, after which the Mexican and South American species

[56] Deussen, A. Geology of coastal plain of Texas west of Brazos River. U. S. Geol. Surv. Prof. Paper No. 126:3. *fig. 2.* 1924.

became separated and have diverged along their respective evolutionary lines.

As already stated, the oldest species of *Grindelia* occupying the oldest land areas are *G. lanceolata, G. texana,* and all the species of the Mexican Plateau. To this list might be added *G. scabra* and var. *neomexicana, G. arizonica* and varieties, *G. Havardii, G. grandiflora,* and perhaps several others. The youthful species have been derived from those occupying the Mexican, Ozark, and Edwards Plateau and Texas Hills region, or from species derived from occupants of the geologically more ancient areas. Many of these species, such as *G. oolepis, G. Blakei, G. humilis, G. littoralis,* etc. are endemics, just beginning their evolution. Some youthful species on young territory have a wide distribution, such as *G. perennis, G. stricta* and varieties, *G. squarrosa, G. rubricaulis* and varieties, and *G. nana* and varieties.

The fact that youthful species of approximately the same age and on comparatively equally youthful soils may have very broad or very limited ranges argues strongly against the age-and-area hypothesis. Additional evidence against it is the distribution of most of the species of the genus. The genus as a whole is a large one, consisting of 57 species, over 40 varieties (many of which are incipient species), and about 24 forms. It occupies a greater part of western North America and much of South America. However, its distribution is not due to its long period of evolution, but rather to its aggressive and pioneering tendency. Most of the species are exceedingly plastic because of their youth, and the many variations have not yet had time to differentiate themselves, nor have the geographic barriers been great enough to have accomplished this. The genus is to be compared very consistently with such youthful genera as *Aplopappus, Solidago,* and *Artemisia.* In the words of Fernald:[57]

> "Is it not singular that *Eriogonum, Crataegus, Rubus* § *Eubatus, Lupinus, Astragalus, Oenothera, Gilia, Phacelia, Pentstemon, Solidago, Aplopappus,* and *Artemisia* should have not even a single species associated with

[57] Fernald, M. L. Isolation and endemism in northeastern America and their relation to the age-and-area hypothesis. Am. Jour. Bot. **11**: 568, 570. 1924.

the ancient types which inhabit Australia and New Zealand, and that only 0.02 of the total species of *Potentilla, Euphorbia, Aster,* and *Erigeron* should have reached those lands? Is it not equally noteworthy that, with the exception of *Crataegus* and the blackberries *(Rubus* § *Eubatus),* all the *largest* genera of the temperate North American flora should be centralized upon the Tertiary sea bottoms (relatively youthful country) of the Mediterranean and Austro-Russian basins of the Old World and in the vast area of youthful country west and southwest of the Mississippi? The blackberries are most virulent in central and western Europe, a region available to plants only since the Pleistocene glaciation, but likewise in the glaciated region and the Tertiary coastal plain of eastern North America. *Crataegus* has its phenomenal development in the eastern United States and south ern Canada, where it must have produced a multitude of its species in post-glacial time.

"It should be perfectly obvious that these genera and likewise such overwhelmingly large genera of Europe and southwestern Asia (but not of Australia and New Zealand) as *Dianthus* . . . , *Silene* . . . , *Verbascum* . . . , *Cousinia* . . . , *Centaurea* . . . , and *Hieracium* . . . , are really very young, or if geologically old *(Crataegus* and *Rubus* for example), they have been encouraged by modern conditions to rapid multiplication. And, if we estimate success of plants by their ability to cover country, to take care of themselves, and to multiply their variations to the bewilderment of the best systematists, then these are surely successful genera."

In the same article, speaking of the woody Veronicas of New Zealand and the genus *Hebe,* Fernald[58] points out that there is a "similar multiplication of modern species and varieties in many old genera of the northern hemisphere: *Salix, Carya, Betula, Quercus, Crataegus, Rubus, Tilia, Rhododendron,* and others, which date chiefly from Cretaceous time. It simply means that under favorable conditions ancient generic stocks may enter a cycle of rapid multiplication of species."

Relationships of the Genus

Following Bentham and Hooker,[59] Engler and Prantl,[60] and Gray,[61] all authors have placed the genus *Grindelia* in the tribe Asteroideae or Astereae-Solidagininae. Formerly, however, there was not such a universality of opinion. Although many early authors included *Grindelia* with the Astereae, some placed

[58] Fernald, *loc. cit.* p. 571.

[59] Bentham, G. and Hooker, J. D. Gen. Pl. **2**: 250. 1873.

[60] Engler, A. und Prantl, K. Die Nat. Pflanzenfam. **IV**^{5}: 148. 1889.

[61] Gray, A. Syn. Fl. N. Am. **1**^{2}: 116. 1884, and ed. 2. 1888.

it under Achyrideae, Chrysocomeae, or Solidagineae of the Astereae; others, like Cassini,[62] combined *Grindelia, Aurelia* and *Xanthocoma* into the Grindelieae as a subdivision under the Solidagineae. Some followed Reichenbach[63] who proposed the name Grindeliaceae as a section of the Solidagineae,[64] to which were referred *Xanthocoma, Grindelia,* and *Donia.*

While the consensus of opinion is that *Grindelia* has been correctly placed in the tribe Astereae, the present writer has concluded that its affinity is with the tribe Heliantheae; and that it represents a connecting link between Heliantheae and Astereae. The following facts bear out such a conclusion. The bristle- or awn-like pappus, composed mostly of 2–10 (rarely to 15 according to Cabrera) slender or paleaceous bristles, is heliantheaceous and also helenieaceous rather than astereaceous. The caducous pappus is not known elsewhere in the Astereae, but there are several genera in the Heliantheae (among them *Helianthus, Berlandiera* in part, and *Melanthera)* which possess deciduous or even caducous pappus-bristles. Further, the resinous character of the involucre and of the leaves is shared by a number of genera in the Heliantheae and in Helenieae but is exceptional in the Astereae (being found mostly in some species of *Aplopappus, Chrysothamnus, Vanclevea,* etc.). Again, the studies by Miss Koch[65] on the ray- and disk-florets of *Grindelia squarrosa* show that the anatomy of *Grindelia* was definitely of the Heliantheae type and not at all that of the Astereae.

Finally, the receptacle in *Grindelia* shows affinities with Heliantheae rather than Astereae. In most of the species it is deeply foveolate, but close examination of the heads in anthesis shows that the foveolate appearance is due to each floret being set in a single foveola. However, each foveola is bordered on four sides by more or less coalescent outgrowths,

[62] Cassini, H. Dict. Sci. Nat. **37**: 468. 1825.

[63] Reichenbach, H. G. L. Conspectus. p. 107. 1828.

[64] For the complete references of the disposition of *Grindelia* by authors up to 1874, see Pfeiffer, L. Nom. Bot. **2**: 1504. 1874.

[65] Koch, M. F. Studies in the anatomy and morphology of the composite flower. I. Am. Jour. Bot. **17**: 938–952; II. 995–1010. 1930.

and each outgrowth tapers upward into an acute to subulate apex becoming several millimeters long in many species. When well developed these subulate processes strikingly resemble a reduced type of chaff. They are coriaceous, cartilaginous, or firmly membranaceous and have become concrescent, giving the appearance of a honeycombed receptacle. In *Baldwinia,* one of the Heliantheae, the chaff of the receptacle has become concrescent, coriaceous, or cartilaginous, and persistent, forming a deeply alveolate structure in which the achenes are enclosed. On account of the properties possessed in common by *Grindelia* and many Heliantheae (and also Helenieae) these foveolate outgrowths of *Grindelia* may be regarded as actually reduced or specialized chaff which has become more or less degenerate. Moreover, the dorsally pubescent terminal appendages of the stylar branches and the anthers of *Grindelia* could be included in the Heliantheae just as well as in the Astereae.

While the evidence seems to point to the actual affinity of *Grindelia* with the tribe Heliantheae, one cannot overlook the affinity of the genus with certain homochromous Astereae, such as *Vanclevea, Aplopappus* (especially section Prionopsis), *Xanthisma, Acamptopappus,* and perhaps *Chrysothamnus.* T. S. Brandegee[66] originally placed his genus *Eastwoodia* in the Astereae on account of its involucre, style-tips, and the general habit of the desert species of *Aplopappus,* although he recognized that it differed from all other genera of the tribe by its complicate-chaffy receptacle and pappus composed of 5–8 unequal persistent awns. An astereaceous genus with a complicate-chaffy receptacle combined with a pauci-aristate pappus is certainly very anomalous; and Greene[67] recognized it as an anomalous genus of the Astereae. The genus *Eastwoodia* differs from *Grindelia* in having a persistent pappus and complicate-chaffy receptacle but it is quite closely related, much more so than are *Gutierrezia, Gymnosperma,* or *Penta-*

[66] Brandegee, T. S. Two undescribed plants from the Coast Range. Zoë **4**: 397–398. 1894.

[67] Greene, E. L. Flora Franciscana. part. IV. 361. 1897.

chaeta. According to the judgment of the present writer, *Eastwoodia* is out of place in the Astereae, and should certainly be in the Heliantheae.

Of the various homochromous astereaceous genera with which *Grindelia* in the past has been allied, attention should be directed to *Aplopappus.* In discussing its affinities with other genera, Hall[68] suggests a possible connection of the section Prionopsis of *Aplopappus* with *Grindelia* because the "much narrowed and deciduous pappus-awns" of the latter "closely resemble section Prionopsis." Later in his description of the single species, *Aplopappus ciliatus,* of the section Prionopsis, he says of the pappus "all bristles . . . tardily deciduous, often in groups."[69] However, the present author examined many specimens of *Aplopappus ciliatus* and found the pappus always truly persistent. With care one can actually force the pappus which is united at the base to fall off as a whole, and that is about the extent of its being deciduous. The real relationship, if any, between *Grindelia* and *Aplopappus* section Prionopsis is in the reduced number of pappus-bristles compared with most of the other sections. A much closer connection between *Grindelia* and *Aplopappus,* and probably the best one, is to be found in *Aplopappus occidentalis* (section Isopappus) which has, according to Hall,[70] a ray-pappus of 5–6 slender deciduous bristles and a disk-pappus of 1–8 deciduous bristles, and in addition possesses a viscid and glandular involucre.

Vanclevea is closely related to *Grindelia* by its resinous involucre and pappus of comparatively few (12 or so) bristles, but differs in having a persistent pappus of more numerous bristles, very elongated exserted stylar branches and appendages, leaves of entirely different insertion and position, as well as a peculiarly shedding epidermis of the stem. *Vanclevea* appears to be more closely related to *Acamptopappus* and is also related to *Chrysothamnus.* The latter in turn is

[68] Hall, H. M. The genus *Haploppaus.* Carnegie Inst. Wash. Publ. No. 389: 27. 1928.

[69] Hall, *loc. cit.* p. 84.

[70] Hall, *loc. cit.* pp. 214–216.

connected through its section Punctati with section Ericameria of *Aplopappus.*

Grindelia does not appear to be related closely to *Gutierrezia, Amphipappus,* and *Gymnosperma.* These genera would

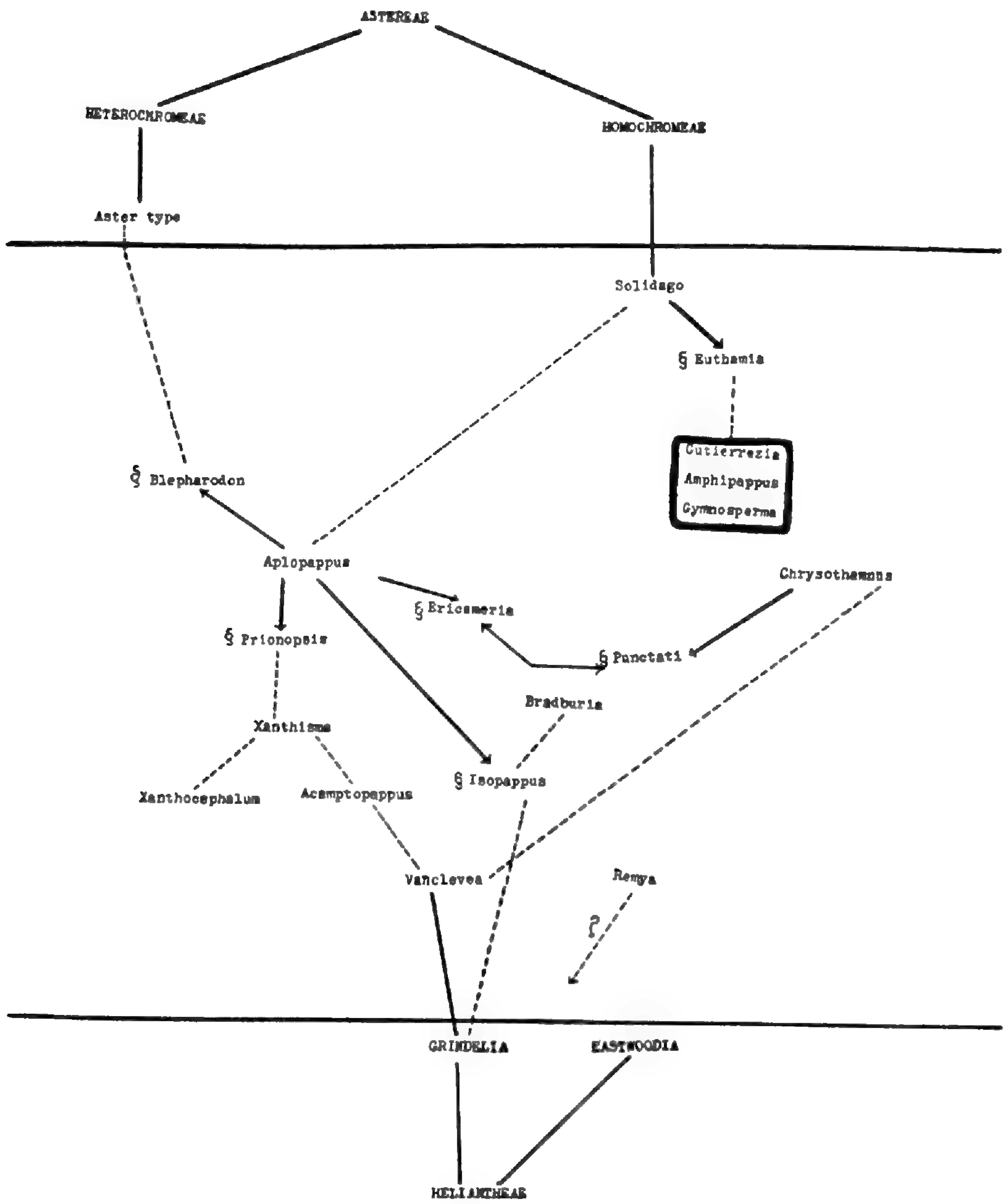

Fig. 2. Chart showing relationships of the genus *Grindelia.*

seem to be more closely allied to section Euthamia of *Solidago,* because of their rather numerous small heads, similar habit, and superficial similarity of involucral bracts. The pappus, however, of these genera is entirely different.

Remya, a genus of the Sandwich Islands, although usually placed near or next to *Grindelia,* is not especially closely allied, and is certainly not as near as are *Vanclevea, Eastwoodia,* certain species of *Aplopappus, Acamptopappus,* and others. *Remya* differs from *Grindelia* in having a persistent pappus, sub-bilabiate ray-corollas, small narrower heads, and in habit. Lastly, *Pentachaeta* is more closely related to other homochromous genera of the Astereae than to *Grindelia.*

It would appear that many of the homochromous Astereae are at one end of that tribe and have given rise to members which are transitional to the Heliantheae and Helenieae. *Grindelia* and *Eastwoodia* seem to be two such genera which possess characters that stamp them as being more heliantheaceous than astereaceous (fig. 2).

Phylogeny

Grindelia is an excellent example of a very natural genus, like *Crataegus, Rubus, Salix, Viola, Dodecatheon,* etc. Such genera, where definite homogeneity is maintained throughout and all the species exhibit the characteristic generic morphological limitations, are not likely to be confused with others. Often genera which are quite coherent allow themselves to be subdivided into natural sections or subgenera. With *Grindelia,* however, the species are so closely inter-related and give to the genus such a high degree of homogeneity that the establishment of sections would be artificial and well-nigh impossible. True, various species tend to form into little groups, but the lines are not sufficiently sharp to permit subgeneric or sectional groups. For example, the rugose surface of the mature achene in a number of Mexican species, combined with a capillary-like pappus, would be important enough for a sectional category were it not that other Mexican species with a similar type of pappus have smooth achenes. Knobby or tooth-like processes or undulate-bordered ridges at the apex of the achene are possessed by many Pacific Coast species and might be used for a sectional character, except for the fact that some Pacific Coast species possess a subtruncate apex or one with scarcely any indication of apical processes or the like; besides there are many transitional types which it would not be possible to place in a definite category.

Rubus, Crataegus, Artemisia, Eriogonum have also had a relatively recent evolution or a recent cycle of rapid multiplication of types. With such genera we are having the opportunity of examining a large suite of recently evolved, closely related forms, in a conspicuously branching evolutionary tree. In most cases there are relatively so few, if any, hiatuses, that their evolutionary history is more or less apparent and requires only a careful and close analytical study to unite the relationships. Often the phylogenetic sequence is very closely correlated with the geographical distribution and limitations. In *Grindelia* this is quite evident. All the recently evolved and closely related species and varieties of the Pacific Coast and interior plains and prairies show a remarkably inter-related complex of linkages, the geographic ranges of which overlap at the margins.

Probably some of the Mexican and South American species of *Grindelia* were at one time associated with one another and were derived from a common ancestral form. They have been separated, however, since early Cenozoic time, when Central and South America were separated by seas, and they have since diverged along independent paths. Most of the North American species seem to have been derived from species of the Ozark and Edwards Plateaus and Texas Hills section. The major phylogenetic trends of the non-Mexican, North American species seem to have been closely correlated with major northward paths of migration from the Mexican species, and radiation taken place eastward and westward.

From *G. oxylepis* and its variety *eligulata* or *G. subdecurrens* of Mexico two major paths of migration are correlated with specific differentiation. *Grindelia oxylepis* has given rise to *G. arizonica* and varieties, which in turn link up with the Pacific Coast species complex and these species *(G. oxylepis* var. *eligulata* and *G. subdecurrens* of Mexico) seem to connect at several points with the species complex, *G. Havardii-G. squar-*

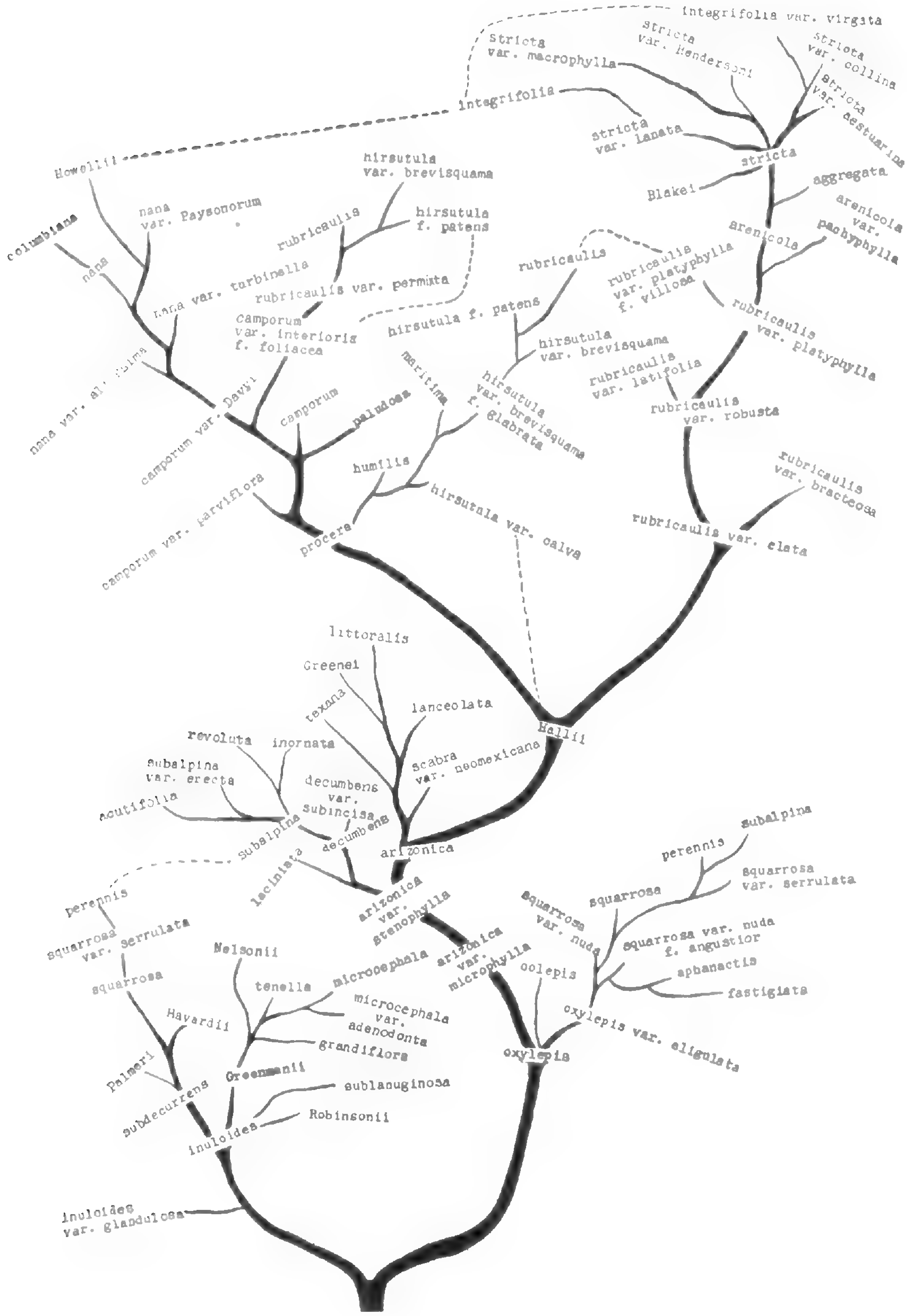

Fig. 3. Chart showing phylogenetic tree of the species, varieties, and forms of *Grindelia*.

rosa-G. perennis and related types. It is possible to derive the radiate *G. Havardii* from the radiate Mexican *G. subdecurrens* because of their common characters: squarrose or spreading involucral bracts, firm resinous-punctate, evenly crenulate-serrulate leaves, and a more or less conspicuously resinous involucre. From *G. Havardii* of western Texas and adjacent New Mexico the transition to the radiate *G. squarrosa,* principally by the bracts becoming more reflexed and the pappus-awns serrulate or setulose, seems logical. By a narrowing of the leaves *G. squarrosa* var. *serrulata* has become set off from the species as the latter migrated westward into the Colorado mountain region. *Grindelia perennis* has segregated from *G. squarrosa* var. *serrulata* as the species invaded the high northern plains from North Dakota, central and northern Wyoming, and Montana northward into Canada.

Another line of derivation of *G. squarrosa* from a Mexican type is also possible. *Grindelia oxylepis* var. *eligulata,* a discoid Mexican type, has evidently given rise, on the one hand, to the eligulate *G. aphanactis* of New Mexico, Arizona, southern Colorado, and southeastern Utah, and on the other hand, to the discoid *G. squarrosa* var. *nuda* and its form *angustior.* These last two occupy a southern range from southern Kansas, western Oklahoma, and central and western Texas, the f. *angustior* being scattered in the western and northwestern portion of the Texas Panhandle region. From the discoid *G. squarrosa* var. *nuda* it is very possible that the radiate *G. squarrosa* has been derived. The latter occupies a more northern range which touches that of the discoid *G. squarrosa* var. *nuda* in northwestern Texas and southern Kansas. If *G. squarrosa* has been derived from *G. squarrosa* var. *nuda,* the only possible derivation of the latter would be from the discoid Mexican *G. oxylepis* var. *eligulata.* However, if one sought for a derivation of *G. squarrosa* through a radiate type it would have to come from *G. Havardii* and it, in turn, from the Mexican *G. subdecurrens.*

It is just as possible for a ligulate type to have evolved from a discoid one, as the reverse situation. One would suppose that the addition of a zygomorphic, ligulate corolla to a composite head of otherwise actinomorphic flowers would denote a mark of evolutionary advance over a head with entirely actinomorphic flowers. Zygomorphy throughout the angiosperms is looked upon as an advance over actinomorphy. Hall,[71] however, regarded the discoid types of *Aplopappus* as cases of suppression from ordinary radiate types, and therefore a mark of evolutionary advance. This suppression may have occurred in *G. squarrosa* var. *nuda,* but it would seem, on the basis of geographical migration northward from a Mexican ancestor, that *G. squarrosa* may well have been derived from the southern phase of *G. squarrosa* var. *nuda,* and this in turn from the Mexican *G. oxylepis* var. *eligulata.* However, the derivation of *G. squarrosa* may have been through the *G. subdecurrens-G. Havardii* alliance, and *G. squarrosa* var. *nuda* might be interpreted as a discoid type derived from *G. squarrosa. Grindelia columbiana* and *G. rubricaulis* var. *bracteosa* appear to have resulted from suppression of the ray florets of *G. nana* and *G. rubricaulis* var. *robusta* respectively.

The main line of evolution, however, concerns the Pacific Coast species. If the Mexican *G. oxylepis* is taken for the ancestral type, it is found to connect with *G. arizonica* var. *microphylla* of Arizona, and this in turn with *G. arizonica.* From *G. arizonica* two lines of development have taken place. One begins with *G. arizonica* var. *stenophylla* of southwestern Colorado and northwestern New Mexico (probably derived from *G. arizonica),* with which are allied *G. decumbens* and its variety *subincisa, G. laciniata, G. subalpina, G. acutifolia,* and *G. revoluta.* Related to *G. arizonica* and varieties are *G. scabra* and var. *neomexicana* of New Mexico and western Texas. Obviously related to this alliance are *G. lanceolata* and *G. texana,* both occurring on areas that have been available for plant occupation since the close of the Cretaceous (the Edwards Plateau and Texas Hills section of Texas) or even since the Paleozoic (the Ozark Plateau). From *G. lanceolata* has

[71] Hall, *loc. cit.* p. 19.

been derived *G. littoralis,* a recently evolved species, occurring on the youthful, recent coastal soils about Galveston Bay.

The other line from *G. arizonica* has proceeded towards the Pacific Coast species complex. The most obvious connection is with *G. Hallii* of the Julian-Cuyamaca Lake region of San Diego County, southern California. In addition to their fairly common distributional areas, both have involucral bracts with primitive erect-appressed, or only slightly spreading, short tips, small heads, and herbaceous habit with relatively short stems. From *G. Hallii* one can derive the remaining California element. Since *G. arizonica,* the ancestor of *G. Hallii,* has in turn been derived from Mexican types similar to *G. oxylepis,* it is quite interesting to find this Sonoran element as the ancestral type from which the later California element of the genus has been derived. Moreover, the relationship of some of the Californian flora from a derived Mexican element is strongly borne out by floristic studies.[72] A study of the northward trend of migration of *Grindelia,* with the resultant differentiation of specific and varietal types derived from *G. Hallii,* shows that two main lines of evolution have taken place: one along the coast, the other northward up the Great Valley and lower foothills of the Coast and Sierra Nevada Range. These lines have diverged in the characters of the involucral bracts, the interior valley and foothill types mostly retaining erect, ascending, spreading or squarrose involucral bracts, and the coastal line possessing a recurved or revolute type. *Grindelia Hallii* has potentialities of both types.

From the evolution of the interior type from *G. Hallii,* we find *G. procera* to be the most closely related. It has become a decidedly more luxuriant species, with larger leaves, more height, etc., but has retained the primitive small heads and relatively short involucral bracts with erect, ascending, or slightly spreading tips of *G. Hallii.* It is found in the San Gabriel Mountains of Los Angeles County and then ranges from Tulare Lake Basin in Kern and Tulare Counties north

[72] Jepson, W. L. Man. Fl. Pl. Cal. pp. 3 and 10. 1925.

along the San Joaquin River Valley to San Francisco Bay region as far as Sacramento County. It then gives rise to *G. camporum* by enlarging the heads, lengthening the pappus awns and involucral bracts, the tips of the latter becoming elongated and conspicuously spreading or squarrose. The linkage between these two species is very evident through *G. camporum* var. *parviflora* which possesses the small heads and habit of *G. procera* but has the bracts, pappus, and achenes of *G. camporum.*

Grindelia camporum, mostly of the lower San Joaquin River Valley from Contra Costa and San Joaquin Counties south to Merced and Fresno Counties and appearing in Los Angeles County, has given rise in Los Angeles and Kern Counties to var. *australis* with recurved bracts. It is replaced by *G. camporum* var. *Davyi* along the greater part of the Sacramento River Valley and tributaries, and in the lower foothills of the western slopes of the Sierra Nevadas and of the Coast Range. In the very youthful salt marshes and estuaries of San Francisco Bay *G. camporum,* with var. *Davyi,* and *G. procera,* all of alluvial or otherwise terrestrial soils, have given rise to *G. humilis* and varieties of salt marshes. Since *G. procera* is of very recent origin and since the San Joaquin and Sacramento Rivers both represent drowned river valleys as they empty into San Francisco Bay, it would appear that *G. camporum* and its var. *Davyi,* as well as *G. procera,* have given rise at the mouths of these drowned rivers to the more youthful estuarine species. Thus, *G. camporum* or var. *Davyi* appear to have evolved in the Suisun marshes into *G. humilis* var. *paludosa,* whereas *G. humilis* and f. *reflexa* would seem to have come from either *G. procera* or *G. camporum* var. *Davyi.*

In the northern Coast Range region of California and towards the Oregon boundary, *G. camporum* var. *Davyi* develops heads with revolute or recurved bracts and shorter pappus awns, thus giving rise to *G. nana* var. *altissima* and var. *turbinella.* Cutting through the Klamath Gap (in northeastern California and southwestern Oregon) northeastwards, east of the Cascades into Oregon, northern Nevada, Washington, Idaho, and western Montana the range of *G. nana* and varieties is continued.

More or less of a continuous series from *G. Hallii* to *G. nana* and varieties has now been traced. The other line of evolution developing from *G. Hallii* is first found in *G. rubricaulis* var. *elata.* There the involucral bracts are definitely revolute or strongly recurved at the tips, a character merely beginning as a tendency in *G. Hallii.* This var. *elata* rather begins where *G. Hallii* leaves off, ranging from the boundary of southern California in San Diego County northward along the coast to Ventura County, giving rise from Orange County northward to *G. rubricaulis* var. *robusta.* On the Santa Barbara Islands and to a limited extent on the adjacent mainland in Santa Barbara County a luxuriant form, var. *latifolia,* has become differentiated from var. *robusta.* Around the Monterey Bay region, still further north, and to a limited extent on the Santa Barbara Islands, another variation, var. *platyphylla,* is to be found.

Grindelia hirsutula with varieties is found in the Coast Range hills and valleys around San Francisco Bay from Sonoma County south into San Luis Obispo County. Certain variations of it are connected through *G. hirsutula* f. *patens,* on the one hand, with *G. rubricaulis,* and on the other, with *G. camporum* var. *interioris* f. *foliacea.*

From the coastal *G. rubricaulis* var. *platyphylla* has evolved *G. arenicola.* Certain collections of these two entities occurring in the Monterey Bay Region are scarcely inseparable, perhaps due to hybridization, but northward from Carmel, Monterey County, particularly along sand dunes and coastal beaches, *G. arenicola* becomes a definite species. Approximately at its northern limit, in southern Oregon and in some places in coastal northern California, it merges into *G. stricta,* a species ranging from southern Alaska to northern California. In *G. stricta* the leaves have become much thinner, fleshier, more elongated, the basal ones not conspicuously dilated or subtruncate at apex as in *G. arenicola,* the bracts less recurved and more spreading. There are intermediates between the two which are difficult to place; these occur where the ranges of the two species overlap. *Grindelia stricta,* in the Puget Sound and Vancouver Island region, develops an intricately interwoven series of variations, some more or less confined to particular habitats, such as sand beaches, coastal slopes, and estuaries. Some of these variations have remained more or less glabrous, while others have taken on various degrees of pubescence. In some the leaves and involucre have become more resinous, in others less so. These are all recently evolved variations which are related to the similarly geologically youthful *G. integrifolia* and var. *virgata.*

Among the Mexican species we find a similar interwoven complex, although generally the species are somewhat more distinct. The Texan *G. microcephala* and varieties have been derived through *G. tenella,* and *G. tenella, G. Nelsonii, G. grandiflora* show in turn close affinity with *G. Greenmanii.*

It is evident that various trends of evolution may have originally been initiated from one species, at least one extant species possessing morphological potentialities which would lead to several lines of development. The relatively few gaps in the development of the generic tree of *Grindelia* are due to the recent evolution of many of the species, combined most likely with the fact that many of the ancestral forms, or forms very similar to extinct ancestral forms, are extant.

The cytological work undertaken in collaboration with Dr. T. W. Whitaker[73] strongly corroborates the concepts of derivation and phylogeny in the present paper. The species have been found to be either diploid or tetraploid, the former being a more primitive type cytologically, morphologically, as well as geographically and geologically, whereas the tetraploid type appears to be the most recently evolved species occurring on the most youthful areas. It seems possible to trace all diploid types back to the Sonoran stock, as well as to relate all the more recently evolved tetraploid types either from other tetraploid types or from diploid stock.

[73] Whitaker, T. W. and Steyermark, J. A. Cytological aspects of *Grindelia* species. Bull. Torr. Bot. Club **62**: 69–73. 1935.

Specific Concept

Aside from variation naturally caused by environmental factors, some of the difficulties in the differentiation of species and varieties of *Grindelia* are no doubt due to natural hybridization and probably also to other chromosomal aberrations (chiasmotypy, apogamy, etc.). Hybridization may be suspected wherever species or varieties occur in the same area and where transitional or aberrant forms are found. Variations within a species may be quite distinct within certain limited localities, but an examination of a large suite of specimens, both in the herbarium and in the field, shows that these variations comprise one long seemingly endless line. The extremes of this interwoven chain-complex may be quite distinct and remote and yet one cannot maintain them as specific entities because of the mass of transitional material. Thus, *G. rubricaulis* and var. *elata* or var. *bracteosa* are obviously distinct, and would represent definite species were it not that *G. rubricaulis* is connected with var. *platyphylla* through the pubescent var. *platyphylla* f. *pilosa,* while var. *platyphylla* is closely allied to var. *robusta* which in turn bears obvious relation to var. *elata* and var. *bracteosa.*

Many of the species have been so recently evolved that the various differentiations have not been sufficiently segregated, and a long complex of closely related series is the inevitable result. For this reason the present author has been compelled to reduce a number of species to varieties or forms or to recognize many varieties and forms. Numerous differentiations have been set off within the genus, and all such divergences from the species have been recognized. If these many tendencies and definite variations were not recognized, the inevitable "lumping" might result in too polymorphic a species. In many cases, the species, as represented by the historical type, is only an insignificant or minor part of the whole, while a variety of such a species may be the common and widely distributed type found. For instance *G. microcephala* var. *adenodonta, G. hirsutula* var. *brevisquama, G. rubricaulis* var.

robusta and var. *elata* represent the more widely dispersed and more commonly collected forms in the species, but, unfortunately are not the entities involved in the real historical nomenclatorial species.

STUDIES IN THE ANACARDIACEAE. I

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In the course of critical studies on the North American species of *Rhus* and their immediate allies, several cases have come to hand where it seems desirable to place on record pertinent notes, and to make a few new combinations to bring the matter in accord with the International Rules of Botanical Nomenclature.

Among important distributions of plant specimens, the following notes seem worthy of recording: *M. E. Jones 27097,* Sept. 21, 1930, distributed as a *Rhus,* is a species of *Fagara; M. E. Jones 27095,* Nov. 25, 1930, distributed as a *Rhus,* is *Thouinia acuminata* Wats.; *A. H. Curtiss 33,* Jan. 12 and May 23, 1903, distributed as *Bursera,* is *Metopium toxiferum* Krug & Urb.; *C. A. Purpus 4065,* May, 1909, distributed as *Bursera,* is, in part, *Actinocheita filicina* (DC.) Barkl.

Toxicodendron vernicifera (DC.) E. A. & F. A. Barkley, n. comb. = *Rhus vernicifera* DC., Prodr. **2**: 68. 1825.

Pseudosmodingium Pterocarpus (Sessé & Moc.) Barkl., n. comb. = *Rhus Pterocarpus* Sessé & Moc., Pl. Nov. Hisp., p. 47; 1888.

This species is very similar to *Pseudosmodingium perniciosum* (HBK.) Engl., from which it differs in having much shorter petiolules, mucronate and broadly ovate leaflets with more obtuse bases. The leaflets in this species are sparsely puberulent, while in *P. perniciosum* they are glabrous throughout. Specimen examined: Mexico: "Plantae Novae Hispaniae," 1787-1804, *Sessé, Mociño, Castillo & Maldonado 4938* (Field Museum Herbarium, no. 847794, part of type).

Issued April 30, 1937.

Ailanthus peregrina (Buc'hoz) Barkley, n. comb.

Ailanthus glandulosa Desf., Mém. Acad. Paris for 1786, p. 265. 1789.

Albonia Peregrina Buc'hoz, Herb. Color. Amér., *pl. 57*. 1783.

Rhus peregrina (Buc'hoz) Stapf, Index Londonensis **1**: 113. 1929.

R. Succedaneum Buc'hoz, Herb. Color. Amér., *pl. 57*. 1783.

The plants so beautifully portrayed in the work of Buc'hoz,[1] here cited, are an exact match for flowering and fruiting specimens of *Ailanthus glandulosa* Desf., and they are undoubtedly conspecific with it; but in accordance with the International Rules the plant must retain its first specific epithet, hence the above transfer.

[1] Buc'hoz, P. J. Herbier colorié de l'Amérique, représentant les plantes les plus rares et les plus curieuses, qui se trouvent dans cette nouvelle partie du monde, pour servir à l'intelligence de l'histoire générale et oeconomique des 3 règnes. Paris, 1789.

Explanation of Plate

PLATE 9

Plate 57 from Buc'hoz' 'Herbier colorié de l'Amérique, . . .' showing the plant Buc'hoz called *Albonia Peregrina* and *Rhus Succedaneum,* which is here interpreted as conspecific with *Ailanthus glandulosa* Desf.

Albonia Peregrina. *Nobis*. Rhus Succedaneum. *Linn. Le faux Vernix*.

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A MONOGRAPHIC STUDY OF RHUS AND ITS IMMEDIATE ALLIES IN NORTH AND CENTRAL AMERICA, INCLUDING THE WEST INDIES[1]

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[1] An investigation carried out at the Missouri Botanical Garden in the Graduate Laboratory of the Henry Shaw School of Botany of Washington University and submitted as a thesis in partial fulfillment of the requirements for the degree of doctor of philosophy in the Henry Shaw School of Botany of Washington University.

Issued September 27, 1937.

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Introduction

The present study suggested itself to the author while engaged on some correlated taxonomic studies related to Dr. Ray M. Balyeat's work on the specificity of skin irritants produced by various plants, during which it became apparent that the various elements referred to the great Rhus-complex were so confused as to make phytochemical and dermatological studies in a like degree uncertain.

The excellent treatises of Engler (32)[1] and of Gray (40) form a most admirable basis for this study. Since their publication, however, extensive explorations and collections, especially in Mexico, have been made, as a result of which, and also of further study of old collections and differences in interpretations of generic and specific concepts, many new names and

[1] The numbers in parentheses refer to the assembled bibliography at the end of part I of this paper.

combinations have appeared. Some workers have regarded the Rhus-complex as composed of many comparatively small genera; others have considered it a "polymorphous" genus composed of a number of distinct sections or subgenera.

Critical studies of the various elements of the Anacardiaceae are now in progress and will be developed by the author eventually into a monograph of the entire family.

I. General Discussion

HISTORY[1]

The history of the group of species of the Anacardiaceae which Linnaeus included in his genus *Rhus* is long and interesting. Two members, now known as *Cotinus Coggygria* Scop. and *Rhus Coriaria* L., were known at least as early as classical antiquity for they figure in Theophrastus' 'Enquiry into Plants' (115). From Greek times they have been widely known because of their economic importance. The former was used in the preparation of dye and for its colored wood; the latter as a medicine, for seasoning, and for the tanning of hides. They were also included in most of the botanical treatises of medieval and Renaissance time. While as far back as 1591, *Cotinus* was called *Rhus Allobrogum* by L'Obel (66), the two were seldom treated together as *Rhus* until the eighteenth century, although their close affinity was apparently realized and in numerous works the treatment of one immediately followed the other.

Rhus Coriaria L. and *Cotinus Coggygria* Scop. were the only members of the group treated botanically before 1600. However, following the widespread exploration during the seventeenth and eighteenth centuries many additional species were reported.

In 1620, in Bauhin's 'Prodromos' (7), the North American plant, later designated as *Rhus glabra* L., was published, although erroneously reported as being from Brazil. Three years later in the same author's 'Pinax' (8), another North

[1] For a more complete early history of *Rhus* see: Barkley, F. A. & E. D. Barkley. A brief history of *Rhus* to the time of Linnaeus. (Manuscript.)

American member, now known as *Rhus typhina* Torner, was also mentioned. *Rhus Copallina* L. appeared in Parkinson's 'Theatrum Botanicum' (78) in 1640 as *Lentisci Peruani Similia Molle Dicta.* The very closely related Asiatic species, *Rhus javanicum* L., *Rhus hypoleuca* Champ., and *Rhus punjabensis* Steward, did not enter botanical literature until later. *Rhus javanicum* L. was the first of these, having been described in Linnaeus' 'Species Plantarum' (63) in 1753.

The *Toxicodendron* element of the complex appeared first in Cornut's 'Canadensium Plantarum' (22) where a plant, evidently belonging to the species now termed *Toxicodendron radicans* (L.) Kuntze, was described and figured as *Edera trifolia Canadensis.* It again appeared in 1696 in Plukenet's 'Almagestum Botanicum' of the 'Opera Omnia Botanica' (82) as *Arbor americana alatis foliis fusco lacteo venenata.* Their Asiatic relatives, *Toxicodendron succedanea* (L.) Kuntze and *Toxicodendron vernicifera* (DC.) Barkl. & Barkl., the latter of which was long confused with *Toxicodendron Vernix* (L.) Kuntze, were reported in 1712 in Kaempfer's 'Amoenitatum Exoticarum' (53) under the names *Fari no ki* and *Sitz dsju* respectively.

The four African species of the Rhus-complex, which form the basis for the section GERONTOGEAE of Engler, appeared botanically in 1696 in Plukenet's 'Almagestum Botanicum' of his 'Opera' (82).

Metopium Brownei (Jacq.) Urb. first appears with description as *Terebinthus maxima, pinnis paucioribus majoribus atque rotundioribus, fructo sparso,* in 1696, in Sloane's 'Catalogus Plantarum, quae in Insula Jamaica, sponte proveniunt . . .' (102), and was beautifully illustrated in 1725 in volume two of the same author's 'Natural History of Jamaica' (103).

The only known species of *Actinocheita* (5) was first published as *Rhus filicina* by de Candolle in his 'Prodromus' (18) in 1825, later by Sessé & Mociño (101) as *Rhus Tetlatziam,* and by Turczaninow (121) as *Rhus potentillaefolia.* It has been collected so infrequently that its distinctive characters have been overlooked, and as a result it has been long included in *Rhus.*

Malosma was first described from California as *Rhus laurina* Nuttall ex Torrey & Gray (119) in 1838. In 1842 Walpers (122) transferred it to *Lithraea,* which genus, however, differs from *Malosma* in having ten stamens. Engler (32) treated it as *Rhus laurina,* but he added Nuttall's manuscript name for it, *Malosma laurina,* as a synonym.

There are several elements of *Rhus* found in North America, which, unlike *Rhus glabra* L., *Rhus typhina* Torner, and *Rhus Copallina* L., differ markedly from the type and in part have received various generic designations. The first known was that which has been variously segregated generically under the names *Turpinia* (Rafinesque, 1808 [85]), *Lobadium* (Rafinesque, 1819 [86]), and *Schmaltzia* (Desvaux, 1813 [28]). This element appeared with the publication of one of its species, *Rhus aromatica* Ait., as *Myrica trifoliata foliis ternatis dentatis* in Linnaeus' [Printz' 'Plantae Africanae Rariores' in] 'Amoenitates Academicae' (83) in 1760. Its very diverse western ally, *Rhus trilobata* Nutt., was published in Torrey and Gray's 'Flora of North America' (119).

Another element somewhat closely allied to *Rhus aromatica,* which has been variously segregated as *Rhoeidium,* appeared with the publication of its single species, *Rhus microphylla* Engelm., in Asa Gray's 'Plantae Wrightianae' (38) in 1852. The group of related species from the west coast of North America that has been variously segregated as *Styphonia* (Nuttall ex Torrey & Gray, 1838 [119]) and *Neostyphonia* (Shafer, 1908 [14]) was first reported with the publication of *Rhus mollis* by Humboldt, Bonpland, and Kunth (58) in 1824. This was followed in 1838 by *Styphonia integrifolia* Nuttall in Torrey and Gray's 'Flora of North America' (119). *Rhus Lentii* was subsequently described by Kellogg (54) in 1863 and *Rhus ovata* by Watson (123) in 1885. A group of southwestern and Mexican relatives of *Rhus integrifolia* (Nutt.) Benth. & Hook., having pinnately compound leaves, entered botanical literature in 1842 with the publication of *Rhus Schiedeana* Schlecht. (99) of Mexico. Another species of Texas and New Mexico was published in 1850 almost simultaneously, as *Rhus virens* Lindh. (37) and *Rhus sempervirens* Scheele (98). In 1858, *Rhus ciliolata* Turcz. (121) from Mexico was described.

With further exploration and collection in Mexico more and more species were reported. A little-worked, poorly known, but nevertheless distinctive assemblage of species is the group which varies geographically and morphologically around the Mexican plant described in 1830 by Schlechtendal and Chamisso (99) as *Rhus terebinthifolia*. The next of this group to be described as a species was *Rhus Palmeri* Rose (89), from Sonora, Mexico. More study and further collections have led to the publication of several new species since 1900.

As will be noted from the accompanying chart (table i), Tournefort (120), in 1700, disregarding *Metopium* and the African species, distributed the remaining known members of this complex into three genera: *Rhus* including *Rhus Coriaria*

TABLE I

GENERIC CONSIDERATIONS BY VARIOUS WORKERS OF *RHUS* AND ITS IMMEDIATE ALLIES (EXCLUSIVE OF MELANOCARPAE AND GERONTOGEAE ENGL.). THE "ELEMENTS" IN THIS COMPLEX ABOVE THE RANK OF SPECIES ARE LISTED; THOSE TREATED AS PART OF THE GENUS *RHUS* ARE INDICATED BY A CIRCLE (○); IF TREATED AS GENERICALLY DISTINCT, BY A CROSS (X).

AUTHOR	*Rhus*	*Pseudosumac*	*Styphonia*	*Pseudoschmaltzia*	*Rhoeidium*	*Lobadium*	*Actinocheita*	*Malosma*	*Toxicodendron*	*Cotinus*	*Metopium*
1700 Tournefort (120)*	○	....	....	....	....	....	....	....	X	X	....
1753 Linnaeus (63)	○	....	....	....	....	....	....	....	○	○	○
1759 Linnaeus (65)	○	....	....	....	....	....	....	....	○	○	○
1766 Crantz (25)	○	....	....	....	....	....	....	....	○	○	....
1768 Miller (72)	○	....	....	....	....	X[1]	....	....	X	○	....
1785 Marshall (70)	○	....	....	....	....	○	....	....	X[2]	....	....
1789 Aiton (2)	○	....	....	....	....	○	....	....	○	○	....
1794 Moench (73)	○	....	....	....	....	....	....	....	X	X	....
1803 Michaux (71)	○	....	....	....	....	○	....	....	○	....	....
1806 Mirbel (11)	○	....	....	....	....	....	....	....	○	○	○
1806 Lamarck & Poiret (60)	○	....	....	....	....	○	....	....	○	○	○
1813 de Candolle (17)	○	....	....	....	....	....	....	....	○	○	....
1814 Pursh (84)	○	....	....	....	....	○	....	....	○	....	....
1819 Rafinesque (86)	○	....	....	....	....	X[3]	....	....	X	....	....
1820 Roemer & Schultes (88)	○	....	....	....	....	○	....	....	○	○	○
1824 Torrey (117)	○	....	....	....	....	○	....	....	○	....	....
1825 Sprengel (110)	○	....	....	....	....	○	....	....	○	○	○
1825 de Candolle (18)	○[4]	....	○[4]	....	....	○[5]	○[4]	....	○[4]	○[5]	○[5]

TABLE I (Continued)

AUTHOR	*Rhus*	*Pseudosumac*	*Styphonia*	*Pseudoschmaltzia*	*Rhoeidium*	*Lobadium*	*Actinocheita*	*Malosma*	*Toxicodendron*	*Cotinus*	*Metopium*
1826 Torrey (118)	O	....	....	....	....	O	....	....	O	....	....
1830 Hooker (49)	O[4]	....	....	....	....	O[5]	....	....	O[4]	....	....
1832 Don (30)	O[4]	....	O	....	....	O[5]	O[4]	....	O[4]	O[5]	O[5]
1838 Torrey & Gray (119) .	O[6]	....	X	....	....	O[7]	....	O[7]	O[6]	O[7]	....
1840 Hooker & Arnott (50)	O	O	....	....	....	O	....	....	O	....	....
1841 Steudel (113)	O	O	O	....	....	O	O	....	O	O	O
1842 Walpers (122)	O	....	....	....	....	O	....	X[8]	O	....	....
1842 de Schlechtendal (99)	....	O	....	O	....	O	....	....	O	....	....
1845 Wood (125)	O	....	....	....	....	O	....	....	O	O	....
1846 Gray (35)	O	....	....	....	....	....	....	....	O	O	....
1848 Gray (36)	O[4]	....	....	....	....	O[5]	....	....	O[4]	....	....
1849 Nuttall (75)	....	....	X	....	....	....	....	....	....	X	O
1859 Cooper (21)	O	....	X	....	O	....	....	X[8]	O	....	O
1860 Chapman (19)	O	....	....	....	....	O	....	....	O	O	O
1862 Bentham & Hooker (9)	O	....	O	....	....	....	....	O	....	....	....
1866 Grisebach (46)	O	....	....	....	....	....	....	....	....	....	O
1869 Koch (56)	O[4]	....	....	....	....	O[5]	....	....	O[5]	X	....
1877 Wood (126)	O	....	....	....	....	O	....	....	O	O	....
1877 Lavallée (61)	O	....	....	....	....	O	....	....	O	O	....
1878 Rothrock (90)	O	....	....	O	....	O	....	....	O	....	....
1879 Hemsley (48)	O	O	O	O	O	O	O	....	O	....	....
1883 Engler (32)	O[10]	O[10]	O	O[10]	O[10]	O[10]	O[10]	O[20]	O[20]	X	X
1888 Sessé & Mociño (101)	O	....	O[10]	....	....	O	O	....	O	....	....
1889 Wood & Willis (127) .	O	....	....	....	....	O	....	....	O	O	O
1891 Sargent (95)	O	....	....	....	....	....	....	....	O	....	X
1891 Kuntze (59)	O[1]	O[1]	....	O[1]	O[1]	O[1]	O[1]	O[1]	O[1]	....	....
1891 Coulter (23)	O	....	O[1]	O	O	O	....	....	O	O	....
1892 Patterson (79)	O	....	....	O	O	O	....	O	O	O	O
1892 Engler (33)	O[10]	O[10]	O	O[10]	O[10]	O[10]	....	....	O[20]	X	X
1892 Sargent (96)	O	....	O[10]	....	....	....	....	....	O	X	O
1892 Dippel (29)	O[11]	....	O	....	....	O[12]	....	....	O[7]	X	....
1893 Koehne (57)	O[13]	....	....	....	....	O	....	....	O[5]	X	....
1894 Britton (12)	O	....	....	....	....	O	....	....	O	X	....
1897 Gray (40)	O[14]	....	O[14]	O[14]	O[14]	O[14]	....	O[14]	O[14]	O[5]	O[5]
1901 de Dalla Torre & Harms (26)	O	O	O	O	O	O	O	O	O	X	X
1901 Britton (13)	O	....	....	....	O	O	....	....	O	X	....
1903 Small (104)	O[15]	....	....	O[15]	O[15]	O[15]	....	....	X[16]	X	X
1905 Greene (42-44)	O	....	....	....	X	X[9]	....	....	X	....	....
1905 Sargent (97)	O	....	....	....	....	....	....	....	O	X	X
1906 Piper (80)	O	....	O	....	....	....	....	....	O	....	....
1906 Loesener (67)........	O	O	O	O	....	....	O	....	....	....	....
1907 Schneider (100)	O[17]	....	....	....	....	O[18]	....	....	O[7]	X	....
1908 Gray, Robinson & Fernald (41)	O[4]	....	....	....	....	O[5]	....	....	O[20]	O[5]	....

TABLE I (Continued)

AUTHOR	*Rhus*	*Pseudosumac*	*Styphonia*	*Pseudoschmaltzia*	*Rhoeidium*	*Lobadium*	*Actinocheita*	*Malosma*	*Toxicodendron*	*Cotinus*	*Metopium*
1908 Britton & Shafer (14)	O	....	X[18]	....	....	....	....	....	X	X	X
1909 Coulter & Nelson (24)	O	....	....	....	....	O	....	....	O	....	....
1910 Abrams (1)	O	....	X[19]	....	....	X[9]	....	X[8]	X	....	....
1911 Daniels (27)	O	....	....	....	....	X[9]	....	....	X	....	....
1913 Small (105)	O	....	....	....	....	....	....	....	X	....	X
1913 Farwell (34)	O	....	....	....	....	O	....	....	O	....	....
1913 Britton & Brown (16)	O	....	....	....	....	X[9]	....	....	X	X	....
1914 Piper & Beattie (81)	O	....	....	....	....	....	....	....	O	....	....
1915 Wooton & Standley (128)	O	....	....	O	X	X[9]	....	....	X	....	....
1917 Rydberg (92)	O	....	....	....	....	O	....	....	X	....	....
1925 Jepson (51)	....	....	O	....	....	O	....	O	O	....	....
1925 McNair (69)	O	....	....	....	....	....	....	....	O	....	....
1925 Tidestrom (116)	O	....	....	....	....	O	....	....	X	....	....
1927 Rehder (87)	O	....	....	....	....	O[5]	....	....	O[6]	X	....
1932 Rydberg (94)	O	....	....	....	....	O	....	....	X	....	....
1933 Small (106)	O	....	....	....	....	X[9]	....	....	X	X	X
1935 Munz (74)	O	....	O	....	....	O	....	O	O	....	....
1936 Lemée (62)	O	....	O	....	O	O	....	O	O	X	X
1936 Jepson (52)	....	....	O	....	....	O	....	O	O	....	....
1937 Barkley—	O[17]	O[5]	O[5]	O[5]	O[5]	O[5]	X	X	X	X	X

[1] As *Toxicodendron*.
[2] As *Rhus-Toxicodendron*.
[3] As *Lobadium* and *Turpinia*.
[4] Section SUMAC.
[5] As section.
[6] As subgenus RHUS.
[7] As subgenus.
[8] As *Lithraea*.
[9] As *Schmaltzia*.
[10] In section TRICHOCARPAE.
[11] Section SUMAC of subgenus TRICHOCARPAE.
[12] Section LOBADIUM of subgenus TRICHOCARPAE.
[13] Subsection SUMAC of section TRICHOCARPAE.
[14] Section RHUS.
[15] With the generic designation *Schmaltzia*.
[16] With the generic designation *Rhus*.
[17] Subgenus SUMAC.
[18] Subgenus SCHMALTZIA.
[19] With the generic designation *Neostyphonia*.
[20] Section VENENATAE.

* The parenthetical numbers refer to the articles listed in the assembled bibliography at the end of part I.

L. and its immediate American relatives; *Cotinus* for *Cotinus Coggygria* Scop.; and *Toxicodendron* for *Toxicodendron radicans* (L.) Kuntze and *Toxicodendron Vernix* (L.) Kuntze. However, in the 'Species Plantarum' of 1753, Linnaeus (63) established the genus *Rhus* by the inclusion of eleven species[1]

[1] *Rhus Cobbe* L. is disregarded as being non-Anacardiaceous [*Allophyllus Cobbe* (L.) Blume of the Sapindaceae].

which are now considered Anacardiaceous, submerging therein all three of the Tournefortian genera.[1] Almost immediately, Miller (72), in his eighth edition of the 'Gardener's Dictionary,' segregated *Toxicodendron.* Since that time *Rhus* has been reviewed in part and in its known entirety many times, some of the more notable treatments being shown in table I. These varied from the mere nomenclatorial catalogues of Steudel (113), Patterson (79), and Kuntze (59), to the careful descriptions and re-evaluations in the monographic studies of the group by Engler (32), Gray (40), and Greene (42-45).

One of the earliest comprehensive studies of *Rhus* is that of de Candolle (18) in his 'Prodromus,' in which he treats *Rhus* with *Mauria* HBK., *Duvaua* Kunth, and *Schinus* L., in Tribe SUMACHINEAE of the 'Terebinthaceae.' He considers the species of *Rhus* as constituting five sections: (a) COTINUS; (b) METOPIUM; (c) SUMAC, equivalent to the genera *Rhus* and *Toxicodendron* of Tournefort, as well as most of the African species; (d) THEZERA, composed of two species, *Rhus pentaphylla* Desf. and *R. ziziphina* Tineo; and (e) LOBADIUM.

The most careful treatment of *Rhus* in its entirety is the excellent monograph by Engler (32) in de Candolle's 'Monographiae Phanerogamarum.' In this work *Cotinus* and *Metopium* are segregated as genera and all of the other species of *Rhus, sensu Linnaei,* are distributed into four sections: (a) TRICHOCARPAE built around *Rhus Coriaria* L. and equivalent to the genus *Rhus* as treated in the present monograph (except that *Rhus trichocarpa* Miq. would here be considered as belonging in the Toxicodendron-complex and that *Rhus potentillaefolia* Turcz. is here treated as constituting the monotypic genus, *Actinocheita);* (b) VENENATAE, which included the Toxicodendron-complex and *Malosma;* (c) GERONTOGEAE, which contained most of the African and Indian species from Sections SUMAC DC. and THEZERA DC.; and (d) MELANOCARPAE,

[1] *Rhus* is one of the six genera of the Anacardiaceae given in Linnaeus' 'Species Plantarum' (63) which Engler includes in his delimitation of the family; the other genera being *Anacardium, Spondias, Pistacia, Schinus,* and *Mangifera.* Engler gives fifty-eight genera in his treatment of the Anacardiaceae in Engler and Prantl's 'Naturlichen Pflanzenfamilien.'

which included the two black-fruited species, *Rhus retusa* Zoll. and *R. simarubaefolia* Gray.

In 1891 Kuntze (59) revived the Tournefortian name *Toxicodendron* and made new combinations by renaming most of the species of *Rhus, sensu Engleri.* In 1903 Small (104) designated the term *Schmaltzia* for the genus *Rhus* in a restricted sense, reserving the name *Rhus* for the plants usually called (when segregated) *Toxicodendron.*

In 1897, Gray (40) treated *Rhus* of the United States in the most inclusive sense in which it has ever been considered. In addition to *Cotinus, Metopium,* and *Rhus,* in the sense of Engler, he included the American representative of *Pistacia* as *Rhus mexicana* (HBK.) Gray. Gray's work was keenly executed, and it is interesting to note that seemingly he was the only early botanist to understand the similarities between such species as *Rhus virens* Lindh., *R. integrifolia* (Nutt.) Benth. & Hook., *R. microphylla* Engelm., and *R. aromatica* Ait., for he alone included them all in LOBADIUM, as contrasted with the "true sumacs," of his section RHUS.

The most important single work concerning the Central American species is Hemsley's 'Biologia Centrali-Americana' (48), while that for the West Indies is Grisebach's 'Catalogus Plantarum Cubensium . . .' (46).

The later American workers have not been in accord in their interpretation either of generic limits or of species in this complex. Small (104–106), Britton (12–16), Abrams (1), and Greene (42–45) seem inclined to segregate *Styphonia, Toxicodendron,* and *Schmaltzia, sensu strictissimo.* Coulter (23), among others (see table I), includes *Toxicodendron* and *Schmaltzia* in *Rhus,* while Jepson (51, 52) and Munz (74) would in addition include *Styphonia* and *Malosma.* In the interpretation of species such conservative workers as Robinson and Fernald, following the treatment by Gray (41), consider the group as composed of very few large species. Britton (12–16), Small (104–105), Rydberg (91–94), and others have treated the group as composed of comparatively few, but somewhat smaller species; while some students of the group, the foremost of which was Greene (42–45), have delimited a great number of small local species.

The work of Engler (32) and of Gray (40) may be taken as models of the most excellent conservative treatment of the group in the area under consideration. However, no recent attempt has been made to clarify the identity or validity of the many new combinations which have since occurred, and it is hoped that the present revision will help to evaluate them in the light of modern usage.

MORPHOLOGY

In common with many of the Anacardiaceae, the species under consideration have cyclic, heterochlamydic, and mostly 5-parted flowers, with a superior, tricarpellary compound pistil, usually with a single fertile carpel, containing (in these species) a single basally attached and anatropous ovule. All have a disk between the pistil and stamens. The stamens are as many as the petals and alternate with them. The calyx in fruit is not enlarged, and the petals are more or less truncate.

An insight into the general morphological relationship between the genera under consideration and the related genera in the Anacardiaceae may be gained by reference to the key to the tribes of the Anacardiaceae and to the genera of the tribe Rhoideae from Engler's treatment of the family in Engler and Prantl's 'Die Natürlichen Pflanzenfamilien' (33). Some of the comparative morphological characters of the Rhus-complex are indicated in table II and in the following synoptic key[1] to the genera studied:

O Style on the side of the fruit; leaves simple .... Cotinus

O Style placed more or less at the apex of the fruit; leaves simple or compound.

 Δ Layers of the fruit coat not finally separate; drupe longer than broad, not depressed; endocarp thin; leaves pinnately compound .... Metopium

 Δ Layers of the fruit coat separating in various ways; the drupe almost globular, oval, or depressed, and often somewhat flattened; endocarp thick and bony.

[1] For the sake of convenience, the sections Melanocarpae and Gerontogeae of Engler are included in brackets and italicized, although they are not further considered in this study.

□ Ovary upon a gynophore; epicarp clothed with filiform silky hairs over 3 mm. long..ACTINOCHEITA

□ Ovary not upon a gynophore; epicarp when clothed with hairs, with hairs less than 1.5 mm. long.

′ Drupes red, pubescent with glandular hairs........................RHUS

′ Drupes white or black, glabrous or sparingly pubescent with non-glandular hairs.

√ [*Drupes black, glabrous; exocarp and mesocarp adhering*..*MELANOCARPAE*

√ *Drupes white or dun-colored, glabrous or sparingly pubescent; mesocarp and endocarp adhering.*

o *Mesocarp not waxy, but resinous; leaves usually ternate*..*GERONTOGEAE*]

o Mesocarp waxy; leaves usually simple or pinnately compound.

″ Drupes less than 2 mm. in diameter; mesocarp without fibers; effluvium innocuous; leaves coriaceous, simple; inflorescence a terminal thyrsus; evergreen shrubs or small trees....MALOSMA

″ Drupes over 2.5 mm. in diameter; mesocarp with "fibers"; effluvium poisonous; leaves thin, compound; inflorescences lateral panicles; deciduous shrubs, small trees or vines..TOXICODENDRON

Underground Parts.—The root system in most of this complex is quite shallow. There is a widespread tendency to a vegetative reproduction by offshoots and rhizomes so that the plants characteristically appear in clumps or clones. However, individual specimens are common, and in some species apparently normally occur singly.

Habit and Habitat.—There is a great difference in habit and habitat in the various species. Some are exceedingly widespread and adaptive; others are quite restricted in habitat. The members of the component genera of the entire group are typically shrubs and small trees, although some of the tropical species of the subgenus SCHMALTZIA are subscandent, while in *Toxicodendron* they are often lianas—some species of this genus in fact may be subshrubs, shrubs, or lianas. The genus *Rhus* is typically a few-branched shrub, although some species are small trees; in the subgenus SCHMALTZIA the plants are often many-branched shrubs.

Stems.—The stems vary considerably. In the subgenus SCHMALTZIA (pl. 15) and in the genera *Toxicodendron, Cotinus, Metopium,* and *Malosma* the branches are comparatively slen-

Einteilung der Familie.

A. 5 Carpelle frei oder nur 1. B. stets einfach, ganzrandig . . . . . **I. Mangifereae.**
B. Carpelle mit einander in einen Stempel vereinigt. B. selten einfach, häufig gefiedert oder gedreit.
a. Carpelle meist 5—4, selten mehr oder 3. Jedem Carpell entspricht im Frkn ein Fach, welches an seinem oberen Ende eine Sa. trägt . . . . . **II. Spondieae.**
b. Carpelle 3 (vielleicht nur 1 bei *Pentaspadon*). Frkn. nur mit einem, 1 Sa. tragenden Fach, die beiden anderen sehr klein oder fehlend.
α. Frkn. und Fr. frei. B. verschieden. . . . . **III. Rhoideae.**
β. Frkn. selten frei (*Nothopegia*), der becherförmig oder röhrenförmig ausgehöhlten Blütenachse eingesenkt. . . . . **IV. Semecarpeae.**
C. Nur 1 Carpell. - ♀ Bl. völlig nackt. B. einfach, gesägt, gegenständig **V. Dobineeae.**

. . . .

III. Rhoideae.

Carpelle 3, selten 1 (? *Pentaspadon*), die Gr. an der Spitze seitlich od. an der Spitze, frei oder unterwärts vereinigt. Frkn. oberständig, meist 1fächerig, sehr selten noch 2—3fächerig, dann aber mit nur 1 fruchtbaren Fach, die 1 Sa. an meist kurzem Funiculus, welcher vom Grunde aus oder nahe am Grunde aufsteigt oder von der Wandung unterhalb der Spitze abgeht, hängend. Stb. in 2 Kreisen oder 1 Kreis. Steinfr. bisweilen mit einem durch die vergrößerten Kelchb. gebildeten Flugapparat, seltener Flügelfr., 1fächerig oder 1samig. E. meist gekrümmt, seltener gerade. — B. abwechselnd, einfach oder gedreit oder gefiedert.

A. Bl. mit einfacher, homoiochlamydeischer Blh. oder nackt.
a. Frkn. seitlich zusammengedrückt; 3 kleine N. seitwärts am oberen Ende. B. einfach **21. Haplorhus.**
b. Frkn. fast kugelig oder kurz eiformig, in einen Gr. zusammengezogen. Gr. kurz 3spaltig; 3 große, länglich-verkehrt-eiformige oder längliche N. B. einfach oder gefiedert **22. Pistacia.**
B. Bl. mit doppelter Blh., mit 2 Kreisen von Stb., die vor den Blb. stehenden bisweilen als Staminodien entwickelt. B. gefiedert.
a. Sa. aufsteigend. N. einzeln, einseitswendig. . . . . **23. Pentaspadon.**
b. Sa. vom Scheitel des Faches herabhangend. N. kopfformig, 3lappig **24. Microstemon.**
C. Bl. mit doppelter Blh., mit doppelt oder ebenso viel Stb. als Blb., selten mit mehr.
a. Blutenachse tief becherförmig. Blb. kaum langer und breiter als die Kelchb. Frkn. 2—3facherig. B. gefiedert . . . . **25. Thyrsodium.**
b. Blutenachse flach oder zwischen Frkn. und den Stb. in einen Discus erweitert, selten hohl.
α. E. gerade, mit sehr kurzem Stämmchen. Stb. ebenso viel oder doppelt so viel oder mehr als Blb. Sa. hängend. B. gefiedert.

I. Fr. durch ein langes, zusammengedrücktes Gynophor in die Höhe gehoben. Stb. ebenso viel als Blb. . . . . **26. Faguetia.**
II. Fr. eine sitzende Steinfr.
1. Kelchb. an der Fr. nicht vergroßert.
* Stb. die Blb. nicht überragend, ebenso viel als Blb. bis mehr als doppelt so viel **27. Sorindeia.**
** Stb. die Blb. überragend, nur ebenso viel . . . . . **28. Trichoscypha.**
2. Kelchb. an der Fr. stark vergroßert, flügelformig. Stb. ebenso viel als Blb. **29. Parishia.**
β. E. mehr oder weniger gekrümmt, mit freiem oder den Keimb. anliegendem Stämmchen. Stb. doppelt so viel oder ebenso viel als Blb. Sa. aufsteigend oder hängend. B. einfach oder gedreit oder gefiedert.
I. Frkn. 2—3fächerig.
1. 2—3 Fächer des Frkn. mit je 1 in der Mitte des Faches von der Wand herabhängenden Sa. Fr. 1samig. E. mit kurzem, leicht gekrümmtem Stämmchen **30. Protorhus.**
2. Frkn. unvollständig 2fächerig, mit 1 fruchtbaren Fach. Sa. vom Scheitel herabhängend. E. sehr gekrümmt, mit langem Stämmchen und um das sterile Fach herum gekrümmten Keimb. . . . . **32. Campnosperma.**
II. Frkn. 1fächerig.
1. E. mit freiem, kurzem oder längerem Stämmchen. Stb. doppelt so viel als Blb.
* Sa. hängend . . . . **33. Euroschinus.**
** Sa. aufsteigend . . . . **34. Rhodosphaera.**
2. Das Stämmchen des E. den Keimb. anliegend.
* Bl. mit doppelt so viel Stb. als Blb.
÷ Sa. hängend.
○ Endocarp der Steinfr. dunn pergamentartig . . . . . . **35. Mauria.**
○○ Endocarp der Steinfr. knochenhart, das Mesocarp mit bandförmigen Harzgängen versehen . . . . **36. Schinus.**
÷÷ Sa. aufsteigend . . . . **37. Lithraea.**
** Bl. mit ebenso viel Stb. als Blb.
÷ Steinfr. ungeflügelt oder ringsum mit geflügeltem Rand.
○ Gr. oder N. seitlich an der Fr.
△ Sa. aufsteigend.
X Blb. stumpf. Kelch bei der Fruchtreife nicht vergrößert. B. einfach **38. Cotinus.**
XX Blb. spitz. Kelch bei der Fruchtreife vergrößert und die Fr. einschließend. B. gefiedert . . . . **39. Loxostylis.**
△△ Sa. von der Spitze des Faches herabhängend.
X Zweigchen des ♀ Blütenstandes zuletzt verbreitert. Gr. einfach. B. einfach . . . . **40. Laurophyllus.**
XX Zweigchen der Blütenstände stets dünn. 3 Gr. Fr. ringsum breit geflügelt. B. gedreit . . . . **41. Smodingium.**
○○ Gr. oder N. an der Fr. mehr oder weniger endständig.
△ Schichten der Fruchtwandung zuletzt nicht getrennt. Kelchb. an der Fr. nicht vergrößert.
X Endocarp dick, knochenhart. Mesocarp fleischig, B. einfach **42. Heeria.**
XX Endocarp dünn. B. einfach . . . . **31. Baronia.**
XXX Endocarp dünn. B. gefiedert.
□ Bl. 3teilig . . . . **43. Comocladia.**
□□ Bl. 5teilig . . . . **44. Metopium.**
△△ Schichten der Fruchtwandung zuletzt auf verschiedene Weise sich trennend. Die Kelchb. an der Fr. nicht vergrößert.
X Steinfr. nierenförmig, stark zusammengedrückt. B. gefiedert **45. Pseudosmodingium.**
XX Steinfr. fast kugelig oder eiförmig oder etwas niedergedrückt, oft leicht zusammengedrückt. Sa. aufsteigend. B. einfach oder gedreit oder gefiedert . . . . **46. Rhus.**
△△△ Schichten der Fruchtwandung zuletzt nicht getrennt. Kelchb. an der Fr. vergrößert, flugelformig. Sa. hängend . . . **47. Astronium.**
÷÷ Steinfr. zusammengedruckt, oberwarts in einen Flugel erweitert. Gr. seitlich an der Fr.
○ Die ganze Fruchtwandung dunn. Kelch 5lappig **48. Loxopterygium.**
○○ Epicarp der Fruchtwandung dunn. Endocarp dick, steinhart **49. Schinopsis.**

. . . .

Von unsicherer Stellung, da der E. nicht bekannt ist.
A. B. einfach. Madagaskar . . . . **50. Micronychia.**
B. B. gefiedert. Unterkalifornien . . . . **51. Veatchia.**
Fossile Gattung der *Rhoideae* . . . . **52. Heterocalyx.**

Fig. 1. Engler's key to the tribes of the Anacardiaceae and to the genera of the tribe RHOIDEAE. From Engler and Prantl's 'Natürlichen Pflanzenfamilien' 3[5]: 144, 154–157, in part. 1896.

TABLE II.

A CHART TABULATING SOME OF THE MORPHOLOGICAL CHARACTERS OF THE VARIOUS ELEMENTS OF THE RHUS-COMPLEX. A DOT INDICATES THE OCCURRENCE OF THE CHARACTER, WHILE A CIRCLE INDICATES THAT IT IS MERELY SOMEWHAT CHARACTERISTIC OF THE GROUP.

					RHUS							TOXICODENDRON	
		COTINUS	ACTINOCHEITA	METOPIUM	SUMAC	SCHMALTZIA: PSEUDOSUMAC	SCHMALTZIA: STYPHONIA	SCHMALTZIA: PSEUDOSCHMALTZIA	SCHMALTZIA: RHOEIDIUM	SCHMALTZIA: LOBADIUM	MALOSMA	EUTOXICODENDRON	VERNIX
	Evergreen		●	●		●	●	●			●		
	Deciduous	●			●				●	●		●	●
Habit	vines											○	
	trees	●	●	●	●		●				●		●
	shrubs					●		●	●	●			
Leaves	imparipinnate		●	●	●	●		●	●				●
	ternate									●		●	
	simple	●					○				●		
Texture	coriaceous		●	●			●	●			●		
	thin	●			●	●			●	●		●	●
Inflorescence	lateral panicle		●	●								●	●
	thyrsus	●			●						●		
	compound spike					●	○	●	●	●			
Pedicels	absent					●	●	●	●	●			
	short		●	●	●						●	●	●
	long	●											
Bracts	lanceolate, deciduous	●	●		●						●	●	●
	deltoid, persistent			●		●	●	●	●	●			
Styles	terminal		●	●	●	●	●	●	●	●	●	●	●
	lateral	●											
Styles	free	●									●		
	partially united		●		●	●	●	●	●	●		●	●
	united			●									
Ovary	sessile	●		●	●	●	●	●	●	●	●	●	●
	stalked		●										
Drupe	gibbous	●											
	symmetrical		●	●	●	●	○	●	●	●	●	●	●
Fruit-coat	only pilose		●										
	short pilose					○	○	○	○	○			
	glandularly hairy				●	○	○	○	○	○			
	glabrous	●		●							●	○	○
Mesocarp	not waxy	●	●	●	●	●	●	●	●	●			
	waxy										●	●	●
Putamen	bony	●	○		●	●	●	●	●	●	●	●	●
	chartaceous			●									
Fruit-color	green	●											
	yellow-white										●	●	●
	red-orange		●	●	●	●	●	●	●	●			
Effluvium	innocuous	●			●	●	●	●	●	●	●		
	poisonous		●	●								●	●

der, ranging from extreme slenderness to stoutness, while in *Actinocheita* and the subgenus SUMAC (pl. 13, fig. b) they are typically thick and staghorn-like. The species under consideration are unarmed, except *Rhus microphylla* Engelm. which is subspinose. The surface of the young stems varies from quite glabrous, sparsely pubescent, canescent, to densely pilose. The stems are often pruinose.

Effluvium.—Schizo-lysigenous canals are present in the phloem of the root and stem and extend to the leaves and flowers. The effluvium in these canals is a thin milky substance which soon hardens and blackens on contact with the air. In *Metopium* and *Toxicodendron* it contains an irritant poison, affecting most people to a greater or lesser degree, while in *Rhus, Malosma* and *Cotinus* it is apparently innocuous. *Actinocheita* has once been reported as poisonous.

Leaves.—The leaves are always alternate. They vary from simple, through trifoliolate, to imparipinnately many-foliolate. Often there is much diversity in the leaf outline of one species. In texture the laminae are extremely thin to coriaceous. The upper surface may be dull or lustrous. The laminae are usually entire but are often serrate or dentate-serrate or crenulate, even differing widely on the same plant. The margins may be quite non-revolute, revolute, or even conspicuously inrolled beneath and may or may not be white-corneous. The upper surface ranges from a varnish-like luster to very dull, and varies to a small degree in the same species; the under surface is usually dull and lighter in color than the upper surface. The rachis segments may be wingless to broadly winged. In many species the veins are conspicuously whitened above, or above and below. In some species even the very small veins are quite distinct (pl. 13, fig. g). The leaflets are usually sessile or subsessile, although in some species they are petiolulate.

Pubescence.—The pubescence of leaves, stems, and fruits consists of multicellular unbranched hairs alone, or of these intermixed with club-shaped multicellular hairs. The pubescence on the leaf (pl. 13, fig. a) when present varies greatly, from appressed hairs to a soft pilosity; it is typically cinereous in color but in some species and varieties tends to be conspicuously ferruginous.

Inflorescence.—The flowers in all species are borne in clusters which are typically paniculate (pl. 15). In the genera *Metopium* and *Actinocheita* the panicles are erect and lateral; in *Toxicodendron,* lateral and mostly pendulous; in the genera *Cotinus* and *Malosma,* and in the subgenus Sumac, they form a terminal thyrsus which is very compact in *Malosma* and the subgenus Sumac. However, in the subgenus Schmaltzia the inflorescence is a compound spike which is usually rather stout and lateral even if clustered near the apex of the branches, but in the section Pseudosumac the panicles are very slender and are both apical and lateral near the apex of the branches. The pedicels typically equal or exceed the flowers in length, the conspicuous exception being Schmaltzia, where the flowers, except in two or three species, are quite sessile.

Bracts.—The bracts are usually considerably longer than broad, either blunt or acute at the apex, and deciduous; a conspicuous exception being in Schmaltzia, where they are ovate, short deltoid-ovate, or even appearing as a vaginate pouch. Typically, a single bract subtends each flower; however, a bract and two bracteoles subtend each flower in the subgenus Schmaltzia. In *Metopium* and in Schmaltzia the bracts are more or less persistent.

Flowers.—The entire group tends to have relatively small, polygamo-dioecious, pentamerous flowers (pls. 10–12).

Calyx.—The calyx, except in abnormal flowers, is five-parted, usually composed of five sepals which join below the disk. However, in *Metopium* the calyx is five-lobed. The calyx-lobes vary from broadly lanceolate to rotund-ovate. Typically, the calyx is persistent.

Corolla.—The corolla, except for abnormal flowers, is composed of five petals which vary in shape from lanceolate to obovate-rotund. In most species the petals are deciduous.

Disk.—The disk varies within wide limits in the complex. In some cases it is very broad, thin, cup-shaped, and is much or little lobed. Often it becomes much thicker and narrower, a tendency which is culminated in *Actinocheita* where it is so narrowed and thickened that it is no longer cup-shaped but appears as a columnar gynobase.

Stamens.—The stamens are borne under the edge of the disk, alternating with the petals and lobes of the disk. The comparative length of the filament varies greatly in the different species. In some it is considerably enlarged below. The anthers fall into three general groups: oval, oblong, or "lanceolate." The size of the stamens varies greatly in the same species according to the degree of sexuality.

Stigmas and Styles.—In *Metopium* the stigma and style are undivided. In the other members of the complex the stigmas are usually separate, while the styles are united in varying degrees, or are entirely distinct as in *Malosma* and *Cotinus.* The styles are attached to the apex of the ovary, except in *Cotinus,* where they are laterally inserted.

Ovary and Fruit.—The ovary shows extreme variation within the complex, but is relatively constant within the species. It is tricarpellary, but with a single fertile carpel. The fruit is a more or less dry drupe, approximately as broad as long in all members of the group except *Metopium* (pl. 14, fig. c), and may be more or less flattened. In *Cotinus* the epicarp is glabrous, dull, and conspicuously veined; in *Metopium* and *Malosma* it is glabrous and shining, more or less light-colored, and in *Malosma* with a dark line running down one side from the apex to base; in *Toxicodendron* it is from straw- to cinereous-colored and typically glabrous, although in some species a sparse microscopic close-lying pubescence may be present, and in others a papillate-scabrous pubescence; in *Actinocheita* it has very long, silky pilosity; in *Rhus,* as here delimited, it has a red glandular pubescence: in SUMAC, this is intermingled with deeply red-stained, club-shaped or filiform hairs, and in SCHMALTZIA intermingled with multicellular unbranched hyaline hairs.

Ovule and Seed.—The single anatropous ovule in the one fertile cell of the ovary produces the seed. The seed vary in size quite considerably, being two millimeters or less in *Malosma* and over ten millimeters in *Rhus Lentii* Kellogg. In some species they are rather plump, in others quite flat; sometimes the outline is quite irregular, sometimes very regular; in some species they are quite smooth while in others they are heavily ridged. In *Metopium* the seed-coat is thin and chartaceous, while in the other genera it is hard and bony, although only moderately so in *Actinocheita*.

SPECIFIC DELIMITATION

The universally accepted ideal of modern taxonomy is to show practicable units of classification as well as phylogeny. The degree of differentiation within generic groups, their intergradation, minor fluctuations, and hybridizations in varying degrees mean that taxonomists have been unable to set a uniform standard; so that delimitations are somewhat arbitrary and artificial. Each monographer must rely on his own interpretation of specific and generic concepts. The results, while not achieving uniformity nor necessarily a happy phylogeny, are often agreeably usable, which is a consideration of prime practical importance.

John Ray was one of the first to give a definite meaning to the term species. He considered a group of organisms which are more like each other than those belonging to other groups and capable of interbreeding with each other, a species; and further that variations within a species as being more or less continuous. At present the word species signifies a grade in classification assigned to groups of individuals considered to be more closely interrelated by common descent than to forms judged to be outside of that species. The known individuals of the species differ less markedly amongst themselves than they do from individuals considered as not of the species, and the differing individuals of a species are linked by intermediate forms. At present the most usable criteria for the delimitation of species are morphology and geographic distribution.

While cytology and genetics would doubtless furnish additional pertinent data, their requirement of living material is at present prohibitively cumbersome for most monographic studies. Morphological data of course are subjectively selected, and geographic distribution is to be interpreted as known geographic range.

The degree of variation in the different species is extremely wide. Probably the most stable of the species studied are *Rhus virens* Lindh., *R. choriophylla* Woot. & Standl., *R. Andrieuxii* Engl., *R. typhina* Torn., *R. Copallina* L., *R. Michauxii* Sarg., *R. Barclayi* (Hemsl.) Standl., and *Toxicodendron Vernix* (L.) Kuntze.

The author has had to be content to interpret large groups of varying individuals as polymorphic or inclusive species unless a series of concomitant variations were found. The outstanding example of such a polymorphic species is *Rhus glabra* L., where many extreme variations are to be found, but which are apparently quite independent of one another and occur throughout much of the range of the species. *Toxicodendron radicans* (L.) Kuntze, *Rhus microphylla* Engelm., and *R. aromatica* Ait. are other large, polymorphic species. The variation in such species probably may be best considered as an early stage of speciation.

The variations of *Rhus trilobata* Nutt., which are more or less concomitant and tend to be found in localized areas, probably may be best considered as a later stage of speciation. Likewise many species in section PSEUDOSUMAC may be interpreted as comparatively recently evolved.

In variations among many species, such as *Rhus terebinthifolia* Schlecht. & Cham. and *R. costaricensis* Riley, *R. integrifolia* (Nutt.) Benth. & Hook. and *R. ovata* Wats., *R. Lentii* Kellogg and *R. integrifolia* (Nutt.) Benth. & Hook, especially when closely related, with overlapping ranges and with variation toward the neighboring related species, an infiltration of the characters of the related species through hybridization suggests itself.

The taxonomic difficulties are apparently often increased in polymorphic species by hybridization; some of the variations of *Rhus trilobata* Nutt. and *R. aromatica* Ait., *R. glabra* L. and *R. typhina* Torn., *Toxicodendron radicans* (L.) Kuntze and *T. quercifolia* (Michx.) Greene, found in areas of common distribution, are conceivably due in part to this cause.

GENERIC RELATIONSHIP

The selection of genera for this study is an arbitrary one, based on a group of species forming an historical unit (the Linnaean concept of *Rhus*). It contains elements somewhat separated phylogenetically which form a few genera in a much larger complex (the tribe RHOIDEAE). Most of the genera have many morphological characters in common, reappearing in different combinations throughout the group, so that more than the broadest generalizations as to their phylogeny would necessarily be mostly speculation. However, the species concerned certainly fall into three natural groupings which are not too intimately related: *Cotinus, Metopium,* and those species that Engler included in *Rhus*.

In *Cotinus* the characters of the inflorescence—long fertile and plumose sterile pedicels, lateral styles, and very thin, permanently united fruit coats—all indicate wide phylogenetic divergence from the other genera. Its long geologic history as a little variable type would also seem to lend support to this view.

The morphology of *Metopium* is not so divergent from that of *Rhus,* although the general coarseness of the plant, the permanently adhering fruit coats, the papery endocarp, and the more or less united calyx-lobes indicate considerable phylogenetic segregation, a deviation certainly as distant from *Rhus* as are *Mosquitoxylum* and *Pseudosmodingium.*

The members of the narrower Rhus-complex can apparently be regarded as forming a phylogenetically related group of genera. Considering their morphology they fall into two general categories, *Rhus* and *Actinocheita* forming one, and *Malosma, Toxicodendron,* and the groups of species designated by Engler as Sections GERONTOGEAE and MELANOCARPAE, the other.

While *Actinocheita* has a general vegetative morphology suggestive of the subgenus SUMAC, the dense mat of very long, silky, non-glandular, unbranched hairs on the fruit and especially the highly modified disk in the form of a gynophore would indicate a major phylogenetic segregation.

Another group of genera has several physiological characteristics which are distinctly suggestive in the way of phylogeny. First, the species grouped by Engler in the sections GERONTOGEAE and MELANOCARPAE (with which this work is not concerned) have little, if any, wax in the fruit coat, while the mesocarp of *Malosma* and *Toxicodendron* has a considerable amount. Second, while the sap of *Malosma* is quite innocuous, that of *Toxicodendron,* in common with several other Anacardiaceous genera, contains a powerful irritant poison.

The subgenus SUMAC is an assemblage of about a dozen species generally distributed over much of North America, Asia, and around the Mediterranean. Perhaps their most distinguishing characters are the deciduous, lanceolate bracts subtending the flowers and the red pubescence of the fruit which in most of the species consists of club-shaped, glandular hairs intermingled with variously shaped, red-stained hairs. The entire subgenus is surprisingly uniform in many of its characters, notably the staghorn-like branches, the thin, imparipinnately compound leaves, and the predominance of serrate-margined leaflets.

On the other hand, the subgenus SCHMALTZIA as here delimited is an assemblage of about thirty species with rather similar floral morphology but rather diverse vegetative morphology. The group is typified by the bracts, which are usually broader than long, by the spicate ultimate branches of the inflorescence, and by the sessile flowers, which are subtended by a bract and two bracteoles. There is much minor variation in the leaves and inflorescence. In section LOBADIUM the flowers are intermediate in size and occur in rather compact, rigid, compound spikes, and the leaves are thin to subcoriaceous, and trifoliolate. In the monotypic section RHOEIDIUM, the flower characters are essentially the same, but the very small leaves are pinnately many-foliolate and the rachis is winged. In sections STYPHONIA and PSEUDOSCHMALTZIA the inflorescence is a compact or expanded, but rigid, branched, axillary or terminal, compound spike, with very large flowers (for *Rhus!*). The leaves of section STYPHONIA are typically simple but are rarely trifoliolate; those of PSEUDOSCHMALTZIA are typically trifoliolate to pinnately many-foliolate with naked or winged rachis. In section PSEUDOSUMAC the very small flowers are disposed in delicate, much-branched, very diffuse, terminal and axillary, compound spikes.

A morphological sequence from some species of section PSEUDOSCHMALTZIA, such as *Rhus virens* Lindh., to most of the other species can be traced. From this center a connection can be shown with *Rhus terebinthifolia* Schlecht. & Cham. through *Rhus Hartmanii* Barkl.; likewise with *Rhus integrifolia* (Nutt.) Benth. & Hook. through *R. choriophylla* Woot. & Standl. or *R. chondroloma* Standl. The relationship to *Rhus microphylla* Engelm. and *R. trilobata* Nutt. is not so easy to follow, but in the latter species there is a possibility that it is through such forms as *Rhus Galeottii* Standl. or *R. Arsenei* Barkl.

The branching of the inflorescence and the tri-bracteate, sessile flowers of SCHMALTZIA closely approximate the condition found in the related genus *Mosquitoxylon*. There is a rather wide gap in many morphological details between the subgenera SUMAC and SCHMALTZIA. The nearest approach to an intermediate species in inflorescence characters is *Rhus Lentii* Kellogg, which has a loose terminal panicle and ovate, deciduous bracts. If the interpretation of such fossil specimens known as *Rhus coriarioides* and *R. vexans* Lesquereux (Tertiary of Florissant, Colorado) is correct, it would seem that these subgenera had diverged very early.

There is little paleobotanical evidence to show the phylogeny of the members of the complex, for most of the known fossil genera and subgenera—*Toxicodendron, Cotinus, Metopium,* SUMAC, SCHMALTZIA and "GERONTOGEAE"—seem to be traceable at least to the Miocene where they often appear as forms remarkably similar to present species (10, 20, 31, 55).

The keys to species and varieties, while partly artificial, indicate in a general way a phylogenetic synopsis of each genus.

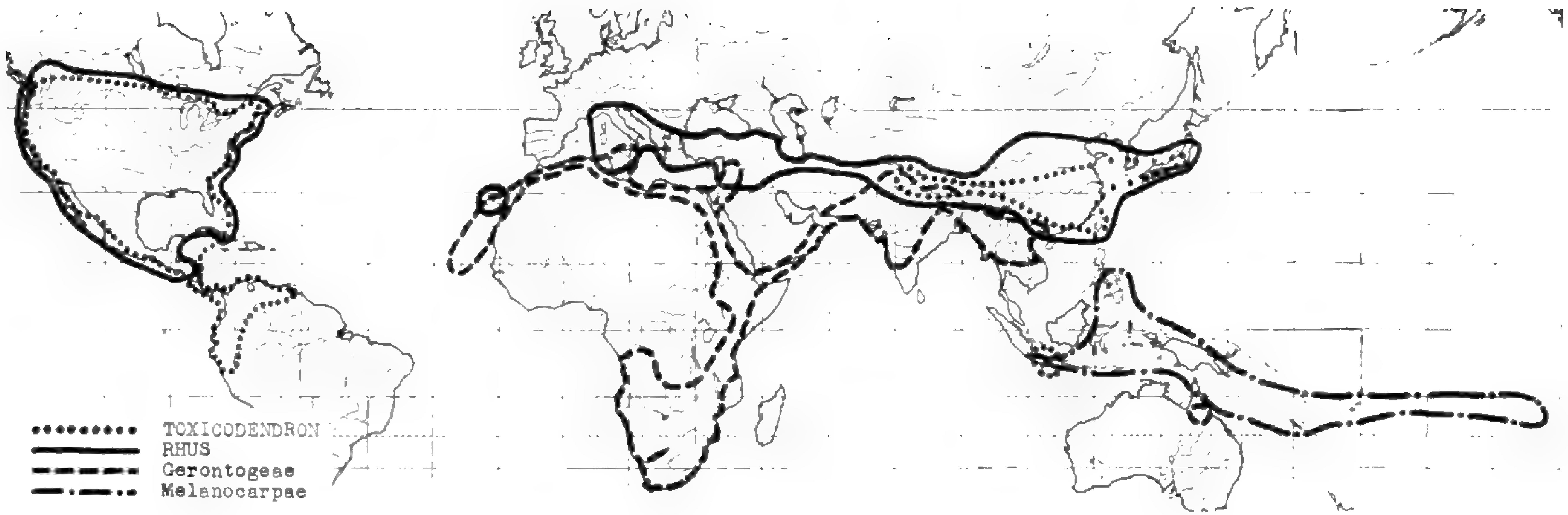
GEOGRAPHIC DISTRIBUTION

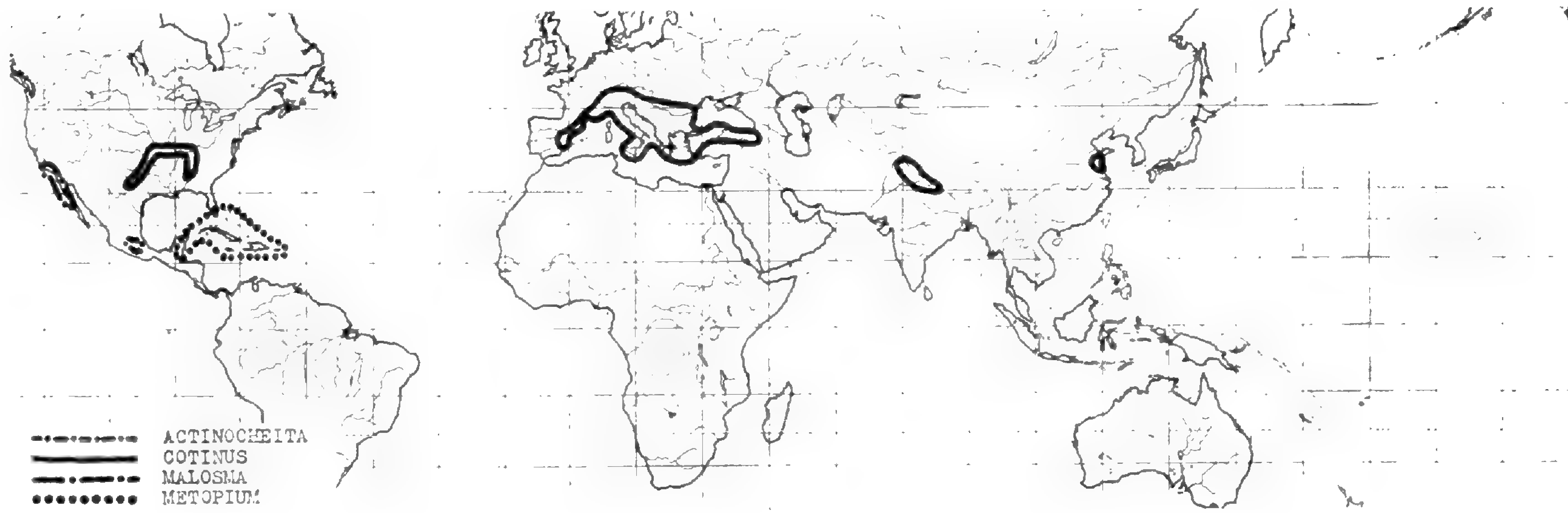
The Anacardiaceae attains its highest development in the tropics and subtropics of both hemispheres, but in the existing flora it is especially well represented in the Malaysian region. The Rhus-complex, however, is the exception for the family, for it is mostly extra-tropical, with centers of distribution in both the northern and southern hemispheres.

Rhus is the most widespread genus of the complex, and SUMAC is the more widespread of the subgenera, forming a continuous band in the North Temperate Zone (figs. 2–3). Two generally dispersed species and several of more restricted range occur in North America, their distribution being centered in southeastern United States. In Eurasia SUMAC is represented by several species whose ranges center around southeastern China, with the single species, *Rhus Coriaria* L., extending into Asia Minor, along the European Mediterranean shores, and to the Canary Islands. The distribution of SCHMALTZIA is centered in Mexico; that of sections PSEUDOSUMAC and PSEUDOSCHMALTZIA in Mexico: RHOEIDIUM in southwestern Texas, LOBADIUM in Texas, and STYPHONIA in southern California.

At present *Cotinus* is found in isolated areas in the North Temperate Zone in both the Old and New World (fig. 3). It is a very old genus (10, 31), and the present intermittent distribution probably represents mere remnants of a former widespread range.

Toxicodendron is distributed over North America from Canada southward to South America from Venezuela to Peru. In Asia it is found from Japan, through China, to the Himalayas of northern India, and in Java. Section EUTOXICODENDRON occurs throughout the United States, southward well into Mexico, and in Japan and China. Section VERNIX is represented in the New World by *Toxicodendron Vernix* (L.) Kuntze in eastern United States, and by *T. striata* (Ruiz & Pav.) Kuntze which occurs from southern Mexico into northwestern South





Figs. 2 and 3. The geographic distribution of the Rhus-complex: fig. 2 (upper), the distribution of *Rhus*, *Toxicodendron*, GERONTOGEAE, and MELANOCARPAE; fig. 3 (lower), of *Cotinus*, *Malosma*, *Metopium*, and *Actinocheita*.

America. In the Old World there are several species in eastern Asia and one in Java.

Metopium is a small genus with restricted range. For the most part it is West Indian, but occurs on the mainland in Florida and in Yucatan.

Malosma is a monotypic genus restricted in range to southern California and Lower California.

Actinocheita is another monotypic genus endemic to a limited area in Mexico, in the region of the states of Guerrero, Puebla, and Oaxaca.

ECONOMIC USES[1]

The family Anacardiaceae contains numerous plants of economic importance; however, the employment of many is at present more a matter of historical than of practical interest.

Many of the genera are the source of tannins, dyes, woods, medicines, fruits, and other products of varying degrees of importance. Plants of the genera considered in this monograph have appeared from prehistoric times in the ethnobotany of three diverse culture centers: *Toxicodendron* in China and later in Japan, *Rhus* and *Cotinus* in the Occident, and *Rhus* in the Amerindian cultures of the Americas. Probably the most important use is in the production of the finest grades of Chinese and Japanese lacquer. Lacquer is an irritant poison. Workers in the industry seem to become immune, but those not so immunized may be painfully poisoned by handling the lacquered articles.[2] The production of a high grade of varnish is not limited to the Asiatic members of *Toxicodendron*, for the sap of many of the poisonous genera of

[1] See also Sweet and Barkley (114).

[2] This poison is the same as found in most species of the genus to a lesser, or mostly to a greater, extent. Prophylactic and therapeutic treatments number in the hundreds. Washing the skin just before or after exposure with a 5 to 10 per cent ferric chloride solution in either 50 per cent alcohol or in 25 per cent glycerine, or washing repeatedly just after exposure with a soap containing an excess of alkali, usually lessens the skin irritation. After the appearance of the skin eruption many local remedies, such as hot potassium permanganate baths and lead or aluminum acetate lotions, have been found useful. More recently extracts containing the toxic agent in hydro-alcoholic saline or almond oil solution are being successfully employed to produce rapid and, in many cases, relatively permanent immunity. See also McNair (68), Barkley and Howard (6), and Barkley (3).

the Anacardiaceae, particularly *Toxicodendron,* has the property of becoming black and drying into a durable varnish.

Some of the members of the genus *Toxicodendron* have been widely used for medicine in America. Toxicodendron, poison oak, or sumac veneneux—the leaves of *Toxicodendron radicans* (L.) Kuntze—was formerly official in the United States, and a tincture is used by homeopathic practitioners. The Meskwaki and Potawatomi medicine men used it for poulticing some kinds of swellings. An infusion of the young branches and leaves of *Toxicodendron Vernix* (L.) Kuntze is employed in homeopathic practice.

To the Indians of the southwestern United States, the squaw bush, lemita, or lemonade sumac, *Rhus trilobata* Nutt. has long been of utmost importance. The sour berries were eaten ripe, or with salt when green, and were often collected and dried for later use. The Indians also made a refreshing drink by soaking the fruit with sugar in water. Dr. Edward Palmer (76) states that the "young twigs of this plant are used in the manufacture of baskets. The wood exhales a peculiar odor, which is always recognizable about Indian camps, and never leaves articles made from it. It grows loosely in mountain ravines, and attains a height of five to eight feet." In Utah, Arizona, southern California, and New Mexico, the Indians depend solely upon this plant for material to make their baskets. It is far more durable and tougher than the willow, which is not used by these Indians. Their baskets will hold water, and are often used as cooking vessels, hot stones being dropped in from time to time until the food is done. Wooton and Standley (128) say that the Indians also used the roots of this plant for their basketry and for setting dyes. Mexicans sometimes mix the stems with willow branches in making baskets. The wood of this species was much employed by the Indians for bows, and the leaves are reported as a smoking ingredient of the Comanches.

Havard (47) says that the bruised fruits of several species of sumac—*Rhus glabra* L., *R. typhina* Torn., *R. Copallina* L., *R. integrifolia* (Nutt.) Benth. & Hook., and *R. ovata* Wats.—

were added to water to make it more cooling, refreshing, and palatable. The very acid berries of *Rhus integrifolia,* which are covered with a white oily effloresence, were gathered by Indians to prepare a refreshing drink, either being used fresh or dried or roasted. The fruit of *Rhus ovata* Wats., described as being very acid but coated with a thin, sweet, waxy encrustment, was formerly collected by the natives, the combination making an excellent cooling drink. Standley (111) says that the flowers of *Rhus ovata* yield a good quality of honey and that the flower clusters were boiled and eaten by the Coahuila Indians of California, while a decoction of the leaves was employed as a remedy for coughs and for pains of the chest. The hard heavy wood of the California mahogany, *Rhus integrifolia* (Nutt.) Benth. & Hook., is valued as fuel.

According to Standley (111), Reko reports that the Zapotics of Oaxaca employ *Rhus terebinthifolia* Schlecht. & Cham. in steam baths as a remedy for rheumatism and syphilis, and as a preparation for parturition.

Both *Rhus typhina* Torn. and *Rhus glabra* L. have been of particular importance in the economics of the American Indian. According to Smith (109), the root of *Rhus typhina* Torn. was used by the Pillager Ojibwe as a medicine to stop hemorrhages. In speaking of the use of this plant (107), he says:

> "This tree is a very valuable one to the Indians, yielding three distinct kinds of medicines. The root bark, divested of the outer skin and inner wood, yields a tea which is a remedy for 'inward' troubles. . . . The inner bark of the trunk is considered a valuable pile remedy and is spoken of as being 'puckering' or astringent. The 'top,' or twigs, of the smaller shrubs is hairy, and because of this is used in the treatment of various female diseases. The acid-flavored berries are used in combination with other herbs like the Greater St. John's Wort for consumption and pulmonary troubles."

The berries of *Rhus typhina* were mixed with the root of *Euphorbia corollata* and the bark of *Quercus macrocarpa* and used by the Meskwaki Indians as a remedy for pinworms. Smith (107, 109) reports that the Menomini and Ojibwe boil the roots to procure a yellow dye, the leaves and bark (especially that of the roots) being rich in tannin. According to

Sargent (97), the young shoots are used in the preparation of pipes for drawing the sap of the sugar maple.

In the Rhus-complex, *Rhus glabra* L. is the outstanding example of the wide use "primitive" man could make of a plant which at first glance would seem entirely useless. The fruit, besides making a cooling drink in the summer, was cooked in water with maple sugar by the Ojibwe to form a hot drink during the winter. Parker (77) states that the Iroquois Indians eat raw newly grown sumach sprouts as a salad and alterative. Smith (109) says:

> ". . . all parts of the smooth sumac are suitable for medicine, the root bark, trunk bark, twig bark, leaves, flowers and fruit. The root bark tea is used as a hemostatic. Trunk and twig innerbark are used in combination with other medicine for their astringent qualities. Blossoms are sometimes steeped for sore eyes, leaves are used for poultices and the fruit is considered a throat cleanser as well as being the basis of a beverage."

An infusion of *Rhus glabra* was formerly official in the Pharmacopoeia of the United States. The Pawnee Indians employed a decoction of the fruit for dysmenorrhoea and dysentery. An infusion of the inner bark of the root has been recommended for mercurial ptyalism; it was used by the Pawnee Indians for urinary troubles. West (124) reports that the Omahaws mixed the leaves with tobacco for smoking. In order to obtain an orange color, many Indians boiled their rush, woven bark mats, and other materials in a mixture of the central pith of the stems of *Rhus glabra* and bloodroot.

In addition to their other uses, some of the sumacs are much grown as ornamental shrubs. *Rhus javanica* L., *R. glabra* L., *R. typhina* Torn., and *R. Copallina* L., the more popularly grown species, are used mostly for their large pinnate foliage which turns a brilliant orange or red early in the fall. Also, their large staghorn-like branches and clusters of deep red fruits which persist through the winter make them rather attractive the year around. The laciniate varieties of *Rhus glabra* and *Rhus typhina* are much planted because of their very ornamental fern-like foliage. *Cotinus americanus* Nutt. is grown for its brilliant autumnal coloring.

An economic value, frequently overlooked,[1] is afforded by the species of *Toxicodendron* and *Rhus* as a ground cover to protect land from erosion. They are also of prime importance as pioneer species in the revegetation of denuded areas; their importance in this position in the prairie region of North America is indicated by the term Rhus-Symphoricarpus Community which is often applied to a pioneer phase of the deciduous woodland. The species of the subgenus Sumac are of especial interest in wild-life management not only in the provision of cover for game, but in supplying food during the critical seasons of late winter and early spring.

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[1] From correspondence with Ben O. Osborn and others.

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II. Taxonomy

ABBREVIATIONS

The herbaria from which material has been studied and from which specimens are cited in this monograph are indicated by the following abbreviations:

A = Herbarium of the New York State Museum.

B = Brooklyn Botanic Garden Herbarium.

Cath = Catholic University of America Herbarium.

CA = California Academy of Sciences Herbarium.
Calif = University of California Herbarium, Berkeley.
Deam = Personal Herbarium of Chas. C. Deam.
Farwell = Personal Herbarium of O. A. Farwell.
F = Field Museum of Natural History Herbarium.
G = Gray Herbarium of Harvard University.
K = Herbarium of the Royal Botanic Gardens, Kew.
M = Missouri Botanical Garden Herbarium.
Madrid = Madrid Botanical Garden Herbarium.
Minn = University of Minnesota Herbarium.
ND = University of Notre Dame Herbarium (including the Greene Herbarium).
NY = New York Botanical Garden Herbarium.
Okla = University of Oklahoma Herbarium.
P = Pomona College Herbarium.
PA = Herbarium of the Academy of Natural Sciences of Philadelphia.
Penn = University of Pennsylvania Herbarium.
RMt = Rocky Mountain Herbarium at the University of Wyoming.
US = United States National Herbarium.

KEY TO GENERA

Leaves simple; pedicels of sterile flowers at length becoming plumose; style lateral; drupe becoming very gibbous............................*Cotinus*
Leaves usually compound; pedicels of the sterile flower never becoming plumose; style terminal; drupe almost symmetrical.
  Stigma short and undivided; putamen smooth and chartaceous......*Metopium*
  Stigmas distinct or partly united; putamen crustaceous or bony.
    Ovary upon a column formed by the disk; epicarp clothed with filiform silky hairs over 3 mm. long.............................*Actinocheita*
    Ovary not upon a column; epicarp, when clothed with hairs, with hairs less than 1.5 mm. long.
      Drupes red, noticeably pubescent with red glandular hairs............*Rhus*
      Drupes whitish or dun-colored, glabrous or sparingly pubescent, pubescence on fruit never glandular.
        Drupes very small; mesocarp without fibers; plant apparently innocuous; leaves coriaceous, simple; inflorescence a terminal thyrsus; evergreen shrubs.............................*Malosma*
        Drupes larger; mesocarp with "fibers"; effluvium poisonous; leaves thin, compound; inflorescence in lateral panicles; deciduous shrubs, small trees or vines.........................*Toxicodendron*

COTINUS [Tourn.] Miller, non Gomez de la Maza.

Cotinus Tourn., Inst. Rei Herb., p. 610. 1700; Miller, Gard. Dict., abrdg. ed. 4. 1754; Moench, Meth., p. 73. 1794; Nutt., N. Am. Sylva **3**: 1. 1849; Engler in DC., Monogr. Phaner. **4**: 349. 1883; Dippel, Handb. Laubholzk. **2**: 382. 1892; Engler in Engl. & Prantl, Nat. Pflanzenfam. 3^5: 164. 1892; Sargent, Sylva **3**: 3. 1892; Koehne, Deutsche Dendrol. p. 359. 1893; Britton, Manual, p. 601. 1901; Small, Fl. Southeast. U. S., p. 726. 1903; Britton, N. Am. Trees, p. 613. 1908; Britt. & Brown, Illustr. Fl., ed. 2. **2**: 484. 1913; Sargent, Manual, ed. 2. p. 657. 1922; Bailey, Man. Cult. Pl., p. 459. 1924; Schaffn., Manual Ohio, p. 348. 1928; Small, Man. Southeast. Fl., p. 808. 1933; Stem. & Myers, Okla. Fl., p. 298. 1937.

Rhus L., Sp. Pl. **1**: 267. 1753, in part; Miller, Gard. Dict., ed. 8. 1768, in part; Willd., Sp. Pl. **1**: 1477. 1798, in part; DC., Cat. Pl. Hort. Bot. Monsp., p. 55. 1813, in part; DC., Prodr. **2**: 67. 1825, sect. COTINUS; Endl., Gen. Pl., p. 1131. 1840, sect. COTINUS; Ench. Bot., p. 599. 1841, sect. COTINUS; Walp., Rep. Bot. Syst. **1**: 551. 1842, in part; Gray, Gen. Pl. U. S. **2**: 157. 1846, in part; Gray, Syn. Fl. N. Am., p. 381. 1897, sect. COTINUS.

Deciduous shrubs or small trees with yellow wood, scaly bark, and strong-smelling juice. Leaves alternate, simple, slender-petioled, entire or slightly toothed, dull green, glabrous or more or less pilose-pubescent. Flowers polygamous, yellowish-white, mostly abortive, in loose, terminal panicles, with the pedicels of the numerous abortive flowers elongating and becoming plumose-villous. Bracts of the inflorescence lanceolate, deciduous. Sepals 5, imbricate, persistent. Petals 5, oblong, twice as long as the lance-ovate sepals, somewhat spreading. Stamens 5, shorter than the petals, inserted under the annular disk; filaments short; anthers shorter than the filaments. Ovary oblique, sessile, 1-celled, with 3 short lateral styles. Fruit a small, dry, green, veiny, reniform, gibbous drupe, with the fruit coats dry and permanently united.

Europe, Asia, and North America.

Type species: **Cotinus Coggygria** Scop., Fl. Carn. **1**: 220. 1772 (*Rhus Cotinus* L., Sp. Pl. **1**: 267. 1753).

Geologically speaking *Cotinus* is very old, having been well represented in the Miocene. Ethnologically it is old, having a written history antedating the Christian era. It seems to be a conservative genus in which minor morphological variations occur to a much lesser degree than in most genera of the group. It is represented in the New World by a single species of interrupted distribution in the Mississippi Valley.

1. **Cotinus americanus** Nutt., N. Am. Sylva **3**: 1. 1849; Sarg., Gard. & For. **4**: 340. 1891. Pl. 16, fig. 2.

Cotinus cotinoides Britt., Mem. Torr. Bot. Club **5**: 216. 1894.

Rhus Cotinus Torr. & Gray, Fl. N. Am. **1**: 216. 1838, non L., Sp. Pl. **1**: 267. 1753; Nutt., Trav. Ark., p. 177. 1821, without description.

Rhus cotinoides Nutt. ex Torr. & Gray, Fl. N. Am. **1**: 217. 1838, in syn.; Cooper, Rept. Smiths. Inst. for 1858, p. 250. 1859; Chapm., Fl. South. U. S., p. 70. 1860.

Rhus americana Sudw., Bull. Torr. Bot. Club **19**: 80. 1892.

Small trees 2–10 m. tall; twigs at first glaucous, later becoming brown; leaves scattered, alternate, thin, obovate or elliptical, 5–17 cm. long, 3.5–9 cm. wide, obtuse or somewhat acutish at apex, rarely emarginate, usually cuneate at the base, the lowest short-petioled, upper long-petioled, at first puberulent, at maturity dark green and smooth above, paler and sparsely pubescent beneath, particularly along the midrib and larger veins, turning brilliant orange and scarlet in the fall; petioles 0.5–6 cm. long; inflorescence appearing late in April or early in May in short terminal panicles about 10 cm. long; flowers many, polygamo-dioecious, mostly abortive, the pedicels of the abortive flowers becoming long and plumose-villous; bracts of the inflorescence lanceolate, more or less persistent; sepals 5, lanceolate, acute, 1 mm. long, 0.3 mm. broad, glabrous; petals 5, oblanceolate, rounded, 2 mm. long, 1 mm. broad, glabrous; fruit produced sparingly, 4 mm. long, reniform, fruiting panicles about 30 cm. long.

This species is very similar to the European *Cotinus Coggygria* Scop., but has larger, thinner, obovate leaves, more cuneate leaf-bases, and a less showy fruiting panicle. The American plant lacks the conspicuously whitened leaf margin common in the European species, and also tends to be somewhat larger and more tree-like.

Distribution: Tennessee and Alabama, Missouri to Oklahoma, and Texas (fig. 4).

Alabama[1]: Monte Sano near Huntsville, April 3, May 28, *Herb. Geol. Surv. Ala.* (ND); near Huntsville, Oct. 7, 1898, *Canby (Sargent & Muir) 22* (F, M); dense forests on shelves of calcareous rocks near Huntsville, *Mohr* (M); calcareous rocks, mountainous woods, near Huntsville, May 2, 1882, *Mohr* (F, M); mountainous

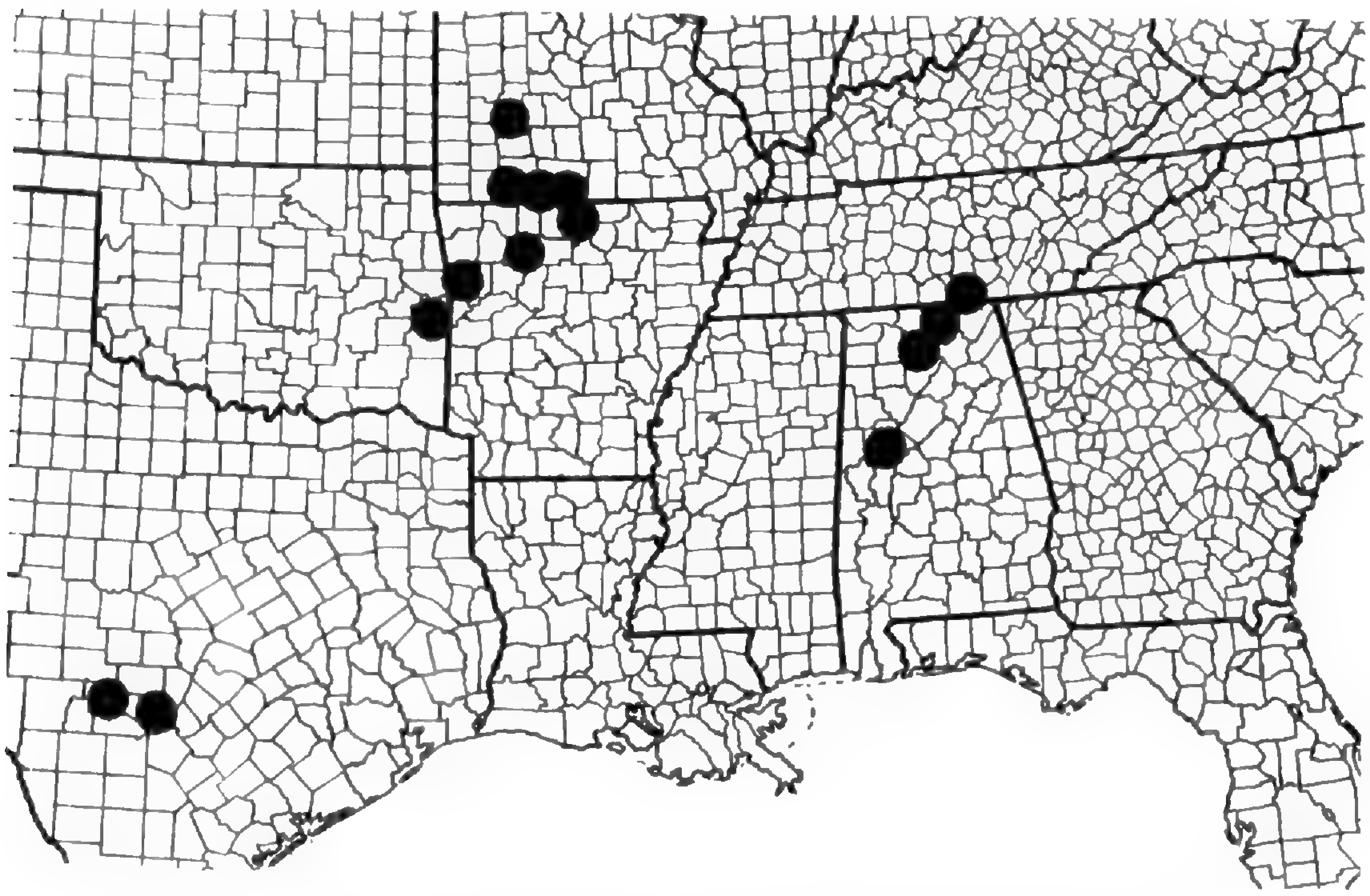

Fig. 4. The geographic distribution of *Cotinus americanus* Nutt.

woods near Huntsville, May 24, 1882, *Mohr* (M); near Huntsville, May, 1892, *Mohr 23* (ND); Huntsville, July 1891, *Shimek* (F, M); along limestone rocks on slope of plateau southeast of Woodland Mills, May 19, 1934, *Harper 3230* (M, ND); Tuscaloosa, May 22, 1926, *Wheeler 358* (F).

Tennessee: Cumberland Mt. at Cowan, May 8, 1898, *Eggert* (M).

Missouri: glades, Pontiac, Sept. 20, 1929, *Kellogg 15221* (M); Tecumseh, Oct. 7, 1927, *Palmer 32914* (M); rocky slopes, bald knobs, "Bald Jesse," Gainesville, June 26, 1928, *Palmer 34732* (M); along rocky river bluffs, Pontiac, June 27, 1928, *Palmer 34793* (M); top of limestone bluffs along Pomme de Terre River, ½ mile north of Burns, July 17, 1934, *Steyermark 13595* (M); high bluffs of White River,

[1] In the citation of specimens, the geographic arrangement is north to south and east to west: Canada, United States, Mexico, Central America, West Indies, and South America. In the various states the collections are grouped by counties; however, the county names are omitted here to conserve space.

June 4, 1914, *Palmer 5856* (F, M); rocky banks and bluffs, Roark, Sept. 28, 1920, *Palmer 19219* (M); wooded lower slopes of "Bald Joe," April 30, 1924, *Palmer 24612* (M); common on bluffs, Swan, June 6, 1898, *Bush 64* (F, M, ND); common on bluffs, Swan, June 2, 1899, *Bush 21* (M, ND); common on rocky bluffs, Forsyth, June 10, 1899, *Bush 50* (M); bluffs of White River, Branson, Oct. 23, 1913, *Palmer 4710, 4723*, rocky bluffs, Branson, Sept. 29, 1920, *Palmer 19253* (M); rocky bluffs and ledges, hollows between bald knobs, Melva, Sept. 17, 1924, *Palmer 26187* (M); along high rocky bluffs of Long Creek, near Oasis, June 3, 1931, *Palmer 39482* (F, M); Taney Co., Sept. 1936, *Sayres* (M); Swan Creek bluffs, Forsyth, Aug. 7, 1897, *Trelease 257* (M); Swan, Aug. 6, 1897, *Trelease 258* (M); club house, White River, 12 miles from Forsyth, May 1906, *Wideman* (M).

ARKANSAS: Norfolk, May 21, 1927, *Demaree 3040* (M); rocky bluffs, Cotter, June 14, 1914, *Palmer 5971* (M); rocky bluffs of White River, Cotter, July 24, 1916, *Palmer 10556* (M); bluffs at Van Buren, April 5, 1929, *Demaree 6406* (F); rocky bluffs of Buffalo River, Jasper, May 8, 1925, *Palmer 27085* (M).

OKLAHOMA: [wooded calcareous banks on Grand River, a tributary of the Arkansas], "Arkansas," *Nuttall* (PA **type**); along rocky ravines, west side of Rich Mountains, near Page, April 14, 1929, *Palmer 33313* (M).

TEXAS: rocky woods, Banders Pass, 1884, *Reverchon 1643* (M); Spanish Pass, July 5, 1911, *Clemens* (M); rocky hillsides, Spanish Pass, May 23, 1916, *Palmer 9865* (M); Kerrville, July 1909, *Mackensen 8* (F).

METOPIUM P. Browne

Metopium P. Browne, Hist. Jamaica, p. 177. 1756; Engler in DC., Monogr. Phaner. **4**: 367. 1883; Engler in Engl. & Prantl, Nat. Pflanzenfam. **3**^{5}: 167. 1892; Urban, Bot. Jahrb. **21**: 612. 1896; Small, Fl. Southeast. U. S., p. 726. 1903; Urban, Symb. Antil. **5**: 403. 1908; Small, Fl. Miami, p. 112. 1913; Sargent, Manual, ed. 2, p. 658. 1922; Standl., Contr. U. S. Nat. Herb. [Trees & Shrubs Mex.] **23**: 664. 1923; Small, Man. Southeast. Fl., p. 808. 1933.

Cotinus M. Gomez de la Maza, El Prog. Med. (Havana) **8**: 50. 1896, in part, non Mill., Gard. Dict., abrdg. ed. 4. 1754.

Rhus Willd., Sp. Pl. **1**: 1477. 1798, in part; DC., Prodr. 2: 67. 1825, sect. METOPIUM; G. Don, Gen. Hist. Dichl. Pl. **2**: 69. 1832, sect. METOPIUM; A. Rich. in Sagra, Hist. Cuba, Bot: 381. 1839; Endl., Gen. Pl., p. 1131. 1840, sect. METOPIUM; Ench. Bot., p. 599. 1841, sect. METOPIUM; Nutt., N. Am. Sylva **2**: 120. 1849, in part; Griseb., Cat. Pl. Cub., p. 67. 1866, in part; Sargent, Sylva **3**: 13. 1892, in part; Gray, Syn. Fl. N. Am. **1**: 382. 1897, sect. METOPIUM.

Deciduous trees with flaky bark. Leaves alternate, imparipinnate with 1–7 leaflets, more or less persistent. Leaflets coriaceous or subcoriaceous, glabrous, with more or less whitened and subrevolute margins, veins often whitened, prominent below or above and below; rachis almost terete. Flowers polygamo-dioecious or perfect, in loose ascending panicles in the axils of the deciduous leaves. Calyx 5-lobed, persistent, ciliate-

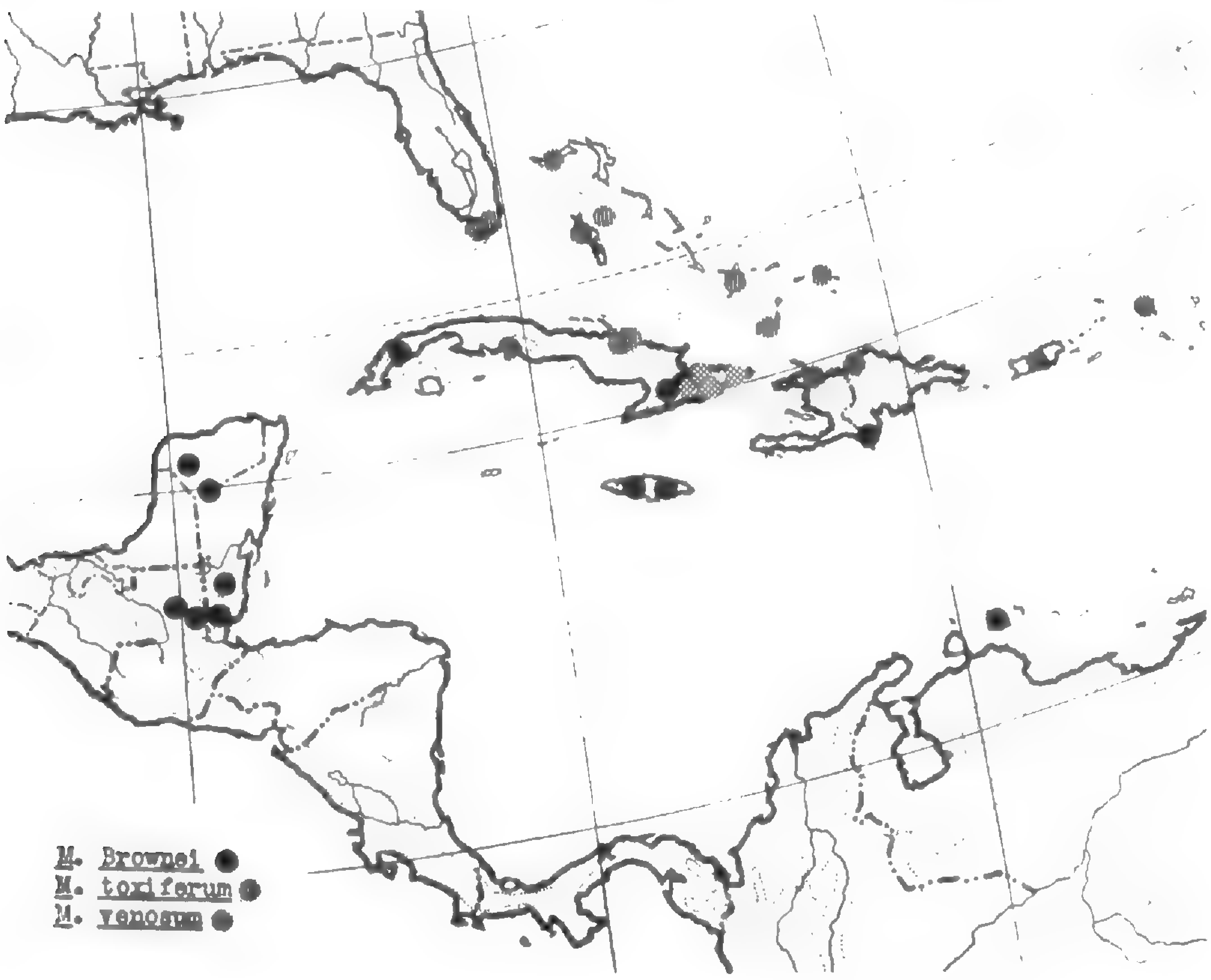

Fig. 5. The geographic distribution of the species of *Metopium*.

margined. Petals 5, ascending, glabrous. Ovary 1-celled, sessile on the disk; style terminal; stigma slightly 3-lobed. Drupes usually elongated, epicarp glabrous, shining; mesocarp thick; fruit coats permanently united; seed chartaceous, diamond-shaped, flattened, smooth.

Florida, West Indies, and Central America. Berry describes a fossil species from the Wilcox (Lower Eocene) of Tennessee, Mississippi, and Texas.

Type species: **Metopium Brownei** (Jacq.) Urb., Symb.

Antil. **5**: 402. 1908 (*Terebinthus Brownei* Jacq., Enum. Syst. Pl. Carib., p. 18. 1760).

KEY TO THE SPECIES

Branches slender; leaflets lanceolate............................*1. M. venosum*
Branches coarse; leaflets deltoid to ovate.
Leaflets deltoid to ovate-elliptical, distinctly revolute, mostly not undulate in desiccation; calyx-lobes imbricated in the bud; anthers shorter than filaments; Florida, the Bahamas, Porto Rico to Cuba.......*2. M. toxiferum*
Leaflets ovate or oval, slightly revolute, usually undulate in desiccation; calyx-lobes not imbricated in the bud; anthers longer than filaments; Cuba to Central America..................................*3. M. Brownei*

1. Metopium venosum (Griseb.) Engler in DC., Monogr. Phaner. **4**: 367. 1883. Pl. 17, fig. 1.

Rhus venosa Griseb., Cat. Pl. Cub., p. 67. 1866.

A slender bush or small tree, 2–4 m. tall; branches slender; leaves 5–7-foliolate, 15–20 cm. long, rachis segments 1.5–3 cm. long; leaflets lanceolate, 3.5–7.5 cm. long, 0.75–2.5 cm. broad, smooth, shining above, subcoriaceous, veins reticulate, prominent above and below, margins slightly whitened, slightly revolute, not undulate in desiccation, apex acuminate, base cuneate and decurrent on the petiolule, lateral petiolules 0–9 mm. long; petioles slender; panicles axillary above the leaves, lax-flowered, glabrous, peduncles and pedicels slender; calyx-lobes half orbicular, some imbricate in the bud; stamens with slender filaments longer than the oval anthers.

A very distinct, but little-collected species of restricted range in eastern Cuba.

WEST INDIES:

CUBA: ORIENTE: Baracoa, 1914, *Ekman 3513* (NY); alt. 500 m., Alto de la Mesa de Prada, southern Baracoa region, July 17–Aug. 4, 1924, *Leon 11802* (NY); Cayo Grande, Canete, Baracoa, Sept. 4, 1907, *Roig 118* (NY); dry rocky hillside, Serpentine Formation, alt. 400–500 m., Sierra Nipe, along the trail Piedra Corda to Woodfred, Dec. 13, 1909, *Shafer 3158* (NY, US); alt. 100–200 ft., trail, Rio Yamaniguey to Camp Toa, Feb. 22–26, 1910, *Shafer 4192* (F, NY, US); dry serpentine thickets, Baracoa to Florida, March 15, 1910, *Shafer 4323* (F, NY, M photo., US); dry serpentine hill, Loma Santa Teresa, near El Yungue, Oriente, Dec. 2, 1910, *Shafer 7737* (NY, US); Moa Bay, east of Rio Moa, Jan. 2–3, 1911, *Shafer 8306* (NY, US); Loma del Pinal Mayavi, Cuchillas de Baracoa, May 14, coll. of 1860–1864, *Wright 2288* (G, NY, M, **cotypes**).

2. **Metopium toxiferum** (L.) Krug & Urb., Bot. Jahrb. **21**: 612. 1896.

Metopium Linnaei Engler in DC., Monogr. Phaner. **4**: 367. 1883, in part.

M. Linnaei var. *Oxymetopium* Engler in DC., *ibid.* **4**: 368. 1883.

M. Metopium Small, Fl. Southeast. U. S., p. 726. 1903.

Amyris toxifera L., Syst. Nat., ed. 10. **2**: 1000. 1759.

Persea alpigena Spreng. in L., Syst. Veg., ed. 16. **2**: 268. 1825, excl. syn.

Rhus metopium A. Rich. in Sagra, Hist. Cuba, Bot. 381. 1839; *ibid.* **10**: 157. 1845, excl. syn.

R. Oxymetopium Griseb., Cat. Pl. Cub., p. 67. 1866.

A low tree about 3–7 m. tall; branches medium-heavy; leaves 1–7-foliolate, 12–25 cm. long, 4–5 cm. between leaflets, rachis coarse; leaflets deltoid to ovate-elliptical or orbicular, oval or lanceolate-deltoid, 3.5–8 cm. long, 2.5–6 cm. broad, smooth, shining above, coriaceous to heavy-coriaceous, veins reticulate, prominent above and below, or prominent only below, margins distinctly whitened and strongly revolute, slightly or not at all undulate in desiccation, apex acuminate or abruptly acuminate, rarely obtuse, base retuse, truncate or obtuse, rarely slightly decurrent, and rarely unequal; lateral petiolules 2–22 mm. long, medium-heavy; flowers with calyx-lobes obscurely imbricated in the bud; calyx-lobes half orbicular; stamens with filaments longer than the oval anthers; fruit dull, about 10 mm. long, 6 mm. broad; petioles coarse; panicles somewhat diffuse, erect, with coarse peduncles and pedicels.

A comparatively widespread species of the northern part of the West Indian region. It varies within comparatively narrow limits, but the specimens from the Bahamas tend to have somewhat thicker leaflets, which are smooth and shining above, and the fruits are somewhat shorter than the average of the species.

Distribution: Florida, the Bahamas, Porto Rico to Cuba (fig. 5).

UNITED STATES:

FLORIDA: pine lands, near Camp Jackson, March 25, 1904, *Britton 241* (F); Miami, Nov. 1903, *Carter & Small 1234* (F); Brickell Hammock, Miami, April 30, 1930, *Duckett* (M); in tropical hammock, Brickell Hammock, Miami, May 9, 1933, *Duckett 230* (ND); Miami, May–July, 1877, *Garber* (F); Homestead, March 12, 1930, *Moldenke 778a* (M); Biscayne Bay, 1874, *Palmer 97* (F, M); 10 miles southwest of Royal Palm Hammock, Everglades, May 22, 1925, *Palmer 27505* (M); between Cutler and Longview Camp, Nov. 9–12, 1903, *Small & Carter* (F); Biscayne, Jan. 1, 1896, *Webber 269* (F); Elliott's Key, Jan. 4, 1896, *Webber 339* (M); Miami, 1904, *Westgate* (F); Planters, April 1903, *Hitchcock* (F); Bahia Honda Key, *Chapman 38* (F); coral soil in forests, Bahia Honda Key, May, *Curtiss 448* (F, M); thickets at base of old lighthouse, July 16, 1895, *Curtiss 5477* (M); Key Largo, April 27, 1896, *Curtiss 5638* (M); Key West, March 28–30, 1906, *Hitchcock* (F); near south beach, Key West, Feb. 28–March 9, 1904, *Lansing 2020* (F); No Name Key, May 1891, *Simpson 227* (F); Palm Beach Co., Dec. 26, 1895–Jan. 11, 1896, *Hitchcock 329, 330* (F).

WEST INDIES:

ANGUILLA ISLES: Salt Key Banks at the south end, May 15–16, 1909, *Wilson 8034* (F, M, NY).

BAHAMA ISLANDS: Port Horne, Nov. 20, 1890, *Hitchcock* (M); west of Spring Point, Acklin Island, Dec. 21, 1905–Jan. 6, 1906, *Brace 4500* (F, NY); Mangrove Cay, Andros Island, Aug. 18–Sept. 10, 1906, *Brace 4962* (F, US); Conch Sound, Andros Island, May 8, 1890, *Northrop 552* (F); coppice, Smith Hill, Long Bay Cays Section, Andros Island, Jan. 23–24, 1910, *Small & Carter 8672* (F, NY, US); Crooked Island, Nov. 1890, *Hitchcock* (M); low scrub lands, Jacksonville and vicinity, East Caicos, Feb. 26 and 27, 1911, *Millspaugh 9110* (F, NY); Fortune Island, Feb. 4, 1888, *Eggers* (US); Fortune Key, Nov. 1890, *Hitchcock* (M); Fortune Key, winter 1890–1891, *Rothrock 513* (F); Cheroki Sound, Great Abaco Island, Dec. 30, 1904, *Brace 1976* (NY); coastal coppice, Pinders Point, Great Bahama Island, Feb. 5–13, 1905, *Britton & Millspaugh 2514* (F, NY); Great Inagua, Dec. 4, 1890, *Hitchcock* (M); salt pond hill, Great Inagua, Oct. 12, 1904, *Nash & Taylor 969* (F, NY); Blakesville, Great Inagua, Oct. 18, 1904, *Nash & Taylor 1136* (F, NY); white lands, salt pond hill to salt ponds, Great Inagua, Oct. 26, 1904, *Nash & Taylor 1327* (F, NY); Matthew Farm to Homer Savannah, Great Inagua Island, Nov. 4, 1904, *Nash & Taylor 1424* (NY); west end, Little Inagua, Dec. 21, 1907, *Wilson 7774* (F, NY); Abraham Bay and vicinity, Mariquana, Dec. 6–8, 1907, *Wilson 7502* (F, NY); near Nassau, New Province Island, May 23, 1903, *Curtiss 33* (M, US); Nassau, New Providence Island, Nov. 1890, *Hitchcock* (M); pine barrens, Providence, April 7, 1904, *Millspaugh 2056* (F); soldier's road, near Blue Hill road (pine region), about 3 miles south of Nassau, New Providence Island, March 19, 1905, *Wight 220* (F, NY); vicinity of Groutstown, New Providence Island, May 28–29, 1909, *Wilson 8227* (F, NY); North Caicos, Kew and vicinity, Caicos Islands, Dec. 18, 1907, *Wilson 7747* (F, NY).

CUBA: 1860–1864, *Wright 2287* (M cotype of *Rhus Oxymetopium* Griseb.); *Wright 2289* in part (US); CAMAGUEY: savanna north of La Gloria, Feb. 9, 1909, *Shafer 287* (F, US); Cayo Guajaba, March 7, 1909, *Shafer 671* (F, US); Punta Guajaba, Cayo Guajaba, Oct. 8, 1909, *Shafer 2431* (F, US); western part of Cayo Cruz, Oct. 28, 1909, *Shafer 2807* (F, US); SANTA CLARA: Milpa, Cienfuegos Bay, April 20, 1930, *Jack 7925* (F).

DOMINICAN REPUBLIC: San Gabriel Island, west of San Lorenzo, April 5–10, 1921, *Abbott 1251* (US); rocky coast 3–4 miles west of San Lorenzo Bay, south coast of

Samaná Bay, sea-level, April 5–10, 1921, *Abbott 1271* (US); District Monción, near Los Junquitos, alt. 350 m., May 5, 1931, *Valeur 860* (M), July 22, 1931, *698* (F, M).

HAITI: Port de Paix, *Ekman 3644* (US); Port de Paix, Dec. 25, 1928, *Leonard 11193* (M, US); Port de Paix, Jan. 25, 1929, *Leonard 12338* (M, US); mountain trail, mountains south of Jean Rabel, Feb. 9, 1929, *Leonard 13085* (US); near Bombardopolis, alt. 610 m., Feb. 21, 1929, *Leonard 13374* (US); near Basse Terre, Tortue Island, March 22, 1929, *Leonard 13966* (US); arid coral rocks, near Basse Terre, Tortue Island, *Leonard 14074* (US); near Bassin Bleu, alt. 630–1500 m., April 14–19, 1929, *Leonard 14865* (US); near La Vallée, Tortue Island, May 4–10, 1929, *Leonard 15338* (US); dry coastal thickets east of Port de Paix, May 13, 1929, *Leonard 15650* (US).

PORTO RICO: Salinas de Cobo-Rojo, Feb. 17, 1885, *Sintenis 528* (US); Tenuelas in Monte Vi, July 8, 1886, *Sintenis 4800* (F, M, US).

3. **Metopium Brownei** (Jacq.) Urb., Symb. Antil. **5**: 402. 1908.

Metopium Linnaei Engler in DC., Monogr. Phaner. **4**: 367. 1883, in part.

M. Brownei var. *brachycarpum* Urb., Symb. Antil. **5**: 403. 1908.

Cotinus Metopium M. Gomez de la Maza, El Prog. Med. (Havana) **8**: 50. 1896.

Rhus Metopium L., Syst. Nat., ed. 10. **2**: 964. 1759; Fawcett & Rendle, Fl. Jamaica **5**: 9. 1926; Brisseau-Mirbel & Jolyclerc, Hist. Nat. Pl. **17**: 177. 1806, as *r. methopium.*

R. quinquefolia Stokes, Bot. Mat. Med. **2**: 161. 1812.

R. metopia St. Lag., Ann. Soc. Bot. Lyon **7**: 133. 1880.

Terebinthus Brownei Jacq., Enum. Syst. Pl. Carib., p. 18. 1760, as *T. Brovvnii.*

Tree 5–25 m. tall; branches medium in size; leaves 5–7-foliolate, 18–30 cm. long, 3–5 cm. between leaflets, rachis slender; leaflets ovate, oval, or very rarely slightly obovate, 5–11 cm. long, 2.5–6.5 cm. broad, somewhat shining above, thin, coriaceous, veins reticulate, prominent above and below, margins somewhat whitened, very slightly revolute, usually undulate in desiccation, apex abruptly acuminate or obtuse or very rarely slightly emarginate or obcordate, base truncate, obtuse, or cuneate, often unequal and decurrent on the petiolule; petiolules 5–16 mm. long, slender; calyx-lobes hemispherical, not imbricated in the bud; stamens with lanceolate anthers much exceeding the short filaments; fruit shining, about 1.5 cm. long, half as broad; petioles slender; panicles diffuse, lax, spreading, with slender peduncles and pedicels.

A comparatively widespread species whose range extends from Cuba to Jamaica and Central America. The specimens from Jamaica often have thinner and more orbicular leaflets than is typical for the species as a whole. Gaumer reports that this tree furnishes the most beautiful of all the varieties of rosewood—difficult to work and poisonous to the workmen. While this species and *Metopium toxiferum* are very similar in general aspect, they seem to be quite distinct.

Distribution: Haiti and Cuba to Jamaica, Curaçao, and in Central America (fig. 5).

MEXICO:

YUCATAN: Izamal, *Gaumer 601* (F, M); Laguna de Chichankanab, *Gaumer 1867* (F, M); between Sisal and Progreso, March, 1916, *Gaumer 23223* (F, M); 1917–1921, *Gaumer 23974* (F); April 1917, *Gaumer & Sons 23674* (F, M); *Millspaugh 25* (F).

CENTRAL AMERICA:

GUATEMALA: PETÉN: in Bajo Baxactun, April 22, 1931, *Bartlett 12695* (M); Remate, Lake Petén, March 25, 1933, *Lundell 2080* (F); Sabana San Francisco, La Libertad, April 4, 1933, *Lundell 2459* (F); La Libertad, April 28, 1933, *Lundell 3063*, and May 31, 1933, *3534* (F); Municipio de San José, April 14, 1933, *Pacheco 1485* (F).

BRITISH HONDURAS: Maskall, April 23, 1934, *Gentle 1212* (F, M); Maskall pine ridge, July 26, 1934, *Gentle 1352* (M); coastal region, Honey Camp, Oct. 14, 1929, *Lundell 592* (F); near Honey Camp, 1930, *Meyer 176* (F); BELIZE DISTRICT: Manatee pine ridge, 1931–1932, *Gentle 102* (F); SOUTHERN DISTRICT: All Pines, July 10, *Schipp 540* (F, M).

WEST INDIES:

CUBA: eastern Cuba, 1860–1864, *Wright 2289* (M); ORIENTE: in sylva, Aug. 3, 1915, *Ekman 6297* (F); limestone hills, south of Holquin, April 11, 1909, *Shafer 1317* (US); PINAR DEL RIO: Las Martinas to the Coast, Dec. 19, 1911, *Shafer 11120* (M, US); *Wright 2289* in part (US).

CURAÇAO: jagged limestone, St. Peter, March 20–27, 1913, *Britton & Shafer 3080* (US); on Tafelberg, Feb. 27, 1917, *Curran & Haman 148* (US).

DOMINICAN REPUBLIC: BARAHONA: Sept. 23, 1926, *Ekman 7062* (US); Hoya de Enriquillo, Jimaní, at Laguna del Fondo, April 4, 1928, *Ekman 9867* (US); May 1910, *Fuertes 32* (F, M, US).

HAITI: Carrefour-Fouché to Trouin, April 16, 1926, *Ekman 5869* (US); near Pétionville, alt. 350 m., June 15–28, 1920, *Leonard 11933* (US).

JAMAICA: Norbrook, June 3, 1895, *Campbell 5753*, and Feb. 28, 1896, *6195* (F); Long Mountain, March 9, 1900, *Harris* (F); Watson's Mill, Manchester, May 1, 1896, *Harris 6416* (F); Great Goat Island, April 19, 1906, *Harris 9224* (F, US); Lititz Savanna, Oct. 7, 1914, *Harris 11766* (F, M, US); Pigeon Island, 10 miles off Old Harbor Bay, April 6–7, 1920, *Maxon & Killip 1577* (F, US).

ACTINOCHEITA Barkley

Actinocheita Barkl., Ann. Mo. Bot. Gard. **24**: 2. 1937.

Rhus DC., Prodr. **2**: 67. 1825, in part; Turcz., Bull. Soc. Nat. Moscou **31**: 469. 1858, in part; A. DC., Calq. Dess. Fl. Mex. Moc. & Sessé, *t. 189.* 1874, in part; Hemsl., Biol. Cent.-Am. Bot. **1**: 217, 218. 1880, in part; Engler in DC., Monogr. Phaner. **4**: 383. 1883, in part; Sessé & Moc., Pl. Nov. Esp., p. 47. 1887, in part; ed. 2, p. 44. 1893, in part; Standl., Contr. U. S. Nat. Herb. [Trees & Shrubs Mex.] **23**: 665. 1923, in part.

Toxicodendron Kuntze, Rev. Gen. Pl., pt. 1, p. 153. 1891, in part.

Deciduous trees with few staghorn-like, ash-gray branches. Leaves alternate, imparipinnate, more or less persistent, clustered near the apex of the branches; leaflets many, densely pubescent, rugose; rachis not winged. Bracts of the inflorescence lanceolate, deciduous. Flowers polygamo-dioecious, in ascending panicles in the axils of the leaves, appearing with the leaves. Petals and sepals 5, spreading. Ovary 1-celled, raised upon a column formed by the disk and partly adherent to it; style 3-branched, terminal. Drupe almost symmetrical, clothed with long, soft, reddish hairs.

Type species: **Actinocheita filicina** (DC.) Barkl. (*Rhus Filicina* DC., Prodr. **2**: 67. 1825).

The seldom-collected, single species, of which this genus is composed, while resembling several members of the Rhus-complex in various features, is quite distinctive in its general aspect and morphology. It resembles SUMAC in its staghorn-like stems and deciduous leaves which are imparipinnately compound with many leaflets, but the leaves are more densely clustered near the apex and the leaflets are peculiarly rugose and crenate-lobed. The inflorescence is axillary, composing an open compound leafy panicle, also unlike that of SUMAC, where it is a dense terminal thyrsus. The situation of the ovary on a column is vaguely suggestive of the condition in *Anacardium*, but in the Rhus-complex it is found only in *Actinocheita*. Glabrous, short-pubescent, and glandular-pubescent fruits are found in the complex, but in no other genus do long, silky, simple hairs occur. It has been reported as poison to the touch.

1. **Actinocheita filicina** (DC.) Barkl., Ann. Mo. Bot. Gard. **24**: 2. 1937. Pl. 17, fig. 2.

Rhus Filicina DC., Prodr. **2**: 67. 1825; A. DC., Calq. Dess. Fl. Mex. Moc. & Sessé. *pl. 189*. 1874; Hemsl., Biol. Cent.-Am. Bot. **1**: 217. 1880.

R. potentillaefolia Turcz., Bull. Soc. Nat. Moscou **31**: 469. 1858; Hemsl., Biol. Cent.-Am. Bot. **1**: 218. 1880; *ibid.* **4**: 21. 1886, in note; Engler in DC., Monogr. Phaner. **4**: 383. 1883; Standl., Contr. U. S. Nat. Herb. [Trees & Shrubs Mex.] **23**: 669. 1923.

R. Tetlatziam Sessé & Moc., Pl. Nov. Esp., p. 47. 1887; ed. 2, p. 44. 1893.

Bursera bipinnata (Schlecht.) Engler in DC., Monogr. Phaner. **4**: 49. 1883, in part, as to *Rhus filicina* in syn.; Hemsl., Biol. Cent.-Am. Bot. **4**: 19. 1886, in part, as to *Rhus filicina* in syn.

Toxicodendron potentillifolium Kuntze, Rev. Gen. Pl., pt. 1, p. 154. 1891.

Shrubs and small trees to 5 m. in height, with few staghorn-like branches covered with tuberculate leaf scars; branches ash-gray, glabrous below and densely pubescent at the apex, nude at base and clothed heavily near the summit with leaves; leaves alternate, rugose, imparipinnate, 9–33 cm. long, deciduous; leaflets 13–29, sessile, broadly linear, to 6 cm. long, sometimes as small as 0.5 cm., hoary-tomentose, lighter below, with revolute margins, lobes crenate, usually cristate-pointed, apex more or less acute, base truncate; rachis naked, densely pubescent; flowers polygamo-dioecious, disposed in ascending panicles half as long as the subtending leaves and appearing with them; bracts linear to subrotund, persistent, pilose-hirsute; sepals 5, deltoid-lanceolate, densely pubescent; stamens with thickened filaments longer than the ovoid anthers; pistil with 3 short styles, ovary on a torus formed by the disk, 1-celled, ovule anatropous; drupe almost symmetrical, villous, clothed with long, soft, violet-red hairs.

Type specimen: In all probability the original material on which this species was founded no longer exists; but the species is based primarily on *plate 189* of 'Calque des Dessins de la Flora du Mexique, de Mociño and Sessé,' 1874, and is typified by *Pringle 4752*, which is represented in the larger herbaria of America and Europe.

Distribution: Puebla, Guerrero, and Oaxaca, Mexico (fig. 6).

MEXICO: coll. of 1791, *Haenke 1503* (F).

GUERRERO: Acuitlapan, 1900 m., Oct. 1935, *Abbott 11* (G); mountains above Iguala, Oct. 4, 1900, *Pringle 9164* (F, G, M).

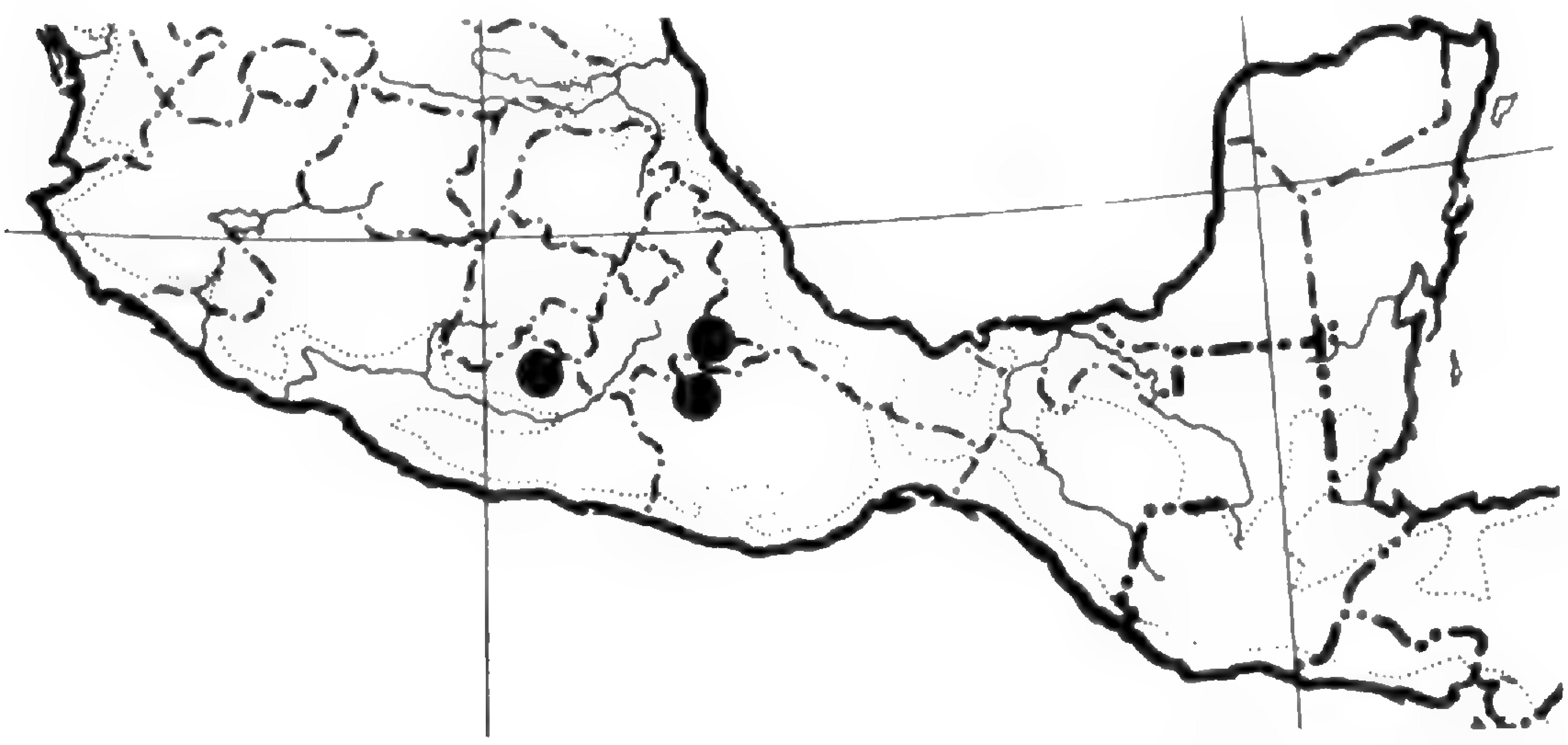

Fig. 6. Portion of Mexico, showing the geographic distribution of *Actinocheita filicina* (DC.) Barkl.

OAXACA: Cañon del Tomellin, Estacion de Almoloyas, Sept. 29, 1907, *Conzatti 2019* (F, NY); District of Nochixtlan, Cuesta de Henuadilla, *Conzatti 4247* (US); Cuesta de Nochixtlan, alt. 2000 m., May 1899, *Gonzalez & Conzatti 937* (G); six miles above Dominguillo, Oct. 3, 1893, *Nelson 1593* (US), and Oct. 30, 1894, *1825* (G, US, NY); limestone ledges, Tomellin Cañon, July 31, 1894, *Pringle 4752* (B, Calif, F, G, M, NY, PA, US); Nov. 27, 1895, *Seler 1419* (G, NY); Rio Seco, Necaltepec, alt. 3100 ft., Sept. 21, 1895, *Smith 777* (G).

PUEBLA: Tehuacan, June 1905, *Purpus 1236* (Calif, F, G, M, NY); Tlacuilotepec, May 1909, *Purpus 4065*, in part (F, G, M, NY); Tehuacan, Sept. 1911, *Purpus 5702* (Calif, M); Tehuacan, Aug. 1905, *Rose, Hough & Painter 9967* (G, NY, US).

RHUS [Tourn.] L., emend. Moench

Rhus Tourn., Inst. Rei Herb., p. 611. 1700; L., Sp. Pl. 1: 265. 1753, in part, as to species 1, 2, 3, and 5; Gen. Pl., ed. 5, p. 129.

1754, excl. *Toxicodendron* and *Cotinus* Tourn.; Moench, Meth., p. 72. 1794; Jacq., Pl. Rar. Hort. Schoenb. **3**: 50. 1798, in part; Willd., Sp. Pl. **1**: 1477. 1798, in part; Brisseau-Mirbel & Jolyclerc, Hist. Nat. Pl. **17**: 176. 1806, as *rhus* in part; DC., Cat. Pl. Hort. Bot. Monsp., p. 55. 1813, in part; DC., Prodr. **2**: 67. 1825, sect. SUMAC in part; Hook., Fl., Bor.-Am. **1**: 126. 1830, sect. SUMAC in part; Endl., Gen. Pl., p. 1131. 1840, sect. SUMAC, *Rhus;* Ench. Bot., p. 599. 1841, sect. SUMAC, *Rhus;* Walp., Rep. Bot. Syst. **1**: 551. 1842, in part; Gray, Gen. Pl. U. S. **2**: 157. 1846, in part; Manual, p. 78. 1848, sect. SUMAC in part; Griseb., Cat. Pl. Cub., p. 67. 1866, in part; Engler, Bot. Jahrb. **1**: 379. 1881, sect. TRICHOCARPAE; Engler in DC., Monogr. Phaner. **4**: 376. 1883, sect. TRICHOCARPAE excl. *R. trichocarpa* & *R. potentillaefolia;* Gray (Wats. & Coult.), Manual, ed. 6, p. 118. 1889, sect. SUMAC; Dippel, Handb. Laubholzk. **2**: 376. 1892, in part; Engler in Engl. & Prantl, Nat. Pflanzenfam. **3**[5]: 168. 1892, sect. TRICHOCARPAE excl. *R. trichocarpa;* Sargent, Sylva **3**: 13. 1892, in part; Koehne, Deutsche Dendrol., p. 359. 1893, sect. TRICHOCARPAE; Gray, Syn. Fl. N. Am. **1**: 383. 1897, sect. RHUS in part as to SUMAC; Britton, Manual, p. 600. 1901, in part; Piper, Contr. U. S. Nat. Herb. [Fl. Wash.] **11**: 383. 1906, in part; Coult. & Nels., New Man. Cent. Rocky Mts., p. 312. 1909, in part; Britt. & Brown, Illustr. Fl., ed. 2. **2**: 481. 1913; Small, Fl. Miami, p. 112. 1913; Woot. & Standl., Contr. U. S. Nat. Herb. [Fl. N. Mex.] **19**: 408. 1915; Rydb., Fl. Rocky Mts. & Adj. Plains, p. 550. 1917, and ed. 2. 1922; Key Rocky Mt. Fl., p. 152. 1919; Sargent, Manual, ed. 2. p. 660. 1922, in part; Standl., Contr. U. S. Nat. Herb. [Trees & Shrubs Mex.] **23**: 665. 1923, in part; Bailey, Man. Cult. Pl., p. 461. 1924; Jepson, Man. Fl. Pl. Calif., p. 607. 1925, in part; Tidestr., Contr. U. S. Nat. Herb. [Fl. Utah. & Nev.] **25**: 347. 1925, in part; Rehder, Man. Cult. Trees & Shrubs, p. 536. 1927, sects. SUMAC and LOBADIUM; Schaffn., Manual Ohio, p. 347. 1928; Rydb., Fl. Prair. & Plains, p. 526. 1932; Small, Manual Southeast. Fl., p. 809. 1933; Munz, Manual S. Calif. Bot., p. 292. 1935, in part; Jepson, Fl. Calif. **2**: 444. 1936, in part; Stem. & Myers, Okla. Fl., p. 296. 1937.

Cotinus M. Gomez de la Maza, El. Prog. Med. (Havana) **8**: 50. 1896, in part, non Mill. Gard. Dict., abrdg. ed. 4. 1754.

Lobadium Raf., Am. Month. Mag., p. 357. 1819; Jour. Phys. **89**: 98. 1819.

Neostyphonia Shafer in Britt., N. Am. Trees, p. 612. 1908; Abrams, Bull. N. Y. Bot. Gard. **6**: 403. 1910; Fl. Los Angeles, p. 219. 1917.

Rhoeidium Greene, Leafl. Bot. Obs. & Crit. **1**: 143. 1905; Woot. & Standl., Contr. U. S. Nat. Herb. [Fl. N. Mex.] **19**: 408. 1915.

Schmaltzia Desv., Jour. de Bot. Appl. **1**: 229. 1813; DC. Prodr. **2**: 72. 1825, as *Schmalzia* in syn.; Small, Fl. Southeast. U. S., p. 728. 1903; Greene, Leafl. Bot. Obs. & Crit. **1**: 128. 1905; Abrams, Bull. N. Y. Bot. Gard. **6**: 401. 1910; Britt. & Brown, Illustr. Fl., ed. 2. **2**: 482. 1913. Woot. & Standl., Contr. U. S. Nat. Herb. [Fl. N. Mex.] **19**: 406. 1915; Abrams, Fl. Los Angeles, p. 219. 1917; Schaffn., Manual Ohio, p. 348. 1928; Small, Manual Southeast. Fl., p. 811. 1933; Stem. & Myers, Okla. Fl. p. 298. 1937.

Styphonia Nutt. in Torr. & Gray, Fl. N. Am. **1**: 220. 1838; Endl., Gen. Pl., p. 1131. 1840; Ench. Bot., p. 599. 1841; Walp., Rep. Bot. Syst. **1**: 555. 1842; Nutt., N. Am. Sylva **3**: 4. 1849; Hemsl., Biol. Cent.-Am. Bot. **1**: 218. 1880, as *Stiphonia.*

Toxicodendron Kuntze, Rev. Gen. Pl., pt. 1, p. 153. 1891, in part.

Turpinia Raf., Med. Repos. N. Y. **5**: 352. 1808; Desv., Jour. de Bot. **2**: 166. 1809.

Innocuous, mostly deciduous shrubs and small trees. Leaves alternate, simple, ternate or imparipinnate, mostly thin, rachis terete or winged. Flowers numerous, mostly polygamo-dioecious, in terminal thyrsi or in lateral and terminal compound spikes. Bracts of the inflorescence lanceolate or ovate, deciduous or persistent. Calyx of 5 sepals, mostly persistent. Petals 5, ascending. Ovary 1-celled, sessile on the disk; style terminal, 3-parted. Drupes red, about as broad as long, slightly compressed, pubescent with glandular hairs, or with simple and glandular hairs; mesocarp not ceriferous.

North America, Asia, and southern Europe.

Type species: **Rhus Coriaria** L., Sp. Pl. **1**: 265. 1753.

Rhus as here delimited is composed of two very diverse elements: Sumac having stout branches, thyrsoid inflorescences, and intermingled red glandular and red-stained pubescence on the fruit-coat; and Schmaltzia having comparatively slender branches, spicate inflorescences, and intermingled hyaline and red glandular pubescence on the fruit-coat. While these elements might be almost equally well treated as genera, it seems best for the present at least to treat them as subgenera.

KEY TO SUBGENERA

Flowers in dense terminal thyrsi, appearing after the leaves; bracts linear-lanceolate, deciduous, one subtending each flower; bracteoles absent; flowers short-pedicellate; fruit with red glandular pubescence and deeply red-stained hairs .... Sumac

Flowers in terminal compound spikes, appearing with or before the leaves; bracts deltoid or ovate, persistent, one bract and two bracteoles subtending each flower; flowers sessile or rarely short-pedicellate; fruit with red glandular pubescence and hyaline hairs........................ Schmaltzia

Subgenus Sumac (DC.) Schneider

Sumac DC., Prodr. **2**: 67. 1825, as section, in part; Koehne, Deutsche Dendrol. p. 359. 1893, as subsection; Schneid., Illustr. Handb. Laubholzk. **2**: 153. 1907, as subgenus; Rehder, Man. Cult. Trees & Shrubs, p. 537. 1927, as section.

Trichocarpae Engler, Bot. Jahrb. **1**: 379. 1881, as section, in part.

Erect shrubs and small trees with comparatively few staghorn-like branches. Leaves alternate, pinnately compound, deciduous; leaflets sessile; rachis winged or not. Inflorescences thyrsoid, mostly terminal. Flowers numerous, mostly polygamous, pedicellate, each usually subtended by a small thin, lanceolate bract. Drupes red; epicarp pubescent with red glandular and deeply red-stained hairs.

North America, Asia, and southern Europe.

Type species: **Rhus Coriaria** L., Sp. Pl. **1**: 265. 1753.

Sumac is a very natural group of shrubs and trees distributed in Europe, Asia, and North America.

KEY TO SPECIES AND VARIETIES

Rachis winged; leaflets mostly entire.
  Rachis and its wings on at least some of the leaves over 4 cm. broad........ .... 1. *R. Copallina*
  Rachis and its wings usually less than 3.5 mm. broad.
    Leaflets ovate-lanceolate, not strongly falcate, 17–27, with leaflets obtuse or acute.............................. 1a. *R. Copallina* var. *leucantha*
    Leaflets linear-lanceolate, strongly falcate, 13–19, with leaflets acuminate .... 2. *R. lanceolata*
Rachis not winged (except in *R. Michauxii*); leaflets mostly toothed.
  Uppermost rachis segment narrowly winged; leaflets ovate, subcordate at base.. 3. *R. Michauxii*
  Uppermost rachis segments not winged; leaflets lanceolate, usually subcuneate at base.
    Twigs and petioles densely villous-pubescent with long spreading hairs.
      Leaflets serrate.. 4. *R. typhina*
      Leaflets laciniate......................... 4a. *R. typhina* var. *laciniata*
    Twigs and petioles glabrous or puberulent, not villous-pubescent (or sparsely so in *R. glabra* var. *Sandbergii*).
      Fruits covered with long red hairs exceeding 1 mm. in length; branches at first puberulent................................... 5. *R. pulvinata*
      Fruits covered with short red hairs less than .5 mm. in length; branches glabrous or sparsely villous-pubescent.
        Fruits covered with very short glandular hairs about .2 mm. in length; branches glabrous; leaflets serrate, subentire, or laciniate.
          Leaflets serrate or subentire............................ 6. *R. glabra*
          Leaflets laciniate........................ 6a. *R. glabra* var. *laciniata*
        Fruits covered with longer hairs, about .5 mm. in length; branches glabrous or sparsely villous-pubescent; leaflets serrate or dentate.
          Leaflets mostly 7–13, small, serrate, light green; branches sparsely pilose.............................. 6b. *R. glabra* var. *borealis*
          Leaflets mostly 11–17, large, dentate, dark green; branches glabrous .... 7. *R. Ashei*

1. **Rhus Copallina** L., Sp. Pl. **1**: 266. 1753; Gmel. in L., Syst. Nat., ed. 13. **3**: 1615. 1793, as *R. corallina.*

Rhus copallina var. *latifolia* forma *latialata* Engler in DC., Monogr. Phaner. **4**: 384. 1883.

R. copallina var. *extensa* Sprenger, Mitt. Deutsch Dendr. Ges. for 1907, p. 67. 1907.

R. copallina var. *arborescens* Demcker, *ibid.* for 1909, p. 325. 1909.

R. copallina var. *salicifolia* Demcker, *ibid.*

R. copallina var. *nesophila* House, Bull. N. Y. State Mus., Nos. 243–244: 55. 1923.

R. copallina forma *crispa* Farwell, Papers Mich. Acad. Sci. **1**: 95. 1923.

R. pistachiaefolia Salisb., Prodr., p. 169. 1796.

R. lentiscifolia Stokes, Bot. Mat. Med. **2**: 164. 1812.

Schmaltzia copallina Small, Fl. Southeast. U. S., pp. 728, 1334. 1903.

Toxicodendron copallinum Kuntze, Rev. Gen. Pl., pt. 1, p. 153. 1891.

T. copallinum var. *latifolium* Kuntze, *ibid.*, p. 154.

Large shrubs with comparatively slender branches; older branches with numerous conspicuous lenticels, glabrate, the new branches villous-tomentose, buds tan, lanuginose; leaves compound; leaflets 7–17, lanceolate-elliptic or lanceolate-ovate, thin, subrevolute, green, glabrous or sparsely pilose and shining above, somewhat lighter, dull, pilose and glandular-hairy beneath, entire or subserrate-margined, lateral leaflets sessile, 2.5–8.5 cm. long, 1.4–2.8 cm. broad, at apex acute or less often acuminate (or those of uppermost and lowermost leaves obtuse or mucronate), base usually somewhat unequally cuneate, less often unequal and rounded, terminal leaflets sessile or long-petiolulate, 4.5–8 cm. long, 1.5–3 cm. broad, lanceolate-ovate at apex, obtuse or subcuneate at base; terminal petiolule 0–1.5 cm. long, broadly winged, rachis segments about 1.5–2.5 cm. long, winged, the uppermost broadly so, petioles 3–6 cm. long; inflorescence a large terminal thyrsus about 12 cm. long, 10 cm. broad, bracts lanceolate, 0.5–1.5 mm. long, 0.2–0.6 mm. broad, rounded at the apex, pilose on the outer surface and very sparsely pilose within with simple hairs, ciliate with simple hairs, deciduous; flowers many, pedicels about 1.7 mm. long, each flower subtended by a single bract; sepals deltoid, subacute, 1.2 mm. long, 1.1 mm. broad, pilose on the outer surface and glabrous on the inner, ciliate with simple and glandular hairs, persistent; petals greenish-white in the dried state, about 2–2.5 mm. long, 1–1.2 mm. broad, glabrous on the outer surface, a few hairs on the inner, ciliate with simple and glandular hairs, deciduous; filaments longer than the sepals, anthers lanceolate, 1.2–2 mm. long, 0.8 mm. broad; stigmas 3, styles 3; fruit 4 mm. long and 4 mm. broad, somewhat flattened, red, pilose, and with red glandular hairs; seed 2.5 mm. long, 2.5 mm. broad, smooth or somewhat roughened, usually larger at one end.

Rhus Copallina is a widespread species of eastern North America. Typically it has broadly winged rachis, few-foliolate

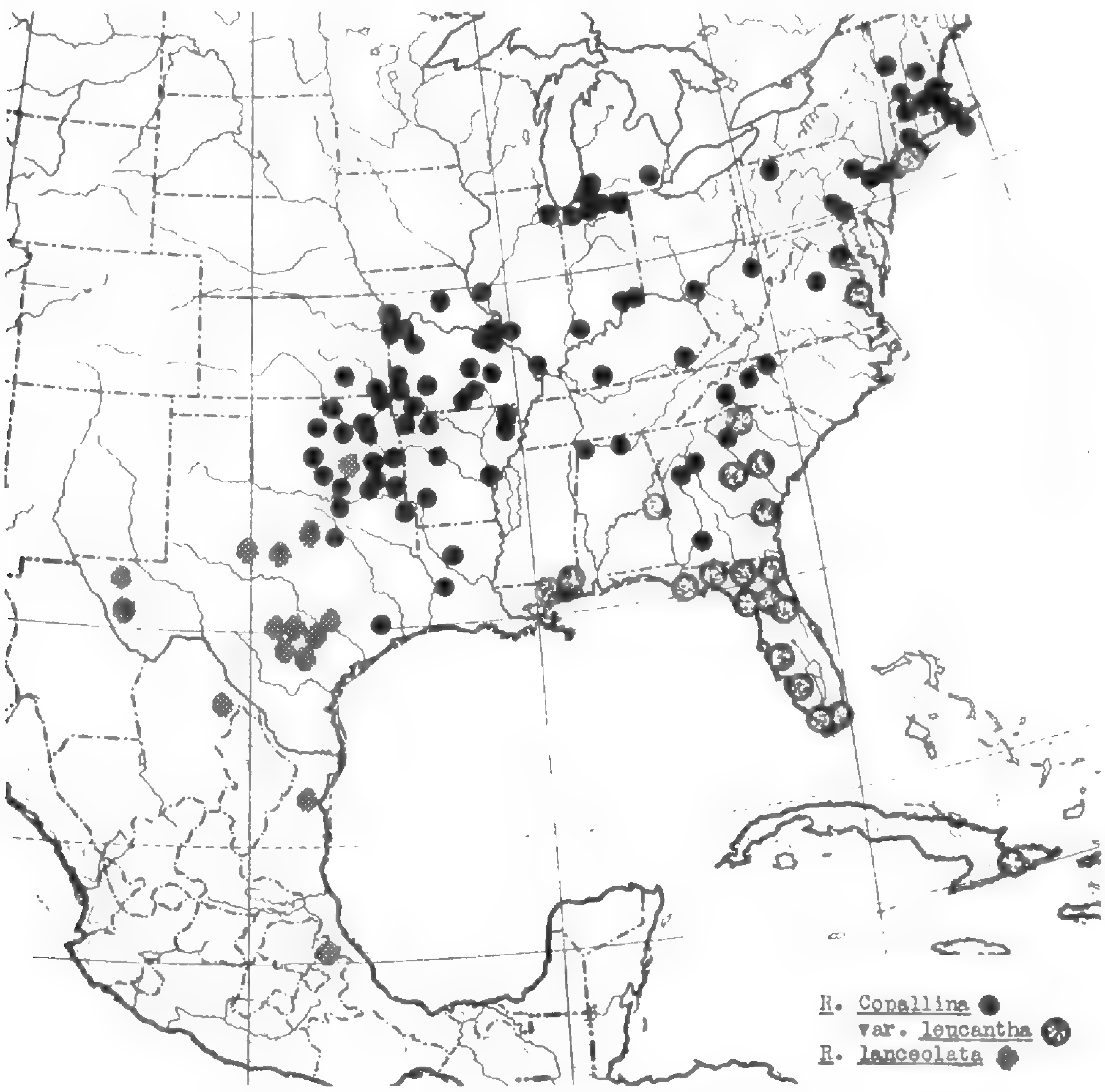

Fig. 7. The geographic distribution of *Rhus Copallina* L., *R. Copallina* var. *leucantha* (Jacq.) DC., and *R. lanceolata* (Gray) Engler.

leaves, with broadly lanceolate, acute leaflets which are shining above and often entire or serrate, even in the same leaf. There is some indication that it may hybridize with its variety and with *Rhus lanceolata*.

Distribution: New Hampshire to Georgia, west to Michigan, Missouri, and Texas (fig. 7).

UNITED STATES:

New Hampshire: thicket in pasture, Hookset, Aug. 16, 1925, *Batchelder* (M).

Vermont: sandy field near Scanlon Swamp, alt. 475 ft., Sept. 16, 1924, *Dutton* (M); dry ledge, Benson, June 27, 1923, *Knowlton* (M).

Massachusetts: Nonquitt, Aug. 3, 1888, *Sturtevant* (M); sandy woods, near Indian Hill, Lamberts Cove, Aug. 26, 1927, *Fogg* (M); Sunderland, Aug. 7, 1887, *Churchill* (M); Montague, Aug. 9, 1887, *Churchill*, and June 12, 1888 (M); roadside thicket, region of Ashley Pond, Holyoke, Sept. 7, 1926, *Seymour 607* (M); between South Sudbury and Framingham, Aug. 2, 1903, *Greenman 2104* (M); Lincoln, Aug. 23, 1903, *Greenman 2145* (M); Framingham, June 25, 1897, *Smith* (M); Randolph, Aug. 10, 1884, *Churchill*, and Aug. 4, 1889 (M); Harland Street, Milton, Oct. 1, 1898, *Churchill* (M); Douglass, May 30, 1934, *Weatherby, Smith, Harris & Rossbach 2783* (M).

Connecticut: New Haven, Oct. 1902, *Baker* (M).

New York: thickets, Ocean Side, Sept. 20, 1917, *House* (A type of *R. copallina* var. *nesophila)*; Hempstead Plains, Long Island, Sept. 7, 1892, *von Schrenk* (M).

New Jersey: sandy plains, Manchester, Sept. 1, 1870, *Redfield 1159* (M); Cape May, Sept. 9, 1879, *Redfield* (M); Livingston, July 25, 1907, *Lighthipe* (M); in thicket along roadside, Watchung, July 22, 1930, *Moldenke 1318* (M, NY); from a glacial marsh, Westfield, Aug. 16, 1925, *Drushel 5351* (M).

Pennsylvania: Fruitville Pike, Oct. 1892, *Eby* (M); July 8, 1883, *Galen 362* (M); Penryn, Aug. 1890, *Eby* (M); between Churchtown Road and Beartown, Sept. 6, 1892, *Heller 524* (M, ND); Mount Gretna, May 1889, *Eby* (M); Mount Alton, 1909, *Illick*, and July 20, 1909 (M); Pocono Plateau, July 21, 1904, *Harshberger* (M).

Delaware: along Little Duck Creek, near Leipsic, Aug. 2, 1934, *Larsen 773* (M).

Maryland: near Plummers Island, July 20, 1917, *Nieuwland* (M); beyond Riverdale, Aug. 5, 1905, *Greene* (ND); Riverdale, Aug. 18, 1899, *Palmer* (M).

District of Columbia: summer 1906, *Greene* (ND); along canal near High Island, Aug. 6, 1905, *House 1359* (M); Brookland, July 29, 1910, *Nieuwland 657* (ND); Washington, Sept. 1896, *Tidestrom* (ND).

Virginia: Arlington, Aug. 1, 1880, *Trelease* (M); Eckington, July 29, 1891, *Blanchard* (M).

North Carolina: dry woodlands, Biltmore, Aug. 9, 1897, *ex Biltmore Herb. 3284a* (M); summit of Stone Mountain, July 31, 1891, *Small & Heller 339* (M); north of Mount Airy, June 21, 1909, *Rusby* (NY).

South Carolina: hedges, suburbs of Anderson, Aug. 11, 1917, *Davis 7776* (M); fertilizer mill near Anderson, Aug. 18, 1917, *Davis* (M); Stephenson's farm, suburbs of Anderson, Oct. 9, 1918, *Davis 7878* (ND); woods, Anderson, July 15, 1919, *Davis 8409* (M); dry roadsides, Anderson, Aug. 25, 1919, *Davis 5281* (M).

Georgia: Stone Mountain, May 30, 1933, *Miller, Perry, Boyd & Myers 544* (M); hedges and fence rows, Dr. Gillespie's Pocoson place, May 1, 1928, *Gillespie 4920*, and May 16, 1928, *5032* (ND); Gwinnett Co., near McGuire's mill, Yellow River, alt. 750 ft., July 11, 1893, *Small* (F).

Alabama: hills near South Florence, July 21, 1899, *Eggert* (M); Huntsville, 1891, *Shimek* (M); Monte Sano, Huntsville, 1891, *Shimek* (M).

Mississippi: Askerman, June 1905, *Jensen 16* (M); Ocean Springs, Aug. 3, 1900, *Tracy 7012* (F, M).

LOUISIANA: border of woods near St. Martinsville, July 10, 1893, *Langlois* (ND); low woods, Lake Charles, Sept. 11, 1915, *Palmer 8518* (M); upland woods, Natchitoches, Sept. 28, 1915, *Palmer 8724* (M).

OHIO: open hillsides, Roosevelt Game Reserve, Friendship, July 29, 1934, *Demaree 10791* (M).

WEST VIRGINIA: Upshur Co., Aug. 1, 1896, *Pollock* (M).

MICHIGAN: Grand Beach, June 19, 1911, *Nieuwland 872* (ND); north of Bankson, Sept. 1, 1914, *Nieuwland 14078* (ND); sandy hill, Lawton, Sept. 9, 1928, *Anderson* (M); 7-mile road, Detroit, Sept. 13, 1911, *Nieuwland 1685* (ND).

INDIANA: north of Brookland, Aug. 18, 1911, *Nieuwland* (M); sandy roadside, Hunter Lake, Sept. 12, 1923, *Deam 39669* (Deam); woods near Grayford, July 23, 1922, *Deam 37053* (Deam); on a dune about 2 miles east of Indiana Harbor, Sept. 23, 1906, *Deam 1716* (Deam); Miller, Aug. 20, 1908, *Greenman*, and *3174*, *3175* (M); Osborn, Aug. 15, 1911, *Greenman* (M); Miller, Aug. 1884, *Ohlendorf* (M); sand-dune woods, Miller, Aug. 20, 1913, *Smith 5774* (M); Lake Maxinkuckee, Sept. 15, 1906, *Clark* (ND); sand, east side Lost Lake outlet, Lake Maxinkuckee, Oct. 8, 1906, *Clark* (ND); border of a wooded ravine near Otwell, Sept. 23, 1932, *Deam 53329* (Deam); Mineral Springs, Sept. 25, 1913, *Nieuwland 11651* (ND); Notre Dame, 1908, *Nieuwland 2457* (ND); road to Red Mill, Notre Dame, Aug. 6, 1909, *Nieuwland 371* (ND); open wooded hillsides about Hogback Lake, July 15, 1906, *Deam* (M); in a low place on the border of a wood about 1 mile southeast of Fairview, July 20, 1929, *Deam 47434* (Deam).

KENTUCKY: Pine Mountain, Harlan Co., Aug. 1893, *Kearney 143* (M); Bowling Green, Oct. 20, 1899, *Price* (M).

TENNESSEE: near Parrotsville, Sept. 29, 1906, *Norton* (ND).

ILLINOIS: rocky open hillsides, Belknap, May 13, 1919, *Palmer 15135* (M); "in Wäldern," St. Clair, July 24, 1879, *Eggert*, and Aug. 26, 1879 (M); Shepherd, Sept. 23, 1914, *Davis 3218* (M).

MISSOURI: barrens on the Meramec, June 1833, *Engelmann* (M); woods, Eagle Rock, Aug. 8, 1905, *Bush 3164* (M); Lamar, Sept. 1933, *Warner 4* (M); Poplar Bluff, July 1893, *Eby* (M); edge of prairie, Aug. 15, 1865, *Broadhead* (M); common in woods, Harlem, July 23, 1899, *Mackenzie* (M); Rhyse, July 29, 1928, *Kellogg 1850* (M); Springfield, July 31, 1892, *Dewait* (M); rocky open ground, Willow Springs, July 8, 1914, *Palmer 6221* (M); Iron Mountain Lake, July 24, 1927, *Kellogg 1030*, and June 22, 1928, *1851* (M); Pilot Knob, June 17, 1888, *Pammel* (M); dry hills, Pilot Knob, July 1897, *Russell* (M); Jackson Co., Oct. 11, 1892, *Bush* (M); Swope Park, July 4, 1896, *Bush 885* (ND); Webb City, Aug. 18, 1901, *Palmer 15* (M); very common on dry prairies, Webb City, July 24, 1903, *Palmer 959* (M); near Orongo, Aug. 23, 1926, *Palmer 31485* (M); Shoal Creek, Joplin, Oct. 7, 1897, *Trelease 248* (M); Festus, Oct. 23, 1936, *Barkley 1092* (M); Columbus, June 21, 1930, *Palmer 36673* (M); Mount Airy, July 1833, *Engelmann* (M); common in woods, Pleasant Grove, Aug. 12, 1899, *Bush 270* (M); Prospect Hill at brick kilns, St. Louis, Oct. 26, 1896, *ex Glatfelter Herb.* (M); St. Louis, Aug. 1838, *Riehl 156* (M); mouth of Meramec, St. Louis Co., July 5, 1891, *ex Glatfelter Herb.* (M); Watson Road 7 miles from St. Louis, July 20, 1893, *ex Glatfelter Herb.*, and 1894 (M); Bach's Crossing, Meramec Highlands, June 26, 1910, *Craig* (M); Meramec Station, July 22, 1879, *Eggert* (M); hills Valley Park, July 24, 1879, *Eggert*, and Aug. 21, 1879 (M); Allenton, Aug. 28, 1884, *Kellogg* (M); Allenton, July 18, 1884, *Letterman*, and Aug. 1, 1894 (M); Meramec

Highlands, Sept. 9, 1896, *Pammel* (M); Kirkwood, July 18, 1926, *Woodson 742* (M); common, Montier, June 30, 1894, *Bush 142* (M); Potosi, July 24, 1885, *Wislizenus 57* (M).

ARKANSAS: Benton Co., *Plank* (M); Eureka Springs, July 16, 1898, *ex Glatfelter Herb.* (M); Eureka Springs, May 7, 1903, *Gurney* (M); Piggott, Aug. 11, 1927, *Demaree 4129* (M); Jonesboro, June 29, 1929, *Demaree 6950* (M); McNab, Sept. 9, 1919, *Palmer 16332* (M); Wheatley to Brinkley, Sept. 1, 1934, *Demaree 10905* (M); near Nogo, Aug. 15, 1932, *Merrill 3* (M).

KANSAS: Cherokee Co., 1896, *Hitchcock 645a* (M); Olathe, July 1892, *Hitchcock* (M); copses, Wilson Co., 1896, *Haller 645* (M).

OKLAHOMA: common, Red River bottoms, near Grant, June 5, 1916, *Houghton 4045* (M); east of Norman, July 15, 1928, *Barkley 414* (Okla); southwest of Norman, July 11, 1924, *Bayliff* (Okla); east of Norman, July, *Clifton 73* (Okla); roadside south of Norman, May 10, 1930, *Cowan 73* (Okla); east of Noble, June 29, 1922, *Jeffs* (Okla); pasture between Norman and Noble, July 8, 1928, *Martin 85* (Okla); Sapulpa, July 22, 1894, *Bush 175* (M); open woods along Washita River, near Davis, July 29, 1933, *Palmer 42042* (M); rocky ground, Tishomingo, Sept. 10, 1914, *Palmer 6489* (M); dry hillsides and sways, east of Gowen, June 12, 1930, *Clark 2720* (Okla); near Page, July 11, 1914, *Blakley 1516* (M); Guthrie, July 8, 1893, *Waugh* (M); McCurtain Co., June 5, 1930, *Little & Olmsted 7*, and June 16, 1930 (Okla); near Muskogee, July 25, 1926, *Little 242* (Okla); at edge of woods, Pawhuska, Aug. 9, 1913, *Stevens 1998* (M); along stream, Commerce, Aug. 4, 1929, *Bush 10146* (M); 6 miles east of Miami, July 1928, *Whaley 111* (Okla); Stillwater, July 12, 1893, *Waugh*, and *133* (M); east of Trousdale, June 6, 1932, *Barkley 229* (Okla); in woods east of Finley, June 23, 1919, *Jeffs* (Okla); Dawson, July 8, 1928, *Myers 111* (Okla).

TEXAS: woods near Buchanan, June 13, 1898, *Eggert* (M); south of Dallas, July 16, 1898, *ex Glatfelter Herb.* (M); common in bottoms, Dallas, Sept. 26, 1900, *Bush 1117* (M); Hutchins, June 20, 1900, *Reverchon 1933* (M); Denison, Oct. 28, 1933, *Griggs 44* (M); Houston, June 20, 1872, *Hall 77* (M); Houston, June 1842, *Lindheimer* (M); Willis, *Warner* (M).

1a. Rhus Copallina L. var. **leucantha** DC., Prodr. **2**: 68. 1825.

Rhus Copallina var., Griseb., Cat. Pl. Cub., p. 301. 1866.

R. copallina var. *latifolia* forma *angustialata* Engler in DC., Monogr. Phaner. **4**: 384. 1883.

R. leucantha Jacq., Pl. Rar. Hort. Schoenb. **3**: 50. 1798.

R. obtusifolia Small, Fl. Miami, p. 112. 1913.

Cotinus Copallinus M. Gomez de la Maza, El Prog. Med. (Havana) **8**: 50. 1896.

Schmaltzia obtusifolia Small, Fl. Southeast. U. S., pp. 729, 1334. 1903.

S. leucantha Small, *ibid.*, ed. 2, pp. 1350, 1375. 1913.

Twigs usually slender; leaflets 17–27, thin to subcoriaceous, revolute and entire or subserrate-margined, somewhat pallid and sparse-pilose below, lateral leaflets oblong-lanceolate or oblong-elliptic, 2–5.5 cm. long, 0.7–1.5 cm. broad, at apex obtuse or acute, obliquely cuneate at base, terminal leaflets sessile or long-petiolulate, lanceolate.

This variety, which occurs (fig. 7) in southeastern United States and in parts of the West Indies, differs from the species by having more and smaller leaflets, which are usually more revolute. In some specimens the leaflets are mostly obtuse and in others mostly acute.

UNITED STATES:

NEW YORK: Cush's Pond, Long Island, Sept. 23, 1876, *Schrenk* (M).

VIRGINIA: vicinity of Williamsburg, Aug. 27, 1912, *Sargent, Thayer & Smith* (M).

SOUTH CAROLINA: hills north of Vaucluse, Aug. 6, 1898, *Eggert* (M); Whitner Park, Anderson, Sept. 9, 1919, *Davis* (M).

GEORGIA: vicinity of Thomson, Aug. 18, 1907, *Bartlett 1153* (Deam); Darien, May 24, 1909, *Smith 2102* (F).

FLORIDA: Corkscrew River, Sept. 1878, *Garber* (F); Lake City, Aug. 29–31, 1895, *Nash 2497* (F, M, ND); Lake City, June 28, 1893, *Quaintance* (M); Lake City, Sept. 14, 1894, *Rolfs 544*, and Aug. 6, 1895, *654* (F, M); Coral Gables, Feb. 13, 1933, *Demaree 10238* (M); Miami, March 1903, *Hitchcock* (F); near Jacksonville, Aug. 21 and Sept. 24, 1894, *Curtiss 5129* (M); Apalachicola, *ex Chapman Herb.* (M); Jefferson Co., June–July 1898, *Hitchcock* (F); near Eustis, Aug. 16–25, 1894, *Nash 1659* (F, M, ND); Marco, July–Aug. 1900, *Hitchcock* (F); Fort Myers, July–Aug. 1900, *Hitchcock 38* (F, M); Bocagrande, Nov. 1913, *von Schrenk* (M); Cedar Keys, *Palmer (95) 1160* (M); near Manatee, Aug. 20 and Sept. 9, 1898, *Simpson 51* (F); Orange Springs, Dec. 29, 1906, *Mill* (M); Long Key, May 6, 1908, *Bessey 117* (M); near Pine Crest, Jan. 6, 1930, *Moldenke 367* (M).

ALABAMA: Macons Mills, Aug. 20, *Baker* (M); Auburn, Aug. 11, 1897, *Earle & Baker* (M).

MISSISSIPPI: Biloxi, Aug. 1, 1896, *Pollard 1142* (F, M, ND); Cat Island, Aug. 26, 1900, *Tracy & Lloyd 274* (F, M); Ocean Springs, Aug. 7, 1895, *Skehan* (M).

WEST INDIES:

CUBA: 1860–1864, *Wright 2290* (M); PINAR DEL RIO: San Diego de los Baños, Aug. 31–Sept. 3, 1910, *Britton, Earle & Gager 6762* (US); mountains north of San Diego de los Baños, April 16, 1900, *Palmer & Riley 555* (US); Arroyo del Sumidero, Aug. 7–9, 1912, *Shafer & Leon 13671* (US).

2. **Rhus lanceolata** Gray ex Engler in DC., Monogr. Phaner. **4**: 384. 1883, in syn.; Britton, N. Am. Trees, p. 606. 1908.

Rhus Copallina var. *lanceolata* Gray, Bost. Jour. Nat. Hist. [Plant. Lindh. II] **6**: 158. 1850.

R. copallina var. *angustifolia* Engler in DC., Monogr. Phaner. **4**: 384. 1883.

R. copallina var. *angustifolia* forma *integrifolia* Engler in DC., *ibid.*, excl. specim. *Rugel 77a.*

R. copallina var. *angustifolia* forma *serrata* Engler in DC., *ibid.*

Schmaltzia lanceolata Small, Fl. Southeast. U. S., pp. 728, 1334. 1903.

A small tree about 10 m. tall with slender branches; older branches with numerous lenticels on the brown bark, the newer ones villous, soon glabrate, buds whitish, tomentose; leaves compound; leaflets 13–19, linear-lanceolate, falcate with the abaxial side wider than the adaxial, thin, subrevolute, entire or subserrate-margined, green and shining above, lighter and dull, pilose and somewhat glandular-hairy below, lateral leaflets sessile, 3–5.5 cm. long, 0.7–1.2 cm. broad, near the apex long-acuminate or only acuminate, base unequal, cuneate, terminal leaflets sessile or long-petiolulate, 3–4 cm. long, 0.5–0.7 cm. broad, long-acuminate, base cuneate or rarely narrowly rounded; terminal petiolule 0–0.7 cm. long, winged rachis segments about 1.3–1.7 cm. long, winged although the lower often obscurely so, petioles 2.5–3.5 cm. long; inflorescence a large terminal thyrsus about 10 cm. long, 7 cm. broad, bracts ovate, 1.3 mm. long, 1.1 mm. broad, round at the apex, pilose on the outer surface and glabrous on the inner surface, ciliate with simple hairs, deciduous; flowers many, each subtended by a single bract, pedicels 1.5 mm. long; sepals deltoid, subacute, 1.2 mm. long, 0.9 mm. broad, pilose on outer surface and glabrous on the inner surface, ciliate with simple and glandular hairs, persistent; petals whitish in the dried state, about 3 mm. long, 1 mm. broad, glabrous on the outer surface and with a few hairs on the inner surface, ciliate with simple and glandular hairs, deciduous; filaments very long, anthers lanceolate, 2 mm. long, 1 mm. broad; stigmas 3, styles 3; fruit 3.5 mm. long, 4 mm. broad, somewhat flattened, red; seed 3 mm. long, 2 mm. broad, smooth, slightly larger at one end.

Rhus lanceolata occurs along water-courses from Oklahoma to Mexico (fig. 7). Its leaflets are typically falcate and linear-lanceolate. In the Mexican portion of the range they tend to be less falcate and slightly broader.

Distribution: in the United States, Oklahoma and Texas, to Puebla, Mexico.

UNITED STATES:

OKLAHOMA: near Turner Falls State Park, Arbuckle Mts., July 29, 1933, *Palmer 42024* (M).

TEXAS: *Reverchon 153* (M); Edwards Plateau, near San Antonio, *Mackensen 33* (F); near Brownwood, Nov. 1, 1924, *Palmer 26811*, and Nov. 1, 1925, *29516* (M); Baird, Sept. 30, 1918, *Palmer 14543* (M); New Braunfels, July, 1846, *Lindheimer 244*, and *344 (243)*, and Aug. 1846, *345 (243)* (M); Comanche Spring, New Braunfels, July 1850, *Lindheimer 728* (F, M); near Frijole, alt. 5520 ft., Aug. 10, 1930, *Grassl 174* (F); Dallas, Sept. 26, 1900, *Bush 1116* (M); Dallas, June 15, 1898, *ex Glatfelter Herb.* (M); Dallas, Aug. 1881 or July 26, 1882, *Letterman*, and Aug. 1882 (M); Dallas, Aug. and Sept., *Reverchon (Curtiss 444)* (F, M), July 1883, and July and Sept. 1886, *152* (F); Hutchins, Aug. 10, 1900, *ex Reverchon Herb.* (M); Dallas, Aug. 10, 1900, *Reverchon*, and Aug. 10 and 22, 1900, *1932*, and Aug. 22, 1900, and Sept. 26, 1900, *1932B* (M); Gillespie Co., *ex Jermy Herb. 699* (M); Granbury, Sept. 15, 1914, *Palmer 6526* (F, M); upper Limpia Canyon, Davis Mts., June 11, 1926, *Palmer 30882* (M); Davis Mts., Oct. 9, 1926, *Palmer 32140* (M); Nolan Co., Aug. 4, 1934, *Barkley 1075* (M); 20 miles south of Sweetwater, Aug. 5, 1934, *Goodman 2252* (M); Sweetwater, May 29, 1918, *Palmer 13802* (M); Strawn, June 26, 1918, *Palmer 14244* (M); Lake Worth, Sept. 4, 1920, *Ruth*, and *778* (F); Austin, Aug. 19, 1886, *Letterman* (M); Austin, Sept. 22, 1916, *Palmer 10769* (M); Austin, Aug. 10, 1925, *Schulz 2350* (F).

MEXICO:

COAHUILA: Del Carmen Mts., Aug. 9, 1936, *Marsh 636* (F); Rancho Agua Dulce, Municipio de Musquiz, July 2, 1936, *Wynd & Mueller 416* (M).

PUEBLA: Pahuatlan, July 12, 1913, *Salazar* (US).

TAMAULIPAS: near crest of range above Mesa de Tierra, Sierra de San Carlos, vicinity of San José, July 12, 1930, *Bartlett 10269* (F, US); Cerro Barril, near San José, Sierra de San Carlos, alt. 4600 ft., July 19, 1930, *Bartlett 10491* (US).

3. **Rhus Michauxii** Sargent, Gard. & For. **8**: 404. 1895.

Rhus pumilum Michx., Fl. Bor.-Am. **1**: 182. 1803, non Meerb., Pl. Sel. Ic., *pl. 14.* 1798.

Schmaltzia Michauxii Small, Fl. Southeast. U. S., pp. 729, 1334. 1903.

Toxicodendron pumilum Kuntze, Rev. Gen. Pl., pt. 1, p. 154. 1891, non Greene, Leafl. Bot. Obs. & Crit. **1**: 124. 1905.

A low shrub with stout twigs; branches puberulent and hirsute, the older almost glabrate, sparsely lenticellate, buds tan, lanuginose; leaves compound; leaflets 9–21, usually about 13, ovate to lanceolate-elliptic, thin, subrevolute, margin dentate or serrate-dentate, green and sparsely pilose above, somewhat lighter and densely ferruginous-pilose below, lateral leaflets sessile, 4–9 cm. long, 2–4.5 cm. broad, apex acute to subacuminate, base subcordate, terminal leaflets 5–9 cm. long, 2–5.5 cm. broad, apex subacute to subacuminate, base subcordate; petiolules usually winged, pilose, terminal 1–2.5 cm. long, rachis segments about 3 cm. long, petioles about 8 cm. long, stout, pilose; inflorescence a large terminal thyrsus about 12 cm. long, 8 cm. broad, bracts deltoid-lanceolate, 1 mm. long, 0.4 mm.

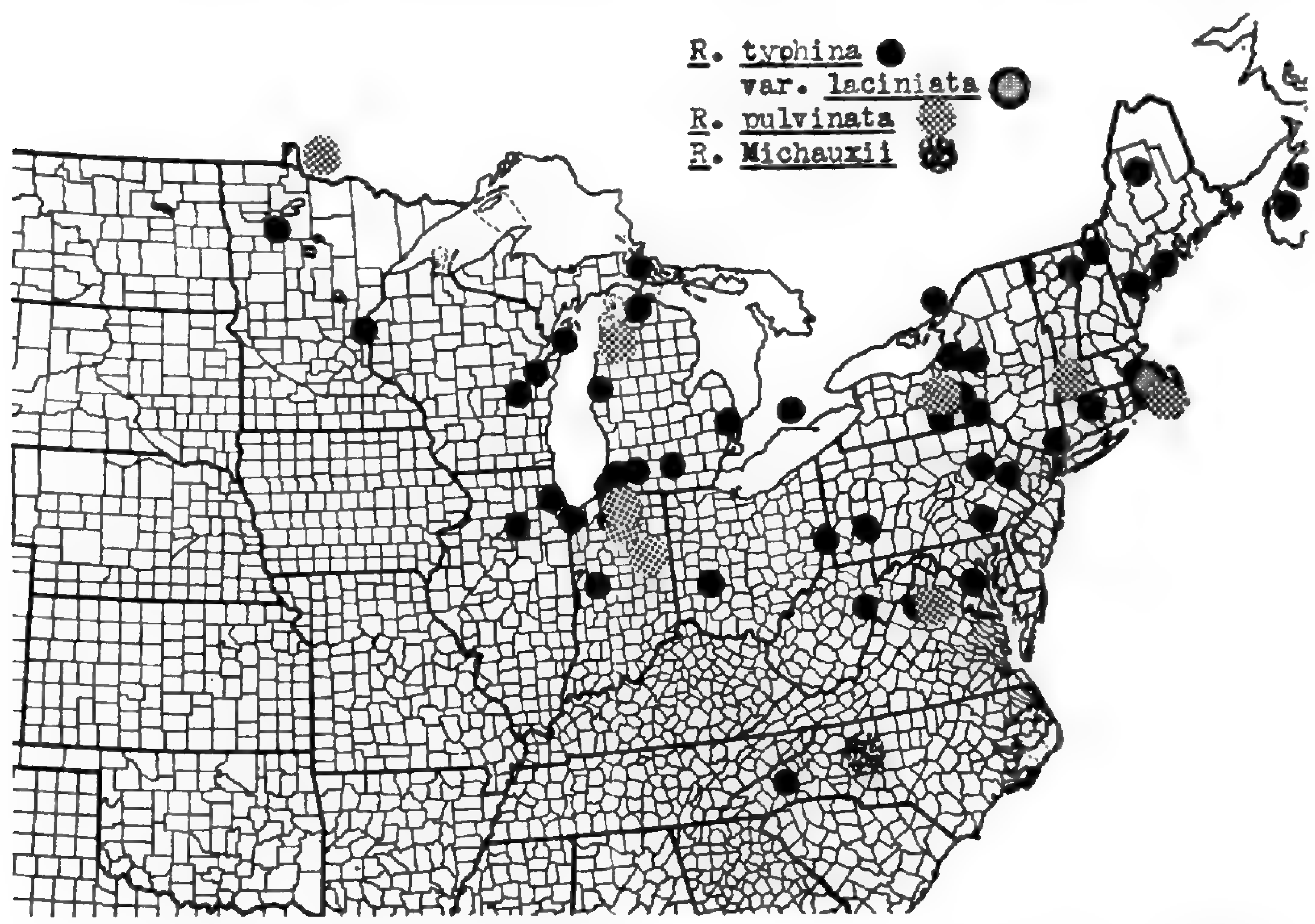

Fig. 8. The geographic distribution of *Rhus typhina* Torn., *R. typhina* var. *laciniata* Wood, *R. pulvinata* Greene, and *R. Michauxii* Sarg.

broad, pointed at the apex, pilose on the outer surface and glabrous on the inner, ciliate with simple hairs, deciduous; flowers many, polygamo-dioecious, pedicels 1 mm. long; sepals lanceolate, 1.5 mm. long, 0.7 mm. broad, sparsely pilose and somewhat glandular pubescent without, glabrous on the inner surface, not ciliate, persistent; petals yellowish-white in the dried state, elliptical but with an acuminate "hooded" apex, about 2 mm. long, 0.9 mm. broad, sparsely pilose with a few glandular hairs on the outer surface, glabrous on the inner surface, not ciliate, deciduous; filaments alate, longer than the sepals, anthers oblong, 1 mm. long, 0.7 broad; stigmas 3, styles 3, disk 1 mm. broad, very thin, and scarcely lobed; fruit 3.5 mm. long, 4 mm. broad, somewhat flattened, red, covered with dense layer of red hairs; seed 2 mm. long, 1.5 mm. broad, smooth in outline.

Rhus Michauxii is a very distinct species whose closest affinities seem to be with *R. javanica* L. and *R. Coriaria* L. of Asia and Europe. It is a very low, but stout, shrub, puberulent throughout, with the rachi winged near the apex of the leaves. It is endemic to a small area in North Carolina (fig. 8).

UNITED STATES:

NORTH CAROLINA: middle North Carolina, *Ashe* (M); on dry hill, Davie Co., July 7, 1895, *Ashe 239* (M); Farmington, Aug. 27, 1895, *ex Biltmore Herb.* (F, M), July 1 and Aug. 27, 1896, *872* (F); open woods, abandoned fields, roadsides, etc., Farmington, July 2 and Aug. 31, 1897, *ex Biltmore Herb. 872b* (M).

4. **Rhus typhina** Torner, Cent. Pl. II, p. 14. 1756; Torner in L., Amoen. Acad. **4**: 311. 1760; L., Sp. Pl., ed. 2. p. 38. 1762.

Rhus typhina var. *arborescens* Willd., Enum. Pl. Hort. Berol., pt. 1, p. 323. 1809.

R. typhina var. *frutescens* Willd., *ibid.*

R. typhina var. *viridiflora* Engler in DC., Monogr. Phaner. **4**: 378. 1883.

R. typhium Crantz, Inst. Herb. **2**: 275. 1766.

R. Carolinianum Miller, Gard. Dict., ed. 8. 1768.

R. viridiflora Duhamel, Arb., ed. nov., **2**: 163. 1804; Poir., Encyc. Meth. [Dict.] **7**: 504. 1806.

R. vididiflora var. *canadense* Poir., *ibid.*

R. canadensis Hort. ex Engler in DC., Monogr. Phaner. **4**: 377. 1883, non Miller, Gard. Dict., ed. 8. 1768, nec Marsh., Arbust. Am., p. 129. 1785.

R. gracilis Hort., ex Engler in DC., *ibid.*

R. hirta Sudw., Bull. Torr. Bot. Club **19**: 81. 1892, non Harv., ex Engler in DC., Monogr. Phaner. **4**: 425. 1883.

R. hirta var. *typhina* Farwell, Rept. Mich. Acad. Sci. **15**: 180. 1913.

R. frutescens Hort. ex Handlist Trees Kew, pt. 1, p. 103. 1894.

R. hirta L. ex Small, Fl. Southeast. U. S., p. 1334. 1903.

Datisca hirta L., Sp. Pl. **2**: 1037. 1753.

Schmaltzia hirta Small, Fl. Southeast. U. S., pp. 729, 1334. 1903.

Toxicodendron typhinum Kuntze, Rev. Gen. Pl., pt. 1, p. 154. 1891.

A small tree with stout branches; branches villous, buds tan, lanuginose; leaves compound; leaflets 9–27, lanceolate to lanceolate-elliptic, thin, subrevolute, margin serrate, green and almost shining above, lighter and more or less glaucous below, lateral leaflets sessile, 6–13 cm. long, 1.2–3.5 cm. broad, apex acuminate, base blunt, slightly unequal, terminal leaflets long-petiolulate, 3.5–9 cm. long, 1–4.5 cm. broad, apex acuminate or subacuminate, base subcordate; terminal petiolule about 1.5 cm. long, rachis segments about 0.7–1.5 cm. long, hirsute, petioles 6–10 cm. long, villous, stout; inflorescence a terminal thyrsus about 8 cm. long, 4 cm. broad, bracts linear-lanceolate, 1.5 mm. long, 0.5 mm. broad, pointed at the apex, villous on the outer surface and with long simple hairs on the inner surface, ciliate with simple hairs, deciduous; flowers many, each flower subtended by a single bract, pedicels 1.2 mm. long; sepals deltoid, 1.5 mm. long, 0.5 mm. broad, pilose on the outer surface, glabrous on the inner, ciliate with simple hairs, persistent; petals whitish in the dried state, oblanceolate, "hooded" at the apex, about 3.5 mm. long, 1.5 mm. broad, pilose, not ciliate, deciduous; filaments much longer than the sepals, anthers rectangular, 1.5 mm. long, 0.8 mm. broad; stigmas 3, styles 3; fruit 4 mm. long and 4.5 mm. broad, somewhat flattened, red, covered with a dense layer of long red hairs; seed 2.7 mm. long, 2 mm. broad, smooth, only slightly larger at one end.

This species of northeastern North America has much the same series of variations that are found in *Rhus glabra* L. It is most easily distinguished from *Rhus glabra* by the long and dense pilosity of the stems and petioles, and the very long deeply colored red hairs on the fruit-coat. Like *Rhus glabra* it has a bipinnate variety (see below).

Distribution: Nova Scotia to North Carolina, west to Minnesota and Iowa (fig. 8).

CANADA:

NOVA SCOTIA: Mossman's near Bridgewater, Aug. 3, 1910, *Greene* (ND); woods above Eller's house, Aug. 14, 1910, *Greene* (ND); near Hartville, Aug. 15, 1910, *Greene* (ND); La Have River, Aug. 3, 1910, *Macoun 81288* (F).

ONTARIO: Kingston Mills, July 2, 1894, *Ford* (F); Port Stanley, Aug. 26, 1910, *Greene* (ND).

UNITED STATES:

MAINE: Otisfield, July 1849, *Blake* (F); North Deering, July 29, 1910, *Greene* (ND); Bristol, Aug. 3, 1898, *Chamberlain* (ND); Monhegan Island, Aug. 10, 1921, *Churchill* (M); valley of the Piscataquis River, June 27, and Aug. 7, 1895, *Fernald 242* (in part) (ND).

NEW HAMPSHIRE: Shelburne, July 1884, *Lamb* (F).

VERMONT: Peacham, Aug. 6, 1885, *Blanchard*, and July 20, 1892 (F).

MASSACHUSETTS: West Quincy, April 20, 1896, *Churchill* (M); Quincy, Oct. 26, 1901, *Murdoch 1056* (F); Plymouth, Aug. 1922, *Dunhan* (F); Dorchester, July 16, 1882, *Churchill*, Aug. 10, 1885, and June 28, 1896 (M).

CONNECTICUT: Southington, June 25, 1897, *Bissell 40*, and July 16, 1897, *467* (M).

NEW YORK: Binghamton, *Millspaugh* (F); Chemung Co., July 7, 1895 and June 11, 1896, *Lucy (Heller 7785)* (F); Utica, July 8, 1874, *Hunt* (F); Fulton, July 12, 1888, *Rowlee* (M); Oswego, July and Sept., *Wibbe* (ND); between Ringwood and Ellis Hollow, July 18, 1917, *Gershoy 8419* (M); vicinity of Oscawana Lake, Aug. 21, 1931, *Wilson* (NY).

PENNSYLVANIA: Smithville Swamp, June 17, 1887, *Small* (F); Beach Haven, June 23, 1889, *Heller* (F); Mount Alton, 1909, *Illick* (M); Bethlehem, *Kreut 186* (F); Westmoreland Co., June 23, 1876, *Pierron* (F).

MARYLAND: High Island, July 21, 1905, *Greene* (ND); canal near High Island, July 21, 1905, *Greene* (ND).

DISTRICT OF COLUMBIA: near Georgetown, July 3, 1906, *Greene*, and July 16, 1914, and July 20, 1914 (ND); Potomac valley above Chain Bride, Oct. 9, 1910, *Greene* (ND); Brookland, Sept. 3, 1911, *Nieuwland 9171a*, and *9171b* (ND).

VIRGINIA: Stony Man Mountain and vicinity, near Luray, alt. 3600 ft., Aug. 25, 1901, *Steele 5* (M).

NORTH CAROLINA: in cultivation at Biltmore, Sept. 1896, *ex Biltmore Herb. 870*, and Aug. 30, 1897, *870a* (M).

WEST VIRGINIA: Wheeling, June and July, 1878, *Guttenberg 442* (F); Pickens, June 24, 1908, *Smith 1376* (F).

MICHIGAN: Bankson Lake, southern Michigan, July 15, 1909, *Nieuwland* (M), and Aug. 8, 1915 (ND); Harbert, Sept. 3, 1914, *Johnson 1098* (F); Douglas Lake, July 12, 1919, *Deam 28718* (Deam); Dune Mound, French Lake, July 7, 1930, *Hermann 2216* (F); Schoolcraft, June 3, 1903, *Burgess 24* (F); Mackinac Island, July 28–29, *Millspaugh 141* (F); Mason Co., July 15, 1910, *Chaney 152* (F); lakes at Lawton, 1909, *Nieuwland 2337*, and *9466* (ND); Lawton, 1910, *Nieuwland 9497* (ND).

INDIANA: Clarke, June 4, 1900, *Lansing 894* (F); Pine, Aug. 4, 1896, *Umbach* (F); Clarke, June 30, 1897, *Umbach* (F); near Syracuse, June 18, 1929, *Deam 46970* (Deam); East Chicago, June 19, 1900, *Bebb 326* (F); Culver, east of Lake Maxinkuckee, Aug. 18, 1906, *Clark*, and Sept. 18, 1906 (ND); Lake Maxinkuckee, Sept. 1906, *Clark* (ND); Sugar Creek just east of Deer's Mill, July 19, 1915, *Deam 17576* (Deam); Notre Dame, 1907, *Nieuwland 93* (ND); 4 miles south of Granger, on Big Four Railroad, June 23, 1909, *Nieuwland 41* (ND); St. Mary's, July 7, 1909, *Nieuwland 93* (ND); ice-house at Notre Dame University, Sept. 24, 1909, *Nieuwland 375* (ND); South Bend, Aug. 6, 1913, *Nieuwland 11635* (ND); Mishawaka, July 1891, *E. B. U.* (F); Clear Lake, July 4, 1904, *Deam* (M).

WISCONSIN: Brown Co., June 20, 1886, *Schuette* (F); Door Co., June 29, 1919, *Millspaugh 4322* (F); Madison, June 5, 1925, *Palmer 27598* (M); Neenah, June 16, 1890, *Schuette* (F).

ILLINOIS: near Lincoln Park, Chicago, July 3, 1877, *Bross* (F); near Ravenswood, 1887, *Lloyd* (F); East Dubuque, June 12, 1925, *Palmer 27863* (M); Starved Rock, Sept. 7 and 8, 1914, *Lansing 3885* (F); La Salle Co., Sept. 1921, *Thone 302* (F).

MINNESOTA: Chidagule, June 1891, *Sandberg* (ND); Chisago City, June 1890, *Sandberg* (M); Schoolcraft Island, July 30, 1929, *Grant 2977* (M).

OHIO: John Bryan State Park, Yellow Springs, Sept. 10, 1935, *Demaree 11670* (M).

IOWA: McGregor, Aug. 15, 1925, *Pammel 585*, and Aug. 18, 1925, *1195* (M); northwest of Luxemburg, June 10, 1933, *Shimek* (M); Armstrong, Sept. 7, 1882, *Cratty* (M).

4a. Rhus typhina Torner var. **laciniata** Wood, Class-book Bot., ed. 2. p. 284. 1877; Hort. (Manning) ex Rehder, Deutsch Gärt.-Zeit. **15**: 211. 1900; Hort. ex Cowell in Bailey, Cycl. Am. Hort. **4**: 1530. 1902.

Rhus typhina forma *dissecta* Rehder, Rhodora **9**: 115. 1907.

R. typhina var. *filicina* Sprenger, Mitt. Deutsch Dendr. Ges. for 1907, p. 67. 1907.

R. typhina var. *filicifolia* Sprenger ex Demcker, *ibid.*, for 1909, p. 325. 1909.

R. filicifolia Demcker, *ibid.*

R. hirta var. *laciniata* Schneid., Illustr. Handb. Laubholzk. **2**: 154. 1907, excl. syn. *Rhus viridiflora* Poir.

R. hirta var. *dissecta* Nash, Addisonia **1**: 73. 1916.

A stout-branched, densely pubescent shrub; leaves bipinnately compound, pinnae 19–29, each with 1–7 leaflets, lateral leaflets laciniate, 3–5 cm. long, 0.2–0.5 cm. broad, undulate to laciniate, the terminal large, deltoid, laciniate; petiole and rachis very stout.

UNITED STATES:

MASSACHUSETTS: Plymouth, Aug. 1922, *Dunham* (F).

INDIANA: cultivated, Notre Dame, Sept. 5, 1912, *Nieuwland 10380* (M); cultivated, St. Mary's, Notre Dame, Oct. 9, 1912, *Nieuwland 10348*, and *1920* (ND).

MISSOURI: cultivated, Missouri Botanical Garden, Aug. 27, 1904 (M); cultivated, St. Louis, July 29, 1910, *Sherff* (F); west of Skinker Road, near Forest Park, St. Louis Co., July 5, 1913, *Drushel* (M).

5. Rhus pulvinata Greene in Fedde, Rep. Spec. Nov. **5**: 45. 1908.

Rhus americana Hort. ex Dippel, Handb. Laubholzk. **2**: 367. 1892, non Sudw., Bull. Torr. Bot. Club **19**: 80. 1892.

R. glabra × *typhina* Koehne, Deutsche Dendrol., p. 359. 1893.

R. gymnoclada Greene in Fedde, Rep. Spec. Nov. **5**: 45. 1908.

R. hybrida Rehder, Mitt. Deutsch. Dendrol. Ges. for 1913, p. 256. 1913.

A stout-branched shrub or small tree; branches puberulent, peduncle and branches of the inflorescence hirsute; leaves compound; leaflets 15–21, lanceolate, thin, subrevolute, margin serrate-dentate, green above, somewhat lighter and glaucous below, lateral leaflets sessile, 5–10 cm. long, 1.5–2.5 cm. broad, apex acuminate to subacuminate, base obtuse, terminal leaflets about 7 cm. long, 2.5 cm. broad, acuminate at apex, obtuse at base; terminal petiolule 0.2–1 cm. long, rachis segments about 2.5 cm. long, petioles 6–10 cm. long; inflorescence a terminal thyrsus about 10 cm. long, 5 cm. broad; fruit 3.5 mm. long, 3 mm. broad, somewhat flattened, red, covered with a dense layer of long red hairs; seed 2.5 mm. long, 2.2 mm. broad, smooth, slightly larger at one end.

In many respects this plant is intermediate between *Rhus glabra* and *R. typhina,* having glabrous leaves, puberulent petioles, puberulent to glabrate stems, and red, long-pilose fruit. However, until its hybrid origin is demonstrated, it seems best to treat it as a species.

Distribution: Massachusetts to Virginia, west to Ontario and Indiana (fig. 8).

CANADA:

ONTARIO: Strathroy, Aug. 21, 1910, *Greene,* Aug. 22, 1910, and June 12, 1913 (ND).

UNITED STATES:

MASSACHUSETTS: Sheffield, Aug. 2, 1920, *Churchill* (M); Uncatena Island, Aug. 10, 1927, *Fogg* (M).

NEW YORK: Mount Olivet Cemetery, Ithaca, Nov. 5, 1922, *Muenscher 14821* (M).

VIRGINIA: Stony Man Mountain in the Blue Ridge, near Luray, 1901, *Steele,* and Sept. 2, 1901 (US **type**, M photo.).

MICHIGAN: Sleeping Bear Dune, July 27, 1929, *Gates 15866* (F, US).

INDIANA: near Rochester, Aug. 2, 1923, *Deam 39245* (Deam); road to Red Mill, Aug. 6, 1909, *Nieuwland 2426* (ND); south of South Bend, 1910, *Nieuwland 9467* (ND); Studebaker's woods, South Bend, Sept. 16, 1911, *Nieuwland 1819*, and Sept. 25, 1913, *11638* (ND); Lake Maxinkuckee, Sept. 15, 1906, *Clark* (ND type of *R. gymnoclada*, M photo.).

6. **Rhus glabra** L., Sp. Pl. **1**: 265. 1753.

Rhus glabrum var. *canadense* Marsh., Arbust. Am., p. 129. 1785.
R. glabrum var. *carolinense* Marsh., *ibid.*
R. glabra var. *coccinea* DC., Prodr. **2**: 67. 1825.
R. glabra var. *dioica* DC., *ibid.*
R. glabra var. *hermaphrodita* DC., *ibid.*
R. glabra var. *occidentalis* Torr., Bot. Wilkes' Exped., p. 257. 1862–1874.
R. glabra var. *elegans* Engler in DC., Monogr. Phaner. **4**: 377. 1883.
R. glabra var. *cismontana* Cockerell in Daniels, Fl. Boulder, Colo., p. 167. 1911.
R. Canadense Miller, Gard. Dict., ed. 8. 1768; Poir., Encyc. Meth. **7**: 504. 1806.
R. elegans Ait., Hort. Kew. **1**: 366. 1789.
R. elegans var. *glauca* Demcker, Mitt. Deutsch. Dendr. Ges. for 1909, p. 325, 327. 1909.
R. elegans var. *superba* Demcker, *ibid.*
R. hypselodendrum Moench, Meth., p. 73. 1794.
R. laevicaulis Torr. ex Gray, Mem. Am. Acad. **4**: 28. 1849.
R. sanguinea Hort. ex Lavallée, Arb. Segrez., p. 53. 1877, nomen., ex Dippel, Handb. Laubholzk. **2**: 367. 1892.
R. viridiflora Hort. ex Engler in DC., Monogr. Phaner. **4**: 376. 1883, non Poir.
R. coccinea Hort. ex Dippel, Handb. Laubholzk. **2**: 367. 1892.
R. carolinense Marsh. ex Hook. & Jacks., Ind. Kew. **2**: 713. 1895.
R. macrothyrsa Goodding, Bot. Gaz. **37**: 56. 1904.
R. occidentalis Blankinship, Mont. Agr. Coll. Sci. Stud. **1**: 86. 1905; Greene, Proc. Wash. Acad. Sci. **8**: 193. 1906.
R. albida Greene, *ibid.* 194.

R. aprica Greene, *ibid.* 193.
R. arbuscula Greene, *ibid.* 184.
R. arguta Greene, *ibid.* 192.
R. asplenifolia Greene, *ibid.* 196.
R. atrovirens Greene, *ibid.* 182.
R. auriculata Greene, *ibid.* 178.
R. cismontana Greene, *ibid.* 189.
R. elegantula Greene, *ibid.* 195.
R. ithacensis Greene, *ibid.* 178.
R. longula Greene, *ibid.* 186.
R. ludoviciana Greene, *ibid.* 183.
R. media Greene, *ibid.* 188.
R. nitens Greene, *ibid.* 190.
R. oreophila Greene, *ibid.* 177.
R. petiolata Greene, *ibid.* 185.
R. pulchella Greene, *ibid.* 182.
R. pyramidata Greene, *ibid.* 180.
R. sambucina Greene, *ibid.* 190.
R. sorbifolia Greene, *ibid.* 195.
R. tessellata Greene, *ibid.* 191.
R. valida Greene, *ibid.* 185.
R. calophylla Greene in Fedde, Rep. Spec. Nov. **5**: 45. 1908.
R. angustiarum Lunell, Am. Midl. Nat. **3**: 144. 1913.
R. Hapemanii Lunell, *ibid.* 147.
Schmaltzia glabra Small, Fl. Southeast. U. S., pp. 729, 1334. 1903.
Toxicodendron glabrum Kuntze, Rev. Gen. Pl., pt. 1, p. 154. 1891.

A large shrub with stout branches; branches glabrous except those of the inflorescence sparsely to densely puberulent, older stems with scattered lenticels, often glaucous; leaflets 11–31, lanceolate to elliptic-lanceolate, thin, subrevolute and serrate or rarely subentire-margined, from deep to light green and smooth above, somewhat lighter beneath, often glaucous above and below, lateral leaflets subsessile, 6–12 cm. long, 1.5–3 cm. broad, apex acuminate, base unequal and subcordate to subcuneate, terminal leaflets long-petiolulate or sessile, 5–9.5 cm. long, about 1.5–3.5 cm. broad, apex acuminate, base rounded unless leaflet sessile, then cuneate; terminal petiolule 0–2 cm. long, rachis segments about 3 cm. long, petiolules about 1 mm. long, petioles 8–11 cm. long, thick; inflorescence a large terminal thyrsus about 14 cm. long, 7 cm. broad, bracts linear-lanceolate, 1 mm. long, 0.4 mm. broad, pointed at the apex, pubescent or glabrous on the outer surface and glabrous within, ciliate with simple hairs, deciduous; flowers many, petiolulate, each flower subtended by a single bract; sepals lanceolate, 2 mm. long, 1 mm. broad, pilose on both surfaces, very sparsely so on the outer surface, more or less ciliate with simple hairs, persistent; petals whitish in the dried state, lanceolate and curved inward at the tip, about 0.5 mm. long in the staminate flower, shorter in the pistillate flower, 1 mm. broad, short-pilose on the outer surface and long-pilose on the inner, deciduous; filaments the same length as the sepals, anthers lanceolate, 1.5 mm. long, 0.8 mm. broad in the staminate flowers; stigmas 3, styles 3; fruit 4 mm. long, about as broad, somewhat flattened, red, covered with a dense layer of short red hairs; seed 2.5–3 mm. long, 2–2.5 mm. broad, smooth, slightly larger at one end.

This widespread species is one in which much variation occurs. The color of the leaves varies from a pale to a deep green, and the glaucescence may be nearly white to almost unnoticeable. The degree of revoluteness and serration also varies considerably. The difference in leaflet number on leaves of a single plant is often as much as fourteen. From field observation and greenhouse and herbarium studies of such variations, it would seem that these variations are individual and due to ecological conditions rather than to varietal or specific segregations. However, two rather marked variations do occur (see below). In one case the variety is a stout shrub bearing bipinnate leaflets, and in the other case it is a rather slender-stemmed, small-leaved shrub, with sparse-pilose branches and with the red hairs of the fruit-coat quite different from those of the species (see pl. 13, fig. d).

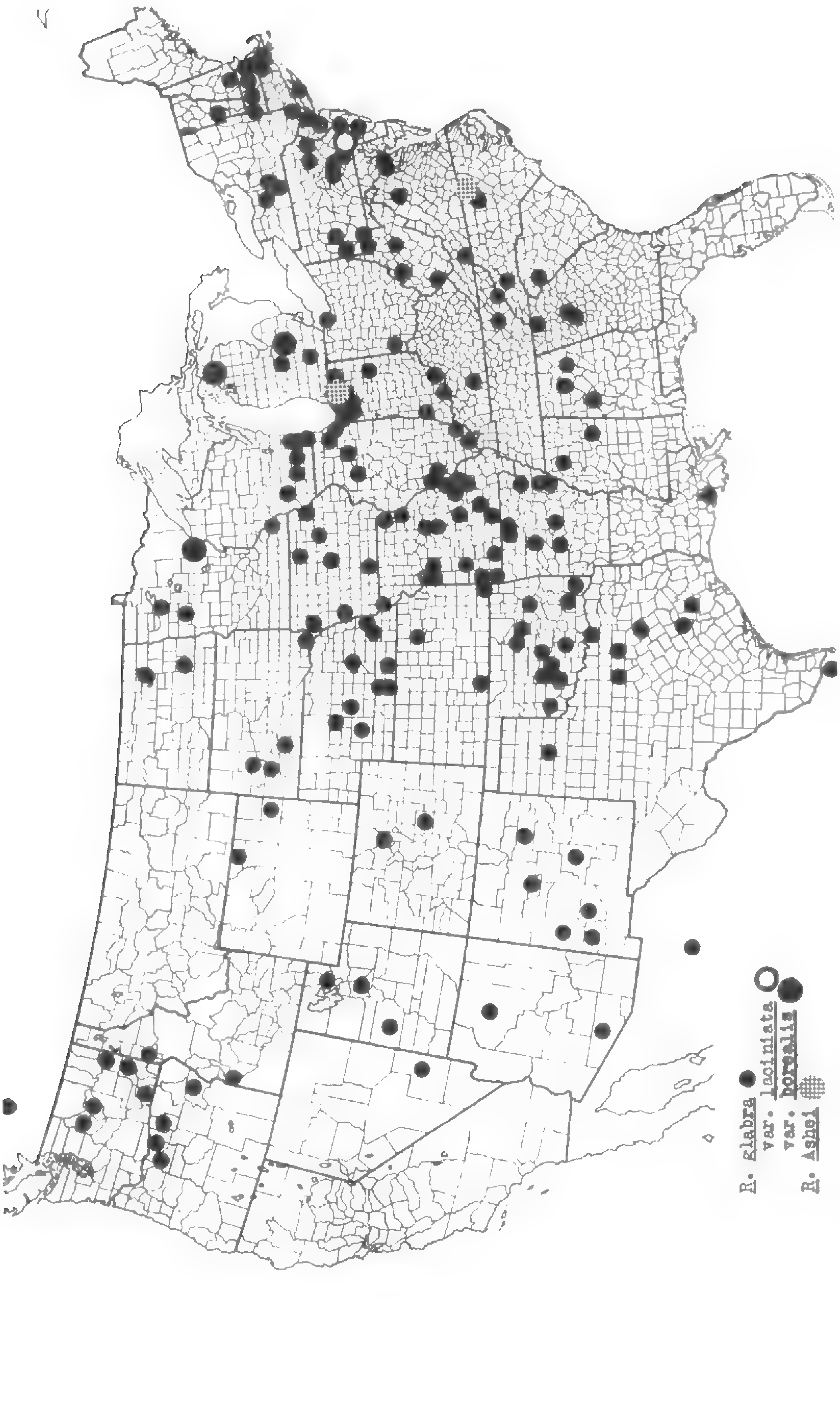

Fig. 9. The geographic distribution of *Rhus glabra* L., *R. glabra* var. *laciniata* Car., *R. glabra* var. *borealis* Britt., and *R. Ashei* (Small) Greene.

Distribution: New Hampshire to Georgia west to British Columbia, eastern Washington, Oregon, and Nevada, to Tamaulipas and Chihuahua (fig. 9).

CANADA:

British Columbia: Ashcroft, June 28, 1907, *Cowles 216* (F, M).

UNITED STATES:

New Hampshire: Hillsboro, July 28, 1920, *Batchelder* (M).

Vermont: Brandon, alt. 475 ft., Sept. 9, 1922, *Dutton* (M).

Massachusetts: Barnum Street, Sheffield, July 26, 1920, *Churchill* (M); Nonquitt, Aug. 23, 1888, *Sturtevant* (M); near Water Shop Pond, Springfield, Aug. 5, 1924, *Seymour 489* (M); Southampton, *ex Chapman Herb.* (M); upper Moody Road, Dracut, July 20, 1927, *Beattie* (Okla), July 26, 1929 (M); East Framingham, Aug. 4, 1890, *Sturtevant* (M); Milton, July 29, 1888, *ex Churchill Herb.* (M); Harland Street, Milton, July 17, 1898, *Churchill* (M); Dorchester, July 30, 1882, *Churchill,* and Sept. 21, 1884 (M); Petersham, July 13, 1908, *Jack* (M).

Rhode Island: Cumberland, Sept. 13, 1903, *Greenman 1822* (M).

New York: Jerome Park, New York, Oct. 11, 1930, *Wilson* (NY); Chemung Co., July 8, 1896, *Lucy 7784* (F); Cold Spring Harbor, Aug. 24, 1903, *Whitford 62* (F); near Cornell University boathouse, Ithaca, July 7, 1913, *Palmer & Wiegand 765* (M); Ithaca, July 22, 1878, *Trelease* (M); Fall Creek, Ithaca, July 17 and Sept. 1893, *Wiegand* (US type of *R. ithacensis);* near Lake Waccabuc, Aug. 12, 1894, *Pollard* (US type of *R. pyramidata);* Yonkers, Nov. 2, 1930, *Wilson* (NY); Penn Yan, *Sartwell* (M).

New Jersey: Alpine, Oct. 8, 1932, *Wilson & Alexander* (NY); .75 mile northwest of Shiloh, July 24, 1927, *Adams 851* (M); Watchung, July 5, 1930, *Moldenke 1321* (M), July 27, 1931, *6058* (NY).

Pennsylvania: 1907, *Jennings* (ND); Pittsburgh, Aug. 2, 1907, *Jennings* (ND); Kittanning, Aug. 16, 1906, *Jennings* (ND); mountains north of Harrisburg, July 12, 1888, *Small* (M); Ohiopyle, alt. 2000 ft., Sept. 2, 1907, *Jennings* (ND); Deep Valley, Aug. 9, 1907, *Jennings* (ND); Mountville, Aug. 1895, *Eby* (M); near Georgetown, July 28, 1890, *Small* (F); Penryn Park, Sept. 18, 1893, *Eby* (M); Beach Haven, June 29, 1889, *Heller* (F); Mount Alton, 1900, *Illick* (M); Pocono Plateau, July–Aug. 1904, *Harshberger* (M); Schuylkill Park, Philadelphia, July 5, 1869, *Redfield 1164* (M).

Maryland: canal opposite High Island, July 21, 1905, *Greene* (ND); College Park, *Steward* (M).

District of Columbia: Washington, *Blanchard,* and July 14, 1891 (M); M Street road N. E., Washington, Oct. 12, 1892, *Blanchard,* in part (M); banks of the Potomac near Georgetown, July 3, 1906, *Greene* (ND); Rock Creek Park, Aug. 15, 1906, *Greene* (ND); Congress Heights, Aug. 16, 1906, *Greene* (ND); banks of Potomac, Aug. 16, 1906, *Greene* (ND); site of old Pennsylvania Railway Station, Sept. 20, 1909, *Greene* (ND); Brookland, July 27, 1910, *Holm* (M); Brookland, July 3, 1900, *Nieuwland 627,* June 27, 1910, *610* (ND); High Island chain bridge, July 13, 1910, *Nieuwland 648* (ND); Brookland, July 5, 1911, *Nieuwland 1637* (ND), July 30, 1911 (M), Sept. 5, 1911, *1637,* and 1912, *1637* (ND).

Virginia: near Luray, alt. 3400 ft., Aug. 30, 1901, *Steele 177* (M); south fork of the Holston River at St. Clair Bottom, alt. 2200 ft., July 30, 1892, *Small* (M).

North Carolina: Lake Junaluska below Mission Inn, July 8, 1936, *Noell 105* (M); Biltmore, July 10 and Sept. 1, 1896, *ex Biltmore Herb. 1378* (M), July 10 and Sept. 28, 1897, *1378b* (F, M); Chapel Hill, *Ashe* (US type of *R. oreophila).*

South Carolina: Anderson, July 14, 1919, *Davis* (M).

Georgia: between Gray and Macon, June 1, 1928, *Gillespie 4894* (ND); Stone Mountain, July 12, 1902, *Smith 2396* (F); Blue Ridge Mts., Aug. 11, 1909, *Smith 2627* (F); Yellow River, July 27, 1897, *Eggert* (M); Yellow River near McGuire's mills, alt. 750 ft., July 11, 1893, *Small* (F, US type of *R. pulchella).*

Alabama: June 18, 1897, *Eggert* (M); Gadsden, 1888, *McCarthy* (US type of *R. atrovirens);* bank of Warrior River, between Riverview and Holt, Oct. 24, 1908, *Harper 135* (M).

Mississippi: Agricultural College, Aug. 11–17, 1896, *Pollard 1261* (F, M, cotypes of *R. auriculata);* near Batesville, Sept. 17, 1896, *Eggert* (M).

Louisiana: Cote Blanche, Oct. 10, 1882, *Langlois* (ND type of *R. ludoviciana,* M photo.).

Ohio: Oxford, July 9, 1910, *Overholts* (M); Oak Harbor, Aug. 1927, *Moore* (Okla).

West Virginia: near Ripley, June 27, 1930, *Berkley 846* (M); near Varney School, July 7, 1930, *Berkley 986* (M); near Buckhannon, July 17, 1895, *Pollock* and July 17, 1896 (M).

Michigan: region of Douglas Lake, June 27, 1928, *Hanna 404* (M); Jackson Co., Sept. 19, 1898, *Camp* (F type of *R. media,* M photo.); Lawton, 1909, *Nieuwland 2425* (ND); Lake Michigan, Lawton, July 19, 1909, *Nieuwland* (M).

Indiana: Lost Lake, Aug. 18, 1906, *Clark* (ND type of *R. arbuscula);* Chaw Lake, July 2, 1912, *Nieuwland* (M); near Hartford City, June 25, 1905, *Deam,* July 9, 1910, *7030,* and *7034* (Deam); Clark Co., July 30, 1909, *Deam 5421* (ND); Stone Lake, July 7, 1920, *Deam 31347* (Deam); New Albany, July 31, 1911, *Deam 9358* (Deam); Medaryville, July 14, 1920, *Deam 31736* (Deam); Decker, April 20, 1911, *Deam 7872* (Deam); near Howe, Aug. 29, 1914, *Deam 14956* (Deam); Miller, July 6, 1912, *Nieuwland* (M); north of Hudson Lake, Aug. 17, 1912, *Nieuwland 10416* (ND); near Culver, July 2, 1911, *Deam 8990, 8991* (Deam, ND), Aug. 31, 1914, *15082,* Aug. 19, 1915, *17945,* and June 30, 1921, *34379* (Deam); 8 miles northeast of Cannelton, Oct. 2, 1920, *Deam 33348* (Deam); Mineral Springs, *Nieuwland 11741* (ND); near Pulaski, June 7, 1924, *Deam 40565* (Deam); Notre Dame, *Nieuwland 627,* 1909, *9077* (ND); ice-house, Notre Dame, July 5, 1909, *Nieuwland 5* (M, ND), *5a* (ND); Notre Dame, 1910, *Nieuwland 9468,* Sept. 17, 1910, *676* (ND); road from Carter's Field, Notre Dame, June 23, 1913, *Nieuwland 11270* (ND); road from ice-house to Carter's Field, Notre Dame, Sept. 10, 1913, *Nieuwland 11507* (M, ND); Wells Co., July 25, 1897, *Deam* (F).

Kentucky: Bowling Green, Aug. 23, 1899, *Price* (M).

Tennessee: Charlotte Pike, June 10, 1881, *Gattinger* (M); within 3 miles of Wolf Creek Station, Sept. 14, 1897, *Kearney 639* (M, ND); near Green River, Knoxville, July 1898, *Ruth 835* (M).

Wisconsin: Waupaca, 1907, *Garische* (M); Dane Co., 1862, *Greene* (ND); Madison, June, 5, 1925, *Palmer 27599* (M); Jefferson Junction, July 10, 1903, *Eggert* (M); Fox River, July 25, 1907, *Gates & Sleeper 1815* (F); near Milwaukee, Aug. 1906, *Ogden* (ND); Rochester, July 24, 1907, *Gates & Sleeper 1811* (F); .5 mile east of Richland Center, June 7, 1912, *Lansing 3430* (F).

Illinois: Riverside, July 6, 1878, *Bross* (F); Leyden, *Gates 746* (F); Riverside, July 21, 1876, *Grassly* (F); West Pullman, Sept. 8, 1900, *Lansing 1111* (F); Thornton, June 18, 1902, *Lansing 1335* (F); Hinsdale, Sept. 12, 1902, *Smith 577* (F type of *R. valida,* M photo.); Shawneetown, June 19, 1919, *Palmer 15491* (M);

Illinois State Park, Starved Rock, June–Sept. 1921, *Thone 185* (M); Golconda, Oct. 8, 1919, *Palmer 17008* (M); near Wady Petra, June 30, 1897, *Chase 57* (M), Aug. 7, 1897, *80* (M).

MINNESOTA: Delnoit, July 15, 1912, *Chandonnet* (M); Squaw Lake, July 22, 1932, *Buell 489* (M); Spicer, Aug. 1892, *Frost* (F, M); Stockton Bluffs, Aug. 23, 1888, *Holzinger* (US type of *R. longula).*

IOWA: Cedar River region, July 8, 1929, *Burk 638* (M); Buffalo Slough, Mason City, Aug. 31, 1927, *Shimek* (M); Edgewood, May 31, 1923, *Shimek* (M); Decatur Co., June 13, 1896, *Fitzpatrick* (F); Missouri Valley, Harrison Co., Aug. 13, 1908, *Shimek* (M); Blairs Bridge, July 5, 1925, *Shimek* (M); near Joy Creek, 7 miles southeast of Westfield, June 4, 1926, *Shimek,* and May 25, 1929 (M); Ames, *Hitchcock* (M).

MISSOURI: near Watson, Sept. 3, 1920, *Palmer 18961* (M); Columbia, May 20, 1876, *Tracy* (M); Cass Co., June 1865, *ex Broadhead Herb.* (M); Bear Creek, north of Bearcreek, July 16, 1934, *Steyermark 13351* (M); Dumas, July 27, 1923, *Bush 10113* (M); Jefferson City, June 1867, *Krause* (M); Willow Springs, July 8, 1914, *Palmer 6222* (M); Pilot Knob, June 7, 1888, *Pammel* (M); Des Arc, Nov. 22, 1907, *Smith 45* (F); Independence, June 17, 1895, *Bush 147* (M); Courtney, July 1, 1934, *Bush* (M, ND); Webb City, June 16, 1901, *Palmer 75,* and June 14, 1903, *16* (M); Joplin, Oct. 13, 1907, *Palmer 1128,* and July 4, 1918, *14297* (M); near Joplin, June 18, 1923, *Palmer 23355* (M); 5 miles southeast of Catawissa, June 22, 1929, *Steyermark 1105* (M); Columbus, June 21, 1930, *Palmer 36630* (M); Noel, Sept. 7, 1913, *Palmer 4167* (M); Riverview Park, Hannibal, Aug. 28, 1911, *Davis 722* (M); Hannibal, Aug. 22, 1912, *Davis 3898* (M); Ely Street, Hannibal, June 9, 1915, *Davis 4407* (M); Jerome, June 2, 1914, *Kellogg 311* (M); Bismarck, June 25, 1920, *Palmer 18071* (M); Hall's Ferry Road, St. Louis Co., June 29, 1893, *ex Glatfelter Herb.* (M); St. Louis Co., July 25, 1936, *Barkley 1084* (M); Forest Park, St. Louis, *Eggert,* and June 24–29, 1875 (M); Bach's Crossing, Meramec Highlands, June 26, 1910, *Craig* (M); St. Louis County, June 13, 1876, *Eggert* (M); Jefferson Barracks, June 17, 1890, *Hitchcock* (M); Allenton, Aug. 30, 1884, *Kellogg* (M); Old Orchard, Oct. 1886, *Pammel* (M); 3 miles west of Valley Park, Sept. 18, 1929, *Steyermark 1139* (M); Creve Coeur, June 14, 1885, *Wislizenus 56* (M); campus, Washington University, July 7, 1926, *Woodson 563* (M); Montier, June 30, 1894, *Bush 139* (M); Galena, May 27, 1914, *Palmer 5776* (M); James Fork of the White River, June 1, 1914, *Palmer 5821* (M); Washington Co., July 1, 1928, *Kellogg 1853* (M).

ARKANSAS: Cotter, June 16, 1914, *Palmer 6011,* and Sept. 1, 1915, *8410* (M); Decatur, *Plank* (M); Jonesboro, June 29, 1929, *Demaree 6958* (M); near Hot Springs, June 4, 1923, *Palmer 23044* (M); Marianna, June 21, 1935, *Griffin & Demaree 43* (M); Rush, June 18, 1914, *Palmer 6025* (M); near Nogo, Aug. 15, 1932, *Merrill 2* (M); Pulaski Heights, Little Rock, Sept. 30, 1931, *Demaree 8335* (M); Wheatley, Sept. 1, 1934, *Demaree 10906* (M).

NORTH DAKOTA: Kathryn, July 28, 1911, *Bergman* (Okla); Devils Lake, Narrows, June 26, 1913, *Lunell 701* (Minn type of *R. angustiarum,* M photo.); Devils Lake, June 26, 1913, *Lunell* (ND); Devils Lake, Narrows, Aug. 12, 1913, *Lunell* (Deam, M, US), July 13, 1914 (Deam); Devils Lake, July 4, 1930, *Palmer 36892* (M).

SOUTH DAKOTA: Spearfish Canyon, Aug. 2, 1926, *Hayward 203* (F); Vermilion, June 29, 1910, *Visher 4134* (M); 2 miles northwest of Sturgis, Aug. 30, 1911, *Carr 95* (M); Piedmont, June & Aug., 1895, *Pratt* (F type of *R. sambucina*, M photo.); Johnson's mill, Rapid Creek, Black Hills National Forest, alt. 4300 ft., July 15, 1910, *Murdock 4256* (F); near Piedmont, *Palmer 37018* (F, M), June 28, 1929, *37617* (M); Black Pipe Creek, Aug. 22, 1911, *Visher 2277* (F).

NEBRASKA: Platte River, Louisville, June 18, 1934, *Morrison 1094* (M); Anselmo, July 6, 1889, *Webber* (M); Franklin, 1893, *Laybourne* (M); Minden, July 15, 1907, *Hapeman* (ND), July 8, 1912 (Minn), Sept. 12, 1912, (Minn type of *R. Hapemanii*, ND), July 10, 1933, (ND), July 14, 1933 (M); Lancaster Co., June 1885, *Milligan 32* (F); Lincoln Co., July 1901, *Baker* (M); Loup River, Nance Co., July 14, 1857, *Hayden* (M); Nuckolls Co., June 21, 1898, *Hedgcock 2522* (M); near Plummer Ford, Dismal River, Aug. 24, 1893, *Rydberg 1443* (US type of *R. cismontana).*

KANSAS: Kiowa, July 1892, *Hitchcock* (M); Medicine Lodge, July 22, 1933, *Palmer 41836* (M); near Galena, June 6, 1924, *Palmer 25340* (M); Riley, June 12, 1895, *Norton 72* (M); Manhattan, Sept. 1923, *Salmon* (M).

OKLAHOMA: Caddo Co., June 30, 1903, *van Vleet 54* (Okla); 7 miles northeast of Norman, May 27, 1928, *Barkley 415* (Okla.), and 3 miles west of Norman, July 1929, *Barkley* (Okla); 2 miles west of Norman, June 25, 1924, *Bruner* (Okla); east of Norman, near Little River, June 1, 1927, *Fielder 38* (Okla); east of Norman, Oct. 17, 1926, *Little 513* (Okla); near Camp Boulder, Wichita Mountains, June 5, 1926, *Little 473* (Okla); Sapulpa, July 27, 1894, *Bush 170* (M); 4 miles east of Tuttle, June 21, 1928, *Personett 27* (Okla); 4 miles north of Reed, June 8, 1931, *Bull 187* (Okla); McCurtain Co., June 5, 1930, *Little & Olmsted 31*, and June 7, 1930, *132* (Okla); Arbuckle Mts., April 20, 1927, *Fielder* (Okla); 2 miles west of Muskogee, Aug. 5, 1926, *Little 248*, and June 15, 1927, *736* (Okla); Platt National Park, Sulphur, May 20, 1935, *Merrill & Hagen 459* (F); 12 miles south of Stillwater, July 14, 1927, *Stratton 169* (M); Stillwater, June 9, 1893, *Waugh 103* (M); north of Sacred Heart, May 21, 1932, *Barkley 196* (Okla); 8 miles northeast of Finley, June 25, 1919, *Jeffs* (Okla); Woods Co., June 1917, *Clifton 99* (Okla); near Fairvalley, June 1, 1913, *Stevens 714* (M).

TEXAS: Paloduro, Sept. 11, 1917, *Young* (M); College Station, Aug. 13, 1921, *Ferris & Duncan 3277* (M); Denison, Oct. 28, 1933, *McGregor 43* (M); Willis, *Warner* (M); Corsicana, June 1, 1915, *Palmer 7823* (M); Strawn, June 26, 1918, *Palmer 14243* (M); Polytechnic, May 10 and June 6, 1912, *Ruth 143* (M).

WYOMING: Wolf Creek, Sheridan Co., July 12, 1896, *Nelson 2303* (US type of *R. asplenifolia*, M); Beaver Creek, Weston Co., July 21, 1901, *Nelson 8456* (M).

COLORADO: alt. 6000 ft., July 20, 1895, *Cowan* (M), *95* (US type of *R. tessellata);* near Boulder, alt. 5400 ft., July 14, 1920, *Hanson C274* (M); Boulder, 1908, *Pace 311* (M); Gregorio Canyon, 6100 ft., July 16, 1906, *Daniels 221* (M); Manitou Iron Springs, 1874, *Brandegee 910* (M).

NEW MEXICO: Capelin Canyon, Sandia Mts., alt. 8100 ft., July 15, 1911, *Ellis 256* (M); Santa Fe Creek Valley, July 8, 1847, *Fendler 110* (M); Whitman's Camp, 18 miles east of Albuquerque, Sept. 7, 1895, *Mulford 1204* (M); on Mogollon Creek, Mogollon Mts., Catron Co., July 14, 1903, *Metcalfe*, and *227* (M); Santa Rita, Aug. 8, 1895, *Mulford 706* (M); White Mts., Lincoln Co., June 1936, *Hinckley 766* (F); White Mts., alt. 6400 ft., Aug. 20, 1897, *Wooton 581* (M, ND); mountains west of Las Vegas, 1881, *Vasey* (US type of *R. sorbifolia);* south end of the Black Range, Kingston, about alt. 6600 ft., June 16, 1904, *Metcalfe 998* (M).

ARIZONA: Pine Canyon, Chiricahua Mts., alt. 6500 ft., Aug. 25, 1906, *Blumer 96*, and *98* (ND), *1293* (F, M); Paradise, Aug. 26, 1906, *Blumer 98b* (US type of *R. calophylla*); Stephens' Ranch, Chiricahua Mts., alt. 5700 ft., July 8, 1907, *Blumer 1267* (M); Cochise Co., Aug. 8, 1907, *Stephens FC15* (ND); Flagstaff, July 13, 1889, *Greene* (ND); Flagstaff, Aug. 29, 1922, *Hanson A169* (M); Francisco Peaks, alt. 2300 m., Aug. 18, 1901, *Leiberg 5871* (US type of *R. albida*); near Flagstaff, alt. 7000 ft., July 18, 1898, *MacDougal 309* (F); Gila Co., Aug. 27, 1936, *Little 4286* (M, ND); Fort Apache, June 21–30, 1890, *Palmer 585* (US type of *R. elegantula*); Santa Rita Mts., Pima Co., June 24, 1882, *Pringle* (M).

IDAHO: Clarks Fork Valley, below Parma, 680 m. alt., Aug. 21, 1895, *Leiberg 1554* (M); Nez Perce Co., alt. 3500 ft., July 14, 1896, *Heller 3421* (M, ND).

UTAH: Provo State Canyon, alt. 6000 ft., 1894, *Jones 5612* (M); Beaver Mts., Millard Co., Sept. 1909, *Greene* (ND); Farmington Canyon, near Salt Lake City, July 14, 1902, *Pammel & Blackwood 3661* (M); Provo, June 16, 1902, *Goodding 1129* (M); mouth of Rock Canyon, Provo, alt. 5000 ft., May 28, 1934, *Harrison 7541* (M); Provo, alt. 6000 ft., July 10, 1894, *Jones 5612* (M, US type of *R. nitens*); Weber Co., June 1889, *Dodge 111* (M).

NEVADA: Caliente, May 29, 1902, *Goodding 988* (M, US type of *R. macrothyrsa*).

WASHINGTON: Camas Creek, Aug. 20, 1897, *Gorman 632* (US type of *R. aprica*); along Columbia River, north of Wenatchee, May 5, 1929, *Benson 1312* (M); east of Leavenworth, alt. 1100 ft., July 14, 1920, *Otis 990* (M); near Rock Island, June 15, 1931, *Thompson 6756* (M); near Old Fort Okanogan, June 8, 1841, *Pickering & Brackenridge* (Wilkes' Exped.) *927* (US type of *R. glabra* var. *occidentalis*); Spokane, Aug. 1892, *Sandberg* (M); Spokane, July 1898, *Savage, Cameron & Lenocker* (F, M); Walla Walla, July 1898, *Savage, Cameron & Lenocker* (F); Wawawai, May 1897, *Elmer 872*, July 17, 1892, *Lake* (M); Almota, July 5, 1892, *Lake & Hull* (M); Whitman Co., June 27, 1933, *Thompson 9250* (M, ND).

OREGON: Rattlesnake Spring, July 21, 1930, *Palmer 37994* (M); Ione, Sept. 1902, *Baker 122* (M); near Rhea Creek, 540 m., Sept. 11, 1894, *Leiberg 893* (M, US type of *R. arguta*); 2 miles above mouth of the John Day River, May 25, 1925, *Henderson 5199* (M); along the Seattle River, near Grant, June 30, 1887, *Howell 1108* (M, ND); along Bakeoven Creek, Maupin, Aug. 3, 1924, *Whited 1059* (ND).

MEXICO:

CHIHUAHUA: Sierra Madre, June 21–July 29, 1899, *Nelson 6002* (US); in the Sierra Madre near Colonia Garcia, alt. 7500 ft., July 20, 1899, *Townsend & Barber 154* (F, M, ND, US).

TAMAULIPAS: above Mesa de Tierra, near San José, Sierra de San Carlos, July 12, 1930, *Bartlett 10281* (US).

6a. Rhus glabra L. var. **laciniata** Carrière, Rev. Hort. for 1863, p. 7. 1863.

Rhus bipinnata Greene, Torreya **5**: 155. 1905.

R. glabra forma *laciniata* Robinson, Rhodora **10**: 35. 1908.

A stout-branched, glabrous shrub with leaves bipinnately compound, of 19–29 pinnae, each pinna with 1–11 leaflets, lateral leaflets lanceolate, 3–5 cm. long, 0.6–1 cm. broad, entire, serrate or laciniate, the terminal laciniate, petiole and rachis very stout.

UNITED STATES:

Pennsylvania: near West Chester, Oct. 5, 1876, *Engelmann* (M).

Delaware: cultivated, Centerville, July 17, 1877, *Commons* (M).

Indiana: cultivated, Notre Dame, Aug. 5 and Oct. 5, 1912, *Nieuwland 10380* (M, ND), 1923 (ND).

Missouri: cultivated, Missouri Botanical Garden, Sept. 17, 1906, *Kellogg* (M).

6b. **Rhus glabra** L. var. **borealis** Britton, Manual, p. 601. 1901.

Rhus glabra var. *Sandbergii* Vasey & Holz. ex Greene, Proc. Wash. Acad. Sci. **8**: 187. 1906.

R. borealis Greene, *ibid.* 188.

R. Sandbergii Greene, *ibid.*

A shrub with slender, sparsely pilose branches; leaflets few, small, serrate; fruits covered with glandular hairs about 0.5 mm. in length.

CANADA: Ontario: Strathroy, June 16, 1910, *Greene* (ND).

UNITED STATES:

Michigan: Douglas Lake region, July 16, 1918, *Ehlers* (M); Alma, Aug. 12, 1895, *Davis* (F **type**, M photo.); Glenwood Cemetery, Flint, July 25, 1909, *Sherff* (F).

Minnesota: Thompson, July and Aug. 1891, *Sandberg* (F, US type of *R. Sandbergii,* M photo.).

7. **Rhus Ashei** (Small) Greene, Proc. Wash. Acad. Sci. **8**: 179. 1906.

Rhus caroliniana Ashe, Bot. Gaz. **20**: 548. 1895, non Miller, Gard. Dict., ed. 8. 1768.

Schmaltzia Ashei Small, Fl. Southeast. U. S., pp. 729, 1334. 1903.

Stout-branched shrub; new and old branches glabrous except for the peduncle and branches of the inflorescence which are densely villous-hirsute, buds tan, lanuginose; leaves compound; leaflets elliptic to elliptic-lanceolate, 13–23, thin, not revolute, margin serrate-dentate, dark green, glabrous, and almost shining above, somewhat lighter, glabrous, and dull but not glaucous beneath, lateral leaflets subsessile, 8–13 cm. long, 2.5–4.5 cm. broad, at apex acute to subacuminate, subcuneate to obtuse at base, terminal leaflets 7–9 cm. long, 3–4 cm. broad, acute to subacuminate at apex, obtuse at base; terminal petiolule 1.5–2 cm. long, not winged, rachis segments about 3–5 cm. long, not winged, petiolules about 1 mm. long, petioles 9–11 cm. long, stout; inflorescence a large terminal thyrsus about 18 cm. long, 12 cm. broad, bracts narrowly deltoid-lanceolate, 1.5 mm. long, 0.5 mm. broad, pointed at the apex, glabrous on both surfaces, ciliate with simple hairs, deciduous; flowers many, polygamo-dioecious, each flower subtended by a single bract, pedicels about 1.5 mm. long; sepals deltoid-lanceolate, 1.5 mm. long, 0.7 mm. broad, pilose on the outer surface, glabrous on the inner surface, ciliate with simple hairs, persistent; petals whitish in the dried state, elliptical, acuminate and inrolled at the apex, about 1.5 mm. long, 0.7 mm. broad, sparsely pilose and with a few glandular hairs on the outer surface, long-pilose on the inner surface, not ciliate, deciduous; stigmas 3, styles 3; fruit 4 mm. long and broad, somewhat flattened, red, covered with a dense layer of short red hairs; seed 2.5 mm. long, 2 mm. broad, smooth, larger at one end.

This seldom-collected species of eastern North America is obviously closely related to *Rhus glabra,* but the leaflets are coarser, much deeper green, more dentate, and are not at all glaucous. The red hairs on the fruit are longer than in *Rhus glabra,* but are of the same form in both species.

Distribution: North Carolina and Indiana (fig. 9).

UNITED STATES:

North Carolina: Granville Co., Aug. 10, 1895, *Ashe 825* (M, ND).

Indiana: 4 mile bridge, Notre Dame, Sept. 10, 1913, *Nieuwland 11624* (M); Studebaker's woods, South Bend, Sept. 25, 1913, *Nieuwland 11638* (M, ND).

Subgenus Schmaltzia (Desv.) Schneider, emend. Barkley

Schmaltzia Desv., Journ. de Bot. Appl. **1**: 229. 1813; DC., Prodr. **2**: 72. 1825, as *Schmalzia* in syn.; Schneid., Illustr. Handb. Laubholzk. **2**: 148. 1907, as subgenus.

Lobadium Raf., Am. Monthly Mag., p. 357. 1819.

Neostyphonia Shafer in Britt., N. Am. Trees, p. 612. 1908.

Rhoeidium Greene, Leafl. Bot. Obs. & Crit. **1**: 143. 1905.

Styphonia Nutt. ex Torr. & Gray, Fl. N. Am. **1**: 220. 1838.

Turpinia Raf., Med. Repos. N. Y. **5**: 352. 1808.

Trichocarpae Engler, Bot. Jahrb. **1**: 379. 1881, as section, in part.

Spreading shrubs, small trees, or rarely scandent plants; branches many, comparatively slender. Leaves simple, trifoliolate, or imparipinnately compound, deciduous or not. Inflorescence a compound spike, either stout and contracted or slender and diffuse. Flowers mostly polygamous, numerous, sessile or nearly so, subtended by squamaceous chartaceous or coriaceous, concave bracts, each enclosing a pair of bractlets; bracts deltoid-lanceolate or broadly ovate and pubescent on the outer surface with simple and usually with glandular hairs intermixed, commonly ciliate with simple and glandular hairs. Drupes red or orange; epicarp pubescent with simple and glandular hairs.

North America, from Canada to Costa Rica.

Type species: **Rhus aromatica** Ait., Hort. Kew. **1**: 367. 1789 (*Toxicodendron Crenatum* Miller, Gard. Dict., ed. 8. 1768).

Three elements of Schmaltzia have been variously proposed as generic segregates by Rafinesque, Nuttall, Greene, and others; in each case the author points out the morphological divergence from Sumac, but mostly overlooks the similarity to the other elements of this group. Inferring from his treatment, Gray alone seems to have realized their mutual relationships.

KEY TO THE SECTIONS

Flowers usually appearing with the leaves; evergreen shrubs and trees, mostly of subtropical North America.
- Axillary inflorescences not surpassed by subtending leaves; leaves thin-coriaceous; inflorescences with many loose, slender, lateral spikes ...... Pseudosumac
- Axillary inflorescences surpassed by the subtending leaves; leaves coriaceous; inflorescences with few, contracted, usually lateral, stout spikes.
  - Leaves mostly simple ...... Styphonia
  - Leaves mostly imparipinnately compound ...... Pseudoschmaltzia

Flowers usually appearing before the leaves; mostly deciduous shrubs of temperate North America.
- Spinescent shrubs with very small, 3–9-foliolate leaves; rachis winged; bracts and bracteoles approximately the same size ...... Rhoeidium
- Gracefully diffuse or subscandent shrubs, usually with 3-foliolate leaves; rachis not winged; bracteoles much smaller than the bracts.... Lobadium

Section Pseudosumac Barkley, n. sect.

Slender shrubs with many lax, diffuse branches, each clothed with alternate, subcoriaceous, and persistent odd-pinnate leaves; leaflets more or less pubescent, usually entire and subrevolute-margined; rachis not winged. Flowers many, white or cream-colored, in apical, laxly paniculate, compound spikes, perfect or polygamo-dioecious, sessile; each flower subtended by a subovate, subacute and persistent bract and two similar

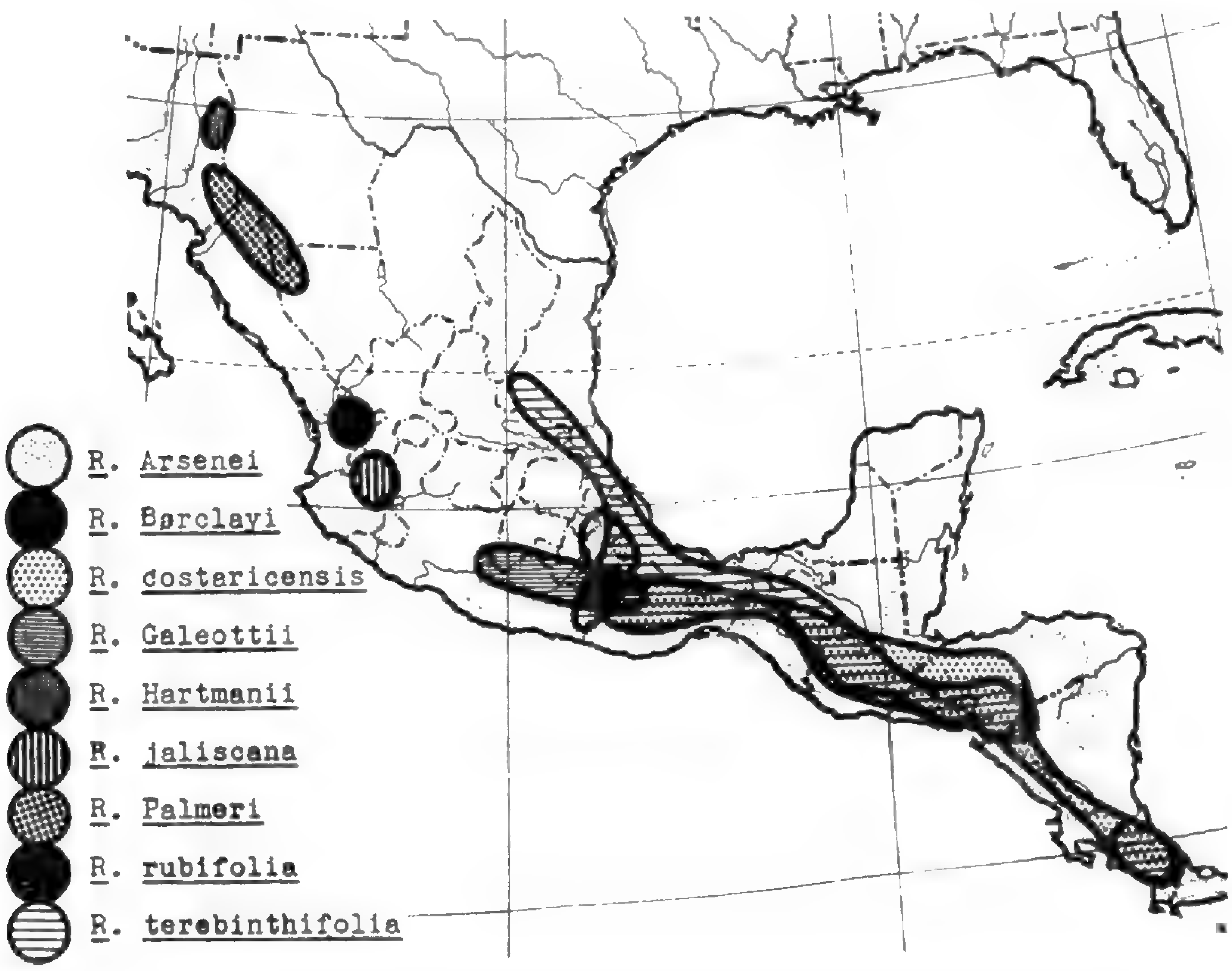

Fig. 10. The geographic distribution of the species in Section Pseudosumac.

bracteoles. Drupe red, slightly broader than long; seed bony, smooth, flattened, smaller at one end.

Mexico to Costa Rica (fig. 10).

Type species: **Rhus terebinthifolia** Schlecht. & Cham., Linnaea **5**: 600. 1830.

Pseudosumac is a natural assemblage of species having slender, subscandent, diffuse branches terminated by very slender, diffuse, compound spikes of very small flowers. *Rhus Hartmanii* seems to indicate a relationship between this group and Pseudoschmaltzia.

KEY TO THE SPECIES AND VARIETIES

Leaflets of the leaves below the inflorescence small, 1–2 cm. long.
  Leaflets mostly 9–15, petiolulate, rarely lobed.
    Stem and leaves densely pubescent; inflorescence relatively coarse...... ....*8. R. Hartmanii*
    Stem and leaves puberulent; inflorescence relatively slender....*9. R. jaliscana*
  Leaflets mostly 3–5, sessile or subsessile, often lobed............*10. R. Arsenei*
Leaflets of the leaves below the inflorescence relatively large, 1.5–7.5 cm. long.
  Leaflets when mature mostly sessile or subsessile.
    Leaflets not rugose; veins not prominent below..............*11. R. Galeottii*
    Leaflets rugose; veins prominent below.
      Leaflets usually 5–7; inflorescence diffuse.................*12. R. rubifolia*
      Leaflets usually 3; inflorescence compact...*12a. R. rubifolia* var. *subcordata*
  Leaflets when mature petiolulate (very shortly so in No. 15).
    Bracts glabrous or nearly so, not ciliate at apex; stem glabrate; pubescence coarse, sparse, confined mostly to the areas between the veins........ ....*13. R. Barclayi*
    Bracts pubescent, ciliate at apex; stem pubescent (except in No. 16a); pubescence fine, confined chiefly to the veins or densely distributed over the entire under-surface of the leaflets (except in No. 16a).
      Leaflets mostly oblong-lanceolate; northern Mexico..........*14. R. Palmeri*
      Leaflets mostly broadly lanceolate to narrowly ovate; central and southern Mexico and Central America.
        Pubescence of leaflets not confined to veins either above or below, copious below; leaflets more or less acute, subsessile.......... ....*15. R. costaricensis*
        Pubescence of leaflets sparse, mostly confined to veins both above and below, or glabrate; leaflets more or less long-acuminate, usually distinctly petiolulate.
          Leaflets mostly small, with pubescence on veins both above and below; stems pubescent......................*16. R. terebinthifolia*
          Leaflets mostly larger, glabrous or glabrate; stems glabrate...... ....*16a. R. terebinthifolia* var. *Loeseneri*

8. Rhus Hartmanii Barkl., n. sp.[1] Pl. 18, fig. 1.

Shrub or small tree; branches tan, pubescent; leaves compound, petioles about 1.5 cm. long, stout; leaflets about 15, thin, broadly lanceolate, subfalcate, about 2.5 cm. long, 1 cm. broad, subacute at the apex, mucronate, more or less unequal, obtuse

[1] **Rhus Hartmanii** Barkley, n. sp. Arbuscula; foliis imparipinnatis, foliolis 11–17 tenuibus lato-subfalcatis lanceolatis circiter 2.5 cm. longis 1 cm. latis subacutis mucronatis supra sparse et subtus dense molliterque pubescentibus integris marginibus subrevolutis basi inaequalibus plerumque breve-petiolulatis; floribus multis in spicis terminalibus et lateralibus diffusis compositis dispositis, bracteis persistentibus.—Collected at Oakridge Pass, Sonora, Mexico, alt. 5700 ft., Dec. 12 and 13, 1890, *Hartman 324* (US 306131 **type**).

to cuneate at the base, revolute-margined, entire, dark green, dull and sparsely pubescent above, lighter and densely pubescent beneath, short-petiolulate to subsessile, terminal petiolules about 0.5 cm. long, lateral petiolules about 1–2 mm. long; rachis segments about 1 cm. long; inflorescence a loose, compound spike, terminal and in the axils of the uppermost leaves, bracts ovate, 1 mm. long, 1 mm. broad, rounded at the apex, pilose on both surfaces, ciliate with simple hairs; flowers numerous, sessile; sepals ovate, 1.5 mm. long, almost as broad, glabrous on both surfaces, ciliate with simple hairs, persistent; petals whitish in the dried state, ovate, 2 mm. long, almost as broad, glabrous on the outer surface, pilose on the inner surface, ciliate with simple hairs, filaments shorter than the se-

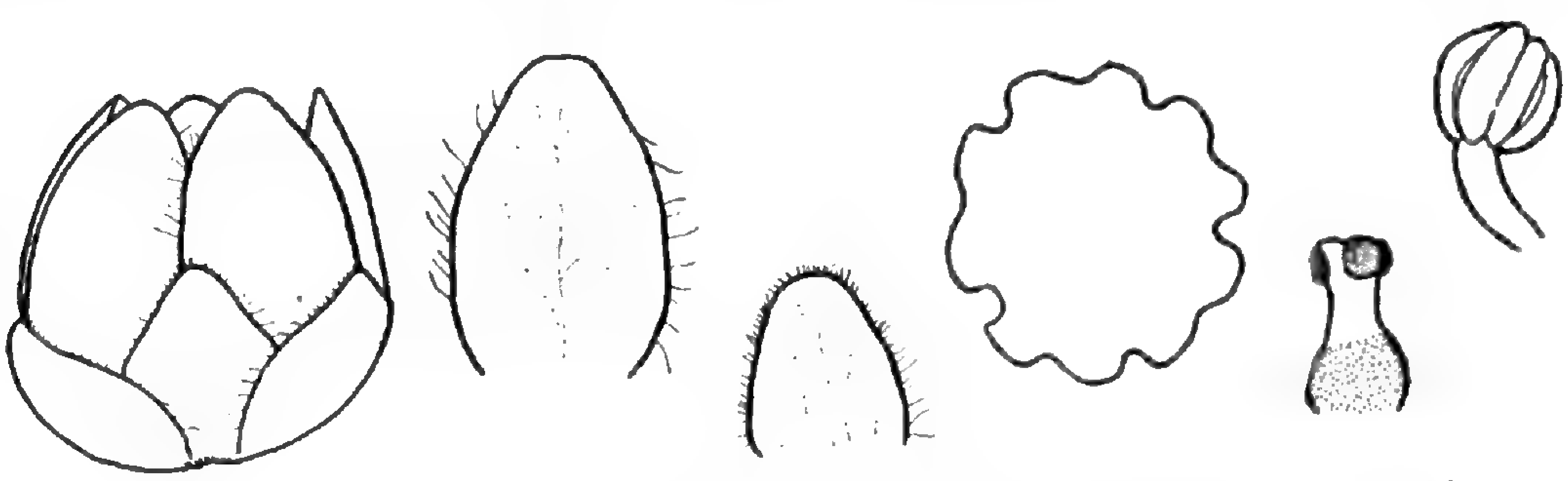

Fig. 11. Floral morphology of *Rhus Hartmanii* Barkl. × 10½.

pals; anthers oval; fruit red, pubescent with simple and glandular hairs.

This species seems to be closely related to *Rhus jaliscana*, but differs from it in being canescent, with much shorter inflorescences which diverge from the axis at a greater angle.

Distribution: Sonora, Mexico (fig. 10).

MEXICO:

SONORA: canyon, Rinconada, Nov. 27, 1890, *Lloyd 378* (US); Oakridge Pass, alt. 5700 ft., Dec. 12 and 13, 1890, *Hartman 324* (Calif, G, M photo., NY, PA, US type); Huehuerachi, Dec. 12, 1890, *Hartman 379* (PA), same locality and date, *Lloyd 379* (Calif, F, G, NY, Penna).

9. **Rhus jaliscana** Standl., Contr. U. S. Nat. Herb. **20**: 219. 1919.

Shrub or small tree, 3–5 m. high; branches tan, appearing glabrate but minutely and sparsely pilose, lenticels prominent; leaves compound, petioles about 2 cm. long; leaflets 13–15, thin, narrowly ovate, bluntly acute and mucronate at the apex, unequal and subcuneate at base, short-petiolulate, subrevolute and entire-margined, barely pilose, bluish, dull, rough to the touch above, barely pilose on the veins and essentially glabrous below, terminal leaflets 2–2.5 cm. long, 0.8–1.1 cm. broad, decurrent, with petiolules 0–0.5 cm. long, lateral leaflets 1.8–3 cm. long, 0.6–1.4 cm. broad, the lower with petiolules 0.4 cm. long, the uppermost sessile; rachis segments about 0.9–1.1 cm. long; inflorescence a loose, terminal, compound spike 25 cm. long, 15 cm. broad, bracts broadly ovate, 1 mm. long, 1.3 mm. broad, rounded at the apex, sparsely pilose at the center on the outer surface, glabrous on the inner surface, ciliate with simple hairs, persistent; flowers numerous, sessile; sepals deltoid-ovate, 1.25 mm. long, 1 mm. broad, glabrous on both surfaces, ciliate with simple hairs; petals whitish in the dried state, deltoid-ovate, about 1 mm. long, 0.8 mm. broad, glabrous on the outer surface, sparsely pilose within, not ciliate; styles 3; disk large, lobed, pink; fruit 7 mm. broad, 6 mm. long, red, pubescent with simple and glandular hairs.

This species is apparently most closely related to *Rhus Palmeri*. However, it has more numerous, smaller, and petiolulate leaflets, and much longer branches to the inflorescence.

Distribution: Jalisco, Mexico (fig. 10).

MEXICO:

JALISCO: barranca, Guadalajara, Nov. 23, 1930, *Jones 27099* (Calif, M, NY); moist places in the barranca near Guadalajara, Nov. 3, 1888, *Pringle 1774* (Calif, F, G, M photo., ND, NY, PA, US **type**); barranca near Guadalajara, Nov. 18, 1889, *Pringle 2756* (B, Calif, F, M), alt. 5000 ft., Dec. 7, 1902, *9712* (F, G, M, NY, US); Barranca Ibarra, Guadalajara, alt. 1500 m., Jan. 1923, *Reko 4600* (US); between Bolanos and Guadalajara, Sept. 22, 1897, *Rose 3093* (US); between Ataquiza and Chapala, Oct. 4, 1903, *Rose & Painter 7608* (G, US); La Barranca, Guadalajara, Feb. 28, 1907, *Safford 1458a* (US).

10. **Rhus Arsenei** Barkl., n. sp.[1] Pl. 18, fig. 2.

Small shrub; branches slender, tan or chocolate-brown,

[1] **Rhus Arsenei** Barkley, n. sp. Arbuscula; foliis imparipinnatis, foliolis plerumque 3–5 ovalibus circiter 2 cm. longis 1 cm. latis acutis vel rare mucronatis subcuneatis sessilibus marginibus revolutis utrinque pilosis, lateralibus integris, terminalibus saepe 1–2–lobatis vel serratis, rhache non alato; floribus in spicis terminalibus lateralibusque gracilibus diffusis compositis dispositis, bracteis persistentibus.—Collected at Acatzingo, Distrito de Tepeaca, vicinity of Puebla, Mexico, alt. 1900–2110 m., Aug. 1907, *Arsène & Amable 1566* (M **type**).

minutely pubescent, dotted with prominent lenticels; leaves compound, petiole 0.7–1.5 cm. long, slender; leaflets 3–7, thin, elliptical to ovate, acute at apex, rarely mucronate, sessile, revolute-margined, entire or once or twice serrate, pilose, dark and almost shining above, paler and ferruginous-pilose below, terminal leaflet 0.3–2.3 cm. long, 0.1–1 cm. broad, decurrent and thereby cuneate at base, lateral leaflets 0.8–1.8 cm. long, 0.4–1.2 cm. broad, subcuneate to obtuse at base; rachis segments about 0.3–1 cm. long; inflorescence a compound spike, terminal and in the axils of the uppermost leaves, exceeding the leaves in length, about 8 cm. long and 4 cm. broad, bracts broadly ovate, 1 mm. long, about as broad, acute at the apex, sparsely pilose in the center of the outer surface, glabrous on the inner

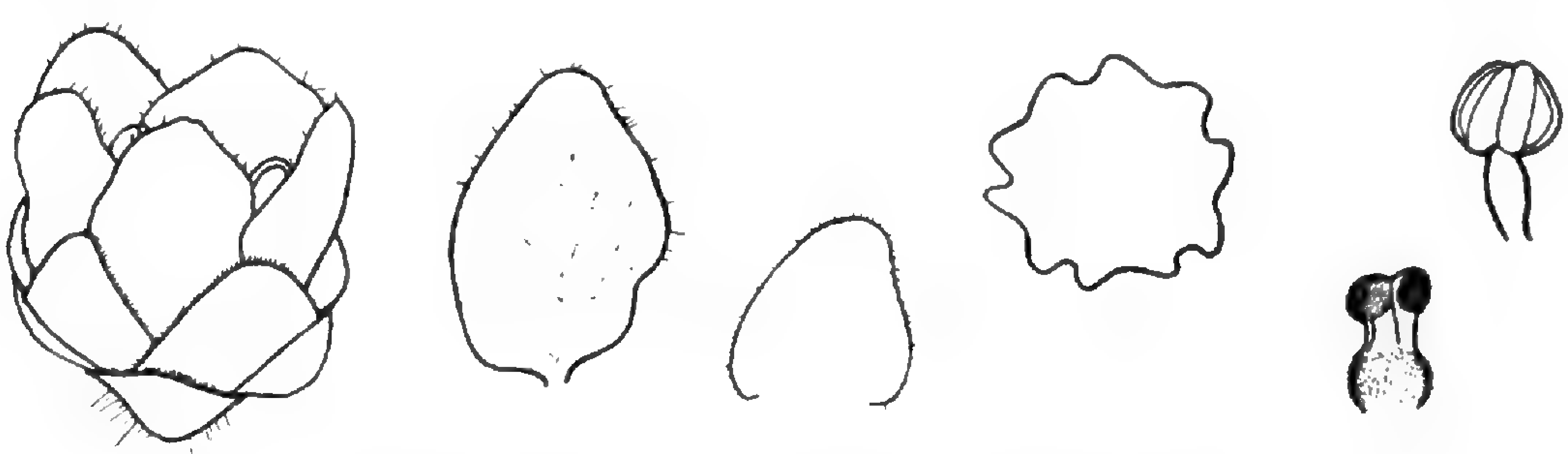

Fig. 12. Floral morphology of *Rhus Arsenei* Barkl. × 10½.

surface, light green, persistent; flowers numerous, sessile; sepals deltoid-ovate 1.2 mm. long, almost as broad, glabrous on both surfaces, ciliate with simple hairs; petals white in the dried state, deltoid, about 1.4 mm. long, 1 mm. broad, glabrous on both surfaces, ciliate; filaments as long as the sepals; anthers oval, 0.5 mm. broad and long; disk 1.5 mm. broad, yellow, lobed; ovary 0.5 mm. broad.

This species is a small shrub with very small, mostly trifoliolate leaves, which are sparsely and coarsely pubescent. The leaflets are mostly sessile and are often tridentate.

Distribution: Puebla and Oaxaca, Mexico, to Guatemala.

MEXICO:

OAXACA: de Las Sedas a Salomé, Distrito de Etla, alt. 2100 m., Aug. 20, 1921, *Conzatti 4205* (US);

PUEBLA: Las Palmillas, Acatzingo, Distrito de Tepeaca, near Puebla, alt. 2110 m., July, 1907, *Arsène & Amable 2255* (M, US); Acatzingo, Distrito de Tepeaca, near Puebla, alt. 1900–2110 m., Aug. 1907, *Arsène & Amable 1566* (M **type**, US); Acatzingo, Feb. 3, 1919, *Arsène "7"* (F).

CENTRAL AMERICA:

GUATEMALA: Brenas y Setos, alt. 1400 m., July 1921, *Tonduz 713* (US).

11. Rhus Galeottii Standl., Field Mus. Bot. Ser. **11**: 163. 1936.

Rhus Metopium Sessé & Moc., Pl. Nov. Hisp., p. 47. 1887, non L., Syst. Nat., ed. 10. **2**: 964. 1759.

Shrubs 1 m. high; twigs very slender, the younger densely pilose, the older more or less glabrate and dotted with a few scattered lenticels; leaves compound, petioles 1.5–3 cm. long, slender; leaflets 3–5, membranaceous, subrevolute, entire or inconspicuously sinuate-crenulate-margined, green and pilose above, somewhat lighter and densely ferruginous-pilose below, terminal leaflet oblong-oval or oval-obovate, 4–7.5 cm. long, 2–4 cm. broad, sometimes trilobate near the apex, cuneate or long-decurrent at the base, with petiolules 2–5 mm. long, lateral leaflets oval, oblong-elliptic or oval-obovate, 2–3.5 cm. long, 1.3–2.2 cm. broad, rounded, submucronate-subemarginate at the apex, rotundate or subcuneate at the base, sessile or subsessile; rachis segments about 1.3 cm. long; inflorescence a small, terminal, compound spike about 2.5–5 cm. long, 2 cm. broad, bracts broadly ovate, 0.5 mm. long, 0.8 mm. broad, rounded at the apex, pilose on both surfaces, somewhat glandularly-hairy, persistent; flowers several, sessile; sepals deltoid-ovate, 1 mm. long, scarcely as broad, glabrous on both surfaces, ciliate with simple hairs; petals whitish in the dried state, rhombic-obovate, about 1.5 mm. long, 0.9 mm. broad, glabrous but with margin ciliate with simple hairs.

This species bears from 3–7 subsessile, thin and rather smooth, typically obovate and obtuse leaflets. Its relationship is obviously between *Rhus rubifolia* and *R. terebinthifolia*, and some of the specimens are separable with difficulty from the latter.

Distribution: Mexico and Oaxaca, Mexico (fig. 10).

MEXICO: without definite locality, coll. of 1787–1804, *Sessé, Mociño, Castillo & Maldoñado 855, 4939* (F, Madrid).

MEXICO: hill, Cañitas, District of Temascaltepec, Oct. 20, 1933, *Hinton 5027* (NY).

OAXACA: Las Sedas, 2080 m., Aug. 1, 1897, *Conzatti & Gonzalez* (G); Talea, Sept. 1844, *Galeotti 7247* (F, US, cotypes, M photo.); Yautepec, Jan. 6, 1896, *Seler 1729* (NY); Las Sedas, alt. 6000 ft., Sept. 1894, *Smith 841* (NY, US).

12. Rhus rubifolia Turcz., Bull. Soc. Nat. Moscou **31**[1]: 470. 1858.

Toxicodendron rubifolium Kuntze, Rev. Gen. Pl., pt. 1, p. 154. 1891.

Shrub; branches tan, dotted with prominent lenticels, subglabrous to sparsely pilose; leaves compound, petioles about 2 cm. long; leaflets 5–7, oval to ovate, thin, acute at apex, subcuneate at base, strongly revolute and entire-margined, dark, conspicuously pilose above, densely yellow-pilose below, terminal leaflet 2.5–5 cm. long, 1.3–3 cm. broad, subcordate, petiolules about 1 cm. long, lateral leaflets 2–4 cm. long, 0.8–2.2 cm. broad, sessile; rachis segments 1–2 cm. long; inflorescence a loose terminal compound spike in the axils of the upper leaves, exceeding the leaves in length, bracts broadly ovate, 0.9 mm. long, 1.5 mm. broad, obtuse at the apex, pilose on the outer surface, glabrous on the inner surface, ciliate with simple hairs, persistent; flowers numerous, sessile; sepals deltoid-ovate, 1.1 mm. long, scarcely as broad, glabrous on both surfaces, ciliate with simple hairs; petals pinkish in the dried state, deltoid-ovate to rhombic-ovate, 1.9 mm. long, 1.1 mm. broad, glabrous on the outer surface, sparsely pilose on the inner surface, ciliate; filaments as long as the sepals; anthers oval, 0.6 mm. long, about as broad; disk 1.5 mm. broad, lobed, pink.

Distribution: Oaxaca, Mexico (fig. 10).

MEXICO:

OAXACA: alt. 1750 m., July–Aug. 1900, *Conzatti & Gonzalez 1046* (US); coll. of 1840, *Galeotti 2515* (F photo., M photo.); Monte Alban, alt. 5500 ft., Nov. 24, 1894, *Pringle 583* (G); Monte Alban, Oct. 22, 1904, *Seler 4389* (G, US, M photo.); Monte Alban, Nov. 24, 1894, *Smith 321* in part (G).

12a. Rhus rubifolia var. **subcordata** (Turcz.) Engler in DC., Monogr. Phaner. **4**: 393. 1883.

Rhus subcordata Turcz., in Bull. Soc. Nat. Moscou **31**[1]: 470. 1858.

Branches gray to brown, at first pilose, later glabrate; leaves usually ternately compound, petioles 1–2 cm. long; leaflets usually 3, ovate, subacute, obtuse to subcuneate at base, thin, rugose, subentire, pilose above and beneath, dark and reddish above, yellowish-green beneath, petiolule of terminal leaflet 1–5 mm. long, lateral leaflets sessile or subsessile; rachis segments about 1 cm. long; inflorescence a very small, terminal, compact, compound spike about 2 cm. long and half as broad.

In the variety the leaflets are fewer than in the species, more cordate at the base, and the inflorescence is more compact.

MEXICO:

OAXACA: Villa Alta to Talea, alt. 1200 m., Feb. 20, 1919, *Reko 4021* (US); Monte Alban, near Oaxaca City, alt. 5500–6000 ft., 1894, *Smith 840* (M, M photo.); Sierra de San Felipe, alt. 7000–8000 ft., Oct. 10, 1894, *Smith 840b* (NY, US); Monte Alban, Nov. 24, 1894, *Smith 321* in part (G).

13. Rhus Barclayi (Hemsl.) Standl., Contr. U. S. Nat. Herb. **20**: 218. 1919.

Rhus terebinthifolia var. *Barclayi* Hemsl., Biol. Cent.-Am. Bot. **1**: 219. 1880.

Branches tan, glabrate; leaves compound, petiole 2–5 cm. long; leaflets about 9, thin, broadly lanceolate, revolute and entire-margined, dark green and dullish above, lighter below, acuminate at apex, subcordate to subcuneate at base, lateral leaflets 2–7 cm. long, 1–3 cm. broad, with petiolules 0.1–0.7 cm. long, terminal leaflets usually smaller, with petiolules about 0.5 cm. long; rachis segments 1–2.5 cm. long; inflorescence a diffuse, compound spike, terminal and in the axils of the uppermost leaves, bracts deltoid-ovate, 1.8 mm. long, 0.8 mm. broad, glabrous on both surfaces, ciliate with simple hairs near the base, persistent; flowers numerous, sessile; sepals deltoid-ovate, 1.5 mm. long, 1 mm. broad, puberulent at base on the outer surface, ciliate with simple hairs; petals whitish in the dried state, ovate, about 2 mm. long, 1 mm. broad, glabrous on the outer surface, pubescent on the inner surface, sparsely ciliate; filaments shorter than the sepals; anthers round; fruit red, pubescent with simple and glandular hairs.

This species is a west-coast relative of *Rhus terebinthifolia,* but differs from that species in having a coarse pubescence scattered over the leaflets, a glabrous stem, and non-ciliate floral bracts.

Distribution: Jalisco and Tepic, Mexico (fig. 10).
MEXICO:

JALISCO: Arroyo Seco Canyon, trail from San Sebastian to Arroyo Seco, Sierra Madre Occidental, alt. 1500 m., Jan. 8, 1927, *Mexia 1433* (CA, Calif, F, M, NY, US).

TEPIC: Sierra de Nayarit, Feb. 10, 1927, *Jones 23130* (Calif, M, NY), Feb. 14, 1927, *22887* (CA, Calif, F, G, NY), Feb. 15, 1927, *22886* (Calif, F); between Colomo and Arroyo Juan Sanchez, alt. 800–2000 ft., April 6, 1897, *Nelson 4166* (US); Jan. 5–Feb. 6, 1892, *Palmer 1907* (F, G, M photo., NY, US).

14. Rhus Palmeri Rose, Contr. U. S. Nat. Herb. **1**: 95. 1891.

Shrub 1.5–2 m. high; branches brown, pubescent; leaves compound, petioles about 1.5 cm. long, stout; leaflets about 11, thin, oblong-lanceolate, 3–5 cm. long, 1–2 cm. broad, falcate, acute at apex, submucronate, more or less unequal at the cuneate or subcuneate base, revolute-margined, entire, dark green, dull, and pubescent above, lighter and densely pubescent beneath, short-petiolulate to subsessile, terminal petiolule about 0.8 cm. long, lateral petiolules 0.5–2 mm. long; rachis segments about 1.3 cm. long; inflorescence a loose, mostly terminal, compound spike, bracts deltoid-oval, 1.2 mm. long, 1 mm. broad, rounded at the apex, pilose on both surfaces, ciliate with simple hairs; flowers numerous, sessile, each flower subtended by a bract and two bracteoles; fruit 5 mm. long, 6 mm. broad, red, pubescent with simple and glandular hairs.

This species is a subcanescent shrub, having about 9–11 rather large leaflets and a small terminal inflorescence. Its affinity is with *Rhus jaliscana* and *R. terebinthifolia.*

Distribution: Sonora, Sinaloa, and Durango, Mexico (fig. 10).
MEXICO:

DURANGO: Sianori, 1924, *Ortega 5385* (G, US); San Ramon, April 21–May 18, 1906, *Palmer 159* (US).

SINALOA: moist places, Cerro del Palo Solo, San Ignacio, alt. 700 m., May 14, 1919, *Montes & Salazar 832* (US); Balboa, Jan. 1923, *Ortega 4984* (US).

SONORA: Sierra de Los Alamos, March 25–April 8, 1890, *Palmer 321* (US **type**, M photo.); near Alamos, high up in the Sierra de Alamos, March 19, 1910, *Rose 13100* (G, NY, US).

15. Rhus costaricensis Riley, Kew Bull. Misc. Inf. for 1922, p. 184. 1922.

Rhus terebinthifolia var. *pilosissima* Loesen., Bull. Herb. Boiss., II. **6**: 836. 1905.

Shrubs; branches maroon-colored, obscured by a dense ferruginous pilosity, dotted with prominent lenticels; leaves compound, petioles about 2.3 cm. long, stout; leaflets 5–9, thin, elliptic-ovate, acute at apex, obtuse at base, revolute-margined, entire, sparsely pilose, dark, almost shining above, lighter and dull, ferruginous-pubescent below, terminal leaflet 3.5–5 cm. long, 1.8–2.6 cm. broad, somewhat decurrent on the 0.5-cm. long petiolule, lateral leaflets 3.2–5 cm. long, 1.4–2.5 cm. broad, sessile or subsessile; rachis segments about 1.4 cm. long; inflorescence a strictly terminal, compound spike 12 cm. long, 17 cm. broad, bracts broadly ovate, 1 mm. long, about as broad, acute at the apex, sparsely pilose on the outer surface, glabrous on the inner surface, ciliate with simple hairs, persistent; flowers numerous, sessile; sepals deltoid-ovate, acute, about 1.2 mm. long and broad, glabrous on both surfaces, ciliate with simple hairs; petals tan-white in the dried state, oval to ovate, 1.5 cm. long, 1 cm. broad, glabrous on the outer surface, pilose on the inner surface, ciliate with very long (0.5 mm.) simple hairs; filaments as long as sepals; anthers oval, about 0.5 mm. in diameter; fruit 7 mm. long, 8 mm. broad, red, pubescent with simple and glandular hairs.

This is a densely canescent and rather distinct species. Several specimens of intermediate character between this species and *Rhus integrifolia* were found, which probably are due to hybridization.

Distribution: Guerrero to Chiapas, Mexico, south to Costa Rica (fig. 10).

MEXICO:

CHIAPAS: Comitan, 1620 m., June 11, 1906, *Cook 83* (US); Tuxtla Guttierrez, Jan. 11, 1926, *Juzepczuk 1473* (F); between Llunir and Zoteapa, Jan. 13, 1926, *Juzepczuk 1520* (F); between Arriaga and Pichucalco, Jan. 21, 1926, *Juzepczuk 1846* (F); between San Cristobal and Teopisca, alt. 6700–8500 ft., Dec. 4, 1895, *Nelson 3451a* (F, US).

GUERRERO: between Petatlen and Chilapa, alt. 5000–6500 ft., Dec. 15, 1894, *Nelson 2148* (G, US).

CENTRAL AMERICA:

GUATEMALA: coll. of 1892, *Heyde 549* (US); ALTA VERAPAZ: Cobán, Jan. 1908, *von Tuerckheim II 1506* (US); HUEHUETENANGO: Jacaltenango, May 31, 1905, *Cook 55* (US); SANTA ROSA: Carrizal, alt. 5000 ft., Jan. 1893, *Heyde & Lux (Donnell Smith 4330)* (G, NY, US).

SALVADOR: SAN VICENTE: Volcan de San Vicente, alt. 1200–1500 m., March 7–8, 1922, *Standley 21530* (NY, US).

HONDURAS: COMAYAGUA: El Playon, San Luis, alt. 3500 ft., May 20, 1932, *Edwards P-257* (F); hills above the plains of Siguatepeque, near El Achote, alt. 1350 m., Aug. 5, 1936, *Yuncker, Dawson & House 6344* (F); COPÁN: El Cordoncillo, Agua Fria Valley, near Copán, alt. 700 m., Jan. 7, 1907, *Pittier 1825* (US).

COSTA RICA: Tablazo, alt. 1800 m., Jan. 23, 1935, *Valerio 1038* (F); Cartago, alt. 4250 ft., March 1888, *Cooper 348 (Donnell Smith 5729)* (F, G, M, NY, US); El Llamo, alt. 1400 m., 1926, *Rojas 203* (US); SAN JOSÉ: banks of Rio Virilla, alt. 1100 m., Dec. 1895, *Tonduz 9823 (Donnell Smith 6999)* (F, G, M, NY, US, cotypes).

16. Rhus terebinthifolia Schlecht. & Cham., Linnaea **5**: 600. 1830.

Toxicodendron terebinthifolium Kuntze, Rev. Gen. Pl., pt. 1, p. 154. 1891.

Shrubs 1.5–3 m. high; branches ferruginous-pubescent to subglabrous; leaves compound, petioles 1–2.5 cm. long, slender; leaflets 3–11, thin, elliptical to lanceolate, acute, mucronate or acuminate at the apex, subcuneate and unequal at the base, revolute-margined, entire, sparsely pilose above and beneath, dark and almost shining above, duller and paler beneath, terminal leaflet 2–3.5 cm. long, 0.8–1.2 cm. broad, decurrent and subsessile, lateral leaflets 2–4.5 cm. long, 0.7–1.5 cm. broad, sessile or subsessile; rachis segments 1–2 cm. long; inflorescence a slender, compound spike, terminal and axillary to the upper leaves, exceeding the leaves in length, 9 cm. long, 10 cm. broad, bracts broadly ovate, 1 mm. long, about as broad, acute at the apex, sparsely pilose in the center on the outer surface, glabrous on the inner surface, ciliate with simple hairs, persistent; flowers numerous, sessile, sepals deltoid-ovate, 1 mm. long, about as broad, glabrous on both surfaces, ciliate with simple hairs, light green; petals white in the dried state, deltoid-ovate, about 1.5 mm. long, almost as broad, glabrous on both surfaces, ciliate; filaments about as long as the sepals; anthers oval, 0.5 mm. long, about as broad; disk 1.5 mm. broad, white, lobed; fruit 6 mm. broad, 5 mm. long, red, pubescent with simple and glandular hairs.

This species hitherto has been frequently misinterpreted, and as a result most of the specimens of the section PSEUDOSUMAC collected until quite recently have been referred here.

The leaves are shining, but pubescent on the veins, and in herbarium material are often blackened.

Distribution: Tamaulipas to Guerrero, in Mexico, south to Costa Rica (fig. 10).

MEXICO: coll. of 1791, *Haenke 1504* (F); coll. of 1905, *Lemmon* (Calif, US); Mirador, Oct. 11, 1841, *Liebmann 29* (G, M, NY), Feb. 3, 1842, *31* (G), coll. of 1841–1843, *284* (Calif, US).

CHIAPAS: Canjób, April 30, 1904, *Goldman 917* (US); between San Cristobal and Teopisca, alt. 6700–8500 ft., Dec. 4, 1895, *Nelson 3464* (G, US).

GUERRERO: Acapulco, coll. of 1791, *Haenke 1245* (F).

PUEBLA: Pahuatlán, March 1914, *Salazar* (US).

TAMAULIPAS: Juamave, Feb. 3, 1932, *von Rozynski 784* (F, NY).

VERA CRUZ: Valle de Cordoba, Dec. 15–16, 1865, *Bourgeau 1476* (G, US), Feb. 2, 1866, *1892* (G); Canton de Huatusco, alt. 1200 m., Dec. 1898, *Conzatti 826* (US); Orizaba, Sierra de San Cristobal, 1853, *Mueller 1082, 1281* (NY); Zacuapan and vicinity, Oct. 1906, *Purpus 2279* (Calif. F, G, M, NY, US); in the woods of Papantla, Jan. 1829, *Schiede 715* (F, G, M, **cotypes**).

CENTRAL AMERICA:

GUATEMALA: Sept. 1927, *Morales 769* (US); Dec. 26, 1896, *Seler 3296* (G); ALTA VERAPAZ: in scrub, Cobán, alt. 4000 ft., Aug. 28, 1920, *Johnson 628* (US); Cobán, alt. 4300 ft., Feb. 1886, *von Tuerckheim (Donnell Smith 340)* (F, G, NY, PA, US), alt. 1350 m., Jan. 1908, *II 1506* (F, M); BAJA VERAPAZ: near Rosa, alt. 1600 m., May 6, 1906, *Cook 9* (US, M photo.); San Augustin, Sierra de las Minas, Jan. 15, 1908, *Kellerman 7620* (F); CHIMALTENANGO: Nov. 2, 1936, *Alameda 236* (F); ESCUINTLA: Santa Lucia, alt. 5200 ft., Oct. 1922, *Salazar 97* (US); QUICHÉ: San Miguel, Uspantán, alt. 6000 ft., April 1892, *Heyde & Lux 517 (Donnell Smith 3277)* (G, M, NY, US).

SALVADOR: MORAZÁN: Sierra de Osicala, 1929, *Calderon 2500* (F, US); SAN VICENTE: Volcán de San Vicente, alt. 1200–1500 m., March 7–8, 1922, *Standley 21530* (G).

HONDURAS: Yoro, alt. 2800 ft., Feb. 5, 1934, *Edwards 754* (F).

COSTA RICA: CARTAGO: Cerro de La Carpintera, alt. 1500–1850 m., Feb. 1924, *Standley 35476* (US); Dulce Nombre, alt. 1400 m., Feb. 27, 1924, *Standley 35833* (US).

16a. Rhus terebinthifolia var. **Loeseneri** Barkl., n. var.[1]

Leaflets large, stems and leaves glabrous.

The variety has larger leaflets than the species, and the entire plant is glabrous except for the coarse pubescence in the inflorescence.

CENTRAL AMERICA:

GUATEMALA: ALTA VERAPAZ: Tactic, Dec. 23, 1896, *Seler 3287* (G, NY, US **type**, M photo.).

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[1] **Rhus terebinthifolia** var. **Loeseneri** Barkley, n. var. Arbuscula cum foliolis magnis late lanceolatis glabra inflorescentia excepta.—Collected at Tactic, Alta Verapaz, Guatemala, Dec. 23, 1896, *Seler 3287* (US 1400804 **type**).

HONDURAS: COMAYAGUA: El Achote, near Siquatepeque, alt. 1500 m., Feb. 18–19, 1928, *Standley 56098* (F, US).

Section STYPHONIA (Nutt.) Barkley, n. sect.
Styphonia Nutt. in Torr. & Gray, Fl. N. Am. **1**: 220. 1838.
Neostyphonia Shafer in Britt., N. Am. Trees, p. 612. 1908.

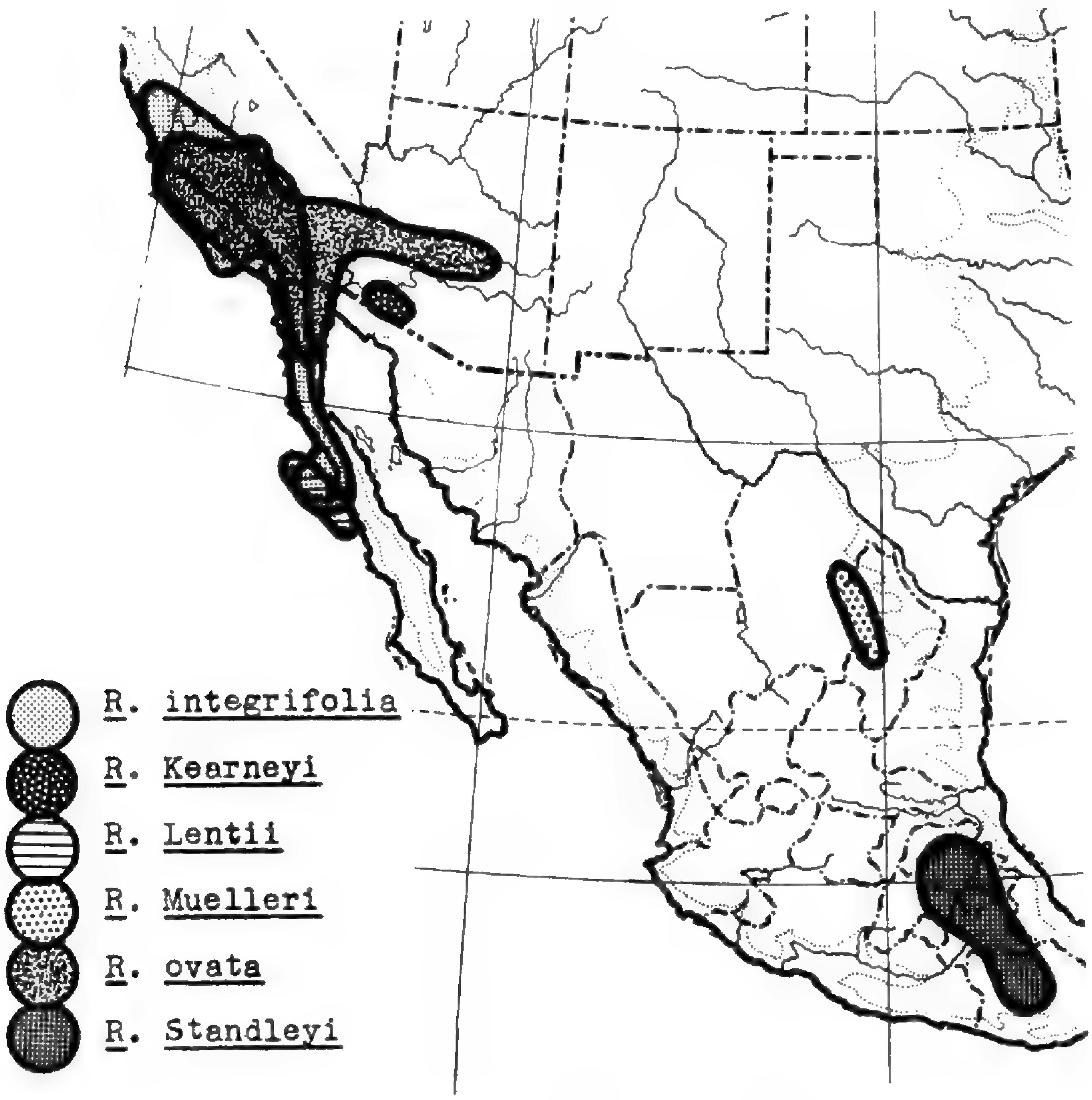

Fig. 13. The geographic distribution of the species in Section STYPHONIA.

Evergreen trees and shrubs with rigid, thickened branches. Flowers many, white or pink, in apically clustered spikes formed in autumn, expanding with the leaves, polygamo-dioecious, mostly sessile. Bracts of the inflorescence subovate and subacute to broadly lanceolate, mostly persistent, one bract and two bracteoles subtending each flower. Drupe red, flattened, broader than long, leaves simple or rarely trifoliolate, coriaceous, shining above, entire or often repand-serrate, glabrous to densely pubescent.

Southern Mexico to California (fig. 13).

Type species: **Rhus integrifolia** (Nutt.) Benth. & Hook. f. ex Rothrock in Wheeler's Rept. U. S. Geogr. Surv. **4**: 84. 1878 (*Styphonia integrifolia* Nutt. ex Torr. & Gray, Fl. N. Am. **1**: 220. 1838).

STYPHONIA is a very well-marked group of small evergreen trees having thick, simple leaves. The inflorescences are compact, compound, terminal spikes with large flowers about 6 mm. long. Most of the species have rather large fruits which are usually much compressed laterally. The species occur from southern California to southern Mexico.

KEY TO SPECIES AND VARIETIES

Inflorescence not spicate, bracts deciduous, flowers short-pedicellate; leaves glaucous, minutely short-appressed puberulent above, white hoary-tomentose beneath, margin not at all revolute........................*17. R. Lentii*

Inflorescence usually with dense spicate branches, bracts usually persistent, flowers sessile; leaves soft-tomentose or mostly glabrous, margin revolute.

- Leaves pilose with spreading hairs and with glandular pubescence on lower surface; bracts deltoid; leaves elliptic to orbicular, very short-petiolate or sessile.
  - Leaves densely pilose, margin strongly recurved, subsessile; bracts long-deltoid; petals not ciliate, pinkish, sepals rose-red; southern Mexico ....*18. R. Standleyi*
  - Leaves sparsely pilose, margin merely revolute, short-petiolate; bracts ovate-deltoid; petals ciliate, whitish, sepals whitish; northern Mexico ....*19. R. Muelleri*
- Leaves essentially glabrous at maturity; bracts ovate; leaves orbicular to ovate, petiolate.
  - Leaves obtuse or subacute, flat, more or less short-petiolate; fruit 9 × 11 mm.
    - Sepals and bracts ciliate with glandular hairs; leaves mostly oval, base cuneate to obtuse, not subcordate; California and Lower California.
      - Leaves obtuse; inflorescence compact.................*20. R. integrifolia*
      - Leaves subacute; inflorescence more or less diffuse.................. ....*20a. R. integrifolia* var. *cedrosensis*
    - Sepals and bracts ciliate, but not glandularly so; leaves mostly oblong-elliptic; base of leaves subcordate; Arizona..........*21. R. Kearneyi*
  - Leaves acute, often conduplicate, usually long-petiolate; fruit smaller.
    - Long-petiolate; sepals and bracts ciliate with simple hairs......*22. R. ovata*
    - Short-petiolate; sepals and bracts ciliate with simple and glandular hairs ....*22a. R. ovata* var. *Traskiae*

17. Rhus Lentii Kellogg, Proc. Calif. Acad. Sci. **2**: 16. 1863; Just's Bot. Jahresb. **21²**: 158, 654. 1893, as *R. Leutii.*

Toxicodendron Lentii Kuntze, Rev. Gen. Pl., pt. 1, p. 154. 1891.

Shrub 1.5–3 m. high; branches maroon, at first puberulent; leaves simple, coriaceous, rugose, blades orbicular or less often subovate, 1.5–6 cm. long, 1.2–5 cm. broad, obtuse at base and apex, or apex subacute, not at all revolute-margined, entire, upper surface gray-glaucous, minutely short-pubescent, lower surface tan, glaucous, densely white hoary-villous; petioles 0.2–4 cm. long, stout, pubescent; inflorescence a terminal open thyrsus about 3 cm. long, somewhat broader, bracts ovate, 1.75 mm. long, 1.75 mm. broad, acute-tipped, pubescent, early deciduous; flowers numerous, pedicellate; sepals subrotund, about 3 mm. long, two-thirds as broad, pilose on the outer surface and on the margin; petals yellowish in the dried state, obovate-rotund, about 4 mm. long, 3 mm. broad, essentially glabrous on the outer surface, sparsely long-pilose on the inner surface, ciliate with simple hairs; fruits red, pilose and glandularly hairy, 15 mm. long, 15 mm. broad, strongly flattened.

The morphology of this species is in several respects anomalous for the subgenus. Most outstanding is the inflorescence, which is a coarse terminal panicle. The floral bracts, while of the usual form for the subgenus, are usually deciduous. The fruit is much larger than in any other *Rhus*. On the other hand, many characters are such as to leave no doubt of its relationship to Styphonia, and it seems probable that it is a "primitive" type in this group.

Distribution: endemic on Cedros Island and in a limited area of Lower California (fig. 13).

MEXICO:

Lower California: San Pablo Point, June 22, 1897, *Anthony* (Calif); San Bartolome Bay, April 12, 1897, *Brandegee* (Calif), and March 13, 1911, *Rose 16212* (US); San Pablo Bay, Dec. 10, 1889, *Pond* (US); cedros island:—Aug. 4, 1922, *Anchorage & Hanna* (CA); July–Oct. 1896, *Anthony 98*, and March–June 1897, *305* (Calif, F, M, US); April 2, 1897, *Brandegee* (Calif); Turtle Bay, June 1, 1925, *Mason 1970*, and June 3, 1925, *1985* (CA, F, US); March 18–20, 1889, *Palmer 730* (Calif, F, ND, US); Dec. 8, 1888, *Pond* (ND), Feb. 1889 (US); March 10, 1910, *Rose 16049* (US); June 3, 1925, *Solis* 3 (US); 1905-1906, *Stewart 68* (CA); 1857, *Veatch* (CA **type**, M photo.).

18. Rhus Standleyi Barkl., n. nom.

Rhus mollis HBK., Nov. Gen. & Sp. **7**: 602. 1824, non Jacq. Fragm. Bot. Illustr., *pl. 115.* 1809.

Styphonia mollis Nutt. ex Torr. & Gray, Fl. N. Am. **1**: 220. 1838.

Toxicodendron molle Kuntze, Rev. Gen. Pl., pt. 1, p. 154. 1891.

Shrub or small tree, 1.5–5 m. high; branches maroon, hirsute; leaves simple, subsessile, thin, subrugose, broadly obovate, 4.5–8.5 cm. long, 2–5.5 cm. broad, cuspidate-acute or obtuse, rarely emarginate, auriculate, entire or rarely lobed near the base, strongly revolute-margined, upper surface bright green, shining through the soft pubescence, paler green beneath, villous, glandularly pubescent; inflorescence a terminal, very dense, compound spike about 5 cm. long, nearly as broad, bracts ovate to deltoid-lanceolate, 2.2–5 mm. long, 2 mm. broad, acute-tipped, pilose and glandularly haired, ciliate with simple hairs, persistent; sepals subrotund, about 2.5 mm. long, 1.5 mm. broad, pilose near the midrib and base on the outer surface, ciliate with long simple hairs, persistent; petals white to pinkish in the dried state, obovate-rotund, about 3 mm. long, 1.75 mm. broad, entirely glabrous, not ciliate; filaments slightly shorter than the sepals; anthers rotund, 0.8 mm. long and broad; fruit 7 mm. in diameter, flattened, red, pubescent with intermixed simple and glandular hairs.

This is an old, well-established, and very distinct species of southern Mexico, which has soft-pubescent, thin leaves with strongly revolute margins. The term *Rhus mollis* having been preoccupied, the author has renamed the plant after P. C. Standley of the Field Museum, Chicago.

Distribution: Hidalgo to Vera Cruz and Oaxaca (fig. 13).

MEXICO: without definite locality, coll. of 1868, *Hahn* (M).

HIDALGO: Dublan, alt. 6800 ft., Oct. 15, 1902, *Pringle 9711* (F, M, US).

MEXICO: between Tula and Cuantitlan, Jan. 6, 1849, *Gregg 600* (M); hills of Rio Hondo, alt. 7800 ft., Feb. 12, 1899, *Pringle 7725* (F, M).

OAXACA: Cerro San Antonio, alt. 1700 m., Oct. 1906, *Conzatti 1579* (US); Miahuatlan to Ejutla, alt. 2300 m., Dec. 15, 1906, *Conzatti 1640* (F, US); Cerro Santo Domingo, alt. 1000 m., Dec. 22, 1906, *Conzatti 1655* (F); Cerros de Nochixtlan, alt. 2200 m., Oct. 17, 1921, *Conzatti 4293* (US); Lomas de Las Sedas, Distrito de Etla, alt. 1950 m., Oct. 18, 1933, *Conzatti 4988* (M); near Oaxaca, alt. 6000 ft., Aug. 1894, *Pringle 4815* (B, Calif, F, M, ND, US); Parian, Nov. 27, 1895, *Seler 1487* (US); Las Sedas to Huitzo, Distrito de Etla, alt. 1900 m., Dec. 23, 1920, *Silvio & Conzatti 4100* (US); Las Sedas, alt. 6000 ft., Sept. 8, 1894, *Smith 840a* (M); Monte Alban, near Oaxaca City, alt. 5500–6000 ft., Oct. 1894, *Smith 839* (US), Nov. 1894, *739* (M, US).

PUEBLA: Acatzingo, near Puebla, Distrito de Tepeaca, alt. 1900–2110 m., July 1907, *Amable & Arsène 3597* (M, US); vicinity of Puebla, alt. 2330 m., Sept. 16, 1907, *Arsène 1907* (M, US); Acatzingo, 1908, *Arsène 9* (F); alt. 2330 m., Sept. 16, 1936, *Arsène 2066* (US); Tehuacan, Dec. 1841, *Liebmann 1484F* (Calif), *8664* (US), *14847* (F); Cepoxuchil, alt. 2330 m., Oct. 27, 1909, *Nicolas* (US), *5053* (US); near San Luis Tultitlanapa, near Oaxaca, July 1908, *Purpus* (Calif); Esperanza, April 1912, *Purpus 5819* (Calif, F, US); Tepeaca to Santa Rosa, June 27, 1899, *Rose & Hough 4721* (US); Tehuacan to Esperanza, Sept. 14, 1906, *Rose 11435* (US).

TLAXCALA: Santa Ana Chiantempan, near Puebla, alt. 2250 m., Nov. 14, 1907, *Arsène 1850* (US); Nov. 6, 1908, *Arsène* (M, US).

VERA CRUZ: Maltrata, Jan. 1883, *Kerber 246* (US).

19. **Rhus Muelleri** Standl. & Barkl., n. sp.[1] Pl. 19, fig. 1.

Shrub or small tree; new branches brown, puberulent, soon becoming furrowed and rough; leaves orbicular, 4.5–7 cm. long, 3.5–5.5 cm. broad, thin-coriaceous, obscurely repand-serrate or entire, more or less revolute-margined, obscurely puberulent above, somewhat puberulent and glandularly pubescent beneath, obtuse at apex, cordate or subcordate at base; petioles short, 2–4 mm. long; inflorescence a small, dense, terminal, compound spike, bracts broadly deltoid–ovate, densely pilose, more or less persistent; sepals ovate, 2 mm. long, 1.5 mm. broad, pilose on the outer surface, sparsely pubescent on the inner surface, ciliate with simple hairs; anthers ovate, 0.8 mm. long, filaments about 0.8 mm. long; fruit red, oblong, constricted at the ends, laterally compressed, pubescent with simple and glandular hairs.

This species is undoubtedly related to *Rhus Standleyi*, from which it differs in being so sparsely pilose as to appear glabrous, in having short petioles, merely revolute leaf-margins,

[1] **Rhus Muelleri** P. C. Standley & F. A. Barkley, n. sp. Arbuscula; foliis orbicularibus circiter 6 cm. longis 4.5 cm. latis sparse pilosis subtus glandulosis, marginibus obscure crenulato-serratis plus minusve revolutis; floribus in spicis parvis densisque terminalibus compositis dispositis, bracteis bracteolisque deltoideo-ovatis ciliatis persistentibus; floribus circiter 4.5 mm. longis; petalis ciliatis—Collected in mountains near Monterey, Nuevo Leon, Mexico, July 15, 1933, *C. H. & M. T. Mueller 328* (F **type**).

ovate-deltoid bracts, and ciliate petals. It is named after the collector, C. H. Mueller.

Distribution: Coahuila and Nuevo Leon (fig. 13).

MEXICO:

COAHUILA: northwest slopes of Sierra San Lázare, Municipio de Castaños, June 18, 1936, *Wynd & Mueller 169* (M).

NUEVO LEON: dry exposed ridge, Top o' World, mountains near Monterey, July 15, 1933, *Mueller 328* (F 683108 **type**).

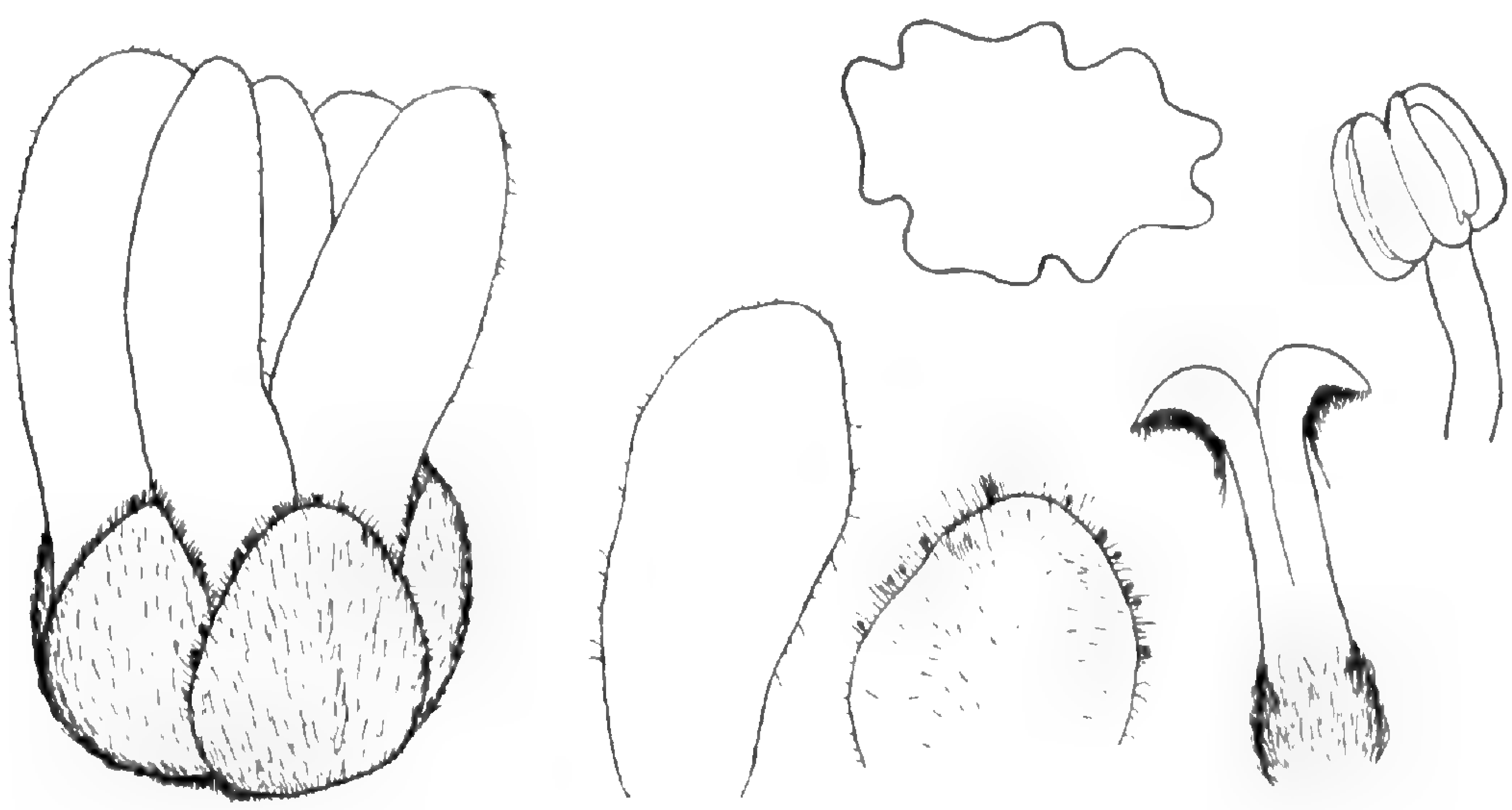

Fig. 14. Floral morphology of *Rhus Muelleri* Standl. & Barkl. × 10½.

20. Rhus integrifolia (Nutt. ex Torr. & Gray) Benth. & Hook. f. ex Rothr. in Wheeler's Rept. U. S. Geogr. Surv. **6**: 84. 1878; Benth. ex Engler in DC., Monogr. Phaner. **4**: 388. 1883; Engler, *ibid.*, p. 387, in part.

Rhus integrifolia var. *serrata* (Nutt.) Engler, *ibid.*, p. 388.

R. Hindsiana Engler, *ibid.*

Neostyphonia integrifolia Shafer in Britt., N. Am. Trees, p. 612. 1908.

Styphonia integrifolia Nutt. ex Torr. & Gray, Fl. N. Am. **1**: 220. 1838; Bentham, Bot. Voy. Sulphur **1**: 11. 1844.

S. serrata Nutt. ex Torr. & Gray, Fl. N. Am. **1**: 220. 1838.

Toxicodendron Hindsianum Kuntze, Rev. Gen. Pl., pt. 1, p. 154. 1891.

T. integrifolium Kuntze, *ibid.*

Shrub or small tree, 1–8 m. high; branches chocolate-brown, more or less obscured by a dense gray pubescence, later gray, glabrate, dotted with brown lenticels; leaves usually simple but sometimes trifoliolate, ovate, ovate-elliptic, or elliptic-lanceolate, 1.25–6.25 cm. long, 1–3.5 cm. broad, rounded-obtuse or rarely subacute, obtuse to subcuneate at base, subrevolute-margined, entire, or irregularly or regularly repand-serrate, upper surface scurfy-crustose, silvery, lower at first pubescent, yellowish-green; petioles 0.2–0.8 cm. long, stout, pubescent; inflorescence a small, terminal, compound spike 3 cm. long, slightly narrower, bracts broadly deltoid, 2–3.5 mm. long, about half as broad, densely non-glandular-pubescent on the outer surface but with a few glandular hairs interspersed, ciliate with glandular and non-glandular hairs, persistent; flowers numerous, sessile; sepals subrotund, about 3 mm. long, nearly as broad, glabrous except for the pilose base on the outer surface, ciliate with simple and glandular hairs; petals reddish in the dried state, obovate-rotund, about 3.75 mm. long, two-thirds as broad, pilose at the base on the inner surface, ciliate with simple hairs.

This species of the coastal regions of southern California and northern Lower California has thick-coriaceous leaves. The extreme variation in leaf-margin, from entire to regularly repand-serrate, early led to its interpretation as two species. This character, while apparently consistent in some specimens, is quite variable in others. The specimen on which *Rhus Hindsiana* is based has somewhat longer leaves than is typical, but all intermediate types have been observed and in other respects the specimens are typical. On Santa Catalina Island and in the Santa Monica Mountains variability in leaf form is much greater than in most of its other area of distribution. On Santa Catalina Island trifoliolate-leaved specimens are common. The variety is from Cedros Island, and has subacute leaves, more or less deciduous bracts, and inflorescences intermediate in type between those of the species and those of *Rhus Lentii.* Further study may show this variety to be a hybrid between *Rhus Lentii* and *R. integrifolia.*

Distribution: southern California and northern Lower California (fig. 13).
UNITED STATES:
CALIFORNIA: southwestern California, July 1902, *Grant 1356* (US); foothills

of the San Bernardino Mts., March 1881, *Parish 705* in part (Calif); Mojave, 1860–1861, *Cooper 376* (US); Claremont, April 1, 1904, *Baker 4156* (Calif); Santa Monica Exp. Sta., Jan. 1897, *Barber 289* (Calif); Santa Monica, July 3, 1904, *Berg* (Calif); Griffith Park, June 4, 1902, *Braunton 389* and *390* (US); Santa Monica Mts., *Clokey & Templeton 4605* (M); Santa Monica, Oct. 1896, *Davy 2769* (Calif); Las Flores Canyon, Santa Monica Mts., March 28, 1930, *Epling & Ellison* (M, US); Garvanza, May 1902, *Grant 1120* (F); Santa Monica, July 1902, *Grant 1118* (F); Pasadena, April 1904, *Grant 1120* (Calif); Claremont, July 7, 1898, *Hall 978* (Calif); Los Angeles, Sept. 1887, *Hasse* (F); Santa Monica Mts., Feb. 1890, *Hasse* (M); Los Angeles, Feb. 19, 1890, *Hasse* (US); Claremont, April 1912, *Howery* (M); San Gabriel, *Lobb 405* (K, M photo.); Tuna Canyon, Verdugo Hills, alt. 1100 ft., March 20, 1931, *MacFadden 10E* (Calif); Elysian Park, Los Angeles, March 13, 1901, *Setchell* (Calif); San Fernando Valley, alt. 650 ft., May 1, 1912, *Smith 4903* (F); SANTA CATALINA ISLAND:—Jan. 30, 1874, *Baker & Dall* (US), *17* (F, US); May 20, *Brandegee* (F); March 31, 1889, *Fritchey* (M); Avalon, June 16, 1936, *Hall 8288* (Calif); June and July, *Knopf 311* (F); Pebble Beach Canyon, March 2–April 10, 1921, *Knopf* (F), *10* (US), April 9, 1922, *273*, Aug. 6, 1922, *487, 488, 489*, and Aug. 1922, *490* (F); April 1885, *Lyon 233* (F, G); Hamilton Beach Canyon, Jan. 3, 1920, *Millspaugh 4533* (F); Cherry Valley, March 17, 1920, *Millspaugh 4800* (F); Pebble Beach, April 1, 1920, *Millspaugh 4915* (F); Schoolhouse Mountain, April 28, 1920, *Nuttall 13* (F); Cherry Cañon, June 12, 1912, *Smith 5090* (F); Pebble Beach Cañon, alt. 50 ft., June 18, *Smith 5116* (F); Nov. 1908, *Sudworth* (US); Avalon, Feb. 1896, *Trask* (US), *91* (F, US), Oct. 1896 (M), Dec. 1896 (Calif), April 1897 (US), April 1897, *95* and *103*, and Feb. 1898, *142* (F, US), in arroyas, Feb. 1898 (US), March 1898, *Trask*, in part (US), 1898, *248* and *418*, and Jan. 1901, *417*, (F, NY), March 1899, *249* (F, G), Feb. 1901 (ND), June 1896 (Calif);—near Soledad on Soledad River, Oct. 1903, *Sudworth* (US); Santa Ana Canyon, March 9, 1929, *Blankinship* (M); Orange Co., 1902, *Zumbro 387* (Calif); Wilder's Cañon, Jumba Hills, Riverside, Feb. 23, 1908, *Reed 2238* (Calif, F); Arcamorga Wash, east of Upland, alt. 1600 ft., March 10, 1917, *Johnston 60* (Calif); Mission Creek, San Bernardino, March 8, 1930, *Jones 26543* (ND); hills near Edelez, April 4, 1909, *Parish 6890* (Calif); low hills, San Bernardino, March 1881, *Parish 705* (F); Santa Margarita Ranch, near Ysidora, April 23, 1903, *Abrams 3307* (F, M); San Diego, Sept. 3, 1904, *Berg* (Calif); Coronado, Nov. 3, 1904, *Berg* (Calif); San Diego, March 1906, *Brandegee* (F), Oct. 1906 (Calif); San Clemente Island, Aug. 25, 1894, *Brandegee* (Calif, US); San Diego, March 10 and April 27, 1902, *Brandegee 818* (Calif, F, M, ND); near Las Flores, Feb. 5, 1933, *Bright & Wyman 8005* (US); old clearing, La Jolla, Feb. 23, 1914, *Clements 188* (F, M); San Diego, 1875, *Cleveland* (G, M photo.); Pacific Beach, near San Diego, June 19, 1915, *Collins & Kempton 192* (US); San Diego, March 12, 1891, *Dunn* (Calif); dunes at the Boundary Monument south of San Diego, Nov. 3, 1880, *Engelmann* (M); Point Loma, near San Diego, Nov. 6, 1880, *Engelmann* (M); Torrey Pines Reservation, alt. 50 m., April 10, 1924, *Fleming & Eggleston 19684* (M); San Diego, Nov. 1879, *James 1* (US); San Diego, March 9, 1882, *Jones 3046* (M); San Marcos, Feb. 1931, *Klensmith* (Calif); San Diego, *Nuttall* (G **type**, M photo.); Mission Cañons, San Diego, April 30, 1883, *Orcutt*, and Feb. 10, 1884 (F); San Diego, Feb. 23, 1885, *Orcutt 178* (ND), *1421* (M); San Diego, coll. of 1875, *Palmer 47* (F, G, M); La Jolla, alt. 25 ft., Dec. 15, 1928, *Parks 328* (Calif, M, US); San Diego, May 1852, *Thurber 562* (F, M); San Clemente Island, Oct. 1896, *Trask* (ND); San Clemente Island, Oct. 1902, *Trask 53* (US), *54* (US); near Torrey Pines Park, June 17, 1928, *Wiggins 3285* (Calif); near San Diego, *Wright 33* (Calif); near Pelican Bay, Santa Cruz Island, April 26, 1930, *Abrams & Wiggins 80* (Calif); Santa Ynez Mountains, Santa Barbara, 1888, *Brandegee* (Calif); Santa Cruz Island, April 1888, *Brandegee* (Calif); Pelican Bay, Santa Cruz Island, alt. 15 m., June 10, 1930, *Clokey 4994* (Calif); near Santa Barbara, May 16, 1908, *Eastwood 133* (Calif, F, M); Concepcion to Jalama, alt. 30 m., March 29, 1924, *Eggleston 19580* (US); Santa Barbara, May 1902, *Elmer 3898* (F, M, US); Santa Barbara, March 1884, *Green* (F); Santa Barbara, *Nuttall* (G type of *Styphonia serrata*, M photo.); Santa Barbara, May 26, 1906, *Roadhouse* (Calif); southeastern part of Ventura Co., alt. 15 m., March 1929, *Clokey & Templeton 4605* (Calif, M, US); Oxnard, 1901, *Davy 7809* (Calif).

MEXICO:

LOWER CALIFORNIA: March–June 1897, *318A* (M); Rosario, May 20, 1889, *Brandegee* (Calif); Canyon of Rio Antonio, between San Vicente and Johnston's ranch, March 1, 1934, *Ferris 8513* (NY); just south of San Vicente on road to Johnston's ranch, March 1, 1934, *Ferris 8514* (NY); San Quentin, 1841, *Hinds* (K type of *R. Hindsiana*, M photo.); Ensenada, April 7, 1921, *Johnston 3011* (CA); Tia Juana, Dec. 29, 1922, *Nelson 10033* (Calif); Santo Tomas, May 31, 1889, *Pond* (Calif); Ensenada, alt. 100 ft., Sept. 5, 1912, *Smith 5330* (F, M, US); 2 miles south of "Halfway House," 37 miles south of Tia Juana, Sept. 8, 1929, *Wiggins & Gillespie 3905* (F, M, US); CEDROS ISLAND:—Aug. 10, 1896, *Anthony* (Calif); summit of ridge, June 6, 1925, *Mason 2034* (CA, US); March 18–20, 1889, *Palmer 735* (US).

20a. Rhus integrifolia var. **cedrosensis** Barkl., n. var.[1] Pl. 20, fig. 1.

Small tree; leaves simple, ovate, subacute; inflorescence a spicate thyrsus, bracts ovate, mostly deciduous.

MEXICO:

LOWER CALIFORNIA: Cedros Island: June 6, 1925, *Mason 2039* (CA); March 11, 1911, *Rose 16134* (NY **type**, M photo, US).

21. Rhus Kearneyi Barkl., n. sp.[2] Pl. 19, fig. 2.

Small tree; new branches gray or tan, minutely puberulent, the older glabrate; leaves oblong-elliptic to oval, 2.5–5 cm.

[1] **Rhus integrifolia** var. **cedrosensis** Barkley, n. var. Arbuscula; foliis simplicibus ovatis subacutis; floribus multis in spicis plus minusve diffusis compositis; bracteis bracteolisque plus minusve deciduis—Collected on Cedros Island, Lower California, Mexico, March 11, 1911, *Rose 16134* (NY **type**).

[2] **Rhus Kearneyi** Barkley, n. sp. Arbuscula; foliis breve-petiolatis simplicibus glabratis integris oblongo-ellipticis vel ovatis circiter 5 cm. longis 3.5 cm. latis subacutis subcordatis; inflorescentiis terminalibus in spicis compositis parvis densis, bracteis bracteolisque ciliatis persistentibus; floribus circiter 5 mm. longis, sepalis ciliatis.—Collected in Tinajas Altas Mountains, Yuma Co., Arizona, March 29, 1930, *Harrison & Kearney 6573* (US **type**).

long, 1.5–3.5 cm. broad, coriaceous, entire, revolute-margined, glabrous except for a few glandular hairs, apex rounded to subacute, base subcordate to cordate; petioles short, 3–9 mm. long; inflorescence a small, dense, terminal, compound spike, bracts deltoid-ovate, subacute, densely pilose on both surfaces, a few glandular hairs on the outer surface, ciliate with simple hairs, persistent; sepals broadly deltoid, 2 mm. long, 2.5 mm. broad, ciliate with simple hairs, slightly pubescent on the outer

Fig. 15. Floral morphology of *Rhus Kearneyi* Barkl. × 10½.

surface, glabrous on the inner surface, persistent; petals rhombic ovate, 3.5 mm. long, 2 mm. broad, slightly pilose at the base on the outer surface; anthers oval, 1.5 mm. long; filaments 1 mm. long; fruit red, oblong, constricted at the ends, laterally compressed, 10 mm. long, 9 mm. broad, pubescent with simple and glandular hairs.

This interesting new species from the Tinajas Altas is apparently quite distinct. It is named in honor of Dr. T. H. Kearney, Bureau of Plant Industry, Washington, D. C. Its morphological relationships seem to be closest to *Rhus Standleyi* and *R. ovata.* It may be most easily distinguished from *R. ovata* by its oblong, short-petioled leaves which do not tend to fold along the midrib. Compared to *R. Standleyi* its leaves are much heavier and are glabrous.

Distribution: southern Arizona (fig. 13).

UNITED STATES:

ARIZONA: Tinajas Altas Mts., Nov. 20, 1913, *Goldman 2311* (US); Tinajas Altas Mts., March 29, 1930, *Harrison & Kearney 6573* (M, US **type**).

22. **Rhus ovata** Wats., Proc., Am. Acad. **20**: 358. 1885.

Rhus integrifolia Engler in DC., Monogr. Phaner. **4**: 388. 1883, in part.

Neostyphonia ovata Abrams, Bull. N. Y. Bot. Gard. **6**: 403. 1910.

Shrub or small tree, 1–10 m. high; branches chocolate-brown, at first puberulent, soon glabrate; leaves simple or rarely trifoliolate and then often imperfectly so, ovate-elliptic to broadly ovate, 5–8.5 cm. long, 3.5–5.5 cm. broad, coriaceous, glabrous, somewhat acuminate, acute, base cuneate to obtuse, margin usually entire and wavy, but often regularly or irregularly repand-serrate, subrevolute, the upper surface smooth, mottled green, darker than the lower surface; petioles purplish, usually 1.5–2 cm. long, stoutish, essentially glabrous; inflorescence a large, dense, terminal compound spike about 5 cm. long, 4.5 cm. broad, bracts ovate, 1.5 mm. long, 2 mm. broad, rose-colored, rounded at the apex, sparsely pubescent, glabrous on the inner surface, margin ciliate with non-glandular hairs; sepals oval, 2.5 mm. long, 2.5 mm. broad, rounded at the apex, glabrous except for the non-glandularly ciliate margin and outside at the base; petals broadly ovate, 5 mm. long, 2 mm. broad, glabrous on the outer surface, sparsely pilose at the base of the midrib on the inner surface, margin ciliate; anthers about 0.7 mm. broad, about twice as long; filaments slightly longer than the sepals.

While this species has larger, longer-petiolate leaves and smaller fruits than *Rhus integrifolia* and while the leaves are acute and tend to fold along the midrib, there is such similarity between the two species that they were for many years confused and both treated under the name *Rhus integrifolia.* Like that species, the leaves of *R. ovata* vary greatly in size, shape, and margin. In the Santa Monica Mountains and on Santa Catalina Island, they are often more or less trifoliolate. In the coastal regions of California they tend to be elliptic and cuneate at the base, while over the inland areas they tend to become broadly ovate and obtuse at the base. The variety of this species has shorter petioles and glandular-ciliate bracts and sepals. Further study may show this to be a hybrid between the species and *Rhus integrifolia.*

Distribution: central Arizona to southern California and northern Lower California (fig. 13).

UNITED STATES:

ARIZONA: Packard to Payson, Nov. 1, 1928, *Eastwood 16614* (CA); Prescott to Phoenix, Nov. 9, 1928, *Eastwood 16786* (CA); Prescott to Phoenix, Nov. 6, 1928, *McKelvey 346* (US); Tetso and Gila Rivers, April 27, 1867, *Palmer 36* (M), 1869 (US); Globe, Nov. 5, 1913, *Bailey* (US); Collom Camp, Mazatzal Mts., alt. 1200 m., *Collom 297* (M); Roosevelt to Payson, Oct. 25, 1928, *Eastwood 15843* (CA); Pinal Mts., from Globe to Clifton, Oct. 26, 1928, *Eastwood 15883* (CA); Superior-Miami road, *Kearney & Peebles 9248* (Calif); Gila Co., Aug. 31, 1935, *Little 4057* (ND); 18 miles from Globe on road to Roosevelt Reservoir, July 3, 1928, *Wolf 2481* (CA); Fish Creek, Apache Trail, May 19, 1919, *Eastwood 8776* (CA); Apache Trail, summit of Fish Creek Hill, April 2, 1932, *Gillespie* (US); *5573* (Calif); Fish Creek, June 14, 1916, *Jackson 29* (US); Aquarius Mts., May 14, 1931, *Eastwood 18373* (CA); Prescott Forest, June 19, 1921, *Jones* (Calif); Pine Creek, near Camp Verde, Aug. 26, 1891, *McDougal 669* (US), French Gulch, Senator Range, March 10, 1915, *Ruddock* (CA).

CALIFORNIA: southwest California, May 1901, *Grant 2443* (US); City Creek, Feb. 3, 1904, *Kellogg* (US); Coast Hills, Sierra Valley, May, 187?, *Lemmon 82* (F); Mountain Spring, eastern base of Coast Range, May 8, 1894, *Mearns* (US); foothills of the San Bernardino Mts., March 1881, *Parish 705* in part (Calif), April 1, 1888, *2018* (F); southern California, 1876, *Parry & Lemmon 42* (F); Coyote Canyon, Los Corotes, western borders of the Colorado Desert, April 1902, *Hall 2828* (Calif); east of Whitewater Ranch in dry wash of Colorado Desert, April 14, 1922, *Munz & Keck 5004* (Calif); near the "ridge road," west of Bakersfield, May 8, 1933, *Nelson 545* (M); Sepulveda Canyon, Santa Monica Mts., June 17, 1902, *Abrams 2559* (F, M); Santa Monica Mts., May 30, 1930, *Anderson & Epling* (Calif, M, US); hills near Monrovia, April 3, 1903, *Baker 4147* (Calif, F, M); Santa Monica Canyon, winter 1897, *Barber 311* (Calif); Wilson Trail, alt. 1400 ft., Mt. Wilson, Aug. 31, 1910, *Blake 824* (F); Pasadena, May 1890, *Brandegee* (Calif); Sherman, May 27, 1902, *Braunton 360* (US); Claremont, May 1912, *Burnell* (M); alluvial bottom, Santa Monica Mts., alt. 200 m., April 1929, *Clokey & Templeton 4431* (Calif, M, US); hillsides, Santa Monica Mts., March 29, 1916, *Crawford & Hiatt* (M); Topanga Canyon, May 8, 1926, *Epling* (M); Topanga Canyon, Santa Monica Mts., May 18, 1929, *Epling & Ellison* (Calif, M, US); above Calabasas, Santa Monica Mts., alt. 1200 ft., May 16, 1931, *Ewan 4203* (M); Santa Monica, June 1890, *Hasse*, June 1891 (M), and June 5, 1891 (US); Eagle Rock, April 23, 1912, *Smith 4812* (F); SANTA CATALINA ISLAND:—May 1890, *Brandegee* (Calif); Silver Canyon, May 29, 1936, *Nuttall 281* (F); Avalon, Sept. 1896, *Trask* (M), April 1897 (US), Aug. 1897 (M), Nov. 1897 (US), 1898 (CA, M), March 1898 (M), March 1898, *92* (F, US), coll. of 1898, *414* (F), March *1901* (US), *39, 415, 435* (F), March 1901 (M), May 1901, *413* (F), and March 1911 (M);—Santa Ysabel, April 2, 1893, *Henshaw 191* (US); 1.5 miles below Trabuco Camp Grounds, Trabuco Canyon, west slope of Santa Ana Mts., March 6, 1931, *Wolf (1857)* (Calif); Nuevo, April–June 1894, *Brandegee* (Calif); 2 miles east of Pinyon Flat, Santa Rosa Mts., alt. 3500 ft., July 3, 1933, *Duran 3498* (Calif, M); Temescal, April 9, 1898, *Hall 875* (Calif); east slope of San Jacinto Mts., alt. 800 m., March 22, 1898, *Leiberg 3162* (US); Glen Ivy, May 18, 1932, *Munz & Johnson 5327* (Calif); Asbestos Mountain, at side of Santa Rosa Mountain, alt. 4400 ft., Oct. 8, 1912, *Smith 5479* (F); Idyllwild, San Jacinto Mts., alt. 5000 ft., Aug. 1925, *Spencer 287* (Calif); Banning, Sept. 27, 1894, *Toumey* (Calif); Morongo Pass, near Riverside County line, alt. 500 ft., March 3, 1929, *Braunton 1026* (Calif); between San Bernardino and Martin's ranch on the road to Cajon Pass, alt. 400 m., Jan. 3, 1911, *Coville & Funston 110* (US); Mission Creek, March 8, 1930, *Jones 26543* (M); Reche Canyon, April 1, 1888, *Parish 2018* (Calif, M); foothills at Redlands, April 20, 1891, *Parish 2202* (US); Waterman Canyon, San Bernardino Mts., alt. 2500 ft., June 29, 1894, *Parish 3490* (M, US); near San Bernardino, alt. 1000–1500 ft., April 5, 1895, *Parish 3631* (Calif, ND); Reche Canyon, San Bernardino Valley, alt. 360–400 m., March 13, 1908, *Parish 6802* (Calif, F); dry mesas, near base of mountains, San Bernardino Valley, alt. 300 m., June 8, 1917, *Parish 11336* (Calif); foothills, San Bernardino, March 1881, *Parish 705* (US); hills, Campo Creek, between Campo and Potrero, June 3, 1903, *Abrams 3719* (M, US); Twinoak, June 11, 1900, *Bailey 304* (US); coll. of 1898, *Barrows* (Calif); mountains of San Diego, *Brandegee* (Calif); Ramona, May 29, 1894, *Brandegee* (Calif); near Banner, April 1898, *Brandegee* (Calif); Warner Springs, April 9, 1913, *Eastwood 2160* (US); Fall Brook, March 28, 1882, *Jones* (US), *3318* (M); Mountain Spring, May 10, 1894, *Mearns 2987*, and May 14, 1894, *3148* (US); summit of Wagon Pass, Coast Range, May 15, 1894, *Mearns 3200* (US); San Felipe Valley, April 15, 1927, *Meyer 80* (Calif); Mission Canyons, San Diego, April 30, 1883, *Orcutt* (F), *98* (M); San Diego, April 23, 1885, *Orcutt* (US); Pala, April 1881, *Parish 551* (F); Jacumba Hot Springs, near Monument 233, May 17, 1894, *Schoenfeldt 3234*, and May 24, 1894, *3264* (US); near San Diego, alt. 1900 ft., April 8, 1916, *Spencer 137* (Calif, US); San Diego, coll. of 1922, *Woodcock* (F); in Santa Ynez Mts., near Santa Barbara, 1888, *Brandegee* (Calif); Santa Cruz Island, April 1888, *Brandegee* (Calif); Santa Barbara, coll. of 1891, *Dunn* (Calif); Painted Cave Ranch, near Santa Barbara, May 9, 1908, *Eastwood 78* (Calif, F, M, US); Santa Ynez Mts., near Santa Barbara, Aug. 1902, *Elmer 3904* (F, M, US); Santa Cruz Island, July and Aug. 1886, *Greene* (F, ND).

MEXICO:

LOWER CALIFORNIA: San Pedro Martin, May 6, 1893, *Brandegee* (Calif); road from Mexicali to Tiajuana, alt. 3000 ft., March 1932, *Cota* (Calif); La Huerta, at the west base of Hanson Laguna Mts., alt. 2800 ft., June 2, 1905, *Goldman 1120* (US); mountains, Sept. 11, 1884, *Orcutt* (Calif); Palm Valley, northern Lower California, April 8, 1885, *Orcutt 137* (ND); near Santo Tomas, July 15, 1885, *Orcutt 1425*, April 12, 1886, and *1423* (M); Nochoguero Valley, June 4, 1894, *Schoenfeldt 3430* (US).

22a. Rhus ovata var. **Traskiae** Barkl. n. var.[1] Pl. 20, fig. 2.

Small tree, 3–6 m. high; branches brown, at first puberulent, soon glabrate; leaves simple, ovate to ovate-elliptic, bluntly acute, bluntly cuneate at base, upper surface dull-glaucescent, yellowish beneath; bracts of the inflorescence broadly ovate, densely pubescent at the base on the outer surface, ciliate with simple and glandular hairs.

UNITED STATES:

California: Avalon, Santa Catalina Island, April 1897, *Trask* (US), March 1898 (M **type**, US).

Section Pseudoschmaltzia Barkley, n. sect.

Shrubs or small trees, with branches at first covered with a gray or yellow-gray puberulence or pilosity. Flowers many, whitish, typically in stout, lateral, compound spikes shorter than the subtending leaves, often also with a terminal inflorescence, polygamo-dioecious, sessile and subtended by a bract and two bracteoles; bracts and bracteoles deltoid-lanceolate or broadly ovate and persistent. Drupes red or orange, somewhat flattened; seed bony, oval, flattened, smooth. Leaves alternate, imparipinnate with 3–15 persistent leaflets; leaflets more or less subcoriaceous, revolute or not, glabrous, glaucous, or pubescent, often smooth and shining above, but sometimes dull; rachis and petiole usually stout, in most species not winged, lateral leaflets usually short-petiolulate.

Texas to Arizona, south to Guatemala (fig. 16).

Type species: **Rhus virens** Lindh., Bost. Jour. Nat. Hist. [Pl. Lindh. II] **6**: 159. 1850.

[1] **Rhus ovata** var. **Traskiae** Barkley, n. var. Arbuscula 3–6 m. alta; foliis simplicibus breve-petiolatis ovatis vel ovato-ellipticis subacutis supra subglaucis infra flavo-viridibus; bracteis late ovatis ciliatis cum pubescentia simplici et glandulifera. —Collected at Avalon, Santa Catalina Island, California, March 1898, *Trask* (M **type**).

PSEUDOSCHMALTZIA is a group of easily definable species, which are mostly shrubs having imparipinnate, evergreen leaves, and stout, either terminal or lateral, compound spikes. There seems to be a well-marked relationship between this group and STYPHONIA.

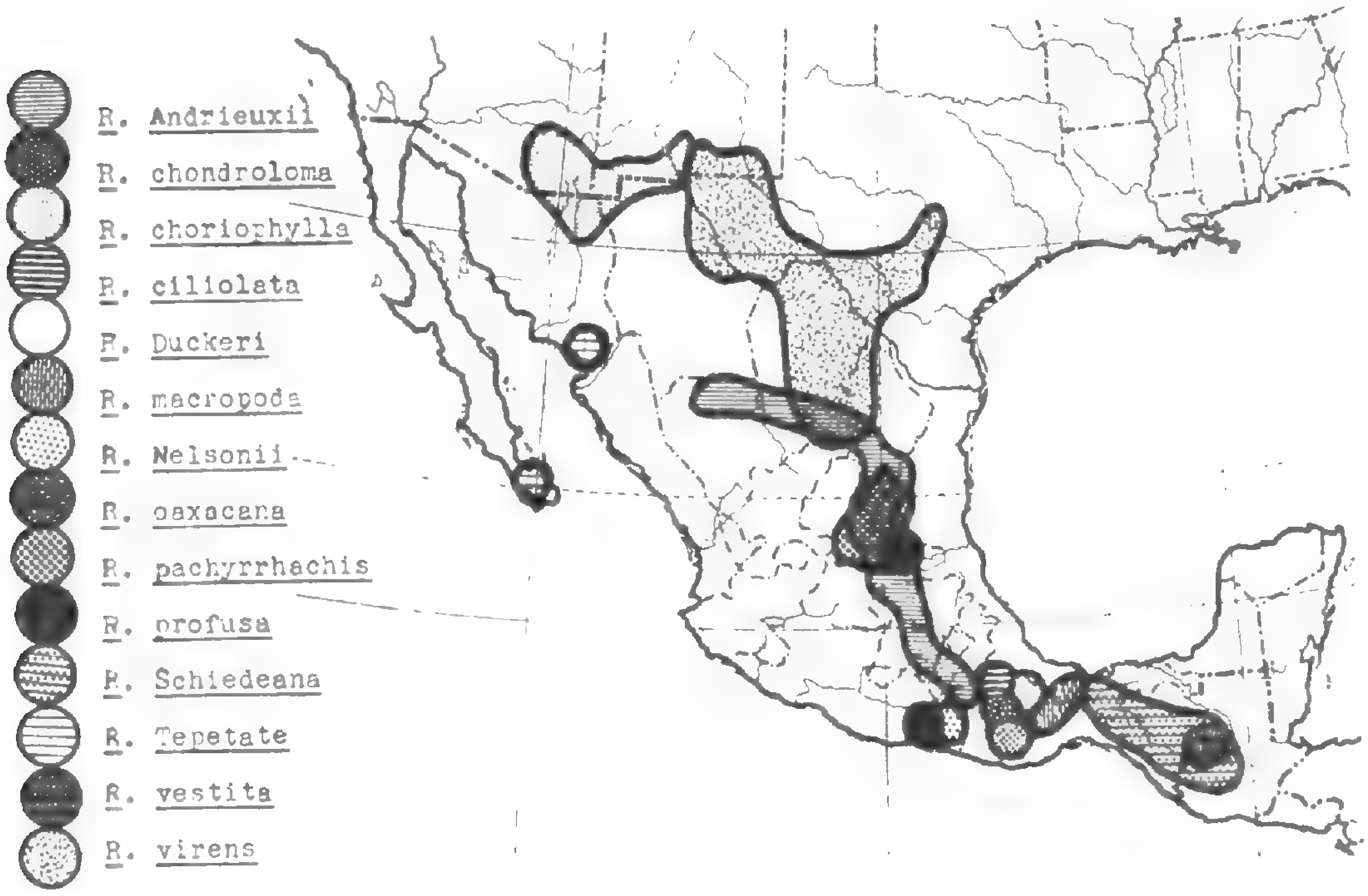

Fig. 16. The geographic distribution of the species in Section PSEUDOSCHMALTZIA.

KEY TO SPECIES AND VARIETIES

Rachis narrowly winged; leaflets usually 3–5, terminal usually much larger than lateral ones.
  Stems and leaves glabrous; leaflets mostly obovate, abruptly truncate...... ....*23. R. chondroloma*
  Stems and leaves with a dense spreading pubescence; leaflets mostly ovate, rounded..*24. R. Duckeri*
Rachis not winged; leaflets 3–13, terminal usually smaller than lateral ones.
  Stems and upper leaf surfaces, at least in the early stages, with a dense spreading pubescence.
    Leaflets mostly oblong, not strongly acuminate.
      Upper leaf surface dull green; from northeastern Mexico............ ....*25. R. pachyrrhachis*
      Upper leaf surface lustrous; from Chiapas and Guatemala.
        Pubescence on upper surface of leaflets confined to the veins........ ....*26. R. vestita*
        Pubescence on upper surface of leaflets not confined to the veins.... ....*26a. R. vestita* var. *Ghiesbreghtii*

Leaflets lanceolate to ovate-lanceolate, strongly acuminate.
Pubescence on upper leaf surface soft and diffuse; inflorescence about 10 cm. long..*27. R. Nelsonii*
Pubescence on upper leaf surface not soft, mostly confined to the veins; inflorescence about 5 cm. long........................*28. R. oaxacana*
Stems and upper leaf surfaces glabrous or puberulent, rarely glaucous.
Lateral leaflets 4 cm. long or less; branches relatively slender; leaflets sparsely pubescent or glabrous beneath.
Leaflets sparsely pubescent below, soft to the touch; inflorescences few, usually terminating the branches.......................*29. R. virens*
Leaflets glabrous, not soft to the touch; inflorescences usually numerous, both axillary and terminal.
Leaflets 3–5, ovate to ovate-lanceolate, mostly more than 3 cm. long, subacuminate, not distinctly shining above, terminal leaflets usually slightly larger than lateral ones; range mostly limited to Arizona and New Mexico......................*30. R. choriophylla*
Leaflets 5–13, ovate, mostly less than 3 cm. long, acute, distinctly shining above, terminal leaflets usually not larger than lateral ones; Mexico................................*31. R. Andrieuxii*
Lateral leaflets more than 4 cm. long; branches relatively stout; leaflets sparsely puberulent or glabrous beneath.
Leaflets sessile or very short-petiolulate, subacute to acute.
Leaflets ovate-lanceolate, mostly reddish above, apex subacute, base rounded or cuneate, slightly oblique; southern Mexico and Guatemala...*32. R. Schiedeana*
Leaflets oblong-ovate or oblong-obovate, green above, apex obtusish or abruptly acute, base subcuneate, lowermost subcordate, oblique; northern Mexico: Sonora and Lower California...*33. R. Tepetate*
Leaflets petiolulate, acuminate or subacuminate.
Inflorescence axillary; leaflets usually 5, acuminate; reticulum of small veins obscure............................*34. R. macropoda*
Inflorescences terminal and axillary; leaflets usually 3 or 9, long-acuminate, reticulum of small veins conspicuous.
Leaflets usually 3, mostly ovate......................*35. R. ciliolata*
Leaflets usually 9, mostly lanceolate..................*36. R. profusa*

23. Rhus chondroloma Standl., Field Mus. Bot. Ser. **11**: 164. 1936.

Branches dark brown, minutely cinereous-puberulent; leaflets 3–7, coriaceous, shining on both surfaces, subrevolute and distinctly white-corneous margined, entire, at first inconspicuously glaucous-puberulent above and minutely pubescent below, later glabrate on both surfaces, bluish-gray above, paler below, conspicuously pallid-veined, subtruncate to emarginate at apex, cuneate to rounded at base, terminal leaflets distinctly obovate to obcordate, decurrently long-subpetiolulate, 1.7–4 cm. long, 2–3 cm. broad, lateral leaflets elliptic-ovate, sessile or subsessile, 1.5–4 cm. long, 1–2.5 cm. broad; petioles 1–2.5 cm. long, wingless, subterete, minutely puberulent or glabrate, rachis segments 1–2.5 cm. long, stout, often narrowly winged; inflorescence a terminal, small, compound spike about 4 cm. long and broad, bracts ovate-deltoid, 1 mm. long, 1.5 mm. broad, with simple and glandular hairs on the outer surface, glabrous on the inner surface, ciliate with long simple hairs; sepals rotund, 1.2 mm. in diameter, glabrous, not ciliate; petals in the dried state whitish, oval, 2 mm. long, 1.3 mm. broad, glabrous, not ciliate; filaments shorter than sepals; anthers rectangular, 0.75 mm. broad, about as long; styles 3, more or less distinct.

It seems incredible that such a well-marked species should have remained in herbaria undescribed for thirty years. The obovate, coriaceous leaflets with their shining surface and whitened margin make the species distinctive. In some respects it stands intermediate between sections PSEUDOSCHMALTZIA and STYPHONIA.

Distribution: Puebla (fig. 16).
MEXICO:
PUEBLA: Tehuacan, June 1905, *Purpus 1290* (Calif, F **type**, M, NY); El Riego, June 1912, *Purpus 5838* (Calif).

24. Rhus Duckeri Barkl., n. sp.[1] Pl. 21.

A shrub with branches at first maroon-colored, covered with a dense gray tomentum and numerous maroon-colored lenticels; leaflets usually 3–5, oval or obovate, submucronate at the apex, rounded or subcuneate at the base, thin-coriaceous, subrevolute, entire-margined, soft-pubescent above and below, dark and shining above, lighter and dull below, terminal leaf-

[1] **Rhus Duckeri** Barkley, n. sp. Arbuscula; foliis imparipinnatis, foliolis 3–5 ovalibus vel obovatis circiter 5 cm. longis 3 cm. latis utrinque molliter et dense tomentosis submucronatis subcoriaceis integris, marginibus non revolutis, foliolis terminalibus plerumque maioribus quam foliolis lateralibus, rhachide alato; floribus in spicis terminalibus compositis dispositis, bracteis bracteolisque ciliolatis et persistentibus.—Collected at Cuesta de Ejutla, Nacaltepec, Oaxaca, Mexico, alt. 6000 ft., April 6, 1895, *L. C. Smith 464* (US **type**).

lets 1.5–7.5 cm. long, 1.2–5 cm. broad; with petioles 0.6–2 cm. long, lateral leaflets 1.5–6 cm. long, 1.2–3.5 cm. broad, sessile, petioles 1.5–2 cm. long, rachis segments 1.5–2.5 cm. long, winged, stout; inflorescences terminal and lateral compound spikes, bracts deltoid, acutish, about 2 mm. long, 1.5 mm. broad, brownish, densely pubescent on the outer surface with simple and glandular hairs, slightly pubescent on the inner surface, persistent; sepals subrotund, about 1.5 mm. long, almost as broad, with a few hairs at the base of the outer surface, glabrous on the inner surface, ciliate with simple and glandular hairs; petals tan in the dried state, obovate-rotund, about 2 mm. broad, 3 mm. long, glabrous on both surfaces, not ciliate;

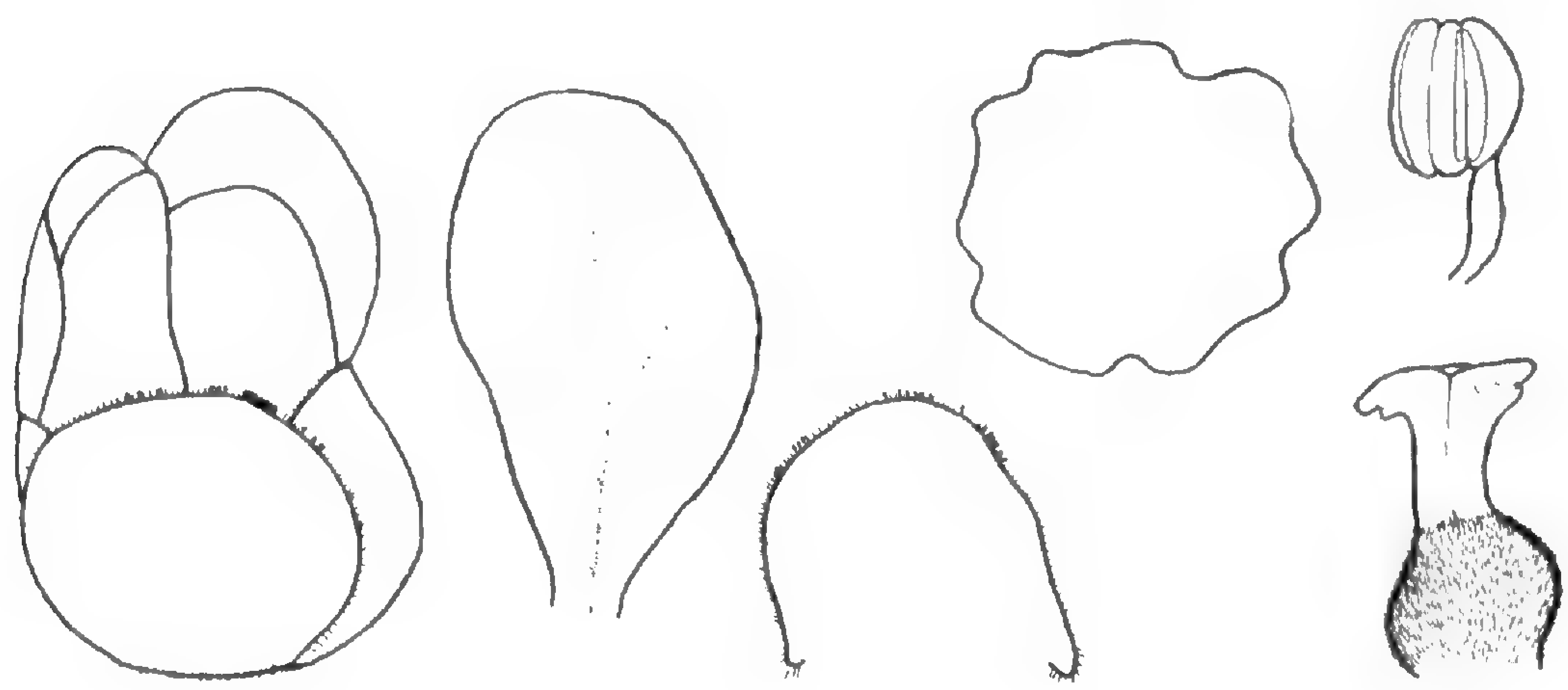

Fig. 17. Floral morphology of *Rhus Duckeri* Barkl. × 10½.

filaments as long as the sepals; anthers oval, about 0.8 mm. broad, slightly shorter; fruit red, with glandular and simple pubescence.

While the type of this very distinctive species was collected over forty years ago, it has apparently remained undescribed. It is evidently a coarse shrub having thick, puberulent leaflets with prominently whitened margins. The plant is densely canescent. It is named in honor of the author's wife, née Elizabeth Anne Ducker.

Distribution: Oaxaca (fig. 16).

MEXICO:

Oaxaca: Cuesta de Ejutla, Nacaltepec, alt. 6000 ft., April 6, 1895, *Smith 464* (F, US **type**, M photo.).

25. Rhus pachyrrhachis Hemsl., Biol. Cent.-Am. Bot. **1**: 218. 1880, excl. specim. *Ghiesbreght 511;* Diagn. Pl. Nov., pt. 3, p. 1. 1880, excl. specim. *Ghiesbreght 511.*

Rhus Schiedeana Schlecht. ex Engler in DC., Monogr. Phaner. **4**: 391. 1883, in part.

Branches maroon-brown, covered with a yellow-gray tomentum; leaflets 9–13, lanceolate to elliptical, obcordate to obtuse at the base, rounded or acute at apex, revolute and strongly inrolled at the margin, entire, dull green and soft villous-pubescent on both surfaces, glandularly pubescent below, terminal leaflet 2–3 cm. long, 0.7–1.5 cm. broad, lateral leaflets 2–3 cm. long, 2.5–5 cm. broad, coriaceous, petiolules 0–3 mm. long; petioles about 1.5 cm. long, rachis segments about 1–1.5 cm. long, stout; inflorescence in lateral compound spikes 5 cm. long, 3 cm. broad, bracts broadly ovate, 2.5 mm. long, 2 mm. broad, rounded at the apex, brownish, densely pubescent on the outer surface, glabrous on the inner surface, ciliate with simple and glandular hairs, persistent; sepals subrotund, about 2.5 mm. long, 1.7 mm. broad, glabrous except on the outer surface near the base, ciliate with simple and glandular hairs; petals brownish in the dried state, ovate to rhombic-ovate, about 2.5 mm. long, 1.75 mm. broad, glabrous on the outer and inner surfaces, not ciliate; filaments shorter than the sepals; anthers rectangular, 0.8 mm. long, about as broad; fruit red, about 7 mm. long, 8 mm. broad, pubescent with simple and glandular hairs.

This is a densely pubescent species of northeastern Mexico. Its affinities seem to be with *Rhus virens* and *R. vestita.* The leaflets are thin and strongly reflexed.

Distribution: Nuevo Leon, San Luis Potosi, and Tamaulipas (fig. 16).

MEXICO:

NUEVO LEON: Hacienda Pablillo, Galeana, Aug. 11, 1936, *Taylor 71* (F).

SAN LUIS POTOSI: Alvarez, Sept. 5–10, 1902, *Palmer 61* (F, G, M, NY); 220° N. lat., alt. 6000–8000 ft., 1878–1879, *Parry & Palmer 125* (F, G, Kew **type**, M, PA); Minas de San Rafael, Nov. 1910, *Purpus 4922* (Calif, F, G, M); in the San Miguelito Mts., coll. of 1876, *Schaffner 95* (G), coll. of 1879, *455* (CA, F, NY), *908* (G, NY).

TAMAULIPAS: sierra near Jaumave, 1932, *von Rozynski 505* (F).

26. Rhus vestita Loesen., Bull. Herb. Boiss. II. **6**: 835. 1906.

Rhus Schiedeana forma *vestita* Radlk. ex Smith, Enum. Pl. Guatemal., pt. 3, p. 22. 1893.

R. Succedaneum Sessé & Moc., Pl. Nov. Hisp., p. 47. 1887, non *R. succedanea* L., Mant. **2**: 221. 1767.

Shrubs; branches maroon-brown with a yellow-gray tomentum; leaflets 7–9, elliptic, acute, obtuse at the base, coriaceous, subrevolute-margined, entire, pubescent on the veins above and below, somewhat glandularly pubescent below, shining above, dull beneath, terminal leaflets 3–3.5 cm. long, 1.5–2 cm. broad, lateral leaflets 3–4.5 cm. long, 2–2.5 cm. broad, petiolules about 4 mm. long; petioles about 2 cm. long, rachis segments about 2 cm. long, stout; inflorescence a terminal compound spike, 10 cm. long, nearly as broad, bracts broadly ovate, 2 mm. long, about as broad, rounded to subacute, brownish, densely pubescent on the outer surface, glabrous on the inner surface, persistent; sepals subrotund, about 2.25 mm. long, 1.75 mm. broad, glabrous except on the outer surface near the base, ciliate with simple and glandular hairs; petals brownish in the dried state, rhombic-ovate, about 3 mm. long, 2 mm. broad, glabrous on both surfaces, not ciliate; filaments slightly shorter than the sepals; anthers rectangular, 0.8 mm. long, about as broad.

This species has few leaflets, which are coriaceous and have scarcely revolute margins. While its variety (see below) is intermediate in several respects between it and *Rhus pachyrrhachis*, with which it has been confused, its affinities seem undoubtedly to be with *Rhus vestita;* from the latter it differs most markedly in the revolute margins of the leaflets and in the general distribution of pubescence.

Distribution: southern Mexico and Guatemala (fig. 16).

MEXICO: without definite locality, coll. of 1787–1804, *Sessé, Mociño, Castillo & Maldonado 854* (Madrid), *4941* (F, Madrid).

CENTRAL AMERICA:

GUATEMALA: HUEHUETENANGO: Los Hingis above Chiantla, May 29, 1906, *Cook 43* (US); QUICHE: San Siguam, alt. 5800 ft., April 1892, *Heyde & Lux (Donnell Smith 3032)* (G, M, US, **cotypes**).

26a. Rhus vestita var. **Ghiesbreghtii** Barkl., n. var.[1]

Rhus pachyrrhachis Hemsl. ex Engler in DC., Monogr. Phaner. **4**: 391. 1883, in part.

R. sempervirens var. *pachyrrhachis* Engler, *ibid.* 1883, excl. syn.

R. Schiedeana Schlecht. ex Engler, *ibid.*, as to specim. *Ghiesbreght 511.*

Leaflets large, pubescence of leaflets not confined to the veins.

MEXICO:

CHIAPAS: Teopisca, coll. of 1864–1873, *Ghiesbreght 511* (Kew, M **type**); Canjob, March 27, 1904, *Goldman 791* (US).

27. Rhus Nelsonii Barkl., n. sp.[2] Pl. 22, fig. 1.

Large shrub; branches brown, at first densely ferruginous-pilose; leaves pinnately compound; leaflets 7–9, ovate or ovate-lanceolate, acute or acuminate at the apex, obtuse or subcordate at the base, subcoriaceous, margin obscurely subrevolute, entire, soft-pubescent but shining above, lighter and densely soft (ferruginous-)-pubescent below, glandularly pubescent on both surfaces, terminal leaflet 3–7 cm. long, 1.2–2.8 cm. broad, with petiolule 0.7–1 cm. long, lateral leaflets 2.5–5.5 cm. long, 1–2.5 cm. broad, with petiolules about 1.5 mm. long; inflorescences lateral, about 12 cm. long, about 8 cm. broad, bracts brown, ovate, pubescent, persistent; fruit pubescent with simple and glandular hairs.

From the specimens examined, this species seems to be quite distinct from *Rhus oaxacana.* However, their general aspects are similar, and when *R. Nelsonii* is better known it may prove to be a more pubescent phase of *R. oaxacana.* It is most easily distinguished from the latter by its soft-pubescent upper leaf-

[1] **Rhus vestita** var. **Ghiesbreghtii** Barkley, n. var. Arbuscula; foliis imparipinnatis, foliolis magnis, pubescentia non circumscripta ad venas.—Collected at Teopisca, Chiapas, Mexico, coll. of 1864–1873, *Ghiesbreght 511* (M **type**).

[2] **Rhus Nelsonii** Barkley, n. sp. Arbuscula; foliis imparipinnatis, foliolis 7–9 ovato-lanceolatis circiter 5 cm. longis 2.5 cm. latis longo-acuminatis subcoriaceis supra molle-pubescentibus sed lucidis infra dilutioribus et densius molle-pubescentibus, rhachide non alato; floribus in spicis lateralibus compositis dispositis, spicis circiter 10 cm. longis, bracteis bracteolisque persistentibus.—Collected in foothills above Chilpancingo on Mani range, alt. 6000± ft., May 15, 1903, *Nelson 7047* (NY **type**).

surface and its longer inflorescences. It is named for the collector of the type, E. W. Nelson.

Distribution: Guerrero (fig. 16).
MEXICO:
GUERRERO: foothills above Chilpancingo on Mani range, alt. about 6000 ft., May 15, 1903, *Nelson 7047* (US, NY **type**).

28. **Rhus oaxacana** Loesen., Bull. Herb. Boiss. II. **6**: 834. 1906.

Branches maroon-brown; leaflets 3–7, ovate-lanceolate, subacuminate, obtuse or subrotund and usually unequal at the base, subcoriaceous, subrevolute and entire-margined, pubescent above and beneath especially on the veins, somewhat glandularly pubescent and inconspicuously lustrous above, very dull yellowish-gray beneath, terminal leaflets 6–8 cm. long, 2–3 cm. broad, petiolules 0.6–1.8 cm. long, lateral leaflets 4–7 cm. long, 1–3 cm. broad, petiolules about 0.2 cm. long; rachis segments about 2 cm. long, stout; inflorescence terminal, 4.5 cm. long, 3.5 cm. broad, bracts lanceolate, 2.5 mm. long, 0.75 mm. broad, acutish, yellowish-green, pubescent on the outer surface with long, spreading hairs (about 0.7 mm. long), glabrous on the inner surface, persistent; sepals deltoid-lanceolate, about 2 mm. long, almost as broad, pubescent on the outer surface with long hairs, ciliate with simple hairs, colorless at margin and green near midrib; petals white in the dried state, rhombic-lanceolate, about 3 mm. long, 2.25 mm. broad, glabrous without, with scattered hairs on the inner surface, not ciliate; filaments shorter than the sepals; anthers oval, 1 mm. long and broad; fruit red, pubescent with simple and glandular hairs, about 8 mm. long and broad.

This is a seldom-collected species of Oaxaca, having ovate-lanceolate, strongly acuminate leaflets, comparatively short inflorescences, and the pubescence of the leaflets confined chiefly to the veins.

Distribution: Oaxaca (fig. 16).
MEXICO:
OAXACA: north end of valley of Oaxaca, alt. 6800-7800 ft., Oct. 3, 1894, *Nelson 1569* (NY, M photo.); canyon along wagon road, 6 miles above Dominguillo, alt.

4500–5500 ft., Oct. 30, 1894, *Nelson 1828* (NY); *Pringle 5655* (G); San Martin, Tlaxiaco, Dec. 5, 1895, *C. & E. Seler 1472* (G, NY, cotypes, M photo.).

29. Rhus virens Lindh. ex Gray, Bost. Jour. Nat. Hist. [Pl. Lindh. II] **6**: 159. 1850.

Rhus sempervirens Scheele, Linnaea **23**: 566. 1850.

Toxicodendron sempervirens Kuntze, Rev. Gen. Pl., pt. 1, pp. 153–154. 1891.

Schmaltzia virens Small, Fl. Southeast. U. S., pp. 729, 1334. 1903, and ed. 2. 1913.

Shrubs; branches brown, at first puberulent, later glabrate; leaves evergreen, compound; leaflets mostly 5–9, rhombic-ovate, rarely ovate or lanceolate-ovate, acutish, cuneate at the base, coriaceous, subrevolute and entire-margined, pubescent but shining and dark above, lighter, dull, sparsely soft-pilose, and with some glandular hairs beneath, terminal leaflets 2–4 cm. long, 1–1.75 cm. broad, long-petiolulate, lateral leaflets 1.25–4 cm. long, 1–2 cm. broad, short-petiolulate with petiolules about 2 mm. long; petioles about 1.5 cm. long, rachis segments about 1.25 cm. long, thin; inflorescence terminal, 4 cm. long, nearly as broad, bracts broadly ovate, 1.75 mm. long, nearly as broad, rounded-acutish at the apex, brownish, pilose on the outer surface, glabrous on the inner surface, ciliate with simple and glandular hairs, persistent; sepals subrotund, about 2 mm. long, about as broad, sparsely pilose on the outer surface, glabrous on the inner surface, ciliate with simple and glandular hairs; petals tan in the dried state, narrowly obovate-rotund, about 3 mm. long, 2 mm. broad, glabrous on the outer surface, pilose on the inner surface, not ciliate; filaments about as long as the sepals; anthers rectangular, 0.8 mm. long, about as broad; fruit 6 mm. long, 5 mm. broad, pubescent with simple and glandular hairs.

This is a widespread species of southwestern United States and northern Mexico. The leaflets of the Mexican specimens are more pubescent on the upper surface and tend to be somewhat larger. While *Rhus virens* Lindh. and *Rhus sempervirens* Scheele were published in the same year, it seems that the Lindheimer name appeared earlier in the year. This species, *Rhus Andrieuxii*, and *R. choriophylla* form a closely allied series, which, while very similar, are quite distinct.

Distribution: south-central Texas and southeastern New Mexico, south to Chihuahua and Nuevo Leon (fig. 16).

UNITED STATES:

TEXAS: expedition from western Texas to El Paso, New Mexico, May to Oct. 1849, *Wright 83* (Calif.); on dry hills near Bandera, Feb. 25, 1931, *von Schrenk* (M); Leon Springs, May 29, 1911, *Clemens* (M), *834* (RMt); Chisos Mts., June 19, 1931, *Mueller 8065* (M); Alpine, May 1925, *Studhalter 1041* (M); hills, New Braunfels, *Lindheimer (514)*, 1846, *123*, *348A*, Aug. and Sept. 1846, *348B*, and 1847 (M); Comanche Spring, New Braunfels, Nov. 1849, *Lindheimer 731* (F, M, Okla); Comal Co., Oct. 1850, *Lindheimer 729* (F, M, Okla), 1849–1851, *730* (F, M); Bears Mountain, Gillespie Co., *Jermy* (M); Cedar Mountain, *Jermy 122* (M); Limpia Canyon, 1889, *Nealley* (F); rocky banks, Limpia Canyon, 8 miles northwest of Ft. Davis, June 17, 1926, *Palmer 30997* (M); rocky bluffs and slopes, foothills of Davis Mts., Ft. Davis, Oct. 8, 1926, *Palmer 32109* (M); Boerne, May 22, 1916, *Palmer 9847* (M); Spanish Pass, Sept. 28, 1916, *Palmer 10847* (M); Chinati Mts., Aug. 1936, *Hinckley 821* (F); Presidio Co., *Reverchon 20* (M); rocky bluff near Twin Mts., 1882, *Reverchon 25*, May 20, 1903, *3812* (M); near Austin, May 13, 1872, *Hall 76* (F); Uvalde, Oct. 5–10, 1880, *Palmer 188 (14255)* (M); Comstock, March 20, 1911, *Blair 231* (M); stony hills near Devils River, Sept. 10, 1900, *Eggert* (M).

NEW MEXICO: rocky slopes near the Carlsbad Caverns, Sept. 27, 1931, *Payson 54* (RMt).

MEXICO:

CHIHUAHUA: Santa Eulalia Mts., Oct. 16, 1885, *Pringle 357* (F, G, Penn).

COAHUILA: Muzquiz, July 7, 1936, *Marsh 367* (F); Sierra del Carmen, Aug. 21, 1936, *Marsh 566* (F); Mount Casacot, 21 miles southeast of Monclova, Feb.–Oct. 1880, *Palmer 189* (G, US); shrub-covered valley floor, Rancho Agua Dulce, Municipio de Muzquiz, July 1, 1936, *Wynd & Mueller 396* (M).

NUEVO LEON: Diente Canyon, mountains near Monterey, July 1933 (F); Sierra Madre above Monterey, alt. 3000 ft., Aug. 20, 1903, *Pringle 11397* (F, G).

30. Rhus choriophylla Woot. & Standl., Contr. U. S. Nat. Herb. **16**: 146. 1913.

Low shrub with few branches; branches maroon-brown, with a gray puberulence; leaflets 3–5, ovate, acute, obtuse to subcuneate at the base, coriaceous, subrevolute and entire-margined, pale green, rather dull above and below, terminal leaflet 2.5–5 cm. long, 1.5–2.5 cm. broad, long-petiolulate, lateral leaflets 2.5–5 cm. long, 1–2.25 cm. broad, with petiolules about 2 mm. long; inflorescence about 5 cm. long, about as broad, bracts ovate, acuminate, 3 mm. long, 1.75 mm. broad, acuminate (bracteoles 2 mm. long, 1.5 mm. broad, rounded at the apex), tan, densely pubescent on the outer surface, glabrous on the inner surface, ciliate with simple and glandular hairs, persistent; sepals deltoid, rounded at the apex, about 2 mm. long, 1.25 mm. broad, glabrous, ciliate with simple and glandular hairs; petals white in the dried state, rhombic-ovate, about 3 mm. long, half as broad, glabrous on the outer surface, slightly pilose at the base on the inner surface, not ciliate; filaments shorter than the sepals; anthers rectangular, 0.8 mm. long, about as broad; fruit 7 mm. long, 6 mm. broad, pubescent with simple and glandular hairs.

This species has its closest allies in *Rhus virens* and *R. Andrieuxii.* Compared with *Rhus virens* the leaflets are fewer, larger and glabrous, also the inflorescences are numerous and mostly lateral.

Distribution: southwestern New Mexico, adjacent Arizona and Sonora (fig. 16).

UNITED STATES:

New Mexico: Organ Mts., Oct. 4, 1903, *Wooton* (RMt); Peña Blanca, Organ Mts., March 15, 1903, *Wooton* (M); Alamogordo, Sacramento Mts., alt. 4600 ft., April 12, 1902, *Rehn & Viereck* (RMt).

Arizona: Sorierta Valley, alt. 5700 ft., Aug. 1874, *Rothrock* (F); Bonita Canyon, Chiricahua Mts., alt. 6000 ft., Nov. 2, 1906, *Blumer* (ND), *1326* (F, M); rocky slopes, Mule Mts., Aug. 1911, *Goodding 968* (RMt); Bowie, Sept. 21, 1884, *Jones 4321* (F); Huachuca, March 23, 1894, *Toumey 16* (M); Santa Rita Mts., alt. 5500 ft., Sept. 26, 1880, *Engelmann* (M); above range reserve, Santa Rita Mts., Sept. 12–Oct. 18, 1903, *Griffiths 6060* (M); Santa Rita Mts., Sept. 9, 1884, *Pringle* (F), *15842* (M); Oracle, alt. 4600 ft., Aug. 28, 1903, *Jones* (M).

MEXICO:

Sonora: Fronteras, alt. 4550 ft., Sept. 22, 1890, *Hartman 31* (G).

31. Rhus Andrieuxii Engler in DC., Monogr. Phaner. **4**: 389. 1883.

Toxicodendron Andrieuxii Kuntze, Rev. Gen. Pl., pt. 1, p. 153. 1891.

Shrubs; branches brown, at first covered with a gray puberulence; leaflets 5–13, lanceolate-ovate, rhombic-oblanceolate-ovate or ovate, subacute to obtuse, unequally obtuse to cuneate at base, coriaceous, entire, not revolute-margined, more or less white corneous-margined, pubescent on the veins, otherwise glabrous above and beneath or somewhat glandularly pubescent beneath, shining and bluish-gray above, dull and yellowish beneath, nerves broad and veins remotely reticulate, terminal leaflets 2–3 cm. long, 0.7–1.5 cm. broad, with petiolules 2–9 mm. long, lateral leaflets 1.5–3 cm. long, 0.7–2 cm. broad, with petiolules about 1 mm. long; rachis segments 0.7–1.2 cm. long, petioles about 1.5 cm. long; inflorescences terminal, or terminal and lateral, compound spikes, bracts ovate-deltoid, blunt, 0.7 mm. long, about as broad, puberulent with simple glandular hairs on the outer surface, glabrous on the inner surface, ciliate with simple and glandular hairs; sepals deltoid-rotund, 1 mm. long, about as broad, glabrous, ciliate with simple and glandular hairs; petals in the dried state whitish, elliptic-ovate, 2 mm. long, 1.3 mm. broad, glabrous, not ciliate, filaments shorter than sepals; anthers rectangular, 0.8 mm. broad, about as long; fruit red, pubescent with simple and glandular hairs, 8 mm. long, about as broad.

This species of central Mexico has numerous small, ovate and acute leaflets, which are shining and rather grayish above. Its closest affinity apparently is with *Rhus virens*.

Distribution: Coahuila to Durango, south to Oaxaca (fig. 16).

MEXICO: 1833, *Andrieux 271* (F photo.); without definite locality, 1787–1804, *Sessé, Mociño, Castillo & Maldoñado 4942* (F).

COAHUILA: Saltillo, Sierra Madre, July 17–20, 1880, *Palmer 190* (F, G).

DURANGO: between Ramos and Inde, Aug. 11–14, 1898, *Nelson 4698* (NY).

HIDALGO: Zimapan, *Coulter 780* (F); rocky gulches, Ixmiquilpan, Sept. 1905, *Purpus 1289* (Calif, F, G, M, NY).

NUEVO LEON: Sierra Madre, near Monterey, Aug. 27, 1889, *Pringle 2677* (B).

OAXACA: from Fecomatlán to Pueblo Viejo, District of Nochixtlán, alt. 2500 m., June 21, 1907, *Carlos & Conzatti 1886* (F, US).

PUEBLA: El Riego, June 1905, *Purpus 1289A* (Calif, F, G, M, NY); July 1907, *Purpus 2730* (Calif); in the vicinity of San Luis Tultitlanapa, near Oaxaca, July 9, 1908, *Purpus 2730A* (Calif, F, G, M, NY, US), July 1908, *2730B* (Calif, F, G, M, US).

SAN LUIS POTOSI: Serrania de Santa Ana, Feb. 22, 1913, *Salazar* (US).

TAMAULIPAS: Cerro Parrena, Sierra San Carlos, July 13, 1930, *Bartlett 10308* (F); La Sardina, Sierra San Carlos, Aug. 14, 1930, *Bartlett 10953* (F); vicinity of Victoria, alt. about 320 m., Feb. 1–April 9, 1907, *Palmer 206* (Calif, F, G, NY); near Jaumave, *von Rozynski 244* (Calif), Dec. 5, 1931, *245* (F); near Victoria, 1931–1933, *von Rozynski 603* (F, M); near Nogales-Jaumave, March 1933, *von Rozynski 703* (F).

32. **Rhus Schiedeana** Schlecht., Linnaea **16**: 480. 1842; Engler in DC., Monogr. Phaner. **4**: 391. 1883, excl. specim. *Ghiesbreght 511* and *Parry & Palmer 125*.

Toxicodendron Schiedeanum Kuntze, Rev. Gen. Pl., pt. 1, p. 154. 1891.

Shrub or small tree; branches brownish-gray, at first covered with a gray puberulence; leaflets mostly 9, elliptic-lanceolate, subacute, unequally rounded at the base, thin-coriaceous, subrevolute and entire-margined, glabrous except on the veins and for some glandular pubescence beneath, usually reddish and shining above, dull beneath, terminal leaflet 4–6 cm. long, 1.6–2.75 cm. broad, long-petiolulate, lateral leaflets 4–6.5 cm. long, 1.25–2.5 cm. broad, short-petiolulate; petioles about 2.5 cm. long, rachis segments about 2 cm. long, pubescent, wingless, stout; inflorescences terminal, or terminal and lateral, bracts deltoid-lanceolate, rounded-acutish, about 2 mm. long, almost as broad, brownish, densely pubescent on the outer surface with simple and glandular hairs, persistent; flowers numerous, white; sepals subrotund, about 2.4 mm. long, almost as broad, pubescent with simple and glandular hairs on the outer surface, glabrous on the inner surface, ciliate with simple and glandular hairs; petals white in the dried state, obovate-rotund, about 3.5 mm. long, 2 mm. broad, glabrous on both surfaces, not ciliate; filaments as long as the sepals; anthers oval, about 1 mm. long; fruit red, pubescent with glandular and simple hairs, 6 mm. long, 8 mm. broad; disk about 3 times as broad as the ovary, rather thick.

This species of southern Mexico and Guatemala has been confused frequently with several of the other members of this section.

Distribution: Vera Cruz and Chiapas, Mexico, to Guatemala (fig. 16).

MEXICO:

CHIAPAS: San Vicente, June 5, 1906, *Cook 76* (US); San Vicente, April 23, 1904, *Goldman 883* (US, M photo.); Juncana, April 27, 1904, *Goldman 894* (US); laguna, between Acala and San Cristobal, Feb. 24, 1931, *Souviron & Erlandson 61* (US).

VERA CRUZ: Palmar, Sept. 7, 1936, *MacDaniels 905* (F).

CENTRAL AMERICA:

GUATEMALA: ALTA VÉRAPAZ: Cobán, alt. 4300 ft., March 1887, *von Tuerckheim 1153* (US); BAJA VERAPAZ: Rosa, Sept. 1888, *von Tuerckheim 1432* (US); Berge bei Rosa, Oct. 1912, *von Tuerckheim 3913* (US).

33. Rhus Tepetate Standl. & Barkl., n. sp.[1] Pl. 22, fig. 2.

A shrub 2 m. high; branches brown, at first puberulent, dotted with prominent maroon-colored lenticels; leaflets 7–9, oblong, obtuse to subacute and submucronate at apex, subcuneate to subcordate at the base, subcoriaceous, distinctly subrevolute-margined, entire, obscurely and sparsely pubescent above and below with simple and glandular hairs, shining, green, and conspicuously whitened above at the veins, dull and paler below, terminal leaflet 3.5–6.5 cm. long, 2.5–4 cm.

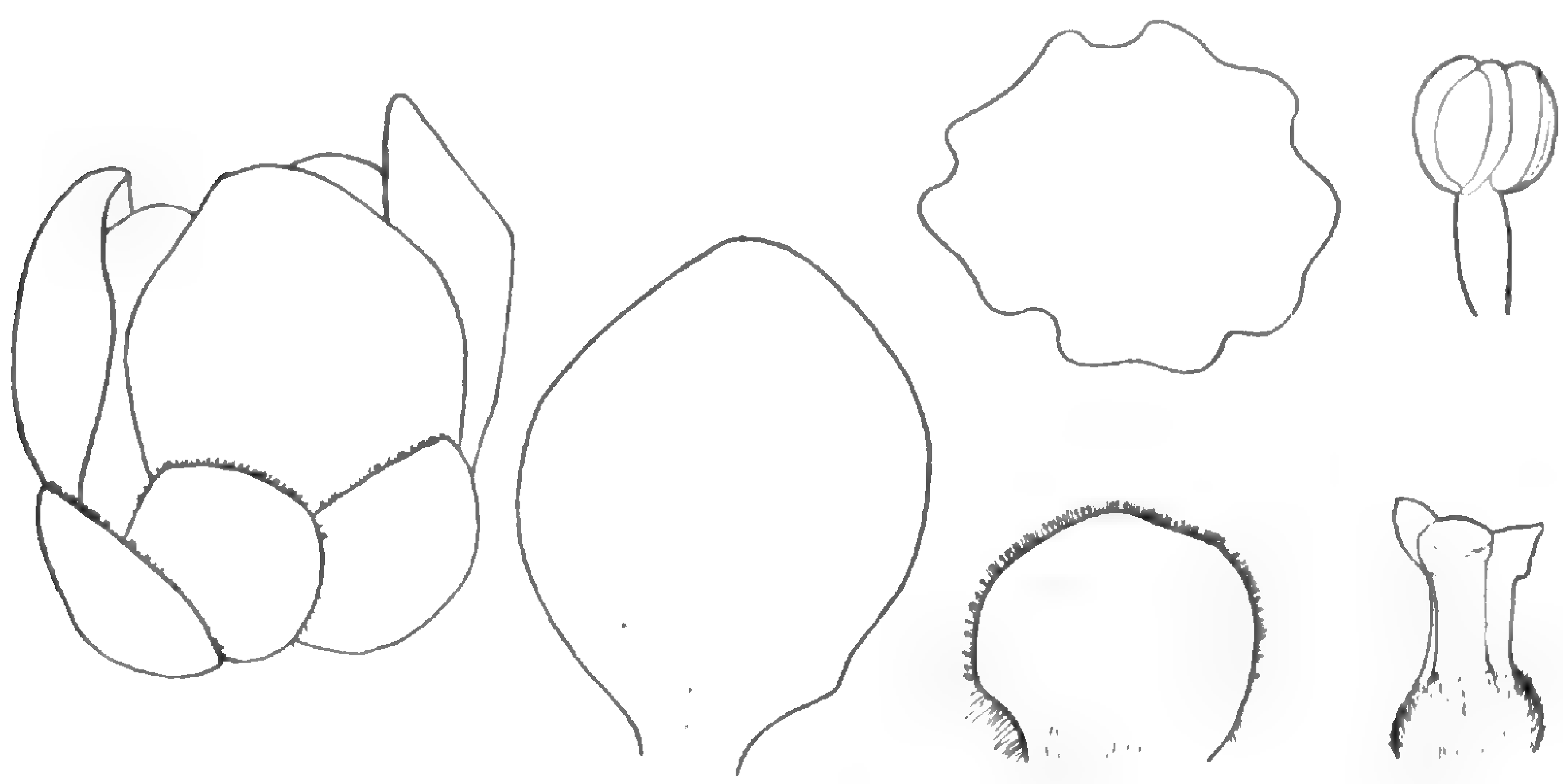

Fig. 18. Floral morphology of *Rhus Tepetate* Standl. & Barkl. × 10½.

broad, lateral leaflets sessile, 2.5–4.5 cm. long, 1.5–3 cm. broad; petiole about 2 cm. long, stout; inflorescences lateral, 5.5 cm. long, 4 cm. broad, bracts brown, ovate-deltoid, 1.2 mm. long, about as broad, pointed, pubescent with simple and glandular hairs on the outer surface, glabrous on the inner surface, ciliate with simple and glandular hairs (bracteoles narrower, lighter-colored, and round at apex), persistent; sepals pallid, subrotund, about 1.4 mm. long, about as broad, glabrous on both sur-

[1] **Rhus Tepetate** P. C. Standley & F. A. Barkley, n. sp. Arbuscula; foliis imparipinnatis, foliolis 7–9 oblongo-ovatis vel oblongo-obovatis 4 cm. longis 3 cm. latis supra obscure et rare pubescentibus sed lucidis, infra obscure pubescentibus glandulosisque subcoriaceis integris obtusis vel subacutis basi inaequalibus plus minusve subcordatis marginibus subrevolutis, rhachide non alata; floribus multis in spicis lateralibus compositis dispositis, bracteis persistentibus.—Collected in Sierra Charuco, Rio Mayo, Sonora, Mexico, September 10, 1935, *Howard Scott Gentry 1746* (F **type**).

faces, strongly ciliate with simple and glandular hairs; petals whitish in the dried state, broadly obovate-rotund, about 3.5 mm. long, 2.2 mm. broad, glabrous on the outer surface, sparsely pilose at base of the inner surface, not ciliate; filaments longer than the sepals; anthers oval, about 0.8 mm. long and broad; fruit not seen.

Morphologically this species is similar to *Rhus Schiedeana*, from which it may be distinguished by its broader and more oblong, more obtuse, subcordate leaflets as well as by its geographic range. Some of the specimens from Lower California have narrower and more obscurely oblong leaflets than the type. The specific name is the local vernacular of the shrub, of Nahuatl derivation.

Distribution: southern Sonora and southern Lower California (fig. 16).

MEXICO:

LOWER CALIFORNIA: Sierra de la Laguna, Jan. 23, 1890, *Brandegee* (Calif), *111* (PA); Sierra de San Francisco, Oct. 18, 1890, *Brandegee 111* (Calif); Sierra de la Laguna, Oct. 2, 1899, *Brandegee* (Calif, NY); from San Bernardo to El Sanz, Sierra de la Laguna, alt. 4500 ft., Jan. 21, 1906, *Nelson 7442* (US).

SONORA: canyon, Rio Mayo, Sierra Charuco, Sept. 10, 1935, *Gentry 1746* (Cath, M, F **type**).

34. Rhus macropoda Barkl., n. sp.[1] Pl. 23, fig. 1.

Shrub or small tree; branches maroon-brown; leaflets 3–9, usually 5, ovate, acuminate, subcuneate and usually unequal at the base, subcoriaceous, entire-margined, not revolute, mostly glabrous above and beneath but with some glandular hairs, obscurely pubescent on the veins, green above, veins and margins prominently pallid, dull and lighter green below, long-petiolulate, terminal leaflet 5–9 cm. long, 3–4 cm. broad, petiolules 1.5–2.5 cm. long, lateral leaflets 4–9 cm. long, 2.5–4 cm. broad, petiolules 0.5–1 cm. long, rachis segments about 4 cm. long, slender;

[1] **Rhus macropoda** Barkley, n. sp. Arbuscula; foliis imparipinnatis, foliolis 3–9 plerumque 5 ovatis circiter 8 cm. longis 4 cm. latis subacuminatis subcoriaceis utrinque fere glabris vel plus minusve pubescentibus glandulosisque basi subcuneatis et plerumque inaequalibus in nerviis obscure pubescentibus, veniis pallidis minute et obscure reticulatis puberulentis, petiolulis ca. 1 cm. longis; floribus multis in spicis lateralibus compositis dispositis, bracteis persistentibus.—Collected at San Miguel Alborrados, Oaxaca, Mexico, alt. 6500 ft., July 2, 1894, *E. W. Nelson 539*, (US **type**).

inflorescences lateral, axillary, compound spikes 7 cm. long, 6 cm. broad, bracts ovate, acute, 1 mm. long, 1 mm. broad, yellowish-green, pubescent on the outer surface with both glandular and spreading non-glandular hairs, glabrous on the inner surface, persistent; sepals deltoid-lanceolate, about 2 mm. long, 1.5 mm. broad, ciliate with simple and glandular hairs, yellowish-green; petals white in the dried state, narrowly obovate-rotund, about 3 mm. long, 2 mm. broad, glabrous on the outer surface, with scattered hairs at the base on the inner surface, not ciliate.

The conspicuously whitened veins and very long petiolules of the leaves of this species give it a superficial resemblance to

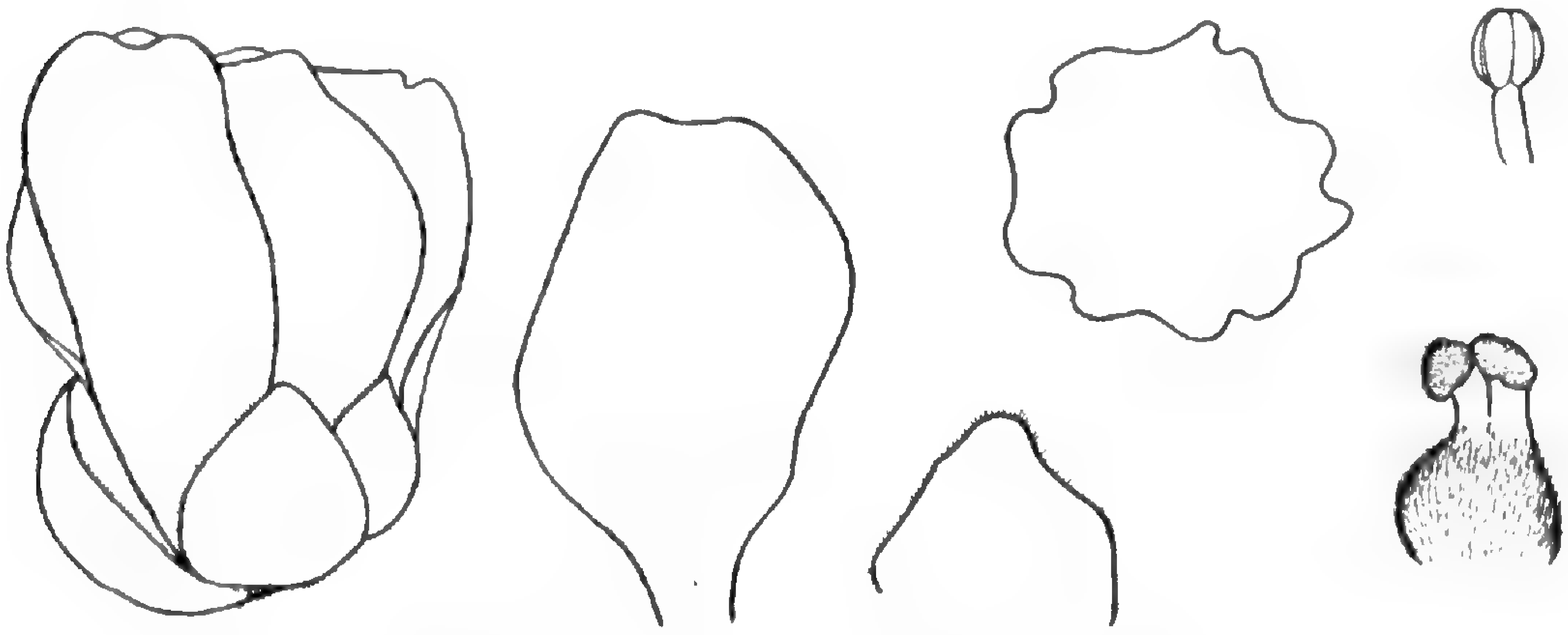

Fig. 19. Floral morphology of *Rhus macropoda* Barkl. × 10½.

Metopium and make it one of the most easily recognizable species of this section.

Distribution: Vera Cruz and Oaxaca (fig. 16).

MEXICO:

OAXACA: San Miguel Alborrados, alt. 6500 ft., July 2, 1894, *Nelson 539* (US **type**, M photo.); west slope of Mount Zempoaltepec, alt. 7700–8000 ft., July 5–13, 1894, *Nelson 541* (US).

VERA CRUZ: Palmar, Sept. 7, 1936, *MacDaniels 882* (F).

35. **Rhus ciliolata** Turcz., Bull. Soc. Nat. Moscou **31**[1]: 470. 1858.

Shrubs; branches dark brown with an obscure gray puberulence; leaves trifoliolate, petiole about 3 cm. long, stout; leaflets deltoid-ovate, acuminate at apex, obtuse to subcordate and unequal at base, petiolulate, coriaceous, obscurely subrevolute and entire-margined, shining on both surfaces, glabrous except on veins above and for some glandular hairs below, a fine reticulum of small veins very prominent, especially in the older leaves, terminal leaflet 5–8 cm. long, 1.7–3.2 cm. broad, petiolules about 1 cm. long, lateral leaflets 3.5–4.5 cm. long, 2–2.5 cm. broad, petiolules 2–4 mm. long; inflorescence terminal, about 3 cm. long, 2 cm. broad, bracts deltoid, pilose on the outer surface, persistent; fruit pubescent with simple and glandular hairs, about 8 mm. long and broad.

The trifoliolate leaves, the ovate, long-acuminate leaflets, and the conspicuous reticulum of small veins characterize this little-known species. The affinity of this species is probably with *Rhus oaxacana.*

Distribution: Puebla (fig. 16).

MEXICO:

PUEBLA: in the vicinity of San Luis Tultitlanapa, near Oaxaca, July 1908, *Purpus 3166* (Calif, G, M photo., NY, US).

36. Rhus profusa Barkl., n. sp.[1] Pl. 23, fig. 2.

Shrub or small tree; branches brown, furrowed, at first puberulent; leaflets 9–13, broadly lanceolate, subcuneate and unequal at the base, long-acuminate, acute at the apex, coriaceous, entire and frequently revolute-margined, glabrous and shining above, glabrous except on the midvein and for glandular hairs below, with a reticulum of fine veins prominently pallid below, terminal leaflet about 6 cm. long, 2–2.5 cm. broad, petiolule 0.3–1.3 cm. long, lateral leaflets 4.5–6 cm. long, 2–3 cm. broad, subsessile with petiolules 0–3 mm. long; petiole about 2.5 cm. long, stout; inflorescences lateral and terminal, 8–18 cm. long, 7–10 cm. broad, bracts brown, pubescent on the outer surface, ciliate with simple hairs, persistent; sepals deltoid, blunt, about 1.2 mm. long, 1.2 mm. broad, glabrate, ciliate with simple hairs, persistent; petals narrowly obovate, slightly pubescent on inner surface, 2 mm. long, 1 mm. broad; anthers oval, about 0.8

[1] **Rhus profusa** Barkley, n. sp. Arbuscula; foliis imparipinnatis, foliolis 9–13 circiter 5 cm. longis 2.5 cm. latis late lanceolatis acuminatis coriaceis supra glabris et lucidis infra cum reticulo venularum pallidarum, foliolis lateralibus subsessilibus, foliolo terminale petiololulato foliolas laterales subaequanto, rhachide non alato; floribus multis in spicis lateralibus terminalibusque compositis dispositis, bracteis bracteolisque persistentibus.—Collected near Las Caños, San Luis Potosi, Mexico, Oct. 15–21, 1902, *Edw. Palmer 214* (US **type**).

mm. in diameter; filaments thick, about as long as the sepals; fruit 7 mm. long, 7 mm. broad, pubescent with simple and glandular hairs.

The erect, spreading inflorescence of this species is its most outstanding character. However, its long-acuminate, lanceolate, and shining leaflets make it a very distinctive species. The specimen from Guerrero is somewhat atypical.

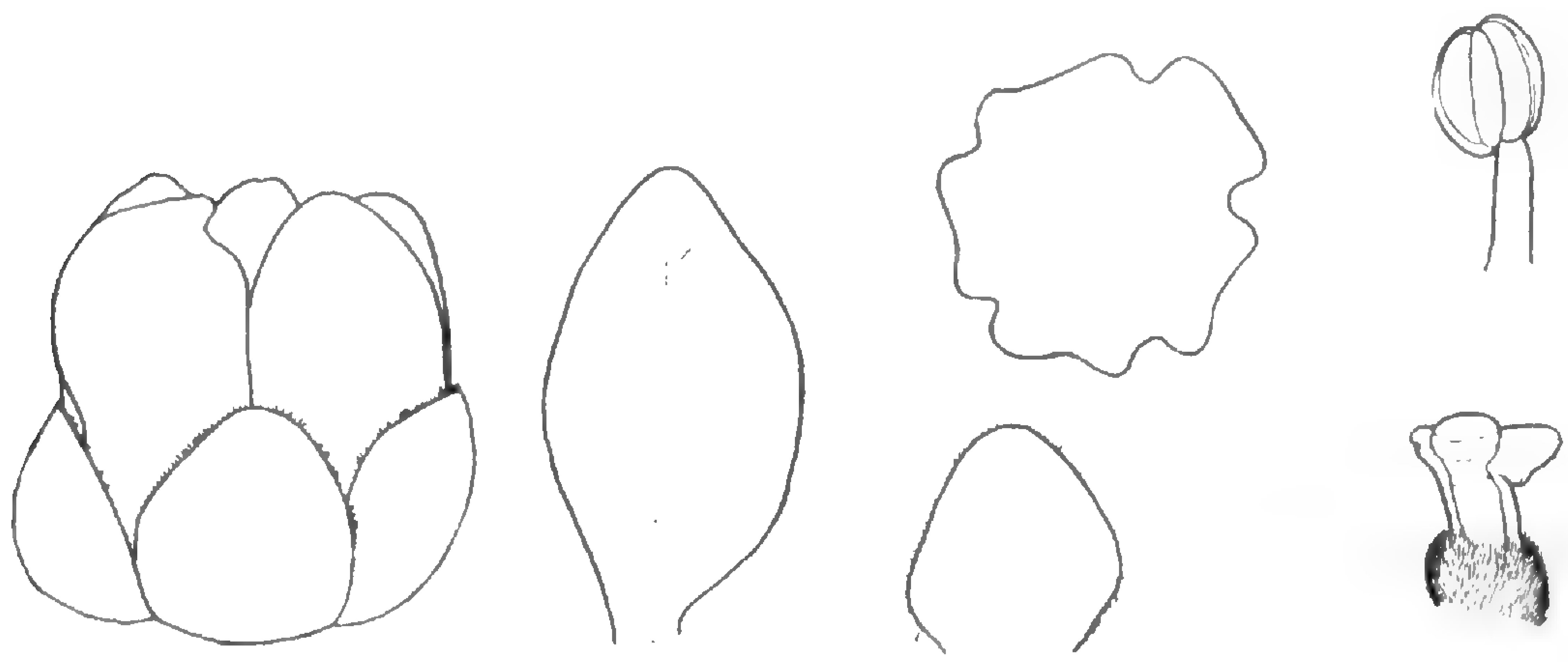

Fig. 20. Floral morphology of *Rhus profusa* Barkl. × 10½.

Distribution: San Luis Potosi and Guerrero (fig. 16).

MEXICO:

GUERRERO: between Chilapa and Tixtla, alt. 5200–7000 ft., Dec. 17, 1894, *Nelson 2167* (US).

SAN LUIS POTOSI: near Las Caños, Oct. 15–21, 1902, *Palmer 214* (F, M photo., US **type**).

Section RHOEIDIUM (Greene) Barkley, n. sect.

Rhoeidium Greene, Leafl. Bot. Obs. & Crit. **1**: 143. 1905.

Large, deciduous, spinose shrubs. Flowers cream-colored, polygamo-dioecious, in solitary or small clustered spikes formed in the summer and autumn, expanding in the spring before the leaves, sessile or nearly so and subtended by coriaceous, concave and persistent bracts, each enclosing a pair of smaller bractlets. Drupe orange-red, almost symmetrical; seed bony, rough, somewhat flattened. Leaves 3–9-foliolate, thin, more or less pubescent.

Texas to Arizona, south to central Mexico (fig. 21).

Type species: **Rhus microphylla** Engelm. ex A. Gray in Smiths. Contr. [Pl. Wright. I] **3**[5]: 31. 1852.

This section contains a single, somewhat variable species widespread in the arid regions of temperate North America. While standing quite distinct, its nearest affinities seem to be with section LOBADIUM.

37. **Rhus microphylla** Engelm. ex A. Gray in Smiths. Contr. [Pl. Wright. I] **3**[5]: 31. 1852. Pl. 24, fig. 1.

Rhus microphylla var. *vestita* Engler in DC., Monogr. Phaner. **4**: 387. 1883.

Rhoeidium cinereum Greene, Leafl. Bot. Obs. & Crit. **1**: 144. 1905.

R. glabellum Greene, *ibid.* 143.

R. microphyllum Greene, *ibid.* 143.

R. Potosinum Greene, *ibid.* 144.

R. retusum Greene, *ibid.* 144.

R. rugulosum Greene, *ibid.* 144.

R. vestitum Greene, *ibid.* 144.

Schmaltzia microphylla Small, Fl. Southeast. U. S., pp. 728, 1334. 1903.

Toxicodendron microphyllum Kuntze, Rev. Gen. Pl., pt. 1, p. 154. 1891.

Shrub or small tree, 1–5 m. high; branches tending to be spinescent, brown, at first puberulent, lenticels prominent; leaves pinnately compound, petiole about 3 mm. long; leaflets 5–9, oval to lanceolate-ovate, obtuse and mucronate to subacute, base cuneate and more or less unequal, sessile, thin, subrevolute and entire-margined, appressed-pilose and dull on both surfaces, slightly darker above, terminal leaflet 0.4–1.2 cm. long, 3–4 mm. broad, lateral leaflets 0.4–1 cm. long, 1.5–4 mm. broad; rachis segments 2–6 mm. long, winged; inflorescence a rigid, once-branched compound spike borne at the upper nodes, about 5 cm. long, nearly as broad, bracts broadly ovate, 1 mm. long, 1.75 mm. broad, brownish, densely pilose on the outer surface and with a few scattered glandular hairs, glabrous on the inner surface, ciliate with simple hairs, persistent; flowers numerous, each one subtended by a bract and two narrower bracteoles, pedicels 0.5 mm. long; sepals deltoid-rotund, about 1 mm. long, 0.8 mm. broad, acute, glabrous on both surfaces, ciliate with simple hairs; petals whitish in the dried state, rhombic-ovate to ovate, about 2.3 mm. long, 1.2 mm. broad, glabrous without, pilose on the inner surface, ciliate; filaments longer than the sepals; anthers oval, 0.6 mm. broad,

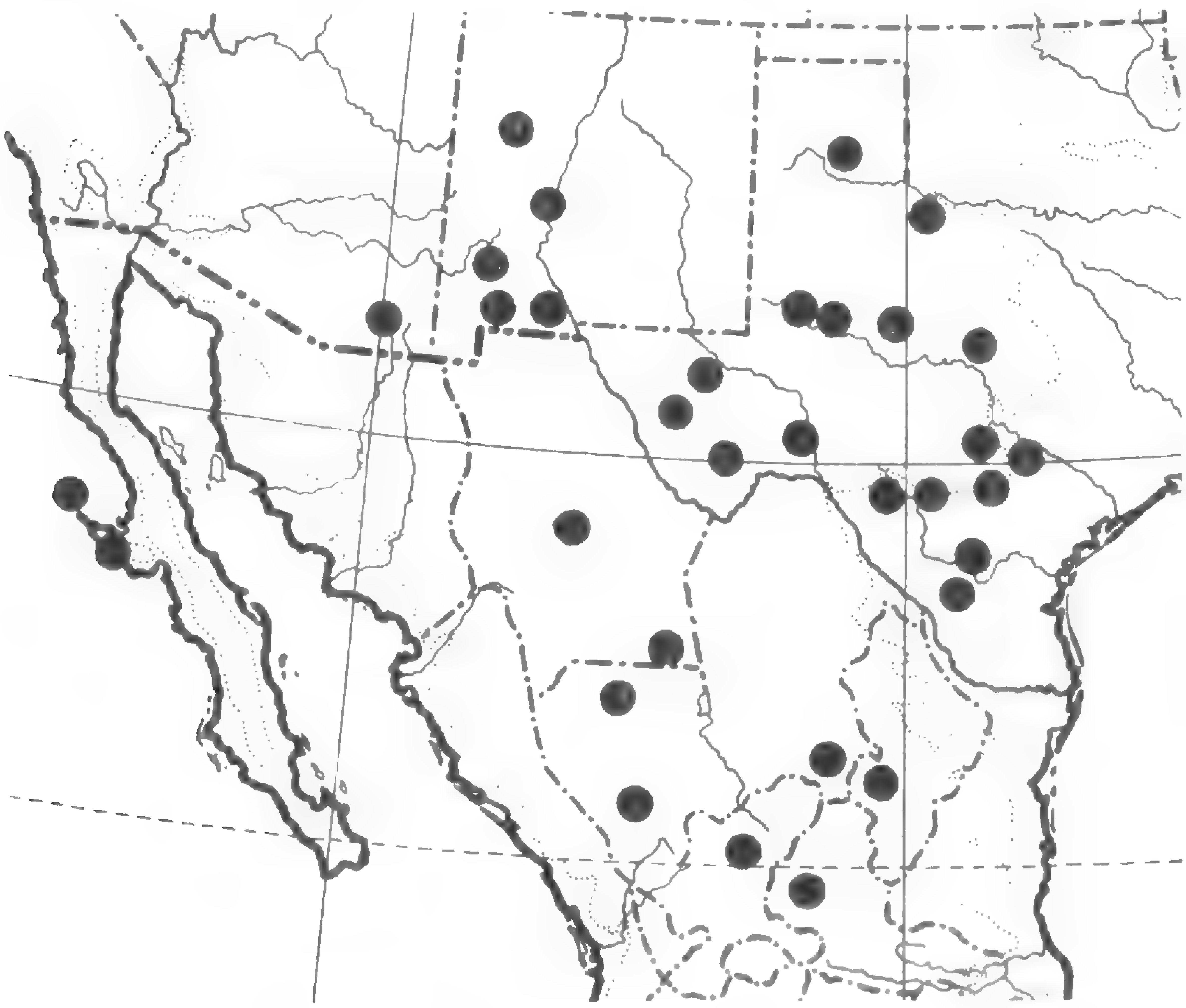

Fig. 21. The geographic distribution of *Rhus microphylla* Engelm.

0.8 mm. long; disk 1.7 mm. broad, yellow, lobed; style more or less united; fruit 5 mm. long, 5 mm. broad, orange-red, pubescent with simple and glandular hairs.

While this species shows some variations, they are so minute as to make the species appear remarkably uniform over its range. It is a shrub which resembles its competitors in the desert-plains scrub, but which is strikingly unlike the other members of the complex in general aspect.

Distribution: western Texas to southeastern Arizona, south to Durango, Nuevo Leon, and Zacatecas (fig. 21).

UNITED STATES:

TEXAS: 1880, *Palmer* (US type of *R. rugulosum);* Gamble's Ranch, June 6, 1918, *Palmer 13972* (M); San Antonio, June 12, 1911, *Clemens 835* (M); Bexar Co., 1903, *Jermy* (M); dry upland thickets, San Antonio, March 16, 1916, *Palmer 9182* (M); mesa north of the Chisos Mts., June 27, 1931, *Moore & Steyermark 3290* (M); Chisos Mts., June 30, 1931, *Mueller 8064* (M); Marathon, Aug. 13, 1936, *von Schrenk 54* (M); Brownwood, Sept. 1880, *Reverchon* (F); 20 miles west of New Braunfels, Oct. 1846, *Lindheimer 249,* 15 miles west of New Braunfels, Nov. 1849, *200* (M), Comanche Spring, New Braunfels, March 1850, *734*[1] (M, US), May 1850, *735* (M, Okla, US); flats near Van Horn, July 11, 1900, *Eggert* (M); frequent at base of mountain, El Paso, April 3, 1919, *Hanson* (M); El Paso, April 1881, *Vasey* (M); Cherryspring, *(Jermy) 564,* and Threadgile Valley, Gillespie Co., *774* (M); Medicine Mound, Oct. 28, 1916, *Palmer 11175* (M); near Big Spring, June 11, 1900, *Eggert,* and May 9, 1901 (M); mesa west of Mt. Livermore, Jeff Davis Co., alt. 1800 m., June 14, 1931, *Moore & Steyermark 3085* (M); Limpia Canyon, 10 miles northwest of Fort Davis, June 17, 1926, *Palmer 30996,* and May 12, 1914, *Young* (M); Bracketville, March 22, 1900, *Trelease 42* (M); Cotulla, March 17, 1917, *Palmer 11308* (M); near Stanton, June 13, 1900, *Eggert* (M); desert plains, Aug. 3, 1934, *Barkley 1074* (M); west of Pecos, April 20, 1902, *Tracy & Earle 112* (M); near Feodora, May 26, 1928, *Palmer 33552* (M); Fort Concho, March–April 1882, *Reverchon (Curtiss' 449)* (ND type of *R. glabellum,* M, US), Aug. 11, 1875, *(156) 693* (M); dry rocky ground, Sabinal, June 8, 1916, *Palmer 10122* (M); Comstock, March 21, 1911, *Blair 217* (M); Laredo, March 21, 1903, *Reverchon* (M).

NEW MEXICO: Goldsburg, April 5, 1934, *Allen* (M); east of Agricultural College, May 3, 1906, *Standley 39* (M); 1852, *Wright 1341* (US type, M photo.); near Las Cruces, 9100 ft., July 1, 1897, *Wooton 68* (M, ND); Peloncillo Mts., 20 miles northeast of Rodeo, alt. 4000 ft., June 16, 1930, *Goodman & Hitchcock 1146* (M); Berendo Creek, May 23, 1904, *Metcalfe 924* (M); Florida Mts., Aug. 27, 1895, *Mulford 1045* (M); between San Marcial and Nogal Canyon, June 23, 1921, *Ferris & Duncan 2343* (M); dry hills near Los Lunas, Aug. 1880, *Rusby 70* (M).

ARIZONA: Oct. 16, 1904, *Thornber 544* (M); Paradise, Chiricahua Mts., alt. 5300 ft., Aug. 21, 1906, *Blumer 94* (ND), *1322* (M); Douglas, May 1907, *Goodding 2236* (M); Douglas, April 8, 1930, *Jones 25655* (M, ND).

MEXICO:

CHIHUAHUA: San Bernardino Springs between Mapini, Durango, and Guajuquilla, April 18, 1847, *Gregg 482* (M); mountains northwest of Chihuahua, June 18, 1936, *LeSueur 770* (F); near Lake Santa Maria, Sept. 7, 1899, *Nelson 6422* (US type of *R. retusum);* vicinity of Chihuahua, alt. 1300 m., April 8–27, 1908, *Palmer 19* and *54* (F); near Chihuahua, March 20 and May 25, 1885, *Pringle 171* (F), and April 2 and Oct. 18, 1886, *894* (M, US); Aug. 1852, *Thurber (Mex. Bound. Surv.)* (F).

COAHUILA: pueblo near Saltillo, March 30, 1847, *Gregg 378* (M); del Carmen Mts., Sept. 12, 1936, *Marsh 839* (F); Saltillo, April 16, 1902, *Nelson 6113* (M);

[1] There was some question as to what was intended as the type of this species; while this was distributed as the type collection, *Wright's 1341* was mentioned in the original description and has later been shown to be the type.

6 miles east of Saltillo, April 15–20, 1880, *Palmer 193* (F), Saltillo, 1898, *31*, and *141* (F, M, US); "Sierra de Barbacon," July 1910, *Purpus 4500* (F, M); east of Hacienda La Rosa, Municipia de Ramos Ariape, June 14, 1936, *Wynd & Mueller 48* (M).

Durango: Durango, April–Nov. 1896, *Palmer 91* (F, M, US, **cotypes** of *R. cinereum*), and *92* (F, M, US); Sierra de Barbecoa, July 1910, *Purpus 4500* (US); Indé, alt. 2000 m., June 1927, *Reko 5157* (F).

Lower California: Cedros Island, Dec. 8, 1888, *Pond*, and Port San Bartolomé, Nov. 27, 1889 (ND).

Nuevo Leon: Hacienda Pablillo, Galeana, Aug. 14, 1936, *Taylor 165* (F); Ceralvo, below Monterey and Malamora, May 29, 1847, *Wislizenus 359* (M).

San Luis Potosi: Charcas, July–Aug. 1934, *Lundell 5197*, and *5309* (F); coll. of 1878, *Parry & Palmer 126* (F, M, **cotypes** of *R. Potosinum*).

Zacatecas: near Cedro, June 1908, *Kirkwood 201* (F).

Section Lobadium (Raf.) DC., Prodr. **2**: 72. 1825.

Lobadium Raf., Am. Month. Mag., p. 357. 1819; Koehne, Deutsche Dendrol., p. 360. 1893, as subsection.

Rhus Ait., Hort. Kew. **1**: 365. 1789, in part.

Schmaltzia Desv., Journ. de Bot. Appl. **1**: 229. 1813; Small, Fl. Southeast. U. S., p. 728. 1903, in part; Greene, Leafl. Bot. Obs. & Crit. **1**: 128. 1905; Schneid., Illustr. Handb. Laubholzk. **2**: 148. 1907, as subgenus.

Toxicodendron Miller, Gard. Dict., ed. 8. 1768, as to *T. Crenatum* Kuntze, Rev. Gen. Pl., pt. 1, p. 153. 1891, in part.

Trichocarpae Engler, Bot. Jahrb. **1**: 379. 1881, as section, in part.

Turpinia Raf., Med. Repos. N. Y. **5**: 352. 1808, non Vent., Choix d. Pl., p. 31. 1803.

Gracefully diffuse shrubs with slender, spreading branches. Flowers numerous, yellow or white, polygamo-dioecious, in solitary or small apically clustered spikes formed in the summer and autumn, expanding in the spring before or with the leaves, sessile or pedicellate, and subtended by coriaceous, concave and persistent bracts, each enclosing a pair of much smaller bractlets. Drupe orange-red, almost symmetrical; seed bony, smooth, somewhat flattened. Leaves 1–5-foliolate, but mostly 3-foliolate, thin, more or less pubescent.

North America, from Canada to southern Mexico.

Type species: **Rhus aromatica** Ait., Hort. Kew. **1**: 367. 1789 (*Toxicodendron Crenatum* Miller, Gard. Dict., ed. 8. 1768).

This section is probably related to PSEUDOSCHMALTZIA through such species as *Rhus allophylloides* and *R. Duckeri.* The Mexican species are rather well defined. In the area of overlap in the United States, the species are separable with difficulty.

KEY TO THE SPECIES AND VARIETIES

Scandent shrubs, about 3 meters in length; bracteoles over half as large as the bracts..*38. R. allophylloides*
Erect shrubs, rarely much exceeding 1 meter in height; bracteoles less than half as long as the bracts.
Basal leaflets mostly ovate-lanceolate; flowers subsessile, usually flowering before the appearance of the leaves; terminal leaflets mostly over 4 cm. long; eastern and central North America and Mexico.
Leaflets and branches at first densely ferruginous-pilose; central Mexico.
Leaflets densely pilose at maturity..................*39. R. schmidelioides*
Leaflets not pilose at maturity......*39a. R. schmidelioides* var. *potosinensis*
Leaflets and branches at first glabrous or puberulent, never densely ferruginous-pilose; eastern North America................*40. R. aromatica*
Basal leaflets mostly obovate; flowers long-pedicellate, usually flowering at the time of the appearance of the leaves; terminal leaflets mostly under 4 cm. long (except in *41a*); western and central North America.
Terminal leaflets usually over 4 cm. long; central North America...... ....*41a. R. trilobata* var. *serotina*
Terminal leaflets usually under 4 cm. long (except in *41g*); western North America (except *41b*).
Terminal leaflets much longer than broad; fruit small (about 6 mm. diam.); central North America and the Rocky Mountains.
Leaflets at maturity usually glabrate; fruit mostly sparsely pubescent; Great Plains and the Rocky Mountains........*41. R. trilobata*
Leaflets at maturity densely puberulent; fruit densely pilose; Great Lakes region.......................*41b. R. trilobata* var. *arenaria*
Terminal leaflets nearly as broad as long; fruit mostly large (over 7 mm. diam.); southwestern North America and along the Pacific Coast.
Flowering in July and August; pedicels usually exceeding 5 mm. in length.........................*41c. R. trilobata* var. *racemulosa*
Flowering before July; pedicels usually less than 4 mm. in length.
New branches densely pubescent, leaves tomentose, at least below ....*41d. R. trilobata* var. *pilosissima*
New branches and leaves mostly glabrate, at least not densely pubescent.
Mostly unifoliolate..............*41e. R. trilobata* var. *simplicifolia*
Mostly trifoliolate.
Terminal leaflet not deeply lobed; leaflets more or less glabrate ....*41f. R. trilobata* var. *anisophylla*
Terminal leaflet deeply lobed; leaflets mostly somewhat pubescent......................*41g. R. trilobata* var. *quinata*

38. Rhus allophylloides Standl., Field Mus. Bot. Ser. **4:** 220. 1929. Pl. 24, fig. 2.

A semiscandent shrub about 3 m. long; leaflets 3, rhombic-ovate, acute, cuneate at the base, subcoriaceous, revolute-margined, serrate-dentate near the apex, entire towards the base, soft-pubescent above, densely soft-pubescent beneath, terminal leaflets 7–10 cm. long, 3.5–5.5 cm. broad, with petiolules about 1 cm. long, lateral leaflets 4.5–7 cm. long, 2–3.5 cm. broad, sessile; inflorescence terminal, 5 cm. long, 3.5 cm. broad, bracts

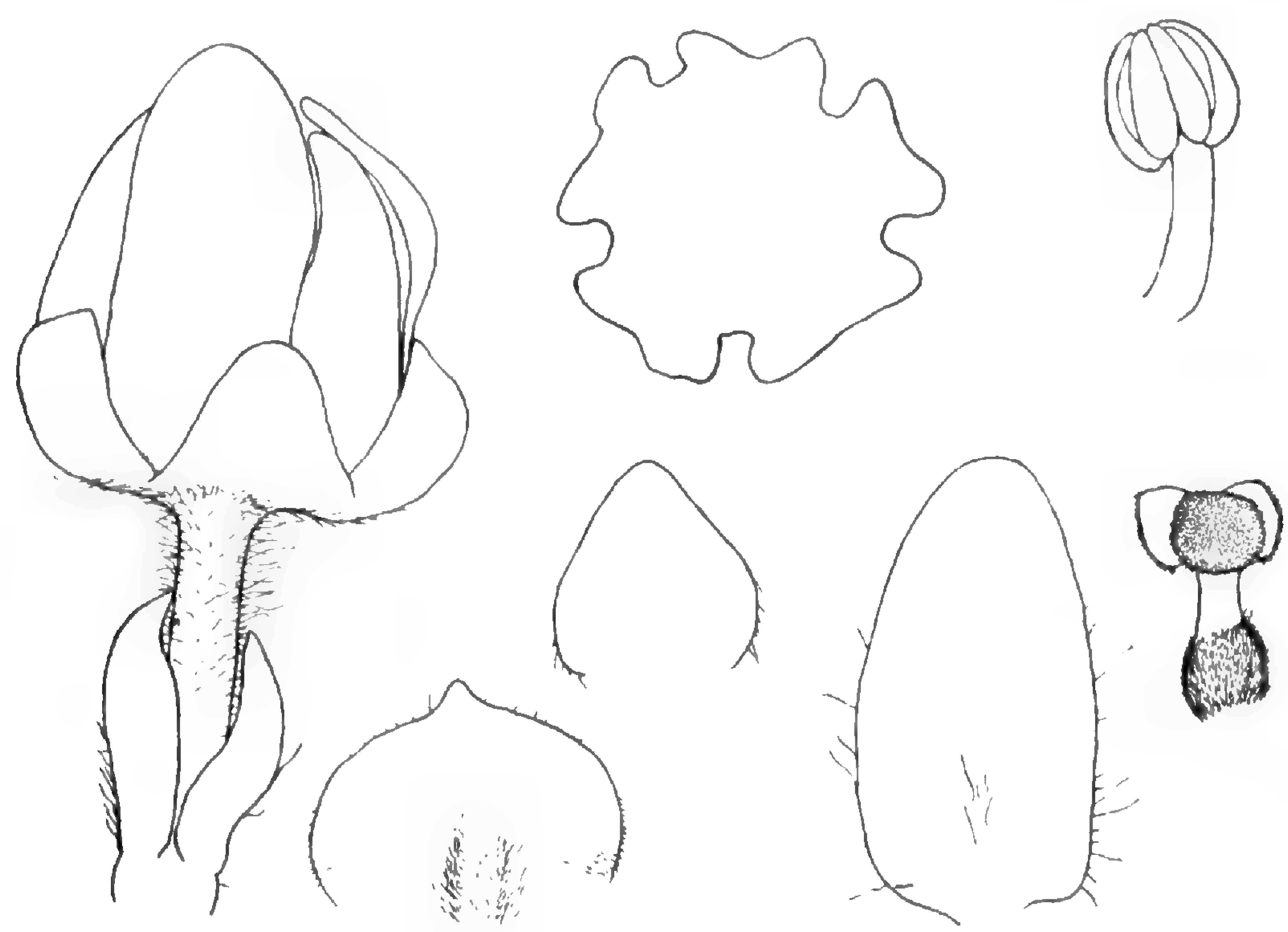

Fig. 22. Floral morphology of *Rhus allophylloides* Standl. × 10½.

deltoid, about 2 mm. long and broad, acutish, pubescent on both surfaces and ciliate with simple hairs, persistent; sepals deltoid-ovate, 1.5 mm. long, width slightly narrower, glabrous, ciliate with simple hairs; petals white in the dried state, elliptical, about 3 mm. long, 2 mm. broad, ciliate with simple hairs; filaments about as long as the sepals; anthers oval, 1 mm. long and broad; fruit red, pubescent with simple and glandular hairs.

Distribution: Jalisco to Michoacan (fig. 23).

MEXICO:

JALISCO: near stream in thicket on steep hillside, trail from San Sebastian to Real Alto, Sierra Madre Occidental, alt. 2000 m., Feb. 4, 1927, *Mexia 1640* (F, US **type,** M photo.); Real Alto, trail to Arroyo las Canelillas, Sierra Madre Occidental, Feb. 22, 1927, *Mexia 1729* (US).

MICHOACAN: Uruapan, 1925–1926, *Woronow 2919* (F).

39. Rhus schmidelioides Schlecht., Linnaea **16**: 482. 1842.

Rhus aromatica var. *schmiedelioides* Engler in DC., Monogr. Phaner. **4**: 386. 1883.

Shrub; branches dark brown, densely ferruginous-pilose; leaflets 3, subcoriaceous, rhombic-ovate, acute at the apex,

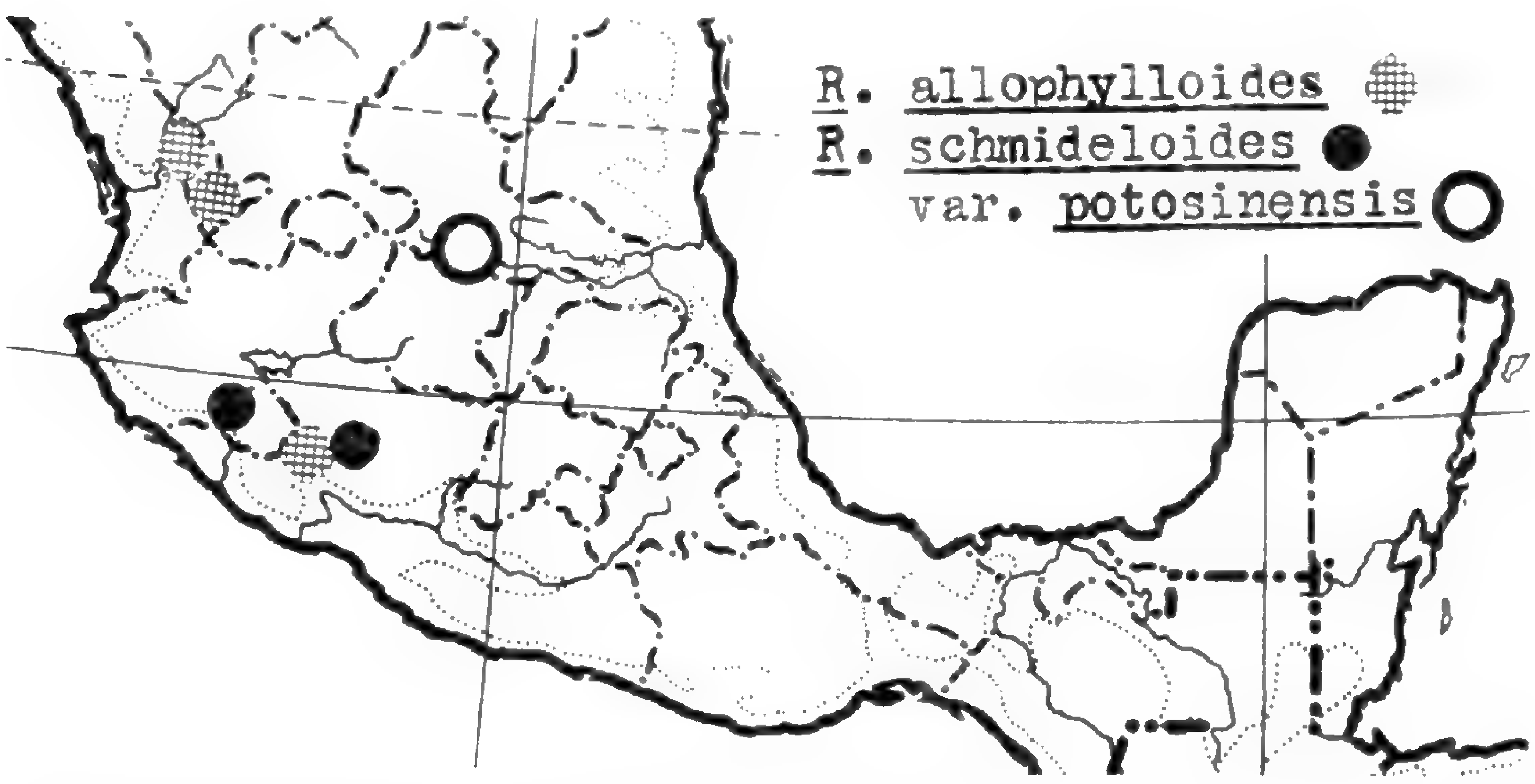

Fig. 23. The geographic distribution of *Rhus allophylloides* Standl., *R. schmidelioides* Schlecht., and *R. schmidelioides* var. *potosinensis* Barkl.

cuneate at the base, dentate-serrate-margined, ferruginous pubescent above and beneath, lighter below; leaflets sessile, terminal about 3.5 cm. long, 2.2 cm. broad, lateral leaflets about 1.7 cm. long, 1 cm. broad; petiole about 1.5 cm. long; inflorescence a terminal, small, compound spike about 3 cm. long, 2 cm. broad, bracts deltoid, 1 mm. long, 0.7 mm. broad, glabrous, sparsely ciliate; sepals ovate, 1 mm. long, 0.7 mm. broad, apex obtuse, sparsely pilose on the inner surface, glabrous on the outer surface, scarcely ciliate; petals ovate, 1.5 mm. long, 1 mm. broad, glabrous on the outer surface, sparsely pilose on the inner surface, not ciliate; fruit red, 6 mm. long, 6 mm. broad, pubescent with simple and glandular hairs.

This species closely resembles *R. aromatica* Ait. of eastern United States. Like that species, the amount of pubescence varies considerably. The diseased specimen from Michoacan is atypical.

Distribution: Jalisco to Michoacan (fig. 23).
MEXICO: coll. of 1891–1892, *Palmer* (US, M photo.).
JALISCO: Colima Volcano, July 13, 1892, *Jones 122* (M, US).
MICHOACAN: Santa Catarina, near Uruapan, Jan. 21, 1926, *Woronow* (F).

39a. Rhus schmidelioides var. **potosinensis** Barkl., n. var.[1] Shrub; leaves trifoliolate, long-petiolate; leaflets dentate-crenate, not pilose at maturity.

The variety tends to have longer petioles, and the leaflets tend to be much less pubescent when mature than in the species.

MEXICO:
SAN LUIS POTOSI: Alvarez, May 19–22, 1905, *Palmer 586* (Calif, M **type**, US, M photo.).

40. Rhus aromatica Ait., Hort. Kew. **1**: 367. 1789.
Rhus aromatica var. *glabra* Engler in DC., Monogr. Phaner. **4**: 385. 1883.
R. canadense Marsh., Arbust. Am., p. 129. 1785, non Mill., Gard. Dict., ed. 8. 1768.
R. canadensis var. *illinoensis* Fernald, Rhodora **10**: 52. 1908.
R. suaveolens Ait., Hort. Kew. **1**: 368. 1789.
R. illinoensis Ashe, Bull. Torr. Bot. Club **55**: 465. 1928.
R. illinoensis var. *formosa* Ashe, *ibid.* 466.
R. Nortonii Rydb., Brittonia **1**: 93. 1931.
R. crenata Rydb., Fl. Prair. & Plains, p. 526. 1932, non Thunb., ex Hoffm., Phytogr. Blaetter **1**: 28. 1803.
Betula triphylla Fant in Thunberg, Diss. Bot. Desc., p. 12, *pl. 1, fig. 2.* 1807.
Lobadium amentaceum Raf., Am. Month. Mag., p. 358. 1819.
L. suaveolens Raf., Jour. Phys. **89**: 98. 1819.

[1] **Rhus schmidelioides** var. **potosinensis** Barkley, n. var. Arbuscula; foliis ternatis, foliolis dentato-crenatis maturitate non pilosis.—Collected at Alvarez, San Luis Potosi, Mexico, May 19–22, 1905, *Edw. Palmer 586* (M **type**).

L. trifoliatum Raf., Cat. Bot. Gard. Trans. Univ., p. 14. 1824.

L. aromaticum Raf. ex Steud., Nom. Bot., ed. 2, p. 451. 1841.

Myrica trifoliata Printz, Pl. Afr. Rar. [In L., Amoen. Acad. **5**: CVI. p. 77. 1764], p. 28. 1760; Hort. ex Steud., Nom. Bot., ed. 2, p. 451. 1841.

Schmaltzia aromatica Desv., Jour. de Bot. Appl. **1**: 229. 1813; Steud., Nom. Bot., ed. 2. **2**: 531. 1841.

S. suaveolens Desv., *ibid.*

S. crataegifolia Greene, Leafl. Bot. Obs. & Crit. **1**: 130. 1905.

S. crenata Greene, *ibid.* 128.

S. formosa Greene, *ibid.* 131.

S. illinoensis Greene, *ibid.* 131.

S. Nortonii Greene, *ibid.* 132.

S. serrata Greene, *ibid.* 129.

Toxicodendron Crenatum Mill., Gard. Dict., ed. 8. 1768.

T. cuneatum Mill., ex Koch, Dendrol. **1**: 579. 1869.

Turpinia glabra Raf., Med. Repos. N. Y. **5**: 352. 1808.

T. aromatica Raf., *ibid.*

T. pubescens Raf., *ibid.*

T. suaveolens Raf., *ibid.*

Shrub 0.5–1.5 m. high; branches light brown at first, usually slender, puberulent or sometimes glabrate; leaves deciduous, petiole about 2.5 cm. long; leaflets 3, thin, sessile or subsessile, at first puberulent, later glabrate, terminal leaflet broadly ovate to rhombic-ovate, 4–8 cm. long, 2.2–6 cm. broad, crenate-dentate to serrate near apex, entire and abruptly cuneate at the base, lateral leaflets oval, 3.5–4.5 cm. long, 1.7–3.5 cm. broad, crenate-dentate to serrate near the apex, entire and obtuse at the base; inflorescence a terminal compound spike about 6 cm. long, 3 cm. broad, bracts broadly ovate, 1 mm. long, 1.8 mm. broad, densely pubescent on both surfaces, glabrate near apex on the outer surface, ciliate with simple and glandular hairs; flowers almost sessile; sepals ovate, 0.8 mm. long, 0.8 mm. broad, glabrous on both surfaces, not ciliate, persistent; petals ovate, 1.5 mm. long, 0.8 mm. broad, glabrous on both surfaces, not ciliate; fruit red, about 5 mm. long, 5 mm. broad, pubescent with simple and glandular hairs.

A species with much variation, yet easily recognizable throughout its range. While related to *R. schmideloides,* the only plant it is likely to be confused with is *R. trilobata* var. *serotina* (Greene) Barkl. It seems probable that there has

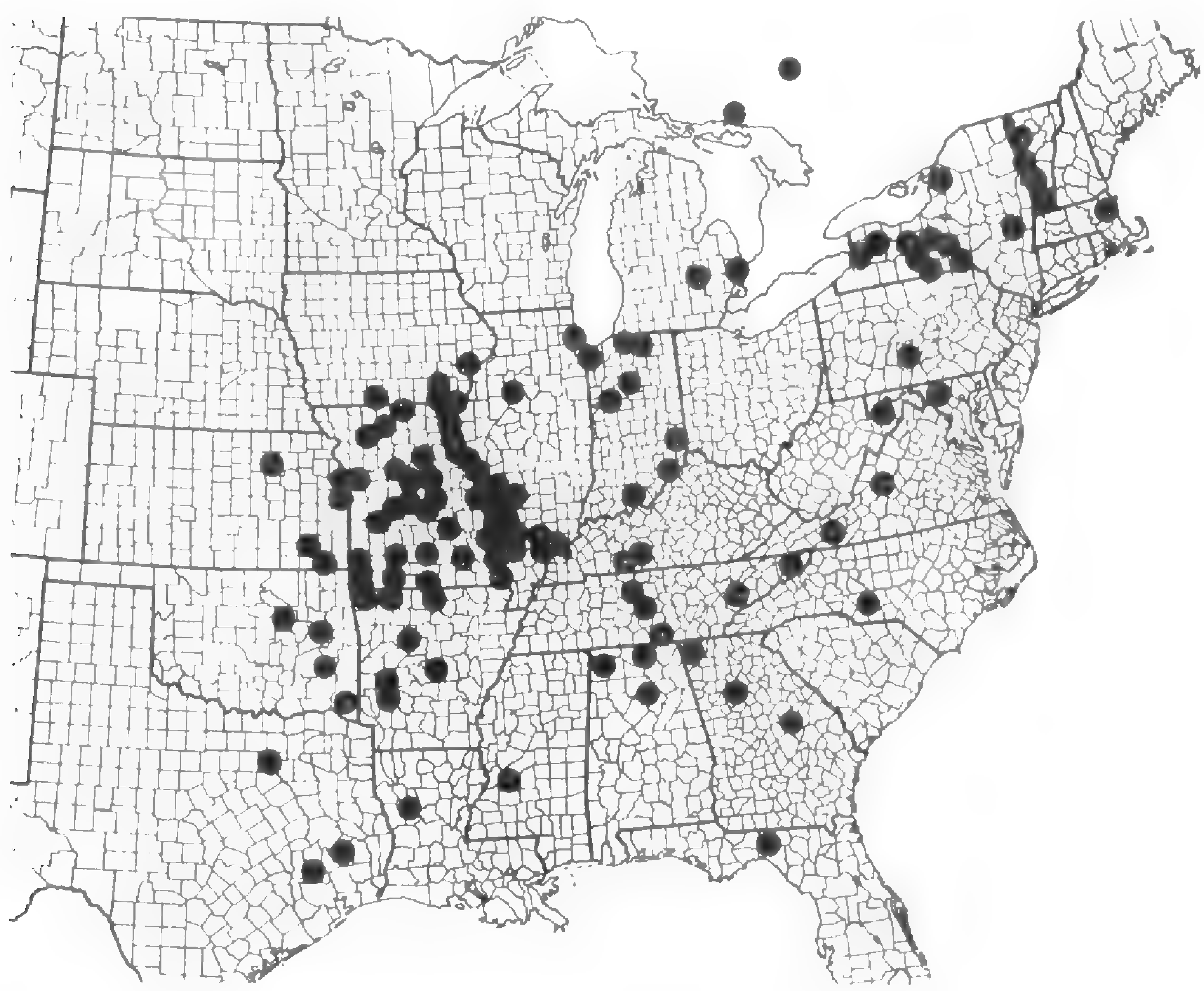

Fig. 24. The geographic distribution of *Rhus aromatica* Ait.

been hybridization between the two species where their ranges overlap. In its westward range the leaves of *R. aromatica* become smaller.

Distribution: Quebec, south to Florida, west to Nebraska and Texas (fig. 24).

CANADA:

QUEBEC: Ile Lemieux, valley of the Ottawa, Aug. 27, 1924, *Rolland-Germain 13022* (M).

ONTARIO: Shannonville, June 2, 1884, *Fowler* (M).

UNITED STATES:

VERMONT: Snake Mountain, Weybridge, Aug. 7, 1896, *Eggleston* (F); Pownal, June 25, 1931, *Carpenter* (CA); North Pownal, Aug. 1, 1898, and May 9, 1902, *Churchill*, July 25, 1898, *Eggleston* (M); Charlotte, April 19, 1878, and June 1, 1879, *Horsford* (F); Benson, June 27, 1923, *Knowlton* (M).

MASSACHUSETTS: Arnold Arboretum, Jamaica Plain, 1922, *Blazic* (CA).

NEW YORK: Glenmont, May 25, and Aug. 4, 1929, *House 16099* (M); Choconut Ravine, 1885, *Millspaugh* (F); Chemung Co., June 16, 1895, and May 6, 1897, *Heller 7776* (F); Sullivan Hill, May 11, 1879, *Lucy 1678* (F); Buffalo, *Clinton* (F); "North Woods," Le Roy, July 4, 1893, *Hill 51* (F); north side of Black River, 2 miles east of Brownville, July 8, 1931, *Muenscher & Maguire 2381* (M); Henderson, Aug. 1896, *Tidestrom* (ND); Dexter, *ex Vasey Herb.* (M); Ontario Co., 1828–1834, *Hall* (F); Ovid, May 22, 1858, *Brewer & Chickering* (F); Fall Creek Ithaca, July 31, 1893, *von Schrenk*, and May 24, 1878, *Trelease* (M); north of Esty, July 6, 1918, *Wiegand 10243* (M); Penn Yan, *Sartwell* (M).

PENNSYLVANNIA: Huntingdon Co., July 1878, *Porter* (F).

MARYLAND: Emmitsburg, *Foreman* (F).

VIRGINIA: Lexington, May 19, 1881, *Churchill*, and Natural Bridge, May 30, 1891 (M); Natural Bridge, April 27, 1886, *Kennedy 7* (RMt); Wytheville, 18??, *Schriver* (F).

NORTH CAROLINA: falls of Yadkin River, Aug. 18, 1892, *Small* (F); Stanly Co., Aug. 18, 1891, *Small & Heller* (F).

GEORGIA: middle Georgia, March 1843, *Rugel* (M); Stone Mountain, May 20, 1897, *Eggert*, May 30, 1933, *Miller, Perry, Boyd & Myers 543* (M); Stone Mountain, alt. 1600–1630 ft., Sept. 6–12, 1894, *Small*, DeKalb Co., May 1–8, 1895, Currahee Mountain, alt. 900–1800 ft., Sept. 1–3, 1894 (F); Chickamauga Park, near Chattanooga, Tennessee, May 27, 1911, *Churchill* (M); northwest of Sandersville, June 13, 1902, *Harper 1329* (F, M, cotype of *S. crenata*).

FLORIDA: Jefferson Co., June–July 1898, *Hitchcock 338* (F).

ALABAMA: Blount Springs, May 5, 1898, *Baker* (F, RMt); Tuscumbia, July 20, 1899, *Eggert* (M); Huntsville, *Mohr* (F); Huntsville, July 1891, *Shimek* (F).

MISSISSIPPI: Jackson, April 18, 1927, *Woodson & Anderson 1547* (M).

LOUISIANA: Natchitoches, April 24, 1915, *Palmer 7362* (CA, M).

WEST VIRGINIA: near Burlington, Aug. 21, 1930, *Berkley 1655* (M).

MICHIGAN: near Pleasant Lake, June 1, 1910, *Ehlers 822* (M); near Port Huron, May 7 and June 22, 1895, *Dodge* (F, M).

INDIANA: Fitch's Glenn, about 4 miles west of Logansport, May 18, 1928, *Deam 45717*, Blue River, 1 mile south of Milltown, Oct. 5, 1920, St. Joseph River about 1.5 miles northwest of Bristol, July 7, 1920, *31355*, along White Water River, west of Cedar Grove, May 19, 1919, *27530*, and along the Ohio River about 4 miles east of Madison, June 20, 1915, *16239* (Deam); shore of Lake Michigan, Roby, May 17, and Sept. 11, 1898, *Lansing 158* (F); St. Joseph River west of the Elkhart County line, May 25, 1923, *Deam* (Deam); 4-mile Bridge, northwest of Notre Dame, Aug. 28, 1925, and June 20, 1929, *Nieuwland* (ND); 4-mile Bridge, St. Joseph River, Oct. 12, 1930, *Nieuwland & Just* (ND); near Big Wea Creek about 4 miles southwest of Lafayette, June 4, 1927, *Deam 44460* (Deam); West Lafayette, May 23, 1912, *Overholts* (M).

KENTUCKY: coll. of 1840, *Short* (M), coll. of 1859 (F); Russelville, June 5, 1920, *Palmer 17740* (M); Bowling Green, June 1890, *Price* (M).

TENNESSEE: near Nashville, Aug. 12, 1897, *ex Biltmore Herb. 869a* (M); Cumberland Mountain, July 21, 1897, *Eggert* (M); along Tennessee River, Knoxville, May 1895, *Ruth* (F, RMt); Knoxville, June 1896, *Ruth*, April and June 1898, *31, 3* (M); near Murfreesboro, April 22, 1929, *Palmer 35491* (M); limestone bluff, Bluff City, May 20, 1934, *Underwood 774* (ND).

ILLINOIS: 1873, *Brendel* (US type of *S. illinoensis*); June 20, 1875, *Eggert* (M); McClure, Sept. 29, 1919, *Palmer 16619* (CA, M); Kenilworth, June 15, 1908, *Calkins 295* (F); Evanston, May 30, 1890, *ex Letterman Herb.* (M); Tunnel Hill, May 17, 1919, *Palmer 15184* (M); Peoria, April and June 1900, *McDonald* (RMt); Grassland, Aug. 20, 1887, *Pammel* (M); Alto Pass, May 2, 1919, *Palmer 15013* (CA, M); Cobden, June 8, 1885, *Waite* (US type of *S. formosa*).

IOWA: Decatur Co., Oct. 14, 1897, *Anderson* (M, RMt); near Fairfield, May 19, 1929, *Palmer 35824* (M); Keokuk, July 5, 1895, *Shimek* (F); Moscow, 18??, *Hitchcock* (M); Muscatine, Sept. 10–12, 1898, *Pammel & Reppert 1217* (M); Pittsburg, June 14, 1902, *Shimek* (M).

MISSOURI: Bush Station, Aug. 11, 1914, *Davis 2991* (M); bluffs of the Osage, Warsaw, Aug. 26, 1897, *Trelease 250* (M); near Lutesville, April 26, 1931, *Palmer 39106* (M); Hinkson Creek on Black's Mill Road, south of Columbia, May 21, 1933, *Drouet 409* (M); Columbia, June 3, 1928, *Kellogg 1852* (M); Poplar Bluff, Aug. 6, 1897, *Savage & Stull* (F); Dumas, Aug. 25, 1921, *Bush 9521*, and July 27, 1923, *10127* (M); Jefferson City, *Krause* (M); Cooper Co., Sept. 30, 1934, *Bush 14145* (M, ND), and *14146* (ND); near Pattonsburg, June 15, 1924, *Palmer 25469* (M); Elmont, May 23, 1914, *Emig 247* (M); Gray Summit, May 19, 1928, *Greenman 4536* (M); Pacific, June 13, 1897, *Trelease 249* (M); Greene Co., April 27 and May 26, 1888, *Blankinship* (M); near Trenton, June 15, 1924, *Palmer 25489*, near Ironton, May 17, 1923, *22652* (M); Shut-in, Arcadia, May 8, 1925, *Woodson 377* (M); Swope Park, Kansas City, June 13, 1937, *Barkley 1150* (ND); campus, Kansas City University, June 14, 1937, *Barkley 1* (ND); Independence, June 18, 1895, *Bush 62*, Vale, June 8, 1906, *3928*, Dodson, Oct. 4, 1906, *4162*, Oct. 11, 1921, *9728*, Greenwood, Oct. 3, 1923, *10225*, Swope Park, Kansas City, Oct. 6, 1923, *10230*, and Courtney, June 2, 1931, *12117* (M); Carterville, Aug. 5 and 10, 1906, *Palmer 873*; Webb City, March 15, 1909, *1597*, and May 3, 1909, *1866*, Jasper, May 6, 1909, *1900* (M); Turkey Creek, Joplin, Oct. 7, 1897, *Trelease 252* (M); Kimmswick, May 1862, *Engelmann* (M); near Festus, May 31, 1926, *Mathias 533* (M); 3 miles northwest of Festus, June 20, 1929, *Steyermark 1104* (M); Kimmswick, April 12, 1885, *Wislizenus 59* (M); Wyaconda River, La Grange, Oct. 31, 1914, *Davis 3497, 3497A*, and Whiteside, Sept. 12, 1911, *993* (M); Noel, May 2, 1914, *Palmer 5461* (M); St. Francis River, near Silvermine, May 20, 1927, *Greenman* (M); Lanes Prairie, May 8, 1934, *Bush 13492* (M); Hannibal: Aug. 28, 1911, *Davis 718*, Mark Twain's Cave, June 10, 1913, *348*, Ely Street, May 4, 1914, *2332*, north of town, May 30, 1914, *2646*, south of town, May 16, 1921, *3509* (M); Mississippi bluffs, Helton, June 16, 1917, *4519* (M); between Iberia and Tuscumbia, July 4, 1934, *Steyermark 13006* (M); Morgan Co., Sept. 30, 1934, *Bush 14179* (M, ND), and *14180* (ND); 4 miles southwest of Joplin, May 28, 1923, *Palmer 22927* (M); Shoal Creek, near Joplin, Oct. 7, 1897, *Trelease 253* (M); near Bakersfield, Oct. 7, 1927, *Palmer 32865*, and "Bald Jesse," near Gainesville, June 26, 1928, *34756* (M); Perry Co., along Shawanee Springs branch (Taylor Springs branch) of Cinq Hommes Creek, about 3 miles south of Perryville, July 29, 1934, *Steyermark 13970* (M); Jerome, May 4, 1913, *Kellogg 384* (M); Eolia, May 26, 1914, *Davis 2418* (RMt), May 29, 1916, *1238*, and Minor's farm, near Eolia, June 25, 1917, *7615* (M); between Livonia and Unionville, July 2, 1933, *Palmer & Steyermark 41099* (M); south of Oakwood, Oct. 9, 1914, *Davis 3708* (M); Redgeville, April–Aug. 1899, *Jenson 14* (M); Osceola, July 28, 1933, *Bush 12805* (CA, M); Flat River, Oct. 13, 1897, *Trelease 254, 255, 256* (M); Ste. Genevieve, June 23, 1920, *Palmer 18029* (M); near Webster Groves, Nov. 1926, *Bettis* (M); Meramec Highlands, May 14, 1918, *Churchill* (M); Valley Park, Nov. 9, 1936, *Cutler 607* (M); Mincke, May 19, 1918, *Drushel 4028* (M); St. Louis, June 20, 1875, and April 24, 1877, *Eggert*, near Allenton, May 2, 1896, (M); Windsor Springs, May 30, 1890, *Hitchcock* (M); Meramec Highlands, July 29, 1905, *Johnson* (M); Cliff Cave, July 22, 1898, *Kellogg* (M); Allenton, March and May 1880, *Letterman*, March 25, 1880 (CA), and May 20, 1880 (M); Meramec Highlands, June 13, 1909, *Ohlweiler*, Oct. 12, 1905, *Shannon 222a*, and June 26, 1910, *Sherff 79* (F); May 2, 1925, *Bush 14730*, Herndon, May 2, 1935, *14740*, and Montier, Aug. 4, 1927, *11442* (M); near Galena, Sept. 25, 1923, *Palmer 23880*, and April 30, 1924, *24582* (M); Piedmont, Sept. 1897, *Russell* (M); Williamsville, Sept. 9, 1897, *Trelease 251* (M); 6 miles north of Cedar Gap, alt. 1675 ft., May 22–June 3, 1911, *Lansing 2960*, 1 mile south of Cedar Gap, May 22–June 3, 1911, *2990* (F).

ARKANSAS: Cotter, Sept. 1, 1915, *Palmer 8411* (CA, M); Benton Co., *Plank* (M); Eureka Springs, April 24, 1928, *Nelson 10903* (RMt); Pope Creek, May 1, 1927, *Ashe* (CA); Langley, Oct. 5, 1932, *Demaree 9511* (M); near Nogo, Oct. 19, 1932, *Merrill 96* (M); cross-roads, about a mile south of Sleepy Hollow filling-station on Highway 10, Pulaski Co., April 29, 1935, *Lodewyks, 233* (M).

KANSAS: Olathe, Oct. 3, 1934, *Bush 14227* (M); 4 miles west of Oswego, June 27, 1929, *Rydberg & Imler 318* (M); Miami Co., May 20, 1885, *Oyster* (CA); Riley Co., April 25, 1895, *Norton 74* (RMt cotype of *S. Nortonii*), and Oct. 12, 1895, *74a* (M, RMt, US), and Sept. 21, 1895, *Clothier 74b* (RMt); near Neodesha, Oct. 31, 1923, *Palmer 24359* (M).

OKLAHOMA: Devil's Promenade, Sept. 18, 1921, *Bush 9629*, Sapulpa, July 30, 1894, *190* (M); Gowen, June 12, 1930, *Clark 2705* (Okla); North Hairpin Bend, Highway 21, McCurtain Co., June 7, 1930, *Little & Olmsted 123* (Okla); Muskogee Co., May 22, 1927, *Little*, June 18, 1927, and Aug. 24, 1927, *3164* (Okla).

TEXAS: Buzzard Spring, Aug. 1, *Reverchon 7*, and Angelina Bottom, May 7, 1903 (M); Dallas, May 10, 1900, *Bush 689* (M); east of the Trinity River, May, 1874, *Reverchon 149* (M); Willis, *Warner* (M); Livingston, April 12, 1914, *Palmer 5211* (M).

41. Rhus trilobata Nutt. ex Torr. & Gray, Fl. N. Am. **1**: 219. 1838.

Rhus trilobata var. *glaberrima* Engler in DC., Monogr. Phaner. **4**: 386. 1883.

R. aromatica var. *trilobata* Gray, Am. Jour. Sci. II. **33**: 408. 1861.

R. Osterhoutii Rydb., Fl. Rocky Mts. & Adj. Plains, p. 551, 1064. 1917.

R. oxyacanthoides Rydb., *ibid.*
Schmaltzia trilobata Small, Fl. Southeast. U. S., pp. 728, 1334. 1903.
S. Bakeri Greene, Leafl. Bot. Obs. & Crit. **1:** 132. 1905.
S. botryoides Greene, *ibid.* 138.
S. cognata Greene, *ibid.* 141.
S. elegantula Greene, *ibid.* 136.
S. glabrata Greene, *ibid.* 132.
S. glauca Greene, *ibid.* 138.
S. glomerata Greene, *ibid.* 140.
S. hirtella Greene, *ibid.* 137.
S. leiocarpa Greene, *ibid.* 133.
S. oxyacanthoides Greene, *ibid.* 134.
S. quercifolia Greene, *ibid.* 141.
S. sabulosa Greene, *ibid.* 135.
S. subpinnata Greene, *ibid.* 133.
S. tridophylloides Greene, *ibid.* 141.
S. pubescens Osterh., Muhlenbergia **7:** 11. 1911.
Toxicodendron trilobatum Kuntze, Rev. Gen. Pl., pt. 1, p. 154. 1891.
T. triphyllum var. *trilobatum* forma *glaberrimum* Kuntze, *ibid.*

Shrub 0.3–1.5 m. high; twigs slender, bark gray, the new branches tan, puberulent, the older glabrate; leaflets 3, subcoriaceous to thin, subrevolute, glabrous and green above, barely pubescent below, crenate, with about 3 entire or crenate-dentate lobes near the rounded apex, subemarginate to submucronate, entire near the cuneate base, sessile, terminal leaflet obovate, 2 cm. long, 1.5 cm. broad, lateral leaflets obovate, 1 cm. long, 1 cm. broad; petiole 0.5 cm. long; inflorescence a dense compound spike, bracts deltoid, 1.5 mm. long, 1.7 mm. broad, densely pubescent on the outer surface, glabrous on the inner surface, ciliate with non-glandular hairs, persistent; flowers numerous, pedicels about 2.5 mm. long; sepals deltoid-lanceolate, 1.2 mm. long, 0.4 mm. broad, rounded at the apex, glabrous, ciliate with non-glandular hairs, persistent; petals yellowish in the dried state, obovate, 2.7 mm. long, 1.5 mm. broad, glabrous on the outer surface, pilose on the inner surface, not ciliate; anthers oval, 0.6 mm. long, 0.6 mm. broad, filaments about as long as the sepals; fruit 6 mm. long, 7 mm. broad, somewhat flattened, red, covered with a layer of short red glandular hairs and sparsely pilose with simple hairs; seed 5 mm. long, 3.5 mm. broad, slightly roughened.

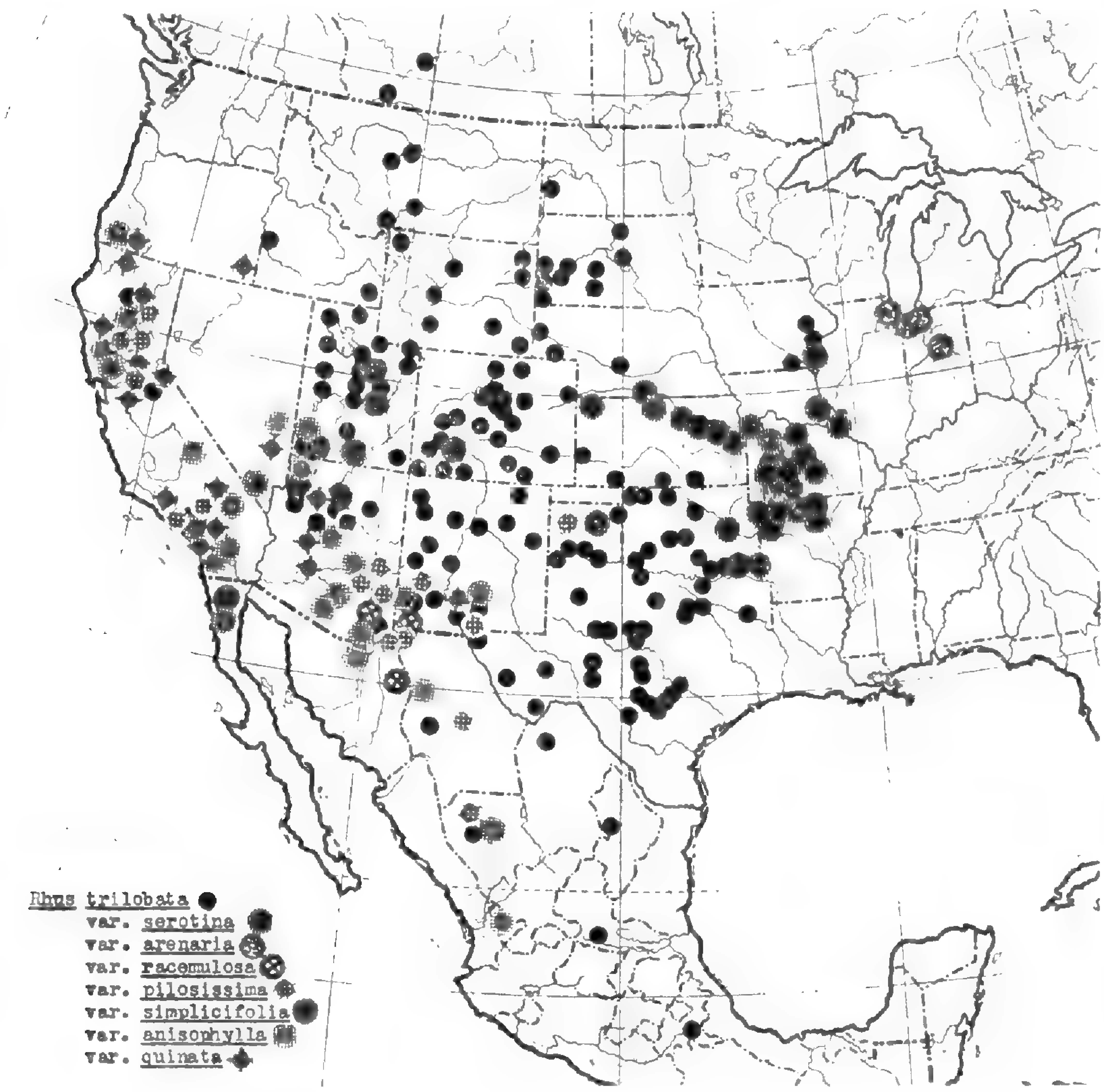

Fig. 25. The geographic distribution of *Rhus trilobata* Nutt. and its varieties.

An extremely variable assemblage of plants probably best treated taxonomically as a single polymorphic species running into several more or less consistent geographic variations.

Distribution: Iowa, Alberta, and California, to south-central Mexico (fig. 25).

CANADA:

ALBERTA: Medicine Hat, June 5, 1894, *Macoun 4075*, Milk River, July 9, 1895, *10075* (M).

SASKATCHEWAN: South Saskatchewan, Sept. 5, 1880, *Macoun 78* (F).

UNITED STATES:

IOWA: Davis Co., July 18, 1895, *Fitzpatrick* (F); Cedar Rapids, May 15, 1896, *Shimek* (F, M), Big Sand Mount, northeast part of Louisa County, July 19, 1922 (M).

NORTH DAKOTA: Medora, June 19, 1900, *Bergman* (Okla); near Medora, Aug. 16, 1927, *Larsen 179* (M).

SOUTH DAKOTA: Bald Hills, Black Hills National Forest, June 8, 1910, *Murdock 4090* (F); without definite locality, *Thornber 551* (F); Peno Hills, Aug. 1891, *Williams* (M); Pinean Hills, Aug. 7, 1891, *Williams & Wilcox* (M); Hill Canyon, 8 miles northeast of Dewey, July 28, 1927, *Hayward 2471* in part (RMt), Hot Springs, Aug. 15, 1926, *453* (F); Hot Branch Canyon, near Hot Springs, Aug. 6, 1928, *McIntosh 1042* (RMt); July 28, 1911, *Visher 2558* (RMt); Missouri Valley, Pierre, *ex Herb. Coulter* (F); Spearfish Canyon, Aug. 1 and 2, *Hayward 113, 174* (F); near Piedmont, June 8, 1929, *Palmer 37014* (M); Black Hills near Fort Meade, Sept. 1, 1887, *Forwood 59* (US type of *S. glabrata*); Piedmont, May and July 1895, *Pratt* (F); Bad Lands, Pennington Co., 5 miles south of Scenic, Aug. 22, 1926, *Hayward 580* (F), Rapid City, June 12, 1927, *751, 791* (RMt), and May 10, 1925, *Lee 519* (RMt); Bad Lands near Wall, June 15, 1929, *Palmer 37263* (M); Black Hills, Rockerville, June, 1910, *White* (M); Fort Pierre, 1853–1854, *Hayden* (M); Swan Creek, Aug. 1, 1911, *Visher 3349* (M), Bear Creek, July 8, 1911, *2074* (F).

NEBRASKA: coll. of 1853–1854, *Hayden 192*, and forks of the Platte, July 8, 1858 (M); Sidney, May 23, 1922, *Nelson* (RMt); 9 miles south of Gothenburg, May 30, 1931, *Morrison 1027* (M); Scotts Bluff Co., Aug. 13, *Baker* (M).

KANSAS: near Medicine Lodge, July 22, 1933, *Palmer 41835* (M); Cowley Co., April 1898, *White* (M); Syracuse, July 15, 1893, *Thompson 120* (M); Seward Co., Aug. 29, 1897, *Hitchcock 1106* (M, RMt, cotypes of *S. quercifolia*, M photo.); 12 miles east of Liberal, July 11, 1929, *Rydberg & Imler 870* (M).

OKLAHOMA: "Indian Territory," April 23, 1877, *Butler* (M); on the upper Canadian River, April 1864, *Gordon 92* (M); Salt Fork of the Arkansas River, 5.5 miles north of Cherokee, June 21, 1930, *Jackson 335* (Okla); Limestone Gap, April 23, 1871, *Butler 78* (M), and 11 miles north of Limestone Gap, April 23, 1877, *40* (F); prairie, top of Devils Canyon, Sept. 27, 1936, *Little 3903* (ND); 3 miles west of Norman, May 1, 1928, *Barkley* (Okla); Norman, April 20, 1924, *Bruner*, and 2 miles southwest of Norman, April 20 and July 5, 1924 (Okla); Norman, Oct. 3, 1914, *Emig 367* (M); near the South Canadian River, near Norman, May 26, 1922, *Jeffs* (Okla); Norman, May 1, *Kitchens 48* (Okla); near the South Canadian River, April 29, 1924, *Vincent 67* (Okla); Cleveland Co., April 29, 1901, *White* (RMt); west of Minco, July 3, 1928, *Myers 72* (Okla); near Hornbeck's, May 3, 1913, *Stevens 268* (M); north bank of Red River, 5.5 miles southwest of Eldorado, March 27, 1927, *Little 535* (Okla); Devil's Den, near Tishomingo, May 27, 1931, *Palmer 39434* (M); Mountain Park, Kiowa Co., July 17, 1903, *Duncan 40* (M); Frank's Conglomerate Peak, Arbuckle Mts., *Fielder* (Okla); Price's Falls, April 30, 1926, *Stratton 6* (M); Cimarron River near Perkins, June 14, 1893, *Waugh 131* (M, US type of *S. tridophylloides*); near Cora, May 28, 1913, *Stevens 766* (M); Cedar Top, Sept. 2, 1936, *Eskew 1355* (Okla); Cache, July 26, 1936, *Kaieser 6* (Okla); 5 miles west of Snyder, Oct. 23, 1936, *Hopkins 846* (Okla); Chickasha, April 22, 1936, *Osborn 469 R* (Okla).

TEXAS: Pinto Canyon, near Rindosa, April 13, 1919, *Hanson* (M); western

Texas, 1890, *Nealley* (F); valley of Trinity River, April 4–May 20, 1912, *Ruth 357* (M); Paloduro Canyon, May 31, 1902, *Reverchon* (M); Paloduro, Sept. 14, 1917, *Young* (M); near Coyote Lake, Bailey Co., Aug. 25, 1921, *Ferris & Duncan 3442* (CA, M); San Antonio, June 28, 1911, *Clemens* (CA), and *831* (M); Bracken, June 26, 1903, *Groth 1* (F); coll. of 1903, *Jermy* (M); San Antonio, March 16, 1916, *Palmer 9191* (CA, M); Upper Blue Creek Canyon, Chisos Mts., alt. 1520 m., July 1, 1931, *Moore & Steyermark 3326* (CA, M); Chisos Mts., June 19, 1931, *Mueller 8066* (M); near Brownwood, Oct. 3, 1924, *Palmer 26759*, and Clyde, May 30, 1918, *13808* (M), and *13809* (CA, M); Comal Co., Oct. 1846, *Lindheimer 230, 347*, New Braunfels, May 1848 (M), and Comanche Spring, May 1849, *733* (F, M, Okla); near Comanche, May 9, 1900, *Eggert* (M); Dallas, April 16, 1900, *Bush 612*, and May 10, 1900, *688* (M); near Dallas, June 23, 1899, *Eggert*, and May 3, 1900 (M); Dallas, June 15, 1898, *ex Glatfelter Herb.* (M); Dallas Co., April and May 1892, *Purpus 62* (F); Dallas, March and May, *Reverchon (Curtiss 499)* (F, M), May 1876, and June 1880 (F); El Paso, 1881, *Vasey* (F), and April 1881 (M); Hudson Mountain, *ex Jermy Herb. 87* (M); Denison, Oct. 28, 1933, *Creighton & Gilchrist* (M); Longview, April 2, 1915, *Palmer 7126* (CA); Estelline, July 8, 1903, *Reverchon 3813*, and "Red River," Estelline, May 25, 1904 (M); San Marcos, Nov. 6, 1897, *Irelean* (M); near Canadian, June 7, 1901, *Eggert*, and Granbury, May 7, 1900 (M); Davis Mts., Oct. 4, 1926, *Palmer 31928* (M); Limpia Canyon, April 24, 1902, *Tracy & Earle 258* (F, M, ND); Spanish Pass, May 23, 1916, *Palmer 9866* (CA, M); Kerrville, alt. 1600–2000 ft., April 25–30, 1894, *Heller 1658* (F, M); Llano, April 19, 1931, *Fisher 38* (F); Lubbock, near Posey, 1930, *Demaree 7764* (M); near Colorado, June 8, 1900, *Eggert* (M); Nolan Co., Aug. 3, 1934, *Barkley* (M); Sheffield, April 13, 1930, *Jones 25652* (M); "Red River," Randall Co., Aug. 13, 1900, *Eggert* (M); Sonora Exp. Sta., Sutton Co., alt. 700 m., July 13, 1920, *Eggleston 16688* (F); Tarrant Co., June 2, 1920, *Ruth 357* (F); San Angelo, March 29, 1917, *Palmer 11403* (CA); Austin, May 8, 1872, *Hall* (F), *75* (M); Austin, April 1, 1916, *Palmer 9328*, Uvalde, March 22, 1917, *11346* (CA, M); Rio San Pedro, 1851, *Wright 917* (US type of *S. sabulosa*); Pease River bottoms near Vernon, Aug. 20, 1921, *Ferris & Duncan 3349* (CA, M); Belknap, March 9, 1858, *Hayes 111* (F); Graham, Oct. 28, 1902, *Reverchon* (M).

MONTANA: Black Eagle Falls, Great Falls, July 22, 1885, *Anderson* (F); Bozeman, alt. 4500 ft., May 5, 1906, *Blankinship 667* (RMt); Bozeman, May 18, 1901, *Jones 67* (RMt); Helena, July 7, 1909, *Butler 4123* (CA); 1 mile northwest of Fish Creek, Sweet Grass Co., *Hitchcock 2351* (CA).

YELLOWSTONE NATIONAL PARK: Red Mountain, Whiskey Gap, June 16, 1932, *Hanna 1002* (M); Gardiner River, June 18, 1902, *Mearns* (F); near Table Mountain, June 2, 1894, *Nelson 159*, and along the Gardiner River, July 19, 1899, *5964* (M).

WYOMING: without definite locality, June 8, 1892, *Buffum 170* (RMt); Blue Grass Hills, July 8, 1894, *Nelson 3063 (322)*, Platte Plains and Hills, July 13, 1894, *446* (ND, RMt); Naturita, alt. 5400 ft., April 20, 1914, *Payson 235* (RMt); between Sheridan and Buffalo, June 15–July 15, 1900, *Tweedy 3533* (RMt); Kemp Creek Hills, July 20, 1910, *Willits 440* (RMt); east of Laramie, June 21, 1891, *Buffum* (RMt); Sand Creek, July 29, 1929, *Greenman 6015* (M); Laramie Peak, Aug. 7, 1895, *Nelson 1477* (RMt), and Sand Creek, May 31, 1900, *6983* (M, RMt); east of Laramie, June 1, 1902, *Shellon 57* (RMt); Beulah, Aug. 3, 1926, *Hayward 228* (F); Pole Creek Canyons, June 2, 1894, *Nelson 159* (ND, RMt); near Cheyenne, June 25, 1896, *Greene* (ND); Pinebluff, May 15, 1897, *Nelson 2881* (RMt); Leucite Hills, June 17, 1901, *Merrill & Wilcox 704* (RMt); Green River, May 31, 1897, *Nelson 3065* (F), and Worland, Aug. 1909, *9300* (RMt); Newcastle, July 9, 1927, *Hayward 2028* in part (F, RMt).

COLORADO: Trail Glen, alt. 2150 m., July 22, 1901, *Clements 32* (M, RMt); Horsetooth Gulch, May 15, 1897, *Crandall 1251* (RMt); Pawnee Buttes, July 1, 1906, *Dodds 2099* and *2106* (RMt); Mesa Verde National Park, July–Aug. 1913, *Haas 11* (RMt); Wickiup Cañon, Mesa Verde National Park, alt. 6400 ft., May 30, 1925, *Schmoll 1643* (RMt); Ute Pass, June 30, 1886, *Trelease* (M); Mesa Verde National Park, July 1, 1935, *Zobel* (M); Littleton, Aug. 30, 1923, *Pammel* (Okla); Arboles, alt. 6000 ft., June, 1899, *Baker 456* (F, M, ND, RMt), and June 10, 1899 (ND); hillside, Pagosa Springs, Aug. 13, 1917, *Payson 1155* (M, RMt); Piedra, along trail to Chimney Rock, June 21, 1924, *Schmoll 1215*, and Devils Creek, July 7, 1924, *1377* (RMt); Rule Creek, Bent Co., May 22, 1913, *Osterhout* and *4876* (RMt); Boulder, May 1900, *Archibald A165* (RMt); west of Sanitarium, Boulder, June 5, 1917, *Johnston & Hedgcock 802* (RMt); near Boulder, June 1899, *Ramaley A62* (RMt); Blue Bell Canyon, near Boulder, June 18, 1906, *Robbins 1583* (RMt); near Boulder, July 1902, *Tweedy 4948* (RMt); Buena Vista, June 18, 1918, *Eastwood 7093* (CA); Salida, June 27, 1917, *Payson 1012* (M); near Empire, 1875, *Greene* (ND); Berkeley, Denver, June 13, 1916, *Bethel 9*, and July 16, 1916, *8* (CA); Inspiration Point, June 26, 1918, *Churchill* (M); along Clear Creek, Denver, Aug. 7, 1910, *Eastwood 22* (CA, M); 3 miles south, 2 miles east of the Chase Ranch, Sedalia, July 12, 1917, *Johnston & Hedgcock 790* (RMt); Sedalia, 3 miles east to Castle Rock, July 12, 1917, *Johnston 790* (M); Garden of the Gods, Colorado Springs, Aug. 17, 1915, *Drushel 3164* (M); Manitou, Sept. 9, 1905, *ex Glatfelter Herb.*, and South Cheyenne Cañon, Sept. 11, 1905 (M); Garden of the Gods, Colorado Springs, Sept. 18, 1899, *Holm* (F); Colorado Springs, June 23, 1879, *Jones* (RMt); Colorado Springs, July 19, 1872, *Redfield 427* (M); Williams Canyon, Aug. 17, 1927, *Woodson 1879* (M); Cañon City, Sept. 7, 1896, *Greene* (ND type of *S. subpinnata*); southeast of La Veta, May 18, 1900, *Rydberg & Vreeland 5909* (RMt); Golden, May 27, 1916, *Eastwood 5408* (CA); Durango, July 20, 1898, *Baker, Earle & Tracy 525* (M, ND, cotypes of *S. cognata*); Durango, May 21, 1916, *Eastwood 5306* (CA); Fort Collins, alt. 5000 ft., May 15 and July 9, 1896, *Baker* (M, cotype of *S. Bakeri*); May 15 and July 6, 1896, *Earle* (F); along Masonville road, west of Fort Collins, June 20, 1929, *Mathias 358* (M); Trinidad, June 13, 1916, *Eastwood 5553, 5583* (CA); Deer Run, Aug. 25, 1901, *Baker 919* (ND); Gunnison Mesa, Grand Junction, May 15, 1916, *Eastwood 5069*, and Grand Junction, June 21, 1918, *7228* (CA); Grand Junction, Aug. 27, 1896, *Greene* (ND type of *S. oxyacanthoides*, M photo.); Dolores, July 28, 1917, *Payson 1121* (RMt), *1121A* (M); Cimarron, alt. 6900 ft., July 11, 1901, *Baker 406*, (M, ND, RMt); Cedar Creek, near Montrose, July 9, 1917, *Payson* (M), *1043* (M, RMt), alt. 5000 ft., July 14, 1924, *3931* (RMt); Paradox, alt. 5400 ft., June 19, 1912, *Walker 122* (RMt); "Mill," Nast, July 1918, *Schedin* (RMt); open prairie, 11 miles south of Pueblo, June 8, 1922, *Wiegand & Upton* (F); Norwood Hill, alt. 7000 ft., Aug. 10, 1912, *Walker 414* (M, RMt); northwest of Grover, May 24, 1926, *Johnston 198* (RMt); Wray, July 1–4, 1919, *Eggleston 15214* (F).

NEW MEXICO: White Sands, May 4, 1933, *Castetter 2122* (RMt); Puije Indian Ruins, Oct. 14, 1928, *Eastwood 15541* (CA); Balsam Park, Sandia Mts., alt. 8300 ft., April 15, 1914, *Ellis 254* (M); without definite locality, May 1847, *Fendler 99a* (F), *112* (M); Santa Clara Canyon, July 1, 1936, *Marcelline 1854* (F); near the Cimarron, Santa Fe road, June 15, 1846, *Wislizenus 474* (M); O-O Canyon, Datil National Forest, alt. 2100 m., Sept. 27, 1919, *Eggleston 16146* (F); 11 miles west of Datil, Datil National Forest, alt. 8300 ft., July 3, 1918, *Ferris 1211* (CA); Warm Spring, south of the Mogollon Mts., alt. 4000 ft., July 6, 1900, *Wooton* (M); Cimarron, June 2, 1931, *Nelson 11505* (RMt); near Ute Park, Cimarron River, Oct. 7, 1934, *O'Byrne & Magner 3414, 3415, 3416, 3417* (M); Dripping Springs, May 1926, *Child 552* (M); west of the Organ Mts., March 24, 1895, *Wooton* (RMt), and Mesilla, alt. 3900 ft., June 21, 1897, *48* (M, RMt, cotypes of *S. leiocarpa*); Silver City, 1911, *Beard* (M); Silver City, April 3, 1919, *Eastwood 8196*, and May 3, 1919, *8406, 8407* (CA); Mangas Springs, 18 miles northwest of Silver City, alt. 4700 ft., April 22, 1903, *Metcalfe 420* (RMt); Central, July 23, 1895, *Mulford 404* (M); along Gila River, April–July 1881, *Rusby 72* (F, M); Gallup, June 14, 1916, *Eastwood 5610* (CA); head of Rio Fresnol, Alamo National Forest, Aug. 12, 1911, *Barlow* (F); Sacramento Mts., Alamogordo, alt. 4600 ft., April 14, 1902, *Rehn & Viereck* (RMt); Tularosa Creek, 3 miles south of Mescalero, July 19, 1928, *Wold 2805* (CA); Nara Visa, April 21, and Aug. 22, 1911, *Fisher* (RMt); Jemez Springs, Aug. 4, 1931, *Nelson 11571*, and University Field School Camp, Jemez Springs, Aug. 15, 1931 (RMt); Aztec, April 27, 1899, *Baker* (ND); Las Vegas, June 26, 1895, *Mulford 35* (M); 15 miles west of Santa Fe, alt. 6000 ft., May 22, 1897, *Heller 3571* (M, ND); north of Percha, Black Range, alt. 6000 ft., July 12, 1914, *Metcalfe 1119* (CA, F); Water Cañon, Magdalena Mts., July 13, 1910, *Herrick 53* (F); Water Canyon, west of Socorro, April 14, 1925, *Nelson 10174* (RMt); Acomita, alt. 4000 ft., May 14, 1932, *Castetter 1421* (RMt).

Arizona: Padre Cañon, Oct. 21, 1928, *Eastwood 15763* (CA); Campbell's Ranch, Azucar Mts., April 15, 1931, *Jones 78973* (M); Willow Springs, 1874, *Rothrock 203* (F); Frick Park, Bisbee, June 5, 1915, *Carlson* (CA); Cave Creek Canyon, Chiricahua Mts., alt. 4000–5000 ft., Aug. 24–26, 1927, *Kusche*, and alt. 6000–8000 ft., June 26–29, 1927 (CA); Painted Desert, near Tuba, July 15–31, 1920, *Clute 105* (M, RMt); grand canyon of the colorado river:—trail from Grand View, Sept. 26–28, 1913, *Eastwood 3643*, Hermit Trail, April 9, 1917, *5941*, and Indian Gardens, April 14, 1917, *6098, 6099* (CA); July 10, 1892, *Wooton* (US type of *S. hirtella*);—Mount Eden, near Flagstaff, June 6, 1923, *Hanson A557* (CA); near Flagstaff, alt. 7000 ft., July 15, 1898, *MacDougal 295* (F, RMt); Flagstaff, May 1893, *Wilson* (US type of *S. elegantula*); Gila Co., Aug. 27, 1936, *Little 4287* (M, ND); Fort Apache, July 26, 1910, *Goodding 680* (RMt); Navajo Co., June 21–30, 1890, *Palmer 590* (US type of *S. botryoides*), and Walnut Grove and Prescott, April 20 and 28, 1876, *9982 (60, 61)* (M).

Idaho: Shoshone Falls, June 5, 1912, *Bennitt 129* (RMt); along Snake River, May 22, 1911, *Macbride 868* (F); Twin Falls and Shoshone Falls, July 26, 1911, *Nelson & McBride 1350* (F, M); coll. of 1892, *Sandberg 1008* (CA); Shoshone Falls, May 27, 1899, *Trelease & Saunders 4390* (M); Pocatello, May 27, 1893, *Palmer 44* (US), and July 22, 1893, *396* (US type of *S. glomerata*); Payette, Snake River bluffs, alt. 2000 ft., May 22, 1911, *Macbride 868* (M), and May 22, 1911, *Nelson 868* (RMt).

Utah: Zion National Park, July 10, 1928, *Dunham* (F); without definite locality, June 25, 1918, *Eastwood 7702* (CA); without definite locality, June–July

1869, *Eaton 112* (CA); without definite locality, coll. of 1875, *Ward 6* (F); near Beaver Dam, alt. 6500 ft., May 30, 1913, *Redecker 38* (RMt); Logan Cañon, July 18, 1898, *Mulford 187* (M); Helper, Aug. 4, 1899, *Trelease 4391* (M), Red Cañon, June 20, 1933, *Eastwood & Howell 778* (CA); Green River flats, near Flaming Gorge, alt. 5500 ft., May 30, 1932, *Williams 457* (CA, M); Nephi, June 17, 1933, *Eastwood & Howell 579* (CA); MacIntyre Ranch, west of Nephi, July 9, 1928, *Harris C28225*, and west of Holden, July 18, 1921, *C21743*, and June 25, 1928, *C2827* (M); Simonson's Ranch, alt. 5000 ft., June 17, 1933, *Maguire & Becraft 2686* (M); Marysvale, alt. 6000 ft., May 31, 1894, *Jones 5338g* (M); along Bullion Creek above Marysvale, July 21, 1905, *Rydberg & Carlton 7026* (RMt); near Emigration Canyon, near Salt Lake City, June 9, 1908, *Clemens* (F), and Fort Douglas, Oct. 4, 1909 (RMt); Salt Lake City, Aug. 16, 1902, *Cooper 410* (RMt); Salt Lake City, June 1872, *Engelmann* (M); Wasatch foothills near Salt Lake City, April 14, 1930, *Fisk* (M); City Creek Cañon, near Salt Lake City, July 25, 1930, *Palmer 38032* (M); Ensign Mountain, Salt Lake City, alt. 5000 ft., July 12, 1902, *Pammel & Blackwood 3565* (CA, M); Armstrong and White Canyons, near the Natural Bridges, alt. 1600–1800 m., Aug. 4–6, 1911, *Rydberg & Garrett 9449* (RMt); Fountain Green, Aug. 23, 1928, *Harris C28834* (M); Glenwood, May 8, 1875, *Ward 6* (F); near highway west of Echo City, July 19, 1929, *Goodman 759* (M); Tooele, Aug. 7, 1928, *Harris C28632* (M); Uinta Basin, June 12, 1929, *Phelps* (CA); on road to Mt. Timpanogos, June 15, 1933, *Eastwood & Howell 408* (CA); St. George, March 29, 1880, *Jones 1608* (F).

CALIFORNIA: Roscoe, near Los Angeles, May 27–June 10, 1906, *Eastwood 227*, and San Gabriel Canyon, May 29, 1919, *8953* (CA); Bootjack, Oct. 11, 1931, *Howell 8137* (CA); Big Bend, Henderson P. O., May 8, 1923, *Bethel* (CA).

MEXICO:

CHIHUAHUA: Majalca, Aug. 24, 1935, *LeSueur M205*, and Santa Clara Canyon, Oct. 10–19, 1935, *M428* (F); southwest of San Ysidro, District of Guerrero, May 14, 1929, *Mexia 2529* (CA, M), and May 16, 1929, *2535* (CA).

COAHUILA: Canyon de Sentenela on Hacienda Piedra Blanca, Sierra del Carmen, July 8, 1936, *Wynd & Mueller 613* (M).

DURANGO: Durango, April–Nov. 1896, *Palmer 785* (US type of *S. glauca*); Tepehuanes, March 25–April 16, 1906, *Palmer* 15 (F).

NUEVO LEON: Mesa Canyon, near Monterey, July 1933, *Mueller 96* (F).

PUEBLA: Cerro Amaluguilan, Dec. 6, 1906, *Arsène* (US); Cerro de Baxtle, July 1907, *Purpus 2725*, near San Luis Tultitlanapa, near Oaxaca, July 1908, *Purpus* in part (Calif).

SAN LUIS POTOSI: Alvarez, May 19–22, 1905, *Palmer 586* (F).

41a. Rhus trilobata var. **serotina** (Greene) Barkley, n. comb.

Rhus canadensis var. *serotina* Palmer & Steyerm., Ann. Mo. Bot. Gard. **22**: 591. 1935.

Schmaltzia lasiocarpa Greene, Leafl. Bot. Obs. & Crit. **1**: 141. 1905.

S. serotina Greene, *ibid.* 131.

A large shrub; leaflets large, thin, terminal 4–9 cm. long, 5–8 cm. broad, crenate-dentate or lobed above, puberulent, subrevolute-margined; fruit 6 mm. in diameter, densely pilose and glandularly pubescent.

A fairly uniform variety with fruit characters similar to the species, and with leaf characters intermediate between those of the species and *R. aromatica* Ait.

UNITED STATES:

IOWA: skunk-cabbage bog, northwest of Bayfield, May 26, 1923, *Shimek*, and 8 mi. northwest of Muscatine, June 9, 1928 (M).

MISSOURI: Fairy Cave, April 26, 1935, *Bush 14657* (M); Myer's Spur, May 3, 1909, *Palmer 1866* (M); Eagle Rock, May 28, 1898, *Bush 259*, Aug. 12, 1905, *3225*, and Shell Knob, May 27, 1936, *15598, 15599* (M); near Washburn, June 3, 1926, *Palmer 30468* (M); along Roaring River in Roaring River State Park, May 11, 1934, *Steyermark 7799* (M); Roaring River, Sept. 7, 1898, *Trelease 968* (M); Cole Camp, May 10, 1926, *Palmer 30036* (M); Hinkson Creek on Black's Mill Road south of Columbia, May 21, 1933, *Drouet 408* (M); along Sac River below mouth of Bear Creek and Alder Branch, northeast of Stockton, July 14, 1934, *Steyermark 13478* (M); near Turnback, May 5, 1929, *Palmer 35608* (M); Grand River, 3 mi. northeast of Piney, Oct. 8, 1934, *Steyermark 15979*, along Pomme de Terre River, east of Doran Spring, 3 mi. south of Hermitage, July 12, 1934, *13396* (M); Swope Park, Kansas City, June 14, 1937, *Barkley* (ND); Independence, May 6, 1894, *Bush 148* (M, ND **type**), Grain Valley, May 7, 1899, *92*, Vale, June 8, 1906, *3927*, Greenwood, Sept. 19, 1906, *4139*, and May 10, 1912, *6676*, Dodson, Oct. 11, 1921, *9729*, Swope Park, May 4, 1923, *10033*, and May 11, 1923, *10050, 10052, 10054*, also May 21, 1923, *10064, 10066*, June 9, 1924, *10244, 10244A, 10249*, and June 20, 1924, *10258, 10259* (M); near Buzzards Nest, Swope Park, Kansas City, April 29, 1917, *Hoffmann* (M); Swope Park, Kansas City, June 13, 1937, *Clark* (ND); Grand View, May 18, 1917, *Hoffmann* (M); Grain Valley, May 7, 1899, *Mackenzie* (RMt); Webb City, May 5, 1901, *Palmer 706*, Carterville, April 14, 1907, *1109*, and April 28, 1909, *1805*, near Oronogo, June 16, 1923, *23347*, North Fork of Spring River, near Alba, May 15, 1926, *32127* (M); Festus, April 28, 1932, *Kellogg 25843* (M); along Gasconade River northwest of Hazel Green, May 3, 1934, *Steyermark 7797* (M); Noel, April 24, 1909, *Bush 5512* (M); Noel, May 2, 1914, *Palmer 5463* (M); along Osage River south of Mary's Home, July 5, 1934, *Steyermark 13117*, along Missouri River south of Lupus, Aug. 22, 1934, *14773*, South Fork of Salt River, north of Victor, Nov. 4, 1934, *16347*, Osage River near mouth of Procter Creek, July 7, 1934, *13176* (M); near Pontiac, Oct. 11, 1927, *Palmer 33093* (M); "Bald Jesse," about 6 miles northwest of Gainesville, June 9, 1933, *Steyermark 8396* (M); Jerome, May 4, and June 22, 1913, *Kellogg 380* (M); Pomme de Terre River, 0.5 mi. north of Burns, July 17, 1934, *Steyermark 13591*, and along Piney Fork near Hooker, May 4, 1934, *7798* (M); Osage River near Osceola, May 6, 1929, *Palmer 35643* (M); Allenton, alt. 500 ft., April 10, 1880, *Letterman 83* (F); Stone Co., April 25, 1936, *Bush 14656*, and April 29, 1936, *15321*, also Baxter, May 27, 1936, *15608, 15609*, and Reeds Spring, June 9, 1936, *15673* (M); James Fork of White River near Galena, April 29, 1924, *Palmer 24577* (M); central Stone County, Sept. 15, 1898, *Trelease 968* (M); Walnutshade, April 29, 1936, *Bush 15301* (M); Branson, June 5, 1914, *Palmer 5874*

(F, M), and Swan Creek near Forsyth, June 4, 1931, *39496* (M); Jack's Fork of Current River, 4.5 mi. southeast of Arroll, Aug. 16, 1934, *Steyermark 14586* (M).

ARKANSAS: Cotter, Oct. 27, 1913, *Palmer 4752* (RMt), *4754*, and Sept. 1, 1915, *8411*, and White River near Cotter, Sept. 18, 1924, *26207* (M); Sulphur Springs, May 5–6, 1928, *Demaree 4988*, and east of Garfield, May 5 and 12, 1929, *6629* (F, M); Blue Springs, April 16, 1928, *Moore & Demaree 4782* (M); Eureka Springs, Sept. 20, 1913, *Palmer 4384*, and May 7, 1925, *27040* (M); Van Buren, April 5, 1929, *Demaree 6410* (F); near Batesville, April 22, 1926, *Palmer 29767* (M); Marion Co., April 24, 1924, *Bush 13350* (M).

NEBRASKA: Republican Valley, May 14, 1894, *Laybourne 88* (M).

KANSAS: Douglas Co., Oct. 3, 1934, *Bush 14269* (M, ND); McDowell Creek, Oct. 13, 1935, *Gates 18776* (M); Olathe, Oct. 3, 1934, *Bush 14229* (ND), also La Cygne, Sept. 19, 1934, *14001* (M, ND), and April 23, 1936, *15264* (M), also Louisburg, Sept. 19, 1934, *14038* (M, ND); near Osborne City, June 9, 1894, *Shear 104* (US type of *S. lasiocarpa*); Atwood, May 9, 1891, *Fry* (M); Manhattan, June 22, 1893, *Dorman* (ND), and 1887, *Kellerman* (M).

OKLAHOMA: near Broken Bow, May 13, 1930, *Sears 1378* (Okla); Muskogee Co., April 17, 1927, *Little 550*, and *734* (Okla).

TEXAS: Gamble's Ranch, June 4, 1918, *Palmer 13896* (CA, M).

41b. Rhus trilobata var. **arenaria** (Greene) Barkl., n. comb.
Schmaltzia arenaria Greene, Leafl. Bot. Obs. & Crit. **1**: 130. 1905.

A low shrub with very slender branches; leaflets narrowly ovate-cuneate, about 2.2 cm. long, 1.7 cm. broad, crenate-dentate towards the obtuse apex, subrevolute; fruit about 6 mm. in diameter, pubescent with glandular hairs, and densely pilose with simple hairs.

A rather constant variety, mostly of the sand dunes of the Great Lakes region.

UNITED STATES:

INDIANA: near Lake, *Blatchley* (Deam); shore of Lake Michigan, Miller, May 16, 1899, *Chase 1067* (M); shore of Lake Michigan, near Chicago, Sept. 4, 1893, *Churchill* (M); near Miller, Aug. 14, 1911, *Deam 9578*, south of Pine, Sept. 15, 1923, *39749* (Deam); Miller, May 9, 1878, *Grassley* (F); Whiting, June 7, 1899, *Lansing 586*, and Clarke, June 4, 1900, *868*, and Aug. 5, 1900, *1103*, Edgemoor, June 4, 1903, *1702*, Clarke Junction, June 15, 1903, *1765*, Edgemoor, July 24, 1906, *2501*, also Pine, May 23, 1908, *2711* (F); Miller, May 1, 1911, *Nieuwland 2653* (ND), June 2, 1911, *854*, *854a* (M, ND); Miller, Sept. 4, 1911, *Sherff* (F); Clarke, May 15, 1897, *Umbach* (F, **cotype**), May 15 and June 19, 1897 (F); south of Lake Michigan, July 1893, *White 16759* (M); Clark, June 14, 1897, *ex Moore Herb.* (RMt); 5 miles north of Chesterton, Aug. 22, 1915, *Deam 17998* (Deam); Mineral Springs, May 29, 1913, *Nieuwland 11053*, and June 6, 1915, also Dune Park, May 19, 1929 (ND).

ILLINOIS: Edgebrook, 1908, *Duesner* (F); World's Fair site, shore of Lake Michigan, Chicago, May 16, 1891, *Moffatt* (M).

41c. Rhus trilobata var. **racemulosa** (Greene) Barkl., n. comb.

Schmaltzia racemulosa Greene, Leafl. Bot. Obs. & Crit. **1**: 142. 1905.

S. scaberula Greene, *ibid.* 138.

A shrub with very slender branches, usually finely puberulent to glabrous; leaflets bluntly rhombic-ovate, mostly 3.5–4 cm. long, crenate-dentate toward the apex, entire near the rather abruptly cuneate base; flowers with pedicels usually exceeding 5 mm. in length; flowering in July and August.

UNITED STATES:

NEW MEXICO: 27 mi. south of Animas, Animas Range, July 9, 1928, *Wolf 2575* (CA).

ARIZONA: Bonita Canyon, Chiricahua Mts., alt. 6000 ft., Aug. 19, 1906, *Blumer 1324*, and Nov. 2, 1906, *1321* (F, M); near Fort Huachuca, Aug. 1894, *Wilcox 378* (US type).

MEXICO:

CHIHUAHUA: near Colonia Garcia, Sierra Madre, alt. 7500 ft., July 29, 1899, *Townsend & Barber 191* (Calif, F, M, ND, RMt).

SONORA: Cochuto, alt. 5000 ft., Oct. 2, 1890, *Hartman 80* (US type of *S. scaberula*).

41d. Rhus trilobata var. **pilosissima** Engler in DC., Monogr. Phaner. **4**: 386. 1883.

Rhus Canadensis var. *mollis* Gray in Patterson, Check-list, p. 21, 1892.

R. aromatica var. *mollis* Ashe, Bot. Gaz. **24**: 377. 1897.

R. Emoryi Wooton ex Greene, Leafl. Bot. Obs. & Crit. **1**: 134. 1905.

Schmaltzia anomala Greene, *ibid.* 139.

S. Emoryi Greene, *ibid.* 133.

S. malacophylla Greene, *ibid.* 138.

S. pulchella Greene, *ibid.* 134.

Leaflets rhombic-ovate, crenate-dentate near the blunt apex, entire near the rather abruptly cuneate base; fruit large; new branches and leaflets densely ferruginous-pilose.

UNITED STATES:

TEXAS: Amarillo, May 29, 1902, *Reverchon 3058* (M).

NEW MEXICO: Puije Indian Ruins, Oct. 14, 1928, *Eastwood 15556* (F), and along road from Albuquerque to Gallup, Oct. 18, 1928 (CA); Van Patten's, Organ

Mts., June 11, 1906, *Standley* (M); Organ Mts., June 11, 1906, *Wooton* (RMt), alt. 4800 ft., Sept. 1, 1897, *584* (M, ND cotype of *R. Emoryi* and of *S. Emoryi*); Organ Mts., 1852, *Wright 1342* (US type of *S. pulchella*); Mangas Springs, 18 mi. northwest of Silver City, alt. about 4300 ft., April 22, 1903, *Metcalfe 25* (ND); near Silver City, March and July 1880, *Rusby 71* (F); Magdalena, base of Blue Mts., June 20, 1921, *Ferris & Duncan 2294* (CA).

Arizona: Senvita Valley, May 1880, *Lemmon* (F); Hall's Ranch, Whitetail Canyon, Chiricahua Mts., Aug. 22, 1906, *Blumer 1319* (F, M); Pinal Mountains, Oct. 26, 1928, *Eastwood 15884* (CA); Gila Co., Oct. 14, 1936, *Little 4288*, and Oct. 25, 1936, *4201* (M, ND); Fort Grant, June 15, 1912, *Goodding 1053* (RMt); Apache Trail and adjacent regions, Oracle, May 25, 1929, *Eastwood 17463* (CA, M photo.).

California: Little Chico Creek, 1883, *Austin* (ND type of *S. anomala*), Butte Co., March and April 1896, *767* (M), April 1883 (F); along Rock Creek, 12 mi. northeast of Chico, March 19, 1915, *Heller 11773* (CA); Mokelumne Hill, *Blaisdell* (CA); Glenn Co., May 26, 1914, *Heller 11429* (F, ND); Griffith Park, April 13, 1902, *Braunton 203* (US), and June 11, 1902, *487* (US type of *S. malacophylla*); Pasadena, May 1901, *Grant 1119* (F); Los Angeles Co., May 5, 1912, *Smith 4934* (F); Capell Creek, between St. Helena and Putah Creek Canyon, March 20, 1923, *Wriglet* (CA); San Bernardino, 1881, *Parish 550* (F); Anderson, April 2, 1913, *Smith* (CA).

MEXICO:

Chihuahua: west of the City of Chihuahua, Oct. 10–19, 1935, *LeSueur M431* (F); near the City of Chihuahua, June 5–10, 1908, *Palmer 338* (F).

Durango: Tepehuanes, June 4–25, 1906, *Palmer 313* (Calif, F, M).

Jalisco: Sierra de Nayarit, June 28, 1855, *Schott* in part (F).

41e. Rhus trilobata var. **simplicifolia** (Greene) Barkl., n. comb.

Rhus canadensis var. *simplicifolia* Greene, Bull. Torr. Bot. Club **17**: 13. 1890.

R. utahensis Goodding, Bot. Gaz. **37**: 57. 1904.

Schmaltzia affinis Greene, Leafl. Bot. Obs. & Crit. **1**: 135. 1905.

S. cissodes Greene, *ibid.* 136.

S. simplicifolia Greene, *ibid.* 135.

S. ribifolia Greene, *ibid.* **2**: 156. 1911.

Leaves ovate to oval, crenulate-margined or lobed, sometimes deeply lobed near the base or even trifoliolate, more or less light glaucous-green, 1.5–3.5 cm. long, 1.5–3.5 cm. broad, short-petiolate; fruit sparsely pubescent.

A rather uniform variety, much resembling *R. trilobata* var. *anisophylla* Jepson in leaf characters, other than in number of leaflets.

UNITED STATES: southern Utah, northern Arizona, coll. of 1877, *Palmer 81* (M).

OKLAHOMA: Limestone Ridge, 11 mi. north of Limestone Gap, April 23, 1877, *Butler* (M).

COLORADO: western Montrose County, alt. 5000 ft., July 14, 1924, *Payson 3932* (M).

ARIZONA: Navajo Indian Reservation, July 1916 (M); GRAND CANYON OF THE COLORADO RIVER:—Bright Angel Trail, Sept. 26, 27 and 28, 1913, *Eastwood 3763* (CA), Grand View Trail, June 16, 1916, *5695* (CA, M), Hermit Trail, April 9, 1917, *5974*, Hermit Creek, April 10, 1917, *5976*, Hermit Trail, April 11, 1917, *6034*, Bright Angel Trail, May 6, 1917, *Meiere* (CA), near Indian Gardens, Bright Angel Trail, May 10, 1903, *Merriam* (US type of *S. cissodes*); Kaibab Trail to Roaring Springs, Grand Canyon National Monument, June 23, 1933, *Eastwood & Howell 1016* (CA);—Peach Springs, 1889, *Greene* (ND).

UTAH: San Rafael, April and May 15, 1931, collector unknown *5621, 5624* (M); Kanab, alt. 5300 ft., April 22, 1894, *Jones 5236e* (M, cotype of *S. affinis*); Diamond Valley, May 16, 1902, *Goodding 832* (M, cotype of *R. utahensis*); Santa Clara Valley, April 30, 1894, *Jones 5132* (M).

MEXICO: San Matias Pass, San Pedro Martir Mts., June 28, 1905, *Goldman 1187* (US type of *S. ribifolia*).

LOWER CALIFORNIA: El Rancho Viejo, April 30, 1889, *Brandegee* (Calif); Topo Canyon, July 27, 1883, *Orcutt 26 (8951)* (Calif).

41f. Rhus trilobata var. **anisophylla** Jepson, Man. Fl. Pl. Calif., p. 608. 1925.

Schmaltzia anisophylla Greene, Leafl. Bot. Obs. & Crit. **1**: 136. 1905.

S. cruciata Greene, *ibid.* 139.

S. hederacea Greene, *ibid.* 135.

S. Oregana Greene, *ibid.* 140.

S. puncticulata Greene, *ibid.* 137.

S. straminea Greene, *ibid.* 139.

S. trinervata Greene, *ibid.* 137.

Leaflets broadly ovate, cuneate-dentate, rounded or subacute at apex, abruptly cuneate at the base, terminal leaflet 1–6 cm. long, 0.8–4.5 cm. broad, lateral leaflets 0.5–3 cm. long, 0.5–3 cm. broad; fruit large.

A rather uniform variety, more or less merging into the species in the eastern portion of the range and into variety *simplicifolia* in the Rockies.

UNITED STATES:

NEW MEXICO: Silver City, 1911, *Beard* (M); Alamogordo, Aug. 6, 1931, *Fisher 43* (F).

ARIZONA: Fish Creek, Apache Trail, May 19, 1919, *Eastwood 8749*, Burro Creek, Aquarine Mts., May 14, 1931, *18381* (CA); Cameron, alt. 5800 ft., June 8, 1922, *Hanson A170* (F, M); *Voth 70* (F); Hall's Ranch, Whitetail Canyon, Chiricahua Mts., Aug. 22, 1906, *Blumer 1320* (F); Bisbee, May 31, 1915, *Carlson* (CA); North Fork of Pinery Canyon, 2–4 mi. above junction with South Fork, Chiricahua Mts., alt. 6000–7000 ft., July 17, 1919, *Stone 648* (RMt); edge of Painted Desert, Oct. 20, 1928, *Eastwood 15718*, Kaibab Trail to Roaring Spring, Grand Canyon National Monument, June 23, 1933, *Eastwood & Howell 1015* (CA); San Francisco Mts., Sept. 2, 1889, *Knowlton 170* (US type of *S. trinervata*); Grand Canyon of the Colorado River, *Millspaugh 135* (F); Collom Camp, Mazatzal Mts., alt. 1200 m., March 15 and June 15, 1935, *Collom 351* (M, M photo.); Pinal Mts., Oct. 26, 1928, *Eastwood 15870*, along road from Packard to Payson, Nov. 1, 1928, *16615*, on road to Payson, Nov. 3, 1928, *16663* (CA); 5 mi. south of Pine, July 1, 1928, *Wolf 2465* (CA); Union Pass, May 31, 1893, *Wilson* (ND type of *S. puncticulata*); Lower Trail, Rincon Mts., Oct. 15, 1909, *Blumer* (F); Santa Rita Mts., May 27, 1881, *Pringle* (F); Oracle, May 25, 1929, *Eastwood 17462* (CA); 20 mi. east of Fort Whipple, July 15, 1865, *Coues & Palmer 287* (M); Prescott, May 20, 1919, *Eastwood 8794* (CA); Walnut Grove, April 1876, *Palmer 60*, and Prescott, March and April 1876, *61* (F); half-mile east of Prescott, alt. 5000 ft., June 28, 1928, *Wolf 2353* (CA).

NEVADA: Mica Spring, alt. 4000 ft., April 14, 1894, *Jones 5064m* (M cotype of *S. hederacea*); Kyle Canyon, Charleston Mts., May 25, 1919, *Tidestrom 9607* (F); Karshaw, Meadow Valley Wash, April 26, 1902, *Goodding 614* (RMt).

UTAH: St. George, Nov. 5, 1922, *Nelson 9995* (RMt).

OREGON: Grant's Pass, May 27, 1884, *Howell* (F cotype of *S. Oregana*), April 20, 1887 (F, ND).

CALIFORNIA: near Brewery Springs, Surprise Canyon, Panamint Mts., alt. 1550 m., April 13, 1891, *Coville & Funston 618* (US **type**); Surprise Canyon, Panamint Mts., alt. 5300 ft., June 12, 1930, *Ferriss 7983* (M); Mt. Sanhedrin, June 1917, *Reynolds* (CA); Acton, Mt. Gleason, June 1902, *Elmer 3680* (F); Vermont Canyon, Griffith Park, Los Angeles, March 2, 1928, *Howell 3364*, and St. Helena Creek below Patten's, March 28, 1926, *1769* (CA); along Lyttle Creek, San Gabriel Reserve, alt. 800 m., April 27, 1898, *Leiberg 3338* (US type of *S. straminea*); March 26 and 27, 1932, *Dunn & Martin* (M); Vandeventer Flats, Santa Rosa Mountain, Oct. 6, 1912, *Smith 5469* (F); New York Mts., Ivanpah, April 21, 1932, *Ferris & Bacigalupi 8080* (CA, ND); 49 Palms Canyon, near 29 Palms, June 13, 1931, *Hoffmann* (CA); Highland Avenue, east of Upland, alt. about 1000 ft., June 11, 1927, *Howell 2478* (CA); near Bonanza King Mine, East Slope, Providence Mts., Mohave Desert, alt. 4000 ft., May 21–24, 1920, *Munz, Johnston & Harwood 4048* (RMt); Moore's Ranch, 15 mi. south of Cima, alt. 4500 ft., June 28, 1931, *Stark* (CA); San Diego Co., April 23, 1920, *Eastwood 9436, 9473* (CA); San Diego, March 23, 1882, *Jones 3090* (CA, M); Hot Springs, July 24, 1875, *Palmer 46* (F, M cotype of *S. cruciata*); west of Paynescreek, May 2, 1924, *Heller 13856* (F).

MEXICO:

CHIHUAHUA: east of Pearson, Sierra Madre, July 25, 1911, *Barlow* (F); southwest of San Ysidro, District of Guerrero, May 14, 1929, *Mexia 2529*, and May 16, 1929, *2535* (Calif).

DURANGO: between San Julian and Cerro Prieto, alt. 7000–8500 ft., Sept. 9, 1898, *Nelson 4947* (US).

JALISCO: Sierra de Nayarit, June 28, 1855, *Schott* in part (F).

LOWER CALIFORNIA: 15–20 mi. east of Ensenada, on road to Ojos Negros, Sept. 14, 1929, *Wiggins & Gillespie 4052* (CA, F, M).

SONORA: Cananea, Sept. 1, 1909, *Donnelly 38* (Calif); Cochuto, alt. 5000 ft., Oct. 2, 1890, *Hartman 80* (Penn); San José Mts., 5 mi. south of Naco, alt. 6000 ft., July 6, 1928, *Wolf 2507* (CA).

41g. Rhus trilobata var. **quinata** Jepson, Erythea **1:** 141. 1893.

Rhus Canadensis var. *quinata* Gray, Syn. Fl. N. Am. **1:** 386. 1897.

Schmaltzia quinata Greene, Leafl. Bot. Obs. & Crit. **1:** 139. 1905.

Leaflets glabrate, crenate to crenate-dentate near the blunt apex, terminal leaflet fan-shaped, usually deeply 3-lobed, 2–5 cm. long, 2–5 cm. broad, basal leaflets obovate, crenate, 1–3 cm. long, 0.6–3 cm. broad.

A variety similar to var. *anisophylla,* from which it is readily distinguished by usually having larger leaflets, the terminal of which is commonly dissected into three divisions.

UNITED STATES: coll. of 1845, *Fremont's Expedition to California 49* (M).

NEW MEXICO: head of Rio Fremal, Alamo National Forest, Aug. 12, 1911, *Barlow* (CA).

ARIZONA: Bright Angel Creek, Grand Canyon of the Colorado River, June 20, 1916, *Eastwood 5892* (CA); Maricopa Co., *Booth 94* (ND); near Prescott, Nov. 6, 1928, *Eastwood 16691* (CA).

NEVADA: Karshaw, Meadow Valley Wash, April 26, 1902, *Goodding 614* (M), and Snow Springs, April 5, 1905, *2153* (RMt).

OREGON: Grant's Pass, April 20, 1887, *Howell 1107* (M); banks of Snake River, Ontario, May 3, 1896, *Leiberg 2005* (CA).

CALIFORNIA: coll. of 1860–1867, *Bolander* (F); on the Klamath River, Aug. 20, 1880, *Engelmann* (M); Mint Canyon, April 24, 1926, *Epling* (M); Quail Spring, Morongo Mts., March 10, 1928, *Howell 3399* (CA); canyon of Big Chico Creek, March 19, 1914, *Heller 11212* (CA, F, M, ND); Big Sandy Creek, April 1–5, 1915, *McDonald,* and Huntingdon Lake, July 1926 (CA); west of Willows, April 23, 1922, *Eastwood 11178* (CA); on the Newville-Covelo road, July 7, 1914, *Heller 11533* (CA, F, M, ND); Kelseyville, April 17, 1928, *Blankinship* (M), and Mt. Konocti, July 22, 1928 (CA); Mt. Sanhedrin, May 23, 1925, *Eastwood 12898* (CA); without definite locality, Aug. 25, 1888, *Greene* (ND); on Eel River 1 mi. below Hullville, Aug. 4, 1902, *Heller 6026* (F, M, RMt); Kelseyville, April 1, 1931, *Jussel,* and Jordan Park, Cobb Mountain, April 30, 1933, and between Cobb Mountain and Adams Springs on the Binkley Ranch, June 27, 1933, *227* (CA); Santa Monica Mts., April 1901, *Abrams 1310,* Sepulveda Canyon, March 11, 1902, *3113* (M); Claremont, May 5, 1904, *Baker 4734* (M); Aliso Canyon, Santa

Monica Mts., June 26, 1897, *Barber 191* (RMt); Acton, June 1902, *Elmer 3680* (M); Griffith Park, Los Angeles, May 18, 1925, *Epling* (M); near Lancaster, April 10, 1927, *Hart* (CA); Claremont, April 1912, *Howery* (M); Wilmington, March 1923, *Whited 945* (ND); North Fork and vicinity, May 30–June 8, 1903, *Griffiths 4463* (M); Tiburon, Aug. 1923, *Walther* (CA); Mariposa, Sept. 27, 1903, *Congdon* (M); Pope Valley Creek 4 mi. east of Samuels Springs, Napa Range, May 30, 1929, *Howell 4266* (CA); St. Helena, April 1, 1921, *Hunt* (CA); Conn Creek, Napa River basin, May 1, 1894, *Jepson* (ND); San Jacinto Canyon, alt. 3000 ft., April 3, 1918, *Parish 11698* (M); Santa Rosa Mountain, 1912, *Smith 5469* (M); Banning, May 28, 1928, *Van Dyke* (CA); San Bernardino, April and June 1888, *Parish* (M), and March and July 1889 (F); Warner Springs, April 18, 1913, *Eastwood 2819*, Descanso, June 26, 1919, *9185* (CA); Oakrun, May 21, 1894, *Baker & Nutting* (ND); Cayton, May 8, 1923, *Bethel* (CA); Millville, June 26, 1912, *Eastwood 679* (CA); Mt. Shasta, alt. 5000–10000 ft., Aug. 1–15, 1897, *Brown 595* (F, M); near Yreka, 1910, *Butler 1615* (M, RMt, M photo.); west of Paynescreek, May 11, 1924, *Heller 13856* (M); near Indian Creek, alt. 1250 ft., April 11–16, 1919, *Ferris 1531* (CA); Nordhoff, April 12, 1916, *Eastwood 4937, 4952* (CA).

MALOSMA (Nutt.) Engler

Malosma Engler in DC., Monogr. Phaner. **4**: 393. 1883, in syn.; de Dalla-Torre & Harms, Gen. Siph., p. 287. 1907, in syn.; Abrams, Fl. Los Angeles, p. 220. 1917.

Lithraea Miers, Trav. Chili **2**: 529. 1826, in part; Endl., Gen. Pl., p. 1130. 1840, sect. MALOSMA; Ench. Bot. p. 599. 1841, sect. MALOSMA; Walp. Rep. Bot. Syst., p. 551. 1842, sect. MALOSMA; Abrams, Bull. N. Y. Bot. Gard. **6**: 403. 1908.

Rhus Nutt. ex Torr. & Gray, Fl. N. Am. **1**: 219. 1838, sect. MALOSMA; *ibid.* **1**: 681. 1840, as subgenus LITHREA; Gray, Syn. Fl. N. Am. **1**[1]: 383. 1897, sect. MALOSMA; Standl., Contr. U. S. Nat. Herb. [Trees & Shrubs Mex.] **23**: 665. 1923, in part; Jepson, Man. Fl. Pl. Calif., p. 607. 1925, in part; Munz, Man. S. Calif. Bot., p. 292. 1935, in part; Jepson, Fl. Calif. **2**: 444. 1936, in part.

Small evergreen trees with broad tops, glabrous throughout; innocuous. Leaves alternate, simple, more or less persistent, coriaceous, glabrous, margins more or less whitened, entire and subrevolute; petioles long. Flowers polygamodioecious, in dense terminal thyrsi. Sepals 5, persistent. Petals 5, deciduous. Ovary with 1 fertile cell, sessile on the disk; styles 3, more or less distinct, terminal. Drupes whitish, small, almost symmetrical, somewhat flattened; the sterile carpels forming a dull, raised line down one side of the fruit; epicarp glabrous, shining; mesocarp thick, waxy.

California and Lower California.

Type species: **Malosma laurina** (Nutt.) Nutt. ex Engler in DC., Monogr. Phaner. **4**: 393. 1883 (*Rhus laurina* Nutt. ex. Torr. & Gray, Fl. N. Am. **1**: 219. 1838).

Malosma is in some ways similar to *Toxicodendron* and in some ways to STYPHONIA. It is like STYPHONIA in its simple, coriaceous, evergreen leaves, and in being innocuous. It is like *Toxicodendron* in its whitish, glabrous, ceriferous drupes. It differs from both, however, in having the two abortive carpels of the ovary forming a raised line down one side of the fruit, and in having a dense terminal thyrsus. There is a single species.

1. **Malosma laurina** (Nutt.) Nutt. ex Engl. in DC., Monogr. Phaner. **4**: 393. 1883, in syn. Pl. 25, fig. 1.

Rhus laurina Nutt. ex Torr. & Gray, Fl. N. Am. **1**: 219. 1838.

Lithraea laurina Walp., Rep. Bot. Syst. **1**: 551. 1842.

Toxicodendron laurinum Kuntze, Rev. Gen. Pl., pt. 1, p. 154. 1891.

Large, rounded, evergreen shrubs or trees, 2–4 m. tall, with aromatic odor; branches slender, glabrous, glaucescent, brown below, red at apex; leaves scattered, alternate, ovate or elliptical, rarely lanceolate or oblong, 4–9 cm. long, 2–4 cm. broad, coriaceous, smooth, reddish above, paler, greenish, and glaucescent beneath, simple, entire and subrevolute-margined, retuse or obtuse, emarginate or mucronate, somewhat folded along the midrib, obtuse or truncate at base; petioles 1–4 cm. long; flowers polygamo-dioecious, in a dense, terminal, intricately branched thyrsus 4–10 cm. long; bracts spatulate; sepals 5, ovate-deltoid, strongly imbricated, glabrous, persistent; petals 5, white, spreading, elliptical, glabrous; stamens with thickened filaments as long as the lanceolate-ovate anthers; pistil with three short, thickened, separate styles, ovary

1-celled; drupe about 1.5 mm. in diameter, glabrous, whitish, with a raised, often darkened line down one side, otherwise almost symmetrical.

Distribution: southern California and northern Lower California (fig. 26).

UNITED STATES:

CALIFORNIA: southern California, 1876, *Parry & Lemmon 43* (F, M); Little Santa Anita Canyon, July 2, 1902, *Abrams 2639* (F, M); Santa Monica Forestry Station, July 31, 1897, *Barber* (M); Los Angeles, July 23, 1910, *Blake 439* (F); Sierra Madre, Sept. 8, 1935, *Carter 955* (M); Santa Monica Mts., alt. 300 m., June

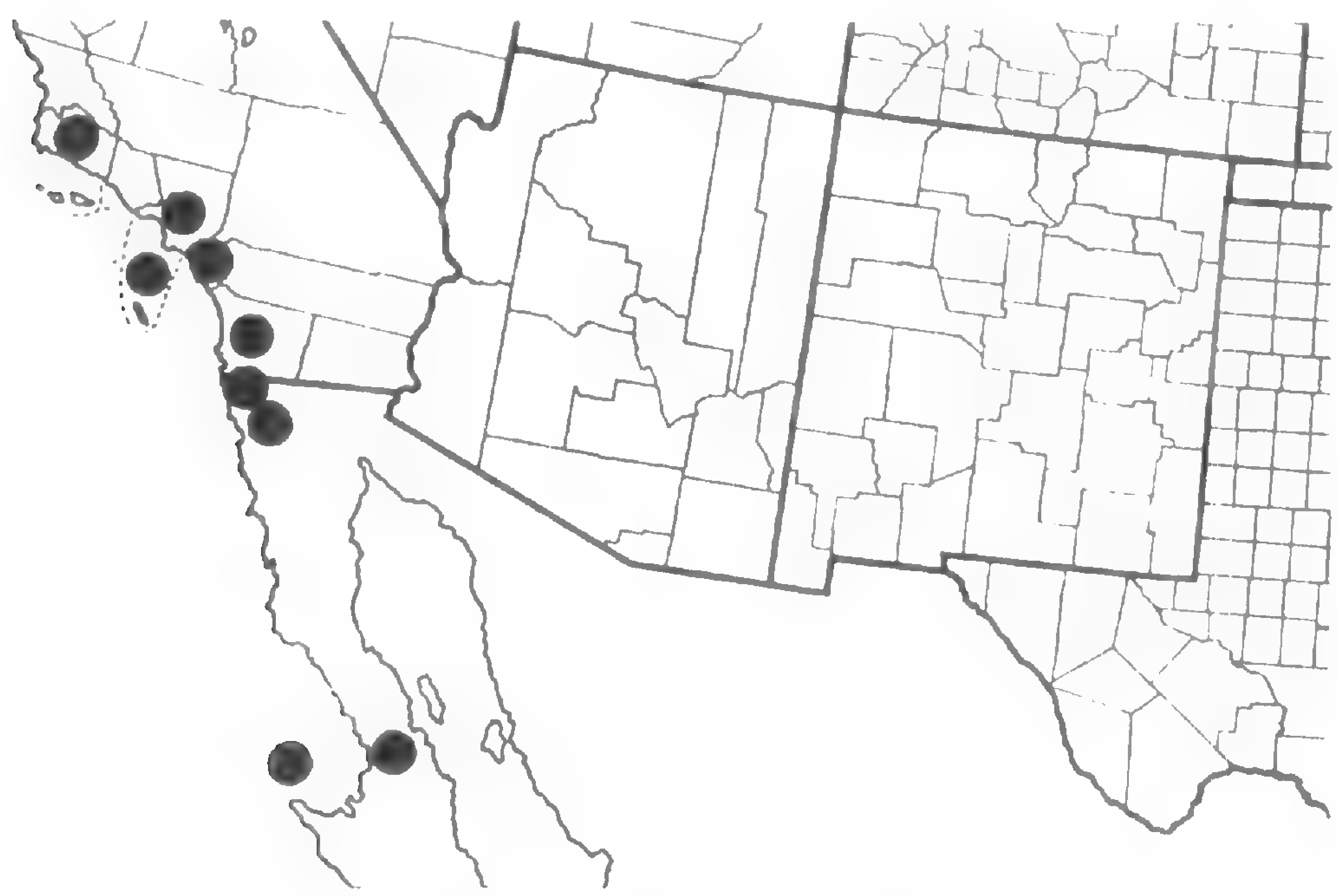

Fig. 26. The geographic distribution of *Malosma laurina* (Nutt.) Nutt. ex Engler.

1929, *Clokey & Templeton 4588* (M); Claremont, June 10, 1915, *Davis* (M); Santa Monica Mts., Sept. 16, 1880, *Engelmann* (M); Altadena, May 1902, *Grant 1117* (F); Topango Canyon, Santa Monica Mts., June 3, 1916, *Hiatt* (M); San Fernando plains, June 1887, *Parish 1928* (F, M, ND); Santa Monica Canyon, Santa Monica, alt. 200 ft., March 15, 1912, *Smith 4458* (F); San Demas Canyon, San Gabriel Mts., alt. 2150 ft., Nov. 29, 1933, *Wheeler 2277* (ND); SANTA CATALINA ISLANDS:—May 1889, *Brandegee* (F); July 23, 1915, *Drushel* (M); Dec. 1900, *Eby* (M); Pebble Beach near fork of road, July 14, 1921, *Knopf 164*, and Camp Banning Canyon, Nov. 6, 1921, *502* (F); Avalon Valley, June 6, 1920, *Nuttall 309*, and May 15, 1930, *1157* (F); Aug. 17, 1915, *Rusby 401* (F); Avalon Canyon, May 24, 1912, *Smith 5164*, and May 26, 1912, *4988* (F); Avalon, May 1896, *Trask* (M);—Santa Ana Canyon, March 9, 1929, *Blankinship* (M); Santa Maria, July 1894, *Anderson* (ND), San Diego Co., July 13 and Aug. 1, 1902, *Brandegee 1643* (F, M), and San Diego, July 1906 (F); Point Loma, near San Diego, Nov. 6, 1880, *Engelmann* (M); La Jolla, Nov. 28, 1919, *Millspaugh 4460* (F); San Diego, 1875, *Palmer 48* (F, M); Coast Range, Rainbow Post Office, June 17, 1897, *Parish 4462* (M), Fall Brook, Nov. 6, 1891 (F); Pueblo Lands, La Jolla, July 29, 1912, *Smith 5227* (F, M); San Diego, July 24, 1895, *Snyder* (F); Santa Barbara, Aug. 21, 1904, *Abrams 4154* (F, M); Mission Canyon, near Santa Barbara, May 16, 1908, *Eastwood 130*, and Sept. 12, 1908, *204* (F, M); Santa Barbara, Aug. 1902, *Elmer 4015* (F, M); Santa Barbara Co., 1865, *Torrey 75* (M).

MEXICO:

LOWER CALIFORNIA: Sierra de San Francisquito, Oct. 18, 1890, *Brandegee 112*, El Rancho Viejo, April 30, 1889, and San José de Gracia, April 8, 1889, and San Enrique, April 1889 (Calif); San Carlos River, Sept. 10, 1923, *Eastwood 12416* (CA); Todos Santos, July 5, 1882, *Fish* (F); Rosalia Bay, *(Orcutt) 122* (M), and Tiajuana, June 30, 1884 (F); Cape Colnett, May 27, 1889, *Pond* (ND); on San Pedro Martir, Aug. 1, 1903, *Robertson 46* (Calif); Ensenada, 1912, *Smith 5319* (F, M); San Antonio Canyon, Sept. 8, 1930, *Wiggins & Demaree 4760* (CA, F, ND); 2 miles north of Rosarito Beach, Sept. 7, 1929, *Wiggins & Gillespie 3874* (F, M); CEDROS ISLAND:—March–June, 1896, *Anthony* (Calif), Aug. 7, 1896, *28* (Calif, F, M), July–Oct. 1896, *122* (F); June 3, 1925, *Mason 1981* (CA, F); Dec. 7, 1888, *Pond* (ND);—GUADALUPE ISLAND:—June 1906, *Brown* (Calif), winter of 1892–1893, *Franceschi 9* (F, M); coll. of 1898, *Drent* (Calif).

TOXICODENDRON [Tourn.] Miller

Toxicodendron Tourn., Inst. Rei Herb., p. 610. 1700; Mill., Gard. Dict., ed. 8. 1768, excl. *T. Crenatum, T. Arboreo & T. Arborescens;* Medic., Phil. Bot. **1**: 156. 1789; Moench, Meth., p. 73. 1794, as *Toxicodendrum;* Kuntze, Rev. Gen. Pl., pt. 1, p. 153. 1891, in part; Greene, Leafl. Bot. Obs. & Crit. **1**: 115. 1905; Abrams, Bull. N. Y. Bot. Gard. **6**: 401. 1910; Britton, N. Am. Trees, p. 401. 1908; Small, Fl. Miami, p. 112. 1913; Britt & Brown, Illustr. Fl., ed. 2. **2**: 483. 1913; Woot. & Standl., Contr. U. S. Nat. Herb. [Fl. N. Mex.] **19**: 408. 1915; Abrams, Fl. Los Angeles, p. 219. 1917; Rydb., Fl. Rocky Mts. & Adj. Plains, p. 551. 1917; Key Rocky Mt. Fl., p. 153. 1919; Fl. Rocky Mts. & Adj. Plains, ed. 2, p. 551. 1922; Tidestr., Contr. U. S. Nat. Herb. [Fl. Utah & Nev.] **25**: 347. 1925; Schaffn., Manual Ohio, p. 348. 1928; Rydb., Fl. Prair. & Plains, p. 527. 1932; Small, Manual Southeast. Fl., p. 809. 1933; Stem. & Myers, Okla. Fl., p. 297. 1937.

Philostemon Raf., Fl. Ludovic., p. 107. 1817; Steud., Nom. Bot., ed. 2. **2**: 320. 1841, as *Philostemum.*

Pocophorum Necker, Elem. Bot. **2**: 226. 1790.

Rhus L., Sp. Pl. **1**: 265. 1753, in part, as to species 4, 6 & 7;

Gen. Pl., ed. 5. p. 129. 1754, in part as to *Toxicodendron* Tourn. in syn.; Willd., Sp. Pl. **1**: 1477. 1798, in part; DC., Cat. Pl. Hort. Bot. Monsp., p. 55. 1813, in part; Prodr. **2**: 67. 1825, sect. SUMAC in part; Hooker, Fl. Bor.-Am. **1**: 126. 1830, sect. SUMAC in part; G. Don, Gen. Hist. Dichl. Pl. **2**: 70. 1832, sect. SUMACH in part; Endl., Gen. Pl., p. 1131. 1840, sect. SUMAC in part; Ench. Bot., p. 599. 1841, sect. SUMAC in part; Walp., Rep. Bot. Syst. **1**: 551. 1842, in part; Gray, Manual, p. 78. 1846, sect. SUMAC in part; Gen. Pl. U. S. **2**: 157. 1846, in part; Manual, ed. 2, p. 76. 1856, sect. TOXICODENDRON; Koch, Dendrologie **1**: 574, 580. 1869, sect. SUMACH in part and sect. TOXICODENDRON; Engler, Bot. Jahrb. **1**: 379. 1881, sect. VENENATAE; Engler in DC., Monogr. Phaner. **4**: 376. 1883, sect. VENENATAE excl. *R. laurina;* Dippel, Handb. Laubholzk. **2**: 366. 1892, in part; Engler in Engl. & Prantl, Nat. Pflanzenfam. **3**^{5}: 168. 1892, sect. VENENATAE; Sargent, Sylva **3**: 13. 1892, in part; Koehne, Deutsche Dendrol. **1**: 360. 1893, sect. TOXICODENDRON; Britt. & Brown, Illustr. Fl. **2**: 385. 1897, in part; Gray, Syn. Fl. N. Am. **1**: 382. 1897, sect. RHUS in part as to *Toxicodendron;* Britton, Manual, p. 600. 1901, in part; Piper, Contr. U. S. Nat. Herb. [Fl. Wash.] **11**: 383. 1906, in part; Schneid., Illustr. Handb. Laubholzk. **2**: 149. 1907, subgenus TOXICODENDRON; Robinson & Fernald, Gray's New Manual, p. 552. 1908, sect. VENENATAE; Coult. & Nels., New Man. Bot. Cent. Rocky Mts., p. 312. 1909, in part; Sarg., Manual, ed. 2, p. 660. 1922, in part; Standl., Contr. U. S. Nat. Herb. [Trees & Shrubs Mex.] **23**: 665. 1923, in part; Jepson, Man. Fl. Pl. Calif., p. 607. 1925, in part; Rehder, Man. Cult. Trees & Shrubs, p. 538. 1927, in part; Munz, Man. S. Calif. Bot., p. 292. 1935, in part; Jepson, Fl. Calif. **2**: 448. 1936, in part.

Rhus-Toxicodendron Marsh., Arbust. Am., p. 130. 1785.

Vernix Adanson, Fam. Pl. **2**: 342. 1763.

Deciduous trees, shrubs, or woody vines with poisonous effluvium. Leaves alternate, ternate or imparipinnate, thin, glabrous or sparingly pubescent. Flowers usually polygamodioecious in pendent, axillary, lateral panicles. Bracts of the inflorescence lanceolate, deciduous. Sepals 5, persistent. Petals 5, ascending. Ovary 1-celled, sessile on the disk; style terminal, three-parted. Drupes large, whitish, about as broad as long, slightly compressed, glabrous or sparingly pubescent with simple hairs; mesocarp rich in wax and copiously "fibrous"; epicarp at length falling away from the mesocarp.

North and South America and Asia.

Type species: **Toxicodendron radicans** (L.) Kuntze, Rev. Gen. Pl., pt. 1, p. 153. 1891 (*Rhus Toxicodendron* L. Sp. Pl. **1**: 266. 1753).

The generic recognition of *Toxicodendron* as distinct from *Rhus* has long been a matter of controversy, and one which in the nature of such things can never be answered in an absolute manner. The non-glandular pubescence when present on the fruit-coat, the ceriferous mesocarp, the consistently poisonous effluvium, and the paniculate inflorescence in *Toxicodendron,* as contrasted with the glandular pubescence always present on the fruit-coat, the non-waxy mesocarp, the constantly innocuous effluvium, and the thyrsoidal inflorescence of *Rhus,* as well as many minor characters consistently different between these elements, are characters that seem to the author sufficiently well marked to separate the two as distinct genera.

KEY TO THE SECTIONS

Leaflets 3; small shrubs or vines.............................. *Eutoxicodendron*
Leaflets 5–17; large shrubs or trees.................................... *Vernix*

Section EUTOXICODENDRON Schneid., Illustr. Handb. Laubholzk. **2**: 149. 1907.

Toxicodendron Koch, Dendrologie **1**: 580. 1869, as section.

Deciduous woody vines or small shrubs, with comparatively slender branches. Flowers usually polygamo-dioecious in small, pendent, lateral, axillary panicles. Leaves alternate, thin, trifoliolate.

North America from Canada to southern Mexico, and in Japan and China.

EUTOXICODENDRON is predominantly a North American group, being represented in Asia by a single species. The species are usually quite variable, especially as regards fruit size, leaf margin, and habit.

KEY TO THE SPECIES AND VARIETIES

Seeds comparatively smooth; fruit usually distinctly papillose or pubescent; leaflets coarsely and irregularly lobate-denate..............*1. T. quercifolia*
Seeds mostly roughened; fruit mostly not pubescent; leaflets mostly entire but occasionally deeply and somewhat acutely lobate-denate, serrate-dentate, or crenate-dentate.
  Leaflets mostly obtuse or rounded at the apex, entire, crenate or bluntly lobed; Pacific Coast species...........................*2. T. diversiloba*
  Leaflets acute or acuminate, sometimes abruptly acute, entire, serrate or deeply lobed; generally distributed in North America.
    Leaflets entire or irregularly few-toothed, mostly not deeply toothed or lobed.
      Fruit mostly glabrous.
        Seeds not constricted at the side.........................*3. T. radicans*
        Seeds constricted at the side.............*3a. T. radicans* var. *divaricata*
      Fruit densely pilose with simple hairs........*3b. T. radicans* var. *littoralis*
    Leaflets regularly deeply serrate-toothed or lobed.
      Leaflets regularly and coarsely serrate-toothed or lobed, not tending to be trilobate.........................*3c. T. radicans* var. *verrucosa*
      Leaflets deeply lobed, the terminal tending to be deeply trilobate...... ....*3d. T. radicans* var. *eximia*

1. **Toxicodendron quercifolia** (Michx.) Greene, Leafl. Bot. Obs. & Crit. **1**: 127. 1905; "Michx." ex Dippel ex Durant & Jackson, Index Kew., suppl. 1, p. 433. 1901–1906. Pl. 26, fig. 1.

Toxicodendron Pubescens Mill., Gard. Dict., ed. 8. 1768, in part.

T. compactum Greene, Leafl. Bot. Obs. & Crit. **1**: 126. 1905.

T. monticola Greene, *ibid.* 126.

T. Toxicodendron Britt. in Britt. & Brown, Illustr. Fl., ed. 2. **2**: 484. 1913.

Rhus Toxicodendron L., Sp. Pl. **1**: 266. 1753, in part.

R. Toxicodendron var. *quercifolium* Michx., Fl. Bor.-Am. **1**: 183. 1803; Engler in DC., Monogr. Phaner. **4**: 395. 1883, in part; Dippel, Handb. Laubholzk. **2**: 376. 1892.

R. quercifolia Steud., Nom. Bot., ed. 1. p. 689. 1821.

R. pubescens Engelm. ex Engler in DC., Monogr. Phaner. **4**: 394. 1883, in syn.

Small shrubs, with slender, pubescent branches; leaflets three, at first densely pubescent above and below, later glabrate especially above, ovate, regularly lobate-dentate with 3–7 rounded, blunt or rarely subacute lobes, apex rounded, subacute or rarely subacuminate, base obtuse or subcuneate, terminal leaflet 5–9 cm. long, 4–7 cm. broad, petiolule about 2 cm. long, lateral leaflets somewhat smaller, inequilateral and often subentire on the upper margin and 3–7-lobed on the lower

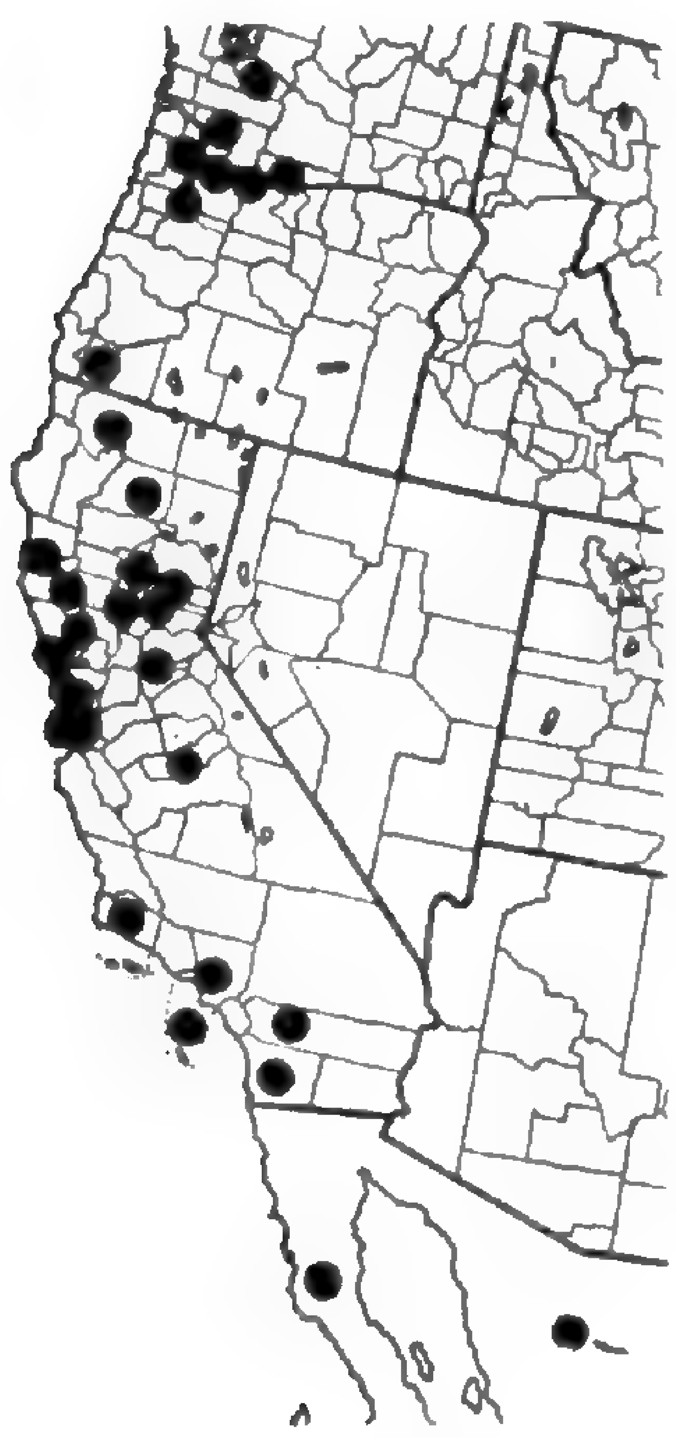

Fig. 27. The geographic distribution of *Toxicodendron diversiloba* (Torr. & Gray) Greene.

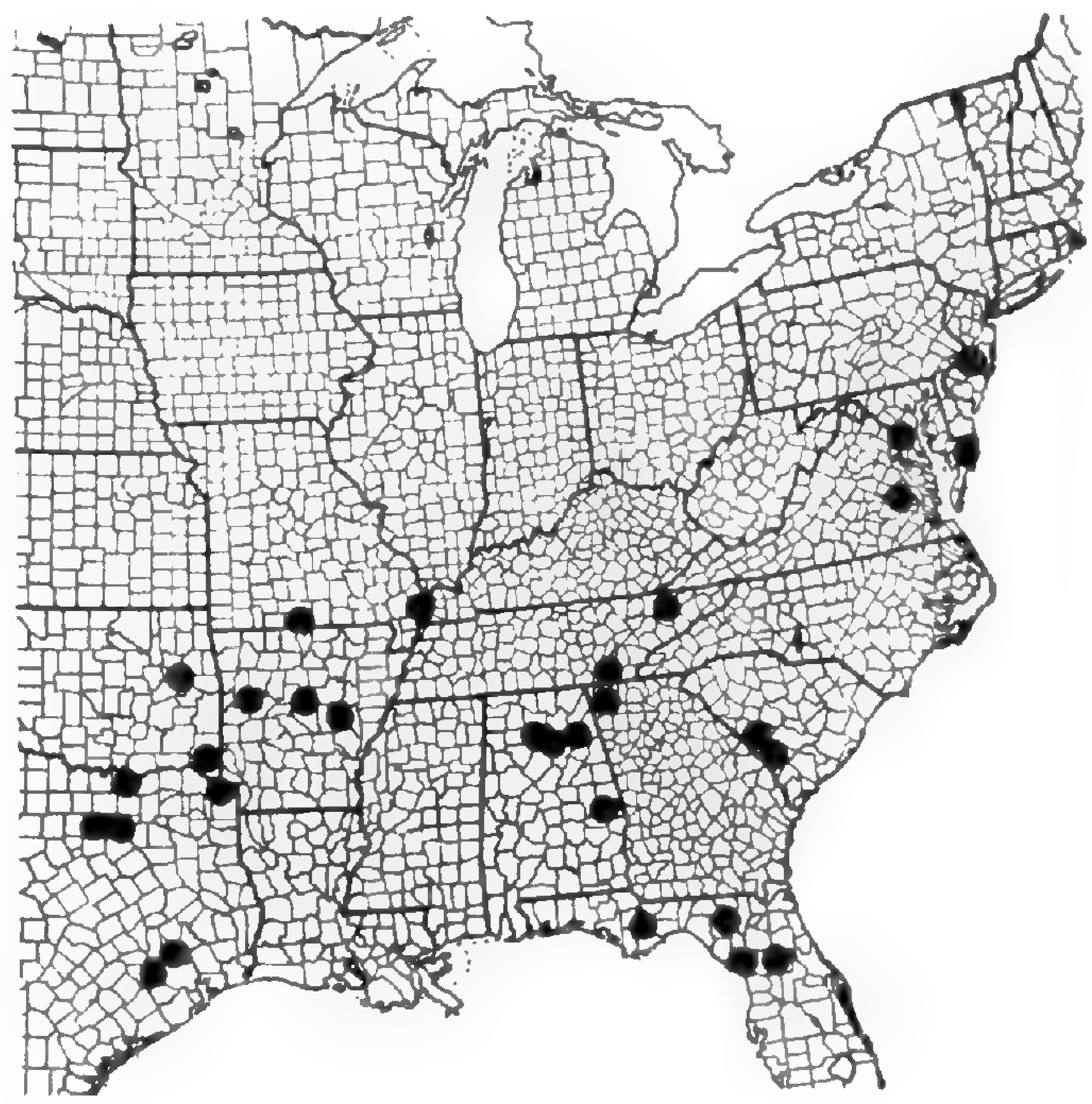

Fig. 28. The geographic distribution of *Toxicodendron quercifolia* (Michx.) Greene.

margin, petiolules about 5 mm. long; inflorescences lateral panicles, bracts lanceolate-deltoid, 0.6 mm. long, 0.3 mm. broad, glabrate, ciliate, deciduous; sepals deltoid-ovate, 1 mm. long, 0.5 mm. broad, glabrate; petals oblanceolate, glabrous, 3 mm. long, 1 mm. broad; anthers lanceolate, 1.3 mm. long, 0.9 mm. broad, filaments 1 mm. long; fruit cream-colored, mostly pubescent; seed about 3 mm. long, 4 mm. broad, 2.5 mm. thick.

For this section of the genus, this is a species of remarkable uniformity as regards variation in leaf outline, pubescence, fruit character, and habit. There is little evidence of hybridization between this species and *Toxicodendron radicans* unless it be with the varieties in Texas and Oklahoma.

Distribution: New Jersey to Florida, west to Oklahoma and Texas (fig. 28).

UNITED STATES:

New Jersey: *ex Bernhardi Herb.* (M).

Maryland: Snow Hill, Sept. 13, 1902, *Norton* (M).

District of Columbia: Georgetown, May 28, 1859, *Schott* (F); near Terra Cotta, May 10, 1911, *Holm* (M).

Virginia: Richmond, May 13, 1894, *Churchill* (M).

South Carolina: Graniteville, May 21, 1899, *Eggert*, and near King, May 24, 1899 (M); near Williston, April 15, 1932, *Palmer 39870* (M).

Georgia: near the line between Tennessee and Georgia, Lookout Mountain, May 6, 1906, *Churchill* (M); Lookout Mountain, July 1898, *Ruth 356* (US type of *T. monticola*, M photo.), *386* (ND).

Florida: Levy Co., June & July 1898, *Hitchcock* (F); Aspalaga, April 1898, *ex Chapman Herb.* (M); near Ocala, April 5, 1929, *Palmer 35178* (M); Suwanee Co., June and July 1898, *Hitchcock* (F, M).

Alabama: Blount Co., June 20, 1897, *Eggert* (M); St. Bernard, May 20, 1919, *Wolf 78* (ND); Etowah Co., June 30, 1897, *Eggert* (M); Auburn, April 17, 1897, *Earle & Baker* (M), and 1898, *517* (F).

Louisiana: Chopin, April 21, 1915, *Palmer 7326*, and Chestnut, April 17, 1916, *9472* (M).

Tennessee: near Rutledge, Sept. 30, 1906, *Norton* (ND); Lookout Mountain, June 28, 1897, *Eggert* (M); Lookout Mountain, near Chattanooga, May 17, 1911, *Churchill*, and May 18, 1911 (M).

Missouri: 1 mile west of Charleston, July 12, 1933, *Palmer & Steyermark 41516* (M); near Tecumseh, Oct. 9, 1927, *Palmer 33025*, "Bald Jesse," near Gainesville, Oct. 10, 1927, *Palmer 33068* (M), and June 26, 1928, *34728* (F, M).

Arkansas: Cove Creek, Faulkner Co., 1925, *Demaree 70* (M); Fulton, May 21, 1909, *Bush* (M); West Mountain, Logan Co., April 24, 1924, *Palmer 24520*, and near Hazen, May 22, 1924, *25052* (M); near Hazen, May 22, 1924, *Wheeler 78*, and *85* (F).

Oklahoma: McCurtain Co., June 16, 1930, *Little & Olmsted 229* (Okla); Muskogee Co., June 19, 1927, *Little 1744* (Okla); 1 mile southwest of Tecumseh, July 21, 1937, *Barkley & Osborn 1405* (ND).

Texas: *ex Herb. Berlandierianum Texano-Mexicanum 625* (M); Bexar Co., April 8, 1935, *Parks B59, B60, B61* (M); Bowie Co., June 13, 1898, *Eggert* (M); Dallas, May 1876, *Reverchon*, and Denison, April 22, 1904 (M); near Conroe, April 15, 1928, *Palmer 33331* (M); Tarrant Co., June 20, 1928, *Ruth 550* (F); Huntsville, May 26, 1917, *Palmer 12049* (M); Hempstead, June 8, 1872, *Hall 78* (F).

2. **Toxicodendron diversiloba** (Torr. & Gray) Greene, Leafl. Bot. Obs. & Crit. 1: 119. 1905.

Toxicodendron comarophyllum Greene, *ibid.* 120.

T. coriaceum Greene, *ibid.* 120.

T. dryophilum Greene, *ibid.* 121.
T. isophyllum Greene, *ibid.* 121.
T. lobadioides Greene, *ibid.* 119.
T. oxycarpum Greene, *ibid.* 121.
T. vaccarum Greene, *ibid.* 122; McNair, Field Mus. Bot. Ser. **4**: 59. 1925, as *T. vacicarum,* in syn.
Rhus lobata Hook., Fl. Bor.-Am. **1**: 127. 1830, non Poir., Encyc. Meth. Suppl. **5**: 264. 1804.
R. diversiloba Torr. & Gray, Fl. N. Am. **1**: 218. 1838.
R. diversiloba forma *radicans* McNair, Field Mus. Bot. Ser. **4**: 61. 1925.
R. diversiloba forma *quinquifolia* McNair, Bull. Torr. Bot. Club **63**: 473. 1936.
R. varielobata Steud., Nom. Bot., ed. 2. **2**: 452. 1841.
R. diversifolia Torr. & Gray ex Engler in DC., Monogr. Phaner. **4**: 395. 1883, in syn.
R. Toxicodendron subsp. *diversiloba* Engler in DC., *ibid.*

Shrubs or vines, with slender puberulent branches; leaflets 3 or very rarely 5, ovate, entire, crenate-dentate, or bluntly lobed, glabrate on both surfaces, apex mostly obtuse or rounded, base rounded to subcuneate, terminal leaflet 2–6.5 cm. long, 1.5–4 cm. broad, with petiolules 5–15 mm. long, lateral leaflets mostly about equilateral, 2.5–6 cm. long, 1–5.5 cm. broad, short-petiolulate or sessile; inflorescences lateral panicles, bracts oblanceolate, 1 mm. long, 0.3 mm. broad, glabrate, ciliate, deciduous; sepals deltoid-ovate, 1 mm. long, 0.5 mm. broad, glabrate; petals oblanceolate, glabrous, 3 mm. long, 1 mm. broad; anthers lanceolate, 1.1 mm. long, 0.6 mm. broad, filaments 1 mm. long; fruit whitish, mostly glabrous; seed about 3.5 mm. long, 5 mm. broad, 2.5 mm. thick.

Characteristic of the section Eutoxicodendron, this species is extremely variable. In habit it may be either a vine or a shrub. In outline its leaflets are predominantly ovate or obovate and obtuse, but the margins vary from entire, crenate-dentate, to crenate-lobed.

Distribution: Washington south to Lower California and Michoacan (fig. 27).

UNITED STATES: Pacific Coast, June and July 1880, *Howell* (F).

WASHINGTON: near Kelso, July 19, 1930, *Palmer 37961* (M); Seattle, May 13, 1911, *Bardell* (M); Columbia River, Klickitat Co., May 6 and July 1885, *Suksdorf* (F, US type of *T. lobadioides*, M photo.).

OREGON: *ex Chickering Herb.* (M); Willamette Slough, June 1877, *Howell* (M); Willamette Hills, May 1892, *Mulford* (M); Hood River Co., May 15, 1924, *Henderson* (M); Hood River, Aug. 1898, *Savage, Cameron & Lenocker* (F, M); 10 miles south of Kerby, June 7, 1928, *Thompson 4653* (M); Cobata Hook, banks of the Willamette, Salem, 1871, *Hall 82* (F, M); Portland, May 1886, *Drake & Dickson*, and April 1890 (F); Portland, 1909, *Nieuwland 2321*, and 1910 (ND); Multnomah Co., May 24, 1903, *Sheldon 12087* (F); Bridal Veil, Aug. 12, 1910, *Smith 3117* (F); Scroggins Creek, Washington Co., June 7, 1928, *Thompson 4291* (M).

CALIFORNIA: Sierra Valley, 187?, *Lemmon 79* (F); Berkeley, July 4, 1880, *Engelmann*, Oct. 22, 1880, and Oct. 23, 1880 (M); near Berkeley, 1886, *Greene* (ND); Amador Co., 1891, *Hansen* (ND), and New York Falls, Agricultural Station, alt. 2000 ft., 1892, *53* (M); near Chico, 1883, *Austin* (ND), Little Chico Creek, April 1896, and *749* (M), Little Chico Cañon, May 1896 (ND type of *T. dryophilum*, M phôto.); Table Mountain, 8 miles north of Oroville, June 6, 1913, *Heller 10787* (F, M), cañon of Big Chico Creek, March 19, 1914, *11211* (F, M, ND), and Stilson Cañon, Chico, April 13, 1916, *12321* (F, M); Mount Konocti, April 26, 1923, and June 13, 1924, *Blankinship* (M); Claremont, June 1912, *Burnell* (M); Claremont, April 15, 1916, *Cox* (M); near Los Angeles, May 1902, *Eby* (M); Mandeville Canyon, Santa Monica Mts., April 10, 1930, *Epling*, and Arroyo Seco, near Pasadena, May 1925 (M); Pasadena, May 2, 1882, *Jones 3206* (M); Rubio Canyon, Mount Lowe, March 12, 1912, *Smith 4396* (F, M), and Eagle Rock Valley, May 1, 1912, *4904* (F); Claremont, March 12, 1923, *Whited 885* (ND); SANTA CATALINA ISLAND:—March 31, 1889, *ex Fritchey Herb.* (M); Aug. 1, 1922, *Knopf 485* (F); Bannings Harbor, Jan. 15, 1920, *Millspaugh 4596*, Avalon Canyon, Feb. 18, 1920, *4716*, and March 8, 1920, *4734* (F type of *R. diversiloba* forma *radicans*); Swains Canyon, July 20, 1920, *Nuttall 622*, Pebble Beach Canyon, Sept. 7, 1920, *834* (F); Avalon Canyon, June 7, 1912, *Smith 5069* (F);—Madera Co., North Fork and vicinity, May 30–June 8, 1903, *Griffiths 4599* (M); Sausalito, Aug. 12, 1872, *Redfield 45* (M); near Mendociño, alt. 500 ft., May 1898, *Brown 780* (M); June 1898, *750* (F); Tassajara Hot Springs, June 1901, *Elmer 3178* (M); Monterey, July 8, 1880, *Engelmann* (M); Carmel Highlands, June 5, 1925, *Epling 8296* (M); Salinas Valley, July 1880, *Vasey 86* (F); near Calistoga, June 15, 1894, *Greene* (ND), Nevada Co., alt. 5000 ft. (ND); Placer Co., Aug.–Oct. 1892, *Carpenter* (ND); near San Jacinto, alt. 600 m., March 9, 1898, *Leiberg 3117* (US type of *T. isophyllum*, M photo.); Tighe's, near San Diego, 1875, *Palmer 45* (F), and July 6, 1875 (M, cotype of *T. comarophyllum*); Santa Barbara, May 1902, *Elmer 3940* (F, M); near Stanford University, Palo Alto, April 17, 1902, *Baker 547* (M, ND); Black Mountain, May 1903, *Elmer 4785* (M); foothills of Los Gatos, April 20, 1904, *Heller 7327* (F, M); Saratoga Springs, May 11, 1888, *Leeds* (F), Los Gatos, April 12, 1889, and near San José, April 23, 1891 (F); Stanford University, Palo Alto, April 5, 1906, *McMurphy 56* (M); Santa Cruz, 1884, *Ball* (US type of *T. oxycarpum*, M photo.); Cow Creek Mountains, May 23, 1894, *Baker & Nutting* (ND type of *T. vaccarum*, M photo., ND not cotype); Klamath River, 6 miles below Hornbrook, Aug. 6, 1922, *Abrams 9900* (M); Marysville Buttes, alt. 400 ft., April 18, 1917, *Ferris 651* (M).

MEXICO:

LOWER CALIFORNIA: Box Cañon, 36 km. north of Enseñada, Sept. 11, 1929, *Wiggins & Gillespie 3997* (F, M).

MICHOACAN: La Maria, Marelia, June 1909, *Arsène 10* (F).

SONORA: Ouirocoba, Rio Fuerte, June 15, 1936, *Gentry 2246* (F).

3. Toxicodendron radicans (L.) Kuntze, Rev. Gen. Pl., pt. 1, p. 153. 1891. Pl. 26, fig. 2.

Toxicodendron radicans var. *normale* Kuntze, *ibid.*, p. 154.
T. radicans var. *microcarpa* Farwell, Am. Midl. Nat. **12**: 125. 1930.
T. radicans var. *volubile* Farwell, *ibid.*
T. Glabrum Mill., Gard. Dict., ed. 8. 1768.
T. Pubescens Mill., *ibid.*, in part.
T. Serratum Mill., *ibid.*
T. Volubile Mill., *ibid.*
T. Vulgare Mill., *ibid.*
T. magnum Bertram ex Steud., Nom. Bot., ed. 2. **2**: 694. 1841.
T. triphyllum Mill. ex Kuntze, Rev. Gen. Pl., pt. 1, p. 153. 1891.
T. arizonicum Greene, Leafl. Bot. Obs. & Crit. **1**: 123. 1905.
T. Blodgettii Greene, *ibid.* 126.
T. goniocarpum Greene, *ibid.* 125.
T. hesperium Greene, *ibid.* 118.
T. laetevirens Greene, *ibid.* 123.
T. longipes Greene, *ibid.* 118.
T. macrocarpum Greene, *ibid.* 117.
T. Negundo Greene, *ibid.* 117.
T. phaseoloides Greene, *ibid.* 123.
T. pumilum Greene, *ibid.* 124.
T. punctatum Greene, *ibid.* 125.
T. Rydbergii Greene, *ibid.* 117.
T. rufescens Greene, *ibid.* **2**: 46. 1910.
T. desertorum Lunell, Am. Midl. Nat. **2**: 185. 1912.
T. fothergilloides Lunell, *ibid.* 186.
Philostemon radicans Raf., Fl. Ludovic., p. 107. 1817.
Rhus radicans L., Sp. Pl. **1**: 266. 1753.

R. radicans var. *microcarpa* DC., Prodr. **2**: 69. 1825.
R. radicans var. *volubilis* DC., *ibid.*
R. radicans var. *vulgaris* DC., *ibid.*
R. Toxicodendrum L., Sp. Pl. **1**: 266. 1753, in part; Torr. & Gray, Fl. N. Am. **1**: 218. 1838, as *R. Toxicodendron.*
R. Toxicodendron var. *microcarpon* Michx., Fl. Bor.-Am. **1**: 183. 1803.
R. Toxicodendron var. *vulgare* Michx., *ibid.*
R. Toxicodendron var. *vulgaris* forma *radicans* Engler in DC., Monogr. Phaner. **4**: 394. 1883.
R. Toxicodendron var. *vulgaris* forma *volubilis* Engler, *ibid.*
R. Toxicodendron var. *radicans* Dippel, Handb. Laubholzk. **2**: 376. 1892.
R. Toxicodendron var. *Rydbergii* Garrett, Spring Fl. Wasatch Reg., ed. 3, p. 69. 1917.
R. Toxicodendron forma *radicans* McNair, Field Mus. Bot. Ser. **4**: 68. 1925.
R. humilis Salisb., Prodr. 170. 1796, as *Rhus Humile.*
R. scandens Salisb., *ibid.*, as *R. Scandens.*
R. toxicarium Salisb., *ibid.*, as *R. Toxicarium.*
R. microcarpa Steud., Nom. Bot., ed. 1, p. 689. 1821.
R. bahamensis G. Don, Gen. Hist. Dichl. Pl. **2**: 72. 1832.
R. acutiloba Turcz., Bull. Soc. Nat. Moscou **36**: 612. 1863.
R. toxicodendra St. Lag., Ann. Soc. Bot. Lyon **7**: 133. 1880.
R. tridentatum Sessé & Moc., Pl. Nov. Hisp., p. 47. 1887, non Thunb. ex Linn. f., Suppl., p. 184. 1781, nec Sond. ex Harv. & Sond., Fl. Cap. **1**: 511. 1859, nec Willd. ex Engler in DC., Monogr. Phaner. **4**: 438. 1883.
R. Uillosum Sessé & Moc., Pl. Nov. Hisp., p. 47. 1887, non *R. villosa* Linn. f., Suppl., p. 183. 1781, nec Hochst. ex A. Rich., Tent. Fl. Abyss. **1**: 145. 1847, nec E. Mey. ex Engler in DC., Monogr. Phaner. **4**: 427. 1883, nec Engler, Bot. Jahrb. **24**: 501. 1898.
R. Blodgettii Kearney, Bull. Torr. Bot. Club **21**: 486. 1894.

R. pubescens Farwell, Ann. Rept. Comm. Parks Detroit **11**: 73. 1900.

R. Rydbergii Small ex Rydb., Mem. N. Y. Bot. Gard. **1**: 268. 1900.

R. floridana Mearns, Proc. Biol. Soc. Wash. **15**: 148. 1902.

Rhus-Toxicodendron radicans Marsh., Arbust. Am., p. 131. 1785.

R.-T. toxicodendrum Marsh., *ibid.*

Shrubs or vines, with slender, glabrate to densely puberulent branches; leaflets 3, or very rarely 5, ovate, entire or irregularly serrate or dentate, acute to acuminate at apex, rounded to subcuneate at base, glabrate above, glabrate or pubescent below, terminal leaflet 3–20 cm. long, 1.3–13 cm. broad, with petiolules 1–4.5 cm. long, lateral leaflets mostly inequilateral, 3–17 cm. long, 1.3–10 cm. broad, petiolules 1–5 mm. long; inflorescences lateral panicles, bracts deltoid, 0.9 mm. long, 0.6 mm. broad, glabrate, ciliate, deciduous; sepals deltoid-ovate, 1 mm. long, 0.8 mm. broad, glabrate; petals oblanceolate, glabrous, 3 mm. long, 1 mm. broad; anthers lanceolate, 1 mm. long, 0.6 mm. broad, filaments 1.5 mm. long; fruit whitish, mostly glabrous; seed about 3 mm. long, 4 mm. broad, 2 mm. thick.

This is a most inconstant species, exhibiting considerable variation in size of fruit, leaf outline, and size of inflorescence. The leaflets are characteristically ovate and acute, but the margins vary from entire, through serrate, to deeply dentate. These variations may occur on a single plant or the leaves of an entire plant may be very similar. Likewise the plants are either shrubs or vines, or a portion of a shrubby plant may rub against a support and then become scandent. In the western portion of the range the leaf is rather uniformly broadly ovate and serrate, and the plant is more uniformly a small shrub than in the eastern portion of the range. In the southern part of the range the leaflets tend to become narrowly ovate or even lanceolate. The general diversity of the species has been well summarized by McNair, *loc. cit.*, p. 68. It is probable that there is occasional hybridization between the species and the varieties.

Distribution: Nova Scotia to Florida, west to British Columbia and Arizona; Nuevo Leon and Sonora to Oaxaca; Bermuda and the Bahamas (fig. 29).

CANADA:

NOVA SCOTIA: near Godfrey Lake, Yarmouth Co., Aug. 12, 1921, *Fernald & Long 24097* (M).

QUEBEC: Longueil, June 1908, *Victorin* (ND).

ONTARIO: Stokes Bay, Bruce Peninsula, Aug. 29, 1934, *Krotkov 9192* (M).

SASKATCHEWAN: Moose Jaw, June 20, 1896, *Macoun 12442* (ND).

ALBERTA: Spring Coulee, near Rosedale, alt. 2200–2500 ft., Aug. 20, 1915, *Moodie 1215* (NY).

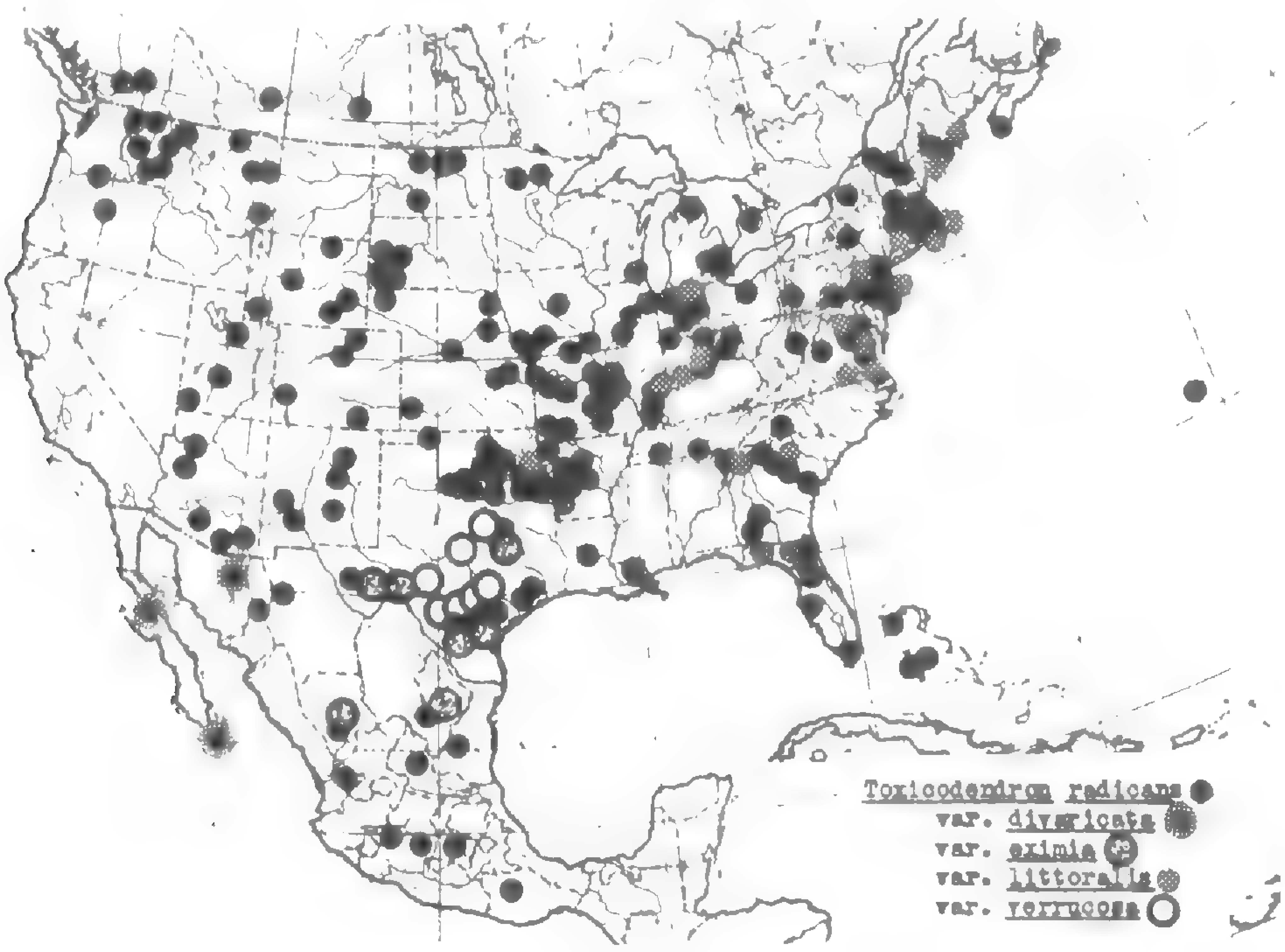

Fig. 29. The geographic distribution of *Toxicodendron radicans* (L.) Kuntze, and its varieties.

BRITISH COLUMBIA: Spence Bridge, May 25, 1889, *Macoun* (M); Hope, Victoria, Aug. 1910, *Newcombe 348* (F); Radium Hot Spring, June 30, 1927, *Sanson*, and Fairmont Hot Springs, June 31, 1927 (NY).

UNITED STATES: 1843, *Fremont's 2nd Exped.* (NY).

MAINE: Winthrop, 1862, *Sturtevant* (M); Bristol, July 28, 1898, *Chamberlain* (ND); White Island, off Boothbay, July 5, 1903, *Churchill* (M).

VERMONT: Barnet, June 20, 1884, *Blanchard*, and Aug. 20, 1886 (M); Willoughby Lake, June 5, 1895, *Churchill* (M); Quechee Gulf, July 4, 1910, *Britton* (NY).

MASSACHUSETTS: Hyannisport, July 4, 1896, *Churchill* (M), Hoosac Valley, Lanesboro, Aug. 17, 1915, and Aug. 19, 1916 (M); Salters Point, Dartmouth, July 9, 1923, *Knowlton* (M); Nonquitt, June 21, 1888, *Sturtevant*, also May 22, 1889, June 4, 1889, June 5, 1889, and June 21, 1889 (M); Nonamesset Island, Elizabeth Islands, June 23, 1928, *Fogg 2345* (M); Bradford, June 17, 1914, *Churchill* (M);

West Holyoke, June 22, 1925, *Seymour 490* (M); by Merrimac River, Lowell, June 14, 1927, *Beattie* (Okla); Lexington, May 30, 1896, *Churchill*, and Reservation, West Quincy, Sept. 2, 1895 (M); Norwell, June 26, 1910, *Knowlton* (M); Dorchester, July 16, 1882, *Churchill*, and Sept. 27, 1885 (M); Middletown, June 13, 1836, *Buckley* (M).

CONNECTICUT: Thompson, June 10, 1922, *Churchill & Lane* (M).

NEW YORK: Henderson, Aug. 1896, *Tidestrom* (NY); Fall Creek, Ithaca, June 19, 1878, *Trelease* (M); Lansing, Sept. 14, 1919, *Wiegand 12401* (M).

NEW JERSEY: north shore of Nescochaque Lake, Pleasant Mills, May 25, 1933, *Hermann 4207* (M); south shore of Crystal Lake on Main Branch of Newton Creek, Westmont, June 6, 1926, *Adams 236* (M); Somerset Co., *Perry* (M).

PENNSYLVANIA: Squaw Run near Pittsburgh, June 21, 1885, *Shafer* (ND); Mercersburg, June 1850, *Porter* (M); Mountville, Aug. 1896, *Eby* (M); near Philadelphia, June 10, 1873, *Redfield 1167* (M); Philadelphia, *Trig* (M).

MARYLAND: south of Annapolis, Aug. 18, 1913, *Tidestrom 6639* (M).

DISTRICT OF COLUMBIA: Dalecarlia Reservoir, May 23, 1905, *Painter 1291* (M); vicinity of Washington, Oct. 8, 1897, *Steele* (M).

VIRGINIA: near Luray, Aug. 29, 1901, *Steele 157* (M); immediate vicinity of Colonial Beach, Aug. 2–3, 1912, *Tidestrom & Bartlett 5971* (M).

NORTH CAROLINA: Tryon, May 18–20, 1899, *Churchill* (M).

SOUTH CAROLINA: near Graniteville, May 21, 1899, *Eggert* (M); Anderson: Baldwin woods, May 8, 1912, *Davis 8168*, and Whitner Park, July 7, 1921, *1710* (M); near Denmark, April 15, 1932, *Palmer 39863* (M); Clemson College, May 17, 1906, *House 2162* (M).

GEORGIA: between Gray and Macon, June 1, 1928, *Gillespie 4889*, and Dougherty Co., May 1, 1928, *4947* (ND); near the line between Tennessee and Georgia, Lookout Mountain, May 6, 1906, *Churchill* (M).

FLORIDA: Indian River, east Florida, 1874, *Palmer 96* (M); *Saurman* (M); Gainesville, May 1925, *O'Neill* (M); near Jacksonville, March 28, 1894, *Curtiss 4646* (M); Tampa Bay, May 12, 1893, *Rolfs* (M); Alva, July–Aug. 1900, *Hitchcock* (M, cotype of *R. floridana*); near Ocala, April 6, 1931, *Palmer 38400* (M); Pine Key, *Blodgett* (NY, probably type of *R. Blodgettii*, M photo.).

MISSISSIPPI: 1858, *Cyard* (M).

LOUISIANA: Natchitoches, April 23, 1915, *Palmer 7353* (M); New Orleans, April 16, 1846, *Fendler* (M); in the vicinity of Alexandria, May 22, 1899, *Ball 429* (M); north of Lake Maurepas, March 26, 1937, *Seibert 702, 703*, and *721* (M); near St. Martinsville, April 13, 1893, *Langlois* (ND).

OHIO: Oxford, June 20, 1910, *Overholts* (M); Cedar Point, Sandusky, July 17, 1906, *Jennings* (ND); John Bryan State Park, Yellow Springs, July 11, 1935, *Demaree 11455* (M).

WEST VIRGINIA: near Bucklin, June 1, 1895, *Pollock* (M).

MICHIGAN: Grand Beach, Sept. 3, 1917, *Nieuwland* (ND); south shore of Douglas Lake, July 16, 1912, *Harper* (NY); Agricultural College, East Lansing, June 9, 1896, *Skeels* (M); Ross, July 10, 1889, *Sones* (M); Rochester, Sept. 18, 1907, *Farwell 1492a* (Farwell); Ann Arbor, *Fritchey 26* (M); Belle Isle, Oct. 19, 1894, & spring 1895, *Farwell 1492* (Farwell type of *R. pubescens*).

INDIANA: northern Indiana, Aug. 20, 1917, *Nieuwland* (ND); Michigan City, June 18, 1911, *Deam 8854* (Deam), and Lake Maxinkuckee, Oct. 8, 1906 (ND);

Lake Maxinkuckee, Sept. 15, 1906, *Clark* (ND); Otwell, June 5, 1934, *Deam 55009*, and Chesterton, Aug. 22, 1915, *18007* (Deam); Notre Dame, June 6, 1911, *Nieuwland* (M), *2666*, *3269*, and Aug. 20, 1917 (ND); Crossplains, June 19, 1915, *Deam 16183*, and Wells Co., June 22, 1897 (Deam), and June 7, 1903 (M).

KENTUCKY: coll. of 1812, *Short* (M).

TENNESSEE: near Sherwood, June 7, 1897, *Eggert* (M); Bolivar, May 14, 1920, *Palmer 17499* (M).

WISCONSIN: Cobblestone Beach, Garrett Bay, June 14, 1933, *Fassett 16238* (M); near Ellison Bay, Sept. 14, 1925, *Palmer 28772* (M); Milwaukee, *Lapham* (M); Baraboo River, near Ableman, June 6, 1925, *Palmer 27657* (M).

ILLINOIS: Mississippi bottoms in Illinois, May 26, 1875, *Eggert* (ND); Stony Island, July 21, 1914, *Smith 6033* (M); Tunnel Hill, May 17, 1919, *Palmer 15168* (M); Illinois State Park, Starved Rock, June–Sept. 1921, *Thone 264* (M); Peoria, June 10, 1912, *Churchill* (M); Mounds, May 7, 1919, *Palmer 15072* (M); Red Bud, June 3, 1888, *Pammel* (M); near Cahokia, June 1, 1874, *Eggert* (M); opposite St. Louis, Aug. 1863, *Engelmann* (M); near Pittsburg, Aug. 29, 1891, *Douglass* (M).

MINNESOTA: Schoolcraft Island, July 30, 1929, *Grant 2976* (M); Ingersand, Sand Lake, Sept. 12, 1925, *Johnson 1891*, and Farley's, Aug. 7, 1926, *2122* (M).

IOWA: Decatur Co., June 12, 1901, *Anderson*, and June 15, 1901 (M); Ames, Sept. 1909, *Campbell 57*, and no date, *Hitchcock* (M).

MISSOURI: along Chariton River, near Novinger, June 16, 1924, *Palmer 25504* (M), near Watson, Sept. 3, 1920, *18912*, near Cole Camp, May 10, 1926, *30035*, Van Buren, July 6, 1914, *6207*, and Missouri River near Forest City, June 12, 1924, *25402* (M); woods, Sibley, June 28, 1907, *Bush 4805*, and Independence, May 31, 1921, *9365*, Swope Park, Kansas City, June 12, 1923, *10103*, Courtney, June 17, 1932, *12469*, *12469B*, *12470*, *12471*, *12472* (M), June 8, 1934 (M, ND), *13892* (M), and *13744* (ND); Webb City, May 10 1901, *Palmer 52*, Larussel, Oct. 2, 1908, *1517*, also Jasper, May 6,1909, *1903*, Webb City, June 4, 1909, *2135*, Prosperity, Sept. 17, 1913, *4351*, and Turkey Creek near Joplin, June 18, 1923, *23361* (M); Kimmswick, July 7, 1885, *Wislizenus 58* (M); near Columbus, June 21, 1930, *Palmer 36615* (M); Riverview Park, Hannibal, Aug. 25, 1923, *Davis* (M); North Fork of White River, near Tecumseh, Oct. 7, 1927, *Palmer 32912*, and near Pontiac, June 27, 1928, *34792* (M); Jerome, May 25, 1914, *Kellogg 310* (M); Bear Creek, Oct. 10, 1922, *Davis* (M); opposite Alton, St. Charles Co., Oct. 8, 1891, *Deng* (M); St. Louis Co., May 21, 1914, *Emig 287* (M); Carsonville, May 25, 1886, *ex Fritchey Herb. 228* (M); Allenton, *Letterman*, and July 10, 1884, 1894, June 1900, and May 20, 1912 (M); Old Orchard, Oct. 1886, *Pammel* (M); Kirkwood, July 18, 1926, *Woodson* (M); Montier, May 15, 1894, *Bush 144*, Swan, May 20, 1907, *4594* (M); Branson, Oct. 23, 1913, *Palmer 4714* (M).

ARKANSAS: Twin Mountain, Benton Co., Oct. 15, 1928, *Demaree 4579* (F, M); near Hot Springs, June 5, 1923, *Palmer 23098* (M); Fulton, April 30, 1905, *Bush 2508*, and April 28, 1914, *Palmer 5146* (M); base of Magazine Mountain, Logan Co., May 10, 1924, *Palmer 24810* (M); Caddo Creek Bottoms, Norman, Oct. 8, 1932, *Demaree 9563* (M); near Nogo, Sept. 23, 1932, *Merrill 52* (M); Arkansas River bottoms below Natural Steps, Oct. 12, 1931, *Demaree 8569* (M).

NORTH DAKOTA: Fort Totten, July 2, 1912, *Bergman 1895*, and May 28, 1912, *Holm* (M); Butte, June 16, 1907, *Lunell*, also Minnewauken, June 26, 1907 (NY), Pleasant Lake, Aug. 14, 1911, and June 11, 1912 (Deam), Sand Hills, July 13, 1899, *705* (Minn type of *T. desertorum*, M photo.); Wade, June 25, 1907, *Bell 104* (Okla); Devil's Lake, June 29, 1902, *Lunell 706* (Minn type of *T. fothergilloides*, M photo.), July 1, 1905, *706* (Minn, M photo.), and June 26, 1913 (M); near Devils Lake, July 4, 1930, *Palmer 36868* (M).

South Dakota: Warren's Woods, June 14, 1902, *Johnson* (M); Hermosa, alt. 3500 ft., June 26, 1892, *Rydberg 594* (NY); Deadwood, July 16, 1913, *Carr 83* (M, NY); near Piedmont, June 8, 1929, *Palmer 37020* (M); Black Hills, *Pratt 36* (NY); Bad Lands, near Wall, June 15, 1929, *Palmer 37264* (M, NY); Rockerville, Black Hills, June 1909, *White* (M); White River valley, Aug. 8, 1911, *Visher 2184* (NY).

Nebraska: Fort Clark, July 1853–1854, *Hayden* (M); Republican Valley, May 20, 1894, *Laybourne 47* (M); banks of Platte River opposite Columbus, June 5, 1929, *Palmer 36060* (M, NY); Newcastle, June 23, 1893, *Clements* (NY); Minden, Sept. 1913, *Hapeman* (M); Kearney Co., June 13, 1891, *Rydberg 41* (NY); Monroe Canyon, Sept. 4, 1901, *Baker* (M).

Kansas: Syracuse, July 11, 1893, *Thompson 102* (M, NY, cotypes of *T. macrocarpum*); St. George, May 28, 1890, *Kellerman* (M); Manhattan, 1883, *Bassler* (ND); Riley Co., Aug. 6, 1892, *Norton* (ND), Sept. 28, 1895, *73* (M, cotype of *T. Negundo*), and 1896, *73a* (M).

Oklahoma: near Knowles, May 19, 1913, *Stevens 516* (M); ten miles west of Norman, May 10, 1928, *Barkley* (Okla), by the Canadian River, 3 miles south of Norman, Aug. 14, 1934 (M); east of Lexington, May 10, 1930, *Gowan 74* (Okla); vicinity of Fort Sill, May 20, 1916, *Clemens 11676* (M); Cache Creek bank, July 14, 1934, *Pottz* (M); Sapulpa, July 22, 1894, *Bush 57* (M); six miles north of Reed, June 8, 1931, *Bull 158* (Okla); Tishomingo, Sept. 7, 1914, *Palmer 6412* (M); north of Red Oak, June 13, 1930, *Clark 2856* (Okla); near Boss, May 22, 1916, *Houghton 3718* (M); McCurtain Co., June 5, 1930, *Little & Olmstead 1550*, also Highway 21, N. Hairpin Bend, June 7, 1930, *113*, and July 13, 1930, *565* (Okla); Commerce, Aug. 3, 1923, *Bush 10142* (M); ten miles south of Stillwater, July 14, 1927, *Stratton 162* (M); Hartshorne, Aug. 9, 1930, *Clark* (Okla); Tecumseh, June 22, 1932, *Isaacson & Barkley* (Okla); Clayton, June 10, 1893, *Waugh 124* (M).

Texas: *Berlandier 2475* (M); Hortons, Aug. 6, *Reverchon* (M); Gamble's Ranch, June 5, 1918, *Palmer 13928* (M); Leon Springs, May 29, 1911, *Clemens 830* (M); Bexar Co., April 8, 1935, *Parks B50, B51, B52, B53, B54, B55, B56, B57, B58, B63, B64, B65, B66, B67, B68* (M); near Blanco, May 11, *Palmer 33893* (M); Columbia, April 14, 1899, *Bush 142* (M); Columbia, March 25, 1914, *Palmer 5024* (M); Comal Co., 1842, *Lindheimer*, Aug. 1846, *247*, also near New Braunfels, Sept. 1846, *246*, and 1847, *346* (M); West Dallas, June 23, 1899, *Eggert* (M); Dallas Co., May 1876, *Reverchon 188* (M); Gillespie Co., *ex Jermy Herb.* (M); near Houston, April 22, 1899, *Eggert* (M); Houston, April 1842, *Lindheimer* (M); Navidad River, Ganado, March 20, 1916, *Palmer 9233* (M); Little Aguja Canyon, Davis Mts., June 12, 1928, *Palmer 34521* (M, NY); near Lubbock, 1930, *Demaree 7629* (M); D'Hanis, Oct. 19, 1916, *Palmer 11089*, and San Angelo, Oct. 25, 1916, *11137* (M); Tom Green Co., 1879, *Tweedy* (NY); Leona River, near Uvalde, April 30, 1928, *Palmer 33638* (M).

Montana: Great Falls, Aug. 5, 1885, *Williams 291* (NY type of *R. Rydbergii*, M photo.); Bigfork, July 21, 1908, *Butler 3062* (NY); near Bozeman, alt. 5000 ft., Aug. 14, 1905, *Blankinship 106* (M); Helena, *Anderson* (NY); in the vicinity of Helena, June 3, 1891, *Kelsey* (NY); along the upper Madison River, Madison Co., June 17, 1937, *Lenz* (M, ND).

Wyoming: Freezeout Hills, July 11, 1898, *Nelson 4857* (M, NY); Pole Creek canyons, Albany Co., June 2, 1894, *Nelson 154* (ND); Wind River Range, Fremont Co., alt. 6000 ft., Aug. 20, 1905, *Johnson* (NY); Hartville, July 16, 1894, *Nelson 557* (ND); Big Horn, alt. 5000 ft., June 28, 1899, *Tweedy 2289* (NY); Evanston, alt. 6800–6900 ft., Aug. 2, 1902, *Pammel & Blackwood 3630* (M).

Colorado: near Boulder, elev. 5000–6000 ft., July 1902, *Tweedy 4946* (NY); Fort Collins, alt. 5000 ft., June 23, 1893, *Crandall* (NY), and Dixon Canyon, Las Animas Co., June 25, 1897 (NY); Norwood Hill, San Miguel Co., Aug. 18, 1912, *Walker 498* (NY).

New Mexico: 1847, *Fendler 98* (M); Capelin Canyon, Sandia Mts., alt. 8100 ft., June–July 1914, *Ellis 245* (M, NY); Santa Fe Canyon, Oct. 3, 1913, *Rose, Fitch & Parkhurst 17743* (NY); on or near the west fork of the Gila River, in the Mogollon Mts., alt. 7500 ft., Aug. 2, 1903, *Metcalfe 339* (M, ND, NY); Salado Canyon, July 27, 1900, *Earle 485* (M, NY); Mora Ocate Creek, June 22, 1846, *Wislizenus 502* (M); Winsor's Ranch, Pecos National Forest, alt. 8400 ft., June 29, 1908, *Standley 4011* (M, NY); Las Vegas, 6400 ft., June 5, 1902, *Tuttle* (NY); Kingston, alt. 6600 ft., July 9, 1904, *Metcalfe 1088* (M, NY, cotypes of *T. punctatum*).

Arizona: Chiricahua Mts., Chaperon Canyon above road crossing, Oct. 7, 1906, *Blumer 102*, and alt. 7500–8000 ft., July 1, 1907, *UR2* (ND), alt. 7500 ft., July 1, 1907, *1325* (M), Big Emigrant Canyon, alt. 4500 ft., Nov. 6, 1906, *102a* (ND); Huachuca Mts., June 29–July 5, 1903, *Griffiths 4846* (M); Fort Huachuca, April 26–May 21, 1890, *Palmer 453a* (US type of *T. arizonicum*); west fork, Oak Creek Canyon, south of Flagstaff, alt. 5200–5500 ft., June 13, 1927, *Goddard 569* (M); vicinity of Flagstaff, alt. 7000 ft., June 2, 1898, *MacDougal 28* (NY, US type of *T. pumilum*, M photo.); Gila Co., Aug. 17, 1935, *Little 4007* (ND); Fort Lowell, Oct. 1880, *Lemmon* (M); Santa Catalina Mts., May 5, 1894, *Toumey* (US type of *T. laetevirens*); Nogales, 1892, *ex Brandegee Herb.* (Calif); Nogales, 1908, *Rose 11943* (US); Rio Verde, Fort Whipple, Aug. 28, 1865, *Coues & Palmer 465* (M).

Idaho: Bonner's Ferry, Aug. 30, 1926, *Epling 10465* (M); east side of Lake Pend d'Oreille, Hope, Aug. 25, 1892, *Sandberg, MacDougal & Heller 963* (NY).

Utah: City Creek Canyon, near Salt Lake City, July 25, 1930, *Palmer 38033* (M); south of Glenwood, alt. 6300 ft., June 12, 1875, *Ward 212* (US type of *T. longipes*, M photo.); Springdale, alt. 4000 ft., May 14, 1894, *Jones 5249* (M).

Washington: coll. of 1889, *Vasey 212* (US); Wenatchee, Aug. 6, 1896, *Whited 241* (US type of *T. hesperium*, M photo.); Dry Falls, Coulee City, June 22, 1935, *Thompson 9115* (M, ND); Spokane Co., Sept. 9, 1902, *Kreager 538* (NY, US); Spokane, July 1898, *Savage, Cameron & Lenocker* (M); near International Boundary, between Kettle and Columbia Rivers, June 6, 1902, *Macoun 63750* (ND, NY); Waitsburg, May 31, 1897, *Horner 129* (US); Wawawai, May 1897, *Elmer 778* (M, NY, US).

Oregon: 1897, *Sheldon 8280* (US); Deschutes River, Creek Co., May 8, 1885, *Howell* (US); bank of Deschutes River, Redmond, Aug. 17, 1919 and July 4, 1920, *Whited 122* (ND); near Hood River, Oct. 1, 1923, *Henderson* (M).

MEXICO: Fortin, March 1883, *Kerber 397* (F); coll. of 1787–1804, *Sessé, Mociño, Castillo & Maldoñado 856, 930, 1382,* and *1445* (F, Madrid); Sierra del Pajarito, June 27–28, 1855, *Schott* (F).

CHIHUAHUA: San Diego, alt. 6000 ft., March 28, 1891, *Hartman 589* (Calif, F); Cajon Creek, near United States boundary line, July 2, 1892, *Mearns 394* (M).

DURANGO: Durango, April–Nov. 1896, *Palmer 106,* in part (F).

JALISCO: Sierra de Nayarit, Territoire Huichol, *Diquet* (NY).

MEXICO: Mount Ixtaccihuatl, alt. 7000–8000 ft., 1903, *Purpus 269* (Calif, M).

MICHOACÁN: vicinity of Morelia: Rincón, April 11, 1909, *Arsène 3011,* also Loma Santa Maria, alt. 1950 m., April 18, 1909, *2509,* and June 14, 1909, *2763* (M), also San Augustin, Sept. 7, 1910 (F); near Uruapan, Jan. 22, 1926, *Woronow 2769* (F).

NUEVO LEON: Hacienda Pablillo, Galeana, Aug. 27, 1936, *Taylor* (F).

OAXACA: June 22, 1909, *Conzatti 2409* (F).

SAN LUIS POTOSI: coll. of 1878, *Parry & Palmer 124* (M).

SONORA: Tunicachi, alt. 5600 ft., Dec. 7, 1890, *Hartman 102* (US type of *T. phaseoloides,* M photo.); El Alamo, near Magdalena, May 20, 1925, *Kennedy 7106* (CA, Calif).

TAMAULIPAS: vicinity of Victoria, Feb. 1–April 9, 1907, *Palmer 138,* and *165* (Calif, F, M), also *228* (F, M).

WEST INDIES:

BERMUDA ISLANDS: Paget Marsh, Bermuda, Aug. 31–Sept. 20, 1905, *Brown & Britton 214* (F, G, US).

BAHAMA ISLANDS: Staniard Creek, Andros Island, Feb. 1–3, 1910, *Small & Carter 8850* (F, US); West End, Great Bahama Island, April 16–May 8, 1905, *Brace 2570* (F); Eight Mile Rocks, Great Bahama Island, Feb. 5–13, 1905, *Britton & Millspaugh 2446* (F, US); near Delaport, New Providence Island, Feb. 22, 1905, *Britton 2416* (F); North Cat Cay, April 15, 1904, *Millspaugh 2336* (F).

3a. **Toxicodendron radicans** (L.) Kuntze var. **divaricata** (Greene) Barkl., n. comb.

Toxicodendron divaricatum Greene, Leafl. Bot. Obs. & Crit. 1: 122. 1905.

Rhus divaricata McNair, Field Mus. Publ. Bot. **4**: 69. 1925, non Eckl. & Zeyh., Enum. Pl. Afr., p. 146. 1834.

R. Greenei McNair, *ibid.* [in addenda].

Vines with trifoliolate leaves; leaflets lanceolate to ovate, subacuminate to acuminate, entire or irregularly serrate, obscurely sparse-pubescent, usually subcuneate at base; fruit glabrous; seed constricted at the side.

MEXICO:

LOWER CALIFORNIA: Sierra de la Laguna, Jan. 23, 1890, and 1892, and Oct. 4, 1899, *Brandegee,* and Sierra San Lazaro, Sept. 1893, also La Chupanosa, Oct. 17, 1893 (Calif); Calmalli, Jan.–March 1898, *Purpus* (Calif, US **type**, M photo.).

SONORA: Agua Nueva Arroya, El Alamo, Magdalena, May 20, 1925, *Kennedy 7034* (Calif).

3b. Toxicodendron radicans (L.) Kuntze var. **littoralis** (Mearns) Barkl., n. comb.

Toxicodendron aboriginum Greene, Leafl. Bot. Obs. & Crit. **1:** 125. 1905.

Rhus littoralis Mearns, Proc. Biol. Soc. Wash. **15:** 148. 1902.

R. Toxicodendron forma *malacotrichocarpum* A. H. Moore, Rhodora **11:** 163. 1909.

Shrubs and vines with trifoliolate leaves; leaflets often broadly ovate, acute, usually entire but rarely crenate-dentate, usually subcordate at base; fruits distinctly pubescent; occurring with the species from Maine to Virginia and Oklahoma.

UNITED STATES:

MAINE: Mount Desert Island, July 8, 1890, *Redfield* (M); Pemaquid Beach, Bristol, Sept. 9, 1898, *Chamberlain & Dinsmore 832* (G type of *R. Toxicodendron* forma *malacotrichocarpum*, M photo.).

MASSACHUSETTS: West Falmouth, Sept. 4, 1894, *Churchill* (M).

RHODE ISLAND: Newport Co., Aug. 24, 1901, *Mearns 541* (ND), Sept. 10, 1901, *235* (US), and *233* (US **type**, M photo.).

CONNECTICUT: Bridgeport, June 18, 1895, *Eames* (US).

NEW JERSEY: Toms River, Aug. 8, 1909, *Mackenzie 4256* (M, US).

PENNSYLVANIA: valley of the Lehigh River, Northampton, Aug. 21, 1923, *Churchill* (M).

DISTRICT OF COLUMBIA: northeast of Washington, July 27, 1893, *Boettcher 250* (M).

VIRGINIA: banks of Appomattox River near Petersburg, Aug. 22, 1908, *Rehder 1908* (M); near Hampton, July 22, 1927, *Churchill* (M); immediate vicinity of Colonial Beach, Aug. 2–3, 1912, *Tidestrom & Bartlett 5962* (M).

SOUTH CAROLINA: Anderson, July 29, 1920, *Davis 1796* (M).

GEORGIA: below Lula Falls, near Chattanooga, Tennessee, June 4, 1911, *Churchill* (M).

FLORIDA: June and July 1898, *Hitchcock* (M); near Sirmans, May 16, 1925, *Palmer 27268* (M).

INDIANA: about 2 miles northeast of Solon, June 20, 1923, *Deam 38907*, and Clark County State Forest about 4 miles northwest of Henryville, Aug. 22, 1923, *39791*, and west of New Albany, Sept. 1, 1912, *12314* (Deam); Notre Dame, 1909, *Nieuwland 2243*, and road to Red Mill, 1910, *2427* (ND); 2 miles southwest of Chrisney, Aug. 13, 1919, *Deam 28959*, also 4 miles southeast of Crossplains, June 19, 1915, *16182*, and Neuburn woods about 7 miles southwest of Evansville, Sept. 28, 1920, *33102* (Deam).

OKLAHOMA: Choctaw Agency, 1853, *Bigelow* (US type of *T. aboriginum*, M photo.).

3c. Toxicodendron radicans (L.) Kuntze var. **verrucosa** (Scheele) Barkl., n. comb.

Toxicodendron verrucosum Greene, Leafl. Bot. Obs. & Crit. **1:** 124. 1905.

T. rhomboideum Greene, *ibid.* 125.

R. verrucosa Scheele, Linnaea **21:** 592. 1848.

R. aromatica Lindh. ex Scheele, *ibid.* 593.

R. rhomboidea Small, Fl. Southeast. U. S., pp. 727, 1334. 1903.

Small shrubs with trifoliolate leaves; leaflets rhomboid-ovate, acute to acuminate, usually regularly and deeply incised-dentate, mostly glabrate except on veins and margins; fruit glabrous; occurring mostly in Texas.

UNITED STATES:

OKLAHOMA: bluff above Turner Falls, Murray Co., April 26, 1936, *Demaree 12294* (Okla).

TEXAS: near Brownwood, Oct. 31, 1924, *Palmer 26781*, also Brown Co., Nov. 1, 1924, *26821*, and Nov. 2, 1925, *29566* (M); Comal Co., 1840, *Lindheimer 127* (M), also 1845, *346* [*135*] (M, cotype), and Aug. 1846, *346* [*245*] (M); New Braunfels, 1847, *Lindheimer 346*, and 1851 (M); Comanche Peak, near Granbury, May 5, 1900, *Eggert*, and Sept. 16, 1914, *Palmer 6559* (M); Hood Co., Sept. 5, 1903, *Reverchon* (M); Spanish Pass, Kendall Co., May 23, 1916, *Palmer 9867* (M); Kerrville, April 25–30, 1894, *Heller 1670* (F, M, cotypes of *R. rhomboidea*, M photo.); Guadalupe River, near Kerrville, May 7, 1928, *Palmer 33803*, also Menard, May 12, 1917, *11898*, Trinity River near Fort Worth, Oct. 31, 1925, *29474*, Austin, April 1, 1916, *9329*, and Montell, Oct. 14, 1917, *12975* (M).

3d. Toxicodendron radicans (L.) Kuntze var. **eximia** (Greene) Barkl., n. comb.

Toxicodendron biternatum Greene, Leafl. Bot. Obs. & Crit. **1:** 124. 1905.

T. eximium Greene, *ibid.* 123.

Rhus eximia Standley, Contr. U. S. Nat. Herb. [Trees & Shrubs Mex.] **23:** 668. 1923.

R. Toxicodendron var. *eximia* McNair, Field Mus. Bot. Ser. **4:** 69. 1925.

Vines with trifoliolate leaves; leaflets broadly ovate, mostly acuminate, the terminal tending to be trilobate, the lobes rounded or rarely acutely incised-dentate, puberulent; fruit obscurely sparse-pubescent; occurring in Texas and Mexico.

UNITED STATES:

Texas: Bexar Co., April 8, 1935, *Parks B62* (M); Chisos Mountains, Brewster Co., May 23, 1928, *Palmer 34076* (M); Eagle Nest on the Rio Grande, Maverick Co., *Havard* (US type of *T. biternatum*, M photo.); Tarrant Co., Aug. 29, 1920, *Ruth 550* (F); Uvalde, April 30, 1928, *Palmer 33630* (F), also Devils River, Valverde Co., March 26, 1917, *11382*, and May 14, 1918, *13603*, and Pecos River, near Rio Grande, April 24, 1928, *33466* (M).

MEXICO:

Durango: Durango, April–Nov. 1896, *Palmer 106* (F in part, M, Calif, **co-types**).

Nuevo Leon: San Agustin, alt. 800 m., Aug. 1911, *Abbot 246* (M).

Section Vernix (Adanson) Schneider, Illustr. Handb. Laubholzk. **2**: 151. 1907.

Vernix Adanson, Fam. Pl. **2**: 342. 1763.

Deciduous trees or large shrubs, with comparatively few, rather stout branches. Flowers usually polygamo-dioecious in large, pendent, lateral, axillary panicles. Leaves alternate, thin, imparipinnately many-foliolate.

Eastern North America, Central America, northern South America, and southeastern Asia.

Type species: **Toxicodendron Vernix** (L.) Kuntze, Rev. Gen. Pl., pt. 1, p. 153. 1891 (*Rhus Vernix* L., Sp. Pl. **1**: 265. 1753).

For the most part Vernix is a group of small trees and large shrubs. It is represented in North America by two species, but in Asia there are several species.

KEY TO THE SPECIES

Seed flat, comparatively smooth, about 6 mm. broad; Central and South America...*4 T. striata*

Seed thick, rough, about 4 mm. broad; eastern North America........*5 T. Vernix*

4. Toxicodendron striata (Ruiz & Pavon) Kuntze, Rev. Gen. Pl., pt. 1, p. 153. 1891. Pl. 25, fig. 2.

Rhus striata Ruiz & Pavon, Fl. Peruv., p. 29. 1802.

R. juglandifolia Willd. ex. Roem. & Schult. in L. Syst. Veg., ed. 15. **6**: 649. 1820.

R. juglandifolia var. *Lindeniana* Engler in DC., Monogr. Phaner. **4**: 401. 1883.

R. juglandifolia var. *Samo* Engler, *ibid.*

R. Samo Tulasne, Ann. Sci. Nat., Bot. III. **6**: 367. 1846.
R. Lindeniana Turcz., Bull. Soc. Nat. Moscou **31**: 468. 1858.

Trees and large shrubs with stout branches which are at first scurfy-pubescent; leaflets 11–17, broadly lanceolate, 5–10 cm. long, 2.7–4 cm. broad, abruptly acuminate at the apex, unequal and rounded at the base, thin, subrevolute, entire-margined, glabrous on both surfaces or slightly pubescent on veins below, dark and shining above, lighter and dull below, lateral leaflets with petiolules about 4 mm. long, terminal leaflet with petiolules about 2 cm. long, rachis segments about 4 cm. long; inflorescences large, lateral panicles, bracts lanceolate, about 0.8 mm. long, about 0.3 mm. broad, pubescent, deciduous; sepals semicircular, about 1 mm. broad, almost as long, glabrous; petals tan in the dried state, oval, 2.5 mm. long, 1.7 mm. broad, glabrous; anthers lanceolate, 2 mm. long, 1 mm. broad; filaments 1.5 mm. long; stigmas 3, styles almost entirely connate; fruit whitish, glabrous; seed about 5 mm. long, 7 mm. broad, 2 mm. thick.

Distribution: Vera Cruz, south to Brazil and Peru (fig. 30).

MEXICO: 1841–1843, *Liebmann 277* (Calif, M photo, US).

CHIAPAS: between Teneapa and Yajalon, alt. 3000–5000 ft., Oct. 13, 1895, *Nelson 3293* (US).

OAXACA: Cafetal Allianza, alt. 700 m., Aug. 1917, *Reko 3353* (US).

VERA CRUZ: Zacuapan, Aug. 1906, *Brandegee 2019* (US); Zacuapan, Aug. 9, 1906, *Purpus 2019* (Calif, F, M), and Oct. 1914, *7378* (Calif, F, M, US).

CENTRAL AMERICA:

GUATEMALA: ALTA VERAPAZ: Chicoyonito, alt. 4300 ft., April 1889, *Donnell Smith 1791* (US); COBÁN: June 1906, *von Tuerckheim II 1255* (US).

COSTA RICA: *Brenes 5032* (F); Las Cauras, Aug. 1919, *Lankester K296* (F); Cerro Jucosinal, March 3, 1928, *Stork 1095* (F); 2 miles southwest of Agua Caliente, April 1, 1928, *Stork 1328*, and near Novarro Valley, May 1, 1928, *1712* (F); ALAJUELA: San Ramon, Oct. 26, 1925, *Brenes 4552 (337)*, and bois La Palma de San Ramon, June 27, 1927, *5559 (151)* (F); CARTAGO: Rio Reventado, alt. 6000 ft., March 1887, *Cooper (Donnell Smith 5728)*, and *466 (5728)* (US); Alto de La Estrella, March 26–27, 1924, *Standley 39274* (US).

PANAMA: CHIRIQUI: forests around El Boquete, alt. 1000–1300 m., March 6, 1911, *Pittier 3029* (US).

SOUTH AMERICA:

COLOMBIA: CAUCA: highlands of Popayan, alt. 1600–2000 m., *Lehmann 6652*, Inza, *8462* (F); Huila, Rio Paez Valley, Tierra Odentro, alt. 1600–1900 m., Jan. 1906, *Pittier 1259*, El Saladito above Cali, road to Buenaventura, Western Cordilleras, Dec. 21, 1905, *763* (US); Cauca Valley, "El Ramal" to Rio Sucio west of Popayan, July 3, 1922, *Pennell & Killip 8089* (US); CUNDINAMARCA: Pecho, 1600–2400 m., Jan. 1906, *Lehmann 7561* (F, US); MAGDALENA: Santa Marta, June 1898–1901, *Smith 822*, also Sept. 1898–1901, *406* (F, M, US), and *824* (F, M).

VENEZUELA: between la Cortada del Guayabo and San Diego los Altos, alt. 25 km., July 2, 1928, *Pittier 13019* (US); LOS ANDES: Merida, Tabay, alt. 2000–2400 m., Oct. 14, 1930, *Gehriger 566* (US); MIRANDA: Alto del Guayabo, alt. 17 km., Caracas to Cua, April 17, 1924, *Pittier 11513* (US).

BRAZIL: Bahia, *Salzmann* (M).

PERU: Yanano, alt. 6000 ft., May 13–16, 1923, *Macbride 3787* (US); CUZCO: San Miguel, alt. 1800 m., May 26, 1915, *Cook & Gilbert 912* (US); Valle de Santa Ana, alt. 1000 m., May 1932, *Herrera 3483* (US).

5. **Toxicodendron Vernix** (L.) Kuntze, Rev. Gen. Pl., pt. 1, p. 153. 1891, as emended by Michaux.

Toxicodendron Pinnatis Mill., Gard. Dict., ed. 8. 1768; Willd., Sp. Pl. **1**: 1479. 1798 (as *Toxicodendron Pinnatum*).

T. Vernix Shafer in Britt., N. Am. Trees, p. 610. 1908.

Rhus Vernix L., Sp. Pl. **1**: 265. 1753, in part; Michx., Fl. Bor.-Am. **1**: 183. 1803.

R. Vernicifera Salisb., Prodr., p. 169. 1796, non DC., Prodr. **2**: 68. 1825.

R. venenata DC., *ibid.*

Rhus-Toxicodendron Vernix Marsh., Arbust. Am., p. 130. 1785.

Large shrubs; leaflets 5–11, narrowly oblong-ovate to subovate, abruptly acuminate at apex, cuneate at base narrowing into a short petiolule, subrevolute and entire-margined, glabrous above and below or somewhat pubescent below especially on the veins, dark green above, lighter below, 6–7 cm. long, 2.4–4.5 cm. broad, terminal petiolule about 2.7 cm. long, lateral petiolules about 0.9 cm. long, rachis segments about 4 cm. long; inflorescences lateral panicles, bracts lanceolate, about 0.7 mm. long, 0.2 mm. broad, almost glabrous, deciduous; sepals bluntly deltoid-lanceolate, 1.3 mm. long, 0.7 mm. broad, glabrous; petals oblanceolate, 2 mm. long, 0.5 mm. broad, glabrous; anthers oblong, 1 mm. long, 0.6 mm. broad; filaments about 1.8 mm. long; stigmas 3, styles almost entirely connate; fruit whitish, glabrous; seed 3.5 mm. long, 5 mm. broad, 2.9 mm. thick, longitudinally deeply striate.

A virulently poisonous shrub of rather uniform morphology, found characteristically in the swamps of eastern North America.

Distribution: on the coastal plains from New Hampshire to Florida and Texas, and in the Great Lakes region (fig. 30).

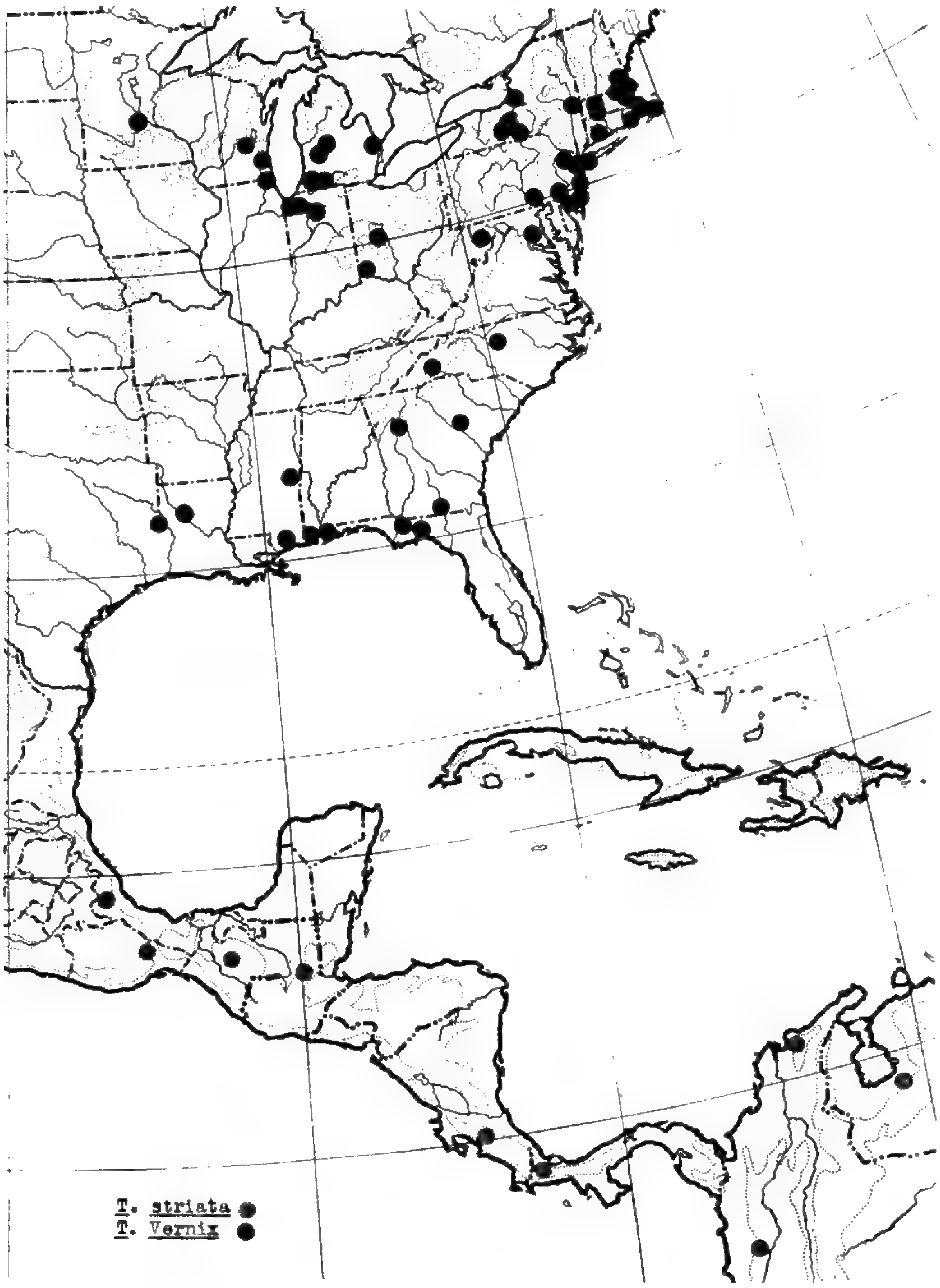

Fig. 30. The geographic distribution of *Toxicodendron striata* (Ruiz & Pav.) Kuntze and *T. Vernix* (L.) Kuntze.

UNITED STATES:

NEW HAMPSHIRE: Fremont, Sept. 14, 1927, *Batchelder* (M).

MASSACHUSETTS: Hyannisport, July 5, 1896, *Churchill* (M); Nonquitt, 1888, *Sturtevant* (M); Southwick, Sept. 12, 1914, *Seymour 280* (M); Amherst, July 11, 1874, *Bishop* (F); Amherst, June 9, 1880, *Clark* (F); Cambridge, *ex Engelmann Herb. 15572*, and environs of Cambridge, Oct. 1856, *15582* (M); near Cambridge, Oct. 1856, *Engelmann* (M); Concord, Oct. 24, 1897, *Greenman 2395* (M); Framingham, Aug. 1893, *Smith* (M); Milton, June 20, 1870, *Churchill*, and West Quincy, June 29, 1898, and Dorchester, June 24, 1882 (M).

RHODE ISLAND: Warwick, Aug. 16, 1873, *Congdon* (F).

CONNECTICUT: New Haven, 1836, *ex Buckley Herb.* (M).

NEW YORK: Mutton Hill, *Millspaugh* (F); near New York City, *Holton* (F); Oswego, July 18, ?, *Webbe* (ND); Troy, 1828–1834, *Hall* (F); Ovid, June 30, 1858, *Brewer & Chickering* (F), May 1857, *Chickering* (M); Indian Spring, Ithaca, July 22–26, 1878, *Trelease* (M); Michigan Hollow Swamp, Danby, July 23, 1919, *Wiegand 12397* (M); Penn Yan, *T.* (M).

NEW JERSEY: *Dean* (M); Atsion, June 16, 1866, *Redfield* (M); Camden, Aug. 1878, *Martindale* (M); Secaucus, Sept. 2, 1876, *Schrenk*, and Keyport, June 24, 1876 (M); Franklin, July 1879, *Rusby* (M).

PENNSYLVANIA: July–Aug., 1883, *Galen 361* (M); Sept. 17, 1868, *Rothrock* (F); Dillerville Swamp, Sept. 27, 1892, *Heller 525* (F, M); Smithville Swamp, June 17, 1889, *Small* (F), also June 29, 1889 (M), Aug. 30, 1889, and Sept. 18, 1889 (F); Germantown, 1876, *Letterman* (M); York Co., Sept. 19, 1899, *ex Glatfelter Herb.* (M).

DELAWARE: Rehoboth Beach, Sept. 5, 1908, *Churchill* (M).

DISTRICT OF COLUMBIA: in the vicinity of Washington, May 30, 1876, and Sept. 20, 1874, *Ward* (M); near Washington, June 188?, *McCarthy* (F).

NORTH CAROLINA: Biltmore, June 16 and Oct. 2, 1897, *ex Biltmore Herb. 1837b* (F, M); Flat Rock, Aug. 1842, *Buckley* (M); Chapel Hill, *Ashe* (M).

SOUTH CAROLINA: near Graniteville, May 21, 1899, *Eggert*, also May 23, and May 24 (M).

GEORGIA: west base of Stone Mountain, July 4, 1893, *Small*, and along Withlacoochee River, near Valdosta, June 6–12, 1895 (F).

FLORIDA: Adamsville, Oct. 15, 1894, *Curtis* (F); near Quincy, April 10, 1929, *Palmer 35246* (M); inter Tallahassee et fluv. Ocklocknee, July 1843, *Rugel* (M).

ALABAMA: Hugger's Reservation, Baldwin Co., July 24, 1934, *Lemeric* (ND); Gateswood, May 2, 1903, *Tracy 8742* (F, M); Auburn, May 29, 1897, *Earle & Baker* (M); Spring Hill, Aug. 6, 1897, *Bush 231* (M).

MISSISSIPPI: southern Mississippi, May 1867, *Hilgard* (M); Biloxi, July 6, 1897, *Tracy 3426* (M); near Kewanee, May 14, 1925, *Palmer 27185* (M).

LOUISIANA: Chopin, April 21, 1915, *Palmer 7239*, and May 6, 1915, *7542* (M).

OHIO: Urbana, Sept. 15, 1935, *Demaree 11696* (M); near Cincinnati, 1836, *Short* (M).

WEST VIRGINIA: near Elk Garden, Aug. 20, 1930, *Berkley 1639* (M).

MICHIGAN: Sugarloaf Lake, June 16, 1903, *Burgess 170*, and tamarack swamp, Oct. 3, 1903, *467* (F); Ross, July 10, 1889, *Sones* (M); near Peirson, June 18, 1933, *Palmer 40445* (M); Port Huron, July 1891, *ex Glatfelter Herb.* (M); near

Port Huron, July 4 and Aug. 4, 1895, *Dodge* (F); Flowerfield, June 8, 1903, *Burgess 111* (F); Lawton, Sept. 28, 1909, *Nieuwland 9018* (ND).

INDIANA: east of East Chicago, June 19, 1900, *Bebb 319* (F); Miller's, June 18, 1877, and June 8, 1878, *Grassly,* also Sept. 22, 1900, *Lansing 1215,* and June 19, 1897, *Umbach,* and Oct. 1, 1898 (F); near Miller's, Sept. 22, 1901, *Millspaugh 27* (F); Hank's Marsh, Lake Maxinkuckee, Oct. 13, 1906 (ND); Tremont, the dunes of Lake Michigan, Chesterton, Aug. 22, 1925, *Churchill* (M); Dune Park, Aug. 29, 1911, *Hill 27* (F); near Porter, Sept. 16, 1903, *Lansing 1623* (F); Mineral Springs, June 24, 1916, *Nieuwland* (ND).

KENTUCKY: coll. of 1840, *Short* (M).

WISCONSIN: Jefferson Co., Sept. 1869, *Greene* (ND); Milwaukee Co., coll. of 1861, *Lapham* (M).

ILLINOIS: near Long Lake, Sept. 5, 1925, *Palmer 29304* (M).

MINNESOTA: Nov. 1891, *Douglass* (M); Lake Harriet, Minneapolis, Aug. 1894, *Anderson* (F).

TEXAS: San Augustine, April 2, 1918, *Palmer 13261,* and Sept. 20, 1918, *14471* (M).

EXCLUDED AND DOUBTFUL SPECIES

Rhus antillana Eggers, Fl. St. Croix and Virg. Isl., p. 41. 1879 = **Picrasma antillana** (Eggers) Urban, Symb. Antil. **5**: 378. 1908.

Rhus arborea DC., Prodr. **2**: 73. 1825 = *Toxicodendron Arboreum* Mill., Gard. Dict., ed. 8. 1768 = **Schmidelia Cominia** Swartz, Fl. Ind. Occ. **2**: 667. 1800.

Rhus arborescens DC., Prodr. **2**: 73. 1825 = **Schmidelia** sp.

Rhus catawbiense Just's Bot. Jahresber. **39**[1]: 969. 1911, in error = **Rh**[**ododendron**] **catawbiense** Michx. in Engler & Drude, Veg. der Erde **8**: xxxvii. 1911.

Rhus crenatifolia Schlecht., Linnaea **16**: 483. 1842, apparently belongs in section LOBADIUM, but its exact status must remain undetermined until examination of the type: *Schiede,* Tula, Sept.

Rhus Florita Jones, Contr. West. Bot., No. 18, p. 22. 1935 = **Sapindus marginatus** Willd., Enum. Pl. Hort. Berol., p. 432. 1809.

Rhus Cavanillesii DC., Prodr. **2**: 69. 1825 = **Rhus lucida** L., Sp. Pl., p. 382. 1753.

Rhus metopioidea Turcz., Bull. Soc. Imp. de Moscou **31**[1]: 468. 1858. The author has been unable to obtain the type, *Linden 1799*, or authentic material of this species, so that it yet remains doubtful.

Rhus peregrina (Buc'hoz) Stapf, Ind. Lond. **1**: 113. 1929 = **Ailanthus altissima** (Miller) Swingle, Jour. Wash. Acad. Sci. **6**: 495. 1916.

Rhus perniciosa HBK., Nov. Gen. & Spec. **7**: 10. 1824 = **Pseudosmodingium perniciosum** (HBK.) Engler, Bot. Jahrb. **1**: 419. 1881.

Rhus polyantha Benth., Pl. Hartw., p. 60. 1840 = **Picramnia polyantha** Planch., Hook. Lond. Jour. Bot. **5**: 577. 1846.

Rhus Pterocarpus Sessé & Moc., Pl. Nov. Hisp., p. 47. 1887 = **Pseudosmodingium rhoifolium** (DC.) Barkl., Ann. Mo. Bot. Gard. **24**: 500. 1937.

Rhus Succedaneum Buc'hoz, Herb. Col. Am., *pl. 57*. 1783, non. L., 1767 = **Ailanthus altissima** (Miller) Swingle, Jour. Wash. Acad. Sci. **6**: 495. 1916.

Rhus Veatchiana Kellogg, Proc. Calif. Acad. Sci. **2**: 24. 1863 = **Pachycormus discolor** (Benth.) Coville, Contr. U. S. Nat. Herb. **16**: 344. 1916.

Due to the inadequacy of the original description or failure to cite specimens, the disposition of the following names must remain doubtful, at least for the present:

Rhus fruticosum Sessé & Moc., Fl. Mex., p. 84. 1887.

R. heterophyllum DC., Cat. Pl. Hort. Bot. Monsp., p. 136. 1813.

R. lineata Spreng. in L. Syst. Veg., ed. 16. **1**: 936. 1825.

R. lineatifolia Ortega, Hort. Matr., Dec. 7, p. 89. 1800.

R. macrophylla Hook. & Arn., Bot. Beechey's Voy., p. 413. 1840 = *Toxicodendron macrophyllum* (H. & A.) Kuntze, Rev. Gen. Pl., pt. 1, p. 154. 1891.

R. refescens Desv. ex Ham., Prodr. Pl. Ind. Occ., p. 32. 1825.

R. saxatilis DC., Prodr. **2**: 71. 1825.

R. schinoides Willd. ex Roem. & Schult. in L. Syst. Veg., ed. 15. **6**: 649. 1820.

R. tetlatin Kraemer, Bull. Pharm. **11**: 174. 1897.

R. variifolium DC., Prodr. **2**: 73. 1825.

Summary

On the basis of a critical morphological study, six genera, fifty-two species, and twenty-one varieties are recognized in the Rhus-complex of North America. The recognized genera are: *Actinocheita, Cotinus, Malosma, Metopium, Rhus,* and *Toxicodendron.* Nine new species and five new varieties are described, one new name proposed, and eight new varietal combinations made.

List of Exsiccatae

The distribution numbers are printed in *italics;* unnumbered collections are indicated by a dash. The numbers in parenthesis are those of the species and varieties in the genera treated in this study.

ACTINOCHEITA

Abbott, Mrs. Gordon. *11* (1).
Conzatti, C. *2019, 4247* (1).
Gonzalez, V. & C. Conzatti. *937* (1).
Haenke, Thaddaeus. *1503* (1).
Nelson, E. W. *1593, 1825* (1).
Pringle, C. G. *4752, 9164* (1).
Purpus, C. A. *1236, 4065 p.p., 5702* (1).
Rose, J. N., Walter Hough & J. H. Painter. *9967* (1).
Seler, Caec. & Ed. *1419* (1).
Smith, Rev. Lucius C. *777* (1).

COTINUS

Buckley, S. B. —, — (1).
Bush, B. F. *21, 50, 64* (1).
Canby, W. M., C. S. Sargent & J. Muir. *22* (1).
Clemens, Mr. & Mrs. J. — (1).
Demaree, Delzie. *3040, 6406* (1).
Eggert, H. — (1).
Geol. Surv. Ala. Herb. — (1).
Harper, Roland M. *3230* (1).
Kellogg, John H. *15221* (1).
Mackensen, G. *8* (1).
Mohr, Charles. —, —, —, —, *23* (1).
Nuttall, Thomas. — (1).
Palmer, E. J. *4710, 4723, 5856, 5971, 9865, 10556, 19219, 19253, 24612, 26187, 27085, 32914, 33313, 34732, 34793, 39482* (1).
Reverchon, J. *1643* (1).
Sayres, F. W. — (1).
Shimek, B. — (1).
Steyermark, Julian A. *13595* (1).
Trelease, W. *257, 258* (1).
Wheeler, H. E. *358* (1).
Wideman, Mr. & Mrs. — (1).

MALOSMA

Abrams, LeRoy. *2639, 4154* (1).
Anderson, R. D. — (1).
Anthony, A. W. —, *28, 122* (1).
Barber, J. H. — (1).
Blake, S. F. *439* (1)
Blankinship, J. W. — (1).
Brandegee, Katherine. — (1).
Brandegee, T. S. —, —, —, —, —, *112* (1).
Brown, — (1).
Carter, Annetta M. *955* (1).
Clokey, Ira W. & Bonnie Templeton. *4588* (1).
Davis, A. R. — (1).
Drent, Harry. — (1).
Drushel, J. A. — (1).
Eastwood, Alice. *130, 204, 12416* (1).
Eby, A. F. — (1).
Elmer, A. D. E. *4015* (1).
Engelmann, George. —, — (1).
Fish, Fanny E. — (1).
Franceschi, F. *9* (1).
Grant, Geo. B. *1117* (1).

Hiatt, O. T. — (1).
Knopf, Ezra C. *164, 238, 502* (1).
Mason, H. L. *1981* (1).
Millspaugh, C. F. *4460* (1).
Nuttall, L. W. *309, 1157* (1).
Orcutt, C. R. — (1).
Palmer, Edw. 48 (1).
Parish, S. B. *4462* (1).
Parish, S. B. & W. F. Parish. —, *1928* (1).
Parry, C. C., & J. G. Lemmon. *43* (1).
Pond, Lt. Chas. F. —, — (1).
Robertson, Geo. *46* (1).
Rusby, H. H. *401* (1).
Smith, Huron H. *4458, 4988, 5164, 5227, 5319* (1).
Snyder, Mary S. — (1).
Torrey, John. *75* (1).
Trask, Blanche. — (1).
Wheeler, Louis C. *2277* (1).
Wiggins, I. L. & D. Demaree. *4760* (1).
Wiggins, I. L. & D. K. Gillespie. —, *3874* (1).

METOPIUM

Abbott, W. L. *1251, 1271* (2).
Bartlett, H. H. *12695* (3).
Brace, L. J. K. *1976, 4500, 4962* (2).
Britton, N. L. *241* (2).
Britton, N. L. & C. F. Millspaugh. *2514* (2).
Britton, N. L. & J. A. Shafer. *3080* (3).
Campbell, E. *5753, 6195* (3).
Carter, J. J. & J. K. Small. *2134* (2).
Chapman, A. W. —, *38* (2).
Curran, H. M. & M. Haman. *148* (3).
Curtiss, A. H. *33, 448, 5477, 5638* (2).
Duckett, Francis. —, 230 (2).
Eggers, — (2).
Ekman, E. L. *3513* (1); *3644* (2); *5869, 6297, 7062, 9867* (3).
Fuertes, Fr. *32* (3).
Garber, A. P. — (2).
Gaumer, G. F. *601, 1867* (3).
Gaumer, G. J. *23223, 23974* (3).
Gaumer & Sons. *23674* (3).
Gentle, Percy H. *102, 1212, 1352* (3).
Harris, Wm. —, *6416, 9224, 11766* (3).
Hitchcock, A. S. —, —, —, —, —, —, —, *329, 330* (2).
Jack, J. G. *7925* (2).
Lansing, O. E., Jr. *2020* (2).
Leon, F. *11802* (2).
Leonard, Emery C. *11933* (3).
Leonard, Emery C. & Genevieve M. Leonard. —, *11193, 12338, 13085, 13374, 13966, 14074, 14865, 15338, 15650* (2).
Lundell, C. L. *2056, 9110* (2); *592, 2080, 2459, 3063, 3534* (3).
Maxon, Wm. R. & Ellsworth Killip. *1577* (3).
Millspaugh, C. F. *25* (3).
Millspaugh, C. F. & C. M. Millspaugh. *9110* (2).
Moldenke, Harold N. *778a* (2).
Myers, Wm. C. *176* (3).
Nash, Geo. V. & Norman Taylor. *969, 1136, 1327, 1424* (2).
Northrop, John I. & Alice R. Northrop. *552* (2).
Pacheco, M. *1485* (3).
Palmer, E. J. *27505* (2).
Palmer, Edw. *97* (2).
Pollard, C. L., G. N. Collins & E. L. Norris. *95* (2).
Roig, J. T. *118* (1).
Rothrock, J. T. *513* (2).
Schipp, W. A. *540* (3).
Shafer, J. A. *287, 671* (2); *1317* (3), *2431, 2807* (2); *3158, 4192, 4323, 7737, 8306* (1); *11120* (3).
Simpson, J. H. *227* (2).
Sintenis, P. *528, 4800* (2).
Small, J. K. & J. J. Carter. —, *8672* (2).
Valeur, E. J. *698, 860* (2).
Webber, H. J. *269, 339* (2).
Westgate, J. M. — (2).
Wight, A. E. *220* (2).

Wilson, Percy. *7502, 7747, 7774, 8034, 8227* (2).
Wright, Charles. *2287, 2288* (1); *2289* in part (2); *2289 p.p.* (3).

RHUS
Abrams, LeRoy. *1310* (41g); *2559* (22); *3113* (41g); *3307* (20); *3719* (22).
Abrams, LeRoy & Ira L. Wiggins. *80* (20).
Adams, J. W. *851* (6).
Alameda, *236* (16).
Allen, Paul. — (37).
Anchorage, S. E. & G. D. Hanna. — (17).
Anderson, Edgar. —(1).
Anderson, F. W. — (41).
Anderson, H. & Carl C. Epling. — (22).
Anderson, J. P. — (40).
Andrieux, M. *271* (31).
Anthony, A. W. —, —, *98, 305*, (17); —, *318A* (20).
Archibald, Jennie M. *A165* (41).
Arsène, Bro. G. — (18); — (41); *7* (10); *9* (19); *1850, 1907, 2066* (18).
Arsène & Amable, Bros. *1566, 2255* (10); *3597* (18).
Ashe, William Willard. —, *239* (3), — (6); *825* (7); — (40).
Austin, Mrs. R. M. —, —, *767* (41d).
Bailey, Vernon. —, *304* (22).
Baker, Carl F. — (1a); — (40); —, —, —, *406, 456, 919* (41); *4147* (22); *4156* (20); *4734* (41g).
Baker, C. F., F. S. Earle & S. M. Tracy. *525* (41).
Baker, H. P. — (1); —, *122* (6); — (41).
Baker, M. & W. H. Dall. — (20); *17* (20).
Baker, M. S. & Frank Nutting. — (41g).
Barber, J. H. *191* (41g); *289* (20); *311* (22).
Barkley, Elizabeth Ducker. *198* (6); *229* (1).
Barkley, Fred A. —, — (41); —, *414* (1); *415* (6); *1074* (37); *1075* (2); *1084* (6); *1092* (1); *1150* (40).
Barkley, Robert W. I & II. *2* (40).
Barkley, William Webster. — (6); — (41a).
Barlow, Bronson. — (41); — (41f); — (41g).
Barrows, D. P. — (22).
Bartlett, Harley Harris. *1153* (1a); *10269* (2); *10281* (6); *10308* (31); *10491* (2); *10953* (31).
Batchelder, Charles Foster. — (1); — (6).
Bayliff, William. — (1).
Beard, A. — (41); — (41f).
Beattie, Frederick S. —, — (6).
Bebb, Robert. *326* (4).
Bennitt, Dorman. *129* (41).
Benson, Lyman. *1312* (6).
Berg, N. K. —, —, — (20).
Bergman, H. F. — (6); — (41).
Berkley, Earl E. *846, 986* (6); *1655* (40).
Berlandier, J. L. *2362* (29).
Bessey, Ernst A. *117* (1a).
Bethel, Ellsworth. —, *8, 9* (41); — (41g).
Bettis, Mrs. James R. — (40).
ex Biltmore Herb. — (3); *869a* (40); *870, 870a* (4); *872, 872b* (3); *1378, 1378b* (6); *3284a* (1).
Bissell, C. H. *40, 467* (4).
Blair, R. E. *217* (37); *231* (29).
Blaisdell, F. E. — (41d).
Blake, J. — (4).
Blake, S. F. *824* (22).
Blakley, O. W. *1516* (1).
Blanchard, Ferdinand. — (1); —, — (4); —, —, — *p.p.* (6).
Blankinship, J. W. — (20); — (40); —, — (41g); *667* (41).
Blatchley, W. S. — (41b).
Blazic, Antone. — (40).

Blumer, J. C. — (30); — (41f); *94* (37); *96, 98, 98b, 1267, 1293* (6); *1319* (41d); *1320* (41f); *1321* (41c); *1322* (37); *1323* (39); *1324* (41c).
Bolander, H. N. — (41g).
Booth, *94* (41g).
Bourgeau, M. *1476, 1892* (16).
Brandegee, Katherine. —, — (20); — (22).
Brandegee, T. S. —, —, — (17); —, —, —, —, — (20); —, —, —, —, —, —, —, — (22); —, — (33); — (41e); *111* (33); *818* (20); *910* (6).
Braunton, Ernest. *203* (41d); *360* (22); *389, 390* (20); *487* (41d); *1026* (22).
Brendel, F. — (40).
Brewer & Chickering, — (40).
Bright, John F. & Catherine Wyman. *8005* (20).
Britton, N. L., F. S. Earle, & C. S. Gager. *6762* (1a).
Broadhead, G. C. — (1).
ex Broadhead Herb. — (6).
Bross, Mason. — (4); — (6).
Brown, H. E. *595* (41g).
Bruner, W. E. — (6); —, — (41).
Buckley, S. B. — (4).
Buell, M. F. *489* (6).
Buffum, B. C. —, *170* (41).
Bull, Rotha. *187* (6).
Burgess, A. B. *24* (4).
Burk, Myrel. *638* (6).
Burnell, L. — (22).
Bush, B. F. — (1); — (6); *62* (40); *92* (41a); *139* (6); *142* (1); *147* (6); *148* (41a); *170* (6); *175* (1); *180* (40) *259* (41e); *270* (1); *612, 688* (41); *689* (40); *885* (1); *1116* (2); *1117, 3164* (1); *3225, 3927* (41a); *3928* (40); *4139* (41a); *4162* (40); *5512, 6676* (41a); *9521, 9627, 9728* (40); *9729, 10033, 10050, 10052, 10054, 10064, 10066* (41a); *10113* (6); *10127* (40); *10146* (1); *10225, 10230* (40); *10244, 10244A, 10249, 10258, 10259* (41a); *11442, 12117, 12805* (40); *13350* (41a); *13492* (40); *14001, 14038* (41a); *14145, 14146, 14179, 14180, 14227* (40); *14229, 14269, 14649, 14656, 14657* (41a); *14730, 14740* (40); *15264, 15301, 15321, 15598, 15599, 15608, 15609, 15673* (41a).
Butler, B. T. *4123* (41).
Butler, George D. —, *40, 78* (41); — (41e); *1615* (41g).
Calderón, Salvador. *2500* (16).
Calkins, William Wirt. *295* (40).
Camp, S. H. & D. R. Camp. — (6).
Carlos, Hengo & C. Conzatti. *1886* (31).
Carlson, John I. — (41); — (41f).
Carpenter, Dana S. — (40).
Carr, W. P. *95* (6).
Castetter, E. F. *1421, 2122* (41).
Chandonnet, Z. L. — (6).
Chaney, Ralph W. *152* (4).
Chamberlain, E. B. — (4).
ex Chapman Herb. — (1a); — (6).
Chase, Agnes. *1067* (41b).
Chase, Virginius H. *57, 80* (6).
Child, Marion. *552* (41).
Churchill, J. R. —, —, —, —, — (1); —, —, —, —, — (4); — (5); —, —, —, — (6); —, —, —, —, — (40); — (41); — (41b).
ex Churchill Herb. — (6).
Clark, Jasper A. — (41a).
Clark, H. Walton. —, — (1); —, —, — (4); — (5); — (6).
Clark, Ora M. —, *2705* (40); *2720* (1).
Clemens, Mr. & Mrs. J. — (29); —, *831* (41); *834* (29); *835* (37).
Clemens, Mrs. Joseph. —, — (41).
Clements, F. E. & E. S. Clements. *32* (41); *188* (20).
Cleveland, D. — (20).
Clifton, R. L. *73* (1); *99* (6).
Clinton, G. W. — (40).
Clokey, Ira W. *4994* (20).

Clokey, Ira W. & Bonnie Templeton. 4431 (22); 4605 (20).
Clothier, G. L. 74b (40).
Clute, Willard N. 105 (41).
Collins, G. N. & J. H. Kempton. 192 (20).
Collom, Rose E. 297 (22); 351 (41f).
Commons, A. — (6a).
Congdon, J. W. — (41g).
Conzatti, C. 826 (16); 1579, 1640, 1655 (18); 4205 (10); 4293, 4988 (18).
Conzatti, C. & V. Gonzalez. — (11); 1046 (12).
Cook, C. F. 9 (16); 43 (26); 55 (15); 76 (32); 83 (15).
Cooper, Juan J. 348 [5729] (15); 376 (20).
Cooper, W. S. 410 (41).
Cota, F. M. — (22).
Coues, E. & Edward Palmer. 287 (41f).
Coulter, J. M. 780 (31).
ex Herb. Coulter. — (41).
Coville, Frederick V. & Frederick Funston. 110 (22); 618 (41f).
Cowen, J. H. — (6); 95 (6).
Cowles, Henry C. 216 (6).
Craig, Moses. — (1); — (6).
Crandall, E. S. 1251 (41).
Cratty, J. R. — (4).
Crawford & Hiatt, — (22).
Creighton & Gilchrist, — (41).
Curtiss, A. H. 5129 (1a).
Cutler, Hugh. 607 (40).
Daniels, Francis. 221 (6).
Davis, Charles A. — (6b).
Davis, Rev. John. — (1); — (1a); — (6); 348, 718 (40); 722 (6); 993, 1238, 2332, 2418, 2646, 2991 (40); 3218 (1); 3497, 3497A, 3509, 3708 (40); 3898, 4407 (6); 4519, 5281 (1); 7615 (40); 7776, 7878, 8409 (1).
Davy, J. Burtt. 2769 (20).
Deam, Charles C. — (1); — (4); —, —, — (40); 1716 (1); 5421, 7030, 7034, 7872, 8990, 8991, 9358 (6); 9578 (41b); 14956 (6); 15082, 16239 (40); 17576 (4); 17945 (6); 17998 (41b); 27530 (40); 31347 (6); 31355 (40); 31736, 33348 (6); 33439 (40), 34379 (6); 37053 (1); 39245 (5); 39669 (1); 39749 (41b); 40565 (6); 44460, 45717 (40); 46970 (4); 47434, 53329 (1).
Deam, Mrs. Charles C. 28718 (4).
Demaree, Delzie. 4129 (1); 4988, 6410, 6629 (41a); 6950 (1); 6958 (6); 7764 (41); 8335 (6); 9511 (40); 10328 (1a); 10791, 10905 (1); 10906 (6); 11670 (4).
Dewait, — (1).
Dodds, G. S. 2099, 2106 (41).
Dodge, Charles K. — (40); 111 (6).
Donnelly, S. S. 38 (41f).
Dorman, J. B. — (41a).
Drouet, Francis. 408 (41a); 409 (40).
Drushel, J. A. — (4a); 3164 (41); 4028 (40); 5351 (1).
Duesner, C. W. — (41b).
Duncan, Mrs. J. T. 40 (41).
Dunhan, William H. — (4); — (4a); — (41).
Dunn, G. W. — (20); — (22); 7309 (20).
Dunn, N. & A. M. Martin. — (41f).
Duran, Victor. 3498 (22).
Dutton, D. Lewis. — (1); — (6).
Earle, F. S. — (41).
Earle, F. S. & C. F. Baker. — (1a).
Eastwood, Alice. — (41d); 22 (41); 78 (22); 133 (20); 227 (41); 679 (41g); 2160 (22); 2819 (41g); 3643 (41); 3763 (41e); 4937, 4952 (41g); 5069, 5306, 5408, 5553, 5583, 5610 (41); 5695 (41e); 5892 (41g); 5941 (41); 5974, 5976, 6034 (41e); 6098, 6099, 7093, 7228, 7702, 8196, 8406, 8407 (41); 8749 (41f); 8776 (22); 8794 (41f); 8953 (41); 9185 (41g); 9436, 9473 (41f); 11178, 12898 (41g); 15541 (41); 15556 (41d); 15718 (41f); 15763 (41); 15843 (22); 15870 (41f);

15883 (22); *15884* (41e); *16614* (22); *16615, 16663* (41f); *16691* (41g); *16786* (22); *17462* (41f); *17463* (41d); *18372* (22); *18381* (41f).
Eastwood, Alice & John Thomas Howell. *408, 579, 778* (41); *1015* (41f); *1016* (41e).
Eaton, D. C. *112* (41).
Eby, A. F. —, —, — (1); —, — (6).
Eby, J. H. — (1).
Edwards, J. B. *F-257* (15); *754* (16).
Eggert, H. —, —, —, —, —, —, —, — (1); — (1a); —, —, —, —, —, —, — (6); — (29); —, —, —, — (37); —, —, —, —, —, — (40); —, —, —, —, —, —, — (41).
Eggleston, Willard W. —, — (40); *15214, 16146, 16688* (41); *19580* (20).
Ehlers, J. H. — (6b); *822* (40).
Ellis, Charlotte C. *254* (41); *256* (6).
Elmer, A. D. E. *872* (6); *3680* (41f, 41g); *3898* (20); *3904* (22).
Emig, W. H. *247* (40); *367* (41).
Engelmann, George. —, —, — (1); — (6a); —, — (20); — (30); — (40); — (41); — (41g).
ex Engelmann Herb. — (6a).
Epling, Carl C. — (22); — (41g).
Epling, Carl C. & Lincoln Ellison. — (20); — (22).
Epling, M. & Carl C. Epling. — (41g).
Eskew, C. T. *1355* (41).
Ewan, Joseph Andorfer. *4203* (22).
Fendler, A. *99a* (41); *110* (6); *112* (41).
Fernald, M. L. *242* (4).
Ferris, Roxana S. *1211* (41); *1531* (41g); *7983* (41f); *8513* (20); *8514* (20).
Ferris, Roxana S. & Rimo Bacigalupi. *8080* (41f).
Ferris, Roxana S. & Carl D. Duncan. *2294* (41d); *2343* (37); *3277* (6); *3349, 3442* (41).
Fielder, Mary. — (6); — (41); *38* (6).
Fisher, George L. —, *38* (41); *43* (41f).
Fisk, V. C. — (41).
Fitzpatrick, T. J. & M. F. L. Fitzpatrick. — (6); — (41).
Fleming, G. L. & W. W. Eggleston. *19684* (20).
Fogg, John M., Jr. — (1); — (5).
Ford, A. B. — (4).
Foreman, — (40).
Forwood, W. H. *59* (41).
Fowler, J. — (40).
Fremont's Expedition to California. *49* (41g).
Fritchey, J. Q. A. — (20).
Frost, W. D. — (6).
Fry, L. S. — (41a).
Galen, James. *362* (1).
Galeotti, H. *2515* (12); *7247F* (11).
Garber, A. P. — (1a).
Garische, E. F. — (6).
Gates, Frank C. *746* (6); *15866* (5); *18776* (41a).
Gates, Frank C. & R. R. Sleeper. *1811, 1815* (6).
Gattinger, A. — (6).
Gentry, Howard Scott. *1746* (33).
Gershoy, A. *8419* (4).
Ghiesbreght, A. *511* (26a).
Gillespie, John W. — (22); *4894* (6); *4920, 5032* (1); *5573* (22).
Glatfelter, N. M. — (1).
ex Glatfelter Herb. —, —, —, —, —, — (1); — (2); — (6); —, —, — (41).
Goldman, E. A. *791* (26a); *883, 894* (32); *917* (16); *1120* (22); *1187* (41e); *2311* (21).
Goodding, Leslie N. *614* (41f, 41g); *680* (41); *832* (41e); *968* (30); *988* (6); *1053* (41d); *1129* (6); *2153* (41g); *2236* (37).
Goodman, George Jones. *759* (41); *2252* (2).
Goodman, George Jones & C. Leo Hitchcock. *1146* (37).

Gordon, A. *92* (41).
Gorman, M. W. *632* (6).
Gowan, Robert L. *73* (1).
Grant, George B. *1118* (20); *1119* (41d); *1120, 1356* (20); *2443* (22).
Grant, M. L. *2977* (4).
Grassl, Carl B. *174* (2).
Grassly, C. W. — (6); — (41b).
Gregg, Josiah. *378, 483* (37), *600* (18).
Greene, Edward L. —, — (1); —, —, —, —, —, —, —, —, —, —, — (4); —, —, — (5); —, —, —, —, —, —, —, —, — (6); — (6b); — (20); — (22); —, —, —, — (41); — (41e); — (41g).
Greenman, Jesse More. —, — (1); — (40); *1822* (6); *2104, 2145, 3174, 3175* (1); *4536* (40).
Greenman, Jesse More & Milton T. Greenman. *6015* (41).
Griffin, Millard & Delzie Demaree. *43* (6).
Griffiths, David. *4463* (41g); *6060* (30).
Griggs, Thomas. *44* (1).
Groth, B. H. A. *1* (41).
Gurney, J. — (1).
Guttenberg, G. *442* (4).
Haas, W. H. *11* (41).
Haenke, Thaddaeus. *1245* (16); *1504* (16).
Hahn, L. — (18).
Hall, Elihu. —, *75* (41); *76* (29); 77 (1).
Hall, H. M. *875* (22); *978* (20); *2828* (22); *8288* (20).
Hall, James. — (4); — (40).
Haller, W. H. *645* (1).
Hanna, Leo A. *404* (6); *1002* (41).
Hanson, Herbert C. — (37); — (41); *A169* (6); *A170* (41f); *C274* (6); *A557* (41).
Hapeman, H. —, —, —, —, — (6).
Harper, Roland M. *135* (6); *1329* (40).
Harris, J. Arthur. *C2827, C21743, C28224, C28632, C28834* (41).
Harrison, B. F. *7541* (6).
Harrison, G. J. & T. H. Kearney. *6573* (21).
Harshberger, John W. — (1); — (6).
Hart, Cecil. — (41g).
Hartman, C. V. *31* (30); *80* (41c, 41f); *324, 379* (8).
Hasse, H. E. —, —, — (20); —, —, — (22).
Hayden, F. V. — (6); —, —, *192* (41).
Hayes, Sutton. *111* (41).
Hayward, Herman E. *113, 174* (41); *203* (6); *228, 453, 580, 751, 791, 2028 p.p., 2471 p.p.* (41).
Hedgecock, George G. *2522* (6).
Heller, A. Arthur. — (4); — (6); *524* (1); *1658* (41); *6026* (41g); *7776* (40); *111212* (41g); *11429* (41a); *11533* (41g); *11773* (41d); *13856* (41f).
Heller, A. A., & E. Gertrude. *3421* (6); *3571* (41).
Henderson, L. F. *5199* (6).
Henshaw, H. W. *191* (22).
Hermann, F. J. *2216* (4).
Herrick, C. Judson & Ruth Herrick. *53* (41).
Heyde, Enrique Th. *549* (15).
Heyde, E. T. & E. Lux. [*3032*] (26); *517* [*3277*] (16); [*4330*] (15).
Hill, E. J. *51* (40).
Hinckley, L. C. *766* (6); *821* (29).
Hinds, Richard Brisley. — (20).
Hinton, G. B. *5027* (11).
Hitchcock, Albert S. — (1); —, —, — (1a); —, —, — (6); —, — (40); *38* (1a); *338* (40); *645a* (1); *1106* (41).
Hitchcock, C. Leo. *2351* (41).
Hoffmann, Ralph. —, — (41a); — (41f).
Holm, Th. — (6); — (41).
Holzinger, John M. — (6).
Hopkins, Milton. *846* (41).
Horsford, F. H. — (40).
Houghton, H. W. *4045* (1).

House, H. D. —, *1359* (1); *16099* (40).
Howell, John Thomas. —, — (41f); *1107* (41g), *1108* (6); *1769*, *2478*, *3364* (41f); *3399*, *4266* (41g); *8137* (41).
Howery, C. E. — (20); — (41g).
Hunt, Clara. — (41g).
Hunt, Edwin. — (4).
Illick, Joseph. —, — (1); — (4); — (6).
Irelean, — (41).
Jack, J. G. — (6).
Jackson, H. H. T. *29* (22); *335* (41).
James, J. F. *1* (20).
Jeffs, Royal Edgar. —, — (1); — (6); — (41).
Jennings, Otto E. —, — (6).
Jennings, Otto E. & Grace K. Jennings. —, —, — (6).
Jenson, M. C. *14* (40); *16* (1).
Jepson, Willis L. — (41g).
Jermy, G. — (29); — (37); — (41); *122* (29); *564*, *774* (37).
ex Jermy Herb. *87* (41); *699* (2).
Johnson, A. G. — (40).
Johnson, Frank W. *1098* (4).
Johnson, Harry. *628* (16).
Johnston, E. L. *198*, *790* (41).
Johnston, E. L. & G. G. Hedgcock. *790*, *802* (41).
Johnston, Ivan M. *60*, *3011* (20).
Jones, Marcus E. — (22); — (30); — (41); *122* (39); *1608* (41); *3046* (20); *3090* (41f); *3318* (22); *4321* (30); *5064m* (41f); *5132*, *5236e* (41e); *5338g* (41); *5612* (6); *22886*, *22887*, *23130* (13); *25652* (41); *25653* (29); *25655* (37); *26543* (20), (22); *27099* (9); *78973* (41).
Jones, Wyatt W. — (22); *67* (41).
Jussel, M. S. —, —, *227* (41g).
Juzepczuk, S. *184f* (32); *1473*, *1520*, *1846* (15).
Kaieser, Margaret. *6* (41).
Kearney, Thomas H., Jr. *143* (1); *639* (6).
Kearney, T. H. & R. H. Peebles. *9248* (22).
Kellerman, W. A. — (41a); *7620* (16).
Kellogg, John H. — (1); — (6); — (6a); — (40); *311* (6); *380* (40a); *384* (40); *1030*, *1850*, *1851* (1); *1852* (40); *1853* (6); *25843* (41a).
Kellogg, R. S. — (22).
Kennedy, George G. *7* (40).
Kerber, E. *246* (18).
Kirkwood, J. E. *201* (37).
Kitchens, L. W. *48* (41).
Klensmith, E. J. — (20).
Knopf, Ezra C. —, —, *10*, *273*, *311*, *487*, *488*, *489*, *490* (20).
Knowlton, Clarence N. — (1); — (40).
Knowlton, F. H. *170* (41f).
Krause, O. — (6); — (40).
Kreut, A. F. K. *186* (4).
Kusche, J. Aug. —, — (41).
Lake, E. R. — (6).
Lake & Hull, — (6).
Lamb, C. — (4).
Langlois, A. B. —, — (1).
Lansing, O. E., Jr. *158* (40); *586*, *868* (41b); *894* (4); *1103* (41b); *1111*, *1335* (6); *1702*, *1765*, *2501*, *2711* (41b); *2960*, *2990* (40); *3430* (6); *3885* (4).
Larsen, Esther L. *179* (41); *773* (1).
Laybourne, W. A. — (6); *88* (41a).
Lee, Henry. *519* (41).
Leiberg, John B. *893*, *1554* (6); *2005* (41g); *3162* (22); *3338* (41f); *5871* (6).
Lemmon, J. G. — (41d); *82* (22).
Lemmon, Mr. & Mrs. J. G. — (16).
LeSueur, Harde. *431* (41d); *770* (37); *M205*, *M428* (41).
Letterman, George W. —, — (1); —, —, — (2); —, —, — (40); *83* (41a).
ex Letterman Herb. — (40).
Liebmann, F. M. *29*, *31*, *284* (16); *8664*, *14847* (18).

Lighthipe, L. H. — (1).
Lindheimer, F. — (1); —, —, — (29); — (41); *123* (29); *200* (37); *230* (41); *244* (2); *249* (37); *344 (243), 345 (243)* (2); *347* (41), *348A, 348B, 514* (29); *728* (2); *729, 730, 731* (29); *733* (41); *734, 735* (37).
Little, Elbert L., Jr. — (6); —, — (40); *242* (1); *248, 473, 513* (6); *535* (41); *550, 734* (41a); *736* (6); *3164* (40); *3903* (41), *4057* (22); *4201* (41d); *4286* (6); *4287* (41); *4288* (41d).
Little, Elbert L., Jr. & Charles E. Olmsted. *7* (1); *31* (6); *123* (40); *132* (6); *276* (1).
Lloyd, C. E. *378, 379* (8).
Lloyd, R. N. — (4).
Lobb, W. *405* (20).
Lodewyks, Maude C. *233* (40).
Lucy, T. F. —, *449, 1678* (40); *7784* (6); [*7785*] (4).
Lundell, C. L. *5197, 5309* (37).
Lunell, J. —, —, —, *701* (6).
Lyon, *233* (20).
Macbride, J. Francis. *868* (41).
McCarthy, Geraldus. — (6).
MacDaniels, L. H. *882* (34); *905* (32).
McDonald, F. E. — (40).
McDonald, Julia. —, — (41g).
MacDougal, D. T. *295* (41); *309* (6); *669* (22).
MacFadden, Fay A. *10E* (20).
McGregor, Joe Lee. *43* (6).
McIntosh, A. C. *1042* (41).
McKelvey, Susan Delano. *346* (22).
Mackensen, B. *33* (2).
Mackenzie, Kenneth K. — (1); — (41a).
Macoun, John M. *78, 4075, 10075* (41); *73669* (6); *81288* (2).
Maguire, Bassett & R. J. Becraft. *2686* (41).
Marcelline, M. *1854* (41).
Marsh, Ernest G., Jr. *367, 566* (29); *636* (2); *839* (37).
Martin, Louise. *85* (1).
Mason, H. L. *1970, 1985* (17); *2034, 2039* (20a).
Mathias, Mildred. *358* (41); *533* (40).
Mearns, Edgar A. — (22); — (41); *2987, 3148, 3200* (22).
Meiere, Mrs. Ernest. — (41e).
Merriam, C. H. — (41e).
Merrill, Elmer D. & E. N. Wilcox. *704* (41).
Merrill, George M. *2* (6); *3* (1); *96* (40).
Merrill, George M. & Wm. A. Hagen. *459* (6).
Metcalfe, O. B. — (6); *25* (41d); *227* (6); *420* (41); *924* (37); *998* (6); *1119* (41).
Mexia, Ynes. *1433* (13); *1640, 1729* (38); *2529, 2535* (41, 41f).
Meyer, C. V. *80* (22).
Mill, C. D. — (1a).
Miller, J. H., L. M. Perry, E. S. Boyd & M. C. Myers. *543* (40); *544* (1).
Milligan, J. M. *32* (6).
Millspaugh, C. F. — (4); — (40); *135* (41f); *141, 4322* (4); *4533, 4800, 4915* (20).
Moffatt, W. S. — (41b).
Mohr, Charles. — (40).
Moldenke, Harold N. *367* (1a); *1318* (1); *1321, 6058* (6).
Montes, M. Narvaez & Antonio E. Salazar. *832* (14).
Moore & Demaree, *4782* (41b).
ex Moore Herb. — (41b).
Moore, John Adam & Julian A. Steyermark. *3085, 3290* (37); *3326* (41).
Moore, Rufus H. — (6).
Morales, *769* (16).
Morrison, John L. *1027* (41); *1094* (6).
Mueller, C. H. *2109* (29); *8064* (37); *8065* (29); *8066* (41).
Mueller, C. H. & M. T. Mueller. *96* (41); *328* (19).
Mueller, Fred. *1082, 1281* (16).
Muenscher, W. C. *14821* (5).

Muenscher, W. C. & Bassett Maguire. *2381* (40).
Mulford, A. Isabel. *35, 187, 404* (41); *706* (6); *1045, 1129* (37); *1204* (6).
de Munchhausen, H. A. *331* (1).
Munz, Philip A. & I. M. Johnston. *5327* (22).
Munz, Philip A., I. M. Johnston & R. D. Harwood. *4048* (41f).
Munz, Phillip A. & David Keck. *5004* (22).
Murdoch, John, Jr. *1056* (4); *4090* (41); *4256* (6).
Myers, I. J. *72* (41); *111* (1).
Nash, George V. *1659, 2497* (1a).
Nealley, T. C. — (29); — (41).
Nelson, Aven. —, —, *159, 868, 1477* (41); *2303* (6); *2881, 3063 (322), 3065, 6983* (41); *8456* (6); *9300* (41); *9995* (41f); *10033* (20); *10174* (41); *10903* (40); *11505, 11571* (41).
Nelson, Aven & J. Francis Macbride. *1350* (41).
Nelson, Aven & Elias Nelson. *5964* (41).
Nelson, Aven & Ruth A. Nelson. *545* (22).
Nelson, E. W. *539, 541* (34); *1569, 1828* (28); *2148* (15); *2167* (36); *3451a* (15); *3464* (16); *4166* (13); *4698* (31); *4947* (41f); *6002* (6); *6113, 6422* (37); *7047* (27); *7442* (33).
Nicolas, —, *5053* (18).
Nieuwland, J. A. —, — (1); —, — (4); — (4a); —, —, —, — (6); — (6a); —, — (40); —, — (41b); *5, 5a* (6); *41, 93* (4); *371* (1); *375* (4); *610, 627, 648* (6); *657* (1); *676* (6); *854, 854a* (41b); *872* (1); *1637* (6); *1685* (1); *1819* (5); *2337* (4); *2425* (6); *2426* (5); *2457* (1); *2653* (41b); *9077* (6); *9171a, 9171b, 9466* (4); *9467* (5); *9468* (6); *9497* (4); *10348, 10380* (4a); *10380* (6a); *10416* (6); *10627* (1); *11053* (41b); *11270, 11507* (6); *11624* (7); *11635* (4); *11638* (5), (7); *11651* (1); *11741* (6); *14078* (1).
Nieuwland, J. A. & Th. Just. — (40).
Noell, Julia. *105* (6).
Norton, J. B. — (1); *72* (6); *74, 74a* (40).
Nuttall, L. W. *13* (20); *281* (22).
Nuttall, Thomas. —, — (20).
O'Byrne, S. L. & J. M. Magner. *3414, 3415, 3416, 3417* (41).
Ohlendorf, W. C. — (1).
Ohlweiler, W. W. — (40).
Orcutt, C. R. —, — (20); —, —, —, —, — (22); *26* [*8951*] (41e); *98, 137* (22); *178, 1421* (20); *1423, 1425* (22).
Ortega, Jesús G. *4984, 5385* (14).
Osborn, Ben O. *469 R* (41).
Osterhout, George E. —, *4876* (41).
Otis, I. C. *990* (6).
Overholts, L. O. — (6); — (40).
Oyster, J. H. — (40).
Pace, L. *311* (6).
Palmer, Edward. — (1); — (22); — (37); — (39); *15* (41); *19, 31* (37); *36* (22); *44* (41); *46* (41f); *47* [*5327*] (20); *54* (37); *60* (41f); *61* (25), (41f); *81* (41e); *91, 92, 141* (37); *159* (14); *188 (14255), 189* (29); *190* (31); *193* (37); *206* (31); *214* (36); *313* (41d); *321* (14); *338* (41d); *396* (41); *585* (6); *586* (39a), (41); *590* (41); *730* (17); *735* (20); *785* (41); *1160* [*95*] (1a); *1907* (13); *9982* [*60, 61*] (41).
Palmer, Ephraim L. & K. M. Wiegand. *765* (6).
Palmer, Ernest J. *15* (1); *16, 75* (6); *706* (41a); *873* (40); *959* (1); *1109* (41a); *1128* (6); *1597* (40); *1805* (41a); *1866* (40), (41a); *1900* (40); *4167* (6); *4384, 4752, 4754* (41a); *5211, 5461* (40); *5463* (41a); *5776, 5821* (6); *5874* (41a); *6011, 6025* (6); *6221*

(1); *6222* (6); *6489* (1); *6526* (2); *7126* (41); *7362* (40); *7823, 8410* (6); *8411* (40), (41a); *8518, 8724* (1); *9182* (37); *9191, 9328* (41); *9847* (29); *9866* (41); *10122* (37); *10769* (2); *10847* (29); *11175, 11308* (37); *11346, 11403* (41); *13802* (2); *13808, 13809* (41); *13896* (41a); *13972* (37); *14243* (6); *14244* (2); *14297* (6); *14543* (2); *15013* (40); *15135* (1); *15184* (40); *15491* (6); *16332* (1); *16619* (40); *17008* (6); *17740, 18029* (40); *18071, 18961* (6); *22652* (40); *23044* (6); *23347* (41a); *23355* (6); *23880, 24359* (40); *24577* (41a); *24582* (40); *25340* (6); *25469, 25489* (40); *26207* (41a); *26759* (41); *26811* (2); *27040* (41a); *27598* (4); *27599* (6); *27863* (4); *29516* (2); *29767, 30036, 30468* (41a); *30882* (2); *30996* (37); *30997* (29); *31485* (1); *31928* (41); *32109* (29); *32127* (41a); *32140* (2); *32865* (40); *33093* (41a); *33552* (37); *34756, 35491* (40); *35608, 35643* (41a); *35824* (40); *36630* (6); *36673* (1); *36892* (6); *37014* (41); *37018* (6); *37263* (41); *37617, 37994* (6); *38032* (41); *39106* (40); *39434* (41); *39496* (41a); *41835* (41); *41836* (6); *42024* (2); *42042* (1).

Palmer, Ernest J. & Julian A. Steyermark. *41099* (40).

Palmer, Wm. & J. H. Riley. *555* (1a).

Pammel, L. H. —, — (1); — (4); —, — (6); — (40); —, *585* (4).

Pammel, L. H. & R. E. Blackwood. *3565* (41); *3661* (6).

Pammel, L. H. & Ferd Reppert. *1217* (40).

Parish, S. B. *2018, 2202, 3490, 3631, 6802* (22); *6890* (20); *11336* (22); *11698* (41g).

Parks, H. E. & S. T. Parks. *328* (20).

Parry, C. C., & J. G. Lemmon. *42* (22).

Parry, C. C. & Edward Palmer. *125* (25); *126* (37).

Payson, Edwin B. —, *235, 1012, 1043, 1121, 1121A, 1155* (41).

Payson, Edwin B. & Lois B. Payson. *3931* (41); *3932* (41e).

Payson, Lois B. *54* (29).

Personett, K. *27* (6).

Phelps, Kate E. — (41).

Pierron, P. E. — (4).

Pittier, H. *1825* (15).

Plank, E. N. — (1); — (6); — (40).

Pollard, Charles Lewis. — (6); *1142* (1a); *1261* (6).

Pollock, W. M. — (1); —, — (6).

Pond, Charles F. —, —, — (17); — (20); —, — (37).

Porter, Thomas C. — (40).

Pratt, Alice D. — (6); — (41).

Price, Sadie F. — (1); — (6); — (40).

Pringle, C. G. — (6); — (30); — (41f); *171* (37); *357* (29); *894* (37); *1774* (9); *2677* (31); *2756* (9); *4815* (18); *5655* (28); *5833* (12); *7725, 9711* (18); *9712* (9); *11397* (29); *15842* (30).

Purpus, C. A. — (18); — p.p., *62* (41); *1289, 1289A* (31); *1290* (23); *2279* (16); *2725* (41); *2730, 2730a, 2730B* (31); *3166* (35); *4500* (37); *4922* (25); *5819* (18); *5838* (23).

Quaintance, A. L. — (1a).

Ramaley, Francis. *A62* (41).

Redeker, H. *38* (41).

Redfield, John H. — (1); *427* (41); *1159* (1); *1164* (6).

Reed, Fred M. *2238* (20).

Rehn, J. A. G. & H. L. Viereck. — (30); — (41).

Reko, B. P. *4021* (12a); *4600* (9); *5157* (37).

Reverchon, J. —, — (2); —, —, —

(37); — (40); —, —, —, — (41); *7* (40); *20, 25* (29); *149* (40); *152, 153* (2); *693* [*156*] (37); *1932, 1932B* (2); *1933* (1); *3058* (41d); *3812* (29); *3813* (41); [*444*] (2); [*449*] (37), (41).
ex Reverchon Herb. — (2).
Reynolds, Mrs. L. R. — (41f).
Riehl, N. *156* (1).
Roadhouse, J. E. — (20).
Robbins, W. W. *1583* (41).
Rojas, Ruben Torres. *203* (15).
Rolfs, P. H. *544, 654* (1a).
Rolland-Germain, F. *13022* (40).
Rose, J. N. *3093* (9); *13100* (14); *16049* (17); *16134* (20a); *16212* (17).
Rose, J. N. & Walter Hough. *4721* (18).
Rose, J. N. & Joseph H. Painter. *7608* (9).
Rose, J. N. & J. S. Rose. *11435* (18).
Rothrock, J. T. — (30); *203* (41).
Rowlee, W. W. — (4).
von Rozynski, H. W. *244, 245* (31); *505* (25); *603, 703* (31); *784* (16).
Ruddock, George T. — (22).
Rugel, F. — (40).
Rusby, Henry H. — (1); *70* (37); *71* (41d); *72* (41).
Russell, Colton. — (1); — (40).
Ruth, Albert. — (2); —, —, *3, 31* (40); *143* (6); *357* (41); *778* (2); *835* (6).
Rydberg, Per Axel. *1443* (6).
Rydberg, Per Axel & E. C. Carlton. *7026* (41).
Rydberg, Per Axel & A. O. Garrett. *9449* (41).
Rydberg, Per Axel & Ralph Imler. *318* (40); *870* (41).
Rydberg, Per Axel & F. K. Vreeland. *5909* (41).
Safford, William E. *1458a* (9).
Salazar, F. — (2); — (16); — (31); *97* (16).
Salmon, S. C. — (6).
Sandberg, J. H. —, — (4); — (6); — (6b); *1008* (41).
Sargent, C. S., B. Thayer & B. H. Smith. — (1a).
Sartwell, H. P. — (6); — (40).
Savage, T. E., J. E. Cameron & F. E. Lenocker. — (6).
Savage & Stull, — (40).
Schaffner, J. G. *95, 908* (25).
Schaffner, J. G. & Wilhelm Schaffner. *455* (25).
Schedin, L. M. & N. T. Schedin. — (41).
Schiede, G. *715* (16).
Schmoll, Hazel M. *1215, 1377, 1643* (41).
Schoenfeldt, L. *3234, 3264, 3430* (22).
Schott, A. — (29).
von Schrenk, Hermann. — (1); —, — (1a); — (29); — (40); *54* (37).
Schriver, Howard. — (40).
Schuette, J. H. —, — (4).
Schulz, Ellen D. *2350* (2).
Sears, Paul Bigelow. *1378* (41a).
Seler, Caec. & Ed. *1472* (28); *1487* (18); *1729* (11); *3287* (16a); *3296* (16); *4389* (12).
Sessé, Mociño, Castillo & Maldonado. *854* (26); *855, 4939* (11); *4941* (26); *4942* (31).
Setchell, W. A. — (20).
Seymour, F. C. *489* (6); *607* (1).
Shafer, J. A. & Bro. Leon. *13671* (1a).
Shannon, James I. *222a* (40).
Shear, C. L. *104* (41a).
Shellon, G. T. *57* (41).
Sherff, Earl E. — (4a); — (6b); — (41b); *79* (40).
Shimek, B. —, — (1); — (4); —, —, —, —, —, — (6); —, —, — (40); —, — (41); —, — (41a).
Short, C. W. —, — (40).
Silvio, Lelia & C. Conzatti. *4100* (18).
Simpson, J. H. *51* (1a).

Skehan, J. — (1).
Small, John Kunkel. — (1); — (4); —, —, —, — (6); —, —, —, — (40).
Small, John Kunkel & A. A. Heller. — (40); *339* (1).
Smith, Charles L. *739, 839* (18); *840* (12a); *804a* (18); *840b* (12a); *841* (11).
Smith, Ernest C. — (1); *577* (6).
Smith, Huron H. *45* (6); *1376* (4); *2102* (1a); *2396, 2627* (6); *4582* (20); *4812* (22); *4903* (20); *4934* (41d); *5090, 5116, 5330* (20); *5469* (41f), (41g); *5479* (22); *5774* (1).
Smith, Lucius C. *321* (12), (12a); *464* (24).
Smith, L. E. — (41d).
Solís, Octavio. *3* (17).
Souviron, M. J. & C. C. Erlandson. *61* (32).
Spencer, Mary F. *137, 287* (22).
Standley, Paul C. — (41d); *39* (37); *21530* (15), (16); *35476, 35833* (16); *56098* (16a).
Stark, B. D. — (41f).
Steele, Mr. & Mrs. E. S. —, — (5); *5* (4); *177* (6).
Stephens, Bettie. *FC15* (6).
Stevens, G. W. *268* (41); *714* (6); *766* (41); *1998* (1).
Steward, G. L. —(6).
Stewart, Alban. *68* (17).
Steyermark, Julian A. *1104* (40); *1105, 1139* (6); *7797, 7798, 7799, 8396* (41a); *13006* (40); *13117, 13176, 13396, 13478* (41a); *13551* (6); *13591* (41a); *13970* (40); *14586, 14773, 15979, 16347* (41a).
Stone, Witmer. *648* (41f).
Stratton, Robert. *6* (41); *169* (6).
Studhalter, R. A. *1041* (29).
Sturtevant, E. L. — (1); —, — (6).
Sudworth, George B. —, — (20).
Taylor, Mary. *71* (25); *165* (37).
Thompson, C. H. *120* (41).
Thone, Frank H. *185* (6); *302* (4).
Thornber, J. J. *544* (37); *551* (41).
Thurber, George. — (37); *73* (29); *562* (20).
Tidestrom, Ivar. — (1); — (40); *9607* (41f).
Tonduz, Adolpho I. *713* (10); *9828* [*6999*] (15).
Toumey, J. W. — (22); *16* (30).
Townsend, C. H. T. & C. M. Barber. *154* (6); *191* (41c).
Tracy, S. M. — (6); *7012* (1).
Tracy, S. M. & F. S. Earle. *112* (37); *258* (41).
Tracy & Lloyd, *274* (1a).
Trask, Blanche. —, —, —, —, —, —, —, —, —, — *p.p.* (20); —, —, —, —, —, —, —, —, —, —, — (22); —, — (22a); *39* (22); *53, 54, 91* (20); *92* (22); *95, 103, 142, 248, 249* (20); *413, 414, 415* (22); *417, 418* (20); *435* (22).
Trelease, William. — (1); — (6); — (40); — (41); *42* (37); *248* (1); *249, 250, 251, 252, 253, 254, 255, 256* (40); *968* (41a); *4391* (41).
Trelease, William & de Alton Saunders. *4390* (41).
von Tuerckheim, H. *1153, 1432, 3913* (32); *II 1506* (15), [*340*] (16).
Tweedy, Frank. *3533* (41); *4948* (41).
Uline, Edwin Burton. — (4).
Umbach, L. M. —, — (4); —, — (41b).
Underwood, J. K. *774* (40).
Valerio. Manuel. *1038* (15).
Van Dyke, Mrs. E. C. — (41g).
van Vleet, A. H. *54* (6).
Vasey, G. R. — (6); — (37); —, — (41).
ex Vasey Herb. — (40).
Veatch, John A. — (17).
Vincent, Helen N. *67* (41).
Visher, S. S. *2074* (41); *2277* (6); *2558, 3349* (41); *4134* (6).
Voth, H. R. *70* (41f).
Waite, M. B. — (40).

Walker, Ernest P. *122, 414* (41).
Walther, Eric. — (41g).
Ward, Lester F. *6* (41).
Warner, S. R. — (1); — (6); — (40).
Warner, W. G. *4* (1).
Waugh, F. A. —, — (1); *103* (6); *131* (41); *133* (1).
Weatherby, C. A., L. B. Smith, S. K. Harris & G. B. Rossbach. *2783* (1).
Webber, H. J. — (6).
Whaley, Celeste. *111* (1).
White, Mark. — (41).
White, Paul J. — (41).
White, T. F. *16759* (41b).
White, W. E. — (41).
Whited, Kirk. *945* (41g); *1059* (6).
Whitford, H. M. *62* (6).
Wibbe, J. Herman. — (4).
Wiegand, K. M. — (6); *10243* (40).
Wiegand, M. C. & G. B. Upton. — (41).
Wiggins, Ira L. *3285* (20).
Wiggins, I. L. & D. K. Gillespie. *3905* (20); *4052* (41f).
Wilcox, Timothy E. *378* (41c).
Williams, Louis O. *457* (41).
Williams, T. A. —, *90* (41).
Williams & Wilcox, — (41).
Willits, Vic. *440* (41).
Wilson, Norman C. — (41); — (41f).
Wilson, Percy. — (4); — (6); — (6).
Wilson, Percy & E. J. Alexander. — (6).
Wislizenus, Frederick. *56* (6); *57* (1); *59* (40); *359* (37); *474* (41).
Wolf, Carl B. *2353, 2465* (41f); *2481* (22); *2507* (41f); *2575* (41c); *2805* (41); [*1857*] (22).
Woodcock, F. G. — (22).
Woodson, Robert E., Jr. *377* (40); *563* (6); *742* (1); *1879* (41).
Woodson, Robert E., Jr. & E. Anderson. *1547* (40).
Wooton, E. O. —, — (30); —, —, — (41); — (41d); *48* (41); *68* (37); *581* (6); *584* (41d).
Woronow, G. — (39); *2919* (38).
Wright, Charles. *83* (29); *917* (41); *1341* (37); *1342* (41d); *2290* (1a).
Wright, Will S. *33* (20).
Wriglet, Elizabeth. — (41d).
Wynd, F. Lyle & C. H. Mueller. *48* (37); *169* (19); *396* (29); *416* (2); *613* (41).
Young, M. S. — (6); — (37); — (41).
Yuncker, T. G., R. F. Dawson & H. R. House. *6344* (15).
Zobel, Henrietta L. — (41).
Zumbro, C. A. *387* (20).

TOXICODENDRON

Abbot, *246* (3d).
Abrams, LeRoy. *9900* (2).
Adams, J. W. *236* (3).
Anderson, A. P. — (5).
Anderson, F. W. — (3).
Anderson, J. P. —, — (3).
Arsène, G. — (3); *10* (2); *2509, 2763, 3011* (3).
Ashe, W. W. — (5).
Austin, Mrs. R. M. —, —, —, *97, 749* (2).
Baker, C. F. *547* (2).
Baker, H. P. — (3).
Baker, M. S. & Frank Nutting. — (2).
Ball, Carleton R. *429* (3).
Ball, J. — (2).
Bardell, E. M. — (2).
Barkley, Fred A. —, — (3).
Barkley, Fred A. & Ben O. Osborn. *1405* (1).
Bassler, Thomas. — (3).
Batchelder, Charles Foster. — (5).
Beattie, Frederick S. — (3).
Bebb, Robert. *319* (5).
Bell, W. B. *104* (3).
Bergman, H. F. *1895* (3).
Berkley, Earl E. *1639* (5).
Berlandier, J. L. *625* (1); *2475* (3).
ex Bernhardi Herb. — (1).

Bigelow, J. M. — (3b).
ex Biltmore Herb. *1377b* (5).
Bishop, E. F. — (5).
Blanchard, Ferdinand. —, — (3).
Blankinship, J. W. — (2); *106* (3).
Blodgett, J. L. — (3).
Blumer, J. C. *102, 102a, 1325, UR2* (3).
Boettcher, F. L. J. *250* (3b).
Brace, L. J. K. *3570* (3).
Brandegee, T. S. —, —, —, —, — (3a); *2019* (4).
ex Brandegee Herb. — (3).
Brenes, A. M. *4552* [*337*], *5032*, *5559* [*151*] (4).
Brewer & Chickering, — (5).
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Explanation of Plate

PLATE 10

Flowers representative of the Rhus-complex. × 6.

Fig. a. ***Rhus trilobata*** var. *serotina* (Greene) Barkley *(Moore & Demaree 4782)*. The lower right bract is depicted as torn to show the small lateral bracteoles.

Fig. b. ***Rhus terebinthifolia*** Schlecht. & Cham. *(Türckheim 1506)*.

Fig. c. ***Actinocheita filicina*** (DC.) Barkl. *(Pringle 9164)*.

Fig. d. ***Rhus Andrieuxii*** Engler *(Purpus 2730A)*.

Fig. e. ***Rhus integrifolia*** (Nutt.) Benth. & Hook. *(Baker 818)*.

Fig. f. ***Cotinus americanus*** Nutt. *(Eggert*, May 8, 1898). Note the densely pubescent pedicels of the abortive flowers.

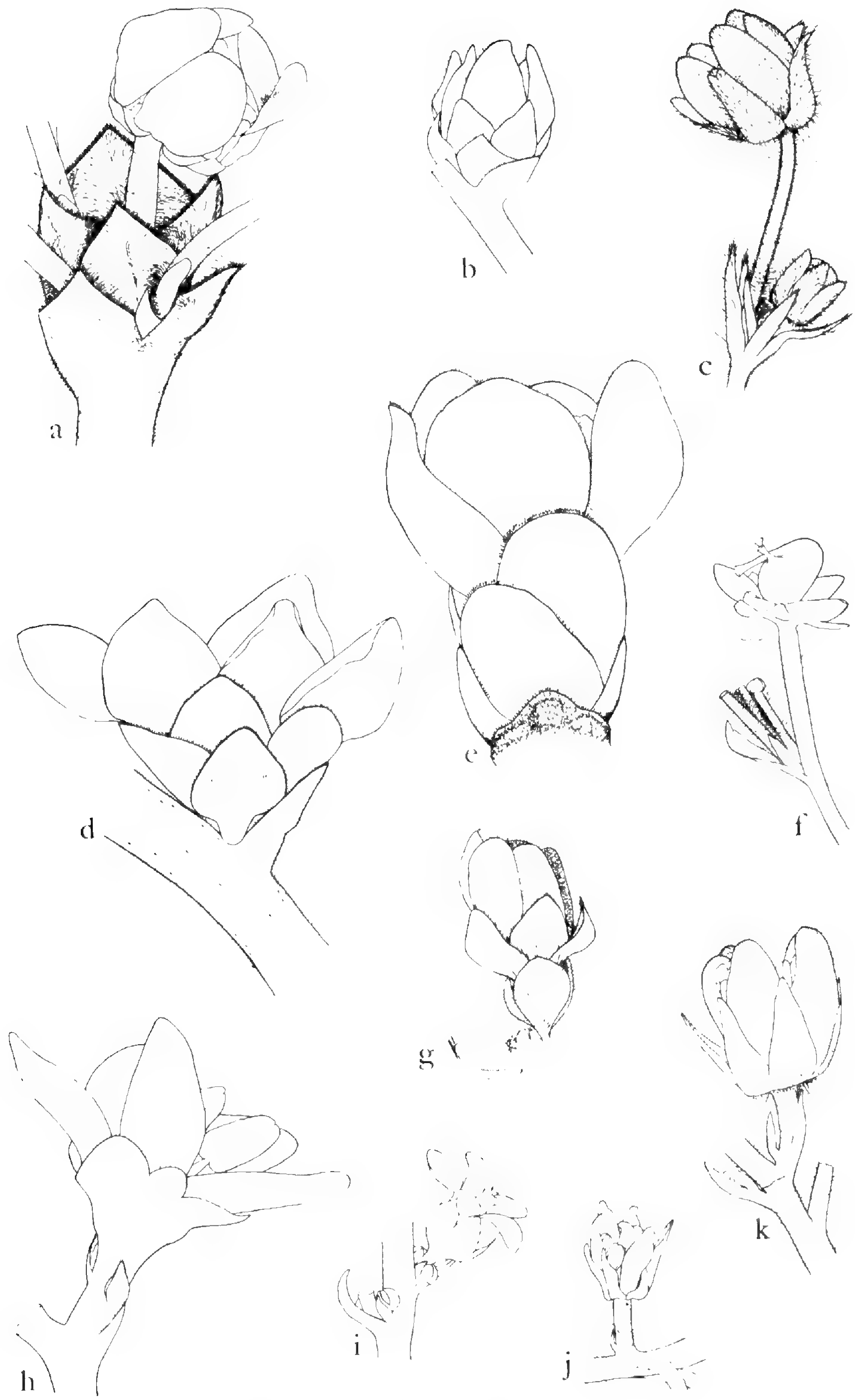
Fig. g. ***Rhus microphylla*** Engelm. *(Eggert*, May 9, 1901). The bract, one bracteole, and the flower have been removed at the lower left to show the character of the pedicel.

Fig. h. ***Metopium toxiferum*** (L.) Krug & Urb. *(Duckett*, April 30, 1930).

Fig. i. ***Malosma laurina*** (Nutt.) Nutt. ex Engler *(Abrams 2639)*.

Fig. j. ***Toxicodendron Vernix*** (L.) Kuntze *(Short*, Ky., 1840).

Fig. k. ***Rhus glabra*** L. *(Churchill*, July 30, 1882).



BARKLEY—THE RHUS COMPLEX

Explanation of Plate

PLATE 11

Longitudinal sections through flowers representative of the Rhus-complex. × 6.

Fig. a. ***Rhus microphylla*** Engelm. (————. April 20, 1902, plains west of Pecos).

Fig. b. ***Rhus Barclayi*** (Hemsl.) Standl. *(Mexia 1433).*

Fig. c. ***Actinocheita filicina*** (DC.) Barkl. *(Purpus 1236).*

Fig. d. ***Rhus aromatica*** Ait. (————, May 25, 1929, Glenmont, N. Y.).

Fig. e. ***Rhus ovata*** Wats. *(A. & R. Nelson,* May 8, 1933).

Fig. f. ***Cotinus americanus*** Nutt. *(Eggert,* May 8, 1898).

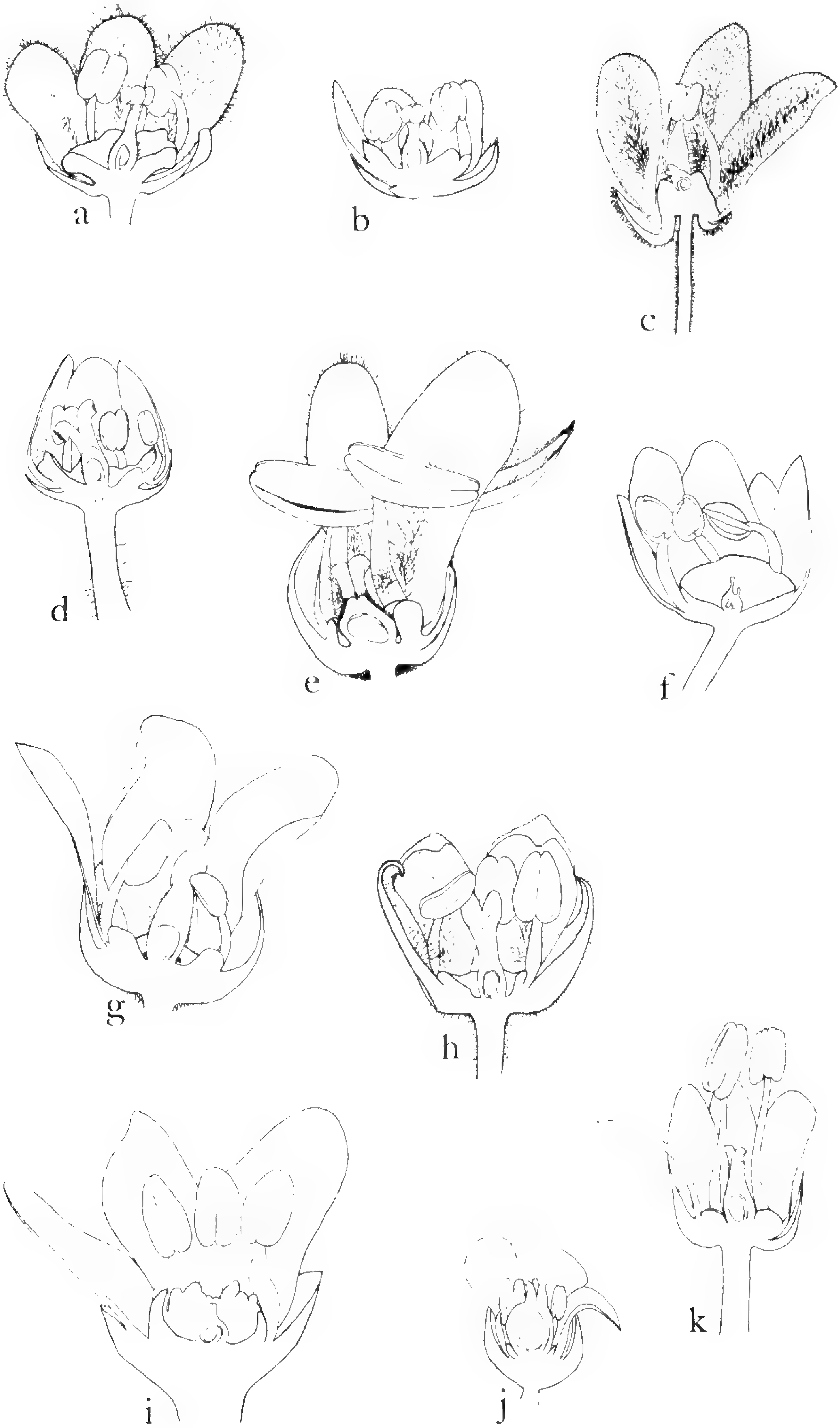
Fig. g. ***Rhus virens*** Lindh. *(Redfield,* Oct. 5–10, 1880).

Fig. h. ***Rhus glabra*** L. *(Churchill,* July 30, 1882).

Fig. i. ***Metopium toxiferum*** (L.) Krug & Urb. *(Moldenke 778a).*

Fig. j. ***Malosma laurina*** (Nutt.) Nutt. ex Engler *(Elmer 4015).*

Fig. k. ***Toxicodendron Vernix*** (L.) Kuntze *(Tracy 8742).*



BARKLEY—THE RHUS-COMPLEX

EXPLANATION OF PLATE

PLATE 12

Flower structure in the Rhus-complex. × 4.5. In each flower the outline of the disk and lateral views of the pistil, stamen, sepal, and petal are depicted, the upper figures representing the parts of the pistillate flower, the lower those of the staminate flower.

Fig. a. *Rhus microphylla* Engelm. (*Eggert*, May 9, 1901, and ———, April 20, 1902.

Fig. b. *Rhus terebinthifolia* Schlecht. & Cham. (*Türckheim 1506*, and *Purpus 2279*).

Fig. c. *Rhus trilobata* var. *serotina* (Greene) Barkley (*Norris*, June 21, 1880, and *Moore & Demaree 4782*).

Fig. d. *Rhus Andrieuxii* Engler (*Palmer 190* and *Purpus 2730A*).

Fig. e. *Rhus integrifolia* (Nutt.) Benth. & Hook. (*Howery*, April 1, 1912, and *Baker 818*).

Fig. f. *Cotinus americanus* Nutt. (*Eggert*, May 8, 1898).

Fig. g. *Metopium toxiferum* (L.) Krug & Urb. (*Curtiss 448* and *Moldenke 778a*).

Fig. h. *Actinocheita filicina* (DC.) Barkl. (*Pringle 4752* and *Purpus 1236*).

Fig. i. *Rhus glabra* L. (*Tracy*, May 20, 1876, and *Churchill*, July 30, 1882).

Fig. j. *Toxicodendron Vernix* (L.) Kuntze (*Short*, Ky., 1840, and *Tracy 8742*).

Fig. k. *Malosma laurina* (Nutt.) Nutt. ex Engler (*Elmer 4015* and *Engelmann*, Sept. 16, 1880).

BARKLEY—THE RHUS-COMPLEX

Explanation of Plate

PLATE 13

Fig. a. A portion of a leaf of *Rhus trilobata* var. *serotina* showing unbranched pubescence of a type common in the Rhus-complex *(Steyermark 13006)*. × 8.

Fig. b. Stem structure of *Rhus*. Cross-section of a one-year-old stem of *Rhus aromatica* (left) and of *Rhus glabra* (right). Note the comparative size of the pith.

Fig. c. Pubescence from the epicarp of the fruit of *Rhus glabra (Palmer 14243)*. × 28.

Fig. d. Pubescence from the epicarp of the fruit of *Rhus glabra* var. *borealis (Sandberg*, Aug. 1891). × 28.

Fig. e. A portion of the margin of a sepal of *Rhus Muelleri* showing the character of the glandular hairs. × 28.

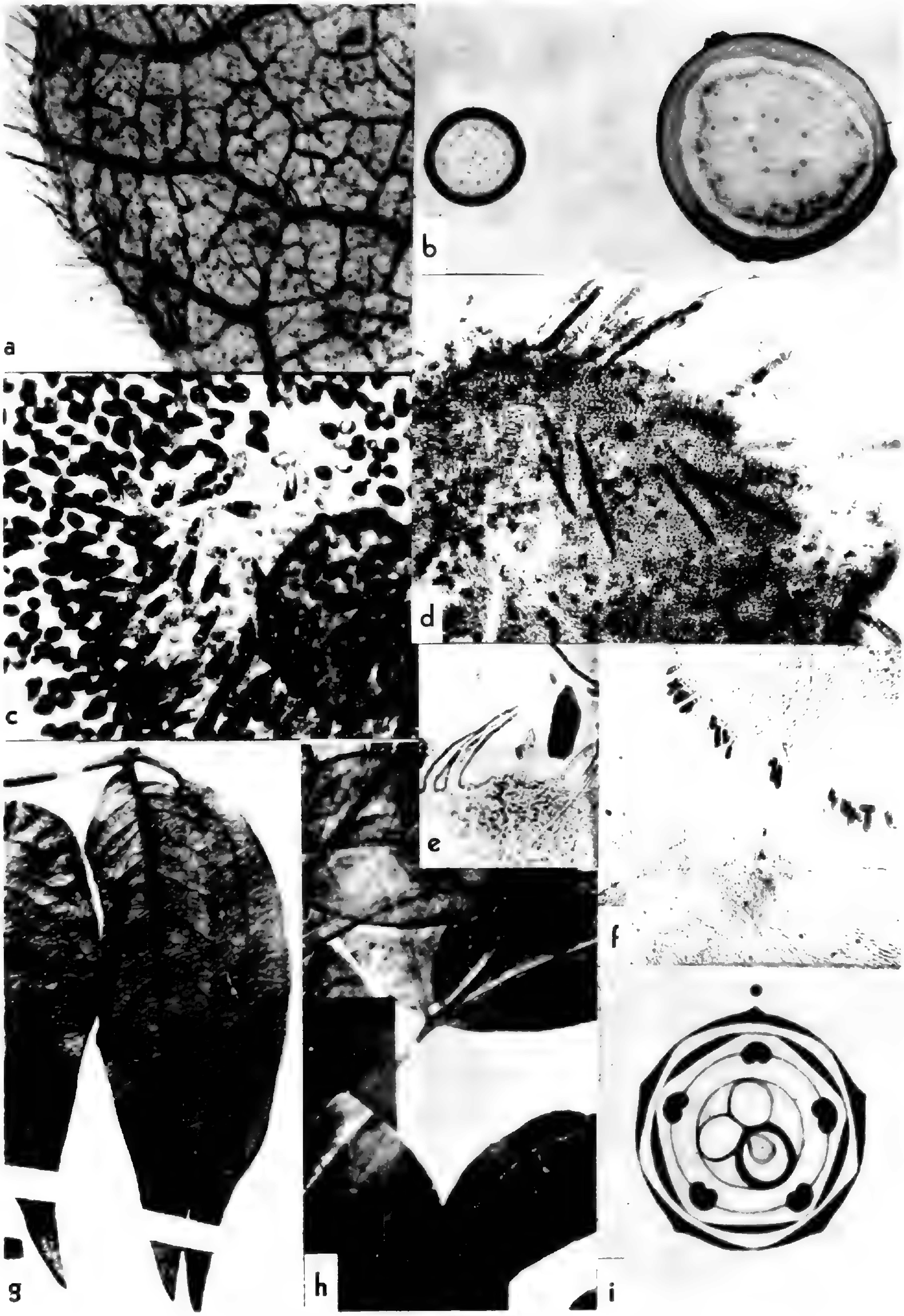
Fig. f. Portions of the petal (below) and sepal (above) of *Rhus Muelleri*, taken from the type specimen. Note the mixed simple and glandular ciliation on the sepal. × 7.

Fig. g. Leaflets of *Rhus oaxacana (Nelson 1569)*. The small veins of some species are quite conspicuous in herbarium material.

Fig. h. Leaflets of *Rhus virens (Wynd & Mueller 396)*. The smaller veins of many species are quite inconspicuous.

Fig. i. Floral diagram of *Rhus* (after Goebel).

(Photographs by the author.)



BARKLEY—THE RHUS-COMPLEX

Explanation of Plate

PLATE 14

Fruits and seeds of *Rhus* and its immediate allies, × 4.1:

Fig. a. Fruit and seed of *Actinocheita filicina (Seler 1419).* Note the long pilosity of the fruit-coat and the rugosity of the seed.

Fig. b. *Cotinus americanus (Palmer 27085).* Note the veiny fruit, the lateral, separate styles, and the long pedicel.

Fig. c. *Metopium toxiferum (Valeur 698).*

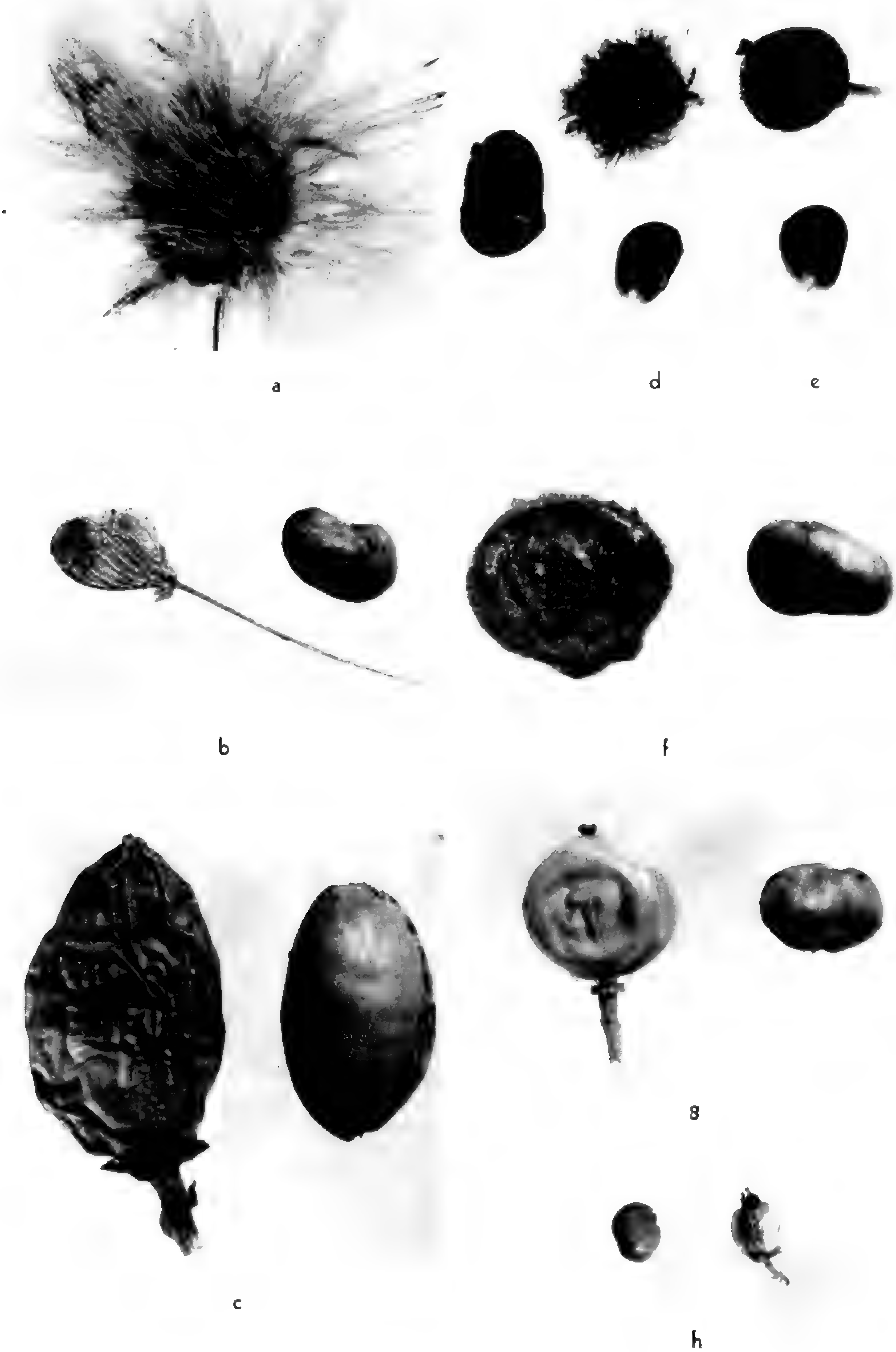
Figs. d and e. *Rhus typhina (Wilson 142)* and *Rhus glabra (Palmer 4167).* Note the pilosity of the former, and the short pubescence of the latter (see also pl. 13, fig. c).

Fig. f. *Rhus Andrieuxii (Rozynski 703).* The pubescence of the fruit-coat is composed of long, simple, non-glandular, and short, club-shaped, glandular hairs.

Fig. g. *Toxicodendron Vernix (Batchelder,* Sept. 14, 1927).

Fig. h. *Malosma laurina (Eby,* Dec. 1900). Note the separate styles and the raised line down the side.

(Photographs by Woodson and Barkley.)



BARKLEY—THE RHUS-COMPLEX

Explanation of Plate

PLATE 15

Inflorescence structure in *Rhus:*

Fig. a. ***Rhus ovata*** × .63 *(Braunton 1026).*
Fig. b. ***Rhus Arsenei*** × .63 *(Arsène & Amable 1566).*
Fig. c. ***Rhus typhina*** × .95 *(Jos. Illick,* Mt. Alton, Pa., 1909). Note the contrast between the compound spikes of *Rhus ovata* and *R. Arsenei* and the thyrsus of *R. typhina.*

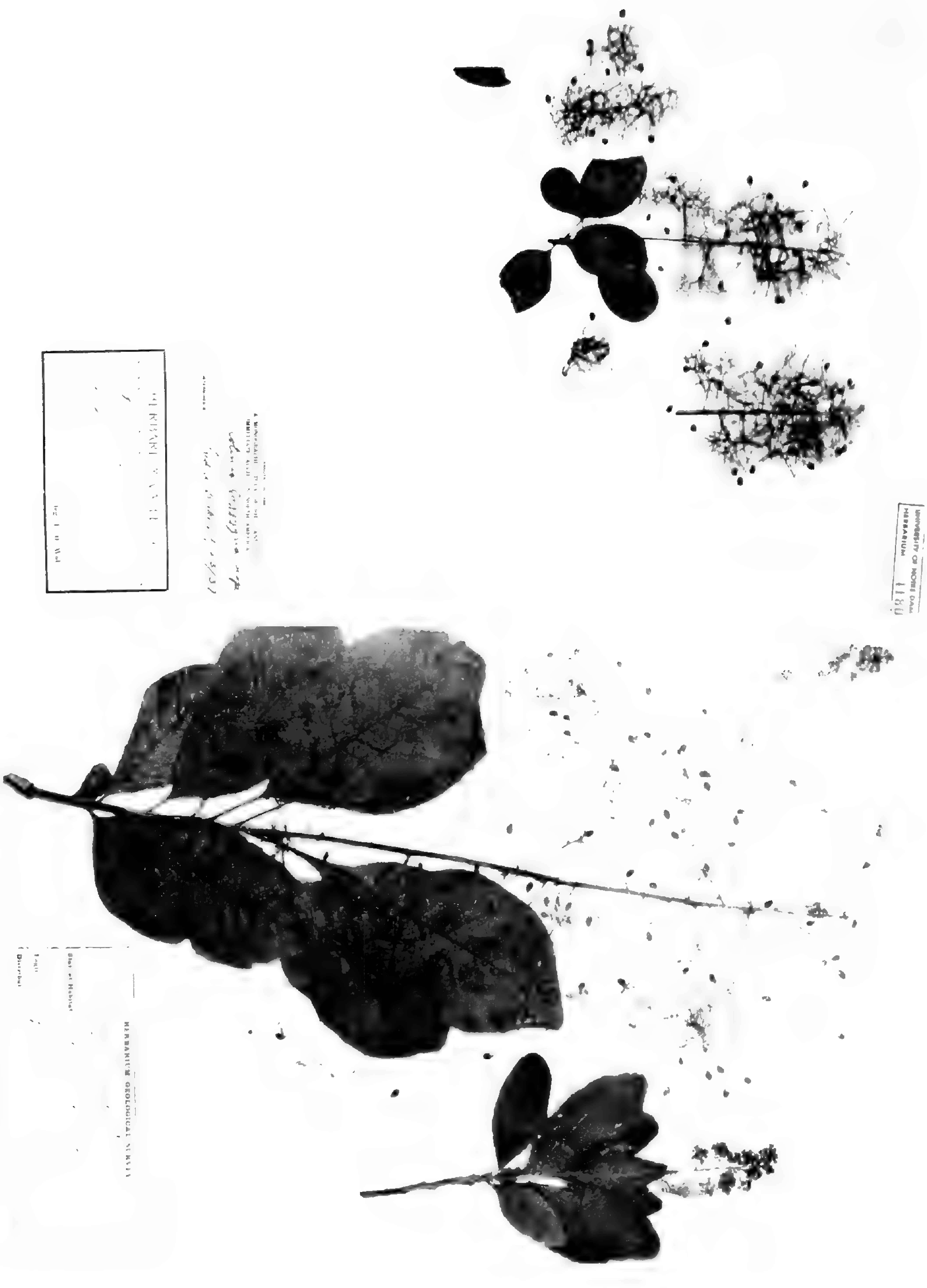
BARKLEY—THE RHUS-COMPLEX

Explanation of Plate

PLATE 16

Fig. 1. *Cotinus Coggygria* Scop.

Fig. 2. *Cotinus americanus* Nutt. The leaves of this species are typically larger than in the European species, more decurrent on the petiole and the leaf margin is not noticeably thickened; also the inflorescence is less compact. Note the difference in aspect between the inflorescence at anthesis and in fruit.



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BARKLEY—THE RHUS-COMPLEX

Explanation of Plate

PLATE 17

Fig. 1. ***Metopium venosum*** (Griseb.) Engler. From the type collection, *C. Wright*, May and October, 1860–1864, eastern Cuba.

Fig. 2. ***Actinocheita filicina*** (DC.) Barkley. From specimen, *Purpus 1236*, in Field Museum Herbarium. The insert at the upper left is a reproduction of *plate 189* from de Candolle's 'Calque des Dessins.'

BARKLEY—THE RHUS-COMPLEX

EXPLANATION OF PLATE

PLATE 18

Fig. 1. *Rhus Hartmanii* Barkley. From the type specimen, *Hartman 824,* December 12, 1890, from Oakridge Pass, Sonora, Mexico, in the United States National Herbarium.

Fig. 2. *Rhus Arsenei* Barkl. From the type specimen, *Arsène & Amable 1566,* August 1907, Acatzingo, District of Tepeaca, Puebla, Mexico, in the Missouri Botanical Garden Herbarium.

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BARKLEY—THE RHUS-COMPLEX

Explanation of Plate

PLATE 19

Fig. 1. *Rhus Muelleri* Standl. & Barkl. From the type specimen, *C. H. & M. T. Mueller 328*, July 15, 1933, mountains near Monterrey, Nuevo Leon, Mexico, in the Field Museum Herbarium. Note the orbicular leaves, the short petioles, and the obscurely repand-serrate, revolute margins.

Fig. 2. *Rhus Kearneyi* Barkley. From the type specimen, *Kearney & Harrison 6573*, March 29, 1930, Tinajas Altas Mountains, Arizona, in the United States National Herbarium.

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BARKLEY—THE RHUS-COMPLEX

Explanation of Plate

PLATE 20

Fig. 1. *Rhus integrifolia* var. *cedrosensis* Barkley. From the type specimen, *J. N. Rose 16134*, March 11, 1911, Cedros Island, Lower California, in the New York Botanical Garden Herbarium. Note the inflorescence and the leaf.

Fig. 2. *Rhus ovata* var. *Traskiae* Barkley. From the type specimen, *Trask*, March 1898, Avalon, Santa Catalina Island, California, in the Missouri Botanical Garden Herbarium.

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BARKLEY—THE RHUS-COMPLEX

Explanation of Plate

PLATE 21

Rhus Duckeri Barkley. From the type specimen, *L. C. Smith 464*, April 6, 1895, Cuesta de Ejutla Nacaltepec, Oaxaca, Mexico, in the United States National Herbarium.

BARKLEY—THE RHUS-COMPLEX

Explanation of Plate

PLATE 22

Fig. 1. *Rhus Nelsonii* Barkley. From the type specimen, *E. W. Nelson 7047*, May 1903, above Chilpancingo, Guerrero, Mexico, in the New York Botanical Garden Herbarium.

Fig. 2. *Rhus Tepetate* Standley & Barkley. From the cotype specimen, *Gentry 1746*, September 10, 1935, Sierra Charuco, Rio Mayo, Sonora, Mexico, in the Missouri Botanical Garden Herbarium.

BARKLEY—THE RHUS-COMPLEX

Explanation of Plate

PLATE 23

Fig. 1. *Rhus macropoda* **Barkley.** From the type specimen, *E. W. Nelson 539*, July 2, 1894, San Miguel Alborrados, Oaxaca, Mexico, in the United States National Herbarium.

Fig. 2. *Rhus profusa* Barkley. From the type specimen, *Edw. Palmer 214*, October 15–21, 1902, near Los Caños, San Luis Potosi, Mexico, in the United States National Herbarium.

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BARKLEY—THE RHUS-COMPLEX

Explanation of Plate

PLATE 24

Fig. 1. *Rhus microphylla* Engelm. The specimen, *C. Wright 1341*, 1852, N. Mex. (left), in the United States National Herbarium, appears to be the type, although *Lindheimer 734* was distributed as the type collection. The specimen on the right, *Reverchon*, 1882, from Fort Concho, Texas, is the type of ***Rhoeidium glabellum*** Greene. The two specimens show typical leaf variation.

Fig. 2. *Rhus allophylloides* Standl. From the type specimen, *Mexia 1640*, February 4, 1927, trail from San Sebastian to Real Alto, Jalisco, Mexico, in the United States National Herbarium.

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BARKLEY—THE RHUS-COMPLEX

Explanation of Plate

PLATE 25

Fig. 1. *Malosma laurina* (Nutt.) Nutt. ex Engler. Note the simple, long-petiolate leaves which fold along the midribs, and the dense terminal thyrsus.

Fig. 2. *Toxicodendron striata* (Ruiz & Pav.) Kuntze.

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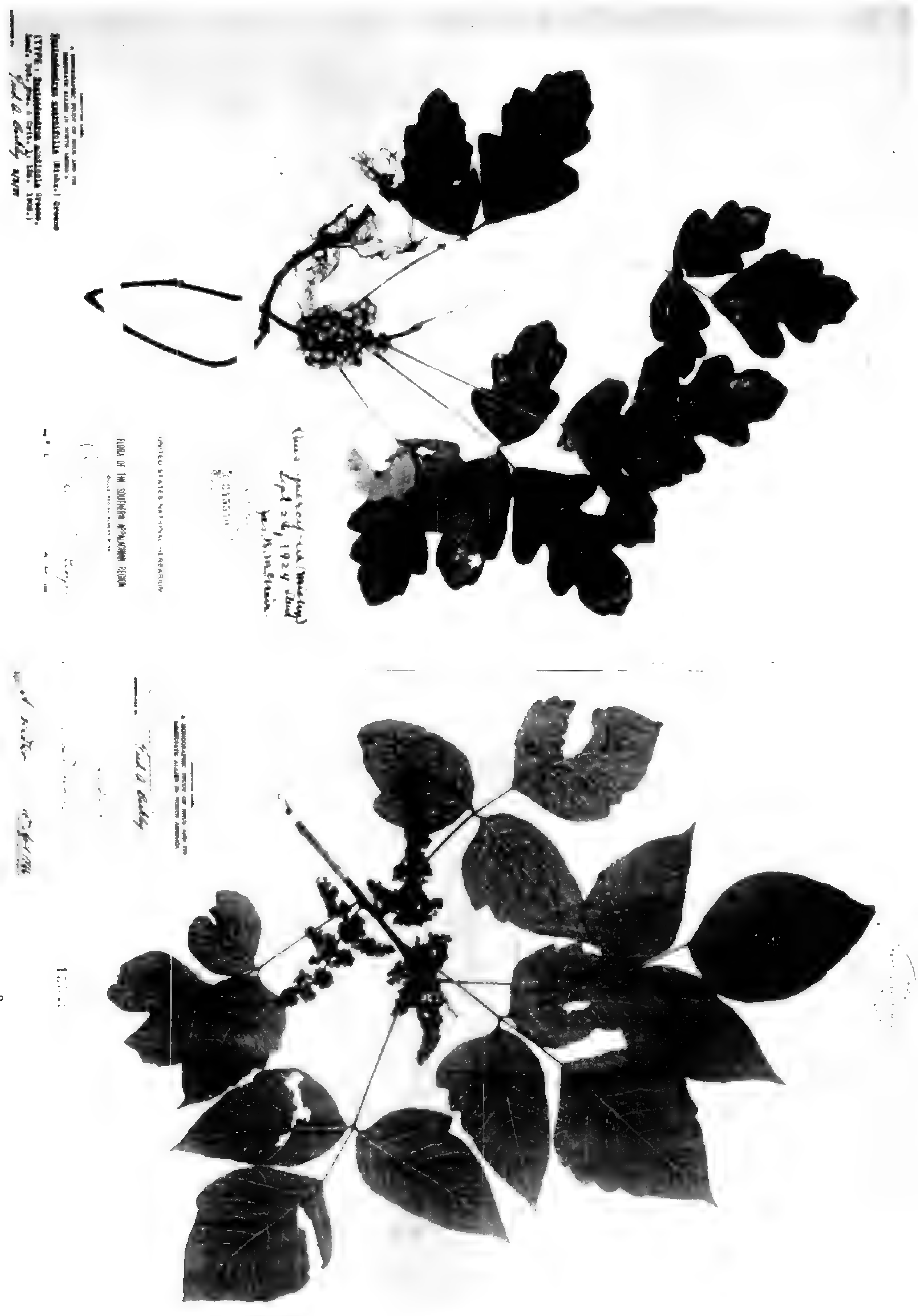
BARKLEY—THE RHUS-COMPLEX

Explanation of Plate

PLATE 26

Fig. 1. *Toxicodendron quercifolia* (Michx.) Greene.

Fig. 2. *Toxicodendron radicans* (L.) Kuntze. This specimen, collected by Fendler in New Orleans, April 16, 1846, shows the leaf variation typical on plants of this species. Note also the lateral panicles.



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BARKLEY—THE RHUS-COMPLEX

STUDIES IN THE ANACARDIACEAE. II[1]

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Through the kindness of Dr. E. D. Merrill my attention has been called to the fact that the combination *Ailanthus peregrina* Barkl. as given in "Studies in the Anacardiaceae. I" is untenable, since it is antedated by *A. altissima* (Miller) Swingle. The following combination and synonymy should therefore be substituted for that on page 264 of the present volume of the ANNALS.

Ailanthus altissima (Miller) Swingle, Jour. Wash. Acad. Sci. **6**: 495. 1916.

Ailanthus glandulosa Desf., Mem. Acad. Sci. Paris for 1786. p. 265, *pl. 8.* 1788.

Ailanthus procera Salisb. Prodr., p. 171. 1796.

Ailanthus Cacodendron Schinz & Thell., Mem. Soc. Sci. Nat. Cherbourg **38**: 679. 1912.

Ailanthus peregrina Barkl., Ann. Mo. Bot. Gard. **24**: 264. 1937.

Albonia Peregrina Buc'hoz, Herb. Color. Amér., *pl. 57.* 1783.

Pongelion glandulosum Pierre, Fl. Cochinchin. **4**: *pl. 294.* 1893.

Rhus Sinense Houttuyn, Natuur. Hist. II. **2**: 212. 1774.

Rhus Cacodendron Ehrhart, Hannov. Mag. **21**: 225–226. 1783.

Rhus Succedaneum Buc'hoz, Herb. Color. Amér., *pl. 57.* 1783.

Rhus peregrina Stapf, Index Lond. **1**: 113. 1929.

Toxicodendron Altissimum Miller, Gard. Dict., ed. 8. 1768, excl. synonymy.

[1] Issued September 27, 1937.

Also, further study has shown that in accordance with the International Rules of Botanical Nomenclature the plant recently published as *Pseudosmodingium Pterocarpus* should bear the name:

Pseudosmodingium rhoifolium (DC.) Barkl., n. comb.

Pseudosmodingium Pterocarpus (Sessé & Moc.) Barkl., Ann. Mo. Bot. Gard. **24**: 263. 1937.

Rhus pterocarpa DC., Prodr. **2**: 84. 1825, in syn.

Rhus Pterocarpus Sessé & Moc., Pl. Nov. Hisp., p. 47. 1888.

Spathelia (?) rhoifolia DC., Prodr. **2**: 84. 1825; DC., in A. DC., Calq. Dess. Fl. Mex. Moc. & Sessé, p. 3, *pl. 190.* 1874.

Apparently this species was originally based on the collection of Sessé and Mociño, No. 4938, a portion of which, now deposited in the Field Museum of Natural History, sheet no. 847794, has been examined.

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MONOGRAPH OF TETRAMERIUM AND HENRYA[1]

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INTRODUCTION

Two closely related but different generic units, described first by Nees von Esenbeck as *Tetramerium* and *Henrya,* have long been the occasion for discussion among taxonomists. While over a period of years further studies in the field and of herbarium material have advanced the understanding of these plants, yet the published results in combining and separating the two genera have demonstrated that a more critical comparative morphological study was necessary to reevaluate the two entities represented and to eliminate if possible further confusion concerning them. Consequently studies of herbarium material in the Henry Shaw School of Botany, supplemented by material generously loaned from many herbaria in this country and Europe and of living specimens grown from seed in the Missouri Botanical Garden, have been made during the past four years. The following paper embodies the results of these studies together with some historical, morphological, and phylogentic factors, as well as the geographical distribution of the genera and species under consideration.

[1] An investigation carried out at the Missouri Botanical Garden in the Graduate Laboratory of the Henry Shaw School of Botany of Washington University and submitted as a thesis in partial fulfillment of the requirements for the degree of doctor of philosophy in the Henry Shaw School of Botany of Washington University.

Issued November 23, 1937.

Taxonomic History

Tetramerium and *Henrya* are generic names which were proposed by Nees von Esenbeck to designate two genera of the natural family Acanthaceae. Complete descriptions and careful illustrations of them were published in Bentham's[1] 'Botany of the Voyage of the Sulphur' in 1844. In this work, this distinguished student of the Acanthaceae characterized four species, namely *Tetramerium nervosum* and *T. polystachyum*, *Henrya insularis* and *H. Barclayana*. Two more species, *Tetramerium hispidum* and *Henrya scorpioides*, were subsequently described by the same author.[2] Since these last two species were published in 1847, further contributions to the knowledge of both genera have appeared in literature, such as *T. glandulosum*, *T. ovalifolium*, and *T. ovatum* Oersted in 1854, *T. platystegium* Torrey in 1859, *H. costata* A. Gray in 1886, *T. glutinosum* Lindau in 1894, *H. imbricans* J. Donnell Smith in 1891, *T. aureum*, *T. diffusum*, and *T. tenuissimum* Rose in 1895, *H. grandifolia* Fernald in 1895, *H. costata* A. Gray var. *glandulosa* Brandegee in 1903, *T. gualanense* Robinson & Bartlett in 1907, *T. flavum* Eastwood in 1909, and *T. nemorum* and *T. geniculatum* Brandegee in 1913.

At the beginning of the author's studies in 1933, there were twenty-five published species and varieties which had been referred either to one or the other of these two genera. After careful examination of the morphological and other characteristics of these plants, with extensive consideration of the taxonomic importance of each character, it is felt that the recognition of *Tetramerium* and *Henrya* as two related but morphologically distinct genera, as defined by Nees von Esenbeck, clarifies the previously confused condition of this group. The present treatment recognizes twenty-five species and varieties in *Tetramerium* and twenty-one species and varieties in *Henrya*.

Acknowledgments

For the privileges and use of the facilities of the Missouri Botanical Garden and the Henry Shaw School of Botany of

[1] Nees in Benth. Bot. Voy. Sulphur, p. 147, *pl. 48.* 1844.

[2] Nees in DC. Prodr. 11: 467. 1847.

Washington University, the author wishes to express his appreciation to Dr. G. T. Moore, Director. Appreciation is also extended to the other members of the faculty for their helpful suggestions in their special fields of study. To Miss N. Horner, Librarian, and other members of the library staff, thanks are expressed for aid in compiling the bibliographic material. Sincere gratitude is extended to Dr. J. M. Greenman, Curator of the Herbarium, under whose immediate direction this work has been done, for his generous and wise guidance and assistance.

The cooperation of the curators of several herbaria, some of which are listed below, in permitting loans of specimens under their care has greatly facilitated this work; the author is appreciative of their generous assistance. The institutions which have loaned material for this study and whose specimens are cited in this paper are the following:

B = Herbarium of the Berlin Botanical Garden and Museum.
CalAcad = Herbarium of the California Academy of Sciences.
Cop = Herbarium of the University of Copenhagen.
Cornell = Herbarium of Cornell University.
D = Dudley Herbarium of Leland Stanford, Jr. University.
F = Herbarium of the Field Museum of Natural History.
G = Gray Herbarium of Harvard University.
K = Herbarium of the Royal Botanic Gardens, Kew.
M = Herbarium of the Missouri Botanical Garden.
NY = Herbarium of the New York Botanical Garden.
P = Herbarium of Pomona College.
PhilAcad = Herbarium of the Academy of Natural Sciences, Philadelphia.
Pitt = Herbarium of Carnegie Museum, Pittsburgh.
Stock = Herbarium of the University of Stockholm.
UAriz = Herbarium of the University of Arizona.
UCal = Herbarium of the University of California.
UMich = Herbarium of the University of Michigan.
US = United States National Herbarium.
UTex = Herbarium of the University of Texas.
Utrecht = Herbarium of the University of Utrecht.

Tetramerium

GENERAL MORPHOLOGY

Roots.—The fibrous root system is not extensive, sometimes branching from a slender primary root and producing varying modifications in accordance with the habitat. The roots are perennial and maintain themselves usually from year to year, the new shoots borne near the base of the old ones. Roots also appear frequently in certain species at the nodes of the subprostrate stems. Taxonomically, they present characters of rather infrequent value.

Stems.—The stems are mostly slender and freely branched, the branches opposite. Usually they are more or less terete, but sometimes become somewhat quadrangular in cross-section with rather rounded angles. The branches are more or less herbaceous and die back towards the ground during unfavorable growing seasons; new shoots develop during more advantageous periods of growth. The lower forms are commonly decumbent-prostrate, ascending, or loosely ascending-spreading. The pubescence is at first usually evenly distributed; later it frequently occurs in lines on alternating sides between the nodes, and finally the stem and branches on the exfoliation of the bark become glabrous.

Leaves.—In shape and size the leaves vary considerably on the same plant. The primary leaves, when present, are usually the larger but fall comparatively early. In some cases their shape remains constant in all stages, but in others, the variations are so extensive as to have no practical taxonomic value. Their margins are always entire. They tend rather frequently to be strongly veined underneath and have petioles of varying lengths, although they are sessile in one species. In all cases the leaves are opposite. Their surface is often more or less pubescent, usually more so on the upper surface and more conspicuously so on the midrib and nerves.

Bracts.—The bracts vary greatly and present probably one of the best taxonomic criteria due to their conspicuous appearance and persistence over a considerable period of time. They vary in shape from the broad rotund-ovate type, as in *T. nervosum,* to the linear type, as in *T. aureum* and *T. diffusum.* The apex is usually mucronulate or occasionally mucronate. Often the lower bracts are foliaceous, simulating the younger leaves. On the outer surface are found conditions ranging from a close even pubescence as in *T. Standleyi,* scattered pubescence as in *T. hispidum,* to a glabrate condition as shown in

T. leptocaule and *T. fruticosum.* When present, the pubescence is usually more conspicuous on the midrib and nerves. The bracts are also more or less ciliate. The bracteoles are present in a majority of the species. In most cases, as in *T. polystachyum,* there are usually two lanceolate-linear or filiform bracteoles. A few species, as *T. hispidum,* have also two or sometimes three shorter secondary bracteoles present in many cases, but not uniformly throughout the species.

Pubescence.—The trichomes are found to be both unicellular and multicellular and vary considerably in abundance, length, rigidity, thickness, and glandulosity. In general, the early stages of the plant exhibit a more closely pubescent condition than the later ones although in some instances, as *T. glutinosum,* the closely appressed lanate hairs vary but little through the periods of growth. Although the length of hairs varies to some extent in accordance with the development of the plant, constant lengths within specific limits are maintained; for example, *T. nervosum* exhibits rather long trichomes, *T. sessilifolium* and *T. Langlassei* those of intermediate length, and *T. polystachyum* and *T. leptocaule* minute hairs that are barely distinguishable. The degree of pubescence also ranges considerably from that which is pilose in *T. Standleyi* and lanate in *T. glutinosum,* hirsute in *T. hispidum,* to stiffly hirsute in *T. aureum* and *T. Hintonii.* Considerable variation in thickness also occurs. The glandular hairs vary from a minutely globular-tipped hair to a relatively broad and flat-tipped hair. In some forms there are intermixtures of long and short, erect, recurved, or subappressed non-glandular and glandular hairs. Such a condition is shown in *T. macrostachyum.*

Inflorescence.—The inflorescence is always more or less spicate and terminal or lateral in position. Commonly, the spike has closely imbricated bracts, caused in part by the short internodes. Occasionally, as in *T. diffusum,* the longer internodes completely eliminate the imbrication of the floral bracts. The strongly decussating position of the floral bracts gives the inflorescence a conspicuous four-angled appearance, a character which is relatively constant throughout the genus.

Calyx.—The calyx is four- to five-lobed, the lobes filiform to lanceolate, diminutive and quite inconspicuous. The lobes usually bear on the outer surface in a lesser degree pubescence of the general type of the bract.

Corolla.—The corolla is tubular-infundibuliform and bilabiate. The tube is about half the length of the entire corolla and slightly expanded at the base. The anterior lip is three-lobed, the lobes varying from lanceolate to broadly ovate, and the middle lobe is more or less concave, usually enclosing in part the stamens and pistil. The posterior lip is lanceolate to broadly ovate, tending to broadness towards the apex, and entire to conspicuously emarginate at the apex. The surface is mostly glabrous but scattered hairs occur occasionally and in *T. platystegium* form an even pubescence, particularly on the outer surface. The buds are imbricated in aestivation.

Stamens.—There are two mostly terete filaments inserted at the base and near the margin of the middle lobe of the anterior lip, or, as in one species in Section II, near the margins of the lateral lobes of the anterior lip. On the filament near the base, a few scattered reflexed hairs are frequently present. Each filament bears two nearly parallel sporangia. The stamens are included and usually slightly shorter than the corolla. The pollen is ellipsoid to spherical.

Fruit.—The fruit consists of an obovate-oblong capsule constricted from the base to about one-third its total length. The seeds are borne on retinacula, usually four, rarely two, disciform, muriculate on one surface and glabrous on the other.

GEOGRAPHICAL DISTRIBUTION AND INTERSPECIFIC RELATIONSHIPS

The genus *Tetramerium* as delimited in the present paper includes twenty-three species and two varieties. Its general geographical distribution extends from southern United States, southeast to Colombia and Ecuador. One species, *T. nervosum,* occurs in the Galapagos Islands where it was possibly introduced. Considering the extent of this range and the relative abundance of species and individuals, the center of distribution of this genus falls in west-central Mexico. These plants for the most part grow in rather dry, more or less xerophytic situations at relatively low altitudes and are consequently limited largely to such habitat zones.

In the following chart, an attempt is made to indicate interspecific relationships within the genus.

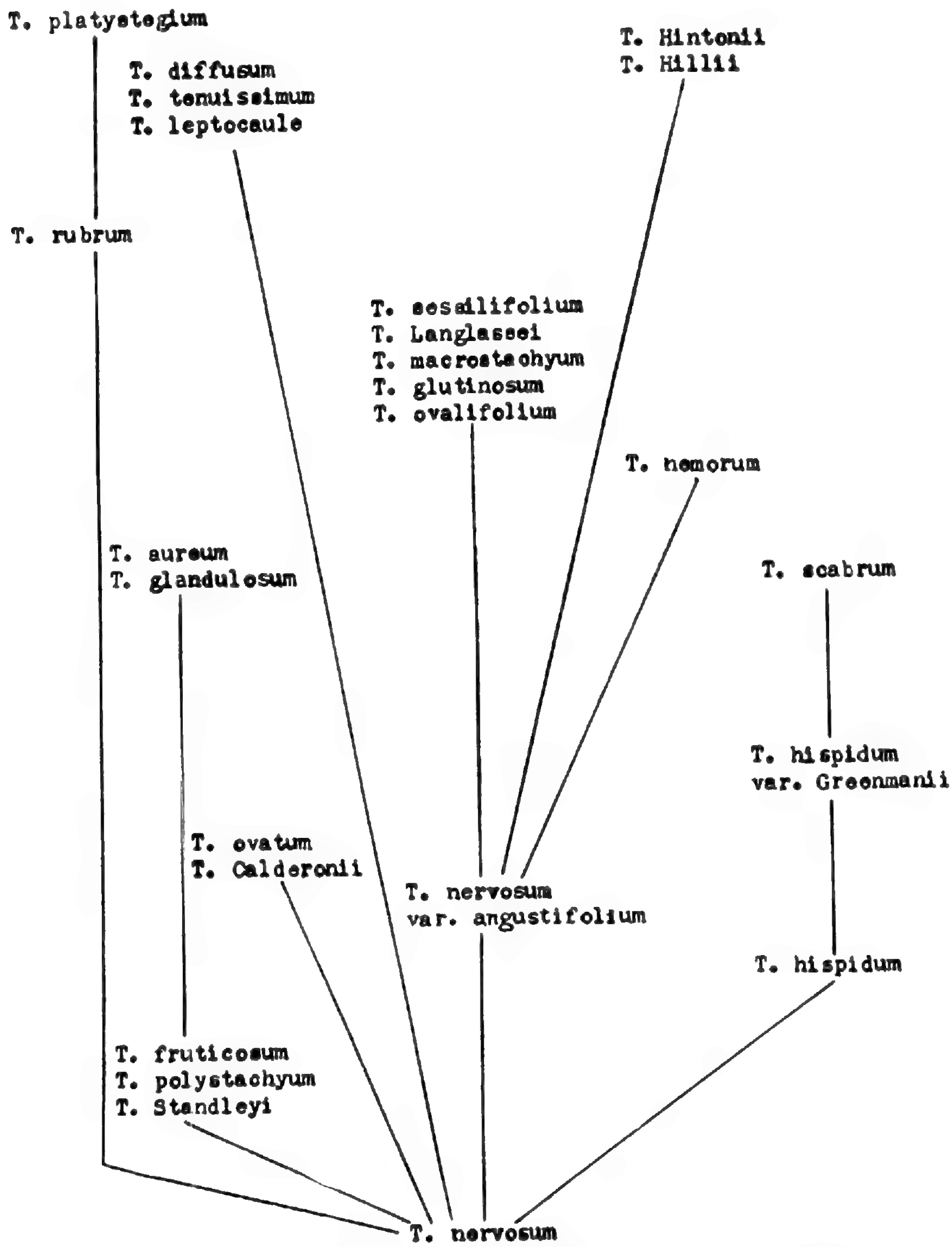

Fig. 1. Diagram to show interspecific relationships of *Tetramerium*.

TAXONOMY

Tetramerium Nees in Benth. Bot. Voy. Sulphur, p. 147. 1844; Nees in DC. Prodr. **11**: 467. 1847; Benth. & Hook Gen. Pl. **2**: 1121. 1876, in part; A. Gray, Syn. Fl. N. Amer. **2**[1]: 330. 1878; Hemsley, Biol. Cent.-Am. Bot. **2**: 525. 1882, in part; Lindau in Engler & Prantl, Nat. Pflanzenfam. IV, Abt. 3b, p. 331. 1895, in part, not *Tetramerium* Gaertn. f. Fruct. et Sem. **3**: 90. *pl. 196.* 1805.

Fruticose or suffruticose perennials. Roots fibrous. Stems erect to spreading-decumbent, occasionally 4-angled in cross-section, smooth, whitish, bearing exfoliating bark; branches opposite, shoots of the season arising from a ligneous base, pubescence distributed over the surface or disposed in two opposite lateral lines. Leaves opposite, sessile or petiolate, entire, rotund-ovate to linear, both surfaces pubescent to glabrous. Inflorescence terminal and axillary, spicate, more or less imbricated. Bracts single, herbaceous, opposite, entire, sessile to short-petiolate, loose or imbricated, cordate to linear, 3–5-nerved, pubescent to glabrous, ciliate, apex more or less mucronate, erect or recurved. Bracteoles 1 to several, herbaceous, sessile to short-petiolate, filiform to ovate-acuminate, pubescent to glabrous, ciliate. Inflorescence a 4-angled terminal or axillary spike. Flowers usually solitary, occasionally 2 or 3, sessile or short-pedicellate, subtended by bracts and bracteoles. Calyx 4–5-parted, cleft nearly to the base, lobes usually equal, filiform to ovate-acuminate, pubescent to glabrate, ciliate. Corolla tubular-infundibuliform, bilabiate, anterior lip 3-lobed, lip and all lobes oblanceolate to oblong, nearly equal, tube straight or slightly curved, one-half to two-thirds length of corolla, expanding slightly at base, abruptly dilating in throat. Stamens 2, inserted in the corolla-throat, wholly included; filaments long, cylindrical, gradually enlarging near the base, lower portion loosely and retrorsely hispidulous; anthers consisting of two uniformly fertile, oblong-obtuse sporangia somewhat converging towards the apex, one slightly longer at base, borne on a rather broad connective; pollen ellipsoid to spherical, pores 3, equatorial, 20 to 50 μ in diameter, surface minutely scrobiculate. Ovary biloculate, retinacula acuminate, ovules usually 4, rarely 2, stylar shaft surmounted by bifid stigma, base thickened, apex obtuse. Capsule obovate, apiculate, contracted below into a solid base, usually hispid, rarely glabrous towards the apex, dehiscing from the apex; seeds usually 4, rarely 2, surface tuberculate or muriculate.

Type species: *Tetramerium nervosum* Nees in Benth. Bot. Voy. Sulphur, p. 148, *pl. 48.* 1844.

KEY TO THE SECTIONS

A. Tube equal to one-half length of corolla.................................Section I. EUTETRAMERIUM. Spp. 1–21

AA. Tube equal to two-thirds length of corolla.................................Section II. TORREYELLA. Spp. 22–23

Section I. EUTETRAMERIUM, n. sect. Leaves linear to cordate. Bracts linear to cordate. Calyx-lobes 4 or 5. Corolla-tube one-half the total length of corolla. Stamens inserted on middle lobe of anterior lip of corolla. Pollen-grains ellipsoid. Capsule terete. Seeds usually 4, infrequently 2, 1–2.2 × 0.8–2 mm. Species 1–21 incl.

KEY TO THE SPECIES

A. Bracts of the inflorescence rotund-ovate, ovate-oblong to ovate-elliptic.
- B. Bracts rotund-ovate to ovate, slightly longer than broad.
  - C. Bracts pubescent or puberulent, usually without gland-tipped hairs intermixed.
    - D. Bracts hirsute-pubescent on the surface.
      - E. Leaves rather broadly ovate......................*1. T. nervosum*
      - EE. Leaves mostly narrowly ovate to lanceolate...........................*1a. T. nervosum* var. *angustifolium*
    - DD. Bracts hirsute-puberulent on the surface.
      - F. Bracts strongly constricted at the base; calyx-lobes 5....*2. T. ovatum*
      - FF. Bracts not strongly constricted at the base; calyx-lobes 4...*3. T. Standleyi*
  - CC. Bracts glandular-pubescent or glandular-puberulent.
    - G. Stems conspicuously hirsute; leaves distinctly glandular-pubescent...*4. T. Hillii*
    - GG. Stems not conspicuously hirsute; leaves neither distinctly glandular nor pubescent.................................*5. T. leptocaule*
- BB. Bracts ovate-oblong to elliptic, usually much longer than broad.
  - H. Bracts mostly ovate-oblong, not conspicuously ciliate....*6. T. fruticosum*

HH. Bracts mostly ovate-elliptic, usually conspicuously ciliate.
I. Leaves ovate-elliptic to lanceolate-elliptic; bracts closely pilose on the veins; calyx-lobes 5 .... *7. T. ovalifolium*
II. Leaves ovate to lanceolate; bracts sparsely hirsute on the veins; calyx-lobes 4 .... *8. T. Calderonii*
AA. Bracts of the inflorescence ovate-lanceolate, obovate-lanceolate to linear.
J. Bracts ovate-lanceolate, obovate-lanceolate to lanceolate.
K. Bracts ovate-lanceolate to obovate-lanceolate, mostly abruptly acuminate near the apex, not gradually acuminate.
L. Bracts ovate-lanceolate .... *17. T. hispidum*
LL. Bracts obovate-lanceolate.
M. Leaves not cordate .... *9. T. macrostachyum*
MM. Leaves cordate .... *10. T. nemorum*
KK. Bracts lanceolate-ovate to linear, mostly cuneate to gradually acuminate near the apex.
N. Leaves usually sessile .... *11. T. sessilifolium*
NN. Leaves petiolate.
O. Bracts pubescent with gland-tipped hairs intermixed.
P. Pubescence of bracts flaccid-hirsute, with long gland-tipped hairs intermixed.
Q. Bracts sublanate, with glandular hairs intermixed .... *12. T. glutinosum*
QQ. Bracts not sublanate, pubescent with gland-tipped hairs intermixed.
R. Leaves sparsely hirsute-pubescent ...... *13. T. Langlassei*
RR. Leaves densely glandular-pubescent ...... *14. T. Hintonii*
PP. Pubescence of bracts glandular-hirtellous or hirtellous, with minute gland-tipped hairs intermixed.
S. Secondary leaves lanceolate-ovate to ovate; bracts glandular-hirtellous; calyx lobes 4 .... *15. T. polystachyum*
SS. Secondary leaves elliptic-ovate to oblong-lanceolate; bracts hirtellous with minute gland-tipped hairs intermixed; calyx-lobes 5 .... *16. T. tenuissimum*
OO. Bracts hirsute-pubescent, usually without gland-tipped hairs intermixed .... *17. T. hispidum*
JJ. Bracts lanceolate-oblong, oblanceolate-linear to linear.
T. Bracts lanceolate-oblong, hirsute-pubescent with short gland-tipped hairs intermixed.
U. Bracts strongly recurved .... *17a. T. hispidum* var. *Greenmanii*
UU. Bracts erect .... *18. T. scabrum*
TT. Bracts lanceolate-linear, oblanceolate-linear to linear, mostly conspicuously glandular-pubescent or merely glandular-hirtellous.
V. Stems not copiously branched near the base; branches stout; bracts of the inflorescence crowded.
W. Leaves cuneate to subcordate at the base; petioles not densely glandular-puberulent .... *19. T. glandulosum*

WW. Leaves cuneate to rounded at the base; petioles densely glandular-pubescent..*20. T. aureum*
VV. Stems much-branched near the base; branches slender; bracts of the inflorescence remote....................................*21. T. diffusum*

1. T. nervosum Nees in Benth. Bot. Voy. Sulphur, p. 148, *pl. 48.* 1844; DC. Prodr. **11**: 468. 1847; Seem. Bot. Voy. Herald, p. 325. 1856; Torr. in Bot. U. S. & Mex. Bound. Surv. **2**: 125. 1859; Hemsl. Biol. Cent.-Am. Bot. **2**: 526. 1882; Rob. Proc. Amer. Acad. **38**: 204, 234. 1902, as *T. hispidum.*

Pls. 27, 31–33.

Stem branched, branches spreading, slender, at first evenly pubescent, later pubescent in lines, or glabrous; leaves ovate, 1.5–3.5 cm. long, 1–3 cm. broad, acuminate, acute, subcordate to obtuse at the base, sparsely pubescent on both surfaces, more conspicuously so on the midrib and nerves; petiole 0.5–2 cm. long, pubescent to glabrous; inflorescence a closely imbricated spike, 1–4 cm. long; bracts rotund-ovate to ovate, 6–10 mm. long, 5–7 mm. broad, short-acuminate or cuspidate at the apex, rounded, abruptly contracted below the middle into a subpetiolate base, appressed-hispidulous and intermixed with multicellular hispid hairs on the outer surface, more conspicuously so on the nerves, closely hispid-ciliate, mucronate tip 0.5–1 mm. long, more or less recurved; bracteoles 1–3, linear-lanceolate, 2–3.2 mm. long, hispid; calyx-lobes 4, linear-lanceolate, about 2 mm. long, hispid; corolla 10 mm. long, middle lobe of the anterior lip obovate-oblong, 5 mm. long, 1.8 mm. broad, concave, lateral lobes obovate-oblong, 5.5 mm. long, 2 mm. broad, posterior lip oblong-obovate, 5.4 mm. long, 1.3 mm. broad, subemarginate; pollen-grain about $28 \times 20\ \mu$; capsule 5 mm. long, 1.8 mm. broad, hirsute near the apex, the constricted base 2 mm. long; seeds 4, 1.5×1.2 mm.

Distribution: Central America to northern South America, and the Galapagos Islands.

Guatemala: Agua Blanca, Nov. 1913, *Tejada 95* (US).

Salvador: vicinity of Santa Ana, Dept. Santa Ana, alt. 655–800 m., 8 Jan. 1922, *Standley 19705* (G, US, NY); vicinity of Sonsonate, Dept. Sonsonate, alt. 220–300 m., 18–27 March 1922, *Standley 21770* (G, US).

Nicaragua: without definite locality, coll. of 1867–68, *Tate 296* (K).

Panama: Penonome and vicinity, alt. 15–300 m., 23 Feb.–22 March 1908, *Wil-*

liams 176 (US); Taboga Island, 26–27 Feb. 1923, *Macbride 2787* (G); same locality and date, *Macbride 2789* (US, NY, F); Taboga Island, Dec. 1923, *Standley 27042, 27866, 27979* (US); Balboa, Canal Zone, thicket, Nov. 1923–Jan. 1924, *Standley 32111* (US).

COLOMBIA: Santa Marta, coll. 1822, *Bertero, without number* (M, B, Utrecht); thicket, Dept. Bolivar, alt. 120–170 m., 25 Jan. 1918, *Pennell 4026* (US); Santa Marta, 1898–99, *H. H. Smith 1408* (US, NY, M, B, F, PhilAcad); same locality and date, *H. H. Smith 1973* (US, NY, M, F, PhilAcad).

ECUADOR: Recreo, 16 Dec. 1896, *Eggers 15466* (F); Puna, Guayaquil, without date, *Sinclair, without number* (K TYPE, M photo).

GALAPAGOS ISLANDS: ALBEMARLE ISLAND: without definite locality or date, *Darwin, without number* (K); Iguana Cove, 21 May 1932, *Howell 9408* (CalAcad); Iguana Cove, 30 Dec. 1898, *Snodgrass & Heller 34* (G, US), and 4 March 1899, *87* (G, D); Tagus Cove, alt. "from coast" to 400 m., June 1899, *Snodgrass & Heller 213* (G, D); North Mt., Elizabeth Bay, 25 Feb. 1899, *Snodgrass & Heller 288* (G, US); Crowley Bay, alt. 550 m., 10 Aug. 1905–06, *Stewart 3462* (G); side of cliff above Iguana Cove, 17 March 1905–06, *Stewart 3464* (G, US, M, CalAcad).—INDEFATIGABLE ISLAND: Academy Bay, lower parts, 12 July 1905–06, *Stewart 3469*, and north side, alt. above 60 m., 24 Nov. 1905–06, *3470* (CalAcad).—JAMES ISLAND: lava beds, north side, James Bay, 6 Aug. 1905–06, *Stewart 3471* (G, CalAcad); James Bay, alt. 390 m., 26 Dec. 1905–06, *Stewart 3472* (G); James Bay, 4 June 1932, *Howell 9654* (CalAcad).

The type specimen of this species has broad ovate leaves and broad ovate-rotund bracts with intermixed closely puberulent and longer hispid hairs on the outer surface. The rather close arrangement of the imbrication in the inflorescence presents a noticeable four-angled appearance in cross-section. The species differs noticeably from *T. hispidum*, probably the most widespread species, in having broader leaves and bracts and a more closely imbricated inflorescence.

1a. T. nervosum Nees var. **angustifolium** Nees in DC. Prodr. **11**: 468. 1847; Seem. Bot. Voy. Herald, p. 325. 1856; Hemsl. Biol. Cent.-Am. Bot. **2**: 526. 1882.

Stems slender; leaves lanceolate to lanceolate-ovate; bracts ovate-oblong, 8–9 mm. long, 5–6 mm. broad, glabrate except for a few scattered appressed-hirsute hairs along the nerves on the outer surface, conspicuously hirsute-ciliate, apex more or less erect.

DISTRIBUTION: western and southern Mexico.

SINALOA: Mazatlan, alt. 10 m., Dec. 1925, *Ortega 5984* (G, US, PhilAcad).

NAYARIT: without definite locality and date, *Sinclair, without number* (K TYPE, M photo); Tiger Mine, Acaponeta, 1 March 1927, *Jones 23042* (P); Acaponeta, Feb. 1895, *Lamb 620* (G, NY); vicinity of Acaponeta, April 1910, *Rose, Standley & Russell 14277* (G, US, NY).

GUERRERO: southeastern Guerrero, 10 May 1930, *A. Schultze 503* (B).

This variety differs from the species in having narrower and more slender lanceolate leaves, bracts tending towards the oblong-ovate type, with less pubescence on the surface, and a closer ciliation. It also has a more northern geographical distribution.

2. T. ovatum Oersted in Kjoeb. Vidensk. Meddel. p. 169. 1854; Hemsl. Biol. Cent.-Am. Bot. **2**: 526. 1882.

Stems branched, stoutish, at first evenly pilose, later pilose in lines, or glabrous; leaves lanceolate to lanceolate-ovate, 1.5–5 cm. long, 0.1–3 cm. broad, glabrous on both surfaces, or occasionally with scattered pilose hairs, more distinctly so on the midrib and nerves, inconspicuously pilose-ciliate; petioles 0.1–2 cm. long, evenly pilose to pubescent in lines; inflorescences more or less loosely spicate, spikes 1–4 cm. long, internodes 1–2 mm. long; bracts ovate to obovate, 6–8 mm. long, 5–6 mm. broad, rounded and mucronate at the apex, abruptly contracted below the middle into a subpetiolate base, about 2 mm. long, nerves prominent, closely puberulent on the outer surface, closely-ciliate, erect at the apex, mucro about 0.4 mm. long; bracteoles sometimes 2, lanceolate-linear, 3 mm. long, pubescent; calyx-lobes 5, linear-lanceolate, pubescent; corolla 16 mm. long, middle lobe of the anterior lip obovate, 7 mm. long, 3 mm. broad, concave, lateral lobes oblanceolate-ovate, 8 mm. long, 3 mm. broad, posterior lip obovate-oblong, 7.5 mm. long, 2.7 mm. broad, emarginate; pollen-grains $28 \times 20\ \mu$; capsule 4 mm. long, 2 mm. broad, pubescent near the apex, the constricted base about 1.5 mm. long; seeds 4, 1.2×1 mm.

DISTRIBUTION: southern Mexico.

OAXACA: Puerto Angel, "at sea-level," 12 April 1933, *Morton & Makrinius 2620* (US); San Augustine, Oct. 1842, *Liebmann 10753* (US, B, K, Cop TYPE, M photo, F photo).

This species is closely related to *T. nervosum,* but differs in having bracts with a longer subpetiolate base, more obtuse to rounded apex, more prominent nerves, and a closer short puberulence on the outer surface.

3. T. Standleyi Happ, n. sp.[3]

Shrub about 0.5–1.3 m. high; stems branched, slender, at first evenly pilose, later the pubescence disposed in lines, or glabrous; leaves ovate to lanceolate-ovate, 2–3 cm. long, 0.5–1 cm. broad, mostly glabrate on both surfaces, occasionally with inconspicuous sparsely scattered hairs on the midrib and nerves; petioles 1–3 mm. long, evenly and inconspicuously pubescent to glabrous; inflorescences more or less loosely spicate, spikes 1–4.5 cm. long; bracts mostly ovate to rotund-ovate, about 12 mm. long, 7–8 mm. broad, mucronate, obtusish to rounded, mostly rounded at the base, closely and minutely appressed-puberulent on both surfaces, sparsely hirsute-ciliate, apex erect, mucro inconspicuous; bracteoles 2, lanceolate-linear, 4 mm. long, hirsute; calyx-lobes 4, linear-lanceolate, 2 mm. long, hirsute; corolla about 16 mm. long, middle lobe of the anterior lip oblong-obovate, about 8 mm. long, 2 mm. broad, concave, lateral lobes obovate-oblong, about 8 mm. long, 3 mm. broad, posterior lip oblong-obovate, about 8 mm. long, 2 mm. broad, subemarginate; capsules about 6 mm. long, 2 mm. broad, hirtellous near the apex, the constricted base 1.5 mm. long; seeds 4, 1.7×1.2 mm.

Distribution: Salvador.

San Salvador: La Union, 12 Dec. 1895, *Brenning 193* (B); vicinity of La Union, Dept. La Union, alt. 150 m. or less, 13–21 Feb. 1922, *Standley 20680* (G, US type, NY, M photo); vicinity of San Miguel, Dept. San Miguel, alt. about 110 m., 24–27 Feb. 1922, *Standley 21057* (G, US, NY); vicinity of San Vicente, Dept. San Vicente, alt. 350–500 m., *Standley 21171* (G, US); San Francisco, coll. of 1929, *Calderon 2486* (US, F).

This species appears to be rather generally distributed in certain sections of Salvador. Further collections should con-

[3] **T. Standleyi** Happ, sp. nov., herbacea perennis; caulibus ramosis et gracilibus, pubescentibus vel glabris; foliis ovatis vel lanceolato-ovatis, 2–3 cm. longis, 0.5–1 cm. latis, parce pubescentibus vel glabris; petiolis 1–3 mm. longis; spicis 1–4.5 cm. longis, laxis; bracteis ovatis vel rotundo-ovatis, 12 mm. longis, 7–8 mm. latis, apice obtusis vel rotundis, basi rotundis, utrinque minute adpresso-puberulis, parce hirsuto-ciliatis, mucrone obscuro; bracteolis 2, lanceolato-linearibus, 4 mm. longis; calyce 4-partito; corolla 16 mm. longa.—Collected in the vicinity of La Union, Dept. La Union, San Salvador, alt. about 150 m., 13–21 Feb., 1922, *Standley 20680* (U. S. Nat. Herb., type).

tribute additional information as to its more exact range and abundance. The rather loose inflorescence, the erect obtusish apex of the bracts, and the closely appressed, soft puberulence on the surface of the bracts are distinctive characters.

4. **T. Hillii** Happ, n. sp.[4]

Plant about 1 m. high; stems branched, slender, at first evenly glandular-hirsute, later pubescent in lines, or glabrous; leaves ovate to elliptic-lanceolate, 1–2.5 cm. long, 0.5–1 cm. broad, acuminate, acute to obtusish at base, mostly 2–4-nerved on either side of the midrib, scabrous, glandular-hirtellous intermixed with longer gland-tipped hairs, more conspicuously so on the midrib and nerves; petioles 1–6 mm. long, evenly glandular-pubescent; inflorescences more or less closely spicate, spikes 1–3 cm. long, internodes 1.5–3 mm. long; bracts ovate to rotund-ovate, 6–9 mm. long, about 4 mm. wide, mucronate, often abruptly contracted below the middle to a subpetiolate base, glandular-hirtellous intermixed with scattered multicellular gland-tipped hairs, slightly recurved near the apex, mucro 0.2–0.5 mm. long, conspicuously recurved; bracteoles 2, linear-lanceolate, 6–8 mm. long, about 1 mm. broad, obtuse, glandular-puberulent intermixed with longer simple hairs; calyx-lobes 5, filiform, about 5 mm. long, minutely glandular-puberulent intermixed with scattered longer hairs; corolla 20–22 mm. long, blue and white, the middle lobe of the anterior lip subsagittate and abruptly narrowed below the middle to the base, about 12 mm. long and 7 mm. broad, concave, lateral lobes obovate-oblong, about 13 mm. long and 7 mm. broad, obtuse, posterior lip oblong-obovate, usually 12.5 mm. long, 4 mm. broad, emarginate; pollen-grains about $29 \times 21\ \mu$;

[4] **T. Hillii** Happ, sp. nov.; caulibus ramosis gracilibusque, glanduloso-hirsutis vel glabris; foliis ovatis vel elliptico-lanceolatis, 1–2.5 cm. longis, 0.5–1 cm. latis, apice acuto basi acuto vel obtuso, utrinque ex medio-nervo 2–4 nervis, utrinque parce glanduloso-hirtellis et parce glanduloso-pilosis; spicis plus minusve densis, 1–3 cm. longis, internodiis 1.5–3 mm. longis; bracteis rotundo-ovatis, 6–9 mm. longis, 4 mm. latis, apice acuminato, basi obtuso, glanduloso-puberulis et glanduloso-pilosis, mucrone saepe recurvo; bracteolis 2; calyce 5-partito; corolla 20–22 mm. longa.—Collected at Coyuca-Ancon, Distr. Coyuca, Guerrero, Mexico, 3 March 1934, *Hinton 5724* (Herb. Roy Bot. Gard. Kew, TYPE).

capsules about 6 mm. long, 2.5 mm. broad, glabrous; the constricted base 2 mm. long; seeds 4, 1.8 × 1.6 mm.

DISTRIBUTION: southwestern Mexico.

GUERRERO: Coyuca-Ancon, Distr. Coyuca, 3 March 1934, *Hinton 5724* (K TYPE, M, M photo).

This species can be readily distinguished from its nearest ally, *T. Hintonii,* by the more ovate-elliptic leaves, looser and less glandular pubescence on the leaf surface, fewer and less conspicuous nerves on either side of the leaf midrib, and the more obtuse apex of the bracts.

5. T. leptocaule Happ, n. sp.[5]

Plant 1–5 dm. high; stems branched, slender, at first evenly pubescent and glandular-puberulent, later pubescent in lines, or glabrous; leaves lanceolate to ovate, 0.5–5 cm. long, 0.3–3 cm. broad, acuminate, obtusish, acute to obtuse at the base, at first sparingly pubescent, later glabrate and minutely glandular-puberulent; petioles 0.1–2.5 cm. long, evenly pubescent to pubescent in lines, or glabrous; inflorescences more or less loosely spicate, spikes 1–3 cm. long, internodes usually 2–3 mm. long; bracts mostly ovate, 4–6 mm. long, 2.5–3 mm. broad, mucronate, acute to mostly obtuse or rounded, obtuse to rounded at the base, minutely glandular-puberulent occasionally intermixed with longer hirsute hairs, erect at the apex, mucro about 0.2 mm. long; bracteoles 2, 2–3 mm. long, 0.2 mm. broad, linear, puberulent; calyx-lobes 5, filiform, about 2 mm. long, puberulent; corolla about 10 mm. long, middle lobe of the anterior lip obovate-oblong, about 5 mm. long, 2 mm. broad, slightly concave, lateral lobes lanceolate-obovate, 5–6 mm. long, about 2.5

[5] **T. leptocaule** Happ, sp. nov., herbacea perennis; caulibus ramosis gracilibusque, pubescentibus et glanduloso-puberulis vel glabris; foliis lanceolato-ovatis, 0.5–5 cm. longis, 0.3–3 cm. latis, parce pubescentibus et minute glanduloso-puberulis vel glabris; petiolis 0.1–2 cm. longis; spicis plus minusque laxis, 1–3 cm. longis, internodiis 2–3 mm. longis; bracteis ovatis, 4–6 mm. longis, circiter 3 mm. latis, glanduloso-puberulis et parce pubescentibus, apice erecto; bracteolis 2, circiter 3 mm. longis, puberulis; calyce 5-partito; corolla circiter 10 mm. longa.—Collected on dry llano, Tacupa, Distr. Huetamo, Michoacan, Mexico, 17 Jan. 1934, *Hinton 5494* (Herb. Roy. Bot. Gard. Kew, TYPE).

mm. broad, posterior lip obovate, narrowed at the base, about 5.5 mm. long, 2.5 mm. broad, subemarginate; stigma inconspicuously 2-lobed, stigmatic surface protruded upwardly; pollen-grains about $18 \times 23\ \mu$; capsules about 3.5 mm. long and 1 mm. broad, puberulent from the apex nearly to the base, constricted base about 1 mm. long; seeds 4, about 0.7×0.8 mm.

DISTRIBUTION: southwestern Mexico.

MICHOACAN: dry llano, Tacupa, Distr. Huetamo, 17 Jan. 1934, *Hinton 5494* (K TYPE, M, M photo).

GUERRERO: barranca, Jaripo, Distr. Coyuca, 27 March 1934, *Hinton 5841* (K, M, M photo).

The more lanceolate secondary leaves, the occasionally longer pubescence on the leaf surface, and the more obtuse bracts distinguish this species from the closely related *T. tenuissimum.*

6. T. fruticosum T. S. Brandegee in Zoe **5**: 171. 1903.

Frutescent plant, 1–3 dm. high; stems freely branched, branches slender, at first minutely puberulent intermixed with sparsely scattered longer hairs, later inconspicuously pubescent in lines, or glabrous; leaves lanceolate to ovate, 1–3 cm. long, 0.5–1 cm. broad, gradually acuminate, mucronate, rounded to obtuse at the base, at first puberulent intermixed with longer hairs, more conspicuously so on the midrib and nerves, ciliate, later glabrate; inflorescences more or less loosely spicate, spikes 1–6 cm. long, internodes usually 2 mm. long; bracts oblong-ovate, 7–15 mm. long, 4–6 mm. broad, gradually acuminate, rounded to subtruncate, mucronate, cuneate and gradually narrowed below the middle into a subpetiolate base, at first closely glandular-puberulent intermixed with sparsely scattered longer hairs, later glabrate, inconspicuously ciliate, erect at the apex, mucro 0.2 mm. long; bracteoles 2, linear-lanceolate, 7–10 mm. long, 0.5–0.8 mm. broad, pilose; calyx-lobes 5, lanceolate, 5 mm. long, pilose; corolla 10–12 mm. long, straw-colored, middle lobe of the anterior lip obovate, 5–6 mm. long, about 3 mm. broad, slightly concave, lateral lobes lanceolate-obovate, 6–7 mm. long, 3 mm. broad, posterior lip obovate, narrowed to the base, 6 mm. long, about 2.7 mm. broad, subemarginate; pollen-grains about 28 × 25 μ; capsules 5–6 mm. long, about 2 mm. broad, glabrous, the constricted base about 2 mm. long; seeds 4, 1.8 × 1.2 mm.

DISTRIBUTION: Lower California, Mexico.

LOWER CALIFORNIA: Purisima, Comondu, 15 Feb. 1889, *Brandegee 450* (NY, UCal); Cajoncito, Cape Region, 18 Oct. 1892, *Brandegee, without number* (UCal); "Central Baja California," without date, *Purpus, without number* (UCal); Cañons San Pablo, alt. 300 m., Jan.–March 1898, *Purpus 83* (US, F, UCal, D); San Jose del Cabo, coll. of 1901, *Purpus 489* (G, US, NY, M, M photo, UCal TYPE); above Primiera Agua, near Loreto, 20 Oct. 1930, *Jones 27390* (M).

As at present known, this species is confined to Lower California. The rather slender leaves and the oblong-ovate bracts, with a glandular-puberulent to glabrous surface and a sparse ciliation, are distinctive characters.

7. T. ovalifolium Oersted in Kjoeb. Vidensk. Meddel. p. 170. 1854; Hemsl. Biol. Cent.-Am. Bot. **2**: 526. 1882.

Stems branched, slender, at first evenly pilose, later pubescent in lines, or glabrous; leaves mostly ovate-elliptic, occasionally lanceolate-elliptic, 0.5–3 cm. long, 0.2–1.5 cm. broad, acuminate, obtusish-rounded, mucronate, cuneate below the middle into an obtuse base, at first scattered-pilose on both surfaces, more apparently so on the midrib and nerves, later glabrate, inconspicuously ciliate; petioles 0.1–1 cm. long, pilose; inflorescences closely spicate, spikes 1–3 cm. long, internodes usually 1 mm. long; bracts elliptic-obovate, 6–8 mm. long, 3–4 mm. broad, rounded, mucronate, gradually narrowed below the middle into a cuneate acute base, pilose on the outer surface, more conspicuously so on the nerves, closely ciliate, 0.8–1 mm. long, slightly recurved at the apex, mucro inconspicuous, 0.1–0.2 mm. long; bracteoles 2, lanceolate-linear, 5 mm. long, pilose; calyx-lobes 5, filiform, pilose; corolla 8–9 mm. long, middle lobe of the anterior lip obovate, 4 mm. long, 1.5 mm. broad, lateral lobes oblanceolate-obovate, 5 mm. long, 1.5 mm. broad, posterior lip obovate-oblong, 4.5 mm. long, 1.3 mm. broad, subemarginate; pollen-grains about 27 × 20 μ; capsule 4–5 mm. long, 2 mm. broad, glabrous, the constricted base about 1.5 mm. long, seeds 4, 1.2 × 1 mm.

DISTRIBUTION: central Mexico.

PUEBLA: "Achapulco," Dec. 1841, *Liebmann 10752* (Cop); "Chapulco," Dec. 1841, *Liebmann 10752* (K); "Achapulco," May 1842, *Liebmann 10752* (Cop TYPE, M photo, F photo).

This plant has a rather small elliptic-ovate leaf and a small elliptic bract with a close ciliation.

8. **T. Calderonii** Happ, n. sp.[6]

Suffrutescent plant; stems freely branched, at first evenly glandular-puberulent intermixed with simple hairs, later pilose in lines, or glabrous; leaves lanceolate-ovate to ovate, 1–6 cm. long, 0.5–3.5 cm. broad, long-acuminate, obtuse, sometimes mucronulate, obtuse to rounded at the base, at first with scattered appressed hairs on both surfaces, more conspicuously so on the midrib and nerves, later glabrate; petioles 0.2–3 cm. long, pilose to glabrous; inflorescences closely spicate, spikes 1–5 cm. long, internodes 1–2 mm. long; bracts elliptic-ovate, 10–12 mm. long, rounded, mucronate, rounded and abruptly contracted much below the middle to a subpetiolate base, sparsely hirsute, especially on the nerves, inconspicuously intermixed with scattered minute glandular-puberulent hairs, ciliate, apical portion erect, mucro 0.4 mm. long; bracteoles 2, linear-lanceolate, 6–7 mm. long, glandular-puberulent, ciliate; calyx-lobes 4, linear-lanceolate, 5 mm. long, sparsely puberulent, ciliate; corolla 16–17 mm. long, middle lobe of the anterior lip obovate-oblong, 9 mm. long, 3 mm. broad, concave, lateral lobes oblanceolate-ovate, 10 mm. long, 4 mm. broad, posterior lip oblong-ovate, 9.5 mm. long, 2.5 mm. broad, subemarginate, all lobes sparsely ciliate near the base; pollen-grains about $30 \times 20\ \mu$; capsule 4–5 mm. long, about 2 mm. broad, pu-

[6] **T. Calderonii** Happ, sp. nov., herbacea perennis; caulibus ramosis et gracilibus, glanduloso-puberulis et pilosis vel glabris; foliis lanceolato-ovatis vel ovatis, 1–6 cm. longis, 0.5–3.5 cm. latis, apice acuminato, basi obtuso vel rotundo, utrinque adpresso-pilosis vel glabratis; petiolis 0.2–3 cm. longis, pilosis vel glabris; spicis densis, 1–5 cm. longis, internodiis 1–2 mm. longis; bracteis elliptico-ovatis, 10–12 mm. longis, rotundis, basi abrupte contracto, sparse pilosis et minute glanduloso-puberulis, ciliatis; calyce 4-partito; corolla 16–17 mm. longa.—Collected at Hacienda Concordia, Dept. Usulután, Salvador, Jan. 1924, *Calderon 2098* (N. Y. Bot. Gard. Herb., TYPE).

berulent, more conspicuously so near the apex, the constricted base about 1.5 mm. long; seeds 4, 1.3 × 1.2 mm.

DISTRIBUTION: Salvador.

SALVADOR: Hacienda Concordia, Dept. Usulután, Jan. 1924, *Calderon 2098* (US, NY TYPE, M photo); Hacienda San Antonio, Dept. San Miguel, Jan. 1924, *Calderon 2123* (G, US); shaded bank, vicinity of Ahuachapan, Dept. Ahuachapan, alt. 800–1000 m., 9–27 Jan. 1922, *Standley 19736* (G, US, M).

This species with ovate-oblong bracts with erect apex and inconspicuous glandular-puberulence on the outer surface is quite distinct from its close ally, *T. nervosum*.

9. T. macrostachyum Happ, n. sp.[7]

Stems branched, branches slender, at first evenly pilose intermixed with inconspicuous gland-tipped hairs, later pubescent in lines, or glabrous; leaves lanceolate-ovate to lanceolate, 1–5 cm. long, 0.5–3 cm. broad, obtusish, mucronulate, rounded to obtuse at the base, at first appressed-pilose on both surfaces, more conspicuously so on the midrib and nerves, later sparsely so; petioles 0.3–1.5 cm. long, evenly pilose to pubescent in lines; inflorescences more or less loosely spicate, spikes 4–17 cm. long, internodes usually about 2 mm. long; bracts obovate-oblanceolate, 7–9 mm. long, 2.5–3.5 mm. broad, rounded to obtusish, mucronate, cuneate and contracted from above the middle into a subpetiolate base, conspicuously pilose sparsely intermixed with gland-tipped hairs, erect at the apex, mucro about 0.2 mm. long; bracteoles 2, lanceolate-linear, 6–8 mm. long, puberulent intermixed with inconspicuous gland-tipped hairs; calyx-lobes 5, filiform, about 3 mm. long, pubescent; corolla 16 mm. long, white, middle lobe of the anterior lip obovate, 8 mm. long, 4 mm. broad, concave, lobes oblanceolate-obovate, 9 mm. long, 4 mm. broad, posterior lip obovate-oblong, 7.5 mm. long, 3.8 mm.

[7] **T. macrostachyum** Happ, sp. nov., herbacea perennis; caulibus ramosis et gracilibus, piloso-glandulosis et pubescentibus vel glabratis; foliis lanceolato-ovatis, 1–5 cm. longis, 0.5–3 cm latis, apice acuminato, basi rotundo vel obtuso, utrinque adpresso-pilosis; inflorescentiis plus minusve laxis; spicis 4–17 cm. longis; bracteis obovato-lanceolatis, 7–9 mm. longis, 2.5–3.5 mm. latis, rotundis vel obtusis cuneatisque, supra medium ad basem subpetiolatum contractis, pilosis et parce glandulosis, erectis; calyce 5-partito; corolla 16 mm. longa; stigma exserta.—Collected at Orilla, Balsas River, Guerrero, Mexico, alt. 25 m., 12 May 1898, *Langlassé 161* (U. S. Nat. Herb., TYPE).

broad, subemarginate; stigma inconspicuously 2-lobed, stigmatic surface protruded upwardly; pollen-grains 28 × 20 μ; capsules 5 mm. long, 1.5 mm. broad, puberulent near the apex, the constricted base about 2 mm. long; seeds 4, 1 × 0.8 mm.

DISTRIBUTION: southwestern Mexico.

GUERRERO: Orilla, Balsas River, alt. 25 m., 12 May 1898, *Langlassé 161* (K, G, US TYPE, M photo).

The unusually long spike and the closely glandular-pilose bracts contracted above the middle to a narrow subpetiolate base are distinctive characters of this species.

10. T. nemorum T. S. Brandegee in Univ. Calif. Publ. Bot. **4**: 386. 1913.

Plant 3–5 dm. high; stems freely branched, branches slender, at first evenly and densely glandular-pilose, later pubescent in lines, or glabrous; leaves ovate, 1–4 cm. long, 1.5–2.5 cm. broad, acuminate, obtusish, cordate to truncate at the base, glandular-puberulent, more conspicuously so on the midrib and nerves, later sparsely puberulent occasionally intermixed with short gland-tipped hairs; inflorescences more or less loosely spicate, spikes 1–2 cm. long, internodes about 1 mm. long; bracts oblanceolate-elliptic, 6–7 mm. long, 1.5–2.5 mm. broad, rounded, mucronate, rounded and contracted above the middle into a subpetiolate base 3–4 mm. long, conspicuously pilose intermixed with glandular puberulence; bracteoles 2, linear-lanceolate, 5–6 mm. long, glandular-pilose; calyx-lobes 5, filiform, glandular-pilose; corolla 15 mm. long, middle lobe of the anterior lip obovate, 7 mm. long, 4 mm. broad, concave, lateral lobes oblanceolate-ovate, 8 mm. long, 4 mm. broad, posterior lip about 7.5 mm. long, 4 mm. broad, subemarginate; pollen-grains 20 × 25 μ; capsule 3.5 mm. long, 1.8 mm. broad, glabrous, the constricted base 1 mm. long; seeds 4, 1.0 × 0.9 mm.

DISTRIBUTION: southern Mexico.

VERA CRUZ: Baños del Carrizal, Aug. 1912, *Purpus 6071* (UCal TYPE, M photo).

The cordate leaf, short and inconspicuous spike, and the elliptic-ovate, densely pubescent bract are distinctive characters of this species and unusual in the genus.

11. T. sessilifolium Happ, n. sp.[8]

Plant 3–5 dm. high; stems slender, at first evenly glandular-pilose, later densely pilose in lines to glabrate; lower cauline leaves ovate, upper cauline leaves lanceolate to linear, 0.5–2.5 cm. long, 0.5–1.2 cm. broad, roundish-obtuse, mucronate, rounded to obtusish at the base, sparsely stoutish-pilose on both surfaces, inconspicuously recurved-ciliate; petioles of lower cauline leaves about 0.5 mm. long, upper cauline leaves sessile; inflorescences more or less closely spicate, spikes 2.5–3 cm. long, internodes usually 1–2 mm. long; bracts lanceolate-ovate, 8–11 mm. long, 3–6 mm. broad, acuminate, mucronate, slightly cuneate at the base, glandular-pilose, erect at the apex, mucro 0.5 mm. long; bracteoles 2, linear-lanceolate, 8–9 mm. long, 1 mm. broad, glandular-pilose; calyx-lobes 5, linear-lanceolate, 6 mm. long, glandular-pilose; corolla 11–12 mm. long, middle lobe of the anterior lip obovate, 6.5 mm. long, 2.5 mm. broad, lateral lobes oblanceolate-obovate, 7 mm. long, 2.8 mm. broad, posterior lip obovate-oblong, 6.8 mm. long, 2.3 mm. broad, subemarginate; pollen-grains about $28 \times 22\ \mu$; capsules 7.2 mm. long, 2.9 mm. broad, puberulent, more conspicuously so near the apex, the constricted base 3 mm. long; seeds 4, 2×1.8 mm.

DISTRIBUTION: southwestern Mexico.

JALISCO: near Chapala, 5 Oct. 1903, *Rose & Painter 7618* (US TYPE, M photo).

The sessile upper leaves and the acuminate lanceolate-ovate bracts, together with the rather soft glandular pubescence, are distinctive characters of this species.

12. T. glutinosum Lindau ex Loesen. in Bull. Herb. Boiss. **2:** 565. 1894.

Stems branched, branches stoutish, at first glandular-puberulent intermixed with longer glandular hairs, later densely

[8] **T. sessilifolium** Happ, sp. nov., herbacea perennis; caulibus ramosis et gracilibus, glanduloso-pilosis vel glabris; foliis ovatis vel lanceolato-linearibus, 0.5–2.5 cm. longis, 0.5–1.2 cm. latis, apice rotundo vel obtuso, basi rotundo, utrinque parce pilosis, sessilibus; spicis densis, 2.5–3 cm. longis; bracteis lanceolato-ovatis, 8–11 mm. longis, 3–6 mm. latis, acuminatis, basi subcuneato, glanduloso-pilosis; bracteolis 2, 8–9 mm. longis; calyce 5-partito; corolla 11–12 mm. longa.—Collected near Chapala, Jalisco, Mexico, 5 Oct. 1903, *Rose & Painter 7618* (U. S. Nat. Herb., TYPE).

lanate in lines; leaves elliptical to lanceolate-ovate, 1–5 cm. long, 0.4–2.2 mm. broad, in the early stages rounded, later gradually acuminate, obtusish, mucronulate, obtuse to acutish at the base, densely glandular-lanate to somewhat tomentose on both surfaces; petioles 0.1–1 cm. long, glandular-puberulent intermixed with longer glandular to densely lanate hairs distributed in lines; inflorescences closely spicate, spikes 1–3 cm. long, internodes usually 1–2 mm. long; bracts elliptic-ovate, 7–10 mm. long, 3–4 mm. broad, acuminate, obtuse, mucronate, slightly cuneate and narrowed below the middle to a subpetiolate base, densely glandular-puberulent intermixed with longer glandular hairs, erect at the apex, mucro 0.3 mm. long; bracteoles 2, linear to linear-lanceolate, 7–10 mm. long, 1–1.5 mm. broad, obtuse to rounded, mucronulate, pubescence similar to that of the bracts; calyx-lobes 5, lanceolate, 5–6 mm. long, puberulent; corolla 12 mm. long, anterior and posterior lips about 7 mm. long; pollen grains about $43 \times 30\ \mu$.

DISTRIBUTION: southern Mexico.
MORELOS: near Xochicalco, Distr. Cuernavaca, Dec. 1887, *Seler 401* (B TYPE).

This species is readily recognized on account of the sublanate character of the pubescence.

13. T. Langlassei Happ, n. sp.[9]

Stems branched; branches stoutish, at first glandular-puberulent intermixed with scattered glandular-pilose hairs, later puberulent and pubescent in lines, more or less glabrate; leaves on the lower branches lanceolate, 1–3.5 cm. long, 0.2–1 cm. broad, upper leaves frequently ovate, 5–6 cm. long, gradually acuminate, mucronate, rounded to subcordate at the base, at first glandular-puberulent occasionally intermixed with glan-

[9] **T. Langlassei** Happ, sp. nov., herbacea perennis; caulibus ramosis, glanduloso-puberulis et parce glanduloso-pilosis vel glabris; foliis lanceolatis vel ovatis, 1–6 cm. longis, 0.2–2 cm. latis, apice acuminato, basi rotundo vel subcordato, ultrinque glanduloso-puberulis et parce glanduloso-pilosis vel glabris; petiolis 0.2–1.5 cm. longis; spicis densis, circiter 1.2 cm. longis, internodiis 1 mm. longis; bracteis lanceolatis vel lanceolato-ovatis, 5–6 mm. longis, 1.5–2 mm. latis, apice acuminato, basi cuneato, glanduloso-puberulis et glanduloso-pilosis, apice parce recurvato; bracteolis 2; calyce 5-partito; corolla 14 mm. longa.—Collected at San Geromito, Guerrero, Mexico, alt. 75 m., *Langlassé 713* (Gray Herb. TYPE).

dular-pilose hairs on both surfaces, more conspicuously so on the midrib and nerves, later glabrate; petioles 0.2–1.5 cm. long, evenly glandular-puberulent occasionally intermixed with glandular-pilose hairs, to pubescent in lines; inflorescence closely spicate, spikes about 1.2 cm. long, internodes usually about 1 mm. long; bracts lanceolate to lanceolate-ovate, 5–6 mm. long, 1.5–2 mm. broad, acuminate, acute, mucronate, cuneate and gradually contracted below the middle into a subpetiolate base, glandular-puberulent closely intermixed with long simple pilose hairs, apex slightly recurved, mucro about 0.2 mm. long; bracteoles 2, lanceolate-linear, 4–5 mm. long, puberulent sparsely intermixed with pubescent hairs; calyx-lobes 5, filiform, 3–4 mm. long, glandular-pubescent; corolla 14 mm. long, white, middle lobe of the anterior lip obovate, 7 mm. long, 4 mm. broad, lateral lobes oblanceolate-obovate, 8 mm. long, 4 mm. broad, posterior lip oblong-obovate, about 7 mm. long, 3 mm. broad, subemarginate; pollen-grains about $25 \times 20\ \mu$; capsules 6 mm. long, 2 mm. broad, pubescent near the apex, the constricted base about 2 mm. long; seeds 4, 1.8×1.2 mm.

DISTRIBUTION: southwestern Mexico.

GUERRERO: San Geromito, alt. 75 m., *Langlassé 713* (G TYPE, US, K, B, M photo).

The rather large primary leaves, short spikes, and small densely pubescent, closely imbricated bracts render this species of easy recognition.

14. T. Hintonii Happ, n. sp.[10]

Plant 1 m. high; stems branched, at first densely glandular-pilose, later pilose in lines, more or less glabrate; leaves ovate to elliptical-lanceolate, 1–2.5 cm. long, 0.5–1 cm. broad, acumi-

[10] **T. Hintonii** Happ, sp. nov., herbacea perennis; caulibus ramosis et gracilibus, dense glanduloso-pilosis vel glabris; foliis ovatis vel elliptico-lanceolatis, 1–2.5 cm. longis, 0.5–1 cm. latis, apice acuminato, basi rotundo vel acuto, utrinque glanduloso-puberulis et glanduloso-pilosis vel glabris, utrinque ex medio-nervo 2–4 nervis; spicis plus minusve densis, 1–3 cm. longis, internodiis 1.5–3 mm. longis; bracteis ovatis vel lanceolato-ovatis, 6–9 mm. longis, 4–5 mm. latis, apice rotundis, infra medium cuneatis, glanduloso-puberulis et glanduloso-hirsutis, mucrone recurvato; bracteolis 2, 6–8 mm. longis; calyce 5-partito; corolla 20–22 mm. longa.—Collected on hill, Guayabal, Distr. Temascaltepec, Mexico, 12 Feb. 1933, *Hinton 3375* (Herb. Roy. Bot. Gard. Kew, TYPE).

nate, obtusish, mucronulate at the apex, rounded-obtuse to acutish at the base, glandular-puberulent intermixed with longer glandular hairs on both surfaces, more conspicuously so on the midrib and nerves; petioles 0.1–0.7 mm. long, glandular-puberulent intermixed with longer glandular hairs; inflorescences more or less closely spicate, spikes 1–3 cm. long, internodes usually 1.5 mm. long; bracts lanceolate-ovate, 6–9 mm. long, 4–5 mm. broad, mostly acuminate, acute, and moderately contracted below the middle to a subpetiolate base, glandular-puberulent intermixed with longer glandular hairs, erect at the apex, mucro 0.2–1.2 mm. long, conspicuously recurved; bracteoles 2, 6–8 mm. long, about 1 mm. broad, linear-lanceolate, obtuse, glandular-puberulent intermixed with glandular-pilose hairs; calyx-lobes 5, filiform, about 5 mm. long, minutely glandular-puberulent sparsely intermixed with glandular-pilose hairs; corolla 20–22 mm. long, blue and white, the middle lobe of the anterior lip subsagittate and abruptly narrowed below the middle to the base, 12 mm. long, 7 mm. broad, concave, lateral lobes obovate-oblong, 13 mm. long, 7 mm. broad, obtuse, posterior lip oblong-obovate, 12.5 mm. long, 4 mm. broad, subemarginate; pollen-grains about 28×20 μ; capsules 6 mm. long, 2.5 mm. broad, glabrous, the constricted base 2 mm. long; seeds 4, 1.8×1.6 mm.

DISTRIBUTION: southwestern Mexico.

MEXICO: hill, Guayabal, Distr. Temascaltepec, 12 Feb. 1933, *Hinton 3375* (K TYPE, M, M photo); dry hill, Bejucos, Distr. Temascaltepec, alt. 610 m., 3 Nov. 1933, *Hinton 3589* (K, M).

This species is distinguished from its near relative, *T. Hillii,* by the more costate condition of the leaves, acuminate bracts, and closer and more glandular pubescence.

15. T. polystachyum Nees in Benth. Bot. Voy. Sulphur, p. 148. 1844; DC. Prodr. **11**: 468. 1847; Seem. Bot. Voy. Herald, p. 325, *pl. 68.* 1856, excluding specimen *Seemann 2112;* Hemsl. Biol. Cent.-Am. Bot. **2**: 526. 1882.

Plant subcaespitose; stems freely branched, branches slender, at first evenly glandular-hirtellous intermixed with occasional long simple hairs, later pubescent in lines, or glabrous;

leaves lanceolate to ovate, 1–5 cm. long, 0.5–2.5 cm. broad, acuminate to obtusish, mucronate, acute to rounded at the base, at first scattered appressed-pilose on both surfaces, more conspicuously so on the midrib and nerves, later glabrate; petioles 0.2–1.5 cm. long, pilose to glabrous; inflorescences more or less loosely imbricated, spicate, spikes 1–7 cm. long, internodes mostly 2 mm. long; bracts lanceolate-ovate, 11–12 mm. long, 4–5 mm. broad, obtusish, mucronate, mucro about 0.5 mm. long, cuneate and gradually contracted below the middle into a subpetiolate base, densely glandular-puberulent very sparsely intermixed with scattered appressed hairs, sparsely ciliate, apex erect; bracteoles 2, lanceolate-linear, 4–5 mm. long, glandular-puberulent intermixed with scattered hirsute hairs; calyx-lobes 4, lanceolate-linear, 2–3 mm. long, glandular-puberulent intermixed with hirsute hairs; corolla 11 mm. long, middle lobe of the anterior lip obovate-oblong, 6 mm. long, 3 mm. broad, lateral lobes obovate-oblanceolate, 7 mm. long, 3 mm. broad, posterior lip obovate-oblong, 6.3 mm. long, 2.8 mm. broad, all lobes sparsely short-ciliate near the base; pollen-grains about $32 \times 20\ \mu$; capsules 5 mm. long, 2 mm. broad, the constricted base 1.5 mm. long; seeds 4, 1.5×1.3 mm.

DISTRIBUTION: Central America.

HONDURAS: Tiger Island, Gulf of Fonseca, *Sinclair, without number* (K TYPE, M photo); vicinity of Amapala, Tiger Island, alt. 250 m. or less, 14 Feb. 1922, *Standley 20700* (G, US, NY).

The glabrate leaves and lanceolate-ovate bracts with close glandular pubescence are important diagnostic characters of this species.

16. T. tenuissimum Rose in Contrib. U. S. Nat. Herb. **1:** 349. 1895.

Plant 3–4 dm. high; stems freely branched, branches slender, at first evenly puberulent, later pilose in lines, more or less glabrate; leaves lanceolate to ovate, 1–7 cm. long, 0.3–4.5 cm. broad, acuminate, obtuse, mucronulate, acutish to rounded at the base, glandular-pubescent to glabrate on both surfaces except for scattered hirsute hairs usually on the midrib and nerves; petioles 0.1–2.5 cm. long, evenly glandular-puberulent to pilose in lines; inflorescences more or less loosely spicate, spikes 1–5 cm. long, internodes usually 1–2 mm. long; bracts lanceolate-ovate, 5–7 mm. long, 2–3 mm. broad, acuminate, obtusish, mucronate, closely glandular-puberulent, inconspicuously pilose-ciliate, apex erect, mucro about 0.3 mm. long; bracteoles 2, linear-lanceolate, 5 mm. long, puberulent, ciliate; calyx-lobes 5, filiform, 3 mm. long, puberulent, ciliate; corolla about 12 mm. long, white, middle lobe of the anterior lip obovate, 5.5 mm. long, 2.5 mm. broad, lateral lobes oblanceolate-ovate, 6 mm. long, 2.5 mm. broad, posterior lip obovate-oblong, about 6 mm. long, 2.3 mm. broad, subemarginate; stigma inconspicuously 2-lobed, stigmatic surface protruded upwardly; pollen-grains about 25 × 20 μ; capsule 3.7 mm. long, 1.5 mm. broad, puberulent near the apex, the constricted base 1 mm. long; seeds 4, 1.2 × 1 mm.

DISTRIBUTION: southwestern Mexico.

COLIMA: without definite locality, Feb. 1891, *Palmer 1297* (G, US TYPE, NY, M photo).

The slender bracts, with inconspicuous glandular pubescence, and the slight habit of this species are unusual in the genus.

17. T. hispidum Nees in DC. Prodr. **11**: 468. 1847; A. Gray, Syn. Fl. N. Amer. **2**[1]: 331. 1878; Coult. in Contrib. U. S. Nat. Herb. **2**: 325. 1892; Lindau ex Loesen. in Bull. Herb. Boiss. **2**: 565. 1894; Standley in Contrib. U. S. Nat. Herb. **27**: 351. 1928. Pls. 28; 32, fig. 1; 33, figs. 3 & 8.

T. nervosum Nees var. *hispidum* Torr. in Emory, Bot. U. S. & Mex. Bound. Surv. **2**: 125. 1859.

Suffruticose plant, decumbent to ascending, 1 dm. to 1 m. high; stems several, freely branched, slender, at first evenly hispid, later pubescent in lines, to glabrate; leaves usually lanceolate to lanceolate-ovate, occasionally ovate, 0.5–5 cm. long, 0.1–2.5 cm. broad, usually acuminate to acute at the apex, acuminate to rarely subcordate at the base, at first scattered-pubescent on both surfaces, more conspicuously so on the midrib and nerves, later glabrate; petioles 0.1–1 cm. long, pubescent to glabrate; inflorescences more or less loosely spicate, spikes 1–5 cm. long; bracts usually lanceolate to lanceolate-ovate, occasionally ovate, usually acuminate to acute, occasionally obtusish at the apex, acuminate to acute at the base, contracted below the middle to a subpetiolate base, scattered-hispid on the outer surface, more conspicuously so on the nerves, hispid-ciliate, usually conspicuously recurved near the apex, mucro 0.5–0.8 mm. long; bracteoles 1–5, linear-lanceolate, 1–3 mm. long, hispidulous; calyx-lobes 4, linear-lanceolate, hispidulous; corolla 9–11 mm. long, middle lobe of the anterior lip oblong-obovate, about 5 mm. long, 1.3 mm. broad, obtusish at the apex, concave, lateral lobes ovate-oblong, about 5 mm. long, 2 mm. broad, posterior lip obovate, about 5 mm. long, 2 mm. broad, subemarginate; pollen-grains about $38 \times 20\ \mu$; capsules 4–5 mm. long, about 2 mm. broad, pubescent near the apex, the constricted base about 1.5 mm. long; seeds 4, 1.3×1.2 mm.

Distribution: southwestern United States, Mexico, and Central America.

United States.

Texas: "de Bejar a la colonia d' Austin," April 1828, *Berlandier 1640 = 370* (K).

New Mexico: "Bravo del Norte near Puercos River," without date, *Schott, without number* (F).

Arizona: Titcomb Lake, 11 July 1919, *Stalmach 192* (UTex); Stone Cabin Canyon, Santa Rita Mts., 20 Sept.–4 Oct. 1902, *Griffiths & Thornber 74* (US, UAriz); Santa Rita Forest Reserve, 8–13 Sept. 1902, *Griffiths 3439* (US); fenced area, Santa Rita Forest Reserve, 27 Sept.–4 Oct. 1903, *Griffiths 5957* (US, M); north slope of Santa Rita Mts., 29–31 Aug. 1904, *Griffiths 7006* (M); Santa Rita Mts., 2 Sept. 1929, *Kearney 5987* (US); foot-hills of the Santa Rita Mts., 6 May 1881, *Pringle, without number* (G, US, NY, M, F, PhilAcad, P); same locality, 11 June 1884, *Pringle, without number* (NY, F, PhilAcad); arid gravelly hillsides, Stone Cabin Canyon, Santa Rita Mts., 6–10 July 1903, *Thornber, without number* (UAriz); Stone Cabin Canyon, Santa Rita Mts., alt. 1300 m., 15 Oct. 1903, *Thornber 103* (US, NY, M, UCal, D, P, UAriz); Santa Rita Range Reserve, 29 Sept. 1913, *Wooton, without number* (US); Santa Rita Mts., 10 Sept. 1914, *Wooton, without number* (US); near Patagonia, Santa Cruz Co., 31 May 1930, *Harrison 7177* (US, P); 8 miles south of Vail, alt. 1100 m., 31 Aug. 1903, *Jones, without number* (P); "Babiroquivra Mts.," 19 Sept. 1929, *Jones 25003* (G, M, UCal, CalAcad, P, UTex); Patagonia, May 1902, *Orcutt, without number* (UCal); North Baboquivari Canyon, 11 Oct. 1925, *Peebles, Harrison & Kearney 399* (US); Baboquivari Mts., 21 Aug. 1932, *Peebles 8996* (US, P); Camp Crittenden, alt. 1400 m., coll. of 1874, *Rothrock 686* (G, US, F); South Cañon, Pima Co., 9 April 1928, *Thackery 127* (US).

Mexico.

Without Definite Locality: Mexican Boundary Survey, *without collector, 731* (US); "at locos mulcas," Dec. 1834, *Ehrenberg, without number* (B); "Bade by Grande," without date, *Ehrenberg 678* (G, B); "prope las ajuntas am Montezuma

Fluss,'' Jan. 1840, *Ehrenberg 1072* (G, B TYPE); without definite locality or date, *Parkinson, without number* (K); without definite locality or date, *Seler, without number* (US).

TAMAULIPAS: La Vegonia, vicinity of San José, alt. 800 m., 2 July 1930, *Bartlett 10032* (F); Cañon, La Tamaulipeca, vicinity of San Miguel, 29 July 1930, *Bartlett 10709* (US, F); Sierra de San Carlos, coll. of 1836, *Berlandier 3181* (G, NY, PhilAcad); vicinity of Victoria, alt. about 320 m., 1 Feb.–9 April 1907, *Palmer 86* (G, US, NY, M, F, UCal); Victoria, alt. 600 m., 23 March 1925, *Runyon 830* (US); base of mountains, near Victoria, alt. 400 m., 4 April 1926, *Runyon 943* (US); without definite locality, April 1926, *Runyon & Tharp 4053* (US).

NUEVO LEON: below Dawes, mountains near Monterey, alt. 600 m., July 1933, *C. H. & M. T. Mueller 297* (F); hills, near Monterey, 7 June 1888, *Pringle, without number* (F); calcareous soil, Monterey, alt. 500 m., 7 Sept. 1902, *Pringle 11080* (G, US, NY, M, F).

COAHUILA: Saltillo, coll. of 1878, *Parry 24* (G); Soledad, 25 miles southwest from Monclova, 9–19 Sept. 1880, *Palmer 1089* (G, US, NY, F, PhilAcad).

CHIHUAHUA: rocky hills, Santa Rosa, without date, *Bigelow, without number* (NY); Guayanopa Canyon, Sierra Madre Mts., alt. 1100 m., 24 Sept. 1903, *Jones, without number* (US, D, P); southwestern Chihuahua, Aug.–Sept. 1885, *Palmer 125* (G, US); same locality and date, *Palmer 125/203* (US, NY, K, PhilAcad).

SAN LUIS POTOSI: 22° N. Lat., alt. 1800–2500 m., coll. of 1878, *Parry & Palmer 700* (G, US, M, PhilAcad); Minas de San Rafael, Nov. 1910, *Purpus 4969* (M, F, UCal, P); Sierra de Guascama, June 1911, *Purpus 5230* (G, US, NY, M, F, UCal); near Tancanhuitz, Feb. 1888, *Seler 756* (B).

DURANGO: ''chaparrales zwischen Maximi u. Ojuelo,'' alt. 1300 m., 13 Sept. 1908, *Endlich 253* (B); sparingly about Iron Mt., city of Durango and vicinity, Sept. 1896, *Palmer 625* (G, US, NY, M, Cop, F, UCal).

SONORA: Canyon Sapopa, Rio Mayo, 19 Oct. 1934, *Gentry 1084* (M); Cochuto, alt. 1500 m., *Hartman 76* (G, US, F, UCal); gravelly wash in canyon, at head of San Carlos Bay, 8 July 1921, *Johnston 4362* (G, UCal, CalAcad); under shrubs, dry hills, 2 Dec. 1890, *Lloyd 443* (G); Magdalena, 6 Oct. 1922, *Orcutt 1352* (US); without definite locality, coll. of 1869, *Palmer 27* (G, US); Guaymas, Sept. 1887, *Palmer 240* (G, US); 5 miles below Minas Nuevas, 12 March 1910, *Rose, Standley & Russell 12672* (US, NY); along an arroya, vicinity of Alamos, 13 March 1910, *Rose, Standley & Russell 12741* (US, NY); hillsides, Santa Cruz, 25 Sept. 1857, *Thurber 918* (G, NY, F); along banks of dry stream, 5 mi. south of San Rafael, 21 Oct. 1932, *Wiggins 5942* (D); arroyo 2 mi. east of Rancho San Carlos, on road to Norio, 28 Oct. 1932, *Wiggins 6147* (D); valley of mountain stream near Sonoita, coll. of 1851, *Wright 1466* (G, NY, M, PhilAcad, UCal).

LOWER CALIFORNIA: ''Sierra de Laguna,'' 21 Jan. 1890, *Brandegee, without number* (NY, UCal).

ZACATECAS: without definite locality, *Coulter 1206* (G, K).

SINALOA: Mazatlan, 3 Nov. 1893, *Brandegee, without number* (US, UCal); Culiacan, 7 Sept. 1904, *Brandegee, without number* (G, US, UCal); Presidio de Mazatlan, 7 June 1849, *Gregg 1163* (M); San Blas, 30 Jan. 1927, *Jones 23043* (F, P); Rosario, Jan. 1895, *Lamb 454* (G, D); Cerro del Cajon, Pueblo de las Francas, alt. 65 m., Oct.–Nov. 1917, *Montes & Salazar 10* (US); Ymala, 25 Sept.–8 Oct. 1891, *Palmer 1726* (G, US), same locality and date, *1729* (US); Hacienda Oso, *Partida*

2008 (US); Rosario, 21 June 1897, *Rose 1399* (US); vicinity of Topolobampo, 23 March 1910, *Rose, Standley & Russell 13256* (US, NY); vicinity of Mazatlan, April 1910, *Rose, Standley & Russell 13762* (G, US, M, F); mountains at headwaters of Mazatlan River, Feb. 1889, *W. G. Wright 1295* (US, M, F, UCal, D).

NAYARIT: without definite locality, 5 Jan.–6 Feb. 1892, *Palmer, without number,* (US); Acaponeta, 23 June 1897, *Rose 1448* (US); vicinity of Jalisco, 10 Nov. 1925, *Ferris 5888* (D); Ingenio, Santiago, 2 June 1849, *Gregg 1076* (M).

GUANAJUATO: without definite locality, coll. of 1880, *Duges, without number* (G); without definite locality, coll. of 1889, *Duges 77* (G, US); dry mountains, without definite locality, coll. of 1891, *Duges 77* (G).

JALISCO: near "Amatitlan," uplands west of Guadalajara, 24 May 1849, *Gregg 866* (M); La Barranca, Guadalajara, 16 Nov. 1930, *Jones 27384* (M, P); Tuxpan, Feb. 1904, *Purpus 498* (US, UCal, P).

VERA CRUZ: fields, Rio de Santa Maria, Zacuapan and vicinity, Nov. 1906, *Purpus 2259* (G, US, NY, M, F, UCal); La Fernera, *Purpus 8237* (UCal); Remudadero, Dec. 1922, *Purpus 8867* (UCal, D), same locality, March 1923, *Purpus 9023* (UCal); rocky places, Remudadero, April 1927, *Purpus 11052* (F); rocky soil, Remudadero, Nov. 1926, *Purpus 11059* (US, F); rocky thorn forests near Rancho Remudadero, March 1928, *Purpus 11155* (PhilAcad); same locality and date, *Purpus 11155a* (D); rocky places, Rancho Remudadero, April 1930, *Purpus 11165* (Cop).

QUERETARO: Toliman, Dec. 1840, *Ehrenberg, without number* (P); near Queretaro, 20–23 Aug. 1906, *J. N. & J. S. Rose 11172* (US); Queretaro, coll. of 1910–13, *Arsène 10436* (US).

HIDALGO: Ixmiquilpan, Aug. 1905, *Purpus, without number* (P); Zimapan, without date, *Coulter 1205* (K).

PUEBLA: Coxcatlan, Sept. 1909, *Purpus 4182* (G, US, NY, UCal).

MEXICO: San Siminito, Tejupilco, Distr. Temascaltepec, 28 March 1932, *Hinton 437* (K); Rincón de Aquirres, Tejupilco, Distr. Temascaltepec, alt. 1290 m., 29 May 1932, *Hinton 711* (K); hill, Ypericones, Distr. Temascaltepec, alt. about 1500 m., 17 Dec. 1932, *Hinton 2963* (M, K); Plaza de Gallos, Distr. Temascaltepec, alt. 1200 m., 21 Dec. 1932, *Hinton 2991* (K).

MORELOS: Cuernavaca, 15 Nov. 1865–66, *Bourgeau 1261* (G, K, Utrecht); San Anton, Cuernavaca, 14 Oct. 1904, *Seler 4189* (G, B).

MICHOACAN: Quinceo, vicinity of Morelia, alt. 2800 m., 11 Nov. 1909, *Arsène 3244* (US, M, B); Punguato, vicinity of Morelia, alt. 1950 m., 25 Aug. 1918, *Arsène 6702* (US, M); Hacienda Coahuayula, Feb. 1901, *Emrick 172* (F); La Piedad, without date, *Alcala, without number* (F), same locality, without date, *Arriaga, without number* (F).

COLIMA: without definite locality, 9 Jan.–6 Feb. 1891, *Palmer 1132* (G, US, NY).

GUERRERO: "I. R. F. Balsas," Coyuca, Distr. Coyuca, 25 Jan. 1934, *Hinton 5546* (M, K); "Cerro grande bei Chalapa," Nov. 1929, *Schultze 225* (B).

OAXACA: valley of Etla, Sept. 1895, *Alvarez 738* (G); "Cerro de la Soledad," 20 Nov. 1895, *Seler 1367* (G, NY, B); Monte Alban, near Oaxaca City, alt. about 1700 m., 27 Nov. 1894, *C. L. Smith 728* (NY, M); Oaxaca Valley, alt. 1600 m., 4 Oct. 1894, *C. L. Smith 734* (US).

CAMPECHE: without definite locality or date, *Chrismar, without number* (B).

YUCATAN: Izamal, coll. of 1888, *Gaumer, without number* (F); open lands about Izamal coll. of 1895, *Gaumer 398* (G, US, NY, M, Cop, F, CalAcad); San Anselmo, without date, *Gaumer 1740* (M, F); Temax, without date, *Gaumer 1741* (F); Pocoboch, without date, *Gaumer 2341* (US, M, F, P); Calotmul, without date, *Gaumer 2342* (F, Cop); Kancabconot, March 1917, *Gaumer & Sons 23592* (US, NY, M, B, Cop, F, UCal, CalAcad); Colonia San Cosme, 20 Feb. 1906, *Greenman 351* (G, F); top of mound, Calotmul, 1 Jan. 1932, *Lundell 1147* (F); edges of copses, Chal-tun-ha road near Izamal, 14 Jan. 1895, *Millspaugh 78* (US, F, CalAcad); Progresso, 5 March 1899, *Millspaugh 1683* (F); Merida, 11 Feb. 1903, *Seler 3824* (G, B, F); in clearing, Chichen Itza, 11 June 1932, *Steere 1219* (US); near Merida, coll. of 1896, *Valdez 70* (G, US, NY, M, F, UMich).

SALVADOR: Hacienda San Antonio, Dept. San Miguel, Jan. 1924, *Calderon 2113* (US).

COSTA RICA: dry thicket, Bebedero, Provincia Guanacaste, "near sea level," 3 Feb. 1926, *Standley & Valerio 46694* (US).

This most widely distributed and abundant species is rather variable. The stem ranges from decumbent to erect. The bracts vary from ovate-lanceolate to lanceolate with a rather loose imbrication. The pubescence is generally of rather long and sparse hairs. The color of the corolla varies from white to deep yellow with occasional purplish spot-like markings.

17a. T. hispidum Nees var. **Greenmanii** Happ, n. var.[11]

Suffruticose plant, 1–2 dm. high; stems freely branched, branches slender; leaves lanceolate-ovate, acuminate, acute to somewhat mucronulate, acute to obtuse at the base; inflorescences more or less loosely spicate, spikes 1–7 cm. long; bracts lanceolate-oblong, 10–13 mm. long, about 3 mm. broad, conspicuously recurved, hispid on the outer surface, more noticeably so on the nerves, densely hispid-ciliate, the mucronate tip 0.5–0.8 mm. long; flowers creamy-white with striate purple lines; capsule about 5 mm. long, the constricted base 1 mm. long; seeds 4, 1.5×1.2 mm.

DISTRIBUTION: Nicaragua.

NICARAGUA: between Managua and Asososca, 24 Feb. 1922, *J. M. & M. T. Greenman 5627* (M TYPE); Managua, 14 Dec. 1925, *Chaves 44* (US).

The rather long, conspicuously recurved, densely ciliated bracts mark this variety.

[11] **T. hispidum** Nees var. **Greenmanii** Happ, var. nov., herbacea perennis; spicis plus minusve laxis; bracteis lanceolato-oblongis, 10–13 mm. longis, apice et basi acuminatis, glanduloso-hispidulis et hispidis, apice recurvato; cetero simili speciei.—Collected between Managua and Asososca, Nicaragua, 24 Feb. 1922, *J. M. & M. T. Greenman 5627* (Mo. Bot. Gard. Herb., TYPE).

18. T. scabrum Torr. n. sp. in herb.[12]

Suffruticose plant, 1–2 dm. high; stems freely branched, branches slender, at first evenly glandular-hispid, later pubescent in lines, more or less glabrate; leaves lanceolate to lanceolate-ovate, 1–2 cm. long, 0.4–0.8 cm. broad, closely glandular-hispidulous on both surfaces intermixed with scattered hispid hairs, more conspicuously so on the midrib and nerves, sparsely hispid-ciliate; petioles 1–3 mm. long, pubescent; inflorescences more or less loosely spicate, spikes 1–4 cm. long, internodes usually 1 mm. long; bracts lanceolate-linear, 7–8 mm. long, about 2 mm. broad, obtusish at the apex, mucronate, usually erect, long-cuneate at the base, densely glandular-puberulent intermixed with comparatively short, scattered hispid hairs, more conspicuously so on the nerves, closely ciliate, hairs about 1 mm. long; bracteoles 2, linear-lanceolate, 4–5 mm. long, glandular-puberulent, hispid-ciliate; calyx-lobes 4, linear-lanceolate, 3 mm. long, puberulent, ciliate; capsule about 4 mm. long, 2 mm. broad, puberulent near the apex, the constricted base 1 mm. long; seeds 4, 1.2 × 1 mm.

DISTRIBUTION: northern Mexico.

SONORA: gravelly hills, Fronteras, June 1851, *Thurber 432* (G, NY TYPE, M photo).

SAN LUIS POTOSI: without definite locality, coll. of 1871, *Virlet d'Aoust 810* (Cop).

This pronouncedly decumbent plant shows close affinities with *T. hispidum* in its general characters, but the lanceolate-linear bracts and glandular-hirtellous puberulence, together with its decumbent habit, mark it quite definitely as a distinct species.

19. T. glandulosum Oersted in Kjoeb. Vidensk. Meddel. 171. 1854; Hemsl. Biol. Centr.-Am. Bot. **2**: 526. 1882.

[12] **T. scabrum Torr.**, sp. nov., herbacea perennis; caulibus et ramis gracilibus, glanduloso-hispidis vel glabris; foliis lanceolatis vel lanceolato-ovatis, 1–2 cm. longis, 0.4–0.8 mm. latis, utrinque dense glanduloso-hispidulis, hispidis vel glabris; bracteis lanceolato-linearibus, 7–8 mm. longis, cuneatis, apice obtuso, basi acuto vel obtuso, dense glanduloso-hispidulis et sparse hispidis, mucrone erecto; bracteolis 2; calyce 4-partito.—Collected on gravelly hills, Fronteras, Sonora, Mexico, June 1851, *Thurber 432* (N. Y. Bot. Gard. Herb., TYPE).

Stems freely branched, branches stoutish, at first evenly and densely simple-pilose intermixed with shorter stipitate-glandular hairs, later pubescent in lines, or glabrous; leaves lanceolate-ovate to oblong-ovate, 1–8 cm. long, 0.3–5 cm. broad, acuminate, mucronulate to acute, obtuse to subcordate at the base, scattered-pilose, conspicuously so on the midrib and nerves on both surfaces; petioles 0.3–3.5 cm. long, pilose intermixed with short stipitate-glandular hairs; inflorescences more or less loosely spicate, spikes 1–5 cm. long; bracts oblong-linear to oblong-lanceolate, 7–9 mm. long, 1–2 mm. broad, obtuse to rounded at the apex, mucronate, closely glandular-puberulent intermixed with scattered pilose hairs, densely ciliate; bracteoles 2, linear, 5–6 mm. long, glandular-pubescent; calyx-lobes 5, linear-lanceolate, 3–4 mm. long, glandular-pubescent; corolla 21–23 mm. long, middle lobe of the anterior lip obovate-oblong, 12 mm. long, 6 mm. broad, slightly concave, lateral lobes obovate-oblong, 13 mm. long, 5 mm. broad, posterior lip oblong-obovate, about 11 mm. long, 4 mm. broad, subemarginate; pollen-grains about $37 \times 25\ \mu$; capsules and seeds not seen.

Distribution: southern Mexico.

Oaxaca: Amoloyas, 25 Dec. 1906, *Conzatti 1663* (F); Cuicatlan, alt. 500 m., 2 Dec. 1897, *Conzatti & Gongalez 645* (G); dry land near Lake Chapala, coll. of 1900, *Junvier, without number* (US); "Rio de las Vueltas," Dec. 1842, *Liebmann 10751* (B, Cop type, F photo, M photo); Tomellin Cañon, alt. 900 m., 17 May 1894, *Pringle 5852* (G, Cop); same locality, alt. 1000 m., 30 Nov. 1895, *Pringle 6174* (G, US, NY, M, F, PhilAcad, CalAcad); below Jayacatlan, alt. 1000 m., 9 Feb. 1895, *L. C. Smith 355* (G).

The broad leaves and linear-ovate bracts with rather hirsute pubescence mark this species.

20. T. aureum Rose in Contrib. U. S. Nat. Herb. **1**: 349. 1895. Pl. 33, fig. 4.

Plant 6–9 dm. high; stems freely branched, branches stoutish, at first evenly and densely glandular-pubescent, later glandular-hirsute in lines, glabrate; leaves lanceolate-linear to oblong-ovate, 1–8 cm. long, 0.2–3 cm. broad, long-acuminate, obtuse to acute, mucronulate, scattered-pilose on both surfaces, more closely so on the midrib and nerves, ciliate, later less conspicuously so; petioles 0.2–3 cm. long, glandular-pubescent; inflorescences more or less loosely spicate, spikes 1–4 cm. long, internodes usually 3 mm. long; flowers yellow; bracts linear-oblong to lanceolate-oblong, 7–8 mm. long, 0.8–1.5 mm. broad, acute to rounded at the apex, sometimes mucronate, densely glandular-puberulent intermixed with longer multicellular-glandular hairs; bracteoles 2, linear-oblong, 7–9 mm. long, 0.6–1 mm. broad, similarly pubescent; calyx-lobes 5, linear, 4–5 mm. long, glandular-pubescent; corolla 21–23 mm. long, middle lobe of the anterior lip obovate-oblong, 12 mm. long, 6 mm. broad, lateral lobes obovate-oblong, 13 mm. long, 5 mm. broad, posterior lip obovate-oblong, about 11 mm. long, 4 mm. broad, subemarginate; pollen-grains about $37 \times 22\ \mu$; capsule 7 mm. long, 2.5 mm. broad, glabrous, the constricted base 3 mm. long; seeds 4, 2.4×1.8 mm.

Distribution: Mexico.

Chihuahua: without definite locality, coll. of 1892, *Hartman 1013* (G).

Sinaloa: road from Las Flechas to La Rostra, 22 Feb. 1899, *Goldman 321* (US); Balboa, coll. of 1923, *Ortega 5126* (US); Mazatlan, coll. of 1925, *Ortega 5660* (US).

Colima: without definite locality, 9 Jan.–6 Feb. 1891, *Palmer 1302* (G, US type, NY, M photo).

Puebla: mountains near Tehuacan, Jan. 1902, *Purpus 462* (US, M, P).

This species, found largely in northern and central Mexico, differs from its near relative, *T. glandulosum,* in having more lanceolate leaves, narrower linear bracts, and more densely glandular pubescence with few hirsute hairs intermixed.

21. T. diffusum Rose in Contrib. U. S. Nat. Herb. **1:** 349. 1895.

Stems freely branched; branches slender, at first evenly and minutely glandular-puberulent, later puberulent in lines, or glabrous; leaves lanceolate to lanceolate-ovate, 0.3–2 cm. long, 0.1–1 cm. broad, inconspicuously glandular-puberulent to glabrous on both surfaces; petioles 0.1–6 mm. long, glandular-puberulent; inflorescences loosely spicate, spikes 1–6 cm. long, internodes usually 5 mm. long; bracts lanceolate-oblong, 3–5 mm. long, 0.6–1 mm. broad, obtusish, mucronulate, cuneate below the middle, gradually narrowed to a subpetiolate base, minutely glandular-puberulent; bracteoles 2, linear-lanceolate, 2.5–4 mm. long, obtusish, mucronulate, puberulent; calyx-lobes

5, filiform, about 2 mm. long, puberulent; corolla 10–11 mm. long, middle lobe of the anterior lip obovate, 6.5 mm. long, 2 mm. broad, lateral lobes oblanceolate-obovate, 7 mm. long, 2 mm. broad, posterior lip oblong-obovate, 7 mm. long, 2 mm. broad, slightly emarginate; pollen-grains about 20×15 μ; capsules 5 mm. long, 1.5 mm. broad, puberulent near the apex, the constricted base 1.8 mm. long; seeds 2, 1×0.8 mm.

DISTRIBUTION: southwestern Mexico.

COLIMA: Manzanillo, 1–31 Dec. 1890, *Palmer 994* (G, US TYPE, NY, M photo); on cliffs along ocean, west of Cuyutlan Lagoon, vicinity of Manzanillo, 30 Nov. 1925, *Ferris 6178* (D).

The slender stems, small leaves, loose inflorescence, and very slender linear bracts are distinctive characters of this species.

Section II. TORREYELLA, n. sect. Leaves linear to elliptic-lanceolate. Bracts lanceolate to cordate. Calyx-lobes 5. Corolla-tube two-thirds the total length of corolla. Stamens inserted on median or lateral lobes of anterior lip of corolla. Pollen-grains spherical to ellipsoid. Capsule flattened laterally or terete; seeds 2 or 4, 2–3.2 × 1.5–3 mm. Species 22–23 incl.

KEY TO THE SPECIES

A. Stamens inserted on lateral lobes of anterior lip; capsule flattened laterally; seeds two .... *22. T. platystegium*

AA. Stamens inserted on middle lobe of anterior lip; capsule terete; seeds four .... *23. T. rubrum*

22. T. platystegium Torr. in Bot. U. S. & Mex. Bound. Surv. **2**: 126. 1859; A. Gray, Syn. Fl. N. Amer. **2**[1]: 331. 1878; Coult. in Contrib. U. S. Nat Herb. **2**: 325. 1896. Pls. 29 and 33.

Stems freely branched, slender, at first evenly short-hispid-pubescent, later pubescent in lines, or glabrous; leaves elliptic-lanceolate to elliptic-linear, 1–5 cm. long, 0.2–1.2 cm. broad, acutish to obtuse, acute to cuneate at the base, sparsely hispid to glabrous on both surfaces, more conspicuously so on the midrib and nerves; petioles 1–5 mm. long, hispid to glabrous; inflorescences more or less loosely imbricated, spikes 1–4 cm. long, internodes 3–5 mm. long; bracts ovate, acute, cordate at the base, 1–2 cm. long, 0.8–1.5 cm. broad, inconspicuously hispidulous sparingly intermixed with minute gland-tipped hairs, erect, mucronate; calyx-lobes 5, lanceolate, 2–3 mm. long, hispidulous; corolla 1.8–2.5 cm. long, tube 1.3–1.8 mm. long, middle lobe of the anterior lip elliptic-ovate, 6–7 mm. long, about 3 mm. broad, lateral lobes elliptic-ovate, 6–7 mm. long, 3 mm. broad, posterior lip elliptic-ovate, 6–7 mm. long, 2–2.5 mm. broad, emarginate, stigma exserted; pollen-grains 38 × 38 μ; capsule 8 mm. long, 4 mm. broad, the constricted base 2 mm. long; seeds 2, muriculate, 3.2 × 3 mm.

DISTRIBUTION: southwestern United States and northeastern Mexico.

UNITED STATES.

TEXAS: steep shaded rocky hillsides, Montell, Uvalde Co., 22 June 1917, *Palmer 12326* (M, CalAcad); Ringgold Barracks near Rio Grande City, on the lower Rio Grande, 30 May 1853, *Schott, without number* (type material NY, and F, M photo).

MEXICO.

TAMAULIPAS: Cerro de la Tamaulipeca, vicinity of San Miguel, alt. about 600 m., 24 July 1930, *Bartlett 10557* (F); "Buena Vista Hda.," 18 June 1919, *Wooton, without number* (US).

NUEVO LEON: Monterey, coll. of 1924, *Orcutt, without number* (US).

COAHUILA: Caracol Mts., 21 miles southeast of Monclova, Aug. 1880, *Palmer 1004* (G, US, K).

This species is quite distinct from any other species in this genus known to the writer. The large cordate bracts and the long tubular corolla, together with the shorter filaments exserted from the lateral lobes of the anterior lip, are distinctive characters of this species.

23. T. rubrum Happ, n. sp.[13]

Plant about 1 m. high; stems freely branched, slender, at first evenly glandular-hispid sparsely intermixed with long simple hairs, later somewhat pubescent in lines, more or less glabrous; leaves lanceolate, 2–3 cm. long, 3–6 mm. broad, acutish at both ends, densely glandular-hispidulous sparsely intermixed with

[13] **T. rubrum** Happ, sp. nov., herbacea perennis; caulibus ramosis et gracilibus, glanduloso-hispidis vel glabratis; foliis lanceolatis, 2–3 cm. longis, 3–6 mm. latis, apice et basi acutis, dense glanduloso-hispidulis et parce hispidis; inflorescentiis densis, spicis 2–5 cm. longis; bracteis lanceolato-linearibus, 1–2 cm. longis, apice acuminato, recurvato; basi acuto, dense glanduloso-hispidis; bracteolis 2; calyce 5-partito; corolla 3 cm. longa, rubra, tubo 1.9 cm. longo.—Collected on dry hill, Nanchititla, Distr. Temascaltepec, Mexico, 11 April 1933, *Hinton 3767* (Herb. Roy. Bot. Gard., Kew, TYPE).

longer simple hairs on both surfaces; petioles 3–5 mm. long, pubescent; inflorescences closely imbricated, spikes 2–5 cm. long; bracts lanceolate-linear, 1–2 cm. long, acuminate at the apex, acute at the base, densely glandular-hispid intermixed with long simple hairs, conspicuously recurved, mucronate; bracteoles 2, lanceolate-linear, 8–10 mm. long, about 1 mm. broad, densely glandular-pubescent; calyx-lobes 5, filiform, about 5 mm. long, glandular-puberulent; corolla 3 cm. long, red, tube 1.9 cm. long, middle lobe of the anterior lip oblong-obovate, about 1 cm. long, 3 mm. broad, lateral lobes oblong-obovate, about 1 cm. long, 4 mm. broad, posterior lip oblong-obovate, about 1 cm. long, 4 mm. broad, subemarginate; filaments inserted on the middle lobe of the anterior lip; pollen grains $40 \times 25\ \mu$; capsule 8–10 mm. long, 3–3.5 mm. broad, the constricted base about 3 mm. long, glabrous; seeds 4, 1.5×2 mm., muriculate.

Distribution: central Mexico.

Mexico: dry hill, Nanchititla, Distr. Temascaltepec, 11 April 1933, *Hinton 3767* (K type, M, M photo).

This species is readily distinguished by the long tube and striking reddish coloration of the corolla.

GENUS AND SPECIES EXCLUDED

Tetramerium Gaertn. f. Fruct. et Sem. **3**: 90, *pl. 196.* 1805 = Faramea Aubl. Pl. Guin. p. 102, *pl. 40.* 1775, in part; Coffea L. Syst. ed. 1. 172. 1735, in part.

T. coeruleum Nees ex Mart. in Nov. Act. Nat. Cur. **12**[1]: 13. 1824 = Faramea caerulea DC. Prodr. **4**: 497. 1830.

T. flavum Eastwood, in Proc. Amer. Acad. **44**: 608. 1909 = Henrya **flava** (Eastwood) Happ.

T. geniculatum Brandeg. in Univ. Calif. Publ. Bot. **4**: 386. 1913, is not of this genus; material is insufficient to permit further determination.

T. gualanense Robinson & Bartlett in Proc. Amer. Acad. **63**: 58. 1907 = Henrya **gualanensis** (Robins. & Bartl.) Happ.

T. jasminoides HBK. Nov. Gen. et Sp. **3**: 373, *pl. 287.* 1818 = Faramea jasminoides DC. Prodr. **4**: 497. 1830.

T. latifolium Cham. & Schlecht. in Linnaea **4**: 30. 1829 = FARAMEA LATIFOLIA DC. Prodr. **4**: 497. 1830.

T. montevidense Cham. & Schlecht. in Linnaea **4**: 29. 1829 = FARAMEA MONTEVIDENSIS DC. Prodr. **4**: 497. 1830.

T. multiflorum Bartling ex DC. Prodr. **4**: 497. 1830 = FARAMEA GUAYAQUILENSIS DC. Prodr. **4**: 497. 1830.

T. occidentale Nees ex Mart. in Nov. Act. Nat. Cur. **12**[1]: 13. 1824 = FARAMEA ODORATISSIMA DC. Prodr. **4**: 496. 1830.

T. odoratissimum Gaertn. f. Fruct. et Sem. **3**: 196. 1805 = FARAMEA ODORATISSIMA DC. Prodr. **4**: 496. 1830.

T. oleaefolium Spreng. Syst. **1**: 409. 1825 = COFFEA OLEIFOLIA HBK. Nov. Gen. et Sp. **3**: 372. 1818.

T. paniculatum Spreng. Syst. **1**: 409. 1825 = COFFEA PANICULATA Aubl. Pl. Guin. **1**: 152, *pl. 58*. 1775.

T. racemulosum Nees in Benth. Bot. Voy. Sulphur, p. 148. 1844 = JUSTICEA RACEMULOSA Wikstr. in Vet. Akad. Handl. Stockh. p. 426. 1825.

T. scorpioides (Nees) Hemsl. Biol. Centr.-Am. Bot. **2**: 525. 1882 = HENRYA SCORPIOIDES Nees in DC. Prodr. **11**: 464. 1848.

T. sessilifolium HBK. Nov. Gen. & Sp. **3**: 374. 1818 = FARAMEA SESSILIFOLIA DC. Prodr. **4**: 497. 1830.

T. stipulaceum Cham. & Schlecht. in Linnaea **4**: 31. 1829 = FARAMEA STIPULACEA DC. Prodr. **4**: 497. 1830.

By petition to the International Botanical Congress in 1935, it has been recommended by the Committee on Nomenclature that TETRAMERIUM Nees be placed in the list of conserved genera.

LIST OF EXSICCATAE

The number of the collector is in *italics*. If the collection is unnumbered, this is indicated by a dash. The numbers in parentheses indicate the number designated to the species in this revision.

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Henrya

GENERAL MORPHOLOGY

Roots.—The root system is typical of suffrutescent plants and presents no unusual characters of morphological significance.

Stems.—The stems are erect, ascending, or even pendant, one to several at the base, freely branched, slender, terete to acutely four-angled in cross-section, and occasionally with wings at the angles. The stem may be pubescent or glabrous, and frequently the bark exfoliates in the later stages.

Leaves.—The leaves are opposite, petiolate, ovate to linear, pubescent to glabrous, frequently more conspicuously pubescent on the midrib and nerves. The primary leaves usually are early deciduous. Length of the petiole, outline of leaf, pubescence, and venation are relatively constant for the species and therefore furnish fairly good characters for specific diagnosis.

Bracts.—There are two types of bracts, the outer or cauline and the inner or involucral. The cauline bracts are lanceolate-ovate to lanceolate, and usually much shorter than the involucral bracts. The two involucral bracts, obovate to lanceolate, acuminate to rounded at the apex, are united along the posterior margin from the base to near the apex. The erect or recurved mucro is located directly on or below the apical margin of these bracts. This mucro proves to be a distinctive morphological character often giving substantial supporting evidence for specific differentiation.

Calyx.—The calyx is five-lobed, filiform to lanceolate, and quite diminutive.

Pubescence.—The pubescence is from pilose to hirsute or glandular and is variously intermixed in certain species. On the stems, the pubescence is at first evenly distributed and later disposed in alternating lines on the internodes. On the leaves, the pubescence is frequently more conspicuous on the midrib and nerves. The bracts also frequently bear a more pronounced pubescence on the veins.

Inflorescence.—The spicate inflorescence is terminal and axillary. The spikes, one to several at the nodes, are loosely to closely imbricated. The opposite flowers are subtended by the partially coalesced involucral bracts.

Corolla.—The corolla is tubular-infundibuliform and conforms in general to that of *Tetramerium,* from which it differs in having a corolla-tube proportionately shorter, about one-third the total length.

Stamens.—The stamens are two and project beyond the corolla. In other characters they conform in general to those of *Tetramerium.*

Fruit.—The capsule is constricted at the base for about half the total length. The surface near the apex is usually glabrous. The two housiform seeds are hispid on one surface and glabrate on the other.

GEOGRAPHICAL DISTRIBUTION AND INTERSPECIFIC RELATIONSHIPS

As treated in this study, the genus *Henrya* consists of twenty species and one variety. The geographical range of this genus extends from the northern states of Mexico southwest to the state of Veraguas in Panama. The center of geographical distribution, as well as the relative abundance of individuals, appears to be located in west-central Mexico. Relatively low altitudes and xerophytic habitats characterize on the whole the environments of these plants.

The following chart portrays the interspecific relationships within the genus.

GENERIC RELATIONSHIPS

The genus *Henrya* shows its closest relationship to *Tetramerium* particularly in habit, stem- and leaf-characters. However, in inflorescence, coalescence of involucral bracts, shorter corolla-tube, broader corolla-lip and corolla-lobes, more linear and obtuse style branches, exserted style and stamens, more oblong pollen-grain, two instead of four ovules, mostly gla-

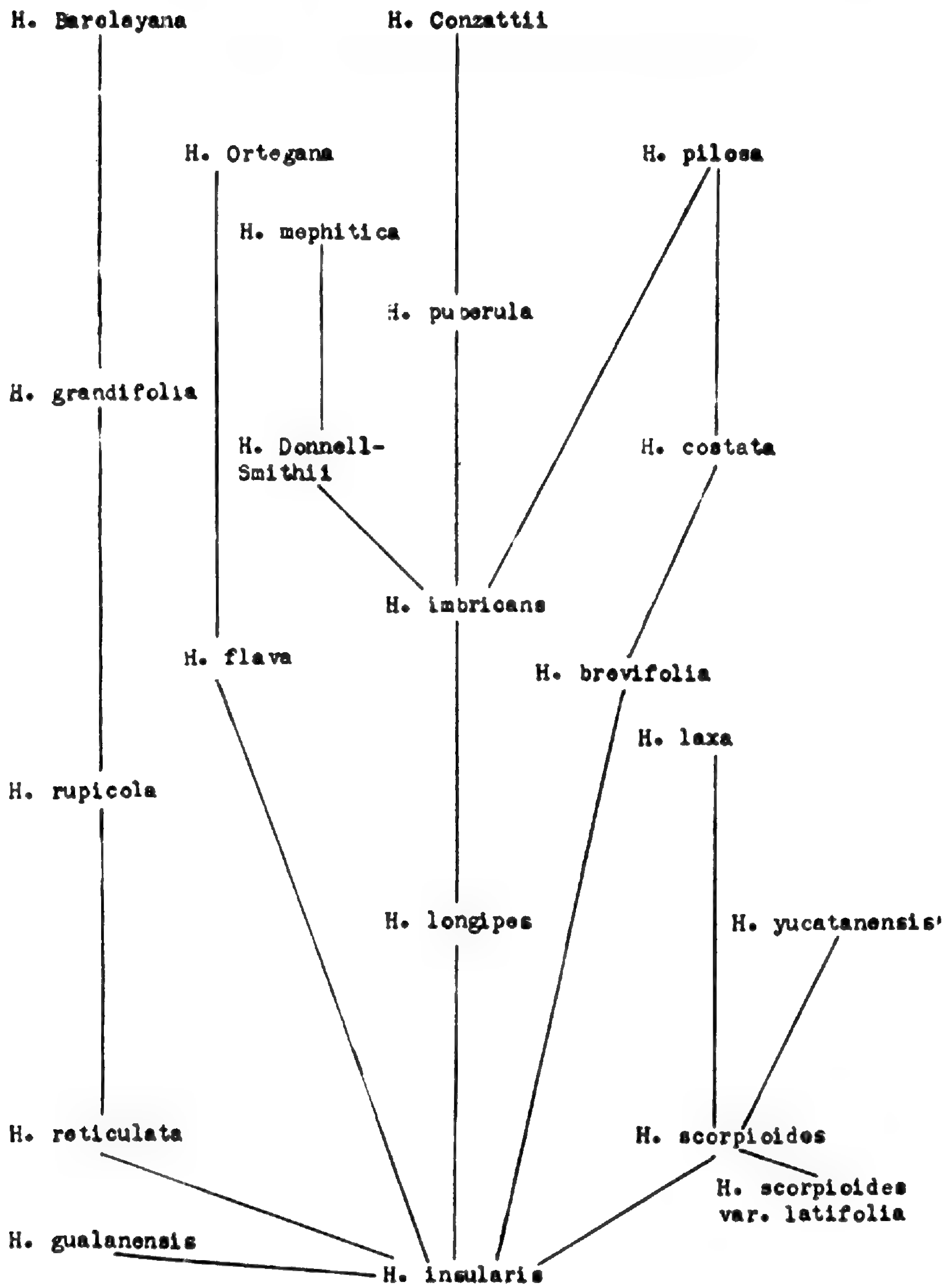

Fig. 2. Diagram to show interspecific relationships of *Henrya.*

brous capsule with a longer constricted, sterile base, obtuse retinacula, and seeds with a hispid surface, *Henrya* stands out in marked contrast, and is well worthy of generic recognition.

In considering other possible relationships in the Acanthaceae, it should be mentioned that the presence of two conspicuous but uncoalesced bracts in some species of the genus *Dicliptera,* possibly comparable to the twin bracts in *Henrya,* may indicate an affinity between these two genera.

TAXONOMY

Henrya Nees acc. to Benth. Bot. Voy. Sulphur, p. 148, *pl.* 49. 1844; Nees in DC. Prodr. **11**: 491. 1847.

Tetramerium Nees Benth. & Hook. Gen. Pl. **2**: 1121. 1876, in part; Lindau in Engler & Prantl, Nat. Pflanzenfam. IV, Abt. 3b. p. 331. 1895, in part.

Fruticose to suffruticose perennials. Roots fibrous. Stems erect, spreading, or decumbent; branches opposite, sometimes terete, frequently 4-angled in cross-section, occasionally conspicuously winged along the angles, at first evenly pubescent, or pubescence disposed in lines, sometimes bearing exfoliating bark. Leaves opposite, entire, rotund-ovate to linear, pubescent to glabrous on both surfaces. Inflorescences terminal and axillary, spicate, loosely or closely imbricated. Cauline bracts solitary, lanceolate-ovate to linear, pubescent to glabrate. Flowers solitary, sessile or short-pedicellate, subtended by involucral bracts which are coalescent from base nearly to apex on posterior side, pubescent to glabrous, mucronate at or near the apex. Calyx-lobes 5, lanceolate-ovate to filiform, pubescent or glabrous. Corolla tubular-infundibuliform, bilabiate, tube straight to slightly curved, slightly enlarged near the base, about one-third the length of the corolla, anterior lip three-lobed, obovate-oblong, posterior lip obovate-oblong, all lobes nearly equal. Stamens 2, exserted, extending beyond corolla-lip; anthers consisting of 2 nearly parallel, oblong obtuse sporangia. Pollen-grains oblong, about twice as long as broad, pores equatorial, surface scrobiculate. Ovary narrowly obovate, base obtuse, retinacula curved, obtuse. Ovules 2, disciform, surface hispid. Capsule obovate, apiculate, lower half to base compressed, usually glabrous. Seeds 2, disciform, hispid.

Type species: *Henrya insularis* Nees in Benth. Bot. Voy. Sulphur, p. 148, *pl. 49*. 1844.

KEY TO THE SPECIES

A. Mucro situated directly on the apical margin of the involucral bract, usually erect.
  B. Subtending bracts of the inflorescences shorter than the involucral bracts.
    C. Involucral bracts usually 6–9 mm. long.
      D. Internodes of the spike usually longer than the involucral bracts.
        E. Leaves ovate to lanceolate .... *1. H. insularis*
        EE. Leaves ovate to obovate.
          F. Leaves usually 3–5-nerved on either side of the midrib; petioles mostly hirsute and glandular .... *2. H. brevifolia*
          FF. Leaves usually 4–8-nerved on either side of the midrib; petioles mostly hirsute, not glandular .... *3. H. costata*
      DD. Internodes of the spike usually shorter than the involucral bracts .... *4. H. longipes*
    CC. Involucral bracts usually 10–13 mm. long.
      G. Stem usually acutely 4-angled.
        H. Lateral veins of the leaf close; bracts of the inflorescences mostly 5–7 mm. long .... *5. H. flava*
        HH. Lateral veins of the leaf remote; bracts of the inflorescence mostly 3–5 mm. long .... *6. H. yucatanensis*
      GG. Stems terete or nearly so .... *7. H. Ortegana*
  BB. Subtending bracts of the inflorescence usually longer than the involucral bracts .... *8. H. gualanensis*
AA. Mucro situated more or less below the apical margin of the involucral bract, sometimes recurved.
  I. Bracts of the involucre acuminate, acute at the apex.
    J. Involucral bracts conspicuously pubescent.
      K. Involucral bracts mostly 3–8 mm. long.
        L. Involucral bracts chiefly hirsute or flaccid-hirsute pubescent, intermixed with gland-tipped hairs.
          M. Involucral bracts short, hirsute-pubescent.
            N. Leaves ovate to ovate-lanceolate .... *9. H. scorpioides*
            NN. Leaves ovate to ovate-rotund.... *9a. H. scorpioides* var. *latifolia*
          MM. Involucral bracts long, pilose-pubescent .... *10. H. pilosa*
        LL. Involucral bracts chiefly glandular-pubescent .... *11. H. laxa*
      KK. Involucral bracts mostly 9–11 mm. long .... *12. H. imbricans*
    JJ. Involucral bracts puberulent or glabrous.
      O. Involucral bracts puberulent; cystoliths not apparent... *13. H. puberula*
      OO. Involucral bracts glabrous; cystoliths apparent........ *14. H. Conzattii*
  II. Bracts of the involucre obtuse to rounded at the apex.
    P. Primary leaf-blade much longer than broad.
      Q. Leaves large, mostly 7–13 cm. long; spikes rather loose .... *15. H. grandifolia*

QQ. Leaves small, 1.5–6 cm. long; spikes rather dense.
R. Involucral bracts 8–12 mm. long.
S. Young leaves glandular-pubescent on both surfaces.......... ....*16. H. Barclayana*
SS. Young leaves more or less puberulent on both surfaces........ ....*17. H. mephitica*
RR. Involucral bracts 5–8 mm. long.
T. Involucral bracts densely glandular-hirsute, mucro near the apical margin........................*18. H. Donnell-Smithii*
TT. Involucral bracts hirsute with scattered gland-tipped hairs, mucro remote from the apical margin...........*19. H. rupicola*
PP. Primary leaf-blade nearly as long as broad............*20. H. reticulata*

1. H. insularis Nees in Benth. Bot. Voy. Sulphur, p. 148, *pl. 49.* 1844. Pl. 33, figs. 6 & 11.

H. scorpioides Nees in DC. Prodr. **11**: 491. 1847, in part.

Tetramerium scorpioides (Nees) Hemsl. Biol. Cent.-Am. Bot. **2**: 526. 1882, in part.

Henrya costata A. Gray var. *glandulosa* T. S. Brandeg. in Zoe **5**: 171. 1903.

Stems freely branched, at first evenly glandular-pilose, later pubescent in lines, or glabrous; leaves ovate, 1–5.5 cm. long, 0.5–2.5 cm. broad, obtusish to cuspidate at the apex, obtuse at the base, usually 3–8-nerved on either side of the midrib, at first glandular-pilose, later sparsely appressed-pilose on both surfaces, more conspicuously so on the midrib and nerves; petiole 0.1–2.5 cm. long, glandular-pilose to glabrous; spikes 1–10 cm. long, rather loose; cauline bracts oblanceolate, 2–3 mm. long, mucronulate, glandular-pilose; involucral bracts oblanceolate, 7–9 mm. long, about 2 mm. broad, acute, glandular-pilose, mucro directly on the apical margin, erect, 0.4 mm. long; calyx-lobes lanceolate-linear, 0.8–1 mm. long, glandular-puberulent; corolla 10 mm. long, middle lobe of the anterior lip oblong-obovate, 4.2 mm. long, 2 mm. broad, lateral lobes obovate-oblong, 4.2 mm. long, 2 mm. broad, posterior lip oblong-obovate, 4.2 mm. long, about 1 mm. broad, acutish at the apex, subemarginate; pollen-grains about 45×25 μ; capsule 7 mm. long, 1.8 mm. broad, glabrous, the constricted base 3.5 mm. long; seeds 2.5×1.9 mm.

DISTRIBUTION: western Mexico and Central America including Panama.

MEXICO.

LOWER CALIFORNIA: Sierra de la Laguna, 26 Jan. 1890, *Brandegee, without number* (G, PhilAcad, UCal); Santa Anita, Cape Region, Jan.–March 1901, *Purpus 266* (US, M, UCal).

SINALOA: "San Vicente," Balboa, 1923, *Ortega 5128* (US); Mazatlan, 1925, *Ortega 5699* (US); vicinity of Mazatlan, April 1910, *Rose, Standley & Russell 13845* (US, F).

NAYARIT: La Barranca, 21 Feb. 1927, *Jones 23188* (M, UCal, P).

JALISCO: without definite locality or date, specimen collected presumably by *Lay & Collie* during the voyage of Captain Beechey to the "Pacific and Bering's Strait," 1825–1828, in part (K).

MEXICO: hill, Nanchititla, Distr. Temascaltepec, 18 Jan. 1933, *Hinton 3410* (K).

PANAMA: island off Veraguas, without date, *Sinclair, without number* (K TYPE, M photo).

The distribution of this species is largely on the Pacific slope of Mexico and Central America. The involucral bracts tend to become slightly shorter and the plant as a whole is somewhat more glandular in the northern parts of its range. It is chiefly distinguished by the rather loose inflorescence and by the mucro, usually erect, situated directly on and continuous with the apical margin of the acuminate-apiculate involucral bracts, which are also relatively long.

2. **H. brevifolia** Happ, n. sp.[14]

Stems freely branched, at first evenly glandular-pilose, later pubescent in lines, or glabrous; leaves obovate to ovate, 0.5–5 cm. long, 0.5–1.5 cm. broad, rounded to cuspidate at the apex, rounded to obtuse at the base, usually 3–5-nerved on either side of the midrib, at first glandular-pilose, later sparsely pilose on both surfaces, more conspicuously so on the midrib and nerves; petiole 0.1–0.5 cm. long, glandular-pilose to glabrous; spikes 1–12 cm. long, rather loose; cauline bracts oblanceolate, 3–5 mm. long, mucronulate, glandular-hispid; involucral bracts oblanceolate, usually 6–8 mm. long, about 2 mm. broad, acute, glandular-hispid intermixed with occasional long simple hairs,

[14] **H. brevifolia** Happ, sp. nov., herbacea perennis; caulibus ramosis et gracilibus, glanduloso-pilosis vel glabratis; foliis ovatis vel obovatis, 0.5–5 cm. longis, 0.5–1.5 cm. latis, apice rotundato vel cuspidato, basi rotundato vel obtuso, utrinque ex medio nervo 3–5 nervis, glanduloso-pilosis vel glabratis; petiolis 0.1–0.5 cm. longis; spicis 1–12 cm. longis, plus minusve laxis; caulis bracteis oblanceolatis, 3–5 mm. longis; involucri bracteis oblanceolatis, 6–8 mm. longis, glanduloso-hispidis, mucrone ad apicem bracteae posito; corolla 10–12 mm. longa.—Collected at Las Duvasvillas, Sonora, Mexico, 18 May 1892, *Brandegee, without number* (Univ. Cal. Herb., TYPE).

mucro directly on the apical margin, erect, 0.3 mm. long, calyx-lobes lanceolate-linear, 0.8 mm. long, glandular-puberulent; corolla 10–12 mm. long, middle lobe of the anterior lip obovate, 7–8 mm. long, about 4 mm. broad, lateral lobes obovate-oblong, about 7 mm. long, 3 mm. broad, posterior lip oblong-obovate, about 7 mm. long, 2.5 mm. broad, emarginate; pollen grains $45 \times 25\ \mu$; capsule 6 mm. long, 1.5 mm. broad, slightly puberulent near the apex, constricted base 3 mm. long; seeds 2.3×1.8 mm.

DISTRIBUTION: northwestern Mexico.

SONORA: Las Duvasvillas, 18 May 1892, *Brandegee, without number* (G, US, NY, M photo, PhilAcad, UCal TYPE, D); Sierra de Alamos, 14 March 1910, *Rose, Standley & Russell 12829* (US).

This species is distinctive because of the prevalence of the small obovate leaves with three to five nerves and with rather broad intervals between them on either side of the midrib. In nervation and in glandular-pubescence it rather tends towards *H. insularis,* and in the shape of the leaves, habit, and general appearance, it resembles *H. costata.* However, it differs from these two species in important morphological characters and has a distinct area of distribution.

3. **H. costata** A. Gray in Proc. Amer. Acad. **21**: 406. 1886.

Tetramerium costatum Millsp. in Field Mus. Bot. Ser. **1**: 47, 320. 1895–96.

Stems freely branched, pendant, slender, at first evenly pilose and inconspicuously intermixed with gland-tipped hairs, later pubescent in lines, or glabrous; leaves ovate to rotund-ovate, 0.5–4.5 cm. long, 0.3–3 cm. broad, abruptly acuminate, mucronate, obtuse to truncate at the base, with usually 4–8 nerves, rather close, curved toward the apex, on either side of the midrib, pilose beneath, sparsely pilose above, more conspicuously so on the midrib and nerves; petioles 0.5–1.5 mm. long, at first densely pubescent, later sparsely so; spikes 1–10 cm. long, rather loose, internodes usually 7–10 mm. long; flowers "straw-color"; cauline bracts oblanceolate, 3–4 mm. long, pilose and inconspicuously intermixed with gland-tipped hairs; involucral bracts oblanceolate, 8–9 mm. long, about 4 mm. broad, acute, pubescent as above, mucro about 0.5 mm.

long, erect, directly on the apical margin; calyx-lobes lanceolate-linear, 1 mm. long, pilose-puberulent; corolla about 11 mm. long, middle lobe of the anterior lip obovate, 7 mm. long, 4 mm. broad, lateral lobes obovate-oblong, 7 mm. long, 2.5 mm. broad, posterior lip oblong-obovate, 7 mm. long, 1.5 mm. broad, subemarginate; pollen-grains about $40 \times 24\ \mu$.

DISTRIBUTION: northern Mexico.

CHIHUAHUA: pendant from precipitous rocks, near Batopilas, Aug.–Nov. 1885, *Palmer 211* (G TYPE, US, M photo, PhilAcad).

This has been perhaps the most frequently misinterpreted member of this genus, and much material has been incorrectly named. It is at present known from one collection only, namely, Dr. Edward J. Palmer's collection from southwestern Chihuahua. As described by Dr. A. Gray, the five to seven nerves on either side of the midrib have been apparently the basis for some misinterpretation. The delimitation as now given indicates that the close-costate condition, particularly at the base of the leaves continuing curvinerved and somewhat parallel to the margin towards the apex, together with the broad ovate to elliptical outline and comparatively small size of the leaves, is characteristic of the species. In general the pubescence is simple-pilose intermixed with a few gland-tipped hairs principally on the surface of the involucral bracts. The mucro is distinctly erect and continuous with apical margin.

4. H. longipes Happ, n. sp.[15]

Stems freely branched, at first hirsute-pubescent intermixed with gland-tipped hairs, later pubescent in lines, or glabrous; leaves ovate to lanceolate, 0.5–8 cm. long, 0.2–3 cm. broad, acute to acuminate at the apex and at the base, mostly 3–5-nerved on either side of the midrib, at first pilose-pubescent on both surfaces, later somewhat glabrate; petiole 0.2–4.5 cm. long; spikes

[15] **H. longipes** Happ, sp. nov., herbacea perennis; caulibus ramosis gracilibusque, pilosis vel glabratis; foliis lanceolatis vel ovatis, 0.5–8 cm. longis, 0.5–3.5 cm. latis, apice basique acuminatis vel parce obtusis, utrinque ex medio-nervo 3–5 nervis, utrinque sparse pilosis vel glabratis; spicis densis, 2–8 cm. longis; caulis bracteis oblanceolatis, 3–5 mm. longis; involucri bracteis 7–8 mm. longis, apice obtuso, glanduloso-pilosis vel pilosis, mucrone erecto, inconspicuo, ad apicem bracteae posito; corolla 10–12 mm. longa.—Collected at San Salvador, Salvador, coll. of 1925, *Calderon 2283* (Field Mus. Herb. TYPE).

dense, terminal and lateral, 2–8 cm. long, 2 to 4 at the cauline nodes, internodes 0.2–1 cm. long; cauline bracts oblanceolate, 3–5 mm. long, acuminate-mucronate, hirsute-pubescent intermixed with gland-tipped hairs; involucral bracts oblanceolate, usually 7–8 mm. long, rounded, hirsute-pubescent intermixed with gland-tipped hairs, mucro directly on the apical margin, erect, inconspicuous, 0.1–0.2 mm. long; calyx-lobes lanceolate-linear, 0.7 mm. long, puberulent; corolla 10–12 mm. long, middle lobe of the anterior lip obovate, 7 mm. long, 3 mm. broad, lateral lobes obovate-oblong, about 7 mm. long, 2.5 mm. broad, posterior lip oblong-ovate, about 7 mm. long, 2.5 mm. broad, subemarginate; pollen-grains about 40×22 μ; capsule 6 mm. long, 2 mm. broad, slightly puberulent near the apex, constricted base 3 mm. long; seeds 2.2×1.8 mm.

DISTRIBUTION: Salvador.

SALVADOR: San Salvador, coll. of 1925, *Calderon 2283* (US, M photo, F TYPE); vicinity of San Salvador, alt. 650–850 m., 2–7 Feb. 1922, *Standley 20449* (G, US, NY); same locality, 30 March–24 April 1922, *Standley 23103* (G, US, NY).

This species approaches *H. imbricans,* but presents several distinct differences. The ovate to lanceolate shape of the leaf with the acuminate apex and the occasionally acute but more commonly acuminate base is rather conspicuous. The petiole also is generally long. The mucro of the involucral bract, although rather short and inconspicuous, is continuous with the margin and usually erect. The bracts are somewhat short and rounded at the apex.

5. **H. flava** (Eastwood) Happ, n. comb.

Tetramerium flavum Eastwood in Proc. Amer. Acad. **44:** 608. 1909.

Plant 6–12 dm. high; stems erect, freely branched, terete to 4-angled, occasionally narrowly winged, at first evenly hispid with glandular hairs intermixed, later pubescent in lines, or glabrous; leaves ovate, 0.5–10 cm. long, 0.2–5 cm. broad, acuminate, mucronate at the apex, obtuse at the base, usually 6–8-nerved on either side of the midrib and prominent on the lower surface, at first pilose to occasionally tomentose beneath, sparsely pilose above, more conspicuously so on the midrib and nerves; petioles 0.1–2 cm. long, glandular-pilose to pilose in lines; inflorescences usually closely spicate, spikes 1–6 cm. long; flowers "canary yellow"; cauline bracts oblanceolate-linear, about 6 mm. long, 1 mm. or more broad, mucronulate, glandular-pilose; involucral bracts oblanceolate, about 1 cm. long, acute, glandular-pilose, closely imbricated, mucro 0.2 mm. long, erect, directly on the apical margin; calyx-lobes lanceolate-linear, 2 mm. long, glandular-pilose-puberulent; corolla about 18 mm. long, middle lobe of the anterior lip obovate, 10 mm. long, 7 mm. broad, the lateral lobes similar in outline, slightly narrower, posterior lip oblong-obovate, 10 mm. long, 3 mm. broad, subemarginate; pollen-grains about 23–40 μ.

DISTRIBUTION: western Mexico.

DURANGO: San Ramon, 21 April–18 May 1906, *Palmer 75* (G TYPE, US, NY, M, M photo, F, UCal).

The large yellow corolla-lobes, the closely imbricated inflorescence, the rather large involucral bracts, the prominent nerves on the under side of the leaf with the close pubescence especially on the midrib and nerves, and the rather consistently acute angles of the four-sided stem all mark this as a distinct species of the genus.

6. **H. yucatanensis** Happ, n. sp.[16]

H. costata Millsp. in Field Mus. Bot. **2**: 100. 1900, not A. Gray.

Stems freely branched, slender, cylindrical to somewhat 4-angled, at first evenly glandular-pilose, later pubescent in lines, or glabrous; leaves ovate, 1–6 cm. long, 0.5–5 cm. broad, abruptly acuminate, acute, obtuse to acuminate at the base, at first appressed-pilose on both surfaces, sparsely on the lower surface, more conspicuously so on the midrib and nerves; petioles 0.1–1.2 cm. long, glandular-pilose; inflorescences more or less closely spicate, the spikes 1–15 cm. long, lateral spikes soli-

[16] **H. yucatanensis** Happ, sp. nov., herbacea perennis; caulibus ramosis et gracilibus, glanduloso-pilosis vel glabratis; foliis ovatis, 1–6 cm. longis, 0.5–5 cm. latis, apice abrupte acuminato, basi obtuso vel acuminato, adpresso-pilosis vel glabratis; spicis plus minusve densis, 1–15 cm. longis; caulis bracteis oblanceolatis, 3–5 mm. longis; involucri bracteis 10–11 mm. longis, apice acuminato, glanduloso-puberulis, mucrone ad apicem bracteae posito; corolla 13 mm. longa.—Collected on brush lands about Izamal, Yucatan, Mexico, Jan.–May 1895, *Gaumer 368* (Mo. Bot. Gard. Herb., TYPE).

tary or in pairs; internodes 5–15 mm. long; flowers yellow; cauline bracts oblanceolate, 3–5 mm. long, acute, mucronulate, glandular-pilose; involucral bracts oblanceolate, 10–11 mm. long, about 3 mm. broad, glandular-pilose, mucro 0.1 mm. long, inconspicuous, erect, directly on the apical margin; calyx-lobes lanceolate, 1.2 mm. long, puberulent; corolla 13 mm. long, middle lobe of the anterior lip obovate, 8 mm. long, 6 mm. broad, lateral lobes obovate, 8 mm. long, 5 mm. broad, posterior lip obovate-oblong, 8 mm. long, 4.2 mm. broad, subemarginate; pollen-grains about $35 \times 20\ \mu$; capsule 6–7 mm. long, 2 mm. broad, somewhat pubescent near the apex, the constricted base about 3 mm. long; seeds 2×1.5 mm.

DISTRIBUTION: southern Mexico.

YUCATAN: brush lands about Izamal, Jan.–May 1895, *Gaumer 368* (G, US, NY, M TYPE, Cop, F, UCal, CalAcad, D, UMich); Silam, without date, *Gaumer 1712* (US, NY, M, F); Calotmul, without date, *Gaumer 1713* (US, Cop, F, CalAcad); without locality, 15–20 Feb. 1901, *Goldman 590* (US); Colonia San Cosmé, 20 Feb. 1906, *Greenman 350* (G, US, NY, B, F); Izamal, 21 Feb. 1906, *Greenman 391* (G, F); stairway east side of Cerro Grande, Izamal, 13 Jan. 1895, *Millspaugh 65* (US, F, CalAcad); Progresso, 5 March 1899, *Millspaugh 1661* (F); ruins of Mayapan, 19 Feb. 1903, *Seler 3875* (G, NY, B, F); stony hill, Izamal, 11 March 1903, *Seler 3922* (G, US, NY, B, F); Tunkas, 3 March 1890, *Stone 244* (PhilAcad).

This species is at present known only from Yucatan. It seems most closely allied to *H. insularis,* from which it differs in having larger, broader, and more conspicuously nerved bracts of the inflorescence, a larger corolla, and a more densely glandular pubescence.

7. H. Ortegana Happ, n. sp.[17]

Plant about 1 m. high; stems freely branched, subterete in cross-section, at first evenly glandular-hirsute, later gland-

[17] **H. Ortegana** Happ, sp. nov., herbacea perennis; caulibus ramosis, gracilibus et subteretibus, glanduloso-hirsutis vel glabris; foliis ovatis vel lanceolato-ovatis, 1–4.5 cm. longis, 0.5–2.5 cm. latis, apice et basi rotundis vel acutis, utrinque ex medio nervo 4–7 nervis, glanduloso-pubescentibus vel glabratis; petiolis 0.1–1.3 cm. longis; caulis bracteis oblanceolato-oblongis, 5–10 mm. longis, minute glanduloso-hirtellis et glanduloso-pubescentibus; involucri bracteis oblongo-oblanceolatis, 10–13 mm. longis, dense glanduloso-hirtellis et glanduloso-pubescentibus, mucrone 0.2–0.3 mm. longo, erecto, ad apicem bracteae posito; corolla 18–20 mm. longa.—Collected at San Ignacio, Sindicate of San Juan, Sinaloa, Mexico, March 1931, *Ortega 6868* (Mo. Bot. Gard. Herb., TYPE).

tipped hairs intermixed with hirsute hairs in lines, or glabrous; leaves ovate to lanceolate-ovate, 1–4.5 cm. long, 0.5–2.5 cm. broad, acuminate, rounded to acute at both ends, usually 4–7-nerved on either side of the midrib, at first glandular-pubescent on both surfaces, later sparsely glandular-pubescent intermixed with occasional hirsute hairs, more conspicuously so on the midrib and nerves, somewhat glabrate; petioles 0.1–1.3 cm. long, at first glandular-hirtellous, later glabrate; inflorescences more or less closely spicate, spikes 1–10 cm. long, internodes usually 0.3–1 cm. long; cauline bracts oblanceolate-oblong, mostly 5–10 mm. long, 1–2 mm. broad, minutely glandular-hirtellous intermixed with longer gland-tipped hairs; involucral bracts oblong-oblanceolate, 10–13 mm. long, 4–5 mm. broad, acute to obtusish at the apex, closely glandular-hirtellous intermixed with longer gland-tipped hairs, mucro 0.2–0.3 mm. long, erect, directly on the apical margin; calyx-lobes lanceolate, about 1 mm. long, glandular-puberulent; corolla 18–20 mm. long, white, middle lobe of the anterior lip oblanceolate, about 10 mm. long, 4 mm. broad, other lobes similar in shape and size; posterior lip emarginate; pollen-grains $48 \times 23\ \mu$; capsule 8–10 mm. long, 4 mm. broad, puberulent near the apex, the constricted base 5 mm. long, seeds 4, 2×1.6 mm.

DISTRIBUTION: western Mexico.

SINALOA: "C. de la Silla," San Ignacio, alt. 1200 m., 20 April 1918, *Montes & Salazar 293* (US); San Ignacio, Sindicate of San Juan, March 1931, *Ortega 6868* (M TYPE, F, CalAcad); definite locality not indicated, coll. of 1933, *Ortega 7184, 7186* (F).

This species seems to be somewhat intermediate between *H. flava* and *H. grandifolia.* The more prominently veined leaves and the larger bracts with a more glandular surface indicate a distinct difference from the first, and the smaller leaves and the mucro directly on the apical margin of the involucral bract separate it from the latter. The white flowers are among the largest of the genus.

8. H. gualanensis (Robinson & Bartlett) Happ, n. comb.
Pl. 33, fig. 5.

Tetramerium gualanense Robinson & Bartlett in Proc. Amer. Acad. **43**: 58. 1907

Plant suffruticose, 1 m. high; stems freely branched, somewhat 4-angled, at first evenly glandular-hirsute, later pubescent in lines, or glabrous; leaves ovate to elliptic, 1–9 cm. long, 0.6–4 cm. broad, abruptly acuminate, obtuse to rounded, abruptly acuminate at the base, 4–6-nerved on either side of the midrib, at first glandular-pilose on both surfaces, sparingly so on the upper surface, later inconspicuously appressed-pilose on both surfaces, becoming glabrate above; inflorescences more or less densely spicate, spikes 1.5–5 cm. long, terminal and solitary or in pairs; flowers white; cauline bracts oblanceolate, 8–12 mm. long, 3–5 mm. broad, usually equal to or exceeding the total length of the involucral bracts, glandular-hirsute on both surfaces, mucronulate; involucral bracts oblanceolate, 9–10 mm. long, 3 mm. broad, glandular-hirsute, mucro 1 mm. long, erect, more or less directly on the apical margin; calyx-lobes lanceolate-linear, 1.5 mm. long, pubescent; corolla 13 mm. long, middle lobe of the anterior lip obovate, 8 mm. long, 4 mm. broad, concave, lateral lobes obovate-oblong, 8 mm. long, 3 mm. broad, posterior lip oblong-obovate, 8 mm. long, 2 mm. broad, subemarginate; pollen-grains about 28 × 22 μ; capsule 6 mm. long, 2.2 mm. broad, the constricted base 3 mm. long; seeds 2.6 × 2 mm.

DISTRIBUTION: Guatemala.

GUATEMALA: Gualan, Dept. Zacopa, alt. 130 m., 18 Jan. 1905, *Deam 397* (G TYPE, M photo, UMich).

The large ovate-rotund leaves, the conspicuously large cauline bracts frequently longer than the subtended involucral bracts, and the long glandular pubescence are characteristic of this distinctive species. Due to the larger cauline bracts, the species appears to be somewhat intermediate between *Henrya* and *Tetramerium.*

9. **H. scorpioides** Nees in DC. Prodr. **11**: 491. 1847.

Pls. 30, 33.

Tetramerium scorpioides (Nees) Hemsl. Biol. Cent.-Am. Bot. **2**: 526. 1882; Lindau ex Loesen. in Bull. Herb. Boiss. **5**: 679. 1897, as *T. scorpioides* (Nees et Bth.) Lindau.

Stems freely branched, at first evenly glandular-pilose, later pubescent in lines, or glabrous; leaves ovate, 0.5–5 cm. long, 0.3–2.5 cm. broad, at first acute, later long-acuminate, obtuse at the apex, obtuse to short-acuminate at the base, 5–7-nerved on either side of the midrib, in the early stages closely pilose intermixed with gland-tipped hairs, later sparsely pilose on both surfaces, more conspicuously so on the midrib and nerves, frequently glabrate on the upper surface; petiole 0.1–1.5 cm. long, densely pilose to glabrate; inflorescences more or less closely spicate, the spikes 2–10 cm. long, terminal and one to several at the nodes; flowers "yellowish-white"; cauline bracts linear-lanceolate, 1–2 mm. long, glandular-pilose; involucral bracts oblanceolate, 6–8 mm. long, about 2 mm. broad, glandular-pilose, mucro 0.3–0.5 mm. long, slightly recurved, 0.1–0.2 mm. below the apical margin; bracteoles when present 2, lanceolate, 1.5 mm. long, puberulent; calyx-lobes lanceolate-linear, about 0.8 mm. long, puberulent; corolla 11–12 mm. long, middle lobe of the anterior lip obovate, 7 mm. long, 3 mm. broad, lateral lobes obovate-oblong, 7 mm. long, about 2 mm. broad, posterior lip oblong-obovate, 7 mm. long, 1.2 mm. broad, emarginate; pollen-grains about $42 \times 20\ \mu$; capsule 5–6 mm. long, about 2 mm. broad, puberulent near the apex, constricted base about 3 mm. long, seeds 2×1.3 mm.

DISTRIBUTION: Mexico and Nicaragua.

MEXICO.

SAN LUIS POTOSI: limestone hills, Las Palmas, 5 June 1890, *Pringle 3506* (G, F); limestone ledges, Las Palmas, April 1894, *Pringle 5947* (M); limestone hills, Las Palmas, alt. 120 m., 9 March 1899, *Pringle 7699* (G, Cop, Utrecht, F); without definite locality, 1851, *Virlet d'Aoust 817* (Cop).

VERA CRUZ: without definite locality, April 1865–66, *Hahn, without number* (K); La Purga, 27 Jan. 1906, *Greenman 224* (G, US, NY, F); Mirador, Jan. 1839, *Linden 190* (K TYPE, B, M photo); rocky soil, Rio de Santa Maria, Zacuapan and vicinity, Nov. 1906, *Purpus 2261* (G, US, M, B, F, UCal); Remudadero, Jan. 1922, *Purpus 8863* (UCal, D, P); same locality, April 1922, *Purpus, without number* (UCal, D, P); rocky thorn forests near Rancho Remudadero, March 1928, *Purpus 11155* (NY, PhilAcad, D); rocky soil, Puente Nacional, April 1928, *Purpus 11155* (US, M, F); rocky thorn forests near Rancho Remudadero, April 1928, *Purpus 11166* (NY, F, PhilAcad); rocky thorn woods, Rancho Remudadero, March 1933, *Purpus, without number* (M); San Francisco, near Vera Cruz, May 1894, *C. L. Smith 1330* (G).

SINALOA: east of Presidio de Mazatlan, 7 June 1849, *Gregg 1159* (M).

MEXICO: by the river, Tejupilco, Distr. Temascaltepec, 9 March 1934, *Hinton 5756* (M, K).

OAXACA: Tomellin Canyon, alt. 700 m., 17 May 1894, *Pringle 4634* (G, US, NY, M, Utrecht, PhilAcad, UCal); Chivela, 7 March 1934, *Mell 2255* (NY); Cerro Concordia, alt. 650–800 m., 8–14 April 1933, *Morton & Makrinius 2673* (US).

NICARAGUA: near Granada, Dec. 1847, *Oersted, without number* (B).

This is one of the most widely distributed species of the genus and is most frequently represented in herbaria. The rather loose spikes, comparatively small acuminate involucral bracts, and the recurved mucro, located slightly below the apical margin, render it of ready recognition.

9a. H. scorpioides Nees var. **latifolia** Happ, n. var.[18]

Leaves mostly ovate-rotund, 1–15 cm. long, 0.7–10 cm. broad, abruptly acuminate, frequently mucronulate; petioles 0.1–7.5 cm. long; mucro of the involucral bracts 0.5 mm. long, divergent, conspicuous.

DISTRIBUTION: central and southern Mexico, and Central America.

MEXICO.

COLIMA: Manzanillo, 2–18 March 1891, *Palmer 1330a* (US, B).

VERA CRUZ: La Ternera, 1919, *Purpus 8235* (B, UCal); Barranca de Panoaya, Dec. 1919, *Purpus 8495* (G, US, M TYPE, B, UCal).

NICARAGUA: without definite locality, coll. of 1853–56, *C. Wright, without number* (G, US).

GUATEMALA: without definite locality or date, *Friedrichsthal, without number* (K).

This variety differs from the species largely by the broader rotund-ovate leaves and the longer petioles. It occurs rather generally within the range of the species.

10. H. pilosa Happ, n. sp.[19]

Stems freely branched; branches slender, at first conspicuously pilose intermixed with occasional gland-tipped hairs, later pubescent in lines, more or less glabrous; leaves broadly

[18] **H. scorpioides** Nees var. **latifolia** Happ, var. nov., herbacea perennis; foliis ovato-rotundis, 1–15 cm. longis, 0.7–10 cm. latis, apice breviter acuminato; petiolis 0.1–7.5 cm. longis.—Collected at Barranca de Panoaya, Vera Cruz, Mexico, Dec. 1919, *Purpus 8495* (Mo. Bot. Gard. Herb. TYPE).

[19] **H. pilosa** Happ, sp. nov., herbacea perennis; caulibus ramosis et gracilibus, pilosis et parce glanduloso-pilosis vel glabratis; foliis rotundo-ovatis vel ovatis, 1–5 cm. longis, 0.7–4 cm. latis, apice breviter acuminato et basi acuto vel subcordato, utrinque parce pilosis vel glabris; petiolis 0.3–4.2 cm. longis; spicis plus minusve densis, 1–3.5 cm. longis; caulis bracteis lineari-lanceolatis, 2 mm. longis; involucri bracteis oblanceolatis, 7–8 mm. longis, pilosis et parce glanduloso-pilosis, mucrone 0.5 mm. longo, sub apice bracteae posito; corolla 10–11 mm. longa.—Collected near Manzanillo, Colima, Mexico, 2–18 March 1891, *Palmer 1330* (U. S. Nat. Herb., TYPE).

ovate to rotund-ovate, 1–5 cm. long, 0.7–4 cm. broad, abruptly acuminate, acute to submucronate, subcordate to abruptly acuminate at the base, usually 3–5-nerved on either side of the midrib, at first sparsely pilose, later glabrous on both surfaces, membranaceous; petiole 0.3–4.2 cm. long, densely pilose to sparsely pilose in lines; inflorescences closely spicate, the spikes 1–3.5 cm. long, terminal and usually solitary or paired at the nodes; cauline bracts linear-lanceolate, about 2 mm. long, pilose; involucral bracts oblanceolate, 7–8 mm. long, about 2 mm. broad, conspicuously white-pilose sparsely intermixed with gland-tipped hairs, mucro 0.5 mm. long, slightly divergent, 0.1–0.2 mm. below the apical margin; calyx-lobes lanceolate, 0.7 mm. long, puberulent; corolla 10–11 mm. long, middle lobe of the anterior lip obovate, 7 mm. long, 3 mm. broad, concave lateral lobes obovate-oblong, 7 mm. long, 2.6 mm. broad, posterior lip oblong-obovate, 7 mm. long, about 1.8 mm. broad, subemarginate; pollen-grains about 40×25 μ; capsule 5–5.5 mm. long, about 2 mm. broad, pubescent near the apex, the constricted base about 2.5 mm. long; seeds 2×1.2 mm.

DISTRIBUTION: southwestern Mexico.

MEXICO.

COLIMA: near Manzanillo, 2–18 March 1891, *Palmer 1330* (G, US TYPE, NY, M photo).

The rotund-ovate membranaceous leaves, mostly glabrate on both surfaces, and the densely pilose bracts with conspicuously long mucros, are important diagnostic characters of this species.

11. H. laxa Happ, n. sp.[20]

Stems freely branched; branches lax, slender, at first stipitate-glandular, later pubescent in lines, or glabrate; leaves

[20] **H. laxa** Happ, sp. nov., herbacea perennis; caulibus laxe ramosis et gracilibus, glanduloso-pubescentibus vel glabratis; foliis ovatis, 1–2.5 cm. longis, 0.5–1 cm. latis, apice acuminato, basi obtuso, utrinque glanduloso-hirsutis vel glabratis; petiolis 1–2 cm. longis; spicis plus minusve laxis, 1–15 cm. longis, internodiis 6–7 mm. longis; caulis bracteis lineari-lanceolatis, 2–3 mm. longis; involucri bracteis oblanceolatis, 6–7 mm. longis, dense glanduloso-hirsutis, mucrone 0.2–0.3 mm. longo, sub apice bracteae posito; corolla 10 mm. longa.—Collected at Acapulco and vicinity, Guerrero, Mexico, Oct. 1894–March 1895, *Palmer 575* (Mo. Bot. Gard. Herb., TYPE).

ovate, 1–2.5 cm. long, 0.5–1 cm. broad, acuminate, mucronulate, obtuse at the base, 3–5-nerved on either side of the midrib, at first glandular-hirsute, later somewhat glabrate; petioles 1–2 cm. long, glandular-hirsute; inflorescences more or less loosely spicate, spikes 1–15 cm. long, internodes usually 6–7 mm. long; cauline bracts linear-lanceolate, 2–3 mm. long, 0.5 mm. broad, glandular-hirsute; involucral bracts oblanceolate, 6–7 mm. long, about 2.5 mm. broad, mucro 0.2–0.3 mm. long, divergent, 0.2–0.3 mm. below the apical margin; calyx-lobes lanceolate, posterior lobe 0.5 mm. long, anterior lobes 1 mm. long, ciliate; corolla 10 mm. long, middle lobe of the anterior lip obovate, 7 mm. long, 3 mm. broad, concave, lateral lobes obovate-oblong, 7 mm. long, 2.8 mm. broad, posterior lip oblong-obovate, 7 mm. long, 1.8 mm. broad, emarginate; pollen-grains about $37 \times 24\ \mu$; capsule 6 mm. long, 1.6 mm. broad, glabrous, the constricted base 3.2 mm. long; seeds 2×1.5 mm.

DISTRIBUTION: southwestern Mexico.

GUERRERO: Acapulco and vicinity, Oct. 1894–March 1895, *Palmer 575* (G, US, M TYPE, F, UCal).

The long lax spikes, the loosely imbricated involucral bracts, and the extremely glandular pubescence definitely characterize this species.

12. H. imbricans Donnell Smith in Bot. Gaz. **16**: 198. 1891.

Plant about 3 dm. high; stems several, decumbent, slender, cylindrical to somewhat 4-angled, at first evenly pilose and closely intermixed with glandular-puberulent hairs, later pubescent in lines, or glabrous, whitish; leaves ovate, 1–3.5 cm. long, 0.5–1.7 cm. broad, acuminate, mucronate, obtuse or rounded to abruptly acuminate at the base, 5–7-nerved on either side of the midrib, closely pilose on the lower surface, sparsely so above, more conspicuously so on the midrib and nerves, closely intermixed with gland-tipped puberulent hairs; petiole 0.2–1 cm. long, glandular-puberulent; inflorescence closely spicate, spikes 1–8 cm. long, terminal and solitary or laterally disposed in pairs; cauline bracts oblanceolate, 5–7 mm. long, 1 mm. broad, pilose intermixed with glandular-puberulent hairs; involucral bracts oblanceolate, 9–11 mm. long, about 4 mm. broad, glandular-puberulent closely intermixed with glandular-pilose and simple hairs, mucro 0.2–0.3 mm. long, divergent, 0.1–0.2 mm. below the apical margin; bracteoles 2, broadly lanceolate, 2.5–3 mm. long, hispidulous; calyx-lobes lanceolate, about 1.5 mm. long, hispidulous; corolla 11–13 mm. long, middle lobe of the anterior lip oblanceolate, about 8 mm. long, 3 mm. broad, lateral-lobes oblanceolate-oblong, 8 mm. long, about 3 mm. broad, posterior lip oblong-oblanceolate, 8 mm. long, 1.5 mm. broad, subemarginate; pollen-grains about $40 \times 20\ \mu$; capsule 6–7 mm. long, about 2.5 mm. broad, glabrous, constricted base about 3 mm. long; seeds 2.7×2.1 mm.

DISTRIBUTION: Guatemala.

GUATEMALA: without definite locality and date, *Kellerman 5215* (US); Laguna Amatitlan, Dept. Amatitlan, alt. 3900 m., *Donnell Smith 1923* (G, US TYPE, NY, M photo, PhilAcad); El Cerrito, between La Laguna and Amatitlan, southern shore of Lake Amatitlan, Dept. Amatitlan, alt. 1300 m., *Pittier 125* (US, B).

This species is readily distinguished by the close imbrication of the spikes, the acute rather long bracts, and the slightly recurved mucro.

13. H. puberula Happ, n. sp.[21]

Stems freely branched; branches slender, at first evenly glandular-puberulent sparsely intermixed with pilose hairs, later evenly pilose, pubescent in lines, more or less glabrate; leaves lanceolate to ovate, 1–3 cm. long, 0.3–1.3 cm. broad, acuminate, acute, obtuse to acuminate at the base, usually 3–5-nerved on either side of the midrib, nerves prominent on the lower side, at first evenly and minutely glandular-puberulent occasionally intermixed with pilose hairs, later sparsely pilose on both surfaces, more conspicuously so on the midrib and nerves; inflorescences densely spicate, spikes 2–3 cm. long, terminal and solitary or in pairs laterally disposed, internodes 2–3 mm. long; cauline bracts linear-lanceolate, 4–5 mm. long, about 0.3 mm. broad, minutely glandular-puberulent, mucro 0.2–0.3 mm. long;

[21] **H. puberula** Happ, spec. nov., herbacea perennis; caulibus ramosis et gracilibus, glanduloso-puberulis, sparse pilosis vel glabris; foliis lanceolatis vel ovatis, 1–3 cm. longis, 0.3–1.3 cm. latis, apice basique acuminatis vel obtusis, utrinque glanduloso-puberulis, pilosis vel glabris; spicis 2–3 cm. longis, internodiis 2–3 mm. longis; caulis bracteis lineari-lanceolatis, 4–5 mm. longis; involucri bracteis oblanceolatis, 9–10 mm. longis, minute glanduloso-puberulis, mucrone 0.5–0.8 mm. longo ad apice bracteae posito.—Collected at Amatitlan, Dept. Amatitlan, Guatemala, alt. 1100 m., Feb. 1928, *Morales 911* (Field Mus. Herb., TYPE).

involucral bracts oblanceolate, 9–10 mm. long, about 2.7 mm. broad, minutely glandular-puberulent, mucro 0.5–0.8 mm. long, puberulent near the base, conspicuously divergent, 0.1–0.2 mm. below the apical margin; calyx-lobes lanceolate-linear, 1.5 mm. long, puberulent; capsule 6 mm. long, 2 mm. broad, glabrous, the constricted base 3 mm. long; seeds 2.3 × 1.5 mm.

DISTRIBUTION: Guatemala.

GUATEMALA: Amatitlan, Dept. Amatitlan, alt. 1100 m., Feb. 1928, *Morales 911* (US, M photo, F TYPE).

The short lateral spikes, the acuminate involucral bracts, and the inconspicuous puberulence are characteristic of this species.

14. H. Conzattii Happ, n. sp.[22]

Stems freely branched; branches slender, cylindrical to somewhat 4-angled, at first inconspicuously pilose in lines, later glabrous; leaves ovate, 0.8–2 mm. long, 0.3–1.3 mm. broad, acuminate, acute, obtuse at the base, 3–5-nerved on either side of the midrib, at first appressed-stoutish-pilose on both surfaces, more conspicuously so on the midrib and nerves; petioles 1–3 mm. long, sparsely pilose to glabrous; inflorescences closely spicate, spikes 1–2.5 cm. long, internodes 2 mm. long; cauline bracts linear-lanceolate, 2–3 mm. long, 0.5 mm. broad, mucronulate, minutely pilose-ciliolate; involucral bracts oblanceolate, 7–8 mm. long, about 2 mm. broad, acutish at the apex, glabrous or occasionally inconspicuously ciliate-margined, mucro about 0.2 mm. long, divergent, 0.1–0.2 mm. below the apical margin; calyx-lobes lanceolate, 1 mm. long, pubescent; pollen-grains about $35 \times 20\ \mu$; capsule 4–5 mm. long, about 1.5 mm. broad, glabrous, the constricted base 2 mm. long; seeds 1.7 × 1.2 mm.

DISTRIBUTION: southern Mexico.

OAXACA: "Cerro de Apango de Hualulco," Distr. Pochullo, alt. 600 m., 20 April 1917, *Conzatti, Reko & Makrinius 3152* (US TYPE, M photo).

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[22] **H. Conzattii** Happ, sp. nov., herbacea perennis; caulibus ramosis, parce pilosis vel glabris; foliis ovatis, 0.8–2 cm. longis, 0.3–1.5 cm. latis, apice acuto, basi obtuso, utrinque parce adpresso-pilosis vel glabris; spicis 1–2.5 cm. longis, densis, internodiis 1–2 mm. longis; caulis bracteis lineari-lanceolatis, 2–3 mm. longis; involucri bracteis oblanceolatis, 7–8 mm. longis, plerumque glabris, parce pilosis, mucrone brevi, sub apice bracteae posito.—Collected at "Cerro de Apango de Hualulco," Distr. Pochullo, Oaxaca, Mexico, alt. 600 m., 20 April 1917, *Conzatti, Reko & Makrinius 3152* (U. S. Nat. Herb., TYPE).

The short spikes, the subapical mucro, and the glabrate condition of the entire plant readily distinguish this species from its immediate allies.

15. **H. grandifolia** Fernald in Bot. Gaz. **20**: 537. 1895.

Plant 7–13 dm. high; stems freely branched; branches slender, at first evenly glandular-hispid, later glandular-pubescent in lines, or glabrous; leaves lanceolate-ovate, 2–13 cm. long, 1–5.5 cm. broad, acuminate, obtusish, acuminate at the base, usually 6–8-nerved on either side of the midrib, at first glandular-pubescent on both surfaces, later scattered appressed-pilose, more conspicuously so on the midrib and nerves; petioles 0.1–3 cm. long, glandular-pubescent to glabrous; inflorescences loosely spicate; spikes 1.5–10 cm. long, internodes usually 10–12 mm. long, axillary spikes solitary; flowers white; cauline bracts oblanceolate, 2–3 mm. long, about 1 mm. broad, obtuse at the apex, conspicuously 3-nerved, densely glandular-pubescent; involucral bracts oblanceolate, 10–12 mm. long, about 3 mm. broad, rounded at the apex, densely glandular-pubescent, mucro 0.1–0.2 mm. long, inconspicuous, about 0.4 mm. below the apical margin; calyx-lobes lanceolate, 2 mm. long, puberulent; corolla about 16 mm. long, white, middle lobe of the anterior lip obovate, 10 mm. long, 5 mm. broad, lateral lobes obovate-oblong, 10 mm. long, 4 mm. broad, posterior lip oblong-obovate, 10 mm. long, 3 mm. broad, subemarginate; pollen-grains about $40 \times 25\ \mu$.

DISTRIBUTION: western Mexico.
SINALOA: Esquinapa, Jan. 1895, *Lamb 505* (G TYPE, M photo).
NAYARIT: Acaponeta, 23–30 Jan. 1897, *Rose 3125* (US).
GUERRERO: Achotla, alt. 900 m., 4 Jan. 1927, *Reko 5048* (US).

The usually large leaves, rather loose inflorescence, and the large involucral bracts with inconspicuous subapical mucro are distinctive characteristics of this species.

16. **H. Barclayana** Nees in Bot. Voy. Sulphur, p. 149. 1844; DC. Prodr. **11**: 468. 1847. Pl. 33, fig. 14.

Tetramerium scorpioides (Nees) Hemsl. Biol. Cent.-Am. Bot. **2**: 526. 1882, in part.

Stems freely branched; branches slender, cylindrical to slightly winged, 4-angled, at first evenly glandular-hirsute, later pubescent in lines, more or less glabrate; leaves elliptical to ovate, 1–3.5 cm. long, 0.5–2 cm. broad, acuminate, mucronulate to obtusish, obtuse to acute at the base, sparsely glandular-pilose on both surfaces, more conspicuously so on the midrib and nerves, usually 3–5-nerved on either side of the midrib; petioles 1–3 mm. long, glandular-hirsute; inflorescences closely spicate, spikes 1–7 cm. long, terminal or solitary in the leaf axils; cauline bracts oblanceolate, 2–4 mm. long, about 1 mm. broad, conspicuously 3-nerved, glandular-hirsute; involucral bracts oblanceolate, 9–10 mm. long, 4 mm. broad, rounded at the apex, glandular-hirsute, mucro about 0.5 mm. long, slightly divergent, 0.5–0.7 mm. below the apical margin; calyx-lobes broadly lanceolate, 1.5 mm. long; corolla 14–16 mm. long, middle lobe of the anterior lip ovate, 10 mm. long, 6 mm. broad, convex, lateral lobes obovate-oblong, 10 mm. long, 5 mm. broad, posterior lip oblong-ovate, 10 mm. long, 4 mm. broad; pollen grains about $40 \times 20\ \mu$.

DISTRIBUTION: southwestern Mexico.

JALISCO: without definite locality or date, specimen collected presumably by *Lay & Collie* during the voyage of Captain Beechy to the "Pacific and Bering's Strait," 1825–1828, in part (K).

NAYARIT: west of Ingenio, Santiago, 1 June 1849, in part, *Gregg 1017* (M); Tiger Mine, Acaponeta, 1 March 1927, *Jones 23049* (F, UCal, P).

COLIMA: Manzanillo Bay, without date, *Barclay, without number*, in part (K TYPE, M photo).

The lanceolate-elliptical leaves, closely imbricated spikes, large rounded apical involucral bracts, densely glandular-pubescence, and subapical mucro readily separate this species from others of the genus.

17. H. mephitica Happ, n. sp.[23]

Suffruticose plant 1–2 m. high; stems and branches cylin-

[23] **H. mephitica** Happ, sp. nov., herbacea perennis; caulibus ramosis et gracilibus, glanduloso-pubescentibus vel glabratis; foliis lanceolatis vel ovato-ellipticis, 1–3 cm. longis, 0.3–1.5 cm. latis, utrinque ex medio-nervo 3–5 nervis, utrinque adpresso-pilosis vel glabratis; spicis 1–6 cm. longis, densis; internodiis 2–4 mm. longis; caulis bracteis lanceolato-linearibus, 4 mm. longis; involucri bracteis oblanceolatis, 9–10 mm. longis, mucrone 0.2 mm. longo, inconspicuo, sub apice bracteae posito; corolla 15 mm. longa.—Collected on dry arid slope, trail to Las Mesitas, San Sebastian, Jalisco, Mexico, alt. 1700 m., 17 March 1927, *Mexia 1864* (Cal. Acad. Sci. Herb., TYPE).

drical to somewhat 4-angled, at first evenly stipitate-glandular, later pubescent in lines, more or less glabrate; leaves lanceolate-elliptic to ovate-elliptic, 1–3 cm. long, 0.3–1.5 cm. broad, nerves usually prominent on the lower surface, mostly 3–5-nerved on either side of the midrib, appressed-pilose, more conspicuously so on the midrib and nerves, later glabrous; petioles 0.1–1 cm. long, pilose to glabrous; inflorescences densely spicate, the spikes 1–6 cm. long, internodes 2–4 mm. long; flowers white, posterior lip streaked with reddish; the cauline bracts lanceolate-linear, 4 mm. long, 0.8 mm. broad, glandular-pilose, mucronate; involucral bracts oblanceolate, closely imbricated, 9–10 mm. long, about 3 mm. broad, obtusish, stipitate-glandular, mucro 0.2 mm. long, inconspicuous, erect, 0.1–0.2 mm. below the apical margin; calyx-lobes lanceolate-linear, about 2 mm. long, glandular-pilose; corolla about 15 mm. long, middle lobe of the anterior lip obovate, 9 mm. long, 4.5 mm. broad, lateral lobes obovate-oblong, 9 mm. long, 4 mm. broad, posterior lip oblong-obovate, 9 mm. long, 2.2 mm. broad, emarginate; pollen-grains about $45 \times 22\ \mu$.

Distribution: western Mexico.

Jalisco: dry rocky arid slope, trail to Las Mesitas, San Sebastian, alt. 1700 m., 17 March 1927, *Mexia 1864* (US, NY in part, M photo, CalAcad type).

The conspicuous veins on the lower side of the leaves, the closely imbricated, large, oblong-obovate involucral bracts, and the inconspicuous apical mucro definitely characterize this species. This plant is said to have a rather pronounced mephitic odor, which, however, is not apparent in dried specimens.

18. H. Donnell-Smithii Happ, n. sp.[24]

Stems freely branched; branches slender, at first evenly glandular-hirsute, later pubescent in lines, more or less gla-

[24] **H. Donnell-Smithii** Happ, spec. nov., herbacea perennis; caulibus ramosis et gracilibus, glanduloso-hirsutis vel glabratis; foliis ovato-rotundis vel ovatis, 1–6 cm. longis, 1–3.5 cm. latis, apice acuminato, basi rotundo vel acuminato, utrinque ex medio-nervo 5–6 nervis, utrinque glanduloso-puberulis; petiolis 0.1–2.5 mm. longis; spicis 1–4 cm. longis, densis, internodiis 3–4 mm. longis; caulis bracteis oblanceolatis, 2–3 mm. longis; involucri bracteis oblanceolatis, 6–7 mm. longis, glanduloso-hirsutis puberulisque, mucrone sub apice bracteae posito; corolla 8 mm. longa.—Collected on Rio de Los Esclavos, Dept. Santa Rosa, Guatemala, alt. 800 m., Feb. 1893, *Heyde & Lux 4559* (Mo. Bot. Gard. Herb., type).

brate, whitish; leaves ovate-rotund to ovate, 1–6 cm. long, 1–3.5 cm. broad, acuminate, mucronulate to acute at the apex, at first rounded, later acuminate at the base, usually 5–6-nerved on either side of the midrib, in the early stages closely glandular-puberulent intermixed with longer glandular hairs on both surfaces, more conspicuously so on the midrib and nerves, later glabrate; petioles 0.1–2.5 cm. long, pubescent to glabrate; inflorescences closely spicate, spikes 1.4 cm. long, terminal and solitary or in pairs at the nodes, internodes 3–4 mm. long; cauline bracts oblanceolate, 2–3 mm. long, glandular-hispid, mucronulate; involucral bracts oblanceolate, 6–7 mm. long, about 3 mm. broad, glandular-hirsute intermixed with a glandular puberulence, mucro 0.2–0.3 mm. long, divergent, 0.1–0.2 mm. below the apical margin; calyx-lobes lanceolate, 1 mm. long, hispidulous; corolla 8 mm. long, middle lobe of the anterior lip obovate, 5 mm. long, 3 mm. broad, concave, lateral lobes obovate-oblong, 5 mm. long, 2.5 mm. broad, posterior lip oblong-obovate, 5 mm. long, 0.7 mm. broad, emarginate; pollen-grains about $42 \times 20\ \mu$; capsule 5 mm. long, 2 mm. broad, hirsute near the apex, constricted base 2.5 mm. long; seeds 1.3×1 mm.

Distribution: Mexico and Central America.

Mexico.

Oaxaca: Lacs de Tutepeque, April 184-, *Galeotti 501a* (G, US, UCal).

Guatemala: without definite locality, coll. of 1892, *Heyde 687* (US); Rio de Los Esclavos, Dept. Santa Rosa, alt. 800 m., Feb. 1893, *Heyde & Lux 4559* (G, US, NY, M type, B, F).

Nicaragua: without locality and date, *Oersted 46* (K); near Granada, Dec. 1847, *Oersted 10765* (Cop).

The short oblong-obovate bracts quite set this species apart from *H. imbricans* which it somewhat resembles. The close glandular pubescence rather suggests *H. Barclayana*, from which it differs in size of bract and in position and shape of mucro.

19. H. rupicola Happ, n. sp.[25] Pl. 33, fig. 13.

Suffruticose plant 1–2 m. high; stems and branches at first glandular-pilose, later glandular-pilose in lines or glabrous;

[25] **H. rupicola** Happ, spec. nov., herbacea perennis; caulibus ramosis et gracilibus, glanduloso-pilosis vel glabratis; foliis ovatis, 1–9 cm. longis, 0.5–4 cm. latis,

leaves ovate, 1–9 cm. long, 0.5–4 cm. broad, acuminate, mucronulate to acute, obtusish to acuminate at the base, 4–6-nerved on either side of the midrib, at first glandular-pilose on both surfaces, more conspicuously so on the midrib and nerves, later glabrate; petioles 0.1–2.5 cm. long, glandular-pilose to glabrous; inflorescences more or less closely spicate, spikes 1–6 cm. long, terminal, solitary or paired in the leaf-axils, internodes 4–5 mm. long; flowers white, posterior lip yellow-streaked, with a red spot; cauline bracts oblanceolate, about 3 mm. long, 1 mm. broad, glandular-hirsute, strongly recurved, mucronate; involucral bracts oblanceolate, 6–7 mm. long, about 3 mm. broad, rounded at the apex, glandular-hirsute, mucro 0.5 mm. long, divergent, 0.8–1 mm. below the apical margin; calyx-lobes lanceolate, posterior lobe 0.6 mm. long, lateral lobes 1.2 mm. long, glandular-hirtellous; corolla 12–13 mm. long, middle lobe of the anterior lip obovate, 8 mm. long, 5 mm. broad, lateral lobes obovate-oblong, 8 mm. long, 4 mm. broad, posterior lip oblong-obovate, 8 mm. long, 2 mm. broad, emarginate; pollen-grains about 38×22 μ.

DISTRIBUTION: southwestern Mexico.

JALISCO: dry arid rocky slope, trail to Las Mesitas, Sierra Madre, San Sebastian, alt. 1700 m., 17 March 1927, *Mexia 1864* (NY, M TYPE, F, UCal, D, UMich); roadside between San Sebastian and Las Palmas, alt. 300–700 m., 30 March 1897, *Nelson 4125* (G, US).

The small involucral bracts suggest a form of *H. insularis,* also found in this region. However, the distinctly obovate-oblong involucral bracts, the subapical mucro, as much as one millimeter below the apical margin, and the conspicuous glandulosity of the pubescence of the bract readily separate it from that species.

The New York Botanical Garden specimen of *Mexia 1864* represents two distinct elements, namely *H. mephitica* and *H. rupicola.*

apice et basi acutis vel obtusis, utrinque glanduloso-pilosis vel glabratis; petiolis 0.1–2.5 cm. longis; spicis 1–6 cm. longis, plerumque plus minusve densis, internodiis 4–5 mm. longis; caulis bracteis oblanceolatis, 3 mm. longis; involucri bracteis oblanceolatis, 6–7 mm. longis, glanduloso-hirsutis, mucrone sub apice bracteae posito; corolla 12–13 mm. longa.—Collected on dry arid rocky slope, trail to Las Mesitas, Sierra Madre, San Sebastian, Jalisco, Mexico, alt. 1700 m., 17 March 1927, *Mexia 1864* (Mo. Bot. Gard. Herb., TYPE).

20. H. reticulata Happ, n. sp.[26]

Suffrutescent erect plants about 1 m. high; stems freely branched; branches slender, at first stipitate-glandular, later glandular-pilose in lines, or glabrous; leaves ovate-rotund to ovate, 1–3 cm. long, 1–2.5 cm. broad, abruptly acuminate, mucronate to cuspidate, truncate to rounded at the base, in the early stages conspicuously reticulate-veined, usually 3–5-nerved on either side of the midrib, appressed-pilose on both surfaces, more especially on the midrib and nerves; petioles 0.2–2.5 cm. long, at first densely pilose sparsely intermixed with stipitate-glandular hairs, later glandular-pilose in lines, or glabrous; inflorescences closely spicate, spikes 1–4 cm. long, lateral spikes solitary or in pairs, internodes 2–3 mm. long; flowers yellowish-white; cauline bracts oblanceolate, about 3 mm. long, glandular-pilose, recurved, mucronate; involucral bracts oblanceolate, 7–8 mm. long, about 2.5 mm. broad, glandular-pilose, mucro 0.5 mm. long, slightly divergent, 0.3–0.4 mm. below the apical margin; calyx-lobes lanceolate, pilosulous; corolla 9 mm. long, middle lobe of the anterior lip obovate, 5.5 mm. long, 3 mm. broad, lateral lobes obovate-oblong, 5.5 mm. long, 3 mm. broad, posterior lip obovate-oblanceolate, 5.5 mm. long, 1.5 mm. broad, subemarginate; pollen grains about 25 × 40 μ; capsule about 5 mm. long, 2 mm. broad, puberulent near the apex, the constricted base about 2.4 mm. long; seeds 1.3 × 1 mm.

DISTRIBUTION: Salvador.

SALVADOR: roadside, vicinity of Ahuachapan, Dept. Ahuachapan, alt. 800–1000 m., 9–27 Jan. 1922, *Standley 20221* (G, US TYPE, NY, M photo); in hedge, vicinity of Ixtepeque, Dept. San Vicente, alt. about 400 m., 6 March 1922, *Standley 21424* (G, US, NY); brushy slope, vicinity of Izalco, Dept. Sonsonate, 19–24 March 1922, *Standley 21801* (G, US, NY).

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[26] **H. reticulata** Happ, sp. nov., herbacea perennis; caulibus ramosis et gracilibus, glanduloso-pilosis vel glabratis; foliis ovato-rotundis, 1–3 cm. longis, 1–2.5 cm. latis, apice breviter acuminato, basi truncato vel rotundo, utrinque ex medio nervo 3–5 nervis, utrinque adpresso-pilosis; petiolis 0.2–2.5 cm. longis, glanduloso-pilosis vel glabratis; spicis 1–4 cm. longis, densis, internodiis 2–3 mm. longis; caulis bracteis oblanceolatis, 3 mm. longis; involucri bracteis oblanceolatis, 7–8 mm. longis, glanduloso-pilosis, mucrone sub apice bracteae posito; corolla 9 mm. longa.—Collected on roadside, vicinity of Ahuachapan, Dept. Ahuachapan, Salvador, alt. 800–1000 m., 9–27 Jan. 1922, *Standley 20221* (US. Nat. Herb. TYPE).

The stems and branches of this plant are rather frequently covered with a dense lanate pubescence. The broad rotund-ovate leaves with usually long petioles indicate a possible relationship with *H. scorpioides* var. *latifolia.* The several spikes are closely clustered at the nodes as in *H. imbricans,* but are much shorter and with bracts bearing a more definitely subapical mucro.

GENUS AND SPECIES EXCLUDED

Henrya Augustiniana Hemsl. in Journ. Linn. Soc. Bot. **26:** 111. 1880.[27] = **Henryastrum Augustinianum** (Hemsl.) Happ, n. gen. and n. comb.

Henrya Silvestrii Pampan. in Nuov. Giorn. Bot. Ital. n.s. **17:** 696. 1900. = **Henryastrum Silvestrii** (Pampan.) Happ, n. comb.

LIST OF EXSICCATAE

The numbers of the collectors are in *italics.* If the collection is unnumbered, this is indicated by a dash. The number in parentheses indicate the number designated the species in this revision.

d'Aoust, V. *817* (8).
Barclay, G. — (16).
Brandegee, T. S. — (1); — (2).
Calderon, S. *2283* (4).
Conzatti, C., R. P. Reko & Makrinius. *3152* (14).
Deam, C. C. *397* (8).
Friedrichsthal, E. — (9a).
Galeotti, H. *510* (18).
Gaumer, G. F. *1712, 1713* (6).
Gaumer, G. F. & Sons. *368* (6).
Goldman, E. A. *590* (6).
Greenman, J. M. *350, 391* (6); *224* (9).
Gregg, J. *1159* (9); *1017* (16).
Hahn. — (9).
Heyde, E. T. *687* (18).
Heyde, E. T. & E. Lux. *4559* (18).
Hinton, G. B. *3410* (1); *5756* (9).
Hooker, J. D. *1045* (1).
Jones, M. E. *23188* (1); *23049* (16).
Kellerman, W. A. *5215* (12).
Lamb, F. H. *505* (15).
Lay & Collie. — (1); — (16).
Linden, J. *190* (9).
Mell, C. D. *2255* (9).
Mexia, Y. *1864* (17); *1864* (19).
Millspaugh, C. F. *65* (6); *1661* (6).
Montes & Salazar, F. *293* (7).
Morales, R. *911* (13).
Morton, C. V. & Makrinius. *2673* (9).
Nelson, E. W. *4125* (19).
Oersted, A. S. *10765, 46* (18).

[27] Since *Henrya* of Nees was proposed in 1844 and continued intermittently since then, is generically distinct from *Tetramerium* of Nees, and since it contains about twenty-one species and varieties, it seems desirable to retain this name and give a new generic name to *Henrya* of Hemsley, which was published in 1880 and contains only two species. Therefore I suggest the name *Henryastrum* for the plant described by Hemsley as *Henrya* in Jour. Linn. Soc. Bot. **26:** 111. 1880.

Ortega, J. G. *5128* (1); *7184, 7186* (7).
Palmer, Ed. *211* (3); *75* (5); *1330a* (9a); *1330* (10); *575* (11).
Pittier, H. *125* (12).
Pringle, C. G. *3506, 4634, 5947, 7699* (9).
Purpus, C. A. *266* (1); —, *2261, 8863, 11155, 11166* (9); *8235, 8495* (9a).
Reko, R. P. *5048* (15).
Rose, J. N. *3125* (15).
Rose, J. N., P. C. Standley & P. G. Russell. *13845* (1); *12829* (2).
Seler, E. *3875, 3922* (6).
Sinclair, S. — (1).
Smith, C. L. *1330* (9); *1923* (12).
Standley, P. C. *20449, 23103* (4); *20221, 21424, 21801* (20).
Stone, W. *244* (6).

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New names and combinations here published are in **bold face** type. Accepted names previously published are in Roman type, and synonyms are in *italics*.

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SUPPLEMENT TO TETRAMERIUM

1b. Tetramerium nervosum Nees var. **acuminatum** Happ, n. var.[28]

Inflorescence loosely imbricated; bracts lanceolate to ovate-lanceolate, acuminate, strongly mucronate, mucro 1–1.5 mm. long, narrowed near the middle into a subpetiolate base.

[28] **T. nervosum** Nees var. **acuminatum** Happ, var. nov.; inflorescentiis laxis, bracteis lanceolatis vel ovato-lanceolatis, basi cuneatis et subpetiolatis, apice acuminatis valde mucronatis, mucrone 1–1.5 mm. longo. Collected in Guayaquil, Province of Guayas, Ecuador, alt. 20 m., 15 Nov. 1936, *Mexia 8401a* (Mo. Bot. Gard. Herb. TYPE).

Ecuador: Province of Guayas, Guayaquil, open lots, alt. 20 m., 15 Nov. 1936, *Mexia 8401a* (M TYPE).

This plant, collected by Mrs. Ynes Mexia, was received after the completion of the thesis on *Tetramerium*. The loosely imbricated spikes and the narrow more acuminate bracts with longer mucronate tips present a striking variation from *T. nervosum*.

Explanation of Plate

PLATE 27

Habit and bracteal arrangement of *T. nervosum* Nees. Illustration made from living specimen grown at the Missouri Botanical Garden. × ½.

HAPP—TETRAMERIUM AND HENRYA

EXPLANATION OF PLATE

PLATE [illegible]8

Habit and bracteal arrangement of *T. hispidum* Nees. Illustration made from living specimen grown at the Missouri Botanical Garden. × ¾.

HAPP—TETRAMERIUM AND HENRYA

Explanation of Plate

PLATE 29

Habit and bracteal arrangement of *T. platystegium* Torr. Illustration made from living specimen grown at the Missouri Botanical Garden. × ½.

HAPP—TETRAMERIUM AND HENRYA

Explanation of Plate

PLATE 30

Habit of *H. scorpioides* Nees. Illustration made from specimen, *Purpus 11155*, in Herbarium of the Missouri Botanical Garden. × ½.

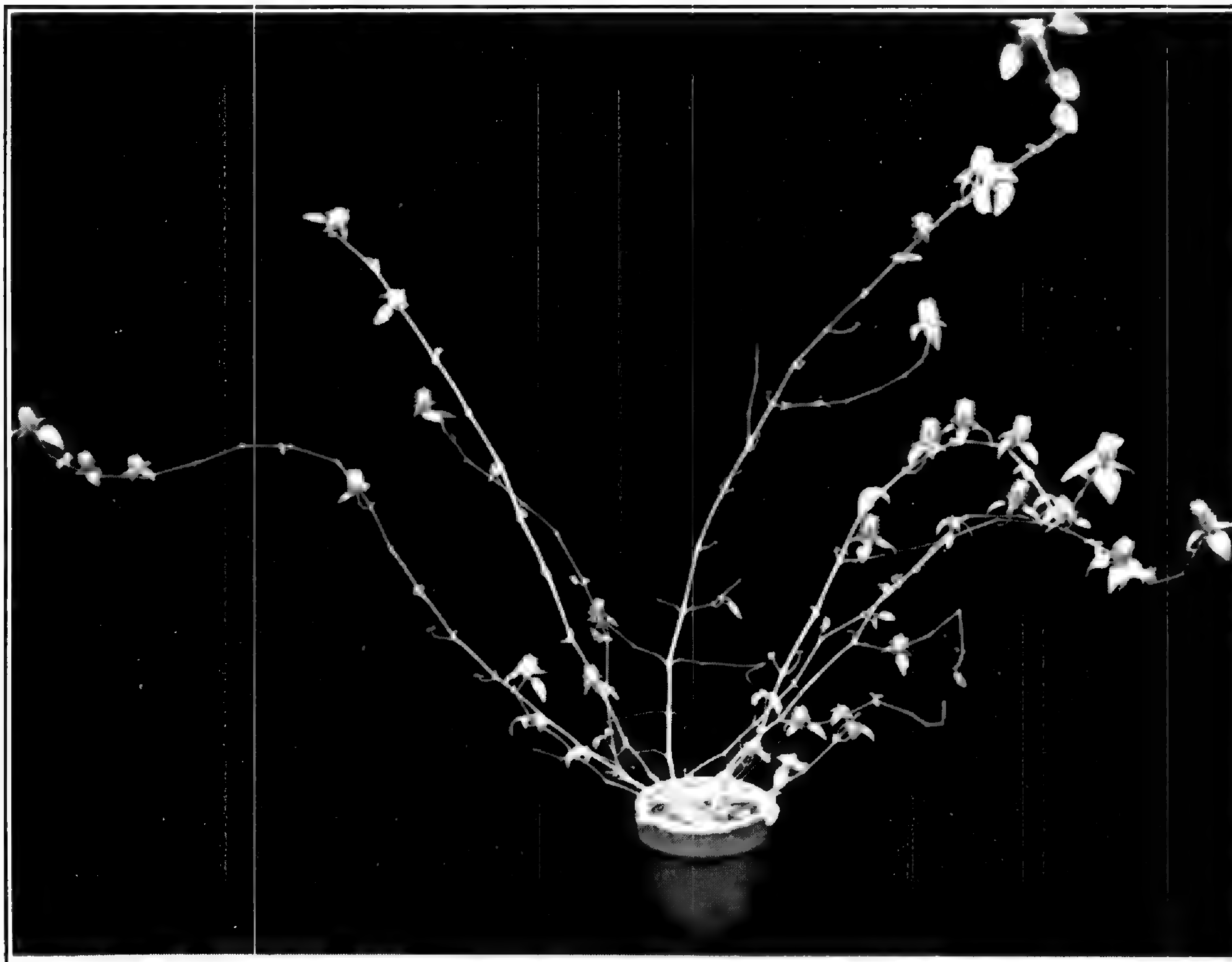
HAPP—TETRAMERIUM AND HENRYA

Explanation of Plate

PLATE 31

Fig. 1. Habit of *T. nervosum* Nees. × 1/6.
Fig. 2. Habit of *T. nervosum* Nees. × 1/2.

Photographs made from living specimens grown at the Missouri Botanical Garden.



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HAPP—TETRAMERIUM AND HENRYA

Explanation of Plate

PLATE 32

Fig. 1. Habit of *T. hispidum* Nees.

Fig. 2. Habit of *T. nervosum* Nees.

Photographs made from living specimens grown at the Missouri Botanical Garden. × ⅓.

1 2

HAPP—TETRAMERIUM AND HENRYA

Explanation of Plate

PLATE 33

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Fig. 24. Capsule of *Tetramerium platystegium* Torr. × 4.
Fig. 25. Capsule of *Tetramerium nervosum* Nees. × 5.
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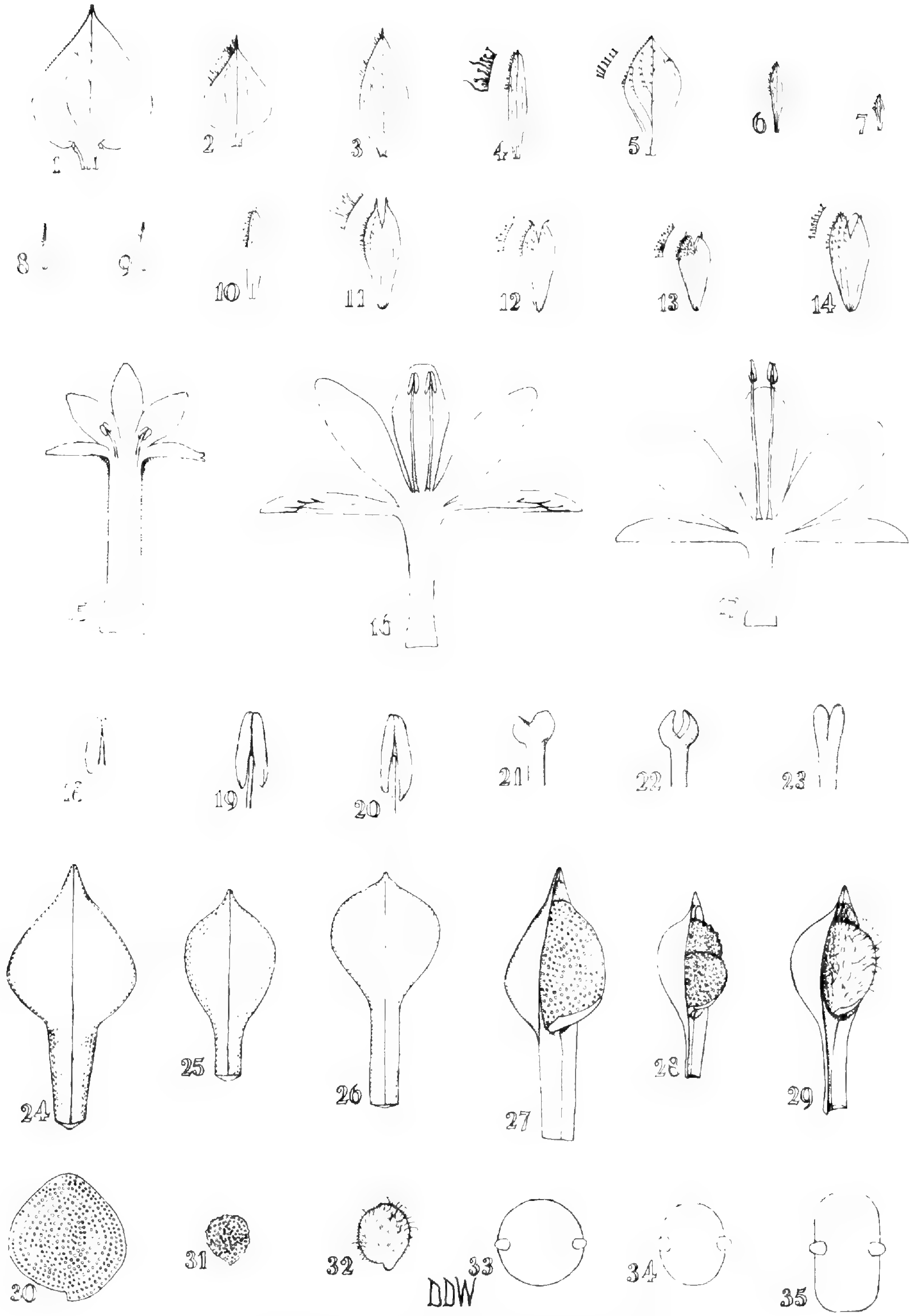
Fig. 35. Pollen-grain of *Henrya scorpioides* Nees. 40 × 20 μ.



HAPP—TETRAMERIUM AND HENRYA

SOME EFFECTS OF METHYL CHOLANTHRENE ON THE MORPHOLOGY AND GROWTH OF YEASTS

CARROLL WILLIAM DODGE

Mycologist to the Missouri Botanical Garden

Professor in the Henry Shaw School of Botany of Washington University

AND BERTHA SANFORD DODGE

With increasing knowledge of the chemistry of cholanthrene and related compounds and their action on the cells of mammals, it has seemed desirable to study their effects on organisms with less complex structures and interrelations of parts, in order to determine the action of these compounds on the morphology of individual cells and on the relation of cells to each other in a relatively simple group of plants such as yeasts. Some growth and fermentation studies have been undertaken, but much more data must be secured by the use of more refined methods before any broad generalizations can be safely made. As this manuscript was nearing completion, Goldstein[1] reported that 1,2,5,6 dibenzanthracene and methyl cholanthrene increased cell division in a bacterium, *Escherichia communior*, so that approximately 50 per cent more cells were present in the eighth to ninth hour than in the control, while phenanthrene showed no effect. No details of methods are given beyond the suggestion that the carcinogens were present in colloidal suspensions.

The writers wish to acknowledge the assistance of Miss Helen Bramsch, a former research assistant, in the preparation of celloidin sections of agar cultures, and Mr. Verne F. Goerger, for the microphotographs. We also gratefully acknowledge the financial assistance of the International Cancer Research Foundation which has made this work possible.

[1] Goldstein, Samuel. 1937. A microbiological test for carcinogenic hydrocarbons. Science N.S. **86**: 176, 177.

Six organisms from our collection of pathogenic and saprophytic fungi were utilized in the preliminary work: *Zymonema dermatitidis* (Gilchrist & Stokes) Dodge, isolated from a case of blastomycotic dermatitis and reported by Moore[2] and since grown on malt extract agar; *Mycocandida onychophila* (Pollacci & Nannizzi) Langeron & Talice, received in 1934 from the Centraalbureau voor Schimmelcultures, Baarn; *Castellania tropicalis* (Castellani) Dodge, originally from Castellani, received in 1927 from Bailey K. Ashford through the kindness of Willard C. Greene; *Saccharomyces ellipsoideus* Hansen, a champagne strain received in 1936 from the American Wine Company through the kindness of Adolf Heck, Jr., and a Tokay strain received in 1935 from P. L. Varney of the Bacteriology Department of the Washington University Medical School; and finally some observations were made upon a very pleomorphic organism isolated by Gruner from the blood of a patient with carcinoma, and given me in 1936 by R. R. Rife.

METHODS

For studies of morphology, colonies on Sabouraud glucose agar (using Bacto products of the Digestive Ferments Company) were imbedded in celloidin, using the technique developed in this laboratory and outlined by Moore,[3] and stained with iron haematoxylin.

Liquid cultures were centrifuged, most of the supernatant liquid decanted, and Hermann's fixative added. After twelve hours, the material was again centrifuged and the fixative decanted. The material was washed several times with distilled water to remove the fixative, centrifuged, and mounted in a drop of Maneval's stain in Amann's lactophenol solution. The repeated centrifuging may have dissociated the cell groups slightly, the amount depending upon the thickness of the geli-

[2] Moore, Morris. 1933. Blastomycosis: report of a case, with a study of an etiologic factor and a classification of the organism. Ann. Mo. Bot. Gard. **20**: 79–118, *pl. 6, 7*.

[3] Moore, Morris. Microscopy. In Dodge C. W. 1935. Medical Mycology: fungous diseases of man and other mammals. pp. 71–73.

fied sheaths of the cells and of protoplasmic connections persisting between the cells. However, since all the material of a single organism was centrifuged at the same time, comparative data would seem valid.

Growth studies were based on increase in colony size on Sabouraud glucose-agar plates and on total dry matter obtained by filtration through alundum crucibles (RA360). Colony size yielded very little quantitative data since the thickness of the colony varied and was not easily measured. Since some of the organisms may be pathogenic in spite of their long cultivation on laboratory media, they were killed by heating to boiling for three minutes, then transferred to centrifuge tubes, and centrifuged. Most of the supernatant liquid was decanted and the organisms washed thrice with distilled water to remove the culture medium. It is conceivable that some of the dry weight was lost by this method due to death and exosmosis. Where the filtrate was cloudy it was filtered again through the same crucible, resulting in a clear filtrate. Here, too, some of the dry matter may have been lost, but since the data presented should be considered as comparative and preliminary, these losses seem relatively unimportant. In the more recent data accumulated for *Saccharomyces,* boiling was omitted and a crucible (RA84) with finer pores was used.

In the preparation of media, about 100 mg. of methyl cholanthrene were shaken in 1000 ml. of distilled water and allowed to stand for three days or more, then the undissolved crystals were filtered off, and the solution here described as saturated was used to make up the various dilutions reported. All media were sterilized at 15 pounds pressure for 15 minutes and all cultures were incubated at approximately 20° C. The agar cultures were inoculated with a single loopful of a suspension of the growth of the organism on an agar slant in 5 ml. of sterile distilled water. The liquid cultures were inoculated with three drops of a suspension of organisms in a peptone glucose liquid culture from a sterile 1 ml. Ostvald pipette. The same suspension was used for all the cultures of a single series.

MORPHOLOGY

Since the differences were more pronounced in the cultures of *Saccharomyces ellipsoideus,* they will be described in detail. The other organisms showed some differences but are more difficult of interpretation and need further study.

In liquid cultures, there is a fine white sediment and no pellicle. The medium remains clear. The cells are mostly short-ellipsoid, about 5.5 μ in longer diameter. The young cells stain deeply with Maneval's stain. A deeply staining body in the center, probably the nucleus, is surrounded by a clearer zone of cytoplasm which is denser next the wall. The cells and cell groups are surrounded by a gelified sheath twice or thrice the thickness of the wall. This sheath is so transparent that it is easily overlooked, but shows more distinctly with polarized light. Protoplasmic connections persist for some time between cells. Budding may be polar, resulting in single chains of cells, but is commonly from 3 to 6 points around a great circle, resulting in a dichotomously branched filament with three points or a large plate with six points. Some of these plates suggest conditions seen in the Chlorophyceae in the Volvocales and Chlorococcales. Nuclear division is amitotic. Occasionally long slender cells, about 3×8.5 μ, containing about four deeply staining granules, are seen. In the older long cells, the protoplasm has contracted to the ends and the middle, leaving two ellipsoidal clear areas. Asci were not observed. In 1/40 saturation with methyl cholanthrene, the cells are similar in size and shape, the metachromatic granules are larger and sometimes fuse as small threads. In 1/10 saturation, the cells are smaller, 3–4 μ, rarely up to 5.5 μ, the cell groups contain fewer cells, the sheath is thinner, and the metachromatic granules fewer. In 1/4 saturation, cells 3–4 μ, groups rare, containing only 3–4 cells, most cells isolated, sheath thin. There are very few metachromatic granules, the vacuoles are large, the protoplast is usually next the cell wall, with a few strands crossing the vacuole. The long ellipsoidal cells are more abundant. In saturated methyl cholanthrene, the cells are larger, mostly

5.5 μ, with some 7 μ, the nucleus is central, staining deeply, the metachromatin is abundant, with thick fibres connecting the granules. The gelified sheath is very thick, and protoplasmic connections are clearly visible. Most of the cells are short-ellipsoid, a few are long-ellipsoid.

On Sabouraud glucose agar, the colony is 6 mm. in diameter, smooth, shining, nearly white and finely merulioid in the center. The cells are nearly spherical, and stain deeply. The sheath is very thin, so that the cells are mostly washed away and the arrangement is not clearly visible. The cells penetrate a short distance into the agar. The mature cells are 5.6–6 × 2–3 μ, and the nucleus is rather large and very deeply stained in the center of the cell. Budding is from two points at the distal end of the cell, resulting in dichotomously branched filaments. Rarely multipolar budding results in a whorl of blastospores at the distal end such as one commonly sees in *Syringospora.* There are usually two vacuoles at either end of the cell.

On Sabouraud agar with 1/50 saturation with methyl cholanthrene, the colony is 5 mm. in diameter, ivory-yellow, the surface smooth and dull. The cells vary from 2.5 to 3.5 μ in diameter, with many shadow cells and some larger, deeply staining cells 4–4.5 μ, spherical or nearly so. The colonies penetrating the agar are 70 × 20 μ, fusiform to ellipsoid, the outer cells deeply staining, 3–3.5 μ in diameter. Some of the deeper cells are suggestive of those seen in 1/6 saturation but are very lightly stained and difficult to see. The cells appear to be in radiating, little-branched chains.

On Sabouraud agar with 1/6 saturation with methyl cholanthrene, the colony is 8 mm. in diameter, marguerite-yellow, smooth and flat. The colony is composed of lightly staining filaments, closely dichotomously branched, ending in unbranched chains of thick-walled, deeply staining cells, suggestive of the chlamydospores of *Syringospora.* The colonies penetrating the agar are fusiform to irregular. The central tissue is composed of more or less parallel, thin-walled hyphae, lightly staining, 1.3–1.5 μ in diameter, dichotomously branched near the tips to produce a palisade of heavily staining hyphae 6–8 cells long, twice or thrice dichotomously branched (pl. 34, figs. 1, 5). The cells are smaller with each branching, about twice as long as broad, suggesting paraphyses or the cortex of some lichens (pl. 34, figs. 2, 3). In this tissue are long ellipsoid cells which do not reach the outer surface of the colony, about $20 \times 7\ \mu$ (pl. 34, figs. 2, 6). Apparently these gradually expand into subspherical cells. At first the cells are deeply stained throughout. In somewhat older cells, the deeply staining portion is composed of a reticulum of thick fibres and small meshes, suggesting the appearance of a reticulate chloroplast. In the still older, subspherical cells (pl. 34, figs. 3, 4), the reticulum is more irregular and the meshes much larger in relation to the fibres. The whole colony is imbedded in a gel which extends about $2\ \mu$ beyond the tips of the palisade layer (pl. 34, fig. 5). In small, young colonies, the individual sheaths of the palisade hyphae can sometimes be seen within the colony gel.

FERMENTATION

Preliminary experiments using fermentation tubes show more rapid fermentation in the presence of methyl cholanthrene, producing about one-third more gas in a given time. Half saturation produces about one-fifth more gas than the control. The effects of the smaller concentrations tried are slight or doubtful. Further work with more refined technique is being carried on.

GROWTH

Colony diameter was recorded on solid media but is not a very accurate measure of growth, owing to differences in thickness in *Saccharomyces ellipsoideus* and *Mycocandida onychophila*. It seemed more reliable with the other organisms studied, but data on these organisms will be published later.

Dry-weight determinations were slower but gave much more accurate data. In our series of experiments saturated methyl cholanthrene in peptone-glucose solution has yielded 83.7 ± 1.2 mg. dry weight, while the controls under the same environmental conditions yielded 64.0 ± 2.7 mg. While our data are not yet conclusive, concentrations as low as ¾ saturation yield amounts approximating that of the saturated, and those of ½ saturation or lower approach values for water. Further work is in progress to ascertain more closely the curve for total dry weight and the rate of growth at the various concentrations. The maximum variation of any cultures from the average of those at a given concentration has been 4.2 per cent, and in most cases has been much less. More variability has occurred in the lower concentrations of methyl cholanthrene.

SUMMARY

Methyl cholanthrene, the most potent of the carcinogens so far reported, profoundly affects the morphology and growth of yeasts. Giant cells and increased differentiation of cells within the colony occur in cultures of *Saccharomyces ellipsoideus* Hansen, champagne strain, after two months. Total dry weight and fermentation are increased approximately one-third in saturated methyl cholanthrene peptone-glucose solution.

EXPLANATION OF PLATE

PLATE 34

Showing the effect of 1/6 saturation with methyl cholanthrene in Sabouraud glucose agar on *Saccharomyces ellipsoideus* Hansen, champagne strain.

Fig. 1. Showing some hyphae of the central tissue and a large ellipsoidal cell in the palisade layer (× 770).

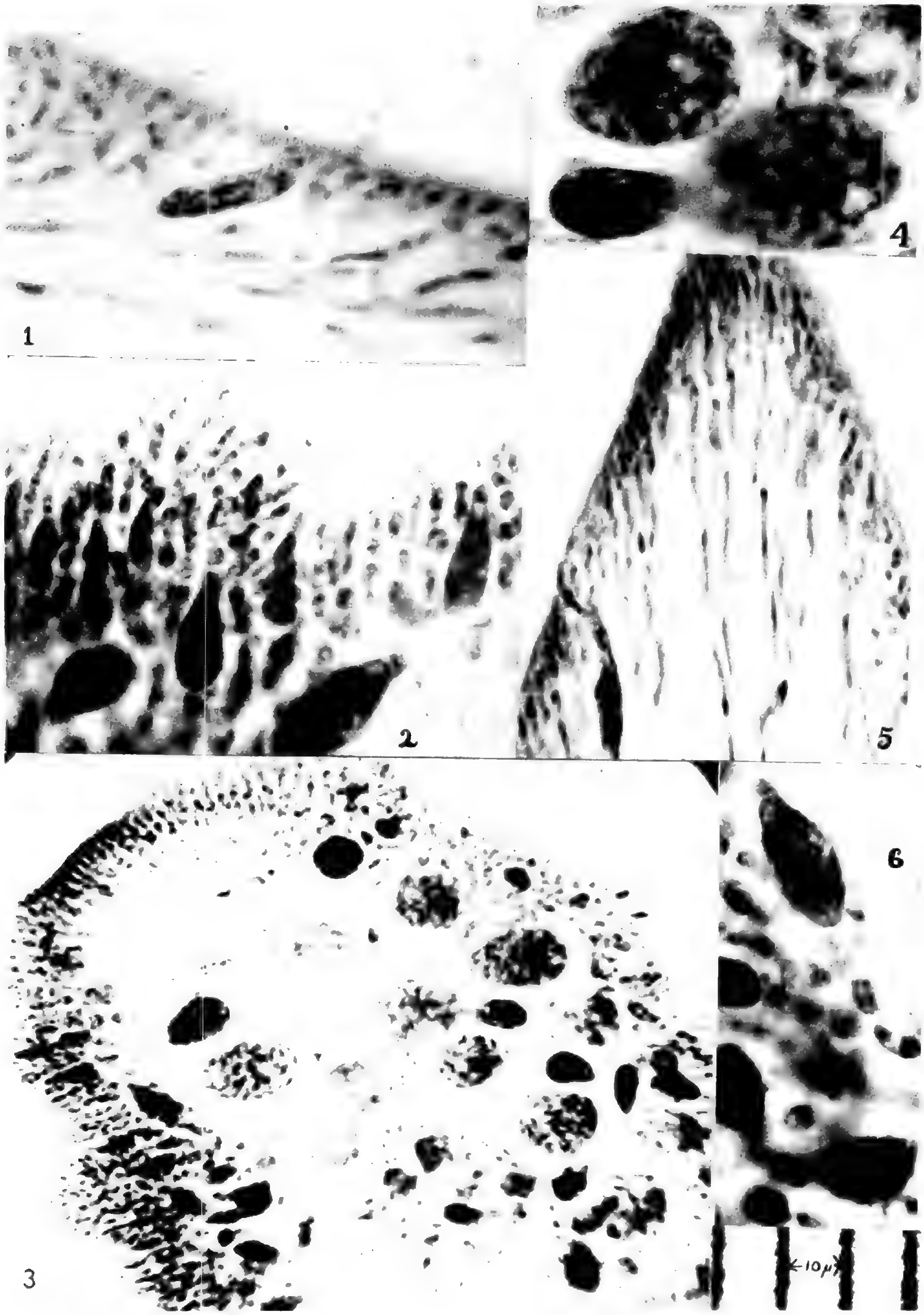
Fig. 2. Section of palisade layer, showing dichotomous branching and ellipsoidal cells dividing at their tips. The line of the surrounding gel is out of focus (× 770).

Fig. 3. Section of colony showing palisade layer, ellipsoidal cells, central tissue with large subspherical cells (× 430).

Fig. 4. Large subspherical cells (× 770).

Fig. 5. Tip of fusiform colony showing central tissue, palisade layer, and one ellipsoidal cell (× 770).

Fig. 6. Ellipsoidal cell dividing, and heavily stained subspherical cells (× 770)



DODGE & DODGE — EFFECT OF METHYL CHOLANTHRENE ON YEASTS

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