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NOTES ON AMERICAN WILLOWS. X¹

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BEFORE I can prepare a key and an enumeration of all the American Willows I have to discuss several more species. Most of them may be referred to the sections *Fulvae* and *Roseae*. Much doubt, however, exists as to the systematic position and the real relationship of some species.

There is yet another group I have not dealt with, namely, the section *Cordatae*, but as I have repeatedly stated, I have not studied this group sufficiently because Mr. C. N. Ball is already writing a monograph on it.²

To-day I can only refer to what I said in the introduction to my last note on the incompleteness of our present knowledge of most of the species and varieties, and on the collections on which I have mainly based my studies. All I can do here is to try to stimulate the interest in the study of Willows. Investigations like those of Griggs³ on the species of Ohio would greatly help us, especially if careful attention is paid to the existing literature on this subject. A critical review of the treatment of the genus given in such books as Britton & Brown's Illustrated Flora, Britton's Manual, Gray's New Manual, Rydberg's Flora of the Rocky Mountains, Jepson's Flora of California, Howell's Flora of the Northwest Coast and others would be of great value but it cannot be done successfully until we are able to interpret more correctly certain species, their relationship and variability.

a. THE SPECIES OF SECTION FULVAE.

This section was proposed by Barratt in 1840 for *S. rostrata* Richardson. He gave a good description of its main characters, and said that it is "nearer allied to some of the European, than any of the American Willows, known to me." Andersson, in 1858 and later, placed the species of this section in his section *Cinerascentes vel Capreae*, and I too, in 1904, referred

¹ Our attention has been drawn by Professor J. C. Nelson to an error on p. 162 of vol. 1 of this Journal in regard to Coville & Applegate's No. 551 of *Salix commutata* which is enumerated under the state of Washington, but should be referred to Oregon, the locality being near the line between Lane County and Crook County or probably, after the subdivision of this county, Deschutes County; the date should read August 17, not 7. ED.

² Mr. Ball's study of the section *Cordatae* is expected to appear in the next issue of this Journal. ED.

³ Griggs, R. F. The Willows of Ohio. (Proc. Ohio State Acad. Sci. vi. pt. 6, pp. 60. 1905.)

S. Bebbiana to the *Capreae*. Both sections, however, are quite distinct, and Ball, in 1909, made a new section *Rostratae* for *S. Bebbiana* and *S. Geyeriana*, apparently overlooking Barratt's name *Fulvae*.

From those of section *Discolores* (see my note IX) the species of the *Fulvae* chiefly differ in their yellowish or light brown scales with a short thin pubescence, their more slender and lax aments, their comparatively longer pedicels and shorter stigmas. They show a closer relationship to the species of section *Griseae* also treated in my last note. Species like *S. humilis* and *S. tristis* with their rostrate capsules are, perhaps, better placed in a separate section because they differ as much from the true *Griseae* (*S. sericea* and *S. petiolaris*) as from the *Fulvae*, the species of which also have rostrate fruits. The taxonomic value of certain characters in a genus like *Salix* can be interpreted very differently, and I shall later explain how much at variance the opinions of our best salicologists really are.

The synonymy of section *Fulvae* is as follows:

Sect. *Fulvae* Barratt, Sal. Am. sect. VII (1840). — Sect. *Cinereae* Borrer apud Hooker, Fl. Bor.-Am. II. 144 (1838), pro parte, quoad *S. rostratam*. — Sect. *Cinerascentes* Andersson in Öfv. Svensk. Vet.-Akad. Förh. XV. 122 (1858), pro parte. — Sect. *Cinerascentes* vel *Capreae* Andersson in Svensk. Vet.-Akad. Handl. VI. 57 (Monog. Salic.) (1867), pro parte; in De Candolle, Prodr. XVI.² 215 (1868), pro parte. — Sect. *Capreae* Schneider, Ill. Handb. Laubholzk. I. 61 (1904), pro parte, non Koch. — Sect. *Rostratae* Ball apud Coulter & Nelson, New Man. Rocky Mts. Bot. 138 (1909).

1. *S. Bebbiana* Sargent in Garden & Forest, VIII. 463 (1895); Silva, IX. 131, t. 477 (1896). — Schneider, Ill. Handb. Laubholzk. I. 61, fig. 11 w-w², 12 s (1904). — Britton & Brown, Ill. Fl. ed. 2, I. 599, fig. 1471 (1913). — *S. rostrata* Richardson, Bot. App. in Franklin, Narr. Jour. Polar Sea, 753 (1823); reprint, 25; ed. 2, 765 (1823); reprint, 37; non Thuillier (1799). — Hooker, Fl. Bor.-Am. II. 147 (1839). — Barratt, Sal. Am. No. 25 (1840). — Torrey, Fl. N.Y. II. 211 (1843). — Carey apud Gray, Man. ed. 1, 428 (1848). — Bebb apud Gray, Man. ed. 6, 482 (1890). — *S. fusca* Hooker, Fl. Bor.-Am. II. 151 (1839), sec. specim. orig., non Linnaeus — *S. vagans* 1. *cinerascens* b. *occidentalis* Andersson in Öfv. Vet.-Akad. Förh. XV. 122 (1858), quoad pl. americ. — *S. vagans* 1. *S. rostrata* Andersson in Svensk. Vet.-Akad. Handl. VI. 87 (Monog. Salic.) (1867), quoad var. *ovovatam*, exclud. formis. — *S. vagans* *occidentalis* Andersson, I. c., pro syn. subspec. *rostratae*. — *S. livida* *occidentalis* Gray, Man. ed. 5, 464 (1867). — *S. vagans* β *rostrata* 3. *ovovata* Andersson apud De Candolle, Prodr. XVI.² 227 (1868). — *S. depressa* c. *rostrata* Seemen in Ascherson & Graebner, Syn. Mitteleur. Fl. IV. 119 (1909).

This species was first described by Richardson (1823) as *S. rostrata*. The type came from the "wooded country from lat. 54° to 64° north." In the herbarium of the New York Botanical Garden there is Richardson's specimen from Fort Franklin (65°) which agrees with the author's description.

The same form is in Herb. Ottawa under No. 24749 (fruiting branchlets) bearing the label "*Salix Scouleriana* Fl. Bor. Am. Dr. Richardson." Bebb, in 1891, made the note to it: "ticket evidently misplaced." If it is, however, a specimen of Richardson's (ex Herb. Mus. Brit.) the name only may be a lapsus calami. On the same sheet there is also a sterile branchlet which is not described by Richardson. In his description everything fits the specimen in Herb. N. Here we find on the same sheet a female specimen collected by Richardson on July 20, 1827 "N.Y. House." According to Franklin (Narr. second Exp. Polar Sea, 315 [1828]) Richardson on July 8, 1827, was at Fort Alexander, Manitoba, whence he went to Montreal. Where he was on the 20th of July is not stated, and I have been unable to find out where "N.Y. House" is. The specimen is identical with that from Fort Franklin.

There is, however, in Herb. Ottawa another specimen collected by Richardson and labeled "*S. rostrata* Richards. Franklin Expedition, between Forts Simpson and Chepewyan" (Chapewyan on Franklin's map). This specimen has narrow elliptic-lanceolate leaves which soon become almost glabrous beneath, and glabrous branchlets. Richardson's statements "folia sesquipollucaria, exstipulata, pube sericea caduca ? vestita subtus grisea sub-glaucia" might refer to this glabrescent form. But if we take this specimen for the type, *S. rostrata* sensu stricto would be the same as our present var. *perrostrata*, and we should be obliged to take up the name var. *obovata* of Andersson for the eastern form which we at present regard as the type.

As I have not seen the material of the Hookerian Herbarium I use the name *Bebbiana (rostrata)* for the pubescent form which, however, is closely connected with var. *perrostrata* by numerous intermediate forms. Richardson's glabrescent specimen has rather thin, acute leaves which measure up to 4:1.2 cm. They are partly distinctly glaucescent beneath, the pubescence being very thin. The fruiting aments are old, the fruits measure about 8 mm., the pedicels about 4 mm. in length, and their pubescence is very thin.

Hooker, Barratt, Torrey and Carey used the name *S. rostrata* Richardson. When Andersson first dealt with the American Willows he named this species *S. vagans cinerascens occidentalis*. He cites Richardson, Gray and Hooker but he does not mention any specimens, and he also refers to it some Siberian forms. The quotation "*S. depressa cinerascens* Trautv." has been omitted in Sal. Bor. Am. 61. All the other forms of *S. vagans* given by Andersson in 1858 are of European origin. In 1867, he has a *S. vagans* 1. *S. rostrata* with the synonym *S. rostrata* Richardson and *S. vagans occidentalis* Andersson. This sub-species *rostrata* includes only American forms, and Andersson enumerates the following five varieties of it: *latifolia*, *lanata*, *obovata* (with forms *subambigua* and *subrepens*), *lanceolata* and *glarescens*. To his second subspecies *cinerascens* Andersson, in 1867, does not refer American forms, but under his third subspecies, *S. livida*, we find a var. *americana* which is said to be connected by inter-

mediates with var. *glabrescens* of the subspecies *rostrata*. In 1868 Andersson reduced his subspecies to varieties, and we find under var. β *rostrata* only four forms: 1 *latifolia*, 2 *lanata*, 3 *ovata* (without any subform), and 4 *latifolia*; var. *glabrescens* of 1867 has been omitted.

Gray in 1867 used the name *S. livida occidentalis* for *S. rostrata*. Bebb, however, took up this name again in 1885 (in Coulter's Manual). Sargent, in 1895, changed the name *S. rostrata* to *S. Bebbiana* on account of the older *S. rostrata* Thuillier (Fl. Envir. Paris ed. 2, 517 [1797]). This new name has been accepted by several later authors. Robinson and Fernald (1909) keep Richardson's name, regarding *S. rostrata* Thuillier as a strict synonym. This name, however, is not an unconditional synonym (as for instance the name *S. longifolia* Lamarck, see Bot. Gaz. LXVII. 340). A. & E.-G. Camus (Class. Saul. d'Europe 1. 163 [1904]) mention *S. rostrata* Thuillier in the synonymy of *S. repens* Linnaeus but again as a synonym of their var. *A vulgaris* subvar. *microphylla*. Von Seemen (in Ascherson & Graebener, Syn. Mitteleurop. Fl. IV. 127 [1909]) refers Thuillier's name as a synonym to his *S. repens* B. *rosmarinifolia* thus regarding it as identical with a form different from that of Camus. It is, therefore, possible that Thuillier's name may be used again as a specific name, and as the case stands it seems not advisable to apply the name *S. rostrata* to an American species.

With regard to the variability of *S. Bebbiana* it ought to be said that the floral characters as a whole seem to be very constant. The length of the style varies to a certain degree but we should need the investigation of a very large series of well-developed female specimens to decide whether the forms with a more conspicuous style (almost equaling the length of the stigmas) can be regarded as distinct. Fernald's var. *projecta*, a still very little known variety, seems to be the only one of which the flowers differ somewhat from those of the type, but here, too, the differences are not very important. On the other hand the variability of the leaves is much greater but it is extremely difficult to limit varieties. Andersson, apparently, did not see copious material, and he was inclined to lay too much stress upon certain variations which look very distinct as long as intermediate forms are not seen. As I have already mentioned Andersson first considered *S. Bebbiana* as var. *occidentalis* of his *S. vagans* 1. *cinerascens*. Later also he kept it as a variety of *S. vagans*.¹ I do not wish to-day to discuss the question whether the American *S. Bebbiana* is so closely related to any of the European-Asiatic forms which have been united under the name *livida*, *depressa* or *Starkeana* that it, too, must be regarded as a variety or a subspecies of it. I think it best to keep the American forms as a separate species.

As already explained, Andersson, in 1867 and 1868, established quite a number of forms of his subspecies or var. *rostrata*. It is strange that he also has besides *rostrata* which only consists of American forms another

¹ This *S. vagans* is the same as *S. livida* of Camus and *S. depressa* of Von Seemen. As I have tried to show the oldest name for this species is *S. Starkeana* Willdenow, see Sargent, Pl. Wils. III. 151 (1916).

American form under his subspecies or var. *livila* of which he, in 1867, says: "Ad formas denudatas *S. rostratae* attamen modificationes permultae adsunt transitoriae." This is his var. or f. *americana* of which the type was collected by Bourgeau "ad fluv. Saskatchewan." The var. *americana*, in 1868, is said to be characterized by "foliis magnis 2-3 poll. longis late lanceolatis v. subovali-ovatis grosse undulato-crenatis, primo tenuibus subtus partim glaucescentibus, demum rigidiusculis utrinque viridibus, nervis pallidioribus et prominenti-reticulatis pulchre percursis." He adds: "E regione ad fl. Saskatchewan plura specimina a Bourgeau lecta vidi." Among Bourgeau's specimens which I have seen none fitted this description. The statement that the leaves later become "utrinque viridibus" is rather strange. It is probable after all that var. *americana* does not belong to *S. Bebbiana*, and it is impossible to ascertain the identity of this variety without seeing the type.

"In *S. lividam americanam* aperte abiens" is Andersson's var. *glabrescens* of *rostrata*, the type of which, too, was found by Bourgeau on the Saskatchewan. From var. *americana* it "vix nisi foliis minutissime pubescentibus et forsitan etiam majoribus differt." In 1868 this var. *glabrescens* is not mentioned by Andersson even as a synonym. One might be inclined to apply this name to what we now call var. *perrostrata* if there was not the statement that the leaves are rather larger than those of var. *americana*. Forms with such large leaves apparently do not belong to *S. Bebbiana* but to *S. discolor* or *S. balsamifera*. Only by a type specimen can the identity of the large-leaved form be established.

There remain to be discussed four more of Andersson's varieties of 1867. Of these var. *obovata*, according to the author is "forma typica. ubique in America septentrionali frequens." He distinguished two forms of it: f. *subambigua* and f. *subrepens*. The first is characterized by "foliis ovali-ovatis, rigidissimis, margine remote serrulatis, subtus lucide tomentellis." It was collected by Lyall "in Sumass-prairie." The second differs by "foliis lingulato-lanceolatis basi longe attenuatis, breve acuminatis, 1½ poll. longis, supra medium vix ½ poll. latis, subtus saepissime tomentosis." Bourgeau found it in the Rocky Mountains. In 1868, both forms are mentioned again but without names, and Andersson here states "Ambarae in Rocky mountains (Bourgeau)." I have not yet seen a specimen of Lyall's from Sumass Prairie or of Bourgeau's from the Rocky Mountains which agree with these descriptions, and I must regard at present the two forms as uncertain, while I take var. *obovata* for a synonym of typical *Bebiana*.

A narrow leafed form of the type seems to be Andersson's var. *lanceolata* of which in 1867 he says: "foliis elongatis supra medium parum dilatatis, fere 2 pollices longis vix ¾ poll. latis, utrinque pilis adpressis incano-hirtis; amentis magis densifloris." He himself adds "foliis tantum angustioribus a praecedente [var. *obovata*] recedunt." The diagnosis of 1868 is somewhat different, and it is impossible to decide the identity and the taxonomic value of this variety without the type.

Among Lyall's specimens from the "Lower Frazer River" in the Kew

Herbarium is one which Andersson himself named "*Salix vagans cinerascens latifolia.*" In 1867 and 1868 he, however, states that the type of *S. vagans cinerascens rostrata latifolia* was collected by Lyall "in ins. Vancouver." The description runs: "foliis $2\frac{1}{2}$ -3 poll. longis, supra medium 1- $1\frac{1}{2}$ poll. latis, longius acuminatis, tenuibus, subintegris, subtus molliter tomentosis; stipulis parvis acutissimis." I have not yet seen a specimen of *S. Bebbiana* from Vancouver Island, and Henry (Fl. South. Brit. Col. 98 [1915]) says of *S. Bebbiana*: "common east of the Cascades. Kamloops; Armstrong; Crows Nest Pass." It apparently does not grow on Vancouver Island. Therefore the type of Andersson's var. *latifolia* may belong to *S. Scouleriana*.

Of Lyall's specimens from the lower Frazer River before me none agrees with Andersson's var. or f. *lanata* which he, in 1867, characterizes as follows: "foliis ex ovato-subcordata basi ovali-oblongis, crassioribus, 1 $\frac{1}{2}$ poll. longis, integris, breve acuminatis, utrinque cinereo-sublanatis; capsulis magnis a basi latissima ovatis; ramis nudiusculis, junioribus fusco-tomentosis." In 1868 Andersson only says: "fol. ovato-subcordatis crassiusculis utrinque dense tomentosis." *S. Bebbiana* rarely has leaves with an ovate-subcordate base, and I have never seen young branches with a fuscous pubescence. On the other hand it seems hardly probable that Andersson misinterpreted this plant because he had seen the fruits. Otherwise one might believe that var. *lanata* should be referred to *S. Scouleriana* or some other species. After all Andersson's varieties and forms mostly are very uncertain. None of them can be regarded as really identical with one of the varieties discussed later.

As far as I can judge by the material I have seen there are two main variations: the typical *S. Bebbiana* (*S. rostrata* Richardson sensu stricto) which is found in the north and east, and a western-southwestern variety agreeing with Rydberg's *S. perrostrata*, and chiefly differing from the type by its smaller, smoother leaves glabrescent below. In his original description of *S. perrostrata* Rydberg does not state the differences between it and *S. Bebbiana*. In 1906 (and 1917) Rydberg says of *S. perrostrata*: mature leaves "thin, glabrous, faintly nerved," and of *S. Bebbiana*: "mature leaves firm, pubescent or tomentose beneath, more strongly nerved." These statements do not prove correct. The texture and nervation are often much alike in both varieties, and only by the glabrousness and by the general impression of the plant is it possible to decide whether it should be referred to the type or to var. *perrostrata*.

The type of *S. perrostrata* came from the Black Hills in South Dakota where it had been collected by Rydberg (No. 1018) near Hermosa in 1892. Rydberg also referred to it a specimen collected by R. S. Williams at Dawson, Yukon Territory. Coville (1901) said: "While his bibliographical references indicate that the species is a segregate of *bebbiana*, the author gives no comparison of distinguishing characters. I am unable to find in his description anything to distinguish our Alaskan specimens from what I take to be typical *bebbiana*, whatever may prove to be the relation of

that species to the Black Hills willow." I have seen a great number of specimens from the Yukon Territory collected by Miss Eastwood which partly can be regarded as var. *perrostrata*, and partly can hardly be distinguished from typical *S. Bebbiana*. Some are very glabrous. I have not yet seen the Alaskan material mentioned by Coville. What I call var. *perrostrata* seems to be the form prevailing from western Nebraska and western South Dakota through Colorado, northern New Mexico, eastern Arizona, Utah, northeastern Nevada and northeastern Oregon; this form apparently is becoming more similar to or is connected with the typical form by many intermediate forms in Idaho, Washington, British Columbia, Alberta, eastern Alaska (Cook Inlet, according to Coville), the Yukon Territory and the western parts of the Northwestern Territories. The typical *S. Bebbiana* seems to be predominant from Fort Franklin in the Northwest Territories to the James Bay and to Newfoundland, its range extending to the south to New Jersey, Pennsylvania, northern Ohio, northern Indiana, northern Illinois and Iowa. Very often it is almost impossible to decide in the herbarium whether a specimen belongs to var. *perrostrata* or to the type. Only a thorough study of copious material collected in those regions where both forms meet can prove whether var. *perrostrata* is a variety of real taxonomic value. Fernald (1914) sees in it the common Rocky Mountain representative of the species, and says that the leaves are less rugose or almost plane and glabrate in age, and the branchlets glabrate or quickly glabrescent. Its synonymy is as follows:

1b. *S. Bebbiana*, var. *perrostrata*, comb. nov. — *S. Bebbiana* Rydberg in Contrib. U. S. Nat. Herb. III. 523 (1896), pro parte maxima, non Sargent. — Coville in Proc. Wash. Acad. Sci. III. 306, fig. 17 (1901), pro parte maxima. — Ball apud Coulter & Nelson, New Man. Rocky Mts. Bot. 138 (1909) pro parte maxima. — *S. perrostrata* Rydberg in Bull. N.Y. Bot. Gard. II. 163 (1901); in Britton, Man. 317 (1901); Fl. Rocky Mts. 195 (1917). — Britton & Brown, Ill. Fl. ed. 2, I. 599 (1913). — *S. rostrata* var. *perrostrata* Fernald in Rhodora, XVI. 177 (1914). — A typo praecipue reredit foliis maturis etiam superioribus subtus fere vel omnino glabrescentibus laevioribus plerisque minoribus saepe tenuioribus, ramulis saepissime magis glabrescentibus.

In Colorado and New Mexico certain forms seem to occur of which the branchlets are somewhat pruinose. I enumerate the following specimens which need further observation.

COLORADO. Teller County: Colorado Springs, Pikes Peak, September 10, 1905, Glatfelter (st.: M.). El Paso County: Manitou, about 3300 m., September 9, 1905, same collector (fr. mat., st.; M.; fructibus adultis glabris sed normalibus¹); Ute Pass, above Manitou Springs, along Fountain Creek, September 1, 1881, G. Engelmann (st., M.; forma incerta satis pubescens).

NEW MEXICO. Santa Fé County: Santa Fé Canyon, 9 miles east of Santa Fé, May 14, 1897, A. A. & E. G. Heller. (No. 3524, f.; M.); Santa Fé Creek above

¹ A form with entirely glabrous ovaries and pedicels has been collected by Macoun, Cabin Creek, Jasper Park, Alberta (No. 95792, O.).

Santa Fé, September 18, 1916, *A. Rehder* (Nos. 604, 609, st.; A.; "shrub 10 feet"); same place, September 4, 1894, *C. S. Sargent* (st., A.; "tree 20 X 1 ft., pendulous branches, rough trunk, deeply furrowed dark brown bark").

With regard to the eastern forms proposed by Fernald of which I have seen the types the following may be said. The first variety is var. *luxurians* (in *Rhodora*, ix. 223 [1907]) which "is clearly an extreme variation of the common *S. rostrata*." It chiefly differs from it by its longer capsules (9 to 12 mm. long) and longer pedicels (5 to 8.5 mm. long). So far it has been only seen "on banks of the St. Lawrence from Rimouski Co. to Gaspé Co." in Quebec. It should be looked for in other localities of the type, and it apparently is nothing but a forma *luxurians*.

Fernald's next variety, var. *capreifolia* (in *Rhodora*, xvi. 177 [1914]) "presents the most extreme development of pubescence in the species . . . while var. *perrostrata* shows the opposite tendency." According to the material before me var. *capreifolia* is closely connected with the type by frequent intermediate forms. Fernald thinks that it "may prove to be the same as *S. vagans* 1. *rostrata* forma *latifolia* Andersson" of which I have already spoken. This is, however, in my opinion an uncertain form, and may even belong to another species. To var. *capreifolia* Fernald refers specimens from Newfoundland, eastern Quebec and Nova Scotia, and it apparently has a wider distribution.

Fernald states "in typical *S. rostrata* Richardson (*S. Bebbiana* Sargent) the new branchlets are pubescent at tip, but the pubescence is early deciduous." In the specimen of Richardson which I regard as the co-type (see p. 66) the branchlets of the season are distinctly pubescent, and only somewhat glabrescent toward the base, but even the branchlets of the preceding year are at least partly pubescent. Very rarely these branchlets are glabrous or almost so. The pubescence of the leaves, too, of typical *rostrata* is hardly very different from that of var. *capreifolia* of which the lower leaves also are partly glabrescent. A closer study of the western form may, however, lead to the hypothesis that there are glabrescent and pubescent forms of the type as well as of var. *perrostrata*.

The most striking of Fernald's forms is var. *projecta* (in *Rhodora*, xvi. 178 [1914]) which so far is very incompletely known. It has only been found in Newfoundland, Wild Cove, south of Bay of Islands, June 11, 1896, by A. C. Waghorne (fr.; G.). According to Fernald it differs from all varieties of *S. Bebbiana* "in the slender elongate ament, the long scales, the short capsules and pedicels shorter than the scales." Unfortunately there are neither mature leaves nor well-ripened capsules. The male plant, too, is unknown. Fernald says: "when better known this may prove to be a distinct species."

2. *S. Geyeriana* Andersson in Öfv. Svensk. Vet.-Akad. Förh. xv. 122 (1858), quoad specim. fem.; in Proc. Am. Acad. iv. 63 (Sal. Bor.-Am. 17) (1858); in Walpers, Ann. Bot. v. 750 (1858); in Svensk. Vet.-Akad. Handl. vi. 86 (Monog. Salic.) (1867), excl. t. 5, fig. 50; in De Candolle, Prodr. xvi.² 226 (1868). — Rydberg in Mem. N.Y. Bot. Gard. i. 114 (Cat. Fl.

Mont.) (1900); Fl. Colo. 95 (1906); Fl. Rocky Mts. 195 (1917). — Howell, Fl. N.W. Am. 619 (1902). — Piper in Contrib. U.S. Nat. Herb. xi. 215 (Fl. Wash.) (1906). — Ball apud Coulter & Nelson, New Man. Rocky Mts. Bot. 138 (1909); apud Piper & Beattie, Fl. N.W. Coast, 117 (1915); in Bot. Gaz. lx. 399 (1915). — Henry, Fl. S. Brit. Col. 98 (1915). — *S. macrocarpa* Nuttall, N. Am. Sylva, i. 67 (1843), pro parte, non Trautvetter. — Bebb in Bot. Gaz. x. 221 (1885). — Macoun, Cat. Can. Pl. ii. 360 (1890). — Ball in Trans. Acad. Sci. St. Louis, ix. 80 (1899).

This Willow was first described as *S. macrocarpa* by Nuttall from specimens collected in Oregon. He does not quote a locality but only says "forming clumps in wet places." According to a co-type in the Gray Herbarium Nuttall had before him a form of var. *meleina*, but in his description he states that "the branches are smooth and brownish black, sometimes glaucous or whitish." Nuttall's name cannot be used because it is preoccupied by Trautvetter.

As Bebb already explained in 1885 Andersson entirely mistook Nuttall's species. He "transferred Nuttall's name to a single specimen collected by Burke 'ad Hudson Bay,' which Nuttall never saw, and described a new species of his own, *S. Geyeriana*, which . . . coincides absolutely with *S. macrocarpa*, Nutt." Andersson's *macrocarpa* is a species with "capsulis breve pedicellatis, conicis, glaberrimis, stylo mediocri, stigmatibus integris; foliis exstipulatis lanceolatis, integris, subtus pallidioribus, utrinque glaberrimis." It is entirely different from Nuttall's Willow which the author regarded as closely related to the Pond Willow (*S. sericea*). Andersson (1858) apparently had no knowledge of Nuttall's description, but he had an opportunity to examine those of Nuttall's specimens which are preserved in the Hookerian Herbarium. When he described his *S. Geyeriana* he based it on Geyer's No. 286 of which the exact locality is unknown. Andersson says "Missouri and Oregon, Rocky mountains." I have seen a photograph of this number and fragments of the female specimen, and also a male ament. The female plant only is *S. Geyeriana*, while the male ament belongs to *S. Bebbiana*. This has already been elucidated by Bebb, and he is right in the statement that Andersson's description is almost wholly drawn from the female plant. The male specimen is only mentioned in the following sentence (1858): "Amenta mascula etiam breviora et crassiora stamina magis aureo-fulvis quam in *S. vaganti* [*S. Bebbiana*]." In 1868, too, Andersson says: "*S. vagantirostratae* valde similis" but to Bebb this comparison seems "unintelligible" because "the affinity of the plant in question — as Nuttall had the sagacity to see — is really with *S. sericea*." I do not quite agree with Bebb because the shape of the capsules is very different in both species. Of *S. sericea* the mature fruits are short and blunt scarcely longer than 5 mm. with a pedicel 1.5 (-1.7) mm. long, while in *S. Geyeriana* the ovoid-rostrate capsules measure almost (5-)6-7 mm. in length excluding the 2-3 mm. long pedicel. Their shape is much more like that of the fruits of *S. Bebbiana*.

According to the female plant of Geyer's No. 286 the typical *S. Geyer-*

iana is the form with pruinose branchlets of which those of the year bear a fine silky tomentum. The statement of Andersson that the pedicel is six times longer than the gland is not correct as it is only 2 to $2\frac{1}{2}$ times longer. The stigmas are not sessile but they show a short style which often is bifid at the top, but hardly longer than the two-cleft stigmas. The statement "foliis molliter tomentosis" seems to indicate that Andersson probably had before him other specimens of *S. Bebbiana* than the male of which I have seen a photograph. In 1867 he speaks of the male aments as "sessilia, ebracteata" while in 1868 he says "vix bracteata." The type of *S. Geyeriana* before me clearly shows a short but distinct peduncle with a few small leaflets at least under the upper aments. The leaf represented in fig. 50 on plate 5 of Andersson's monograph certainly belongs to *S. Bebbiana*, the drawing of the female flower, too, agrees much better with this species. The statement of Geyer that the plant is "10-15 feet high" also refers to *S. Bebbiana* a species which as a whole is so easily distinguishable from *S. Geyeriana*.

There are two forms which can be separated from the type. One has been described by Bebb as var. *argentea* (of *S. macrocarpa*) for the type of which has to be taken a specimen of Lemmon's from Sierra County, California, of which I have seen co-types in Herb. G. and M. In Bebb's Herbarium is a male specimen collected by Lemmon at Sierra Valley without date and number but I have found no real type. This var. *argentea* is probably nothing but a very silky form of the type and its synonymy is as follows:

2b. *S. Geyeriana* var. *argentea*, comb. nov. — *S. Geyeriana* Bebb apud Watson, Bot. Cal. II. 87 (1879), non Andersson. — Rydberg, Fl. Colo. 95 (1906), ex parte. — *S. macrocarpa*, var. *argentea* Bebb in Bot. Gaz. x. 223 (1885); apud Coville in Contrib. U.S. Nat. Herb. IV. 199 (1893). — Ball in Trans. Acad. Sci. St. Louis, IX. 80 (1899). — *S. leucosericea* Bebb & Nelson apud Nelson in Bull. Wyom. Exp. Stat. No. 28, 179 (First Rep. Fl. Wyom.) (1896), nom. nud.¹ — A typo praecipue recedit pubescentia ramulorum foliorumque novellorum densiore et omnino argentea vel tantum pilis paucissimis ferrugineis intermixta.

Of this variety I have seen specimens from the following states and counties: southern Idaho (Owyhee, Bear Lake and Blaine Counties), eastern Oregon (Union, Crook and Harney Counties), Wyoming (Fremont, Sweetwater, Albany, Sheridan and Bighorn Counties), Colorado (Laramie, Lake and San Miguel Counties), Nevada (Elko County), California (Plumas, Sierra, Nevada, Placer, Eldorado, Mono, Tuolumne, Tulare, and Fresno Counties).

Another form of apparently greater taxonomic value is var. *meleina* described by Henry (Fl. S. Brit. Col. 98 [1915]) as follows: "var. *meleina*:

¹ Nelson, l. c., says: "In communicating this name to me Mr. Bebb made the following comment: 'It will shortly appear as above in a government report. This is the Rocky Mountain or Plateau member group which has for its eastern or Atlantic Coast representatives, *S. sericea* and *S. petiolaris*, and for the Pacific Coast *S. macrocarpa*.'"

Taller, 1-7 m. high; twigs black or green and black, without bluish bloom, the older branches often banded with gray and black; leaves oblong, soon glabrous above, very glaucous beneath, the hairs on the lower surface becoming more or less brown. The coast form; Shawnigan; Victoria; New Westminster." As I already stated it is partly the typical *S. macrocarpa* of Nuttall. The leaves sometimes are somewhat denticulate, the lower surface often becomes almost glabrous and their texture is firmer than of those of the type. The branchlets of the year are not unfrequently rather orange-colored (see for example Suskdorf's specimens from Falcon Valley, September 7, 1896). Of var. *meleina* I have seen specimens from British Columbia (Vancouver Island and New Westminster District), Washington (Stevens, King, Mason, Thurston, Pierce, West Klickitat and probably Clarke Counties where Nuttall seems to have collected the type of *S. macrocarpa* on the banks of the Columbia), Montana (Flathead and Missoula Counties) and northwestern Oregon (Columbia and Marion Counties).

The typical *S. Geyeriana* is known to me from the following states and counties: northwestern Idaho (Shoshone and Latah Counties), Montana (Deer Lodge, Gallatin and Madison Counties), Oregon (Grant, Jackson, Crook, Wallowa, and Klamath Counties), Wyoming (Yellowstone Park, Albany and Sheridan Counties), eastern Nebraska (Scotts Bluff County), Colorado (Jackson, Larimer Lake, Gunnison, Mineral, and Grant Counties) and Utah (Sevier County; a specimen of H.D. Langille, from Uinta Mountains, 1902, [No. 125, m., f.; A.; "5-7 feet high"] is uncertain, the leaves show stomata in their upper epidermis), Arizona (Coconino and Apache Counties).

3. *S. Lemmonii* Bebb apud Watson, Bot. Cal. II. 88 (1879); in Bot. Gaz. XVI. 106 (1891) — Jepson, Fl. Cal. 343 (1909), pro parte. — Rydberg, Fl. Rocky Mts. 196 (1917), pro parte. — When Bebb described this species he proposed three varieties basing his descriptions mainly on specimens collected by J. G. Lemmon in Sierra County, California. The first is var. *melanolepis* characterized by pitch-black and slightly or not at all hairy scales. Bebb cites no type but there is one in his herbarium in the Field Museum (No. 7794) consisting of male and female specimens. Here, too, are type specimens of the second var. *macrostachya*, and the third var. *sphaerostachya*, and two sheets which represent the typical form. All these specimens came from Sierra Valley in Sierra County, except those of var. *sphaerostachya* which are only marked "Sierra Nevada."

The type of *S. Lemmonii* (No. 7800 in Herb. Bebb) has unripe fruits and young leaves, and well agrees with that of var. *melanolepis*. The differences mentioned above are of no importance, because we can observe a change in the pubescence of the bracts not only in the aments of the same twig but even in the bracts of the same ament. Only in the male syntype of var. *melanolepis* (sheet 7799 in C.) the glabrousness of the bracts is a little more conspicuous. The size of the aments and the more or less ful-

vous pubescence of the young leaves are the same in both types. The young twigs are thin, slender, mostly covered with a grayish and rusty pubescence but soon becoming glabrous.

Bebb's var. *macrostachya* has female aments which measure up to 6.5 cm. in length but their peduncles are hardly different (Bebb says "more leafy"). The style is 1 mm. long; the fruits are not yet quite mature and scarcely more "tapering to a produced style" than those of the other forms. The male aments are hardly a little larger (to 3.5 : 1.3 cm.), and scarcely more silky than those of the type. In his main description Bebb says: "scales . . . black, thinly pilose." The pedicels always are only 2 to 3 times and not "4-6" times longer than the nectary. The var. *sphaerostachya* certainly is nothing but "a depauperate or subalpine form" as Bebb himself indicated. The type in Bebb's herbarium bears the No. 6752, and it is identical with a cotype in the Gray herbarium. The reddish brown or orange-colored branchlets show faint traces of a glaucous bloom thus pointing to var. *Austinae* (see later).

Bebb likened his species to *S. macrocarpa* (= *S. Geyeriana*) which "differs especially in its smaller pale acute scales, glabrate capsules, and nearly sessile stigmas." *S. Geyeriana meleina* has a rather distinct style (up to 0.5 mm. long), and there seems to be no difference as to the pubescence of the capsules. In this form of *S. Geyeriana* the glaucous bloom of the twigs is also wanting.

The leaves of *S. Lemmonii* are not only "paler or scarcely glaucous beneath" (Bebb) but the mature ones are distinctly glaucescent and by no means "green, nearly alike on both sides," as Jepson says. See Lemmon's specimen with mature leaves which Bebb makes the type in his herbarium (No. 6753 Bebb). *S. Lemmonii* apparently has been misunderstood by recent authors, and the diagnosis of Bebb is rather insufficient. Therefore I think it best to give the following more complete description and an enumeration of the specimens which I have seen. Frutex erectus ut videtur divaricato-ramosus, 1-3, raro ad 5 m. altus. Ramuli novelli tenuiter sericeo-pilosiusculi (pilis argenteis ferrugineisque mixtis), hornotini glabri vel fere glabri, interdum parce pruinosi (confer specimina a cl. Ware in Mono Pass lecta), annotini biennesque brunnescentes, purpurascentes (vel interdum fere atropurpurei), glabri, nitiduli (in *S. Geyeriana* opaci), demum cinereo-nigrescentes; gemmae ut videtur ovoideo-oblongae vel ovoideae, obtusiusculae, ut ramuli coloratae, demum glabrae, divaricatae, floriferae quam foliiferae crassiores. Folia membranacea, sed adulta satis firma, anguste lanceolata, oblanceolata, anguste elliptico-lanceolata, basi acuta vel subobtusa, apice acuta ad subacuminata, interdum subapiculata, infima pleraque obtusiora, margine integra vel (saltem ad medium) parce distanter brevi-denticulata, infima saepe oblongo-spathulata interdum densius obscure glandulosso-denticulata, 1 : 0.3 ad 2.5 : 0.6 cm., superiora perfecte evoluta 3 : 0.8 ad 5.5 : 1 vel 7-9 : 1-1.5-1.8 cm. magna; superne novella plus minusve adpresso sericea vel sericeo-villosula, pilis griseis et ferrugineis mixtis, deinde saepissime cito glabrescentia et adulta glabra

vel pilis paucis difficile recognoscendis praedita, ut videtur vivide et intense viridia, in epidermide stomatibus plus minusve numerosis instructa, laevia vel costa nervisque laevissime prominulis; subtus initio ut superne pilosa, demum etiam, saepe citius, glabrescentia et adulta distincte glaucescentia, pleraque tenuissime adpresso breviter sericea glabrata, costa flavescente elevata, nervis lateralibus utrinque 6–10 (–12) vix prominulis; petioli tenues, pilosuli (saltem superne in sulco), 2–7 mm. vel interdum fere ad 16 mm. longi; stipulae minimae vel parvae, lanceolatae vel semi-ovato-lanceolatae, plusminusve acutae, glanduloso-denticulatae (partim lobulato-dentatae), ut folia pilosae, petiolis pleraeque 2–3-plo breviores, deciduae vel nullae, raro in surculis ad 8 mm. longae. Amenta coetanea, pedunculo brevi bracteato vel distincte foliolato suffulta, rhachi villosula; mascula densiflora, ellipsoideo-cylindrica vel cylindrica, 1:0.7 ad 3:1.2 (rare ad 3.5:1.4) cm. magna pedunculo brevissimo vel vix ultra 5 mm. longo foliolis lanceolatis acutis plus minusve integris superne fere glabris subtus adpresso et satis longe sericeis (pilis ferrugineis argenteisque mixtis) vix ultra 12:4 mm. magnis praedito excluso; bracteae obovatae vel obovato-oblongae, apice rotundatae vel obtusiusculae, laxe longe sericeae, pilis summis quam bractea saepissime subbrevioribus, rarius apice plusminusve glabrescentes; stamna 2, filamentis liberis (interdum paullo vel ad $\frac{1}{3}$ coalitis), fere ad medium pilosis bracteam demum 2–3-plo superantibus, antheris aureis parvis crasse ellipsoideis; glandula 1, ovoideo-rectangularis, truncata, bractea duplo vel subduplo brevior; amenta feminea sub anthesi 1–2.5:0.8–1 cm. magna, pedunculo ut in masculis vel ad 6–12 mm. longo et distinctius foliolato (foliolis saepe deciduis), fructifera 2:1.5 ad 3.5–4:1.8 (rarius ad 6:2) cm. magna; bracteae ut in masculis vel interdum apice acutiusculae, initio pedicellum paullo vel interdum fere subduplo superantes, demum eum aequantes vel rarius eo $\frac{1}{4}$ breviores; ovaria anguste ellipsoideo-conica, breviter sericeo-tomentosa vel laxius plusminusve adpresso sericeo-vilosula; styli breves, saepissime 0.5–1 mm. longi, integri vel apice breviter bifidi; stigmata breviter oblonga, bifida, stylo circiter duplo, rarius paullo tantum breviora; pedicelli distincti, tenues, 1.5–2 vel in fructibus interdum ad 2.5 mm. longi, ut ovaria pilosi vel (in typo) partim vel fere omnino glabri; glandula 1, ventralis, ut in masculis vel paullo angustior, in ovariis pedicello 2–2 $\frac{1}{2}$ -plo, in fructibus interdum ad 3-plo (sed non 4–6-plo ut ab auctore indicatum) brevior. Fructus perfecte maturi ellipsoideo- vel ovoideo-rostrati, pedicello excluso 6–8 mm. longi, ut ovaria vel paullo laxius pilosi.

SPECIMENS EXAMINED: CALIFORNIA. Lassen County: Hot Springs Valley, near Lassen Peak, circ. 2000 m., June 6, 1910, *W. L. Jepson* (No. 4081, fr.; Jeps.; a small-leaved form resembling var. *meleina*). Plumas County: without exact locality, May 1877, *R. M. Austin* (f.; G.; the male specimen is *S. lasiolepis*); June 1878, same coll. (m., f.; G.); May 1879, same coll. (f.; G.; forma incerta ovariis partim pedicellis totis glabris, foliis superne parce stomatiferis); Warner Valley, about 1700 m., June 5, 1910, *W. L. Jepson* (No. 4066, st.; Jeps.; forma porro observanda foliis parvis superne sparse stomatiferis); Portola, May 25, 1918, *A. Eastwood* (No. 7004, f., 7005, m.; A.). Sierra County: Sierra Valley, without date, *J. G. Lem-*

mon (st., old fruits; sheet 6753 in C.), same coll. (f., type of var. *melanolepis*, sheet 7794 in C.; m., sheet 7799); same coll. (fr. juv., type of *S. Lemmonii*, sheet 7800 in C.); same coll. (f.; type of var. *macrostachya*, sheet 6754 in C.; m.; sheet 7795); same coll. (f., fr.; sheets 7798, 7796 in C.); Sierra Nevada, same coll. (f. m.; type of var. *sphaerostachya*; sheet 6752 in C.); west side of Webber Lake, near shore, June 21, 1900, *W. R. Dudley* (No. 5415, m.; St.); shore of Webber Lake, the common Willow, August 29, 1894, *Dudley* (st.; St.). Nevada County: Ice Lake near Soda Springs, on Pacif. Railr., about 2800 m., October 11, 1880, *G. Engelmann* (st.; M.); Truckee, May 1892, *C. F. Sonne* (No. 40, f.; C.); flat land on Yuba River, opposite Cascade, June 15, 1900, *W. R. Dudley* (No. 5151, a. m.; St.); valley near Lake Mary, near Summit, same date and coll. (Nos. 5104, m., 5111, f., 5115, m., 5115^a, f., 5116, f., 5116^a, m., 5117, f., 5120, m., 5122, f., 5128, fr.; St.); along South Yuba River, same date and coll. (Nos. 5139, fr., 5139^a, m.; St.); near hotel at Summit, same date and coll. (Nos. 5103, m., 5130, fr.; St.); grade east of hotel at Summit, same date and coll. (Nos. 5092, 5098, f.; St.); road between Summit and Cisco, same date and coll. (Nos. 5141, f., 5142, fr., 5143, fr., 5144, m., fr., 5145, f., 5146, m.; St.); Donner Lake, 500 yards below upper dam, June 14, 1900, same coll. (No. 5019, fr.; St.); Webber Lake and Serraville Trail, June 21, 1900, same coll. (No. 5475, f.; St.) Glenbrook near Truckee, June 28, 1900, same coll. (Nos. 5775 m., 5777, 5778, 5780, fr.; St.); Tahoe City, on meadow, most common willow, June 29, 1900, same coll. (Nos. 5796, 5799, 5800, fr.; St.); Independence Lake, meadow east of outlet and below bridge, June 19, 1900, same coll. (No. 5278, m.; St.). Placer County: Summit, about 2700 m., July 16, 1909, *A. A. Heller* (No. 9842, f.; G; sub nomine *curtiflora distributa*); low grassy places along Yuba River below Cisco, about 1800 m., June 17, 1917, same coll. (Nos. 12688, 12721, f.; St., C.); Lake Tahoe Region, Deer Park, June 15-19, 1912, *A. Eastwood* (Nos. 364, m., 432, f.; A.); road above Donner Lake, June 14, 1900, *W. R. Dudley* (No. 5081^a, f.; St.); between Donner Lake and Summit on "loop grade," same date and coll. (Nos. 5065, 5065^a, fr., 5066, 5067, f., 5069, m., 5070^a, f., 5077, 5078, fr.; St.); by Lake shore near Maddenie Cr. above McKinney's Cr., June 1900, same coll. (No. 5533, st.; St.). Eldorado County: Tallac (?) House to Desolation Valley, June 1900, same coll. (fr.; St.); near Tallac (?) House, June 28, 1900, same coll. (No. 5666, fr.; St.); near Camp Agassiz, June 17, 1900, same coll. (No. 5665, fr.; St.); Glenn Alpine, June 1900, same coll. (No. 5661, fr.; St.). Alpine County: near Highland Lake, about 2700 m., July 24, 1911, *L. R. Abrams* (Nos. 4748, f., m.; 4751, f.; G., St.); Iceberg (?) Meadow, Clock's fork, about 2200 m., July 22, 1911, same coll. (No. 4745, fr.; St.). Amador County: Silver Lake, about 2700 m., July 1892, *G. Hansen* (No. 199, fr.; M., St.). Mariposa County: Yosemite Valley, May and June 1900, *F. T. Bioletti* (f., m.; A.); vicinity of Lake Tenaya, about 2700 m., June 1902, *Hall & Babcock* (No. 3524, m., fr.; Jeps., St.); Lake Merced, about 2400 m., July 9, 1909, *W. L. Jepson* (No. 3194, fr.; Jeps.); Glacier Point, Turn Pike, May 26, 1888, *J. W. Congdon* (No. 123, f.; St.). Mono County: Mono Pass, Bloody Canyon, about 2800 m., July 23, 1907, *R. A. Ware* (fr.; G.; folia maxima ad 6.5:1.1 cm. magna, ramuli partim parce pruinosi). Tuolumne County: Tuolumne River Meadow, 2 mi. below Soda Springs, about 2750 m., July 18, 1909, *W. L. Jepson* (No. 3357, st.; Jeps.); Kennedy's Lake, about 2700 m., August 12, 1915, *A. L. Grant* (No. 246, fr.; A.). Fresno County: Horse Corral Meadow, region of King's River, August 11, 1900, *W. R. Dudley* (Nos. 3174, fr., 3177, st.; St.); King's River Canyon, same date and coll. (No. 3214, fr.; St.); Upper King's River, Rowell Meadow woods, June 21, 1900, same coll. (fr.; St.). Tulare County: Sequoia National Park, Marble Fork, about 2500 m., July 15, 1902, *G. B. Grant* (No. 1514, fr.; St.); [Milky Meadow to Three Rivers], Whitney (now Volcano) Creek, about 2800 m., July 23-31, 1900, *W. L. Jepson* (No. 954, st.; Jeps.); region of Sequoia National Forest, Vicinity of Homer's Nose, Cahoon Meadow, about 3000 m., July 13, 1897, *W. R. Dudley* (No. 1846, fr.; St.); region of Little Kern River, Barut (?) Corral Meadow, August 10, 1897, same coll. (No.

1979, fr.; St.); Vicinity of Mount Whitney, August 8, 1897, same coll. (No. 2501, st.; St.)

NEVADA. Ormsby County: Snow Valley, 2460–2615 m., June 24, 1902, *C. F. Baker* (No. 1162, f., m.; A., Cal., G., N.). Washoe County: Divide, south of Slide Mountain, in granite, about 2500 m., *A. A. Heller* (No. 10928, fr.; A., C., G., M.); ridge above Bowers, about 2200 m., same date and coll. (No. 10937, fr.; St.); about Marlette Lake, 2460 m., July 10, 1902, *C. F. Baker* (No. 1294, fr.; Cal.).

According to Jepson *S. Lemmonii* is also known from the Wasatch Mountains in Utah, but I have not seen any material from that region. Rydberg states that the species occurs as far east as Idaho. What I have seen from Idaho bearing the name *S. Lemmonii* did not at all belong to this species. This is the case, too, with Cusick's No. 1835 from eastern Oregon which (at least partly) seems to consist of male and female specimens of different species. His No. 1836 mostly represents the following variety.

***S. Lemmonii*, var. *Austinae*, var. nov.** — *S. Austinae* Bebb apud Watson, Bot. Cal. II. 88 (1879); in Bot. Gaz. XVI. 106 (1891). — Bebb described *S. Austinae* from specimens collected by Mrs. R. M. Austin at Indian Valley, Plumas County, California. In Bebb's herbarium I have found only one specimen by this collector under *S. Austinae* (sheet 3388). Bebb did not put a name on it but he made sketches of the male and female flowers on the sheet. It is identical with other sheets in Herb. C. (Herb. Patterson) and in Herb. C. U. In 1891 Bebb stated that "the leaves described belong to *S. Lemmonii*, and in some (though not all) of the specimens male aments of *S. lasiolepis* were intermixed." But "there yet remain the fertile aments not identifiable with any willow of the Pacific Coast region as at present understood." If we take sheet 3388 in C. which well fits Bebb's description for the type it can be said that the leaves are not distinguishable from those of *S. Lemmonii*. The male and female aments, however, may well belong to one species, and the male aments are not identical with those of *S. lasiolepis*. Bebb does not describe the male flowers, but his sketch on the sheet shows glabrous filaments. A close investigation of the flowers revealed to me the fact that the filaments are hairy for about a fifth of their length and are often slightly connected at the base. The flowering branchlets are glabrous, orange-colored, and slightly shining. Those of the male specimen are hardly pruinose while the glaucous bloom is rather conspicuous on the branchlets of the female specimen which are of the same color. This glaucous bloom seems to be the main character to distinguish var. *Austinae* from *S. Lemmonii*. It is also to be seen on the specimens collected by Cusick in eastern Oregon (No. 1306 and 1836) which are named *S. Lemmonii*, and on a piece without number in Bebb's herbarium (sheet 7760 in C.). Pruinose twigs I also observed in Grant's No. 290 from Tuolumne County, the leaves of this specimen having stomata in their upper epidermis. After all I suppose that *S. Austinae* can best be considered a variety of *S. Lemmonii* but certainly a thorough study of more copious material is needed than I have been able to investigate. From the specimens enumerated below I have drawn the following diagnosis. *Frutex vel arbor parva;*

ramuli initio laxe tenuiter pilosuli pilis griseis et paucis fulvis mixtis, hornotini autumno glabri, flavo-brunnei vel ut annotini floriferi magis rubescentes vel purpurascentes, nitiduli, saepe leviter pruinosi; gemmae (in No. 1836 Cusickii) ovoideo-oblongae, acutae, petiolis plusminusve aequilongae. Folia textura coloreque ut in *S. Lemmonii*, initio fusco-pilosoi pilis griseis intermixtis (in costa etc.), pubescentia, deinde quamvis ut in *S. Scouleriana*, anguste lanceolata vel lanceolata, basi acuta vel saepissime satis obtusa, apice acuta vel breviter acuminata (minimis linear-i-ob lanceolatis obtusioribus exclusis), 3.5:0.8 ad 6.5:1.1 vel ad 9:2 vel 8:2.1 cm. magna, margine obscure subserrata vel satis distanter serrata, superne subtusque ut in *Lemmonii*, subitus distincte albescens vel glaucescentia, pruinosa, costa elevata flava nervisque lateralibus flavis graciliter prominulis et satis indistincte reticulata; petioli stipulaeque ut in *Lemmonii*. Amenta praecocia vel subcoetanea, cylindrica, densiflora, pedicello brevi foliola minima 2-3 linear-i-lanceolata superne glabra subitus sericea decidua gerente 1-5 mm. longo suffulta; mascula vix ultra 2.8:1.2 cm. magna; bracteae atrofuscae, obovato-oblongae, utrinque sericeae, obtusae; stamina 2, filamentis basi parce pilosis, interdum paullo coalitis, bracteam duplo superantibus, antheris ellipsoideis flavis; glandula 1, oblongo-rectangularis, truncata, bractea subtriplo brevior; amenta feminea sub anthesi 2-2.8:1 cm. magna; bracteae ut in floribus masculis; flores ut in *Lemmonii*; styli vix ultra 0.5 mm. longi; pedicelli vix ultra duplo longiores quam glandula; stigmata stylo subaequilonga, breviter oblonga, divaricata; glandula ut in masculis. Fructus maturi mihi tantum ignoti.

SPECIMENS EXAMINED: CALIFORNIA. Plumas County: Indian Valley, without date, *Mrs. Austin* (m., f., st.; type in C., sheet No. 3388; the same is sheet 361195 in C. U., 204066 Herb. Patterson in C. and sheet 346815 Herb. Schuette in C.; on sheet 204065 Herb. Patterson in C. is a label of Bebb's with the note: "I suppose we call this all *S. Austinae* — but I begin to fear that the dividing line between *Austinae* and *Lemmonii* is hazy to say the least"). Sierra County: Sierra Valley, without date, *Lemmon* (m., f.; sheet 7792 Herb. Bebb in C.; apparently nothing but typical *Lemmonii*; the same is sheet 7793).

OREGON. Union County: without date, *Cusick* (m., f.; sheet 7760 in C.; named by Bebb "*S. Lemmonii*, mixed with flowers of *S. flavescens*." The male branchlets are distinctly pruinose; the sterile specimen has lanceolate obovate acute leaves with a more or less conspicuous crenate dentation, a glabrous under surface, and distinct stipules). County ?: Mountains of Eastern Oregon; banks of streams, about 1350 m., *Cusick* (No. 1306, fr., st.; sheet 7759 in C.; leaves and branchlets as in the foregoing specimen); a slender shrub of streambanks, April 19, May 9, September, 1898, same coll. (No. 1836, f.; sheet 109712 in C.; named *S. Lemmonii* but looking much like *S. Geyeriana*, leaves without stomata in their upper surface); apparently same region, same date and coll. (No. 1835, f., m. st.; sheet 109711 in C.; the large leaves partly become greenish beneath, the bloom of the twigs is hardly recognizable; in different herbaria are somewhat different specimens under this number.)

Bebb (1891) said, that Cusick found the species in eastern Oregon but unfortunately he did not quote Cusick's numbers. In Bebb's herbarium I have found the three sheets of Cusick's just mentioned. To the sheet 7759 are added two letters of Cusick's, in one of them (dated October 10, 1887) he states that his numbers 1510 and 1610 represent *S. Lemmonii*. I did

not, however, detect specimens bearing these numbers in Bebb's herbarium. Cusick also says in the letter the following as to the differences between *macrocarpa* (*Geyeriana*) and *Lemmonii*: " *S. Lemmonii* is a much larger shrub, sometimes a tree 8 or 10 inches in diameter; seldom or never upright, divaricately branching; growing in widely spreading clumps and commonly on the bank of rocky swift running streamlets. The *macrocarpa* form is smaller, slender and virgate; the tops gradually dissolving into small branchlets, one plant one inch in diameter is large and will be 6 to 8 feet high; it is found more commonly along sluggish or marshy streams. I saw it in great abundance on Stein's Mountains in Malheur Co. in the summer of '86." Possibly Cusick's *Lemmonii* is identical with var. *Austinae*. Another sheet of Cusick's (No. 7758) I take for *S. Scouleriana*. It consists of a sterile specimen with old leaves measuring up to 9-11 : 4-3 cm. and bearing beneath the typical short brownish pubescence of *Scouleriana*.

b. THE SPECIES OF SECTION ROSEAE

This section was proposed by Andersson in 1867 for the species *S. prolixa* Andersson, *S. myrtilloides* Linnaeus and *S. fuscescens* Andersson to which he added a number of European hybrids. The type species is *S. myrtilloides* because he named the section "Stirps X. Salices roseae v. *S. myrtilloidis*," and later, in 1868, "§ 10. Roseae s. *Myrtilloides*." Andersson's first species *S. prolixa* is a very little known Willow. The true *S. myrtilloides* is not found in the New World where it is represented by *S. pedicellaris* Pursh treated by Andersson as a subspecies or as a variety of *S. myrtilloides*. *S. fuscescens*, too, needs further study, and this section as a whole is a group of rather doubtful taxonomic value. The best I can do at present is to discuss briefly these American species, and to advise other students who have a good opportunity to collect better material and to study the plants in the field. The synonymy of the group is as follows:

Sect. *Roseae* (sive *Myrtilloides*) Andersson in Svensk. Vet.-Akad. Handl. vi. 94 (Monog. Salic.) (1867); in De Candolle, Prodr. xvi.² 229 (1868). — Sect. *Arbusculae* Barratt apud Hooker, Fl. Bor.-Am. II. 150 (1839), pro parte, quoad *S. pedicellaris*. — Sect. *Virentes* Andersson in Öfv. Svensk. Vet.-Akad. Förh. xv. 123 (1858), pro parte quoad *S. myrtilloides*. — Sect. *Myrtilloides* Zabel apud Beissner, Schelle & Zabel, Handb. Laubholz-Ben. 30 (1903). — Sect. *Argenteae*, subsect. *Myrtilloides* Schneider, Ill. Handb. Laubh. I. 63 (1904).

1. *S. pedicellaris* Pursh, Fl. Am. Sept. II. 611 (1814). — Poiret in Lamarck, Encycl. Suppl. VI. 62 (1817). — Torrey, Fl. N.Y. II. 213, t. 120 (1843). — Hooker, Fl. Bor.-Am. II. 150 (1839), quoad descr. sed probabiliter exclud. specim. — Carey apud Gray, Man. 429 (1848). — Britton & Brown, Ill. Fl. ed. 2, I. 602 fig. 1479 (913). — Griggs in Proc. Ohio Acad. Sci. IV. 313, t. 16 (1905) ex parte. — Robinson & Fernald, Gray, Man. ed. 7, 324, fig. 655 (1908). — Fernald in Rhodora, XI. 157 (1909). — *S. myrtilloides* Tuckerman in Am. Jour. Sci. XLV. 34 (1843), non Linnaeus. — An-

dersson in Öfv. Svensk. Vet.-Akad. Förh. xv. 125 (1858). — Gray, Man. ed. 5, 465 (1867). — Bebb apud Gray, Man. ed. 6, 485 (1889). — Britton Man. 316 (1901). — Britton & Brown, Ill. Fl. I. 505, fig. 1204 (1896). — Piper in Contrib. U.S. Nat. Herb. vi. 214 (1906). — Ball in Proc. Iowa Acad. Sci. VII. 153, t. 12, fig. 14 (1900). — *S. myrtilloides* [subspec.] *S. pedicellaris* Andersson in Svensk. Vet.-Akad. Handl. 96 (1867). — *S. myrtilloides* var. β *pedicellaris* Andersson in De Candolle, Prodr. XVI.² 230 (1868).

The history, geographical distribution and variability of this "attractive bog willow" was fully given by Fernald in 1909. I do not wish to repeat what this excellent observer has said, and only the following statements from my own observations may be added. The shape of the leaves of the European *S. myrtilloides* is not always different from that of the American species. I have repeatedly observed in American specimens (see for instance Sandberg's No. 521) round-ovate or ovate-oblong leaves which are broadest near the base and rounded or subcordate at base but as a whole the differences indicated by Fernald hold true. I do not, however, agree with his interpretation of the type. Pursh indeed says: "foliis . . . utrinque concoloribus" but his plant was collected in April, and he apparently had not seen mature leaves. I have seen all the specimens referred to the type by Fernald but all of them have leaves with at least a partly more or less glaucous undersurface. I am not convinced that the plant of Pursh of which no type specimen is in existence has to be regarded as different from the widely distributed form which Fernald has named var. *hypoglaeua* (in Rhodora, XI. 161 [1909]). Pursh's plant came from the Catskill Mountains in New York, a region from which I have not seen any material of *S. pedicellaris*.

Fernald's var. *tenuescens* (l. c. 162) seems to me hardly more than a form with narrower leaves. There are some specimens from Illinois (Palmer, No. 15561, in A.) and from Indiana (Deam, No. 20118^a, in A) which need further observation.

2. ***S. prolixa*** Andersson in Svensk. Vet.-Akad. Handl. VI. 94 (1867); in De Candolle, Prodr. XVI.² 229 (1868). — Macoun, Cat. Can. Pl. I. 452 (1886). — Ball apud Piper & Beattie, Fl. N. W. Coast, 115 (1915). — Of this "forma elegantissima habitu omnino singulari" I have seen a photograph and fragments of the type which was collected by Lyall "ad Lower Frazer-River, 49 l.b." in 1859. Unfortunately I have misplaced part of my notes and sketches on it. According to Ball (1915) it chiefly differs from *S. pedicellaris* by longer pedicels, and thinner leaves with a coarser reticulation. It is said by Macoun (1886) to be "not uncommon around Victoria, Vancouver Island, also in the Valley of Thompson River, at Spence's Bridge, B.C." I asked Professor J. K. Henry, the well-known author of the Flora of Southern British Columbia for his opinion on this species, and he wrote to me in a letter of September 7, 1919, as follows: "As to *Salix prolixa* Andersson: I have never seen an authentical or typical specimen of this

plant. The Victoria collectors cannot find it. My own feeling was that it is not distinct from the very common *S. Mackenziana* the leaves of which are sometimes green beneath when the fruit is mature. Willow leaves, on this coast at least, mature very slowly and it is often midsummer before they assume the final shape and character. It does not seem to me that the analysis of Piper & Beattie in their Flora of the North West Coast is very satisfying as far as these two species are concerned. *Salix Mackenziana* about Victoria, B.C., is often a low shrub, while the scales are not black even when dry. The stipules, too, vary. Possibly, however, the specimens I enclose from New Westminster (from a shrub . . . on the moist bank of the Frazer River) you may consider *S. prolixa*."

I am not able to give a final judgment on these specimens. The type of *S. prolixa* is not sufficient to decide the question whether it is a good species or not. It does not possess well-matured fruits and leaves. Henry may be right that the plant which is considered to be *S. prolixa* by Ball does not represent a distinct species. On the other hand, *S. prolixa* may belong to those good species which have a very limited distribution, and are still in need of a better understanding. Not being well enough acquainted with some western forms of the *Cordatae* group I leave it to Ball and other salicologists to demonstrate the true taxonomic value of Andersson's species.

3. *S. fuscescens* Andersson in Svensk. Vet.-Akad. Handl. vi. 97 (1867); in De Candolle, Prodr. xvi.² 230 (1868), excl. var. — Coville in Proc. Wash. Acad. Sci. III. 329, fig. 25 (1901). — *S. myrtilloides* f. 1 et 2 Chamisso in Linnaea, vi. 539 (1831). — *S. rhamnifolia* Hooker & Arnott, Bot. Voy. Beechey, 117, t. 26 (1832), excl. citat., non Pallas. — *S. phlebophylla* Rydberg in Bull. N.Y. Bot. Gard. I. 274 (1895), ex parte, quoad pl. Cape Blossom, non Andersson. — This species has been founded upon Hooker's *S. rhamnifolia* from "Awatschka Bay, in lat. 53°," Kamtchatka, the type of which was collected by Beechey & Mertens and is still unknown to me. In 1858, Andersson mentioned *S. rhamnifolia* Hooker but then he evidently was not quite sure whether this was identical with the plant Pallas and Ledebour took for this species. He also cited Chamisso's *S. myrsinoides* (in Linnaea vi. 540) "ad sinum S:cti Laurentii" of which I have not seen the type, and also Chamisso's forms 1 and 2 of *S. myrtilloides* which, too, I have had no opportunity to compare. No. 1 came "e sinu Eschscholtzii" in Alaska, while No. 2 was collected "in paludibus prope Tigil Kamtschatae occidentalis." In 1867 Andersson proposed the name *S. fuscescens* for what Hooker has called and figured as *S. rhamnifolia*. Andersson's fig. 54 quoted by him in 1868 is not given in his monograph.

Judging by the description and figure given by Hooker and by Andersson's own diagnosis I believe that the specimens regarded by Coville and myself as *S. fuscescens* really represent this species. I have not seen it from America except from Alaska and not eastward of the 150°. The following specimens which I have seen are not mentioned by Coville.

ALASKA. Kuskokwim Valley, 1884, *Weinmann* (f., fr.; G.); between Tyonok, on Cook Inlet, and Rampart City, Yukon River, Camp 7, Beluga Valley, about 330 m., June 10, 1902, *A. H. Brooks & L. M. Prindle* (fr. im.; W.); Yukon Delta, July 14, 1889, *J. C. Russell* (fr.; W.); St. Lawrence Island, July 13, 1899, *B. E. Fernow* (f.; Cor.); Lake Iliamna Region, Iliamna Bay, in sphagnum marsh, June 22, 1902, *M. W. Gorman* (No. 41, fr.; W.; "prostrate and creeping"); Valley of Kobuk River, at Kobuk portage between Alatna and Walker Lake, July 3, 1901, *W. C. Mendenhall* (fr.; W.; "small and creeping, from 3 to 10 in. high. Common in low places"); Seward Peninsula, Nome, 1914, *G. A. Hill* (No. 84, f.; W.); tundra behind Nome, "on moss hummocks plentiful," June 17, 1903, *F. L. Hess* (f., m.; St.; "in spreading communities"); Vicinity of Port Clarence, near entrance to lagoon, below mouth of Kuzitvin River August 2, 1901, *F. A. Walpole* (No. 1674, fr.; W.); Port Clarence, July 12, 1899, *B. E. Fernow* (f.; Cor.); Norton Sound, St. Michael, July 10, 1889, *J. C. Russell* (f.; W.); Cape Blossom, 1884, ? *S. B. McLenyan & St. Corvin* (fr.; G.); Rydberg 1899 as *S. phlebophylla*.

NORTHEASTERN ASIA. Arakam (Tchetchene) Island, 1853/6, *C. Wright* (fr.; G.; mixed with an *arctica* form).

In 1907 Fernald stated that *S. fuscescens* "hitherto known only from northern and western Alaska and the adjacent coast of Siberia, is abundant in bogs on the serpentine tableland of Mt. Albert" on the Gaspé Peninsula. According to my own observations the eastern specimens all belong to var. *hebecarpa* described by Fernald, and it may even be that this variety can be raised to the rank of a species. It chiefly differs from typical *S. fuscescens* by foliis saepissime apice paullo acutiusculis vel distincte acutis, capsulis pedicello brevi ut videtur fere semper piloso vix ultra 1.5 mm. longo excluso vix ultra 6–7 mm. longis brevius rostratis basi crassioribus, saepissime plusminusve vel omnino (praesertim basi) pilosis et distinctius glaucescentibus. What Fernald regards as typical *fuscescens* is in my opinion, only a glabrescent form of var. *hebecarpa* of which the pedicels never become wholly glabrous, and are always comparatively shorter and thicker than those of true *fuscescens*.

There is a female specimen collected by Trelease & Saunders under No. 3443 mixed with *S. ovalifolia* which Coville refers to *S. fuscescens*. It has, indeed, flowers very similar to those of this species but the ovaries are hairy and borne on shorter and thicker pedicels. It looks to me like a hybrid, and I do not think that it is a hairy form of *S. fuscescens* identical with the eastern var. *hebecarpa*.

There remain to discuss several species which I at present am unable to refer to one of the sections with which I have dealt.

The first is

S. arbusculoides Andersson in Svensk. Vet.-Akad. Handl. vi. 147 t. 8. fig. 81 (1867), excl. var. *glabra*. — Bebb in Bot. Gaz. xv. 54 (1890). — Macoun, Cat. Can. Pl. II. 358 (1890). — Coville in Proc. Wash. Ac. Sci. III. 323, fig. 21 (1901). — Rydberg, Fl. Rocky Mts. 196 (1917). — *S. arbuscula* Andersson in Öfv. Svensk. Vet.-Acad. Förh. xv. 130 (1858), excl. var. *labradorica*, non Linnaeus. — *S. humillima* Andersson in De Candolle, Prodr. XVI.² 248 (1868), excl. var. *glabra*. — Macoun, Cat. Can. Pl. I. 449 (1886). —

This Willow was first mentioned by Hooker (1839) as *S. acutifolia* Willdenow. Hooker gave a short description from specimens collected by Drummond and Richardson "Saskatchewan to Fort Franklin on the MacKenzie River," and said: "Mr. Borrer considers this to be the same as true *acutifolia* of Willdenow, from the Caspian Sea." This was, of course, a mistake, and our Willow has nothing whatever in common with Willdenow's well-known species. Hooker himself apparently regarded Borrer's determination as doubtful because he expressly stated that the twigs are not pruinose in the dried specimens. In the Herbarium of the New York Botanical Garden I have found a specimen of Richardson's from the MacKenzie River under "No. 65 Hb. H.B. & T.", and another specimen labeled "*Salix acutifolia* Fl. Bor. Am." of which the later indeed represents the typical *S. arbusculoides*. In 1858, Andersson mentioned *S. acutifolia* Willdenow saying nothing but "Ramum foliatum tantum in herb. vidi." He never quoted Hooker's plant. According to Bebb he passed the specimens of Drummond and Richardson in the Hookerian herbarium as *S. petiolaris*. He referred, in 1858, the plants on which he later based his *S. arbusculoides* to *S. arbuscula* Linnaeus, and at this time he proposed a *S. arbuscula labradorica*, a name later omitted by him. He did not cite a type for it, and only stated "Labrador." In describing his *S. arbusculoides* he gave as type specimen "Prince Albert's Sound (Mietscherling)," and he added "Raë River (Dr. Raë)," and "et in Labrador." (In 1858 he wrote "Miertsching" and "Roe.") Later in the *Prodromus* Andersson proposed a new name, and said of *arbusculoides* "nomine incaute graeco-latino delendo." Here he cited Labrador with a ?. In 1867 as well as in 1868 Andersson has two varieties: var. *puberula* and var. *glabra*.

Bebb, in 1890, has already discussed this species, and stated that "Prof. Macoun who examined Andersson's types for me in the Kew Herbarium, says, that the specimens of Mieschring and Dr. Raë are all on one sheet with no means of telling to which, respectively, the labels belong; that they comprise apparently two or more species and are very imperfect, a few bearing young catkins." I have had no opportunity to compare these specimens but have examined copious material of this species from which I am able to draw the diagnosis given below.

It has been described, too, by von Seemen (1895) as *S. saskatchewan* who based his species on Hooker's *S. acutifolia* of which I have seen the type. Von Seemen does not refer to *S. arbusculoides* or *S. humillima*, and probably did not know Bebb's note. According to a fragment of Von Seemen's type his species is nothing but Andersson's var. *glabra*, and certainly not a form of specific rank. Of the typical *S. arbusculoides* the following description may be given to enable a better understanding of this little known species.

Frutex in regione arctica humilis sed apud Dawson fide cl. Eastwood interdum arbuscula ad 3-6 m. alta ramis rubescens nitidis erectis vel interdum pendentibus; ramuli ab initio glaberrimi vel novelli minute puberuli et cito glabrescentes, hornotini olivacei vel ut annotini atrofusci vel castanei, nitiduli, dein atro-purpurascentes; gemmae floriferae (Eastwood

No. 16) conicae, subrostratae, apice subrecurve, ad 8 mm. longae, fuscae, nitidulae, glabrae, foliiferae ut videtur magis ovoido-oblongae, breviores. Folia adulta chartacea, minora linear-lanceolata, majora anguste lanceloata, rarius anguste elliptico-lanceolata, 1.5:0.4 ad 8:1.3 vel in ramulis vegetioribus ad 9:1.8 (vel in No. 467 *Eastwoodiae* ad 12:2.8 vel 14:2.3) cm. magna, utrinque acuta vel apice sensim breviter acuminata, subintegra, vel plus minusve dense breviter glanduloso-serrata, dentibus 1-20 pro 1 cm., superne ut videtur saepissime ab initio glaberrima vel novella pilis sparsis brevibus adpressis praedita, intense vivide viridia, nitidula, laevia, costa flavescenti nervisque lateralibus planis vel parce prominulis et laxe graciliter reticulata, in epidermide haud stomatifera vel stomatibus plusminusve numerosis (saepe tantum ad costam) praedita, subtus discoloria, glaucescentia vel fere albescens, initio (infimis exceptis glabris) dense adpresso sericea pilis argenteis saepe cum fulvis mixtis, vel tantum parce pilosa et demum plusminusve vel omnino glabrescentia, adulta interdum parce fulvo-sericea, costa flavescenti prominula nervis lateralibus utrinque ad 14 tenuiter prominulis parallelibus angulo acuto circ. 40-45° a costa abeuntibus, vix vel tenuissime reticulata; petioli superne sulcati et (saltem initio) minute puberuli, (2-) 4-8 (-11) mm. longi; stipulae nullae vel distinctae, linear-lanceolatae, glanduloso-serratae, vix ultra 5 mm. longae, in surculis interdum latiores brevioresque. Amenta praecoccia vel subcoetanea, anguste cylindrica, sessilia, mascula (1-) 1.5-4:1 cm. magna, elongata, saepe subcurvata vel flexuosa, basi pedunculo 1 ad vix 5 mm. longo foliolis minimis linearibus normalibus vel squamiformibus 2-3 instructo; bracteae oblongae vel subobovato-oblongae, apice obtusae vel subretusae (sed in eodem amento etiam subacutae) vel angustiores et acutiores, semper fuscantes vel atrobrunnescentes, sparse et satis breviter vel ad apicem densius longe sericeae; stamna 2, filamentis glabris liberis vel imo basi brevissime coarctatis, demum bracteam duplo superantibus, antheris parvis subglobosis vix 1 mm. longis in vivo ut videtur purpurascensibus: glandula 1, ovoido-conica vel ovoido-rectangularis, apice late truncata, saepe leviter emarginata, 2-2½-plo longius quam lata; amenta feminea sub anthesi pedunculo brevi excluso 1.5-3.5:0.5-0.6 cm., fructifera 2:1 ad 6:1.2 cm. magna, pedunculo circ. 3-8 mm. longo ut in masculis foliolato suffulta; bracteae ut in masculis, fere semper obtusae, forma pubescentiaque variabiles; ovaria ellipsoideo-conica, dense breviter sericeo-tomentosa; styli 0.2-0.8, rarius ad 1 mm. longi, saepissime subbifidi, stigmatibus parvis brevibus bifidis divaricatis iis aequilongis (vel initio sublongioribus); glandula ut in masculis, interdum vix longior quam lata sed saepissime 2-3-plo altior; fructus maturi tenuius quam ovaria tomentosi, e basi ellipsoideo vel ovoido plusminusve rostrati, 5-7.5 mm. longi, pedicello 0.5-1.25 mm. longo excluso.

SPECIMENS EXAMINED: NORTHWEST TERRITORIES. Fort McPherson, July 11, 1904, E. A. Preble (Nos. 350, 351, fr.; W.); Fort Norman, Mackenzie, June 12, 1904, same coll. (No. 322, f.; W.); half way between Fort Rae, Great Slave Lake, and MacTavish Bay, Great Bear Lake, Lake St. Croix, August 10, 1903, same coll. (No. 247, st.; W.; forma ad var. *glabram* referenda); Great Slave Lake, Loon

Island, fifty miles north of Fort Resolution, July 10, 1901, *E. A. & A. E. Preble* (Nos. 133, 134, f.; W.); Slave River, about 45 mi. from mouth, August 29, 1914, *F. Harper* (No. 99027, st.; O.); Fort Resolution, July 14, 1901, *E. A. & A. E. Preble* (No. 151, st.; W.); June 21, 1903, *E. A. Preble* (No. 201, f.; W.); Nahami Mts., June 6, 1904, same coll. (No. 317, f.; W.); Churchill, Hudson Bay, August 2, 1910, *J. M. Macoun* (No. 79152, fr.; O.).

YUKON TERRITORY. Vicinity of Dawson, island near footbridge, July 13, 1899, *R. S. Williams* (fr.; N.); same vicinity, April 26, 1914, *A. Eastwood* (No. 16, winter-buds; A.); June 29, 1914, same coll. (No. 31, st.; A.; ad var. *glabram spectans*); May 21, 1914, same coll. (No. 56, partim, f.; A.; ut *praecedens*); May 14, 1914, same coll. (Nos. 56, partim, f., 57, m.; A.); May 15, 1914, same coll. (Nos. 64, m., 65, f.; A.); May 21, 1914, same coll. (Nos. 85, f., 87, m.; A.); May 23, 1914, same coll. (Nos. 98, m., 99, f., 100, m.; A.); May 26, 1914, same coll. (No. 106, f.; A.); June 2 and 3, 1914, same coll. (Nos. 129, m., 130, f.; A.); July 13, 1914, same coll. (No. 217, fr. submat.; A.; var. *glabra*); July 14 and 15, 1914, same coll. (Nos. 229, 239, 240, fr.; A.); June 19, 1914, same coll. (Nos. 301, st.; var. *glabra*; 302, fr.; A.); West Dawson, July 16, 1902, *J. Macoun* (No. 54402, st.; O.: "a small straight tree"); trail to Moosehide, July 1, 1914, *A. Eastwood* (No. 467, st. surc.; A.); islands in Klondike River, July 15, 1902, *J. Macoun* (No. 54401, fr.; O., partim var. *glabra*); Colorado Pup, July 29, 1902, same coll. (No. 54400, st.; O.); Ogilvie, July 8, 1914, *A. Eastwood* (No. 540, st.; A., var. *glabra*); Hard Luck Slough, July 10, 1914, same coll. (No. 565, fr.; A.); Cormacks, July 1, 1914, same coll. (No. 584, st.; A.); Carcross, Lake Bennett, July 16, 1914, same coll. (No. 725, st.; A.); Ingersoll Islands, moist sloughs and river bottoms, May 28, 1899, *M. W. Gorman* (m., f.; N.; "this willow is much eaten by Moose").

ALASKA. White Pass, July 23, 1914, *A. Eastwood* (No. 860, fr.; A.; an uncertain form of which the young leaves are rather tomentose along the under side of the midrib); Fort Gibbon on Yukon River, August 1, 1905, *C. N. H. Heideman* (No. 83, st.; W.; forma incerta; surculi foliis elliptico-lanceolatis membranaceis ad 10:2.2 cm. magnis breviter acuminatis subtus glaucis tenuiter brevissime adpresso sericeis stipulis linearibus).

ALBERTA. Jasper Park, near Jasper, July 22, 1917, *J. M. Macoun* (No. 95376, st.; A., O.); Athabasca River, July 23, 1918, same coll. (No. 95373, fr.; A., O.), same River, near bridge, east end, mixed alluvial soil and gravel, June 20, 1918, same coll. (Nos. 95750, m., 95751, fr. submat.; 95769, f.; 95770, m., f.; A., O.).

The localities of Drummond's specimens are uncertain. They are preserved in Herb. N. under "No. 61, Hb. H.B. & T." fr., "marshes near Rocky Mts.;" "No. 62, Hb. H.B. & T." f., and "No. 63, Hb. H. B. & T." st. No. 62 is Drummond's No. 663.

As a variety may be kept

S. arbusculoides var. *glabra* Andersson in Svensk. Vet.-Akad. Handl. vi. 148 (Monog. Salic.) (1867). — *S. acutifolia* Hooker, Fl. Bor.-Am. II. 150 (1839), non Willdenow. — *S. humillima* var. *glabra* Andersson in De Candolle, Prodr. XVI. 248 (1868). — *S. saskatchavana* von Seemen in Bot. Jahrb. XXI. Beibl. 52, 7 (1895). — *S. saskatchewan* Rydberg, Fl. Rocky Mts. 198 (1917). — This is probably nothing but a glabrescent form and needs further observation. I refer to it the specimens mentioned as var. *glabra* in the enumeration above, and Richardson's plant from Fort Franklin preserved under "No. 65 Hb. H.B. & T." in Herb. N.

As to the true relationship of *S. arbusculoides* I do not wish to make a definite statement. Sometimes the leaves have rather numerous stomata

in their upper epidermis but not unfrequently I could not detect any trace of them. The length of the style and of the pedicel varies to a certain degree, and the shape of the gland is not always alike. These variations need further study. As to the Yukon plant at Dawson Miss Eastwood in a field note makes the following statement: "In habit it is variable but is generally tall and erect with dark red glossy stems. Some bushes have pendent branches, and some have almost fastigiate branches. It often becomes 10-20 feet high, and forms a great deal of the Willow growth along sloughs. It is common along the fence near the barracks, and in the slough on Fifth Street where the bridge crosses. It is one of the features of the vegetation in the town."

The second species of doubtful affinity is

S. argyrocarpa Andersson in Svensk. Vet.-Acad. Handl. vi. 107, t. 6, fig. 60 (Monog. Sal.) (1867); in De Candolle, Prodr. xvi.² 233 (1868). — Bebb in Bull. Torr. Bot. Club, xvi. 211 (White Mt. Will. III) (1889); apud Watson & Coulter, Gray Man. ed. 6, 483 (1890). — Britton & Brown, Ill. Fl. i. 500, fig. 1190 (1896); ed. 2, i. 603 fig. 1484 (1913). — Britton, Man. 318 (1901). — Robinson & Fernald, Gray's Man. ed. 7, 327, fig. 664 (1908). — Von Seemen in Ascherson & Graebner, Syn. Mitteleur. Fl. iv. 92 (1909). — *S. repens*? Bigelow, Fl. Bost. ed. 3, 392 (1840), non Linnaeus. — Carey apud Gray, Man. 430 (1848). — Andersson in Öfv. Svensk. Vet.-Akad. Förh. xv. 126 (1858). — *S. fusca* Oakes in Mag. Hort. Bot. Harvey, vii. 184 (Not. Rar. Pl. New Engl. 7) (1841), non Linnaeus. — *S. ambigua* Tuckerman in Am. Jour. Sci. xlv. 35 (1843), non Ehrhart. — *S. labradorica* Schw. in Herb. ex Bebb in Bull. l. c. 211 (1889), nom. nudum. — *S. argyrocarpa sericea* Andersson in Svensk. Vet.-Akad Handl. vi. 107 (Monog. Sal.) (1867); in De Candolle, Prodr. xvi.² 234 (1868). — *S. depressa* Barratt in Herb., nom. nudum, non Fries.

Bebb (1889) has dealt with this Willow quite extensively. The synonymy given above furthermore shows how this species has been treated by previous authors. I am not sure whether Pursh's *S. repens* (Fl. Am. Sept. 610 [1814]) really is the same as our species. He had a Willow in mind that came from "Nova Scotia and New Foundland," and was "a very small creeping species." I have not yet seen specimens that agree with Pursh's description which apparently is partly taken from Willdenow. Pursh says that the ovaries are pubescent but the capsules glabrous. Von Seemen seems to have been the first who observed the presence of two glands in the male flowers, and he therefore placed this species with *S. glauca*. In my opinion it cannot be referred to sect. *Glaucae*, and may represent the type of a special group.

Besides var. *sericea* which is nothing but the type Andersson in 1867 described as var. "glabrior: foliis magis aequalibus, supra nitide, subtus opaco-viridibus denudatis" which name he (1868) changed into var. *denudata* where he says: "foliis utrinque glabris, subtus opace viridibus, iis *S. pedi-*

cellaris subsimilibus." Not citing a type specimen it is almost impossible to tell what Willow Andersson may have had before him.

I have been able to examine specimens from the White Mountains in New Hampshire, from Table-top Mountain in Gaspé Peninsula and from various localities in southern Labrador.

When I dealt with the species of section *Glaucæ* in my 2nd and 3d notes (see Bot. Gaz. LXVII. 58 [1919]) I omitted a curious species described by Rowlee as *S. Maccalliana* of which he said that it is "obviously related to *Salix glaucops* Anders., but differs in having glabrous serrate leaves. Its leaves and buds suggest *S. lucida*." After having examined probably all the material preserved in American herbaria up to 1919 I suppose that *S. Maccalliana* indeed can be regarded as a member of this group because the flowers show a strange similarity to those of *S. glauca* var. *glabrescens*. The male flowers have a dorsal gland, and the pubescence of the straw-colored or light brown bracts is short. The leaves, however, present a wholly different aspect, and somewhat resemble those of forms which Ball names *S. pseudomyrsinifera*, a species of the *Cordatae* group. I will give the following precise description and enumerate the specimens.

S. Maccalliana Rowlee in Bull. Torr. Bot. Club XXXIV. 158 (1907).—Henry, Fl. S. Brit. Col. 97 (1915).—Rydberg, Fl. Rocky Mts. 198 (1917).—Frutex 1–2 m. altus, ut videtur erectus, strictus, ramosus; ramuli novelli sparse pubescentes, cito glabri, ? balsamei, hornotini olivacei vel purpurascentes, saepe ut annotini biennesque castanei, nitiduli, vetustiores ignoti; gemmae bene evolutae nondum visae. Folia matura crasse chartacea, inferiora minora peduncolorumque anguste vel linear-lanceolata vel oblanceolata, gradatim in superiora majora anguste elliptico-lanceolata vel anguste elliptico-oblonga abeuntia, basi acuta vel obtusa, apice subacuta vel subacuminata, 1.5 : 0.5 ad 6.5 : 1.6 vel in surculis ad 8(–9) : 2.5 cm. magna, margine incrassato distincte glanduloso-crenato-dentata dentibus circ. 2–4 pro 5 mm., superne novella pilis griseis fulvisque saepe satis difficile recognoscendis obsita, in costa saepe densius pilosa, demum subito satis vel omnino glabrescentia, intense viridia (*in vivo* nitidula?), costa nervisque lateralibus flavescentibus plusminusve planis et subtiliter reticulata, in epidermide stomatibus satis magnis ellipticis subnumerosis instructa, subtus initio ut superne pilosis et demum glabra, viridescentia, vix vel paulo pallidiora, ? subnitidula, costa elevata nervisque lateralibus utrinque circ. 8–14 prominulis et etiam tenuiter reticulata; petioli 2–8 mm. longi, flavobrunnei, superne sulcati et pilosuli; stipulae etiam in surculis non visae. Amenta coetanea, pedunculata, rhachi villosa, mascula ovoideo-cylindrica, pedunculo brevi (vix ultra 8 mm. longo) foliola 3–4 normalia ad 2 : 0.6 cm. magna gerente excluso 1.5–2 : 1.2 cm. magna, densiflora; bracteae anguste obovato-oblongae, apice rotundae, flavescentes, breviter pilosae, sed versus apicem plusminusve glabrescentes, venosae; stamina 2, filamentis liberis, circ. $\frac{1}{3}$ pilosis bracteam demum duplo-longioribus, antheris flavis ellipsoideis

circ. 1.5 mm. longis; glandulae 2, ventralis ovoideo-conica vel saepe bipartita, bractea subtriplo brevior, dorsalis minima interdum plusminusve 3-partita; amenta feminea sub anthesi nondum visa, adultiora circ. 3.5–4: 2 cm. magna (pedunculo ad 1–2 cm. longo 3–4-foliolato excluso), basi plusminusve laxiflora, fructifera ad 5:1.6 cm. magna; bracteae ut in masculis, saepe omnino breviter pilosae; ovaria anguste ovoideo-oblonga, dense breviter argenteo-sericeo-tomentosa; styli distincti, 0.8–1.3 mm. longi, apice saepissime bifidi, stigmatibus oblongis divaricatis bifidis stylo paullo ad duplo brevioribus; pedicelli initio glandulam duplo dein ad triplo superantes, in fructu circ. 2 mm. longi; glandula 1, late ovoideo-rectangularis, saepissime bipartita. Fructus maturi e basi ovoideo-rhombica rostrati, 8–10 mm. pedicello excluso longi, ut ovaria tomentosi.

SPECIMENS EXAMINED: ALBERTA. Edge of Bow River, near Cave and Basin, about 1500 m., July 10, 1899, *W. C. McCalla* (No. 2252^a, partim, f.; N.); vicinity of Banff, on water's edge along road to Sun Dance Canyon, about 1500 m., July 10, 1890, same coll. (No. 2252^a, partim; Cor.; "about 1 m. high"); low ground along road to Devil's Head Lake, about 1500 m., June 19, August 11, 1899, same coll. (No. 2252, type, m., st.; Cor. "1.5 m. high"); Banff, August 13, 1908, *Olson* (f.; G.); Morley, foothills of Rocky Mts., damp places, June 17, 1885, *J. Macoun* (No. 24506; O.; olim No. 17, C.); Banff, Cave Avenue, July 4, 1891, same coll. (No. 24517, fr.; O.; olim nos. 28 and 33 in C.); marshy flat near the Bow River, July 15, 1891, same coll. (No. 28, fr., C.; "bush 1.2 m. high"); Spray River, June 30, 1891, same coll. (No. 33, fr.; C.; "low spreading bush on the borders of the same marsh").

BRITISH COLUMBIA. Yale District, Armstrong in the Okanagan Valley, 1912, *E. Wilson* (No. 2, f., m., fr.; Cor.; in O. sub No. 87817); Kootenay District, Cranbrook, June 22, 1914, *J. K. Henry* (fr.; Cal.; "clumps 1.2 to 1.8 m. high").

SASKATCHEWAN. Prince Albert, Camp, thickets by railway, July 6, 1876, *J. Macoun* (No. 13675, st.; Cor., O.); west of Eagle Creek, Bare Hill, in a bog, July 31, 1906, *J. Macoun & W. Herriot* (No. 70260, st., O., G.).

MANITOBA. In thickets east of Brandon, June 6, 1896, *J. Macoun* (No. 13666, fr. im.; C., Cor., O.).

ONTARIO. Thunder Bay District, Lake Superior, north shore, by C.P.R.R. in SW. between Port Arthur and Fort Williams, July 23, 1883, *W. R. Dudley* (f.; C.).

VIENNA, May, 1920.

THE LIGNEOUS FLORA OF THE STAKED PLAINS OF TEXAS

ERNEST J. PALMER

THE traveler who has passed over the high, wind-swept, grassy plains of the Texas Panhandle and viewed the country only from the speeding train might perhaps imagine that an article on the trees and shrubs of the region could be as brief and trite as the celebrated treatise on the Snakes of Ireland; but a closer inspection will reveal the fact that even if Nature has essayed a sinister imitation of St. Patrick's rôle upon the ligneous flora here it has been carried out but indifferently, and that although largely confined to certain limited areas woody plants are by no means rare and the total number of species is not inconsiderable. Moreover, instead of showing any tendency



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