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Hunt Institute was dedicated in 1961 as the Rachel McMasters Miller Hunt Botanical Library, an international center for bibliographical research and service in the interests of botany and horticulture, as well as a center for the study of all aspects of the history of the plant sciences. By 1971 the Library's activities had so diversified that the name was changed to Hunt Institute for Botanical Documentation. Growth in collections and research projects led to the establishment of four programmatic departments: Archives, Art, Bibliography and the Library.

TWO PROBLEMS IN SALIX DISTRIBUTION

By Carleton R. Ball

madroño 1949 10: 81-87

Two peculiar problems in the distribution of certain North American species of Salix have confronted the writer for several years. The first problem is presented by two unrelated species having an extremely extended, but fairly continuous, distribution from south to north. The second problem is concerned with two unrelated species which have a fairly extensive, but finally discontinuous, distribution from east to west. By "unrelated" is meant that the two members of each pair belong to quite widely separated sections of the genus Salix.

The geographical direction of distribution given above is from the region of greater abundance to that of increasing scarcity and final disappearance. It is hoped that some one may throw light on the physiological and/or ecological factors governing these peculiar plant distributions.

A. Extremely Extensive South-North Ranges.

The two species of Salix with greatly extended south-north distribution are S. lasiandra (accompanied by its hairy-twigged variety lancifolia) and S. interior (with its narrow-leafed variety pedicellata). Both species range from the latitude of northern Mexico (30°-32° N.) to the Arctic Circle or beyond (67° N.), or some 2500 miles or more. In each case, the species and its variety occur together throughout almost the entire distance.

1. Salix lasiandra Bentham, the Pacific or Western Shining Willow, and its hairy-twigged variety lancifolia (Andersson) Bebb, occur from northwestern Mexico to Alaska and Yukon. From the hot climate of Baja California and southern California, they pass northward abundantly throughout California, Oregon, Washington, western Nevada, and Idaho. In the south, a long finger of sparse distribution projects eastward across the northern portions of Arizona and New Mexico and the adjoining southern parts of Utah and Colorado (Fig. 1).

In Canada, the species and variety extend northward, with decreasing abundance, across British Columbia and mountainous western Alberta and eastward into the prairies as far as east-central Saskatchewan and thence north at least to the west end of Lake Athabaska in northern Alberta. Farther north and west, the species occurs on the lower Stikine River in northwestern British Columbia near the international boundary north of Wrangell, and again on the headwaters of the Chilkat River at the northern tip of the Alaskan "Panhandle".

Species and variety occur together at several points on the Yukon and Klondike Rivers in the Dawson area of Yukon (64° N.). In Alaska proper, the variety occurs alone at Matanuska, at the head of Cook Inlet in south-central Alaska. It has been found also along the Yukon River at Ft. Yukon (Arctic Circle), Blackburn, and even Holy Cross (62° N., 160° W.), as well as on the tributary Tanana River at Fairbanks, and Nenana. Salcha Slough,

The distribution from northwestern British Columbia across Alaska and western Yukon is sparse but fairly continuous. Similar continuous distribution from Lake Athabaska northwestward across the wide expanse of the Peace River and Liard River drainage is in doubt, but collecting has not been sufficient to prove its absence.

The total recorded range covers about 35 degrees of latitude (32° N. to almost 67° N.). It extends across the Lower and Upper Sonoran, Transition, Canadian, and Hudsonian Life Zones, and almost touches the Arctic Zone at various points on the Yukon River from Dawson to Holy Cross.

2. Salix interior Rowlee, and its slender-leafed variety pedicellata (Andersson) Ball, range northward from the mouth of the Mississippi River (30° N.) across the United States and Canada to slightly beyond the Arctic Circle in Alaska. Westward of the Mississippi, they (and especially the variety), fan out across the Great Plains almost to the foothills of the Rocky Mountains in the United States and Canada. Eastward, the species ranges up the Ohio Valley, across the mountains, down the Potomac Valley to the District of Columbia, and thence northeastward to Delaware, New Hampshire, New Brunswick, and Quebec. Then the line runs west to southern Manitoba and northwestward to Lake Athabaska, the species and variety occurring together in the Prairie Provinces. (Fig. 1).

In the Mackenzie River (Arctic) drainage basin of southern Mackenzie, the species (and occasionally the variey) occur on the Slave River (Ft. Smith), on Great Slave Lake (Hay River), and on the Mackenzie River (Ft. Simpson, Ft. Wrigley, 63° N., 123° W.). Westward, on tributaries of the Mackenzie, the species has been found at the mouth of the Nahanni River (61° N., 124° W.), at Ft. Liard on the Liard River (60° N., 124° W), and on the Upper Liard River at 60° N. This is at about 128° W. and near the B.C.-Yukon boundary.

In Pacific drainage, the species and variety occur in British Columbia, Yukon, and Alaska. In northwestern British Columbia, the species has been found once on the Stikine River, near the Alaskan border north of Wrangell. In Yukon, species and variety occur at several points on the Yukon and Klondike Rivers within some 20 miles of Dawson (64° N., 140° W.). In Alaska, species and variety follow the Yukon River westward, occurring at Circle (66° 30' N., 144° W.), on Porcupine River 40 miles above the mouth (67° N., 144° W.), Ft. Yukon, (66° 30' N., 145° W), between Rampart and Tanana, between Ft. Gibbon and Tenana (65° N., 152° W.), and at Mulato (158° W.). On the tributary Tanana River, the species occurs at Fairbanks and Hot Springs and the variety at Nenana. Outside the Yukon drainage, the species has been found at but one point in Alaska, namely, Paxson's (Roadhouse), just south of the divide separating the north-flowing Tanana and the south-flowing Gulkana-Copper River drainages.

The range recorded above covers 37 degrees of latitude (30°-67° N.) or some 2600 miles, and 90 degrees of longitude (68° W. in New Brunswick to 158° W. in Alaska). The Life Zones covered are the Carolinian, Alleghanian, Canadian, and Hudsonian, with the Arctic Zone almost reached at points on the Yukon River.

One striking fact regarding both S. lasiandra and S. interior is that there is little or no more observable variation in characters between plants collected at the two extremes of this range than between plants collected at any one point within the range.

In these vast ranges, wide differences occur in temperature, precipitation, humidity, length of season, and length of day. Yet these two species seem to show complete ability to adapt themselves to these differences without observable change in characters.

B. Extensive, But Discontinuous, East-West Ranges.

Different species of Salix which occur commonly in our northeastern and north-central States and adjacent Canada penetrate westward to very different distances. Some, like S. interior Rowlee, S. rigida Muhl. (S. cordata Muhl.). and S. discolor Muhl., are replaced in the Rocky Mountains and westward by related species. Others, like S. amygdaloides Anders., reach but do not pass the Sierra-Cascade barrier. Still others, like S. Bebbiana Sargent. S. candida, Fluegge, and S. pedicellaris var. hypoglauca Fern., extend practically to the Pacif Ocean. Two species which penetrate only to the front range of the Rocky Mountains, and that only by discontinuous distribution, are discussed below.

1. Salix serissima (Bailey) Fernald , related to S. lucida Muhl. of the East and to S. caudata (Nuttall) Heller and S. lasiandra Bentham of the West, occurs commonly from New England and Lower Canada westward. The southern boundary of its range lies long the southern edge of the Great-Lakes area to St. Paul and Kandiyohi Co., Minnesota, thence northward through Ottertail and Clearwater Counties, and westward in North Dakota, in the northern tier of counties (Pembina, Rolette). From here the line runs northwestward to Calgary in southern Alberta and the Banff area Northward the range extends to Lake Athabaska and southern Mackenzie (Fig. 2).

By discontinuous distribution, the species occurs in three separate areas to the south and west of its continuous distribution. The first area includes Flathead (Glacier Park) and Chotesu Counties in northwestern Montana, some 150 and 230 miles, respectively, south of Calgary. Far to the west and south of the main distribution are two mountain outposts in South Dakota and Colorado, respectively. In the Black Hills of South Dakota, Prof. A.C. McIntosh found it in sedge moor at two localities near Deerfield, Pennington Co., in 1928 and 1929. In the Front Range of the Rocky Mountains, Prof. Ernest C. Smith collected it at Long's Peak Inn, elev. 9000 feet, on Long's Peak, Larimer Co., Colorado, in 1935, 1936, and again in 1943.

The writer previously had presented the known distribution of this species in the United States and Canada in two different papers (Bot. Gaz. 72:220-22, 1921; Can Field-Nat. 40:147-48, 1923). The first paper brought forth a statement from Francis Welles Hunnewell (Rhod. 25:67-68, 1923) that he had collected S. serrissima on Longs Peak in 1913 and that the determination had been verified by Dr. Fernald. In the second paper, and again in Deam's Shrubs of Indiana, the writer erroneously credited this collection to Pikes Peak instead of Longs Peak, which he regrets.

The Black Hills locality is about 450 miles from the nearest North Dakota station, and about 500 and 600 miles, respectively, from the two Montana stations far to the northwest. The Longs Peak station is 600 miles from Rolette Co., N.D., and 600 and 700 miles, respectively, from the two Montana stations. The species has not been found in the intervening expanse of Rocky and Big Horn Mountains. Are these few southern plants the remnants of its farthest southern push during glacial times and its wide northern distribution a reoccupation of territory lost durin the Glacial Epoch?

2. Salix petiolaris J.E. Smith has much the same eastern distribution (Fig. 2) as S. serissima. It ranges slightly farther south, occupying the northern third of Indiana and the two northernmost tiers of counties in Iowa as far west as the Mississippi-Missouri divide. The line then runs northwest to west-central Minnesota (Chippewa Co.), northeastern South Dakota (Day Co.), and adjacent North Dakota (Richland Co.), and thence passes through McLean, McHenry, and Bottineau Counties, of central and north-central North Dakota, and on into Canada. The western border of its continuous distribution is somewhat farther to the south and west than that of S. serissima. Southward, it is a low clumpy shrub, becomes gradually larger northward, and is often a small tree in the Prairie Provinces, where it extends at least to Lake Athabaska.

Correlated with the somewhat greater western extension of its continuous distribution is its broader and deeper discontinuous penetration far to the south and west. Four separated areas are occupied, namely: 1, the sandhills of northwestern Nebraska and adjacent South Dakota; 2, the Black Hills; 3, Estes Park in northern Colorado: and 4. the Pikes-Peak area in east-central Colorado.

Smith and Pound in 1892, and Bates in 1910-1914, found it at the Rowley Ranch near Kennedy, Cherry Co., Nebr. Pool and Nelson got it at Oasis in 1912; Sandoz near Ellsworth in adjoining Sheridan Co. in 1933; and Tolstead at Bear Creek and Dewey Lake, Cherry Co., in 1941, as also at Ainsworth, Brown Co., to the east. These three contiguous counties all lie in north-central Nebraska and westward. Farther south, Baker collected it at Purdum in Thomas Co. in 1901. Kiener found it in 1943 in Dawson Co., in south-central Nebraska, and also in Arthur Co., near the NE. corner of Colorado. In 1924, Over collected it in Bennett Co., southwestern So. Dakota, just across the State line from Cherry Co., Nebraska.

S. petiolaris is distributed over the eastern face of the Black Hills of southwestern So. Dakota, in Custer, Pennington, Lawrence, and Meade Counties. It was collected by Setzer at Jum Creek (Twp. 2 N., R 5 E.) in 1913; by Murdoch at Bear Butte Creek (Twp. 4 N., R. 4 E.) in 1919; by Over at Castle Creek and near Merritt in 1924; and by McIntosh at Squaw Creek, 12 miles above Game Lodge, and at Sylvan Lake in 1926; and again at Custer and at Castle Creek (Deerfield) in 1928.

In Colorado, the species occurs in two separated localities. Ernest C. Smith collected 7 numbers in Estes Park, elev. 7500 feet, in Larimer Co., in 1933 and 1934. Near Pikes Peak, J. H. Christ found it east of Divide in Teller Co., and in Black Forest, El Paso Co., in 1935.

The sandhills area of Nebraska-South Dakota, and the Black Hills area of South Dakota, lie some 300 to 400 miles west-southwest of the margin of the continuous eastern distribution. The two mountain localities in Colorado are about 100 miles apart and 300 to 350 miles southwest of the Nebraska and South Dakota areas and therefore some 600 to 700 miles southwest of the margin of continuous distribution.

In the case of Salix serissima, there are four isolated and distant Localities of discontinuous distribution, in three States. In the case of S. petiolaris, there are two relatively extensive areas and two isolated mountain localities of such distribution, also in three different States.

U.S. Dept. of Agriculture,
Washington, D.C.

Fig. 1. Distribution of Salix lasiandra and its var. lancifolia (hatching) and S. interior and its var. pedicellata (fine dotting). Localities of marginal collections indicated by triangles (▽) and large dots ( ), respectively.

Fig. 2. Southwestern portion of North American area of continuous distribution of Salix serissima (hatching) and of S. petiolaris (fine dotting). Localities of marginal collections and of discontinuous distribution indicated by large dots ( ) and triangles ( ), respectively.

NORTH AMERICA — 205 C
With Fall Line and Limits of Glaciation

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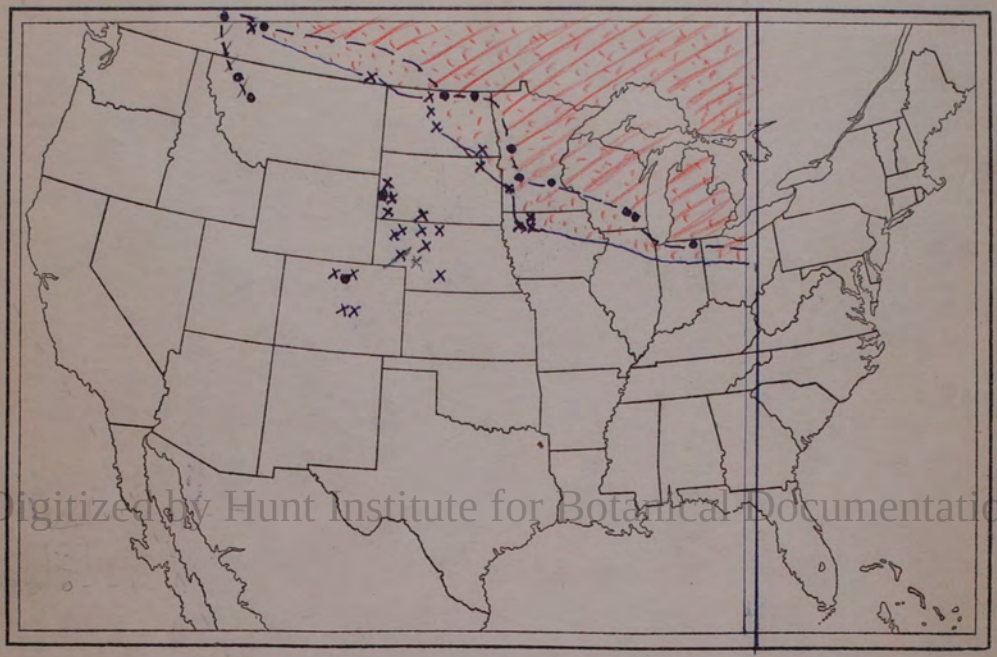

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bind

3814 Jocelyn St., N.W.,
Washington 15, D.C.

Miss Annetta Carter, Secy., Edit. Bd., Madrono,
4004 Life Sciences Bldg., Univ. Calif.,
Berkeley, California.

23 March, 1949.

Dear Annetta:

I have just received your letter of March 21, with galley proof of "Two problems in Salix Distribution", proof of the two cuts, and a request for abstract. I am delighted to note that the corrections in proof are caused by type-setting errors and not by any in my manuscript.

I have read the proof carefully and made a few more corrections. On galley 13, it seems to me that the capital R on Rivers should remain. It is just as much a proper noun in the plural, where the rivers are named, as in the singlar where one river is named.

On galley 14 I have inserted another omitted (in paragraph 4. In par. 5 I have again hyphenated Field-Mat., as it was in the mss. and is in the name of the journal. At the end of par. 6. I have deleted the words "which he regrets". and ended the preceding line with a period. (I still regret the error, though).

In par. 7 of galley 14, your deletion of "to) and insertion of "and", twice, is correct. I was referring to distances from two separate stations there, whereas in the next to last paragraph I was refferring to the whole front and not to specific localities.

In the 3rd paragraph from end of galley 14, I have corrected the spelling of "Jim Creek to "Jim" Creek. It was misspelled in my mss. and corrected but apparently the correction was not clear.

You surely did mess up my Black Hills distribution in that paragraph. Of course, if Madrono has a special form for citation, so be it. But you mixed up two of the collections by McIntosh. The "(Deerfield)" after the second Castle Creek was the town of that name. The first collection was on the creek somewhere; the second near Deerfield. So I have had to make two deletions and two new insertions, which will mean the resetting of the last 8 lines of that paragraph. Just for that, I am going to make you look like a shredded wheat biscuit when next I catch you, if I ever do.

Text figure 1 is hopeless. I can see that it was too closely hatched and dotted in the northwestern area where the two species occur together. I am taking it to the man who made it for me and will see if he can redraw it. As to the re-engraving, it looks to me as if it would have to be done anyway, because of some accident in the making, and that the engraver ought to do that free. As I am having it redrawn in order to get a clearer figure, I'll pay for the whole job.

I am returning corrected proof, and fig. 2, with order for reprints. Willsend fig. 1 and the abstract soon as possible. I find no order blank for reprints, but want 100 copies without covers.

Many thanks for all of your help and with best wishes for your flight to La Paz to escape being turned into a shredded buscuit, I am

Cordially yours,

P.S. I'll bet that Dr. Mason and you will speak Spanish so glibly that you will have difficulty in speaking English from now on.

Carleton R. Ball

Miss Annettta Carter, Madrono

24 April, 1949

Dear Annetta :

When I wrote you on March 23, returning proof, I had no idea it would take so long to get Fig. 1 redrawn. I don't know all the reasons bu ~~xxxxxx~~ suppose fire, flood, illness, and Easter holidays entered in. Finally, I have it and inclose old plate and new drawing herein.

In looking the new drawing over, I discover that my original pencil drawing had the letter x instead of the triangles for the marginal occurrences of S. lasiandar and the new drawing therefore is made that way. These probably will be more readily recognized after the reduced engraving is made. But it does mean that the description of Fig. 1 should be corrected by de;eting the word triangles in line 3 and inserting "letter z". An x also should be placed in the parentheses which follow.

If the printing of the paper has gone forward already, these changes cannot be made, of course, but nobody will be killed by that.

Hoping that you had a fine time in Peru and other "furrin" parts, I am

Cordially yours,

Carleton R. Ball

P.S. Abstract also is inclosed.

(The carbon copy of this letter failed by reversal of the carbon, jence this original typing. CRB.)

3614 Jocelyn St., N.W.,
Washington 15, D.C.

April 15, 1948

Dr. Herbert L. Mason,
Dept. of Botany,
Univ. of California,
Berkeley, California.

Dear Dr. Mason:

I am inclosing a short manuscript on two problems of willow distribution. Two line drawings are attached. This is for publication in Madrono, if found suitable. The smaller drawing could be reduced in height by running a new marginal line about an inch up from the bottom. If not proper for Madrono, please return and postage will be refunded.

I am now getting down to monographing in earnest, after spending some time on other manuscripts. My 166th paper came out in Torr. Bull. last month. I hope it settles S. petiolaris for keeps. Will look up and see what recent reprints are due you and send them on soon.

With all good wishes to you and yours, and the botanical colleagues, I am

Cordially yours,

Carleton R. Ball

MADRONO

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BERKELEY, 4, CALIFORNIA

20 April 1948

Dr. Carleton R. Ball
3814 Jocelyn Street N. W.
Washington 15, D. C.

Dear Dr. Ball:

Thank you for your manuscript, "Two problems in Salix distribution." We are glad to receive it and will submit it to members of the Editorial Board for consideration.

We are glad to hear that work on the Salix monograph is progressing.

Sincerely,

Herbert L. Mason

Herbert L. Mason
Chairman, Editorial Board

HLM/c

Note date!!
Is my face red! In rummaging around this signed but unsealed letter. I owe you + the boss an apology. In July - when we hasten mailing money again I'll send you my Baja Cfa Salix. (poor)
19.VI.48 Annella

3814 Jocelyn St., N.W.,
Washington 15, D.C.

Miss Annetta Carter,
Dept. of Botany, Univ. of California,
Berkeley, California.

June 26, 1948

Dear Annetta:

I have Dr. Mason's letter of April 20 and your red-faced but yellow-papered note of June 19 starting it on its way. All have gone into the archives and will be properly documented in my memoirs. You would better send me a photo with the red face because my illustrations will be in technocolor.

I note your implication that new mailing funds will be available after July 1 and can recall similar experience in the Federal service. If it turns out thatyou have to use them all to get Gov. Warren elected to the Vice Presidency, let me know and I'll send money for mailing the Baja Calif. willows to Washington. If they are to be returned to you, I can send you a frank for mailing them but if I keep any or all of them I can't do that. So consider carefully before deciding to be generous.

Have been slaving on a manuscript for two months and everything else has been neglected. Think I have nice note from you and Laurie Sisson on my birthday and now I shall get busy and write to tell you both what I think of you.

Cordially yours,

Carleton R. Ball

P.S. You remember that all my writing is done with stub pencils (2-3.5 inches) and I am going to run short by winter unless my friends come to my rescue. Have nearly 1900 stubs 1-1.2 inches long. Will look for more by Christmas and will refund postage thereon.

CALIFORNIA BOTANICAL SOCIETY
4004 LIFE SCIENCES BUILDING
UNIVERSITY OF CALIFORNIA
BERKELEY, CALIFORNIA

March 21, 1949

Dr. Carleton R. Ball
3814 Jocelyn Street, N. W.
Washington 15, D. C.

Dear Dr. Ball:

Galley proof of your paper, "Two Problems in Salix Distribution", is enclosed. Please make the necessary corrections and return it to us by the end of the week.

Apparently the engraver had an accident in preparing text figure 1 and blotted out everything in the vicinity of Anchorage. The cut will have to be re-done. Also, it is very difficult to distinguish between the circles and the triangles in much of the cut. We have found, recently, that if the "zip-a-tone" is cut away around inserts, reproduction is much clearer. In your cut, some of the dots and lines have coalesced with the circles and triangles and obscured their original shape. However, if we make any changes in the original figure, we will undoubtedly be billed for the new cut even though it has to be re-done anyway. And the Business Manager would have to bill the author for said cut! What are your wishes in the matter? Figure 2 seems much clearer -- probably because there are fewer interfering lines.

Under Salix petiolaris, I took the liberty of revising the citation of specimens in order to bring them into conformance with Madroño style. Two of the editors who looked over the paper suggested that this be done.

In the third paragraph under Figure 2, the linotype man changed "and" to "to" twice. In the next to last paragraph, in referring to mileage, you use "to" in your manuscript, but "respectively" is omitted; so I assume that it can stand as written.

Reprints should be ordered when you return proof. As you know, reprint rates are given on cover page 2 of Madroño. Your paper runs to six pages and ten lines; so you will probably have to pay for eight pages.

A form for Biological Abstracts is enclosed.

Sincerely,

Annetta

Annetta Carter
Secretary, Editorial Board

AC:js
Encls.

Dr. Mason just returned after two months in Colombia. Am planning on flying to La Paz for two or 3 weeks on the 26th. Things are in full bloom down there