A Guide to the identification of *Salix* (willows) in Alberta

George W. Argus

2008

Devonian Botanical Garden
Workshop on willow identification
Jasper National Park, Alberta

Available from:

George W. Argus
310 Haskins Rd, Merrickville R3,
Ontario, Canada K0G 1N0
email: argus@post.harvard.edu
http://aknhp.uaa.alaska.edu/willow/index.html

CONTENTS

TABLES

A GUIDE TO THE IDENTIFICATION OF *SALIX* (WILLOWS) IN ALBERTA

PREFACE

The main objective of this guide is to aid in the identification of willows in Alberta. It provides a number of resources to aid in the identification of *Salix* in the field and the herbarium. These include a written dichotomous key, descriptions of the species, a list of distinguishing characters, information on habitat, distribution maps, and taxonomic comments and comparison tables for some similar-looking species. Using this information along with the interactive key (Argus 2002-onwards) should permit the identification of most *Salix* specimens.

The accurate identification of *Salix* is not always easy. Nor is it easy to write keys that will identify more than a small percent of unknowns. With practice one can come to know the species by "the way they look." This recognition of general patterns brings into play many more characteristics than can be described in words. These include the general branching pattern, overall color, the way the leaves are borne on the shoot, the appearance of catkins and leaves when they are very young, etc. Field identification comes to rely on these characters despite their variability and the possibility of being misled by superficial look-alikes or developmental variation. An important rule is to exercise caution and to carefully check the unknown against its description or by comparison with herbarium specimens.

Once the characters are defined and understood there are other difficulties that bear on identification that should be recognized.

(1) *Salix* are dioecious; this means that flowers of only one sex occur on a single individual. Most floras provide a single key using staminate, pistillate, and vegetative characters. Such keys are frustrating to use and have led many field botanists to ignore staminate or vegetative specimens because such material is impossible to run through such keys. Other floras have provided three separate keys but these keys are very difficult to construct, especially if the number of species in the flora exceeds 25-30 species. Computerized interactive key go a long way in overcoming these problem.

(2) The flowers are very simple. Staminate flowers consist of stamens and a reduced perianth consisting of one or more nectaries; pistillate flowers consist of an ovary and one or more nectaries. Each flower is subtended by a floral bract. The flowers are aggregated into catkins, which may be sessile on the branch or borne on a short, vegetative shoot. In any one individual, therefore, there are relatively few floral characteristics on which to draw for identification.

(3) Developmental variability poses practical problems. Because of differences in the time of opening of floral and vegetative buds, at any particular time, some plants may bear only flowers, others flowers and juvenile leaves, and yet other may have only leaves. There is also the variability due to stage of development. Degree of hairiness often

changes as hairs are lost in age; quantitative characters vary with developmental stage, e.g. the length of catkins, flowering branchlets, stipes, and ovaries usually elongate in age; and some structures, e.g. stipules or floral bracts, may be lost in age. Characters, therefore, that may be useful in identification may not be present at all stages of development. The best way to understand developmental variation is to tag plants in the study area and to make collections from a single individual at several times during the year. These specimens should show juvenile leaves and catkins, fruiting catkins, mature leaves, and winter twigs.

(4) Most *Salix* species will vary phenotypically in response to moisture, nutrients, shade, and wind. Sometimes normally prostrate species growing in a protected niche may be erect, leaves of a usually small-leaved species may be very large in nutrient rich sites, under shade conditions leaves may be very large. In addition to this phenotypic variability there is also genetic variation. Many characters which at first seem to be diagnostic for a particular species, such as leaf shape, hairiness, toothing, and size, as well as plant stature, size of catkins, hairiness of ovaries, etc., are often distressingly variable. The best way to cope with this variability is to base identifications on "normal" growth or on an assessment of a population rather than an individual.

(5) Hybridization is an important source of variability in willows. In the past it was sometimes overestimated and virtually every individual was seen as involving hybridization between two or three or more species. The reaction to this was to de-emphasize hybridization but we should avoid underestimating its importance. First of all, polyploidy is common in *Salix*. It is likely that most of these polyploids are alloploids which arose through hybridization (Argus 1997). This suggests that all polyploids, ca. 40% of *Salix*, probably involve hybridization. Recent genetic evidence has shown that some species have genomes from other species with little or no morphological expression (Brunsfeld et al. 1992). In a recent study of hybridization between *S. eriocephala* and *S. sericea* (Hardig et al. 2000) the point was made that, depending on the genetic control of character expression, some evidence of hybridization may not be expressed. The authors note that even when it is expressed, "hybrids may be imperfectly intermediate or highly variable resulting in an interpretation that unrecognized hybrid plants are merely part of the morphological variation in one of the species." This finding has important taxonomic implications. While evidently we should avoid including too much morphological variation within a single species we also must avoid attributing every variation to hybridization. Since taxonomic decisions are primarily based on morphological characters we are left walking an *a priori* tightrope.

In Alberta some hybrids can be recognized in the field by their morphological intermediacy. These include: *S. arctica* × *S. glauca, S. candida* × *S. myrtillifolia*, *S. candida* × *S. petiolaris, S. exigua* × *S. melanopsis*, *S. athabascensis* × S. *pedicellaris*, and *S. exigua* × *interior*. Some of these suspected hybrids are inviable or sterile. Others are morphologically intermediate between species occurring in the same area, have patchy hairiness on ovaries, or teratological flowers. Some synthetic hybrids made by Mosseler (1990) between *S. interior* and *S. bebbiana, S. discolor, S. eriocephala,* and *S. petiolaris* lived for only a few years before dying (Mosseler, pers. comm.). I believe the most

practical approach is not to assume hybridization unless there is some confirmatory evidence.

Intraspecific variation poses problems not only in identification, but in gathering descriptive data. In creating the database used in this study all practical efforts were made to sample as much variation as possible, but it is likely that not all variation was recorded. Therefore, when using quantitative data caution should be used to avoid eliminating a species because some measurement falls just outside the extremes recorded in the database. One way to do this is to use a range of measurements rather than a singe measurement.

Finally, the best way to identify species is to get to know the species in the study area. This can be done by making numerous collections, keeping complete field notes, tagging plants and collecting them in different stages of development, and by attempting to identify many plants in a population. Another way is to sample population variability by collecting a single branch, (if possible with both leaves and catkins), from a single plant at fixed intervals, such as every 5-10 paces. Skvortsov (1999) says that he often walks through a stand identifying every willow. This helps him understand not only the general variability in the population but sometimes reveals evidence of hybridization or introgression.

Distribution maps. The maps are based on those published in the Flora of Alberta with the permission of John Packer. Maps of species that have since been subdivided into infraspecific taxa or which are new to Alberta have been updated based on collections in the National Herbarium of Canada (CAN). But the maps are far from complete and should be used only as a general picture of species distribution.

Descriptions. The descriptions were made using DELTA and the *Salix* database (available at http://aknhp.uaa.alaska.edu/willow). For the most part descriptions are completely parallel, but in some cases useful characteristics that are not included in the database were added to the appropriate descriptions.

Elevations are generalized. They are based on elevations recorded on herbarium specimens and in the literature and apply to the entire range of the species.

Illustrations are not given here but some species are illustrated in Argus 1973, 2000; Cody 1996; Cronquist 1964; and Viereck & Little 2007.

Acknowledgements. I thank John Packer for permission to include maps from the Flora of Alberta and the Alberta Natural Heritage Information Centre, Parks and Protected Areas Division for providing up-to-date distribution data and maps.

THE GENUS *SALIX* L. IN ALBERTA

SALICACEAE Mirbel - Willow Family

Dioecious trees or shrubs, sometimes with root shoots. Branching sympodial Buds with 3-10 imbricate bud scales or a single external bud scale. Leaves stipulate, stipules sometimes minute or caducous; blades simple, alternate to subopposite, deciduous, petiolate. Inflorescence a unisexual catkin, pendulous or erect. Flowers unisexual, simple, perianth absent or vestigial, subtended by a scale-like, toothed, fimbriate, or entire bract; stamens 2-30, rarely 1, filaments distinct or connate; anthers 2-loculed; carpels 2-4, connate, unilocular, ovary superior, sessile or stipitate, placentation parietal, ovules 1-18 per carpel. Fruit a capsule, dehiscent by valves; seeds surrounded by an arilate coma of long-silky hairs, embryo small, straight, with 2 cotyledons.

Genera 3 (*Populus, Chosenia, Salix*), species ca. 450, worldwide except Oceania; 2 genera in North America.

1. Buds with 3-10 imbricate bud scales; floral bracts toothed or fimbriate; flowers with a basal, eglandular, cup-like disk; stamens 5-80; stigmas 2-4, simple. ..... ***Populus***
1. Buds with a single bud scale; floral bracts usually entire, sometimes slightly erose, or irregularly toothed; flowers with 1-2 slender, glandular nectaries, sometimes cup-like; stamens 1-7; stigmas 2, simple or bifid. ……..... ***Salix***

***Salix* L.**, Sp. Pl. 2: 1015. 1753 - Willow [Latin *salix*, willow]

Plants trees or shrubs, usually not clonal but some clonal by root shoots, rhizomes, layering or branch fragmentation. Shoot growth sympodial. **Buds** with a single scale, margins fused into a cap or free and overlapping. **Leaves** usually stipulate; petioles sometimes with glands at distal end; blades not heterophylous, but proximal leaves differ in size and shape from later leaves; shape varies from linear to circular; margins glandular-toothed to entire. **Inflorescences** erect, spreading, or pendulous catkins; sessile or terminating a leafy branchlet; usually unbranched; appearing before or with the leaves or flowering through the year. A **floral bract** subtends each flower, apex usually entire, sometimes erose or irregularly toothed, usually persistent in fruit. **Staminate flowers** with an adaxial and sometimes also an abaxial nectary, if both present they may be distinct or connate into a shallow cup; stamens 2 or 3—10 or reduced to 1; filaments distinct or variously connate. **Pistillate flowers** with an adaxial nectary, rarely also with an abaxial nectary, which may be distinct or connate with the adaxial nectary and cup-shaped; ovary one, 2-carpellate, unilocular, and stipitate or sessile; styles 2, usually connate; stigmas 2, entire or bifid; ovules (2--) 4—24 (--42) per ovary. **Fruits** obclavate to ovoid or ellipsoidal capsules, with 2 valves. $x = 19$.

Species ca. 450 distributed mainly in the Northern Hemisphere, absent or uncommon in tropical regions, absent, except as introductions, in Oceania.

CLASSIFICATION

Adapted from Argus 2007.

I. *Salix* subg. **Protitea** Kimura

A. *Salix* sect. *Humboldtianae* Andersson

1. *Salix amygdaloides* Andersson, Öfvers. Förh. Kongl. Svenska Vetensk.-Akad. 15: 114. 1858.

II. *Salix* subg. ***Salix***

B. *Salix* sect. ***Salicaster*** Dumort.

2. *Salix lasiandra* Benth. Ges. Naturf. Freunde Berlin II. 4: 239. 1803.

2a. *Salix lasiandra* Benth. var. ***caudata*** (Nutt.) Sudw. Bull. Torrey Bot. Club 20: 43. 1893. (*S. pentandra* L. [var.] *caudata* Nutt. North Am. Sylva 1 : 61. 1842.)

2b. *Salix lasiandra* Benth. var. ***lasiandra***

3. *Salix pentandra* L. Sp. pl. 2: 1016. 1753.

4. *Salix serissima* (L. H. Bailey) Fernald, Rhodora 6: 6. 1904. (*S. lucida* var. *serissima* L. H. Bailey, Geol. & Nat. Hist. Surv. Minn. Bull. 3: 19. 1887.)

C. *Salix* sect. ***Salix***

5. Salix alba L. Sp. pl. 2: 1021. 1753.

6. *Salix fragilis* L. Sp. pl. 2: 1017. 1753.

7. *Salix* ×*rubens* Schrank, Baiersche Flora 1: 226. 1789.

8. *Salix* ×*sepulcralis* Simonk, Oesterr. Bot. Zeitschr. 40: 424. 1890.

D. *Salix* sect. ***maccallianae*** Argus

9. *Salix maccalliana* Rowlee, Bull. Torrey Bot. Club 34: 158. 1907.

III. *Salix* subg. ***Longifoliae***

E. *Salix* sect. ***Longifoliae*** (Andersson) Andersson

10. *Salix exigua* Nutt. N. Amer. Sylv. 1: 75. 1842.

11. *Salix interior* Rowlee, Bull. Torr. Bot. Club 27: 253. 1900.

12. *Salix melanopsis* Nutt. N. Amer. Sylva 1: 78. 1842.

IV. *Salix* subg. ***Chamaetia***

F. *Salix* sect. ***Chamaetia*** Dumort.

13. *Salix nivalis* Hook. Fl. bor-amer. 2: 152. 1838.

14. *Salix reticulata* L. Sp. pl. 2: 1018. 1753.

15. *Salix vestita* Pursh, Fl. Amer. Sept. 2: 610. 1814.

G. *Salix* sect. ***Ovalifoliae*** (Rydberg) C. K. Schneider

16. *Salix stolonifera* Coville, Proc. Wash. Acad. Sci. 3: 333. 1901.

H. *Salix* sect. ***Diplodictyae*** C. K. Schneider

17. *Salix arctica* Pall. Fl. Ross. 1: 86. 1788.

18. *Salix petrophila* Rydb. Bull. N. Y. Bot. Gard. 1: 268. 1899.

I. *Salix* sect. ***myrtilloides*** (Borrer) Andersson

19. *Salix athabascensis* Raup, Rhodora 32: 111. 1930.

20. *Salix pedicellaris* Pursh, Fl. Am. Sept. 2: 611. 1814.

21. *Salix raupii* Argus, Canad. J. Bot. 52: 1303. 1974.

J. *Salix* sect. ***Glaucae*** (Fries) Andersson.

22. *Salix brachycarpa* Nutt. N. Am. Sylva 1: 69. 1842.

23. *Salix glauca* var. ***villosa*** (D Don ex Hook.) Andersson, Proc. Amer. Acad. Arts 4 : 68. 1858. (*Salix villosa* D.Don ex Hook., Fl. Bor.-Amer. 2: 144. 1838)

V. *Salix* subg. ***Vetrix***

K. *Salix* sect. ***Hastatae*** (Fries) A. Kerner

24. *Salix boothii* Dorn, Canad. J. Bot. 53: 1505. 1975.

25. *Salix barclayi* Andersson, Öfvers. Förh. Kongl. Svenska Vetensk.-Akad. 15: 125. 1858.

26. *Salix commutata* Bebb, Bot. Gaz. 13: 110. 1888.

27. *Salix farriae* C. R. Ball, Contr. U. S. Natl. Herb. 22: 321. 1921.

28. *Salix myrtillifolia* Andersson, Öfvers. Förh. Kongl. Svenska Vetensk.-Akad. 15: 132. 1858.

29. *Salix pseudomonticola* C. R. Ball, Contr. U. S. Natl. Herb. 22: 321. 1921.

30. *Salix pseudomyrsinites* Andersson, Öfvers. Förh. Kongl. Svenska Vetensk.-Akad. 15: 130. 1858.

31. *Salix pyrifolia* Andersson, Monogr. Salicum 162. 1867.

L. *Salix* sect. ***Cordatae*** J. Barratt ex Hook.

32.*Salix*. *famelica* (C. R. Ball) Argus, Harvard Pap. Botany 12: 361. 2007. (*S. lutea* Nutt. var. *famelica* C. R. Ball, Bot. Gaz. 71: 426. 1921.)

33. *Salix prolixa* Andersson, Monogr. Salicum 94. 1867.

M. *Salix* sect. ***Fulvae*** J. Barratt

34. *Salix bebbiana* Sarg. Gard. & For. 8: 463. 1895.

N. *Salix* sect. ***Cinerella*** Ser.

35. *Salix discolor* Muhl. Ges. Naturf. Freunde Berlin II. 4: 234. 1803.

36. *Salix scouleriana* Barratt ex Hook. Fl. Bor.-amer. 2: 145. 1838.

O. *Salix* sect. ***Phylicifoliae*** (Fries) Andersson

37. *Salix drummondiana* J. Barratt ex Hook. Fl. bor.-am. 2: 144. 1838.

38. *Salix planifolia* Pursh, Fl. Am. Sept. 2: 611. 1814.

39. *Salix tyrrellii* Raup, J. Arnold Arb. 17: 231. 1936.

P. *Salix* sect. ***Arbuscella*** Ser.

40. *Salix arbusculoides* Andersson, Monogr. Salicum 147. 1867.

Q. *Salix* sect. ***Candidae*** C. K. Schneider

41. *Salix candida* Flüggé ex Willd. Sp. pl. 4: 708. 1806.

R. *Salix* sect. ***Lanatae*** (Andersson) Koehne

42. *Salix calcicola* Fernald & Wiegand, Rhodora 13: 251. 1911.

42a. *Salix calcicola* Fernald & Wiegand var. ***glandulosior*** Boivin, Nat. canadien 75: 221. 1948

S. *Salix* sect. ***Villosae*** (Andersson) Rouy

43. *Salix alaxensis* (Andersson) Coville, Proc. Wash. Acad. Sci. 2: 280. 1900. (*S. speciosa* ß *alaxensis* Andersson, in DC., Prodr. 16(2): 275. 1868)

44. *Salix barrattiana* Hook. Fl. bor.-amer. 2: 146. 1838.

T. *Salix* sect. ***Geyerianae*** Argus

45. *Salix petiolaris* Sm. Trans. Linn. Soc. 6: 122. 1802.

U. *Salix* sect. ***Sitchenses*** (Bebb) C. K. Schneider

46. *Salix sitchensis* Sanson ex Bong. Mem. Acad. St. Petersb. 6. 2: 162. 1833.

V. *Salix* sect**. *Daphnella*** Sering, Exempl. Desseches Revis. Indet. Gen. Salix 10th page [no pagination] 1824.

47. *Salix daphnoides* Vill. Prosp. Hist. Pl. Dauphine, 51. 1779.

SOME USEFUL MORPHOLOGICAL CHARACTERS

NOTE: Although the following character states are generally diagnostic for the listed taxa some taxa may be variable for the character under which they are listed.

1a. Dwarf shrubs
S. arctica, S. nivalis, S. petrophila, S. reticulata, S. stolonifera
1b. Trees
S. alaxensis, S. alba, S. amygdaloides, S. arbusculoides, S. bebbiana, S. daphnoides, S. famelica, S. exigua, S. fragilis, S. interior, S. lasiandra var. *caudata, S. lasiandra* var. *lasiandra, S. pentandra, S. ×rubens, S. scouleriana, Salix ×sepulcralis, S. sitchensis*

2. Branches somewhat to highly brittle at base
S. amygdaloides, S. alba, S. bebbiana, S. discolor, S. drummondiana, S. fragilis, S. lasiandra var. *caudata, S. lasiandra* var. *lasiandra, S. ×rubens, S. scouleriana, Salix ×sepulcralis, S. serissima, S. sitchensis*

3. Branches strongly glaucous
S. arctica, S. daphnoides, S. discolor, S. drummondiana, S. farriae, S. petrophila, S. planifolia

4. Juvenile leaves ferruginous
S. alaxensis, S. alba, S. amygdaloides, S. barclayi, S. bebbiana, S. daphnoides, S. discolor, S. famelica, S. interior, S. fragilis, S. lasiandra var. *caudata, S. lasiandra* var. *lasiandra, S. maccalliana, S. melanopsis, S. myrtillifolia, S. pedicellaris, S. pentandra, S. planifolia, S. prolixa, S. pseudomonticola, S. pseudomyrsinites, S. ×rubens, S. scouleriana, Salix ×sepulcralis, S. serissima, S. tyrrellii*

5. Stipules absent or minute rudiments
S. alba, S. amygdaloides, S. arctica, S. athabascensis, S. bebbiana, S. brachycarpa, S. discolor, S. famelica, S. exigua, S. interior, S. farriae, S. fragilis, S. glauca var. *villosa, S. maccalliana, S. myrtillifolia, S. nivalis, S. pedicellaris, S. pentandra, S. petiolaris, S. petrophila, S. planifolia, S. pseudomyrsinites, S. reticulata, S. scouleriana, Salix ×sepulcralis, S. serissima, S. sitchensis, S. stolonifera, S. tyrrellii, S. vestita*

6. Petioles with glandular dots or lobes at distal end
S. alba, S. amygdaloides, S. boothii, S. fragilis, S. glauca var. *villosa, S. lasiandra* var. *caudata, S. lasiandra* var. *lasiandra, S. pentandra, S. pseudomonticola, S. pyrifolia, S. reticulata, S. ×rubens, S. ×sepulcralis, S. serissima, S. vestita*

7. Leaf blades amphistomatous
S. alba, S. amygdaloides, S. boothii, S. commutata, S. daphnoides, S. famelica, S. exigua, S. interior, S. fragilis, S. glauca var. *villosa, S. lasiandra* var. *caudata, S. lasiandra* var. *lasiandra, S. maccalliana, S. melanopsis, S. petrophila, S. pseudomyrsinites, S. reticulata, S. ×rubens, S. ×sepulcralis, S. stolonifera, S. tyrrellii*

8. Leaf blades marginal glands epilaminal
S. scouleriana, S. sitchensis

9. Leaf blades not glaucous on abaxial surface
S. barrattiana, S. boothii, S. commutata, S. lasiandra var. *caudata, S. maccalliana, S. melanopsis, S. myrtillifolia, S. pentandra, S. pseudomyrsinites, S. serissima*

10. Leaf blades with, at least, some ferruginous hairs
S. arbusculoides, S. boothii, S. daphnoides, S. discolor, S. drummondiana, S. lasiandra var. *caudata, S. lasiandra* var. *lasiandra, S. maccalliana, S. petiolaris, S. planifolia, S. pseudomyrsinites, S. scouleriana*

11. Catkins flowering before or just before leaves emerge
S. alaxensis, S. arbusculoides, S. barrattiana, S. bebbiana, S. boothii, S. calcicola var. *glandulosior, S. daphnoides, S. discolor, S. drummondiana, S. famelica, S. petiolaris, S. planifolia, S. pseudomonticola, S. pyrifolia, S. scouleriana, S. sitchensis, S. tyrrellii*

12. Floral bracts dark (brown or black)
S. alaxensis, S. arbusculoides, S. arctica, S. barclayi, S. barrattiana, S. boothii, S. calcicola var. *glandulosior, S. candida, S. commutata, S. daphnoides, S. discolor, S. drummondiana, S. famelica, S. farriae, S. glauca* var. *villosa, S. melanopsis, S. myrtillifolia, S. petiolaris, S. petrophila, S. planifolia, S. prolixa, S. pseudomonticola, S. pseudomyrsinites, S. scouleriana, S. sitchensis, S. stolonifera, S. tyrrellii*

13a. Floral bract apex bifid
S. arctica, S. petrophila
13b. Floral bract apex toothed
S. amygdaloides, S. interior, S. lasiandra var. *caudata, S. lasiandra* var. *lasiandra, S. pentandra, S. serissima*
13c. Floral bract apex erose
S. interior, S. fragilis, S. lasiandra var. *lasiandra, S. melanopsis*

14. Pistillate floral bracts deciduous after flowering
S. alba, S. amygdaloides, S. exigua, S. interior, S. fragilis, S. lasiandra var. *caudata, S. lasiandra* var. *lasiandra, S. melanopsis, S. pentandra, S. ×rubens, S. serissima*

15a. Stamens one
S. sitchensis
15b. Stamens three or more
S. amygdaloides, S. lasiandra var. *caudata, S. lasiandra* var. *lasiandra, S. pentandra, S. serissima*

16. Filaments at least partly connate
S. bebbiana, S. boothii, S. brachycarpa, S. candida, S. daphnoides, S. famelica, S. fragilis, S. pedicellaris, S. petrophila, S. prolixa, S. pseudomonticola, S. serissima

17. Staminate abaxial floral nectary present
S. alba, S. amygdaloides, S. arctica, S. athabascensis, S. brachycarpa, S. exigua, S. interior, S. fragilis, S. glauca var. *villosa, S. lasiandra* var. *caudata, S. lasiandra* var. *lasiandra, S. maccalliana, S. melanopsis, S. nivalis, S. pentandra, S. petrophila, S. raupii, S. reticulata, S. × rubens, S. serissima, S. stolonifera, S. vestita*

18a. Ovaries glabrous
S. alba, S. amygdaloides, S. barclayi, S. boothii, S. calcicola var. *glandulosior, S. commutata, S. daphnoides, S. famelica, S. exigua, S. interior, S. farriae, S. fragilis, S. lasiandra* var. *caudata, S. lasiandra* var. *lasiandra, S. melanopsis, S. myrtillifolia, S. pedicellaris, S. pentandra, S. prolixa, S. pseudomonticola, S. pseudomyrsinites, S. pyrifolia, S. raupii, S. ×rubens, Salix ×sepulcralis, S. serissima, S. stolonifera*
18b. Ovaries hairy
S. alaxensis, S. arbusculoides, S. arctica, S. athabascensis, S. barrattiana, S. bebbiana, S. boothii, S. brachycarpa, S. candida, S. commutata, S. discolor, S. drummondiana, S. interior, S. glauca var. *villosa, S. maccalliana, S. melanopsis, S. nivalis, S. petiolaris, S. petrophila, S. planifolia, S. raupii, S. reticulata, S. scouleriana, S. sitchensis, S. stolonifera, S. tyrrellii, S. vestita*

19. Pistillate abaxial floral nectary present
S. brachycarpa, S. lasiandra var. *caudata, S. maccalliana, S. melanopsis, S. nivalis, S. pentandra, S. reticulata, S. stolonifera, S. vestita*

KEY TO THE SPECIES

Modified from the key in Flora of Alberta (Argus 1983).
NOTE: Key has not been fully tested. Any problems should be reported to the author.

1. Largest mature leaves green abaxially, sometimes pale but not glaucous
  2. Largest mature leaves linear or nearly so, margins entire to distantly denticulate; catkins often branched
    3. Largest mature leaves very narrowly elliptic, but the sides not parallel, abaxial surface pale or rarely glaucous; styles evident; nectaries longer than the stipes ..... ***S. melanopsis***
    3’ Largest mature leaves linear, the sides parallel, abaxial surface green; styles absent; nectaries shorter than the stipes
      4. Largest mature leaves persistently silky, margins essentially entire; ovaries usually glabrous; floral bracts 1.2-1.6 mm long; capsules 4-8 mm long. ……..... ***S. exigua***
      4’ Largest mature leaves mostly glabrous or glabrate when mature, margins distantly spinulose-serrulate; ovaries often long-silky or glabrate; floral bracts 1.5-3.5 mm long; capsules 6-10 mm long ..... ***S. interior***
  2’ Largest mature leaves narrowly elliptic to broadly ovate, margins serrulate to crenate; catkins unbranched
    5. Largest mature leaves sparsely villous to densely villous-woolly on both surfaces..... ***S. commutata***
    5’ Largest mature leaves glabrous abaxially

6. Petioles with glandular dots or lobes at base of leaf blades.
7. Floral bracts persistent in fruit, brown. ..... ***S. boothii***
7’ Floral bracts deciduous in fruit, tawny
8. Largest mature leaves glabrous on both surfaces; hypostomatous or with stomata only at tip or along veins; stipules rudimentary or absent. ... ***S. serissima***
8’ Largest mature leaves abaxial surfaces pilose to glabrescent, adaxial surfaces pilose or long-silky to glabrescent; stipules foliaceous. .***S. lasiandra* var. *caudata***
6’ Petioles lacking glandular dots at base of leaf blades.
9. Ovaries silky-villous; largest mature leaves leathery ..... ***S. maccalliana***
9’ Ovaries glabrous; largest mature leaves thin
10. Shrubs decumbent, less than 1 m tall; stipules rudimentary or foliaceous to 2 mm long; juvenile leaves glabrous; styles 0.3-0.5 mm long ..... ***S. myrtillifolia***
10’ Shrubs erect, up to 6 m tall; stipules foliaceous to 12 mm long; juvenile leaves hairy; styles 0.4-0.9 mm long .
11. Stipules 1-5 mm long, semi-ovate, apex not sharply acute; largest mature leaf apex broadly acute to rounded. ..... ***S. pseudomyrsinites***
11’ Stipules 5-12 mm long, apex sharply acute; largest mature leaf apex abruptly acuminate ..... ***S. boothii***
1’ Largest mature leaves glaucous abaxially or leaf surface obscured by hairs
12. Dwarf shrubs, rarely exceeding 20 cm, trailing or forming compact mats
13. Floral bracts glabrous; catkins terminal of previous year’s shoot
14. Largest mature leaves 15-66 mm long, silky abaxially; pistillate catkins with 20-40 or more flowers; capsules 4.5-5 mm long ..... ***Salix reticulata***
14’ Largest mature leaves 5-25 mm long; glabrous abaxially; pistillate catkins with 2-10 (-25) flowers; capsules 3-4 mm long ..... ***Salix nivalis***
13’ Floral bracts hairy; catkins one to several just below tip of previous year’s shoot
15. Largest mature leaves highly glossy adaxially; ovaries glabrous of sparsely hairy on neck ..... ***S. stolonifera***
15’ Largest mature leaves dull or shiny adaxially; ovaries villous-woolly or sparsely so
16. Branchlets villous sometimes glabrous; floral bracts dark brown to black; proximal leaves usually with long, straight hairs on abaxial surface; styles 0.6-2.2 mm long; stipes 0.2-1.6 mm long; plants 3-25 cm tall ..... ***S. arctica***
16’ Branchlets usually glabrous, sometimes pilose; floral bracts tawny to light brown; proximal leaves usually glabrous abaxially; styles 0.4-1.6 mm long; stipes 0.2-0.8 mm long; plants 2-10 cm tall ..... ***S. petrophila***
12’ Tall shrubs to trees from 20 cm, erect
17. Stipules adnate to petioles, branches very strongly glaucous, in age sometimes glaucous only at nodes ..... ***S. daphnoides***
17’ Stipules not adnate to petioles, branches not glaucous or weakly so
18. Largest mature leaves essentially glabrous on abaxial surface
19. Ovaries glabrous
20. Petioles glandular dotted or lobed at the distal end
21. Native trees or tall shrubs

22. Stipules rudimentary; capsules 7-9 mm long; fruiting in late summer ..... ***S. serissima***
22’ Stipules foliaceous, semi-ovate; capsules 5-7 mm long; fruiting in early summer ..... ***S. lasiandra* var. *lasiandra***
21. Introduced or naturalized trees
23. Largest mature leaves less than 3 times as long as wide, length/width 2-4 ..... ***S. pentandra***
23’ Largest mature leaves usually more than 3 times as long as wide, length/width 3.5-7.5
24. Branches and branchlets pendulous ..... ***S. ×sepulcralis***
24 Branches and branchlets erect or spreading
25. Largest mature leaves glossy green adaxially ..... ***S. fragilis***
25’ Largest mature leaves dull adaxially
26. Largest mature leaves remaining silky in age ..... ***S. alba***
26’ Largest mature leaves glabrous or glabrate in age ..... ***S. ×rubens***
20’ Petioles not glandular dotted or lobed at the distal end.
27. Stipules foliaceous, ovate to narrowly elliptic
28. Floral bracts deciduous after flowering, tawny or greenish; leaves amphistomatous ..... ***S. melanopsis***
28’ Floral bracts persistent; tawny to dark brown; leaves hypostomatous
29. Largest mature leaves broadly elliptic to ovate; floral buds swollen; styles to 2.5 mm long ..... ***S. calcicola* var. *glandulosior***
29’ Largest mature leaves narrower; floral buds not swollen; styles shorter
30. Juvenile leaves greenish; catkins on leafy flowering branchlets
31. Floral bracts tawny; inner bud scale membrane free but not separating; staminate flowers with abaxial and adaxial nectaries ..... ***S. raupii***
31’ Floral bracts dark brown to black; inner bud scale membrane free and separating; staminate flowers with only adaxial nectaries
32. Juvenile leaves sparsely villous with white hairs; leaf margins usually glandular serrulate; capsules tawny or greenish ..... ***S. barclayi***
32’ Juvenile leaves glabrous or with fine white and ferruginous hairs on midrib; leaf margins entire; capsules reddish or greenish. ..... ***S. farriae***
30’ Juvenile leaves reddish; catkins sessile or on very short flowering branchlets
33. Branches yellow to grayish yellow; largest mature leaves shallowly serrulate to subentire. ..... ***S. famelica***
33’ Branches reddish brown to pale brown; largest mature leaves serrulate to coarsely glandular-crenate
34. Styles 0.7-1.2 mm long; largest mature leaves narrowly to broadly elliptic to obovate ..... ***S. pseudomonticola***
34’ Styles 0.3-0.6 mm long; largest mature leaves narrowly oblong-obovate. ..... ***S. prolixa***
27’ Stipules absent or rudimentary

35. Leaf apex caudate; trees ..... ***S. amygdaloides***
35’ Leaf apex acuminate, acute, or rounded; shrubs
36. Juvenile leaves translucent; largest mature leaves usually cordate or asymmetrical at base ..... ***S. pyrifolia***
36’ Juvenile leaves opaque; largest mature leaves rounded at base
37. Largest mature leaves glabrous, often glaucous on both surfaces, apex round ..... ***S. pedicellaris***
37’ Largest mature leaves glabrous to sparsely villous, midrib finely erect-hairy, not glaucous adaxially, apex acute ..... ***S. farriae***

19’ Ovaries hairy
38. Catkins sessile; stipes 0.5-2.5 mm long
39. Largest mature leaves dull or satiny adaxially, veins widely spaced and irregular; stipes 2-2.5 mm long; stigmas equal to or longer than style ..... ***S. discolor***
39’ Largest mature leaves glossy adaxially, veins closely spaced and parallel; stipes 0.5-1 mm long; stigmas shorter than style
40. Largest mature leaves hypostomatous, 20-115 mm long; styles 0.6-2 mm long .....***S. planifolia***
40’ Largest mature leaves amphistomatous, 15-65 mm long; styles 0.6-1.2 mm long .....***S. tyrrellii***

38’ Catkins on leafy flowering branchlets; stipes 0.8-5 mm long
41. Catkins densely flowered; stipes 0.8-1.2 mm long; leaves with at lease a few ferruginous hairs .....***S. athabascensis***
41’ Catkins loosely flowered; stipes 2-5 mm long; leaves lacking ferruginous hairs
42. Largest mature leaves long and slender, narrowly elliptic, margins serrulate; floral bracts dark brown ..... ***S. petiolaris***
42’ Largest mature leaves shorter and broader, elliptic to obovate, margins entire to crenate; floral bracts tawny ..... ***S. bebbiana***

18’ Largest mature leaves silky to sparsely villous or densely villous-woolly on abaxial surfaces
43. Ovaries glabrous
44. Catkins before leaves emerge, sessile; stipes 0.2-0.5 mm long; largest mature leaves broadly elliptic to broadly ovate ..... ***S. calcicola* var. *glandulosior***
44’ Catkins flowering after leaves emerge, borne on leafy flowering branchlets; stipes 0.5-1.5 mm long; largest mature leaves elliptic to obovate. ***S. barclayi***

43’ Ovaries hairy
45. Catkins sessile, leafless at base or with a few bract-like leaves
46. Largest mature leaves densely white villous-woolly abaxially
47. Branchlets puberulent to glabrous, often glaucous; styles 0.7-1.3 mm long; stigmas 0.3-0.4 mm long .....***S. drummondiana***
47’ Branchlets densely white-woolly or velvety, not glaucous; styles and stigmas not as above
48. Largest mature leaves white-villous abaxially, veins evident; styles 0.2-0.6 mm long; stigmas 0.6-1.2 mm long ..... ***S. scouleriana***

48’ Largest mature leaves densely white-or gray-woolly abaxially, veins obscured by hairs; styles 1.3-2.8 mm long; stigmas 0.5-1.8 mm long ..... ***S. alaxensis var. alaxensis***

46’ Largest mature leaves silky or woolly abaxially

49. Buds and stipules oily; stipules broadly ovate and prominently glandular ..... ***S. barrattiana***

49’ Buds and stipules not oily; stipules linear to ovate

50. Largest mature leaves obovate, abaxial surface with ferruginous hairs; branchlets and petioles velvety; styles 0.2-0.6 mm long ..... ***S. scouleriana***

50’ Largest mature leaves usually narrowly elliptic, lacking ferruginous or only on juvenile leaves; styles 0.6-1.5 mm long

51. Largest mature leaves densely silky or woolly abaxially, margins revolute .....***S. drummondiana***

51’ Largest mature leaves glabrous or sparsely hairy abaxially, margins flat ..... ***S. planifolia***

44’ Catkins on leafy flowering branchlets

52. Stipes 2-5 mm long, about 10 times as long as the nectaries

53. Largest mature leaves long and slender, narrowly elliptic, margins serrulate; floral bracts dark brown ..... ***S. petiolaris***

53’ Largest mature leaves shorter and broader, elliptic to obovate, margins entire to crenate; floral bracts tawny ..... ***S. bebbiana***

52’ Stipes 0-1.6 mm long, shorter than or twice as long as the nectaries

54. Largest mature leaves silky abaxially with short, straight, appressed hairs

55. Largest mature leaves 5-7 times as long as wide, narrowly ovate, abaxial surface with some ferruginous hairs, margins serrulate; styles 0.2-0.5 mm long ..... ***S. arbusculoides***

55’ Largest mature leaves 2.5-3 times as long as wide, narrowly elliptic to obovate, abaxial surface white-satiny, lacking ferruginous hairs, margins entire; styles 0.4-0.8 mm long ..... ***S. sitchensis***

54’ Largest mature leaves woolly to glabrescent abaxially

56. Largest mature leaves densely white-woolly abaxially, sparsely floccose adaxially, midrib yellowish, prominent; styles reddish ..... ***S. candida***

56’ Largest mature leaves gray-woolly to villous-woolly abaxially, hairs on abaxial surface very sparse, not floccose, midrib not as above; styles greenish

57. Mature leaves strongly impressed-reticulate adaxially, petioles with dark glandular dots at base of blade; catkins terminating most normal vegetative branchlets, mostly over 27 mm long but ranging from 3-50 mm long ..... ***S. vestita***

57’ Mature leaves not impressed-reticulate adaxially, petioles lacking glands at base of blade; catkins on short leafy flowering branchlets, 0.25-27 mm long

58. Largest mature leaves and juvenile leaves with scattered ferruginous hairs ..... ***S. athabascensis***

58’ Largest mature leaves and juvenile leaves lacking ferruginous hairs

59. Petioles shorter than or up to 3 times length of axillary buds, often reddish; stipes usually lacking; pistillate catkins short-cylindrical to subspherical …….. ***S. brachycarpa***

59’ Petioles longer than 3 times length of axillary buds, usually greenish; stipes 0.5-1.6 mm long; pistillate catkins long-cylindrical ..... ***S. glauca* var. *villosa***

TAXONOMIC TREATMENT

Salix alaxensis* (Andersson) Coville var. *alaxensis **felt-leaf willow**

Mid shrubs to trees, 1-7 m, stems erect, rarely decumbent. Plants not colonial. **Branches** flexible at base, not glaucous, villous; decorticated branches smooth. **Branchlets** gray-brown or red-brown, not glaucous, very densely villous. **Proximal leaf** margins entire. **Juvenile leaves** reddish or yellowish green (often obscured), very densely villous or woolly. **Stipules** foliaceous. **Petioles** convex to flat or shallowly grooved adaxially, strongly ventricose, 3-20 mm, tomentose, not glandular at distal end. **Mature leaf blades** broadly oblong, narrowly elliptic, elliptic, obovate, or broadly obovate, 50-110 × 13-35 mm, length-width ratio 2-4; hypostomatous; abaxial surface obscured by hairs, villous-tomentose; adaxial surface dull, white or gray villous to glabrescent; base acute to cuneate; margins entire or crenate, teeth or glands all around margin; apex acuminate to acute. **Flowering** before leaves emerge. **Floral bracts** brown to black, 1.5-2.5 mm, hairs white, straight; bract apex acute to obtuse, entire. **Staminate** catkins densely flowered, stout, 26-55 mm, peduncles 2-6 mm, flowering branchlets 0-5 mm; stamens 2; anthers purple becoming yellow, 0.6-0.9 mm; filaments distinct, glabrous; abaxial nectaries absent; adaxial nectaries narrowly oblong to oblong, 0.5-1.4 mm. **Pistillate** catkins densely flowered, slender or stout, 29-115 mm, peduncles 3-17 mm, flowering branchlets 0-2 mm; ovaries sparse to moderately densely villous, hairs flattened (refractive), ovaries pyriform, beak gradually tapering to style; stigmas slender-cylindrical, 0.4-0.99-1.28 mm; styles 1.3-2.8 mm; stipes 0-0.4 mm; adaxial nectaries narrowly oblong, 0.6-1.6 mm, longer than stipes; capsules 4-5 mm, 14-18 ovules per ovary.

Chromosome number 2*n* = 38, 2x (Johnson & Packer 1968; Löve & Löve 1982; Suda & Argus 1969). Russia: 2*n* = 38, 2x (Zhukova 1967, 1969).

Distribution. Canada: Alta., B.C., Man., N.W.T., Nunavut, Que., Yukon; **U.S.A.**: Alaska. Eurasia. Map 1.

Habitat. In protected places with good winter snow cover, moderately well-drained to wet sand plains and remnant dune on river deltas, terraces, and river banks, coarse, calcareous gravel on river and lake shores or scree slopes, wet alpine meadows. 1-975 m.s.m.

***Salix alba* L.** **white willow**

Salix alba var. *vitellina* (L.) Stokes

Trees 10–25 m. Stems erect. Plants not colonial. **Branches** flexible to somewhat brittle at base, not glaucous, glabrous or long-silky to glabrate. **Branchlets** yellowish or gray- to red-brown, not glaucous, pilose, villous, or long-silky. Bud scale margins connate. **Proximal leaves** entire. **Juvenile leaves** yellowish green or reddish, abaxial surface long-silky, hairs white. **Stipules** foliaceous. **Petioles** shallowly grooved adaxially, 3–13 mm long, adaxial surface long-silky**,** with glandular dots or lobes at distal end. **Mature leaf blades** narrowly oblong or very narrowly elliptic to lanceolate; 63–115 mm long, 10–20 mm wide, length-width ratio 4.2–7.3; amphistomatous; abaxial surface glaucous, sparsely to very densely long-silky to glabrate, hairs white; adaxial surface dull, sparsely long-silky to glabrate; base acute to cuneate; margins serrate to serrulate; apex acute to acuminate. **Flowering** as leaves emerge. **Floral bracts** tawny, 1.6–2.8 mm long, hairs straight, apex rounded, entire. Pistillate floral bracts deciduous after flowering. **Staminate** catkins moderately densely flowered, slender to stout, 25–55 mm long, flowering branchlets 2–8 mm long; stamens 2; anthers purple becoming yellow, 0.5–0.7 mm long; filaments distinct, hairy on lower half; abaxial nectaries present; adaxial nectaries oblong to square, 0.3–0.7 mm long; abaxial and adaxial nectaries usually separate. **Pistillate** catkins loosely flowered, slender, 24–60 mm long; flowering branchlets 3–14 mm long; ovaries glabrous, obclavate, pyriform; stigmas broad-cylindrical; styles 0.16–0.44 mm long; stipes 0.2–0.8 mm long; abaxial nectaries absent; adaxial nectaries square, 0.3–0.65 mm long, equal to or shorter than stipes. Capsules 3.5–5 mm long, 6–10 ovules per capsule.

Distribution. Canada: Alta, B.C., Man., N.B., Ont., Que., Sask.; U.S.A.: Ariz., Ark., Calif., Colo., Conn., Del., D.C., Ga., Idaho, Ill., Ind., Ky., Maine, Md., Mass., Mich., Minn., Mo., Mont., Nebr., Nev., N.H., N.C., N.Y., Ohio, Pa., R.I., Tenn., Vt., Va., Wash., W.Va., Wis., Wyo.; Eurasia.

Habitat. This European introduction is cultivated and occasionally naturalized in Canada. 70-1950 m.s.m.

Notes. The varieties, cultivars, and hybrids of this species are widely cultivated in North America. The most commonly cultivated form, *S. alba* var. *vitellina* (L.) Stokes, has golden-yellow, erect twigs. A similar plant but with pendulous branches is *S.* ×*sepulcralis* nothovar. *chrysocoma* (Meikle 1984).

***Salix amygdaloides* Andersson** **peach-leaf willow**

Trees 4–20 m. Stems erect. Plants not colonial. Branches flexible to somewhat brittle at base, not glaucous, glabrous. Branchlets yellow-or red- to gray-brown, not glaucous, glabrous. **Bud** scale margins free and imbricate. **Proximal leaves** entire or shallowly serrulate. **Juvenile leaves** reddish or yellowish green, abaxial surface glabrous or pilose, hairs white or ferruginous. **Stipules** minute rudiments (foliaceous on vigorous shoots). **Petioles** deeply grooved adaxially, margins covering groove, 7–21 mm long, adaxial surface glabrous or puberulent, with glandular dots at distal end. **Mature leaf blades** very narrowly elliptic, to lanceolate or oblanceolate; 55–130 mm long, 24–37 mm wide, length-width ratio 2.8–6; hypostomatous or amphistomatous; abaxial surface glaucous,

glabrous; adaxial surface dull, glabrous or pubescent to glabrate; base acute to rounded; margins serrulate; apex acuminate to caudate. **Flowering** as leaves emerge. **Floral bracts** tawny, 1.5–2.8 mm long, hairs wavy, apex acute or rounded, entire or toothed, pistillate deciduous after flowering. **Staminate** catkins densely to loosely flowered, slender to stout, 21–90 mm long, flowering branchlets 3–28 mm long; stamens 3–7; anthers yellow, 0.5–0.6 mm long; filaments distinct, hairy on lower half; abaxial nectaries present; adaxial nectaries narrowly oblong or square, 0.25–0.75 mm long; abaxial and adaxial nectaries separate. **Pistillate** catkins loosely flowered, slender to stout, 25–90 mm long; flowering branchlets 17–35 mm long; ovaries glabrous, pyriform; stigmas flat with rounded tips; styles 0.2–0.4 mm long; stipes 1.4–3.2 mm long; abaxial nectaries absent; adaxial nectaries square, 0.1–0.6 mm long, shorter than stipes. Capsules 3–7 mm long, 16–22 ovules per capsule.

Chromosome number. 2*n* = 38, 2x (Dorn 1975b; Löve 1954; Löve & Löve 1982; Suda & Argus 1968, Zsuffa & Raj 1981)

Distribution. Canada: Alta., B.C., Man., Ont., Que., Sask.; U.S.A.: Ariz., Colo., Idaho, Ill., Ind., Iowa, Kans., Ky., Mich., Minn., Mo., Mont., Nebr., Nev., N.Mex., N.Dak., N.Y., Ohio, Okla., Oreg., Pa., S.Dak., Tex., Utah, Wash., Wis., Wyo. Map 2.

Habitat. Moist to mesic floodplains and lakeshores in the montane zone. 60-2350 m.s.m.

Salix arbusculoides Andersson — little-tree willow

Mid shrubs to trees, 1-6 m, stems erect, plants not colonial. **Branches** flexible at base, not glaucous, glabrous. **Branchlets** red-brown, not glaucous, glabrous or puberulent, hairs spreading. **Proximal leaf** margins entire. **Juvenile leaves** yellowish green, very densely long-silky, hairs white or ferruginous. **Stipules** foliaceous. **Petioles** shallowly grooved adaxially, 3-11 mm, puberulent to glabrescent, not glandular at distal end. **Mature leaf blades** very narrowly elliptic, narrowly elliptic, or elliptic, 38-78 × 7-18 mm, length-width ratio 3-6.5; hypostomatous; abaxial surface glaucous or obscured by hairs, long-silky, hairs white or ferruginous; adaxial surface highly glossy or shiny, glabrous; base acute to cuneate; margins serrulate, teeth or glands all around margin; apex acute. **Flowering** after or just before leaves emerge. **Floral bracts** tawny or brown, 0.8-1.2 mm, hairs white, straight or wavy; bract apex obtuse or rounded, entire. **Staminate** catkins densely flowered, stout or slender, 15-38 mm, peduncles 0.5-6 mm, flowering branchlets 0-2.5 mm; stamens 2; anthers purple becoming yellow, 0.3-0.6 mm; filaments distinct, glabrous; abaxial nectaries absent; adaxial nectaries oblong, 0.55-0.93 mm. **Pistillate** catkins densely or loosely flowered, stout or slender, 18-44 mm, peduncles 1.5-6 mm, flowering branchlets 0-6 mm; ovaries very densely short-silky, hairs flattened, ovaries pyriform, beak gradually tapering to style; stigmas slender-cylindrical, broad-cylindrical, or two plump lobes with continuous stigmatic surface, lobes 0.16-0.29-0.44 mm; styles 0.3-0.5 mm; stipes 0.6-0.9 mm; adaxial nectaries oblong or ovate, 0.6-1 mm, equal to or longer than stipes; capsules 4-6 mm, 16-18 ovules per ovary.

Chromosome number. 2*n* = 38, 2x (Löve & Löve 1982; Suda & Argus 1968, 1969)

Distribution. Canada: Alta., B.C., Man., N.W.T., Nunavut, Ont., Que., Sask.,

Habitat. Stream banks and lake shores, openings in white spruce forests, treed bogs, sedge fens, and edges of alpine and arctic tundra. 1-1970 m.s.m.

Notes. *Salix arbusculoides* is characterized by leaves narrowly elliptic, margins finely glandular-serrulate, glabrous adaxially, and silky abaxially with white or ferruginous hairs. The whitish precipitate, which often appears on the leaf teeth, consists of calcium, silicon, sulphur, and potassium (Ranessa Cooper, pers. comm. 10 Dec. 2002)

***Salix arctica* Pall.** **Arctic willow**

S. crassijulis Trautv., *S. arctica* subsp. *crassijulis* (Trautv.) A. K. Skvortsov; *S. torulosa* Trautv., *S. arctica* subsp. *torulosa* (Trautv.) Hultén.

Dwarf shrubs, 3-25 cm (to 2 m on Attu Island.), stems decumbent, trailing, or erect, plants not colonial or forming colonies by layering. **Branches** flexible at base, not glaucous or strongly so, glabrous. **Branchlets** yellow-brown, red-brown, or violet, not glaucous or weakly to strongly so, glabrous or pilose or villous to glabrescent, hairs spreading or geniculate. **Proximal leaf** margins entire, moderately densely hairy with long straight hairs. **Juvenile leaves** yellowish green, glabrous or sparsely villous (with long, straight hairs pointing toward tip). **Stipules** absent, minute rudiments or foliaceous, caducous. **Petioles** deeply grooved adaxially, 2-35 mm, puberulent or glabrous, not glandular at distal end. **Leaf blades** narrowly elliptic, elliptic, broadly elliptic, subcircular, circular, oblanceolate, obovate, or broadly obovate, 10-85 × 5.5-60 mm, length-width ratio 1-3.6; hypostomatous, or with stomata on adaxial surface only along veins or at apex; abaxial surface glaucous, pilose or short-silky (typically with a silky beard at tip) or long-silky on midrib; adaxial surface shiny or dull, glabrous or pilose (hairs near margin) or long-silky to glabrescent; base cuneate, rounded, or acute; margins entire; apex obtuse (but tip pointed), rounded, or acute. **Flowering** as leaves emerge. **Floral bracts** brown or black, rarely light brown or bicolor, 1.6-3.7 mm, hairs white, long and straight; bract apex broadly rounded, obtuse, or retuse, rarely acute, sometimes retuse, entire or bifid, or with 2-3 undulations. **Staminate** catkins densely flowered, slender, stout, or subglobose, 11-54 mm, peduncles 2-15 mm, flowering branchlets 2-36 mm; stamens 2; anthers purple, 0.4-0.9 mm; filaments distinct, glabrous; abaxial nectaries absent or present; adaxial nectaries narrowly oblong, oblong, or square, 0.5-1.2 mm; abaxial and adaxial nectaries separate. **Pistillate** catkins densely to moderately densely flowered, slender or stout to subglobose, 12-85 mm, peduncles 4-30 mm, flowering branchlets 2-40 mm; ovaries villous, hairs flattened (sometimes refractive), ovaries obclavate or pyriform, beak abruptly tapering to style, slightly bulged below style, or gradually tapering to style; stigmas slender-cylindrical, lobes 0.36-0.56-0.88 mm; styles 0.6-2.2 mm; stipes 0.2-1.6 mm; adaxial nectaries oblong, ovate, or narrowly oblong, 0.4-1.8 mm, longer than stipes; capsules 4-9 mm, 12-15 ovules per ovary. **Chromosome number.** 2*n* = 76, 4x (Dawson pers com., Holmen 1952; Johnson & Packer 1968; Mosquin & Haley 1966); 2*n* = 114, 6x (Suda & Argus 1969). Russia: 4x (Zhukova & Petrovsky 1980), 6x (Zhukova 1969 (greater than 100), Zhukova et al 1973; Petrovsky & Zhukova 1983; Zhukova & Petrovsky 1987).

Distribution. Canada: Alta., B.C., Lab., Nfld., N.W.T., Nunavut, Ont., Que., Yukon; **U.S.A.**: Alaska, Idaho, Wash. Greenland, Eurasia. Circumpolar. Map 4.

Habitat. Most arctic and alpine habitats including hummocks in wet sphagnum bogs and sedge meadows, polygonal tundra, solifluction slopes, snow beds, margins of pools, beach ridges, shale and gypsum ridges, gneissic cliffs, colluvial slopes, talus slopes, glacial moraines, imperfectly drained calcareous silty till, muddy salt flats, frost-heaved clay polygons, dry calcareous gravel, and coarse sandy soil; 1-1981 m.s.m.

Notes. *Salix arctica* is a dwarf habit often forming prostrate mats spreading from a central stem, sometimes with long trailing branches that root where they touch the surface. Leaf size and shape are highly variable but the abaxially surface of the leaves is always glaucous and usually sparsely clothed with long, straight, appressed hairs that may persist as a "beard" at the tip, the margins are entire. Floral bracts are dark brown and clothed with long, straight hairs.

In this treatment the southern Rocky Mountain populations have segregated as *S. petrophila*. The geographical boundary between the two is uncertain. See *S. petrophila* for discussion and Table 5 for a comparison.

Hybrids. One of the most common hybrids is *Salix arctica* × *glauca* (Argus 1965, 1973, Bay 1992, Argus 2003). In 1965 Argus wrote, "This hybrid is characterized by various combinations of the characteristics of *S. arctica* and *S. glauca*. The *S. glauca* characteristics include erect habit, leaves less oblanceolate and without the attenuate base of *S. arctica*, shorter petioles, bracts light-colored with shorter wavy trichomes [hairs], and styles distinct. The *S. arctica* characteristics include prostrate habit, pruinose [glaucous] stems and buds, sparse branchlet-pubescence, dark-colored bracts with long, straight trichomes, leaves with long straight trichomes on the lower [abaxial] surface projecting in a "beard" at the apex, capsules reddish with long stigmas, and dark colored anthers." Specimens identified as hybrids combine these characters in various ways. It is often difficult to recognize these hybrids because their convergent morphology makes the recognition of intermediates difficult. Hybrids are also known with *S. barclayi* and *S. stolonifera* (Argus 1973).

***Salix athabascensis* Raup** **Athabasca willow**

S. pedicellaris var. *athabascensis* (Raup) Boivin; *S. fallax* Raup.

Mid shrubs, 0.6-1.3 m, stems erect, plants not colonial. **Branches** flexible at base, not glaucous, glabrescent. **Branchlets** red-brown, not glaucous, sparsely to moderately densely pubescent, hairs geniculate. **Proximal leaf** margins entire. **Juvenile leaves** yellowish green, sparsely to moderately densely villous or long-silky, hairs white or ferruginous. **Stipules** minute rudiments. **Petioles** shallowly grooved adaxially, 3-10 mm, puberulent or villous, not glandular at distal end. **Mature leaf blades** oblong, narrowly elliptic, elliptic, oblanceolate, or obovate, 17-50 × 8-18 mm, length-width ratio 1.9-3.2; hypostomatous; abaxial surface glaucous, glabrescent; adaxial surface dull or shiny, glabrous or pilose or long-silky to glabrescent, hairs white or ferruginous; base rounded, acute, or obtuse; margins entire, or rarely remotely serrulate, teeth or glands at proximal end; apex acute or more or less acuminate. **Flowering** as leaves emerge. **Floral bracts** tawny, sometimes bicolor, 1-1.6 mm, hairs white, wavy; bract apex rounded, entire. **Staminate** catkins densely flowered, stout or subglobose, 13-27 mm, peduncles 1-4 mm, flowering branchlets 1.5-9 mm; stamens 2; anthers purple becoming yellow, 0.4-0.6 mm; filaments distinct, hairy on lower half; abaxial nectaries absent or present; adaxial

nectaries oblong or ovate, 0.4-1.2 mm; abaxial and adaxial nectaries separate. **Pistillate** catkins loosely flowered, stout to subglobose or globose, 9-50 mm, peduncles 0.5-8 mm, flowering branchlets 3.5-26 mm; ovaries very densely long-silky, hairs flattened, ovaries pyriform, beak slightly bulged below style; stigmas broad-cylindrical, lobes 0.28-0.35-0.48 mm; styles 0.48-1 mm; stipes 0.8-1.3 mm; adaxial nectaries oblong, 0.4-1.25 mm, shorter than stipes; capsules 5.6-7.2 mm, 6-14 ovules per ovary.

Chromosome number 2*n* = 76, 4x (Argus 1965; Löve & Löve 1982; Suda & Argus 1969); 2*n* = 95, 5x (Argus 1965); 2*n* = 114, 6x (Suda & Argus 1969)

Distribution. Canada: Alta., B.C., Man., N.W.T., Sask., Yukon; **U.S.A.**: Alaska. Map 5.

Habitat. Fens, bogs, and treed bogs.

Notes. *Salix athabascensis* is characterized by leaves narrowly elliptic, sparsely pilose to glabrescent with appressed white or ferruginous hairs; catkins loosely flowered, ovaries silky, sometimes with some ferruginous hairs, long stipes (0.8-1.3 mm), and short nectaries. It is similar to *S. pedicellaris*, with which it hybridizes. See Table 1 for comparison with *S. pedicellaris.*

Table 1. Comparison of *Salix athabascensis* and *Salix pedicellaris*

	S. athabascensis	***S. pedicellaris***
Characteristics		
Ovaries	long-silky	glabrous
Style length	0.48-1 mm	0.1-0.2 mm
Branchlet hairs	short, curved	very minute, straight
Mature leaves	sparsely silky	glabrous

***Salix barclayi* Andersson** **Barclay's willow**

Mid to tall shrubs, 0.7-5 m, stems erect (sometimes decumbent), plants not colonial. **Branches** flexible at base, not glaucous (rarely so), glabrous or villous. **Branchlets** yellow-green or yellow-brown or red-brown, not glaucous, villous or pubescent to glabrescent (rarely glabrous). **Proximal leaf** margins serrulate. **Juvenile leaves** yellowish green or reddish, glabrous or pilose, hair persistent on adaxial midrib. **Stipules** foliaceous. **Petioles** shallowly grooved or convex to flat adaxially, 3-20 mm, villous or pilose, not glandular at distal end. **Mature leaf blades** oblong, narrowly elliptic. elliptic, oblanceolate, or obovate, 33-100 x, 12-48 mm, length-width ratio 1.6-4; hypostomatous; abaxial surface glaucous, glabrous or rarely pilose to glabrescent; adaxial surface shiny, glabrous or pilose or glabrescent, midrib remaining pilose, hair white; base rounded or obtuse, sometimes cordate or acute; margins serrulate, rarely subentire, teeth or glands all around margin; apex acute or acuminate. **Flowering** as leaves emerge. **Floral bracts** brown or black, 1.6-2.8 mm, hairs white, straight, wavy, or curly; bract apex acute or rounded, entire. **Staminate** catkins densely flowered, stout, 12-55 mm, peduncles 0-5 mm, flowering branchlets 0-17 mm; stamens 2; anthers yellow, 0.6-1 mm; filaments distinct, glabrous; abaxial nectaries absent; adaxial nectaries oblong, 0.45-0.8 mm. **Pistillate** catkins moderately densely flowered, stout, subglobose, or slender, 22-70 mm, peduncles 2-10 mm, flowering branchlets 4-24 mm; ovaries glabrous, obclavate or pyriform, beak gradually tapering to style; stigmas slender-cylindrical or broad-

cylindrical, lobes 0.28-0.48-0.72 mm; styles 0.6-2.5 mm; stipes 0.4-1.5 mm; adaxial nectaries oblong or ovate, 0.4-0.8 mm, shorter than stipes; capsules 3-8 mm, 18-24 ovules per ovary.

Chromosome number. 2*n* = 76, 4x (Dorn 1976).

Distribution. Canada: Alta., B.C., N.W.T., Yukon; **U.S.A.**: Alaska, Idaho, Mont., Oreg., Wash., Wyo. Map 6.

Habitat. Thickets on glacial moraine, lake and river shores, subalpine and alpine slopes, and moist to mesic forest openings; 1-2835 m.

Notes. *Salix barclayi* is characterized by leaves elliptic to obovate, sparsely hairy adaxially and glabrous and glaucous abaxially, often drying brownish, margins serrulate; stipules prominently glandular dotted; ovaries glabrous and nectaries about half as long as the stipes.

The ranges of *S. farriae* and *S. barclayi* are sympatric. In the Rocky Mountains and the Pacific Northwest the two are often difficult to separate. *Salix farriae* is unique in having mature leaves with a few, minute, ferruginous hairs on the adaxial midrib. It also has plump stigmas compared to the cylindrical stigmas of S. barclayi, its leaves are usually much less hairy than in *S. barclayi*, and its leaf margins usually entire rather than serrulate. See Table 2 for a comparison. Intergrades between the two, reported by Dorn (1975a: 1504), from Alberta probably are hybrids. See Table 6 for a comparison with *S. prolixa* and *S. pseudomonticola*.

Table 2. Comparison of *Salix barclayi* and *Salix farriae*

	S. barclayi	***S. farriae***
Characteristics		
Juvenile leaves	usually pilose, or moderately densely villous	glabrous to sparsely villous
Leaf margins	usually serrulate	usually entire or slightly toothed
Leaf adaxial surface	with only white hairs	often with ferruginous hairs
Leaf shape	oblong, narrowly elliptic, elliptic, oblanceolate, or obovate	narrowly elliptic to elliptic
♂ flowering branchlets	0-17 mm	1-5 mm
♀ flowering branchlets	4-24 mm	1.5-14 mm
Floral bracts	moderately densely hairy	sparsely hairy
Anther length	0.6-1 mm	0.3-0.6
Style length	0.6-2.5 mm	0.3-1.2 mm

***Salix barrattiana* Hook.** **Barratt's willow**

S. albertana Rowlee, *S. barrattiana* var. *marcescens* Raup.

Low to mid shrubs, 0.3-1.5 m, stems erect or decumbent, plants not colonial. **Branches** flexible at base, not glaucous or weakly so, glabrous or villous in patches to glabrescent. **Branchlets** red-brown or violet, not glaucous, coarsely and moderately densely villous, with a balsamic odor. **Proximal leaf** margins entire. **Juvenile leaves** yellowish green or color obscured by hairs, very densely long-silky. **Stipules** foliaceous, oily. **Petioles** shallowly grooved or convex to flat adaxially, 4-15 mm, villous or puberulent, not glandular at distal end. **Mature leaf blades** narrowly elliptic, elliptic,

broadly elliptic, oblanceolate, or obovate, 35-95 × 10-29 mm, length-width ratio 2.2-5; hypostomatous; abaxial surface not glaucous, long-silky-woolly to glabrescent; adaxial surface shiny, villous or pubescent to glabrescent; base acute, obtuse, or rounded; margins entire or rarely serrulate, teeth or glands all around margin or at proximal end; apex acute or obtuse. **Flowering** before leaves emerge. **Floral bracts** brown or black, 2.8-5.2 mm, hairs white, straight; bract apex acute or obtuse, entire. **Staminate** catkins densely flowered, stout or subglobose, 18-50 mm, peduncles 0-7 mm, flowering branchlets 0-2 mm; stamens 2; anthers yellow (purple?), 0.4-0.6 mm; filaments distinct, glabrous; abaxial nectaries absent; adaxial nectaries narrowly oblong or oblong, 0.4-1.8 mm. **Pistillate** catkins densely flowered, slender or stout, 25-85 mm, peduncles 3-11 mm, flowering branchlets 0-5 mm; ovaries densely villous, hairs flattened (refractive), ovaries pyriform, beak gradually tapering to style; stigmas slender-cylindrical or broad-cylindrical, lobes 0.28-0.47-0.64 mm; styles 0.6-1.8 mm; stipes 0.2-0.6 mm; adaxial nectaries oblong or narrowly oblong, 0.6-1.3 mm, longer than stipes; capsules 4.5-6 mm, 16-21 ovules per ovary.

Chromosome number. Unknown.

Distribution. Canada: Alta., B.C., N.W.T., Yukon; **U.S.A.**: Alaska, Mont., Wyo. Map 7.

Habitat. Thickets along gravelly streams, hillsides, meadows, and wet alpine tundra; commonly on limestone; 162-3200 m.

Notes. *Salix barrattiana* is characterized by stems gray-hairy and erect; leaves gray-hairy and typically crowded on the branchlets with short internodes; and buds and stipules that are oily and emit a noticeable balsamic odor.

***Salix bebbiana* Sarg.** **gray willow, Bebb's willow, long-beaked willow**

Mid to tall shrubs or trees, 0.5-10 m, stems erect, plants not colonial. **Branches** flexible to somewhat brittle at base, not glaucous, glabrous or pilose to glabrescent; decorticated branches with longitudinal striae. **Branchlets** red-brown, not glaucous**,** moderately to very densely villous. **Proximal leaf** margins entire. **Juvenile leaves** yellowish green or reddish, pilose, tomentose, or long-silky. **Stipules** foliaceous, small and caducous, or minute rudiments. **Petioles** convex to flat adaxially, 2-12 mm, puberulent, not glandular at distal end. **Mature leaf blades** narrowly oblong, narrowly elliptic, elliptic, oblanceolate, or obovate, 20-80 × 10-33 mm, length-width ratio 2-3.8; hypostomatous; abaxial surface glaucous, long-silky-tomentose to glabrescent, hairs; adaxial surface dull, pubescent or short-silky to glabrescent, hairs; base acute or obtuse; margins entire, crenate, or irregularly serrate, teeth or glands all around margin; apex abruptly acute or obtuse. **Flowering** after or just before leaves emerge. **Floral bracts** tawny, 1.2-3.2 mm, hairs white, straight or wavy; bract apex rounded, entire. **Staminate** catkins moderately densely flowered, stout to subglobose or globose, 6-40 mm, peduncles 0.5-3 mm, flowering branchlets 0.5-8 mm; stamens 2; anthers yellow or purple becoming yellow, 0.5-0.8 mm; filaments distinct or connate less than half, glabrous or hairy on lower half; abaxial nectaries absent; adaxial nectaries oblong or ovate, 0.3-0.8 mm. **Pistillate** catkins loosely flowered, stout, slender, or subglobose, 14-80 mm, peduncles 0.5-6 mm, flowering branchlets 1-7 mm; ovaries sparsely short-silky, hairs flattened (refractive), ovaries obclavate, long-beaked, beak slightly bulged below style; stigmas

slender-cylindrical or broad-cylindrical, lobes 0.32-0.44-0.64 mm; styles 0.1-0.4 mm; stipes 2-5 mm; adaxial nectaries oblong or square, 0.3-0.75 mm, shorter than stipes; capsules 5-9 mm, 6-16 ovules per ovary.

Chromosome number. 2*n* = 38, 2x (Dorn 1975b, 1976; Löve 1954; Löve & Löve 1982). Russia: 2x (Yurtsev & Zhukova 1982; Zhukova {and Petrovsky}et al. 1977).

Distribution. Canada: Alta., B.C., Lab., Man., N.B., Nfld., N.W.T., N.S., Nunavut, Ont., P.E.I., Que., Sask., Yukon; **U.S.A.**: Alaska, Ariz., Calif., Colo., Conn., Idaho, Ill., Ind., Iowa, Maine, Md., Mass., Mich., Minn., Mont., Nebr., Nev., N.H., N.J., N.Mex., N.Dak., N.Y., Ohio, Oreg., Pa., R.I., S.Dak., Utah, Vt., Wash., Wis., Wyo. Eurasia. Map 8.

Habitat. Riparian and upland white spruce forests, wet lowland thickets, black spruce treed bogs, prairie margins, dry south-facing slopes, and disturbed areas; 2-3300 m.

Notes. *Salix bebbiana* is characterized by leaves rugose, margins entire to crenate; stipules caducous; ovaries on very long stipes (2-5 mm), nectaries about 1/10 as length as the stipes, and floral bracts tawny. It often has contrasting yellowish buds and red-brown branchlets.

***Salix boothii* Dorn** **Booth's willow**

S. myrtillifolia auctt., *S. novae-angliae* auctt., *S. pseudomyrsinites* auctt., *S. pseudocordata* Andersson) Rydb.)

Low to tall shrubs 0.25–6 m, stems erect, plants not colonial. **Branches** flexible at base, not glaucous, glabrous or pilose to villous. **Branchlets** yellowish, or yellow- to red-brown, not glaucous, glabrous or pilose to villous. **Bud** scale margins connate. **Proximal leaves** entire or serrulate with widely spaced teeth. **Juvenile leaves** yellowish green, abaxial surface pilose to villous, hairs white. **Stipules** foliaceous. Petioles flat or shallowly grooved adaxially, 3–17 mm long, adaxial surface pilose, villous, or pubescent, with or without glandular dots at distal end. **Mature leaf blades** ligulate or narrowly oblong to narrowly or broadly elliptic; 26–102 mm long, 8–30 mm wide, length-width ratio 2–5.2; amphistomatous or hypostomatous; abaxial surface not glaucous, glabrous or pilose to short-silky, hairs white or ferruginous; adaxial surface shiny or highly glossy, glabrous or pilose to glabrate; base acute to rounded; margins entire or serrulate; apex abruptly short-acuminate. **Flowering** after or just before leaves emerge. **Floral bracts** dark brown, 0.7–2 mm long, hairs wavy or curly, apex rounded to retuse, entire. **Staminate** catkins densely flowered, stout to subglobose, 6–26 mm long, flowering branchlets (sometimes essentially lacking), 0.5–2 mm long; stamens 2; anthers yellow or purple becoming yellow, 0.6–0.8 mm long; filaments distinct to connate less than half, glabrous or hairy on lower half; abaxial nectaries absent; adaxial nectaries narrowly oblong to ovate, 0.6–1.3 mm long. **Pistillate** catkins densely to moderately densely flowered, stout, 10–70 mm long; flowering branchlets 1–5 mm long; ovaries glabrous, pyriform; stigmas broad-cylindrical or flat with rounded tips; styles 0.3–1 mm long; stipes 0.5–2.5 mm long; abaxial nectaries absent; adaxial nectaries oblong or ovate, 0.3–0.8 mm long, shorter than stipes. Capsules 2.5–6 mm long, 12–18 ovules per capsule.

Chromosome number. 2*n* = 76 (Dorn 1975a)

Distribution. Canada: Alta., B.C., Sask.; U.S.A.: Ariz., Calif., Colo., Idaho, Mont., Nev., Oreg., Utah, Wash., Wyo. Map 9.

Habitat. Subalpine streams and meadows; 1525-3200 m.

Notes. For a comparison with the similar *S. myrtillifolia* and *S. pseudomyrsinites* see Table 3.

Salix brachycarpa* Nutt. var. *brachycarpa **small-fruit willow**

Low to mid shrubs, 0.2-1.5 m, stems erect or decumbent, plants not colonial. **Branches** flexible at base, not glaucous, villous or short-silky to glabrescent. **Branchlets** red-brown, not glaucous, villous, woolly, or long-silky. **Proximal leaf** margins entire. **Juvenile leaves** yellowish green, very densely long-silky. **Stipules** minute rudiments or foliaceous. **Petioles** shallowly or deeply grooved adaxially, sometimes margins overlapping, 1.3-4 mm (shorter than bud), villous, glabrous or long-silky to glabrescent, not glandular at distal end. **Mature leaf blades** narrowly oblong, oblong, narrowly elliptic, elliptic, narrowly oblanceolate, or obovate, 10-40 × 5-16 mm, length-width ratio 1.5-3; hypostomatous; abaxial surface glaucous, white villous or long-silky; adaxial surface shiny, white pilose, villous or long-silky to glabrescent; base rounded or acute; ***margins entire***; apex acute or obtuse. **Flowering** as leaves emerge. **Floral bracts** tawny, 1-3 mm, hairs white, wavy or straight; bract apex rounded, entire. **Staminate** catkins densely flowered, subglobose, stout, or globose, 4-18 mm, peduncles 0-3 mm, flowering branchlets 0.25-10 mm; stamens 2; anthers purple becoming yellow, 0.3-0.5 mm; filaments distinct or connate less than half, glabrous or hairy on lower half; abaxial nectaries present; adaxial nectaries oblong or narrowly oblong, 0.5-1.4 mm; abaxial and adaxial nectaries separate, or coalescent and cup-shaped. **Pistillate** catkins densely flowered, stout to globose, 5-33 mm, peduncles 1-3 mm, flowering branchlets 0.5-20 mm; ovaries very densely woolly, villous, or long-silky, hairs flattened, ovaries pyriform, beak slightly bulged below style; stigmas slender-cylindrical or broad-cylindrical, lobes 0.24-0.32-0.4 mm; styles 0.5-1.5 mm; stipes 0-0.5 mm; abaxial nectaries present or absent; adaxial nectaries oblong, 0.8-2 mm, longer than stipes, abaxial and adaxial nectaries separate, or coalescent and cup-shaped. Capsules 3-6 mm, 2-5-18 ovules per ovary.

Chromosome number 2*n* = 38, 2x (Argus 1965; Löve & Löve 1975; 1982; Suda & Argus 1968).

Distribution. **Canada**: Alta., B.C., Man., N.W.T., Nunavut, Ont., Que., Sask., Yukon; **U.S.A.**: Calif., Colo., Idaho, Mont., N.Mex., Oreg., Utah, Wash., Wyo. St. Pierre and Miquelon. Map 10.

Habitat. Open forests, sedge fens, seepage on limestone, scree slopes, and gravel floodplains; 2010-4025 m.

Notes. *Salix brachycarpa* is characterized by a low, shrubby habit; very short petioles (1.3-4 mm); stout to globose catkins; densely white woolly ovaries, short stipes (0-0.5 mm), and small anthers (0.3-0.5 mm). Putative hybrids with *S. glauca* var. *villosa* have been reported (Argus 1973).

***Salix calcicola* Fernald and Wiegand var. *glandulosior* Boivin**

Low shrubs 0.2-0.5 m, stems erect; plants not colonial. **Branches** flexible at base, red-, gray-, or yellow-brown, weakly glaucous, villous in patches or glabrescent; epidermis flaking. **Branchlets** red- or yellow-brown, moderately densely villous. **Leaves**

may persist for one or more years, becoming gray-brown. **Proximal leaves** entire. **Juvenile leaves** yellowish green, abaxial surface moderately densely, villous, hairs white. **Stipules** foliaceous, may persist for one or more years, apex acute or rounded. **Petioles** shallowly grooved or convex to flat adaxially, 1.5-8 mm, not glandular at distal end, adaxial surface hairy. **Mature leaf blades** elliptic, broadly elliptic, subcircular, or narrowly elliptic, 23-49 × 10-30 mm, length-width ratio 1.3-2.7; hypostomatous, or stomata on adaxial surface along veins and at apex; abaxial surface glaucous, glabrous, moderately densely or sparsely, villous or pilose or glabrescent, hairs spreading, white, straight; adaxial surface shiny or dull, moderately densely or sparsely, villous or pilose or glabrescent, hairs white; venation pinnate; base rounded, cordate, or acute; margins slightly revolute or flat (not purplish), entire or serrulate, 5-13-22 teeth or glands per cm; apex obtuse (pointed tip) or acute. **Flowering** before leaves emerge. **Floral bracts** brown or black, 1.6-3.4 mm, abaxial surface hairy all over, hairs straight, white; apex rounded or acute, entire. **Staminate** catkins densely flowered; flowering branchlets 0 mm; stamens 2; 0.6-0.7 mm; filaments distinct, glabrous; abaxial nectaries absent; adaxial nectaries oblong, 0.5-0.9 mm. **Pistillate** catkins densely flowered; flowering branchlets 0-4 mm; ovaries greenish or greenish brown, or reddish when young, pyriform, beak gradually tapering to style, glabrous, stigmas broad-cylindrical, lobes 0.2-0.28-0.36 mm; styles connate, greenish or tawny to reddish or brownish(when young, 0.9-1.8 mm; stipes 0.3-0.6 mm; abaxial nectaries absent; adaxial nectaries oblong, 0.2-1.1 mm, shorter than, equal to, or longer than stipes; capsules 4-5.5 mm.

Chromosome number. Unknown.

Distribution. Canada: Alta. **U.S.A.**: Colo. Map 11.

Habitat. River floodplain, wet meadows and in dwarf birch thickets. 1200-1840 m.

Notes. *Salix calcicola* var. *glandulosior* is characterized by leaves with numerous (up to 22 per cm), closely spaced glands or very shallow teeth. It is known in Alberta from riparian habitats in Banff and Jasper national parks (confluence of the North Saskatchewan and the Alexandra rivers, the Lower Whirlpool R., and confluence of the Clearwater R. and Mallach Cr.). It is also known from a single locality on Mt. Fairplay, Colorado, where it grows in a cirque basin in a wet, willow thicket on limestone at an elevation of 3700 m. This variety is closely related to and disjunct from the eastern arctic var. *calcicola*.

***Salix candida* Flüggé ex Willd.** **sage willow, sage-leaf willow**

S. candida f. *denudata* (Andersson) Rouleau.

Low to mid shrubs, 0.3-1 m, stems erect, plants not colonial or forming colonies by layering. **Branches** flexible at base, not glaucous, woolly (in patches or floccose) to glabrescent. **Branchlets** yellow-brown or gray-brown, not glaucous densely woolly to floccose. **Proximal leaf** margins entire. **Juvenile leaves** yellowish green, very densely tomentose. **Stipules** foliaceous. **Petioles** shallowly or deeply grooved adaxially (often obscured by hairs), 3-10 mm, tomentose or densely woolly, not glandular at distal end. **Mature leaf blades** ligulate, very narrowly elliptic, narrowly elliptic, or oblanceolate, 47-103 × 5-20 mm, length-width ratio 3.3-12; hypostomatous; abaxial surface obscured by hairs but glaucous, dull tomentose or woolly, cobwebby in age; adaxial surface dull or shiny, dull tomentose (floccose); base acute; margins entire or undulate, teeth or glands

all around margin; apex acute. **Flowering** as leaves emerge. **Floral bracts** tawny or brown, 1.2-1.8 mm, hairs white, straight; bract apex rounded, entire. **Staminate** catkins densely flowered, stout to subglobose or globose, 9-30 mm, peduncles 1-3 mm, flowering branchlets 0-5 mm; stamens 2; anthers yellow or purple, 0.5-0.6 mm; filaments distinct or connate less than half, glabrous; abaxial nectaries absent; adaxial nectaries narrowly oblong or oblong, 0.58-1 mm. **Pistillate** catkins densely to moderately densely flowered, slender or stout, 14-60 mm, peduncles 0-8 mm, flowering branchlets 1-7 mm; ovaries very densely tomentose or woolly, hairs cylindrical (very slender, sometimes appears to be flattened), ovaries pyriform, beak slightly bulged below style or gradually tapering to style; stigmas broad-cylindrical, lobes 0.4-0.45-0.52 mm; styles 0.3-1.9 mm; stipes 0.1-1.2 mm; adaxial nectaries oblong, 0.4-1 mm, shorter than stipes or equal to stipes; capsules 4-6 mm, 12-18 ovules per ovary.

Chromosome number. 2*n* = 38, 2x (Löve & Löve 1982; Suda & Argus 1968).

Distribution. St. Pierre and Miquelon; **Canada**: Alta., B.C., Lab., Man., N.B., Nfld., N.W.T., N.S., Nunavut, Ont., P.E.I., Que., Sask., Yukon. **U.S.A.**: Alaska, Colo., Conn., Idaho, Ill., Ind., Iowa, Maine, Mass., Mich., Minn., Mont., N.J., N.Dak., N.Y., Ohio, Pa., S.Dak., Vt., Wash., Wis., Wyo. Map 12.

Habitat. River floodplains, marl bogs, fens, and meadows; 119-2805 m.

Notes. *Salix candida* is characterized by leaves narrowly elliptic, densely dull-woolly abaxially and dark green or brownish adaxially with dull white floccose indumentum; and densely woolly branchlets and ovaries. It hybridizes with *S. myrtillifolia* and *S. petiolaris*.

***Salix commutata* Bebb** **under-green willow**

S. barclayi var. *commutata* (Bebb) Kelso

Low to tall shrubs, 0.2-3 m, stems erect, plants not colonial. **Branches** flexible at base, not glaucous or sometimes weakly so, pilose to glabrescent. **Branchlets** yellow-green, yellow-brown, or red-brown, not glaucous***, pilose, villous, or woolly***. **Proximal leaf** margins entire or serrulate. **Juvenile leaves** yellowish green, long-silky or silky-tomentose. **Stipules** foliaceous, sometimes oily. **Petioles** shallowly grooved or convex to flat adaxially, 1.5-11 mm, pilose or tomentose, not glandular at distal end. **Mature leaf blades** narrowly oblong, oblong, elliptic, or broadly elliptic, 10-100 × 5-44 mm, length-width ratio 1.5-3.4; hypostomatous or amphistomatous; abaxial surface not glaucous, glabrous, tomentose, pilose or villous to glabrescent; adaxial surface dull or shiny, glabrous or pilose or villous to glabrescent; base obtuse, rounded, cordate, or acute; margins entire or serrulate, teeth or glands all around margin, or only at proximal end; apex acute, obtuse, or acuminate. **Flowering** as leaves emerge. **Floral bracts** brown, tawny, or bicolor, 1-3 mm, hairs white, straight or wavy; bract apex acute or rounded, entire. **Staminate** catkins densely to moderately densely flowered, stout to subglobose, 10-80 mm, peduncles 1-5 mm, flowering branchlets 2-30 mm; stamens 2; anthers yellow or purple becoming yellow, 0.4-1 mm; filaments distinct, glabrous; abaxial nectaries absent; adaxial nectaries oblong or square, 0.2-0.8 mm. **Pistillate** catkins densely to moderately densely flowered, slender or stout to subglobose, 15-100 mm, peduncles 1.5-8 mm, flowering branchlets 3-30 mm; ovaries glabrous, pyriform or obclavate, beak gradually or abruptly tapering to style; stigmas two plump lobes with continuous

stigmatic surface or broad-cylindrical, lobes 0.16-0.34-0.4 mm; styles 0.5-1.5 mm; stipes 0.3-2 mm; adaxial nectaries oblong, square, or ovate, 0.3-0.7 mm, shorter than stipes; capsules 3.5-8 mm, 10-28 ovules per ovary.

Chromosome number. 2*n* = 38, 2x (Dorn 1975a).

Distribution. **Canada**: Alta., B.C., N.W.T., Sask.,Yukon; **U.S.A.**: Alaska, Idaho, Mont., Oreg., Wash. Map 13.

Habitat. Rocky alpine and subalpine slopes, glacial moraine, open spruce woods, streamsides, gravel benches along rivers, and wet fens; 1-2400 m.

Notes. *Salix commutata* flowers after the leaves emerge, its leaves are not glaucous abaxially, often distinctly straggly hairy on both sides with straight and wavy hairs, short petioles (1.5-11 mm); stipules often as long as the petioles, and glabrous, reddish-green ovaries. It hybridizes with *S. barclayi*.

***Salix daphnoides* Vill.** **violet or daphne willow**

Shrubs or trees, 2--10 m. **Branches** red-brown, strongly glaucous, losing glaucescence in age but remaining so at nodes, glabrescent. **Branchlets** yellow-brown, not glaucous (except in age), usually glabrescent, sometimes sparsely or moderately densely tomentose; buds *caprea*-type. **Proximal leaf** margins entire. **Juvenile leaves** reddish or yellowish green. **Stipules** usually rudimentary on early ones, foliaceous on late ones, lanceolate to ovate, apices acuminate or acute, often adnate to petioles. **Petioles** shallowly grooved adaxially, sometimes convex to flat, 5--18 mm, tomentose to glabrescent. **Mature leaf blades** oblong, lorate, narrowly elliptic, or elliptic, 50--96(--120) x 1--35(--40) mm, 2.5--6.4 times as long as wide, sometimes amphistomatous, base cuneate to concave, margins slightly revolute, serrate to crenate, apex acuminate, surfaces abaxially glaucous, glabrescent or midrib sparsely tomentose, hairs sometimes also ferruginous, spreading, straight, long or short, adaxially shiny, midrib sparsely tomentose or throughout; juvenile leaves sparsely to moderately densely long-silky abaxially, hairs sometimes a few ferruginous; proximal blade margins closely gland-dotted. **Flowering** before or just before leaves emerge. **Floral bracts** dark brown or bicolor, 2.8--3 mm, apex acute to convex, moderately densely hairy throughout, hairs straight. **Staminate** catkins 30--47 x 9--20 mm, flowering branchlets 0--1.2 mm; staminate adaxial nectary narrowly oblong to flask-shaped, 0.5--1 mm; anthers purple becoming yellow, short- to long-cylindrical or ellipsoid, 0.5--0.7 mm; filaments distinct or basally connate, glabrous. **Pistillate** catkins 20--50 mm, stout, densely flowered, flowering branchlets ca. 1.5 mm; pistillate adaxial nectary oblong to square, 0.4--0.9 mm, shorter to longer than stipe; stipe 0.6--0.8 mm; ovary pyriform, glabrous; styles 0.6--1.5 mm; stigmas flat, abaxially non-papillate, tip rounded, 0.4--0.7 mm; capsules 3.2--4.4 mm, ovules 4--6 per ovary. .

Chromosome number. 2*n* = 38, 2x (Blackburn & Heslop-Harrison 1924, Marklund in Floderus 1931, Fedorova-Sarkissova 1946, Majovsky & Vachova 1982, Chmelar 1979, Sanduh & Mann 1988, Dobeŝ et al. 1997)

Distribution. Europe. **Canada**: Alta., Ont., Que., Sask; **U.S.A.**: Mass., Minn.

Habitat. Introduced from Europe and cultivated but rarely naturalized. Cultivated on prairies for windbreaks and elsewhere for its ornamental catkins.

Notes. The stipules in this species are unusual in becoming attached to base of the petioles as they dilate around reproductive buds.

***Salix discolor* Muhl.** **pussy willow**

Tall shrubs, 2-6 m, stems erect, plants not colonial. **Branches** flexible to somewhat brittle at base, not glaucous or sometimes so, villous to glabrescent; decorticated branches with short, sparse longitudinal striae, 2-7 mm. **Branchlets** red-brown, dark brown, yellowish, or yellow-brown, not glaucous, moderately densely villous to glabrescent, hairs spreading or geniculate. **Proximal leaf** margins entire. **Juvenile leaves** reddish or yellowish green, sparsely to densely pilose with white or ferruginous hairs. **Stipules** foliaceous or minute rudiments. **Petioles** convex to flat adaxially, 6-17 mm, tomentose, not glandular at distal end. **Mature leaf blades** narrowly elliptic, elliptic, oblanceolate, or obovate, 30-135 × 12-33 mm, length-width ratio 2.3-4.5; hypostomatous; abaxial surface glaucous, pilose to glabrescent, hairs white or ferruginous; adaxial surface dull or shiny, pilose or glabrescent, hairs white or ferruginous; base obtuse, acute, or cuneate; margins entire, crenate, or undulate, teeth or glands all around margin (more prominent distally); apex acute to subacuminate. **Flowering** before leaves emerge. **Floral bracts** dark brown, black, or bicolor, 1.5-2.5 mm, hairs white, straight; bract apex acute or obtuse, entire. **Staminate** catkins densely flowered, stout to subglobose, 20-50 mm, peduncles 0-5 mm, flowering branchlets 0-3 mm; stamens 2; anthers yellow or purple, 0.5-1 mm; filaments distinct, glabrous or hairy only at base; abaxial nectaries absent; adaxial nectaries oblong, 0.6-1.1 mm. **Pistillate** catkins densely flowered (loose in fruit), slender or stout, 28-105 mm, peduncles 1-6 mm, flowering branchlets 0-7 mm; ovaries short-silky, hairs flattened (refractive), ovaries obclavate or pyriform, beak gradually tapering to or slightly bulged below style; stigmas slender-cylindrical, lobes 0.48-0.64-0.72 mm; styles 0.3-1 mm; stipes 2-2.7 mm; adaxial nectaries oblong or ovate, 0.7-1.3 mm, shorter than stipes; capsules 6-11 mm, 6-16 ovules per ovary.

Chromosome number 2*n* = 76, 4x (Löve & Löve 1982; Suda & Argus 1968; Zsuffa & Raj 1981); 2*n* = 95, 5x (Suda unpublished, based on a teratological plant); 2*n* = 114, 6x (Dorn 1976; Suda, unpublished).

Distribution. Canada: Alta., B.C., Lab., Man., N.B., Nfld., N.W.T., N.S., Ont., P.E.I., Que., Sask.; **U.S.A.**: Colo., Conn., Del., Ill., Ind., Iowa, Ky., Maine, Md., Mass., Mich., Minn., Mo., Mont., N.H., N.J., N.C., N.Dak., N.Y., Ohio, Pa., R.I., S.Dak., Vt., W.Va., Wis., Wyo. Map 14.

Habitat. Wet thickets in boreal forest. 610-2440 m.

***Salix drummondiana* Barratt ex Hook.** **Drummond's willow**

S. subcoerulea Piper, *S. drummondiana* var. *subcoerulea* (Piper) C. R. Ball; *S. bella* Piper, *S. drummondiana* var. *bella* (Piper) C. R. Ball

Mid to tall shrubs, 1-5 m, stems erect, plants not colonial. **Branches** highly brittle to somewhat brittle at base, strongly glaucous, glabrous or glabrescent. **Branchlets** red-brown or yellow-brown, often mottled, strongly glaucous, glabrous or sparsely puberulent, pilose, or velvety to glabrescent. **Proximal leaf** margins entire. **Juvenile leaves** yellowish green, sparsely short-silky adaxially or very densely so abaxially, hairs white or ferruginous. **Stipules** absent, rudimentary, or foliaceous on later leaves. **Petioles** convex to flat or shallowly grooved adaxially, 2-12 mm, villous or velvety, not glandular at distal end. **Mature leaf blades** ligulate, narrowly elliptic, elliptic, or oblanceolate, 40-

85 × 9-26 mm, length-width ratio 3-6.2; hypostomatous; abaxial surface obscured by hairs, short-silky, woolly, or long-silky, hairs white or ferruginous, midrib prominent, glabrous, yellow; adaxial surface shiny or dull, short-silky to glabrescent, hairs white or ferruginous; base acute or cuneate; margins entire or shallowly toothed to undulate, teeth or glands all around margin; apex acute or acuminate. **Flowering** before leaves emerge. **Floral bracts** brown or black, 1.2-2.8 mm, hairs white, straight; bract apex acute or rounded, entire. **Staminate** catkins densely flowered, stout, 19-40 mm, peduncles 0-6 mm, flowering branchlets 0 mm; stamens 2; anthers purple becoming yellow, 0.4-0.6 mm; filaments distinct, glabrous; abaxial nectaries absent; adaxial nectaries oblong, 0.3-0.63 mm. **Pistillate** catkins densely flowered, slender or stout, 20-85 mm, peduncles 0-5 mm, flowering branchlets 0-6 mm; ovaries short-silky, hairs flattened, ovaries pyriform, beak gradually tapering to style; stigmas slender-cylindrical or two plump lobes with continuous stigmatic surface, lobes 0.32-0.43-0.6 mm; styles 0.5-1.5 mm; stipes 0.3-2 mm; adaxial nectaries narrowly oblong, oblong, or ovate, 0.4-1 mm, shorter than, equal to, or longer than stipes; capsules 2.5-6 mm, 6-12 ovules per ovary.

Chromosome number. 2*n* = 38, 2x (Dorn 1975b); 2*n* = 57 (Suda & Argus 1968); 2*n* = 76, 4x (Dorn 1975b).

Distribution. Canada: Alta., B.C., N.W.T., Sask., Yukon; **U.S.A.**: Calif., Colo., Idaho, Mont., Nev., N.Mex., Oreg., Utah, Wash., Wyo. Map 15.

Habitat. Subalpine thickets, open spruce forests, streamsides, and gravelly floodplains; 620-3350 m.

Notes. Stipules are usually lacking or minute but can be present on later leaves. They usually are small ovate or sometimes slender lobes. Plants with prominent linear or lanceolate stipules and leaves woolly abaxially are hybrids with *S. alaxensis*.

The species sometimes is vegetatively similar to *S. sitchensis.* See that species for a discussion and Table 7 for comparison.

***Salix exigua* Nutt. var. exigua** **Narrow-leaf willow, coyote willow**

Mid shrubs, tall shrubs, or trees, 0.5-5 m, stems erect; plants forming colonies by root shoots. **Branches** flexible at base, yellow-, gray-, or red-brown, not glaucous, tomentose to glabrescent; epidermis flaking. **Branchlets** yellow-brown or red-brown, glabrous or sparsely to very densely tomentose or short-silky villous to puberulent. **Proximal leaf** margins entire. **Juvenile leaves** yellowish green, abaxial surface very densely, long-silky, hairs white. **Stipules** foliaceous or minute rudiments, apex acuminate to acute. **Petioles** convex to flat or shallowly grooved adaxially, 1-9 mm, leaf length-petiole length ratio 8.6-28.5-53.8, not glandular, adaxial surface hairy. **Mature leaf blades** linear or ligulate; 30-143 × 2-8 mm, length-width ratio 10-28(-37.5); amphistomatous; adaxial surface shiny margins slightly revolute, entire or remotely spinulose-serrulate, 1-4 teeth or glands per cm; abaxial surface glaucous or obscured by hair, moderately to very densely long- or short-silky or silky-villous, hairs appressed or spreading, white, straight or wavy; adaxial surface sparsely long-silky to glabrescent, hairs white, shiny; base cuneate; apex acuminate or acute. **Catkins** flowering as leaves emerge or flowering throughout season. **Floral bracts** tawny, sometimes greenish,1.2-1.6 mm, abaxial surface hairy all over or sometimes glabrate, hairs white, wavy or straight; bract apex rounded, entire; pistillate bracts deciduous after flowering. **Staminate** catkins

slender or stout, densely flowered, 13-54 × 2-10 mm; flowering branchlets 1.5-70 (-160) mm; stamens 2; anthers yellow or reddish becoming yellow, 0.6-0.8 mm; filaments distinct, hairy on lower half; abaxial nectaries present, adaxial nectaries oblong, 0.3-0.8 mm, abaxial and adaxial nectaries distinct. **Pistillate** catkins loosely flowered, slender or stout, 14.5-70 mm, 4-12 mm; flowering branchlets 2-65 mm; ovary beak slightly bulged below style, ovaries greenish or reddish, obclavate or pyriform, glabrous or sometimes hairy on beak, hairs straight, cylindrical; stigmas flat with pointed tips or broad-cylindrical, lobes 0.25-0.43-0.5 mm; styles connate, greenish or tawny, 0-0.2 mm; stipes 0.2-0.9 mm; adaxial nectaries oblong or ovate, 0.3-0.9 mm, shorter than, equal to, or longer than stipes; capsules 4-8 mm.

Chromosome number. 2*n* = 38, 2x (Dorn 1975b; Suda & Argus 1968).

Distribution. **Canada**: Alta., B.C. **U.S.A.**: Ariz., Calif., Colo., Idaho, Mont., Nebr., Nev., N.Mex., Oreg., Tex., Utah, Wash., Wyo. Map 17.

Habitat. Silty, sandy, or gravelly river floodplains; 600-2800 m.

Note. *Salix exigua* is a riparian species which spreads clonally by root shoots. It is characterized by leaves linear, catkins that often are branched; and deciduous floral bracts. The ranges of *S. exigua* and *S. interior* overlap in southern Alberta. Most populations of these species between about 49° and 50° contain many intergrades. Further study is needed of these taxa in southwestern Alberta.

***Salix famelica* (C. R. Ball) Argus** **familiar willow**

S. eriocephala Michx. var. *famelica* (C. R. Ball) Dorn; *S. lutea* Nutt. var. *famelica* C. R. Ball; *S. lutea* sensu auctt. non Nutt.

Mid to tall shrubs or trees, 1.5-7 m, stems erect, plants not colonial. **Branches** not glaucous, yellowish, yellow-brown, gray-brown, glabrous, tomentose at nodes, or pubescent to glabrescent. **Branchlets** yellow-brown or red-brown, not glaucous or weakly so with sparkling wax crystals, usually glabrous but sometimes pubescent, pilose, or moderately densely villous to glabrescent. **Proximal leaf** margins entire or serrulate. **Juvenile leaves** reddish or yellowish green, glabrous or pilose to villous. **Stipules** minute rudiments or foliaceous. **Petioles** convex to flat or shallowly grooved adaxially; base not ventricose; 3-27 mm, glabrous or puberulent, pubescent, tomentose or velvety, not glandular at distal end. **Mature leaf blades** narrowly oblong, very narrowly elliptic, narrowly elliptic, or lanceolate, 28-116 × 10-30 mm, length-width ratio 2.6-7; hypostomatous; abaxial surface glaucous, glabrous or pubescent or pilose or glabrescent, midrib often hairy; adaxial surface dull or shiny, glabrous or pilose, long-silky or tomentose to glabrescent, midrib hairy; base acute or, rounded; margins serrate, serrulate, or crenulate to entire, teeth or glands all around margin; apex acuminate, caudate, or acute. **Flowering** after (in pistillate) or before leaves emerge (in staminate). **Floral bracts** dark brown or tawny, 0.8-1.6 mm, hairs white, straight or wavy; bract apex rounded or obtuse, entire. **Staminate** catkins densely to moderately densely flowered, slender to stout or subglobose, 15-42 mm, peduncles 0.5-2 mm, flowering branchlets 0.5-4 mm; stamens 2; anthers yellow or purple becoming yellow, 0.45-0.68 mm; filaments distinct or connate less than half, glabrous; abaxial nectaries absent; adaxial nectaries narrowly oblong, oblong, or flask-shaped, 0.5-1.1 mm. **Pistillate** catkins loosely to moderately densely flowered, slender or stout, 22-70 mm, peduncles 0.5-4 mm, flowering

branchlets 0.5-9 mm; ovaries glabrous, pyriform or obclavate, beak gradually tapering to style or slightly bulged below style; stigmas flat with rounded tips or two plump lobes with continuous stigmatic surface, lobes 0.12-0.22-0.32 mm; styles 0.2-0.6 mm; stipes 0.7-2.4 mm; adaxial nectaries oblong or flask-shaped, 0.8-0.93 mm, shorter than stipes; capsules 5-6 mm, 12-18 ovules per ovary.

Chromosome number. 2*n* = 38, 2x (Löve & Löve 1982; Suda & Argus 1968).

Distribution. Canada: Alta., Man., N.W.T., Ont., Sask.; **U.S.A.**: Colo., Iowa, Kans., Minn., Mo., Mont., Nebr., N.Dak., S.Dak., Wyo. Map 16.

Habitat. Riparian willow thickets on sandy-clay, gravelly, or bouldery banks and floodplains; 0-1650 m.

Note: The main obvious differences between *S. famelica* and *S. prolixa* are the color of the branches and length of stipes. In general the 2-3-year old branches of *S. famelica* are yellowish to yellow-gray whereas those of *S. prolixa* are usually are red-brown, but rarely some are grayish. The entire population in Jasper has yellowish branches. The stipes of *S. prolixa* seem to be somewhat longer (1.3-4.2 mm) whereas those of *S. famelica* are smaller (0.7-2.75 mm) but the differences is slight. There is a specimen in CAN from Fort Saskatchewan with yellowish branches but stipes 3-4 mm long. It may be a hybrid or it may just be the range of variation in *S. famelica*. Dorn (1995) also separates *S. famelica* (as *S. eriocephala* var. *famelica*) and *S. prolixa* based on the prominence of leaf toothing; he describes the teeth in *S. famelica* as more prominent than in *S. prolixa*. I cannot separate them on that characteristic except to note that sometimes *S. prolixa* can have very inconspicuous teeth or be almost entire, but inconspicuous toothing also occurs in *S. famelica*.

See *Salix pseudomonticola* for discussion.

***Salix farriae* C. R. Ball in Standley** **Farr's willow**

S. hastata var. *farriae* (C. R. Ball) Hultén

Low to mid shrubs 0.2–1.5 m, stems erect, plants not colonial. **Branches** flexible at base, not glaucous, glabrous or glabrate. **Branchlets** yellow- to red-brown, not glaucous, glabrous, puberulent or pilose to glabrate. Bud scale margins connate. **Proximal leaves** entire or serrulate. Juvenile leaves yellowish green, abaxial surface glabrous or pubescent, midrib villous adaxially, hairs white or ferruginous. **Stipules** foliaceous or minute rudiments. **Petioles** shallowly grooved to flat adaxially, 5–8 mm long, adaxial surface puberulent, not glandular at distal end. **Mature leaf blades** narrowly elliptic to elliptic; 20–75 mm long, 8-35 mm wide, length-width ratio 2.7–3.4; hypostomatous; abaxial surface glaucous, glabrous or pubescent (?) to glabrate; adaxial surface shiny or dull, glabrous or puberulent on midrib with white or ferruginous hairs; base obtuse to rounded; margins entire or serrulate; apex acute. **Flowering** as leaves emerge; floral bracts brown, black or bicolor, 0.7–1.5 mm long, hairs wavy, apex rounded, entire. **Staminate** catkins densely flowered, stout, 10–22 mm long, flowering branchlets 1–5 mm long; stamens 2; anthers yellow, 0.3–0.6 mm long; filaments distinct, glabrous; abaxial nectaries absent; adaxial nectaries oblong, ovate or square, 0.2–0.88 mm long. **Pistillate** catkins densely to loosely flowered, stout, 12–36 mm long; flowering branchlets 1.5–14 mm long; ovaries glabrous, pyriform; stigmas 2 plump lobes with continuous stigmatic surface; styles 0.3–1.2 mm long; stipes 0.5-1.2 mm long; abaxial

nectaries absent; adaxial nectaries oblong or ovate, 0.2–0.6 mm long, shorter than stipes. Capsules 3–6 mm long, 12–20 ovules per capsule.

Chromosome number. Unknown

Distribution. **Canada**: Alta., B.C., N.W.T., Yukon; **U.S.A.**: Idaho, Mont., Oreg., Wash., Wyo. Map 19.

Habitat. Wet meadows and stream banks from the montane to subalpine zones; 630-2745 m.

Note: *Salix farriae* is a cordilleran disjunct related to *Salix hastata,* an amphiberingian species ranging from Scandinavia to northern Yukon and N. W. T.. There are reasons for treating this slightly different population as *Salix hastata* var. *farriae* as was proposed by E. Hultén 1967); but Dorn (1975a) maintained them as a species because of flavonoid differences between the two. Species rank is also supported by phenetic study (Argus 1977) in which they clustered together on the same branch and had dissimilarities values are at the same level as other closely related species. See *S. barclayi* for discussion and Table 2 for comparison.

Salix fragilis L. **crack willow**

Trees, 3-15 (-20) m, stems erect; plants not colonial. **Branches** highly brittle at base, yellow-brown or gray-brown or red-brown, not glaucous, glabrous or glabrescent; epidermis not flaking. **Branchlets** yellow-brown (olive-brown) or yellow-green or brownish or red-brown, glabrous, sparsely or moderately densely or very densely, pubescent or pilose or long-silky or velvety or glabrescent. **Leaves** falling in autumn. **Proximal leaves** entire. **Juvenile leaves** yellowish green or reddish, abaxial surface glabrous, sparsely or moderately densely, white, long-silky or short-silky or pubescent. **Stipules** foliaceous or minute rudiments, deciduous in autumn, apex acuminate. **Petioles** shallowly grooved adaxially or deeply grooved adaxially, 4.4-20 mm, with, paired glandular dots or clusters of glandular dots or stalked glands or foliaceous glands, at distal end, adaxial surface glabrous or hairy. **Mature leaf blades** lanceolate or narrowly oblong or very narrowly elliptic, 70-150(-180) × 13-30 mm, length-width ratio 3.5-7.5; amphistomatous, or hypostomatous; abaxial surface glaucous, glabrous, sparsely (very), short-silky or long-silky or glabrescent, hairs appressed, white, straight or wavy (ca. 0.5); adaxial surface shiny or highly glossy; venation pinnate; base obtuse, or rounded, or cuneate (broadly so); margins flat, remotely or irregularly serrate or serrate, 3-10 teeth per cm; apex acuminate or caudate. **Flowering** as leaves emerge. **Floral bracts** tawny or green, 1-3 mm, abaxial surface hairy all over, hairs straight, white; apex acute or rounded, entire or erose; pistillate bracts deciduous after flowering. **Staminate** catkins moderately densely flowered; flowering branchlets 5-11 mm; stamens 2 (rarely 3); anthers yellow, 0.4-0.8 mm; filaments distinct or connate less than half, hairy on lower half; abaxial nectaries present; adaxial nectaries oblong, 0.3-0.63 mm, abaxial and adaxial nectaries not coalescent. **Pistillate** catkins loosely flowered; flowering branchlets 8-20 mm; ovaries greenish or reddish, obclavate, beak gradually tapering or slightly bulged below style, glabrous, stigmas flat with rounded tips, lobes 0.2-0.4 mm; styles connate or slightly free at distal end, greenish or tawny to reddish or brownish, 0.5-0.8 mm; stipes 0.5-1.5 mm; abaxial nectaries absent; adaxial nectaries oblong or square, 0.3-0.63 mm, shorter than stipes; capsules 4-5 mm.

Chromosome number. 2*n* = 38, 2x (Federova-Sarkissova 1946, Murin & Vachova 1974); 2*n* = 76, 4x (Blackburn & Helsop-Harrison 1924, Neumann & Plotaschek 1972, Chmelar 1979, Zsuffa & Raj 1981, Krichfalushij & Golyshkin 1985, Ma et al. 1990); 2*n* = 114, 6x (Suda 1963, Löve & Löve 1942).

Distribution. Europe. **Canada**: Alta., N.B., Nfld., Ont., Que. **U.S.A.**: Conn., D.C., Ill., Iowa, Kans., Ky., Maine, Md., Mass., Mich., Minn., Nebr., N.H., N.Y., Pa., R.I., Utah, Vt., Va., Wash., W.Va., Wis. (North American range uncertain. All reports may be *S.* ×*rubens*.)

Habitat. Introduced from Europe and cultivated but rarely naturalized.

Notes. This species is difficult to separate from the hybrid *S.* ×*rubens*. Skvortsov (1973) saw no authentic material from North America but study is needed.

***Salix glauca* var. *villosa* (D. Don ex Hook.) Andersson** **gray-leaf willow**

S. glauca subsp. *glabrescens* (Andersson) Hultén; *S. villosa* D. Don ex Hook.

Plants low to tall shrubs, 0.3-2 m, stems erect or decumbent. **Branches** villous (sometimes persistent) or glabrescent. **Branchlets** red-brown or yellow-brown, moderately to very densely villous or tomentose. **Proximal leaf** margins entire or serrulate. **Juvenile leaves** sparsely to very densely villous. **Stipules** minute rudiments or foliaceous. Petioles 3-14 mm, not glandular at distal end. **Mature leaf blades** narrowly elliptic, elliptic, oblanceolate, or obovate, 29-80 × 8-24 mm, length-width ratio 2.2-3.9; hypostomatous or amphistomatous (especially in southern Rocky Mountains); abaxial surface pilose or villous to glabrescent; adaxial surface pilose or villous to glabrescent; base acute to cuneate; margins entire; apex acute or obtuse (but tip pointed). **Floral bracts** tawny, brown or bicolor, 1-3.4 mm, hairs wavy; bract apex acute or obtuse, entire (sometimes slightly toothed). **Staminate** catkins densely flowered, 15-50 mm, peduncles 2-7 mm, flowering branchlets 1.5-20 mm; anthers purple becoming yellow, 0.4-0.8 mm; adaxial nectaries oblong or ovate, 0.6-1.3 mm. **Pistillate** catkins moderately densely flowered or loosely flowered, slender to stout, 14-65 mm, peduncles 2-10 mm, flowering branchlets 2-27 mm; ovaries very densely villous or tomentose, hairs flattened, ovaries pyriform, beak gradually tapering or slightly bulged below style; stigma lobes 0.2-0.4-0.64 mm; styles 0.4-1.4 mm; stipes 0.3-1.5 mm; adaxial nectaries 0.6-1.4 mm; capsules 5-8 mm, 6-15 ovules per ovary.

Chromosome number. 2*n* = 114, 6x (Suda & Argus 1968).

Distribution. Canada: Alta., B.C., Man., N.W.T., Sask., Yukon; **U.S.A.**: Colo., Idaho, Mont., N.Mex., Oreg., Utah, Wash., Wyo. Map 20.

Habitat. Margins of rivers and creeks, openings in spruce woods, thickets on subalpine slopes; ca. 1440-3810 m.

Notes. *Salix glauca* var. *villosa* is characterized by a tendency toward more glabrescent leaves, less prominent stipules, and smaller leaves and catkins. It intergrades with var. *acutifolia* (Hook.) C. K. Schneider in northern British Columbia and southern Yukon.

Salix interior Rowlee **sandbar willow**

S. exigua subsp. *interior* (Rowlee) Cronquist.

Mid shrubs, tall shrubs, or trees, 4-6 m, stems erect; plants forming colonies by root shoots. **Branches** flexible at base, yellow-, gray-, or red-brown, not glaucous, glabrous or sometimes villous to glabrescent; epidermis flaking, or not. **Branchlets** yellow-brown or red-brown, glabrous or sparsely to moderately or very densely tomentose or villous to glabrescent. **Proximal leaf** margins entire. **Juvenile leaves** reddish or yellowish green, abaxial surface moderately to sparsely, long-silky, hairs white. **Stipules** minute rudiments or absent or occasionally foliaceous, apex acuminate to caudate. **Petioles** convex to flat or shallowly grooved adaxially, 1-9 mm, leaf length-petiole length ratio 13.7-53.8(-120), not glandular, adaxial surface glabrous or hairy. **Mature leaf blades** linear or ligulate; adaxial surface shiny 60-160 × 4-11 mm, length-width ratio (6.5-)11-19(-31); amphistomatous; margins flat, remotely spinulose-serrulate, 2-3.3-5 teeth or glands per cm; abaxial surface glaucous, sometimes very thinly so and not evident, sparsely or moderately densely, villous or long-silky to glabrescent; adaxial surface sparsely or moderately densely, villous or pilose to glabrescent, hairs white; base cuneate; apex acuminate or acute. **Catkins** flowering as leaves emerge or flowering throughout season. **Floral bracts** tawny, sometimes greenish, 1.5-3.5 mm, abaxial surface hairy mainly at proximal or distal end to glabrescent, hairs white, wavy; bract apex acute or rounded, entire, erose, or toothed; pistillate bracts deciduous after flowering. **Staminate** catkins slender or stout, densely or moderately densely flowered, 26-56 mm × 5-9 mm; flowering branchlets 2-35 mm; stamens 2; anthers yellow, 0.4-0.7 mm; filaments distinct, hairy on lower half; abaxial nectaries present, adaxial nectaries ovate or narrowly oblong, 0.6-1.4 mm, abaxial and adaxial nectaries distinct. **Pistillate** catkins loosely flowered, slender or stout, 32-65 mm, 7-15 mm; flowering branchlets 8-32 mm; ovaries greenish or reddish, obclavate or pyriform,ovary beak abruptly tapering to style, ovaries long-silky or glabrescent, hairs flattened; stigmas broad-cylindrical, lobes 0.32-0.38-0.72 mm; styles connate or free about half their length to almost distinct, 0-0.2 mm; stipes 0.5-0.8 mm; adaxial nectaries narrowly oblong, 0.4-1.1 mm, shorter than or equal to stipes; capsules 6-10 mm.

Chromosome number. 2*n* = 38, 2x (Chmelar 1979; Löve & Löve 1982; Neumann & Polatcshek 1972; Suda & Argus 1968; Zsuffa & Raj 1981).

Distribution. Canada: Alta., B.C., Man., N.B., N.W.T., Ont., Que., Sask., Yukon; **U.S.A.**: Alaska, Ark., Colo., Conn., Del., D.C., Idaho, Ill., Ind., Iowa, Kans., Ky., La., Maine, Md., Mass., Mich., Minn., Miss., Mo., Mont., Nebr., N.J., N.Dak, N.Y., Ohio, Okla., Pa., S.Dak., Tenn. Tex., Vt., Va., W.Va., Wis., Wyo. Map 18.

Habitat. Silty, sandy, or gravelly river floodplains, slough margins, and sedge meadows; 15-1770 m.

Notes. *Salix interior* is a riparian species which spreads clonally by root shoots. It is characterized by leaves linear, catkins that often are branched; and deciduous floral bracts. It hybridizes with *S. melanopsis* and intergrades have been seen from Waterton National Park (CAN). See *S. exigua* for comments on hybridization.

***Salix lasiandra* Benth.** **shining willow**

Tall shrubs to trees, **stems** erect, plants not colonial. **Branches** flexible to highly brittle at base, shiny, to highly glossy, not glaucous, glabrous or pilose to glabrescent (remaining pilose at nodes), epidermis not flaking. **Branchlets** yellow-, gray-, or red-brown, not glaucous, glabrous or pilose, villous, or sometimes velvety to glabrescent. **Proximal leaf** margins entire or serrulate (closely glandular and shallowly toothed). **Juvenile leaves** reddish or yellowish green, glabrous or densely villous or long-silky, hairs white or ferruginous. **Stipules** foliaceous, glandular adaxially, apex obtuse or rounded. **Petioles** deeply grooved adaxially (edges sometimes touching), glabrous or pilose***, with glandular dots or lobes at distal end.*** **Mature leaf blades** abaxial surface not glaucous or glaucous, glabrous or pilose to glabrescent, hairs white or ferruginous; adaxial surface shiny or highly glossy, glabrous or pilose or long-silky to glabrescent, hairs white or ferruginous; base acute, obtuse, or rounded; margins flat, serrulate, 6-14 teeth per cm all around margin. **Flowering** as leaves emerge. **Floral bracts** tawny, hairs white, wavy; bract apex rounded, entire, toothed, or erose; pistillate bracts deciduous after flowering. **Staminate** catkins moderately densely flowered, slender or stout; stamens 4-5; anthers yellow, 0.6-1 mm ; filaments distinct; abaxial nectaries present; abaxial and adaxial nectaries separate or coalescent and cup-shaped. **Pistillate** catkins densely to moderately densely flowered; ovaries greenish, greenish-brown or reddish, pyriform, beak gradually tapering or slightly bulged below style, glabrous; stigmas broad-cylindrical or two plump lobes; styles connate or slightly separate at distal end; abaxial nectaries absent, rarely present; adaxial nectaries shorter than stipes.

Notes. *Salix lasiandra* is characterized by stamens 4 or 5, flowers with both abaxial and adaxial nectaries; leaves lanceolate to oblanceolate, tips long-acuminate to caudate; immature leaves with white or ferruginous hairs; pistillate floral bracts deciduous after flowering.

Both varieties are sympatric at the south end of Kootenay Lake, BC. *S. lasiandra* var. *lasiandra* was not in flower and was heavily infested with sawfly galls whereas *S. lasiandra* var. *caudata* was in flower and was not infested by sawflies. In this area the two taxa differed not only in leaf glaucescence, the presence of stomata in the adaxial epidermis, and sawfly attraction, but *S. lasiandra* var. *lasiandra* has stiffer leaves than *S. lasiandra* var. *caudata*. See Table 7 for comparison with *S.* ×*rubens.*

Key to varieties of *Salix lasiandra*

1 Leaves glaucous on abaxial surfaces; staminate flowers with abaxial nectaries that are distinct from adaxial nectaries; petioles with clusters of spherical or foliaceous glands at distal ends; largest medial blades convex or rounded at bases. ..... ***Salix lasiandra var. lasiandra***

1. Leaves not glaucous on abaxial surfaces; staminate flowers with abaxial and adaxial nectaries connate at bases into a cup; petioles with a pair or clusters of foliaceous glands at distal ends; largest medial blades convex or slightly decurrent at bases. .... ***Salix lasiandra var. caudata***

***Salix lasiandra* Benth. var. *caudata* (Nutt.) Sudw.** **tail-leaf willow**

S. pentandra var. *caudata* Nutt., N. Amer. Sylva 1: 61. 1843; *S. lucida* subsp. *caudata* (Nutt.) E. Murray

Petioles 1-15 mm. **Mature leaf blades** amphistomatous; ligulate, very narrowly elliptic, narrowly elliptic, lanceolate, to very narrowly so, 53-170 × 9-31 mm, length-width ratio 3.1-9.8; base acute or rounded; apex caudate or acuminate; abaxial surface not glaucous. **Floral bracts** 2.8-4 mm; apex entire or toothed. **Staminate** catkins 20-50 × 8-15 mm, flowering branchlets 3-27 mm; anthers 0.7-1 mm; filaments hairy only at base; abaxial nectaries present; adaxial nectaries 0.3-0.63 mm; abaxial and adaxial nectaries shallowly coalescent and shallowly cup-shaped. **Pistillate** catkins slender or stout, 30-63 × 9-15 mm, flowering branchlets 10-30 mm; stigma lobes 0.2-0.28-0.32 mm; styles 0.2-0.6 mm; stipes 0.8-4 mm; abaxial nectaries absent, rarely present, (0-) 0.3-0.63 mm; adaxial nectaries 0.2-0.5 mm, abaxial and adaxial nectaries distinct or coalescent and shallowly cup-shaped. Capsules 6-11 mm.

Chromosome number 2*n* = 76, 4x (Dorn 1975b).

Distribution. Canada: Alta., B.C., N.W.T., Sask., Yukon; **U.S.A.**: Alaska, Calif., Colo., Idaho, Mont., Nev., Oreg., S.Dak., Utah, Wash., Wyo. Map 21.

Habitat. Riparian willow alder thickets or openings in poplar woods on sandy to gravelly bars and floodplains; 35-3050 m.

Salix lasiandra* Benth. var. *lasiandra **Pacific willow**

S. lasiandra Benth. Pl. Hartweg. 335. 1857. *S. lancifolia* Andersson, *S. lasiandra* var. *lancifolia* (Andersson) Bebb, *S. lasiandra* var. *recomponens* Raup.

Petioles 2-30 mm. **Mature leaf blades** hypostomatous or with stomata on adaxial surface only along veins or at apex; rarely amphistomatous; narrowly oblong, very narrowly elliptic, narrowly elliptic, lanceolate to very narrowly so, or oblanceolate, 53-170 × 10-35 mm, length-width ratio 3.1-9.8; base acute, rounded or obtuse; apex caudate to acuminate; abaxial surface glaucous. **Floral bracts** 1.7-4 mm; apex entire, toothed, or erose. **Staminate** catkins 21-78 × 9-14 mm, flowering branchlets 5-25 mm; adaxial nectaries 0.2-0.5 mm; abaxial and adaxial nectaries distinct. **Pistillate** catkins 18.5-103 × 6-17 mm, flowering branchlets 6-56 mm; ovaries greenish, greenish brown, or reddish; stigma lobes 0.16-0.29-0.36 mm; styles 0.2-0.8 mm; stipes 0.8-2 mm; abaxial nectaries absent; adaxial nectaries 0.2-0.63 mm; capsules 4-11 mm.

Chromosome number 2*n* = 76, 4x (Wilkinson 1944).

Distribution. Canada: Alta., B.C., Man., N.W.T., Sask., Yukon; **U.S.A.**: Alaska, Ariz., Calif., Colo., Idaho, Mont., Nev., N.Mex., Oreg., Utah, Wash. Map 22.

Habitat. Riparian thickets on file alluvium (loess), sandy or gravelly floodplains, wet sedge fens in forest openings, and in willow-alder thickets along upland drainage ways; 0-2715 m.

Notes. *Salix lasiandra* var. *lasiandra* is characterized by stamens 4 or 5, both abaxial and adaxial nectaries; leaves lanceolate to oblanceolate, tips long-acuminate to caudate; immature leaves with white or ferruginous hairs; pistillate floral bracts deciduous after flowering.

***Salix maccalliana* Rowlee** **MacCalla's willow**

Mid to tall shrubs, 1-5 m, stems erect, plants not colonial or forming colonies by layering. **Branches** flexible at base, not glaucous, glabrous. **Branchlets** red-brown or yellow-brown, not glaucous, puberulent or glabrescent, hairs geniculate, appressed, or spreading. **Proximal leaf** margins serrulate. **Juvenile leaves** reddish, moderately densely short-silky or tomentose, hairs white or ferruginous. **Stipules** minute rudiments or foliaceous on later leaves. **Petioles** convex to flat or shallowly grooved adaxially, 4-15 mm, pilose or pubescent, not glandular at distal end. **Mature leaf blades** ligulate or narrowly oblong, 40-85 × 8-25 mm, length-width ratio 2.9-5.7; hypostomatous or amphistomatous; abaxial surface not glaucous but pale, glabrous or pubescent to glabrescent with short, stiff, white or ferruginous hairs; adaxial surface highly glossy, glabrous or puberulent or tomentose to glabrescent, hairs white and ferruginous; base rounded or cuneate; margins entire, serrulate, or crenate, teeth or glands all around margin; apex acute or sometimes acuminate. **Flowering** as leaves emerge. **Floral bracts** tawny, sometimes bicolor, 1.6-3.6 mm, hairs white or ferruginous, wavy; bract apex rounded or truncate, entire. **Staminate** catkins densely flowered, stout to subglobose, 15-40 mm, peduncles 0.5-4 mm, flowering branchlets 1.5-11 mm; stamens 2; anthers purple becoming yellow, 0.8-1 mm; filaments distinct, hairy on lower half; abaxial nectaries present or absent; adaxial nectaries oblong or narrowly oblong, 0.5-1 mm; abaxial and adaxial nectaries separate, or coalescent and cup-shaped. **Pistillate** catkins densely flowered, slender or stout to subglobose, 24-43 mm, peduncles 1-7 mm, flowering branchlets 3-12 mm; ovaries very densely villous, hairs flattened, ovaries pyriform, beak gradually tapering to style; stigmas broad-cylindrical, lobes 0.28-0.47-0.56 mm; styles 0.8-1.2 mm; stipes 0.8-2 mm; adaxial nectaries oblong, 0.4-1 mm, shorter than stipes, abaxial and adaxial nectaries separate. Capsules 7-11 mm, 12-16 ovules per ovary.

Chromosome number 2*n* = ca. 190, ca. 10x (Löve & Löve 1982; Suda & Argus 1968); 2*n* = ca. 214, ca. 11x (Dorn 1975a); 2*n* = ca. 224, ca. 12x (Suda & Argus 1968).

Distribution. Canada: Alta., B.C., Man., N.W.T., Ont., Que., Sask., Yukon; **U.S.A.**: Minn., N.Dak., Wash. Map 23.

Habitat. Riverbanks, wet slough margins and marshes, treed bogs, and fens; 80-1400 m.

Notes. *Salix maccalliana* is characterized by leaves leathery, glossy and green on both surfaces; juvenile leaves silky with white and ferruginous hairs; ovaries large (6-8 mm) and densely villous, styles long (0.8-1.2 mm); floral bracts tawny or lemon-green; stamens surrounded by a cup-like nectary.

The dodecaploid (12×) ploidal level of *Salix maccalliana*, the highest of any *Salix*, suggests a complex evolutionary origin. Its staminate flowers, and sometimes its pistillate flowers, have both abaxial and adaxial nectaries, resembling some members of both *Salix* subg. *Salix* and subg. *Chamaetia*. Its villous ovaries and persistent pistillate floral bracts resembles *S*. subg. *Chamaetia* and subg. *Vetrix* and its growth form and overall phenetic similarity (Argus 1997) place it near *S*. (subg. *Salix*) sect. *Salicaster*. It is probable that it incorporates genomes from several subgenera making its subgeneric placement arbitrary.

***Salix melanopsis* Nutt.** **dusky willow**

S. exigua subsp. *melanopsis* (Nutt.) Cronquist

Mid to tall shrubs 0.8–4 m, stems erect, plants forming colonies by root shoots. **Branches** flexible at base, not glaucous or weakly so, glabrous, villous (matted hairs) to glabrate. **Branchlets** gray-brown, not glaucous, glabrous, puberulent, villous or sparsely to very densely long-silky to glabrate. Bud scale margins connate. **Proximal leaves** entire to serrulate. **Juvenile leaves** reddish or yellowish green, abaxial surface villous, hairs white. **Stipules** foliaceous. **Petioles** shallowly grooved adaxially, 2–5 mm long, adaxial surface glabrous, not glandular at distal end. **Mature leaf blades** ligulate or narrowly oblong, to narrowly elliptic or narrowly oblanceolate; 30–85 mm long, 6–20 mm wide, length-width ratio 2.8–8; amphistomatous; abaxial surface glaucous or not glaucous, pilose, villous, or long-silky to glabrate, hairs white; adaxial surface shiny, villous to glabrate; base acute; margins entire to spinulose-serrulate or remotely so; apex acute. **Flowering** as leaves emerge or throughout season. **Floral bracts** tawny or light brown, 1.3–2.8 mm long, hairs wavy, apex rounded, entire or erose, pistillate bracts deciduous after flowering. **Staminate** catkins moderately densely flowered, slender to stout, 14–46 mm long, flowering branchlets 2–52 mm long; stamens 2; anthers yellow, 0.6–0.9 mm long; filaments distinct, densely hairy on lower half; abaxial nectaries present; adaxial nectaries narrowly oblong to oblong, 0.4–1.2 mm long; abaxial and adaxial nectaries separate. **Pistillate** catkins moderately densely flowered, slender to stout, 19–52 mm long; flowering branchlets 4–70 mm long; ovaries glabrous, inverse club- or pyriform; stigmas slender-cylindrical, flat with rounded tips or 2 plump lobes with continuous stigmatic surface; styles 0.2–0.4 mm long; stipes 0.2–0.7 mm long; abaxial nectaries absent; adaxial nectaries oblong or ovate, 0.4–1 mm long, longer than stipes. Capsules 4–5 mm long, 10-22 ovules per capsule.

Chromosome number. Unknown

Distribution. **Canada**: Alta., B.C.; **U.S.A**.: Calif., Colo., Idaho, Mont., Nev., Oreg., Wash., Wyo. Map 24.

Habitat. Pioneer on moist to mesic gravel or sandy floodplains of mountain streams and rivers. 0-3050 m, ca. 1060-2100 m in Alberta

Notes. See *Salix interior* for comment on hybridization.

***Salix myrtillifolia* Andersson** **blueberry willow**

Low to mid shrubs, ***0.1-0.6 m***, stems decumbent or erect, plants forming colonies by layering. **Branches** flexible at base, not glaucous, pubescent to glabrescent. **Branchlets** gray-brown or red-brown or yellow-brown or yellow-green, not glaucous (sometimes glaucous), sparsely pubescent, hairs geniculate. **Proximal leaf** margins serrulate. **Juvenile leaves** reddish or yellowish green, glabrous. **Stipules** minute rudiments or foliaceous, up to 5 mm. **Petioles** deeply or shallowly grooved adaxially, 1.5-8 mm, glabrous or pubescent, not glandular at distal end. **Mature leaf blades** elliptic, narrowly elliptic, obovate, or broadly obovate, 17-74 × 8-30 mm, length-width ratio 1.2-4.5; hypostomatous; abaxial surface not glaucous, glabrous; adaxial surface shiny, glabrous; base rounded, cordate, or cuneate; margins serrulate, crenulate, or undulate, teeth or glands all around margin; apex acute, obtuse, or rounded. **Flowering** as leaves emerge.

Floral bracts brown, bicolor, black, or tawny, 0.4-1.1 mm, hairs white, curly or wavy; bract apex rounded, retuse, or acute, entire. **Staminate** catkins moderately densely to densely flowered, stout, 11-36 mm, peduncles 0-3 mm, flowering branchlets 0.5-6 mm; stamens 2; anthers purple becoming yellow, 0.3-0.6 mm; filaments distinct, glabrous; abaxial nectaries absent; adaxial nectaries oblong or square, 0.2-0.34-0.4 mm. **Pistillate** catkins moderately to densely flowered, slender or stout, 12-43 mm, peduncles 0.5-4 mm, flowering branchlets 1.5-12 mm; ovaries glabrous, pyriform, beak slightly bulged below style; stigmas two plump lobes with continuous stigmatic surface, lobes 0.16-0.23-0.32 mm; styles 0.3-0.5 (to 0.7) mm; stipes 0.6-1.7 mm; adaxial nectaries square, oblong, or ovate, 0.2-0.4 mm, shorter than stipes; capsules 4-6 mm, 10-14 ovules per ovary.

Chromosome number 2*n* = 38, 2x (Dorn 1975a; Suda & Argus 1968).

Distribution. Canada: Alta., B.C., Man., N.B., N.W.T., Nunavut, Ont., Que., Sask., Yukon; **U.S.A.**: Alaska, Colo., Wyo. Map 25.

Habitat. Deep moss in treed bogs, fens, river banks, subalpine spruce thickets; 88-2805 m.

Notes. *Salix myrtillifolia* is characterized by a low, decumbent growth form (rarely reaching 1-2 m tall), usually in deep moss; mature leaves green on both surfaces, very short styles (0.3-0.5 mm), and sparsely hairy floral bracts. See *Salix pseudomyrsinites* for discussion of differences and taxonomy. *S. myrtillifolia* may hybridize with *S. candida*. See Table 3 for comparison with *S. pseudomyrsinites* and *S. boothii*.

Table 3. Comparison of three species with leaves not glaucous on abaxial surface: *Salix myrtillifolia, Salix pseudomyrsinites,* and *Salix boothii*

	S. myrtillifolia	***S. pseudomyrsinites***	***S. boothii***
Characteristics			
Height	0.1-0.6 m	1-7 m	0.25-6 m
Juvenile leaves	glabrous	hair white and ferruginous	hair white
Petioles: glands	not glandular	not glandular	glandular or not
Petiole length	1.5-8 mm	2.5-8 mm	3-17 mm
Leaves adaxial midrib	glabrous	pubescent with white and ferruginous hairs	glabrous or sparsely white hairy
♂ nectary	0.2-0.4 mm	0.2-0.6 mm	0.2-0.6 mm
♀ flowering branchlet	1.5-12 mm	0.5-10 mm	1-5 mm

***Salix nivalis* Hook.** **dwarf snow willow**

S. reticulata subsp. *nivalis* (Hooker) Löve, Löve & Kapoor

Dwarf shrubs 0.01–0.04 m, stems trailing to erect, plants forming rhizomatous mats. **Branches** flexible at base, not glaucous or weakly so, glabrous, pubescent to glabrate. **Branchlets** yellow- to red-brown, not glaucous or weakly so, glabrous or pilose. **Bud** scale margins connate, buds split and remain at base of shoot. **Proximal leaves** entire. **Juvenile leaves** yellowish green, abaxial surface glabrous. **Stipules** absent. **Petioles** deeply grooved adaxially, 1.5–7 mm long, adaxial surface glabrous, not glandular at distal end. **Mature leaf blades** elliptic to broadly so; 6–22 mm long, 4–15 mm wide, length-width ratio 1.1–2.8; hypostomatous; abaxial surface glaucous, glabrous; adaxial surface shiny, glabrous; base acute or rounded; margins entire; apex acute to rounded or

retuse. **Flowering** as leaves emerge. **Floral bracts** tawny to light rose, 0.8–1.8 mm long apex rounded, entire. **Staminate** catkins moderately densely flowered, 6–11 flowers per catkin, stout to globose, 4–18 mm long, flowering branchlets 0.5–17 mm long; stamens 2; anthers purple becoming yellow, 0.4–0.6 mm long; filaments distinct, glabrous or hairy at base; abaxial nectaries present; adaxial nectaries narrowly oblong, oblong or square, 0.5–1.2 mm long; abaxial and adaxial nectaries coalescent and cup-shaped. **Pistillate** catkins moderately densely to loosely flowered, 4–17 flowers per catkin, stout to globose, 3.5–12 mm long; flowering branchlets 1–10 mm long; ovaries short-silky, inverse top-shaped; stigmas broad-cylindrical; styles 0.2–0.4 mm long; stipes 0–0.8 mm long; abaxial nectaries present or absent; adaxial nectaries oblong 0.2–0.93 mm long longer than stipes; abaxial and adaxial nectaries separate or coalescent and cup-shaped. Capsules 3–4 mm long, 8-10 ovules per capsule.

Chromosome number. 2*n* = 38, 2x (Löve, Löve, & Kapoor 1971)

Distribution. Canada: Alta., B.C.; U.S.A.: Calif., Colo., Idaho, Mont., Nev., N.Mex., Oreg., Utah, Wash., Wyo. Map 26.

Habitat. Moist tundra in alpine zone; 18-4025 m.

Notes. This species was previously treated as a subspecies of *S. reticulata* (Argus 1986b, 1991); but because the area of overlap between the two is small and evidence of intergradation between them is tenuous it is best treated a separate species (Argus 1997). Its catkins are borne on flowering branchlets that are as long as normal vegetative branchlets. See Table 4 for a comparison with *S. reticulata*.

Table 4. Comparison of *Salix reticulata* and *Salix nivalis*

	S. reticulata	***S. nivalis***
Characteristics		
Stipules	minute rudiments	absent
Leaf length	15-30-66 mm	5-15-25 mm
Leaf abaxial surface	long-silky	glabrous
Leaf adaxial surface	impressed-reticulate	plane or inconspicuously reticulate
Leaf stomata	amphistomatous	hypostomatous
Catkin flower number	20-40 or more	2-10-25
Filaments	hairy lower half or all over	glabrous or hairy only at base
Ovary shape	obclavate or pyriform	obturbinate
Capsule length	4.5-5 mm	3-4 mm
Ovules per ovary	12-18	6-10

***Salix pedicellaris* Pursh** **bog willow**

S. pedicellaris var. *hypoglauca* Fernald

Low to mid shrubs, 0.2-1.5 m, stems erect or decumbent, plants forming colonies by layering. **Branches** flexible at base, not glaucous, glabrous or glabrescent. **Branchlets** yellow-brown or red-brown, or red-yellow, not glaucous, glabrous or sparsely velvety with minute hairs to glabrescent. **Proximal leaf** margins entire. **Juvenile leaves** reddish or yellowish green, translucent, glabrous or puberulent, or pubescent, hairs white or ferruginous. **Stipules** minute rudiments. **Petioles** deeply or shallowly grooved adaxially, 3-8 mm, glabrous or puberulent, not glandular at distal end. **Mature leaf blades** narrowly

oblong, oblong, narrowly elliptic, elliptic, broadly elliptic, narrowly oblanceolate, or oblanceolate, 19-69 × 5-20 mm, length-width ratio 1.8-4.9; leathery; hypostomatous; abaxial surface glaucous, glabrous; adaxial surface dull, glaucous, glabrous; base acute or rounded; margins entire; apex acute or rounded. **Flowering** as leaves emerge. **Floral bracts** tawny or light rose, 0.8-1.6 mm, hairs white, straight or wavy; bract apex rounded, entire. **Staminate** catkins loosely flowered, 9-20 mm, flowering branchlets 3-10 mm; stamens 2; anthers yellow, 0.4-0.6 mm; filaments distinct or connate less than half, glabrous or hairy on lower half or hairy only at base; abaxial nectaries absent; adaxial nectaries oblong or narrowly oblong, 0.5-1.1 mm. **Pistillate** catkins loosely flowered, 13-30 mm, flowering branchlets 15-50 mm; ovaries glabrous, obclavate, beak abruptly tapering to style; stigmas flat with rounded tips or broad-cylindrical, lobes 0.2-0.25-0.36 mm; styles 0.1-0.2 mm; stipes 2.1-3.2 mm; adaxial nectaries oblong, 0.2-1.4 mm, shorter than stipes; capsules 4-8 mm, 4-6 ovules per ovary.

Chromosome number 2*n* = 38, 2x (Löve 1954); 2*n* = 57, 3x (Suda & Argus 1969); 2*n* = 76, 4x (Löve & Löve 1982; Löve & Ritchie 1966).

Distribution. Canada: Alta., B.C., Lab., Man., N.B., Nfld., N.W.T., N.S., Nunavut, Ont., Que., Sask., Yukon; **U.S.A.**: Conn., Idaho, Ill., Ind., Iowa, Maine, Mass., Mich., Minn., N.H., N.J., N.Dak., N.Y., Ohio, Oreg., Pa., R.I., Vt., Wash., Wis. St. Pierre and Miquelon. Map 27.

Habitat. Bogs, fens, and treed bogs.

Notes. *Salix pedicellaris* is characterized by leaves leathery, glabrous, and glaucous on both surfaces and reticulate adaxially; catkins loosely flowered; ovaries reddish and glabrous; and stipes long (2.1-3.2 mm). Hybridizes with *S. athabascensis* (Argus 1973); see Table 1 for comparison.

***Salix pentandra* L.** **bay-leaf willow, bay willow, laurel willow**

Tall shrubs to trees, 5-15 m, stems erect, plants not colonial. **Branches** flexible at base, not glaucous, glabrous. **Branchlets** yellow-green or red-brown or brownish, glossy, not glaucous, glabrous. **Proximal leaf** margins entire or serrulate. **Juvenile leaves** reddish, glabrous. **Stipules** minute rudiments or foliaceous, caducous. **Petioles** shallowly or deeply grooved adaxially, margins covering groove; base weakly ventricose; 5-15 mm, glabrous, with glandular dots or glandular lobes at distal end. **Mature leaf blades** narrowly elliptic, elliptic, or lanceolate, 50-135 × 20-50 mm, length-width ratio 2-4; leathery; hypostomatous; abaxial surface not glaucous but pale, glabrous, dark green; adaxial surface highly glossy, glabrous; base rounded, obtuse, or cuneate; margins serrulate, teeth or glands all around margin; apex acuminate. **Flowering** as leaves emerge. **Floral bracts** tawny, sometimes greenish, 2-4 mm, hairs white or white and ferruginous, wavy or straight; bract apex rounded, acute, or truncate, entire or toothed; pistillate bracts deciduous after flowering. **Staminate** catkins densely flowered, slender or stout, 24-85 mm, peduncles 3-11 mm, flowering branchlets 9-21 mm; stamens 4-10; anthers yellow, 0.5-0.6 mm; filaments distinct, hairy on lower half; abaxial nectaries present; adaxial nectaries square, ovate, or oblong, 0.5-1.5 mm; abaxial and adaxial nectaries separate, or coalescent and cup-shaped. **Pistillate** catkins moderately to densely flowered, slender or stout, 27-70 mm, peduncles 2-13 mm, flowering branchlets 9-42 mm; ovaries glabrous, pyriform, beak gradually tapering to style; stigmas flat with

rounded tips, lobes 0.36-0.5-0.6 mm; styles 0.4-0.6 mm; stipes 0.5-1.6 mm; adaxial nectaries oblong, square, or ovate, 0.4-0.8 mm, shorter than or equal to stipes, abaxial and adaxial nectaries coalescent and cup-shaped or separate. Capsules 6-9 mm, 18-22 ovules per ovary.

Chromosome number. 2*n* = 76, 4x (Zsuffa & Raj 1981).

Distribution. Canada: Alta., B.C., Man., N.B., Nfld., N.S., Ont., Que., Sask.; **U.S.A.**: Alaska, Colo., Conn., D.C., Ill., Iowa, Ky., Maine, Md., Mass., Mich. Minn., Mont., Nebr., N.H., N.J., N.C., N.Y., Ohio, Pa., R.I., S.Dak., Vt., Va., Wis., Wyo. Native. Eurasia.

Habitat. Introduced and naturalized.

***Salix petiolaris* Sm.** **meadow willow**

Tall shrubs, 1-6 m, stems erect, plants not colonial. **Branches** flexible at base, not glaucous, puberulent to glabrescent. **Branchlets** yellowish or yellow-green, not glaucous (sometimes so), velvety or pubescent. **Proximal leaf** margins entire. **Juvenile leaves** yellowish green, moderately dense long-silky, hairs white or ferruginous. **Stipules** absent or minute rudiments. **Petioles** shallowly grooved adaxially, 3-11 mm, puberulent, not glandular at distal end. **Mature leaf blades** ligulate or very narrowly elliptic, 38-110 × 6-19 mm, length-width ratio 5-9; hypostomatous; abaxial surface glaucous, long-silky to glabrescent, hairs white or ferruginous; adaxial surface dull or shiny, glabrous or pubescent, hairs white or ferruginous; base acute; margins entire or serrate, teeth or glands at distal end, or all around margin; apex acute. **Flowering** just before leaves emerge. **Floral bracts** tawny, light rose, brown, or bicolor, 1-2 mm, hairs white, straight; bract apex rounded, entire. **Staminate** catkins densely flowered, 10-35 mm, flowering branchlets 0-4 mm; stamens 2; anthers purple becoming yellow, 0.4-0.6 mm; filaments distinct, hairy only at base; abaxial nectaries absent; adaxial nectaries square, ovate, or oblong, 0.3-0.7 mm. **Pistillate** catkins loosely flowered, 10-35 mm, flowering branchlets 2-7 mm; ovaries sparsely short-silky, hairs flattened, ovaries pyriform, beak abruptly tapering to style; stigmas slender-cylindrical, lobes 0.24-0.43-0.6 mm; styles 0.2-0.5 mm; stipes 1.5-4 mm; adaxial nectaries oblong or ovate, 0.3-0.88 mm, shorter than stipes; capsules 5-9 mm, 6-12 ovules per ovary.

Chromosome number. 2*n* = 38, 2x (Löve & Löve 1982; Suda & Argus 1968; Zsuffa & Raj 1981).

Distribution. Canada: Alta., B.C., Man., N.B., N.W.T., N.S., Ont., P.E.I., Que., Sask.; **U.S.A.**: Colo., Conn., Ill., Ind., Iowa, Maine, Mass., Mich., Minn., Mo., Nebr., N.H., N.J., N.Dak., N.Y., Ohio, Pa., S.Dak., Vt., Wash., Wis. Map 28.

Habitat. Wet thickets; 180-1450 m

***Salix petrophila* Rydb.** **Rocky Mountain willow**

Salix arctica auctt., *S. arctica* Pall. subsp. *petraea* (Andersson) Löve, Löve and Kapoor)

Dwarf shrubs 0.02–0.1 m, stems decumbent to trailing**,** plants forming mats by layering. **Branches** flexible at base, not glaucous to strongly so, glabrous. **Branchlets** yellowish, yellow-green to yellow-brown, not glaucous or weakly so, glabrous, pubescent

to glabrate. **Bud** scale margins connate. **Proximal leaves** entire. **Juvenile leaves** yellowish green, abaxial surface villous, hairs white. **Stipules** absent, minute rudiments or foliaceous narrow. **Petioles** deeply grooved adaxially, 2–13 mm long, adaxial surface glabrous, not glandular at distal end. **Mature leaf blades** very narrowly elliptic to broadly elliptic, oblanceolate or obovate; 19–44 mm long, 7–21 mm wide, length-width ratio 1.5–4.6; amphistomatous; abaxial surface glaucous, pilose to glabrate, hairs white; adaxial surface dull or shiny, pilose or villous to glabrate, hairs white; base acute to rounded; margins entire; apex acute to acuminate, obtuse or rounded. **Flowering** as leaves emerge. Floral bracts dark brown or tawny, 0.5–3.6 mm long, hairs straight to wavy, apex acute rounded, entire or bifid. **Staminate** catkins moderately densely flowered, stout, 14–28 mm long, flowering branchlets 4–13 mm long; stamens 2; anthers yellow, 0.4–0.8 mm long; filaments distinct to connate less than half, glabrous; abaxial nectaries present or absent; adaxial nectaries narrowly oblong, oblong or square, 0.4–1.2 mm long; abaxial and adaxial nectaries separate. **Pistillate** catkins moderately densely flowered, slender to stout, 18–47 mm long; flowering branchlets 2–40 mm long; ovaries villous, pyriform inverse top-shaped; stigmas broad- or slender-cylindrical; styles 0.4–1.6 mm long; stipes 0.2–0.8 mm long; abaxial nectaries absent; adaxial nectaries oblong, square, narrowly oblong or ovate, 0.5–1.2 mm long, equal to or longer than stipes. Capsules 3.6–5 mm long, 6-12 ovules per capsule.

Chromosome number. 2*n* = 76, 4x (Löve, Löve, & Kapoor 1971)

Distribution. Canada: Alta., B.C.; U.S.A.: Calif., Colo., Idaho, Mont., Nev., N.Mex., Oreg., Utah, Wash.(litt.), Wyo. Map 29.

Habitat. Alpine snow beds, meadows, talus slopes and open dry pool beds in spruce-fir forest; 1670-2130 m.

Notes. *Salix petrophila* is often included in *S. arctica* (cf. Argus 1993); but southern cordilleran populations, extending as far north as southern B.C. and Alberta, seem to be a distinct taxon (Argus 1997). The exact northern limits of this species still need to be established, but in Alberta it does not seem to extend north of Waterton Lakes National Park except for a population on springy slopes above Agnes Lake, Banff National Park, which may be this species. Alpine habitat between Waterton Lakes and Banff national parks, e.g. Mt. Armstrong, Tornado Mountain, and Crowsnest Pass, should be explored for *S. petrophila* and *S. arctica*. See *S. arctica* for comments and Table 5 for a comparison.

Sometimes the filaments and anthers of *S. petrophila* are flushed with purple.

Table 5. Comparison of *Salix arctica* and *Salix petrophila*

	S. arctica	***S. petrophila***
Characteristics		
Branchlets	usually villous, sometimes glabrous	usually glabrous, sometimes pilose
Floral bracts	brown to black	tawny to light brown
Proximal leaves abaxial surface	with long, straight hairs	glabrous or with long, straight hairs
Stipules	usually foliaceous	absent or rudimentary
Style length	0.6-2.2 mm	0.4-1.6 mm
Stipe length	0.2-1.6 mm	0.2-0.8 mm

Salix planifolia Pursh **tea-leaf willow, plane-leaf willow**

S. phylicifolia subsp. *planifolia* (Pursh) Hiitonen.

Low to tall shrubs, 0.15-4 m, stems erect or decumbent, plants not colonial or forming colonies by layering. **Branches** flexible at base, not glaucous or weakly to strongly so, glabrous or pubescent to glabrescent. **Branchlets** yellow-brown, red-brown, or dark brownish, not glaucous, glabrous or pubescent, villous, or short-silky to glabrescent. **Proximal leaf** margins entire or serrulate. **Juvenile leaves** reddish or yellowish green, translucent, glabrous or pubescent to densely long-silky, hairs white or ferruginous. **Stipules** minute rudiments, absent, or foliaceous 1--4.5 mm, narrowly oblong or ovate, sometimes persistent for one year. **Petioles** shallowly grooved adaxially, 2-13 mm, glabrous or pilose or short-silky, not glandular at distal end. **Mature leaf blades** narrowly oblong, narrowly elliptic, elliptic, or oblanceolate, 20-65 × 5-23 mm, length-width ratio 1.5-4.7; hypostomatous or with stomata on adaxial surface only along veins or at apex; abaxial surface glaucous, glabrous or short-silky or long-silky to glabrescent, hairs white or ferruginous; adaxial surface highly glossy, glabrous or short-silky to glabrescent; base acute; margins entire, serrulate, or crenate, teeth or glands at proximal end or all around margin; apex acute. **Flowering** before leaves emerge. **Floral bracts** brown or black, 1-3.2 mm, hairs white, straight; bract apex acute, obtuse, or rounded, entire. **Staminate** catkins densely flowered, stout, subglobose, or globose, 16-39 mm, peduncles 0-3 mm, flowering branchlets 0-4 mm; stamens 2; anthers purple becoming yellow, 0.5-0.7 mm; filaments distinct, glabrous or hairy only at base; abaxial nectaries absent; adaxial nectaries narrowly oblong or oblong, 0.4-1.1 mm. **Pistillate** catkins densely flowered, slender or stout to subglobose or globose, 15-64 mm, peduncles 1-6 mm, flowering branchlets 0-5 mm; ovaries densely short-silky to long-silky, hairs flattened, ovaries pyriform, beak slightly bulged below style or gradually tapering to style; stigmas slender-cylindrical, lobes 0.36-0.52-1.1 mm; styles 0.5-2 mm; stipes 0.3-0.8 mm; adaxial nectaries oblong, square, or ovate, 0.4-1.3 mm, shorter than, equal to, or longer than stipes; capsules 2.5-6 mm, 11-12 ovules per ovary.

Chromosome number. 2*n* = 57, 3x (Suda & Argus 1968, 1969); 2*n* = 76, 4x (Dorn 1875b; Löve & Löve 1964, 1966; Suda & Argus 1968).

Distribution. Canada: Alta., B.C., Lab., Man., Nfld., N.W.T., Nunavut, Ont., Que., Sask., Yukon; **U.S.A.**: Ariz., Calif., Colo., Idaho, Maine, Mich., Minn., Mont., Nev., N.H., N.Mex., Oreg., S.Dak., Utah, Vt., Wash., Wis., Wyo. Eurasia. Map 30.

Habitat. Willow-dwarf birch thickets in fens and on edges of lakes and streams, treed bogs, openings in white spruce forests. 122-4000 m.

Notes. The stipules of *S. planifolia* are usually rudimentary but are sometimes green or brownish, foliaceous, narrowly oblong or ovate lobes, 1-4.5 mm. Occasionally they persistent for more than one year.

***Salix prolixa* Andersson** **Mackenzie's willow**

S. eriocephala var. *mackenzieana* (Hook.) Dorn; *S. mackenzieana* Barratt; *S. rigida* Muhl. *sensu* Argus 1973.

Mid to tall shrubs, 1-5 m, stems erect, plants not colonial. **Branches** flexible at base, not glaucous or weakly so with sparkling wax crystals, glabrous or moderately villous to glabrescent. **Branchlets** yellow-brown or red-brown, not glaucous or weakly so with

sparkling wax crystals, glabrous or velvety to glabrescent. **Proximal leaf** margins entire. **Juvenile leaves** reddish or yellowish green, glabrous or pilose or sparsely long-silky. **Stipules** foliaceous. **Petioles** convex to flat adaxially, 6-12 mm, glabrous or pilose, not glandular at distal end. **Mature leaf blades** narrowly oblong, narrowly elliptic, lanceolate, or obovate, 50-150 × 10-53 mm, length-width ratio 2.4-4.5; hypostomatous, or with stomata on adaxial surface only along veins or at apex; abaxial surface glaucous, glabrous; adaxial surface dull, glabrous or pubescent or pilose to glabrescent; base obtuse, rounded, or cordate; margins serrate, serrulate, or spinulose-serrulate, teeth or glands all around margin; apex acuminate. **Flowering** as leaves emerge or sometimes just emergence. **Floral bracts *brown***, sometimes tawny, 0.8-1.6 mm, hairs white, wavy; bract apex acute or rounded, entire. **Staminate** catkins densely flowered, slender or stout, 20-38 mm, peduncles 1-3 mm, flowering branchlets 0.5-2 mm; stamens 2; anthers purple becoming yellow, 0.5-0.6 mm; filaments distinct or connate less than half, glabrous; abaxial nectaries absent; adaxial nectaries oblong or narrowly so, 0.4-1 mm. **Pistillate** catkins moderately densely to loosely flowered, slender or stout, 17-62 mm, peduncles 0-5 mm, flowering branchlets 0.5-6 mm; ovaries glabrous, pyriform, beak gradually tapering to style or slightly bulged below style; stigmas flat with rounded tips, two plump lobes with continuous stigmatic surface, or slender-cylindrical, lobes 0.16-0.28-0.4 mm; styles 0.3-1 mm; stipes 1.3-4.2 mm; adaxial nectaries oblong, square, or flask-shaped, 0.3-1 mm, shorter than stipes; capsules 4-6 mm, 12-22 ovules per ovary.

Chromosome number. Unknown.

Distribution. Canada: Alta., B.C., N.W.T., Yukon; **U.S.A.**: Calif., Idaho, Mont., Nev., Oreg., Wash., Wyo. Map 31.

Habitat. Forest openings, sand and gravel bars and mud flats along rivers; 0-2255 m.

Notes. See *Salix famelica* for comments. See Table 6 for comparison with *S. barclayi* and *S. pseudomonticola*.

Table 6. Comparison of *Salix prolixa, Salix pseudomonticola,* and *Salix barclayi*

	S. prolixa	***S. pseudomonticola***	***S. barclayi***
Characteristics			
Juvenile leaves	reddish or green	reddish	green
Proximal leaves	entire	entire or serrulate	serrulate
Petioles	reddish	reddish	green
Flowering time	as leaves emerge	before leaves emerge	as leaves emerge
♂ flowering branchlet	0.5-2 mm	0 mm	0-17 mm
♀ branchlet	0.5-6 mm	0-5 mm	4-24 mm

***Salix pseudomonticola* C. R. Ball in Standley** **false mountain willow**

S. padophylla Rydb.; *S. monticola* auct. non Bebb

Mid to tall shrubs, 1-6 m, stems erect, plants not colonial. **Branches** flexible at base, not glaucous or weakly so, glabrous or glabrescent. **Branchlets** yellowish, yellow-green, red-brown, or brownish, not glaucous or strongly so, glabrous or pilose or villous to glabrescent. **Proximal leaf** margins entire or serrulate. **Juvenile leaves** reddish, glabrous or sparsely pubescent, hairs white or ferruginous. **Stipules** foliaceous. **Petioles** shallowly grooved or convex to flat adaxially, 6-20 mm, short-silky or velvety, not glandular at

distal end. **Mature leaf blades** broadly elliptic, elliptic, broadly obovate, narrowly elliptic, or ovate, 25-100 × 12-35 mm, length-width ratio 1.4-3; hypostomatous; abaxial surface glaucous, glabrous or pubescent, or pilose to glabrescent; adaxial surface shiny or dull, glabrous or puberulent, pubescent (especially on midrib), or pilose to glabrescent; base obtuse, rounded, or subcordate; margins serrulate or crenate, teeth or glands all around margin; apex acute or subacuminate. **Flowering** before leaves emerge. **Floral bracts** brown or black, 1-2.4 mm, hairs white, straight; bract apex rounded or acute, entire. **Staminate** catkins densely flowered, stout, 16-37 mm, peduncles 0-3 mm, flowering branchlets 0 mm; stamens 2; anthers purple becoming yellow, 0.4-0.5 mm; filaments distinct or connate less than half, glabrous; abaxial nectaries absent; adaxial nectaries oblong, 0.3-1 mm. **Pistillate** catkins densely to moderately densely flowered, slender or stout to subglobose or globose, 15-70 mm, peduncles 0-6 mm, flowering branchlets 0-5 mm; ovaries glabrous, pyriform or obclavate, beak gradually tapering to style; stigmas flat with pointed tips or two plump lobes with continuous stigmatic surface, lobes 0.1-0.21-0.29 mm; styles 0.5-1.8 mm; stipes 0.5-0.8-3 mm; adaxial nectaries oblong or flask-shaped, 0.3-0.8 mm, shorter than stipes; capsules 4-7 mm, 18 ovules per ovary.

Chromosome number. 2*n* = 38, 2x (Dorn 1975, Löve & Löve 1982, Suda & Argus 1968).

Distribution. Canada: Alta., B.C., Man., N.W.T., Ont., Que., Sask., Yukon; **U.S.A.**: Alaska, Idaho, Minn., Mont., S.Dak., Wash., Wyo. Map 32.

Habitat. Moist fens in drainage ways in white spruce forests, treed bogs, balsam poplar forests, and river floodplains; 3-2315 m.

Notes. *Salix pseudomonticola* is characterized by flowering before leaves emerge; catkins sessile; juvenile leaves, petioles, and lower midribs reddish; stipules small and rounded; and leaves and branchlets sparsely hairy. Branches older than 2 years have a distinctive pattern, which consists of a series of longitudinal splits in epidermis produced as the branch expands. The edge of the epidermis around the split, where it has separated from the branch, is yellow and contrasts with the red-brown branch to which the epidermis still adheres. See Table 6 for a comparison with *S. barclayi* and *S. prolixa*.

Vegetative specimens of *Salix pseudomonticola* with yellow-brown branches can be confused with *S. famelica*. It can be separated by its juvenile leaves with margins prominently and closely gland-dotted; stipules usually prominent, although sometimes caducous; broader leaves (1.4-3 times longer than wide vs. 2.6-7 times longer than wide in *S. famelica*), and petioles that are slender and often longer in relation to leaf length.

***Salix pseudomyrsinites* Andersson** **tall blueberry willow**

S. myrtillifolia var. *pseudomyrsinites* (Andersson) Hultén; *S. myrtillifolia* var. *cordata* (Andersson) Dorn; *S. novae-angliae* auct.

Mid to tall shrubs, 1-7 m, stems erect, plants not colonial. **Branches** flexible at base, not glaucous, villous to glabrescent. **Branchlets** gray-brown, red-brown, yellow-brown, or yellow-green, not glaucous or weakly so, villous, pilose, or tomentose. **Proximal leaf** margins serrulate. **Juvenile leaves** reddish or yellowish green, glabrous or villous, pubescent, or short-silky, hairs white or ferruginous, especially on midrib. **Stipules** foliaceous or minute rudiments. **Petioles** shallowly or deeply grooved adaxially, 2.5-8

mm, glabrous or villous, not glandular at distal end. **Mature leaf blades** elliptic, oblanceolate, narrowly elliptic, oblong, broadly elliptic, or obovate, 32-109 × 10-47 mm, length-width ratio 1.8-4.8; hypostomatous or amphistomatous; abaxial surface not glaucous, glabrous or pilose to glabrescent, hairs white or ferruginous; adaxial surface shiny, glabrous or pubescent, pilose, short-silky. or velvety to glabrescent, hairy especially on midrib, hairs white or ferruginous; base rounded, cordate, or cuneate; margins entire, crenate, or serrulate, teeth or glands all around margin; apex acute, obtuse, or rounded. **Flowering** as leaves emerge. **Floral bracts** brown, bicolor, black, or tawny, 0.56-1.1 mm, hairs white, wavy or curly; bract apex rounded, retuse, entire. **Staminate** catkins densely to loosely flowered, stout, 15-34 mm, peduncles 0.5-2.5 mm, flowering branchlets 0.5-12 mm; stamens 2; anthers purple becoming yellow, 0.4-0.7 mm; filaments distinct, glabrous; abaxial nectaries absent; adaxial nectaries oblong or square, 0.2-0.4-0.6 mm. **Pistillate** catkins moderately densely to densely flowered, slender or stout, 10-60 mm, peduncles 0.5-6 mm, flowering branchlets 0.5-10 mm; ovaries glabrous, pyriform, beak slightly bulged below style; stigmas two plump lobes with continuous stigmatic surface or broad-cylindrical, lobes 0.16-0.24-0.32 mm; styles 0.4-1.6 mm; stipes 0.8-1.4 mm; adaxial nectaries square or oblong, 0.2-0.4 mm, shorter than stipes; capsules 4.4-6.4 mm, 12-18 ovules per ovary.

Chromosome number. 2*n* = 76, 4× (Dorn 1975a).

Distribution. Canada: Alta., B.C., Man., N.W.T., Nunavut, Ont., Sask., Yukon; **U.S.A.**: Alaska. Map 33.

Habitat. Shores of lakes and rivers, dwarf birch thickets, fens, marl bogs, and rarely treed bogs; 45-1000 m.

Notes: *Salix pseudomyrsinites* and *S. myrtillifolia*, although sometimes treated as conspecific (Dorn 1975a), deserve species rank. They are distinct in their habit, habitat, and general appearance, including the glossiness of leaves, as well as a number of technical characteristics (Viereck and Little 1972 and Argus 1973, 1997). *S. pseudomyrsinites* is a tall, erect shrub (1-7 m) of riparian habitats; its juvenile leaves are pubescent with hairs persisting on mature leaves, at least on the adaxial midribs, stipules are usually prominent and leaf-like, and styles tend to be longer (0.4-1.6 mm). *S. myrtillifolia* is a low, decumbent shrub (0.1-0.6 (-1) m) of treed bogs and fens; its juvenile and mature leaves are typically glabrous, stipules usually are rudimentary, and styles tend to be shorter (0.3-0.5 mm). There is no field evidence of hybridization but, infrequently, herbarium specimens appear to be intermediate inasmuch as they have the habit or habitat of one species and the leaf hairiness of the other. The species also differ in their chromosome number. *S. myrtillifolia* is diploid, based on two counts from Saskatchewan (Suda and Argus 1968) and *S. pseudomyrsinites* is tetraploid, based on three counts from Alberta (Dorn 1975a). See Table 3 for comparison with *S. myrtillifolia* and *S. boothii*.

The nomenclature of these species is confused (Dorn 1975a). When treating them as varieties Hultén (1968) used the name *S. myrtillifolia* var. *pseudomyrsinites* (Andersson) Ball ex Hultén and Dorn (1975a) used the name *S. myrtillifolia* var. *cordata* (Andersson) Dorn. At the species level the name *S. novae-angliae* Andersson was used by Argus (1973) and Viereck and Little (1972). The latter name, however, is illegitimate (Dorn 1975a) and has been replaced by *S. pseudomyrsinites* Andersson (Argus 1997, 2007).

***Salix pyrifolia* Andersson** **balsam willow**

S. balsamifera Barratt ex Andersson.

Low to tall shrubs, 0.4-4 m, stems erect, plants not colonial. **Branches** flexible at base, not glaucous, glabrous. **Branchlets** red-brown, yellow-brown, or yellowish, not glaucous or weakly so, glabrous or sparsely velvety. **Proximal leaf** margins serrulate, abaxially surface with long, straight hairs, adaxially surface rugulose. **Juvenile leaves** yellowish green, translucent, glabrous or pilose. **Stipules** foliaceous, caducous. **Petioles** convex to flat or shallowly grooved adaxially, 7-20 mm, glabrous or sparsely velvety, not glandular at distal end. **Mature leaf blades** narrowly oblong, oblong, elliptic, or broadly elliptic, 30-103 × 19-40 mm, length-width ratio 1.5-3.4; hypostomatous; abaxial surface glaucous, glabrous; adaxial surface shiny to highly glossy, glabrous; base cordate or rounded; margins entire, serrulate, irregularly serrate, or undulate, teeth or glands all around margin; apex acute or acuminate. **Flowering** as leaves emerge or staminate just before leaves emerge. **Floral bracts** tawny, 1-2.4 mm, hairs white, straight or wavy; bract apex acute or obtuse, entire. **Staminate** catkins densely to moderately densely flowered, stout or slender, 18-59 mm, peduncles 0.5-5 mm, flowering branchlets 1-5 mm; stamens 2; anthers yellow, 0.5-0.8 mm; filaments distinct, glabrous or sparsely hairy at base; abaxial nectaries absent; adaxial nectaries square or ovate, 0.3-0.45 mm. **Pistillate** catkins loosely flowered, stout or slender, 20-80 mm, peduncles 1-10 mm, flowering branchlets 2-22 mm; ovaries glabrous, obclavate, beak slightly bulged below style; stigmas broad-cylindrical or two plump lobes with continuous stigmatic surface, lobes 0.2-0.23-0.32 mm; styles 0.4-0.5 mm; stipes 1.8-3.5 mm; adaxial nectaries narrowly ovate or square, 0.3-0.7 mm, shorter than stipes; capsules 7-8 mm, 10-19 ovules per ovary.

Chromosome number. 2*n* = 38, 2× (Dorn 1976; Löve & Löve 1982).

Distribution. Canada: Alta., B.C., Lab., Man., N.B., Nfld., N.W.T., N.S., Ont., P.E.I., Que., Sask., Yukon; **U.S.A.**: Maine, Mich., Minn., N.H., N.Y., Vt., Wis. Map 34.

Habitat. Fens, wet lake and slough margins, and treed bogs.

Notes. *Salix pyrifolia* is characterized by juvenile leaves membranaceous and translucent; mature leaves subcoriaceous, a reticulate abaxial surface, and often a cordate base. The buds and foliage are reported to have a balsam-like fragrance.

***Salix raupii* Argus** **Raup's willow**

Mid shrubs, ***1.2-1.8 m***, stems erect, plants not colonial. **Branches** flexible at base, not glaucous, glabrous. **Branchlets** yellow-brown, not glaucous, glabrous. **Proximal leaf** margins serrulate. **Juvenile leaves** yellowish green, glabrous. **Stipules** foliaceous. **Petioles** deeply grooved adaxially, 5-9 mm, glabrous, not glandular at distal end. **Mature leaf blades** narrowly elliptic, 32-58 x 12-19 mm, length-width ratio 2-3.3; hypostomatous; abaxial surface glaucous, glabrous; adaxial surface shiny, glabrous; base rounded, or acute; margins entire; apex acute, or obtuse (pointed tip). **Flowering** as leaves emerge. **Floral bracts** tawny or bicolor, 1.3-2.5 mm; bract apex rounded, entire. **Staminate** catkins moderately densely flowered, stout, 16-40 mm, peduncles 1.5-2.5 mm, flowering branchlets 6-7 mm; stamens 2; anthers yellow or purple becoming yellow, 0.4-0.7 mm; filaments distinct, glabrous; abaxial nectaries present; adaxial nectaries narrowly

oblong, 0.6-1 mm; abaxial and adaxial nectaries separate. **Pistillate** catkins moderately densely flowered, stout, 16-37 mm, peduncles 3-5 mm, flowering branchlets 4-7 mm; ovaries glabrous or puberulent, ovaries pyriform, beak slightly bulged below style; stigmas broad-cylindrical, lobes 0.32-0.52 mm; styles 0.6-0.8 mm; stipes 0.4-1.2 mm; adaxial nectaries narrowly oblong or oblong, 0.5-1.1 mm, equal to stipes or longer than stipes; capsules 4.4-8 mm, 12 ovules per ovary.

Chromosome number. Unknown.

Distribution. Canada: Alta., B.C., N.W.T., Yukon. Map 35.

Habitat. Thickets in moist, open forests and on gravel floodplains; 800-1500 m.

Notes. *Salix raupii*, reported for Alberta in 1986 (Argus 1986), superficially resembles a glabrous form of *Salix glauca* var. *villosa*. Thin layer chromatography of leaf phenolics, revealed a pattern similar to *Salix glauca* vars. *villosa* and *acutifolia* and *S. athabascensis* (Argus 1974). Phenetically its nearest neighbors are *S. glauca s. l.* and *S. athabascensis* (Argus 1997). It clusters with *S. athabascensis* and has been placed in *S.* sect. *Myrtilloides*, but it is evidently very close to *S. glauca* and other members of *S.* sect. *Glaucae*.

***Salix reticulata* L.** **net-vein willow, net-leaf willow**

S. orbicularis Andersson, *S. reticulata* subsp. *orbicularis* (Andersson) Flod., *S. reticulata* var. *gigantifolia* C. R. Ball, *Salix reticulata* subsp. *glabellicarpa* Argus

Dwarf shrubs, 0.3-15 cm, **stems** trailing, plants forming colonies by layering. **Branches** flexible at base, not glaucous or weakly so, glabrous. **Branchlets** yellow-brown or red-brown, not glaucous or weakly so, glabrous. **Proximal leaf** margins entire. **Juvenile leaves** yellowish green, glabrous. **Stipules** minute rudiments. **Petioles** deeply grooved adaxially, margins sometimes covering groove, 3-46 mm, glabrous, not glandular or with glandular dots at distal end. **Mature leaf blades** oblong, broadly oblong, broadly elliptic, subcircular, circular, or obovate, 12-66 × 8-50 mm, length-width ratio 1-1.5; amphistomatous or with stomata on adaxial surface only along veins or at apex; abaxial surface glaucous, white long-silky to glabrescent; adaxial surface shiny or highly glossy, glabrous; venation campylodromous; base obtuse, rounded, or cordate; margins entire or crenulate, teeth or glands all around margin or only at proximal end; apex obtuse, rounded. **Flowering** as leaves emerge. **Floral bracts** tawny or brown; bract apex rounded, glabrous, entire or bifid ferruginous. **Staminate** catkins moderately densely flowered, slender, stout, or subglobose, 6-31 mm, peduncles 4-32 mm, flowering branchlets 2-28 mm; stamens 2; anthers purple becoming yellow, 0.3-0.4 mm; filaments distinct, hairy all over or on lower half; abaxial nectaries present; adaxial nectaries oblong or ovate, 0.5-1 mm; abaxial and adaxial nectaries coalescent into a cup. **Pistillate** catkins densely flowered, slender or stout, 6-35 mm, peduncles 5-46 mm, flowering branchlets 2-37 mm; ovaries moderately to very densely short-silky or sometimes glabrous, hairs flattened, ovaries obclavate or pyriform, beak slightly bulged below or abruptly tapering to style; stigmas broad-cylindrical, stigmas lobes 0.2-0.26-0.36 mm; styles 0.2-0.4 mm; stipes 0-0.8 mm; abaxial nectaries present or rarely absent, 0-0.5 mm; adaxial nectaries narrowly oblong or oblong, 0.5-1 mm, equal to or longer than stipes, abaxial and adaxial nectaries separate or coalescent and coalescent and cup-shaped.

Capsules 4.5-5 mm, 12-18 ovules per ovary. Catkins borne on flowering branchlets that are as long as normal vegetative branchlets.

Chromosome number. 2*n* = 38, 2× (Hedberg, 1967; Löve 1954; Löve & Löve 1982; Packer & McPherson 1974; Suda & Argus 1969). Russia: 2× (Zhukova 1967, 1980; Zhukova et al.1973; Zhukova & Petrovsky 1976, 1977; Petrovsky & Zhukova 1983b).

Distribution. Canada: Alta., B.C., Lab., Man., Nfld., N.W.T., Nunavut, Ont., Que., Sask., Yukon; **U.S.A.**: Alaska. Eurasia. Map 36.

Habitat. Polygonal tundra, dry tussock tundra, partially stabilized sand dunes, sedge meadows, Dryas tundra on alpine cliffs and ledges, snow beds, stabilized talus slopes, and in moss in white spruce woods and treed bogs; 1-3505 m.

Notes. *Salix reticulata* is a dwarf, trailing shrub characterized by leaves prominently reticulate, Catkins borne on flowering branchlets that are as long as normal vegetative branchlets. See Table 4 for comparison with *S. nivalis*.

***Salix* ×*rubens* Schrank** **hybrid white willow**

S. alba × *S. fragilis*

Trees 3–15 m, stems erect, plants not colonial. **Branches** highly brittle at base, not glaucous, pilose to glabrate. Branchlets red-brown or golden-yellow, not glaucous, pilose, villous, long-silky. Bud scale margins connate. **Proximal leaves** entire. **Juvenile leaves** yellowish green or reddish, abaxial surface glabrous or sparsely to very densely long-silky, hairs white. **Stipules** foliaceous. **Petioles** deeply grooved adaxially, 4–16 mm long, adaxial surface pilose or villous, with glandular dots at distal end. **Mature leaf blades** very narrowly to narrowly elliptic; 68–157 mm long, 11–30 mm wide, length-width ratio 3.8–7.3; amphistomatous; abaxial surface glaucous, glabrous or sparsely long-silky to glabrate, hairs white; adaxial surface shiny or dull, glabrous or sparsely long-silky to glabrate, hairs white; base acute to cuneate; margins coarsely serrate or serrulate; apex acuminate to caudate. **Flowering** as leaves emerge. **Floral bracts** tawny, 1–2.8 mm long, hairs straight, apex acute or rounded, entire, pistillate bracts deciduous after flowering. **Staminate** catkins moderately densely flowered, slender to stout, 30–65 mm long, flowering branchlets 3–11 mm long; stamens 2; anthers yellow, 0.5–0.7 mm long; filaments distinct, hairy on lower half; abaxial nectaries present; adaxial nectaries square, ovate or oblong, 0.3–0.7 mm long; abaxial and adaxial nectaries separate or coalescent and cup-shaped. **Pistillate** catkins loosely flowered, slender, 30–95 mm long; flowering branchlets 5–15 mm long; ovaries glabrous, pyriform; stigmas broad-cylindrical; styles 0.4–1 mm long; stipes 0.3–0.5 mm long; abaxial nectaries absent; adaxial nectaries square, 0.3–0.7 mm long, shorter than or equal to stipes. Capsules 4.5–6 mm long, 6-12 ovules per capsule.

Chromosome number. 2*n* = 57 or 76, 3x or 4x (Blackburn & Harrison 1924; Zsuffa & Raj 1981 pers. comm.)

Distribution. **Canada**: Alta., B.C., Man., N.B., Nfld., N.S., Ont., P.E.I., Que., Sask.; **U.S.A.**: Ariz., Ark., Calif., Colo., Conn., Del., D.C., Ga., Idaho, Ill., Ind., Iowa, Ky., Maine, Md., Mass., Mich., Minn., Mo., Mont., Nebr., N.H., N.J., N.Mex., N.Y., Ohio, Oreg., Pa., R.I., S.Dak., Tenn., Utah, Vt., Va., Wash., W.Va., Wis., Wyo.; Eurasia.

Habitat. Introduced from Europe and cultivated and often naturalized.

Notes. *Salix* ×*rubens* is a commonly cultivated and naturalized tree willow. It may persist for many years by trunk suckers and spreads easily by shoot fragmentation. There are at least five clones of *S.* ×*rubens* in cultivation. The pistillate plants are sterile but the staminate plants produce viable pollen (Jonsell 2000).

Salix ×*rubens* is sometimes misidentified as the varieties of *Salix lasiandra*. In addition to the characters in the key it may be separated from *S. lasiandra* by the characters in Table 7.

Table 7. Comparison of *Salix* ×*rubens* and *Salix lasiandra* s.l.

	Salix* ×*rubens	***Salix lasiandra* s.l.**
Characteristics		
Stipule apex	caudate or acuminate	rounded
Juvenile and mature leaves	lack ferruginous hairs	hairs often ferruginous
Pistillate catkins	loosely flowered, slender	densely flowered, stout
Stipes	0.3-0.5 mm	0.8-4 mm

***Salix scouleriana* Barratt ex Hook. Scouler's willow, mountain willow**

S. scouleriana var. *coetanea* C. R. Ball; *S. scouleriana* f. *poikila* (C. K. Schneider) C. K. Schneider.

Tall shrubs to trees, 3-20 m, stems erect, plants not colonial. **Branches** flexible to somewhat brittle at base, not glaucous or weakly so, glabrous or tomentose (hairs persistent for 2-3 years) to glabrescent. **Branchlets** yellow-green or yellow-brown, not glaucous, sparsely to very densely villous, tomentose, or velvety. **Proximal leaf** margins entire. **Juvenile leaves** reddish or yellowish green, villous, short-silky, or long-silky, hairs white or ferruginous. **Stipules** foliaceous. **Petioles** convex to flat adaxially, 2-13 mm, velvety or villous, not glandular at distal end. **Mature leaf blades** narrowly elliptic, elliptic, oblanceolate, or obovate, 29-85 × 9-36 mm, length-width ratio 1.7-3.9; hypostomatous; abaxial surface glaucous, short-silky, woolly, or long-silky, hairs white or ferruginous; adaxial surface shiny, pilose or short-silky to glabrescent, midrib velvety to villous, hairs white or ferruginous; base cuneate, acute, or rounded; margins entire, irregularly serrate, or crenate, teeth or glands all around margin or at proximal end; apex acute or rounded. **Flowering** before leaves emerge. **Floral bracts** dark to light brown or bicolor, 1.5-4.5 mm, hairs white, straight; bract apex rounded or acute, entire. **Staminate** catkins densely flowered, stout to subglobose, 14-38 mm, peduncles 2-5 mm, flowering branchlets 0-4 mm; stamens 2; anthers purple becoming yellow, 0.68-1.2 mm; filaments distinct, glabrous or hairy on lower half; abaxial nectaries absent; adaxial nectaries oblong or square, 0.35-0.93 mm. **Pistillate** catkins densely flowered, slender or stout, 17-55 mm, peduncles 1-6 mm, flowering branchlets 0-8 mm; ovaries very densely long-silky, hairs flattened, ovaries pyriform or obclavate, beak slightly bulged below style; stigmas slender-cylindrical, lobes 0.4-0.82-1.04 mm; styles 0.2-0.6 mm; stipes 0.8-2.3 mm; adaxial nectaries oblong or square, 0.2-0.75 mm, shorter than stipes; capsules 4.5-11 mm, 10-18 ovules per ovary.

Chromosome number. 2*n* = 76, 4× (Suda & Argus 1968).

Distribution. Canada: Alta., B.C., Man., N.W.T., Sask., Yukon; **U.S.A.**: Alaska, Ariz., Calif., Colo., Idaho, Mont., Nev., N.Mex., Oreg., S.Dak., Utah, Wash., Wyo. Mexico. Map 37.

Habitat. Dry lodgepole pine and black spruce forests, treed bogs, mature woods on the edges of rivers and lakes, meadows, and disturbed sites; 1-3400 m.

Notes. *Salix scouleriana* flowers before the leaves emerge, its branchlets and petioles are velvety; leaves often obovate and with appressed white or ferruginous hairs abaxially; and ovaries with long beaks and stigmas. This species displays two forms of pubescence on the abaxial leaf surface, most are sparsely pubescent with short, appressed, white or ferruginous hairs, but some are densely woolly with long, wavy, erect, white hairs and resemble some forms of *S. sitchensis*.

***Salix* ×*sepulcralis* Simonk** **hybrid weeping willow**

S. alba L. × *S. babylonica* L.

Trees, up to 12 m, stems pendulous, plants not colonial. **Branches** not glaucous, pubescent, tomentose, velvety (at nodes) to glabrescent. **Branchlets** yellowish, yellow-green, golden, or yellow-brown, not glaucous, pilose or short-silky to glabrescent. **Proximal leaf** margins entire. **Juvenile leaves** reddish or yellowish green, sparsely to very densely long-silky. **Stipules** foliaceous or minute rudiments, caducous. Petioles shallowly grooved adaxially, 4-8 mm, short-silky, with or without glandular dots at distal end. **Mature leaf blades** narrowly elliptic or very narrowly elliptic, 55-120 × 7-18 mm, length-width ratio 4.2-7.2; hypostomatous or amphistomatous; abaxial surface glaucous, long-silky to glabrescent; adaxial surface shiny, pubescent or long-silky to glabrescent; base cuneate or acute; margins serrulate or spinulose-serrulate, teeth or glands all around margin; apex acuminate or caudate. **Flowering** as leaves emerge. Floral bracts tawny, 1-2 mm, hairs white, straight; bract apex acute, . **Staminate** catkins moderately densely flowered, slender, 22-50 mm, peduncles 0.5-3 mm, flowering branchlets 3-14 mm; stamens 2; anthers yellow, 0.53-0.8 mm; filaments distinct, hairy on lower half or at base; abaxial nectaries present; adaxial nectaries oblong or ovate, 0.4-1.1 mm; abaxial and adaxial nectaries separate. **Pistillate** catkins moderately densely to loosely flowered, slender or stout, 14-40 mm, peduncles 1-5 mm, flowering branchlets 3-14 mm; ovaries glabrous, pyriform, beak gradually tapering to style; stigmas flat with rounded tips, lobes 0.2-0.36 mm; styles 0.15-2 mm; stipes 0-0.2 mm; adaxial nectaries oblong, square, or ovate, 0.3-0.9 mm, longer than stipes; capsules 1-2 mm, 4 ovules per ovary.

Chromosome number. Unknown.

Distribution. Naturalized. **Canada**: Alta, B.C., N.S., Ont., Que.; **U.S.A.**: Alaska, Ariz., Ark., Calif., Conn., D.C., Ill., Ind., Iowa, Ky., La., Maine, Md., Mass., Mich., Mo., Nev., N.H., N.J., N.Mex., N.C., N.Y., Ohio, Oreg., Pa., Tenn., Utah, Va., W.Va. Eurasia. Map 55.

Habitat. Introduced from Europe and cultivated and occasionally naturalized. It is not yet known to occur in Alberta but it is to be expected there.

Notes. The commonly cultivated and sometimes escaped weeping willow with golden or yellowing-green branchlets is *Salix* × *sepulcralis* nothovar. *chrysocoma* (Dode) Meikle. It originated as *Salix alba* var. *vitellina* × *S. babylonica* (Meikle 1984).

***Salix serissima* (L. H. Bailey) Fernald** **autumn willow**

Mid to tall shrubs, 1-5 m, stems erect, plants not colonial. **Branches** mostly flexible at base but sometimes somewhat to highly brittle, not glaucous, highly glossy, glabrous. **Branchlets** yellow-brown or red-brown, not glaucous, glabrous. **Proximal leaf** margins remotely or irregularly serrulate. **Juvenile leaves** reddish or yellowish green, glabrous. **Stipules** absent or minute rudiments. **Petioles** shallowly or deeply grooved adaxially, edges sometimes touching, base weakly ventricose, 3-13 mm, glabrous, with glandular dots at distal end. **Mature leaf blades** narrowly oblong ,very narrowly elliptic, narrowly elliptic, elliptic, lanceolate, or narrowly ovate, 43-103 × 9-33 mm, length-width ratio 2.4-6; leathery; hypostomatous or with stomata on adaxial surface only along veins or at apex; abaxial surface pale but not glaucous, sometimes with a thin wax, glabrous, shiny; adaxial surface highly glossy, glabrous; base acute, obtuse, rounded, or cordate on vigorous leaves; margins irregularly serrate, teeth or glands all around margin; apex acuminate or acute. **Flowering** as leaves emerge. **Floral bracts** tawny to greenish-tawny, 1.2-4 mm, hairs white, straight or somewhat wavy; bract apex acute, truncate, or rounded, toothed; pistillate bracts deciduous after flowering. **Staminate** catkins densely flowered, stout, 15-47 mm, peduncles 3-8 mm, flowering branchlets 5-14 mm; stamens 3-9; anthers yellow, 0.5-0.7 mm; filaments distinct or connate at base, hairy on lower half or at base; abaxial nectaries present; adaxial nectaries oblong or ovate, 0.4-1.1 mm; abaxial and adaxial nectaries separate, or coalescent and cup-shaped. **Pistillate** catkins moderately densely to flowered, stout to subglobose, 16-58 mm, peduncles 3-15 mm, flowering branchlets 9-32 mm; ovaries glabrous, pyriform or obclavate, beak slightly bulged below style or abruptly tapering to style; stigmas broad-cylindrical or flat with rounded tips, lobes 0.4-0.54-0.68 mm; styles 0.3-1 mm; stipes 1.2-2.4 mm; adaxial nectaries ovate or oblong, 0.3-1.1 mm, shorter than stipes; capsules 7-12 mm, 12-16 ovules per ovary.

Chromosome number. 2*n* = 76, 4× (Dorn 1994; Löve & Löve 1982; Zsuffa & Raj 1981).

Distribution. Canada: Alta., B.C., Lab., Man., N.B., Nfld., N.W.T., Nunavut, Ont., Que., Sask.; **U.S.A.**: Colo., Conn., Ill., Ind., Mass., Mich., Minn., Mont., N.J., N.Dak., N.Y., Ohio, Pa., S.Dak., Vt., Wis., Wyo. Map 38.

Habitat. Wet thickets, meadows, and fens; 1700-2960 m.

Notes: In *Salix serissima* the catkins emerge and are in anthesis as the leaves emerge but the fruits ripen in late summer or early fall, later than any other willow. Although its time of flowering is often described as serotinous, i.e. flowering long after the leaves emerge, it actually its fruiting that is serotinous.

***Salix sitchensis* Sanson ex Boug.** **Sitka willow**

S. coulter Andersson, *S. sitchensis* var. *coulter* (Andersson) Jeeps.

Tall shrubs to small trees, 1-8 m, stems erect, sometimes decumbent, plants not colonial. **Branches** flexible to highly brittle at base, not glaucous or sometimes weakly so, glabrous or pilose to glabrescent. **Branchlets** yellow-brown, gray-brown or red-brown, not glaucous, moderately to very densely short-silky, velvety, or villous, hairs, hairs geniculate or spreading. **Proximal leaf** margins entire or shallowly serrulate.

Juvenile leaves yellowish green, very densely long-silky, silky-tomentose, or woolly, sparsely hairy adaxially. **Stipules** foliaceous or minute rudiments. **Petioles** convex to flat or shallowly grooved adaxially, 3-16 mm, tomentose or velvety, not glandular at distal end. **Mature leaf blades** elliptic, narrowly oblanceolate, oblanceolate, or obovate, 31-120 × 17-48 mm, length-width ratio 2-4; hypostomatous; abaxial surface obscured by hairs (but glaucous), long-silky, tomentose, woolly, or silky-woolly; adaxial surface shiny, pilose or short-silky to glabrescent; base cuneate or acute; margins entire, irregularly serrate, or undulate, teeth or glands all around margin; apex rounded, aciculate, obtuse, or acute. **Flowering** as or just before leaves emerge. **Floral bracts** tawny or brown, 1.4-2.4 mm, hairs white, straight or wavy; bract apex rounded or acute, entire. **Staminate** catkins moderately densely to densely flowered, slender or stout, 21-50 mm, peduncles 1-5 mm, flowering branchlets 1-9 mm; stamens 1; anthers purple becoming yellow, 0.5-0.7 mm; glabrous; abaxial nectaries absent; adaxial nectaries narrowly oblong, oblong, or ovate, 0.4-1.3 mm. **Pistillate** catkins moderately densely flowered, slender or stout, 22-70 mm, peduncles 1-7 mm, flowering branchlets 1-20 mm; ovaries very densely long-silky or villous, hairs flattened, ovaries pyriform, beak slightly bulged below style or gradually tapering to style; stigmas broad-cylindrical, lobes 0.16-0.21-0.28 mm; styles 0.4-0.8 mm; stipes 0.4-1.4 mm; adaxial nectaries square, ovate, or flask-shaped, 0.5-0.88 mm, shorter than, equal to, or longer than stipes; capsules 3.5-5.6 mm, 14-16 ovules per ovary.

Chromosome number. 2*n* = 38, 2× (Chmelar 1979; Taylor & Mulligan 1968; Vachova & Chmelar 1976).

Distribution. Canada: Alta., B.C.; **U.S.A.**: Alaska, Calif., Idaho, Mont., Oreg., Wash. Map 39.

Habitat. Gravel bars along rivers, glacial moraines, thickets, and openings in forests; 0-1840 m.

Notes. This species is characterized by leaves obovate, satiny-hairy abaxially, margins revolute; pistillate catkins slender; ovaries densely silky; and staminate flowers with a single stamen. In vegetative features this species is similar to *S. drummondiana*. See Table 7 for a comparison.

A rare disjunct population of *Salix sitchensis* occurs at Whitecourt, Alberta, where it grows on gravelly soil along the Athabasca River. Positive identification is possible because the specimen is staminate and has the one-stamen flowers typical of the species. *Salix sitchensis* has been reported by Dorn (2000) from Banff National Park based on specimens collected by Porsild and Breitung from 12 mi. west of Banff and along the Misty River. These specimens are vegetative and cannot be positively separated from *S. drummondiana*. The area should be restudied for fertile material.

Table 8. Comparison of *Salix drummondiana* and *Salix sitchensis*

	S. drummondiana	***S. sitchensis***
Characteristics		
Branches	often strongly glaucous	usually not or weakly glaucous
Branchlet hairs	sparse	moderately to very dense
Leaf margins	slightly revolute	strongly revolute
Leaf hairs	with white or, rarely, ferruginous hairs	with white hairs
Leaf length/width	3-6.2	2-4.3
Flowering time	before leaves emerge	as or just before leaves
♂flowering branchlet length	0	1-9 mm
Stamen number	2	1
♀flowering branchlet length	0-6 mm	1-20 mm
Stigma	0.3-0.6 mm	0.16-0.4 mm

***Salix stolonifera* Coville** **creeping willow**

Dwarf shrubs, 2-9 cm, stems trailing underground, in moss, or on surface or erect, plants not colonial or forming colonies by layering or rhizomatous mats. **Branches** flexible at base, not glaucous or sometimes weakly so, glabrous. **Branchlets** yellow-brown or greenish brown, not glaucous or sometimes weakly so, glabrous. **Proximal leaf** margins entire. **Juvenile leaves** yellowish green, sparsely pubescent. **Stipules** minute rudiments. **Petioles** deeply or shallowly grooved adaxially, 3-9-20 mm, glabrous, margins ciliate, not glandular at distal end. Mature leaf blades elliptic, broadly elliptic, or subcircular, 16-42 × 12-38 mm, length-width ratio 1-2; amphistomatous, or with stomata on adaxial surface only along veins or at apex; abaxial surface glaucous, pubescent to glabrescent, hairs; adaxial surface highly glossy, glabrous, margin ciliate; base rounded, obtuse, or acute; margins entire or serrulate, teeth or glands at proximal end; bract apex obtuse, rounded, or retuse. **Flowering** as leaves emerge. **Floral bracts** brown, 1.6-2 mm, hairs white, straight or wavy; bract apex rounded, . **Staminate** catkins densely to moderately densely flowered, stout to subglobose, 9-26 mm, peduncles 3-12 mm, flowering branchlets 1-15 mm; stamens 2; anthers purple becoming yellow, 0.5-0.6 mm; filaments distinct, glabrous; abaxial nectaries present; adaxial nectaries oblong or narrowly so to ovate, 0.6-1.3 mm; abaxial and adaxial nectaries separate. **Pistillate** catkins moderately densely to loosely flowered, stout to subglobose or globose, 12-40 mm, peduncles 3-22 mm, flowering branchlets 2-42 mm; ovaries glabrous or beak sometimes hairy in patches or streaks, hairs flattened, ovaries pyriform, beak slightly bulged below style or abruptly tapering to style; stigmas slender-cylindrical or flat with pointed tips, lobes 0.32-0.5-0.88 mm; styles 0.6-1.6 mm; stipes 0.2-0.8 mm; abaxial nectaries present or absent, 0-0.63 mm; adaxial nectaries oblong, 0.5-1.4 mm, longer than stipes, abaxial and adaxial nectaries separate. Capsules 4-5.6 mm, 12-13 ovules per ovary.

Chromosome number. Unknown.

Distribution. Canada: Alta., B.C.; **U.S.A.**: Alaska. Eurasia. Map 40.

Habitat. Wet sedge meadows, hummocky tundra, raised center polygons, *Dryas*-willow-sedge tundra, *Dryas* mats on dry ridge tops; 1-975 m.

Notes. *Salix stolonifera* hybridizes with *S. arctica* and *S. barclayi* (Argus 1973). Salix stolonifera is rare in Alberta where it is known from Mt. Edith Cavell, Cavell Meadows, Highwood Pass, and Maligne Lake. Wherever *Salix stolonifera* and *S. arctica* occur together they forms hybrid swarms. *Salix stolonifera* has glabrous ovaries and leaves; *S. arctica* has densely villous ovaries and leaves with long, silky hairs on the abaxial surface. Plants with ovaries with bare patches or with hair only on the beak and presumed to be hybrids and possibly intergrades. Further study is needed.

Salix tyrrellii Raup **Tyrrell's willow**

Salix planifolia Pursh subsp. *tyrrellii* (Raup) Argus

Mid shrubs to tall shrubs, 0.6-3.5 m, stems erect or trailing, plants not colonial or forming colonies by layering. **Branches** flexible at base, red-brown, not glaucous, glabrous; epidermis flaking. **Branchlets** red-brown, sometimes greenish brown, glabrous. **Leaves** falling in autumn. **Proximal leaves** entire. **Juvenile leaves** yellowish green or sometimes reddish, abaxial surface sparsely white and ferruginous long-silky. **Stipules** foliaceous or minute rudiments, apex acute. **Petioles** convex to flat or shallowly grooved adaxially, 1-3.4-16 mm, not glandular at distal end, adaxial surface glabrous or hairy. **Mature leaf blades** narrowly elliptic, elliptic, oblanceolate, or obovate, 15-29-65 × 3.5-8.8-18 mm, length-width ratio 2.3-3.3-4.4; amphistomatous; abaxial surface glaucous, glabrous, sparsely ferruginous long-silky or glabrescent, hair appressed, straight; adaxial surface highly glossy, sparsely white and ferruginous short-silky to glabrescent; venation pinnate; base acute; margins strongly or slightly revolute, entire, very shallowly serrulate, or shallowly serrulate-crenate, 2-5-7 teeth or glands per cm; apex acute. **Flowering** before leaves emerge. **Floral bracts** light or dark brown, black, or bicolor, 1-3.7 mm, abaxial surface hairy all over, hairs white, straight; apex acute to acuminate or rounded, entire. **Staminate** catkins densely flowered, stout, 14-35 × 12-16 mm, flowering branchlets 0 mm; stamens 2; anthers purple becoming yellow, 0.4-0.68 mm; filaments distinct, glabrous to hairy at base; abaxial nectaries absent; adaxial nectaries oblong, 0.8-1.1 mm. **Pistillate** catkins densely flowered, stout, 17-51 × 10-13-22 mm; flowering branchlets 0-4 mm; ovaries obscured by hairs or greenish, pyriform, beak gradually tapering to style, long-silky, hair straight, flattened; stigmas slender-cylindrical, lobes 0.44-0.55-0.75 mm; styles connate, greenish or tawny to reddish or brownish, 0.6-1.2 mm; stipes 0.2-0.96 mm; abaxial nectaries absent; adaxial nectaries oblong or flask-shaped, 0.63-1.1 mm, equal to or shorter than stipes; capsules 3.6-5 mm.

Chromosome number. Unknown.

Distribution. Canada: Alta., Nunavut, Sask. Map 41

Habitat. Active sand dunes;

Notes. When *Salix tyrrellii* was described it was thought to be endemic to the Lake Athabasca sand dunes in northern Saskatchewan. Later it was found to occur in the Maybelle Lake sand dunes in northeastern Alberta (Raup & Argus 1982). More recently a large series of specimens, from the Rankin Inlet area, Nunavut, showed that *S. tyrrellii* occurred outside of the Athabasca dune system. Based on a study of its taxonomy and phenolic glycosides it was made a subspecies of *S. planifolia* (Argus and Steele 1979). The most important character that separates the two is the presence in *Salix tyrrellii* of abundant stomata on both leaf surfaces (amphistomatous); in contrast *S. planifolia*

usually lacks stomata on the adaxial leaf surface (hypostomatous). If there are any adaxial stomata in *S. planifolia* they are restricted to either the proximal leaves or, if on normal shoot leaves, to the apex or scattered along veins. In addition to the stomatal character, *S. tyrrellii* was shown to have lower levels of phenolic glysosides which may be responsible for its long, slender branchlets (Argus & Steele 1979). The study of vessel elements in sand dune endemics and their progenitors (Cooper & Cass 2001) showed that the species pair differed little in vessel characteristics. I have decided, however, to treat this taxon as a species because of its large range in which it is sympatric with *S. planifolia* (Argus unpublished COSEWIC status report). Further study is needed.

***Salix vestita* Pursh** **rock willow**

S. vestita var. *erecta* Andersson

Low to mid shrubs 0.2–1.5 m, stems erect plants not colonial. **Branches** flexible at *base*, not glaucous, glabrous, long-silky or villous to glabrate. **Branchlets** yellow- to gray-brown, not glaucous, long-silky, pilose, villous. **Bud** scale margins connate. **Proximal leaves** entire to crenate. **Juvenile leaves** yellowish green, abaxial surface very densely long-silky, hairs white or gray. **Stipules** minute rudiments. **Petioles** shallowly to deeply grooved adaxially, 2–8 mm long, adaxial surface glabrous or pubescent to glabrate, with glandular dots at distal end or not. **Mature leaf blades** broadly elliptic to subcircular or obovate; 18–67 mm long, 10–40 mm wide, length-width ratio 1.1–2.3; hypostomatous; abaxial surface glaucous, villous, often long-silky on veins, ***hairs white***; adaxial surface shiny, glabrous sparsely long-silky, hairs white; base obtuse to rounded; margins crenate, entire; apex rounded to retuse. **Flowering** as leaves emerge. **Floral bracts *tawny***, 0.8–1.6 mm long, *hairs very dense*, straight, apex rounded, entire. Pistillate floral bracts persistent after flowering. **Staminate** catkins densely flowered, slender to stout, 10–42 mm long, flowering branchlets (normal vegetative shoots), 3–50 mm long; stamens 2; anthers purple becoming yellow, 0.3–0.5 mm long; filaments distinct, hairy on lower half; abaxial nectaries present; adaxial nectaries narrowly oblong, 0.5–1.2 mm long; abaxial and adaxial nectaries coalescent and cup-shaped or separate. **Pistillate** catkins densely flowered, slender to stout, 10–60 mm long; flowering branchlets 3–40 mm long; ovaries short-silky, pyriform or inverse turnip-shaped; stigmas broad-cylindrical; styles 0.2–0.4 mm long; stipes 0.4–1.2 mm long; abaxial nectaries absent or present; adaxial nectaries oblong, ovate or narrowly oblong (almost filiform), 0.7–1.4 mm long, equal to, longer than or shorter than stipes; abaxial and adaxial nectaries separate or coalescent and cup-shaped. Capsules 3–5 mm long, 12-14 ovules per capsule.

Chromosome number. 2*n* = 38, 2x (Dorn 1975b; Hedberg 1967; Löve & Löve 1975, 1982; Taylor & Brockman 1966)

Distribution. Canada: Alta., B.C., Lab., Man., Nfld., N.S., Nunavut, Ont., Que.; U.S.A.: Mont., Oreg., Wash.; Eurasia (c Siberia). Map 42

Habitat. Moist to dry open forests and rocky streamsides in the upper montane and subalpine zones, rarely in the alpine zone.

Notes. Catkins of *Salix vestita* are borne on flowering branchlets that are as long as normal vegetative branchlets. Branchlets are differentiated into long and short shoots.

Salix vestita is an ancient subcircumpolar species that now has a distribution consisting of a series of isolated, disjunct populations in Central Siberia, the American

northwestern cordillera, the west coast of Hudson Bay, and the northeastern arctic and subarctic.

GLOSSARY

Abaxial. The side away from the axis, dorsal.
Abaxial floral nectaries. Located between the stamens or ovary and the floral bract.
Acuminate. Tip acute, margins distinctly concave and gradually tapering, long or short.
Acute. Margins slightly curved and forming an angle of less than 90^{o}.
Adaxial. The side of a structure toward the axis, ventral.
Adaxial floral nectaries. Located between the stamens or ovary and the axis.
Amphistomatous. Stomata uniformly dense on both leaf surfaces.
Branch. A shoot in at least its second year of growth.
Branchlet. The current year's shoot; bearing leaves.
Broadly elliptic. A plane shape, L:W 1.5:1, widest at middle.
Broadly oblong. A plane shape, L:W 1.5:1, widest in the mid-zone.
Broadly obovate. A plane shape, L:W 1.2:1, widest toward apex.
Broadly ovate. A plane shape, L:W 1.2:1, widest toward base.
Catkin. Inflorescence a spike of unisexual flowers without conspicuous perianth.
Caudate. Tail-like. Long-acuminate.
Circular. A plane shape, L:W 1:1, widest at middle.
Cordate. Leaf base heart-shaped.
Crenate. Teeth of shallow, rounded notches.
Depressed-ovate. A plane shape, egg-shaped but broader than long.
Distal. Toward the tip of a structure, away from point of attachment.
Dwarf shrubs. Plants 0.1 m or less, e.g. *S. reticulata*.
Elliptic. A plane shape, L:W 2:1, widest at middle.
Entire. Margin forming a smooth line, lacking teeth or undulations.
Ferruginous. Rust-colored.
Flask-shaped. With a more or less abruptly tapering neck.
Floccose. Covered with tufts of soft woolly hairs that tend to rub off.
Flowering branchlet. A short, vegetative shoot which terminates in a catkin.
Glabrous. Without hairs.
Glabrate. Becoming glabrous in age.
Glabrescent. The process of becoming glabrous in age but a few hairs remaining.
Glaucous. With a whitish waxy coating which may be polished by rubbing or scratching.
Globose. Solid shape in which length and width are equal; spherical.
Gourd-shaped. Lageniform.
Hemismphistomatous. Stomata on adaxial leaf surface only along veins or at tip.
Hypostomatous. Stomata only on abaxial leaf surface.
Indumentum. General hairiness.
Lanceolate. A plane shape, L:W 3:1 or more, widest toward proximal end.
Ligulate. A plane shape, L:W 6:1, widest in the mid-zone.
Linear. A plane shape, L:W 10:1, widest in the mid-zone.
Long-silky. Densely covered with fine, long (0.5 mm or more long), straight, appressed, shiny hairs.

Low shrubs. Plants 0.15-0.5 m, e.g. *S. myrtillifolia*.
Mid shrubs. Plants 0.6-2.0 m, e.g. *S. humilis*.
Moderately dense. Surface 50% visible.
Narrowly elliptic. A plane shape, L:W 3:1, widest at middle.
Narrowly oblanceolate. A plane shape, L:W 6:1 or more, widest toward apex.
Narrowly oblong. A plane shape, L:W 3:1, widest in the mid-zone.
Narrowly oblong nectary. A slender-rod, 4 or more times longer than wide.
Narrowly ovate. A plane shape, L:W 2:1, widest toward base.
Non-glaucous. Lacking a waxy coating.
Oblanceolate. A plane shape, L:W 3:1, widest toward distal end.
Oblong. A plane shape, L:W 2:1, widest in the mid-zone.
Oblong nectary. A broad-rod, 2-3 times longer than wide.
Obovate. A plane shape, L:W 2:1, widest toward distal end. Inverse egg-shaped.
Obclavate. Broadest at proximal end. Inverse club-shaped
Obnapiform. Broadest at proximal end. Inverse turnip-shaped.
Obtriangular. A plane shape. Inverted triangle narrowest at the proximal end.
Obturbinate. broadest at proximal end. Inverse top-shaped.
Obtuse. Margins slightly curved and forming an angle of greater than 90^{o}
Ovate. A plane shape, L:W 1.5:1, widest toward proximal end. Egg-shaped.
Ovoid. A solid shape widest toward proximal end. Egg-shaped.
Pear-shaped. Pyriform.
Peduncle. The naked stalk Between the flower-bearing axis and the flowering branchlet or the branch.
Pilose. Very sparsely covered with long, soft, wavy or straight, spreading hairs. Sparsely shaggy.
Proximal. Toward the base of a structure, near point of attachment.
Proximal leaves. The first 2-4 leaves at the base (proximal end) of a branchlet or all leaves on a flowering branchlet.
Puberulent. Somewhat densely covered with minute, soft, straight, erect hairs, scarcely visible to the unaided eye.
Pubescent. Densely covered with short, soft, spreading hairs. Not used for general hairiness.
Remotely denticulate. Widely spaced, small, slender teeth extending more or less at right angle to axis.
Remotely or irregularly serrate. Widely separated, uniform teeth with an inclined axis.
Retuse. Slightly notched.
Rounded. Margins forming a smooth arc.
Rudimentary. Used to describe stipules that appear as minute brownish lobes.
Serrate. Uniform large teeth with their axes inclined toward the distal end.
Serrulate. Uniform small teeth with their axes inclined toward the distal end.
Short-silky. Densely covered with short (less than 0.5 mm), soft, straight, appressed, shiny hairs.
Silky. Densely covered with short or long, soft, straight, appressed, shiny hairs.
Slender. More than 4× longer than wide.
Sparse. Surface little obscured.
Spindle-shaped. Ellipsoidal.

Square. About as long as wide.
Squat flask-shaped. Ampulliform.
Stipe. The stalk of an ovary.
Stout. Structure less than 4× longer than wide.
Strongly glaucous. Conspicuous bluish or whitish waxy coating.
Subcircular L:W 1.2:1, widest at middle.
Subglobose. Slightly longer than wide (1.3-1.1×). Subspherical.
Tall shrubs. Plants greater than 2.0 m, e.g. *S. discolor*.
Tomentose. Densely covered with short, rather firm, more or less matted or intertwined, hairs erect or spreading.
Transverse-oblong. A plane shape, L:W 2:1, widest in the mid-zone but broader than long.
Trees. Plants of "tree" stature, sometimes with several boles.
Triangular. Broadest at proximal end.
Truncate. Apex as if cut at right angles to axis.
Undulate. Wavy, up and down, in and out.
Velvety. Very densely covered with short, soft, straight, erect hairs of relatively uniform length.
Very broadly oblong. A plane shape, L:W 1.2:1 or less, widest in the mid-zone.
Very broadly obovate. A plane shape, L:W 1:1 or less, widest toward apex.
Very broadly ovate. A plane shape, L:W 1:1 or less, widest toward base.
Very densely. Surface obscured.
Very narrowly elliptic. A plane shape, L:W 6:1 or more, widest at middle.
Villous. Somewhat densely covered with long, soft, straight or wavy, spreading hairs.
Weakly glaucous. Wax visible only when scratched or as isolated crystals.
Woolly. Very densely covered with long, soft, spreading, wavy, more or less matted or intertwined hairs.

References for terminology

Flora of Australia. 1998. Cumulative Glossary for Vascular Plants. Internet Site last updated 09-Jul-98 by Andrew Lyne (al@anbg.gov.au)

Hewson, H.J. 1988. Plant indumentum. A handbook of terminology. Australian Flora and Fauna Series 9. 27 pp.

Hickey, L. J. 1973. Classification of the architecture of dicotyledonous leaves. Amer. J. Bot. 60: 17-33.

Hickey, L. J. 1979. A revised classification of the architecture of dicotyledonous leaves. Pp. 25-39, in Metcalfe, C. and Chalk, L. Anatomy of the Dicotyledons. 2nd ed. Oxford: Clarendon Press.

Kiger, R. W. and D. M. Porter. 2001. Categorical glossary for the Flora of North America Project. Pittsburgh: Hunt Institute for Botanical Documentation, Carnegie Mellon University.

Lawrence, G.H.M. 1951. The Taxonomy of Vascular Plants. New York: MacMillan Co.

Jackson, B. D. 1928. A Glossary of Botanical Terms. London: Gerald Duckworth & Co. Ltd.

Stearn, W. T. 1966. Botanical Latin. London and Edinburgh: Thomas Nelson Ltd.

CITED AND SELECTED REFERENCES

Argus, G. W. 1965. The taxonomy of the *Salix glauca* L. complex in North America. Contr. Gray Herb. 196: 1-142.

Argus, G. W. 1973. The genus *Salix* in Alaska and the Yukon. Canad. Natl. Mus. Nat. Sci. Publ. Bot. 2. 279 pp.

Argus, G. W. 1974a. A new species of *Salix* from northern British Columbia. Canad. J. Bot. 52: 1303-1304.

Argus, G. W. 1974b. An experimental study of hybridization and pollination in *Salix* (willows). Canad. J. Bot. 52: 1613-1619.

Argus, G. W. 1983. *Salix*. Pp. 198-214, *in* E. H. Moss, *Flora of Alberta*, revised by J. G. Packer. University of Toronto Press.

Argus, G. W. 1986a. *Salix raupii* Argus, new to the flora of Alberta and the Northwest Territories. Canad. Field-Natur. 100: 386-388.

Argus, G. W. 1986b. Studies in the *Salix lucida* Muhl. and *S. reticulata* L. complexes in North America. Canad. J. Bot. 64: 541-551.

Argus, G. W. 1991. Salicaceae. Pages 55-67 *in* G. W. Douglas, G. B. Straley and D. Meidinger *The vascular plants of British Columbia.* Vol. 3. Victoria: B. C. Ministry of Forests, Special Rep. Ser. 3.

Argus, G. W. 1997. Infrageneric classification of New World *Salix* L. (Salicaceae) Systematic Botany Monographs 52.

Argus, G. W. 2000. *Salix*. Pages 10-61 i*n* G. W. Douglas, D. Meidinger, and J. Pojar. Illustrated Flora of British Columbia. Vol. 5. Victoria: British Columbia Ministry of Environment, Lands and Parks, Ministry of Forests.

Argus, G. W. 2003. The identity of *Salix waghornei* (Salicaceae). Harvard Papers in Botany 8: 111-114.

Argus, G. W. 2007. *Salix* L. (Salicaceae) distribution maps and a synopsis of their classification in North America, north of Mexico. Harvard Pap. Botany 12: 335-368.

Argus, G. W., and J. W. Steele. 1979. A reevaluation of the taxonomy of *Salix tyrrellii*, a sand dune endemic. Syst. Bot. 4: 163-177.

Bay, C. 1992. A phytogeographical study of vascular plants of north Greenland. Medd. øm Gronl. 36.

Blackburn, K.B., and Heslop-Harrison, J. W. 1924. A preliminary account of the chromosomes and chromosome behaviour in the Salicaceae. Ann. Bot. 38: 361-378.

Bliss, L. A. 1956. Comparison of plant development in microenvironments of arctic and alpine tundras. Ecol. Monogr. 26: 303-337.

Brayshaw, T. C. 1996a. *Catkin-bearing plants of British Columbia*. Victoria: Royal British Columbia Museum [Extensively revised].

Brunsfeld, S. J., D. E. Soltis, and P. S. Soltis. 1992. Evolutionary patterns and processes in *Salix* sect. *Longifoliae*: evidence from chloroplast DNA. Syst. Bot. 17: 239-256.

Chmelar, J. 1979. The taxonomic importance of chromosome numbers in the genus *Salix* L. [In Czech.] Lesnictví 25: 411-415. (English translation by Secretary of State, Canada.)

Cooper, R. L., and Cass, D. D. 2001. Comparative evaluation of vessel elements in *Salix* spp. (Salicaceae) endemic to the Athabasca sand dunes of northern Saskatchewan. Amer. J. Bot. 88: 583-587.

Cronquist, A. 1964. *Salix*. Pages 37-71 in C. L. Hitchcock et al. *Vascular plants of the Pacific Northwest*. Part 2. Seattle: Univ. of Washington Press.

Densmore, R. A., and Zasada, J. C. 1983. Seed dispersal and dormancy patterns in northern willows: ecological and evolutionary significance. Canada. J. Bot. 61: 3207-3216.

Dobeŝ, C., B, Hahn, and W. Morawetz,. 1997. Chromosomenzahlen zur Gefäzpflanzen-Flora Österreiches. Linzer biol. Beitr. 29(1): 5-43.

Dorn, R. D. 1975a. A systematic study of *Salix* section *Cordatae* in North America. Canad. J. Bot. 53: 1491-1522.

Dorn, R. D. 1975b. Cytological and taxonomic notes on North American *Salix*. Madroño 23: 99.

Dorn, R. D. 1976. A synopsis of American *Salix*. Canad. J. Bot. 54: 2769-2789.

Dorn, R. D. 1994. North American *Salix* (Salicaceae): typification and notes. Phytologia 77: 89-95.

Dorn, R. D. 1995. A taxonomic study of *Salix* section Cordatae subsection *Luteae*. Brittonia 47: 160-174.

Dorn, R. D. 1998. A taxonomic study of *Salix* section *Longifoliae* (Salicaceae) Brittonia 50: 193-210.

Dorn, R. D. 2000. A taxonomic study of *Salix* sections *Mexicanae* and *Viminella* subsection *Sitchenses* (Salicaceae) in North America. Brittonia 52: 1-19.

Federova-Sarkissova, O.V. 1946. On the chromosome numbers of certain willow and poplar species. Acad. Sci. U.R.S.S. Comp. Rend. 54: 353-356.

Hardig, T. M., Brunsfeld, S. J., Fritz, R. S., Morgan, M., and Orians, C. M. 2000. Morphological and molecular evidence for hybridization and introgression in a willow (*Salix*) hybrid zone. Molecular Ecology 9: 9-24.

Hedberg, O. 1967. Chromosome numbers of plants from arctic and subarctic North America. Ark. Bot. 6: 309-326.

Holmen, K. 1952. Cytological studies in the flora of Peary Land, North Greenland. Meddel. Grønl. 128: 3-60.

Huff, C. R. 1992. Riparian vegetation recovery patterns following stream channelization: a geomorphic perspective. Ecology 73: 1209-1226.

Hultén, E. 1967. Comments on the flora of Alaska and Yukon. Ark. Bot. 7: 1-147.

Johnson, A. W., and Packer, J. G. 1968. Chromosome numbers in the flora of Ogotoruk Creek, N.W. Alaska. Bot. Not. 121: 403-456.

Jonsell, B. 2000. Flora Nordica. Vol. 1. Stockholm: The Bergius Foundation, The Royal Swedish Academy of Sciences.

Krasny, M. E., Vogt, F., and Zasada, J. 1988. Establishment of four salicaceous species on river bars in interior Alaska. Holarctic Ecol. 11: 210-219.

Krichfalushij, V.V., and Golyshkin, L.V. 1985. Chromosomal sumbers of certain species of *Salix* L. (Ukranian). Ukr. Bot. Zhurn. 42(2): 33-34.

Löve, A. 1954. Cytotaxonomical evaluation of corresponding taxa. Vegetatio 5-6: 212-224.

Löve, A., and Löve, D. 1942. Chromosome numbers of Scandinavian plant species. Botaniska Notiser 94(1942): 19-59.

Löve, A., and Löve, D. 1964. *In* A. Löve and O. Solbrig, eds. IOPB chromosome number reports II. Taxon 13: 202.

Löve, A., and Löve, D. 1982. *In* IOPB chromosome number reports 74. Edited by A. Löve. Taxon 31: 120-126.

Löve, A., and J. C. Ritchie. 1966. Chromosome numbers from central northern Canada. Canad. J. Bot. 44: 429-439.

Löve, A., Löve, D., and Kapoor, B. M. 1971. Cytotaxonomy of a century of Rocky Mountain orophytes. Arctic and Alpine Research 3: 139-165.

Ma, X.-H., Ma, X.-Q., Li, N. 1990. Chromosome observations of some drug plants in Xinjiang. Acta. Bot. Boreal.-Occid. Sin. 10: 203-210.

Majovsky, J. and M. Vachova. 1982. Karyotaxonomischer Beitrag zu einigen arted der slowakischen flora. Acta Fac. Rerun Nat. Univ. Comenianae Bot. 29: 81-86.

Marklund, G. G. [*Salix* chromosome numbers] *in* Floderus, B. 1931. *Salix*. In *Hartmans handbok i Skandinaviens flora*, by O.R. Holmberg, 1–160. Stockholm: P.A. Nordstedt and Söners Förlag.

McBride, J. R. and Strahan, J. 1984. Establishment and survival of woody riparian species on gravel bars of an intermittent stream. Amer. Midl. Nat. 112: 235-245.

Meikle, R. D. 1984. *Willows and poplars of Great Britain and Ireland*. Botanical Society of the British Isles, Handbook No. 4. [Available from: BSBI, c/o British Museum (Natural History), Cromwell Rd., London SW7 5BD]

Mosquin, T., and Haley, D. E. 1966. Chromosome numbers and taxonomy of some Canadian arctic plants. Canad. J. Bot. 44: 1209-1218.

Murin, A., and Vachova, M. 1974. *In* J. Majovsky, et al. Index to chromosome numbers of Slovakian flora. Pt. 4., Acta Fac. Rerum Nat. Univ. Comenianae, Bot. 23: 1-23.

Nanson, G., and Beach, H. 1977. Forest succession and sedimentation on a meandering-river floodplain in northeast British Columbia, Canada. J. Biogeography 4: 228-251.

Neumann, A., and Polatschek, A. 1972. Cytotaxonomischer Beitrag zur Gattung *Salix*. Ann. Naturhist. Mus. 76: 619-633.

Noble, M. G. 1979. The origin of *Populus deltoides* and *Salix interior* zones on point bars along the Minnesota River. Amer. Midl. Nat. 102: 59-67

Packer, J. G., and McPherson, G. D. 1974. Chromosome numbers in some vascular plants from northern Alaska. Canad. J. Bot. 52: 1095-1099.

Petrovsky, V. V., and Zhukova, P. G. 1983a. The chromosome numbers, morphology, ecology, and taxonomy of the willows of northeast Asia. Bot. Zhur. [In Russian] 68: 29-38.

Porter, G. L. 1990. Willow species of disturbed sties in the Sub-boreal Spruce Zone in North-central British Columbia. Forest Resources Development Agreement Handbook. B. C. Ministry of Forests, Research Branch, 31 Bastion Square, Victoria, B. C. V8W 3E7.

Purdy, B. G., and Bayer, R. J. 1995. Allozyme variation in the Athabasca sand dune endemic, *Salix silicicola*, and the closely related widespread, *S. alaxensis*. Systematic Botany 20: 179-190

Raup, H. M. 1959. The willows of boreal western America, Contr. Gray Herb., Harvard Univ. 185: 1-95.

Raup, H. M. 1941. Botanical problems in boreal America. Bot. Rev. 7: 147-284.

Sanduh, P.S., and Mann, S.K. 1988. SOCGI plant chromosome number reports VIII. J. Cytology and Genetics 24: 179-183.

Schneider, C. K. 1921b. Notes on American willows. XII. a. Systematic enumeration of the sections, species, varieties and forms of American willows. b. Some remarks on the hybrids hitherto observed among American willows. c. Some remarks on the geographical distribution of the American willows. d. Analytical keys to the species of American willows. J. Arnold Arbor. 3: 61-125.

Skvortsov, A. K. 1999. *Willows of Russia and adjacent countries. Taxonomical and geographical review*. Univ. Joensuu Fac. Mathem. and Natru. Sci. Rept. Ser. 39. 307 pp.

Suda, Y. 1963. The chromosome numbers of salicaceous plants in relation to their taxonomy. Sci. Rept. Tohoku Univ. Ser. 4 (Biol.) 29: 413-430.

Suda, Y., and Argus, G. W. 1968. Chromosome numbers of some North American *Salix*. Brittonia 20: 191-197.

Suda, Y., and Argus, G. W. 1969. Chromosome numbers of some North American Arctic and Boreal *Salix*. Canad. J. Bot. 47: 859-862.

Taylor, R. L., and Mulligan, G. 1968. Flora of the Queen Charlotte Islands. Pt. 2. Cytological aspects of the vascular plants. Monogr. Res. Branch Canad. Dept. Agric. 4(2): 1-148.

Tisdale, E. W., Fosberg, M. A., and Poulton, C. E. 1966. Vegetation and soil development on a recently glaciated area near Mount Robson, British Columbia. Ecology 47: 517-523.

Vachova, M., and Chmelar, J. 1976. *In* I.O.P.B. Chromosome Number Reports 53. Edited by A. Löve. Taxon 25: 490.

Viereck, L. A. 1966. Plant succession and soil development on gravel outwash of the Muldrow Glacier, Alaska. Ecol. Monogr. 36: 181-199.

Viereck, L. A., and E. L. Little. 1972. Alaska trees and shrubs. Agric. Handb. 410. Washington, D.C.: U. S. Department of Agriculture. Forest Service.

Viereck, L. A., and E. L. Little, with contributions by, D. F. Murray and G. W. Argus.. 2007. *Alaska trees and shrubs*. 2nd ed. Fairbanks: Univ. of Alaska Press. 359 pp.

Watling, R. and Raven, J. A. 1992. Willow Symposium. Proceedings of the Royal Society of Edinburgh. Vol. 98.

Wilkinson, J. 1944. The cytology of *Salix* in relation to its taxonomy. Ann. Bot. N.S. 8: 269-284.

Yurtsev, B. A., and Zhukova, P. G. 1982. Chromosome numbers of some plants of northeastern Yakutia (the drainage of the Indigirka River and its middle reaches). [In Russian.] Bot. Zhur. 67: 778-787. (English translation by Secretary of State, Canada.)

Zasada, J. C., and Viereck, L. A. 1975. The effects of temperature and stratification on germination in selected members of the Salicaceae in Interior Alaska. Canad. J. Forest Res. 5: 333-337.

Zhukova, P. G. 1967. Chromosome numbers in some plant species from the north-eastern parts of the U.S.S.R. II. [In Russian.] Bot. Zhur. 52: 983-987.

Zhukova, P. G. 1969. Chromosome numbers in certain plant species indigenous to the north-east of the U.S.S.R. IV. [In Russian.] Bot. Zhur. 54: 1985-1990.

Zhukova, P. G. 1980. Chromosome numbers of some southern Chukotka plant species. [In Russian.] Bot. Zhur. 65: 51-59.

Zhukova, P. G., Korobkov, A. A., and Tikhonova, A. D. 1977. Chromosome numbers of

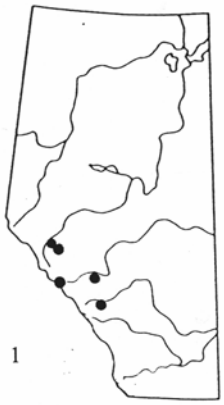
some plant species in the eastern arctic Jakutia. [In Russian.] Bot. Zhur. 62: 229-234.
Zhukova, P. G., and Petrovsky, V. V. 1976. Chromosome numbers of some western Chukotka plant species II. [In Russian.] Bot. Zhur. 61: 963-969.
Zhukova, P. G., and Petrovsky, V. V. 1977. Chromosome numbers and taxonomy of some species of the Anyui Mts. [In Russian.] Bot. Zhur. 65: 651-659.
Zhukova, P. G., and Petrovsky, V. V. 1980. Chromosome numbers of some western Chukotka plant species III. [In Russian.] Bot. Zhur. 62: 1215-1223.
Zhukova, P. G., and Petrovsky, V. V. 1987. Chromosome numbers and taxonomy of some plant species from the northern Asia regions. [In Russian.] Bot. Zhur. 72: 1617-1624.
Zhukova, P. G., Petrovsky, V. V., and Plieva, T. N. 1973. The chromosome numbers and taxonomy of some plant species from Siberia and the Far East. [In Russian.] Bot. Zhur. 58: 1331-1342.
Zsuffa, L., and Raj, Y. 1981. Chromosome numbers of some Salix species. Ontario Tree Improvement and Forest Biomass Institute, Maple, Ontario. File Report.

Salix Web Sites

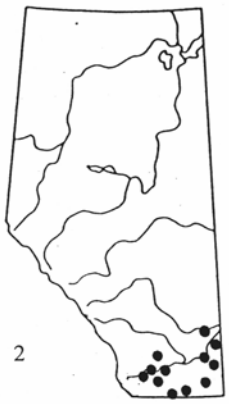
http://aknhp.uaa.alaska.edu/willow/index.html. An interactive key to New World *Salix* based on the Argus DELTA database. The files, including Intkey, *Salix* database, and text instruction on its use, must be downloaded to your computer. There are links to other *Salix* books and papers.

http//www.mun.ca/biology/delta/arcticf/sal. Treatment of *Salix* for the Flora of the Canadian Arctic Archipelago. It includes descriptions, illustrations, maps, and the interactive identification of *Salix*.

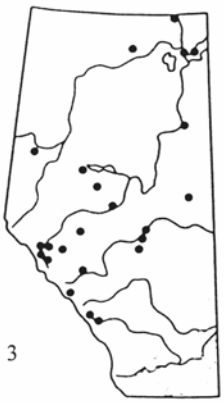
http//flora.huh.harvard.edu:8080/actkey/actkey.jsp?setId=3001. An online interactive key to New World *Salix* based on the Argus DELTA *Salix* database.



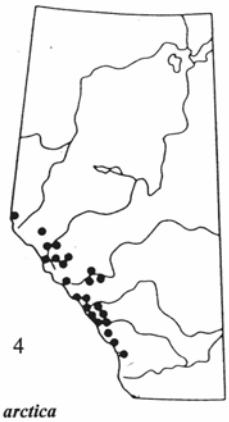
Salix alaxensis var. *alaxensis*



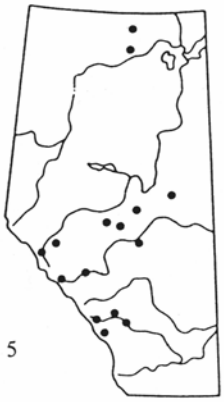
Salix amygdaloides



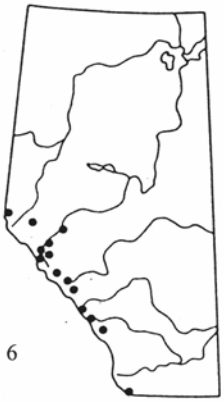
Salix arbusculoides



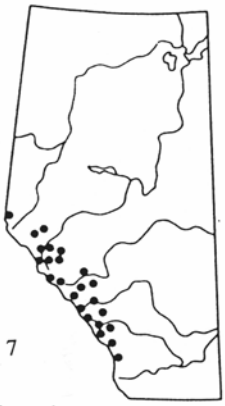
Salix arctica



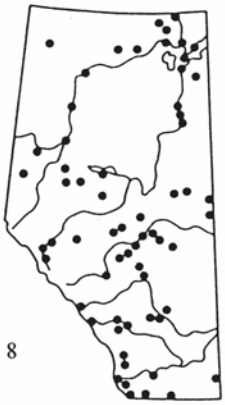
Salix athabascensis



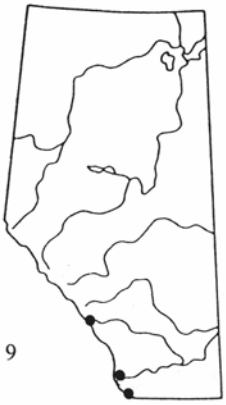
Salix barclayi



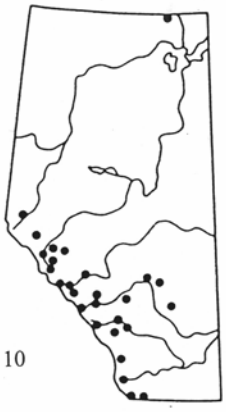
Salix barrattiana



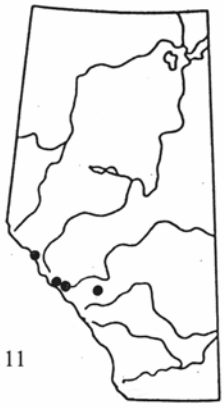
Salix bebbiana



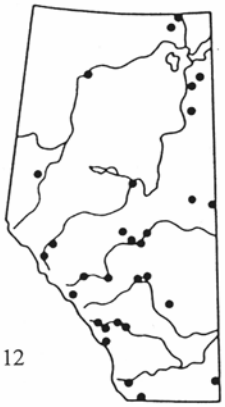
Salix boothii



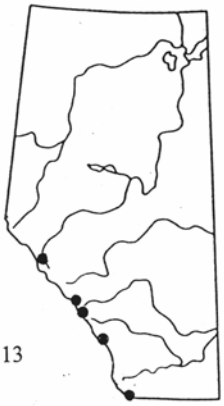
Salix brachycarpa var. *brachycarpa*



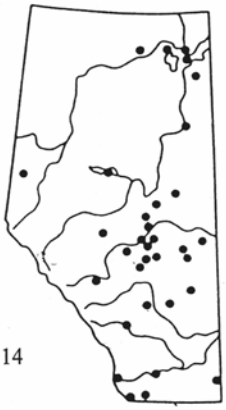
Salix calcicola var. *glandulosior*



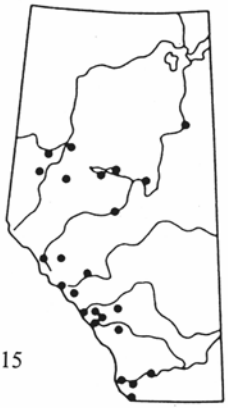
Salix candida



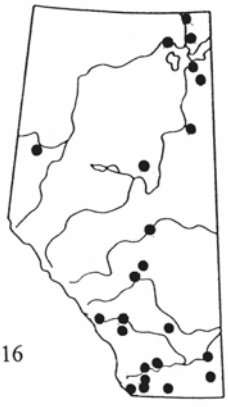
Salix commutata



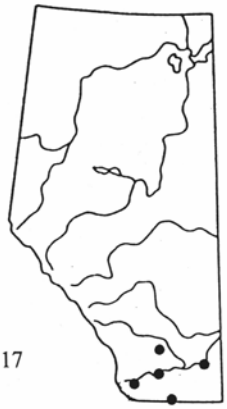
Salix discolor



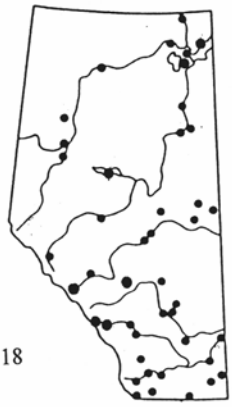
Salix drummondiana



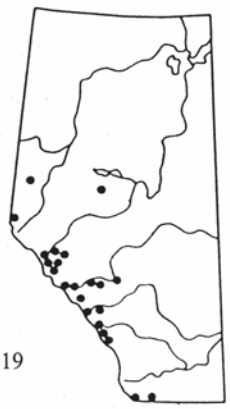
Salix eriocephala var. *famelica*



Salix exigua ssp. *exigua*

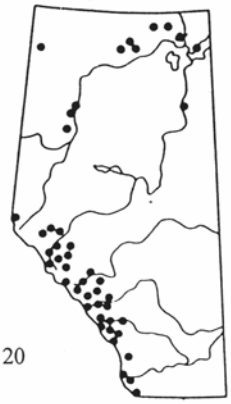


Salix exigua ssp. *interior*



19

Salix farriae



20

Salix glauca ssp. *glabrescens*

21

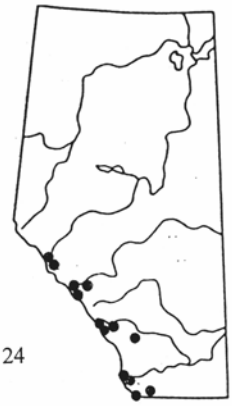
Salix lucida ssp. *caudata*

22

Salix lucida ssp. *lasiandra*

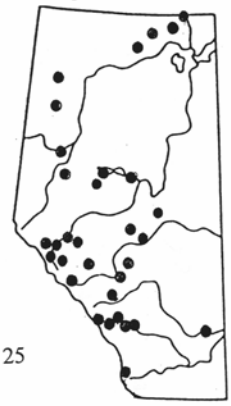
23

Salix maccalliana



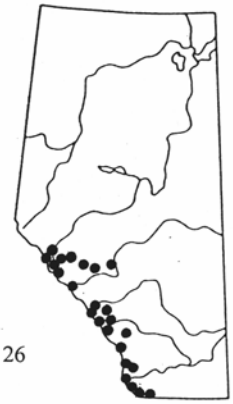
24

Salix melanopsis



25

Salix myrtillifolia

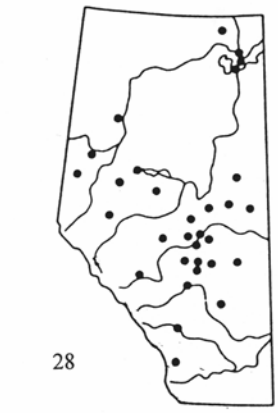


26

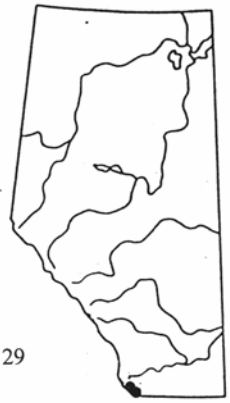
Salix nivalis

27

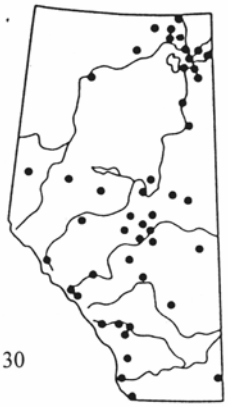
Salix pedicellaris



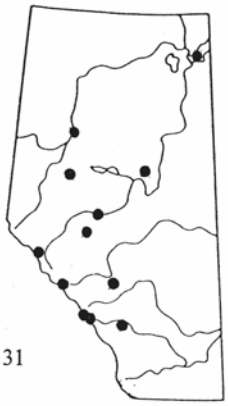
28 *Salix petiolaris*



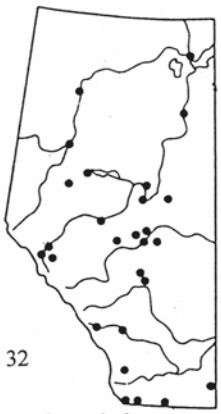
29 *Salix petrophila*



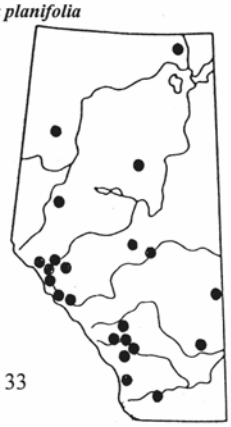
30 *Salix planifolia*



31 *Salix prolixa*



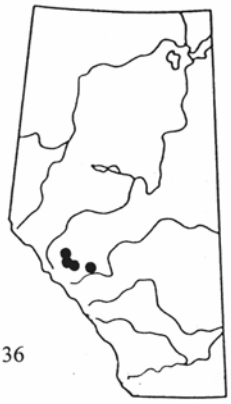
32 *Salix pseudomonticola*



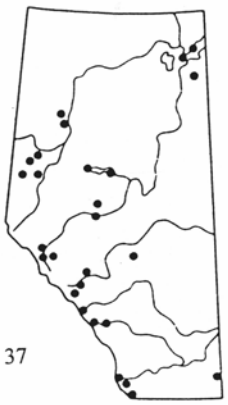
33 *Salix pseudomyrsinites*

34 *Salix pyrifolia*

35 *Salix raupii*

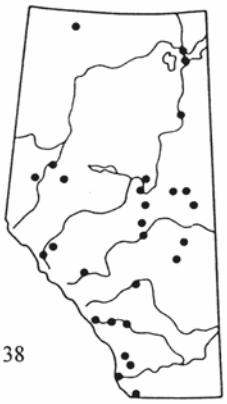


36 *Salix reticulata* ssp. *reticulata*



37

Salix scouleriana



38

Salix serissima

39

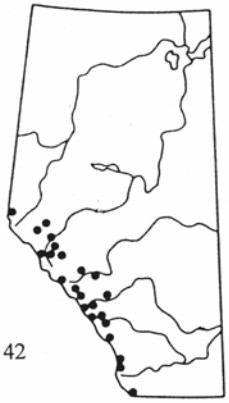
Salix sitchensis

40

Salix stolonifera

41

Salix tyrrellii



42

Salix vestita