Scientific Name: *Salix bebbiana* Sarg. **Family:** *Salicaceae*

Common Names: Bebb's willow, gray willow

***Salix bebbiana* leaf and catkin forms.**

Plant Description

Deciduous, perennial, erect shrub or small tree 0.5 to 5 m high, dark reddish brown twisted branches; shallow dense roots; alternate leaves are elliptic to obovate, glaucus beneath, 2 to 9 cm long with margins entire to scalloped; 2 to 9 mm petioled; male and female flowers loosely in catkins (2 to 5 cm long) on separate plants (Moss 1983). Roots shallow and dense (Tesky 1992). Plants live 20 years (Government of the Northwest Territories n.d.).

Fruit: 6 to 9 mm long beaked capsules that split open along 2 sides (Moss 1983).

Seed: 5 to 7 seeds per capsule, which are surrounded by a coma of fine hairs (Zasada et al. 2008).

Habitat and Distribution

Common along shores, forest openings, in thickets and wetlands and also in the tundra. Shade intolerant, grows best in full sunlight (Hardy BBT 1989). Indicator of healthy riparian communities (Hale et al. 2005).

Distribution: Widespread across the northern hemisphere in temperate to arctic zones. Aspen, conifer and mixed wood as well as sand dunes and floodplains. Alaska, Yukon to Labrador, south to California, New Mexico, Indiana, Maryland, Newfoundland (Moss 1983).

Soils: Grows in most textures of soil with a pH ranging from 5.5 to 7.5, preferring moist sandy or gravel soils and will tolerate short periods of inundation. Not drought resistant (Tesky 1992).

Phenology

Flowers from April to August (Tesky 1992).
Flowers May to July, seed ripens June to July.
Fruit ripens quickly after flowering (Tesky 1992).

Pollination

Bees are the main pollinators (Tesky 1992).
Salix species are also pollinated by wind (Macdonald 1986).

Seed Dispersal

Seed attached to pappus for wind dispersal.

Genetics

2n=38 (Moss 1983).

Symbiosis

Host of ectomycorrhizal fungi (Hagerman and Durall 2004).

Seed Processing

Collection: Because *Salix* seeds are quickly dispersed by wind, branches may be cut just before seed dispersal and placed in water and kept in shed for easier seed collection. The seeds are then easily stripped from branches (Macdonald 1986).

Seed Weight: 0.1818 g/1,000 seeds (Young and Young 1992).
Harvest Dates: As soon as ripe (May to June), when the fruit changes from green to yellowish (Young and Young 1992).
Cleaning: Seed does not need to be separated from the capsules (Young and Young 1992).
Storage Behaviour: Orthodox; seeds can be dried, without damage, to low moisture contents, their longevity increases with reductions in both moisture content and temperature (Royal Botanic Gardens Kew 2008).
Storage: Short viability limits storage of seed to 4 to 6 weeks (if seeds are kept moist and refrigerated in sealed containers) although reduction in germination is observed after only 10 days (King 1980).
Simpson and Daigle (2009) found that seed stored at 4°C did not retain seed viability; seed stored at a moisture content between 5% to 10% did best at -20°C for a storage period of 60 months (though not statistically different from the other sub-zero temperatures, -80 to 145°C).
Longevity: Up to 3 years if kept frozen at -10ºC to -20ºC (Densmore and Zasada 1983).

Propagation

Natural Regeneration: Establishes itself by basal stem sprouting, seed, suckers and root (Rawson 1974).
Germination: Fresh, summer-dispersed non-dormant seeds have the best germination percentages (95% to 100%) after 12 to 24 hours at 5ºC to 25ºC, up to 1 week. Moist substrate and light is required (Densmore and Zasada 1983).
Comparing germination of seed in burned and unburned natural areas, seeds in the burned sites had high germination percentages (Baskin and Baskin 2001).
Pre-treatment: None required (King 1980).
Dirr and Heuser (1987) recommend sowing seeds in moist ground immediately after collection.
Direct Seeding: Seeding the fruit was not successful in Northeastern Alberta.
Seed Rate: 3 to 5 catkins/m².

Vegetative Propagation: Softwood cuttings, from tip or base, 20 cm, are more successful than hardwood (Holloway and Zasada 1979).
The cuttings should be planted on sites with sufficient moisture (Tesky 1992).
Cuttings were a successful propagation method on wetland sites in the oil sands reclamation area in Fort McMurray: 10% survival of soft tip cuttings the 1st year and 6% survival the 2nd year; and 21% survival of pole cuttings the 1st year and 16% survived the 2nd year.
A study in Alaska found that *Salix bebbiana* cuttings had difficulty rooting (Holloway and Peterburs 2009).

***Salix bebbiana* catkin**

Aboriginal/Food Uses

Food: Wood can be burned to smoke meat. After boiling the branches twice (first water discarded) can be used to add flavour to home-brew. Flowering branches can relieve diarrhoea, and stomach aches;

inner bark can bring relief to constipation; branches or roots can help sooth toothaches; roots can also relieve fatigue, and stop external bleeding.
Medicinal: Flowering branches can relieve diarrhoea, and stomach aches; inner bark can bring relief to constipation; branches or roots can help sooth toothaches; roots can also relieve fatigue, and stop external bleeding. Prolonged therapy of pain relief by slow release of natural salicylates from willow bark (Johnson et al. 1995).
Other: Various constructive uses such as: pipe stems, bows, canoe ribs, snowshoes, whistles, drumsticks, basket rims, looms, sweat lodge frames, dream catcher frames, rope twine, fishnets, and curling rods for hair (Johnson et al. 1995, Wilkinson 1990).

Wildlife/Forage Usage

Wildlife: Major source of browse for moose, elk, bighorn sheep and deer. Small mammals, birds and beaver eat the shoots, buds, and catkins.
Some birds (black-capped chickadees) excavate cavities for nesting. Sapsuckers use the sap extensively (Rawson 1974).
Provides cover and protection for many birds and mammals (Tesky 1992).
Livestock: Because these shrubs grow widely scattered, livestock can easily access them. Forage production is moderate to high. Highly palatable for livestock and big game (Tesky 1992).
Grazing Response: Decreases in response to grazing (Hale et al. 2005). Hardy BBT (1989) indicate high browsing tolerance while Hale et al. (2005) indicate heavy utilization may eliminate the species from riparian areas.

Reclamation Potential

S. bebbiana can be important for revegetation of disturbed sites because of its easy vegetative reproduction and vigorous sprouting under natural conditions (Wilkinson 1990). It is adapted to a broad range of soil surface temperature conditions (Zasada and Viereck 1975) and soil textures (Tesky 1992). It is a relatively good soil and slope stabilizer (Hale et al. 2005, Tesky 1992).

Commercial Resources

Availability: Seeds not commercially available.
Cultivars: None are known.
Uses: Herbal market, wickerwork, and decorative bark with diamond-shaped patterns (canes, lamp posts, furniture, and candle holders). Willow charcoal used in artist's charcoal pencils (Marles et al. 2000).

Notes

Salix bebbiana is listed as 100% intact in the Alberta oil sands region (Alberta Biodiversity Monitoring Institute 2014).
S. bebbiana has an optimum seed-bearing age of 10 to 30 years (Hardy BBT 1989).

Photo Credits

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Line diagram: Wikimedia commons, 2012.

References

Alberta Biodiversity Monitoring Institute, 2014. The status of biodiversity in the oil sands region of Alberta. Alberta Biodiversity Monitoring Institute, Edmonton, Alberta. 47 pp. http://www.abmi.ca/FileDownloadServlet?filename=The%20Status%20of%20Biodiversity%20in%20the%20Oil%20Sands%20Region%20of%20Alberta_2014_Supplemental%20Report.docx&dir=REPORTS_UPLOAD [Last accessed June 16, 2014].

Baskin, C.C. and J.M. Baskin, 2001. Seeds – Ecology, Biogeography, and Evolution of Dormancy and Germination. Academic Press, San Diego, California, USA.

Densmore, R. and J. Zasada, 1983. Seed dispersal and dormancy patterns in northern willows: Ecological and evolutionary significance. Canadian Journal of Botany 61: 3207-3216.

Dirr, M.A. and C.W. Heuser, 1987. The reference manual of woody plant propagation: From seed to tissue culture: A practical working guide to the propagation of over 1100 species, varieties, and cultivars. Varsity Press, Athens, Georgia. 239 pp.

Government of the Northwest Territories, n.d. Bebb willow (long-beaked willow) *Salix bebbiana (S. rostrata)*. IN: NWT Species Monitoring – Infobase. http://nwtspeciesatrisk.com/en/Infobase?page=Infobase [Last accessed January 6, 2014].

Hagerman, S.M. and D.M. Durall, 2004. Ectomycorrhizal colonization of greenhouse grown Douglas-fir (*Pseudotsuga menziesii*) seedlings by inoculum associated with the roots of refuge plants sampled from a Douglas-fir forest in the southern interior of British Columbia. Canadian Journal of Botany 82: 742-751.

Hale, G., N. Ambrose, A. Bogen, K. Spicer-Rawe, M. Uchikura and E. Saunders, 2005. Bebb's/Beaked Willow *Salix bebbiana*. IN: A Field Guide to Common Riparian Plants of Alberta. Cows and Fish Program, Lethbridge, Alberta. p. 18.

Hardy BBT Limited, 1989. Manual of plant species suitability for reclamation in Alberta - 2nd Edition. Alberta Land Conservation and Reclamation Council Report No. RRTAC 89-4. 436 pp. http://hdl.handle.net/10402/era.22605 [Last accessed May 15, 2013].

Holloway, P.S. and M.R. Peterburs, 2009. Propagation of Twelve Alaska Native Plants by Summer Stem Cutting. Journal of Environmental Horticulture 27(4): 207-210.

Holloway, P. and J. Zasada, 1979. Vegetative propagation of eleven common Alaska woody plants. Pacific Northwest Forest and Range Experiment Station, United States Department of Agriculture, Forest Service, Portland, Oregon. 12 pp.

Johnson, D., L. Kershaw, A. MacKinnon and J. Pojar, 1995. Plants of the Western Boreal Forest and Aspen Parkland. Lone Pine Publishing and the Canadian Forest Service. Edmonton, Alberta. 392 pp.

King, P.J., 1980. Review of seed pretreatments required for germination of candidate native tree and shrub species in the Eastern slopes of the Rocky Mountains and foothills of Alberta. Alberta Energy and Natural Resources, Alberta Forest Service, Edmonton, Alberta. ENR Report Number 154. 56 pp.

Macdonald, B., 1986. Practical woody plant propagation for nursery growers. Timber Press, Inc., Portland, Oregon. 669 pp.

Marles, R.J., C. Clavelle, L. Monteleone, N. Tays and D. Burns, 2000. Aboriginal Plant Use in Canada's northwest Boreal Forest. Natural Resources Canada and Canadian Forest Service. UBC Press, Vancouver, British Columbia. 368 pp.

Moss, E.H., 1983. Flora of Alberta. A manual of flowering plants, conifers, ferns, and fern allies found growing without cultivation in the province of Alberta, Canada. 2nd edition. University of Toronto Press, Toronto Ontario. pp. 204-205.

Rawson, J.W., 1974. Willows. USDA Forest Service. General Technical Report NE 9: 147-149.

Royal Botanic Gardens Kew, 2008. *Salix bebbiana*. Seed Information Database. http://data.kew.org/sid/SidServlet?ID=20200&Num=Zcq [Last accessed June 14, 2013].

Simpson, J. D. and B.I. Daigle, 2009. Five years, storage of seeds from three willow species. Native Plants Journal 10(1): 63-67.

Tesky, J.L., 1992. *Salix bebbiana*. IN: Fischer, W.C. (compiler). The fire effect information system. United States Department of Agriculture, Forest Service, Intermountain Research Station, Intermountain Fire Sciences Laboratory. Missoula, Montana. http://www.fs.fed.us/database/feis/plants/tree/salbeb/introductory.html [Last accessed June 12, 2013].

Wilkinson, K., 1990. Beaked Willow; Bebb Willow *Salix bebbiana*. IN: Trees and Shrubs of Alberta. A Habitat Field Guide. Lone Pine Publishing, Edmonton, Alberta. pp. 72-73.

Young, J.A. and C.G. Young, 1992. Seeds of woody plants in North America. Dioscorides Press, Portland, Oregon. 407 pp.

Zasada, J.C., D.A. Douglas and W. Buechler, 2008. *Salix* L.: willow. IN: Bonner, F.T. and R.P Karrfalt, 2008. The woody plant seed manual. United States Department of Agriculture. Agriculture Handbook 727. pp. 1000-1009. http://www.uri.edu/cels/ceoc/documents/WoodyPlantSeedManual-Complete.pdf [Last accessed October 10, 2013].

Zasada, J.C. and L.A.Viereck, 1975. The effect of temperature and stratification on germination in selected members of the Salicaceae in Interior Alaska. Canadian journal of Forest Research 5(2): 333-337.