Plants 4 Bees: Blueberry

Common Name: Blueberry (Highbush and 'Wild' or Lowbush)

Scientific Name: *Vaccinium corymbosum* L. and *Vaccinium angustifolium* Aiton.

Native Range and Canadian Distribution: The genus *Vaccinium sp.* has a circumpolar distribution with species in North America, Europe and Asia. The two types of blueberries most commonly harvested in Canada are the highbush (*Vaccinium corymbosum* L.) and the lowbush or 'wild' blueberry (*Vaccinium angustifolium* Aiton.). Both species are members of the Ericaceae or heath family. The Ericaceae live in temperate climates and include other species such as American cranberry (*Vaccinium macrocarpon* Aiton.) small cranberry (*Vaccinium microcarpum* (Turcz. Ex Rupr.) Schmalh.), various heaths, heather, huckleberry, azalea and rhododendron.

The highbush blueberry 'complex' is highly variable and includes diploids, tetraploids, hexaploids, and various hybrid combinations. It has long been a subject of taxonomic confusion and controversy. Numerous taxonomic treatments have been proposed. In 1945 it was proposed to classify the highbush complex into 12 species. This classification became widely accepted but in more recent years it has been accepted that the 12 should be considered one species again.

Lowbush blueberry is native to the Atlantic provinces, central Canada, Manitoba and the northeastern United States, growing as far south as West Virginia. Highbush blueberry is a more southern plant, native from Illinois and Indiana northeastward to Nova Scotia, south to Florida, and west to Texas. It has been introduced to BC and New Brunswick for cultivation.

BC produces over 90% of the highbush blueberry crop in Canada. Over 99% of commercial blueberry production in BC is located in the lower mainland region, with the remainder on Vancouver Island. In Nova Scotia, the bulk of the production of highbush is in the Annapolis Valley. In addition Nova Scotia produces 16,000 tonnes of lowbush blueberries, about half of Canada's crop. Oxford, NS is considered the wild blueberry capital of Canada. New Brunswick produces about 4,200 tonnes of wild berries on about 8,500 ha.

Blossoms of Highbush Blueberry
Photo: Kwantlen Polytechnic University, Langley, BC

Description: The 'wild' blueberry is a low-growing, ground covering, perennial shrub that reaches 5 - 60 cm in height. The highbush blueberry is a perennial, deciduous, woody many-stemmed upright shrub growing to a height of 1.5 - 4.5 m – well suited to orchard management. The commercial cultivars were developed by selective breeding from the native blueberries by the USDA in the first half of the 20th century.

A distinguishing feature of blueberry is their alternate elliptic leaf, 4 - 8 cm long, smooth above, sometimes hairy beneath. The leaves are glossy bluegreen in summer, turning purple or red in the fall.

The flowers are small, 6 - 13 mm long, the white or pink-tinged corolla is 5-lobed bell shaped, appearing when leaves are about half formed. Flowers are borne in short, few-flowered terminals or axillary racemes. Lowbush blueberry flowering season is May to June with the fruit ripening July to August, while *V. corymbosum*, in the southern portion of its range, flowers sporadically over a 2 to 3 month period. In Canada flowering of highbush is synchronous and lasts a maximum of 25 days. Fruiting begins about 62 days after flowering. Flowering of highbush

blueberry occurs in southern Ontario - mid-May to early June, eastern Ontario and Quebec - early June to late June, and southwestern Nova Scotia - mid-June.

The fruit is a globular berry averaging 4 - 12 mm in diameter. Some cultivars produce fruit up to 2.5 cm in diameter. The berries are very sweet, blue to blue-black with a pale grey bloom. Each contains numerous nutlets averaging approximately 1.2 mm in length. Plants generally first flower at approximately 2 to 4 years of age.

Lowbush blueberry typically forms dense, extensive colonies. Roots are shallow and fibrous but may possess a taproot, which can extend to 1 m in depth. Woody rhizomes average 4.5 mm in diameter and 6 cm in depth.

Ecology: Highbush and lowbush blueberries hybridize resulting in many hybrids. Both blueberries have been cultivated and can be very important to wildlife. The berries feed many types of birds, bears and small mammals.

Lowbush blueberry is found in a variety of habitats from swamps to dry upland woods throughout Quebec to Nova Scotia. It occurs as an understory in a variety of forest communities and on the 'barrens' of Atlantic Canada as well as the exposed rocky outcrops of the Canadian Shield. Shade is detrimental to the growth of lowbush in the Atlantic Provinces but is necessary for optimal growth in Manitoba's dry, sunny continental climate. 'Wild' blueberries can tolerate soil pH of 3.9 to 5.3 but prefer about 4.8.

Highbush blueberry is wide spread but seldom occurs as community dominant. Two habitats where it can be dominant are open swamps or bogs and high-elevation balds (grassy slopes above the tree line in more southern latitudes).

Highbush blueberry is intolerant of shade, generally found at lower elevations along the edges of swamps and bogs, sandy margins of lakes, ponds, and streams, and within open areas of moist woods. It grows best on hummocks or raised bogs which provide moist, acidic, well-aerated, highly-organic soils. Acidic soils are preferred, with pH between 2.7 and 6.6 with low fertility. Plants can withstand extended periods of flooding.

Fletcher Colpitts (right) beekeeper and David Hatt blueberry grower, Pennfield NB
Photo: Heather Clay

Methods of Reproduction and Spread: Both blueberries reproduce from seed of the annual fruit crop. Managed colonies of honey bees are generally used as the primary pollinator. Pollen from blueberry is sticky and heavy and not easily transported by wind. Many solitary bee species associated with blueberries sonically vibrate the anthers (often referred to as 'buzz pollinating'), causing the pollen to be released. Honey bees cannot do this and therefore collect less pollen from the anthers at each visit than many of the solitary bee species.

The seeds are dispersed in the droppings of frugivorous birds and mammals. Long-distance dispersal is rare because most animals which consume blueberries are territorial. Even when fruit ripening coincides with migration of songbirds, dispersal distances are short because berry pulp rarely stays in the gut of birds for more than 20 minutes. Speculation suggests that the fruit ripening patterns of blueberry may be related to the nutritional needs of avian seed dispersers. Mass fruiting in the north occurs in mid-summer when avian dispersers are numerous.

The seeds have thick coats and require cold stratification before germination can occur. In the southern extent of the range germination typically occurs in the winter following spring dispersal while in the northern latitudes the seeds have thinner seed coats and germinate in the autumn shortly after dispersal.

Highbush blueberry rarely produce rhizomes however in eastern Quebec and Ontario where it introgresses with lowbush blueberry it may sometimes 'layer' when "disturbed or burnt". The plant will occasionally produce new plants from root sprouts 1 - 2 m away from the parent. Lowbush on the other hand can be readily propagated from hard, semihard, and softwood cuttings, and from rhizome segments. Cuttings can be used where rapid propagation is desired.

Honey/Pollen Potential: Lowbush is the most important commercial blueberry in Canada and the northeastern United States. It is grown commercially in Ontario, Quebec, New Brunswick, Nova Scotia and Maine. A major portion of the crop is gathered from 'managed' wild stands, often on crown lands, where honey bees are used for pollination.

Swinger unloading hives on blueberry fields, Lac St Jean QC. Photo: Peter Keating

Cross-pollination by insects is necessary for a good fruit set. Without insect pollination fruit set is less than 52 % while in cross-pollinated plants the range is 81 to 90 %. In some areas, the widespread use of insecticides has decimated native wild bee populations. Although honey bees are less effective pollinators than wild bees, managed colonies have higher numbers of bees and fly at lower temperatures than native bees. Growers generally contract commercial pollination services to bring in hives of honeybees in an effort to improve fruit set and thus yield. The recommended stocking rate is 2 to 6 colonies/ha. Shrubs with relatively few flowers often fail to attract pollinators, and plants with fewer than 30 flowers rarely produce fruit. Productive plants may bear more than 400 flowers.

'Wild' blueberries in eastern Canada are often raised on marginal lands with poor soils. Pollination is required early in the beekeeping year. Many beekeepers consider blueberry pollen to be of poor nutritional value for honey bees as it is low in total protein content and low in some amino acids. There is concern about possible increased rates of European foulbrood while on the blueberry barrens. Honey yield on lowbush blueberry can be 7 – 16 kg/colony but can also be zero after a cool overcast spring. Highbush has a higher density of flowers and is generally grown in a warmer climate and thus has a higher honey yield ranging from 22.5 – 45 kg/colony. The nectar flow generally lasts 8 to 10 days. The honey is light to amber and often granulates quickly.

Article compiled by: Douglas Clay

References:

Delaplane, K.S., D.F.Mayer. 2000. Blueberry (Chapter 24). In: Crop Pollination by Bees. CABI Publishing, Wallingford, UK. pg 169-181.

Douglas, G.W., G.B. Straley, D.V. Meidinger, and J. Pojar (editors). 1998. Illustrated Flora of British Columbia. (8 Volume Series). B.C. Ministry of Environment, Lands & Parks and B.C. Ministry of Forests. Victoria, Canada.

Javorek, S.K., K.E. Mackenzie, S.P. Vander Kloet . 2002. Comparative Pollination Effectiveness Among Bees (Hymenoptera: Apoidea) on Lowbush Blueberry (Ericaceae: *Vaccinium angustifolium*). Annals of the Entomological Society of America 95(3):345-351. Available online at: http:// www.bioone.org / doi / abs

Keating, P. 2003. One Hive, Two Crops: Pollinating Berries in Quebec. Hivelights 16(2):14-16.

Lovell, H.B. 1977. Honey plants. Gleanings in Bee Culture. Medina, USA. 96pp.

MacKenzie, K., D. Rogers, and S. Javorek. 1997. The Alfalfa Leafcutting Bee, *Megachile rotundata* FABR.: An Alternative Managed Pollinator of Lowbush Blueberry. Acta Hort. (ISHS) 446:87-90. Available online at: http:// www.actahort.org / books / 446/446_11.htm

Ramsay, J. 1987. Plants for Beekeeping in Canada and the northern USA. IBRA, Cardiff, UK. 198pp.

Runesson, U.T. (undated). Borealforest. org. Faculty of Forestry and the Forest Environment, Lakehead University, Thunder Bay, Canada. Available online at: http:// www.borealforest.org /

Tirmenstein, D. A. 1991. *Vaccinium angustifolium*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http:// www. fs.fed.us / database / feis / [accessed June 29 2009].

Uchytil, R.J. 1993. *Vaccinium corymbosum*. In: Fire Effects Information System, [Online] U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http:// www.fs.fed.us / database / feis / [accessed June 29 2009].

Blueberry for Health

The principal components of blueberries are water, natural sugars, crude proteins, vitamins, trace minerals, fats (in seeds) and fiber. The fruit is a good source of vitamin C, containing 14 mg per cup of berries. The energy found in seed and pulp portions varies considerably among geographic locations. Northern plants produce fruit with low seed energy and high pulp energy, while southern plants produce fruit with high seed energy and low pulp energy.

Blueberry caloric values for three regions are: Florida - 52 calories/berry, Nova Scotia - 141 calories/berry, and Ontario - 184 calories/berry.

Blueberries contain phytochemicals that act as cancer inhibiting antioxidants. Data from the USDA Human Nutrition Research Center on Aging (Boston, MA) shows blueberries are among the fruits with the highest antioxidant activity. Phytochemcials such as anthocyanin, proanthocyanidin, resveratrol, flavonol, and tannin that prevent damage to cells by free radicals are present in blueberries. Consumption of blueberries (and similar berry fruits including cranberries) may also alleviate the cognitive decline occurring in Alzheimer's disease and other conditions of aging. Feeding blueberries to animals has been shown to lower brain damage in experimental stroke. Researchers at Rutgers University in New Jersey have identified compounds in blueberries called proanthocyanidins that promote urinary tract health and reduce the risk of infection by preventing bacteria from adhering to the cells that line the walls of the urinary tract.