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Black Chokeberry (*Aronia melanocarpa* Michx.): A Semi-Edible Fruit with No Pests

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Abstract

Black chokeberry (*Aronia melanocarpa* Michx.) has several potential uses as a cultivated horticultural crop. Cultivars have been bred for larger edible fruits and ornamental value. The fruits are high in pectin and anthocyanins, and have no known pest problems. The somewhat unpleasant taste of the raw fruit may limit its use to blended juices, liqueurs, and medicinal products

The chokeberries (*Aronia* spp.) are in the Rose Family (Rosaceae). There are two unambiguous species in the genus *Aronia*, black chokeberry (*Aronia melanocarpa*) and red chokeberry (*Aronia arbutifolia* L.), as well as a controversial third species called purple chokeberry (*Aronia prunifolia* Marsh.) which has intermediate traits between the former (8). This paper will focus on the black-fruited *Aronia melanocarpa*, which has the greatest potential as a cultivated horticultural crop.

Taxonomy

Aronia melanocarpa, Family Rosaceae, is grouped in Subfamily *Maloideae*, with *Pyrus, Malus, Amelanchier, Sorbus* and *Photinia*, and is included by some authors in *Pyrus* or *Photinia*. There are reports of crosses with rowan (*Sorbus* spp.) (10). It is known to be capable of crossing with red chokeberry (*Aronia arbutifolia*); this could be the origin of the purple chokeberry (*Aronia prunifolium*) (8). The coloration of the mature pomes is the most distinctive feature of the three *Aronia* species, and the only character dependable enough to be used for identification.

Aronia melanocarpa produces purple-black pomes 6 mm or larger in diameter, borne in clusters of 8-14 fruits on red pedicels. The fruits often persist beyond leaf drop, losing some of their sour astringent flavor the longer they are left on the plant. The fruits grow on a shrub 90-180 cm tall and wide, with glabrous leaves, lustrous foliage and white-pink flowers, which open in May. Attractive leaves, flowers, fruit, and fall color have made them of some interest in ornamental horticulture (12). Cultivars include 'Autumn Magic', selected for its fall color, and 'Nero' and 'Viking', which were developed in Europe for large crops of edible fruits (6). A breeding program in Sweden has produced hybrid crosses with *Sorbus americana* which show promise for improving the fruit by increasing the range of flavor characteristics (9).

Disease and Pests

One of the best arguments for increased use of *Aronia melanocarpa* fruit is the relative absence of disease or pest problems. There are no known insect or bird problems, probably due to the acid taste of the fruit, which comes from the high anthocyanin content. The only diseases reported for *Aronia* are the occasional rust and ringspot; neither seems to impact fruit quality (3,12).

Potential Uses for Aronia Fruit

Aronia melanocarpa, native to Appalachia and New England, was well known to Native Americans and early settlers. It was later exported to Europe, where it became popular in

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Eastern European countries where its juice is used for jellies, yogurt, pie-filling, beverages, and spirits. The high pectin content makes it a suitable addition to mixed fruit jams with low pectin fruits (5).

Not all attempts to incorporate *A. melanocarpa* into food have wonderful results (11). The raw fruit is dry, sour, and somewhat astringent. In the world of food products, it might follow a similar path to that of the cranberry, making its way into consumer consciousness through a single product, then jumping into blended juices, medicinal extracts, preserves, etc. Whatever path the black chokeberry takes to reach the human palate, it will require some processing to reduce the "choke" and increase the "berry". When the fruits are ripened to full maturity (late August - early September), they can contain up to 20% sugar, but the simultaneous oxidation of organic molecules in the fruit produces unattractive brown compounds (10).

In Eastern Europe *A. melanocarpa* is used in the production of cordial liqueurs, and recent research in Germany has investigated its potential as a basis for wine fermentation (1). *Aronia* wine would be of special interest because *Aronia* is high in anthocyanin pigments and polyphenolics (4), which are suspected to be responsible for red-wine drinkers in France and Italy having lower rates of coronary heart disease than their North American and Northern European counterparts (15).

Anthocyanins in *Aronia melanocarpa*

Much of the interest in *Aronia melanocarpa* fruit is focused on its anthocyanin content. Anthocyanins are a class of chemical compounds, which produce a disagreeable taste at high concentration as they are in *Aronia* pomes. (This may serve to deter predatory animals, including humans.) Anthocyanins tint plant tissues red; in the case of *A. melanocarpa* the fruits are almost black, but dilute solutions of juice reveal the color to be a greatly concentrated red. Anthocyanins indicate pH with their color, becoming redder with increased acidity below pH 4.0, virtually colorless from pH 4.0-5.0, with varying colors above pH 5.0 depending on which anthocyanins are present.

Food science researchers have investigated anthocyanins in general (4) and shown that pigments derived from A. melanocarpa in particular are potentially useful as a food dye (14). The benefits of an easy-to-produce, naturally derived red food dye are, however, limited by the tendency of the anthocyanin to fluctuate in color according to pH.

Medical researchers have found *Aronia melanocarpa* fruit to be a source of anthocyanins with antimutagenic properties (7). However, identification of the major anthocyanins in *A. melanocarpa* fruit is still under investigation (13). *A. melanocarpa* also contains flavonoids, beneficial antioxidants, polyphenols, minerals and vitamins, including compounds that specifically fight cancer and cardiac disease (2).

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Prunus Rootstocks: Chilling Requirement and Response to Root Zone Temperature

Rootstocks for stone fruit varieties differentially influence tree physiology and one possible explanation for these differences is that varieties vary in their response to root zone temperature (RZT). To examine the effects of RZT, two trials using actively growing plants of five different *Prunus* rootstocks with chill requirements between 100 and 1100 h were undertaken. Plants were grown at RZTs of 5, 13 and 19°C for 6 weeks after which total dry matter accumulation and its partitioning amongst roots, stems and leaves was determined. In general, the magnitude of total dry matter and its component parts was positively correlated with RZT and significant differences were found among varieties. Individual varieties ranked differently at the three RZTs with respect to total dry matter. RZT significantly influenced partitioning. These differences were greatest at low RZTs and became less as RZT increased. Several patterns of partitioning were found. The low chill varieties (Okinawa and Flordagold) were little affected by RZT. The higher chill varieties (Green Leaf Nemaguard (GL), Golden Queen (GQ) and Fay Elberta (FE)), reacted more strongly to RZT and were particularly affected by the lowest RZT. For these varieties, the root mass ratio rose and stem mass ratio fell as RZT increased. With respect to leaf mass ratio, two different trends were found: the leaf mass ratio for FE and GQ positively correlated with RZT whilst the relationship for GL was negative. The authors believe these findings suggest that the response to RZT is related to a variety's chill requirement, offer an explanation for differences in performance of rootstock-scion combinations at different locations, and will aid the development of more accurate tree performance models by taking RZT into account. See Malcolm, P. et al. 2007. Growth and its partitioning in *Prunus* rootstocks in response to root zone temperature. Scientia Hort. 112:58-65.