

Sambucus nigra ssp. *caerulea*'s Ecological Importance,
Cultural Value, and Array of Edible and Medicinal
Potential

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Executive Summary

Blue elderberry has a lot of potential on the market but is currently overshadowed by more common elderberries. The cultural significance, medicinal properties, and environmental benefits provided by the plant offer a variety of attractive characteristics for consumers. Its desirability for pollinators and resilience in environments where other market crops may not be able to thrive awards many advantages to the grower. Being almost entirely edible, blue elderberry could be used to add extra flavor to recipes, as well as to support your health. While many things are still unknown, there have been a few studies that provide more information on what it would be like to grow this crop commercially.

I. INTRODUCTION

A. Study Species.

Sambucus nigra ssp. *caerulea*, commonly known as blue elderberry, has been an under-researched species that has played a role in the lives of North American indigenous people. Although currently underutilized in the market, the range of uses this plant carries is undeniable and should be taken advantage of as a new plant product; its non-invasive tendencies make it an attractive species that anyone can grow. Moreover, as climate change continues to pose harm to the world's ecosystems, blue elderberry shows resilience in ever worsening conditions.

B. Taxonomic Classification.

Sambucus nigra ssp. *caerulea* goes by a variety of common names: blueberry elder, tree of music, Walewort, New Mexican elderberry, and many more for its different uses and habitats, sometimes even called a different scientific name: *Sambucus mexicana* (Stevens and Nesom 2001). The specific epithet also has different spellings: most commonly *caerulea*, but some use *cerulea* and *coerulea*, which is important to note when searching for information. The history of blue elderberry's taxonomy is very complex in terms of family, genus, and species. Although previously placed in the Caprifoliaceae, recent genetic testing has found closer relations to plants in the Adoxaceae (Mikulic-Petkovsek et al. 2014). Complications with its scientific name revolve around spelling and whether or not blue elderberry may be a subspecies of black elderberry, *Sambucus nigra*. Genetic testing has concluded that certain properties have shown to be quite similar to other subspecies of black elderberry, suggesting that it may not be its own species (Uhl et al. 2022). This discourse creates some confusion regarding the scientific naming

of the species as these findings determined that *Sambucus nigra* ssp. *caerulea* is the proper name.

C. Geographic Distribution in the Wild.

Blue elderberry is most commonly found roughly between 30°N and 60°N latitudes and altitudes of 3-3,000 meters, most often in North America with occasional sightings in Europe as a non-native. It is most often observed in its native range of central to western areas of the United States of America, from northwestern Mexico to British Columbia (Stevens and Nesom 2001). Native to North America, specifically the western United States of America (Uhl et al. 2022), the standard habitats include riparian woodlands, stream banks, and river banks, and in the understory of forests. The diversity of habitats that blue elderberry can grow in means there are a variety of other species that it is found with depending on habitat: *Acer negundo* (box elder) or *Juglans hindsii* (northern California walnut) in riparian woodlands; and *Rosa californica* (California wild rose) or *Cephalanthus occidentalis* (buttonbush) in understories. (Stevens and Nesom 2001). Its preference for sunny areas with moist to moderately dry conditions allows for drought tolerance (Uhl et al. 2022; Goodridge et al., 2008), which would allow drier regions to cultivate blue elderberry as a crop.

Blue elderberry can have multiple stems and grows about two to eight meters tall (McDonough et al. 2018) and several meters wide (Figure 1) (Uhl et al. 2022). Its roots are relied on for storing nutrients and are fast-growing, easily suckering to form a new stem and root system when affected by fire (McDonough et al. 2018; Uhl et al. 2022), allowing minimal damage in dry environments. The leaves are pinnately compound; the leaflets are glabrous with serrate margins. Inflorescences are compound cymes (Figure 1), bearing glaucous berries about 6

mm wide (Figure 2) (McDonough et al. 2018). With a bloom season spanning May through September, and optimal fruiting in July and August, this crop has good potential as a food source (Rayburn et al. 2018).

Sambucus nigra ssp. *caerulea* is not an invasive species, increasing its potential for where this crop could be utilized, and is considered a great native alternative to invasive species such as *Buddleia* (Goodridge et al. 2008).

D. Uses: Indigenous, Medicinal, and More

This crop has historically been used by indigenous people, specifically the Cahuillas of southern California, for food and herbal medicine (Stevens and Nesom 2001; Uhl et al. 2022), as well as in ceremonies in the form of clapper sticks by the Acjachemen Indians (Walker et al. 2004). The wood was harvested, dried, and cut along the length of the stick. Important rituals were done throughout this process: the Acjachemen would pray and offer sage and tobacco before harvest, and decorations important to their culture were painted or burned into the wood. The instrument was used to keep rhythm by slapping it on one's palm during song and dance, which is why blue elderberry is known as the tree of music in this culture (Walker et al. 2004).

The vast amount of uses that every part of the plant can be used for is vital in considering its market value, as the berries, flowers, and leaves are fit to eat as well as contain medicinal properties (Figures 1 and 2). It is important to ensure the berries are picked properly; blue and purple berries are perfect for consumption, while the red berries found on other *Sambucus* species are toxic (Stevens and Nesom 2001). As long as they are in the correct growth stage, they can be utilized for wine, jam, syrup, and pies. Even the flowers can be battered and fried. The petals of the flowers have an aromatic flavor that can be enjoyed raw or added to teas, pancakes,

or fritters, but the plant contains hydrocyanic acid and sambucine (Stevens and Nesom 2001) which do need to be taken into consideration when eating. When overeaten, these alkaloids can cause nausea, but while they may create health problems, there are many helpful medicinal uses when applied properly.

The flowers contain tannins, which provide a variety of treatments for medical conditions such as congestion, fevers, headaches, and more (Stevens and Nesom 2001). Elderberries in general contain phenolic compounds which contain anti-inflammatory properties and are high in antioxidants that can protect humans from various diseases and infections (Mikulic-Petkovsek et al. 2014; Uhl et al. 2022). These qualities can be used in a variety of ways, including infusing flowers in tea. An increase in potential health benefits from these phenolic compounds can be achieved by steeping the tea for an extended time (Figure 3). Further research into the health benefits provided by elderberries could allow blue elderberry to enter the market at a larger scale since it is currently not widely thought of for high-end fruit sales.

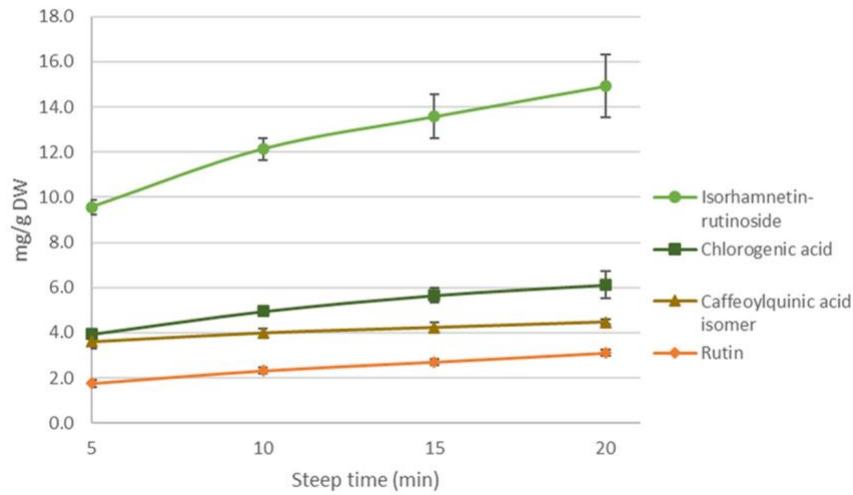


Figure 1: Blue elderberry growth habit and inflorescences (Norms Farms 2019).



Figure 2: Cluster of blue elderberries (Seven Oaks Native Nursery 2023).

(a)



(b)

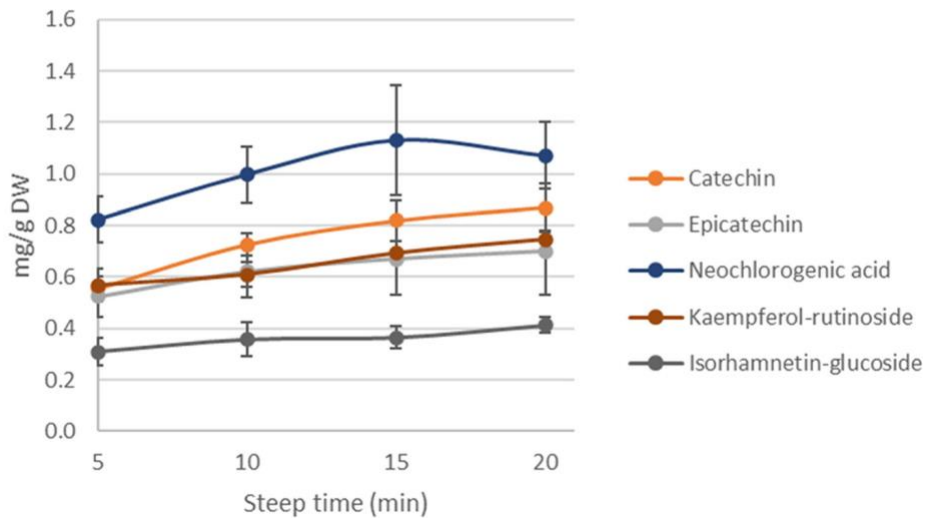


Figure 3: Concentration level of phenolic compounds (>1.50 mg g⁻¹ (a) and <1.50 mg g⁻¹ (b)) in blue elderberry flowers when steeped in hot water: a) Isorhamnetin-rutinoside, Chlorogenic acid, Caffeoylquinic acid isomer, Rutin and b) Catechin, Epicatechin, Neochlorogenic acid, Kaempferol-rutinoside, Isorhamnetin-glucoside (Uhl and Mitchell 2022).

II. CROP SPECIES

A. History and Potential Uses.

Blue elderberry has yet to be taken advantage of in the horticultural market, although other elderberries are popular as herbal dietary supplements (Engels and Brinckmann 2013). There are no cultivars on the market of blue elderberry, and it is still undomesticated. Some companies selling wild seeds include Trade Wind Fruits, Strictly Medicinal Seeds, and Southern Seeds. Because of the lack of breeding, Trade Winds Fruit sources their seeds directly from a private seed grower and collector in Corvallis, Oregon, rather than through a distributor. PanAmerican Seed Company's involvement with the breeding of many perennials makes them a potential breeder or producer company to domesticate the species whereas Ball Seed Company could be a good potential distributor of finished product. There seems to be a general understanding of the methods of growing blue elderberry by seed, although growth takes a considerable amount of time and each plant varies. Growing by seed is overall more productive than using cuttings, as most cuttings do not survive (Stevens and Nesom 2001).

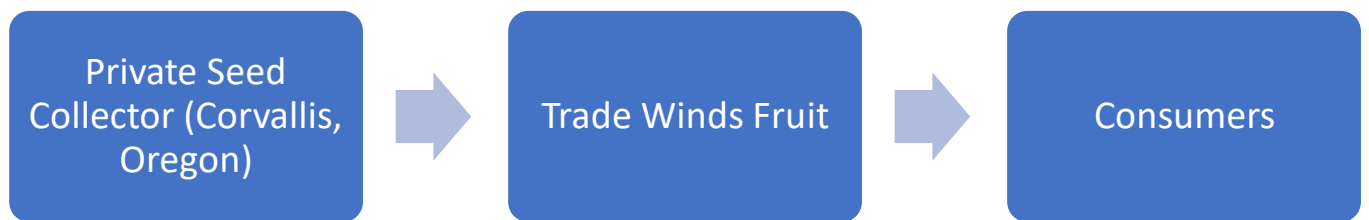


Figure 4: Distribution chain of *Sambucus caerulea* seeds to Trade Winds Fruit.

III. PRODUCTION INFORMATION

A. Anticipated Cultural Requirements.

Blue elderberry would be sold as an herbaceous perennial, considering its growth habit allows continuous growth when placed in the correct growing conditions. If given the chance to produce fruit year after year, it would make this plant more appealing to consumers, as elderberries generally require three to four years for the best production of fruit (Młynarczyk, et al 2018). With extensive possible uses, blue elderberry can be marketed for many of its characteristics; its berries and flowers are edible and beneficial to human health (Mikulic-Petkovsek et al. 2014; Uhl et al. 2022), and the plant is valuable to wildlife, benefiting bees, birds, and small mammals (Dettenmaier and Kuhns 2013). Selling blue elderberry on the market would be most successful in zones six through nine, although it would survive in zones five and ten as well. Its drought tolerance is also worth noting, as consumers are likely interested in more resilient crops with the effects of climate change causing droughts to become more common, severe, and longer lasting (U.S. Geological Survey).

Production of blue elderberry can be quite difficult because of what is unknown as well as the inconsistencies in the different methods to ensure germination. The thorough treatment of the seed is the most important and most complicated aspect of guaranteeing germination and growing this plant. Stratification is most important in the successful germination of blue elderberry, where seeds can be placed in peat, vermiculite, and sand over two months at temperatures of 21 to 30°C. The seeds should be sown around 0.64 cm below the soil surface and covered with about 1 cm of sawdust mulch. Seedlings should be transferred to standard pots that are about 7.6 cm tall and can be planted outdoors after about six to eight months. When planted in the fall, seedlings in moist sites may not require extra water, but it is necessary to evaluate

whether the site has adequate moisture so that the seedlings can establish (Stevens and Nesom, 2001).

B. Market Niche.

Since *Sambucus nigra* ssp. *caerulea* blooms beginning in May, springtime would be the best target sales date so that buyers can allow the plant to acclimate. The seasonal growth that is naturally seen in blue elderberry is likely the most productive this crop could be, as once it reaches a certain age and size, complications would arise if attempting to force the crop year-round. Limitations to take note of is the extensive process that blue elderberry seeds require to germinate; growers would need to adequately schedule this crop so that enough seedlings are available to sell at the correct time. For example, for plants ready to be planted in the ground in the spring, seeds need to be sowed as soon as May of the previous year (McDonough et al. 2018), which requires early planning and extra space in the greenhouse. Products currently on the market that would most likely be competitors to blue elderberry are *Sambucus canadensis* and *Sambucus nigra*. These species are already well researched and well known, with similar fruits and berries, which creates the possibility of blue elderberry being less desirable until more research is done.

1. Marketing Story

Blue elderberry provides benefits to humans, animals, and pollinators through its flowers and berries. Adding this shrub to your yard will allow local wildlife and bees to thrive and provide you with berries that are advantageous for your health. Its non-invasive tendencies make this species a low-risk plant to introduce to any landscape, especially pollinator gardens, with a long bloom season supplying beautiful white flowers from May through September. With retailers

already selling blue elderberry seeds, you can plant this shrub today and be rewarded with a multitude of benefits for everyone involved.

IV. PRODUCT INFORMATION GUIDE (PIG) & CROP SCHEDULE

A. Seed Treatment

While it is difficult to say how long *Sambucus nigra* ssp. *caerulea*'s germination and growth stages will need to take place, there are general guidelines and time frames to follow when growing this plant. For successful germination, eight to twelve weeks of cold stratification is vital, but gibberellic acid treatments also initiate growth. However, using both of these methods can increase germination rates which would be more efficient if this crop were to be produced commercially (McDonough et al. 2018). Without treatment, germination rates will be extremely low, or the seeds may take so long to germinate that producers would lose money by growing blue elderberry.

B. Sowing and Preferred Conditions

One successful production method is to sow as many as five seeds per cell, later going back to disperse the seedlings to one per cell (McDonough et al. 2018). This method would save both greenhouse space and materials for producers with how inconsistent and difficult germination is for blue elderberry. To cover the seeds, about 1 cm of sawdust can be placed over them once they are sown about 0.64 cm deep (Stevens and Nesom 2001).

Its preferred pH is between 4.9 and 7.5, and because of its drought tolerance, intermediate moisture levels will be adequate (McDonough et al. 2018), which makes it a relatively low-maintenance crop once each seedling is in its cell. Conifer starter, grower, and finisher are

effective fertilizers applied at 24-100 mg/L, especially when combined with calcium nitrate beginning around the end of weeks five and six (Figure 6). Seedlings will grow with a nightly temperature as low as 18°C and daily temperatures up to 32°C (McDonough et al. 2018). There is little knowledge regarding photoperiod or ways to control growth with light; it is more important to focus on controlling temperature to encourage growth.

C. Growth Stages

With the variability in blue elderberry growth because of the lack of research, it is hard to come up with an accurate number of weeks that each growth stage will take. While in total it will likely be six months or more (McDonough et al. 2018), this makes it hard to know an exact number as each stage could differ in length. This also depends on the resources that the seedling has which may vary between producers; until further research is done, production will see variable growth in this crop.

D. Selling the Crop

Most seedlings should be at least eight months old or even older before planting outside, as once they finish germinating, they should be exposed to lower temperatures to ensure cold hardiness (Stevens and Nesom 2001; McDonough et al. 2018). If the plant was sold shortly after germination and cold hardiness were established, three-liter pots would be appropriate, if closer to a year old, a ten-liter container could be used (Figure 7). Plants would be sold ready to be planted regardless of the time of year, but because of its larger size and sprawling form, there will be some difficulty when it comes to the transportation of the finished crop.

Seed Form	Recommended Plug Size	Plug Crop Weeks	Seed Cover	Initial Media pH/EC
raw	72; 1 to 5 seeds per cell	24	Cover with 0.64 cm potting mix, 1 cm sawdust	6.0-7.0 pH

Stage 1: 4-6 weeks	Stage 2: 4-6 weeks	Stage 3: 4-6 weeks	Stage 4: 4-6 weeks	Key Tips
(m) Medium (t) 18-32°C	(m) Medium (t) 18-32°C (f) 10:30:20 at 42 mg/L	(m) Medium (t) 18-32°C (f) 20:7:19 at 100 mg/L	(m) Medium (t) 18-32°C (f) 4:25:35 at 24 mg/L	Direct sowing not recommended, 8-12 week cold stratification, gibberellic acid treatment

Figure 5: *Sambucus nigra* ssp. *caerulea* **Product Information Guide**

(m) moisture (t) temperature (f) fertilizer

Week	Block weight (%)	Fertilizer	Rate (ppm N)	Fertilizer	Rate (ppm N)
0-2	> 90	Clear water	—	—	—
3-4	85	Starter 10:30:20	42	—	—
5-6	80-85	Starter 10:30:20	42	CN-15	51
7-15	80-85	Grower 20:7:19	100	CN-15	85
16-22	75	Finisher 4:25:35	24	CN-15	77
23+	75	Alt. Micronutrients	—	Alt. CN-15	26

Notes: Seeds sown in early May. Additional micronutrients included with each fertilization at the following rates: Fe 0.02 g/l, B 0.0015 g/l, Mg 0.239 g/l. Fertiligated no more than twice a week, additional irrigation with clear water only. Week 23+ alternate micronutrients with calcium nitrate.

Figure 6: Effective fertilizer schedule used in propagation protocol (McDonough et al. 2018)



Figure 7: Blue elderberry three months after the completion of the McDonough et al. propagation protocol (McDonough 2018).

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