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ASSESSMENT OF PLANT PRODUCTIVITY AND FRUIT QUALITY IN TWO ELDERBERRY (*SAMBUCUS NIGRA* L.) CULTIVARS GROWN IN MĂRĂCINENI, ARGEȘ

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Abstract
Elderberry (Sambucus nigra L.) is recognized for its rich profile of bioactive compounds and its broad potential in promoting health. Gaining deeper insights into these properties can help maximize its use within the food industry. The fruit is notably abundant in biologically active substances, especially (poly)phenols and terpenoids. Researchers indicates that various food processing methods can significantly impact the concentration and efficacy of these compounds. From a health perspective, both in vitro (laboratory-based) and in vivo (animal or human) studies have demonstrated that elderberry exhibits a variety of beneficial effects, including antioxidant, anti-inflammatory, anticancer, antiviral (particularly against influenza), antimicrobial, antidiabetic, cardioprotective, and neuroprotective activities. These effects are believed to occur through modulation of key cellular signaling pathways and molecular targets. Despite the encouraging evidence, clinical trials confirming these health benefits in humans are still relatively scarce. Nonetheless, elderberry remains a promising natural ingredient with strong potential for use in functional foods and nutraceuticals designed to help prevent or manage chronic health conditions. The objective of this study is to analyze the plant productivity and fruit quality of two edelberry cultivars in Mărăcineni, Argeş.

Keywords: cultivars, elderberry, health perspective, Mărăcineni

1. INTRODUCTION

The American elderberry (*Sambucus canadensis*) and the European elderberry (*S. nigra*) are two closely related species from the *Adoxaceae* family, though they are sometimes placed in other families such as *Caprifoliaceae* or *Sambucaceae* (USDA, ARS, 2008). While often treated as separate species, some researchers (like Bolli, 1994) (Charlebois et al., 2010) consider them subspecies of *S. nigra*. These plants are mostly native to the Northern Hemisphere but have spread widely around the world. Birds eat their fruit and quickly disperse the seeds, allowing elderberries to thrive along forest edges and disturbed areas like roadsides and railways. Although the focus here is on elderberries as fruit crops, they are also valued as ornamental plants—especially *S. nigra*, which comes in various leaf colors and unique cut-leaf forms. Traditionally, all parts of the plant—bark, roots, stems, flowers, and berries-have been used in Indigenous medicine (Moerman, 1998), and recent research has renewed interest in their medicinal properties (Thomas et al., 2008). In Europe, three main species of the *Sambucus* genus can be found: red elderberry (S. racemosa), a shrub with toxic coral-red berries; dwarf elder (*Sambucus ebulus*), a perennial herb without woody stems and bearing inedible black fruit; and black elderberry (*S. nigra*), a shrub known for its edible

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black berries. Elderberry has a long history of medicinal use, traditionally employed to treat a variety of ailments. Today, it is commonly included in dietary supplements aimed at supporting immune health. Different parts of the plant—including the flowers, fruit, leaves, and bark—are used in herbal medicine. In recent years, interest in elderberry has significantly increased. Nearly every part of the plant can be utilized in various industries, especially due to its health benefits. Elderberry is recognized as a natural source of compounds with antioxidant and anti-cancer properties. The fruit purée is often used as a natural food dye, while the juice is popular in the production of medicinal syrups. The berries themselves possess diaphoretic (sweat-inducing), diuretic, and laxative effects, which help the body eliminate toxins. They also have pain-relieving properties and are used to help treat conditions such as trigeminal neuralgia, sciatica, migraines, and even certain types of cancer. Elderberry fruits are a rich source of vitamins A, B, and C. The vitamin C content varies significantly by variety, ranging from 6 to 35 mg per 100 grams of fruit (Ercisli et al., 2009). Studies of different cultivars, hybrids, and wild elderberries have identified a complex phytochemical profile that includes 5 organic acids, 19 anthocyanins, 11 flavanols, and 9 polyphenolic acids—all of which vary in type and concentration depending on the cultivar and location of harvest (Vebericet al., 2009; Mikulic-Petkovsek et al., 2014; Mikulic-Petkovsek et al., 2016). Additionally, three triterpenes have been identified in the fruit, with levels influenced by both variety and harvest time (Salvador et al., 2015). Elderberry fruit contains approximately 0.99% ash, which includes essential minerals such as potassium (K), calcium (Ca), iron (Fe), magnesium (Mg), phosphorus (P), sodium (Na), zinc (Zn), copper (Cu), manganese (Mn), selenium (Se), chromium (Cr), nickel (Ni), and cadmium (Cd) (Kołodziej et al., 2011; Nile et al., 2014).According to nutritional analysis, 100 grams of raw elderberries provide the following average composition: water: 79.80 g, energy: 73 kcal (305 kJ), protein: 0.66 g, total fat: 0.50 g, carbohydrates: 18.40 g, dietary fiber: 7.0 g, ash: 0.64 g, minerals: Ca: 38 mg, Fe: 1.60 mg, Mg: 5 mg, P: 39 mg, K: 280 mg, Na: 6 mg, Zn: 0.11 mg, Cu: 0.061 mg, Se: 0.6 mg, Vitamins: Vitamin C: 36 mg, Vitamin A: 30 µg RAE (600 IU), B-complex (per 100g): thiamin 0.070 mg, riboflavin 0.060 mg, niacin 0.5 mg, pantothenic acid 0.140 mg, B6 0.230 mg, folate 6 µg. Fatty Acids: Saturated: 0.023 g (palmitic 0.018 g, stearic 0.005 g), Monounsaturated: 0.080 g (oleic acid 18:1), Polyunsaturated: 0.247 g (linoleic 0.162 g, alpha-linolenic 0.085 g). Wild European elderberries from Turkey have shown particularly high nutritional value, with a protein content of 2.68–2.91%, a total antioxidant capacity of 6.37 mmol/100 g fresh weight, total phenolics of 6432 mg GAE/100 g, and total anthocyanins reaching 283 mg cyanidin-3-glucoside/100 g FW (Akbulut et al., 2009).

2. MATERIAL AND METHODS

The research was carried out in the experimental field of the Research Institute for Fruit Growing Pitești – Mărăcineni. The plant material included two elderberry (*Sambucus nigra*) cultivars, 'Elrom' and 'Brădet', cultivated in open field conditions at a spacing of 3.0 × 1.0 meters. Fruits were harvested at full maturity to assess production per plant, average berry weight, berry length and diameter, number of berries per raceme, raceme weight, and total soluble solids content. For morphological measurements, 20 fruits were collected from each cultivar and evaluated using a digital caliper. Berry weight was determined as the average of 10 fruits per cultivar using an electronic balance. A total of 5 racemes were sampled per cultivar for the determination of berry count and raceme weight.

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Statistical Analysis. All analyses were performed in triplicate, and data are presented as mean ± standard deviation (SD). Statistical analysis was conducted using Excel 2021 with the XLSTAT add-in.

3. RESULTS

The analysis of quality parameters for the two elderberry (*Sambucus nigra*) cultivars, 'Elrom' and 'Brădet', highlights significant differences in terms of yield per plant, fruit size, and soluble solids content (TSS). The 'Elrom' cv. stands out with a higher average yield (2.21 kg/plant) compared to 'Brădet' cv. (1.60 kg/plant), as well as larger fruits, with an average weight of 0.17 g, a length of 6.41 mm, and a diameter of 6.35 mm. These characteristics suggest a greater potential for processing or direct consumption. In contrast, 'Brădet' cv. produces significantly smaller fruits (0.13 g, 2.37 mm length, 2.15 mm diameter), which might limit its commercial use but could still be valuable in traditional or niche products. Regarding the total soluble solids content (TSS), both genotypes show relatively similar values: 'Elrom' cv. (11.97 °Brix) and 'Brădet' cv. (11.36 °Brix), with a slight advantage in favor of 'Elrom' cv. This trait is important for sweetness and flavor, influencing the suitability of the fruits for juice, syrup, or wine production. The overall average for both genotypes indicates a mean yield of 1.9 kg/plant, with an average TSS of 11.67 °Brix, suggesting good potential for cultivation and commercial use.

Table 1. The quality parameters fruit of edelberry (*Sambucus nigra*)

Cultivar	Production/plant (kg) Mean ± SD	Berry weight (g/fruit) Mean ± SD	Length (mm) Mean ± SD	Diameter (mm) Mean ± SD	TSS °brix Mean ± SD
Elrom	2.21±0.33	0.17±0.03	6.41±0.55	6.35±0.05	11.97±1.19
Brădet	1.6±0.20	0.13±0.02	2.37±0.57	2.15±1.1	11.36±1.09
Total	1.9±0.41	0.15±0.03	4.39±2.27	4.25±2.41	11.67±1.07

The analysis of raceme quality parameters in the two cultivars reveals notable differences. The 'Elrom' cultivar exhibited a higher average number of berries per raceme (275 ± 74.32) compared to 'Brădet' cv. (206 ± 19.29), suggesting a greater yield potential per inflorescence. Similarly, the average raceme weight was higher in 'Elrom' cv. (45.33 ± 4.04 g) than in 'Brădet' (38.31 ± 2.71 g), indicating a superior biomass accumulation. The greater variability observed in 'Elrom' cv. (as reflected by the higher standard deviation) may be attributed to genetic factors or environmental influences, suggesting a possible need for crop uniformity. Overall, the mean values for the two parameters across both cultivars—240.5 ± 61.54 berries per raceme and 41.82 ± 4.93 g—can serve as useful benchmarks for future selection and breeding programs aimed at enhancing elderberry productivity.

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Table 2. The quality parameters racem of edelberry (*Sambucus nigra*)

Cultivar	Berries per raceme	Raceme weight
Elrom	275±74.32	45.33±4.04
Brădet	206±19.29	38.31±2.71
Total	240.5±61.54	41.82±4.93

4. CONCLUSIONS

The comparative study of the two *Sambucus nigra* cultivars, 'Elrom' and 'Brădet', reveals significant differences in terms of fruit and inflorescence quality parameters. The 'Elrom' cv.stood out with higher yield per plant (2.21 kg) and larger fruits, both in terms of weight (0.17 g) and size (length and diameter), making it well-suited for industrial processing or direct consumption. Additionally, this cultivar showed a slightly higher content of total soluble solids (TSS), indicating a richer flavor profile and enhanced taste quality, which are valuable traits for juice, syrup, or wine production. In contrast, the 'Brădet' cultivar produced significantly smaller but more uniform fruits, which may limit its commercial appeal in large-scale markets but could still be valuable for traditional uses or niche products. Overall, the results suggest that 'Elrom' has greater commercial potential, while 'Brădet' could serve specialized purposes, contributing to biodiversity conservation and product diversification in elderberry cultivation.

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