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THE STUDY OF SOME CHOKEBERRY GENOTYPES IN THE CONDITIONS OF SOUTHWESTERN ROMANIA

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Abstract

At the Research-Development Station for Plant Cultivation on Sandy Soil Dabuleni, three genotypes of Aronia melanocarpa were evaluated between 2022-2025. The Viking, Nero, and Melrom genotypes were tested for their suitability for expansion in fruit-tree plantations from the southwestern area of Romania. Following the study, it was found that the evaluated genotypes recorded good yields ranging between 14.25 and 16.00 kg/bush, with an average bush height of 152 to 168 cm in the 7th year after planting. The Melrom variety stood out from the other varieties studied, with an average fruit weight of 0.99 g, the largest number of berries in an inflorescence (22) and an average yield of over 16.00 kg/bush (44 tons/ha).

Key words*: Aronia melanocarpa, bush vigour, yield, fruit quality.*

INTRODUCTION

In the southern part of Romania, the climate with mild winters in the last decade, characterized by maximum temperatures that did not exceed -12°C, has put the fruit growers in the area to the test. So, the mild winters followed by springs that appeared in February, which determined the very early flowering of the stone fruit species, the late frosts that occurred during their flowering period (of peaches and apricots) had negative effects on the production of those species grown on the sandy soils of southern Romania, with negative economic effects felt by the fruit growers of this area. Thus, a real challenge arose for the researchers to find an assortment of species that would escape this spring's late frost from the first of April. One of these species was *Aronia melanocarpa*, a species belonging to the *Rosaceae* family, native to North America, where it was among the most important berries known and first used by the Indians (Bussieres.et al. 2008) as a food source. The berries were dried and ground for use in soups, stews, and cakes. The time of year when the chokeberry berries ripened was called the "black cherry month". The Native Americans used the parts of the entire bush as both medicine and food (Skvortsov, 1982 cited by Dinu et al., 2022). It is used for the vegetative parts as remedies for various ailments. For example, the dried root was chewed and placed on wounds to stop bleeding; the bark was boiled and used together with other additives as a remedy for stomach and intestinal problems; while the roots and branches were used to prepare preparations against coughs, tuberculosis, stomach pains, intestinal worms, and malaria, high fever, colds, and body chills (Strik, 2003).

In Europe, *Aronia melanocarpa* was introduced in the middle of the 18th century from the eastern part of North America. Here, it attracted attention primarily due to its appearance, since its white flowers, blooming in April-May, are considered among the most beautiful in terms of decorative appearance. Also, notable are the leaves of chokeberry in their autumn colours, which seem to glow with a special red colour. For this reason, *Aronia melanocarpa* received the award of the Royal Horticultural Society in 1972.

In Russia, was introduced at the beginning of the 20th century, when the famous Russian biologist

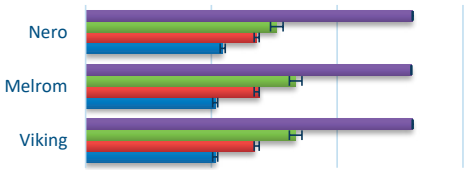
Ivan Michurin experimented with crossing it with other species from the *Rosaceae* family. Since 1946, it has been recognized as a species for fruit production in the Soviet Union, where planting on a larger scale subsequently began. Thus, it became the subject of intense scientific research due to the abundance of active principles, the numerous positive results from research on the preventive and healing effects of ripe fruits, and Russian scientists granting it the status of a medicinal plant (Nicola et al., 2020). Following the Chernobyl nuclear disaster, chokeberry fruits were used to alleviate human health problems caused by radiation. The chokeberry fruits were also called the "cosmonaut fruit" because Russian astronauts regularly consumed them in the 1950s, considering them a source of nutrients and vitamins (Rosca et al., 2019). *Aronia melanocarpa* has proven to be a species with a great capacity for adapting to pedoclimatic conditions (such as humid habitats, but also dunes, rocky slopes, and steep cliffs, as well as on overgrown or bare rocky outcrops) (Dinu et al., 2022). The studies show the spread of chokeberry, as an invasive plant, in the spontaneous flora (Vinogradova et al., 2018; Leostrin et al., 2021), it tolerates arid or excessively wet soils and very low temperatures, and is also resistant to diseases and pests (Cho et al., 2017). These characteristics allow chokeberry cultivation with fewer phytosanitary treatments, as well as rehabilitation by populating abandoned lands with vegetation (Bussieres, 2008), we know that the success of a species grown depends mainly on pedoclimatic conditions (Paltineanu et al., 2020).

MATERIALS AND METHODS

To the Dabuleni Research and Development Station for Plant Culture on Sands, an experimental lot was planted in 2019, with three cultivars: *Viking*, *Nero* and *Melrom*. The planting was carried out at a distance of 3 meters between rows and 1.5 meters between plants within each row, on raised beds, mulched with agrotechtextile, and irrigated by drip. Fertilization in the experimental plot was carried out according to the fertilization scheme presented in "Technical and Economic Guide - Fruit Trees and Shrubs" (Sumedrea et al., 2014). To identify the growth and fruiting parameters of the studied genotypes we make the following evaluations: the phenological data according to the BBCH scale (Meier, 2001; Cosmulescu, 2022), of the flower buds; the shoot growth dynamics (cm) were evaluated monthly, and the annual average was calculated. The bush volume (V) was calculated according to the formula: V= ⍺ (bush diameter in the row direction + diameter between rows) 2 x bush height)/3. The fruits quality was evaluated by analysing three repetitions for each genotype, annually, for the following characteristics: average fruit weight (g), determined by weighing and measuring berries; fruit diameter (mm); fruit height (mm) were measured with an electronic calliper; the number of berries in clusters. The fruits' biochemistry determinations were carried out, such as: soluble dry matter (% Brix) with the Atago device; vitamin C content (mg %) and fruit pH (Croitoru M., 2021). The results obtained were calculated and statistically interpreted with ANOVA, Duncan's test at $p \leq 0.5$, and the bars in each column of the figures represent the standard deviation, and the letters accompanying the values in the figures represent the significance according to Duncan's test.

RESULTS AND DISCUSSIONS

The development of the fruiting part of the bushes. The Figure 1, show that the swelling of the flower buds in all studied genotypes took place in the third decade of March, and flowering in the third decade of April; thus, according to statistics, this species escapes the incidence of late spring frosts that appear in the first and second decades of April. Monitoring of phenological data did not reveal any differences in earliness or tardiness between the analysed genotypes, so that starting from the end of August the fruits can be harvested. It should be noted that the longer they stay on the bush, the astringent taste of the fruit's decreases, and if the harvest is made after the first autumn frost the astringency of the fruits is much reduced.



	Viking	Melrom	Nero
BBCH89	26-aug.	25-aug.	26-aug.
BBCH71	25-mai	25-mai	10-mai
BBCH 63	22-apr.	26-apr.	24-apr.
BBCH 51	22-mar.	22-mar.	28-mar.

Figure 1. The fruit BBCH at the studied black chokeberry genotypes (BBCH 51 - bud swelling, BBCH 63 - beginning of flowering, BBCH 71 - full flowering, beginning of petal shedding, BBCH 89 - ripen fruit)

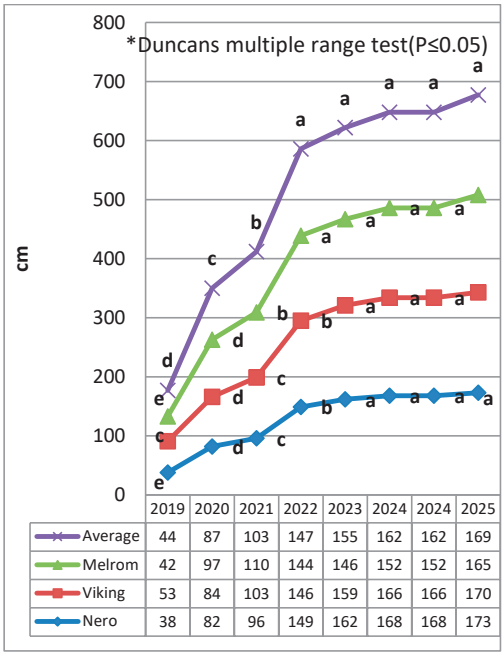


Foto 1. The *Melrom* black chokeberry genotype - BBCH71

The bush growth. Analysis of the average data recorded over the entire study period shows that, in terms of bush height growth, they had an annual growth increase of over 30 cm until the 4th year after planting (2022), the differences recorded from one year to another were statistically significant, and starting with the 5th year after planting, the increase in height growth fell into the same statistical class (Figure 2).



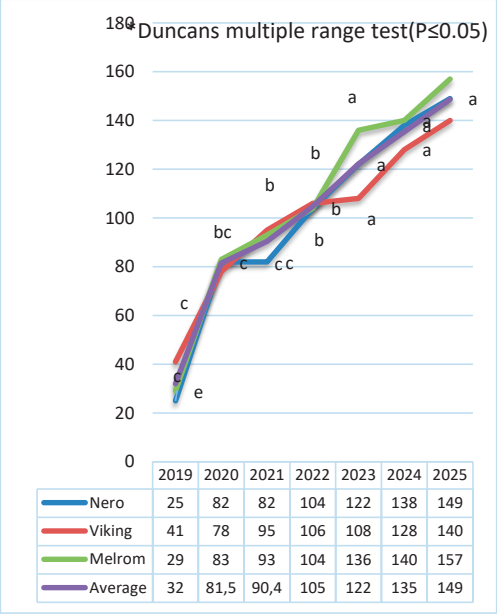
Foto 2. The *Melrom* black chockeberry genotype in 2022 year (4th year after planting)



	2019	2020	2021	2022	2023	2024	2024	2025
Average	44	87	103	147	155	162	162	169
Melrom	42	97	110	144	146	152	152	165
Viking	53	84	103	146	159	166	166	170
Nero	38	82	96	149	162	168	168	173

Figure 2. The studied black chokeberry cultivars bushes height (cm)

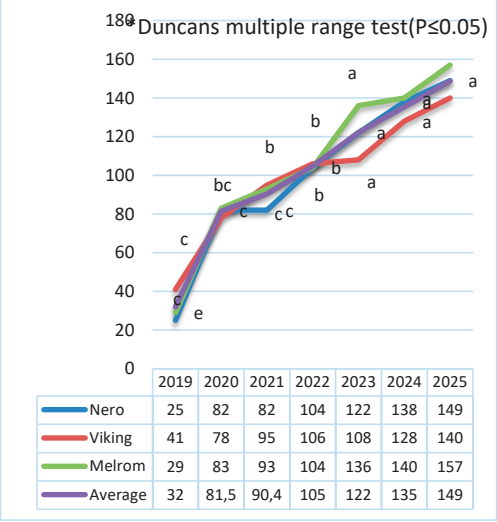
Regarding the growth of bushes in diameter presented in Figure 3, we note that in the 6th year (2024) from planting the highest average value was recorded for the *Melrom* genotype (140 cm) (Foto 1), and the differences between the study years were statistically assured.



	2019	2020	2021	2022	2023	2024	2025
Nero	25	82	82	104	122	138	149
Viking	41	78	95	106	108	128	140
Melrom	29	83	93	104	136	140	157
Average	32	81,5	90,4	105	122	135	149

Figure 3. The studied black chokeberry cultivar bushes' thickness (cm)

The evaluation of the bush volume over the entire study period shows that the *Nero* and *Melrom* varieties recorded bush volume values of 1 and 1.1 m^3, respectively, although in the first year after planting they recorded lower values than the *Viking* cv. The quality of black chokeberry fruits.



	2019	2020	2021	2022	2023	2024	2025
Nero	25	82	82	104	122	138	149
Viking	41	78	95	106	108	128	140
Melrom	29	83	93	104	136	140	157
Average	32	81,5	90,4	105	122	135	149

Figure 4. The studied black chokeberry cultivars, bushes volume (m^3)

The quality of black chokeberry fruits. Following the study carried out in Tables 1 and 2, we present the average values recorded over the entire study period for the three cultivars under study. Thus, regarding the average fruit weight, we find that the *Melrom* cv. recorded the highest value of 0.99 g/fruit without a statistically significant difference from the *Nero* cv with an average fruit weight of 0.91 g/fruit, both varieties differed by a difference of 0.30 g from the *Viking* cv. a statistically significant difference assured. In the case of fruit firmness, the annual average values recorded during the study period show that the highest value was recorded for the *Nero* cv. Regarding the biochemical content of the fruits, we find that the *Melrom* cv. recorded the highest vitamin C content, and Nero the highest soluble dry matter content (Tabel 1).

The analysis of the data in Table 2 shows that the annual average values recorded for the biometric characteristics of the fruits to the studied cultivars in each year of the study show that, in the case of the *Nero* cv, there were no statistically significant differences from one year to another in five of the 6 fruit quality characteristics analysed. The analysis of the *Viking* cv in each study year revealed statistically significant differences only in the case of fruit height and diameter, and in the case of the *Melrom* cv, no statistically significant differences were recorded in any of the fruit quality characteristics analysed.



Foto 3. *Melrom* Cv fruit production in 2022 year

The fruit production per bush was recorded annually starting with the third year after planting, so that, on average over the three years after planting, the highest fruit production per plant was recorded for the Melrom variety (16.07 kg/bush) (Figure 5)

Table 1. The black chokeberry fruits quality: average values in the study period

The fruits quality characteristics	Cultivar		
	Nero	Viking	Melrom
Berry weight (g)	0.91 a	0.73 b	0.99 a
Firmness (gF/cm^2)	0.464 a	0.440 b	0.448 ab
pH	4.01	3.68	4.32
Soluble solids (% Brix)	23.57	17.20	19.23
Vitamin C (mg/100g)	22.5	24.5	25.1

Table 2. The black chokeberry fruits biometric characteristics

Cultivar	Year	No berries in cluster	The fruit height (mm)	The fruit thickness (mm)
Nero	**2019**	22.6 a	12.07 a	11.68 a
	2020	19.6 a	12.26 a	12.07 a
	2021	21.33 a	13.49 a	12.38 a
	2022	22.0 a	12.19 a	12.30 a
	2023	18.54 a	11.55 a	11.85 a
	2024	18.11 a	11.98 a	12.10 a
	2025	21.3 a	12.21a	12.30a
	average	20.6 a	12.31 a	12.06 a
Viking	**2019**	18.33 a	13.97 a	13.97 a
	2020	19.33 a	13.61 a	12.86 ab
	2021	21.00 a	13.09 ab	12.49 b
	2022	21.33 a	13.95 a	13.56 ab
	2023	16.00 a	11.65 b	12.17 b
	2024	21.00 a	13.07 ab	13.51 ab
	2025	17.31a	13.88 a	13.92 a
	average	19.2 a	13.25 a	13.03 a
Melrom	**2019**	19.66 a	14.59 a	13.72 a
	2020	24.0 a	13.97 a	13.97 a
	2021	21.33 a	14.61 a	14.20 a
	2022	24.00 a	14.22 a	13.97 a
	2023	23.00 a	14.46 a	14.41 a
	2024	23.11 a	14.14 a	14.22 a
	2025	19.82 a	14.48 a	14.40 a
	average	22.4 a	14.37 a	14.05 a

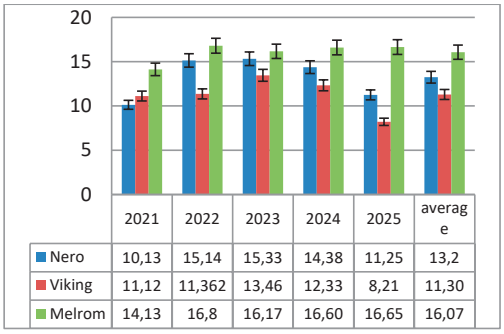


Figure 5. The fruit production to the studied black chokeberry cultivars (kg/bush)

CONCLUSIONS

The black chokeberry studied cultivars bloomed in the last decade of April, so they escaped the frequency of late spring frosts in the last years.

The volume of the bushes throughout the study period had recorded increases in every study year. At the end of the study, the *Nero* and *Melrom* cultivars reached a bush volume of over 1 m^3.

The *Melrom* genotype stood out compared to the other studied cultivars, with an average fruit weight of 0.98 g, the highest number of berries in the inflorescence (22) and an average production of over 16.07 kg / bush.

All three black chokeberry cultivars performed according to the consulted literature; it was confirmed to be productive in the sandy soil conditions from Southwestern Romania, and it can be expanded in large commercial plantations.

ACKNOWLEDGEMENTS

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