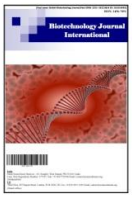

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Selection of Perspective Varieties of Cornelian Cherry in the Area of Tuzla Canton

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Authors' contributions

This work was carried out in collaboration among all authors. 'All authors read and approved the final manuscript.

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ABSTRACT

Organic food production contributes to the preservation of human health, preservation and protection of the environment and increase of soil fertility, reduction of all forms of pollution as a consequence of intensive agricultural production and animal husbandry. Hence by purchasing products that carry the label organic product consumers indirectly affect the protection and preservation of the environment Organic food is food that is worth investing in due to the smaller amount of harmful substances in the products.
Cornel cherry (*Cornus mas L.*) is one of the most suitable species for organic production. It is adaptable to various abiotic factors and is resistant to numerous pests and diseases.
Aims: The aim of the study was to select promising dogwood phenotypes from the natural population for further reproduction by grafting.
Study Design: The subject of the research was selected 6 self-growing dogwoods from a rural area.
Place and Duration of Study: Samples of fruit were collected at the site of Ćehaje, City of

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Srebrenik,Tuzla Canton, BiH in the spring of 2019.
Methodology: In order to determine the best traits, the measurement of physical quantities, determination of coefficients of variation and analysis of chemical characteristics of dogwood fruits harvested from trees of 6 wild phenotypes marked as DKA1, DKA2, DKA3, DKA4, DKA5 and DKA6 were performed.
Results: Based on the analyzed indicators, the DKA6 phenotype showed the best results.

Keywords: Organic food; cornel cherry; perspective phenotypes; environmental protection.

1. INTRODUCTION

Ecological or organic production is a comprehensive management system for farms and food production that combines best environmental practices, a high degree of biodiversity, conservation of natural resources, the application of high animal welfare standards and production methods that are appropriate given that some consumers prefer products produced using natural substances and processes [1-2]. Therefore, organic production has a dual role. On the one hand, it provides a specific market for consumers of organic products, and on the other hand, it provides public goods that contribute to environmental protection, animal welfare and rural development [3]. Organic food is produced without the use of most conventional pesticides, synthetic fertilizers, bioengineering or ionizing radiation. In order for products to be called organic, production must meet a certain established organic standard and must be certified by a recognized certification body [4]. In the last two decades, the consumption of organic food has increased significantly [5]. Recent scientific research indicates that consumers buy organic food mainly because they believe that products are safer, healthier, of better quality and better for animals and the environment [6].

The ecological dimension of organic agriculture is a critical reflection of the current, and above all modern agricultural development based on the intensive use of (non-renewable) resources and the use of chemicals in food production. Today, the harmful effects of conventional, intensive agriculture are known and proven, and on the other hand the multiple benefits of environmental [7].

At the global level, in organic farming there are the most permanent lawns (69%), followed by arable land (17%), the least permanent crops (7%), while 7% of the area has no data on the method of use. According to the geographical distribution of uses, most permanent grasslands are located in Oceania, and arable land and permanent crops in Europe [8]. The market for organic agricultural products had a turnover of € 90 billion in 2017, and the countries with the largest markets for organic products are the United States (€ 40 billion), Germany (€ 10 billion), and France (€ 7.9 billion). The entire European Union traded € 34.3 billion in organic products. Switzerland has the highest consumption of per-capita organic products with € 300, followed by Denmark and Sweden. It is obvious that the value of consumption of ecological products correlates with the degree of economic development, ie the level of GDP per-capita [9]. The development of organic production in Bosnia and Herzegovina began in 1996 with the activities of non-governmental organizations in the implementation of projects funded by foreign development agencies and other European countries [10].

Many areas of BiH, which, due to their natural potentials, natural biodiversity, unpolluted areas and traditionally determined population for agricultural production, have better predispositions in the production of safe food. In addition, in the territory of BiH in the regions registered for certain organic production, there are processing capacities for processing and processing. According to the German Institute for Agricultural Research (FiBL) in Bosnia and Herzegovina in 2017 there were 304 producers, 32 processors and 15 exporters organic products. There are processing facilities for finishing and processing of medicinal plants that are already in the process of certification of organic production, as well as other capacities (cheese, meat, grain processing, cold storage, etc.) that can very quickly, in part or in full, be introduced into the certification system and their development is the backbone organic production. The development of organic agriculture is not constant and even and it will depend on technological development and factors that affect the development of agriculture as a whole. In Europe, it took 30 years for organic production to reach a share of 1% of agricultural land and the

food market. The main difficulties in the conversion of conventional to organic production are the lack of adequate fertilizers, plant protection products against diseases and pests, and the lack of equipment used in organic production [11].

Cornel cherry has great potential importance in organic fruit production because due to its resistance it can be successfully grown giving a high yield without the use of pesticides and mineral fertilizers, without any special care measures [12-14].

In the process of fruit production, a very important process is standardized varietal production. Therefore, it is necessary to select genotypes with better characteristics and develop their standard production. Research of the natural gene pool and breeding of new varieties of dogwood depends on efficient reproduction. Introduction and cultivation of perspective selections and varieties of cornel cherry (*Cornus mas L.*) in intensive orchards, farms and household backyards is difficult due to the lack of adequate propagation methods, which results in a deficit of planting material [15] [14] Given the great importance of cornel cherry as a health-safe food, today intensive work is being done on selection and breeding in many countries rich in populations of this species.

2. MATERIAL AND METHODS OF WORK

A total of 6 self-growing cornel cherry from the non-urban area were selected as the subject of the research, Ćehaje, City of Srebrenik,Tuzla Canton, BiH (44° 43' 6.92"N and 18° 29' 32.1"E). Physiologically ripe fruits were harvested in August 2019 and marked with DKA1, DKA2, DKA3, DKA4, DKA5 and DKA6.

After harvesting, and on a sample of 100 fruits from each dogwood, morphometric measurements were performed, measurements of the physical dimensions of the fruit were performed: length, width, weight of the whole fruit, weight of the stone.

Based on the obtained results, the index of fruit shape and yield of fruit flesh were determined. The measurement results are shown in graphs and tables. In order to determine the variability of the properties, the coefficient of variation (CV) was calculated for each examined trait, which according to Bijelić et al. [16] the most reliable indicator of relative data dispersion.

3. RESULTS AND DISCUSSION

Fruit size is a varietal trait that depends on the number of fruits on the tree, technological procedures and microclimatic conditions, and is expressed by the weight and dimensions of the fruit [17] Although the fruits originate from dogwood trees located in the same location and are influenced by the same abiotic factors, differences in the examined properties were observed.

From Fig. 1 it can be concluded that the average fruit length is from 12.35 mm (DKA4) to 16.43 mm (DKA6).

From Table no. 1, it can be determined that the minimum and maximum average fruit lengths of DKA samples are smaller in relation to the results of all previous researches except the work of Brindža et al. [18] Mratinić et al. [19] and the work of Turkish authors Demir and Kalyoncu [20]

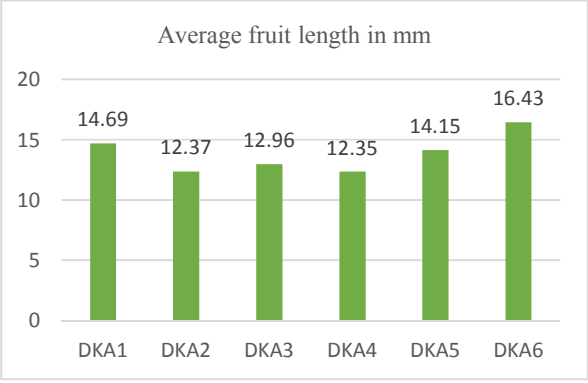

Fig. 1. Average fruit length in mm

Table 1. Comparison of average plate lengths with previous research

Research	Average Fruit Length (mm)
Galeryuz et al. (1998)	19,50 -25,16
Galeryuz et al. (1998)	16,97-24,85
Ercisli et al. (2006)	17,53-22,96
Bijelić et al. (2007)	13,64-19,69
Bijelić et al. (2012)	17,93-27,79
Turali and Koca (2008)	14,24-22,20
Demir and Kalyoncu (2003)	10,91-16,39
Jaćimović and Božović (2014)	14,30-22,83
Mratinić et al. (2015)	12,20-21,90
Brindža et al. (2009)	12,05-19,55
IN THIS RESEARCH	12,35-16,43

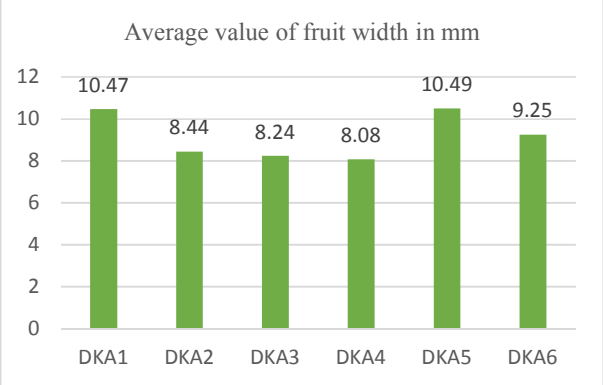

Fig. 2. Average value of fruit width in mm

The highest average width was in the DKA5 sample and the lowest in the DKA4 sample. DKA1 and DKA5 had uniform low width values.

In paper „Biological and Commercial Characteristics of Cornelian Cherry (*Cornus mas L.*) Population in the Gemer Region of Slovakia" [18] and in the work of Mratinić et al. [19] The authors state a lower minimum average fruit width in relation to DKA samples, while in all other works presented in the table the results show higher average minimum and maximum values of fruit width in relation to DKA samples.

On average, DKA6 had the highest fruit weight and DKA4 the lowest. The average masses of samples DKA1 and DKA5 have approximately equal values.

Lower minimum average fruit weights compared to DKA samples were recorded by the authors Mratinić et al. [19] and Jećimović and Božović [20], and lower minimum and maximum average masses are stated by Tural and Koca [21] in the research „Physico-chemical and antioxidant properties of cornelian cherry fruits (*Cornus mas L.*) grown in Turkey". Results of other works show higher average minimum and maximum mass values.

The average value of seed mass was highest in DKA6 and lowest in DKA2. Samples DKA1 and DKA 3 had the same average seed weights.

Bijelić et al., State higher average minimum and maximum seed weights, and in the work of Demir and Kalyoncu [20] and Jećimović and Božović [21-22], a lower minimum average seed weight was recorded compared to DKA samples.

The most economically important property of cornel cherry fruits is certainly the mass of the mesocarp, i.e. the share of the usable part in the total mass of the fruit, and it is expressed through the yield. This property is most important in the selection of cornel cherry. The lowest average mass of yield was determined in the sample DKA4, and the highest in the sample DKA 5 and DKA6.

Fruit weight is a property that is in the strongest direct correlation with mesocarp mass, while the

influence of fruit width and length is mostly indirect, through fruit mass. DKA6 had the highest whole fruit mass and the largest mesocarp mass. The DKA4 sample had the lowest whole fruit weight and the lowest mesocarp mass.

Table 2. Comparison of average fruit width with previous studies

Research	Average fruit width (mm)
Galeryuz et al. (1998)	14,42-16,30
Galeryuz et al. (1998)	13,35-15,41
Ercisli et al. (2006)	10,80-16,83
Bijelić et al. (2007)	11,92-15,11
Bijelić et al. (2012)	12,70-18,97
Turali and Koca (2008)	9,59-13,21
Demir and Kalyoncu (2003)	10,91-16,40
Jaćimović and Božović (2014)	10,46-16,91
Mratinić et al. (2014)	8,00-16,00
Brindža et al. (2009)	7,43-15,22
In this research	8,08-10,49

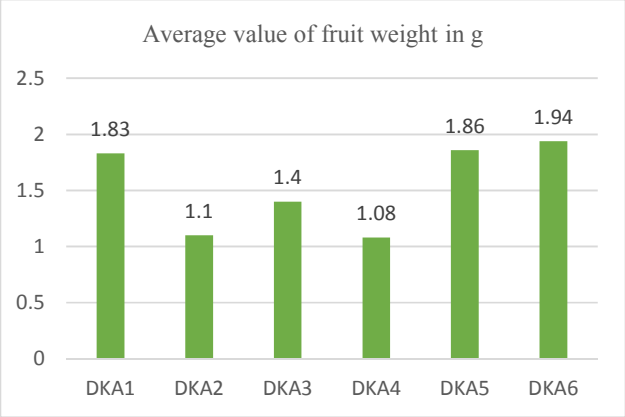

Fig. 3. Average value of fruit weight in g

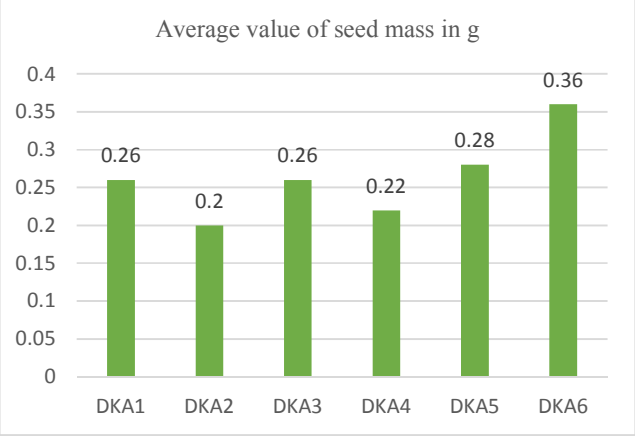

Fig. 4. Average value of seed mass in g

Table 3. Comparison of average seed weight with previous research

Research	Average Seeed Mass (g)
Bijelić et al. (2007)	0,28-0,50
Bijelić et al. (2012)	0,40-0,83
Jećimović and Božović (2014)	0,18-0,61
Demir and Kalyoncu (2003)	0,14-0,37
In this research	0,20-0,36

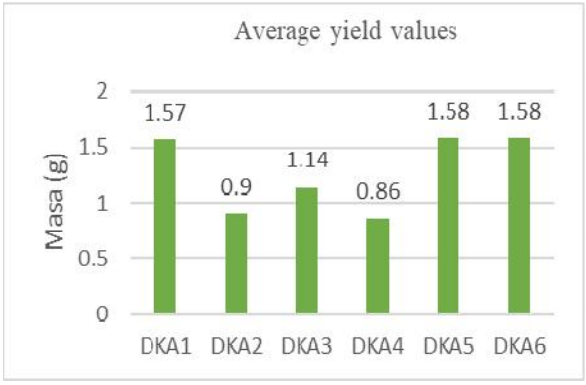

Fig. 5. Average yield values

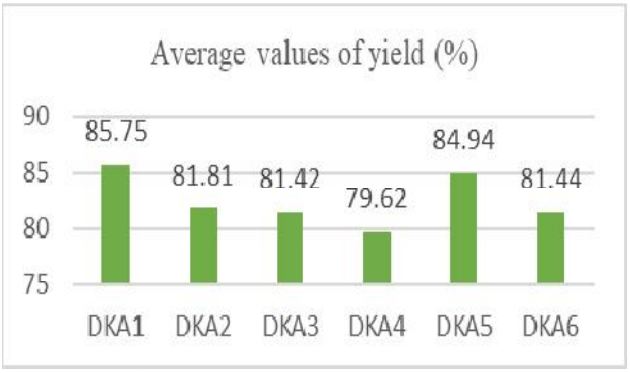

Fig. 6. Average values of yield (%)

According to Bijelić et al. [15] cornel cherry fruit is highly usable if the yield is over 75% which satisfies all examined phenotypes. This data is very important from the point of view of processing and obtaining confectionery products. DKA1 sample had the highest average yield (%), and DKA 4 the lowest average yield (%).

The minimum average value of the yield is equal to the value recorded in the work of Ercisli et al. [23] and is higher in relation to the results of all other research except for the results of the author Klimenko [24] and the authors Jećimović and Božović [21] The maximum average value of the yield is higher than the results published in the papers Bijelić et al. [21] and Cornescu and Cosmulescu [25].

The highest value of the fruit shape index was recorded in the sample DKA6, and the lowest in the sample DKA5. In the work of. Bijelić et al. [16] recorded fruit index values ranging from 1.21 to 2.50. The fruit index in the range from 1.10 to 1.85 is stated in the research of Mratinić et al.

DKA2 and DKA6 had the most stable fruit length, and the greatest variation was found in the DKA3 phenotype, 9.46%. Variation of fruit length in the work of Bijelić et al. (16) ranged from 4.22% to 6.08%. A more unstable fruit length was found in the work of Mratinić et al. (19) with variations from 7.2% to 12.2%.

Table 4. Comparison of average yield value (%) with previous surveys

Research	Average Yield (%)
Bijelić et al. (2007)	74,97-84,21
Bijelić et al. (2012)	79,00-88,46
Cornescu and Cosmulescu (2017)	72,08-79,27
Ercisli et al. (2006)	79,26-88,34
Jećimović and Božović (2014)	79,78-89,93
Klimenko (2004)	89,00-92,50
In this research	79,26-85,75

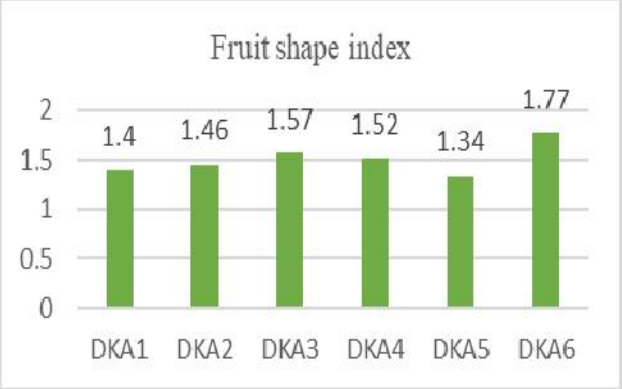

Fig. 7. Fruit shape index

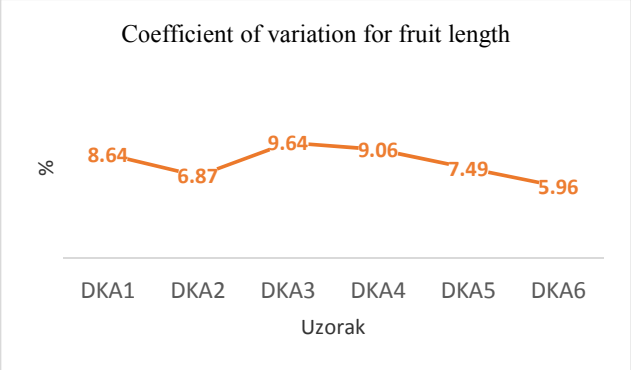

Fig. 8. Coefficient of variation for fruit length

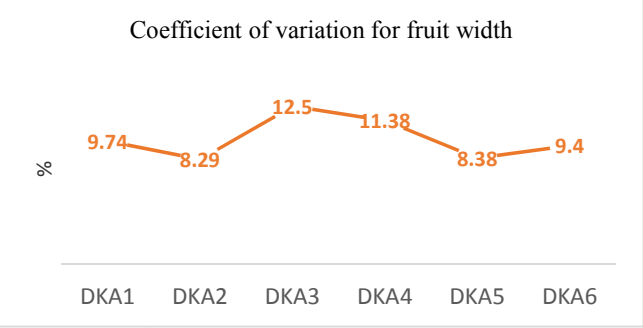

Fig. 9. Coefficient of variation for fruit width

Bijelić et al. [16] state the variation of fruit width from 4.57% to 7.85%, and Mratinić et al. [19] from 7.3% to 15.5%. In this work, DKA2 had the most stable fruit width, and the largest variations in this size were recorded in the DKA3 sample.

The lowest coefficient of variation for fruit weight was recorded in the sample DKA6 (14.43%) and the highest in DKA4 (23.14). Variations of the coefficient of variation for fruit weight ranged from 12.27% to 18.54% in the authors Cornescu and Cosmulescu [25] from 10.50% to 16.42% in the authors Bijelić et al. [16] and from 19.1% to 26.7 in the author Mratinić et al . [19].

The DKA 3 phenotype had the most stable seed weight and the DKA4 phenotype had the highest coefficient of variation. Cornescu and Cosmulescu [25] and Bijelić et al. [16] state the variation of the coefficient of variation for seed weight from 13.02% to 21.3% and from 9.34% to 15.19%.

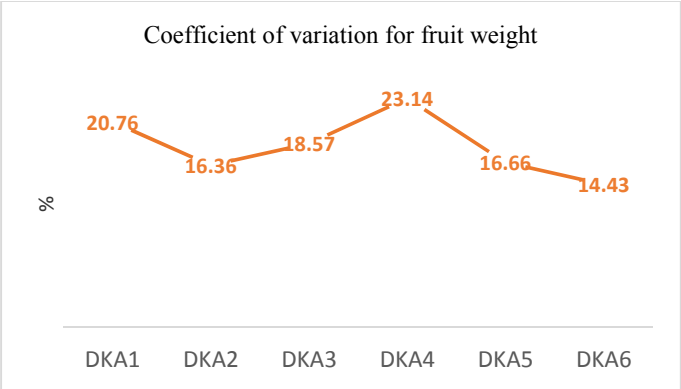

Fig. 10. Coefficient of variation for fruit weight

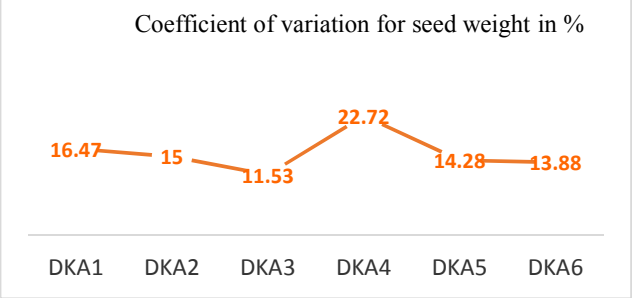

Fig. 11. Coefficient of variation for seed weight in %

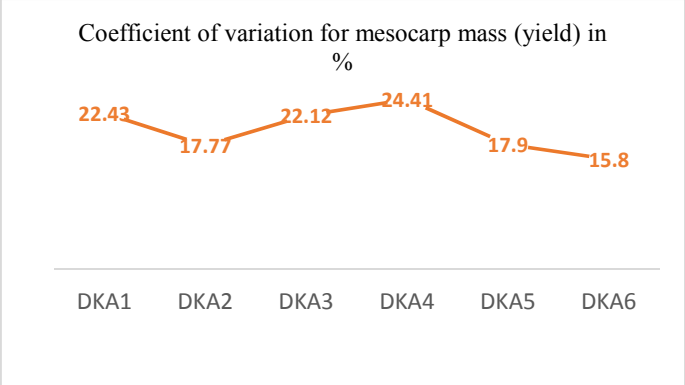

Fig. 12. Coefficient of variation for mesocarp mass (yield) in%

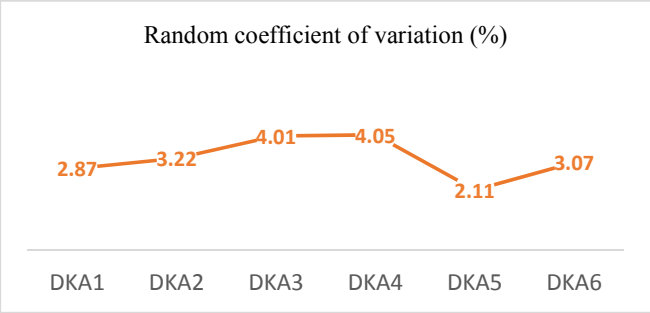

Fig. 13. Random coefficient of variation (%)

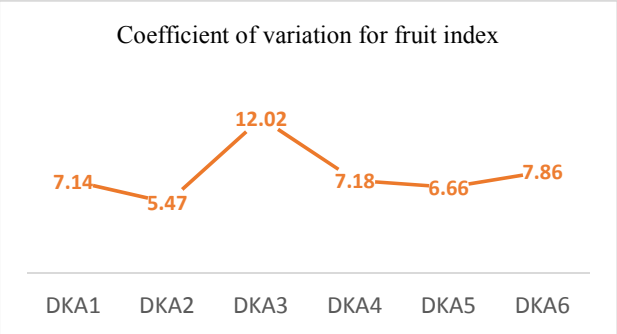

Fig. 14. Coefficient of variation for fruit index

Of all the examined properties, the mass of the mesocarp varied the most. The lowest coefficient of variation was in the sample DKA6, and the highest in DKA 4. The coefficient of variation for mesocarp mass in the authors Cornescu and Cosmulescu [25] ranged from 14.37% to 22.06%, and in the authors Bijelić et al. [16] from 11.77% to 18.93%.

Samples DKA3 and DKA4 had the largest and uniform coefficients of variation for yield (%) 4.01% and 4.05%. The lowest coefficient of variation was recorded for the DKA5 sample. Bijelić et al. (16) found variation of the coefficient of variation for the yield (%) from 2.24% to 4.41%, and the authors Cornes and Cosmulescu [25] from 3.33% to 6.56%.

The highest coefficient of variation for the fruit shape index had the DKA3 phenotype, and the lowest DKA2. In the study of Jaćimović and Božinović [21], ranges of the coefficient of variation for the fruit index from 6.2% to 11.3% were recorded.

4. CONCLUSIONS

Taking into account the objectives of the work, the conducted research and the review of the available literature, the following can be concluded:

The examined fruit samples of 6 self - growing cornel cherry showed uniqueness and mutual diversity in terms of physical and chemical characteristics.

The highest average fruit length was recorded in the DKA6 sample (16.43 mm). Compared to other samples, DKA1 (10.47 mm) and DKA5 (10.49 mm) had the highest average fruit width.

Sample DKA6 had the highest average fruit weight (1.94 g), and the highest average seed weight (0.36 g)

The average value of mesocarp mass (yield) was uniform and also the highest in samples DKA1 (1.57 g), DKA5 (1.58 g) and DKA6 (1.58 g). All samples had a yield of over 75%, which is very important for processing and obtaining confectionery products.

Based on the determined coefficient of variation, the samples DKA2 (6.87) and DKA6 (5.96) had the most stable fruit length, and DKA2 (8.29) had the smallest variation in fruit width.

The lowest coefficient of variation for fruit weight was sample DKA6, (14.43), and for seed weight sample DKA3 (11.53). The most stable yield was found for sample DKA6 (15.8), while the most stable yield (%) was found for sample DKA5 (2.11).

Based on the results, the DKA6 phenotype possessed the best traits and would be promising for reproduction by grafting.

DISCLAIMER

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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