

## Fruit Characteristics of Autochthonous Sweet Cherry Cultivars (*Prunus avium* L.) from the Banjaluka Region

Ljubomir Radoš<sup>1</sup>, Tanja Krmpot<sup>1</sup>, Fejzo Begović<sup>2</sup>

<sup>1</sup>University of Banja Luka, Faculty of Agriculture, Republic of Srpska, BiH

<sup>2</sup>School center Podrinje, Tuzla, FBiH, BiH

### Abstract

Banjaluka region is characterized by a very rich diversity of old and autochthonous sweet cherry cultivars, which represent a very important genetic potential for future breeding programs. Autochthonous sweet cherry cultivars are spontaneously propagated and used in very few areas for production and consumption in the fresh condition. A very small percentage of autochthonous cultivars are used in local markets or in some forms of processing. The main reason for this is the small number of individual trees whose fruits are used for own household and their poor management. In order to popularize the production and sale of autochthonous sweet cherry cultivars, during this research was performed the basic pomological measurements of the five most common autochthonous sweet cherry cultivars in the Banjaluka region (Ašlamka, Banjalučka crnica, Bjelica-Biljur, Cipov and Crveni hrušt). Pomological (the weight and dimensions of the fruit, weight and dimensions of the pit, dimension of the stalk and the firmness of the fruit flesh) and chemical (total soluble solids content of the fruit) fruit characteristics were determined. Results showed differences in investigated parameters between the cultivars.

*Key words:* *Prunus avium* L., autochthonous cultivar, fruit, pomological properties, quality

### Introduction

Sweet cherry (*Prunus avium* L.) is one of the oldest commercial exploitation of fruit trees, whose fruits humans used as food in prehistoric age. The first written record to sweet cherry cultivation come by Romans and Theophrastus in 300 B.C. (Brown et al., 1996).

According to Vavilov (1951), the primary center of sweet cherry origin is in Middle East gene center which includes the areas of Asia Minor, the Caucasus, Iran, Iraq and Syria.

Today, sweet cherry is grown on all continents with the most fruits production in Europe (44%), Asia (39%) and North America (13%) (Milatović et al., 2011). It is one of the most important fruit species and its world's production is constantly rising over the past several decades (Dirlewanger et al., 2007). Sweet cherry is one of the oldest fruit species in Banjaluka region, unlike apples, pears and plums, sweet cherry is a typical fruit of the garden (Radoš, 1996) and is grown in free form of large dimensions and grafting to wild sweet cherry. The true origin of the autochthonous cultivars is unknown, so it is called autochthonous cultivars or by some toponyms, for example: Azijanka, Mostarka, Talijanka, etc. In Bosnia and Herzegovina, domestic autochthonous cultivars have been cultivated for a long period and since the middle of the 1950s systematic work started in introduction and production of new, more valuable sweet cherry cultivars.

The study of autochthonous cultivars and wild fruit forms contributes to the conservation of biodiversity that represents the genetic potential of the great importance for breeding objectives and selection. Also, the cultivation of autochthonous cultivars contributes the preservation of biological and genetic diversity as well as the stability of agroecosystems. In Plant Gene Bank of Yugoslavia it was selected 175 genotypes of sweet cherry (Paunović et al., 1996). After this period, the first activities on the conservation, collection and sustainable use of autochthonous germplasm in BiH, including old fruit cultivars, were restored through the project the South East European Development Network on Plant Genetic Resources (SEEDNet). This activities realised with the Institute of Genetic Resources of the University of Banja Luka as the partner for the implementation of this project in the Republic of Srpska.

Understanding of the basis biodiversity is one of the most important factors for the proper conservation, management and usage of plant genetic resources. The importance of wild and old traditional cultivars is consequential important for breeding programs as an inexhaustible source of genetic diversity (Mondini et al., 2009).

The aim of this study was to description of the basic fruits morphological characteristics of five most common sweet cherry cultivars in the Banjaluka region.

## Materials and Methods

The fruits selected for pomological analysis were taken from five autochthonous cultivars previously marked trees which are located in three different locations in the Banjaluka region.

Cultivars: Banjalučka crnica, Biljur-Bjelica, Crveni hrušt were taken from location Kriškovci, Ašlamka was taken from Maglajani-Laktaši, and autochthonous cultivar Cipov was taken from location Jutkovic, Gradiška municipality. At the stage of technological maturity, 30 fruits per cultivar were taken from five selected sweet cherry cultivars of autochthonous cultivars. All measurements were made at the Laboratory for the Pomology of the Faculty of Agriculture, University of Banja Luka. The following parameters were measured: fruit weight, fruit length and width, stalk length and width, pit weight, pit length and width, fruit firmness and total soluble solid (TSS) content of the fruit juice.

Fruit weight was determined by weighing on a digital scale KERN EMB 600 (KERN and Sohn GmbH, Germany) with a measuring range of 0-600 ± 0.01 g. Length and width of the fruit, stalks and pits were carried out by a digital caliper (Unior, No 270). The firmness of the fruit (kg cm<sup>2</sup>) is determined by penetrometer FT 327 (Fruit Pressure Tester; Facchini, Italy). Freshly squeezed and filtered juice of each fruit was used for determination of total soluble solid content using a refractometer ATAGO (Atago Co. Ltd, Tokyo, Japan).

For biometrical and statistical comparison of data standard descriptive measures were used in combination with general linear models and appropriate post-hoc pairwise testing. The statistical significance of the differences was set at  $p < 0.05$ . Biometrical calculations of data were made with statistical software IBM SPSS 22. Practical significance of the obtained results was discussed in relation to measured characteristics.

## Results and Discussion

Old cultivars have enormous value from the point of view of biodiversity. Some of these cultivars have good resistance or excellent inner quality, while others satisfy special consumer demands (Ognjanov et al., 2012).

The choice of fruit available on the market must be broadened if fruit consumption is to become more varied. This could be achieved not only by re-introducing old varieties into cultivation, but also by using them as crossing partners in the development of new cultivars (Ildikó, 2013).

Morphological and pomometric methods are very important from the economy - technological aspect of fruit characteristic, so that can often be auxiliary methods in combination with good modern methods to provide very reliable results. Although study of morphological traits is valuable and useful in genotype identification, the results might be affected by plant development status and environmental fluctuations (Struss et al. 2001).

Consistent characteristics of sweet cherry autochthonous cultivars in scientific literature are very rare, even though the fruits of these cultivars are used on the local market or in private households. The basic fruits morphological characteristics are shown in Table 1.

Table 1. Fruit characteristics (mean and standard error) of studied cherry cultivars  
*Особине плода (аритметичка средина и стандардна грешка) анализираних сорти трешања*

Year	Cultivar	Fruit weight	Fruit length	Fruit width	Fruit firmness	TSS
		[g]	[mm]	[mm]	[kg cm <sup>2</sup> ]	[°Brix]
		$\bar{X} \pm S_{\bar{x}}$	$\bar{X} \pm S_{\bar{x}}$	$\bar{X} \pm S_{\bar{x}}$	$\bar{X} \pm S_{\bar{x}}$	$\bar{X} \pm S_{\bar{x}}$
2015	Ašlamka	5.97 ± 0.11	18.5 ± 0.44	19.5 ± 0.42	0.83 ± 0.03	15.3 ± 0.26
	Banjalučka crnica	3.48 ± 0.09	15.4 ± 0.19	16.4 ± 0.26	0.70 ± 0.03	17.7 ± 0.24
	Bjelica-Biljur	4.03 ± 0.16	16.9 ± 0.31	16.5 ± 0.38	0.43 ± 0.03	17.3 ± 0.32
	Cipov	3.07 ± 0.07	14.7 ± 0.16	16.5 ± 0.23	1.17 ± 0.04	18.8 ± 0.21
	Crveni hrušt	5.95 ± 0.08	17.9 ± 0.34	19.9 ± 0.33	1.07 ± 0.07	16.4 ± 0.26
2016	Ašlamka	5.34 ± 0.11	19.3 ± 0.16	20.8 ± 0.19	1.22 ± 0.05	14.7 ± 0.22
	Banjalučka crnica	3.76 ± 0.06	17.1 ± 0.13	18.6 ± 0.14	1.20 ± 0.07	18.2 ± 0.40
	Bjelica-Biljur	4.14 ± 0.17	17.3 ± 0.29	18.1 ± 0.31	0.80 ± 0.05	23.3 ± 0.78
	Cipov	1.88 ± 0.07	13.3 ± 0.15	14.3 ± 0.18	1.91 ± 0.08	13.6 ± 0.74
	Crveni hrušt	4.84 ± 0.13	18.0 ± 0.17	19.7 ± 0.20	1.64 ± 0.08	15.3 ± 0.24
LSD <sub>0.05</sub>		19.1 <sup>**</sup> , 0.32	9.5 <sup>**</sup> , 0.72	20.6 <sup>**</sup> , 0.78	4.1 <sup>**</sup> , 0.16	22.3 <sup>**</sup> , 1.24

\*significant difference (p<0.05), \*\*highly significant difference (p<0.01)

Analysis of fruit characteristics at autochthonous sweet cherry cultivars indicated statistically significant interaction between cultivars in different years of the study for all measured characteristics (Table 1). The highest average fruit weight had 'Ašlamka' (5.97 g) in 2015 and (5.34 g) in 2016, but the lowest 'Cipov' (3.07) in 2015 and (1.88 g) in 2016. The height and width of the fruit particularly singled out cultivars 'Ašlamka' and 'Crveni hrušt' while cultivar 'Cipov' had the smallest both measured characteristics.

As for the firmness of the fruit, 'Cipov' was singled out (1.17 kg cm<sup>2</sup>) in 2015 and (1.91 kg cm<sup>2</sup>) in 2016, while the lowest firmness of the fruit cultivar had 'Bjelica-Biljur' (0.43 kg cm<sup>2</sup>) in 2015 and (0.80 kg cm<sup>2</sup>) in 2016. As for total soluble solids of the fruit juice content, marked cultivar 'Cipov' (18.8°Brix) in 2015 and cultivar 'Bjelica-Biljur' as the sweetest cultivar (23.3 °Brix) in 2016.

The average fruit weight had (4.5 g) in 2015 and (3.9 g) in 2016. The average fruit length had (16.68 mm) in 2015 and (17.00 mm) in 2016, while the average fruit width had (17.76 mm) in 2015 and (18.30 mm) in 2016. Also, the average fruit firmness had (0.84 kg cm<sup>2</sup>) in 2015 and (1.35 kg cm<sup>2</sup>) in 2016. The average values (TSS) of the fruit juice content had (17.1 °Brix) in 2015 and (17.0 °Brix) in 2016.

Table 2. Pit and stalk characteristics (mean and standard error) of studied cherry cultivars  
*Особине стабла и коштице (аритметичка средина и стандардна грешка) анализираних сорти трешања*

Year	Cultivar	Stalk length	Stalk width	Pit weight	Pit length	Pit width
		[mm]	[mm]	[g]	[mm]	[mm]
		$\bar{X} \pm S_{\bar{x}}$	$\bar{X} \pm S_{\bar{x}}$	$\bar{X} \pm S_{\bar{x}}$	$\bar{X} \pm S_{\bar{x}}$	$\bar{X} \pm S_{\bar{x}}$
2015	Ašlamka	32.1 ± 0.83	0.72 ± 0.02	0.29 ± 0.005	11.1 ± 0.07	8.53 ± 0.07
	Banjalučka crnica	43.0 ± 0.91	0.90 ± 0.05	0.30 ± 0.005	9.8 ± 0.06	8.60 ± 0.08
	Bjelica-Biljur	36.6 ± 0.70	0.86 ± 0.02	0.24 ± 0.007	10.5 ± 0.11	8.04 ± 0.08
	Cipov	32.3 ± 0.70	0.91 ± 0.04	0.23 ± 0.004	8.89 ± 0.09	7.89 ± 0.08
	Crveni hrušt	35.6 ± 0.85	0.99 ± 0.04	0.29 ± 0.005	9.89 ± 0.07	8.76 ± 0.08
2016	Ašlamka	40.2 ± 0.99	1.11 ± 0.03	0.41 ± 0.009	11.2 ± 0.11	9.04 ± 0.05
	Banjalučka crnica	48.9 ± 0.96	1.01 ± 0.01	0.41 ± 0.005	10.2 ± 0.07	8.55 ± 0.05
	Bjelica-Biljur	36.3 ± 0.96	1.09 ± 0.03	0.34 ± 0.009	10.8 ± 0.12	8.23 ± 0.07
	Cipov	37.8 ± 0.54	0.96 ± 0.01	0.26 ± 0.007	8.7 ± 0.09	7.84 ± 0.06
	Crveni hrušt	37.4 ± 0.72	1.08 ± 0.02	0.41 ± 0.007	10.6 ± 0.11	8.82 ± 0.04
LSD <sub>0.05</sub>		57.9**, 2.34	5.2**, 0.84	32.4**, 0.02	11.4**, 0.24	9.6**, 0.18

\*significant difference (p<0.05), \*\*highly significant difference (p<0.01)

As for the dimensions of the stalk (Table 2) 'Banjalučka crnica' had the longest stalk (43.0 mm) in 2015 and (48.9 mm) in 2016, while the cultivar 'Ašlamka' had the shortest stalk (32.1 mm) in 2015 and cultivar 'Bjelica-Biljur' (36.3 mm) in 2016. From the same data characteristics, it is evident that the cultivar 'Crveni hrušt' had the widest stalk (0.99 mm) in 2015 and cultivar 'Ašlamka' (1.11 mm) in 2016. The cultivar 'Ašlamka' had the narrowest stalk (0.72 mm) in 2015 and cultivar 'Cipov' (0.96 mm) in 2016.

Cultivar 'Banjalučka crnica' had the highest weight of the pit (0.30 g) in 2015 and cultivars 'Ašlamka', 'Banjalučka crnica' and 'Crveni hrušt' (0.41 g) they had in 2016. The highest length of the pit, was determined at the cultivars 'Ašlamka' (11.1 mm) in 2015 and (11.2 mm) in 2016. Also, the highest width of the pit, was determined at the cultivar 'Crveni hrušt' (8.76 mm) in 2015 and cultivar 'Ašlamka' (9.04 mm) in 2016. The lowest weight of the pit had cultivar 'Cipov' (0.23 g) in 2015 and (0.26 g) in 2016. Same cultivar had the lowest length (8.89 mm) in 2015 and (8.70 mm) in 2016, as well as the lowest width of the pit (7.89 mm) in 2015 and (7.84 mm) in 2016.

Based on obtained results (Table 1 and Table 2), cultivar 'Cipov' in comparison with the other analyzed cultivars is significantly distinguished in pomological characteristics. This cultivar in comparison with other analyzed cultivars has the smallest weight in 2015 and 2016, fruit length and width also the lowest total soluble solid content measured in fruit juice. The same cultivar also has the smallest weight, length and width of the pit in 2015 and 2016.

## Conclusion

Based on research results of pomological characteristics of five autochthonous sweet cherry cultivars, it can be summarized the following:

- All tested sweet cherries cultivars had small fruit because the average fruit weight ranged from 3.07 g at 'Cipov' cultivar in 2015 and 1.88 g in 2016. to 5.97 g at 'Ašlamka' cultivar in 2015 and 5.34 g in 2016;
- The average fruit length had (16.68 mm) in 2015 and (17.00 mm) in 2016, while the average fruit width had (17.76 mm) in 2015 and (18.30 mm) in 2016;
- The lowest firmness of the fruit cultivar had 'Bjelica-Biljur' (0.43 kg cm<sup>2</sup>) in 2015 and (0.80 kg cm<sup>2</sup>) in 2016 and that is the softest cultivar;
- The sweetest cultivar was 'Cipov' with total soluble solid of (18.8 % Brix) in 2015 and cultivar 'Bjelica-Biljur' with total soluble solid of (23.8 % Brix) in 2016, and the smallest content of total soluble solid was recorded at 'Ašlamka' cultivar, with (14.7 % Brix) in 2015 and cultivar 'Cipov' with (13.6 % Brix) in 2016;
- As for the dimensions of the stalk cultivar 'Banjalučka crnica' had the longest stalk (43.0 mm) in 2015 and (48.9 mm) in 2016, while the cultivar 'Ašlamka' had the shortest stalk (32.1 mm) in 2015 and cultivar 'Bjelica-Biljur' (36.3 mm) in 2016;
- The cultivar 'Crveni hrušt' had the widest stalk (0.99 mm) in 2015 and cultivar 'Ašlamka' (1.11 mm) in 2016;
- The average weight of the pit was (0.27 g) in 2015 and (0.36 g) in 2016;
- The highest length of the pit, was determined at the cultivars 'Ašlamka' (11.1 mm) in 2015 and (11.2 mm) in 2016 and the highest width of the pit, was determined at the cultivar 'Crveni hrušt' (8.76 mm) in 2015 and cultivar 'Ašlamka' (9.04 mm) in 2016.

Analysis of fruit characteristics of autochthonous cultivars indicated statistically significant interaction between cultivars in different years of study for all measured characteristics.

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# Карактеристике плода аутохтоних сорти трешње (*Prunus avium* L.) бањалучког региона

Љубомир Радош<sup>1</sup>, Тања Крмпот<sup>1</sup>, Фејзо Беговић<sup>2</sup>

<sup>1</sup>Универзитет у Бањој Луци, Пољопривредни факултет, Република Српска, БиХ

<sup>2</sup>Школски центар Подриње, Тузла, ФБиХ, БиХ

## Сажетак

Бањалучка регија се одликује веома богатим и разноликим диверзитетом старих и аутохтоних сорти трешње, које представљају веома важан генетички потенцијал за будуће оплемењивачке програме. Аутохтоне сорте трешања се спонтано размножавају и у врло уском подручју користе за производњу и потрошњу у свјежем стању. Врло мали проценат плодова тих сорти се користи на локалним пијацама или у неким видовима прераде. Основни разлог за овакво понашање је мали број појединачних стабала чији плодови се користе у властитом домаћинству. У циљу популаризације производње и продаје аутохтоних сорти трешње, током овог истраживања извршено је основно помолошко мјерење пет најзначајнијих аутохтоних сорти трешње у бањалучком региону (Ашламка, Бањалучка црница, Бјелица-Биљур, Ципов и Црвени хрушт). Одређене су помолошке (маса и димензија плода, маса и димензија коштице, димензија петелке и тврдоћу мяса плода) и хемијске (садржај растворљиве суве материје у соку плода) карактеристике плода. Добијени резултати показују разлике у испитиваним параметрима између сорти.

*Кључне ријечи:* *Prunus avium* L., аутохтона сорта, плод, помолошке особине, квалитет

Ljubomir Radoš  
E-mail address: [ljubomir.rados@agro.unibl.com](mailto:ljubomir.rados@agro.unibl.com)

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