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The Pomological Traits of Autochthonous Pear Varieties in the Area of North Montenegro

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ABSTRACT

Results of monitoring phenological characteristics of 12 autochthonous pear varieties were summarized during the years. The phenophase of flowering in the examined autochtonious pear cultivars begins at the earliest in the varieties: Buzdovanka, Kaličanka and Kačmorka (26.04). The variety Medunak begins to bloom at the latest (05.05). Morphological fruit characteristics were described, and chemical characteristics were pointed out (content of dry substance, content of sugar and total acid). In our study, the highest average fruit weight of the pear varieties was in the Turšijača variety (148.9 g) and the lowest in the Sijerak variety (34.8 g). The highest percentage of soluble dry matter was found in the pear variety Buzdovanka (16.47%) and the lowest in the pear variety Sijerak (10.06%). The lowest total soluble solids (TSS) were contained in the following pear varieties: Pećanka (8.51%), Turšijača (8.73%) and Sijerak (8.75%), while the highest total soluble solids (TSS) contained were following pear varieties: Buzdovanka (13.24%) and Jarac (11.72%). The highest content of total acids is found in the following pear varieties: Turšijača (0.35%) and Jarac (0.31%), and the lowest in the variety Kačmorka (0.12%). The paper also shows results of fruit thinning and its influence on fruit weight, fruits length and fruits diameter of the examined sorts.

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INTRODUCTION

Pear, after the apple, represents one of the most important cultivars of pome fruits grown in the moderate climate zone (Hussain *et al.*, 2013). The fruits of the most common commercial cultivars of pear are highly valued by consumers thanks to low amount of calories and high nutritional value, as well as the pleasant taste (Senser *et al.*, 1999). In addition to fresh consumption, commercial and autochthonous pear fruits are used as raw materials for different types of processing in Montenegro.

The pear (*Pyrus* spp.) genus is variously said to consist of from 20 to over 70 wild or domesticated species (Terpo, 1985; Oliveira *et al.*, 2007; Potter *et al.*, 2007 and Rehder, 1940). It is relatively difficult to give an accurate number of pear species, because they easily cross-pollinate, and the obtained crosses have ambiguous taxonomic status. The existence of a very large number of cultivars, species, subspecies, varieties and clones reinforces the need for genetic characterization and verification. The wild pear is the only species of pears that grows naturally in the region of Nort Montenegro.

Pear is the most important temperate fruit crop and has been cultivated in Europe and Asia from antiquity (Janick, 2002). The pear tree cultivating has a long tradition in the area of Nort Montenegro. According to statistical data for Montenegro, the production of pears fruit on gardens and extensive orchards are 2648,9 t (total production) and yield per ha is 10,4 t/ha (Monstat, 2019).

In addition to the standard production and commercial characteristics of the pear variety for organic production, it must also meet specific requirements in terms of resistance to the most important diseases and pests. It is desirable to raise pears using varieties that are resistant to the disease: *Venturia inaequalis*, *Erwinia amylovara*, as well as pests: first of all, pear flea (*Psylla piri*), etc. (Šebek, 2011).

The actuality of these studies is increased by the positive results obtained in the world that relate to the resistance to disease of autochthonous varieties of pears, especially from the area Polimlje and wider Balkan Peninsula. It is pointed out that the title of the 'Balkan Peninsula reasures' can only be carried by varieties of pears Karamanka and Jerebasma, that are highly resistant to *Psilli pyri* and the *Erwinia amylovora* (Bele and Stuart, 1990).The special attention has been paid to the group of varieties resistant to the causal agent of pear fireblight *Erwinia amylovora* Burill. The most important and superior among them are Canadian cultivars resistant to the above mentioned pathogen (Harrow Sweet, Harrow Delight), American cultivar (Potomac) and Rumanian cultivar (Getika) (Nıkolıć *et al.*, 2000).

Autochthonous pear varieties are still keeping their importance in Montenegro and they are valuable resources as human food and an important part of rural landscape. Although the structure of varieties for organic pear production has changed over the last few decades in favor of better, better quality varieties, many growers appreciate autochtonous varieties, especially those that satisfy fertility, greater resistance to economically significant diseases and pests, frost and drought. Before deciding on the use of autohtonious varieties in organic pears orchards, especially in the mountainous area of Montenegro, it is necessary to select the best varieties according to quality and resistance (Šebek, 2008; Šebek and Kovačević, 2014).

MATERIAL and METHODS

The most important biological and pomological properties of 12 old pear varieties (Pećanka, Lubeničarka, Medunak, Kaličanka, Buzdovanka, Sinka, Turšijaača, Kačmorka, Koravac, Jeribasma, Jarac and Sijerak) from the area of North Montenegro were presented in the paper.

The study focused on few segments. Very first one included recording of the phenological traits – first flowering, full flowering, end of flowering and harvest date.

Phenological characteristics were determined as below: the beginning of flowering was recorded when at least 5% of the flowers bloomed; full flowering was accepted when at least 80% of the flowers bloomed, the end of flowering was determined when 90% of the flowers bloomed and corollas began to fall off, and harvest date was established when the fruits were sufficiently colored and soft to be eaten.

The other segment comprised pomological, i.e. physical traits - fruit weight (g), fruit length (mm), and fruit diameter of the examined sorts. Fruit mass were determined by measuring by the electric scale "METLER 1200". The result is shown in grams with the accuracy of 0.01g. Fruit dimensions – length and width were measured by vernier scale. The results are shown in mm. Dry mater was determined by drying at 105°C. Total soluble solids were determined by refractometer. The acidity was measured by titration with 0.1 N NaOH.

The study includes fruit thinning and their influence on fruit weight, fruits length and fruit diameter of the examined sorts. Obtained results were statistically processed by the method of variance analysis and checked by LSD tests.

RESULTS and DISCUSSION

The structure of the pear assortment, apart from the autochthonous varieties, also includes commercially important varieties, which are characterized by much larger fruits and better flesh quality (mesocarp) than the autochthonous pear varieties. However, many producers appreciate the autochthonous pear varieties in Montenegro and believe that they may be interesting for valorisation through tourist capacities, because this is something that is different and more powerful than the classical offer in EU countries. The significance of indigenous pear varieties is greater if disease and pest resistance is also taken into account (Šebek, 2011). Bacterial infestation caused by *Erwinia amylovora* is one of the most harmful pear diseases in the world (Bell and Zwet, 1993). Studying the effect of bacterial infestation (*Erwinia amylovora*) on 365 pear genotypes, Sestras *et al.* (2008), based on observations of natural infection, isolate nine susceptibility classes. In this study, the autochthonous Takisha variety is in the low attack class [9.1 AD% (attack degree)] and the Jeribasma variety is in the medium attack class [13 AD% (attack degree)]. Bell and Stuart (1990) point out that, by monitoring indigenous pear varieties from Serbia and Montenegro, they have found high resistance to *Psylla piricola* Först in the following autochthonous pear varieties: Jeribasma, Karamanka, Smokvarka, Mednik, Običan Vodenjak and Zelenika. The same authors emphasize the fact that the Smokvarka is a hybrid between *Pyrus communis* L. and *Pyrus elaeagnifolia* Pall. The aforementioned characteristics of the autochthonous pear varieties indicate that they must not be forgotten in organic fruit production.

Blooming time in fruit species depends on both the hereditary basis of variety and weather conditions before and during flowering in some years. Since pear is the fruit species with relatively late blooming, usually there is no late spring frost danger on flowers. However, at higher altitudes where there is a possibility of frost during flowering and it may be recommended varieties that bloom late (Šebek, 2011).

Table 1. Blooming of autochtonous pear varieties

Varieties	Beginning of flowering	Full bloom	End of flowering
Pećanka	02.05	08.05	13.05
Lubeničarka	29.04	06.05	10.05
Medunak	05.05	11.05	14.05
Kaličanka	26.04	29.04	05.05
Buzdovanka	26.04	29.04	05.05
Sinka	28.04	02.05	08.05
Turšijača	28.04	02.05	06.05
Kačmorka	26.04	29.04	05.05
Koravac	28.04	07.05	05.05
Jeribasma	28.04	02.05	08.05
Jarac	28.04	03.05	09.05

The phenophase of flowering in the examined autochtonious pear cultivars begins at the earliest in the varieties: Buzdovanka, Kaličanka and Kačmorka (26.04). The variety medunak begins to bloom at the latest (05.05). The end of flowering is the earliest in the varieties: Buzdovanka, Kaličanka and Kačmorka (05.05), and at the latest in the Sierak variety. (Šebek, 1995; Šebek and Jaćimović, 1997).

Also, the aforementioned research shows that the flow of flowering of a certain pear variety is more strongly conditioned by the hereditary traits, and the duration of flowering is conditioned by weather. It can be seen from the above that the autochtonous pear varieties have adapted the onset of flowering phenophase to the conditions of northern Montenegro. The flowering phase begins when the danger of late spring frosts is over.

According to the time of ripening of the fruit, the varieties of pears can be divided into three groups: Group I (ripens from the end of VII to the end of VIII month) Pećanka, Lubeničarka, Buzdovanka and Sinka; Group II (ripens in IX month) Medunak, Kaličanka, Turšijača, Kačmorka and Koravac; Group III (ripens in the X month) - Koravac, Jeribasma, Jarac and Sijerak. According to the groups mentioned above, most varieties ripen during the ninth month. (Šebek, 1995; Šebek and Jaćimović, 1997).

The highest percentage of soluble dry matter was found in the pear variety Buzdovanka (16.47%) and the lowest in the pear variety Sijerak (10.06%). Based on the content of dry matter in the tested pear varieties, they can be divided into three groups (according to the classification Nenadović-Mratinić and Vulić, 1988).
Group I low content of dry matter (9.12%) varieties: Pećanka, Lubeničarka, Kaličanka, Sinka, Turšijača, Kačmorka, Koravac, Jeribasma and Sijerak. Group II - medium high content of dry matter (13.15%) - varieties: Medunak and Jarac. Group III - high dry matter content (more than 15%) - variety: Buzdovanka (Šebek, 1995).

The lowest total soluble solids (TSS) were contained in the following pear varieties: Pećanka (8.51%), Turšijača (8.73%) and Sijerak (8.75%), while the highest total soluble solids (TSS) contained were following pear varieties: Buzdovanka (13.24%) and Jarac (11,72%) (Šebek, 1995).

If we want to compare the TSS content in the fruits of autochtonous pear varieties in our investigation with the TSS content in the fruits of autochthonous pear cultivars in other studies, we will emphasize the following literature data:

a) For the fruits of autochthonous pear cultivars in the territory of Bosnia and Herzegovina, the variation interval of the TSS content is from 13.51% to 19.72%. (Đurić *et al.*, 2015).
b) For the fruits of autochthonous pear cultivars in the territory of Pakistan, the variation interval of the TSS content is on a slightly lower level (11.03 to 14.42%). (Hussain *et al.*, 2015).
c) Researches of autochthonous pear varieties that were made after our investigation on the Upper Polimlje area have extended the results on the chemical properties of the fruit of autochthonous pear varieties. For the fruits of autochthonous pear cultivars in the territory of Gornje Polimlje (Bijelo Polje), the variation interval of the TSS content is 11.68% ('Pećanka') to 22.17% ('Vidovača'). The high TSS content (> 15%) was determined for the following cultivars: 'Begar', 'Ječmenka', 'Jeribasma', 'Krivodrška', 'Samoraska', 'Sijerak', 'Vidovača' and 'Zelenika'. The highest level of TSS content was recorded in fruits of 'Begar', 'Zelenika' and 'Vidovača' (18.5%, 19% and 22.17%, respectively) (Jaćimović *at. al.*, 2015).

The highest content of total acids is found in the folowing pear varieties: Turšijača (0.35%) and Jarac (0.31%), and the lowest in the variety Kačmorka (0.12%). According to the content of total acids, which range from 0.10 - 0.59% in the varieties of pears, we have divided into three groups of varieties (E. Nenadović-Mratinić and Vulić, 1988; Šebek, 1995).

Group I (from 0.10 to 0.20% - low content of total acids) - with following varieties: Lubeničarka, Medunak, Kaličanka, Buzdovanka, Sinka, Kačmorka and Koravac. Group II (from 0.20 to 0.40% - medium high content of total acids) - with following varieties: Pećanka, Turšijača, Jeribasma and Jarac. Group III (from 0.40 to 0.59% high content of total acids) variety; Sierak.

According to the results presented above, it can be concluded that among the examined varieties of pears, varieties with a low content of total acids predominate. Comparing the ratio of soluble dry matter content to total acidity, it is observed that the varieties with the highest dry matter content, at the same time, are among the tested varieties of pears with low total acidity content (Šebek, 1995).

In our study, the highest average fruit weight of the pear varieties was in the Turšijača variety (148.9 g) and the lowest in the Sijerak variety (34.8 g). The coefficient of variation is highest for pear varieties with the lowest fruit weight (Sijerak, Kačmorka and Pećanka). An exception is the Kaličanka variety, which has a small but uniform fruit (low value of the coefficient of variation). Other varieties have relatively uniform fruits, ie., there is no large variation in fruit mass within a single variety. According to the size of the fruit, we classified the examined pear varieties into four groups. Group I (varieties of very small fruit weight less than 50 g): Pećanka, Kaličanka, Kačmorka and Sijerak. Group II (varieties of small fruit weight - from 50 g to 80 g): Lubeničarka, Medunak, Sinka I Koravac. Group III (varieties of medium-sized fruit weight - from 80 g to 100 g): Jeribasma and Jarac. Group IV (varieties of large fruit weight - more than 100 g): Buzdovanka and Turšijača (Šebek, 1995; Šebek *et al.*, 1997).

If we want to compare the fruit weight in the fruits of autochtonous pear varieties in our investigation with the fruit weight in the fruits of autochthonous pear cultivars in other studies, we will emphasize the following literature data:

a) Selamovska *et al.*, (2015) examined the local pear varieties in West Macedonia, which showed the variation of fruit weight in the range of 13.8 g to 214.1 g.
b) Đurić *et al.*, (2015) examined the fruit weight of local pear varieties (*Pyrus communis* L.) in north-western part of Bosnia and Herzegovina and concluded that it ranged from 31.1g to 109.4 g.

Comparing our data with those of other authors, it can be concluded that dimensions of the fruit are in approximate range (Selamovska *et al.*, 2015; Đurić *et al.*, 2015) indicating that similar fruit weight causes similar dimensions, because there is positive correlation between these characteristics. This can be explained by the fact that the fruit weight is more influenced by environmental factors than the dimensions (Šebek, 2010).

The greatest fruit length of the pear varieties was found in the variety of Turšijača (70.60 mm) and the smallest in the variety of Sierak (34.13 mm). The greatest fruit width of the pear varieties was found in the variety of Turšijača (46.43 mm) and the smallest fruit width was in the variety of Kaličanka (34.13 mm). The greatest variation in the length and width of the fruit is present in the varieties of Sierak, Kačmorka and Pećanka and the smallest is present in the varieties of Kaličanka and Jarac (Šebek ,1995; Šebek *et al.*, 1997).

Fruit producers must focus on implementing all measures that will meet market requirements to constantly produce high quality fruits in maximum quantity (Link, 2000). It is often impossible to maximize all quality parameters because of the positive and negative reactions between them, and therefore a responsibly balanced trade-off between quality and quantity must be established (Link, 2000). Manual interspace thinning, which is applied late, after the June rash of the fruits, may increase the size of the fruit, but not reduce the alternative fertility (Maas, 2006). In addition, it is slow and expensive because of the large number of workers employed.

Some indigenous pear varieties in the same inflorescence will trap more fruits, leading to competition for nutrients between them. In the year when the fruit forms a far greater number of flower buds / flowers than they need for fertility in the flowering vegetation, and the fruit is well harvested, an excessive number of fruits is formed which is a great burden for the fruit. Competition between fruits reduces their size (Dussi *et al.*, 2006) and adversely affects other traits: color, shape, taste, firmness and durability.

The results of the fruit thinning test over three years (2016-2018) on 12 pear varieties (Pećanka, Lubeničarka, Medunak, Kaličanka, Buzdovanka, Sinka, Tursijača, Kačmorka, Koravac, Jeribasma, Jarac and Sijerak) were presented in our earlier work. The study included thinning of fruits and their effect on fruit weight, fruit length and fruit diameter of the varieties tested. Manual thinning of the fruit had a positive effect on the fruit weight in the following autochtonous pear varieties: Pećanka, Kaličanka, Kačmorka, Sijerak, Lubeničarka, Medunak, Sinka, Koravac and Jeribasma (Šebek, 2020).

Manual interspace thinning of the fruits had a positive effect on the weight of the fruit in all autochthonous varieties of pear from group I (varieties of very small fruit weight) as follows: Pećanka, Kaličanka, Kačmorka and Sijerak; also for all varieties in Group II (small fruit weight varieties), namely: Lubeničarka, Medunak, Sinka and Koravac also for one variety from group III (medium-sized fruit weight): variety Jeribasma. There was no effect of the manual interspace thinning technique on the

fruit mass of the three varieties, namely: Buzdovanka, Turšijača and Jarac. Due to the importance of the above, the results of manual interspace thinning of the fruit are also presented in Table 2.

Table 2. Average values of examined morphological indicators of fruits

Sort	Fruits weight (g)				Fruits length (mm)				Fruits diameter (mm)			
	Thinning		Control		Thinning		Control		Thinning		Control	
	g	CV%	G	CV%	mm	CV%	mm	CV%	mm	CV%	mm	CV%
1	68.4	20.5	46.9	22.2	42.1	17.4	36.5	17.7	47.5	15.1	41.1	15.6
2	81.2	15.2	71.1	15.7	58.2	11.0	51.1	11.6	44.2	10.0	40.6	10.1
3	78.9	15.1	55.7	15.6	62.2	9.8	54.4	11.3	48.5	10.8	43.3	9.7
4	52.2	15.2	37.8	15.5	47.5	12.5	39.5	9.9	42.2	8.5	34.1	8.2
5	109.9	17.4	104.4	17.7	69.9	12.0	68.5	12.3	57.9	9.9	57.7	10.1
6	74.2	18.1	51.7	19.0	60.1	11.1	54.8	11.7	46.8	9.0	42.2	9.6
7	152.6	17.2	148.9	17.5	72.2	12.2	70.6	12.7	66.1	10.5	64.4	10.9
8	59.2	22.2	44.0	25.4	49.8	17.8	43.3	18.3	45.6	14.0	42.1	16.2
9	97.7	16.5	79.1	19.1	64.2	12.2	57.2	12.9	49.8	9.7	45.4	10.3
10	98.5	16.8	84.4	17.4	60.1	12.1	54.7	13.2	48.6	10.8	45.3	11.6
11	99.5	15.0	96.6	15.4	60.2	10.2	59.8	10.5	58.9	9.2	58.8	9.2
12	59.2	21.4	34.8	27.2	40.9	17.7	34.1	19.2	41.1	16.0	35.1	17.2
LSD												
0.05			4.66				1.22				1.45	
0.01			6.90				1.96				1.88	

Legend: 1-Pećanka, 2- Lubeničarka, 3- Medunak 4- Kaličanka, 5- Buzdovanka, 6- Sinka, 7-Turšijača, 8- Kačmorka, 9- Koravac, 10- Jeribasma, 11- Jarac, 12- Sijerak.

Let us recall the positive effect of the manual interspace thinning of the apple variety Priol delises, the first recognized apple variety by Slovenian breeder Joseph Priol. Črnko (1976), cit. according to Gliha (1978), in the experiment with manual thinning, in the Priolov delises variety, increased the proportion of the first class to 95%. Also, the decline of the fruits was much smaller and the harvest better.

In our study, the yellow base color of the epidermis was found in 5 varieties (Pećanka, Medunak, Kaličanka, Buzdovanka and Kačmorka), light green in 4 varieties (Lubeničarka, Jeribasma, Jarac and Sijerak), yellow-green in 2 varieties (Sinka and Koravac) and green - yellow in 1 variety (Turšijača). As far as coloration is concerned, we can conclude that there are five varieties with no supplementary color (Pećanka, Sinka, Kačmorka, Koravac and Jarac). The other 7 varieties can be divided into two groups:

Group I (supplementary color present on a small number of fruits): Turšijača, Sijerak and Buzdovanka.

Group II (supplementary color present on all fruits): Medunak, Jeribasma, Kaličanka and Lubeničarka. Dark red supplementary color was found in the variety (Lubeničarka), red color was found in four varieties (Kaličanka, Buzdovanka, Turšijača and Sijerak) and the color of baked brick was found in 2 varieties (Medunak and Jeribasma).

Small lenticels are present in varieties: Kaličanka, Kačmorka, Jarac and Sijerak (4). Medium-sized lenticels are present in varieties: Lubeničarka, Medunak, Buzdovanka and Jerebasma (4). Large lenticels are present in varieties: Pećanka, Sinka, Turšijača and Koravac (4).

The color of the lenticels of the tested pear varieties is different. The color of rust is predominant, and it occurs in ten varieties. The exceptions are green lenticels in the Kaličanka variety and reddish lenticels in the Lubeničarka variety (Šebek Gordana, 2020).

Table 3. Fruit skin color and size and color of lenticel on fruit

Varieties	The color of the epidermis		Lenticele		Supplementary color in fruit with fruit thinning
	Basic	Supplementary	Size	Color	
Pećanka	green-yellow	none	large	rust	-
Lubeničarka	open- green	Dark red	medium	reddish	more intense
Medunak	green	baked brick	medium	rust	more intense
Kaličanka	yellow-green	red	small	green	more intense
Buzdovanka	yellow-green	red at 40%	small	rust	same
Sinka	yellow-green	none	large	rust	-
Turšijača	green	red at 10%	large	rust	Same
Kačmorka	yellow-green	none	small	rust	-
Koravac	green-yellow	none	large	rust	-
Jeribasma	light-green	baked brick	medium	rust	more intense
Jarac	Intensely green	none	small	rust	-
Sijerak	light-green	red at 10%	small	rust	Same

Development of drought tolerance for autochtonous pear varieties is the result of overall expression of many adaptive traits in a specific environment. The adaptive traits can be physiological and morphological, such as: selection of rootstocks resistant to drought, selection of autochthonous cultivars with greater water attaining capabilities, selection of autochtonous pear varieties tolerant to dry conditions, etc. Thus, in order to improve yield of fruits under drought stress conditions, selection of autochtonous pear varieties with short life span (drought escape), incorporation of traits responsible for well – developed root system, high stomatal resistance, high water use efficiency (drought avoidance) represent the traits responsible for increasing and stabilizing yield of fruits during drought stress period (drought tolerance). Drought stress is highly variable in its timing, duration and severity, and this result in high environmental variation and G×E variation (Witcombe *et al.*, 2005).

Drought resistance is an excellent aspect of the autochthonous pear varieties in regard to the production of one-year-old seedlings. The dynamics of leaf dehydration per measured interval was determined by method of Eremeev 1964 (cit. according to Šebek, 2010). Eremeev's method is relevant for determination of water attaining capability of leaves. Loss of water at the time of transpiration will be monitored by measuring of the weight of cut leaves (Slavik, 1974 cit. according to Šebek, 2010). Level of regained hydration will be monitored after 12h from cutting the leaves from one-years seedlings of autochthonous pear varieties. The loss of water due to

transpiration followed by measuring the weight of leaves (Šebek, 2010). The dynamics of leaf dehydration was measured in order to obtain initial resistance rate of autochthonous pear varieties towards drought conditions. The dynamics of leaf dehydration depends on the thickness of leaf cuticle and leaf average size. Out of the studies autochthonous pears varieties, the highest water attaining capability had the leaves of varieties "Kaličanka". Over the monitored time interval (8 hours upon sample taking), leaves taken from the annual twigs of the studied varieties (one-year old seedlings) lost on average 35.50% of water. The lowest level of the stated capability was recorded with the leaves of cultivar "Kačmorka" (40.44%). Over the monitored time interval (8 hours upon sample taking), leaves taken from the annual twigs of the control (one-year old rootstocks *Pyrus communis* L.) lost on average 35.08% of water. The leaves of cultivar "Kaličanka" had the highest water attaining capability. The lowest level of the stated capability was recorded for the leaves of cultivar "Kačmorka". The results of this research (Šebek, 2010) also showed that the water attaining capability of the leaves in one-year old seedlings of autochthonous pear cultivars as an indicator of their resistance to drought was genetic characteristic of the varieties. Most of the autochtonous pear varieties tested showed results close to the values obtained from the control (*Pyrus communis L*) which is good from the point of view of possible use of autochtonous varieties of pear for production in the mountainous area of Montenegro, as well as for selection work.

The most important result of our earlier research is the fact that we determined the compatibility between researched autochthonous varieties of pears and vegetative rootstocks (Quince MA and Quince Ba 29) (Šebek and Kovčević, 2014; Šebek, 2019).

CONCLUSION

Autochthonous pears varieties in Nort Montenegro revealed high variation in most of the searched parameters.

The phenophase of flowering in the examined autochtonious pear cultivars begins at the earliest in the varieties: Buzdovanka, Kaličanka i Kačmorka (26.04). The variety Medunak begins to bloom at the latest (05.05), even later than the selected type of wild pear. The end of flowering is the earliest in the varieties: Buzdovanka, Kaličanka and Kačmorka (05.05), and at the latest in the Sierak variety.

According to the time of ripening of the fruit, the varieties of pears can be divided into three groups: Group I (ripens from the end of VII to the end of VIII month) Pećanka, Lubeničarka, Buzdovanka and Sinka (4); Group II (ripens in IX month) Medunak, Kaličanka, Turšijača, Kačmorka and Koravac (5); Group III (ripens in the X month) - Koravac, Jeribasma, Jarac and Sijerak (4).

The highest percentage of soluble dry matter was found in the pear variety Buzdovanka (16.47%) and the lowest in the pear variety Sijerak (10.06%).

The lowest total soluble solids (TSS) were contained in the folowing pear varieties: Pećanka (8.51%), Turšijača (8.73%) and Sijerak (8.75%), while the highest total soluble solids (TSS) contained were following pear varieties: Buzdovanka (13.24%) and Jarac (11,72%).

The highest content of total acids is found in the following pear varieties: Turšijača (0.35%) and Jarac (0.31%), and the lowest in the variety Kačmorka (0.12%).

The highest average fruit weight of the pear varieties was in the Turšijača variety (148.9 g) and the lowest in the Sijerak variety (34.8 g). The coefficient of variation is highest for pear varieties with the lowest fruit weight (Sijerak, Kačmorka and Pećanka). An exception is the Kaličanka variety, which has a small but uniform fruit (low value of the coefficient of variation). Other varieties have relatively uniform fruits, ie., there is no large variation in fruit mass within a single variety.

The production of seedling material of autochthonous sorts with vegetative rootstocks Quince MA and Quince Ba 29 is enormous contribution for even partially saving of fruit genofond that is the unity product of our ecological environment and autochthonous biogenesis.

DECLARATION OF COMPETING INTEREST

The author declares that there is no conflict of interest.

CREDIT AUTHORSHIP CONTRIBUTION STATEMENT

The author declared that the following contributions are correct.

Gordana Šebek: Writing-original draft, methodology, formal analysis, review and editing.

REFERENCES

Bell RL and Stuart LC (1990). Resistance in Eastern European *Pyrus* germplasm to pear psylla nymphal feeding. *HortScience, 25: 789-791.*

Bell RL and Zwet T (1993). New fire blight resistant advanced selections from the USDA Pear Breeding Program. *Acta Horticulturae, 338: 415-420.*

Dussi MC, Giardina G, Reeb P, De Bernardin F and Apendino, E (2006). Fruit thinning effects in the apple cv. 'Royal Gala'. *Acta Horticulturae, 727: 401-408.*

Đurić G, Žabić M, Rodić M, Stanivuković , Bosančić B and Pašalić B (2015). Biochemical and pomological assesment of European pear accessions from Bosnia and Herzegovina. *Horticultural Science (Prague), 42 (4): 176-184.*

Gliha R (1978). Apple varieties in modern production. *Moša Pijade*. Zagreb (In Croatian).

Hussain S, Masud T, Ali S, Bano R and Ali A (2013). Some physic-chemical attributes of pear (*Pyrus communis L.*) cultivars grown in Pakistan. *International Journal of Biosciences, 3 (12): 206-215.*

Jaćimović V, Božović Đ and Lazović B (2015). Biological characteristics of autochthonous pear varieties (*Pyrus communis* L.) in the Upper Polimlje region. *Fruit Growing, 51: 7-11.*

Janick J (2002). Ancient Egyptian agriculture and the origins of horticulture. *Acta Horticulturae, 582: 23-39.*

Link H (2000). Significance of flower and fruit thinning on fruit quality. *Plant Growth Regulation. 31: 17-26.*

Maas (2006). Le varieta introdotte nel mondo neglianni 80: Pesco. Nettarine. Percoche. *L informatore Agrario, 45: 5-29* (In Italian).

Monstat (2019). Statistical Yearbook of Montenegro. *Statistical Office,* Montenegro.

Nikolić M, Milenković A and Mılenković S (2000). Developments in pear breeding: Cultivars and rootstocks. *Proceedings of Institute PKB Agronomic*, 6 (1): p. 223-230, Belgrade, Serbia (In Serbian).

Nenadovic-Mratinic, E and Vulic T (1988). Indigenous apple varieties in the undersized region. *Yugoslav Fruit Growing, 22 (4): 319-324.*

Oliveira CM, Mota M, Monte-Corvo L, Goulao L and Silva DM (2007). Molecular typing of Pyrus based on RAPD markers. *Scientia Horticulturae, 79: 163-174.*

Potter D, Eriksson T, Evans RC, Oh S, Smedmark, JEE, Morgan DR, Kerr M, Robertson KR, Arsenault M, Dickinson TA and Campbell CS (2007) Phylogeny and classification of Rosaceae*, Plant Systematics Evolution, 266: 5-43.*

Crnko J (1976). *Priols delicious and lonjon the new apple cultivars.* Master's Thesis. Biotehniska Fakulteta, Ljubljana (In Slovenian).

Rehder A (1940). Manual of cultivated trees and shrubs. *Mac Millan*, New York, NY.

Selamovska A, Miskoska-Milevska E, Najdenovska O and Canev I (2015): Fruit characteristics of some traditi onal pear varietes in the Prespa region. *Acta Agriculturae Serbica, XX (40): 107-115.*

Senser F, Scherzo H and Munchen G (1999). Tablas De composicion de alimentos, 2nd edition. *Editorial Acribia,* Zaragosa.

Sestras A, Sestras R, A Barbosi A and Militaru M (2008). The Differences among Pear Genotypes to Fire Blight (Erwinia amylovora) Attack, Based on Observations of Natural Infection. *Notulae Botanicae Horti Agrobotanici Cluj-Napoca, 36 (2): 98-103.*

Šebek G (1995). *The study of agro-biological characteristics of autochthonous varieties of apple and pear in the area of upper Polimlje.* Master's Thesis. University of Belgrade, Faculty of Agriculture (In Serbish).

Šebek G, Peković Đina, Jaćimovič Vučeta, Veličković Nebojša (1997). Morphological and organoleptic characteristics of fruits of autochthonous varieties of pears of the upper Polimlje. *Contemporary Agriculture. 5 (6): 45-51.*

Šebek G and Jacimovic V (1997) Some more important physiologic characteristics of autochthonous apple and pear varieties in the region of upper Polimlje*. Agriculture and Forestry 43 (1-2): 23-30.*

Šebek G (2008). *Low temperature resistance of autochthonous pear varieties from the Upper Polimlje area.* Proceedings of the 2nd Slovenian Fruit Growing Congress and International Participation. Strokovno sadjarsko društvo Slovenije. 561-566 Krško (In Serbish).

Šebek G (2010). The possibility of using native varieties for organic pears. *Proceedings of the First International Gender Conference of Healthy, Organic and Organic Food Production Bio Planet BOOK*, Zlatibor (Serbia). 131-140 (In Serbish).

Šebek G (2011). Organic fruit production. LMOC projekt. *Austrian Development Agencu.* (In Serbish)

Šebek G and Kovačević V (2014): Compatibility and verdure of seedling for autochtonous pear in the region of north Montenegro. *Genetika, 46 (1): 277-286.*

Šebek G (2019). *Biological characteristics of fruit planting material grafted on Ba 29 rootstock in Montenegro. 24th International symposium on biotechnology,* Faculty of Agronomy, *Čačak, Serbia.*

Šebek G (2020). *The influence of fruitlet interspace thinning on weight of fruit of autochthonius varieties of pears grown in upper Polimlje*. 25th International Symposium on Biotechnology, Faculty of Agronomy, Čačak, Serbia (In Serbish).

Terpo A (1985). Studies on taxonomy and grouping of *Pyrus* species*. Feddes Repertorium, 96: 73-87.*

Witcombe JR, Joshi KD, Gyawali S, Musa AM, Johansen C, Virk DS and Sthapit B (2005): Participatory plant breeding is better described as highly clientoriented plant breeding. I. Four indicators of client-orientation in plant breeding. *Experimental Agriculture, 41: 299-319.*