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E-mail: vitkov_bg@abv.bg

REPRODUCTIVE MANIFESTATIONS OF SOME APPLE CULTIVARS AND FORMS FROM THE LOCAL GENE POOL IN THE REGION OF THE TOWN OF APRILTSI

Vasil Vitkov

Research Institute of Mountain Stockbreeding and Agriculture, 5600 Troyan, Bulgaria

SUMMARY

2012-2013 .
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Malus, L.
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- 197.9 g;
- 158.3 g.
101 150 g
51 100 g.

The study was conducted during the period of 2012/2013 in the area of the town of Apriltsi, a typical representative of the Central Balkan Mountain fruit-growing region. Expeditionary researches were conducted on local and old apple cultivars and forms, threatened from extinction. Their reproductive characteristics were studied.

A great diversity of cultivars of genus *Malus*, L. could be observed in the region of the town of Apriltsi. The combination of agro-ecological conditions in the Marishnitsa locality is favourable to the studied apple cultivars and forms for abundant fruit-bearing, in spite of their age, as for 'Stefanka' cultivar was achieved a record yield – 1 t per tree according to data from the landlords. The highest average weight per fruit was registered for 'Belle de Boskoop' cultivar – 197.9 g; 'Troyanka' cultivar also belongs to the large-sized fruit cultivars – 158.3 g. Fourteen cultivars have average-sized fruits from 101 to 150 g and the same is the number of those with small-sized fruits from 51 to 100 g. 'Shekerka' cultivar is the

– 47.8 g.

only one that belongs to the group of very small-sized fruits – 47.8 g. Most of the studied cultivars have fruits with attractive appearance, intense colour of fruit skin, juicy and tasty fruit flesh, rich chemical composition and valuable nutritional and dietary qualities.

Their good storage capability at ordinary home conditions is also valuable economic quality.

Key words: apple, local cultivars and forms, fruit weight, fruit skin colour, chemical composition

INTRODUCTION

The fear in people of recently offered food products, including fruits, contaminated by many chemical agents, brings forth a striving for increasingly greater demand for organic food.

A lot of organic farms have already been registered, which produce fruits using only allowed fertilizers and plant protection products.

They however have a high price, which is the reason for fruit growers to search for alternative technology for fruit production. One of these is the use of old and local fruit cultivars, which are distinguished by very good adaptability to unfavourable natural and climate conditions, and they are also less susceptible to diseases and pests (Hristov, 1956).

Here is the place for fruit growing

(,1956).

1964; Silbereisen et al., 1996).

together with the development of new fruit production technologies to search, study and preserve the valuable old cultivars and forms, which are a product of local selection (natural sexual hybridization and selection) and to offer the best of them (Vasilev, 1964; Silbereisen et al., 1996).

(1958)

In the middle of the last century, Stoichkov et al. (1958) announced some foreign cultivars ('Kozhesta Reneta', 'Beurr Diel' etc.), which had been introduced in our country after 1880, for being extinct from our orchards long ago, because their susceptibility towards extreme heats, drought and warm weather in the end of winter and beginning of spring, was very low (Stoichkov et al., 1958).

1880 .

1958).

Local cultivars and forms are distinguished among one another considerably in relation to their susceptibility towards extreme cold and hot weather, the insufficient atmospheric moistening and large fluctuation in atmospheric temperatures in the end of winter and beginning of spring.

For example, the trees of 'Karastoyanka', 'Kichovka', 'Ayvaniya' etc., freeze more severely and more often in comparison with other cultivars, such as 'Tetovka', in case of turning cold, because they awake faster to growth in warm weather in the end of winter, but 'Skrinyanka'

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, 1958).

and 'Buhavitsa' suffer severely from extreme heats and drought weather. These significant differences among local cultivars were not very often taken into account, therefore they were not able to survive in the assortment of some habitats (Stoichkov et al., 1958).

However, the situation is different along the northern slopes of the Central Balkan Mountain, where the temperature fluctuations do not have large amplitudes and till nowadays a lot of old apple cultivars could be found. In order to preserve germplasm, they have to be identified, studied and preserved for the coming generations.

There are both a lot of the old apple cultivars, threatened by extinction, and some of the local forms in the region of Apriltsi, derived by open pollination. The vegetative presentations of selected trees in that region were studied in another scientific work of ours.

The aim of the present work was to find old, threatened by extinction local apple cultivars and forms and to study their reproductive characteristics.

MATERIAL AND METHODS

During the summer-autumn period of 2012 and 2013, a series of expeditionary researches were conducted on apple cultivars and

2012 2013 .

600 m.		forms in the region of the town of Apriltsi, Marishnitsa neighbourhood. The average altitude is about 600 m. The soils are gray and dark gray forest. The annual rainfall amount was 900 mm. The climate is characterized by cool summers and prolonged, but relatively mild winter. The settlement is situated in the foothill of the northern slopes of the Central Balkan Mountain, just below Maragidik and Botev mountain peaks.
900 mm.		
90 %		More than 90% of the apple trees here were planted before the establishment of the former Labor Cooperative Farms. About 1/3 of them are differentiated as orchards, where until now there is no huge falling of trees. They are harvested mainly for the production of juice and pectin.
1/3		
38		38 apple cultivars and forms were marked, described and studied in Marishnitsa.
	(g),	Reporting elements - fruit weight (g), according to methodology for studying plant resources in fruit species (Nedev et al., 1979);
	(
,1979);		
	-	- fruit shape – visually according to the methods of the International Union for the Protection of New Varieties of Plants (UPOV);
(UPOV);	(mm) –	- fruit size (mm) – height and diameter (after UPOV);
	(UPOV);	- fruit ratio height/diameter (after UPOV);
	(UPOV);	- length of fruit stalk (mm);

(mm);
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- colour of fruit skin (visually);
- taste qualities;
- chemical composition of fruits: dry matter (%) – refractometrically; total and reduced sugars – according to Shoort method; acids, such as malic through titration by 0.1 N solution of NaOH.
- yield (kg/tree).

RESULTS AND DISCUSSION

Fruit weight

Fruit size is hereditary differentiated trait of the pomelo tree varieties. Under one and the same conditions, fruits of some cultivars are large-sized, the others are average-sized, third ones are small-sized, therefore in order to give a more accurate assessment for fruit size, grown in a certain habitat, fruit-growers besides the categories, such as small, average, large, they use additional classification such as: very large, very small, below average size, over average size (Stoichkov et al., 1958).

The fruit size is assessed in most cases according to their absolute weight, which is an important pomological trait, which is used in identifying the pomelo tree varieties. Grown under equal conditions, apple cultivars according to this physical trait (Nedev et al., 1979) are grouped in five categories: very small, when their weight is less than 50 g, small

50 g, , -
 51 100 g;
 , 101-
 150 g, - 151 200 g
 - 201 g. -
 (1958)
 : - 25
 g; - 25 50 g;
 - 50 75 g;
 - 75 100 g;
 - 100 125
 g; - 125 175 g;
 - 175 g.

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 (9
) - 197.9 g;
 (22) - 158.3 g.
 (14)
 101 150 g
 51 100 g.
 (30) - 47.8 g.
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when their weight varies from 51 to 100 g; average-sized, when their weight is 101-150 g, large – from 151 to 200 g and very large – more than 201 g. In order to make a better comparative assessment of apple cultivars, Stoichkov et al. (1958) introduce seven categories: very small – up to 25 g; small – from 25 to 50 g; below average-sized from 50 to 75 g; average-sized – from 75 to 100 g; over average-sized – from 100 to 125 g; large – from 125 to 175 g; very large – over 175 g.

According to Nedev's scale, the fruit of studied apple cultivars and forms apply as follows: the largest average weight of one fruit is registered for 'Belle de Boskoop' cultivar (9 in the list) – 197.9 g; 'Troyanka' cultivar also belongs to large-sized fruits (22) - 158.3 g.

The most numerous (14 pieces) are groups of cultivars with average-sized fruits from 101 to 150 g and small-sized fruits from 51 to 100 g. 'Shekerka' (30) variety is the only one that belongs to the group of very small-sized fruits – 47.8 g. (Table 1).

In order to bring more clarity, in addition to the absolute weight of apple fruits, it is good to know also their relative weight, which gives an idea for the density of pericarp (flesh) and shows their suitability for one or another use.

1.

Table 1. Morphological characteristics of fruits in the studied cultivars and forms (weight, height, diameter, fruit stalk)

No of tree	Cultivar, form	Weight g	/Fruit size mm		h/d		
			h	d	/Fruit stalk length mm		
1	/Troyanka	115.5a	59.2a	63.4b	0.93c	15.2a	
2	/Transparente	de86.3ab	46.8b	58.0d	0.80c	16.9b	
Croncels							
3	/Winter lemon	72.9c	46.8b	55.2c	0.85d	8.2ab	
4	/Skriyanka	142.4a	64.7a	69.6b	0.92a	9.2d	
5		112.8g	52.1c	64.9b	0.80g	10.1e	
6	/ Golden Pearmain	124.4b	54.1a	65.6ab	0.82a	14.2b	
7	/ Yellow Bellflower	129.8c	62.5d	66.4b	0.94c	20.0ab	
8	/ Ribston Pippin	133.9f	56.7g	68.4c	0.82b	14.3c	
9	/ Belle de Boskoop	197.9b	68.5c	80.0b	0.86f	12.5d	
10	/Stefanka	60.8c	41.8bc	53.8a	0.78c	12.5b	
11	1/Form 1	89.7f	47.9f	54.1g	0.88b	11.2c	
12	/Gudeshka	51.3d	41.8e	51.0d	0.81f	12.2e	
13	2/Form 2	94.1a	48.7c	56.4b	0.86c	17.1a	
14	/Stefanka	63.4b	42.3ab	54.3c	0.77a	12.1c	
15	/Winter lemon	75.7f	47.2g	56.4f	0.83e	9.0g	
16	/ Balkan Ayvaniya	63.0ab	50.5f	59.1c	0.85c	17.8f	
17	- /Shekerka	49.6bc	45.4a	48.2c	0.94b	13.7c	
Bozhechka form							
18	/Green Newtown Pippin	113.4b	50.2a	65.7c	0.76c	15.2ab	
19	/Ordinary Petrovka	68.3d	41.2ab	47.2c	0.87a	9.7a	
20	/Skriyanka	119.1b	55.0b	69.2ab	0.79c	9.2ab	
21	3/Form 3	59.1c	44.8f	50.5b	0.89ab	14.2c	
22	/Troyanka	158.3f	58.7c	70.7d	0.83c	19.5ab	
23	/Ayvaniya	76.2e	50.8c	55.7ab	0.91c	16.7e	
24	/Jonathan	112.5a	54.9c	64.8b	0.85a	20.2c	
25	/Angelitsa	131.1b	59.3ab	67.1a	0.88c	20.5ab	
26	/Kandile	116.3ab	51.8a	67.0ab	0.77c	10.2b	
27	4/Form 4	64.1c	48.2bc	53.9c	0.89d	10.8f	
28	/Yamborka	68.7e	45.3f	53.2g	0.83f	6.8bc	
29	/Winter lemon	97.8c	52.3bc	61.3ab	0.85b	14.8c	
30	/Shekerka	47.8f	43.9e	47.4bc	0.93b	15.2f	
31	/Kozhesta reneta	56.8b	42.1bc	52.3a	0.80bc	14.8b	
32	/Karastoyanka	75.2e	48.1f	60.1ab	0.80g	9.2ab	
33	/Tsiganka	138.8a	61.2a	69.2b	0.88b	17.2a	
34	/Kantarka	124.7ab	55.2a	69.5c	0.79ab	16.5b	
35	/Reinette du Canada	128.2b	54.8ab	68.8a	0.80c	11.5ab	
36	/Balkan Ayvaniya	81.3a	51.4a	60.7c	0.85a	12.3f	
37	5/Form 5	92.8ab	75.0c	54.0ab	1.23a	25.3b	
38	/Winter Green	122.8b	54.1ab	67.0a	0.81c	18.8c	

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p=0.05

* The averaged values are divided in accordance with Duncan's multiple range test at p=0.05

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Fruit shape

In Bulgarian Pomology (Stoichkov et al., 1958) are differentiated 10 shapes of apple fruits.

There are 7 forms in the latest version of methodology of UPOV (2005), which characterize the apple fruit. According to it, the predominant part of the studied fruits of the apple cultivars and forms in Marishnitsa have a globose shape – 24, 9 are obloid, 3 are conic – such as ‘Shekerka’ (30), ‘Ordinary Petrovka’ (19), ‘Ribston Pippin’ (8), and form 5 has ellipsoid shape and ‘Balkan Ayvaniya’ is ovoid (Table 1).

Fruit size

Fruit sizes of all pomefruit tree varieties vary in rather wide ranges under the influence of climate and soil conditions, rootstock, age of plants and agro-technics in their cultivation.

In case of effective pollination and regular insemination of flowers, the growth and final size of longitudinal and transverse diameter of apple fruit, to a great extend depend on requirements of different cultivars for heat and heat regime of the habitat in the phase of fruit formation.

- The insufficient thermal security, in the end of spring and beginning of

summer, reduces fruit size, like the extreme and prolonged drought in summer.

The extreme increase and decrease of atmospheric temperature during vegetation period, however, does not influence equally the fruits of different cultivars.

Under other equal conditions, the fruit size depends also on heat regime of soil, to which the apple cultivars react in a different way. This is one of the possible causes for different size of fruits of one and the same cultivar - 'Troyanka' (1 and 22) in Marishnitsa.

Another possible reason for that is the same age of trees. It is well-known also that fruits of different cultivars, in a particular habitat, vary according to their size and because of the age alternations in their aerial organs.

Growth power of rootstock and its adaptability to habitat soil conditions also have a strong influence over the size of apple fruits. According to Stoichkov et al. (1958) strongly growing rootstocks more often are the cause for formation of small-sized apple fruit, because the leaf surface of such trees is disproportionately small in comparison with fruits,

which remain on the tree.

In the cultivar categorization according to their fruit size, it is good to remember the circumstance that their quality could not be always judged by their sizes. It is reasonably accepted that the quality of very small and very large fruit is quite unsatisfactory.

Very small fruits are not attractive, their waste product is much and dry matter percentage is quite low, while very large fruits are transported and being preserved with significant losses.

Agro-technical measures in tree growing, such as pruning, soil cultivation, fertilization, irrigation, disease and pest control have a positive influence and help to increase fruit size.

While Bulgarian methodology for studying of plant resources in fruit growing is related to their weight and size, in UPOV methodology the size of apple fruit is discussed only in 9 categories: 1 very small-sized; 2 from very small to small; 3 small; 4 small to average; 5 average; 6 average to large; 7 large; 8 large to very large and 9 very large.

After UPOV, according to the

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 UPOV

height indicator (longitudinal diameter), fruits are low, average and high. 'Chadel' is the standard cultivar for the highest fruit in the above-mentioned methodology.

Only form 5, from the studied cultivars, belongs to the group of fruit height of 75 mm. With average diameter, like 'Golden Delicious', are 4 ('Skrinyanka'), 7 ('Yellow Bellflower'), 9 ("Boskopska hubavitsa") and 33 ('Tsiganka') (Table 1).

The other cultivars and forms fall in the group of low height. As the standard cultivar for this group is specified 'Auralia' cultivar. The local cultivars 'Stefanka' and 'Gudeshka' have the lowest value for this indicator – 41.8 mm.

Transverse diameter of fruit varies within wide range from 47.4 mm for 'Shekerka' (3) to 80 mm for 'Belle de Boskoop' (9). With relatively large width of are also 'Troyanka' (70 mm), 'Skrinyanka' (69.65 mm), 'Reinette du Canada' (69.7 mm), 'Tsiganka' (69.2 mm) (Table 1). 19 cultivars have an average fruit diameter (over 60 mm), and 9 of them are small.

UPOV methodology considers for standard cultivars those with large, average and small diameter of fruits respectively 'Melrose', for

average - 'Golden delicious', and for small - Orei.

Fruit ratio height/diameter

The ratio height/diameter of fruit is of a great interest. According to UPOV methodology for apple fruit it is the following: very small, small, average, large and very large.

Variability of that indicator, for the apple cultivars and forms included in the present study, is small – from 1.23 for form 5 to large 0.76; 0.77 and 0.78, respectively for 'Green Newtown Pippin' (18), 'Kandile' (26) and 'Stefanka' (10). For the other cultivars from our list, the fruit ratio height/diameter averagely is 0.8 – 0.9.

Length of fruit stalk

Very short fruit stalk are found (under 1 cm) in 'Yamborka' – 6.8 mm (28); 'Winter lemon' – 8.2 mm (3); 'Skrinyanka' – 9.2 mm (4 and 20) and 'Karastoyanka' – 9.2 mm (32). The largest in number (27) is the group of cultivars with average length of fruit stalks – from 10 to 20 mm. Only 4 from the studied cultivars and forms have fruit length stalk over 20 mm - 'Yellow Bellflower' – 20.0 mm; 'Jonathan' – 20.2 mm; 'Angelitsa' – 20.5 mm and form 5 – 25.3 mm.

average - 'Golden delicious', and for small - Orei.

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Fruit skin colour

There is a great variety in fruit skin colour.

Some fruits have yellow-green fruit skin, without spots and any redness ('Transparente de Croncels', 'Angelitsa', 'Ordinary Petrovka', 'Winter lemon'), others are green or yellow-green with washed redness or slightly visible carmine stripes, without or with well-seen small rust spots.

For example, 'Yamborka', 'Kantarka', form 5, 'Shekerka', 'Ayvaniya', 'Balkan Ayvaniya', 'Stefanka', 'Yellow Bellflower' and 'Winter Golden Pearmain'. Fruits of 'Kojesta reneta', 'Reinette du Canada', 'Green Newtown Pippin' have green main colour, covered more or less with rust, which does not deteriorate their quality, as it is typical for these cultivars.

The great diurnal temperature amplitude is the cause for red-coloured cultivars to be especially deep coloured and to have very attractive fruit, without any special (additional) cares to be applied.

These are 'Jonathan', 'Ribston Pippin', 'Troyanka', 'Tsiganka', Forms 1 and 2, 'Belle de Boskoop' (Table 2).

2.

Table 2. Morphological characteristics of fruits in studied cultivars and forms (shape, colour, taste qualities)

No tree	Cultivar, form	Fruit shape	Fruit skin colour	Taste qualities of fruit flesh
1	/Troyanka	globose	red-green	slightly sour, good
2	Transparente de Croncels	globose	yellow-green	juicy, sweet sour
3	Winter green	globose	green-yellow	firm with predominant acids
4	Skrinyanka	globose	/red	wine sour, good
5	/Boyken	globose	green with rust spots	juicy, crisp, sour
6	Golden Pearmain	obloid	yellow-green with blush	juicy, slightly sour, up to excellent quality
7	Yellow Bellflower	globose	green-yellow with blush	juicy, aromatic, very good to excellent
8	Ribston Pippin	conical	ed with green stripes	juicy, slightly sourish
9	Belle de Boskoop	globose	red with green stripes	juicy, pleasantly sour
10	/Stefanka	obloid	green with red stripes	juicy without acids
11	1/Form 1	globose	red-yellow	slightly sour, tender, crisp
12	Gudeshka	globose	yellow-green	slightly sour, tender
13	2/Form 2	obloid	/red	slightly, crisp, without acids
14	/Stefanka	obloid	green with red stripes	juicy, without acids
15	Winter lemon	globose	green-yellow	firm with predominant acids
16	Balkan ayvaniya	globose	green with red stripes	dense, spongy, sweet
17	/Shekerka-Bozhechka form	globose	yellow-red	sweet, tender, good quality
18	Green Newtown Pippin	obloid	green with rust spots	juicy, sweet sour up to excellent quality
19	Ordinary Petrovka	conic	/green	slightly juice, sweet, satisfactory
20	/Skrinyanka	globose	green with blush	juicy, sweet, wine sour
21	3/Form 3	globose	green with red stripes.	grained, sweet, spongy
22	/Troyanka	globose	yellow-green with red stripes	slightly acid, good
23	/Ayvaniya	globose	yellow-green with blush	juicy, sweet, good
24	/Jonathan	globose	red with rust	juicy, sourish, up to excellent quality
25	/Angelitsa	globose	/yellow green	dense, spongy, sweet

26	/Kandile	obloid	/green	spongy, soft, sweet, inferior
27	4/Form 4	globose	green with rusty stripes	juicy, slightly acid
28	/Yamborka	globose	yellow-green with red blush	much juicy, pleasant, sourish
29	Winter green	obloid	yellow-green with rust spots	firm, with predominant acids
30	/Shekerka	conic	green-yellow with red stripes	sweet, juicy, spongy
31	Kozhesta reneta	obloid	green-brown with rust	crisp, pleasant, slightly sourly
32	Karastoyanka	obloid	green with red stripes	dense, juicy, crisp
33	/Tsiganka	globose	dark red with green stripes	dense, sweet-sour, satisfactory
34	/Kantarka	globose	yellow-green with red stripes	dense, juicy, sourish, good
35	Reinette du Canada	globose	/yellow green	juicy, sourish, up to excellent quality
36	Balkan ayvaniya	ovoid	green with red carmine	dense, spongy, sweet
37	5/Form 5	ellipsoid	yellow with blush	juicy, slightly sour, good
38	Winter Green	globose	/green	firm with predominant acids

Taste qualities

Taste qualities of fruit flesh are formed in a complex by the density, texture, juiciness and its chemical composition (sugars, acids, aromatic substances etc.)

The high altitude, and the associated cooler climate with it, increased air humidity and great amplitude in diurnal temperatures during ripening of fruit are the reasons for firm and juicy flesh, the fresh sour taste and very strong apple flavour for the predominant part of discussed cultivars and forms.

Only a few cultivars are distinguished with pronounced sweet taste and softer fruit flesh.

(13), (10), (17), (23), (2).

These are 'Stefanka' (10), Form 2 (13), 'Shekerka Bozhechka' (17), 'Ayvaniya' (23), 'Shekerka' (30) (Table 2). Different cultivars have specific individual distinctive traits in their fruit taste, which make them easily distinguishable. Their characteristics have outstanding homogeneity and stability, which are preserved during their long period of existence.

Chemical composition of fruits

Apple fruits are very valuable dietary food for people. They contain sugars, organic acids, mineral salts, vitamins, ferments, which are very beneficial for the human organism, especially in winter months (Iliev, Penev, 1964).

1964). (1949) 70-90% 1.3-3.3% 23% 7.5-

According to Tserevitinov (1949), apple fruits contain averagely 70/90% water, 1.3-3.3% insoluble substances (cellulose, starch, insoluble proteins, fat, protopectin etc.), and 7.5-23% soluble solids (sugars, acids, tannin, aromatic substances etc.).

The chemical composition and nutritional value of apple fruits are influenced by a lot of factors. The more important are:

-the altitude has an influence over ripening of apple fruits.

<p>100 m</p>	<p>(1957) According to (1957), at each 100 m elevation, the ripening of fruits is delayed with 8 days.</p>
<p>8</p>	<p>-meteorological conditions during the vegetation period have a very strong influence over the chemical composition of apple fruits. In years with rain and cool summer they form less sugar and aromatic substances and their taste qualities are decreased.</p>
<p>-</p>	<p>-the physical properties of soil and content of different nutritional elements in it have a distinctive influence over the chemical composition of fruits.</p>
<p>-</p>	<p>Sugars are reduced when applying nitrogenous fertilizers and they are increased in applying higher doze of phosphorus and potassium fertilizers.</p>
<p>-</p>	<p>Full fertilization has the most favourable effect on yields, chemical composition and preservation of apple fruits.</p>
<p>-</p>	<p>-irrigation, pruning and other agro-technical events</p>
<p>-</p>	<p>-rootstock - fruits gathered by trees, which have been engrafted on crab apple, according to Budagovski (1959), are distinguished by smaller size and poorer colour.</p>
<p>-</p>	<p>-the time for performing the chemical analysis during storage period.</p>

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In Table 3 are shown the values of the chemical indicators of 12 apple cultivars from Marishnitsa.

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(3.12.2013 .)

Table 3. Chemical composition of apple fruits from Marishnitsa (3.12.2013)

Cultivar	Re% Dry matter Re%	% Total sugars%	% Inverted sugar%	% Sucrose	% Acids	Vit.C mg%	% Tannin	mg% Anthocyanins mg%	% Pectin
Tsiganka	13.0	7.85	6.65	1.14	0.50	21.12	0.127	2.74	0.22
Winter lemon	15.5	10.05	8.70	1.28	0.67	21.12	0.085	1.29	0.24
Balkan Ayvaniya	15.0	7.85	7.70	0.14	0.20	17.60	0.127	4.19	0.30
Skriyanka	13.0	8.20	8.20	1.54	0.87	19.36	0.127	1.77	0.44
Kozhesta reneta	14.0	11.10	8.90	2.09	0.34	12.32	0.106	2.10	0.23
Yamborka	14.5	11.95	8.90	2.90	0.34	14.08	0.106	1.77	0.18
Ayvaniya	14.0	12.30	11.10	1.14	0.18	17.60	0.064	1.77	0.28
Winter green	10.5	9.90	9.40	0.48	0.40	20.24	0.085	2.74	0.48
Reinette du Canada	13.0	11.10	8.05	2.90	0.20	7.92	0.170	6.77	0.67
Yellow Bellflower	15.5	13.45	11.15	1.62	0.18	9.68	0.085	4.52	0.66
Kantarka	14.0	12.45	9.40	2.90	0.27	11.44	0.127	4.35	0.31
Jonathan	14.5	12.30	11.75	0.52	0.34	12.32	0.064	3.55	0.53

10.5 () 15.5%
() (3).
10%
– 7.85%,
– 7.85%,
8.20% – 9.9%.
–
– 13.45%.

Dry matter content varies within the limits from 10.5 ('Winter Green') to 15.5% ('Yellow Bellflower' and 'Winter lemon') (Table 3). Only four cultivars have total sugars below 10% in their fruits - 'Tsiganka' - 7.85%, 'Balkan Ayvaniya' – 7.85%, 'Skriyanka' – 8.20% and 'Winter Green' – 9.9%. The highest sugar content is in fruits of 'Yellow Bellflower' – 13.45%. With high content of inverted sugar – over 11% are distinguished also 'Jonathan',

11%

3

1962).

0.67% 0.87%

3).

0.34%

0.20% (

- 0.18%,

- 0.20%

0.27%.

- 'Yellow Bellflower' and 'Ayvaniya' cultivars.

Only 'Skriyanka' is without sucrose, and 'Balkan Ayvaniya', 'Winter Green' and 'Jonathan' have very low values of this indicator, which makes them suitable for diabetics.

Fruit contains mainly malic and citric acid, as the malic acid is about 3 times more than citric (Daskalov et al., 1962).

- Total content of organic acids in apple fruit depends mainly on the cultivar, but the results from our study confirm the great influence of agro-climate complex in a certain habitat.

- For example, 'Winter lemon' and 'Skriyanka' showed the highest acid content two months after harvest, respectively 0.67% and 0.87% (Table 3). 'Jonathan', 'Winter green', 'Yamborka' and 'Kojesta reneta' have 0.34% acids, and in the fruits of the other cultivars they are about 0.20% ('Yellow Bellflower' - 0.18%, 'Reinette du Canada', 'Balkan Ayvaniya' and 'Tsiganka' - 0.20% and 'Kantarka' - 0.27%.

- The content of vitamin C in apple fruits from Marishnitsa is considerably higher than those produced in Plovdiv fruit growing region. For example, in fruits of

1958).
 20 mg%
 - 10 mg%
 0.25%.
 - 170%.
 0.127%
 - 106%,
 - 0.1%.

1.29% mg%
 , 6.77 mg%

'Ayvaniya' cultivar, it is double (Stoichkov et al., 1958). 'Tsiganka', 'Winter lemon' and 'Winter green' cultivars contain over 20 mg% vitamin C.

The lowest values – below 10 mg% of this indicator are found in 'Reinette du Canada' and 'Yellow Bellflower' cultivars.

Tannin substances in fruit juice give astringent and tart taste. In apple crab they are about 0.25%. 'Reinette du Canada' has the highest content of tanning substances from the analyzed fruits from Marishnitsa – 170%. 'Tsiganka', 'Balkan Ayvaniya', 'Skrinyanka' and 'Kantarka' cultivars have 0.127% tanning substances, 'Yamborka' and 'Kojesta reneta' - 106%, and the others – below 0.1%. Their fruits do not have astringent taste.

The content of anthocyanins in fruits is connected with their antioxidant effect.

The apple cultivars under investigation have high content of anthocyanins from 1.29% mg% for 'Winter lemon', to 6.77 mg% for 'Reinette du Canada', which emphasizes their healing properties and makes them especially valuable dietary food.

The content of pectin depends very much on the cultivar and environmental conditions, where it is being grown. 'Reinette

du Canada', 'Yellow Bellflower' and 'Jonathan' have the highest content. The high pectin content makes the mountain apple fruits valuable raw material for its production.

Yield

The alternative fruit bearing is characteristic for the old apple trees in Marishnitsa. There are more common cases, when in one year all cultivars are fruit bearing and rarely – in the empty year only single trees give fruits.

In the full years, the fruit gathering become very difficult, because a specific organization is necessary, consistent with their period of buying up. Usually the picking does not happen only once, first the easily accessed branches are picked up manually, in order to keep them for winter storage and the rest of the fruits are shaken down, gathered and transported to buying-up centers.

(700-1000 kg/

) The high yield (700-1000 kg/tree) requires much time for picking-up, a lot of seasonal workers, wrapping suitable for transportation and transport means, as well as a number of other organizational issues (in such years the purchase price is very low from 8 to 10 stotinki/kg), which often is the cause for some trees to remain without being gathered and fruits are being wasted. Low agro-technics and the unsatisfactory

8 10 /kg),

).
 (-
 1 t
 a
 300 kg
 100
 kg/
 -
 4 6

disease and pest protection are the main reasons for periodical fruit bearing (usually every other year). All that makes it difficult for us to take into account the average yield per tree.

The yield of observed cultivars was reported after information from the farmers. For example, Danka and Iliya Karkamovi reported for 1 t of fruits gathered from one tree of 'Stefanka' cultivar. The yield is very high not only for trees with large size. Many small-sized fruit cultivars, such as 'Yovevka', 'Shekerka', 'Sinapka', although having average crowns in size, they give high yields due to large amount of fruit retention.

In full years, the average yield is about 300 kg, and only in rare cases 100 kg/tree, and in empty years fruits are insignificantly few.

Fruits of apple cultivars and forms from Marishnitsa are distinguished with very good storage capability under ordinary conditions in a cool cellar, as their consuming ripeness lasts from 4 to 6 months.

CONCLUSIONS

Reproductive characteristics of the studied apple cultivars and forms give us reason to make the following conclusions:

The highest average weight per fruit was registered for 'Belle

- 197.9 g;
 - 158.3 g.
 101
 150 g
 51 100 g.
 - 47.8 g.
 UPOV
 24
 , ,
 .
 /
 - 1.23
 5 0.76; 0.77
 0.78,
 ,
 .
 /
 0.8-0.9.
 :
 -
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 ;
 -
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 ;
 -
 ;

de Boskoop' – 197.9 g; 'Troyanka'
 cultivar also belongs to the large-
 sized fruit cultivars – 158.3 g.
 Fourteen cultivars have average-
 sized fruits from 101 to 150 g, and
 fourteen cultivars are with small-
 sized fruits from 51 to 100 g.
 'Shekerka' cultivar is the only one
 that belongs to the group of very
 small-sized fruits – 47.8 g.
 According to UPOV methodology,
 the predominant part of the studied
 fruits of the apple cultivars and
 forms in Marishnitsa has a globose
 shape – 24. There are also
 cultivars with obloid, conic,
 ellipsoid and ovoid fruits.

Variability height/diameter
 ratio indicator of fruit in the studied
 apple cultivars and forms is very
 great – from 1.23 for form 5 to
 0.76; 0.77 and 0.78, respectively
 for 'Green Newtown Pippin',
 'Kandile' and 'Stefanka'.

For the other cultivars
 height/diameter ration of fruit is
 averagely 0.8-0.9.

The interest in fruits from that
 region has been and remains
 intensive for a lot of reasons:

- they have an attractive appearance, strongly tinted, having juicy and tasty fruit flesh;
- they have a rich chemical composition and valuable nutritional and dietary qualities;
- they have a high content of pectin and are important raw material for its production;

- , -they are organic, because are grown without mineral fertilizers and the application of plant protection measures;
- ;
- -they prove to be good for storage under ordinary home conditions.

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***Leptosphaeria coniothyrium* (Fuckel) Sacc.**

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2

*E-mail: aleksandarleposavic@yahoo.com

THE INTENSITY OF THE FUNGUS *Leptosphaeria coniothyrium* (Fuckel) Sacc. ATTACK IN WILLAMETTE AND MEEKER RASPBERRY PLANTATIONS

Aleksandar Leposavi ^{1*}, Darko Jevremovi ¹, Svetomir Stamenkovi ²

¹Fruit Research Institute, a ak, Republic of Serbia

²University of Priština, Faculty of Agriculture, Lešak, Kosovo

SUMMARY

2012 2014

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" "

60 cm

Leptosphaeria coniothyrium (Fuckel) Sacc.,

The study was carried out from 2012 to 2014, in two raspberry plantations established at two sites in the municipality of Ivanjica. One plantation with cv Willamette, was located at Prilike site, while the other with cv Meeker was in Bedina Varoš.

The canes were counted in four repetitions in both plantations. Mature canes were counted at 4 m length and 0.6 m width on both sides of the row.

The assessment of the intensity of *Leptosphaeria coniothyrium* (Fuckel) Sacc. infection, the causal agent of raspberry cane blight, was done in early November.

Three year results showed that the number of mature canes at both sites was higher in cv Willamette, indicating higher vegetative potential of the variety as related to cv Meeker, suggesting that both

in West Serbia.

The highest intensity of infection is achieved in seasons with heavy rainfalls during the intensive growth of canes, before and during harvest (Ivanovi & Ivanovi, 2005). Cane blight is often associated with attacks by raspberry cane midge (*Resseliella theobaldi* (Barnes)).

coniothyrium

- in West Serbia.

- The highest intensity of infection is achieved in seasons with heavy rainfalls during the intensive growth of canes, before and during harvest (Ivanovi & Ivanovi, 2005). Cane blight is often associated with attacks by raspberry cane midge (*Resseliella theobaldi* (Barnes)).

Due to the importance of raspberry production for the Republic of Serbia and the damage caused by the fungi, it is important to determine the intensity of the attack of the *L. coniothyrium* in raspberry varieties Willamette and Meeker in years with different weather conditions.

The obtained results can be used to determine the optimal time of pesticides application in order to prevent the occurrence and the control of the disease.

MATERIAL AND METHODS

2012 2014

" "

(GPS N43°37'29.34", E20°09'46.91") at 438 m

(GPS

The research was conducted from 2012 to 2014 in two raspberry plantations in Ivanjica municipality. The first plantation with variety Willamette was located in Prilike site (GPS coordinates N43°37'29.34", E20°09'46.91") at 438 m above sea level.

The second plantation was located in Bedina Varoš site (GPS

E20°14'25.81")	N43°34'06.53", 497 m	coordinates N43°34'06.53", E20°14'25.81") at 497 m above sea level. The terrain was hillside with the row direction North-south in both sites.
		Plantations were formed in one-line trellis system.
0.18 m,	2.5 m.	The distance between fruiting canes was 0.18 m with the distance of 2.5 m between rows. Common agro- and pomotechnical measures were applied in both plantations.
	4/6	The plantations were maintained in integrated pest management principles with 4-6 chemical treatments per year.
		The counting of all mature raspberry canes that were selected for the investigation of intensity of fungus attack was done after harvest, just after the trim and removal of canes that have finished their fruiting year.
4	4 m	The area for counting per each of 4 repetitions was 4 m in distance with 0.6 m width per each side of the row. Assessment of the
	0.6 m	intensity of the <i>L. coniothyrium</i> attack in all years was done at the beginning of November according to the directions of UPOV (The International Union for the Protection of New Varieties of Plants) TG43/7 in accordance to the document UPOV/TG/1/2 (www.upov.int). Assessment of attack in field conditions was
<i>coniothyrium</i>		
UPOV (
) TG43/7		
(www.upov.int).	UPOV/TG/1/2	

1 9: 1
 ; 3 -
 ; 5 -
 ; 7 -
 9 -
 ()
 Miši & Tešovi
 (1975),
 (2012),
 463 mm
 m^{-2}
 212 mm m^{-2}
 -
 2013
 (61.5 mm m^{-2}), (10.0 mm
 m^{-2}), (62.5 mm m^{-2})
 (87.0 mm m^{-2}).
 2014 13.23°C
 892.0 mm m^{-2} .
 (125.0 mm m^{-2}),

performed on scale 1 to 9: 1 – no
 attack; 3 – weak attack; 5 – middle
 attack; 7 – strong attack; and 9 –
 very strong attack, according to the
 tests for Value for Cultivation and
 Use (VCU). The classification of
 canes was done according to the
 modified procedure of Miši &
 Tešovi (1975), on completely
 symptomless, partially attacked
 and completely attacked canes.

During the first year of
 investigation (2012), severe
 drought with only 463 mm m^{-2} of
 total rainfall and only 212 mm m^{-2}
 during the period from April to
 October was recorded in both
 localities. The stated conditions
 influenced on lower growth of
 canes for replacement and on the
 general state of physical conditions
 of the plantation.

The average annual air
 temperatures and total rainfall
 were recorded during 2013 for the
 investigated locations. High rainfall
 during summer months was
 recorded: June (61.5 mm m^{-2}), July
 (10.0 mm m^{-2}), August (62.5 mm
 m^{-2}) and September (87.0 mm m^{-2}).
 These conditions highly
 influenced on the chemical
 protection of the plantations from
 pests and diseases.

Average air temperature and
 total rainfall in 2014 were 13.23°C
 and 892.0 mm m^{-2} , respectively.
 The months with extremely highest
 rainfall were May (125.0 mm m^{-2}),
 June (103.5 mm m^{-2}), July (163.0

(103.5 mm m⁻²), (163.0 mm m⁻²) and September (101.0 mm m⁻²).
 (101.0 mm m⁻²).
 -
 (703.0 mm m⁻²), that was 78.1% of total rainfall.

mm m⁻²) and September (101.0 mm m⁻²).
 - The rainfall in vegetative period was high (703.0 mm m⁻²), that was 78.1% of total rainfall.

On the basis of these data, and considering the fact that in experimental plantations integrated pest and disease management principles were implemented, it can be concluded that the basic weather parameters to some extent could affect the study results.

RESULTS AND DISCUSSION

Higher number of mature canes was recorded in variety Willamette (Table 1), as described earlier by Leposavi et al. (2015), which indicates that this variety has a higher vegetative potential in relation to Meeker variety.

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 " (1),
 Leposavi et al. (2015),
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 " .

1. 2012-2014¹
Table 1. Number of mature raspberry canes during 2012-2014²

/ Variety/repetition	2012-2014 ¹				Total	
	1	2	3	4		
	Repetition 1	Repetition 2	Repetition 3	Repetition 4		
Willamette	2012.	15,12	18,31	13,05	17,42	63,90
	2013	47,21	52,31	49,33	49,26	198,11
	2014	66,32	69,04	73,32	70,52	279,20
Meeker	2012	11,32	10,47	9,85	12,23	43,87
	2013	39,58	41,36	35,54	40,21	156,69
	2014	59,00	60,88	52,68	58,20	230,76

¹

4 m;

16 m.

² Length of one repetition is 4 m; total length of the distance for canes counting is 16 m.

Extremely low rainfall during the first growing season of testing has contributed that the counted number of canes in both plantations in both varieties is considerably lower than in the other two years of study (63.90 in Willamette and 43.87 in Meeker).

In contrast, a greater amount and distribution of rainfall in the second two years of study has led to the fact that the number of canes counted in all repetitions (198.11 and 279.20 in Willamette; and 156.69 and 230.76 in Meeker, respectively) significantly exceeds required number of canes for tying in spring (usually 5 to 6 per meter) (Leposavi et al., 2006).

Leaving a larger number of canes per meter or unit area provides a greater possibility of choosing properly developed and undamaged canes during this very important pomotechnical operation.

Classification of healthy and diseased canes was performed by the modified method as follows: 1 - fully resistant varieties (all healthy canes); 2 - highly resistant (91-99% of healthy canes); 3 - resistant varieties (81-90% of healthy canes); 4 - relatively resistant varieties (61-80% of healthy canes); 5 - less susceptible cultivars (41-60% of

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60% (41-60%); 7 - (21-40%); 7 - (0-20%).

(2), (78.53% " " 68.66% " " (56.59% 58.21% " " 55.84% 57.77% " ")).

healthy canes); 6 - susceptible cultivars (21-40% of healthy canes); and 7 - very susceptible cultivars (0-20% of healthy canes).

According to the results obtained in this study (Table 2), both varieties belong to the group of relatively resistant varieties in the first year (78.53% in Willamette and 68.66% of healthy canes in Meeker), or a group of less susceptible varieties in the second two years of the study (56.59% and 58.21% in Willamette and 55.84% and 57.77% of healthy canes in Meeker).

2. *Leptosphaeria coniothyrium* (Fuckel) Sacc.

2012-2014

Table 2. The intensity of *Leptosphaeria coniothyrium* (Fuckel) Sacc. attack on mature canes of investigated raspberry varieties in 2012-2014

Variety	Year	Total	Healthy	Partially infected	Totally infected	% Total % of infected
Willamette	2012	63,90	50,18	7,50	6,22	21,47
	%	100	78,53	11,74	9,73	
	2013	198,11	112,13	49,27	36,71	43,41
	%	100	56,59	24,88	18,53	
	2014	279,20	162,51	66,44	50,25	41,79
	%	100	58,21	23,79	18,59	
Meeker	2012	43,87	30,12	7,88	5,87	31,34
	%	100	68,66	17,96	13,38	
	2013	156,69	87,49	44,12	25,08	44,16
	%	100	55,84	28,16	16,00	
	2014	230,76	133,32	69,43	28,01	42,22
	%	100	57,77	30,08	12,14	

-

-

21.47%

" " 31.34%

" " .

,

- (43.41%

41.79% " " 44.16%

42.22% " ")

Ivanovic &

Ivanovic (2005),

L. coniothyrium.

Lower sensitivity of tested varieties can be attributed to the applied integrated pest and disease management principles.

The lowest percentage of affected canes of both varieties was observed in the first year and ranged from 21.47% in Willamette to 31.34% in Meeker.

In the other two years, the percentage of diseased canes of both cultivars was significantly higher (43.41% and 41.79% in Willamette; and 44.16% and 42.22% in Meeker, respectively), which can be attributed to the influence of extremely high rainfall in the vegetation period of both years.

According to Ivanovic & Ivanovic (2005), these weather are suitable for the development of the disease caused by *L. coniothyrium*.

CONCLUSIONS

Based on the results of our research in studying the intensity of the fungus *L. coniothyrium* attack in raspberry varieties Willamette and Meeker following conclusions may be drawn:

- A higher number of mature canes in both plantations was recorded in Willamette indicating that this variety has a higher vegetative potential in relation to Meeker.

L. coniothyrium,

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The number of counted canes in both cultivars in all three years of investigation is beyond the required number of canes required for tying in the spring.

Both varieties belong to the group of relatively resistant varieties in the first year, or a group of less susceptible varieties in the second two years of the study.

- Despite the extremely high precipitation in the vegetation
- during the second two years of research, lower sensitivity of tested varieties can be attributed to the applied integrated pest and disease management principles.

- Apart from theoretical significance, presented results can be used to determine the optimal time of application of pesticides in order to prevent the occurrence of the disease, as well as its control.

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32000
 *E-mail: mnebojsa@ftn.kg.ac.rs

EVALUATION OF SOME AUTOCHTHONOUS PLUM CULTIVARS GROWN IN A AK REGION

Ivana Gliši , Nebojša Miloševi *

Fruit Research Institute, Kralja Petra I/9, 32000 a ak, Republic of Serbia

SUMMARY

This study was carried out to determine basic phenological and pomological traits and resistance to economically important diseases of six *ex situ* autochthonous plum cultivars derived from *Prunus domestica* L. and two cultivars derived from *Prunus insititia* L.

Observation and recording of their phenological and pomological traits and field resistance to causal agents of economically important diseases were performed using IBPGR, UPOV and standard morphometrical methodologies.

Within the evaluated genotypes flowering onset was between April 15th ('Belošljiva-okešina' and 'Šljiva-Štrpci') and April 24th ('Požega a') whereas fruits ripened between July 15th ('Petrova a') and September 4th ('Požega a').

Fruit and stone weight ranged from 13.18 g ('Petrova a') to 22.18 g ('Požega a')

ex situ
domestica L.
Prunus insititia L.
Prunus
 IBPGR (
 .), UPOV (
 .)
 15- (" "
 " " - ") 24-
 (" ")
 15- (" ")
 4- (" ")
 g (" ") 22.18 g (" ")
 13.18

(Nenadovic Mratinic et al., 2007).

(Neumüller, 2011),
(Paunovic and Paunovic, 1994)

(Ogasanovic et al, 1994)

(Paunovic, 1988).

situ

Prunus domestica L. *Prunus insititia* L

generally used for brandy production (Nenadovic Mratinic et al., 2007). On the other hand, due to tolerance to frost and drought (Neumüller, 2011), resistance (Paunovic and Paunovic, 1994) and quality attributes, autochthonous plum cultivars represent genetic basis for clonal selection.

They are used in different breeding programs aimed at development of new plum cultivars (Ogasanovic et al, 1994) and new plum, apricot and peach rootstocks (Paunovic, 1988).

- Fruit Research Institute Cacak has a long tradition of collecting new and investigating
- genotypes in current plum collection, thus providing source of plum germplasm.

This study was carried out to determine basic phenological and pomological traits, and resistance to economically important diseases of eight *ex situ* grown autochthonous plum cultivars derived from *Prunus domestica* L. and *Prunus insititia* L in order to examine their possible usage as a genetic bases for future breeding programs.

2010 2011
ex situ

Prunus domestica L.
Prunus insititia L.

2001

5 2 m

(5%
),
 (80%
),
 (90%
)
)
)
).

MATERIAL AND METHODS

Filed trial and plant material.

Investigations were conducted in 2010 and 2011 involving *ex situ* observations of six autochthonous plum cultivars derived from *Prunus domestica* L. and two cultivars derived from *Prunus insititia* L.

All cultivars were grafted on Myrobalan seedlings and planted in collection orchard in 2001 at locality Zdravljak, near Cacak.

Trees were planted at 5 × 2 m and trained as pyramidal crown, under non-irrigated cultural practices.

The study focused on determination of basic phenological and pomological traits and resistance to causal agents of economically important diseases.

Biological and fruit-quality traits measurement.

The following phenological characteristics were determined: flowering onset (5% of flowers have bloomed), full flowering (80% of flowers have bloomed), end of flowering (90% of flowers have bloomed and corollas have begun to fall off) and harvest date (fruits are sufficiently colored and soft to be eaten).

Analysis of pomological

Adventure Pro (Ohaus, USA),
 (g).
 (mm)
 „Starrett 727“ (Athol, USA).
 25
 (°Brix)
 „Milwaukee MR
 200“ (ATC, Belgium).
 , 2- , 3-
 , 4 , 5
), (0- , 1-
 , 2- , 3- -
 , 4- , 5-
 , 6- , 7-
 , 8- , 9-)
 (1- , 3- , 5-
 , 7- 9-)
 IBPGR.
 -
 (Plum pox
 virus)
 (Polystigma rubrum
 Pers.), (Puccinia pruni
 spinosae Diet.)
 (Monilinia laxa Aderh
 et. Ruhl)
 UPOV.

- properties involved measuring fruit
 weight (FW), fruit height (H), suture
 diameter (SD), cheek diameter
 (CD), stone weight (SW), soluble
 solids content (SS), skin ground
 color (GC), over skin color (OC)
 and eating quality (EQ). The FW
 and SW were taken using
 Adventure Pro scale (Ohaus,
 USA), and are expressed in g. The
 H, SD and CD (mm) were
 measured by caliper Starrett 727
 (Athol, USA).

A total of 25 fruits and stones were
 sampled per each cultivar in three
 replications. The SS (°Brix) was
 determined by the Milwaukee MR
 200 (ATC, Belgium) hand
 refractometer. GC (1–green, 2–
 light green, 3–light yellow, 4–
 yellow, 5–deep yellow), OC (0–
 white yellow, 1–pink, 2–red, 3–red
 violet, 4–violet, 5–dark violet, 6–
 blue, 7–mahagony, 8–dark blue,
 9–black) and EQ (1–extremely
 poor, 3–poor, 5–fair, 7–good to 9–
 excellent) were described by
 IBPGR methodologies.

- The investigations of field
 resistance to Sharka (*Plum pox
 virus*) and causal agents of red leaf
 spot (*Polystigma rubrum* Pers.),
 rust (*Puccinia pruni spinosae* Diet.)
 and fruit rot (*Monilinia laxa* Aderh
 et. Ruhl) were conducted using the
 UPOV procedure.
 Symptom intensity was determined

1-9 (1- , 3- , 5- , 7- 9-).

on a scale from 1–9 (1–no attack, 3–minor attack, 5–moderate attack, 7–strong attack and 9–very strong attack).

RESULTS AND DISCUSSION

Phenological characteristics of autochthonous plum cultivars are given in Table 1.

1. . - " - " (15-), " (24-). (" - ") 30- ("), 26- (" " - ") 7- (" "). 9 (" ") 13 ("), (" ") (" "). (Webster, 1986).

Flowering onset was recorded in mid-April. The earliest flowering onset was observed in 'Šljiva-Štrpci' and 'Belošljiva- okešina' (April 15th), and the latest in 'Požega a' (April 24th). Full flowering was between April 18th ('Šljiva-Štrpci') and April 30th ('Požega a'), and end of flowering between April 26th ('Bugarka' and 'Šljiva-Štrpci') and May 7th ('Požega a').

Duration of flowering in autochthonous plum cultivars was from 9 ('Petrova a') to 13 days ('Belošljiva- okešina' and 'Požega a'), harvest period being longer than flowering period. Harvest date was from mid-July ('Petrova a') to early September ('Belošljiva- okešina' and 'Požega a').

European plum cultivars flower early, at the time of the year when the risk of frost damage to blossoms is still high (Webster, 1986). In Serbia, flowering onset in autochthonous plum cultivars is between end of March and early

2000). (Mratinic, 2000). - April (Mratinic, 2000).
 - Somewhat later flowering onset in the studied autochthonous plum cultivars in our study is due to environmental conditions.

al., 2010). (Liverani et al., 2010). - Depending on climatic conditions, flowering time may vary by years (Liverani et al., 2010). Similar duration of flowering was reported by Milosevic et al. (2010).

Milosevic et al. (2010). - In terms of harvest date, the obtained results are very similar to the ones published by Milosevic and Milosevic (2012).

Milosevic and Milosevic (2012).

1.

2010–2011

Table 1. Mean values of phenological characteristics of autochthonous plum cultivars grown in the Region of Serbia over 2010–2011

Cultivar (Local name)	/ Flowering				Harvest date
	Onset	Full	End	Duration (days)	
'Petrova a'	19 April	21 April	28 April	9	15 July
'Milinkuša'	19 April	23 April	1 May	12	27 July
'Crvena ranka'	17 April	20 April	29 April	12	2 August
'Bugarka'	16 April	19 April	26 April	10	12 August
'Papra anka'	16 April	20 April	28 April	12	15 August
'Šljiva-Štrpci'	15 April	18 April	26 April	11	19 August
'Belošljiva-okešina'	15 April	19 April	28 April	13	2 September
'Požega a'	24 April	30 April	7 May	13	4 September

Pomological and sensorial characteristics of autochthonous

2. -
 " " (13.18 g),
 " " (22.18 g).
 (26.43 mm, 23.20 mm, 24.90 mm).
 " " (42.65 mm, 31.54 mm),
 " " (30.81 mm).
 " " (0.69 g)
 " " (1.32 g).
 " " (12.80 °Brix),
 " "
 (" ' " " "
 " " " "
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plum cultivars are given in Table 2. The lowest FW was in 'Petrova a' on average (13.18 g), while the highest was in 'Požega a' (22.18 g). The lowest H, SD and CD were observed in 'Petrova a' (26.43 mm, 23.20 mm and 24.90 mm, respectively). The highest H and SD were recorded in 'Požega a' (42.65 mm and 31.54 mm, respectively), whereas the highest CD was in 'Šljiva-Štrpci' (30.81 mm). In the assessed cultivars no correlation was recorded between FW and SW. The smallest and the largest stones were produced by 'Petrova a' (0.69 g) and 'Papa anka' (1.32 g), respectively. The lowest SS was observed in fruits of the earliest cultivar 'Petrova a' (12.80 °Brix), and the highest in the latest cultivar 'Požega a'. In most of the cultivars, GC was light green ('Petrova a', 'Milinkuša', 'Bugarka', 'Papa anka' and 'Požega a'), while in 'Crvena ranka' and 'Belošljiva- okešina' GC was light yellow, and green only in 'Šljiva-Štrpci'. The OC varied from red ('Belošljiva- okešina'), red-violet ('Milinkuša' and 'Crvena ranka'), dark violet ('Petrova a' and 'Šljiva-Štrpci'), blue ('Papa anka') to dark blue ('Bugarka' and 'Požega a'). EQ was mainly fair in fruits of 'Milinkuša', 'Crvena ranka', 'Šljiva-Šutci' and 'Belošljiva- okešina', while fruits of 'Petrova a' and 'Papa anka' had

" , " " "

" , " "

" , "

" , "

Prunus domestica L. - (Milosevic et al., 2010)

- (García-Marino et al., 2008)

Prunus insititia L. Jarebica Muratovic (1977)

g, 14.17 Mratinic 41.70 (2000)

(6.2

28.0 g).

(, , ,)

()

Milosevic Milosevic (2012).

-

.

12

32 °Brix,

17 °Brix (Neumüller, 2011).

-

Milosevic Milosevic (2012).

poor, 'Bugarka' good, and 'Požega a' excellent EQ.

In general, local plum cultivars derived from *Prunus domestica* L. have larger fruits (Milosevic et al., 2010) and higher SS (García-Marino et al., 2008) than cultivars derived from *Prunus insititia* L. Jarebica and Muratovic (1977) determined that the plum fruit weight ranged from 14.17 to 41.70 g, while Mratinic (2000) reported on minimum and maximum values of fruit weight in local plum cultivars (6.2 and 28.0 g, respectively).

Values of measurable properties of fruit (FW, H, SD, CD) and stone (SW) in our study were very similar with results previously reported by Milosevic and Milosevic (2012).

Taste is the most important property of plum fruit quality.

High fruit quality and taste go along with high soluble solids content. SS in plums ranged from 12 to 32 °Brix and late ripening cultivars should have more than 17 °Brix (Neumüller, 2011).

In terms of SS, the results of our study are in agreement with those of Milosevic and Milosevic (2012).

2.

2010-2011

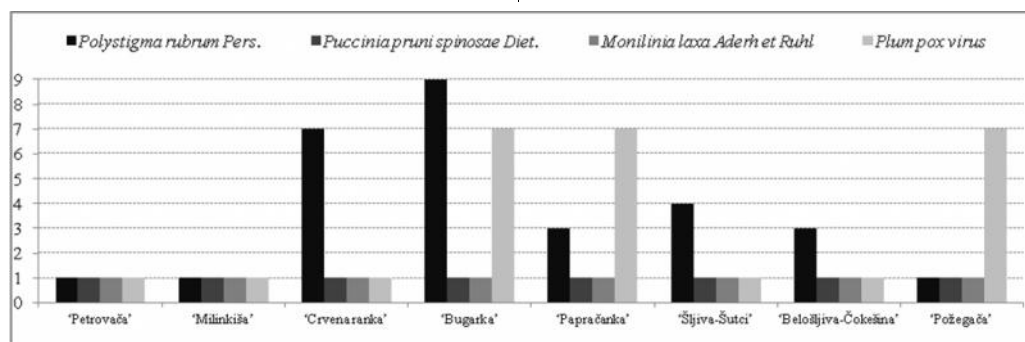
Table 2. Mean values of pomological and sensorial characteristics of autochthonous plum cultivars grown in the Region of Serbia over 2010–2011

Cultivar (Local name)	/FW	/H	/SD	/CD	/SW	/SS	/GC	/OC	/EQ
'Petrova a'	13.18	26.43	23.20	24.90	0.69	12.80	2	5	3
'Milinkuša'	19.49	36.37	28.59	28.59	0.94	19.49	2	3	5
'Crvena ranka'	20.18	37.26	28.44	30.43	0.71	14.50	3	3	5
'Bugarka'	17.19	36.02	27.29	29.31	0.95	14.60	2	7	7
'Papra anka'	21.05	35.87	29.65	29.24	1.32	17.15	2	6	3
'Šljiva-Štrpci'	22.09	36.83	29.60	30.81	1.31	16.80	1	5	5
'Belošljiva- okešina'	16.49	32.70	26.96	28.52	1.22	16.90	3	2	5
'Požega a'	22.18	42.65	31.54	30.10	0.71	19.60	2	7	9

.1.
(*Puccinia pruni spinosae*
Diet.)
Aderh et Ruhl.)

The results of the study of resistance of autochthonous plum cultivars to causal agents of diseases under field conditions are shown in Fig. 1.

All the studied cultivars had no typical symptoms of rust (*Puccinia pruni spinosae* Diet.) and fruit rot (*Monilinia laxa* Aderh et Ruhl.) either on leaves or fruits.



. 1.

2010–2011

Fig. 1. Mean values of resistance of autochthonous plum cultivars to causal agents of diseases under field conditions in the Region of Serbia over 2010–2011

Symptoms of red leaf spot were observed in five genotypes ('Bugarka', 'Papra anka', 'Belošljiva- okešina', 'Šljiva-Štrpci' and 'Crvena Ranka') and ranged from mild (3) to very strong (9). Strong attack of Sharka (7) was observed on leaves and fruits of 'Požega a', 'Papra anka' and 'Bugarka'.

Other genotypes had no visible symptoms of this virus either on leaves or fruits. Autochthonous plum cultivars can be the source of resistance to economically important diseases (Rodrigues et al., 2009).

In this respect, 'Požega a' can be used in breeding programs as a donor of resistance to causal agent of fruit rot, whereas damson plums have resistance to *Polystigma rubrum* Pers. (Misic, 2002).

The presented results relative to fruit size showed that local plum cultivars were inferior to standard commercial cultivars.

Nenadovic Mratinic et al. (2007) concluded that 'Crvena Ranka' was suitable as raw material for the production of high-quality brandies, while Milosevic and Milosevic (2012) reported that fruits of some local cultivars were suitable for fresh use or drying.

However, indigenous plum

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(Milosevic et al., 2010).

cultivars are most valuable as a genetic basis for clonal selection and breeding of new plum cultivars and new rootstocks for plum, peach and apricot (Milosevic et al., 2010).

CONCLUSIONS

Prunus domestica L. *Prunus insititia* L., ('Petrova a')

Flowering onset in autochthonous plum cultivars originating from *Prunus domestica* L. and *Prunus insititia* L. was recorded in mid-April, whereas fruits ripened between mid-July ('Petrova a') and early September.

Fruits were extremely small. Light-yellow skin ground color was dominant, while over color varied from red to dark blue.

Eating quality ranged from poor to excellent. The assessed genotypes showed no typical symptoms of rust and fruit rot.

Symptoms of red leaf spot ranged from mild to very strong. The strong attack of Sharka was observed on leaves and fruits in three genotypes.

Fruits of some examined cultivars could be processed into brendy, whereas some can be used for drying or fresh consumption.

Autochthonous plum cultivars investigated in this study represent outstanding genetic basis and the source of germplasm for further

- plum breeding work.

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However, the results obtained in this study are only preliminary and further examinations will be conducted under field and laboratory conditions in the following years.

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31064.

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