

WATER ATTAINING CAPABILITY OF THE LEAVES IN AUTOCHTHONOUS PLUM CULTIVARS AS AN INDICATOR OF THEIR RESISTANCE TO DROUGHT

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Abstract: The results of this research show that the plant height, stem diameter, branching and uniformity of one-year old seedlings of autochthonous plum cultivars are genetic characteristics of autochthonous plum cultivars, from which rapid growth and uniformity of scions depend. Out of the studies of one-year old seedlings of autochthonous plum cultivars, the highest water attaining capability had the leaves of cultivar ‘Crvena ranka’. Over the monitored time interval (8 hours upon sample taking), leaves taken from the annual twigs of the studied cultivars (one-year old seedlings) lost on average 33,54% of water. The lowest level of the stated capability was recorded with the leaves of cultivar ‘Obični piskavac’ (41.74%).

Key words: plum, genetic bases, germplasm, *Prunus domestica* L., drought

Introduction

Plum is ranked as the second most important fruit tree crop in the temperate climate after apple from the point of view production. Its tasty and good looking fruits have been used extensively during history as fresh or dried fruits, but also processed as jam, marmelade, jelly and brandy. Plums contain health promoting compounds, minerals, vitamins, fibers, and low in calories and among the highest in antioxidant containing foods and for those reasons are beneficial for human consumption (Botu et al., 2012.).

Plum cultivation has a historical tradition, economical, social and cultural implication for the South East of Europe. The European plum (*Prunus domestica* L.) genetic variability in the South East of Europe is large, unique and particular evident in the characteristics of the fruit, plant and adaptability to different ecological conditions. In Serbia and Romania 80% of the plums go into the production of slivovitz or tuica.

Fortunately, some of plum cultivars and biotypes exhibit tolerance to *Plum Pox Potyvirus* (Botu et al., 2012.). As an example, Elisa test that was conducted on cultivar ‘Crvena durgulja’, proved presence of Sharka (PPV), however it did not affect the fruits. Also, ‘Crvena durgulja’ showed as very resistant to other pests and diseases. The cultivar ‘Crvena ranka’ is slightly susceptible to Sharka. The cultivar ‘Komperuša’, Elisa test showed absence of Sharka (PPV). Also, ‘Komperuša’ showed as very resistant to other pests and diseases (Botu et al., 2012.).

‘Požegača’ and number of cultivars used for brandy production predominante in the assortment. The Montenegro plum production is characterized by extensive growing technology, low unstable yields, low-quality fruit, PPV-induced problems and a

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multitude of cultivars. The cultivars include Požegača (35%), foreign standard and introduction newly bred cultivars (15%) and autochthonous (local, primitive) cultivars (50%), and their fruit is typically used for brandy production. Autochthonous plum cultivars are a limiting factor in improving plum production in Montenegro. Nevertheless, they are used as an outstanding source of germplasm and as a genetic basis underlying breeding activities, principally the development of new cultivars, clonal selection (Ogašanić et al., 1994.; Milošević, 2000.), the development of new plum, apricot and peach rootstocks (Paunović, 1988.; Djurić et al., 1998.), resistance to economically important diseases (Paunović and Paunović, 1994.; Rodrigues et al., 2009.) or intensive cultivation (Mratinić, 2000.). Similar investigations with focus on identical or similar objectives were also conducted in the other countries of the former Yugoslavia – Serbia (Milošević, 2000.), Bosnia and Herzegovina (Buljko, 1977.; Jarebica and Muratović, 1977.), Croatia (Jelačić et al., 2008.) and Slovenia (Usenik et al., 2007.). In situ investigations of cultivars derived from *Prunus domestica* L. and *P. insititia* L. in Serbia were conducted by a number of researchers (Paunović et al., 1985.; Paunović, 1988.; Paunović and Paunović, 1994.; Petrović et al., 2002.) who defined important biological, pomological and technological traits of both fruit and tree. They reported that the selected cultivars could be used both as breeding programs and as rootstocks, as well as in further disease-related systematic studies under field and laboratory conditions. The main objective of this study was to determine in situ basic biological traits of some autochthonous plum cultivars derived from *P. domestica* L. and *P. insititia* L. in the area of North Montenegro that could be used as a genetic basis and source of germplasm for future breeding studies and as cultivars for organic plum orchards.

Material and methods

The investigations were conducted continuously in years 2014 and 2015.

One-year old seedlings from 20 autochthonous plum cultivars were planted in the nursery and raised seedlings were evaluated for nursery characteristics: plant height (cm), stem diameter (mm), bat take (%) seedling vigour, uniformity and branching. Uniformity was low (grade 1) when coefficient of variation was less than 15%, and high (grade 2) when it was from 15 to 25%.

The dynamics of leaf dehydration per measured interval was determined by method of Eremeev (1964.). The loss of water due to transpiration followed by measuring the weight of leaves (Slavik, 1974.). The dynamics of leaf dehydration was measured in order to obtain initial resistance rate of autochthonous plum cultivars towards drought conditions. The dynamics of leaf dehydration depends on the thickness of leaf cuticle and leaf average size. The data were subjected to statistical analysis of variance (ANOVA) and means were separated by LSD test at $P < 0.05$ significant level [SAS Institute, 2002].

Results and discussion

The results of this research show that the plant height, stem diameter, branching and uniformity of one-year old seedlings of autochthonous plum cultivars are genetic

characteristics of autochthonous plum cultivars, from which rapid growth and uniformity of scions depend (tab. 1). The plant height of one-year old seedlings of researched autochthonous cultivars of plum was from 53.4 cm (cv. ‘Plavski piskavac’), to 131.9 cm (cv. ‘Crvena durgulja’). The stem diameter of researched one-year old seedlings of autochthonous cultivars of plum was from 6mm (cv. ‘Plavski piskavac’), to 12 mm (cv. ‘Crvena durgulja’). The most significant nursery characteristics which must be estimated in selection of autochthonous plum cultivar are ability to propagate, growth-rate, uniformity and compatibility (Vachun, 1995.). In most of autochthonous cultivars of plum height and stem diameter at the height of 10 cm above the ground were sufficient for successful grafting in August (tab. 1). The bud take data of researched one-year old seedlings of autochthonous cultivars of plum was from 48 % (‘Trnovača’) to 98% (‘Crvena durgulja’). The cultivars ‘Mednica’ and ‘Mudara’, whose bud take data was 92% and 95%, were also very interesting from the aspect of economic production of one-year old seedlings autochthonous plum cultivars.

Tabela 1. Morfološke i kvantitativne karakteristike jednogodišnjih sadnica autohtonih rakijskih sorti šljive na podlozi džanarike (*Prunus cerasifera* Erhr.).

Table 1. Morphological and quantitative characteristics of one-year old seedlings for autochthonous brandy varieties of plum on Myrobalan seedling (*Prunus cerasifera* Erhr.).

Cultivar Sorta	Plant height (cm) (average) Visina sadnice (cm) (prosek)	Stem diameter (mm) (average) Presek (mm) (prosek)	Branchi ng Grananj e	Uniformit y Uniformn ost	Bud take (%) Primanje pupolaka (%) (prosek)	Grow of scions (cm) (average) Porast u drugoj godini (cm) (prosek)	Uniformit y of scions Uniformn ost u drugoj godini (prosek)
Crvena durgulja	131.9 a	12.0 a	1	1	98 a	205 a	1
Crvena ranka	110.2 ab	9.8 b	2	1	85 a	195 a	2
Crnošljiva	109.7 ab	9.2 b	4	1	77 b	193.5 a	1
Dupljanka	125.7 a	11.0 a	2	1	86 a	198.2 a	1
Dronga	119 ab	10 b	2	2	88 a	195.5 a	2
Turgulja	91.4 b	8.0 b	3	1	77 b	155.6 bc	1
Trnovača	57.4 c	6.5 c	3	1	48 c	132.2 c	1
Mednica	114.4 ab	10.2 b	2	2	92 a	198 a	2
Plavski piskavac	53.4 c	6 c	3	1	45 c	130.8 c	1
Petrovača	86.2 bc	7.8 c	1	2	55 c	150.4 c	2
Obični Piskavac	113.4 ab	9.5b	2	1	85 a	197.2 a	1
Grkaja	111.7 ab	9.5b	2	1	88 a	188.4 a	1
Belošljiva	108.2 ab	8.0b	2	1	70 b	197.5 a	1
Šara	121.6 a	10.5 b	1	1	75 b	146.5 c	2
Kapavac	73.2 c	7.2 c	4	1	68 b	195.4 a	1

Komperuša	119.5 ab	10.8 b	2	1	88 a	180 ab	1
Mudovalj	108.6 ab	9.1b c	2	2	75 b	200 a	2
Mudara	128.7 a	11.4 a	1	2	95 a	155bc	2
Metlaš	87 bc	7.8 c	3	1	65 bc	154 c	1
Jesenka	101.8 b	8.8 b	2	1	73 b	173.5 b	1
LSD ₀₀₅	13.1	1.25	0.3	0.2	0.31	14.2	0.23
LSD ₀₀₁	17.4	1.66	0.55	0.31	0.37	18.5	0.35

Most of the germplasm resources have never been subjected to proper germplasm conservation research work. Many local types of genetic value have already disappeared or will be lost in the next few years without any possibility of recovery. Fortunately genetic resources in sparsely populated and less developed areas of Serbia and Montenegro have been less eroded. The main objective of this work was selection of old autochthonous cultivars with better bio-agronomic characteristics such as uniformity of growth, high productivity, reduction of vigor and adaptation to the pedoclimatic environment. However, since the results obtained in this study are only preliminary, reliable estimation will be possible only through a multi-disciplinary approach to examining selected cultivars grown in a collection orchard as well as through further findings to be attained under field and laboratory conditions over the next five to ten years.

Out of the studies autochthonous plum cultivars, the highest water attaining capability had the leaves of cultivar ‘Crvena ranka’ (tab. 2). Over the monitored time interval (8 hours upon sample taking), leaves taken from the annual twigs of the studied cultivars (one-year old seedlings) lost on average 33,54% of water. The lowest level of the stated capability was recorded with the leaves of cultivar ‘Obični piskavac’ (41.74%). Out of the studied water attaining capability of leaves in autochthonous apple cultivars (Šebek, 2004), the highest water attaining capability had the leaves of cultivar ‘Pašinka’. Over the monitored time interval (8 hours upon sample taking), leaves taken from the annual twigs of the studied cultivars (in situ) lost on average 38.09% of water. The lowest level of stated capability was recorded with the leaves of cultivar ‘Arapka’ (40.64%). In terms of the selected wild apples (Šebek, 2004), the highest level of water attaining capability was registered in the leaves of type 2 (32,44%). Leaves taken from the annual twigs out of the studied selected types (in situ) lost on average level (36,61 %) showed the leaves of type 6.

Tabela 2. Dinamika dehidracije listova po mernim intervalima (prosek 2014-2015)(%)
 Table 2. Dynamics of leaf dehydration per measured interval (average 2014-2015)(%)

Sorta <i>Cultivar</i>	Merni intervali (h) <i>Measured interval (h)</i>					
	1h	2h	4h	8h	16h	24h
Crvena durgulja	9.19	18.55	23.83	36.32	63.93	100
Crvena ranka	8.93	18.35	21.5	33.54**	58.24	100
Crnošljiva	9.2	19.1	23.05	36.53	64.17	100
Dupljanka	9.32	18.92	24.08	37.14	64.57	100
Dronga	9.56	19.99	25.18	37.23	66.65	100
Turgulja	9.85	20.14	25.6	37.71	65.05	100
Trnovača	9.4	19.26	24.96	37.42	64.97	100
Mednica	9.99	20.21	24.76	36.07	65.2	100
Plavski piskavac	8.89	18.44	22.56	35.09	62	100
Petrovača	9.67	21.1	26.46	41.45	70.84	100
Obični Piskavac	10.02	21.83	27.6	41.74*	72.45	100
Grkaja	8.82	20.47	25.69	39.19	71.56	100
Belošljiva	9.52	19.71	25.56	41.37	73.78	100
Šara	8.29	18.34	23.54	36.29	64.18	100
Kapavac	9.47	19.28	24.76	38.01	65.8	100
Komperuša	8.73	19.22	24.92	37.22	68.63	100
Mudovalj	9.12	19.63	25.42	38.71	66.69	100
Mudara	8.53	19.39	26.3	39.88	70.1	100
Metlaš	9.11	20.9	26.5	40.96	71.66	100
Jesenka	9.55	19.3	25.3	37.65	67.5	100

Conclusion

The results of this research show that the plant height, stem diameter, branching and uniformity of one-year old seedlings are genetic characteristics of autochthonous plum cultivars, from which rapid growth and uniformity of scions depend. From the aspect of production of one-year old seedlings and evaluation of scions, the most interesting autochthonous plum cultivars are ‘Mednica’ and ‘Mudara’.

The highest water attaining capability had the leaves of cultivar ‘Crvena Ranka’. The lowest level of the stated capability was recorded with the leaves of cultivar ‘Obični piskavac’.

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