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BIO-POMOLOGICAL TRAITS OF SOME AUTOCHTHONOUS OLIVE (*OLEAE EUROPAEAE L)* CULTIVARS OF MONTENEGRIN COAST

BIO-POMOLOŠKE OSOBINE NEKIH AUTOHTONIH SORTI MASLINE (OLEAE EUROPAEAE L) NA CRNOGORSKOM PRIMORJU

Abstract

The research of autochthonous olive cultivars of Montenegrin coast was carried out in period 1986-99 in the existing olive groves of the sub regions of Bar (Ulcinj – Valdanos and Budva - Ivanovići) and Boka Kotorska (Kotor – Grbalj – Kavač, Herceg Novi – Sasovići and peninsula Luštica). In this paper we present unpublished data for the following five cultivars: Sarulja, Gloginja, Zinzulaca, Fran and Barkinja. These investigations included bio-pomological characteristics of the subject cultivars. On basis of the results obtained by this research we may state that four of five studied cultivars are for production of oil, whereas the fifth one has combined traits.

Key words: *Oleae europae,* fruit, morphological, physical and chemical traits

Izvod

Ispitivanje autohtonih sorti crnogorskog primorja je vršeno u periodu od 1986-99. godine u postojećim zasadima masline u podregionima Bara (Ulcinj – Valdanos and Budva - Ivanovići) i Boke Kotorske (Kotor – Grbalj – Kavač, Herceg Novi – Sasovići i poluostrva Luštice). U ovom radu prikazujemo neobjavljene podatke za sledeće sorte: Sarulja, Gloginja, Zinzulaca, Fran i Barkinja. Ispitivanja obuhvataju bio-pomološke karakteristike pomenutih sorti. Na osnovu dobijenih rezultata može se reći da su četiri od pet

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ispitivanih sorti namijenjene za proizvodnju ulja, dok je peta kombinovanih svojstava.

Ključne riječi: *Oleae europae*, plod, morfologija, fizičke i hemijske osobine

INTRODUCTION

The rayon of olive in Montenegrin sub-tropical zone consists of the two sub regions: Bar's sub region (Ulcinj, Bar and Budva) and Boka Kotorska's sub region (Tivat, Kotor and Herceg Novi). They differ for their composition of cultivars, what is significant for this paper. In the assortment of Bar's sub region the cultivar žutica (92.0%) is prevailing, whereas in Boka Kotorska's sub region it is presented with some 36%, and in addition to it there is a number of other domestic cultivars, like: crnica (29%), lumbardeška (13%), sitnica (11%), šarulja (9%), whereas gloginja, fran, zinzulača and barkinja together make the remaining 2%.

graph 1.
Distribution and regions of olive investigation at Montenegrin seaside

So far the research has been implemented and the results published on leading autochthonous cultivars (Miranović 1971, 1971a, 1976, 1979, 1993, Bulić 1921, Zec 1951, Vlašić 1977).

Studies of mentioned cultivars (šarulja, gloginja, zinzulača, fran and barkinja) have been the subject of the project »Bank of the Plant Genes of Yugoslavia« (1986/99) for which K. Miranović was the curator for olives. These cultivars are interesting as a material for further studies and they will be used as plant resources, in collections.

MATERIALS AND METHODS

The studies were performed in period 1986/99 in the existing olive groves of the sub regions of Bar (Ulcinj – Valdanos and Budva - Ivanovići) and Boka Kotorska (Kotor – Grbalj – Kavač, Herceg Novi – Sasovići and peninsula Luštica). Data on presence of specific cultivars in this area have been collected from the municipal statistical bureaus and by conducting a pole with the producers on the spot. The following cultivars have been taken for the study: šarulja, gloginja, zinzulača, fran and barkinja. The studies have included the more significant chasracteristics of olive furit and stone, as well as the chemical structure of the fruit. During the four years, samples consisting of 100 fruits each used to be taken separately for every cultivar from marked trees (the project of bank of plant genes) for morphometric investigations and chemical analyses. The following morphological and physical traits of fruit and stone have veen studied:

- fruit and stone dimensions,
- index of fruit and stone appearance,
- fruit and stone mass, and calculated fruit randman.

We have studied the following components of the chemical structure: moisture contents, respectively contents of dry matter and per cent of raw oil in fresh and dry matter. The dimensions of fruit and stone have been measured by vernier calipers with accurracy of ± 0.05 mm, and their mass has been measured on a technical balance with accurracy of ± 0.01 g. The contents of raw oil has been determined according to Soxlet, and diethylether G.R has been used as the extractor. Dry matter has been determined by drying the sample on 105 °C to the constant weight. The results have been treated by the analysis of variance and tested.

RESULTS

The results of the investigations of five autochthonous cultivars of olives cultivated at Montenegrin coast in two sub regions: Bar's and Boka Kotorska's, have covered the data on their presence, characteristics of fruit and stone as well as on fruit's chemical composition.

The best distributed cultivars in this rayon are Žutica and Crnica, and than Lumbardeška and Sitnica. As mentioned in the introduction, these cultivars have been studied and results presented, respectively published in journals. However, for this paper we have performed the research of the remaining groups of the cultivars: Šarulja (3.34%) in Boka Kotroska sub region and in the group other cultivars (2%) there are cultivars Gloginja, Zinzulača, Fran and Barkinja.

Table 1. Presence of autochthonous olive cultivars on Montenegrin Coast in %
Tab. 1. Raširenost autohtonih sorti masline na crnogorskom primorju (%)

Ord. No Red.br.	*Municipality* Opština	*C u l t i v a r* / Sorta					
		Žutica	Crnica	Sitnica	Lumbardeška	Šarulja	*Other c.*
1.	Ulcinj	98.0	-	-	-	-	2.0
2.	Bar	98.0	-				2.0
3.	Budva	64.0	35.0				1.0
Total	Bar's sub r.	92.0	6.2				1.8
4.	Kotor	38.0	37.0	18.0	-	7.0	-
5.	H. Novi	40.0	30.0	15.0	10.0	-	5.0
6.	Tivat	30.0	20.0	-	30.0	20.0	-
Total	Boka Kotorska	36.0	29.0	11.0	13.0	9.0	2.0
Total	Monten. Coast	64.93	17.83	6.14	5.76	3.34	2.0

Table 2. Usable part of the fruit and contents of oil and water in %
Tab. 2. Jestivi dio ploda i sadržaj ulja i vlage (%)

Ord. No Red.br.	*Cultivar* Sorta	*Fruit's usable part* Jestivi dio ploda	*Oil content in raw fruit %* Saržaj ulja u svj. mat.	*Oil contents in dry matter %* Sadržaj ulja u suv.mat.	*Moisture contents %* Sadržaj vlage
1.	Šarulja	81.82	16.14	45.10	63.96
2.	Gloginja	79.98	18.20	49.50	62.87
3.	Zinzulača	83.73	19.64	55.54	64.65
4.	Fran	86.18	22.11	42.83	48.49
5.	Barkinja	87.01	18.79	50.82	62.81

This table has been composed of data relevant for cultivar's characterization. These data have been tested and they may be commented with certainty.

Morphometric properties of fruits of some olive cultivars

The morphometry of fruit's length and width of (some) studied cultivars of olives: Šarulja, Gloginja, Zinzulača, Fran and Barkinja and its stones have been presented in table 1. On basis of recorded average values (X), standard deviation (SD) and coefficient variation (CV) it is possible to give some characteristics of the fruit and stone of mentioned cultivars. Obtained values are the results of the large samples studied (n=400) in period of four years, so that the recorded coefficient values vary for the length of the fruit from 3.02% to 6.41% (Zinzulača and Gloginja), respectively fruit width from 2.22% (Barkinja) to 3.87% (Gloginja), what indicates a good homogeneity of observed fruits. A consequence of this is that length and width of the stone have a similar relation, since the coefficient in them was law – from 1.85% (stone length in cultivar Fran) to 7.33% (stone length in Zinzulača), respectively for the width of stone from 1.86% (Zinzulača) to 5.72% (Fran).

We assess as statistically significant (from 16.28 to 7.38 mm) the difference of average values of length and width of stone (from 11.46 to 16.71 mm) and width (from 6.95 to 7.38 mm); the unevenness among the studied cultivars has been confirmed between the length and width of the fruits well as the length of stone among the cultivars ($p=0.05$ to $p=0.001$). The difference in fruit length between Šarulja and Gloginja as well as between Barkinja in relation to Zinzulača and Fran is statistically insignificant, whereas in all other combinations the differences are very evident and statistically very significant. It is similar with width of fruit and length of stone; while Gloginja has a larger stone than Šarulja and Zinzulača, what has a significant statistical importance.
Physical properties of studied cultivars (tab. 4) have been compared on basis of fruit mass, mass of flesh and mass of stone the variability of which has been uneven. It has ranged from 3.80% (fruit mass of Barkinja) to 32.36% (flesh mass of Gloginja). The differences in grams of mentioned masses are not statistically significant between the cultivars Šarulja and Gloginja, the same being correct for Fran and Zinzulača, whereas in all other comparisons the diffeernces among them have been very significant ($p=0.01$ to $p=0.001$).

The quality of fruit is determined by its chemical composition. According to data from table 5 the contents of raw fat in dry substance of fruit ranged from 42.83% (Fran) to 55.54% (Zinzulača), and in fresh fruit substance of fruit the raw fat was represented from 16.14% (Šarulja) to 22.11% (Fran). The contents of moisture ranged from 48.49% (Fran) to 64.65% (Zinzulača). Recorded differences are very evident between the cultivar Fran in relation to all other cultivars ($p<0.001$).

Table 3. Average values and standard deviation of data on morphology of fruit and stone of olive cultivars with the assessment of statistical significance of their differences

Tab. 3. Prosječne vrijednosti i standardna varijacija morfometrije ploda i koštice sorti masline i ocjena statističke značajnosti razlika

Olive cultivar Sorte masline	*Average value (X) and standard deviation of fruit and stone (mm)* Prosj. vrijednost (X) i standardna devijacija ploda i koštice(mm)							
	Fruit length Dužina ploda		*Fruit width* Širina ploda		*Stone length* Dižina košt.		*Stone width* Širina košt.	
	X	SD	X	SD	X	SD	X	SD
1. Šarulja	17.11	0.6234	12.96	0.3785	12.89	0.4703	7.00	0.1414
2. Gloginja	16.28	1.0426	13.55	0.5245	11.46	0.5304	7.22	0.1366
3. Zinzulača	23.34	0.7045	16.60	0.3547	15.29	1.1168	6.95	0.1295
4. Fran	24.68	1.0634	16.30	0.4720	16.71	0.3096	7.38	0.4218
5. Barkinja	24.64	1.3932	19.63	0.4351	16.88	1.0786	7.00	0.2024

t – test on assessment of statistically significant differences among the cultivars

t – test i ocjena statističke značajnosti razlika između sorti

1:2	1.531	1.793	4.035***	2.236*
1:3	13.241***	14.032***	3.961***	0.521
1:4	12.283***	11.041***	13.565***	1.709
1:5	9.866***	23.128***	6.781***	0.000
2:3	11.221***	4.817***	6.195***	2.866**
2:4	11.281***	5.802***	13.839***	0.722
2:5	9.608***	17.846***	9.018***	1.800
3:4	2.101*	1.016	2.480*	1.949
3:5	1.665	10.569***	2.048*	0.416
4:5	0.046	10.374***	0.303	1.625

Coefficient of variation (CV) / *Koeficijent varijacije (CV)*

1. Šarulja	3.64	2.92	3.67	2.02
2. Gloginja	6.41	3.87	4.63	1.89
3. Zinzulača	3.02	2.14	7.33	1.86
4. Fran	4.31	2.91	1.85	5.72
5. Barkinja	5.65	2.22	6.63	2.89

Table 4. Physical traits of cultivars' fruit in grams according to the fruit mass, mass of flesh and mass of stone

Tab. 4. Fizičke osobine ploda u g prema masi ploda, masi mesa i masi koštice

Olive cultivar Sorta masline	*Average values (X) and standard deviation of fruit in grams of mass of fruit, mass of flesh and mass of stone*								
	Fruit mass			*Flesh mass*			*Stone mass*		
	X	SD	CV	X	SD	CV	X	SD	CV
1. Šarulja	1.62	0.2940	18.15	1.32	0.2344	17.76	0.28	0.0580	20.73
2. Gloginja	1.80	0.3693	20.52	1.43	0.4757	32.36	0.33	0.0394	11.94
3. Zinzulača	3.41	0.4253	12.47	2.86	0.4437	15.51	0.55	0.0402	7.31
4. Fran	3.91	0.5892	14.83	3.38	0.5187	15.35	0.53	0.0572	10.79
5. Barkinja	5.24	0.1989	3.80	4.56	0.1413	3.10	0.68	0.0879	12.93

t - test on the assessment of statistically significant differences among the cultivars

t - test i ocjena statistički značajnih razlika među sortama

1:2	0.763	0.566	0.931
1:3	6.925***	6.140***	5.019***
1:4	6.954***	7.238***	4.340***
1:5	20.394***	23.667***	6.015***
2:3	5.717***	4.274***	7.829***
2:4	6.068***	5.428***	5.764***
2:5	16.404***	12.455***	7.277***
3:4	1.376	1.524	0.571
3:5	7.797***	7.302***	2.692**
4:5	4.277***	4.390***	2.863**

Table 5. Chemical composition of fruits of the cultivars according to the contents in % of moisture and raw fat in fresh fruit and dry substance of fruit

Tab. 5. Hemijski sastav ploda sorti u %

Olive cultivars Sorte masline	*Contents in %* / Sadržaji u %		
	Moisture Vlaga	*Raw fat in fresh substance of fruit* Sad. ulja u svj. materiji ploda	*Raw fat in dry substance of fruit* Sad. ulja u suvoj materiji ploda
1. Šarulja	63.96	16.14	45.10
2. Gloginja	62.87	18.20	49.50
3. Zinzulača	64.65	19.64	55.54
4. Fran	48.49	22.11	42.83
5. Barkinja	62.80	18.79	50.81

t – test on the assessment of statistically significant differences among the cultivars
t – test i ocjena statistički značajnih razlika među sortama

1:2	0.277	0.344	1.078
1:3	0.176	1.118	2.565*
1:4	3.858***	1.860	0.535
1:5	0.294	0.855	1.400
2:3	0.453	0.450	1.480
2:4	3.577***	1.192	1.639
2:5	0.018	0.186	0.321
3:4	4.040***	0.777	3.131***
3:5	0.471	0.264	1.159
4:5	3.560	1.006	1.961*

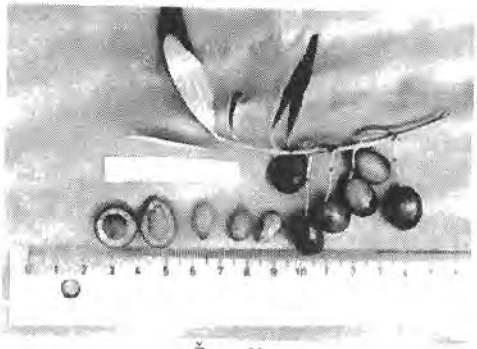
DISCUSSION AND CONCLUSIONS

Data presented in the tables 3, 4 and 5 bring to the conclusion that in this group of cultivars two groups are distinguished for their dimensions, large size of fruit and contents of oil: cultivars for oil (Šarulja, Gloginja) and cultivars with combined properties – both for oil and as table olives (Zinzulača, Fran and Barkinja).

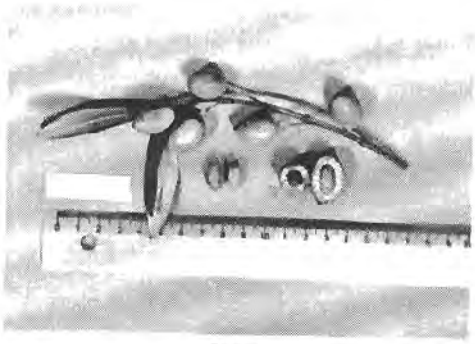
On grounds of morphological studies of autochthonous olive cultivars in the rayon of Montenegrin coast in period 1986/99 the following conclusions may be derived: In the rayon of Montenegrin Coast there are two sub regions: Bar's (Bar, Ulcinj, Budva) and the one of Boka Kotorska (Kotor, Herceg Novi and Tivat), differing for the presence of cultivars; the sub region of Bar has a very harmonized assortment, only on the territory of Budva the number of cultivars is somewhat higher.

The largest fruit size is immanent to the cultivars Barkinja, Zinzulača and Fran, the smallest ones are Šarulja and Gloginja; usable part of the fruit (flesh) has been the most favorable in the cultivars Barkinja and Fran, and most unfavorable in cultivars Gloginja and Šarulja.

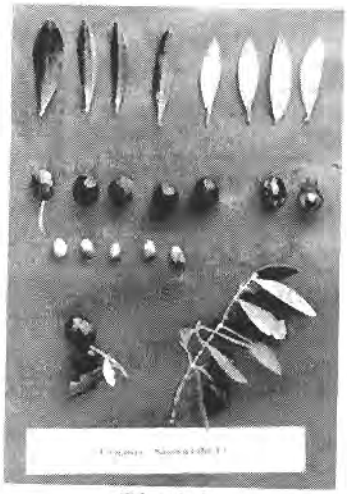
According to the chemical composition of fruit, cultivar Fran is distinguished for its oil contents in the dry substance (42.83%), respectively the most favorable cultivar is Zinzulača (55.54%). For the contents of oil in fresh fruit Šarulja is distinguished (16.14%), and the highest oil contents belongs to the cultivar Fran (22.11%). The contents of moisture has been the smallest in cultivar Fran (48.49%), the highest in cultivar Zinzulača (64.65%). Mentioned differences are significant, so that the cultivar Fran is distinguished as elated to all other cultivars.



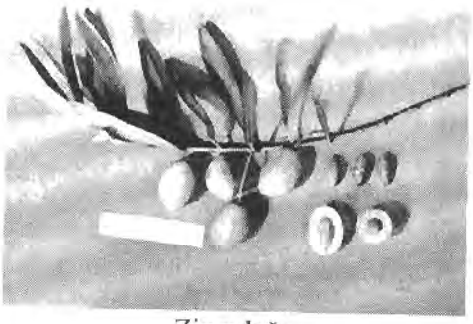
Šarulja



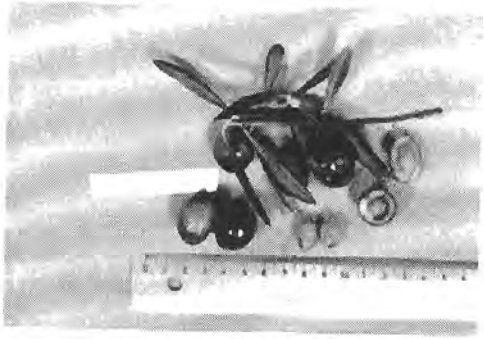
Fran



Gloginja



Zinzulača



Barkinja

On basis of these studies, economically valuable are the cultivars: Fran, Barkinja and Zinzulača, which for some parameters are similar to the cultivar Fran, what requires further research. The remaining cultivars have the value as the autochthonous plant material and they should be kept in collections.

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BIO-POMOLOŠKE OSOBINE NEKIH AUTOHTONIH SORTI MASLINE (OLEAE EUROPAEAE L) NA CRNOGORSKOM PRIMORJU

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Sažetak

Ispitivanje autohtonih sorti masline crnogorskog primorja vršeno je u periodu od 1963-1998. godine. U ovom radu prikazani su neobjavljeni podaci za sledeće sorte: Sarulja, Gloginja, Zinzulaca, Fran i Barkinja. Ispitivane su bio-pomološke karakteristike pomenutih sorti. Na osnovu dobijenih rezultata možemo reći sledeće:

- Sorta Šarulja je raširena u malom broju u podrejonu Boka Kotorska (Grbalj i Luštica). Stablo je prosječne razvijenosti, krošnja je granata. Naziv je dobila prema boji plodova, koji su na početku zrenja prekriveni različitim nijansama žuto-zelene boje sa vinsko-crvenim purpurnim tačkama, tako da se šarene. Pripada sortama kasnog zrenja i nema veći ekonomski značaj. Plodovi su sitni – masa ploda je 1,62 g. Sadržaj ulja u plodu je nizak, 16,14%. Ulje je visokog kvaliteta.
- Gloginja je takože raširena u podrejonu Boke Kotorske (Sasovići, H. Novi). Ima prosječno bujnu krunu. Rodi dobro ali neredovno. Plod je sitan, 1,8 g, koštica je takođe sitna, 0,32 g. Sadržaj ulja u plodu je prosječan – 18,20%. Ulje je dobrog kvaliteta.
- Zinzulača je raširena u Barskom podrejonu (Budva). Dobila je ime prema obliku ploda koji podsjeća na *Ziziphus vulgaris*. Razvija veliko stablo sa uspravnim granama. Plodovi su srednje krupni, mase 3,41 g. Masa koštice je 0,39 g.Srednje je rodnosti. Sadržaj ulja je takođe srednji, 19,64%, ulje je dobrog kvaliteta. Rađa alternativno.
- Fran je sorta sporadično raširena u podrejonu Bara (Ulcinj). Stablo je srednje bujnosti sa uspravnim granama. Rodi alternativno. Plod je srednje krupan, 3,01 g, koštica je takođe srednje krupna, 0,48 g. Sadržaj ulja je izrazito visok 22,11 %. Ulje je dobrog kvaliteta.

Barkinja je rasprostranjena u podrejonu Boka Kotorska (Strp, Sasovići). Stablo je srednje bujno, uspravno, slabo rodno. Plod je krupan, mase 5,23 g. Koštica je takođe krupna, 0,75 g. Plod je za dvojnu namjenu, za ulje i za jelo. Sadržaj ulja je prosječan, 18,79%. Ulje je dobrog kvaliteta, povoljne konzistencije i dobrog ukusa.