

**GENETIC AND PHENOTYPIC VARIABILITY OF CHERRY PLUM  
(*PRUNUS CERASIFERA* EHRH.) POMOLOGICAL CHARACTERISTICS**

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Cherry plum (*Prunus cerasifera Ehrh.*) is one of the most widely spread fruit species in our country. The fruits are mostly used for brandy production, and the seed is used for rootstock production in fruit culture. As cherry plum is resistant to plant diseases and pests, chemical protection is not required. Concerning that, cherry plum is reach and cheap source for the production of healthy food. The objective of this research was the analysis of genetic and phenotypic variability, as well as study on correlation of pomological traits of 49 cherry plum genotypes selected from the native population in Serbia. It was measured that the highest genetic variance in total phenotypic variance was for the fruit height and total sugar content. The lowest genetic variance in total phenotypic variance was for the length of the stalk and dry matter content. The highest genetic variance coefficient (CVg = 22.93%) was calculated for the total acid content, although the lowest value of genetic and phenotypic variance was for the fruit width (CVg = 0.69%; CVf = 0.80%). The highest coefficient of phenotypic and genetic correlation was calculated between the weight and height of the fruit. Native population of cherry plum in Serbia and Montenegro is specific because of the extensive variability of

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the forms, which is highly important for the selection of raw material in breeding process.

*Key words:* cherry plum, variability, pomological traits

## INTRODUCTION

Cherry plum (*Prunus cerasifera Ehrh.*) is one of the most widely grown fruit cultures in the native population of fruit species in Serbia and Montenegro (PEJKIĆ *et al.*, 1991). The fruits are used mainly for the production of brandy, and the seeds are used for the production of nursery rootstock. Since cherry plum is resistant to plant diseases and pests (BOŽOVIĆ and JAĆIMOVIĆ, 2003), the chemical protection is not required. According to that, cherry plum fruits are a rich and cheap source for the production of biologically healthy food (STANKOVIĆ, 1967). Native population of cherry plum in Serbia and Montenegro contains great variability of forms (ŠOŠKIĆ, 1966; 1968; MILUTINOVIĆ *et al.*, 1990, 1997; MILETIĆ, 1995; ČOLIĆ, 2001), which is of great importance for the selection of raw material in breeding process.

The research goals were to study the variability and the participation of genetic and phenotypic components in the expression of pomological traits of cherry plum fruits, the relationship among the traits, as well as genetic and phenotypic correlation between the traits tested.

## MATERIAL AND METHODS

The researches were performed at the school trial field "Radmilovac", Faculty of Agriculture-Belgrade, during 1996-1997 period. The trial was set up and designed on the base of completely randomized block system with three replicates.

The following pomological traits of 49 cherry plum selections were studied: fruit and seed weight, fruit height and width and the length of the stalk. Chemical analyses included the estimation of sugar, acid and dry matter content.

Experimental data were processed according to the methodology of analyses of variance and covariance (HADŽIVUKOVIĆ, 1991). ANOVA statistical programme was used for the data processing.

## RESULTS AND DISCUSSION

One of the first steps of studying the cherry plum population was the estimation of genetic diversity at the same agro and pomotechnical conditions. The variability of analysed traits was estimated on the bases of coefficient of variance, and the results are presented in Table 1.

Among pomological traits tested the highest variability (26.51%) was recorded for the fruit weight, which varied from 5.60 to 15.34 g. This is in accordance with the results presented by STANČEVIĆ *et al.* (1988), MILETIĆ (1995), MILUTINOVIĆ *et al.* (1990; 1997), ŠURLAN-MOMIROVIĆ *et al.* (1999). Fruit width

was less varied (8.90 %), within the interval of 20.70-29.80 mm. Regarding the components of chemical compound, the greatest variability (22.93 %) was estimated for the total acid content, which ranged from 1.21 to 2.97 %; this is in accordance with the results obtained by PEJKIĆ *et al.* (1991).

Table 1. Variability of cherry plum pomological traits tested

Trait tested	Minimal value	Maximal value	Mean value	Cv (%)
Fruit weight (g)	5.60	15.34	9.86	26.51
Seed weight (g)	0.21	1.02	0.59	25.16
Fruit height (mm)	21.20	28.90	25.02	9.70
Fruit width (mm)	20.70	29.80	25.25	8.90
Length of stalk (mm)	12.90	20.80	16.50	13.50
Total sugars (%)	6.64	14.58	8.29	11.39
Total acids (%)	1.21	2.97	1.95	22.93
Dry matter (%)	11.00	15.07	13.03	11.79

The highest participation of genetic variance ( $S^2_g$ ) in total phenotypic variance ( $S^2_f$ ) was found for the fruit height and total sugar content. The lowest participation of genetic variance in total phenotypic variance was found for the length of stalk and dry matter content. Total acid content had the highest coefficient of genetic variance ( $CV_g = 22.93\%$ ). On the other hand, the values of coefficients of genetic and phenotypic variance for the fruit width were the lowest ( $CV_g = 0.69\%$ ;  $CV_f = 0.80\%$ ). In accordance with the participation of genetic variance, very high values of heritability for the fruit height ( $h^2 = 0.87$ ), seed weight ( $h^2 = 0.85$ ), fruit weight and width ( $h^2 = 0.81$ ), total acid content ( $h^2 = 0.99$ ) and total sugar content ( $h^2 = 0.95$ ) were calculated. This suggests that variability of these traits is highly controlled by genes, which is not the case with the length of stalk and dry matter content; the variability of these traits is controlled by the factors of natural conditions.

Table 2. Components of genetic ( $S^2_g$ ) and phenotypic ( $S^2_f$ ) variance of cherry plum pomological traits and heritability in broader sense

	Fruit weight	Seed weight	Fruit height	Fruit width	Length of stalk	Total sugars	Total acids	Dry matter
$S^2_g$	4.492	0.016	0.045	0.032	0.024	0.97	0.20	0.62
$S^2_f$	5.524	0.019	0.051	0.039	0.035	0.98	0.21	2.33
$h^2$	0.81	0.85	0.87	0.81	0.69	0.99	0.95	0.26
$CV_g$	21.49	6.78	0.80	0.69	0.85	11.88	22.93	6.04
$CV_f$	23.82	7.38	0.89	0.80	1.05	11.94	23.50	11.71

The knowledge of the correlation relationship among the observed traits offers a possibility of forming right criterions and choices for the correct selection. According to FALCONER (1983) correlations and dependance among the traits are

due to the effects of pleiotropic genes. The coefficients of genetic and phenotypic correlation are presented in Table 3.

Table 3. Coefficients of genetic ( $r_g$ ) and phenotypic ( $r_f$ ) correlation of cherry plum pomological traits tested

Trait tested		8.	7.	6.	5.	4.	3.	2.	1.
Fruit weight	$r_g$	-0.10	0.02	0.18	0.60 <sup>x</sup>	0.89 <sup>xx</sup>	0.99 <sup>xx</sup>	0.78 <sup>xx</sup>	-
	$r_f$	0.11	0.02	0.15	0.23	0.88 <sup>xx</sup>	0.95 <sup>xx</sup>	0.68 <sup>x</sup>	-
Seed weight	$r_g$	-0.10	0.01	0.21	0.32	0.76 <sup>xx</sup>	0.76 <sup>xx</sup>	-	-
	$r_f$	-0.01	0.01	0.15	0.16	0.69	0.66	-	-
Fruit height	$r_g$	-0.05	0.02	0.12	0.53	0.83 <sup>xx</sup>	-	-	-
	$r_f$	0.14	0.02	0.10	0.16	0.81 <sup>xx</sup>	-	-	-
Fruit width	$r_g$	0.10	0.01	0.19	0.61 <sup>x</sup>	-	-	-	-
	$r_f$	0.10	0.01	0.17	0.28	-	-	-	-
Length of stalk	$r_g$	0.01	-0.05	-0.30	-	-	-	-	-
	$r_f$	-0.15	-0.03	-0.18	-	-	-	-	-
Total sugars	$r_g$	0.06	-0.60 <sup>x</sup>	-	-	-	-	-	-
	$r_f$	0.06	0.34	-	-	-	-	-	-
Total acids	$r_g$	-0.05	-	-	-	-	-	-	-
	$r_f$	0.02	-	-	-	-	-	-	-
Dry matter	$r_g$	-	-	-	-	-	-	-	-
	$r_f$	-	-	-	-	-	-	-	-

<sup>x,xx</sup> - Significant at  $p = 0.05$  and  $0.01$ , respectively

Positive genetic correlation is set on 75.0 % pairs of traits tested, where of 28.57 % pairs of traits tested had a strong and very strong correlation. The greatest statistical very significant genetic correlation ( $r_g = 0.99$ ) is recorded between the fruit weight and fruit height, while the lowest statistical significant genetic correlation ( $r_g = 0.60$ ) is recorded between the fruit weight and the length of the stalk. Significantly negative genetic correlation ( $r_g = -0.60$ ) is recorded between the total sugar and acid contents (Tab. 3.).

Positive phenotypic correlation is defined for 85.71 % pairs of traits tested, where of 14.28 % pairs of traits tested had a strong and very strong correlation. The greatest statistical very significant phenotypic correlation ( $r_f = 0.95$ ) is recorded between the fruit weight and fruit height, while the lowest one ( $r_f = 0.68$ ) is recorded between the fruit and seed weight. Negative, but not significant phenotypic correlation is recorded for the 14.28 % pairs of traits tested.

## CONCLUSION

Among the studied pomological traits and the components of chemical content, the greatest variance is recorded for the fruit weight and total acid content. High values of coefficients of heritability for fruit height and seed weight, fruit height and width, total acid and sugar contents are referred to the genetically controlled variability of these traits, while the length of the stalk and total acid content variability are controlled by the natural conditions. The greatest positive statistical

very significant coefficients of fenotypic and genetic correlation are recorded between fruit weight and fruit height. The only negative statistical significant coefficient is calculated between the total sugar and acid contents. High values coefficients of heritability of cherry plum pomological traits could enable the selection from the wide range of genotypes, those specific ones that could contribute to the improvement of the most important economic traits of present-day plum cultivars and rootstocks.

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**GENETIČKA I FENOTIPSKA VARIJABILNOST POMOLOŠKIH OSOBINA DŽANARIKE (*PRUNUS CERASIFERA* EHRH.)**

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## Izvod

Džanarika (*Prunus cerasifera* Ehrh.) je jedna od najrasprostranjenijih voćaka u spontanoj populaciji naše zemlje. Njeni se plodovi uglavnom koriste za dobijanje rakije, a seme za proizvodnju podloga u voćarstvu. S obzirom da je otporna prema izazivačima biljnih bolesti i štetočinama, ne štiti se hemijskim sredstvima, pa predstavlja bogat izvor i jeftinu sirovinu za dobijanje biološki vredne hrane. Cilj rada bilo je proučavanje genetičke i fenotipske varijabilnosti i korelacija pomoloških osobina 49 genotipova džanarike odabranih iz prirodne populacije Srbije. Najveće učešće genetičke varijanse u ukupnoj fenotipskoj varijansi ustanovljeno je za visinu ploda i sadržaj ukupnih šećera. Najmanje učešće genetičke varijanse u ukupnoj fenotipskoj varijansi utvrđeno je za dužinu peteljke i sadržaj suve materije. Sadržaj ukupnih kiselina odlikovao se najvišim koeficijentom genetičke varijacije ( $CV_g=22.93\%$ ), dok je vrednost koeficijenta genetičke i fenotipske varijacije za širinu ploda bila najmanja ( $CV_g=0.69\%$ ;  $CV_f=0.80\%$ ). Najveći koeficijenti fenotipske i genetičke korelacije zabeleženi su između mase ploda i visine ploda. Spontana populacija džanarike u Srbiji i Crnoj Gori karakteriše se velikom varijabilnošću formi, što ima veliki značaj za izbor početnog materijala u procesu oplemenjivanja.

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