

UDC 575.21; 634.23
Original scientific paper

GENETIC DIVERGENCE OF OBLAČINSKA SOUR CHERRY (*PRUNUS CERASUS* L.) CLONES

Dragan NIKOLIĆ, Vera RAKONJAC, Momčilo MILUTINOVIĆ, and Milica FOTIRIĆ

Faculty of Agriculture, 11080 Belgrade-Zemun, Serbia and Montenegro

Nikolić D., V. Rakonjac, M. Milutinović, and M. Fotirić (2005): *Genetic divergence of oblačinska sour cherry (Prunus cerasus L.) clones*. – Genetika, Vol. 37, No. 3, 191-198.

Based on examination of 10 important pomologic and technologic properties, genetic divergence of 10 selected Oblačinska sour cherry clones was established. The genetic divergence between the analyzed clones was determined using the hierarchical cluster analysis. The UPGA method was used and the Euclidean distance in order to determine the difference between the groups. Four similar clone groups were obtained on the dendrogram. The objective of clone differentiation was primarily yield, although other properties were taken into account as well. As the most yielded clones for the production, that can be recommended, were clone D8 or clone D4 that are genetically very similar, and clone D3.

Key words: Oblačinska sour cherry, clone, cluster analysis

INTRODUCTION

Oblačinska sour cherry is our autochthonous cultivar that was named after the small village Oblačina in south Serbia. Considering other sour cherry cultivars in producing orchards it is represented with the largest number of trees. MIŠIĆ (1989) cited that existing Oblačinska sour cherry population was developed by

Corresponding author: Dragan Nikolić, Faculty of Agriculture, Nemanjina 6, 11080 Belgrade-Zemun, Serbia and Montenegro, e-mail: nikolicd@agrifaculty.bg.ac.yu

vegetative reproduction mainly by shoots. Possibility that the generative reproduction influenced to wide spreading of this cultivar should not be excluded. All of that influenced the fact that Oblačinska sour cherry represents heterogeneous sour cherry population, a mixture of a great number of clones (genotypes).

General characteristic of Oblačinska sour cherry is low vigor, small canopy habit, self-fertility and high and regular yields. Fruit is small (around 3 g), rotundas, with uniformly size and ripening time. Skin is dark red and thin. Fruit flesh is red, medium firm, juicy, with lots of acids, aromatic, high quality and suitable for processing in numerous products. Stalk is easily separated from the fruit and pyramidal shape of scaffolds is giving Oblačinska sour cherry special possibility for the mechanical harvesting (PAVIĆEVIĆ, 1976).

While Oblačinska sour cherry is not pure cultivar but mixture of clones (genotypes), problems with its` reproduction and exploitation occur. Because of those reasons, considering breeding methods, special attention should be pay to the clonal selection. With clonal selection should separate genotypes that, beside good yields, will have large fruits with high soluble solid and organic acid content and with different ripening time.

Considering all of this, based on previously examined variability, in south Serbia producing orchards, 10 phenotypic different clones of Oblačinska sour cherry were separated. While evaluation of clones suitable for further exploitation is done based of numerous desirable characteristics, in this paper, the hierarchical cluster analysis was used for determination of genetic divergence of separated clones. Divergence of clones was determined based on 10 most important pomologic and technologic properties. Besides establishing genetic variability, the most promising clones are recommended for further spreading in production.

MATERIAL AND METHODS

Investigation included 10 Oblačinska sour cherry clones selected from producing orchards of south Serbia. Selected clones were vegetative reproduced on rootstock *Prunus mahaleb* L. and planted at the Experimental Station "Radmilovac" of the Faculty of Agriculture in Belgrade. Planting of clones was done in 1994, on planting distance 4 x 3 m. During period 2000-2002, on sample of three trees per each clone, following pomologic and technologic properties were examined: ripening time, yield, fruit weight, stone weight, randman, fruit stalk length, soluble solid content, total sugar content, invert sugar content and total acid content.

Picking time was taken as ripening time. Yield per tree was determined by measuring all fruits from the tree. On 30 fruits, as sample, collected during full maturity, fruit weight, stone weight and fruit stalk length were measured. Randman, that represents percentage of fruit flesh in total fruit weight, was established calculating. Soluble solid content was determined by hand refractometer, and total and invert sugar content after Somogy Nelson. Total acid content was established by titration with 0.1N NaOH.

For all examined characteristics, mean values were calculated for three-years period of investigation. Genetic divergence between examined clones was determined by using the hierarchical cluster analysis. The UPGA method was used and the Euclidean distance in order to determine the difference between the groups.

RESULTS AND DISCUSSION

Fruits of all examined Oblačinska sour cherry clones averagely ripen, in all three years of the experiment, in first decade of June, in interval from 6th June up to 9th June (Table 1). OGAŠANOVIĆ *et al.* (1985) determined insignificantly exception of the ripening time, from one to two days, in 8 selected Oblačinska sour cherry clones. From Table 1 can be seen that the lowest yield had clone D1 (5.1 kg/tree), but the largest clone D8 (20.6 kg/tree). Clone D4 had the highest fruit weight (3.52 g), stone weight (0.33 g) and fruit stalk length (3.0 cm), while the lowest fruit weight (2.62 g) had clone D7, the lowest stone weight (0.25 g) clones D9 and D10, and the lowest fruit stalk length (2.4 cm) clones D3, D7 and D10. Similar varying intervals for fruit weight from 3.12 g up to 4.01g established MILUTINOVIĆ *et al.* (1980) in examined 6 Oblačinska sour cherry clones and OGAŠANOVIĆ *et al.* (1985), who cited that in 8 selected clones average fruit weight varied from 2.8 g up to 3.1 g. In contrast to the results of our paper, NIKOLIĆ *et al.* (1996) established significantly higher varying interval of the fruit stalk length in 6 selected Oblačinska sour cherry clones that was between 2.36 cm and 4.46 cm. Although fruit of the Oblačinska sour cherry, considering other cultivars is much smaller, ratio between fruit flesh and stone in selected and examined clones in our investigations mostly was satisfied and was from 89.97% (clone D8) up to 91.29% (clone D10).

PAVIĆEVIĆ (1976) cited that in dependence of the year, locality and picking time, soluble solid content in Oblačinska sour cherry is between 12% and 17%, and total acid content from 1.4% up to 2.0%. MILUTINOVIĆ *et al.* (1980) established that in 6 examined Oblačinska sour cherry clones soluble solid content varied from 12.81% to 17.90%, and total acid content from 1.45% to 1.95%, while OGAŠANOVIĆ *et al.* (1985) cited that in 8 selected clones soluble solid content varied from 16.7% to 19.7%, and total acid content from 3.17% to 3.30%. Results in Table 1 are showing that in our paper varying interval of the soluble solid content in examined clones was from 15.96% (clone D8), up to 19.11% (clone D10), varying interval of the total sugar content from 7.38% (clone D4) to 9.28% (clone D5), and varying interval of the invert sugar content from 4.51 % (clone D2) up to 5.36% (clone D10). The lowest total acid content had clone D9 (1.06%) and the highest clone D2 (1.26%).

Based on previously showed results can be noticed that all examined Oblačinska sour cherry clones differ in all investigated characteristics. However, on occasion of establishing genetic variability and estimation of the genotype suitability for growing or further breeding work, lot of characteristics should be parallelly considered. Multivariational analysis and cluster analysis as one of them are methods suitable for establishing genetic distance of the examined material

(LIN, 1982; RAMEY and ROSIELLE, 1983). VITKOVSKIJ *et al.* (1988) cited that values of examined properties in combination with multivariational analysis are performing good base for consolidate affinity of species and cultivars of the genus *Prunus*. So, HILLIG and IEZZONI (1988), by using multivariational analysis, based on 27 morphological properties, established origin and genetic affinity of 16 sour cherry cultivars, and certain number of hybrids and seedlings obtained by open pollination.

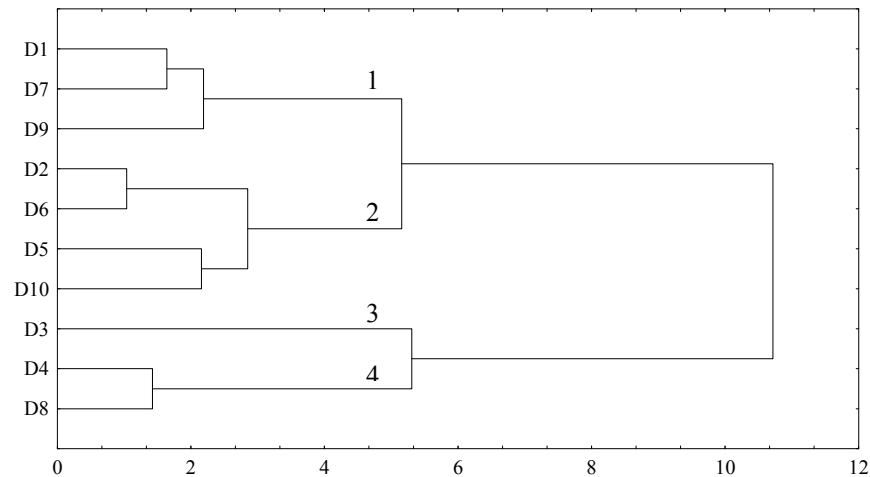


Fig. 1. Dendrogram of phenotypic differences of Oblačinska sour cherry clones constructed based on 10 pomologic and technologic characteristics

In our paper, based on mean value of all examined characteristics, by using hierarchical cluster analysis, dendrogram of the phenotypic differences of the examined Oblačinska sour cherry clones was constructed (Fig. 1). Oblačinska sour cherry clones are connected on different ways, which shows existing of numerous hierarchical levels. Considering values of the Euclidean distance and grouping way, four groups of similar clones are separated. Clones D1, D7 and D9 make first group. Clones D1 and D7, that are in the same hierarchical level have low yield, low fruit weight and medium stone weight, satisfied randman and medium total acid content. Clone D9, which is connected with previous two clones on higher hierarchical level and belongs to the same group, differs from those two clones because it has lower stone weight and lower total acid content. Clones D2 and D6 that are connected on the lowest hierarchical level together with clones D5 and D10 are making second group. Considering clones from the first group they have higher yields. In third group there is only D3 clone. Fourth group includes clones D4 and D8. Common for both clones is high yield and large fruit and stone. Exactly those three characteristics that make them differ from the other clones influenced their classification in a special group.

By analysis of examined properties on grouping investigated Oblačinska sour cherry clones, can be concluded that the biggest influence had yield, but other

characteristics should not be underestimate. RAKONJAC *et al.* (1996), by application of multivariational analysis established that on grouping of wild cherry genotypes influenced numerous properties, but the most important were: yield, ripening time, juice color, tree shape and seed germination.

For increasing genetic variability of Oblačinska sour cherry and preserving its germ plasma, based on results of cluster analysis obtained in our paper, it can be recommended that from each group one clone can be selected and collected. From the other side, clones D8 or D4 from forth group and clone D3 from third group can be recommended for the production because they have high yields.

CONCLUSION

In examined Oblačinska sour cherry clones considerable variability of analyzed pomologic and technologic properties have been established.

Using hierarchical cluster analysis, four groups of similar clones are separated on obtained dendrogram. Three clones are in the first group, four in second, only one in third and two clones in fourth group.

Separation of the clones in groups is primary because of the yield, but other characteristics influenced on separation as well.

As the most yielded clones for the production, that can be recommended, were clone D8 or clone D4 that are genetically very similar, and clone D3.

Received April 12th, 2005

Accepted June 1st, 2005

REFERENCES

- HILLIG K.W. and A.F. IEZZONI (1988): Multivariate analysis of a sour cherry germplasm collection. *J. Amer. Soc. Hort. Sci.*, *113* (6), 928-934.
- LIN C.S. (1982): Grouping genotypes by a cluster method directly related to genotype-environment interaction mean square. *Theor. Appl. Genet.*, *62*, 277-280.
- MILUTINOVIĆ M., J. SIMONOVIĆ, and M. JOVANOVIĆ (1980): Proučavanje klonova Oblačinske višnje. *Jugoslovensko voćarstvo*, *14* (51-52), 109-113.
- MIŠIĆ D.P. (1989): Nove sorte voćaka. Nolit, Beograd.
- NIKOLIĆ D., V. RAKONJAC, M. MILUTINOVIĆ, and M.M. MILUTINOVIĆ (1996): Vrednovanje selekcionisanih klonova Oblačinske višnje. *Jugoslovensko voćarstvo*, *30* (115-116), 343-347.
- OGAŠANOVIĆ D., LJ. JANDA i J. GAVRILOVIĆ (1985): Usporedna proučavanja selekcionisanih klonova Oblačinske višnje. *Jugoslovensko voćarstvo*, *19* (71-72), 165-169.
- PAVIĆEVIĆ B. (1976): Karakteristike Oblačinske višnje. *Jugoslovensko voćarstvo*, *10* (37-38), 153-156.

-
- RAKONJAC V., G. ŠURLAN-MOMIROVIĆ, I. LJUBANOVIĆ-RALEVIĆ, N. RALEVIĆ, and M. MILUTINOVIĆ (1996): Morphological and biochemical variability in different populations of wild sweet cherry (*Prunus avium* L.). *Acta Hort.*, 410, 413-421.
- RAMEY T.B. and A.A. ROSIELLE (1983): HASS cluster analysis: a new method of grouping genotypes or environments in plant breeding. *Theor. Appl. Genet.*, 66, 131-133.
- VITKOVSKIJ V.L., G.B. SAMORODOVA-BIANKI, N.S. ROSTOVA i E.A. TROFIMOVA (1988): Ispolzovanie mnogomernogo analiza količestvenih biohimičeskih priznakov plodov roda *Prunus* L. v celjah klasifikacii i taksonomii. *Dokladi VASHNIL*, 8, 11-14.

**GENETIČKA DIVERGENTNOST KLONOVA OBLAČINSKE VIŠNJE
(*PRUNUS CERASUS* L.)**

Dragan NIKOLIĆ, Vera RAKONJAC, Momčilo MILUTINOVIĆ i Milica
FOTIRIĆ

Poljoprivredni fakultet, 11080 Beograd-Zemun, Srbija i Crna Gora

Izvod

Oblačinska višnja predstavlja sortu populaciju koja obuhvata veliki broj formi različitih po bujnosti, rodnosti, vremenu sazrevanja, krupnoći, boji i kvalitetu plodova. Pošto Oblačinska višnja nije jedan klon već smeša velikog broja klonova (genotipova) nameće se potreba izdvajanja genetički divergentnih formi za eksploataciju i dalji oplemenjivački rad. U ovom radu prikazani su rezultati analize 10 selekcionisanih klonova Oblačinske višnje. Ogljed je izveden na OD "Radmilovac" Poljoprivrednog fakulteta u Beogradu. Tokom trogodišnjeg perioda istraživanja analizirane su sledeće osobine: vreme sazrevanja, prinos, masa ploda, masa koštice, randman, dužina peteljke ploda, sadržaj rastvorljivih suvih materija, sadržaj ukupnih šećera, sadržaj invertnih šećera i sadržaj ukupnih kiselina. Genetička divergentnost između proučavanih klonova ustanovljena je primenom hijerarhijske klaster analize. Korišćen je UPGA metod, pri čemu je razlika između grupa izražena preko Euklidianovog rastojanja. Na dobijenom dendrogramu izdvojeno je četiri grupe srodnih klonova. Razdvajanje klonova u grupe bilo je prvenstveno u funkciji njihovog prinosa, mada su uticaj na razdvajanje imale i ostale proučavane osobine. Kao najprinosniji za proizvodnu praksu mogu se preporučiti klon D8 ili klon D4 koji su genetički veoma bliski i klon D3.

Primljeno 12. IV 2005.

Odobreno 1. VI 2005.