Journal of Pomology, 52, 202 (2019) 59–66
Voćarstvo, 52, 202 (2019) 59–66

UDK: 634.233
Original scientific paper
Originalni naučni rad

Biological properties of sour cherry (*Prunus cerasus* L.) genotypes newly developed at Fruit Research Institute, Čačak

Sanja Radičević[1,*] Radosav Cerović[2], Slađana Marić[1], Nebojša Milošević[1], Ivana Glišić[1], Olga Mitrović[1], Aleksandra Korićanac[3]

[1]*Fruit Research Institute, Čačak, Kralja Petra I 9, 32000 Čačak, Republic of Serbia*
[2]*University of Belgrade, Innovation Centre at Faculty of Technology and Metallurgy, Karnegijeva 4, 11120 Belgrade, Republic of Serbia*
[3]*Master student of University of Kragujevac, Faculty of Agronomy, Cara Dušana 34, 32000 Čačak, Republic of Serbia*
**E-mail: sradicevic@institut-cacak.org*

Received: 18 January 2019; Accepted: 04 February 2019

Abstract. The work on the improvement of sour cherry (*Prunus cerasus* L.) genotypes at Fruit Research Institute, Čačak has been under way since 1960. The major breeding goals are to develop a self-fertile genotypes with consistent yields, superior fruit quality, suitability for industrial processing and fresh consumption, as well as with different ripening time. A special attention has been paid to obtaining genotypes tolerant/resistant to cherry leaf spot (*Blumeriella jaapii* (Rehm.) v. Arx.) and brown rot (*Monilinia laxa* /Ader et Ruhl./ Honey ex Whetz.). The main method is planned hybridization within *Prunus cerasus*. In addition, clonal selection from natural sour cherry populations of Balkan has been applied. The paper presents results of the two-year (2013–2014) study of flowering and ripening time, morphometric properties and chemical composition of fruits, and field resistance to causal agents of economically important diseases and pests of newly-released sour cherry cultivars ['Iskra' ('Köröser Weichsel' × 'Heimanns Rubin'), 'Nevena' ('Köröser Weichsel' × 'Heimanns Konserven Weichsel') and 'Sofija' ('Čačanski Rubin' × 'Heimanns Konserven Weichsel')], and promising genotypes obtained by planned hybridization [II/40 ('Köröser Weichsel' × 'Heimanns Konserven Weichsel' and V/106 (Köröser Weichsel' × 'Heimanns Konserven Weichsel')] or clonal selection from natural population ('G-6' and 'G-10'), in comparison to the standard cultivar ('Heimanns Konserven Weichsel'). 'Sofija' and 'G-10' should be favoured owing to their early ripening time (beginning of second decade of June), exceptional potential for fruit size (7.20 *g* and 6.83 *g*, respectively), well-balanced parameters of chemical composition of fruits, and field-resistance to causal agents of cherry diseases and pests. Due to the numerous positive biological and agronomical traits, sour cherry genotypes developed at Fruit Research Institute, Čačak, deserve to be given a place in commercial orchards, as well as parents within sour cherry breeding programmes worldwide.

Key words: *Prunus cerasus* L., cultivars, promising hybrids, fruit quality, field resistance

Introduction

In the structure of fruit growing in Republic of Serbia, sour cherry has an important place with the production of 98,666 tonnes (average for the period 2010–2014; FAOSTAT database, 2017). Together with raspberry, sour cherry represents the country's most important exporting fruit (Radičević et al., 2016). In assortment structure, different clones of 'Oblačinska' are predominant, accounting for 85% of the total crop along with spontaneously spread 'Cigančica' (Cerović & Radičević, 2008), while the rest make large-fruit sour cherries, i.e. 'Rexelle', 'Heimanns Konservenweichsel', 'Kelleriis 14' and 'Šumadinka' (Mi-

latović et al., 2015). A small share of sour cherries with large fruit and short span in the ripening time among the commercially important cultivars, imposes the need for prolonged harvesting season, especially with earlier-ripening large fruit cultivars, well adapted to agro-ecological conditions of the Republic of Serbia.

The work on developing new sour cherry genotypes at Fruit Research Institute (FRI), Čačak, started in 1960, and resulted in realization of five cultivars, as well as the numerous hybrids, which are under the evaluation process. The main method was planned hybridization within *Prunus cerasus* L. In the first phase, two genotypes are registered as cultivars – 'Čačanski Rubin' ('Shasse Morello' × 'Köröser Weichsel') and 'Šumadinka' ('Köröser Weichsel' × 'Heimanns Konserven Weichsel'), whereas in the second phase, three genotypes were released – 'Sofija' ('Čačanski Rubin' × 'Heimanns Konserven Weichsel'), 'Nevena' ('Köröser Weichsel' × 'Heimanns Konserven Weichsel') and 'Iskra' ('Köröser Weichsel' × 'Heimanns Rubin') (Cerović et al., 1998, Radičević et al., 2010, Radičević & Cerović, 2015).

Breeding programme within *Prunus cerasus* L. at FRI, Čačak is in accordance with modern requirements of sour cherry production, regarding both breeding objectives and a proper choice of parental genotypes (Radičević et al., 2016). New sour cherry cultivars ought to possess a high cropping potential, earlier ripening time than existing ones, fruit quality to suit the needs of industrial processing and fresh consumption (fruit size, low share of stone in the total fruit weight and easily detachable stone, high soluble solids content with a good balance of sugars and acids), tolerance to *Blumeriella jaapii*, self-fertility, and suitability for mechanical harvesting. The breeding concept was significantly influenced by the fact that the pedigree of the commercially important cultivars is dominated by a relatively small number of genotypes. The programme has been realized using the genetic potential of commercial cultivars and autochthonous genotypes from Central and Eastern Europe, characterized by significant diversity within *Prunus cerasus* L. (Iezzoni, 2005; Apostol, 2008).

The aim of this work was to examine the main biological properties of seven sour cherry genotypes resulted from breeding work at FRI, Čačak (newly released cultivars and genotypes obtained by planned hybridization or selection from natural population), as well as to recommend the most promising genotypes for wider growing and utilization in further breeding work.

Material and Methods

Plant material. The study was conducted during a two-year period (2013–2014), in the sour cherry collection at 'Ljubić' facility of FRI, Čačak. The main biological properties of newly released sour cherry cultivars – 'Iskra' ('Köröser Weichsel' × 'Heimanns Rubin'), 'Nevena' ('Köröser Weichsel' × 'Heimanns Konserven Weichsel') and 'Sofija' ('Čačanski Rubin' × 'Heimanns Konserven Weichsel'), promising genotypes obtained by the planned hybridization – II/40 ('Köröser Weichsel' × 'Heimanns Konserven Weichsel') and V/106 (Köröser Weichsel' × 'Heimanns Konserven Weichsel') and promising genotypes singled out applying the clonal selection from natural population ('G-6' and 'G-10') were investigated, and compared to the properties of standard cultivar ('Heimanns Konserven Weichsel' 'H. K. Weichsel'). All the genotypes and standard cultivar were grafted on wild cherry (*Prunus avium* L.) seedling, and represented in the orchard with five trees each.

Phenological characteristics. Flowering time investigation was conducted according to Wertheim (1996). Abundance of flowering graded as excellent (5), very good (4), good (3), poor (2), bad (1) and without flowers (0). Ripening time was determined in the period of full ripeness.

Morphometric properties. Standard morphometrical methods were used for the evaluation of fruit and stone weight, fruit dimensions (height, width and thickness), and stalk length. Fruit shape ratio ($height^2/width \times thickness$) and stone share in the total fruit weight were calculated manually.

Chemical composition of fruits. In 2013, the following parameters were determined: soluble solids content (by manual refractometer), total, inverted sugars and sucrose content (according to Luff-Schoorl; Egan et al., 1981), total acids content expressed in malic acid (by titration of 0.1 N NaOH with phenolphthalein as indicator), existing acidity (using the CyberScan 510 pH meter, Eutech Instruments Pte Ltd, Singapore), sucrose content and sweetness index (calculated manually).

Field resistance to cherry fungal diseases and pests. The investigation of field resistance to causal agents of cherry leaf spot (*Blumeriella jaapii* (Rehm.) v. Arx.), brown rot (*Monilinia laxa* /Ader et Ruhl./ Honey ex Whetz.) and cherry fruit fly (*Rhagoletis cerasi* L.) were conducted according to the VCU test, in compliance with the UPOV procedure (UPOV, 2007). Symptom intensity was determined on a scale from 1 to 9 (1 – no attack, 3 – minor attack, 5 – moderate attack, 7 – strong attack and 9 – very strong attack).
Statistical analysis. The data obtained for morphometric properties were statistically analyzed using two-factor analysis of variance (ANOVA). The significance of differences among mean values was determined by LSD multiple range test at $P \leq 0.05$. The analysis was done using SPSS statistical software package, Version 8.0 for Windows (SPSS. Inc., Chicago, IL).

Results and Discussion

Flowering and ripening time. The investigated sour cherry genotypes had relatively uniform flowering time, with earlier beginning than standard cultivar, except the genotype 'II/40' (Tab. 1). The flowering lasted from 8 days 'Iskra' and 'V/106') to 12 days 'Sofija'). Abundance of flowering was graded as good to excellent.

In terms of ripening time, genotypes were considerably different, ranging from June 9th ('G-6') to June 25th ('II/40') (Tab. 1). Extended ripening season of sour cherries provides more efficient use of harvesting and processing labour and equipment. Assortment of sour cherry cultivars with ripening period over 40 day has been identified as a goal of breeding programmes in several countries (Iezzoni, 1996; Apostol, 2011). It that sense, ripening time of 'G-6', 'G-10' and 'Sofija' was favorable (the end of the first decade / beginning of the second decade of June), because it does not coincide with ripening of majority of comercially important sour cherry cultivars, such as 'Heimanns Konserven Weichsel', 'Rexelle', 'Kelleris 16', 'Šumadinka', etc. (Milatović et al., 2015). Growing of earlier ripening large-fruit sour cherries in the Republic of Serbia influences the achievement of higher prices on the market and good economic effects, due to their ripening coincides with predominant 'Oblačinska'.
Fruit quality. Statistical analysis of the morphometric properties of fruits showed the significant influence of the genotype, year and their interaction on the fruit weight and stone share (Tab. 2). According to Albertini & Della Strada (2001), fruits of the assessed genotypes were classified as very large (>6 *g*), except the fruits of 'G-6' and standard cultivar (large fruits). The highest fruit weight was observed in 'Sofija' (7.16 *g*). Fruits were mostly kidney-flat in shape; the highest value of fruit shape ratio was observed in 'V/106' (0.98), whose fruits were the most elongated.

Stalk of the fruit was long ('Sofija', 'G-6' and 'G-10'), mid-long ('Iskra', 'II/40' and 'V/106') and short 'Nevena'). Analysis of variance showed that this trait was only influenced by genotype. Stone weight was in the small span from 0.35 *g* to 0.43 *g*, which is in accordance with the results of Milatović et al. (2015), who stated that stone weight in cherries varied from 0.3 to 0.6 *g*. The most favorable stone share, as an important parameter for processing industry, was found in 'Sofija' (5.32%), while it had the highest value in 'G-6' (7.12%). According to classification reported by Toth et al. (1996), 'Sofija' and 'Iskra' had small stone

Tab. 1. Characteristics of flowering and ripening phenophases of sour cherry genotypes newly developed at FRI, Čačak (2013–2014, average)
Karakteristike fenofaza cvetanja i sazrevanja plodova novijih genotipova višnje Instituta za voćarsatvo, Čačak (2013–2014., prosek)

Genotype *Genotip*	Flowering phenophase/*Fenofaza cvetanja*				
	Flowering onset *Početak cvetanja*	Full flowering *Puno cvetanje*	End offlowering *Kraj cvetanja*	Abundance *Obilnost*	Ripening time *Vreme sazrevanja*
'Iskra'	April 1st	April 4th	April 9th	4	June 22nd
'Nevena'	March 31st	April 2nd	April 9th	5	June 20th
'Sofija'	April 1st	April 4th	April 13th	4	June 14th
'II/40'	April 3rd	April 6th	April 14th	5	June 25th
'V/106'	April 1st	April 3rd	April 9th	3	June 17th
'G-6'	April 1st	April 3rd	April 10th	5	June 9th
'G-10'	March 31st	April 3rd	April 11th	4	June 11th
'Heimanns K.W.'	April 2nd	April 4th	April 11th	5	June 24th

Tab. 2. Fruit morphometric properties of sour cherry genotypes newly developed at FRI, Čačak (2013–2014)
Morfometrijske osobine ploda novijih genotipova višnje Instituta za voćarstvo, Čačak (2013–2014)

Factor *Faktor*			Fruit weight *Masa ploda (g)*	Fruit shape ratio *Indeks oblika ploda*	Stalk length *Dužina peteljke (mm)*	Stone weight *Masa koštice (g)*	Stone share *Udeo koštice (%)*
Genotype *Genotip* (A)	'Iskra'		6.02 ± 0.05 de	0.80 ± 0.01 de	37.98 ± 0.54 e	0.35 ± 0.00 c	5.73 ± 0.04 d
	'Nevena'		6.21 ± 0.14 cd	0.81 ± 0.01 de	34.99 ± 1.14 f	0.43 ± 0.02 a	6.95 ± 0.08 b
	'Sofija'		7.16 ± 0.17 a	0.88 ± 0.01 b	50.90 ± 1.45 b	0.38 ± 0.00 c	5.32 ± 0.11 d
	'II/40'		6.09 ± 0.16 cde	0.89 ± 0.09 b	42.11 ± 0.55 d	0.39 ± 0.00 c	6.39 ± 0.14 c
	'V/106'		6.25 ± 0.23 c	0.98 ± 0.02 a	42.05 ± 0.55 d	0.43 ± 0.00 a	6.84 ± 0.24 b
	'G-6'		5.93 ± 0.15 b	0.83 ± 0.03 cd	54.19 ± 1.24 a	0.43 ± 0.01 a	7.12 ± 0.20 b
	'G-10'		6.83 ± 0.29 b	0.77 ± 0.01 e	48.13 ± 0.56 c	0.42 ± 0.00 b	6.14 ± 0.20 c
	'Heimanns K.W.'		5.65 ± 0.10 f	0.84 ± 0.01 bc	44.45 ± 0.89 d	0.43 ± 0.00 a	7.60 ± 0.18 a
Year *Godina* (B)	2013		5.93 ± 0,09 b	0.84 ± 0.02 a	44.42 ± 1.45 a	0.41 ± 0.01 a	6.85 ± 0.19 a
	2014		6.60 ± 0,12 a	0.85 ± 0.01 a	44.28 ± 1.21 a	0.40 ± 0.01 a	6.17 ± 0.14 a
	'Iskra'	2013	5.92 ± 0.02 gh	0.81 ± 0.03 ef	38.10 ± 1.10 efg	0.34 ± 0.00 gi	5.80 ± 0.07 gh
		2014	6.11 ± 0.05 fg	0.78 ± 0.01 f	37.86 ± 0.47 fg	0.35 ± 0.00 g	5.67 ± 0.01 h
	'Nevena'	2013	5.91 ± 0.04 ghi	0.80 ± 0.02 f	34.63 ± 2.18 g	0.47 ± 0.00 a	8.01 ± 0.10 a
		2014	6.50 ± 0.07 cd	0.81 ± 0.01 ef	35.35 ± 1.25 g	0.38 ± 0.00 e	5.89 ± 0.02 gh
	'Sofija'	2013	6.84 ± 0.10 b	0.88 ± 0.01 cd	53.61 ± 0.95 a	0.37 ± 0.00 ef	5.46 ± 0.13 hi
		2014	7.47 ± 0.17 a	0.87 ± 0.03 cd	48.20 ± 1.50 b	0.39 ± 0.00 de	5.18 ± 0.15 i
A × B	'II/40'	2013	5.77 ± 0.08 hi	0.88 ± 0.00 cd	41.41 ± 0.75 de	0.38 ± 0.00 e	6.65 ± 0.10 de
		2014	6.41 ± 0.11 de	0.90 ± 0.01 bc	42.81 ± 0.70 cd	0.39 ± 0.00 de	6.14 ± 0.16 fg
	'V/106'	2013	5.76 ± 0.09 bc	1.01 ± 0.03 a	41.13 ± 0.66 def	0.42 ± 0.00 cd	7.36 ± 0.15 b
		2014	6.74 ± 0.13 ij	0.95 ± 0.01 ab	42.97 ± 0.48 cd	0.43 ± 0.00 c	6.33 ± 0.08 f
	'G-6'	2013	5.63 ± 0.10 def	0.78 ± 0.02 f	54.36 ± 1.55 a	0.41 ± 0.01 d	7.01 ± 0.42 cd
		2014	6.24 ± 0.09 ef	0.88 ± 0.05 cd	54.02 ± 2.30 a	0.45 ± 0.01 b	7.22 ± 0.10 bc
	'G-10'	2013	6.22 ± 0.14 ef	0.77 ± 0.02 f	48.84 ± 0.76 b	0.41 ± 0.00 d	6.55 ± 0.15 ef
		2014	7.44 ± 0.13 a	0.76 ± 0.01 f	47.43 ± 0.72 b	0.43 ± 0.00 c	5.74 ± 0.14 gh
	'Heimanns K.W.'	2013	5.43 ± 0.05 j	0.87 ± 0.01 cd	43.28 ± 1.56 cd	0.43 ± 0.00 c	7.99 ± 0.13 a
		2014	5.87 ± 0.02 ghi	0.87 ± 0.00 cd	45.62 ± 0.42 bc	0.42 ± 0.00 cd	7.22 ± 0.07 bc
A			*	*	*	*	*
B			*	ns	ns	ns	*
A × B			*	*	ns	*	*

*/ns – significant/not significant differences for P ≤ 0.05 (F test); small-case letters in columns indicate significant differences for P ≤ 0.05 according to LSD test
**/ns – značajne razlike/razlike koje nisu statistički značajne za P≤ 0,05 (F test); mala slova u kolonama pokazuju značajne razlike za P ≤ 0,05 primenom LSD testa*

share, whereas in other genotypes stone share had medium value.

Sour cherry cultivars have generally been classified as 'morellos' or 'amarelles', referring to red or clear fruit flesh and juice color, respectively (Iezzoni, 1996). In North America, clear-fleshed cultivar 'Montmorency' is used almost exclusively for the production of cherry pies. Among the investigated genotypes, 'Iskra' and 'V/106' are typical 'amarelles' (light red fruit skin, whitish mesocarp and colourless juice). The other genotypes are 'morellos', with ruby red ('Sofija' and 'II/40') to dark red ('Nevena', 'G-6' and 'G-10') skin colour, and coloured mesocarp and juice. In Europe, the red-fleshed 'morello' cultivars are preferred for use in a wide range of processed products. A small part of the 'morello' fruits is being sold as a premium-quality for fresh consumption. Fresh fruits are being picked with the stalk, and fruits weig-

hing 6–8 *g* are desired. Genotypes with red to dark red flesh and juice and with large fruits ('Sofija', 'Nevena', 'II/40' and 'G-10') could be preferable not only for different kind of processing, but also for fresh consumption.

The highest and the lowest soluble solids content was found in 'II/40' (16.10%) and 'V/106' (11.90%), respectively (Tab. 3). The highest and the lowest total sugars content (11.95% and 8.95%, respectively), inverted sugars content (10.81% and 8.35%, respectively) and sucrose content (1.08% and 0.57%, respectively) were also found in these two genotypes (in standard cultivar, lower values were found only for total and inverted sugar content). Contrary, 'II/40' and 'V/106' had the lowest and the highest total acids content (1.03% and 1.88%, respectively). This parameter had lower value in all the investigated genotypes than in standard cultivars. The lowest pH value of fruit juice was found in 'Nevena' (3.27), and the highest in 'G-6' (3.55).

Fruit quality is a complex trait, which includes not only attractiveness of fruit (size, colour), but also sweetness/acidity correlation, juiciness, flavor and texture. A ten-year study of 30 sour cherry cultivars showed a wide range of soluble solids content, from 12.5% to 16.2% (Nikolić et al., 2000). The correlation between total sugars and total acids establishes sweetness index, as a significant indicator of fruit quality. Some of the genotypes with high soluble solids content did not have high sweetness index value 'G-10' and ('Sofija'), whereas in some of the genotypes with lower value of soluble solids content ('G-6') sweetness index was in excess of 9.0 (Tab. 3).

However, acidity level may affect the perception of sweetness – fruits with high sugar content and moderate level of acid will be perceived as sweet as fruits with moderate sugar content and low acids (Callahan, 2003). When breeding goal is a highly pigmented cherry intended for juice or liquers, sugar/acid ratio of fruits and anthocyanin content are crucial (Iezzoni, 1996). Desired traits such as ripening time, fruit weight and soluble solids content are of typical quantitative or polygenic inheritance, accompanied by transgression to a higher or a lesser degree (Wang et al., 2000), so it is hard to obtain all of these characteristics by conventional methods used in sour cherry breeding work.

Field resistance to fungal diseases and pests. Breeding for disease resistance in sour cherry has been primarily focused on resistance to cherry leaf spot, caused by *Blumeriella jaapii*. Cherry leaf spot is one of the most serious fungal diseases of sweet and sour cherry in the world, mainly affecting the leaves (strongly attacked trees may be completely defoliated by mid-summer). Brown rot, caused by *Monilinia laxa*, occurs primarily on sour cherry, mainly inducing blossom and spur blight. Due to a large number of sprays required to control brown rot, especially near harvest, high costs of sprays and, on the other hand, the requierements for reducing chemical treatments, tolerance to brown rot becomes very important breeding objective (Iezzoni, 1996).

The best performance in terms of resistance to *Blumeriella jaapii* gave 'Sofija', 'G-6' and 'G-10' (graded with 1.0) (Fig. 1). As for manifestation of the pressure of *Monilinia laxa*, 'Sofija' and 'G-10' showed better performance in comparison to the others, with symptom intensity of 1.5; the highest pathogen pressure was observed in 'II/40' (graded with 3.5).

Tab. 3. Fruit chemical composition of sour cherry genotypes newly developed at FRI, Čačak (2013)
Hemijski sastav ploda novijih genotipova višnje Instituta za voćarstvo, Čačak (2013)

Genotype *Genotip*	Soluble solids *RSM (%)*	Sugar content/*Sadržaj šećera (%)*			Total acids *Ukupne kiseline (%)*	pH *pH*	Sweetness index *Indeks slasti*
		Total *Ukupni*	Inverted *Invertni*	Sucrose *Saharoza*			
'Iskra'	14.50	9.95	8.98	0.92	1.24	3.30	8.02
'Nevena'	13.90	9.45	8.60	0.81	1.85	3.27	5.11
'Sofija'	14.60	9.12	8.35	0.73	1.70	3.31	5.36
'II/40'	16.10	11.95	10.81	1.08	1.03	3.50	11.60
'V/106'	11.90	8.95	8.35	0.57	1.88	3.28	4.76
'G-6'	13.80	10.20	9.35	0.81	1.13	3.55	9.03
'G-10'	15.40	10.70	9.73	0.92	1.74	3.29	6.15
'Heimanns K.W.'	14.60	8.16	7.35	0.71	1.94	3.30	4.21

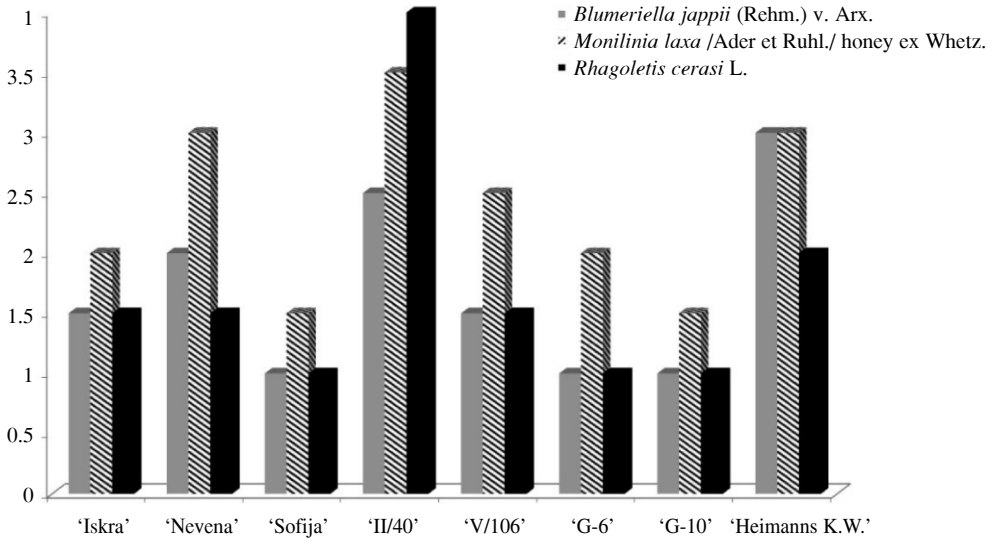

Fig. 1. Field resistance of sour cherry genotypes newly developed at FRI, Čačak, to causal agents of diseases and pests (2013–2014, average)
Poljska otpornost novijih genotipova višnje Instituta za voćarstvo, Čačak, na prouzrokovače bolesti i štetočine (2013–2014, prosek)

Sour cherry genotypes exhibit a wide range of tolerance/susceptibility to fungal diseases in the field conditions, which often depends on agro-environmental conditions. Budan et al. (2005) estimated the level of field susceptibility to leaf spot in 100 accessions in the Romanian Sour Cherry Germplasm Collection. The results showed that none of the genotypes was immune to leaf spot, but some of them had a low level of infection and could be used as potential donors for polygenic resistance. The problem is that many of genotypes showing tolerance to one of the fungal diseases, do not show tolerance to the other. For instance, 'Czengody' is recommended for resistance to *Monilinia laxa* in breeding programs (Szodi et al., 2008), and at the same time it is susceptible to *Blumeriella jaapii* (Schuster, 2004). Given these facts, particular attention should be paid to genotypes that show a low level of symptoms of both pathogens ('Sofija', 'G-6' and 'G-10' showed low infection level, but 'Iskra', 'Nevena and 'V/106' also responded favorably to the infection). If high quality fruits and early ripening time of the genotypes are additionally considered, it is clear that they should be included in further investigation (field resistance and resistance under conditions of artificial infection), and in breeding programmes accordingly.

Pressure intensity of cherry fruit fly (*Rhagoletis cerasi* L.) in 'Sofija', 'G-6' and 'G-10' was graded with 1.0, whereas it was most pronounced in 'II/40' (graded with 4.0). No source of resistance to *Rhagoletis cerasi* has been identified among sour cherries so far. Due to early ripening cultivars may avoid the larval stage of the cherry fruit fly, this breeding possibility should be explored (Iezzoni, 1996).

Conclusion

The advancement in the structure of assortment, along with the use of modern concept of growing can significantly improve an overall state of sour cherry growing in Republic of Serbia. Due to the numerous positive biological and production characteristics, the investigated newly released cultivars and promising hybrids deserve to be in new sour cherry orchards, in order to confirm their commercial value at different localities. They are also an important source of genetic variability, and will have a significant place in further sour cherry breeding work at FRI, Čačak. 'Sofija' and 'G-10' deserve considerable attention owing to their early ripening time, exceptional fruit quality (fruit size and appearance, well-balanced parameters of chemical composition of fruits in relation to the time of maturity), and field-resistance to causal agents of cherry diseases and pests.

Acknowledgments

This work was conducted under Research Project TR 31064: „Development and preservation of genetic potential of temperate zone fruits“, supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

References

Albertini A., Della Strada G. (2001): Monografia di cultivar di ciliegio dolce e acido. Instituto Sperimentale per la Frutticoltura, Roma, Italy.

Apostol J. (2008): New sweet and sour cherry selections in Hungary. Acta Horticulturae, 795: 75–78.

Apostol J. (2011): Breeding of sweet and sour cherry in Hungary. Proceedings of the III Conference 'Innovations in fruit growing – Improving the production of cherries', Belgrade (Republic of Serbia), pp. 49–57.

Budan S., Mutafa I., Stoian I.L., Popescu I. (2005): Field evaluation of cultivar susceptibility to leaf spot at Romania's sour cherry genebank. Acta Horticulturae, 667: 153–157.

Callahan A. (2003): Breeding for fruit quality. Acta Horticulturae, 622: 295–302.

Cerović R., Radičević S. (2008): Sour cherry research and production in Serbia and Montenegro. Acta Horticulturae, 795: 493–496.

Cerović R., Nikolić M., Milenković S. (1998): Breeding of sour cherries for quality and resistance to *Blumeriella jaapii* (Rehm.) V. Arh and *Rhagoletis cerasi* L. Genetika, 30: 51–58.

Egan H., Kirk R., Sawyer R. (1981): The Luff Schoorl method. Sugars and preserves. In: 'Pearson'Schemical Analysis of Foods', 8th edition, Longman Scientific and Technical, Harlow, UK, pp. 152–153.

FAOSTAT Databases (2017): http://www.fao.org/faostat/en/#data/QC

Iezzoni A.F. (1996): Sour cherry cultivars: Objectives and methods of fruit breeding and characteristics of principal commercial cultivars. In: 'Cherries: Crop Physiology, Production and Uses', Webster A.D., Looney N.E. (eds.), CAB International, Wallingford, UK, pp. 113–123.

Iezzoni A.F. (2005): Acquiring cherry germplasm from Central and Eastern Europe. HortScience, 40: 304–308.

Milatović D., Nikolić M., Miletić N. (2015): Sweet and sour cherry – second edition. Scientific Pomological Society of Serbia, Čačak, Republic of Serbia.

Nikolić M., Cerović R., Radičević S. (2000): Biological-pomological properties of new sour cherry cultivars. Journal of Yugoslav Pomology, 34, 131/132: 161–166.

Radičević S., Cerović R. (2015): New sour cherry (*Prunus cerasus* L.) cultivars developed at Fruit Research Institute, Čačak. Journal of Pomology, 49, 191/192: 115–121.

Radičević S., Cerović R., Glišić I., Karaklajić-Stajić Ž. (2010): Promising sour cherry hybrids (*Prunus cerasus* L.) developed at Fruit Research Institute – Čačak. Genetika, 42, 1: 299–306.

Radičević S., Cerović R., Marić S., Đorđević M. (2016): Cherry breeding work at Fruit Research Institute – Čačak (Republic of Serbia). Book of Proceedings, VII International Scientific Agriculture Symposium 'Agrosym 2016', Jahorina (Bosnia and Herzegovina), pp. 472–478.

Schuster M. (2004): Investigation on resistance to leaf spot disease (*Blumeriella jaapi*), in cherries. Journal of Fruit and Ornamental Plant Research, Special Edition, 12: 275–279.

Szodi S.Z., Rozsnay ZS., Rózsa E., Turóczi G.Y. (2008): Susceptibility of sour cherry cultivars to isolates of *Monilia laxa* (Ehrenbergh) Saccardo et Voglino. International Journal of Horticultural Science, 14, 1/2: 83–87.

Toth G., Auer M., Auer F. (1996): Pomological features of sweet cherry cultivars from abroad: their adaptation to Hungarian conditions. Acta Horticulturae, 410: 25–33.

UPOV (2007): Guidelines for the conduct of tests for distinctness, uniformity and stability. Sour cherry (*Prunus cerasus* L.) and Duke cherry (*Prunus* × *gondouini* (Poit. & Turpin) Rehder). International Union for the Protection of New Varieties of Plants, Geneva, Switzerland. http://www.upov.int/edocs/tgdocs/en/tg230.pdf

Wang D., Karle R., Iezzoni A.F. (2000): QTL analysis of flower and fruit traits in sour cherry. Theoretical and Applied Genetics, 100: 535–544.

Wertheim S.J. (1996). Methods for cross pollination and flowering assessment and their interpretation. Acta Horticulturae, 423: 237–241.

BIOLOŠKE OSOBINE NOVIJIH GENOTIPOVA VIŠNJE (*Prunus cerasus* L.) STVORENIH U INSTITUTU ZA VOĆARSTVO, ČAČAK

Sanja Radičević[1,*], Radosav Cerović[2], Slađana Marić[1], Nebojša Milošević[1], Ivana Glišić[1], Olga Mitrović[1], Aleksandra Korićanac[3]

[1]*Institut za voćarstvo, Čačak, Kralja Petra I 9, 32000 Čačak, Republika Srbija*
[2]*Univerzitet u Beogradu, Inovacioni centar Tehnološko-metalurškog fakulteta, Karnegijeva 4, 11120 Beograd, Republika Srbija*
[3]*Student Master akademskih studija Univerziteta u Kragujevcu, Agronomski fakultet, Cara Dušana 34, 32000 Čačak, Republika Srbija*
**E-mail: sradicevic@institut-cacak.org*

Rezime

Rad na stvaranju novih genotipova višnje u Institutu za voćarstvo, Čačak, započeo je 1960. godine. Glavni ciljevi oplemenjivačkog rada su stvaranje samooplodnih sorti višnje visokog potencijala rodnosti, odgovarajućeg kvaliteta ploda (krupnoća, nizak udeo koštice u ukupnoj masi ploda uz njeno lako odvajanje, visok sadržaj rastvorljivih suvih materija, povoljan odnos šećera i kiselina), pogodnih za različite vidove industrijske i prerade u domaćinstvu, kao i za jelo u svežem stanju. Od novih genotipova se očekuje proširenje sezone berbe u odnosu na prosečno vreme sazrevanja u uslovima Čačka (treća dekada juna), prvenstveno u pravcu ranijeg sazrevanja. Posebna pažnja je posvećena stvaranju i selekciji genotipova tolerantnih/otpornih na pegavost lista (*Blumeriella jaapii* (Rehm.) v. Arx.) i sušenje cvetova i grančica trešnje i višnje (*Monilinia laxa* /Ader et Ruhl./ Honey ex Whetz.).

Osnovni oplemenjivački metod je planska hibridizacija u okviru obične višnje (*Prunus cerasus* L.). Takođe, kao veoma značajan se primenjuje i metod selekcije iz prirodne populacije genotipova višnje područja Balkana. Kao rezultat ovakvog rada, do sada je priznato pet sorti višnje ? u ranijem periodu Čačanski Rubin i Šumadinka, a u novije vreme sorte Sofija, Nevena i Iskra, i izdvojeno više elitnih hibrida iz prirodnih i populacija planskih hibrida. Imajući u vidu da u pedigreu komercijalno značajnih sorti dominira mali broj genotipova, oplemenjivački program na stvaranju novih sorti višnje u Institutu za voćarstvo, Čačak, koncipiran je tako da u potomstvu kombinuje pozitivne osobine domaćih i introdukovanih sorti dobro prilagođenih našim agroekološkim uslovima, i autohtonih genotipova za koje su proizvođači tradicionalno vezani, a koji se odlikuju pozitivnim proizvodnim osobinama (rano vreme sazrevanja, krupnoća ploda, otpornost).

U radu su predstavljeni rezultati dvogodišnjeg (2013–2014. godina) ispitivanja vremena cvetanja i sazrevanja, morfometrijskih karakteristika i hemijskog sastava ploda novije priznatih sorti višnje Instituta za voćarstvo, Čačak [Iskra (Köröser Weichsel × Heimanns Rubin], Nevena (Köröser Weichsel × Heimanns Konserven Weichsel) i Sofija (Čačanski Rubin × Heimanns Konserven Weichsel), kao i perspektivnih genotipova dobijenih planskom hibridizacijom [II/40 (Köröser Weichsel × Heimanns Konserven Weichsel i V/106 (Köröser Weichsel × Heimanns Konserven Weichsel)] i selekcijom iz prirodne populacije (G-6 i G-10), poređenih sa osobinama standardne sorte (Heimanns Konserven Weichsel). Sorta Sofija i genotip G-10 se mogu izdvojiti na osnovu ranog vremena sazrevanja (početak druge dekade juna), potencijala za krupnoću ploda (7,20 *g*; 6.83 *g*, resp.), harmoničnog odnosa parametara hemijskog sastava ploda, kao i poljske otpornosti na prouzrokovače ekonomski značajnih bolesti i štetočine. Zahvaljujući brojnim pozitivnim biološkim i proizvodnim osobinama, ispitivani genotipovi zaslužuju da se nađu u komercijalnim zasadima višnje, kao i u oplemenjivačkim programima kao roditeljske sorte.

Key words: *Prunus cerasus* L., sorte, perspektivni hibridi, kvalitet ploda, poljska otpornost