

REZULTATE PRIVIND CREAREA DE SOIURI DE CIREȘ CU EPOCI DIFERITE DE COACERE OBȚINUTE LA SCDP IAȘI

RESULTS ON CREATING CHERRY CULTIVARS WITH DIFFERENT AGES OF RIPENING AT SCDP IAȘI

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Abstract

The goal of the paper is to present the valuable characteristics of some cherry cultivars created at SCDP Iasi, which improve the autochthonous cherry assortment with cultivars having different staged maturation fruits during the entire season of cherry maturation. On the market of fresh fruits, the ones preferred are the cultivars with “bigarreau” fruits, shining red or bicoloured, resistant to cracking, transport and temporary storage, with the weight of over 7 g. Analysing the average productions on four years (2011-2014), from the statistical point of view, it can be noticed that the cultivars ‘Marina’ (29.6 kg/tree) and ‘Margo’ (30.2 kg/tree) showed positive and distinctly significant differences in production compared to the ‘Boambe de Cotnari’ control cultivar (21.7 kg/tree), while the cultivar ‘Anda’ (14.6 kg/tree) showed negative and significant differences compared to the control. In terms of fruit weight (g) and of equatorial diameter (mm), the cultivars that got remarked are ‘Paul’ (8.0 g and 22.9 mm), ‘Anda’ (7.9 g and 23.7 mm) and ‘Maria’ (7.5 g and 22.8 mm) with positive and distinctly significant differences compared to the control.

Cuvinte cheie: cireș, soiuri, fruct, însușiri, faze de maturare

Keywords: cherry tree, cultivars, fruit, characteristics, maturation phases

1. Introduction

Due to the characteristic of having an earlier ripening age for the fruits compared to the other tree species (beginning in May), the cherry is the first ring in the annual chain of fruits production (Budan and Gradinariu, 2000; Ghena and Braniște, 2003; Petre, 2006).

The researches on improving the assortment for the cherry species, for the quality of the cultivars and for avoiding the crowding of the market with fresh fruits on the short term are objectives that gain increasing importance (Cociu and Oprea, 1989).

On the market of fresh fruits, the preferred cultivars are the ones with “bigarreau” fruits, shining red or bicoloured, resistant to cracking, transport and temporary storage with weight of over 7 g (Budan and Gradinariu, 2000; Sansavini and Lugli, 2008; Milatović, 2011).

The goal of the paper is to present the valuable characteristics of some sweet cherry cultivars obtained at Research Station for Fruit Growing Iasi, which improve the autochthonous assortment with cultivars having different ages of maturation for the staged fruits during the entire maturation.

2. Material and methods

As working material, the ones that have been used were the cherry genotypes existent in the national collection. The basis of this germplasm fund were created in 1981, and this fund contains today 555 genotypes from inside the country and from abroad, with old and newer cultivars, local cherry biotypes, hybrids and clones.

The method for creating new cultivars was the classic one, which was to perform controlled sexed hybridizations, harvest the hybrid seeds, obtain hybrid saplings, select depending on the established objectives and test the hybrids (Cociu and Oprea, 1989).

The time period needed for changing the status from hybridization to homologation was long (15-23 years) due to the biological particularities of the species (week germination of the kernels, week viability of the saplings in the first years from plantation/transplantation, late fruit bearing, etc.).

The objectives of the breeding programme took into consideration to create new qualitative competitive cherry cultivars with genetic resistance to diseases, pests, stress factors (frost, drought), tree reduced vigour, flowering lateness and with fruits of superior quality in commercial and technological terms as well as for the chemical characteristics, with ripening time staged during entire sweet cherry maturation season.

The studies have been done during 2011-2014, having as research material eight sweet cherry cultivars (‘Cătălina’, ‘Cetățuia’, ‘Maria’, ‘Paul’, ‘Marina’, ‘Margo’, ‘Anda’ and ‘George’). From the eight

studied genotypes, two have early maturation ('Cătălina', 'Cetățuia'), two have average maturation ('Maria', 'Paul') and four genotypes have late maturation ('Marina', 'Margo', 'Anda' and 'George'). The cultivars were compared to the control cultivar of the area, 'Boambe de Cotnari'.

To create the eight new sweet cherry cultivars that were studied, the genitors used were the cultivars 'Van', 'Boambe de Cotnari', 'Stella', 'Bigarreau Drogan', 'Cilegia di Ottobre', 'HC. 23/31', 'Lijana' and 'Fromm'.

The selected elites have been grafted on mahaleb, after which have been planted in micro crops for contest at a distance of 4 x 5 m. The trees were led under the shape of free flattened palmet, without any sustaining system and without irrigation system.

In the experimental planting, there have been taken notes and measurements concerning: trees vigour, resistance to anthracnose and monilia (Cociu and Oprea, 1989); the main fructification phenophases (Fleckinger, 1960); physical characteristics (fruit and kernel weight, equatorial diameter of the fruit, the ratio fruit/kernel, % kernel from the fruit average, epidermis colour) (The questionnaire UPOV TG/35/7, 2006), chemical and quality characteristics of the fruits (SUS%, pulp firmness, fruit shape, kernel adherence to pulp, fruits resistance to cracking); the productivity (it was determined according to the fruits production kg/tree and to the fertility index that represents % of resulted fruits, at 25-30 days after petals falling and the cultivars with values greater than 30-35 % are considered cultivars with big productivity) (Cociu and Oprea, 1989).

The experimental data were statistically interpreted through the analysis of variance and the variation coefficient (%s) was computed for which the next values are arbitrarily permitted: 0 -10% - low variation coefficient; 10 - 20% - average variation coefficient; 20 – 30% - high variation coefficient.

3. Results and discussions

Following the observations and the measurements done in the national cherry collection, numerous potential genitors were established for different characteristics and useful properties, which were used in intraspecific controlled hybridizations.

Based on these properties, annual programmes for hybridization took place, having as participants 208 genotypes, from which 34 maternal and paternal genitors were frequently used, following 16 properties of the trees and of the fruits.

The results after using the germplasm fund for obtaining new sweet cherry cultivars, between 1980-2014 can be seen in Figure 1. A number of 774 hybrid combinations were created using 208 genitors, obtaining 97,853 hybrid kernels good for sowing. From the hybrids that appeared and started ripening, 86 were selected and promoted as elites, 33 from which, being multiplied, planted and studied in trials field (Figure 1).

During 1999-2014, from the elites studied in the trials field, 24 elites were homologated as new cultivars and in December 2013, four hybrid selections were registered at National Institute for Variety Testing (one cultivar with early ripening time, two cultivars with medium ripening time and one cultivar with late ripening time) (Figure 1).

The cultivars taken for study have middle vigour of the tree. Concerning the diseases resistance, 2013 being a rainy year (in the first six months of the year, 446.5 mm precipitations accumulated), favourable for the evolution of pathogens, they manifested a slight sensibility both to anthracnose (attack frequency 1.9-3.8%) and to monilia (attack frequency 1.8-3.2%) (Table 1).

The flowering period was between the 3rd of April and the 10th of May, therefore, for the cultivars 'Cetățuia' and 'Cătălina', the flowering was early, while the cultivars 'Anda' and 'Margo' manifested lateness in flowering.

The registered values of the natural fertility for the six cultivars were between 9.8% ('Cătălina') and 94.3% ('Maria'), showing a high variation coefficient (40.9%) and they were classified as being cultivars with high productivity, because the fertility index registered values of above 30%, except for the 'Cătălina' cultivar (Table 2).

The harvesting maturity occurred in the 3rd 10-days period of May ('Cetățuia' and 'Cătălina'), the 2nd 10-days of June ('Maria', 'Paul'), the end of the 3rd 10-days of June ('Anda', 'Margo', 'Boambe de Cotnari') – first 10-days of July ('Marina', 'George') and the number of days from the end of flowering to maturity was between 32-74 days, showing a high variation coefficient (24.2 – 22.5%) (Table 2; Fig. 2).

Regardless the year's climatic conditions, the order in which all the sweet cherry cultivars reach maturity is always the same, the only difference being that the time interval between two successive cultivars is longer or shorter that being according also with Darbyshire et al., 2012.

Regarding the average yield on four years (2011-2014), from the statistical point of view, it can be noticed that the 'Marina' (29.6 kg/tree) and 'Margo' (30.2 kg/tree) cultivars showed an increase in yield, with distinctly significant differences compared to the control 'Boambe de Cotnari' cultivar (21.7 kg/tree), and the 'Anda' cultivar (14.6 kg/tree) had negative and significant differences compared to the control (Table 3).

The fruit's weight is a dimension influenced by the local climatic conditions and by the biological particularities of each cultivar. From the statistical point of view, the outstanding cultivars were: 'Paul' (8.0 g) showing highly significant positive differences, 'Anda' (7.9 g) with positive and distinctly significant differences, 'Maria' (7.5 g) with positive and distinctly significant differences, 'Marina', 'Cătălina' and 'Margo' with positive differences compared to the control cultivar (Table 3).

In terms of equatorial diameter (in mm), the notable cultivars were 'Anda' (23.7 mm) with highly significant positive differences, 'Maria' (22.8 mm) and 'Paul' (22.9 mm) with positive distinctly significant differences and 'Marina' (22.2 mm), 'Cătălina' (21.9 mm) and 'Margo' (21.5 mm) with positive differences compared to the control (21.2 mm) (Table 3). For the size of the kernel the sweet cherry cultivars taken in the study registered weight between 0.14 – 0.31 g, being of small to middle size according to the UPOV questionnaire.

The fruit/kernel ratio was between 20.5 ('George') to 29.6 ('Anda') and the cultivars 'Anda', 'Paul', 'Maria' and 'Cetățuia' registered distinctly positive significant differences compared to the control. The percent of the kernel from the weight of the fruit registered values between 3.4% ('Paul') and 4.9% ('George'). From the statistical point of view, the cultivars 'Paul', 'Anda', 'Cetățuia' and 'Maria' registered significantly negative differences compared to the control (Table 3).

The colour of the fruits was different from yellow ('Anda', 'Margo'), bicoloured ('Paul', 'Marina', 'Boambe de Cotnari'), shining red ('Maria', 'Cătălina') to dark red ('Cetățuia', 'George') (Table 4).

The pulp firmness is an important quality element, especially for the fruits destined for fresh consumption (Kappel et al., 2000). In our case, the early cultivars ('Cătălina', 'Cetățuia') have semi-firm pulp and the late cultivars have firm and very firm pulp.

The soluble solids content was between 15.1% ('Paul') and 19.3% ('Anda') (Table 4).

In comparison with the control cultivar 'Boambe de Cotnari' (20.7%), all the cultivars taken in study manifested a superior resistance to the fruits cracking, the registered values being under 16% (Table 4).

4. Conclusions

The new cultivars that were created at SCDP Iasi showed extra earliness ('Cetățuia'), earliness ('Cătălina'), auto fertility ('Maria'), outstanding fruits quality ('Paul') and lateness ('Marina', 'Anda', 'Margo' and 'George'), each of them manifesting precocity and good resistance to diseases specific to cherry (anthracnose and monilia).

The cultivars correspond to the actual goals regarding trees vigour, flowering lateness, fruits resistance to cracking, productivity, fruits quality and a different time of fruit ripening that extends the cherry harvest season.

The creation of new cherry cultivars with early ('Cetățuia', 'Cătălina') and late ('Marina', 'Anda', 'Margo' and 'George') maturation for the fruits assures an extension of 10-15 days for the fresh fruits season and processing.

Fruit maturation on different time for the studied sweet cherry cultivars, assures an assortment on a period of 42 days.

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5. References

1. Budan, S., Grădinaru, G., 2000. Cireșul, Editura Ion Ionescu de la Brad Iași, 262 p.
2. Cociu, V., Oprea, Șt., 1989. Metode de cercetare în ameliorarea plantelor pomicele, Editura Dacia, Cluj-Napoca, 172 p.
3. Darbyshire, R., Webb, L., Goodwin, I., Barlow, E.W.R., 2012. Evaluation of recent trends in Australian pome fruit spring phenology, International Journal of Biometeorology, available as abstract on <http://link.springer.com/article/1#> (accessed 13.02.2013).
4. Ghena, N., Braniște, N., 2003. Cultura specială a pomilor, Editura Matrix Rom, București.
5. Fleckinger, J., 1960. Phenologie et arboriculture fruitiere, Rev. Bon Jardinier, tome 1, p. 362-372.
6. Kappel et al., 2000. Selecting for Firm Sweet Cherries; Proc. EUCARPIA Symp. On Fruit Breed. and Genetics; Ed. M.Geibel, M. Fischer & C. Fischer, Acta Hort., nr. 538, vol. 1, ISHS, p. 355-358.
7. Milatović, D. 2011. Oplemenjivanje i sorte višnje, în Trešnja i višnja, Ed. Naučno voćarsko društvo Srbije, Čačak, Srbije, pp. 119-213.
8. Petre, L., 2006. Rezultate obținute în ameliorarea sortimentului de cireș, vișin și nuc la SCDP Iași, Lucr. Șt. ICDP Pitești-Mărăcineni, vol. XXII, Pitești, p. 45-49.

9. Sansavini, S., Lugli, S., 2008. Sweet Cherry Breeding Programs in Europe and Asia, Proc. 5thIS on Cherry; Eds. A. Eris et al, Acta Hort., nr. 795, ISHS; p. 41-57.
10. ***, 2006. Protocol for distinctness, uniformity and stability tests of sweet cherry (*Prunus avium* L.) available at <http://www.cpvo.europa.eu>.

Tables

Table 1. Tree's characteristics for the sweet cherry cultivars taken in study (RSFG Iași; average on 2011-2014)

Cultivar	Tree vigour*	Resistance to:					
		Anthracnose** (<i>Coccomyces hiemalis</i> Higg.)			Monilia (<i>Monilia fructigena</i> Pers.)		
		F%	I%	A.D.%	F%	I%	A.D.%
Cetățuia	5	1.9	2	0.04	2.9	2	0.04
Cătălina	5	3.1	2	0.06	2.8	2	0.06
Maria	5	2.0	2	0.04	1.8	2	0.04
Paul	5	2.9	2	0.06	3.2	2	0.06
Marina	5	2.1	2	0.04	2.2	3	0.07
Anda	5	1.9	2	0.04	2.1	2	0.04
Margo	5	2.2	2	0.04	2.8	2	0.06
George	5	2.7	2	0.05	2.4	4	0.10
Boambe de Cotnari (control)	5	3.8	2	0.08	2.1	2	0.04

*tree vigour note on the scale 1-9: 1= very week; 3= week; 5 = average; 7= strong; 9= very strong (***, 2006).

**F% - the attack frequency (as percentage); I% - degree for the attack intensity on the scale 1-6: 1 = 3% attacked surface; 3 = 25% attacked surface; 4 = 50% attacked surface; 6 = 100% attacked surface; A.D.% - attack degree (Cociu and Oprea, 1989).

Table 2. The phenophase stages and natural fertility for the sweet cherry cultivars taken in study (RSFG Iași; average on 2011-2014)

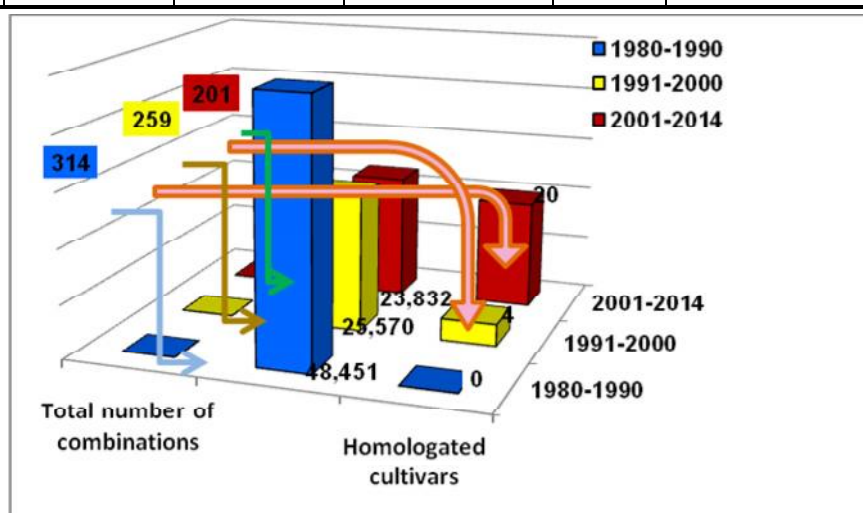
Cultivar/Phenophases	Flowering beginning (phase E)	End of flowering (phase G)	Natural fertility (%)	Fruits maturation date	Number of days from the end of flowering until maturation
Limit dates (earliest – latest):					
Cetățuia	03.04 - 20.04	18.04 - 27.04	77.8	22.05 - 30.05	34 - 35
Cătălina	05.04 - 21.04	21.04 - 01.05	9.8	22.05 - 04.06	32 - 35
Maria	08.04 - 21.04	19.04 - 30.04	94.3	17.06 - 20.06	52 - 60
Paul	05.04 - 20.04	18.04 - 30.04	86.9	15.06 - 19.06	51 - 59
Marina	08.04 - 23.04	19.04 - 01.05	64.8	17.06 - 01.07	60 - 62
Anda	08.04 - 24.04	22.04 - 05.05	45.4	18.06 - 30.06	58 - 64
Margo	15.04 - 28.04	28.04 - 10.05	55.3	18.06 - 26.06	48 - 52
George	09.04 - 23.04	20.04 - 01.05	51.2	02.07 - 10.07	71 - 74
Boambe de Cotnari (control)	08.04 - 21.04	22.04 - 01.05	46.3	13.06 - 25.06	53 - 56
Average	7.7 - 22.3	20.8 - 31.8	60.7	43.2 - 52.6	50.4 - 54.1
Standard deviation	3.2 - 2.4	2.9 - 3.5	23.7	12.5 - 12.3	12.2 - 12.2
Variation coefficient (%)	41.7 - 10.8	14.1 - 11.0	40.9	28.8 - 23.4	24.2 - 22.5

Table 3. Fruits production and fruits physical characteristics for the sweet cherry cultivars taken in study (RSFG Iași; average on 2011-2014)

Cultivar	Average fruits production (kg/tree)	Average weight of the fruit (g)	Average weight of the kernel (g)	Fruit/kernel ratio	Kernel (%)	Fruit equatorial diameter (mm)
Cetățuia	20.5	3.9 ⁰⁰⁰	0.14 ⁰⁰⁰	27.6 ⁺⁺	3.7 ⁰	18 ⁰⁰⁰
Cătălina	18.0	6.8	0.31	22.1	4.7	21.9
Maria	24.2	7.5 ⁺	0.27 ⁰⁰⁰	28.3 ⁺⁺	3.8 ⁰	22.8 ⁺⁺
Paul	16.1	8.0 ⁺⁺⁺	0.27 ⁰⁰⁰	29.1 ⁺⁺	3.4 ⁰⁰	22.9 ⁺⁺
Marina	29.6 ⁺⁺	7.1	0.28 ⁰⁰	25.3	4.0	22.2
Anda	14.6 ⁰	7.9 ⁺⁺	0.27 ⁰⁰⁰	29.6 ⁺⁺	3.5 ⁰	23.7 ⁺⁺⁺
Margo	30.2 ⁺⁺	6.8	0.28 ⁰⁰	24.0	4.2	21.5
George	18.2	5.6 ⁰⁰	0.27 ⁰⁰	20.5	4.9	19.8 ⁰
Boambe de Cotnari (control)	21.2	6.7	0.33	20.6	4.8	21.2
DL 5%	5.7	0.7	0.04	5.1	1.0	1.2
DL 1%	7.8	1.0	0.05	7.0	1.4	1.6
DL 0.1%	10.5	1.3	0.06	9.3	1.8	2.2

Table 4. Physico-chemical and quality characteristics of the fruits for the sweet cherry cultivars (RSFG Iași; average on 2011-2014)

Cultivar	Skin color	Pulp firmness	Fruit shape	SSC (%)	Kernel adherence to pulp	Cracked fruits after 6 hours (%)
Cetățuia	Dark red	Semi firm	Heart shape	16.2	Semi adherent	15.5
Cătălina	Shining red	Semi firm	Kidney shape	17.9	Non adherent	6.3
Maria	Shining red	Firm	Heart shape	18.4	Non adherent	9.3
Paul	Bicolored	Firm	Kidney shape	15.1	Non adherent	3.0
Marina	Bicolored	Firm	Heart shape	16.7	Non adherent	10.1
Anda	Yellow	Very firm	Kidney shape	19.3	Non adherent	10.0
Margo	Yellow	Firm	Heart shape	16.2	Non adherent	1.3
George	Dark red	Firm	Heart shape	16.5	Non adherent	4.0
Boambe de Cotnari (control)	Bicolored	Firm	Heart shape	16.1	Non adherent	20.7

**Fig. 1. Graphical presentation of the hybrid combinations from 1980 - 2014 and the number of registered cultivars**

Cultivar	May	June			July
	10-day period	10-day period			10-day period
	III rd	I st	II nd	III rd	I st
Cetățuia					
Cătălina					
Maria					
Paul					
Boambe de Cotnari (control)					
Anda					
Margo					
Marina					
George					

Fig. 2. The fruits maturation period for the sweet cherry cultivars taken in study

Pictures with the studied sweet cherry cultivars

