ASSESSMENT OF BITTER CHERRY CULTIVARS OBTAINED AT RSFG IASI

EVALUAREA UNOR SOIURI DE CIREŞ AMAR OBȚINUTE LA S.C.D.P. IAŞI

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Abstract. *The aim of the paper is to present the valuable features of bitter cherry cultivars obtained at RSFG Iasi, that improve the cultivars' assortment with different maturation ages of the fruits sequenced all over the cherries' maturation season. In terms of fruit's weight (g) and equatorial diameter (mm), the cultivars Amaris (5.1 g and 21.1 mm) and Amar Galata (4.1 g and 18.0 mm) got remarked statistically during the five years. They recorded very significant differences and distinct positive significant differences in comparison with the witness cultivar Silva (3.0 g and 15.8 mm). For the stone's size, the cultivars recorded a weight between 0.25-0.33 g, recording very negatively significant differences (Amar Maxut with 0.25 g) and negatively distinct significant differences (Amaris with 0.26 g) in comparison with the cultivar Silva as control (0.33 g). Regarding the fruits' resistance to cracking, Amar Maxut (0.3%), Amaris (0.3%) and Amar Galata (3.3%) present a resistance superior to the control cultivar Silva (4.1%).*

Key words: bitter cherry, cultivars, fruit, quality, assortment

Rezumat. *Scopul lucrării este de a prezenta caracterele valoroase a unor soiuri de cireş amar create la SCDP Iaşi, care îmbunătăţesc sortimentul cu soiuri cu diferite epoci de maturare a fructelor eşalonate pe tot parcursul sezonului de maturare a cireşelor. Sub aspectul greutăţii fructului (g) şi a diametrului ecuatorial (mm) s-au remarcat în cei cinci ani soiurile Amaris (5,1 g şi 21,1 mm) şi Amar Galata (4,1 g şi 18,0 mm), din punct de vedere statistic înregistrând diferenţe foarte semnificative şi distinct semnificative pozitiv faţă de soiul martor Silva (3,0 g şi 15,8 mm). Ca mărime a sâmburelui, soiurile au înregistrat o greutate cuprinsă între 0,25-0,33 g, înregistrând diferenţe foarte semnificative negativ (Amar Maxut cu 0,25g) şi distinct semnificative negativ (Amaris cu 0,26 g) faţă de soiul martor Silva (0,33 g). Referitor la rezistenţa fructelor la crăpare, Amar Maxut (0,3%), Amaris (0,3%) şi Amar Galata (3,3%) prezintă o rezistenţă superioară soiului martor Silva (4,1%).*

Cuvinte cheie: cireş amar, soiuri, fruct, calitate, sortiment.

INTRODUCTION

In the North- Eastern area of Romania, the cherry tree, both the one with sweet fruits and the one with bitter fruits was grown since the ancient times

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(Dumitrescu *et. al.*, 1981). The bitter cherries are consumed less in their fresh phase, however they represent a valuable raw material for industrialization as jam, liqueurs, syrups (Petre *et. al*., 2007, Beceanu, 2009; Budan, 2014). Internationally, the syrups and liqueurs made of bitter cherries represent the subject of numerous research studies (Hui, 2006; Webster and Looney, 1998; Nikolic *et. al*, 1998), the jams being less investigated (Jamba and Carabulea, 2002).

The bitter cherry assortment grown in our country was quite poor till 1994, composed of three cultivars (Roz amar Mărculeşti, Amara, Silva) and local populations with many gaps in assuring fruits for industrialization, as a consequence of the lack of valuable cultivars, with batched maturation epochs.

To improve the bitter cherry assortment with new cultivars that are productive, resistant to diseases, with quality fruits, resistant to cracking and with different maturation epochs that could assure an uninterrupted supply of raw material, on a long period of time, for the food industry as well as for the people's needs, positive selection of some local bitter cherry biotypes, that have been planted along cultivars and genotypes from around the country, has been performed at SCDP Iaşi (Petre *et al.,* 1997).

The aim of the paper is to present the valuable features of bitter cherry cultivars obtained at SCDP Iaşi, that improve the cultivars' assortment with different maturation ages for the fruits sequenced all over the cherries' maturation season.

MATERIAL AND METHOD

To harness the biological background with genotypes that exist in the spontaneous flora and the flora grown in the Iaşi area, positive selection of valuable bitter cherry biotypes has been performed. The selected genotypes have been planted in the national collection and in competition micro crops within RSFG Iaşi.

The studies have been conducted during 2012 – 2016, having three bitter cherry cultivars (Amar Galata, Amar Maxut, Amaris) as research material and the comparison has been performed against the Silva cultivar used as control.

The trees can be found in experimental plots, grafted on mahaleb and planted at a distance of 5 x 4 m, with the shape of flattened free palmette crown on the direction of the trees' row, without any sustaining system and without irrigation system. On the row with trees, the soil was prepared with the lateral disk with feeler and between the rows of trees, the soil was grassed. The control of diseases and pests was performed as soon as warnings have been received, phytosanitary treatments being applied.

In the experimental plantation, it was looked for the trees' vigour, resistance to frost and anthracnosis, the main growing and fructification phenophases (Fleckinger J., 1960), the physical traits (fruit's and stone's weight, equatorial diameter of the fruit (D), the colour and the shape of the fruit), the chemical traits and the quality traits of the fruits (soluble dry substance, pulp firmness, stone's adherence to pulp, the fruit/stone ratio, the percentage of the stone from the fruit, fruits' resistance to cracking). The resistance of the fruits to cracking was determined by soaking 100 fruits from each cultivar in distilled water, checking the number of fruits cracked after 6 hours and determining the percentage of cracking per cultivar.

The productivity was determined depending on the fertility index, that represents the percentage of fruits resulted 25-30 days after the petals' fall and they are considered cultivars of big productivity with values above 30-35% (Cociu & Oprea, 1989). The experimental data was statistically interpreted by analysing the variance and the variation coefficient (s%) was calculated, the following values being admitted arbitrarily: 0-10% - small variation coefficient; 10-20% - average variation coefficient; 20-30% - big variation coefficient.

RESULTS AND DISCUSSIONS

As a result of subsequent selections performed during 1981-2011, three bitter cherry biotypes have been chosen, two of which got homologated as new cultivars in 1994 under the name of Amar Maxut and Amar Galata, the third biotype being homologated in 2016 under the name of Amaris.

Regarding the growing vigour of the trees, the Amar Maxut and Amar Galata cultivars have middle vigour, Amaris has weak vigour and Silva has big vigour. All the cultivars, excepting Silva can be recommended for crops with increased density per hectare (tab. 1).

Regarding the resistance to diseases, 2013 and 2016 were rainy years (with precipitations surplus) favourable for the evolution of pathogens (monilia and anthracnosis), the cultivars manifested an easy sensitivity to anthracnosis, the frequency of the attack being between 3.0-3.9% (tab. 1).

Under the conditions of the winter from 2012 (when the minimum temperature, recorded on the 12th of February 2012 was -24.3°C) and under the conditions of March 2013 when the cherry tree was out of the vegetative rest, there were recorded minimum temperatures of -10.8°C (on the 24th of March), the degree of affecting of the flower buds varied in relatively small limits, recording 1% for Amar Galata, 2% for Amar Maxut, 9% for Amaris and 8% for Silva.

Table 1

The features of the tree for the bitter cherry cultivars (average 2012-2016)

Cultivar	Tree's vigour	Resistance to:			
		Frost	Anthracnosis (*Coccomyces hiemalis* Higg.)		
		Affected flower buds (%)	Attack frequency (%)	Attack intensity (%)*	Attack degree (%)
Amar Galata	middle	1	3.8	10	0.38
Amar Maxut	middle	2	3.1	13	0.40
Amaris	weak	9	3.0	14	0.42
Silva (mt)	strong	8	3.9	15	0.59

*- the attack intensity mark on the scale 1-6: 1=1-3% attacked surface; 2=4-10%; 3=11-25%; 4=26- 50%; 5=51-75%; 6=76-100% (Cociu & Oprea, 1989).

The triggering and the flowering have been influenced by the environment conditions, among which, the evolution of temperatures recorded after disbudding had an important role, the speeding up or delaying of the phenophase being dependent on them. Regarding the behaviour of the bitter cherry cultivars, it can

be noticed that during the studied period, the flowering sequencing was produced between the 3rd and the 30th of April, period that overlaps the flowering of the other cultivars, allowing interpollination (tab. 2).

The coefficient of fertility through free pollination represents a main element in the estimation of the pollinators' value. The values recorded for the natural fertility of the three cultivars were extremely high (36.4-61.1%) in comparison with the witness cultivar (30.0%), recording a high variation coefficient (32.7%) and they are classified as cultivars of high productivity, due to the fertility index that recorded values above 30% (tab. 2).

The harvesting maturity was recorded in the 3rd decade of May (Amaris), 2nd decade (Silva, Amar Maxut) and 3rd decade of June (Amar Galata) and the number of days from the end of flowering to maturation was between 34-68 days, recording a high to average variation coefficient (22.3 – 13.7%).

The phenological periods for the same cherry genotypes are variable according to the climatic conditions of each year (Darbyshire *et al.,* 2012). The order in which the cherry cultivars get to maturity is always the same, the only difference being the time range between two subsequent cultivars that could be longer or shorter.

Table 2

Phenological stages and natural feritility for the bitter cherry cultivars (2012-2016)

Cultivar	Flowering start (phase E)	Flowering end (phase G)	Natural fertility (%)	Fruits' maturation date	Number of days between end of flowering and maturation
	Limit dates (earliest - latest):				
Amar Galata	05-25.04	14-30.04	61.1	20-24.06	56-68
Amar Maxut	05-25.04	13-26.04	36.4	10-22.06	58-59
Amaris	03-19.04	09-27.04	38.5	27-30.05	34-49
Silva (control)	04-21.04	14-26.04	30.0	16-20.06	56-64
Average	4.2-22.5	12.5-27.2	41.5	18.2-24.0	51-60
Standard deviation	1.0-3.0	2.4-1.9	13.5	7.1-4.3	11.4-8.2
Variability coefficient (%)	**22.5-13.3**	**19.0-6.9**	**32.7**	**39.1-18.0**	**22.3-13.7**

The physical, chemical and quality features of the fruit are highlighted in tables 3 and 4. In terms of fruits' weight (g) and equatorial diameter (mm), in 5 years, the cultivars Amaris (5.1 g and 21.1 mm) and Amar Galata (4.1 g and 18.0 mm) got remarked, recording, statistically, very significant and distinct positive significant differences in comparison with the witness cultivar Silva (3.0 g and 15.8 mm) (tab. 3).

For the stone's size, the cultivars recorded a weight between 0.25-0.33 g, recording very negative significant differences (Amar Maxut with 0.25 g) and distinct negative significant (Amaris with 0.26 g) in comparison with the control cultivar Silva (0.33 g). The ratio fruit/stone was between 12.8 (Amar Galata and

Amar Maxut) and 19.6 (Amaris) recording, statistically, very positive significant differences in comparison with the control cultivar Silva (9.1).

The percentage of the stone from the fruit's weight recorded values between 5.09% (Amaris) and 7.80% (Amar Galata and Amar Maxut). Statistically, the three cultivars recorded very negative significant differences in comparison with the control cultivar Silva (11.00%).

The content in dry substance is extremely important in cherries, the taste of the fruits being highly dependent on it. The values of this parameter were between 17.7% (Amar Galata) and 19.4% (Amar Maxut), the differences being statistically non-significant in comparison with the control cultivar (tab. 3).

Table 3

The physical and chemical features for the bitter cherry cultivars (average 2012-2016)

Cultivar	Average weight of the fruit (g)	Average weight of the stone (g)	The ratio fruit/stone	Stone from the fruit's weight (%)	The fruit's equatorial diameter (mm)	Soluble dry substance (%)
Amaris	5.1***	0.26^{00}	19.6***	5.09^{000}	21.1***	18.3
Amar Galata	4.1**	0.32	12.8***	7.80^{000}	18.0*	17.7
Amar Maxut	3.2	0.25^{000}	12.8***	7.80^{000}	17.2	19.4
Silva (Mt)	3.0	0.33	9.1	11.00	15.8	17.5
LSD 5%	0.7	0.04	1.37	0.43	2.2	2.4
LSD 1%	1.0	0.06	1.92	0.61	3.1	3.4
LSD 01%	1.5	0.08	2.72	0.86	4.3	4.8

The epidermis' colour is variable as following: bicolour (Amar Galata), dark red (Amaris), black (Amar Maxut and Silva) (fig. 1). For each studied cultivar, the pulp firmness is average and in terms of pulp adherence to stone, only the early cultivar Amaris is non-adherent, all the others being semi-adherent.

Table 4

Physical and quality features of fruits for the bitter cherry genotypes

Cultivar	Epidermis' colour	Pulp firmness	Fruit's shape	Stone adherence to pulp	Fruit's resistance to cracking (%)
Amar Galata	Bicolour	average	Heart-shaped	Semi-adherent	3.3
Amar Maxut	Black	average	Kidney-shaped	Semi-adherent	0.3
Amaris	Dark red	average	Heart-shaped	Non-adherent	0.3
Silva (Mt)	Black	average	Circular	Semi-adherent	4.1

The fruit's shape is heart-shaped for Amar Galata and Amaris, kidney-shaped for Amar Maxut and circular for Silva. Regarding the fruits' resistance to cracking, Amar Maxut (0.3%), Amaris (0.3%) and Amar Galata (3.3%) have a resistance that is superior to the control cultivar Silva (4.1%) (tab. 4).

Fig. 1 – The studied bitter cherry cultivars (original)

CONCLUSIONS

1. From the rich existing genetic background in the North-Eastern area of Romania, numerous bitter cherry biotypes have been identified, from which, following verifications in competition comparative crops, two bitter cherry cultivars were homologated in 1994 (Amar Galata and Amar Maxut) and one, the Amaris cultivar, was homologated in 2016.

2. The Amaris cherry cultivar presents early maturation, Amar Maxut presents average maturation and Amar Galata presents semi-late maturation, assuring a harness period of 26-32 days.

3. In comparison with the control cultivar Silva, the cherry cultivars Amaris, Amar Maxut and Amar Galata have superior qualities concerning the tree's vigour, resistance to frost and diseases, fruit's weight and calibre, small stone, increased content in soluble dry substance and extremely good resistance to the phenomenon of fruit cracking.

REFERENCES

1. **Beceanu D., 2009** – *Materii prime horticole pentru industria alimentară: struguri fructe legume,* Iaşi: Edit. Pim, 199 pp.
2. **Budan S., 2014** - *Romanian Cherry Varieties with Bitter Fruit - Tradition and Present,* Acta Hort. (ISHS) 1032: 25-28.
3. **Cociu V., Oprea Şt., 1989** – *Metode de cercetare în ameliorarea plantelor pomicole,* Editura Dacia, Cluj-Napoca, 172 pp.
4. **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, abstract on http://link.springer.com/article/1# (accessed 13.02.2013).
5. **Dumitrescu Gh., Hriţcu C., Frunză P., Bazgan C., 1981** – *Studiu privind cultura cireşului şi vişinului în judeţul Iaşi,* Cercetări Agronomice în Moldova, vol 3, Iaşi, p77-82
6. **Fleckinger J., 1960** – *Phenologie et arboriculture fruitiere,* Rev Bon Jardinier, p 362-372
7. **Hui Y.H., 2006** - *Handbook of Fruits and Fruit Processing,* Blackwell Publishing, 697 pp.
8. **Jamba A., Carabulea B., 2002** - *Tehnologia păstrării şi industrializării produselor horticole,* Edit. Cartea Moldovei, Chişinău 493 pp.
9. **Nikolić M., Duric G., Cerovic R., 1998** - *Sweet Cherry Research and Production in Yugoslavia.* Proc. 3th IS on Cherry, Acta Hort., ISHS 468: 757-762.
10. **Petre L., Roşca C., Rominger E., 1997** – *Comportarea unor genotipuri de cireş amar în condiţiile zonei Iaşi,* Buletin ştiinţific, nr. 55 (11), ICPP Piteşti-Mărăcineni, p. 1-8.
11. **Petre L., Sîrbu Sorina, Iurea Elena, 2007** - *Physical chemical and technological features of fruits for the cherry breeds and hybrid elites created at SCDP Iaşi Romania,* Lucr. Şt. UŞAMV Iaşi, Seria Horticultură, vol. 50, p. 603-610, ISSN 1454-7376.
12. **Webster A.D., Looney N.E., 1998** - *Cherries: crop physiology production and uses,* CAB International, Wallingford, Oxon U.K., 513 pp.
13. ***** 2006** - *Protocol for distinctness uniformity and stability tests of sweet cherry* (*Prunus avium L.*) available at http://www.cpvo.europa.eu