

CERCETĂRI PRIVIND CALITATEA FRUCTELOR LA UNELE GENOTIPURI DE VIȘIN DIN COLECȚIA NAȚIONALĂ **RESEARCH REGARDING FRUITS QUALITY OF SOME SOUR CHERRY GENOTYPES FROM NATIONAL COLLECTION**

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Abstract

Sour cherry is a particularly valuable fruit species due to its food, technological, therapeutic and agrobiological traits. However, in Romania the sour cherry is cultivated on a small area of only 5,000 ha. In the last 4 years, the requests for the establishment of sour cherry plantations under sub-measure 4.1.a of MADR Bucharest have been increasing, and projects for the establishment of 100 ha have been announced so far. The assortment requested by private growers was limited, due to the fact that in the nurseries there are multiplied a small number of varieties. The objective of this work was to analyze fruit quality parameters of 15 sour cherry genotypes from the national collection of RIFG Pitesti Maracineni (9 Romanian genotypes and 6 genotypes of foreign origin) with the purpose of expanding the valuable ones in the commercial orchards, as well as for the choice of genitors in future breeding programs. The following determinations were carried out: fruit size by weighing, fruits colour with Konica Minolta chromameter, flesh firmness with Qualitest non-destructive penetrometer, soluble solids content with digital refractometer and malic, citric and tartaric acids content with Minitrator Hanna Instrument. Following this study, besides the sour cherry genotypes recommended as gene sources in breeding works, we can also recommend genotypes to be expanded in commercial orchards such as 'Rival', 'Mocănești 10-24', 'Stelar', 'Tarina', 'Timpuri de Pitesti', 'Erdy Nogygyumolcsu', 'Heimanns Conserven' and 'Vaskova'.

Cuvinte cheie: soiuri de vișin, calitate, fond de germoplasmă, surse de gene, ameliorare.

Key words: sour cherry varieties, quality, germplasm fund, gene sources, breeding.

1. Introduction

Sour cherry is a valuable fruit species due to food, technological, therapeutic and agrobiological traits. It provides consumers fruits which are designating for processing in different forms, such as compotes, jam, distilled, candied, frozen, confectionery, etc. (Cimpoies, 2002).

In sour cherry (as well as in sweet cherry), fruits quality differs from year to year within the same variety, thus behaving differently in the process of processing; the production of sour cherries, unlike other species, is designated almost exclusively for processing (Chiriac et al., 1988). Thus, the absence of a suitable variety to obtain competitive products has been an important decision-maker for farmers which want to establish sour cherry orchards. Consumers' preferences for fresh fruits, but especially the continuous diversification of the range of processed products, give a dynamic character to requirements of the fruits quality, which means a continuous adaptability both in the breeding process and in the efficient management of the sour cherry orchards, as well as for processors; depending on how the fruit is used, best varieties reduces the specific costs of raw materials (10-12%), sugar (10-25%) and citric acid (5-15%).

Under the National Rural Development Project 2014-2020, regarding the revitalization of fruit plantations in Romania, the Ministry of Agriculture and Rural Development launched sub-measure 4.1.a, which led to the registration of a large number of applications for the establishment of sour cherry orchards. Thus, in the last 4 years there have been approved projects for the establishment of sour cherry orchards on a total surface of about 50 ha. However, the assortment requested by private growers was limited, due to the fact that nurseries are multiplying a small number of varieties.

That is why the main objective of this paper is the determination of fruit quality parameters for some sour cherry genotypes from National Collection located at RIFG Pitesti Maracineni, with the aim of spreading to the orchards of the valuable ones, as well as for the choice of genotypes useful in future breeding programs.

We believe that approach this topic can complement the knowledge needed to establish orchards with different new varieties and can also attract attention to the varieties studied, giving them the opportunity to be introduced into modern culture.

2. Material and methods

The experience was carried out between 2016 and 2018 period in the Genetics and Breeding Department of the Research Institute of Fruit Growing Pitesti-Maracineni, and it involved the study of 15 sour cherry genotypes, of which 9 Romanians and 6 of foreign origin, located in the sour-cherry national collection, with the aim of expanding the most valuable in commercial orchards and choosing parents for use in the next breeding programs.

The collection was established in 2011 and comprises 158 genotypes grafted on 'Mahaleb' by the linear block method, each variety representing a variant, in 3 repetitions, with a tree / repetition. The planting distance was 4X3 m, which means a density of 833 trees per hectare, canopy shape being flat open center.

The determinations were carried out only in the years 2016 and 2018, because production in 2017 was compromised due to climatic accidents.

Thus, at the 15 sour cherry genotypes the following measurements and observations were carried out:

- fruits weight - was determined by weighing a sample of 20 fruits, expressed in grams;
- caliber - was determined with a caliber, expressed in mm;
- fruits quality (color, dry matter, fruit acidity, firmness). The skin color was visually evaluated and also with the Konica Minolta CR 400 colorimeter in the system (L,a,b). The CIE (Commission Internationale de L'Eclairage) LAB color range is an approximately uniform color scale in which the color space is organized in the shape of a cube. The L* axis is executed from top to bottom, representing a measure of brightness, on a scale from 100 (completely transparent) to zero (completely opaque). Axes a* and b* do not have specific numerical limits. Positive values to a* show red color and negative values, green color. The positive values for b* show the yellow color, and the negative values for the blue color. The soluble dry substance content was determined with a digital refractometer, in % Brix. The fruit content of the acids (malic, citric and tartaric acid), expressed in g / 100 g of fresh pulp or in percent, was determined by the Mini Titrator - Hanna Instrument 84532. The firmness of the fruit was determined with a HPE non-destructive penetrometer with a 0.25 cm² measuring device, expressed in HPE units (from 0 - without firmness - to 100 - very hard) outside the SI, so the measured value represents a coefficient (the relationship between the pressure and the measurement distance) and does not represent the force or other values.

The data were statistically processed using the Duncan test (0.05%).

3. Results and discussions

According to the statistical analysis of the data, it is observed that for each characteristic studied the variation limits are very large.

The size of the fruit on sour cherry is a character with a polygenic determinism, with a large variability between varieties (Iezzoni et al., 1990; Sestraș, 2004). Thus, following the statistical analysis of the data, it was observed that the varieties studied were in 10 homogeneous classes, the average fruit weight ranging between 6.50 g in the 'Erdy Nogygyumolcsu' variety to 3.80 g in the 'Suda Hardy' variety. Among the Romanian varieties, there were remarked 'Mocănești 10-24' (5.75 g), 'Țarina' (5.60 g), 'Rival' (5.45 g) and 'Crișana Nazarcea' (5.10 g), and from foreign ones 'Erdy Nogygyumolcsu' (6.50 g), 'Heimans Conserven' (6.30 g) and 'Vaskova' (5.30 g) (Table 1).

In 2018, it can be seen that the average fruit weight was lower than in the previous year, due to the fact that the fruit production was higher in 2018 than in 2016.

At both groups, the caliber of the fruit was around 20 - 25 mm.

Firmness of sour cherries is a very important quality characteristic for harvesting, transport and marketing, especially for fresh fruits market. In the experience, firmness varied quite a lot between genotypes, ranging from 13.3 HPE units to the 'Vaskova' variety and 34.9 HPE units to the 'Heimans Conserven' variety. Among the Romanian varieties were noted 'Țarina' (33.1 units HPE) and 'Rival' (24.7 units HPE), and among the foreign varieties were noted 'Heimans Conserven' (34.9 units HPE) and 'Erdy Nogygyumolcsu' (24.6 HPE units) with very firm fruits. Fruits firmness varied and within the framework of the variety from year to year; for example in the varieties 'Heimans Conserven' and 'Bizighesti', the difference between the 2 years of study was high, being 11,4 HPE units, and 13.5 HPE units respectively. The variety 'Timpurii de Pitesti' presented insignificant differences from one year to another (0.7 HPE units) (Table 1).

The taste and the color of the fruit and their products contribute to a large extent to the general acceptance by the consumer (Grafe and al., 2008; Zlatic and al., 2017).

On average over the two years of our study, fruits soluble solids content has varied between 11.3% Brix on 'Erdy Nogygyumolcsu' variety and 14.3% Brix on 'Țarina' variety (Table 2). Making a comparison between the values of the fruits soluble solids content recorded separately in the years 2016 and 2018, it

should be noted that, in the year 2018 the genotypes studied had a higher content in the soluble solids content than 2016 (13,88% Brix in 2018, compared to 12.50% Brix in 2016), due to above-average values obtained in 2018 to the varieties 'Mocanesti 10-24', 'Drobeta' and 'Timpurii de Mărculești' (15,2 % Brix, 15.5% Brix, i.e. 16,9 % Brix) (Table 2).

The homogeneity is high enough and as regards the pH, varying within a fairly narrow (3.55 and 4.10), on average 2 years of study (Table 2).

Color intensity, due to unstable pigments, like anthocyanins, measured with the colorimeter, confirms that this attribute depends on the variety. However, there are also small differences from one year to the next, but they are even more obvious among varieties (Budan et al., 1995) (Table 3).

The high values for L*, a* and b* show the light color of the fruit, with red to yellow-orange to 'Montmorency precocce', 'Suda Hardy' and 'Raditeleva', while varieties 'Timpurii de Pitesti' and 'Țarina' have very dark red or burgundy skin and implicit low values of L*, a* and b* (Table 3).

Although color is not a particular objective in sour cherry breeding, it is important both for breeding (as a component of the high quality objective) and for processing where the color of the skin and fruit flesh can determine its destination (juice, compote, confectionery).

4. Conclusions

It can be noted a great genetic variability at the studied genotypes, which ensures a great diversity in order to choice of possible genitors for the breeding programs (eg. 'Erđy Nogygyumolcsu', 'Heimans Conserven', 'Mocanesti 10-24' for fruit size; 'Țarina' and 'Heimans Conserven' for firm fruit and good taste; 'Timpurii de Pitesti', 'Țarina', 'Stelar', 'Erđy Nogygyumolcsu' and 'Vaskova' for intense fruit color).

Although the characteristics of the variety are influencing some physical or biochemical components of the fruits, it can be noticed that the year-to-year differences are sometimes significant, which may motivate the growers to choose more varieties for establish sour cherry orchards (which is also required by certain cultural barriers, such as the self sterility of certain varieties). The varieties in this study which can be recommended for spreading in commercial plantations: 'Rival', 'Mocanești 10-24', 'Stelar', 'Țarina', 'Timpuri de Pitești', 'Erđy Nogygyumolcsu', 'Heimanns Conserven' and 'Vaskova', have bigger fruits (more than 5 g), high content in soluble solids (over 13% Brix), balanced taste (sugar / acidity) and intense fruit color.

For processing, intense coloring and / or high-acid content varieties may be recommended for making juices, concentrates, compotes, or less-colored for confectionery.

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Tables

Table 1. Fruit characteristics of the sour cherry genotypes studied

No.	Variety	Year	Weight (g)*	Size (mm)*	Firmness (HPE units)*
1	Timpurii de Pitești	2016	4,7	22,5	20,3
		2018	4,8	21,5	19,6
		Average	4,75 fgh	22,0 c	20,0 bcde
2	Țarina	2016	5,6	20	31
		2018	5,6	23	35,1
		Average	5,60 cd	21,5 cd	33,1 a
3	Rival	2016	6,5	22	23,4
		2018	4,4	21	26,1
		Average	5,45 cde	21,5 cd	24,7 b
4	Stelar	2016	4,6	20	20,1
		2018	5,2	23	13,2
		Average	4,90 efg	21,5 cd	16,7 def
5	Drobeta	2016	3,8	20,0	15,4
		2018	3,6	20,0	18,7
		Average	3,70 j	20,0 e	17,1 cdef
6	Crișana Nazarcea	2016	5,2	23	25,2
		2018	5	22	21,2
		Average	5,10 defg	22,5 c	23,2 bc
7	Timpurii de Mărculești	2016	4,4	23	21,4
		2018	5,4	23	23,5
		Average	4,90 efg	23,0 bc	22,4 bcd
8	Mocănești 10-24	2016	6,1	20	24,6
		2018	5,4	24	21,3
		Average	5,75 bc	22,0 c	22,9 bcd
9	Bizighești	2016	4,2	20	16,6
		2018	5	23	30,1
		Average	4,60 ghi	21,5 cd	23,4 bc
10	Erdy Nogygyumolcsu	2016	7	25	26,2
		2018	6	25	23,0
		Average	6,50 a	25,0 a	24,6 b
11	Vaskova	2016	6	23	14,6
		2018	4,6	22	11,7
		Average	5,30 cdef	22,5 c	13,3 f
12	Heimans Conserven	2016	6,8	25	40,6
		2018	5,8	23	29,2
		Average	6,30 ab	24,0 ab	34,9 a
13	Suda Hardy	2016	3,8	20	24,7
		2018	3,8	20	19,2
		Average	3,80 j	20,0 e	21,9 bcd
14	Montmorency precocce	2016	4,5	20	14,0
		2018	4	20	17,4
		Average	4,25 hij	20,0 e	15,7 ef
15	Raditeleva	2016	4,6	22	23,2
		2018	3,4	19	15,5
		Average	4,00 ij	20,5 de	19,4 bcde

*Values followed by the same letter are not statistically different (P<0.05).

Table 2. The chemical properties of the fruit in the sour cherry genotypes studied

No.	Variety	Year	SSC (% Brix)	pH	Content in acids (g / 100 g pulp)		
					Citric acid	Malic acid	Tartaric acid
1	Timpurii de Pitești	2016	13,0	4,0	0,43	0,45	0,59
		2018	14,0	4,0	0,85	0,89	0,99
		Average	13,5 abc	4,0 abc	0,64 de	0,67 de	0,79 d
2	Țarina	2016	14,1	4,0	0,95	0,99	1,11
		2018	14,4	4,1	0,89	0,93	1,04
		Average	14,3 a	4,05 ab	0,92 c	0,96 c	1,07 c
3	Rival	2016	11,	4,1	0,81	0,85	0,95
		2018	12,1	3,9	1,02	1,06	1,19
		Average	11,6 cd	4,0 abc	0,91 c	0,95 c	1,07 c
4	Stelar	2016	12,6	3,7	0,59	0,62	0,69
		2018	14,9	4,0	0,80	0,84	0,94
		Average	13,7 ab	3,85 bcd	0,69 d	0,73 d	0,81 d
5	Drobeta	2016	12,8	3,2	1,43	1,50	1,68
		2018	15,5	3,9	1,35	1,41	1,58
		Average	14,1 ab	3,55 e	1,39 a	1,45 a	1,63 a
6	Crișana Nazarcea	2016	13,7	3,9	0,85	0,89	1,00
		2018	14,5	3,9	0,87	0,91	1,01
		Average	14,1 ab	3,9 abcd	0,86 c	0,90 c	1,00 c
7	Timpurii de Mărculești	2016	11,6	3,6	0,67	0,70	0,78
		2018	16,9	3,8	0,79	0,82	0,92
		Average	14,0 ab	3,7 de	0,73 d	0,76 d	0,85 d
8	Mocănești 10-24	2016	12,2	3,6	1,00	1,05	1,18
		2018	15,2	4,0	0,90	0,94	1,06
		Average	13,7 ab	3,8 cd	0,95 c	0,99 c	1,12 c
9	Bizighești	2016	12,6	3,5	0,78	0,82	0,92
		2018	12,4	4,2	0,94	0,98	1,10
		Average	12,5 abcd	3,85 bcd	0,86 c	0,90 c	1,09 c
10	Erdy Nogygyumolcsu	2016	10,1	4,1	0,53	0,56	0,62
		2018	12,5	4,1	0,54	0,57	0,64
		Average	11,3 d	4,1 a	0,53 ef	0,56 ef	0,63 e
11	Vaskova	2016	12,5	4,1	0,54	0,57	0,64
		2018	12,8	3,9	0,85	0,89	1,00
		Average	12,6 abcd	4,0 abc	0,69 d	0,73 d	0,82 d
12	Heimans Conserven	2016	13,9	4,1	0,38	0,40	0,45
		2018	14,1	4,0	0,58	0,61	0,68
		Average	14,0 ab	4,05 ab	0,48 f	0,50 f	0,56 e
13	Suda Hardy	2016	13,9	3,6	1,03	1,08	1,20
		2018	12,6	3,9	1,26	1,32	1,47
		Average	13,2 abc	3,75 de	1,14 b	1,20 b	1,33 b
14	Montmorency precocce	2016	11,9	3,6	0,85	0,89	1,00
		2018	12,5	3,9	1,07	1,12	1,26
		Average	12,2 bcd	3,75 de	0,96 c	1,00 c	1,13 c
15	Raditeleva	2016	11,5	4,0	1,10	1,15	1,28
		2018	13,5	4,0	1,08	1,13	1,27
		Average	12,5 abcd	4,0 abc	1,09 b	1,14 b	1,27 b

* Values followed by the same letter are not statistically different (P <0.05).

Table 3. Color of the fruit – visually and with the Konica Minolta colorimeter

No.	Variety	Year	Visually	Color appreciated with the Konica Minolta colorimeter (Lab)		
				L*	a*	b*
1	Timpurii de Pitești	2016	burgundy	19,17	7,08	1,92
		2018		25,11	14,86	4,54
		Average		22,14 c	10,97 cd	3,23 de
2	Țarina	2016	dark red	21,82	9,60	2,26
		2018		23,51	9,78	1,99
		Average		22,67 cd	9,69 cd	2,13 e
3	Rival	2016	red	22,42	5,70	1,41
		2018		24,45	14,96	3,23
		Average		23,44 cd	10,33 cd	2,32 de
4	Stelar	2016	dark red	23,14	8,71	2,47
		2018		24,30	12,81	3,06
		Average		23,72 cd	10,76 cd	2,77 de
5	Drobeta	2016	red	23,71	15,81	4,55
		2018		23,84	10,04	2,12
		Average		23,78 cd	12,93 bcd	3,33 de
6	Crișana Nazarcea	2016	dark red	22,16	4,43	1,10
		2018		23,98	9,87	1,94
		Average		23,07 cd	7,15 d	1,52 e
7	Timpurii de Mărculești	2016	dark red	23,18	7,84	2,26
		2018		23,07	12,68	3,36
		Average		23,13 cd	10,26 cd	2,81 de
8	Mocănești 10-24	2016	red	24,23	13,00	3,64
		2018		26,44	19,22	5,38
		Average		25,34 bc	16,11 abc	4,51 cd
9	Bizighești	2016	dark red	22,11	12,84	4,59
		2018		23,75	11,30	2,41
		Average		22,93 cd	12,07 bcd	3,50 de
10	Erdy Nogygyumolcsu	2016	dark red	22,09	5,26	1,21
		2018		24,71	13,65	3,43
		Average		23,40 cd	9,45 cd	2,32 de
11	Vaskova	2016	burgundy	21,88	5,62	1,34
		2018		23,57	12,20	2,71
		Average		22,73 cd	8,91 d	2,03 e
12	Heimans Conserven	2016	light red	22,93	8,73	2,30
		2018		26,02	15,80	4,09
		Average		24,48 cd	12,27 bcd	3,19 de
13	Suda Hardy	2016	light red	25,85	15,87	5,58
		2018		29,54	20,98	8,27
		Average		27,69 ab	18,43 ab	6,92 ab
14	Montmorency precocce	2016	light red	24,98	13,64	4,85
		2018		33,62	25,06	11,56
		Average		29,30 a	19,35 a	8,21 a
15	Raditeleva	2016	light red	26,27	15,15	6,24
		2018		27,79	27,89	6,02
		Average		27,03 ab	21,52 a	6,13 bc

* Values followed by the same letter are not statistically different (P <0.05).

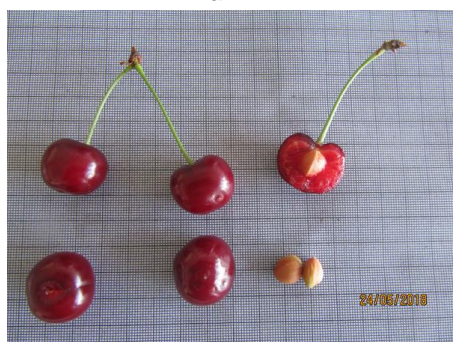
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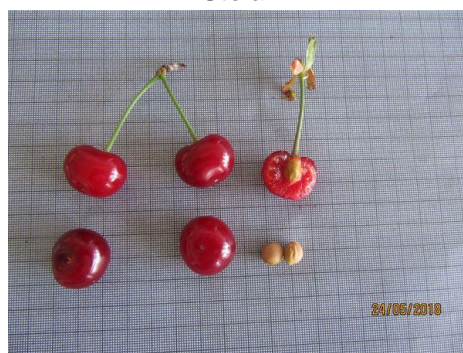
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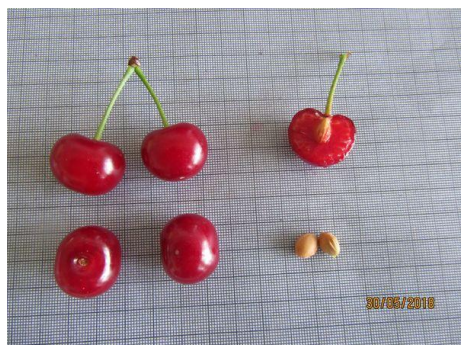
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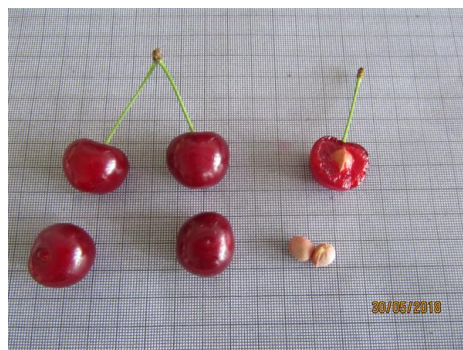
Tarina



Erdy Noggyumolcsu



Heimans Conserven



Vaskova