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RESULTS ON GENETIC VARIABILITY IMPROVEMENT BY SEXUAL HYBRIDISATION IN SWEET CHERRY TO OBTAIN NEW VALUABLE GENOTYPES

Elena Iurea[1], Sorina Sîrbu[1]*, Iulia Mineaţă[1], Iuliana Golache[1], Ionel Perju[1], Ionuţ Ungureanu[1]

[1] Research Station for Fruit Growing Iaşi, Miroslava, Ion Voda cel Viteaz, 3, 707305, Romania

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Abstract
Expanding the genetic variability is an essential condition for achieving the goals in the cherry breeding programme. Sexed hybridization is known to be the only conventional method that can generate many descendants with a continuous spectrum of genetic variation. The study of the genetic nature of parental cultivars and the transmission of traits followed by the breeder to their descendants is highly important for improving the selection efficiency. The studies took place between 2018-2021, using 14 sweet cherry cultivars as research material: seven new cultivars ('Cătălina', 'Maria', 'Croma', 'George', obtained by hybridization and 'Margonia', 'Andante', 'Croma' obtained by open pollination) and seven cultivars being used genitors ('Van', 'Stella' 'Boambe de Cotnari', 'Ciliegia di Ottobre', 'Fromm', 'Lijana', 'Bigarreau Drogan'). Each cultivar was compared against their genitors (♀ × ♂). The values of the fruit's size in the new cherry cultivars were between 7.2 g and 23.2 mm ('George') and 7.7 g and 24.2 mm ('Cătălina', 'Muşatini', 'Croma') and the soluble dry substance was between 16.4 ('Margonia') and 19.9 ('Cătălina'). In terms of fruits' resistance to cracking it was statistically determined that the seven studied cultivars ['Cătălina' (6.6%), 'Muşatini' (3.9%), 'Maria' (9.3%), 'Croma' (19.3%), 'Andante' (11.0%), 'Margonia' (1.5%) and 'George' (5.8%)] have a higher level of resistance in comparison with genitors.

Keywords: breeding, cultivar, fruit, genitors, hybrid.

1. INTRODUCTION

The increase of genetic variability is an essential condition to accomplish the objectives of the sweet cherry breeding programme (Cociu and Oprea, 1989; Branişte et al., 2007; Milatović, 2011). Several transformation, conventional and modern operators are used throughout the programme. Sexual hybridization is estimated to be the only conventional method that can generate many descendants with a continuous spectrum of genetic variation (Gallais, 1990; Cociu et al., 1999). The study of the genetic nature of the parental cultivars and the transmission of traits followed by the breeder to their descendants is highly important for improving the selection efficiency (Höfer and Giovannini, 2017; Quero-Garcia et al., 2017). Research of genetics applied in fruit growing follow a wide diversity of important features in the new cultivars (descendants): productivity, autofertility, fruits quality (big fruit with diameter over 25 mm, with high resistance to diseases and fruit cracking, with firm pulp with a high nutraceutical value), different ripening ages of the fruits, natural resistance to diseases, pests and stress factors, late bloom, reduced and compact habitus of the crown (Sestraş, 2004; Sansavini and Lugli, 2008; Schuster et al., 2014). These paper introduces

*Corresponding author, E-mail address: sorinas66@yahoo.com

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the traits of sweet cherry cultivars approved recently by natural hybridisation (hazard) and controlled intraspecific hybridisation created at RSFG Iași, that improve the cherry assortment with new cultivars that have an improved genetic variability (traits and features) in comparison with the parental genitors (♀ × ♂).

2. MATERIALS AND METHODS

The studies were carried out in the period 2018-2021, using 14 sweet cherry cultivars as research material: 'Cătălina', 'Maria', 'Mușatini', 'Margonia', 'Andante', 'Croma', 'George', 'Van', 'Stella', 'Boambe de Cotnari', 'Fromm', 'Ciliegia di Ottobre', 'Lijana', 'Bigarreau Drogan'. Seven out of the 14 cultivars were new sweet cherry cultivars ('Cătălina', 'Maria', 'Croma' , 'George' were released from hybridization and 'Andante', 'Margonia', 'Croma' are obtained from open pollination) while other seven are their genitors ('Van', 'Stella' 'Boambe de Cotnari', 'Ciliegia di Ottobre', 'Fromm', 'Lijana' and 'Bigarreau Drogan').The genitors of each cultivar are highlighted in table 1.

The method to create new cultivars was performing controlled intraspecific sexual hybridizations or open pollination, hybrid stones harvesting, obtaining hybrid saplings, selection based on the set objectives and testing the hybrids (Cociu and Oprea, 1989; Budan and Grădinariu, 2000).

Table 1. Maternal (♀) and paternal genitors (♂) of sweet cherry cultivars (RSFG Iași)

Cultivars	Genitors (♀ × ♂)						
	Bigarreau Drogan	**Van**	**Stella**	**Ciliegia di Ottobre**	**Boambe de Cotnari**	**Lijana**	**Fromm**
Cătălina		♀			♂		
Mușatini	♀ (OP*)						
Maria		♀	♂				
Croma	♀	♂					
Andante						♀ (OP)	
Margonia		♀ (OP)					
George				♀			♂

* - OP: open pollination

The selected hybrids were grafted onto *Prunus mahaleb* L. seedlings as rootstocks, being then planted in the field trip at 4 × 5 m distance. The variants has three replicates with three trees each (nine trees), all variants located in randomized blocks. The trees were planted in the spring of 2000, guided as palmette as tree shape, limited in height and flattened on row direction, without support or irrigation systems. For each cultivar the comparison was performed against their genitors (♀ x ♂).

The following observations and determinations were made in the experimental plantation: vigour of the trees, frost and anthracnose resistance, self-fertility, natural fertility, the main phenophases of growth and fruiting (Fleckinger, 1964), physical, chemical and quality traits of the fruits, productivity.

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The trunk's section area (cm^2) was determined by measuring the trunk's diameter with the digital calliper, at 40 cm above the root collar and the collected data was converted to cm^2.
The work method for determining the frost damage degree (%) of the generative organs was selecting the flowers (100 buds/flowers for each variant) and correlating the air temperature with the phenophase of the sweet cherry cultivars at the data of the frost. The average percentage of buds/flowers with diseases in the studied cultivars was calculated by averaging the impacted samples at the three levels of tree height (Budan and Grădinariu, 2000).
The natural fertility was determined on control branches by counting at least 200 flowers for each cultivar (50 each in the 4 cardinal points), labelling the branches and counting the resulted fruits after fruits bearing (Cociu and Oprea, 1989; Botu and Botu, 1997).
The self-fertility was determined by isolating the floral buds with mesh bags, counting the flowers on the isolated branches and writing on the tag, counting the resulted fruits (20-25 days after the petals fall) and calculating in percentages based on the number of bagged; at the values over 20-25% are considered self-fertile cultivars (Cociu and Oprea, 1989; Botu and Botu, 1997).
The physical parameters of the fruit were determined:
- weight (g) by weighing 10 fruits/stones in three repetitions with the Radwag electronic scale of 0.01g precision;
- the fruits dimensions by equatorial diameter (mm) were determined with the Luumytools digital calliper in 10 fruits three times; the percentage of stone from the fruit's weight (%);
- the colour and fruit's shape, pulp firmness, stone adherence to pulp and taste were determined according to the UPOV TG/35/7, 2006 questionnaire by visual or respectively tasting mode.
The quality and chemical characteristics of the fruit were determined:
- the soluble dry substance (SDS) was determined by measuring the refractive index using a Zeiss portable digital refractometer (%);
- the cracking resistance of the fruits was determined by the Cristensen method, by counting the cracked fruits after six hours of immersion in distilled water at 20°C (Webster and Looney, 1996).
Productivity was determined based on the fertility index, which is the percentage (%) of the resulting fruits, 25-30 days after the petals fall, and varieties with values above 30-35% were considered high productivity (Cociu and Oprea, 1989).
The experimental data were statistically interpreted using the method of multiple comparisons (Duncan's test, with P 5%).

3. RESULTS AND DISCUSSIONS

From the 14 studied cultivars, 'Margonia' recorded a low vigour of the tree, 'Cătălina', 'Mușatini', 'Maria', 'Croma', 'Andante', 'George', 'Ciliegia di Ottobre', 'Stella', 'Lijana' recorded middle vigour and 'Van', 'Boambe de Cotnari', 'Fromm' and 'Bigarreau Drogan' recorded high vigour (table 2).
In terms of resistance to frost, in 2020 (at the beginning of April when the cherry tree was in bloom, there were minimum temperatures of -5.9 °C) and in 2021 (when the sweet cherry was in the vegetative growth stage, there were minimum temperatures between -2.7 °C and -6.0 °C). Under these conditions, the recently fertilized ovary gets damaged and the production largely gets compromised. Our results are in accordance with similar studies in cherry cultivars (Long, 2013, Xu et al., 2023) showing that the ovary was more sensitive to freezing. The very low temperatures have effected the gynoecium under the given conditions with damages of 49.0% for 'George' (calculated by the degree of damage of the gynoecium) and 65.6% for 'Lijana'.

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Statistically, after comparing each cultivar with their genitors, cultivars 'George' (49.0%), 'Maria' (54.8%) and 'Andante' (58.6%) recorded superior significant differences in comparison with their genitors and cultivar 'Croma' (59.2%) recorded superior significant differences in comparison with their paternal genitor 'Van' (62%) (table 2).
In terms of resistance to diseases, years 2018, 2019, 2020 and 2021 were draughty years (with rainfall deficit), however, in June when the fruits were in the stages of onset of ripening and maturation. In 2018, the quantity of rainfall was 97.6 mm, in 2019, 30.4 mm, in 2020, 82.6 mm and in 2021, 74.0 mm. This climatic factor favored the evolution of pathogens (moniliosis and anthracnose) and fruit cracking, all varieties having a slight sensitivity to anthracnose (the attack frequency was between 2.9-3.8%, with an intensity between 2-5% and attack degree between 0.01-0.15%) (table 2).

Table 2. The features of the tree in the studied sweet cherry cultivars (FGRS Iasi; 2018-2021; n=4)

	The new cultivars and their genitors	Damaged ovaries (%)[1]	Resistance to the leaves anthracnose (*Coccomyces hiemalis* Higg.)			The tree's vigour[3]
			F (%)	I (%)[2]	G.A. (%)	
Calculated in comparison with the genitors of each cultivar (% damaged ovaries)	1. Cătălina	60.0[a]	3.5	4	0.14	5
	(♀) Van	62.0[a]	3.5	2	0.07	7
	(♂) Boambe de Cotnari	64.0[a]	3.7	4	0.15	7
	2. Mușatini	59.0[a]	3.2	3	0.10	5
	(♀ OP*) Bigarreau Drogan	58.3[a]	3.7	4	0.15	7
	3. Maria	54.8[c]	3.1	4	0.12	5
	(♀) Van	62.0[a]	3.5	2	0.07	7
	(♂) Stella	60.8[b]	3.7	4	0.15	5
	4. Croma	59.2[b]	3.5	3	0.02	5
	(♀) Bigarreau Drogan	58.3[b]	3.7	4	0.15	7
	(♂) Van	62.0[a]	3.5	2	0.07	7
	5. Andante	58.6[b]	3.2	4	0.13	5
	(♀ OP*) Lijana	65.6[a]	3.3	4	0.13	5
	6. Margonia	62.0[a]	3,1	3	0,01	3
	(♀OP*) Van	62.0[a]	3.5	2	0.07	7
	7. George	49.0[c]	2.9	4	0.11	5
	(♀) Cilegia di Ottobre	55.0[b]	3.0	5	0.15	5
	(♂) Fromm	63.0[a]	3.8	4	0.15	7

[1]- different letters correspond with the significant statistical difference for $P \leq 5\%$, Duncan test; [2]- intensity attack (note 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); [3]- UPOV test: degree of the tree vigour (note 1-9): 1= very low; 3= low; 5= middle; 7= high; 9= very high (***, 2006); * - OP: open pollination.

During the four years of study (2018-2021), the flowering phenophase took place between April 1st and May 11th for 4-14 days, when the cherry varieties pollinated each other. Analyzing the phenophase of the beginning of flowering in the varieties studied, it was observed that the varieties 'Margonia' and 'Ciliegia di Ottobre' flower a week later than the other varieties (table 3). Late flowering is especially important to avoid late spring frost or frost damages (Ganji et al., 2012) (table 3), but can have difficulties for find compatible pollination cultivars.
Analyzing the fertility coefficient through open pollination, analyzing the averages over the four years of the study, it can be concluded that all sweet cherry varieties are very productive because the values of this indicator are over 30%. In regards to the self-fertility of the cultivars (self-

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pollination), only cultivars 'Maria' (49%) and 'Stella' (46.1%) recorded values of the fertility coefficient for self-polination above 20%, the other cultivars are partially self-fertile, their values oscillating between 1.0-10.9% (table 3). Self-fertility is an important productivity feature, thus introducing the self-fertile cultivars in crops makes the ensuring of pollinators cultivars unnecessary (Iezzoni et al., 1990).

In terms of harvesting maturity for the seven new sweet cherry cultivars compared with their genitors (table 3), in cultivar 'Cătălina' this phenophase unfolds 19 days earlier than genitors ('Van' and 'Boambe de Cotnari'), in cultivar 'Croma' the harvesting maturity unfolds seven days later than their maternal genitor ('Bigarreau Drogan') and 12 days later than their paternal genitor ('Van'), in cultivar 'George' the harvesting maturity unfolds 28 days later than their paternal genitor ('Fromm') and two months (61 days) earlier than their maternal genitor ('Ciliegia di Ottobre'). In cultivars 'Andante' and 'Margonia' the fruits maturation unfolds two weeks later (12 days) than their maternal genitors ('Van' and 'Lijana'). In cultivars 'Maria' and 'Muşatini' this phenophase unfolds at the same time with their genitors (table 3).

The number of days between the end of flowering and fruit ripening was between 41 days in the variety 'Cătălina' (14 days less than the genitors) and 81 days in 'George' (55 days earlier than the maternal genitor ('Ciliegia di Ottobre' and 25 days later than the paternal genitor ('Fromm') (table 3). The order in which the sweet cherry cultivars reach maturity is always the same, the only difference being the time interval between two successive cultivars that can be longer or shorter (Darbyshire et al., 2012).

Table 3 – The main fruiting phases in the studied sweet cherry varieties (FGRS Iaşi; 2018-2021; n=4)

Cultivar/ Phenological stage	Start bloom (data)	The end of flowering (data)	Duration of flowering (days)	Natural fertility (%)	Self-fertility (%)	Fruit's maturation (data)	End of flowering - fruit's maturation period[1] (days)
	Limit data (the earliest to the latest):						
Cătălina	01.04 - 20.04	10.04 -30.04	10 - 11	30.6	10.9	22.05 – 07.06	41^{e}
Muşatini	09.04 - 25.04	14.04 - 02.05	6 - 8	44.8	9.3	07.06 - 22.06	54^{d}
Maria	06.04 –20.04	12.04 -30.04	7 - 11	46.4	49.0	09.06 - 20.06	56^{d}
Croma	09.04 - 22.04	19.04 - 01.05	10 - 11	39.4	3.5	20.06 - 29.06	62^{b}
Andante	07.04 - 25.04	16.04 - 03.05	9 - 10	39.7	5.9	18.06 - 27.06	60^{c}
Margonia	14.04 - 03.05	23.04 -11.05	9 - 10	57.5	1.9	20.06 - 01.07	56^{d}
George	10.04 - 26.04	13.04 - 02.05	4 - 7	32.1	2.9	07.07 - 16.07	81^{ab}
Van	07.04 - 22.04	11.04 - 05.05	5 - 14	38.7	1.3	08.06 -25.06	56^{d}
Stella	07.04 –23.04	10.04 - 05.05	4 - 13	35.4	46.1	11.06 – 24.06	57^{cd}
Boambe de Cotnari	01.04 - 22.04	11.04 - 03.05	11 - 12	32.6	2.3	06.06 - 24.06	55^{d}
Ciliegia di Ottobre	08.04 - 30.04	18.04 – 05.05	6 - 11	31.0	1.1	02.09 - 14.09	136^{a}
Fromm	03.04 – 24.04	14.04 – 02.05	9 - 12	30.2	1.0	10.06 – 23.06	56^{d}
Lijana	03.04 – 21.04	13.04 – 29.04	9 - 11	31.6	3.8	07.06 -22.06	56^{d}
Bigarreau Drogan	07.04 – 23.04	13.04 – 30.04	7 - 8	39.0	2.0	19.06 – 22.06	61^{bc}

[1]- different letters corresponding with the significant statistical difference for $P \leq 5\%$, Duncan test.

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The size of the fruit (weight and equatorial diameter) in sweet cherry is a trait with a polygenic determinism, influenced by climatic and pedological conditions, the applied technology and the biological particularities of each variety (Iezzoni et al., 1990). Analysing these parameters, the average weight of the fruit (g) and the equatorial diameter (mm) of the seven cultivars in comparison with the genitors of each cultivar, it was noticed that statistically, cultivar 'Maria' (7.5 g and 25.0 mm) recorded superior significant differences for the equatorial diameter in comparison with their paternal genitor 'Stella' (7.4 g and 23.3 mm). Cultivar 'Andante' (7.5 g and 23.6 mm) recorded superior significant differences for the equatorial diameter in comparison with their maternal genitor 'Lijana' (7.0 g and 23.0 mm), but 'Croma' (7.7 g and 24.2 mm) recorded inferior significant differences for the equatorial diameter in comparison with their paternal genitor 'Van' (7.8 g and 24.9 mm). 'Cătălina' (7.7 g and 24.2 mm) recorded inferior significant differences for the equatorial diameter in comparison with their maternal genitor 'Van', while for the fruit's weight, the values are comparable with their genitors'. Cultivar 'George' (7.2 g and 23.2 mm) recorded superior significant differences in comparison with the maternal genitor 'Cilegia di Ottobre' (2.5 g and 13.2 mm). The cultivars that recorded similar values with their genitors were 'Muşatini' (7.7 g and 23.4 mm) and 'Margonia' (7.3 g and 24.0 mm) (table 4).

In terms of stone weight (g) and its percentage from the fruit's weight (%), it was statistically noticed that the following cultivars recorded values that are inferior or comparable with their genitors: 'Muşatini' (0.30 g and 3.89%), 'Maria' (0.26 and 3.47%), 'Croma' (0.34 and 4.42%), 'Andante' (0.41 g and 5.47%) and 'George' (0.32 g and 4.44%). Cultivars 'Cătălina' (0.33 and 4.28%) and 'Margonia' (0.37 and 5.07%) recorded superior values in comparison with their genitors (table 4). The stone's size (g) and its percentage from the fruit's weight (%) are important traits for the quality and productivity of the cultivars, especially when the fruits are used for processing (Cociu, 1990).

The fruit's level of soluble dry substance (SDS) is an important parameter in fruits because the taste depending largely on it (Kappel et al., 1996). Our results showed that statistically, the studied varieties recorded comparable values with their genitors were 'Cătălina' (19.9%), 'Muşatini' (17.1%) and 'Andante' (16.5%) (table 4).

Cultivar 'Maria' (18.6%) recorded superior significant differences in comparison with their maternal genitor (♀) 'Stella' (17.4%), also 'George' (17.9%) in comparison with their maternal genitor (♀) 'Cilegia di Ottobre' (17.3%) and 'Maria' (18.6%) in comparison with their paternal genitor (♂) 'Stella' (17.4%) (table 4). The values recorded for the fruit's content in SDS were similar with other studies (Jänes et al., 2010).

In terms of the resistance of fruits to cracking, it was statistically noticed that the seven studied cultivars as follows 'Cătălina' (6.6%), 'Muşatini' (3.9%), 'Maria' (9.3%), 'Croma' (19.3%), 'Andante' (11.0%), 'Margonia' (1.5%) and 'George' (5.8%) were superior to their genitors (table 4). The resistance to the fruit's cracking is highly important feature because it avoids substantial reduction of the economic efficiency (Demirsoy and Demirsoy, 2008).

The quality of tree fruits is crucial for breeding new sweet cherry cultivars. The epidermis colour, fruit shape, flesh firmness, non-adherence of the flesh to the kernel and taste are quality traits that are highly important for the fruits intended for fresh consumption (Schuster et al., 2014).

In terms of physical and organoleptic characteristics of the fruits in the seven new sweet cherry cultivars, the skin colour was yellowish ('Andante' and 'Margonia'), shiny red ('Maria' and 'George') and dark red ('Muşatini', 'Cătălina', 'Croma').

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Table 4 – The physical, chemical and quality traits of the fruits (FGRS Iaşi; 2018 – 2021; n=4)

	New cultivars and their genitors	The average weight of the fruit (g)[1]	The average weight of the stone (g)	Fruit's diameter (mm)	Stone / fruit's weight (%)	SUS (%)**	Cracked fruits after 6 hours (%)
Calculated compared with the genitors of each cultivar	1. Cătălina	7.7^{a}	0.33^{b}	24.2^{b}	4.28^{b}	19.9^{a}	6.6^{c}
	(♀) Van	7.8^{a}	0.28^{c}	24.9^{a}	3.59^{c}	18.5^{a}	43.3^{a}
	(♂) Boambe de Cotnari	7.2^{a}	0.38^{a}	24.1^{b}	5.28^{a}	19.0^{a}	21.3^{b}
	2. Mușatini	7.7^{a}	0.30^{b}	23.4^{a}	3.89^{b}	17.1^{a}	3.9^{b}
	(♀ OP*) Bigarreau Drogan	7.4^{a}	0.43^{a}	23.1^{a}	5.81^{a}	15.8^{a}	9.9^{a}
	3. Maria	7.5^{a}	0.26^{b}	25.0^{a}	3.47^{b}	18.6^{a}	9.3^{b}
	(♀) Van	7.8^{a}	0.28^{b}	24.9^{a}	3.59^{b}	18.5^{a}	43.3^{a}
	(♂) Stella	7.4^{a}	0.30^{a}	23.3^{b}	4.05^{a}	17.4^{b}	50.3^{a}
	4. Croma	7.7^{a}	0.34^{b}	24.2^{b}	4.42^{b}	17.3^{b}	19.3^{b}
	(♀) Bigarreau Drogan	7.4^{a}	0.43^{a}	23.1^{b}	5.81^{a}	15.8^{c}	9.9^{c}
	(♂) Van	7.8^{a}	0.28^{c}	24.9^{a}	3.59^{c}	18.5^{a}	43.3^{a}
	5. Andante	7.5^{a}	0.41^{a}	23.6^{a}	5.47^{b}	16.5^{a}	11.0^{b}
	(♀ OP*) Lijana	7.0^{a}	0.41^{a}	23.0^{b}	5.86^{a}	16.0^{a}	19.5^{a}
	6. Margonia	7.3^{a}	0.37^{a}	24.0^{a}	5.07^{a}	16.4^{b}	1.5^{b}
	(♀ OP*) Van	7.8^{a}	0.28^{b}	24.9^{a}	3.59^{b}	18.5^{a}	43.3^{a}
	7. George	7.2^{b}	0.32^{c}	23.2^{b}	4.44^{c}	17.9^{a}	5.8^{c}
	(♀) Cilegia di Ottobre	2.5^{c}	0.42^{a}	13.2^{c}	16.80^{a}	14.0^{b}	17.3^{a}
	(♂) Fromm	7.6^{a}	0.38^{b}	25.5^{a}	5.00^{b}	18.1^{a}	10.2^{b}

[1]- different letters correspond to statistical significant difference for $P \leq 5\%$, Duncan test;
* - OP = open pollination;
**- SDS = soluble dry substance.

All varieties have flesh not adhering to the stone, the flesh was firm (except for 'Cătălina', an early season cultivar) for which the pulp firmness was middle and they all have a sweet taste. Cultivars 'Cătălina', 'Maria', 'Margonia' and 'George' have a heart-shaped fruit and cultivars 'Muşatini', 'Croma' and 'Andante' have kidney-shaped fruits (table 5).

Table 5 – Physical and quality characteristics of fruits (FGRS Iaşi, 2018-2022)

New cultivars and their genitors	Epidermis colour[1]	Pulp firmness[2]	Fruit's shape[3]	Pulp adherence to stone	Taste[4]
1. Cătălina	7	5	1	Non-adherent	5
(♀) Van	7	7	4	Non-adherent	7
(♂) Boambe de Cotnari	2	7	1	Non-adherent	5
2. Muşatini	7	7	2	Non-adherent	5
(♀OP*) Bigarreau Drogan	1	7	1	Semi-adherent	5
3. Maria	5	7	1	Non-adherent	7
(♀) Van	7	7	4	Non-adherent	7
(♂) Stella	5	5	1	Non-adherent	7

*Corresponding author, E-mail address: sorinas66@yahoo.com

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4. Croma (♀) Bigarreau Drogan (♂) Van	7	7	2	Non-adherent	7
	1	7	1	Semi-adherent	7
	7	7	4	Non-adherent	7
5. Andante (♀ OP*) Lijana	1	9	2	Non-adherent	5
	7	7	1	Semi-adherent	7
6. Margonia (♀OP*) Van	1	7	1	Non-adherent	5
	7	7	4	Non-adherent	7
7. George (♀) Cilegia di Ottobre (♂) Fromm	5	7	1	Non-adherent	7
	2	5	1	Adherent	3
	7	7	5	Adherent	7

* - OP: open pollination
[1]- UPOV test: epidermis colour degree on a scale of 1-8: 1= yellow; 2= half yellow, half red (bicolour); 5= shiny red; 7= dark red; 8 = dark (***, 2006);
[2]- UPOV test: degree of the pulp firmness (scale 3-9): 3=soft; 5=middle; 7=firm; 9=very firm (***, 2006);
[3]- UPOV test: shape of the fruit (scale 1-5): 1= heart; 2= kidney; 4= circular; 5= ellipsis; (***, 2006);
[4]- UPOV test: taste degree of the fruit (scale 3-7): 3= weak; 5= middle sweet; 7= very sweet (***, 2006).

4. CONCLUSIONS

The genetic variability of the cherry species and the strong heterozygosity of the cultivars enable the choosing of suitable genitors for creating new cultivars with a larger genetic basis and with the desired traits through sexual hybridization.

The sexual hybridization allowed the obtaining of seven cultivars with traits that are superior to the parental shapes (♀ x ♂) which got highlighted by good resistance to frost (‘Cătălina’, ‘Muşatini’, ‘Andante’, ‘Maria’, ‘Andante’, ‘George’), late flowering and low vigour of the tree (‘Margonia’), self-fertility (‘Maria’), earliness (‘Cătălina’), lateness (‘George’, ‘Margonia’, ‘Croma’, ‘Andante’), productivity, special fruits quality, high resistance to the cracking and anthracnose.

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*Corresponding author, E-mail address: sorinas66@yahoo.com