Fruit Growing Research, Vol. XXXIX, 2023 DOI 10.33045/fgr.v39.2023.08
https://publications.icdp.ro/index.php

CALITATEA FRUCTELOR UNOR SOIURI DE CIREȘ ÎN RAPORT CU CERINŢELE CONSUMATORULUI

FRUITS QUALITY OF SOME SWEET CHERRY CULTIVARS IN CORRELATION WITH CONSUMER PREFERENCES

Stan Adelina, Mareși Eugenia, Chivu Mihai, Butac Mădălina
Research Institute for Fruit Growing Pitești, Romania

Abstract

The fruit quality is a complex of characteristics and traits, such as: fruit size, the content of sugar, acids, flesh consistence and succulence, flavour, etc. The objective of this study was to analyze fruit quality of sweet cherry cultivars in correlation with consumer preferences. The study was carried out at Genetic and Breeding Department of Research Institute of Fruit Growing Pitesti, Romania on 13 Romanian genotypes ('Daria', 'Maria', 'Radu', 'Izverna', 'Tentant', 'Colina', 'Superb', 'Rubin', 'Simbol', 'Severin', 'H 04-4-38', 'H 06-3-77', 'H 06-11-57') and 11 foreign cultivars ('Kordia', 'Regina', 'Sweetheart', 'Karina', 'Vanda', 'Hertfort', 'Areko', 'Lapins', 'Penny', 'Folfer', 'Bigarreau Burlat'), in 2021 and 2022 years. The following determinations were carried out: fruit size by weighing, flesh firmness with penetrometer non-destructive Qualitest, soluble solids content with digital refractometer and pH with Hanna HI 84532 minititrator, such as sensory evaluation of fruits using a scale from 1 (very low) to 9 (very good). The results showed that the foreign cultivars were superior to the Romanian genotypes from the point of view of the size and fruits quality. Thus, on foreign cvs., the average fruit weight was 9.31 g, while on Romanian ones of 8.39 g. The soluble solids content of fruits was higher on foreign cvs. compared to the Romanian ones (15,59% Brix respectively 14.75% Brix). On the other hand, after the sensory evaluation of the fruits, the total score was slightly higher for the Romanian genotypes (51.20) compared to the foreign ones (51.08). For Romanian consumers the most important characteristics when choosing the cherry fruits are: taste - which must be sweet or medium sweet; size - which must be large and very large; colour – red and dark red; firmness – firm and very firm fruits. These results could be useful to breeders for selection the cultivars as genitors in controlled hybridization, to farmers for correct selection of cultivars on establishing new orchards, and to the fruit market for fresh consumption.

Cuvinte cheie: cireș, sortiment, calitate, evaluare senzorială, cerinţele pieţei.
Key words: sweet cherry, assortment, quality, panel test, market requirements.

1. Introduction

In the last years, sweet cherry area and production around the world has been growing (FAO, 2023). The worldwide of sweet cherry production, in 2021, was 2,732,413 t from an area of 451,064 ha, Asia being the largest producer with 41.4%, followed by Europe with 39.1% and the Americas with 18.0% (FAO, 2023). Also, the demands for sweet cherry fruits have increased in the past decade due to health benefits and the high price (Kahlke et al., 2009; Paunovic et al., 2022).

Although there are a large number of sweet cherry varieties, few of them respond to consumers' requirements in terms of taste and appearance. The market requirements influencing selection of commercial variety include the season of ripening, fruit size, colour and firmness (Paunovic et al., 2022). The grower must satisfy the consumers' requirements before taking into account their own requirements of precocity, productivity, susceptibility to diseases and pest and susceptibility to cracking (Dodd and Bouwer, 2014). Some of varieties are appreciated by farmers, but not by consumers (Bozhkova, 2014).

Based on consumer acceptance, the sweet cherry quality is defined by some physical and chemical characteristics: size, red colour, green stem colour, sweetness, firmness and flavor (Dever et al., 1996, Crisosto et al., 2006, Silva et al., 2021). According to some authors, colour is the main indicators of the fresh cherries (Crisosto et al., 2003, Perez-Sanchez et al., 2010) and other studies indicate firmness as an important textural attribute (Girard and Kopp, 1998).

An „ideal" fruit must be large (more than 10-12 g and 30-32 mm caliber), dark red colour, firm, with good balance between sweetness (sugars) and sourness (acids) (Kappel et al., 1996, Crisosto et al., 2003, Kahlke et al., 2009, Correia et al., 2017, Long et al., 2021). The harvest period is also an important factor which influences the manifestation of the varietal characteristics (Turner et al., 2007, Chauvin et al., 2009, Asănică et al., 2018, Bujdoso et al., 2020).

To understand the consumers' preferences, the objective of this study was to analyze fruit quality of some sweet cherry cultivars with different origin using sensory test combined with some fruits determinations (weight, caliber, firm, soluble solids content and pH).

2. Material and methods

The study was carried out in the sweet cherry field trial established in 2013 in Genetic and Breeding Department of Research Institute of Fruit Growing Pitesti, Romania (central part of Romania 44°53'56" Northern latitude, and 24°51'35" Eastern longitude). The trees were planted at a distance of 4 x 3 m, in 3 replications with 3 trees per variant. The trees were trained as flat open center, without irrigation. Soil is medium-textured, heavy-clay, with low humus content. The 2021-2022 climatic conditions were analyzed comparative with the last 53 years period (1969-2021). The average multi-annual temperature was 10.0°C, the maximum temperature 38.8°C, whereas the minimum temperature –24.4°C; total annual rainfalls recorded was 678.1 mm. During the study period, the average annual temperature was with 1.3°C higher than the multiannual average, and the precipitation was with 64.3 mm lower than the multiannual average

13 Romanian genotypes ('Daria', 'Maria', 'Radu', 'Izverna', 'Tentant', 'Colina', 'Superb', 'Rubin', 'Simbol', 'Severin', 'H 04-4-38', 'H 06-3-77', 'H 06-11-57') and 11 foreign cultivars ('Kordia', 'Regina', 'Sweetheart', 'Karina', 'Vanda', 'Hertfort', 'Areko', 'Lapins', 'Penny', 'Folfer', 'Bigarreau Burlat'), were evaluated in 2021 and 2022 years. The cultivars selected for this study are relatively new, obtained from the Romanian breeding program, but also introduced from abroad.

On these cultivars the following determinations were carried out: fruit weight with a balance in g/fruit; fruit dimensions with caliper in mm; fruit firmness with non-destructive penetrometer Qualitest HPE in HPE units; fruit soluble solids content with Digital Sucrose Refractometer Hanna Instrument 96801, in degree Brix; pH meter for fruit juice using the device Minititrator Hanna Instrument 84532.

Sweet cherries sensory profile evaluation was recorded by a trained panel of 18 judges - farmers, researchers, professors and students from Faculty of Horticulture, ranging from 19 to 60 years of age. Whole fruits were presented to members on platters (10 typical fruits of cultivars), to rate attractively and flavour, in points 1 to 9 (in which 9 designates the best performance) according to a questionnaire used by the Romanian breeders (Annex 1). The rating of fruit appearance was based on fruit size, fruit shape and skin colour. The rating of intern characteristics of fruit was based on taste, flavor, texture and stone size. The total point value was obtained by summing the scores for appearance and intern characteristics of fruit.

In addition, a questionnaire regarding the preferences of the 18 tasters on the cherry fruits according to color, shape, size, taste and firmness has been performed. For this, respondents received a classification of varieties in classes of color, size, shape according to universal descriptors ECP/GR *Prunus* working group (Fig. 1, 2, 3). The fruit taste was rated as very sweet, sweet, medium sweet, acid and very acid, while the firmness was rated as soft, medium firm, firm and very firm.

The data were included in an Excel database and statistically interpreted with the SPSS 14.0 program, which uses the Duncan test (multiple t tests) at 0.05 level of probability.

3. Results and discussions

Determination of physic-chemical properties of sweet cherry cultivars

Sweet cherry is the first fruits of the year, being the subject of one of the most effective commercial activities since the second half of May till July (Budan and Grădinariu, 2000).

Fruit size is an important quantitative factor that influences yield, fruit quality and consumer acceptance.

Average fruit weight (AFW) of Romanian genotypes was 8.39 g ranged from 10.43 g ('H 06-3-77') to 5.83 g ('Maria') and the average fruit size (AFS) was 25.77 mm varied between 24 mm and 28 mm. Inside of Romanian genotypes group noticed 'Izverna', 'H 06-3-77', 'H 04-4-38', 'Rubin', 'Tentant' and 'Daria' with fruits more than 9 g and 26 mm caliber (Table 1).

Inside of foreign cvs. group, AFW was 9.31 g ranged from 14.00 g ('Areko') to 7.20 g ('Vanda') and AFS was 27.45 mm varied between 33 mm ('Areko') and 25 mm ('Sweetheart' and 'Karina'). The biggest fruits had 'Areko', 'Hertford', 'Penny' and 'Folfer' cvs. (more than 10 g and 28 mm) (Table 2).

On average, the fruits of the foreign cvs. were much larger than Romanian genotypes (9.31 g versus 8.39 g).

Consumers from some European countries revealed a preference for fruit with 11-12 g weight and 30 mm size, and Canadian consumers considered the 29-30 mm size ideal diameter for sweet cherries. (Kappel et al., 1996; Crisosto et al., 2003). In the present study it is observed that only the foreign

cultivars correspond to these requirements; however, some Romanian genotypes were optimal for consumers.

Regarding *soluble solids content of fruit* (SSC), some authors consider optimal value between 11 and 25º Brix in sweet cherry (Serrano et al., 2005; Sîrbu et al., 2012). In our study, inside of Romanian group the average SSC was 14.75º Brix, ranged from 19.76º Brix ('Rubin') to 11.90º Brix ('H 06-11-57'). On foreign group the average SSC was 15.59º Brix varied between 18.00º Brix ('Kordia') and 13.06º Brix ('Lapins').

Organic acids are the second main group of organic compounds found in sweet cherries after carbohydrates with impact on the flavour of fruits (Maglakelidze et al., 2015). Some authors reported that the acid content does not influence the quality of sweet cherry, the most sweet cherry cultivars having low level of acids (Vangdal, 1985; Stoianovik et al., 2012).

In our study, foreign cultivars had a higher *pH value* than Romanian genotypes (4.45 versus 4.00) (Tables 1 and 2). Our results for majority of cultivars studied indicate higher value of pH than in other studies, differences which can be explained by the influence of different rootstock, soil and climate conditions, cultural practices and stage of maturity (Drake and Elfving, 2002; Crisosto et al., 2003; Stoianovik et al., 2012; Maglakelidze et al., 2015).

Firmness is another important quality attribute of sweet cherry that is valued by consumers along with crispness (Quero-Garcia et al., 2017). Flesh firmness decreases during the maturation and ripening. Early season sweet cherry varieties are usually less firm at the minimum maturity time than late season varieties (Crisosto et al., 2006). Average fruit firmness of Romanian genotypes was 44.25 HPE units, the lowest firmness recorded 'Maria' cv. (34.40 HPE units) and the highest firmness was recorded 'Tentant' cv. (76.90 HPE units). Average fruit firmness of foreign cultivars was 47.60 units HPE, ranged between 60.80 HPE units at 'Regina' cv. and 32.56 HPE units at 'Lapins' cv. (Tables 1 and 2).

Sweet cherries sensory profile evaluation

Sensory evaluation is an important tool to evaluate the market potential of sweet cherry cultivars.

Even though the results of the evaluation in laboratory highlighted the foreign cultivars, following the sensory evaluation, the Romanian genotypes were more appreciated than the foreign ones, the total score being higher at the Romanian genotypes (51.20) compared to the foreign ones (51.08) (Fig. 6 and 9).

Fruit size together with fruit skin colour and fruit shape contributes to fruit attractiveness. Judging by the score given for fruit size and colour it can be observed that large and dark red fruit are preferred by consumers. Pulp traits combine the scores given by the taste, flavour, texture. Usually consumers prefer the cultivars with very good taste, associated with the external appearance of fruits.

Inside of Romanian genotypes group, the best appearance (size, shape and skin colour) had 'H 04-4-38', 'H 06-3-77', 'Tentant', 'H 06-11-57' and 'Colina' (Fig. 4). The highest score for the internal characteristics of fruits had the following cultivars: 'Colina', 'H 06-3-77', 'H 06-11-57', 'Tentant', 'Maria' and 'Daria' (Fig. 5). The highest value (general score) based on the tasters evaluation were noted for 'Colina' (54.13 points), 'H 06-3-77' (54.19 points) and 'Tentant' (53.91 points) cvs., which were also well appreciated for the commercial aspect as well as for flesh characteristics, taste and flavor (Fig. 6).

Inside of foreign cultivars group, the best appearance (size, shape and skin colour) had 'Kordia', 'Penny', 'Folfer' and 'Areko' (Fig. 7). The highest score for the internal characteristics of fruits had the following cultivars: 'Kordia', 'Folfer', 'Areko', 'Penny' and 'Hertforda' (Fig. 8). The highest value (general score) based on the tasters evaluation were noted for 'Folfer' (54.60 points), 'Areko' (54.14 points) and 'Kordia' (53.68 points) cvs. (Fig. 9).

Response to questionnaire regarding the preferences of the tasters on the cherry fruits

Most of the respondents prefer the red (33.33%) and dark red (44.45%) as the desirable cherry fruit colour. The same number of respondents prefers yellow and orange red fruits colour (Fig. 10).

A cordate fruit shape is the most desirable fruit shape for the largest number of respondents (38.88%), followed by circular fruit shape (22.22%) (Fig. 11).

In the last years, the main objective in the breeding work is obtaining the cultivars with large and very large fruits (more than 10 g and more than 30 mm). Our research showed that large (38.89%) and very large (38.89%) fruits are preferred by respondents (Fig. 12).

The respondents prefer sweet (27.78%) and medium sweet (38.89%) fruits, while acid fruits are preferred by only a small number of respondents (Fig. 13).

The most preferred of respondents are firm (44.45%) and very firm (38.89%) fruits (Fig. 14).

For Romanian consumers the most important characteristics when choosing the cherry fruits are: taste - which must be sweet or medium sweet; size - which must be large and very large; colour – red and dark red; firmness – firm and very firm fruits. Similar data reports Asănică et al., 2018; Bujdoso et al., 2020; Long et al., 2021; Paunovic et al., 2022).

4. Conclusions

These results could be useful to breeders for selection the cultivars as genitors in controlled hybridization, to farmers for correct selection of cultivars on establishing new orchards, and to the fruit market for fresh consumption.

Even though the results of the evaluation in laboratory highlighted the foreign cultivars, following the sensory evaluation, the Romanian genotypes were more appreciated than the foreign ones.

For Romanian consumers the most important characteristics when choosing the cherry fruits are: taste - which must be sweet or medium sweet; size - which must be large and very large; colour – red and dark red; firmness – firm and very firm fruits.

References

1. Asănică A., Stănică F., Tudor V., Iacob A., Zolotoi V., Perojuc L., 2018. Evaluation of the consumer preference for sweet cherry fruits at the „Sweet cherry fest" in Istrita-Buzău. Scientific papers. Series B, Horticulture: 187-190.
2. Bozhkova V., 2014. Chemical composition and sensory evaluation of plum fruits. Trakya University Journal of Natural Sciences, 15 (1): 31-35.
3. Budan S., Grădinariu G., 2000. Cireşul. Ed. Ion Ionescu de la Brad, Iaşi, pp. 9 – 12 (in Romanian).
4. Bujdoso G., Hrotko K., Feldmane D., Giovannini D., Demirsoy H., Tao R., Malchev S., 2020. What kind of sweet cherries do the final consumers prefer? South-Western Journal of Horticulture Biology and Environment, 11: 37-48.
5. Cauvin M.A., Whiting M., Ross C.F., 2009. The influence of harvest time on sensory properties and consumer acceptance of seet cherries. HortTechnology, 19 (4): 748-754.
6. Correia S., Schouten R., Silva A.P., Goncalves B., 2017. Factors affecting quality and health promoting compounds during growth and postharvest life of sweet cherry (*Prunus avium* L.). Front. Plant Sci. 8: 2166.
7. Crisosto C.H., Crisosto G.M., Metheney P., 2003. Consumer acceptance of 'Brooks' and 'Bing' cherries is mainly dependent on fruit SSC and visual skin colour. Postharvest Biol. Technol., 28: 159–167.
8. Crisosto C.H., Crisosto G.M., Neri F., 2006. Understanding tree fruit quality based on consumer acceptance. Acta Hortic., 712: 183–190.
9. Dever M.C., Mac Donald R.A., Cliff M.A., Lane W.D., 1996. Sensory evaluation of sweet cherry cultivars. HortScience, 31: 150–153.
10. Dodd M.C., Bouwer J.J., 2014. The supply value chain of fresh produce from field to home: refrigeration and other supporting technologies. Postharvest Handling. Academic Press: 449-483.
11. Drake S., Elfving D., 2002. Indicators of maturity and storage quality of lapins sweet cherry. Hort. Technology, 12 (4): 687-690.
12. Girard B., Kopp T.G., 1998. Physicochemical characteristics of selected sweet cherry cultivars. J. Agric. Food Chem., 46: 471–476.
13. Kahlke C.J., Olga I., Cooley H.J., Robinson T.L., 2009. Shelf life and marketing window extension in sweet cherries by the use of modified, atmosphere packaging. New York Fruit Quarterly, 17: 21-24.
14. Kappel F., Fisher-Fleming B., Hogue E., 1996. Fruit characteristics and sensory attributes of an ideal sweet cherry. Hort Sci., 31: 443–446.
15. Long L., Lang G., Kaiser C., 2021. Sweet cherries: Crop production science in Horticulture. Goucester. CABI Severn.
16. Maglakelidze E., Bobokasvili Z., Kakashvili V., Tsigriasvili L., 2015. Biological and agricultural properties of sweet cherry (*Prunus avium* L.) cultivars in Georgia. International Journal of Science and Research, vol. 6 (9): 796-801.
17. Quero-Garcia J., Iezzoni A., Pulwska J., Lang G., 2017. Cherries: botany, production and uses. CABI
18. Serrano M., Guillen F., Martínez-Romero D., Castillo S., Valero D., 2005. Chemical constituents and antioxidant activity of sweet cherry at different ripening stages. J. Agric. Food Chem., 53: 2741–2745.
19. Silva V., Pereira S., Vilela A., Bacelar E., Guedes F., Ribeiro C., Silva A.P., Goncalves B., 2021. Preliminary insights in sensory profile of sweet cherries. Foods, 10: 612-623.
20. Sirbu S., Niculaua M., Chirita O., 2012. Physicochemical and antioxidant properties of new sweet cherry cultivars from Iasi, Romania. Agron. Res., 10: 341–350.
21. Paunovic G., Haider D., Koricanac A., Pasalic B., Glisic I., Jovanovic-Cvetkovic T., Cvetkovic M., 2022. Preferences in sweet cherry fruits among consumers in Serbia and Bosnia and Herzegovina. Horticultural Science (Prague) 49 (4): 189-196.
22. Pérez-Sánchez R., Gómez-Sánchez M.A., Morales-Corts M.R., 2010. Description and quality evaluation of sweet cherries cultured in Spain. J. Food Qual., 33: 490–506.

23. Stoianovik M., Milatovic D., Kulina M., Alic-Dzanovic Z., 2012. Pomological properties of sweet cherry cultivars on Gisela 5 rootstock in the region of Sarajevo. Third International Scientific Symposium Agrosum Jahoria, pp. 183-187.
24. Turner J., Seavert C., Colonna A., Long L.E., 2007. Consumer sensory evaluation of sweet cherry cultivars in Oregon, USA. Acta Horticulturae 795: 125-131.
25. Vangdal E., 1985. Quality criteria for fruitfor fresh consumption. Acta Agriculture Scandinavica, 35: 41-47.
26. ***, 2023. Date FAO (Food and Agricultural Organization); www.fao.org.

Annex, Tables and Figures

Annex 1. Questionnaire for assessing fruit quality (cultivars, selections, hybrids)

1. Name ……..						
2. Occupation……..						
3. Tasting location……..						
4. Date of tasting……..						
Analyzed traits	Scale	Sample (cultivar)				
5. External (commercial) aspect of fruits	Marks	1	2	3	4	5
Size	1-9					
Shape	1-9					
Skin colour	1-9					
6. Pulp traits	Marks					
Taste	1-9					
Flavour	1-9					
Texture	1-9					
Stone size	1-9					

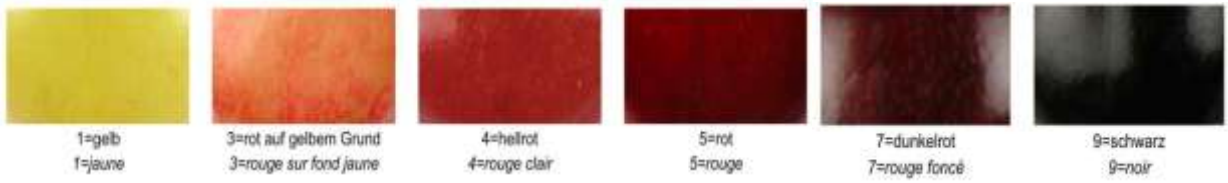

Fig. 1. Fruit skin colours for the cherry cultivars, based on which the survey respondents indicated their purchasing preferences: (1) – yellow; (3) – orange red; (4) – light red; (5) – red; (7) – dark; (9) – blackish (according Descriptors ECP/GR *Prunus* working group)

Fig. 2. Main cherry cultivars fruit shapes based on which the respondents made their purchasing preferences: (1) – cordate; (2) – reniform; (3) – oblate; (4) – circular; (5) – elliptic
(according Descriptors ECP/GR *Prunus* working group)

Fig. 3. Main cherry cultivars fruit size based on which the respondents made their purchasing preferences: (1) – very small; (3) – small; (5) – medium; (7) – large; (9) – very large
(according Descriptors ECP/GR *Prunus* working group)

Table 1. Fruit characteristics of Romanian sweet cherry genotypes*

No.	Genotypes	Weight (g)	Caliber (mm)	Firmness (HPE units)	SSC (% Brix)	pH (%)
1	Daria	9.86 ab	28 a	42.03 c	16.20 b	3.97 c
2	Maria	5.83 e	24 d	34.40 e	14.40 c	4.01 ab
3	Radu	6.40 d	25 c	47.10 b	12.87 d	4.10 a
4	Izverna	10.33 a	26 b	42.60 c	15.30 bc	4.05 ab
5	Tentant	9.50 ab	25 c	76.90 a	15.50 bc	4.02 ab
6	Colina	7.21 c	24 d	42.40 c	15.60 bc	3.77 c
7	Superb	8.20 b	26 b	44.56 bc	15.70 bc	3.87 c
8	Rubin	9.03 ab	26 b	38.80 d	19.76 a	4.07 ab
9	Simbol	6.40 d	25 c	39.53 d	12.43 d	4.50 a
10	Severin	8.20 b	26 b	38.50 d	14.70 c	4.14 a
11	H 04-4-38	9.93 ab	28 a	47.83 b	14.13 c	3.80 c
12	H 06-3-77	10.43 a	28 a	45.70 bc	13.23 d	4.16 a
13	H 06-11-57	7.80 c	24 d	34.90 e	11.90 e	3.50 c
	Average	**8.39**	**25.77**	**44.25**	**14.75**	**4.00**

*Duncan multiple ranges test. Numbers followed by the same letter within a column are not significantly different (P≤0.05).

Table 2. Fruit characteristics of foreign sweet cherry cultivars*

No.	Genotypes	Weight (g)	Caliber (mm)	Firmness (HPE units)	SSC (% Brix)	pH
1	Kordia	8.73 c	27 b	53.43 b	18.00 a	3.95 c
2	Regina	8.48 c	26 c	60.80 a	15.70 c	4.49 b
3	Sweetheart	8.23 c	25 d	45.50 c	16.03 b	4.11 bc
4	Karina	7.36 d	25 d	56.26 b	13.80 d	4.02 c
5	Vanda	7.20 d	26 c	43.80 c	16.60 b	5.10 a
6	Hertfort	11.00 b	30 ab	43.63 c	17.66 ab	4.70 b
7	Areko	14.00 a	33 a	35.25 d	15.23 c	4.60 b
8	Lapins	8.20 c	27 b	32.56 d	13.06 d	4.50 b
9	Penny	11.20 b	29 ab	53.93 b	15.33 c	4,40 b
10	Folfer	10.00 b	28 b	50.23 b	15.63 c	4.90 a
11	Bigarreau Burlat	8.00 c	26 c	48.20 c	14.50 cd	4.20 bc
	Average	**9.31**	**27.45**	**47.60**	**15.59**	**4.45**

*Duncan multiple ranges test. Numbers followed by the same letter within a column are not significantly different (P≤0.05).

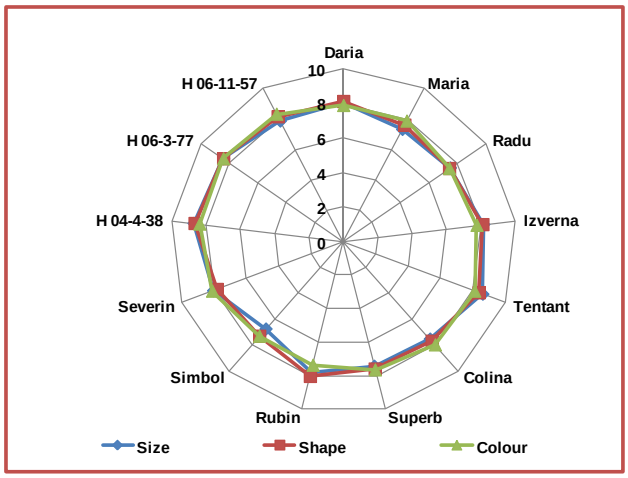

Fig. 4. Line-scale diagram of Romanian sweet cherry genotypes (external traits)

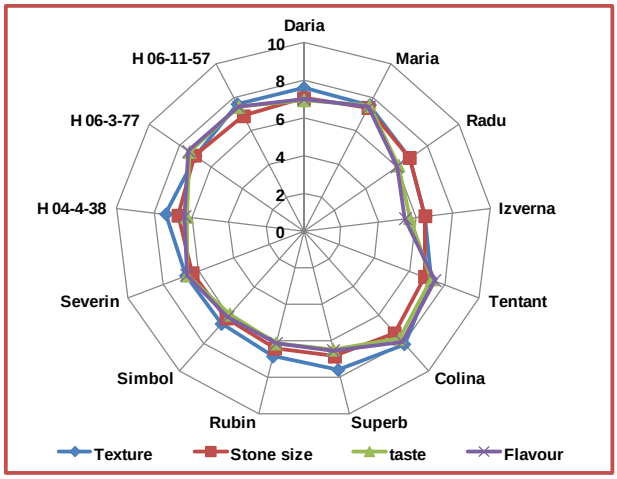

Fig. 5. Line-scale diagram of Romanian sweet cherry genotypes (internal traits)

DOI 10.33045/fgr.v39.2023.08

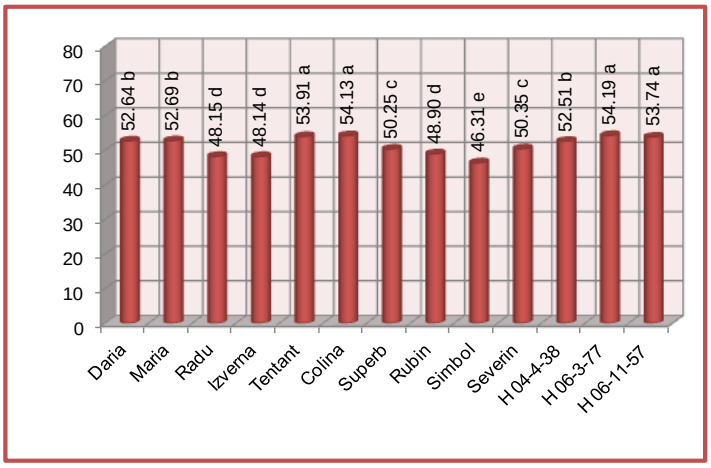

Fig. 6. General score obtained from the sensory evaluation of Romanian genotypes
(Duncan multiple ranges test. Numbers followed by the same letter within a column are not significantly different - P≤0.05)

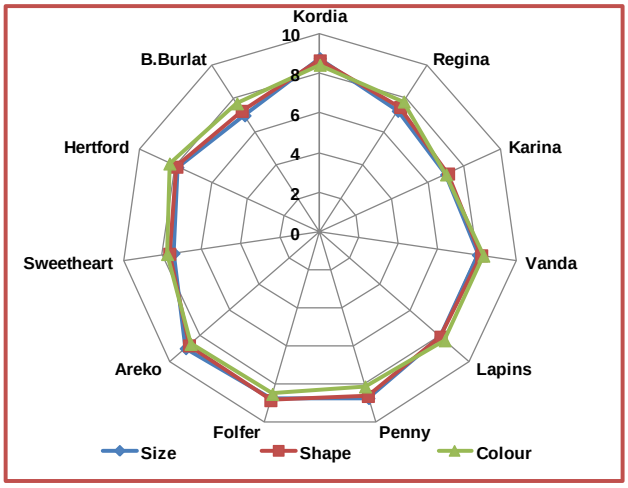

Fig. 7. Line-scale diagram of foreign sweet cherry cultivars (external traits)

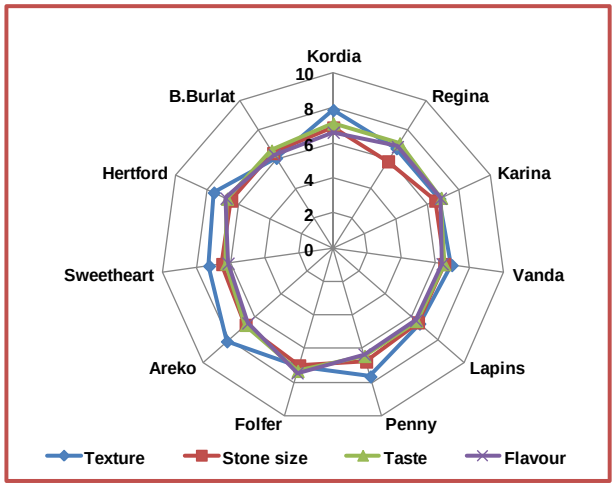

Fig. 8. Line-scale diagram of foreign sweet cherry cultivars (internal traits)

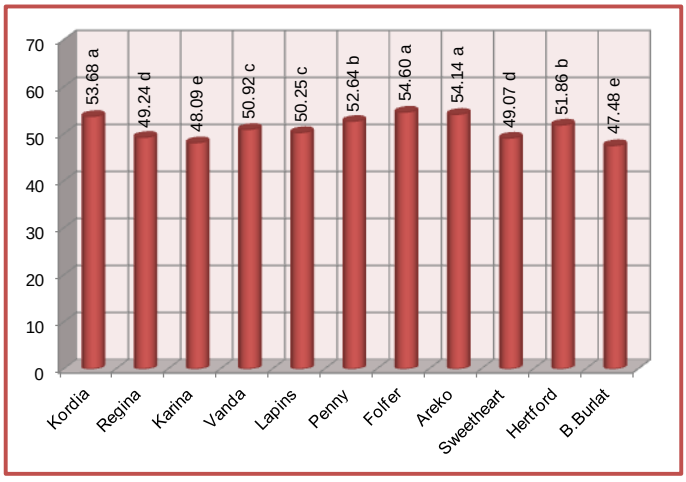

Fig. 9. General score obtained from the sensory evaluation of Romanian genotypes
(Duncan multiple ranges test. Numbers followed by the same letter within a column are not significantly different - P≤0.05)

DOI 10.33045/fgr.v39.2023.08

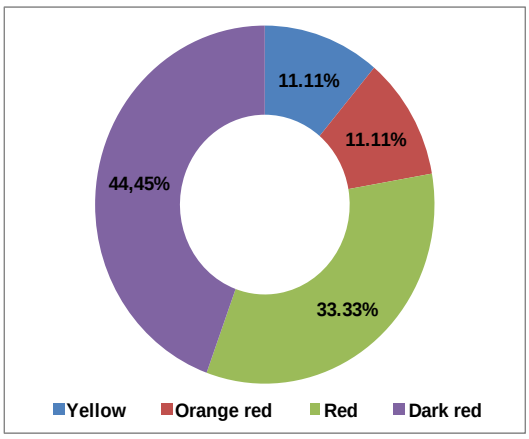

Fig. 10. Respondents' attitude toward the fruit colour

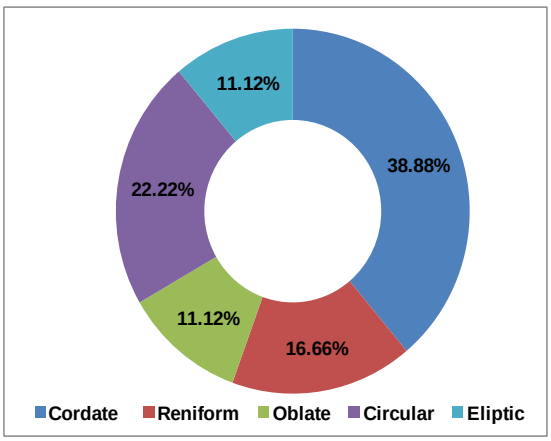

Fig. 11. Respondents' attitude toward the fruit shape

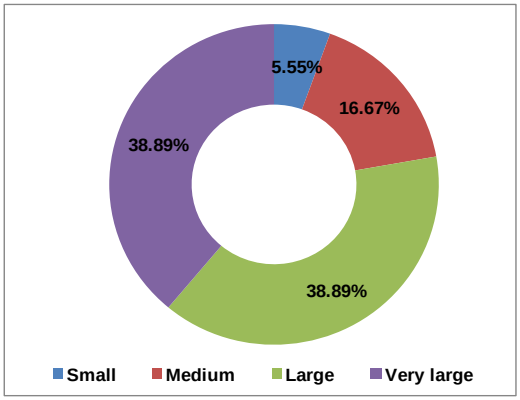

Fig. 12. Respondents'attitude toward the fruit size

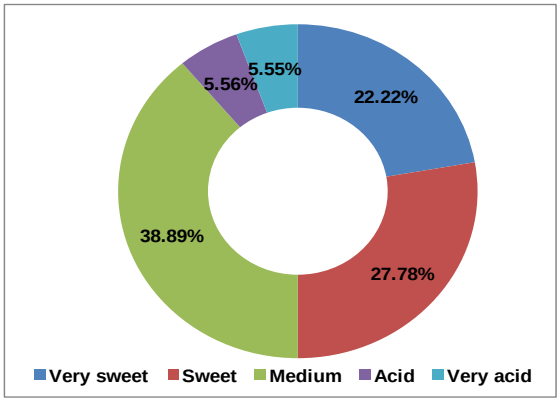

Fig. 13. Respondents' attitude toward the fruit taste

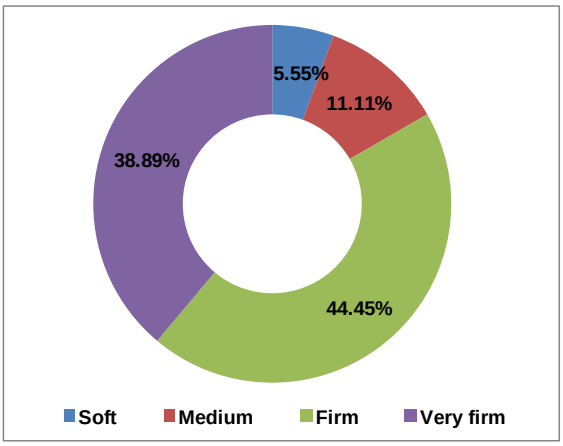

Fig. 14. Respondents' attitude toward the fruit firmness

Fig. 15. Romanian cultivars appreciated by consumers 'Tentant', 'Simbol' and 'Colina'