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CARACTERIZAREA POMOLOGICĂ A UNOR SOIURI LOCALE DE CIREȘ AMENINȚATE CU DISPARIȚIA ȘI CU ORIGINE NECUNOSCUTĂ

BRIEF POMOLOGICAL CHARACTERISTIC OF THREATENED FROM EXTINCTION LOCAL SWEET CHERRY CULTIVARS AND SOME FORMS OF UNIDENTIFIED ORIGIN

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Abstract

A brief pomological description of the sweet cherry cultivars 'Pobeda', 'Kyustendilska Chrustyalka', 'Cherna Konyavska' and 'Mizia', created in the early periods of the selection activity at the Institute of Agriculture in Kyustendil (50s - 70s of the last century) was made. Due to their low spread in the past already these cultivars are threatened with loss. All of them are characterized by large to very large, extremely tasty and firm fruits and have very good transportability. Some local forms of cherries of unknown origin, found as a result of scientific expeditions in the mountainous regions of Kyustendil district are also described. The fruit of 'Pobeda' and 'Cherna Konyavska' are easily detached from the stalks, without tearing and juice leakage, which makes them suitable for mechanized harvesting. The fruit of 'Mizia' have a very high resistance to mechanical pressure and are suitable for transportation. Most of the forms of unknown origin have medium to large fruits, whose diameter varies from 18.1 to 24.6 mm. One of the forms is soft but the others have firm fruits. The shape of the fruit varies from round to broadly heart-shaped. Most of them have dark red to black skin color. The taste of all is sweet and sour and only one form has a slight tartness. Single, very old trees of these varieties and forms were found in abandoned yards and fields in the villages at the western foot of the Konyavska Mountain and in the Southeastern part of the Osogovo Mountain.

Cuvinte cheie: cireș, soi, descriere pomologică.
Key words: sweet cherry, cultivar, pomological description.

1. Introduction

Sweet cherry (*Prunus avium* L.) is a fruit species with high ecological plasticity and is one of the main fruit crops in Bulgaria. Favorable natural conditions for the cultivation and introduction of new varieties, with valuable qualities, create opportunities for large yields of high quality fruits. In almost all countries with developed cherry production, intensive selection work is carried out to create new varieties that meet modern quality requirements in line with market demand (Georgiev et al., 2001; Kappel, et al., 2002; Wang, 2002; Long et al., 2008; Sansavini & Lugli, 2008; Vercammen et al., 2008; Zhivondov et al., 2011; Asanica et al., 2012; Milatović et al., 2013; Christov & Krumov, 2014; Grandi et al., 2017). As a result most of the old local Bulgarian cherry varieties are gradually shifting and are threatened with extinction. Due to their very good adaptability to any climatic anomalies over the decades, excellent taste and high fertility, in the past they were distributed by the population in the Kyustendil region, most often as single trees. As a result of scientific expeditions, single trees of endemic varieties for the region were found, as well as those of unknown origin, cultivated in yards and abandoned fields. Some of the old varieties are grown as single trees in the collection plantations of the Institute of Agriculture - Kyustendil. All of the old varieties must be preserved in the country's gene banks, and used in cherry breeding programs in the future as donors of valuable qualities.

The aim of the study was to make a brief pomological description of endangered old sweet cherry cultivars, created in the early periods of selection activity at the Institute of Agriculture, as well as selected forms of unknown origin, with high adaptability and valuable biological qualities for breeding purposes.

2. Material and methods

The study was conducted in the period 2018-2020. The object of study was the old sweet cherry cultivars: 'Pobeda', 'Kyustendilska Chrustyalka', 'Cherna Konyavska' and 'Mizia', created at the Institute of Agriculture - Kyustendil by Vasil Georgiev in the 50s - 70s of the last century. Now days, only single trees in a collection plantation established in 1996 are preserved. The trees are grafted on 'Mahaleb'

seedlings. Seven local sweet cherry forms of unknown origin (№ 1, 2, 10, 12, 18, 36, 40), selected as a result of some expeditions in the mountainous settlements of Kyustendil region were also studied. Single, very old trees of these forms were found and marked in abandoned yards and fields in the villages at the Western foot of the Konyavska Mountain (Crvenyano, Kopilovtsi, Rajdavitsa), as well as near the village of Eremiah, located in the geographical area Pianets, Southeast of the town of Kyustendil.

The trees were marked with a durable fluorescent spray paint and their coordinates were recorded with a GPS device (Garmin, Montana, 680 t). Comparative variants in the study were the standard varieties 'Van' and 'Bigarreau Burlat'.

The mechanical and chemical analyses of the fruits were determined in consumptive maturity according to the established national methodology (Nedev et al., 1979). The transportability of the fruits of the cultivars was determined experimentally by measuring the resistance of the fruit to mechanical pressure to cracking of the skin. To determine the suitability of varieties for mechanized picking, the strength of detachment of the fruit from the stalk was measured. The endurance of the fruit of the above two resistances (in g) was measured at the harvest, with a suitable tool similar to the AC 2 apparatus (Georgiev et al., 2001). After tearing the stalk from the fruit, the presence/absence of tearing of the skin as well as leakage of juice was reported.

The obtained experimental results were processed by the method of analysis of variance (ANOVA), and LSD-test to prove the statistical significance of the differences between the control and the variants at $p \leq 0.05$ was used.

3. Results and discussions

'Pobeda'. This sweet cherry cultivar is selected from seedlings obtained from free pollination of an unknown cultivar in 1953. On average, during the studied period, the consumptive maturity of the fruit occurred at the beginning of the second ten days of June, three days before those of 'Van'. The flowering is early, it takes place almost simultaneously with 'Bigarreau Burlat', with whom they pollinate each other. The fruits are large (23.4 mm) with an average weight of 6.5 g. The shape of the fruit is broadly heart-shaped with a rounded tip. The skin is medium thick, dark red to black, shiny. The fruit flesh is dark red with a medium-thick texture, juicy. The fruit juice is dark red. It has good to very good taste. Its organoleptic tasting score on a five-point scale is 4. The stone is small (0.27 g). The fruit stalk is short (25.0 mm), thick. The force required to detach the fruit from the stalk is 515.0 g, which makes the fruit crumble relatively easily when shaken. No tearing of the skin and leakage of juice was found, which makes the 'Pobeda' cultivar suitable for mechanized harvesting. The resistance of the fruits to mechanical pressure to cracking of the skin is 1,680 g which makes them transportable (Tables 1, 2).

'Kyustendilska Chrushtyalka'. The cultivar is obtained in 1955 from the combination 'Romanka' × 'Early from Ville' and 'Razdavichka Belvitsa' (mixed pollen). The consumptive maturity of the fruits under the soil-climatic conditions of Kyustendil occurs in the second ten days of June (about 26), almost simultaneously (+ 1 day) with those of 'Van'. Flowering is early. A suitable pollinator for it is 'Bing'. The fruits are large (22.4 mm), with an average weight of 6.8 g, heart-shaped. The skin is dark red, shiny and thick. The flesh is firm, pink-red with yellow veins, juicy, sweet-sour and with very good taste. During the tasting it received a grade of 4 on a five-point scale. The fruit juice is dark red. The stone is medium-sized (0.32 g), easily separated from the flesh. The stalk is medium long (34.0 mm), easily detached from the fruit when shaken. The force of separation of the fruit from the stalk is 495 g. The fruits have a very good transportability. The force of pressure to burst the skin is 1,850 g.

'Cherna Konyavska'. The cultivar originates from the crossing of 'Romanka' × 'Razdavichka Belvitsa' in 1956. The fruits ripen at the end of the second ten days of June (23.06), four days after those of the standard 'Van'. Flowering occurs early (10.04). During the studied period the beginning of full flowering was 6 days before the trees of Van. Suitable pollinators for it are 'Van' and 'Stella' cultivars. The fruits are large with an average weight of 6.7 g and a diameter of 23.3 mm. The shape of the fruit is broadly heart-shaped. The skin is dark red to black, hence the name of the cultivar. The fruit are equal in size, shape and color. The flesh is firm, juicy, with fresh acidity, dark red in color. The juice is dark red. The fruit has good to very good taste. The tasting grade is 3 points. The stone is medium to large (0.35 g) with an elongated broadly ovoid shape. The stalk is medium long (33.8 mm), thick and easily separated from the fruit when shaken, without tearing the skin and leaking juice. The required force to tear the fruit from the stalk is 520 g, which makes the cultivar suitable for mechanized harvesting. The fruits have good transportability. On average for the studied period, the resistance to mechanical pressure is 1,795 g (Tables 1, 2).

'Mizia'. It is obtained from the crossing of cultivars 'Lambert' × 'Kozerska' in 1971. Under the soil and climatic conditions of Kyustendil, the fruit ripen in the first ten days of July, 11 days after those of 'Van'. Flowering is very late (18.04), occurs almost simultaneously with that of the parent couple. A

suitable pollinator for it is 'Star'. The fruits are very large (25.4 mm) with an average weight of 8.7 g. The shape of the fruit is very beautiful, heart-shaped with a pointed tip. The skin is medium thick, black-red, glossy. The juice is dark red. The flesh is firm, crispy and juicy. It has excellent taste with a pleasant sweet and sour taste. The tasting score is the maximum 5. The stone is large (0.42), elongated ovoid, separating from the flesh. The stalk is medium long (36.5 mm), thin. It is relatively difficult to separate from the fruit. The force required for separation is 622 g. No tearing of the skin and leakage of juice was found. The fruits have excellent transportability. Characteristic of the cultivar is that the fruits do not pass their harvest maturity quickly. Their resistance to mechanical pressure until the skin cracks is 2,278 g, thus this cultivar surpasses most of the other cultivars to the type of type "bigarreau" (Tables 1, 2).

In the period 2018 - 2020, during scientific expeditions in the mountainous areas of Kyustendil region, about 150 wild cherry forms and old varieties of unidentified origin were registered. Most of them have low quality fruits. Three forms and four local cultivars of unknown origin were selected, possessing valuable traits. According to the ripening term (average for the study period) form № 4 is early (around May 27). Its fruits ripen 12 days before those of 'Bigarreau Burlat' and 32 days before those of 'Van'. The rest belong to the group of late-ripening sweet cherry cultivars. The consumptive maturity of the fruits of forms № 2, № 1 and № 12 occurs, respectively, 3, 4 and 8 days later than those of the standard 'Van' (June 28), and at № 36, № 18 and № 10 s 12 - 14 days later (Table 1).

According to the accepted classification, the selected cherry forms have medium-sized to large fruits, with a diameter ranging from 18.1 to 24.6 mm and an average weight between 4.6 and 8.1 g. The mechanical analysis shows that with the highest average weight are the fruits of form № 1 (8.1 g), which are almost indistinguishable from the standard 'Van' (8.0 g). A similar trend is observed with regard to fruit size. With the largest diameter are the fruits of form № 10 (24.6 mm), which do not differed from those of 'Bigarreau Burlat', but significant differences were found compared to 'Van' (Table 1).

Fruit of form № 1 (23.8 mm) and № 18 (23.8 mm) have almost the same diameter as that of 'Van'. The other forms have proven smaller fruits than the standard. With the largest stones are the fruits of form № 1 (0.36 g), and the smallest of № 18 (0.28 g). For the others the values are almost the same. All tested forms have proven longer stalk than the standard. The length of the stalk of forms № 10 and № 36 is classified as long, and for the others it is medium length (Table 1).

The results of the chemical analysis show that the content of total sugars is highest in the fruits of form № 36 (11.4%), followed by № 1 and the standard Van (10.6%). In other forms the sugars vary from 7.5% to 9.8%. The highest content of titratable acids have the fruits of form № 36 (0.93%), and the lowest of № 10 (0.47%). For forms № 1 and № 2 the values slightly exceed the values of the standard - 0.58% (Table 1).

In addition to the content and balance of the chemical components, the appearance is also crucial for the sweet cherry fruit quality - shape, size, skin color, as well as the fruit juice. Depending on the direction of use of the fruit - for fresh consumption or processing, different sizes, shapes and colors of fruits are preferred. The shape of the fruit in the studied cherry forms is rounded at № 12, 18 and 36, heart-shaped at № 1, № 40 and broadly heart-shaped at № 10. One of the forms, № 36, have light red skin and the others have dark-red to black color. The fruit of № 10, 12, 18 and 36 are firm, of forms № 1 and 2 they are medium firm, and of № 40 are relatively soft. The taste of all is sweet and sour, and fruit of form № 1 also have a slight tartness (Table 2).

The color of the fruit juice ranges from colorless at № 36 to dark red at № 10. None of the studied forms exceeds the 'Van' (st.) in terms of organoleptic tasting evaluation (5 points). The forms № 1 and № 40 have a very good tasting evaluation (4 points) and in the others it is good (3 points) (Table 2).

4. Conclusions

The old sweet cherry cultivars 'Pobeda', 'Kyustendilska Chrustyalka' and 'Cherna Konyavska' are characterized by large fruits and very good taste. Their fruits are easily separated from the stalks without tearing and leaking juice, which makes them suitable for mechanized harvesting and can find a place in the new orchards due to lack of manpower to harvest cherries. 'Mizia' cultivar has very large fruit with a beautiful heart shape. Characteristic of the cultivar is that the fruits do not pass their harvest maturity quickly and almost do not crack from the rains. Their resistance to mechanical pressure cracks is high and in this respect they are superior to the 'Van', as well as most of the cultivars with firm fruit.

The selected sweet cherry forms of unknown origin have medium to large fruit with a diameter of 18.1 to 24.6 mm. One of them is soft-fruited, with an early fruit ripening period, and the others are late ripening with firm fruit flesh. The shape of the fruit is from rounded to broadly-heart shaped. Most of them have a dark red to black color of the skin. The taste of all is sweet and sour, and in one form with a slight tartness. They have good adaptability and have survived over the time without the application of any agro-technical measures; therefore they are valuable for selection work in the sweet cherry.

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Tables and Figures

Table 1. Phenological phases, mechanical and chemical analyses of fruit of old sweet cherry cultivars and forms of unidentified origin, 2018-2020

Cultivar, form №	Phenological phases			Average fruit mass	Average fruit diameter	Average stone mass	Average fruit stalk length	Transportability		Chemical analysis	
	Beginning of full flowering (date)	Ripening time (date)	(+) or (-) days compared to Van (number)	(g)	(mm)	(g)	(mm)	Mechanical pressure to crack the fruit (g)	Force of separation of fruit from the stalk (g)	Total sugars (%)	Titratable acids (%)
Old sweet cherry cultivars threatened with extinction											
Pobeda	7.04	22.06	-3	6.5	23.4 b	0.27 c	25.0 b	1680	515	8.7	0.50
Kyustendilska chrustyalka	10.04	26.06	+1	6.8	22.4 c	0.32 bc	34.0 a	1850	495	8.2	0.48
Cherna Konyavska	10.04	23.06	-2	6.7	23.3 b	0.35 b	33.8 a	1795	520	8.3	0.45
Mizia	18.04	06.07	+11	8.7	25.4 a	0.42 a	36.5 a	2278	622	8.9	0.45
Van (Ct.)	16.04	25.06	-	7.0	23.3 b	0.28 c	25.2 b	2149	460	10.5	0.60
Local sweet cherry forms of unknown origin											
№ 1	15.04	02.07	+4	8.1	23.8 a	0.36 a	33.7 d	-	-	10.6	0.69
№ 2	15.04	01.07	+3	6.7	22.4 c	0.35 ab	36.5 d	-	-	9.8	0.68
№ 10	16.04	12.07	+14	7.8	24.6 a	0.30 bc	49.0 a	-	-	9.0	0.47
№ 12	17.04	06.07	+8	4.6	20.4 e	0.30 bc	41.0 c	-	-	9.4	0.52
№ 18	15.04	11.07	+13	6.0	23.4 b	0.28 c	44.2 b	-	-	8.7	0.50
№ 36	15.04	10.07	+12	3.4	18.1 f	0.30 bc	47.0 ab	-	-	11.4	0.93
№ 40	04.04	27.05	-32	6.5	21.4 d	0.31 abc	35.9 d	-	-	7.5	0.53
Bigarreau Burlat (Ct.)	05.04	08.06	-20	6.7	24.6 a	0.36 a	33.6 d	-	-	7.9	0.49
Van (Ct.)	15.04	28.06	-	8.0	23.3 b	0.30 bc	26.1 e	-	-	10.6	0.58

Table 2. Some other pomological characteristics of the sweet cherry fruit

Cultivar, form №	Fruit shape	Firmness	Flavor	Fruit skin color	Fruit flesh color	Fruit juice color	Organo-leptic valuation (5-point scale)
Old sweet cherry cultivars threatened with extinction							
Pobeda	Wide cordate with a rounded tip	Medium	Sweet-sour	Dark red to black, shiny	Dark red	Wine red	4
Kyustendilska Chrustyalka	Cordate with a pointed tip	Firm	Sweet-sour	Dark red	Pink red with yellow veins	Dark red	4
Cherna Konyavska	Wide cordate	Firm	Sweet-sour	Dark red to black, shiny	Dark red	Wine red	4
Mizia	Wide cordate with a pointed tip	Firm	Sweet-sour	Black red, glossy	Dark red	Dark red	5
Local sweet cherry forms of unknown origin							
№ 1	Cordate with a rounded tip	Medium	Sweet-sour with a slight tartness	Dark red to black	Red	Red	4
№ 2	Cordate with a rounded tip	Medium	Sweet-sour	Dark red to black	Dark red	Red	3
№ 10	Wide cordate with a pointed tip	Firm	Sweet-sour	Dark red	Dark red	Dark red	4
№12	Rounded	Firm	Sweet-sour	Dark red to black	Dark red	Red	3
№ 18	Rounded	Firm	Sweet - slightly sour	Dark red	Red	Red	3
№ 36	Rounded	Firm	Sweet-sour	Light red	Pale beige	Colorless	3
№40	Cordate	Soft	Sweet-sour	Dark red	Pink	Red	3
Van (st.)	Wide cordate to rounded	Firm	Sweet-sour	Dark red	Pink	Pink	5