FRUIT'S PHYSICO-CHEMICAL CHARACTERISTICS OF TWO BITTER CHERRY CULTIVARS

CARACTERISTICI FIZICO-CHIMICE ALE FRUCTULUI LA DOUĂ SOIURI DE CIREŞ AMAR

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Abstract. *Bitter cherry cultivars are particularly important for both industrial and home conditions processing in jams, liqueurs or syrups. Evaluation of the physico-chemical characteristics of fruit was carried out on samples from harvest years 2007-2010 at two bitter cherry cultivars (Galata and Maxut) created at Fruit Growing Research Station Iasi. Were observed and determined the ripening period, fruit size, stone percentage, soluble solids content, reducing sugars, total acidity, the sugar/acidity ratio, humidity percentage, content of both phenols and anthocyanins. Galata is a bicolor cultivar with great fruits (17.2 mm fruit equatorial diameter and 4.2 g fruit weight) valuable for gems processing. Maxut is a valuable cultivar for its both fruit and flesh dark brown almost black, with great bitterish taste valuable for liqueurs, syrups and jams.*

Key words: *Prunus avium*, fruit processing, jam, sugars, acidity, fenols.

Rezumat. *Soiurile de cireş amar prezintă o importanţă deosebită pentru prelucrarea industrială sau în condiţii casnice sub formă de dulceţuri, lichioruri, siropuri. Evaluarea însuşirilor fizico-chimice ale fructelor a fost realizată pe probe din recolta anilor 2007-2010 la două soiuri de cireş amar (Galata şi Maxut) create la Staţiunea de Cercetare-Dezvoltare pentru Pomicultură Iaşi. S-au observat şi determinat epoca de recoltare, mărimea fructelor, ponderea sâmburelui (%), conţinutul în substanţă uscată solubilă, glucidele reducătoare, aciditatea totală, raportul zahăr/aciditate, umiditatea fructului, continutul in fenoli şi antociani. Soiul Galata este un soi bicolor cu fruct mare (17.2 mm in diametru si 4.2 g in greutate), foarte valoros pentru dulceţuri, iar soiul Maxut este un soi cu fructul şi pulpa de culoare brun închis spre negru, cu gust amar accentuat, valoros atât pentru dulceţuri, dar mai ales pentru lichioruri şi siropuri.*

Cuvinte cheie: *Prunus avium*, prelucrare fructe, dulceaţă, zaharuri, aciditate, fenoli.

INTRODUCTION

Sweet cherries are valuable raw materials to obtain traditional and ecological products such as jam and liqueurs (Vieru et al., 1981 ***, 1992, Peter et al., 2007, b; Beceanu, 2009).

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Internationally, liqueurs and syrups from bitter cherry are the subject of many research investigations (Bretaudeu & Faure, 1991; Hui, 2006, Webster & Looney, 1998; Nikolić et al., 1998), but jam have been less investigated (Jamba & Carabulea, 2002).

Knowledge of physico-chemical properties of fruit to bitter cherries are an important element in defining their quality and their establishment for industrial use (Beceanu, 2009; Beceanu & Chira, 2003; Budan & Grădinariu, 2000; Gherghi et al., 2001; Coşofreţ et al., 2006; Petre, 2007; Webster & Looney, 1998).

By their chemical content in fenols, sweet cherries are a valuable natural source to reduce the risk of many diseases caused by oxidative processes (Jakobek et al., 2009; Chaovanalikit & Wrolstad, 2004).

In this paper we have investigated the physical and chemical properties of fruits from two bitter cherry cultivars grown in the NE of Romania area, to determine their possible recovery in the form of organic products and promoting traditional culture expansion of these cultivars in organic plantations.

MATERIAL AND METHOD

For experimentation were used fruit samples from two bitter cherry cultivars (Galata and Maxut) existing in the experimental plot of Fruit Growing Research Station Iasi, during 2007-2010.

They made observations, measurements and analysis of: fruit size, stone weight, soluble solids content, reducing sugar content, total acidity, sugar/acidity ratio, humidity (%) and phenols content. To determine the fruit size were weighed and measured 10 whole fruit and 10 dried seeds in three repetitions, using a precision electronic balance Radwag type, with 0.01 g sensitivity and a mechanical caliper and then based on these determinations was calculated pulp / stone ratio.

Titratable acidity was determined by neutralization with sodium hydroxide solution 0.1 N, to the point of equivalence, using thymolphthalein as an indicator. Soluble solids content was determined using a hand refractometer (Zeiss). Reducing sugar content was determined by the method of Schoorl (Ghimicescu, 1977). The principle is to reduce alkaline cuppertartrique solution by reducing sugars in hot medium to cuprous oxide. Excess of divalent copper oxidizes iodine potassium to elemental iodide and than free iodine is titrated with sodium thiosulfate. Depending on the amount of thiosulfate consumed, the amount of reduced copper is quantify and then from the tables, the amount of reducing sugars (expressed as glucose, fructose etc.) is also quantify (Ghimicescu, 1977). Fruit humidity (%) was determined by drying samples to constant mass in an oven at 105°C and calculating the difference between the fresh product under analysis and dry product.

Identification of phenolic compounds. For a more complete characterization of bitter cherry cultivars taken under study was performed to determine individual phenolic compounds by liquid chromatography with diode array detector (HPLC - DAD). Fruit samples were centrifuged with a Hettich centrifuge, GmbH & Co. KG, Germany (6000 rotations per minute) and then filtered through membranes with 0.45 mm porosity. Then were used analytical standards to identify specific compound retention time and were drawn curves characteristic of each phenolic compound. Separation method involves using

HPLC Shimadzu LC 20 and the column used was a sequence of two Cromolith Performance 100x4, 6 mm from Merck, Romania (Castellar et al., 2002).

RESULTS AND DISCUSSIONS

The average ripening period of Galata and Maxut was between 18 and 28 June with a number of days from full bloom to maturity between 70 and 98 (table 1).

Table 1

Maturation period of bitter cherry Galata and Maxut (average 2007-2010)

Characteristics	Cultivar	
	Galata	Maxut
Flowering period	1-25.04	10-26.04
Fruit ripening	22-28.06	18-22.06
Number of days from bloom to fruit ripening	83-98	70-74

Physico-chemical characteristics of the fruit from the two bitter cherry cultivars are presented in table 2.

Table 2

Physico-chemical properties of fruit at bitter cherry cultivars Galata and Maxut (average 2007 - 2010 ± SD)

Characteristics	Cultivar	
	Galata	Maxut
Equatorial diameter of fruit (mm)	17.20 ± 0.34	16.10 ± 0.50
Fruit weight (g)	4.08 ± 0.33	3.60 ± 0.56
Stone size (g)	0.26 ± 0.04	0.28 ± 0.03
Fruit/stone ratio (g/g)	16.00 ± 1.04	12.67 ± 0.66
Soluble solids content (Brix)	18.63 ± 1.06	18.30 ± 1.11
Reducing sugar content (g/100 g fresh fruit)	8.45 ± 0.37	13.25 ± 2.07
Titratable acidity (g malic acid /100 g fresh fruit)	0.77 ± 0.06	0.99 ± 0.16
Reducing sugars content / titratable acidity ratio	11.07 ± 0.45	13.72 ± 4.25
Humidity (%)	81.65 ± 0.36	81.99 ± 0.21

Galata registered 17.2 mm in average equatorial diameter and 4.0g in fruit weight, fruit / stone ratio being 16.

Fruit size of Maxut was smaller, fruit/stone ratio being 12.67 (table 2). Sugar/acidity ratio was greater in Maxut (13.72) compared with Galata (11.07) (table 2).

Making bitter cherry chromatograms of samples taken to study indicated the presence of protocatehic acid which is the phenolic compound with the highest proportion of both Galata and Maxut cultivars and also of Boambe de Cotnari, the sweet cherry cultivars taken as control. The highest proportions were dentified syringic, p-cumaric and chlorogenic acids and also epicatechin.

Table 3

The main phenolic compounds identified in some sweet and bitter cherry cultivars (2009)

Phenolic compounds	Cultivar (mg/L)			
	Galata	Boambe de Cotnari	Maxut	±SD
Protocatehic acid	15.41	15.45	15.83	0.23
Vanillic acid	0.31	1.85	0.42	0.86
Rutin	nd	nd	3.43	-
Gallic acid	1.13	1.07	1.10	0.03
Catechin	1.93	1.83	2.54	0.38
Siringic acid	3.08	1.74	5.68	2.0
Epicatechin	6.01	5.53	4.59	0.72
Salicylic acid	nd	0.21	nd	-
Gentisic acid	1.29	1.03	0.98	0.16
Chlorogenic acid	3.93	4.52	4.05	0.31
P-cumaric acid	4.68	5.00	5.09	0.22
Trans resveratrol	nd	nd	2.52	-

In small proportions were identified: catechin, gallic acid, ferulic acid (table 3). Maxut is a bitter cultivar with darkish to brown skin color, so trans-resveratrol and rutin (quercetin-3-rutinoside) was identified in a proportion of 3.43 mg/L, respectively 2.52 mg/L. This phenolic compounds wasnt identified in the fruits composition of Galata which has bicolored skin color or at Boambe de Cotnari also with bicolored skin color but with sweet taste (table 3). Trans-resveratrol and rutin (quercetin-3-rutinoside) are role in body health. Resveratrol prevents the development of skin cancer, have an antinflamator effect and can treat arthritis diseases in high doses (Chaovanalikit & Wrolstad, 2004). Rutin has a role in protecting blood vessels, improves circulation and acts as an antioxidant (Chaovanalikit & Wrolstad, 2004, Budan, 2008). Compared with sweet cherry cultivar Boambe de Cotnari as control, bitter cherry cultivars have been a large quantities of syringic acid as follows: 3.08 mg/L at Galata and 5.68 mg /L to Maxut.

During maturation, the fruit has an uniform growing at Galata from one phase to another (table 5), while at Maxut the fruit has a slower growth in the last stage of maturation mean in the last 6 days before harvesting, from 2.17 g to 2.72 g.

Table 5

Dynamics of fruit size during maturation of bitter cherry cultivars Galata and Maxut (2009)

Characteristics	Cultivar (average on 3 repetitions ± SD)							
	Galata				Maxut			
	Stage I	Stage II	Stage III	Stage IV	Stage I	Stage II	Stage III	Stage IV
Equatorial diameter (mm)	12,27 ±0,10	15,63 ±0,45	17,07 ±0,03	17,37± 0,69	10,95± 0,29	12,37± 0,29	14,33± 0,15	15,73± 0,46
Fruit weight (g)	1,57± 0,05	2,74± 0,01	3,46± 0,05	4,23±0 ,02	1,08±0 ,07	1,53±0 ,05	2,17±0 ,03	2,72±0 ,20

In terms of sensory, Galata has bicolored skin color with yellowish flesh color and a moderate bitter taste (table 6). Maxut has dark brown skin and flesh color, with intensely bitter taste and pronounced flavor.

Table 6

Sensory characteristics of fruit at bitter cherry cultivars Galata and Maxut

Characteristics	Cultivar	
	Galata	Maxut
Skin color	Bicolor	Dark brown
Flesh color	White yellow	Dark brown
Bitter taste	Medium	Intense
Aroma	Medium	Intense

CONCLUSIONS

Galata and Maxut are bitter cherry with valuable potential for organic farming on small surfaces.

In terms of physico-chemical composition, bitter cherry cultivars studied have a high content in phenolic compounds, representing a significant antioxidant source.

Galata is valuable for processing into jams compared to other cultivars because of pulp and skin fruit color and higher fine bitterness. Maxut has value in processing into liquors, syrups and jams but also in food colorants industry due to the intense color of the fruis with intense bitter taste, high in carbohydrate content and enhanced flavor.

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