

ELAIAȘI – NEW SWEET CHERRY CULTIVAR WITH HIGH PRODUCTIVITY AND MEDIUM RIPENING TIME

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ABSTRACT. The aim of this paper is to improve the autochthonous sweet cherry assortment with new cultivars of good adaptability and ecological plasticity, with superior biological potential, productive, with quality fruits and superior features, in comparison to existing cultivars. Due to the characteristic of having an earlier ripening age for the fruits compared to the other tree species (beginning in May), the cherry is the first ring in the annual chain of fruits production. On the fresh fruits market, the preferred ones are the cultivars type ‘bigarreau’, with shining red colour, resistant to cracking, transport and temporary storage with the weight of over 7 g. Analysing the main phenological stages for the two cultivars, it was noticed that the new sweet cherry cultivar ‘Elaiiași’ is average both in flowering beginning time and fruits maturation season. In regards to average productions for five years (2012 - 2016), from the statistical point of view, it was noticed that ‘Elaiiași’ (21.1 kg/tree) recorded production with insignificant positive differences in comparison to the witness cultivar ‘Van’ (20.2 kg/tree). Under the aspect of fruits’ weight and equatorial

diameter, ‘Elaiiași’ (8.8 g and, respectively, 25.1 mm) recorded significant and respectively positive significant differences, in comparison to the witness cultivar ‘Van’ (7.6 g and 23.9 mm). Concerning the fruit’s resistance to cracking, ‘Elaiiași’ cultivar presented a superior resistance (2.7 %) to the witness cultivar ‘Van’ (42.0 %), recording distinct significant negative differences in comparison to this cultivar from the statistical point of view.

Keywords: sweet cherry; assortment; cultivars; fruit; quality.

REZUMAT. Scopul lucrării este de a îmbunătăți sortimentul de cireș autohton cu soiuri având o bună adaptabilitate și plasticitate ecologică, potențial biologic superior, productive, cu fructe de calitate și însușiri superioare soiurilor existente. Datorită însușirii de a avea o epocă de coacere a fructelor mai timpurie decât la celelalte specii pomicele (începând din luna mai), cireșul constituie prima verigă din lanțul anual al producției de fructe. Pe piața de fructe proaspete sunt preferate

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soiurile de tip “bigarreau”, de culoare roșie strălucitoare, rezistente la crăpare, transport și depozitare temporară, cu masa de peste 7 g. Analizând principalele stadii fenologice la cele două soiuri, s-a constatat că noul soi de cireș ‘Elaiși’ este mediu, atât în ceea ce privește începutul înfloritului, cât și cel al maturării fructelor. Referitor la producțiile medii pe cinci ani (2012-2016), din punct de vedere statistic, se constată că soiul ‘Elaiși’ (21,1 kg/pom) a înregistrat diferențe de producție pozitive nesemnificative față de soiul martor ‘Van’ (20,2 kg/pom). Sub aspectul greutateii fructelor și al diametrului ecuatorial, ‘Elaiși’ (8,8 g și 25,1 mm) a înregistrat diferențe semnificative (g) și semnificativ pozitive (mm) față de soiul martor ‘Van’ (7,6 g și 23,9 mm). Referitor la rezistența fructelor la crăpare, soiul ‘Elaiși’ a prezentat o rezistență superioară (2,7%) soiului martor ‘Van’ (45,0%), din punct de vedere statistic înregistrând diferențe distinct semnificativ negative față de acesta.

Cuvinte cheie: cireș; sortiment; soiuri; fruct; calitate.

INTRODUCTION

The sweet cherry tree, through the fruits’ ripening time, the quality and savour which are extremely appreciated by the consumers, but also through the constancy of the productions, constitutes the first ring in the annual chain of fruits’ production (Budan and Grădinariu, 2000; Petre, 2006). On the fresh fruits’ market, the ones that are preferred are the cultivars type ‘bigarreau’ with shining red colour, resistant to cracking, transport and

storage, with the weight of over 7 g (Budan and Grădinariu, 2000; Meland *et al.*, 2014).

The main objective of the genetic breeding and controlled or natural selection, which took place over the centuries, was to obtain new cultivars with improved features and characteristics, superior to the existing cultivars (Cociu and Oprea, 1989; Braniște *et al.*, 2007; Schuster *et al.*, 2014).

Research concerning the improvement of the assortment for the sweet cherry species, in terms of cultivars’ quality, are objective that gains increasing importance (Grădinariu and Istrate, 2004; Sestraș, 2004; Kazantzis *et al.*, 2011; Lichev *et al.*, 2004). Thus, in March 2016, a new cultivar released at Research Station for Fruit Growing Iasi was approved with the name ‘Elaiși’.

The aim of this paper is to improve the autochthonous sweet cherry assortment with cultivars of good adaptability and ecological plasticity, superior biological potential, productive, with quality fruits and superior features.

MATERIALS AND METHODS

The studies were done during 2012 - 2016, over the sweet cherry cultivar ‘Elaiși’ (sin. HC. 841703-2) and the comparison was done with the witness cultivar ‘Van’.

The research method of the new sweet cherry cultivar was the classical one and it represented controlled hybridizations (done in 1984), followed by harvesting hybrid stones, obtaining

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hybrid saplings, selection and individual testing of the hybrid selections.

The trees can be found in the experimental plots from Research Station for Fruit Growing (RSFG) Iasi, the Genetics and Breeding Laboratory. They are grafted on mahaleb as rootstock and planted at a distance of 5 x 4 m, with the shape of free flattened palmed crown on the direction of the row of trees, without a sustaining and an irrigation system. On the row of trees, the soil has been prepared with the lateral disk with palpation and between the rows the soil is grassed. The control over diseases and pests has been done according to the received warnings, phytosanitary treatments being applied.

In 2013 and 2016, in June, when for the most of the sweet cherry cultivars, the fruits were in the maturation stage, it was recorded a rainfall quantity of 179 mm (2013) and 121.8 mm (2016), in comparison to 85.3 mm, value that represents the multiannual average for June, the pluviometric excess being of 93.7 mm (2013), respectively 36.5 mm (2016).

In experimental plantation there have been done observations and determinations concerning: trees' vigour, resistance to anthracnose and monilia (Cociu and Oprea, 1989), the main phenophases of growing and fructification (Fleckinger, 1960); physical features (fruit and stone weight (g) by weighting 10 fruits and stones in three repetitions with the precision electronic scale with 0.01g sensitivity type Radwag; the equatorial diameter of the fruit (mm) has been determined with the digital callipers Luumytools for 10 fruits in three repetitions; the fruit/stone ratio, % of stone from the fruit's weight, epidermis colour has been determined according to the UPOV TG/35/7 questionnaire

(^{xxx}, 2006); chemical and quality features of the fruits (soluble dry substance has been determined refractometrically, using a Zeiss hand refractometer; titrable acidity of the fruits has been determined through the potentiometric method (Ghimicescu, 1977); the total content of polyphenol has been done using the Folin-Ciocalteu method (Jayaprakasha *et al.*, 2001); pulp firmness, fruit shape, stone adherence to pulp have been determined according to the UPOV TG/35/7 questionnaire (^{xxx}, 2006), fruits resistance to cracking has been determined by sinking 100 fruits from each cultivar into distilled water and after 6 hours it was verified how many fruits cracked, determining this way the % of cracking per cultivar (Cociu and Oprea, 1989); the productivity has been determined by weighting the fruits per tree, variants and repetitions (Cociu and Oprea, 1989).

The experimental data were interpreted statistically through the variance analysis.

RESULTS AND DISCUSSION

The cultivars taken for study have middle vigour and concerning the disease resistance, the years 2013 and 2016, being rainy years (in June when for the most of the sweet cherry cultivars, the fruits were in maturation stage), it was recorded a quantity of rain of 179 mm (2013) and 121.8 mm (2016). In comparison with 85.3 mm, which were the multiannual average for June, the pluviometric excess was 93.7 mm (2013), respectively 36.5 mm (2016), being favourable years for the evolution of pathogens, they ('Elaiăși' and 'Van') manifested an easy sensibility both to anthracnose

(attack frequency being between 3.7-3.9%, with an intensity of 2% and attack degree between 0.07-0.08%) and to monilia (attack frequency

being of 2.0%, with an intensity of 2% and attack degree of 0.04%) (*Table 1*).

Table 1 - Tree's vigour and resistance to diseases (RSFG Iași; average 2012 - 2016)

| Genotype | Tree vigour* | Resistance to: | | | | | |
|----------------------------|--------------|--|------|---------|--|------|---------|
| | | Fruits' anthracnose** (<i>Coccomyces hiemalis</i> Higg.) | | | Fruits monilia** (<i>Monilinia fructigena</i> Pers.) | | |
| | | F, % | I, % | A.D., % | F, % | I, % | A.D., % |
| Elaiiași (HC. 841703-2) | 5 | 3.7 | 2 | 0.07 | 2.0 | 2 | 0.04 |
| Van (control) | 5 | 3.9 | 2 | 0.08 | 2.0 | 2 | 0.04 |

* the mark of the vigour of the tree on the 1-9 scale: 1 = very weak; 3 = weak; 5 = middle; 7 = strong; 9 = very strong (^{xxx}, 2006); **F,% - attack frequency (%); I,% - attack intensity on a scale between 1 to 6: 1 = 3% attacked surface; 3 = 25%; 4 = 50%; 6 = 100%; A.D.,% - attack degree (Cociu & Oprea, 1989).

The average date of the stage of flowering beginning for sweet cherry cultivars were 13th of April, date that were considered as a landmark for sweet cherry flowering in the area of Iași. Analysing this phase for the two cultivars, it has been noticed that the new sweet cherry cultivar 'Elaiiași' flowers during the same time with the control cultivar 'Van' (*Table 2*).

Concerning the maturity at harvesting, this oscillates in close limits from one year to another. Thus, it can be noticed that the two cultivars mature in the second decade of June and the number of days from the beginning of flowering to maturation have been, in average, 65 (*Table 2*). These results are consistent with other studies and regardless the climatic conditions of the year, the order in which the sweet cherry cultivars get to maturity remains always the same, with the difference that the time

interval between two successive cultivars is longer or shorter (Darbyshire *et al.*, 2012; Iurea *et al.*, 2015).

By characterizing the two cultivars from the statistical point of view, it can be noticed that 'Elaiiași' (21.1 kg/tree) registered production insignificant positive differences in comparison with the control cultivar 'Van' (20.2 kg/tree) (*Table 3*).

The quality of the fruit is determined by the fruit's size, the skin colour, the stone's size and easy detachment of the stone from the pulp.

The two genotypes taken for study recorded an average weight of the fruit between 7.6 g for the control cultivar 'Van' and 8.8 g for 'Elaiiași', the two cultivars having significant positive differences between themselves (*Table 3*). A continuous increase of the fruit's weight

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determines also a correspondent increase of the equatorial diameter. However, ‘Elaişi’ (25.1 mm)

recorded insignificant differences in comparison with the control (23.9 mm) (*Table 3*).

Table 2 - The main phenological stages (RSFG laşi; average 2012-2016)

| Phenological stages | Year | Genotype | |
|--|----------------|-----------------------|---------------|
| | | Elaişi (HC. 841703-2) | Van (control) |
| Flowering beginning, date | 2012 | 16.04 | 16.04 |
| | 2013 | 22.04 | 21.04 |
| | 2014 | 08.04 | 08.04 |
| | 2015 | 16.04 | 16.04 |
| | 2016 | 05.04 | 04.04 |
| | Average | 13.04 | 13.04 |
| Fruits maturity, date | 2012 | 20.06 | 20.06 |
| | 2013 | 17.06 | 15.06 |
| | 2014 | 17.06 | 17.06 |
| | 2015 | 16.06 | 16.06 |
| | 2016 | 13.06 | 14.06 |
| | Average | 17.06 | 16.06 |
| Number of days from the beginning of flowering to maturation | 2012 | 66 | 66 |
| | 2013 | 57 | 56 |
| | 2014 | 71 | 71 |
| | 2015 | 62 | 62 |
| | 2016 | 70 | 72 |
| | Average | 65 | 65 |

Table 3 - Fruits production and physical features (RSFG laşi; average 2012-2016)

| Genotype | Fruits' average production (kg/tree) | Fruit's average weight (g) | Stone's average weight (g) | Fruit/stone ratio | Stone from the fruit's weight (%) | Equatorial diameter of the fruit (mm) |
|-----------------------|--------------------------------------|----------------------------|----------------------------|-------------------|-----------------------------------|---------------------------------------|
| Elaişi (HC. 841703-2) | 21.1 | 8.8* | 0.32 | 27.5 | 3.63 | 25.1 |
| Van (control) | 20.2 | 7.6 | 0.30 | 25.3 | 3.94 | 23.9 |
| DL 5% | 1.6 | 0.9 | 0.09 | 8.2 | 1.0 | 2.2 |
| DL 1% | 2.6 | 1.5 | 0.15 | 13.6 | 1.7 | 3.7 |
| DL 0,1% | 4.8 | 2.9 | 0.27 | 25.3 | 3.2 | 7.0 |

Note: plantation year: 2000; planting distance: 5 x 4 m

For the stone's size, the cultivars recorded a weight between 0.30-0.32 g, the size being classified as middle according to the UPOV questionnaire.

The ratio fruit/stone for ‘Elaişi’ (27.5) was superior to the control cultivar (25.3) and the percent of stone from the fruit's weight recorded insignificant negative differences

from the statistical point of view, in comparison to the control (3.63%) (*Table 3*).

Both the new cherry cultivar ‘Elaiiași’ and the control cultivar ‘Van’ have a shining red fruit, with firm pulp and the stone does not present adherence to the pulp (*Table 4*) (*Fig. 1*). The pulp’s firmness is an important quality item, especially for the fruits destined for fresh consumption (Kappel *et al.*, 2000).

The shape fruit for ‘Elaiiași’ were heart-shaped and for ‘Van’ were globular.

Concerning the fruit’s resistance to cracking, ‘Elaiiași’ presents a

superior resistance (2.7%) to this cultivar ‘Van’ (42.0%), recording distinct significant negative differences in comparison to this cultivar from the statistical point of view (*Table 4*).

It is extremely important for the sweet cherry cultivars to be resistant to the cracking phenomenon because cracked fruits lose their commercial value, they become more perishable and in the fruit’s fissure, monilia gets installed and they become inedible. This way, the economic efficiency of the sweet cherry production can decrease substantially (Milatović *et al.*, 2011).

Table 4 - Physical and quality features of the fruits (RSFG Iași; average 2012 - 2016)

| Genotype | Epidermis colour | Pulp firmness | Fruit’s shape | Stone adherence to pulp | Percentage of fruits cracked after 6 hours |
|-------------------------|------------------|---------------|---------------|-------------------------|--|
| Elaiiași (HC. 841703-2) | shining red | firm | heart-shaped | non-adherent | 2.7 ⁰⁰ |
| Van (control) | shining red | firm | globular | non-adherent | 45.0 |
| DL 5% | | | | | 10.1 |
| DL 1% | - | - | - | - | 23.2 |
| DL 0,1% | | | | | 73.9 |

Table 5 - Biochemical characteristics of the fruits (RSFG Iași; average 2013 - 2014)

| Genotype | SDS (°Brix)* | TA (mg malic acid/100mL juice)** | SDS/TA (%)*** | Total content of polyphenols (mg GAE/100 mL) |
|-------------------------|--------------|----------------------------------|---------------|--|
| Elaiiași (HC. 841703-2) | 16.30 | 0.46 | 35.43 | 676.71 |
| Van (control) | 16.45 | 0.45 | 36.55 | 670.00 |

* SDS= soluble dry substance; ** TA= titrable acidity; *** SDS/TA= ratio between soluble dry substance and titrable acidity.

The content in dry substance is extremely important for sweet cherry cultivars, the taste of the fruits depending on it. Referring to the

cultivars taken for study, the values of this parameter were between 16.30% (‘Elaiiași’) and 16.45% (‘Van’) (*Table 5*).

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The ratio SDS/TA is considered an extremely important factor for determining the fruits' taste, reflecting a balance between the sweet and sour taste of the fruits (Crisosto *et al.*, 2002). From this point of view, the studied genotypes had values for the SDS/TA ratio between 35.43-36.55% (Table 5).

The total content of polyphenols has a particular importance for determining the taste and the flavour

of the sweet cherries, as well as an antioxidant role with anti-carcinogen effect (Chaovanalikit and Wrolstad, 2004). From this point of view, 'Elaiăși' genotype (676.71 mg GAE /100 mL) got remarked with a higher polyphenols content in comparison to the control cultivar 'Van' (670.00 mg GAE/100 mL) (Table 5).



Figure 1 - Sweet cherry cultivar 'Elaiăși'

CONCLUSIONS

For the new sweet cherry cultivar 'Elaiăși', created at RSFG Iași, all the studied parameters are superior to the control cultivar 'Van' and correspond to the actual objectives concerning the trees' vigour, productivity, fruits' quality and resistance to the phenomenon of fruits' cracking, to biotic and abiotic factors.

The new cultivar can be recommended for the establishment of trees' plantation with large density per hectare.

The cultivar 'Elaiăși' was approved in June 2016, included in

the Official Catalogue of cultivars and it was proposed for patenting.

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