EVALUATION OF SWEET CHERRY CULTIVARS UNDER THE CONDITIONS FROM THE SILVOSTEPPE AREA IN MOLDOVA

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Abstract

The promotion of a cherry assortment with constant yield, low vigour of the trees, self-fertility and high productivity, resistance to biotic and abiotic factors and with ripening at the extremities of the cherries maturation season, represents a permanent concern of researchers. In this context, considering the current patrimonial situation and the perspectives of growing sweet cherry trees in the Iasi area, under a privatized agriculture, the selection of new cultivars to be introduced in the assortment requires a special attention. Analyzing the values of the fertility index during the three years of study (2018 – 2020) it was observed that all the cherry cultivars excepting ‘Kordia’ are highly fertility with values between 30.0% and 66.2%. The cultivars ‘Bucium’, ‘Croma’, ‘Van’, ‘Maria’, ‘Stella’, ‘Cătălina’, ‘Margonia’ and ‘George’ have large fruits (over 7 g and over 22.5 mm) and ‘Kordia’ (6.3 g and 21.1 mm), ‘Scorospelka’ (6.2 g and 22.3 mm), ‘Cetățuia’ (6.0 g and 22.0 mm) and ‘Rivan’ (5.9 g and 21.6 mm) have small fruits. For ‘Scorospelka’, ‘Cetățuia’ and ‘Rivan’, the fruits are large in comparison with other early cultivars. The values of soluble dry substance (SDS) varied between 13.6% (‘Scorospelka’ and ‘Rivan’) and 18.9% (‘Maria’). However, statistically, cultivars ‘Maria’ (18.9%), ‘Bucium’ (18.3%) and ‘George’ (18.1%) recorded superior values in comparison with all the other cultivars.

Cuvinte cheie: cires, sortiment, rezistență la ger, fenofaze de fructificare, caracteristici fizico-chimice
Keywords: sweet cherry, assortment, resistance to frost, fructification phases, natural fertility, physical-chemical traits

1. Introduction

The soil and climate conditions from the Iasi county are favourable for growing sweet cherry trees, excepting a few years with natural disasters (Dumitrescu, 1981; Petre, 1987; Iurea et al., 2009).

The study in field trial of the most valuable cultivars from the autochtonous and worldwide assortment to establish the most adequate for each ecological area represents the main direction in breeding the trees’ assortment (Cociu & Oprea, 1989).

The promotion of a sweet cherry assortment suitable to yield every year, with low vigour trees with valuable self-fertile and productive cultivars, resistant to biotic and abiotic factors and with ripening time at the extremities of the cherries maturation season represents a permanent concern of domain specialists (Cociu, 1990; Budan et al., 1997; Budan & Grădinaru, 2000; Kazantzis et al., 2011; Petre, 2006).

In this context, considering the current patrimonial situation and the perspectives of growing sweet cherry trees in the Iasi area, under a privatized agriculture, the selection of new cultivars to be introduced in the assortment requires a special attention.

2. Material and methods

The studies were performed between 2018 – 2020, using seven autochtonous sweet cherry cultivars (‘Cetățuia’, ‘Cătălina’, ‘Bucium’, ‘Maria’, ‘Croma’, ‘Margonia’ and ‘Bucium’) and five foreign cultivars very widespread in orchards (‘Scorospelka’, ‘Rivan’, ‘Van’, ‘Stella’ and ‘Kordia’) grafted on Prunus mahaleb as research material. The comparison of the cultivars was performed against the variants average.

The experiment was placed on a fertile land, slightly sloping and well drained. The field trial was placed linearly, in three repetitions of 3 trees each, at a distance of 4 x 5 m and guided as a free flattened palmette without supporting and irrigation systems. On the row with trees, the soil has been prepared with the rotary orchard tiller and between the rows, the soil was grassed. The control of diseases and pests was performed in accordance with the received warnings, using phytosanitary treatments.

The meteorological factors were analyzed (during the three years) along with the study on the experimental plantation of the vigour of the trees, resistance to frost, main growing and fructification
phenophases (Fleckinger J., 1960), physical traits (the fruit’s and the stone’s weight (g), the equatorial diameter of the fruit (mm), the fruit/stone ratio, the fruit’s colour), chemical traits (soluble dry substance (%), (questionnaire UPOV TG/35/7, 2006). Highly productive cultivars are considered to have the fertility index (percentage of resulted fruits, 25-30 days after the fall of the petals) with minimum values of 30-35% (Cociu & Oprea, 1989).

The climatic conditions during the research period were less favourable to the sweet cherry tree, influencing the production potential and the biometry of the shoots of the tree negatively. Hence, between 2018 – 2020, the precipitations were largely below the multiannual average (562.6 mm), the deficit being between 32.1 mm in 2018 and 163.5 mm in the first seven months of 2020. From a thermal point of view, during March and the beginning of April in 2019 and 2020, late spring frosts were recorded while the sweet cherry tree already started the vegetation (the swelling of the buds, bud burst and bloom phenophases).

The experimental data was interpreted statistically, analyzing the variance and using the method of multiple comparisons (the Duncan test, with P 5%).

3. Results and discussions

The hereditary traits of the sweet cherry species along with the climate and technology elements act simultaneously on the biological processes. The studied sweet cherry cultivars faced temperatures below 0°C during the phenophases between the swelling of the buds and the full bloom.

During the three years of study, the annual average temperature was 10.7°C in 2018, 11.4°C in 2019 and 11.7°C in the first seven months of 2020 (with a multiannual average of 10.2°C). In March 2019 and 2020, the recorded temperatures were between -2.2°C and -6.2°C (when the sweet cherry tree was in the swelling of the buds phenophase) and in the first days of April 2020, the recorded temperatures were between -1.3°C and -5.9°C, exceeding the resistance threshold of the buds, flowers and young fruits (during this period, the cherry tree was in the bloom phenophase).

By sectioning the flower buds before bloom and after full bloom, it was noticed that the gynoecium had damages at either the ovary or style level highlighted by the necrosis of either of them (Figure 1).

Thus, under the spring conditions of 2019 and 2020, the studied cultivars had a degree of damage of the generative organs in the flower buds between 16.5% (Margonia) and 35% (Scorospelka) (Table 1).

All the studied cultivars present middle vigour, excepting ‘Scorospelka’ and ‘Stella’ that present a strong vigour (Table 1).

The year 2018 was when the sweet cherry started the vegetation process approximately two weeks later than 2019 and 2020 (Table 2).

During the studied period, the bud opening phenophase in the 12 studied cultivars was recorded between the 8th of March and the 8th of April, the beginning of bloom between the 1st and the 16th of April and the end of bloom between the 10th and the 28th of April, having the bloom duration between 4 days for cultivar ‘George’ and 14 days for cultivar ‘Bucium’ (Table 2).

The harvesting maturity was recorded in the decades II-III of May for the early cultivars (Cetăţuia, Cătălina, Scorospelka, Rivan), over the first two decades of June for the cultivars with medium season of maturation (Bucium, Maria, Van, Stella and Kordia), in decade III of June and decades II and I of July for the late cultivars (Croma, Margonia, George). The number of days between the end of bloom and fruits ripening was between 35 days (Cetăţuia, Rivan) and 92 days (George) (Table 2; Figure 2).

By analyzing the fertility coefficient through free pollination on the averages of the 3 years of study, it was noticed that all the sweet cherry cultivars are highly productive because the values of this marker are above 30%, excepting ‘Kordia’ (Table 2).

The main physical-chemical characteristics of the fruits are detailed in table 3.

The quality of the sweet cherries was set mainly by the aspect of the fruits (size, colour), the size of the stone and the fruits’ content in soluble dry substance (Sestraş, 2004). The average weight of a fruit recorded values between 5.9 g (Rivan) and 8.6 g (Bucium) and the equatorial diameter recorded values between 21.6 mm (Rivan) and 25.4 mm (Bucium and Van). Cultivars Bucium, Croma, Van, Maria, Stella, Cătălina, Margonia and George have large fruits (above 7 g and with the equatorial diameter above 22.5 mm), while the others according to the UPOV questionnaire fit in the group of cultivars with medium-sized fruits (Kordia, Scorospelka, Cetăţuia and Rivan) (table 3). Scorospelka, Cetăţuia and Rivan have large fruits in comparison with other early cultivars.

In terms of stone size, the cultivars recorded a weight between 0.24 g (Scorospelka) and 0.35 g (Bucium, Cătălina and Margonia), classifying as small to middle size according to the UPOV questionnaire. The fruit/stone ratio was 18.6 (Rivan) and 27.7 (Maria) (Table 3).

The fruits’ colour for the twelve cultivars vary from whitish yellow (Margonia), bright red (Scorospelka and Rivan), shiny red (Maria, Van and George) to dark red (Bucium, Croma, Cătălina, Kordia and Cetăţuia).
The content in soluble dry substance is highly important in sweet cherries, as the taste of the fruits depends to a large extent on it. A number of researchers consider that in Central Europe, due to the climate conditions, the content above 13.5% of SDS is satisfactory in early sweet cherry cultivars (Dolenc & Štampar, 1998). In this study, this parameter varied between 13.6% (‘Scorospelka’ and ‘Rivan’) and 18.9% (‘Maria’), cultivars ‘Maria’, ‘Bucium’ and ‘George’ recording statistically superior values in comparison with the other cultivars (Table 3).

4. Conclusions

Considering the parameters that decide the value of the cultivars, respectively their resistance to the limiting factors of production, bloom sequencing, productivity, the quality of fruits and the consumption of sweet cherries for as long as possible, it is being suggested that all the studied cultivars should be part of the sweet cherry assortment for the influence area of the Research Station for Fruit-Growing Iaşi.

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Tables and Figures

Table 1. Tree’s vigour and the resistance to frost of the flower buds of sweet cherry cultivars (RSFG Iaşi; average of 2019-2020)

| Cultivar | Tree’s vigour¹ | Resistance to frost of the generative organs in flower buds (%)² | 2019 | 2020 | Average³ | Difference against the variants average | Significance |
|----------|----------------|---------------------------------------------------------------|------|------|---------|----------------------------------------|--------------|
| Cetăţuia | 5              |                                                               | 12   | 24   | 18.0    | -6.3                                   | -ns          |
| Cătălina | 5              |                                                               | 20   | 27   | 23.5    | -0.8                                   | -ns          |
| Scorsospelka | 7          |                                                               | 31   | 39   | 35.0    | +10.7                                  | +ns          |
| Rivan    | 5              |                                                               | 21   | 34   | 27.5    | +3.2                                   | +ns          |
| Bucium   | 5              |                                                               | 21   | 29   | 25.0    | +0.7                                   | +ns          |
| Maria    | 5              |                                                               | 25   | 23   | 24.0    | -0.3                                   | -ns          |
| Van      | 5              |                                                               | 15   | 40   | 27.5    | +3.2                                   | +ns          |
| Stella   | 7              |                                                               | 25   | 37   | 31.0    | +6.7                                   | +ns          |
| Kordia   | 5              |                                                               | 15   | 19   | 17.0    | -7.3                                   | -ns          |
| Croma    | 5              |                                                               | 18   | 20   | 19.0    | -5.3                                   | -ns          |
| Margonia | 5              |                                                               | 15   | 18   | 16.5    | -7.8                                   | -ns          |
| George   | 5              |                                                               | 27   | 29   | 28.0    | +3.7                                   | +ns          |

¹- tree’s vigour grade on a scale of 1-9: 1 = very weak; 3 = weak; 5 = middle; 7 = strong; 9 = very strong (***, 2006).

²- 5% LD = 55.8 %; 1% LD = 78.9 %; 0.1% LD = 112.7 %; ns- non-significant differences.

Table 2. The main fructification phases of the sweet cherry cultivars (RSFG Iaşi; average of 2018-2020)

| Cultivar/ Phenophase | Bud opening (date) | Bloom start (phase E) | Bloom end (phase G) | Bloom duration (no. of days) | Fruits’ maturation date | No. of days between the end of bloom and maturation | Natural fertility (%) |
|----------------------|--------------------|-----------------------|---------------------|------------------------------|------------------------|----------------------------------------------------|-----------------------|
| Cetăţuia             | 25.03-04.04        | 06 - 10.04            | 11 - 19.04          | 6 - 10                       | 15 - 24.05             | 35 – 36                                            | 64.1                  |
| Cătălina             | 20.03-08.04        | 01 - 10.04            | 10 - 19.04          | 10                           | 22 - 28.05             | 36 – 43                                            | 31.4                  |
| Scorsospelka         | 23.03-04.04        | 06 - 09.04            | 12 - 17.04          | 7 – 9                        | 18 - 28.05             | 37 – 42                                            | 30.0                  |
| Rivan                | 26.03-08.04        | 06 - 12.04            | 18 - 20.04          | 9 - 13                       | 07 - 18.06             | 35 – 42                                            | 33.7                  |
| Bucium               | 24.03-07.04        | 06 - 13.04            | 19 - 20.04          | 8 – 14                       | 07 - 20.06             | 51 – 61                                            | 36.8                  |
| Maria                | 20.03-07.04        | 06 - 09.04            | 12 - 19.04          | 7 – 11                       | 09 - 20.06             | 59 – 63                                            | 66.2                  |
| Van                  | 23.03-08.04        | 07 - 13.04            | 18 - 20.04          | 5 – 6                        | 08 - 16.06             | 59 – 60                                            | 37.8                  |
| Stella               | 24.03-08.04        | 07 - 11.04            | 12 - 20.04          | 6 – 10                       | 11 - 17.06             | 59 – 62                                            | 30.4                  |
| Kordia               | 23.03-08.04        | 06 - 13.04            | 11 - 19.04          | 6 – 7                        | 08 - 21.06             | 59 – 65                                            | 21.8                  |
| Croma                | 21.03-07.04        | 09 - 16.04            | 19 - 23.04          | 8 – 11                       | 20 - 26.06             | 63 - 65                                            | 34.4                  |
| Margonia             | 21.03-08.04        | 14 – 16.04            | 23 – 28.04          | 10 – 13                      | 20.06 - 01.07          | 59 - 65                                             | 55.1                  |
| George               | 20.03-08.04        | 10 – 16.04            | 13 - 21.04          | 4 – 6                        | 12 – 16.07             | 87 - 92                                             | 32.3                  |
Table 3. The physical-chemical traits of the sweet cherry cultivars (RSFG Iaşi; average of 2018-2020)

| Cultivar | The fruit’s average weight (g)<sup>1</sup> | The equatorial diameter of the fruit (mm)<sup>1</sup> | The stone’s average weight (g)<sup>1</sup> | Fruit/stone ratio<sup>1</sup> | The fruit’s colour<sup>1</sup> | SDS %<sup>1</sup> |
|----------|-------------------------------------------|-------------------------------------------------|------------------------------------------|-----------------------------|-------------------------------|-----------------|
| Bucium   | 8.6<sup>a</sup>                           | 25.4<sup>a</sup>                                | 0.35<sup>a</sup>                         | 24.8<sup>ab</sup>          | Dark red                      | 18.3<sup>ab</sup>|
| Croma    | 7.7<sup>ab</sup>                          | 24.4<sup>b</sup>                                | 0.30<sup>b</sup>                         | 26.0<sup>c</sup>           | Dark red                      | 17.4<sup>c</sup>|
| Van      | 7.7<sup>b</sup>                           | 25.4<sup>a</sup>                                | 0.30<sup>b</sup>                         | 26.1<sup>ab</sup>          | Shiny red                     | 17.8<sup>bc</sup>|
| Maria    | 7.4<sup>b</sup>                           | 24.6<sup>b</sup>                                | 0.27<sup>b</sup>                         | 27.7<sup>c</sup>           | Shiny red                     | 18.9<sup>c</sup>|
| Stella   | 7.4<sup>b</sup>                           | 23.0<sup>b</sup>                                | 0.31<sup>b</sup>                         | 23.7<sup>bc</sup>          | Shiny red                     | 17.0<sup>c</sup>|
| Cătălina | 7.3<sup>b</sup>                           | 23.6<sup>cd</sup>                               | 0.35<sup>b</sup>                         | 21.4<sup>c</sup>           | Dark red                      | 16.0<sup>c</sup>|
| Margonia | 7.3<sup>b</sup>                           | 23.6<sup>cd</sup>                               | 0.35<sup>b</sup>                         | 20.8<sup>c</sup>           | Whitish yellow                | 15.9<sup>c</sup>|
| George   | 7.3<sup>b</sup>                           | 22.7<sup>e</sup>                                | 0.34<sup>b</sup>                         | 21.5<sup>c</sup>           | Shiny red                     | 18.1<sup>c</sup>|
| Kordia   | 6.3<sup>c</sup>                           | 22.1<sup>e</sup>                                | 0.30<sup>b</sup>                         | 20.8<sup>c</sup>           | Dark red                      | 16.5<sup>c</sup>|
| Scorospelka | 6.2<sup>c</sup>                         | 22.3<sup>dc</sup>                               | 0.24<sup>b</sup>                         | 25.8<sup>bc</sup>          | Bright red                    | 13.6<sup>c</sup>|
| Cetăţuia | 6.0<sup>c</sup>                           | 22.0<sup>e</sup>                                | 0.31<sup>b</sup>                         | 21.3<sup>c</sup>           | Dark red                      | 14.4<sup>c</sup>|
| Rivan    | 5.9<sup>c</sup>                           | 21.6<sup>de</sup>                               | 0.32<sup>b</sup>                         | 18.6<sup>c</sup>           | Bright red                    | 13.6<sup>c</sup>|

¹- different letters correspond with the significant statistical difference for P ≤ 5%, Duncan test.

Fig. 1. Aspects with the gynoecium for the sweet cherry flower buds:
- a – the white button phenophase (the necrotized ovary and the style);
- b – the bloom phenophase (the necrotized ovary and style);
- c – viable ovary and style
### Cultivar Maturation Period

| Cultivar | May | June | July |
|----------|-----|------|------|
|          | II  | III  | I    | II  | III  | I    | II  |
| Cetățuia |     |      |      |      |      |      |      |
| Scorospelka | |      |      |      |      |      |      |
| Cătălina |     |      |      |      |      |      |      |
| Rivan    |     |      |      |      |      |      |      |
| Bucium   |     |      |      |      |      |      |      |
| Van      |     |      |      |      |      |      |      |
| Kordia   |     |      |      |      |      |      |      |
| Maria    |     |      |      |      |      |      |      |
| Stella   |     |      |      |      |      |      |      |
| Croma    |     |      |      |      |      |      |      |
| Margonia |     |      |      |      |      |      |      |
| George   |     |      |      |      |      |      |      |

**Fig. 2.** The sequencing of fruits' maturation in the studied sweet cherry cultivars (2018 – 2020)