

Vegetative propagation of cornelian cherry (*Cornus mas* L.) selections

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Abstract

Cornelian cherry (*Cornus mas* L.) is one of the most valuable fruit shrubs of the Cornaceae family, and therefore the vegetative propagation of the valuable selections is necessary because the material obtained must be used for the future. 4 genotypes were studied (2 perspective selections: H1 and H3 and two cultivars used as a control: 'De Bucovăț' (B) and 'De Orhei' (O) and propagated by grafting (the grafting method used was improved copulation. Biometric observations were focused on diameter below the point of graft (mm), diameter at the graft point (mm), diameter above the graft point (mm), height of graft (cm), number of anticipated, average length of the anticipated (cm), the sum of the anticipated length (cm), the growth increase (cm). Based on the results obtained, it can be concluded that the grafting method, enhanced copulation, within vegetative propagation, can be successfully used in the production of cornelian cherry planting material next to the other known methods; the growth of the anticipated shoots on plant could cause the appearance of flowering buds and implicitly earliness in fruit-setting.

Keywords: *Cornus mas* L.; genotypes; grafting; propagation

Introduction

Cornelian cherry (*Cornus mas* L.) Cornaceae family, which grows in many European countries, without commercial plantations (Fedosova and Luigi, 2012). Cornelian cherry is an economically important fruit species due to nutrient rich fruits, which contain a high amount of ascorbic acid. They can be consumed fresh or processed as jelly, compote, juice, jam, syrup or various alcohol-based preparations (Darrow, 1975; Ivanicka and Cvopa, 1977; Pirlak, 2000; Cosmulescu *et al.*, 2019). As in spontaneous flora there are populations obtained through seeds, with cross pollination, the variability is high (Cornescu and Cosmulescu, 2017; Cornescu Fratutu and Cosmulescu 2019; Cosmulescu and Cornescu, 2020) and productivity is variable; thus, the vegetative propagation of valuable selections is indispensable (Pirlak, 2000). Plants obtained from seeds can be different from mother plants in terms of size, shape and quality of fruits. In the last decades the interest for cornelian cherry fruits has increased significantly and the demand for biological material for setting up plantations cannot be satisfied due to the lack of information on propagation methods. Investigating the natural gene pool and breeding new cultivars of Cornelian cherry depends on efficient propagation (Klimenko,

2004). Biological material obtained generatively can only be fruitful in the year 6-8 after planting, as opposed to the biological material obtained by various methods of vegetative propagation, in which the fruit-setting begins as early as the year 2-3 (Klymenko *et al.*, 2017). The main propagation method is that of grafting with buds on rootstocks obtained from seeds (Fedosova and Luigi, 2012). Also, the clonal propagation of cornelian cherry by cuttings allows the production of propagating material for the selected valuable genotypes (Hassanpour *et al.*, 2014; Marković *et al.*, 2017). Maghradze *et al.* (2009) reported that budding is the main method of cornelian cherry propagation in Georgia region. In Serbia, the main techniques for the vegetative propagation were budding on seedling rootstocks with 85.9-93.0% success rate and rooting of green cuttings (Ognjanov *et al.*, 2009).

The present study aimed at the vegetative propagation, by grafting, of valuable and perspective cornelian cherry selections, in order to preserve their genetical characteristics.

Materials and Methods

The study was carried out at the University of Craiova, Ramnicu-Valcea Fruit and Vegetable Research & Development Station. Biological material taken into the study was propagated by grafting method with detached branch using improved copulation. The four cornelian cherry genotypes (2 perspective selections: H1 and H3 and 2 cultivars of 'De Bucovăț' (B) and 'De Orhei' (O) considered as control, were grafted onto generative rootstocks. At the end of vegetation period of the year 2018 and 2019, the following determinations were made: diameter below grafting point (mm), diameter at the grafting point (mm), diameter above the grafting point (mm), graft height (cm), growth increase (cm), number of anticipated, average length of anticipated (cm), average sum of anticipated length (cm). In order to determine the diameter of biological material, the ultra-fast display calliper with 0.01 mm precision was used and measurements were made 5 cm below and above the grafting point, and also at the grafting point (Figure 1). For the height of graft and the length of the anticipated, the measuring tape / meter was used. Data obtained from determinations were processed using the statistical program (StatPoint Technologies, Warrenton, VA, USA).



Figure 1. Cornelian cherry (*Cornus mas* L.) plant and fruits

Results and Discussion

The obtained seedling material was monitored in the nursery for two years. As control were used two cultivars 'De Bucovăț' and 'De Orhei', grafted under the same conditions with valuable selections H1 and H3. Table 1 shows the results regarding the values obtained for the diameter at the grafting point, below and above the grafting point and the graft / rootstock ratio. There were significant differences between the genotypes studied in terms of characteristics examined. As results from measurements made both in 2018 and 2019, it is observed that the diameter below the grafting point recorded the lowest average value in the control cultivar 'De Bucovăț', respectively 7.93 mm (2018) and 10.48 mm (2019), and the highest in 'De Orhei' control cultivar, respectively, 10.93 mm (2018) and 13.00 mm (2019). Unlike the two cultivars taken as a control, the selected genotypes H1 and H3 presented intermediate values, 7.94 mm (H3) and 8.49 mm (H1) in 2018, respectively, 12.21 mm (H3) and 11.46 mm (H1) in 2019. An average variability for this characteristic was observed in H1, 'De Bucovăț' and 'De Orhei' genotypes (CV% = 12.27-13.77), and high variability in H3 (CV% = 21.12). Regarding the diameter at the grafting point, the average values in 2018 varied between 8.59 mm in 'De Bucovăț' and 12.88 mm in 'De Orhei'. H1 and H3 selections recorded average values between 8.81 mm (H3) and 9.35 mm (H1). In 2019, the average diameter at the grafting point recorded the lowest average values in H1 genotype (14.39 mm) and 'De Bucovăț' control cultivar (13.46 mm), and the highest average value in 'De Orhei' control cultivar (17.50 mm). The diameter above the grafting point recorded the lowest value in 2018 in H1 genotype (6.33 mm) and the highest in 'De Orhei' cultivar (8.57 mm), and in 2019 it had values between 9.11 mm ('De Bucovăț') and 11.36 mm (H3). The authors observe the relatively high variability in the biological material under study. The results obtained are in accordance with those of the literature. Bijelic *et al.* (2016) reported a diameter of plants obtained by grafting in the spring season, with values between 10.00 mm and 13.61 mm. The ratio between the graft diameter and rootstock diameter (measured at 5 cm from the graft point) recorded subunit values between 0.86 and 0.93 (in the second year of observation), which indicates a good compatibility between the two partners.

Table 1. Average growth diameter in biologic material of Cornelian cherry in training fields of nursery (2018-2019)

| Specification | Statistic | Average diameter under grafting point (mm) | | Average diameter at the grafting point (mm) | | Average diameter above the grafting point (mm) | | Graft/ rootstock ratio |
|---------------|-----------|--|-----------------|---|----------------|--|----------------|------------------------|
| | | 2018 | 2019 | 2018 | 2019 | 2018 | 2019 | |
| H1 | Mean±SD | 8.49 ±1.04 | 11.46 ±1.89 | 9.35 ±1.41 | 14.39 ±2.16 | 6.33 ±0.87 | 9.88 ±1.72 | 0.86 |
| | Cv% | 12.27 | 16.46 | 15.03 | 15.03 | 13.73 | 17.45 | |
| H3 | Mean±SD | 7.94 ±1.68 | 12.21 ± 2.49 | 8.81 ±2.14 | 15.37 ±3.07 | 7.31 ±1.86 | 11.36 ±2.41 | 0.93 |
| | Cv % | 21.12 | 20.41 | 24.3 | 19.97 | 25.39 | 21.23 | |
| De Bucovăț | Mean±SD | 7.93 ±1.09 | 10.48 ±2.09 | 8.59 ±1.31 | 13.46 ±3.03 | 6.49 ±1.13 | 9.11 ±2.17 | 0.87 |
| | Cv% | 13.77 | 20.00 | 15.27 | 22.52 | 17.46 | 23.87 | |
| De Orhei | Mean±SD | 10.93 ±1.36 | 13.00 ±1.55 | 12.88 ±3.28 | 17.50 ±7.62 | 8.57 ±1.64 | 11.17 ±3.47 | 0.86 |
| | Cv% | 12.44 | 11.91 | 25.44 | 43.56 | 19.14 | 31.10 | |

SD=Standard deviation; CV%= coefficient of variation

The area of the trunk section area (SST) was also calculated in order to observe in section the increase in the symbionts' thickness (Table 2). The highest calculated value of the trunk section area, at the grafting point, was observed in 'De Orhei' cultivar, 135.92 mm² in 2018, respectively, 270.00 mm² in 2019. The values recorded in H1 and H3 selections (165.89 mm², respectively, 191.69 mm²), were higher than 'De Bucovăț' cultivar (148.30 mm²) and lower than 'De Orhei' cultivar (270.00 mm²), taken as a control. Regarding the other morphological determinations of quality of the examined seedling material, in Table 3 are presented the values of growth elements such as the graft height over the two years, the growth increase, the number of anticipated in the 2nd year after grafting, the length and the sum of their average length. Thus, the graft presented a height between 18.76 cm (H1) and 23.50 cm (H3) with limits of variation between 5 cm (H1) and 50 cm in 'De Orhei' in 2018, and in 2019 the average value of the height varied between 62 cm in 'De Orhei' and 103 cm (H3), with limits of variation between 32 cm in 'De Orhei' and 116 cm (H3). The variability for graft height was very high, in all genotypes analysed. The values obtained are in accordance with those obtained by Bijelic *et al.* (2016), respectively, 74.02 cm and 91.18 cm. Based on the values recorded for the height increase of the graft over the two years, the growth gain was calculated, which achieved the highest average value in H3 selection (80.17 cm), and the lowest in 'De Orhei' cultivar (39.67 cm), with limits of variation between 18 cm 'De Bucovăț' and 100 cm (H1). It is thus observed that the H1 and H3 selected genotypes taken under study showed a higher growth rate than 'De Bucovăț' and 'De Orhei' cultivars, taken as a control. Regarding the number of anticipated shoots/trees in the 2nd field of the nursery (2019), it showed variation limits between 1 (H1) and 12 (H3), unlike Bijelic *et al.* (2016) which reported between 4 and 5 anticipated. The average length of the anticipated ones was relatively higher in the two selections (H1 and H3) compared to control cultivars ('De Orhei' and 'De Bucovăț'), and the variation limits were between 8 cm (H1) and 29 cm (H3 and 'De Orhei'). The average sum of anticipated shoots per plant has recorded higher values in H1 and H3 selections, compared to 'De Orhei' and 'De Bucovăț' cultivars taken as control.

Table 2. Area of trunk section (SST) in cornelian cherry biologic material in training fields of nursery (2018 and 2019)

| Specification | Analysis | SST under graft point (mm ²) | | SST at the graft point (mm ²) | | SST above graft point (mm ²) | |
|---------------|----------|--|----------------|---|--------------|--|-------------------|
| | | 2018 | 2019 | 2018 | 2019 | 2018 | 2019 |
| H1 | Mean± SD | 57.40±13.76 | 105.71± 34.83 | 70.10±21.67 | 165.89±49.53 | 32.00 ± 8.55 | 78.82 ±27.56 |
| | CV% | 23.96 | 32.95 | 30.91 | 29.85 | 26.71 | 34.96 |
| H3 | Mean± SD | 51.3 ±20.22 | 121.11 ± 49.15 | 63.88± 30.29 | 191.69±74.52 | 44.20 ± 21.12 | 105.05 ± 42.69 |
| | CV% | 39.41 | 40.58 | 47.41 | 38.87 | 47.78 | 40.64 |
| 'De Bucovăț' | Mean± SD | 50.20±13.19 | 89.01± 34.48 | 59.09 ± 18.30 | 148.30±72.35 | 33.87 ±11.50 | 68.18 ± 32.70 |
| | CV% | 26.08 | 38.74 | 30.97 | 48.78 | 33.96 | 47.96 |
| 'De Orhei' | Mean± SD | 94.66±24.13 | 133.85±32.56 | 135.92±62.76 | 270±235.41 | 59.02 ±20.84 | 104.26 ± 65.60 |
| | CV% | 25.48 | 24.32 | 46.17 | 86.97 | 35.91 | 62.91 |

Table 3. Morphological properties of one-year nursery plants four selection of cornelian cherry

| Specification | Statistic | Graft height (cm) | | Growth increase (cm) | Number of anticipated | Average length of anticipated (cm) | Average sum of anticipated (cm) |
|---------------|-----------|-------------------|-------------|----------------------|-----------------------|------------------------------------|---------------------------------|
| | | 2018 | 2019 | | | 2019 | 2019 |
| H1 | Mean±SD | 18.76±10.98 | 79.71±19.56 | 60.95 ±20.86 | 4.47±2.48 | 18.42 ±7.15 | 82.34 |
| | CV% | 58.52 | 23.54 | 34.62 | 55.43 | 38.79 | - |
| H3 | Mean±SD | 23.50±11.83 | 103.67±8.69 | 80.17 ± 9.02 | 5.67±3.67 | 13.62 ±3.80 | 77.23 |
| | CV% | 55.33 | 8.38 | 11.25 | 64.76 | 27.90 | - |
| 'De Bucovăț' | Mean±SD | 20.33±13.38 | 72.00±31.46 | 51.67±23.82 | 4.50±2.17 | 11.49 ±5.57 | 51.71 |
| | CV% | 65.81 | 43.70 | 46.1 | 48.18 | 48.44 | - |
| 'De Orhei' | Mean±SD | 22.33±24.01 | 62.00±42.79 | 39.67 ±19.76 | 3.33 ±1.15 | 18.33 ± 10.07 | 61.00 |
| | CV% | 107.49 | 69.02 | 49.8 | 34.64 | 54.91 | - |

Conclusions

The difference in growth between the 2 symbionts (5 cm below and above the grafting point) is insignificant and thus the values of graft and rootstock ratio are low, indicating a good compatibility between the partners. The increase in graft height over 79.00 cm in H1, respectively, 103.00 cm in H3, and the production of the anticipated in the 2nd field of nursery indicate a good development especially in the two studied selections. The growth of the anticipated shoots on plant could cause the appearance of flowering buds and implicitly earliness in fruit-setting. Based on the results obtained, it can be concluded that the grafting method, enhanced copulation, within vegetative propagation, can be successfully used in the production of cornelian cherry planting material next to the other known methods.

Authors' Contributions

Conceptualization: SC, FC and GA; Data curation: SC and GA; Methodology: GA; Writing: FC; Writing - review and editing: SC. All authors read and approved the final manuscript.

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Conflict of Interests

The authors declare that there are no conflicts of interest related to this article.

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