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GROWTH BEHAVIOUR OF THE FLORINA CULTIVAR GRAFTED ON THE M9 ROOTSTOCK WITH DIFFERENT ORIGIN

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Abstract

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The experiment was conducted from 2011 to 2014 in the experimental field of the Fruit growing department at the Agricultural University – Plovdiv, located near the village of Brestnik. The growth behaviour of the Florina cultivar grafted on the M9 rootstock was studied. The M9 rootstock had been produced in a stoolbed from plants with three different origins: from adventive buds at the roots; by clonal micropropagation technology and by somatic organogenesis from leaf explants. The highest thickening speed of the rootstocks in nursery, measured by the end of June, is observed in respect to the plants derived through somatic organogenesis. This also suggests earlier cambial activity. The vegetative growth of the cultivar slows down at the end of the first half of July. The highest total vegetative growth of the cultivar is achieved by the plant derived of the rootstock through somatic organogenesis from leaf explants.

Key words: nursery; apple rootstocks; somatic organogenesis

Introduction

Clonal micropropagation constitutes the most frequently used *in vitro* system for the production of apple rootstocks (Ivanova, 1988). Recently, somatic organogenesis has gained popularity as a new biotechnological method with a growing application in fruit-growing. Somatic organogenesis allows for the structuring of new meristems from cells of somatic tissue. It is expected that the meristem centers in the newly produced plants originate from cells with suppressed genes; thereby, leading to the emergence of plants with new characteristics (Martelli et al., 1993). The new in vitro method is also employed in the production of apple rootstocks through leaf regeneration (Dobrevska, 2008, 2013). Thus, the method is considered as a more effective way for producing apple propagation material.

The current study explores the growth behaviour of the moderately growing Florina cultivar grafted on rootstocks which in turn are produced in a stoolbed by using plants with different origin: root shoots (Trachev et al., 1975), generally applied clonal micropropagation technology (Ivanova, 1988), as well as, somatic organogenesis of leaf explants (Dobrevska, 2008).

Domestic and foreign researchers have analysed different nursery-based rootstock types and cultivars where the used rootstocks are derived from adventive buds at the roots (Pepelyankov and Dobrevska, 1995; Spahiu et al., 2013). Studies also focus on analysing the growth manifestations of plants produced in a stoolbed with clonal micropropagation origin, as well as, the behaviour of some apple rootstocks in a nursery (Webster and Jones, 1989; Webster and Jones, 1992; Quamme and Hogue, 1994; Dobrevska and Zhelev, 2007).

The impact on grafted cultivars of rootstocks, whose origin is also clonal micropropagation, is compared with those whose mother plants originate from root cuttings (Eugene and Neilsen, 1991; Czynczyk et al., 2002; Czynczyk et al., 2003; Czynczyk et al., 2007).

Dobrevska and Ivanova (2004) monitor the growth behaviour of M9 and MM106 which are developed by the somatic

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organogenesis method through leaf explants in a nursery (1st year). The authors conclude the existence of morphological changes but it is unclear whether the latter are somehow related to basic genotype. It is also suggested that further studies are necessary for finding evidence whether the application of somatic organogenesis in the studied rootstocks can enhance the main function of rootstocks – facilitating the growth potential of the grafted cultivars (Martelli et al., 1993).

The specific research topic has not been explored so far. Our intent is to observe growth behaviour of the Floriva cultivar grafted on the M9 rootstock with different origin.

Materials and Methods

The experiment is conducted in a nursery located in the experimental field of the Fruit growing department at the Agricultural University- Plovdiv, near the village of Brestnik (Plovdiv region).

The studied Florina cultivar plants are grafted on a M9 rootstock which in turn is produced in a stoolbed by using plants with three different origins: adventive buds at the roots; clonal micropropagation technology, as well as, somatic organogenesis from leaf explants.

The experiment follows the Fisher block method (Zapryanov and Marinkov, 1978). Each variation includes four repetitions with ten plants in each repetition. After the completion of the planting procedures, the plants are grown following the generally applied methods for working in a nursery.

The following indicators are monitored: rootstock thickness growth dynamics, mm; cultivar thickness growth dynamics, mm; cultivar height growth dynamics, cm; cultivar central axis height, cm; feather twigs length of the cultivar, cm; total growth of the cultivar, cm. The collected statistical data are analysed with the ANOVA method.

Results and Discussion

In a 1st year nursery, the plants with the thickest rootstocks have a clonal micropropagation origin, followed by those with a somatic organogenesis one. The thinnest rootstocks are observed among the plants developed from adventive buds. The highest rate of thickening is maintained up to the end of the second third of June among the rootstocks with somatic organogenesis origin. After that, the rate of thickening slows down and corresponds to the performance of the other two moderately growing variants. This dynamics indicates an earlier decrease in the cambial activity of this variant. These research results and previously available findings (Pepelyankov and Dobrevska, 1995) provide rationale to recommend an earlier grafting schedule for plants with such an origin (Figure 1).

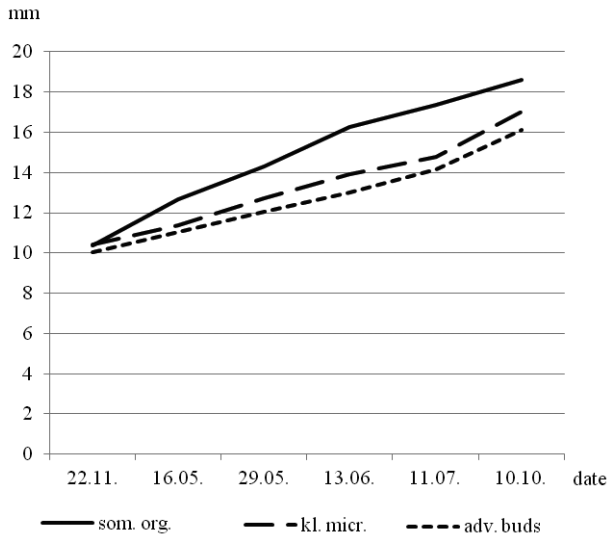

Fig. 1. Rootstock thickness growth dynamics in nursery, mm

During the early vegetation stages in a 2nd year nursery, the smallest grafting thickness is registered is respect to the rootstocks with adventive buds and clonal micropropagation origin, whereas the largest thickness is observed in the instances of somatic organogenesis origin. The latter variant also demonstrates the most consistent accelerated thickening which continues till the end of the vegetation period. In the other two options, there is an unequal rate of thickening which significantly slows down between the middle of June and the middle of July. The tendency remains consistent regarding the plants with adventive buds origin, whereas the ones with clonal micropropagation origin demonstrate an accelerated growth performance (Figure 2).

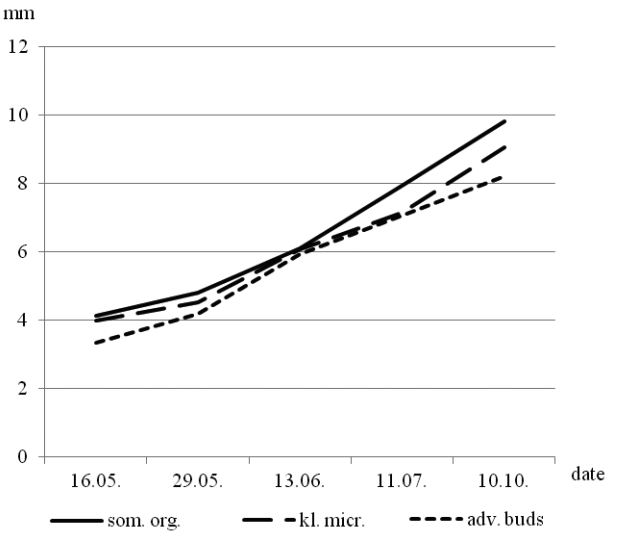

Fig. 2. Cultivar thickness growth dynamics in nursery, mm

The plants with somatic organogenesis origin demonstrate the most moderate growth rate of the central axis which continues till the middle of the vegetation period and even accelerates thereafter (Figure 3). This variant ends the vegetation period with the highest central axis of the cultivar, followed by the variants with clonal micropropagation and adventive buds origin, respectively (Table 1).

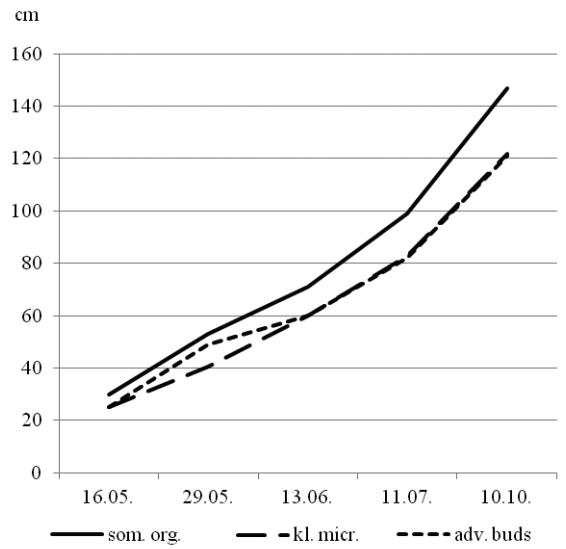

Fig. 3. Cultivar height growth dynamics in nursery, cm

Feather branching is of significant importance for the quality of the propagating material. The length of the feather does not experience any statistically significant differences in the three options. Regarding the volume of the above ground vegetative mass, the highest total growth is demonstrated by the variant with a non-traditional rootstock origin (somatic organogenesis) due to the higher central axis, whereas the smallest growth is observed in the plants with adventive buds origin (Table 1).

It can be noted from the presented charts that the vegetative growth in all options subsides at almost the same rate towards the end of the first half of July. After this period, growth acceleration in all variants is recorded again, thereby indicating a prolongation of vegetative growth. In the specific case, this is caused by the extreme climate conditions in the recent years – frequent and heavy rainfalls combined with relatively high seasonal temperatures.

The registered phenotype manifestations regarding the variant with somatic organogenesis origin are probably due to the different factors of in vitro cultivation in the preparation of the studied supposed soma clones (Dobrevska and Ivanova, 1998). This raises the question of whether the new conditions of rootstock cultivation will lead to possible changes in the propagation material. Only initial external differences are found at this stage of the study. In the future, the experiment can be further developed on the basis of higher-level analysis.

Conclusion

- The highest rate of thickening, which continues till the end of the second third of June, is observed in respect the rootstocks with somatic organogenesis origin. This development suggests earlier cambial activity. Therefore, we recommend earlier grafting.
- The natural vegetative growth of Florina cultivar subsides in the end of the first half of July in all variants.
- The largest total vegetative growth is observed in respect to the rootstock with somatic organogenesis origin due to the highest average central axis of the plants.

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Table 1
Growth indicators of Florina cultivar grafted on M9 in the nursery

Indicators / Variants	Average height of the central axis, cm	Average length of feathers, cm	Total growth, cm
Aadventive buds	121.50	24.01	145.51
Clonal micropropagation	122.00	27.23	149.23
Somatic organogenesis	147.05	29.27	176.32
Significant at 5 %	14.76	15.06	30.77

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