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TOP GRAFTING RESPONSE OF SOME PAWPAW (*ASIMINA TRILOBA* DUNAL) GENOTYPES

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Abstract

Pawpaw or Northern banana (Asimina triloba Dunal) is a recently introduced and nearly unknown fruit with high nutraceutical potential. Originated from the Eastern part of USA, is the only representative of the Annonaceae family cultivated in temperate areas. In Romania was introduced in 1926 by Ioan Suciu family in Pianu Nou, Alba County, who brought some seed from Ohio State. In the last 25 years, extended researches on the plant and new varieties were conducted at the Faculty of Horticulture within USAMV Bucharest. The pawpaw usual applied propagation method is by seeds while the new selected genotypes require grafting to be extended in production. The aim of this study is to present the top grafting response of Simina, a new Romanian variety under registration and several genotypes from Lehman collection, Illinois, USA. The new genotypes were over grafted on mature trees, planted at 4.0 x 2.0 m. The grafting shoots were placed at different height levels in the tree to compare the success rate. Number of shoots, lengths, buds and flowering were monitored with the success grafting rate.

Key words*: Lehman collection pawpaw, Northern banana, Simina.*

INTRODUCTION

Pawpaw or Northern banana (*Asimina triloba* L. Dunal) is a recently introduced and nearly unknown fruit with high nutraceutical potential (Nam et al., 2018). Originated from the Eastern part of United States of America, is the only representative of the *Annonaceae* family cultivated in temperate areas (Layne, 1996). It has the largest edible fruit native in this country (Pomper et al., 2003a). In the last years it is well known for the natural compounds (annonaceous, acetogenins) from leaf, bark, and twig tissue with insecticidal and anticancer properties (Johnson et al., 1996; Ratnayake et al., 1993; McLaughlin et al., 1986; Huang et al., 2003; Avula et al., 2018).

In Romania was introduced in 1926 by Ioan Suciu family in Pianu Nou, Alba County, who brought some seed from Ohio State (Stănică, 2012). In the last 25 years, extended researches on the plant and new varieties were conducted at the Faculty of Horticulture within USAMV Bucharest (Cepoiu et al., 2004). The pawpaw usual applied propagation method was by seeds while the new selected genotypes require other methods like top grafting for production (Stănică et al., 2002). The aim of this study is to present the top grafting response of Simina, a new Romanian variety under registration and of several genotypes from Lehman collection, Illinois, USA.

MATERIALS AND METHODS

Description of the study site and experimental design

The experience was placed in the Experimental Field of the Faculty of Horticulture, USAMV Bucharest. New genotypes were over grafted on mature trees, planted at 4.0 x 2.0 m. Six mature trees were grafted with eleven genotypes: Simina, L-NS, 250-30, G4, G6, SN-15, MJ, 275-17, VE-21, 166-66, 275-56. In the same time, several plants in containers were grafted with Simina variety using the same top grafting method.

The grafting shoots were placed at different height levels in the tree to compare the success rate. Biometric parameters like height and diameter of the grafting point, shoots length, number of the vegetative and flower buds were determined. Success grafting rate was compared.

Biological material

From the grafted genotypes, ten of them are new hybrids from Lehman collection. Simina (sin. Vitroplant 2) (Figure 1) is a new cultivar obtained by selection from hybrids achieved by pollination of Sunflower x Overleese cultivars.

The main characteristics are medium-size vigor tree with spherical crown, auto sterile, recommended as pollinating cultivars being Sunflower, Prima or Overleese.

Figure 1. Flowers of the cultivar Simina

The fruit (Figure 2) is very large (over 200 g), with irregular shape, yellowish green, covered with fine prubine, whitish. White, creamy pulp is sweet, with accentuated taste and a very fine, specific flavor.

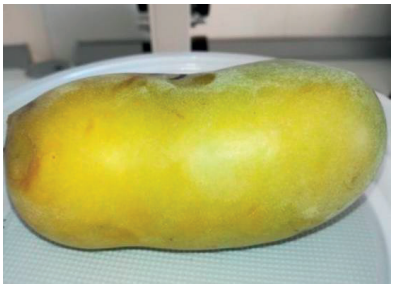

Figure 2. Fruit of Simina at maturity

Contains 23% dry matter, low acidity 0.12% (malic acid), ascorbic acid 35.2 mg/100 g, mineral substances 0.81% of which: calcium 29.79 mg/100 g, magnesium 16.91 mg/100 g and potassium 301.63 mg/100 g.

Seeds are dark brown, mugged, elliptical, large, one fruit having usually 10-12 seeds (Ştefan et al., 2018).

Statistical analysis

Data statistical analysis were performed with Excel (MS Office) and Quattro programs. Anova one-way together with T tests were used.

For correlation between two data sets Excel statistical functions with a significance level $p < 0.05$ were used (Pomohaci and Vâșcă-Zamfir, 2017).

RESULTS AND DISCUSSIONS

The MJ genotype and Simina cultivar had the best results comparing success top grafting rate after the two years taken into study (Figure 3). Genotypes SN-15, 275-17, VE-21, 166-66, 275-56 haven't results after grafting.

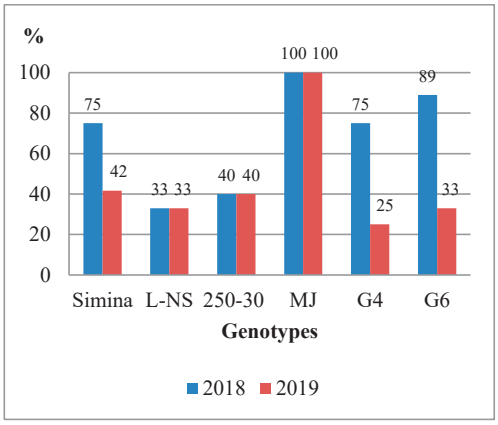

Figure 3. Success grafting rate

Simina cultivar grafted on container plants at different heights had a success grafting rate in average of 67% (Figure 4).

The results for the first year are comparable with those registered by Pomper et al. (2006), where in a rootstock trial field mortality was greatest (58%) for Susquehanna budded onto Susquehanna seedling rootstock, whereas mortality was about 25% with other scion/rootstock combinations.

In another experiment, Pomper et al. (2003b), had similar results on chip budding grafting method, where 95% of trees survived in Frankfort plot. The cultivars Wilson and Taylor had the poorest survival rate (75%). All other cultivars and advanced selections had survival rates bigger than 88%.

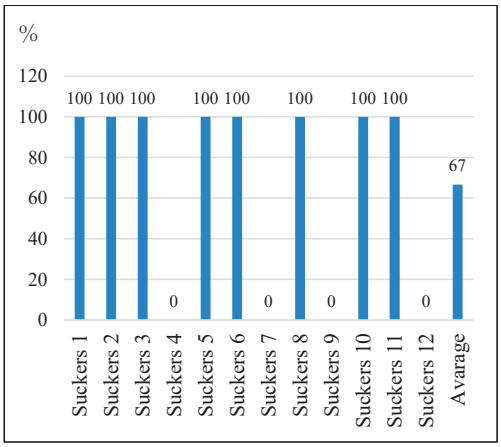

Figure 4. Simina variety success grafting rate

Grafting success rate didn't present influences from the height of grafting point at Simina cultivar (Figure 5).

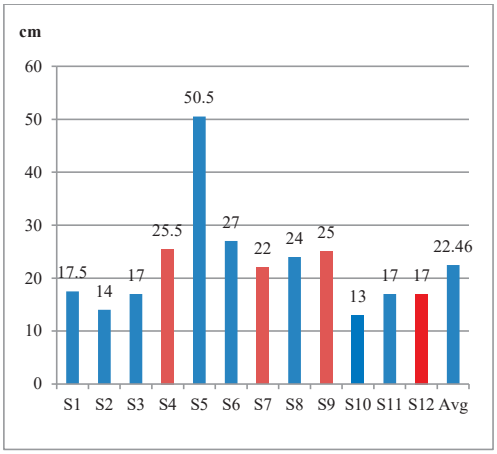

Figure 5. Influence of grafting point heights on success rate

Shoots number

For the shoots number formed on the grafted branches, the best results were obtained by the Simina cultivar, genotypes 250-30 and MJ, the last one multiplied the number of shoots four times in the second year (Figure 6).

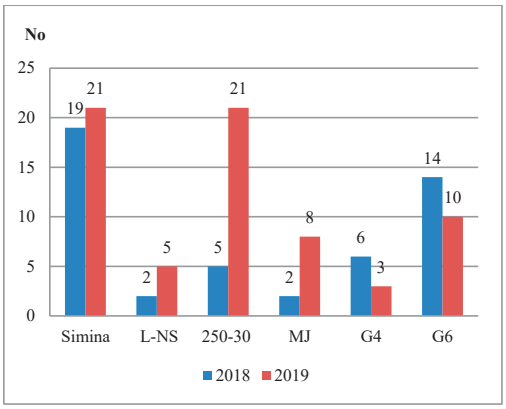

Figure 6. Shoots number formed on grafting branches

Influence of grafting point diameter

On the field trees, at Simina cultivar, viable shoots were registered for diameters of grafting point over 2.05 cm. In the pot plants, this diameter varied from 0.89 to 1.50 cm (Figure 7), without specific influence in this interval.

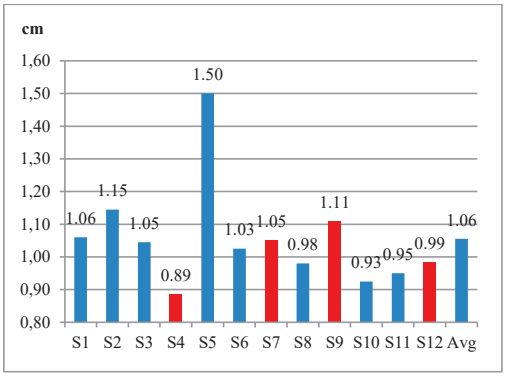

Figure 7. Influence of grafting point diameter on success rate

On L-NS genotype, the diameter varied from 1.55 to 1.65 cm without specific influence. On 250-30 genotype, the diameter varied from 1.7 to 3.67 cm, successful grafting registered on the lower values. On G4 genotype, diameter varied from 1.5 to 2.1 cm, the lowest being successful. On G6 genotype, diameter varied from 1.4 to 3.8 cm, viable shoots being on the 2.35, 3.1 and 3.8 cm.

The average grafting points diameter for these genotypes was significant positive correlated with the shoots number (in 2018: $R^2 = 0.93$, y = 7.39 x – 8.49; in 2019: $R^2 = 0.48$, y = 5.94 x – 3.88 where y = shoots number and x = average genotype diameter).

Total vegetative growth, vegetative and flowering buds

Simina cultivar with genotypes MJ and 250-30 had the most vigorous growth after two years. Comparing the second year genotypes, MJ and 250-30 had nine or eight times higher vegetative growth increase compared to the first year (Figure 8). The average grafting points diameter was significant positive correlated with the shoots length (in 2018: $R^2 = 0.78$, y = 106.79 x – 133.1; in 2019: $R^2 = 0.49$, y = 337.45 x – 399.89 where y = shoots length and x = average genotype diameter).

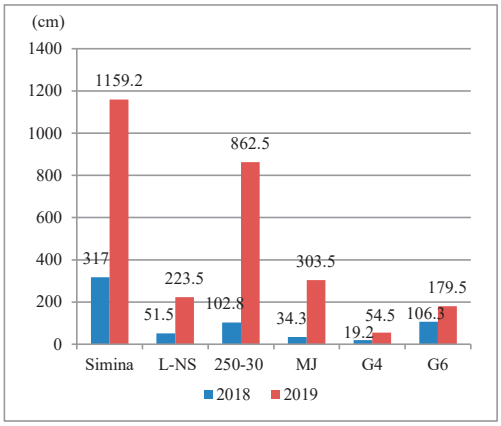

Figure 8. Total graft shoots length (cm)

On the Simina cultivar grafted on pot rootstocks, the most vigorous growth in grafted shoots were recorded on the sucker 1, grafted at 17.5 cm height with a point of grafting diameter of 1.06 cm (Figure 9).

Average shoots length at Simina grafted on field trees was 14.39 cm (2018) compared with 11.90 cm in pot plants (2018).

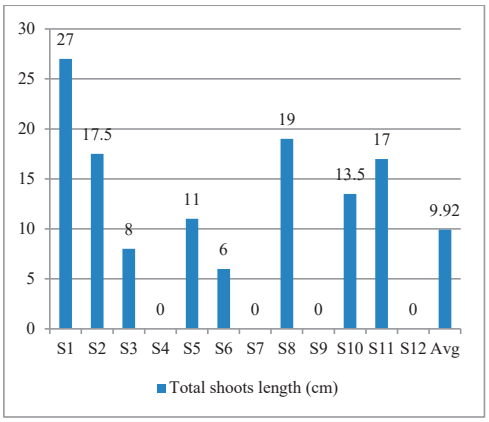

Figure 9. Total graft shoots length at Simina cultivar grafted on pot plants

Simina cultivar recorded the highest number of vegetative buds every year but MJ and 250-30 genotypes in the second year had five respectively four times higher increase rate of vegetative buds number (Figure 10). Similar significant positive correlation were registered between grafting point diameter and vegetative buds number (in 2018: $R^2 = 0.87$, y = 55.5 x – 60.83; in 2019: $R^2 = 0.53$, y = 91.73 x – 97.77 where y = vegetative buds number and x = average genotype diameter).

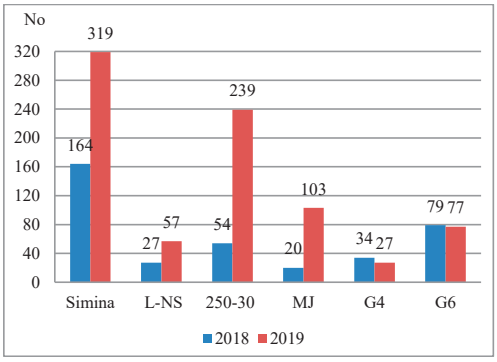

Figure 10. Number of vegetative buds on grafted shoots

On Simina grafted on pot, sucker 10 recorded the highest number of vegetative buds having the lowest height of the grafting point (13 cm) and one of the smallest diameters of the grafting point (0.93 cm) (Figures 11 and 12).

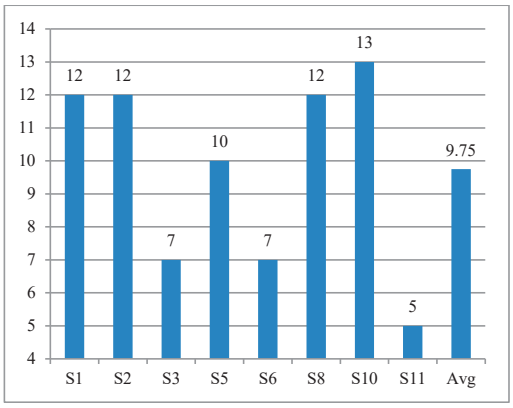

Figure 11. Number of vegetative buds on Simina grafted on pot

Figure 12. New shoots on the grafting branch

In the process of differentiation of the flower buds, the best results were recorded by the MJ genotype (28) (Figures 13 and 14) and Simina cultivar (34). No flower buds were on the pot grafted plants.

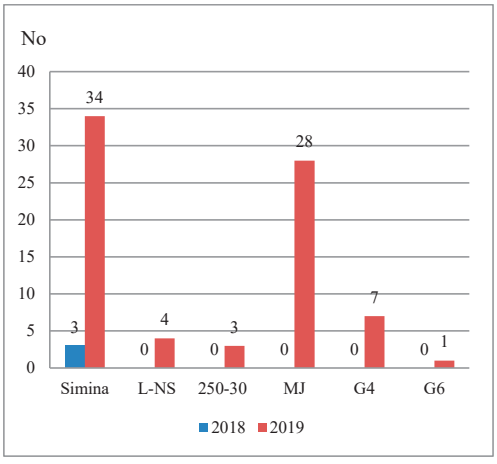

Figure 13. Number of flower buds on grafted shoots

Figure 14. Flower bud of the MJ genotype

For the percentage of flowering, the best results were recorded by the MJ genotype and the Simina cultivar (Figures 15 and 16), in the second year with a number of 17 respectively 20 flowers.

Simina was the only genotype with flowers from the first year. The genotype influenced the flower number similar with Pomper et al (2006) where Sunflower (3.46) had more flower buds per tree than Susquehanna (0.43).

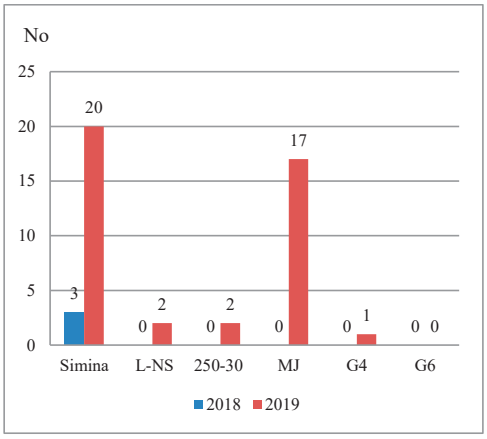

Figure 15. Number of flowers on grafted branches

Figure 16. Flower of the Simina cultivar

CONCLUSIONS

From the initial 11 genotypes, six were successful with the top grafting method. The genotype 250-30 had good results in formation of shoots, growth vigour and formation of buds.

The genotype MJ had good results in formation of shoots, growth vigour and formation of buds, differentiation of flower buds, flowers bound and grafting rate.

Simina had good results in differentiation of flower buds, flowers bound and grafting rate. Simina grafted on the mature plants in orchards had a bigger success grafting rate than the container grafted plants.

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