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# Effects of IBA Treatment and Root Thickness on Some Rooting Parameters in Root Cuttings of *Rosa damascene* Mill

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**Abstract:** In this study, the effects of IBA doses (0**,** 500 and 1500 ppm) and root thickness of the *R. damascena* Mill cuttings on rooting rates, root counts, root lengths and shoot numbers were investigated. The results showed that IBA doses significantly affected rooting rates ($p<0.05$). The highest rooting rate **(**77.67%) was obtained from thick root cuttings with 500 ppm IBA dose application. The highest root number per cutting was found as 6.00 in thick cuttings and cuttings having no IBA application. The longest root branch per cutting was determined to be in the thick root cuttings and control cuttings **(**7.93 cm). The average number of root branch per cutting was determined as 0.77 in thin root cuttings and control cuttings. To conclude, *R. damascena* can easily be propagated with root cuttings with appropriate IBA doses, suggesting that the thicker root cuttings should be chosen for *R. damascena* propagation.

**Keywords:** Rosa damascena, propagation, root cutting, root thickness, IBA.

## INTRODUCTION

Roses have been important part of human life with aesthetic, medical, religious and cultural purposes throughout history [1]. Until today, there have been about 200 natural *Rosa genus* defined in the world [2]. 26 of them grow naturally in Turkey flora [3]. The roses, which are rich in colour, shape and form, show differences according to their presence or absence. It is well known that very few of the rose species, which are colourful, single, semi-double or double flowers, have strong scent. The most important fragrant rose species are *R. damascena* Mill. *R.centifolia* L., *R. alba* L., *R. gallica* L., *R. phoenicia* Boiss, *R. canina* L. ve *R. moschata* Herrm [4]. At the same time, some of these roses are the most important species of oil roses evaluated in producing rose oil for pharmacological and cosmetic purposes.

*Rosa damascena* Mill. is a species in the *Rosa* genus belonging to the *Rosaceae* family, located in the Rosales. This species is named as "Isparta Gülü", "Şam Gülü" or "Pembe Yağ Gülü" in Turkey. The oil rose (*R. damascena* Mill.) is the most important fragrant rose species in the perfume and cosmetic industry due to its high fragrance biochemical components. Today, the rose industry has been concentrated in the Göller Yöresi (Lakes Region) in Turkey. Isparta, Burdur, Afyon, Denizli, Konya and Antalya are located in the west of the Mediterranean region and defined as the Region of Lake in Turkey. World rose flower production (*R. damascena* Mill.) was estimated as 15.000 tons approximately. In 2016, 7.250 tons rose flower was produced in this region. The calculated rose oil obtained from this production is about 7.683 L. These figures have been shown that Turkey has been in the first rank amoung rose flower (*R. damascena*) producer countries [5,4].

*R. damascena*, which has been quite important for the world and our country, can be propagated by vegetative and generative methods. In general, the oil rose has been vegetatively propagated by tissue culture, sucker, cutting, layering and grafting. Seed propagation has been mostly used in breeding studies and in obtaining rootstocks. Vegetative propagation studies have been mostly focused on stem cutting and tissue culture. Generally, in stem cutting propagation, the taking time of cutting and solutions or chemicals applied to the cuttings have been studied in *R. damascena* species. In those studies, researchers obtained rooting rates as between 3.3% to 97% [6-9]. However, there have not been any sufficient studies regarding the propagation of the *R. damascena* species with root cuttings on the literature. Therefore, in the current study, the effects of different IBA doses and root thickness on some rooting parameters of *R. damascena* root cuttings was conducted to test an alternative propagation method which was the propagation of root cutting.

## MATERIALS AND METHODS

### Sampling Plant Material

In this research, root cuttings from plants belonging to the oil rose (*R. damascena*) were used as plant materials. The trial lasted from 14 November 2016 to 22 March 2017 in Rooting Unit of Agriculture Faculty of Ahi Evran University in Kırsehir. Rose plants were removed from a rose garden in Isparta and placed in damp media to be ready for transportation. Kırsehir is located in Middle Anatolian Region while Isparta is located in the western Mediterranean Region of Turkey. Their cuttings were prepared from the roots of the roses obtained from this province in the first week of November. The cuttings, prepared about 10 cm in length, were divided into two groups according to their thickness. The cuttings were classified as fine when their diameter was ≤12.20 mm, while those were ranked as thick when their diameter were ≥24.68 mm.

### Planting of Cuttings

The root cuttings, which were cleaned and measured, were kept in different doses (0, 500 ppm and 1500 ppm) of Indole Butiric Acid (IBA) solution for 3 seconds. The cuttings taken from IBA solutions were planted according to the experimental design of coincidence parcels in peat + perlite mixture (3: 1) at temperature (under heating) and humidity control (under fogging). Trial was conducted in 3 replications each contained 15 root cuttings. In the experiment, the cuttings were placed horizontally without contacting each other on the lines drawn in the rooting environment and covered with peat and perlite mixture. The temperature of the rooting medium was kept constant at 24 °C (± 1). The humidity of rooting environment was set up manually so that the rooting medium was always kept in damp.

### Collecting Data

After the cuttings were planted in the rooting medium, the regular controls were made frequently (daily) to see if there was a problem with the fogging unit and the heating greenhouse. When necessary, ventilation was activated and the duration of fogging was reduced or increased. The cuttings were removed from the rooting medium after 130 days of planting and calculated rooting rate (%), number of roots, root branch length (cm) and number of shoots.

## STATISTICAL ANALYSIS

Rooting rate was calculated as percentage and processed with ArcSin transformation before analysis. The other data regarding the number of roots, root branch length and the number of shoot branches were subjected General Linear Model procedure of SPSS statistical software (Windows version of SPSS, release 16.00) and differences were ranked by Duncan Multiple Range Test in the same software.

## RESULTS AND DISCUSSION

In the current study, the effects of root thickness and IBA (0, 500 ppm and 1500 ppm) doses on rooting rates, number of roots, root branch length and number of shoot branch were investigated in *R. damascena* root cuttings in order to test whether it was possible propagete root cuttings of this species or not. The cuttings were rooted in rooting medium. Cutting medium was heated from underfloor (fixed) and moistened in the form of fogging from the top. The results related to rooting are presented for root thickness and IBA doses as in Table 1.

**Table-1**: **The effects of root tchikness and IBA treatment on rooting parameters**

| Parameters | IC | | | KC | | | SEM | Significance | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 500 | 1500 | 0 | 500 | 1500 | | D | RT | Dx RT |
| Rooting rate (%) | 58.00 ab | 62.00 ab | 15.67 c | 66.67 a | 77.67 a | 23.33 bc | 6.760 | 0.03 | NS | NS |
| Root number | 3.87 ab | 4.13 ab | 0.70 c | 6.00 a | 4.90 a | 1.43 bc | 0.960 | 0.03 | NS | NS |
| Root length (cm) | 5.83 ab | 6.30 ab | 1.47 b | 7.93 a | 7.07 a | 1.83 b | 0.840 | 0.014 | NS | NS |
| Shoot branch number | 0.77 a | 0.73 a | 0.10 b | 0.73 a | 0.57 ab | 0.23 ab | 0.090 | 0.018 | NS | NS |

RT: Rooting rate (%)
RN:Root numbers:
RL: Root length (cm)
SBN: Root branch number
D: Doses
RT: Root thickness
TR: Thin root≤12.20 mm,
THR: Thick root ≥24.68 mm
SEM: Standart Errror of Means

Statistical analysis showed that the effect of IBA doses on rooting rate was significant ($p<0.05$). The highest rooting rate (77.67%) was obtained from thick root cuttings with 500 ppm IBA dose. In the control group where the IBA dose was not applied in the thick root steels, a rooting rate was found out 66.67% with statistical significance with the best rooting rate. A 500 ppm IBA dose had a positive effect on rooting of root cuttings by increasing rooting rate in both thin and thick root cuttings. It was also determined that A 1500 ppm IBA dose in root cuttings reduced rooting rates, irrespective to root thickness (Table 1).The better results in terms of the average number of roots were obtained from control (6.00) and 500 ppm IBA dose (4.90) in thick root cuttings. For both thin and thick root cuttings, the lowest result was obtained from 1500 ppm IBA dose application (0.70-1.43, respectively). For hardwood stem cuttings of *R. damascena* species, Pourkhaloee and Khosh-Khui [7] obtained number of roots per rooted cutting (2.58) at 2 mM Spm plus 200 ppm IBA dose. Also, the highest number 25.03 was obtained by Sanchita et al [10] with 1000 ppm IBA and NAA doses.

The better root lengths were obtained from thick root cuttings, control and 500 ppm IBA application. In thick roots, the root lengths were measured as 7.93 cm in the control group and 7.07 cm in the 500 ppm IBA dose applicated group. Similar to rooting rate and number of roots, root length was affected adversely by 1500 ppm IBA dose with reducing its length. Pourkhaloee and Khosh-Khui [7] studied on *R. damascena* and found out that root length was 8.64 cm for hardwood cuttings at 2 mM Spm plus 200 ppm IBA dose. The number of shoot branch per thin root cutting had the highest value with a mean of 0.77 in the control group and the average value of 0.73 in the 500 ppm IBA dose in both roots thin and thick. It was found out that 1500 ppm IBA dose reduced the number of shoots per cutting in both thin and thick root cuttings. Statistical analysis showed that there was no effect of the thickness of root cutting on the studied rooting parameters rooting rate, the number of root, root lengths and the numbers of shoot branches.

Plants can be propagated both vegetative and generatively. In the vegetative propagation process, the root, stem, leaf, etc. of the plants, all parts can be used. In this research, the plant roots were used as plant materials. One of the physiological activities of plant root is to synthesize plant hormones and some organic compounds. In the natural process, roots are vegetative organs that are capable of forming new roots if they are injured or damaged. Although no studies have been done on root cuttings of *R. damascene*. Root cuttings of other plants have already been well studied. Muhammad [11] reported that in propagation work with *Paulownia elongata*, it is easier to propagate with root cuttings than to propagate with stem cuttings. Zappi [12] reported that *Bouvardia ternifolia* plant could be propagated with both stem cuttings and root cuttings.

Studies on vegetative propagation of *R. damascena* have focused on generally tissue culture and stem cuttings. Sanchita *et al.* [10] studied on rooting of stem cuttings of *R damascena* and obtained the best results from 1000 ppm IBA dosing applications; although they obtained the better results with 500 ppm IBA application for the parameters survival time of the cuttings and duration of shoot formation. Bagheri *et al.* [13] reported that the NAA and IBA hormones significantly increased the number of roots in *R damascena* in vitro. Hajian [9] obtained the highest root rate (97%) in hardwood cuttings at 3000 ppm IBA dosing. The present findings are in line with the results of the study of Pourkhaloee and Khosh-Khui [7] on *R. damascena* hardwood stem cuttings. They determined root numbers as 2.58 and root length as 8.64 cm under propagation condition of 2 mM Spm plus 200 ppm IBA dose.

The results showed that root thickness did not affect the rooting parameters in the present study. Low dose of IBA had benefical effect on rooting parameters while the high IBA dose affected the rooting negatively. Briefly, it was concluded that *R. damascena* can be easily propagated with root cuttings, suggesting that the propagation with root cuttings in the vegetative propagation of *R. damascena* can be offered as an alternative propagation method in ornamental culture or horticulture.

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