

Effect of *Aloe vera* Extract on the Cultivation Practices of *Rosa damascena* Mill

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ABSTRACT

Rosa damascena Mill., a member of the Rosaceae family, is renowned for its captivating fragrance and is widely used in the production of gulkand, rose oil, tea, and rose water. Globally, major oil-producing regions include Bulgaria, China, Iran, India, and Turkey. *Aloe vera* gel extract, rich in bioactive compounds such as salicylic acid, auxins, and gibberellins, is known for promoting plant growth and development. Despite its economic significance, cultivating Damask rose remains challenging for farmers and researchers. This study investigates the effect of *Aloe vera* gel extract and Indole-3-butyric acid (IBA) on propagation parameters of damask rose cultivars Noorjhan and Ranisahiba. Treatments included a control, IBA @ 250 ppm and *Aloe vera* gel pure extract for four hours before planting. Sprouting started in stem and observed that 80% of stem cuttings germinated

completed within one week and all cuttings were germinated in 2nd week. For Noorjhan, it resulted in the highest number of sprouts (5.50), root length (3.20 cm), and no. of roots (4.90). Similarly, Ranisahiba recorded maximum sprouts (4.40), root length (2.86 cm), and no. of roots (5.80). The survival rate of stem cuttings were recorded 97.50% with the application of *Aloe vera* gel and 96.50 % with application of IBA solution in Ranisahiba variety similarly values were recorded in Noorjahan variety 98.02% and 97.03 % by application of *Aloe vera* gel and IBA respectively. These results highlight *Aloe vera* gel extract as a natural and sustainable alternative to synthetic growth regulators, enhancing both root development and survival in Damask rose propagation.

Keywords *Aloe vera*, Damask rose, Cultivation practices, Indole butyric acid, Medicinal, Aromatic plant.

INTRODUCTION

Damask rose (*Rosa damascena* Mill.) is a highly valued aromatic and medicinal perennial plant belonging to the Rosaceae family, renowned for its distinct perfume attributes (Shabbir *et al.* 2020. Kant *et al.* 2023). Its historical significance dates back approximately 5,000 years, with evidence of cultivation in regions such as China, Western Asia, and Northern Africa. The iconic oil-bearing rose is crucial to the economics of several countries, including Bulgaria,

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China, Iran, India, and Turkey, which are the leading producers. In India, the cultivation of the Damask rose occurs across various regions, such as Haryana, Himachal Pradesh, Kashmir, Rajasthan, Punjab and Uttar Pradesh (Kumar *et al.* 2016, Kant *et al.* 2023). The plant is extensively used to produce an array of products such as gulkand, rose oil, tea and rose water, with its essential oil commanding an exceptionally high price in the global market, ranging from \$10,000 to \$12,000 per kilogram (Mahajan and Pal 2020).

Over the years, synthetic plant hormones have been extensively employed in agricultural practices to enhance plant growth and productivity. Among these, Indole Butyric Acid (IBA) and Naphthalene Acetic Acid (NAA) are two prominent auxins that have proven effective in promoting rooting in stem cuttings of various plants (Nasri *et al.* 2015, Shidiki *et al.* 2019, Aziz *et al.* 2024). However, the high cost and potential toxicity associated with synthetic plant growth regulators (PGRs) have prompted a shift toward exploring natural alternatives. Excessive use of synthetic PGRs poses risks to plants, humans, and animals, necessitating the development of sustainable and eco-friendly solutions (Mirihaqalla & Fernando 2020, Kant *et al.* 2023, Aryan *et al.* 2023, Kentelky *et al.* 2023, Aziz *et al.* 2024).

One promising natural alternative is the use of

Aloe vera leaf extract, a well-known medicinal plant from the Asphodelaceae family (Singha *et al.* 2024). *Aloe vera* gel extract is rich in bioactive compounds, including natural plant hormones such as salicylic acid, auxins and gibberellins, which play significant roles in promoting plant growth and development (Mirihaqalla and Fernando 2020, Villafuerte *et al.* 2022). The potential of *Aloe vera* gel extract as a natural PGRs offers an environmentally friendly and cost-effective solution, making it an attractive option for sustainable agriculture (Ali *et al.* 2020, Rajan and Singh 2021, Aryan *et al.* 2023, Singha *et al.* 2024).

In the present study, *Aloe vera* gel extract and NAA were applied to Damask rose cuttings to investigate their effects on rooting and other cultivation practices. The use of natural plant extracts, such as *Aloe vera*, aligns with the growing demand for sustainable agricultural practices, addressing concerns over environmental safety and the health implications of synthetic chemicals. This approach not only reduces dependency on synthetic PGRs but also leverages the multiple benefits offered by *Aloe vera*, which include enhanced rooting, improved plant vigor, and overall growth promotion.

The integration of *Aloe vera* gel extract into the cultivation practices of Damask rose holds significant

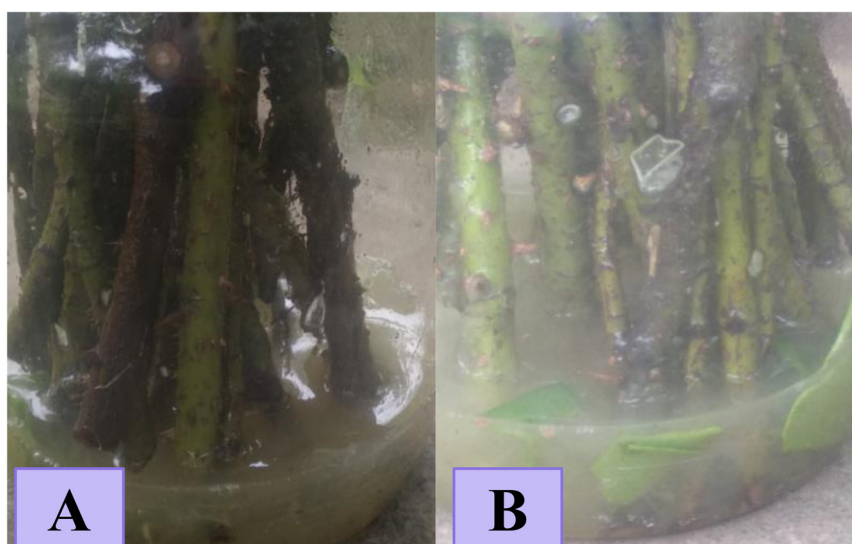


Fig. 1. Damask rose cuttings treated with two rooting agents: A) Indole Butyric Acid (IBA) at 250 ppm concentration B) *Aloe vera* gel extract.

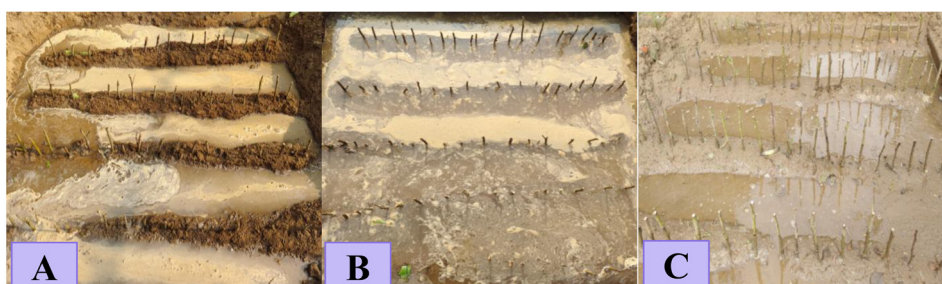


Fig. 2. The image depicts the rooting performance of Damask rose cuttings under different treatments, A) The control group without any treatment, while B) and C) Illustrate the growth of Noorjahan and Ranisahiba cuttings, respectively, both treated with IBA and *Aloe vera* gel extract. The comparison highlights the individual effects of IBA and *Aloe vera* gel extract on the rooting and growth of the Damask rose varieties.

potential for transforming traditional rose cultivation. By harnessing the natural bioactive compounds present in *Aloe vera*, this study aims to contribute to the development of innovative and sustainable techniques for enhancing the propagation and productivity of Damask rose. The findings from this research are expected to provide valuable insights into the feasibility of replacing synthetic PGRs with natural alternatives, thereby paving the way for eco-friendly advancements in horticulture.

MATERIALS AND METHODS

An experiment was conducted on the cultivar of Damask rose namely Noorjahan and Ranisahiba at D.E.I. Botanical Garden (27°13'34.9" N 78°00'51.2" E), DEI, Agra, by fresh 150 stem cuttings of each variety. 50% stem cutting treated with pure *Aloe vera* gel (100% conc) and 50 % treated with Indole Butyric Acid (IBA @ 250 ppm) solution for four hours before planting (Fig. 1). 3 beds were prepared, and the area of each bed was 1x1 m² (Fig. 2). In December month, planted stem cuttings in the beds. 10 plants were chosen at randomly each bed's cultivars, and

the observations and data were analyzed by using SPSS software.

RESULTS AND DISCUSSION

Number of sprouts

The effects of IBA and *Aloe vera* gel on the stem cuttings of two cultivars of Damask rose were presented in Table 1. *Aloe vera* gel significantly affected sprouting (newly young branch) on both cultivars. This indicates that the growth of newly sprouting was significantly promoted by application of *Aloe vera* gel.

However, the most significant effect was recorded on stem cuttings of Noorjahan cultivars. The maximum number of sprouts of Noorjahan (5.50) and Ranisahiba (5.03) were recorded after 30 days of cultivation. Similar results have been reported by Ibrahim and Al-Sayed (2023) who found that *Aloe vera* gel enhances the sprouting percentage in rose stem cuttings due to its rich composition of bioactive compounds such as amino acids, vitamins and polysaccharides,

Table 1. The effect of IBA and *Aloe vera* gel extract on the number of sprouting after 15 days and 30 days intervals of two cultivars of Damask rose. Means with in a column followed by the same letter (s) are not significantly different ($p \leq 0.05$). Means of 10 replicants \pm SE.

Treatments	Noorjahan No. of sprouts		Ranisahiba No. of sprouts	
	15 days	30 days	15 days	30 days
Control	2.40 \pm 0.22 ^b	3.90 \pm 0.17 ^b	2.60 \pm 0.51 ^b	4.50 \pm 0.97 ^b
IBA @ 250 ppm	2.70 \pm 0.21 ^b	4.60 \pm 0.96 ^b	3.30 \pm 0.48 ^b	4.80 \pm 1.13 ^b
<i>Aloe vera</i> gel extract	3.60 \pm 0.16^a	5.50 \pm 0.70^a	4.40 \pm 0.69^a	5.03 \pm 0.78^a

Table 2. The effect of IBA and *Aloe vera* gel extract on the root length (in cm) and number of roots of two cultivars of Damask rose. Means with in a column followed by the same letter (s) are not significantly different ($p \leq 0.05$). Means of 10 replicants \pm SE.

Treatments	Noorjahan		Ranisahiba	
	Root length (cm)	No. of roots	Root length (cm)	No. of roots
Control	1.69 \pm 0.05 ^c	2.60 \pm 0.69 ^c	2.24 \pm 0.09 ^c	3.50 \pm 0.16 ^c
IBA @ 250 ppm	2.53 \pm 0.07 ^b	3.50 \pm 0.84 ^b	2.86 \pm 0.22 ^b	5.00 \pm 0.21 ^b
<i>Aloe vera</i> gel extract	3.20 \pm 0.06^a	4.90 \pm 0.73^a	2.86 \pm 0.13^a	5.80 \pm 0.20^a

which stimulate cell division and elongation. Additionally, Devika *et al.* (2022) and Alsaady *et al.* (2024) showed that *Aloe vera* gel improves sprout emergence in *Hibiscus rosa-sinensis* and *Myrtus communis* stem cuttings, further corroborating its broad applicability as a plant growth enhancer.

Root length and number of roots

The result for the root length and number of roots affected by IBA and *Aloe vera* gel extract on stem cuttings of *Rosa damascena* Mill. were presented in Table 2. The same effects of IBA and *Aloe vera* gel on root length of Ranisahiba (2.86 cm) was measured and maximum root length observed in Noorjahan (3.20 cm) by the treatments of *Aloe vera* gel extract.

The results revealed that maximum root length produced in Ranisahiba 5.8 per cuttings and Noorjahan 4.9 per cutting by the treatments of *Aloe vera*

gel extract. These results are consistent with the findings of Owusu and Kuavedzi (2020) and Aryan *et al.* (2023), who reported that *Aloe vera* gel promotes rooting in *Codiaeum variegatum* and pomegranate cuttings by enhancing auxin activity and nutrient absorption. Similarly, Devika *et al.* (2022) and Wise *et al.* (2024) observed that *Aloe vera* gel improves root architecture in *Hibiscus rosa-sinensis* and cannabis stem cuttings, attributed to its natural auxin-like properties and antimicrobial effects that reduce pathogen-induced stress. Mirihagalla and Fernando (2020) reported that *Aloe vera* gel a natural alternative root-inducing substance, has shown effectiveness for semi-hardwood cuttings of *Syzygium jambos* through air layering.

Survival rate after one month

The effect of IBA and *Aloe vera* gel on both cultivars is present in Fig. 3. The survival rate of stem cuttings were recorded 97.50 % with the application of *Aloe vera* gel and 96.50 % with application of IBA solution in Ranisahiba variety similarly values were recorded in Noorjahan variety 98.02 % and 97.03 % by application of *Aloe vera* gel and IBA respectively. The high survival rate observed in this study aligns with research by Njuaem *et al.* (2021) and Rajan *et al.* (2023), who found that *Aloe vera* gel enhances the post-planting survival of stem cuttings of *Artemisia vulgaris* and *Vitis vinifera* due to its ability to retain moisture and supply essential nutrients during the critical establishment phase. Furthermore, the findings agree with Mirihagalla & Fernando (2020), who reported similar survival rate improvements in stem cuttings of ornamental plants treated with *Aloe vera* gel.

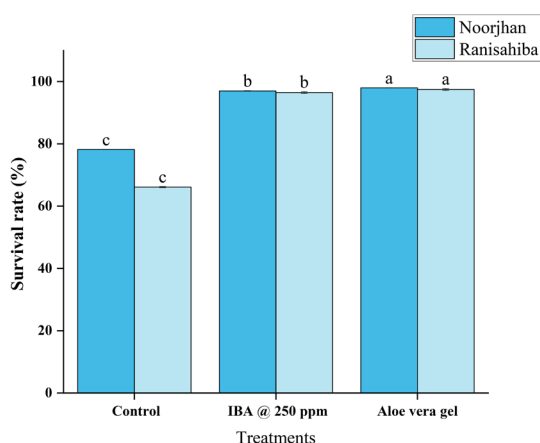


Fig. 3. The effect of IBA and *Aloe vera* gel on the survival rate (%) of Damask rose after one month. T Bars showing the same letter (s) are not significantly different at $*p \leq 0.05$ as determined by DMRT. Error bars (τ) show SE.

CONCLUSION

The study demonstrates that *Aloe vera* gel extract is a

highly effective and sustainable alternative to synthetic growth regulators for propagating Damask rose. *Aloe vera* treatment resulted in superior sprouting, root development, and survival rates in both Noorjahan and Ranisahiba cultivars. Noorjahan recorded the highest sprouting (5.50), root length (3.20 cm), and root number (4.90), while Ranisahiba achieved comparable results with 4.40 sprouts, 2.86 cm root length, and 5.80 roots. Survival rates were also highest with *Aloe vera* gel, reaching 98.02% in Noorjahan and 97.50% in Ranisahiba. These findings confirm the potential of *Aloe vera* gel extract as a natural growth promoter, offering an eco-friendly solution for enhancing Damask rose propagation.

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