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Effect of IBA and rooting media on propagation of Snapdragon (*Antirrhinum majus* L.) cv. Rocket Pink through stem cuttings

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Abstract
An investigation was carried out on propagation of snapdragon (*Antirrhinum majus* cv. Rocket Pink) under the heading "Effect of IBA and rooting media on propagation of snapdragon through stem cuttings"**.** The experiment comprised of 4 levels of IBA (Distilled water, 500 ppm, 1000 ppm and 1500 ppm) and 3 levels of rooting media (Sand, (Sand + Perlite) and (Sand + Perlite + Cocopeat), constituting a total of 12 treatment combinations. Application of IBA significantly decreased days to rooting (10.08), increased number of roots per cutting (10.52), root length (5.06 cm) and survival percentage (85.55). Rooting media also significantly improved the rooting characters. Minimum days to rooting (11.93), highest number of roots per cutting (11.43), root length (5.38 cm) were recorded by (sand + perlite + cocopeat) while sand recorded the highest survival percentage (85.62).

Keywords: IBA and rooting, *Antirrhinum majus* L, stem cuttings

Introduction
Antirrhinum majus L. commonly known as snapdragon or dog flower is native to Mediterranean region from Portugal in the west across Turkey and Syria in the east, the range of this wildflower extends southwards into parts of North Africa and northwards as far as southern France and was believed to have reached Britain where it has been naturalized on mountainous regions. It is mostly found in the temperate regions of the world. In India, 273 species are grown and is commercially cultivated in the states of Assam, Gujrat, Uttar Pradesh, Maharashtra, Karnataka and Tamil Nadu. It is a perennial herb but treated as an annual or biennial. The snapdragon used to be a member of Figwort family (Scrophulariaceae), but following recent changes of taxonomy it is now in the family Plantaginaceae with the various plantains (*Plantago* species) and many other former 'Scrophs'. It is grown as a cut flower, wherein, the flowers are borne on terminal long spikes of many colours and shades. It is also suitable for various landscape plans as bedding plant, in rockeries, pots or herbaceous borders etc.

Snapdragon is normally propagated through seeds but it can be propagated by cuttings in order to have an earlier crop, omitting the first very critical stage of seedling growth. Auxin is well known to stimulate the rooting of cuttings (Hartmann *et al.*, 2002) [6]. The most widely used auxin for commercial rooting is IBA (Nickel, 1990) [12]. Today, IBA and NAA are still the most widely used auxins for rooting stem cuttings and for rooting tissue-culture-produced micro cuttings (Zimmerman and Wilcoxon, 1935) [20].

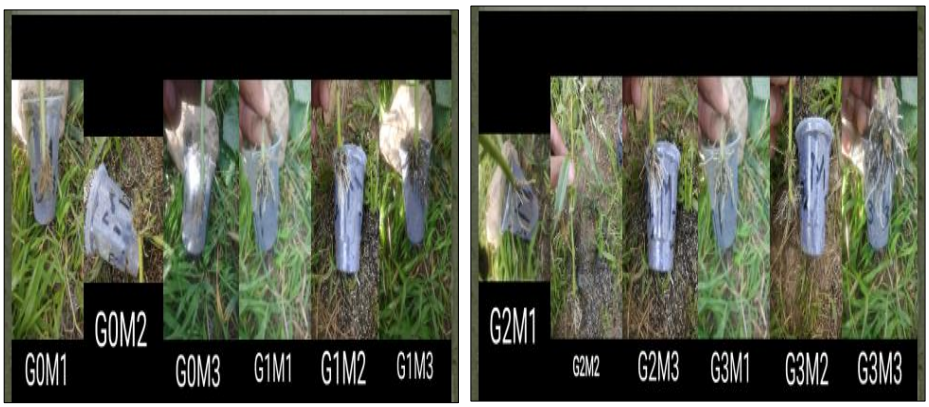
The role of auxins in inducing rooting is an established fact. The effectiveness of auxins to induce rooting, improve the rooting percentage and survival of rooted cuttings has been shown (Mansour *et al*., 1975, Chmiel, 1985 and Hartmann and Kester, 1986) [9, 2, 5]. There exists a lot of contradiction on the optimum concentration and period of treatment of these auxins. The effectiveness of auxins, however, varies not only with the nature and the concentration of the auxins and the plant species, but also with season (Nanda and Kochhar, 1985) [11]. The two most important auxins, i.e Indolebutyric acid (IBA) and Napthalene acetic acid (NAA) have been used widely either singly or in combination for induction of rooting in cuttings of various crop species (Petter, 1992) [13]. Cuttings are treated with different rooting hormones like IBA, NAA etc. to get better rooting. Besides hormones, rooting medium is also important for the growth of the crop. The concentration of auxins and the types of substrate medium to be used for rooting of snapdragon cuttings are important aspects to be considered and investigated

upon, as not much research has been carried out on these aspects in India. With a variety of media available like sand and soilless media *viz*., perlite, cocopeat, rock wool, vermiculite etc., the most suitable media for rooting needs to be standardised. Since no work had been done in the valley on snapdragon cut flowers therefore present investigation was proposed to be undertaken with the objective of optimizing IBA concentration and the best rooting media for rooting in cuttings of snapdragon.

Materials and methods

The present investigation entitled "Effect of IBA and rooting media on propagation of snapdragon (*Antirrhinum majus* L.) Cv. Rocket Pink through stem cuttings" was carried out at Urban Technology Park, SKUAST-K, Habak, Srinagar during 2021 and 2022. Srinagar district of Jammu and Kashmir is situated between 35.5º - 34.7º North latitude and 74.8º- 74.9º East longitude at an altitude of 1588 m above mean sea level. The district is guarded on south-east and north–eastside by the lofty Himaliyan ranges. In general, the climate of the area is temperate-cum-mediterranean and of continental type characterized by hot summers and severe winters. Hottest months are July and August during which temperature shoots up 36˚C. Winter is severe, extending over 70 days from the middle of December to March, when the temperature often goes below the freezing point and the whole of Kashmir valley remains covered under snow. The factors used in this experiment were 4 levels of IBA (G_0 = 0 ppm, G_1 = 500 ppm, G_2 = 1000ppm and G_3 = 1500 ppm), and 3 levels of Rooting Media {M_1=Sand, M_2 = Sand + Perlite (1:1), and M_3 = Sand + Perlite + Cocopeat (1:1:1)} forming a total of 12 treatments used in three replications. Experimental design used was CRD. Tip (terminal) cuttings of snapdragon (*Antirrhinum majus*) cv. Rocket pink were collected from the snapdragon plants grown under field conditions in Urban Technology Park, SKUAST-K, Habak. Cuttings were taken from healthy stock plants. Ten to twelve centimeters long cuttings having 4-5 pairs of leaves were used. Only cuttings without flower buds were taken for the experiment. The cuttings were cut 0.5 cm below the node and were planted in the transparent polypropylene containers containing different rooting media during April 2021 and 2022. Three different rooting media *viz*. sand, sand + perlite (1:1) and sand + perlite + cocopeat (1:1:1) were filled in containers. Holes were punched in the bottom of the containers for drainage. A stock solution of IBA 1500 ppm was prepared by dissolving 1.5 g of IBA in 30 ml ethyl alcohol and the final volume was made up to 1000 ml with distilled water. From this stock solution, different concentrations of IBA were prepared. Quick dip method was used for treatment of cuttings. The basal portions of the cuttings were dipped in the IBA solution for 1 minute for all treatments including distilled water. They were air dried for few seconds and immediately planted in medium to a depth of 1.5-2.0 cm. The cuttings were treated with four different levels of IBA and were planted in transparent polypropylene containers containing three different rooting media (sand, sand + perlite and sand + perlite + cocopeat). The experiment was conducted under partial shade. Intermittent misting was given with hand spray pump twice a day (morning and evening). Fifteen cuttings were kept separately for each treatment to observe the time taken to root. Parameters observed during the experiment were Number of days to rooting, Root number, Root length (cm) and Survival percentage (%).

Cuttings with different Treatments



Rooting of Stem Cuttings

Results and Discussion

1. Days to rooting

IBA is mainly known to initiate rooting. In current study also similar results were obtained with significantly lowest number of days to rooting (10.08) taken by cuttings under 1500 ppm IBA while highest number of days (14.62) were taken under 0 ppm (control) (Table 1). Our findings are in conformity with those of Lingaraj and Chandrasekhariah (1961) [8] in *Antirrhinum majus*, Ganjure *et al*. (2012) [3] in chrysanthemum, Rak and Nowak (1988) [14], Hartmann *et al*. (2002) [6], Gaspar *et al*. (1988) [4], and Stromquist and Hansen (1980) in *Pinus sylvestris*.

For better rooting, rooting media must possess properties of good water holding capacity and better aeration. In current study, among different rooting media M_3 (sand + per lite + cocopeat) possess better water holding capacity and aeration and took minimum number of days (11.93) to rooting in comparison to 13.97 days under M_1 (sand).

Table 1: Effect of IBA and rooting media on rhizogenesis of stem cuttings of snapdragon (*Antirrhinum majus* L.) cv. "Rocket Pink" (Pooled data of 2021 & 2022)

Treatment	Days to rooting	Number of roots	Root length (cm)	Survival percentage (%)
IBA (G)				
Control (G_0)	14.62	8.77	4.26	81.03
IBA 500 ppm (G_1)	11.26	9.83	4.64	82.40
IBA 1000 ppm (G_2)	10.74	10.13	4.86	84.20
IBA 1500 ppm (G_3)	10.08	10.52	5.06	85.55
CD($p \leq 0.05$)	0.13	0.12	0.11	0.12
Media (M)				
Sand (M_1)	13.97	9.38	4.47	85.62
Sand + Perlite (M_2)	12.36	9.70	4.63	83.36
Sand + Perlite + Cocopeat (M_3)	11.93	11.43	5.38	81.19
CD($p \leq 0.05$)	0.11	0.11	0.10	0.10

2. Number of roots per cutting

IBA not only initiate rooting but also increases number of roots per cutting. In the present investigation increasing concentration of IBA from 0 ppm to 1500 ppm increased number of roots per cutting from 8.77 to 10.52 (Table 1). This might be due to auxin application which initiate early and more roots per cutting. The number of roots increases by the application of auxin is a common feature in many herbaceous perennial crops (Hartmann *et al*., 2002) [6]. Similar findings have been obtained by Ullah *et al*. (2013) [19] in Marigold, Shenoy (1992) [15] in Rose, and Singh *et al*. (2013) [16] in Night Queen.

Among different rooting media, M_3 resulted in significantly highest number of roots per cutting (11.43) in comparison to 9.38 under M_1. This might be due to better water holding capacity and better aeration in case of cocopeat.

3. Root length (cm)

IBA had a significant effect on root length with longest roots (5.06 cm) recorded under 1500 ppm in comparison to 4.26 cm under control (Table 1). It may be due to early differentiation of cells and enhanced cell elongation caused by auxin. Auxins initiate synthesis of structural enzyme protein in the formation of adventitious root thus increasing the root length through the process of acidification (Audus, 1963) [1]. Our results are in conformity with those of Swamy *et al*. (2002) [18] in *Robinia pseudoacacia* and *Grewia optiva*.

For better root growth, rooting media should be less compact. Among different rooting media used in the current investigation, M_3 (sand + per lite + cocopeat) resulted in significantly longest roots (11.43 cm) in comparison to 9.38 recorded under M_1 (sand).

4. Survival percentage

Survival percentage is the reflective of better root parameters obtained by the auxin application. In current study, significantly highest survival percentage of 85.55% was recorded under 1500 ppm in comparison to 81.03% under control. Similar results were obtained by Maurya *et al*. (1974) in bougainvillea.

Survival of cuttings in rooting media to some extent depends on content of infection in the medium. Sand among different media used in the current study possesses very less content of infection, thus results in highest survival percentage. In present investigation, M_1 resulted in significantly highest survival percentage (85.62%) in comparison to 81.19% recorded under M_3 (Table 1). Our findings are in conformity with those of Lai and Danu (1985) [7] in carnation cvs. Scania and Arthur Sim.

Summary and conclusions

The results obtained from the experiment "Effect of IBA and rooting media on propagation of snapdragon (*Antirrhinum majus* L.) Cv. Rocket Pink through stem cuttings" laid out during 2021 and 2022 at Urban Technology Park, SKUAST-K, Habak are summarized below:

Both IBA and rooting media had a significant effect on the rhizogenesis of snapdragon stem cuttings.

- Significantly minimum days to rooting (10.08) was recorded in stem cuttings treated with IBA at 1500 ppm while maximum days (14.62) were recorded under IBA at 0 ppm. In case of rooting media, M_3 (sand + perlite + cocopeat) took significantly minimum of 11.93days to rooting while M_1 (sand) took maximum of 13.97 days.
- Number of roots per cutting was significantly highest when stem cutting were treated with IBA at 1500 ppm (10.52) while lowest number (8.77) was recorded under IBA at 0 ppm. In case of rooting media, M_3 recorded highest number of roots per cutting (11.43) while sand recorded lowest (9.38).
- Significantly longest roots (5.06 cm) were recorded in cuttings treated with IBA at 1500 ppm while shortest roots (4.26 cm) were recorded under IBA at 0 ppm. M_3 among three rooting media recorded significantly longest roots (5.38 cm) while sand recorded shortest (4.47 cm).
- Survival percentage was significantly highest when cuttings were treated with IBA at 1500 ppm (85.55) while lowest (50.03) was recorded under IBA at 0 ppm.

In case of rooting media, sand recorded significantly highest survival percentage of 85.62% while M_3 recorded lowest (81.19%).

Conclusions

Minimum days to rooting, highest number of roots per cutting and longest roots were obtained when cuttings were treated with IBA @ 1500 ppm in M_3 (sand + perlite + cocopeat) while survival percentage was best with IBA @ 1500 ppm in M_1 (sand).

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