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EFFECT OF IBA ON ROOTED CUTTINGS OF IXORA AND ALLAMANDA

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ABSTRACT

The study is a review article on Effect of Indole Butyric Acid (IBA) on rooted cuttings of Ixora and Allamanda. The experiment with Ixora was laid out in Factorial Completely Randomized Design with fifteen treatments and three replications. The treatments comprised three types of cuttings i.e., Softwood cuttings, Semi hardwood cuttings and Hardwood cuttings and five concentrations of IBA, 0 ppm, 1000 ppm, 2000 ppm, 3000 ppm, 4000 ppm. The results showed that Ixora cuttings treated with 2000ppm of IBA had shown significant positive effects on most of the root and shoot parameters including root length, number of roots per cutting, root fresh weight, root dry weight, shoot fresh and dry weight, leaf number and shoot length. Among the different cutting types, hardwood cuttings showed significant positive effect on growth and development of Ixora cuttings.

The experiment with Allamanda by different types of stem cuttings, viz., softwood, semi hard wood and hard wood and five concentrations of IBA, 0 ppm, 1000 ppm, 2000ppm, 3000 ppm, 4000 ppm showed that Allamanda cuttings treated with 1000ppm of IBA had shown significant positive effects on most of the root and shoot parameters including root length, number of root per cutting, root fresh weight, root dry weight, shoot fresh and dry weight, leaf number and shoot length. Among the different cutting types, hardwood cuttings showed significant positive effect on growth and development of Allamanda cuttings.

Keywords: Indole Butyric Acid (IBA), Indole Acetic Acid (IAA), parts per million (ppm).

Introduction

Ixora (*Ixora coccinea* L.) is a popular hedging plant in subtropical regions of India. It is a dense, multi-branched evergreen shrub, usually grows up to a height of 1.2–2 m, but able attain 3.6 m high. It is otherwise known as West Indian Jasmine and belongs to the family Rubiaceae. The plants have leathery leaves and produce large clusters of tiny flowers. They produce orange, gold, pink and red flower and it's also known as "Jungle flame" and "flame of the woods". Flowers are suitable for indoor decoration, as they

remain fresh for a long time after plucking and have great economic importance through good aesthetic beautification of the environment. Ixora is a moderate to root plant species and rooting ability is moderate under natural conditions.

Allamanda (*Allamanda cathartica*) is an evergreen climbing shrub that can reach a free-standing height of 2 metres or produce clambering stems 6 metres or more long that reach into the crowns of small trees. Older plants often have multiple stems from the root crown and long stems with relatively few

branches. The plant is sometimes used medicinally, even though it is poisonous. It is commonly grown as an ornamental, sometimes also as a hedge or a ground cover. Adventitious root formation is a key step in vegetative propagation of woody or horticultural species and problems associated with rooting of cuttings frequently result in significant economic losses. The hormone that stimulates the growth of adventitious roots is called auxin, commercially in the form of Indole butyric acid (IBA) and Naphthalene Acetic Acid (NAA). Effect of auxin on initiation of rooting of cuttings of horticultural crops has been reported by many workers. Among the various vegetative methods, propagation by stem cutting is the most successful, convenient and economical method of propagation.

Root initiation with the use of growth regulators occupies a significant position in the field of propagation. All the growth regulators are not equally suitable for rooting performances. Among the growth regulators Indole Butyric Acid (IBA) is the most commonly and widely used to achieve high percentage of rooting success for the ornamental species. When propagation through stem cutting becomes very difficult, treatments with growth regulators are applied in optimum concentration to promote rooting in stem cutting. Hence the objective of this study i) To find out the effect of different concentration of IBA on rooted cuttings of *Ixora* and *Allamanda*. ii) To find out the performance of Softwood, semi hard wood and Hardwood cuttings of *Ixora* and *Allamanda*.

The brief review of various experimental findings pertaining to different aspect of the present study has been reviewed under following heads.

Ixora is commonly grown as an ornamental and as a hedge, valued especially for its floral display. *Allamanda* is an evergreen climbing shrub commonly grown as an ornamental, sometimes also as a hedge or a ground cover. A brief review on relevant research work is outlined here.

Concentration varies among the plant species

Guo *et al.* (2009) discussed that there are great differences in the rooting potential among plant species, in particular, the responses to different types and concentrations of auxins which vary among plant species. Stem cuttings of *Ixora* were subjected to different treatments, comprising season of cutting and level of humidity (using plastic tunnels). The experiment was carried out under the normal nursery conditions to determine the best conditions for growth and development of stem cuttings of plant. The results revealed that the summer season gave the best

performance in number and length of both roots and leaves of the cuttings. Plastic tunnels with water mist gave the best rooting and vegetative growth followed by the cutting under plastic tunnels without mist, irrespective of season. The control treatment (not under plastic cover) gave the poorest results. Mohy Eldeen *et al.* (2008)

Quick dipping of IBA

Auxins are widely applied in stem cutting of various woody plants. Generally, quick-dipping in IBA is one of the used mostly used auxin to propagate plants by any stem cutting as reported by Dhillon, *et al.* (2009). Gupta and Kher (1989) obtained highest percentages (86.7) of rooting, the highest number of primary roots (24.6) and highest cutting survival (96.16%) in *Ixora*. They also observed the performance of *Ixora* treated with 1000, 2000, 3000, 5000 ppm by using dip method for 10 seconds.

Percentage of success

Singh and Motial (1981) reported the highest value (92.29%) were followed by success achieved in *Ixora* with 400 ppm concentration of NAA. The lowest percentage of success (44.33%) was observed in *Ixora* with 0 ppm concentration of IBA. The data in respect of survival percentage of cuttings, the maximum survival percentages of cuttings (62.33%) was observed in hardwood cuttings which was significantly superior over remaining types of cuttings such as semi-hardwood cuttings, (49.06%) and softwood cuttings, (36.86%) respectively. Anmol *et al.* (2021).

Length of the root

Singh (1981) In *Ixora*, the treatment (IBA 2000 ppm) produced maximum root length (6.37 cm) which was significantly superior over all other treatments and minimum root length (4.73 cm) was recorded in control treatment.

Number of shoots per cutting

According to Halder *et al.* (2002) significant variation was found in producing number of shoots per cutting among different ornamental species after 55days of planting the cuttings in rooting media. In this regard *Ixora* overshadowed all other species and produced the remarkably highest number of shoots (6.14) per plant throughout the study period. This result is in conformity with the findings of Gupta and Kher (1989). The increase in number of shoots per cutting in *Ixora* may be due to higher number of nodes and vegetative buds in each cutting. According to Anmol *et al.* (2021), hardwood cuttings of *Ixora* shows minimum days (27.73 days) to rooting which was

significantly superior over semi hardwood cuttings (35.93 days) and softwood cuttings (40.93 days)

Number of leaves per cutting

Bose and Mukherjee (1977) reported increase in no of root with increase in no of shoots with increase in no of leaves. According to Halder *et al.* (2002) there was a significant variation in respect of number of leaves per cutting in different ornamental species. *Ixora* gave the highest number of leaves per cutting (40.10), which was significantly higher than those of any other species. This finding is in accord with the results of Henting and Gruber (1988).

Effect of concentration of growth regulator

Kundu *et al.* (1987) observed that growth regulator mainly IBA was very much effective to achieve high percentage of success in rooting and higher number and length of roots per cutting were produced by *Ixora*. They worked with IBA at different concentrations and found that 400 ppm was the best concentration for propagation of *Ixora* by stem cutting. Bose *et al.* (1973) studied the effects of IAA and NAA on rooting of soft and hardwood cuttings. The highest rooting of 90 percent was recorded in softwood cuttings treated with IAA 1000 ppm and in hard wood cuttings treated with 500 ppm. They also confirmed the effectiveness of IAA and NAA in rooting of cuttings of this species. They also found that IBA at 5000 ppm stimulated rooting in cuttings. Bose *et al.* (1973) conducted an experiment with ten species and cvs. of *Ixora*, eleven cvs. of *Hibiscus rosasinensis*, *Jasminum auriculatum* and *J. grandiflorum* which failed to root from cuttings or show a low percentage of rooting. Under ordinary propagation facilities they developed roots under intermittent mist. Treatment with IBA and NAA further increased the rooting percentage and number of roots. Vegetative or asexual propagation has been established for reproduction of plants which exhibit desirable characteristic. Asexual method of propagation was used different plant parts such as roots, stems, or leaves of stock plants for grafting, tissue culture, division or cutting propagation (Davidson *et al.*; 2000). Generally, propagation by stem cutting has numerous advantages, many plants can be grown in high density trays from a limited amount of stock plants as compared to other a sexual means of reproduction. It is typically less expensive, quicker, relatively simple (Hartmann *et al.*, 2002).

Stem cutting production involves removing shoot tip from mother plant and planting it in growing substrate to root. This method allows for retention of foliar flowering habit a characteristic that may not be carried over via seed production. Successful

propagation of ornamental plants by rooting of vegetative stem cuttings depends on several factors including physiological state us of stem cuttings, the propagation environment, fertility management, and growth regulator treatments, whether applied to the stock plant prior to harvesting or exogenously applied rooting hormones to stem cutting (Atzmon *et al.*, 1997; Hartmann *et al.*, 2002). Softwood, semi-hardwood and hardwood 15-cm-long cuttings of *Allamanda* were prepared leaving 4 leaves/cutting in each case. The cuttings were treated with IBA at 1000-4000 p.p.m. for 15 seconds and were planted in sand and rooting was assessed at 30 days. Rooting was highest (92.5%) in hardwood cuttings treated with 1500p.p.m. IBA, followed by semi-hardwood and softwood cuttings treated with 2000p.p.m. IBA which gave 87.5% rooting in both cases. Data are tabulated on the number of roots/cutting and on the length of the longest root (Singh, 1980).

The effects of different IBA concentrations on different growth parameters of *Ixora*

Different concentrations of IBA had a significant effect on root length, number of leaves & root, root & shoot fresh weight and root & shoot dry weight. These indicated that the growth and development of shoots and roots of *Ixora* cuttings were significantly promoted by IBA. However, the most significant effect was recorded on stem cuttings treated with a concentration of 1000 ppm of IBA. The maximum numbers of roots (58.07) root length (0.62 cm), root dry weight (0.61 g), shoot dry (0.48 g) and fresh weight (1.65 g) of *Ixora* cuttings were observed from cuttings treated with 2000 ppm of IBA. Anmol *et al.* (2021).

Root fresh weight per cuttings

The maximum root fresh weight (12.90 g) was shown from *Ixora* cuttings treated by 1000ppm of IBA. Maximum number of leaves (65.62) and the highest shoot length (16.37 cm) were obtained from cuttings treated with 3000ppm of IBA but not statistically significant compared to stem cuttings treated with 1000 ppm of IBA. The untreated control was the least in all above mentioned growth parameters of roots and shoots (Gupta and Kher, 1989).

Shoot growth per cutting

The best shoot growth performances obtained in this study is a concentration of 2000ppm of IBA gave the best result in the propagation of *Ixora* plants by cutting. As mentioned earlier the best result in most growth parameter of stem cuttings was observed by the IBA concentration (2000ppm) used in this experiment. Hardwood cutting has showed the best shoot performance. The reason may be due to the fact that

hardwood cuttings contain stored foods such as hydrocarbons, nucleic acids, proteins and natural hormones (IAA and/or, cytokinins) that can be used for shoot growth and development (Zuairia Sultana *et al.*, 2005).

Rooting and survival capacity of plant

Observation of the rooting and survival capacity of softwood, semi-hard and hardwood cuttings of *Ixora* treated with 2000ppm IBA showed hardwood cuttings gave 62.33% rooting and the highest plant survival rate assessed 30 days after treatment (Kundu *et al.*, 1987).

Effects of Stem Cutting Types on Growth Parameters of *Ixora* Cuttings:

The results of this study showed that, among different growth parameters only shoot length and leaf number of cuttings were significantly influenced by stem cutting types. Shoot length and leaf number of *Ixora* from hardwood cuttings were significantly higher than those from softwood cuttings. Shoot length of *Ixora* from hardwood cuttings was on an average of about 14.54cm while the shoot length from softwood-cuttings was about 11.42cm and that of semi-hardwood-cuttings was intermediate (13 cm). The maximum number of leaves produced by hardwood-cuttings was about 58.17 followed by semi-hardwood cuttings 51.97 and softwood cuttings 44.92. The other growth parameters such as number of roots, root length root fresh and dry weight were not significantly affected by *Ixora* stem cuttings (Gupta and Kher, 1989).

Number of roots per cutting

The results of the analysis of variance showed that there were no significant interaction effects of hormones and cutting types on the growth parameters of *Ixora* cuttings. However, semi-hardwood cuttings treated with 2000ppm produced the highest number of roots (58.07) followed by hardwood cuttings (53.5) treated with 1000ppm IBA while the control showed the lowest root number in all cases (Gupta *et al.*, 1991).

Root length per cutting

In case of root length, softwood cuttings produced the longest root (1.02 cm) followed by semi-hardwood cuttings. Anmol *et al* (2021).

Shoot length per cutting

Shoot length of cuttings from hardwood treated with 4000ppm IBA was about 16.75 cm followed by cuttings from semi-hardwood cuttings treated with 4000ppm. The untreated controls have produced in all cases the shortest shoot length (Halder *et al.*, 2002). The results of this study showed that the application of

IBA hormone and using different stem cuttings significantly affect rooting capacity and shoot characters of *Ixora*. Among tested IBA concentrations, stem cuttings that received 2000ppm of IBA were ascribed with better rooting capacity and shoot system. The untreated stem cuttings have shown the least root and shoot performance. Among the three stem cutting tested, semi-hardwood and hardwood cuttings of *Ixora* showed good result regarding to shoot characters. However, significant effect on shoot length and leaf number was obtained from hardwood cutting. Results from semi-hardwood cuttings showed an intermediate value in most growth parameter tested. On the contrary softwood cuttings showed the lowest results in most root and shoot characters. There were no interaction effects between IBA concentrations and stem cutting types on the rooting and shoot characters of the cuttings used in this experiment (Halder *et al.*, 2002).

The effects of different IBA concentrations on different growth parameters of *Allamanda*

Different concentrations of IBA had a significant effect on root length, number of leaves & root, root & shoot fresh weight and root & shoot dry weight. These indicated that the growth and development of shoots and roots of *Allamanda* cuttings were significantly promoted by IBA. However, the most significant effect was recorded on stem cuttings treated with a concentration of 1000 ppm of IBA. The maximum numbers of roots (57.56) root length (10.6 cm), root dry weight (0.61 g), shoot dry (0.68 g) and fresh weight (2.11 g) of *Allamanda* cuttings were observed from cuttings treated with 1000 ppm of IBA (Singh, 1980).

Root fresh weight per cuttings

The maximum root fresh weight (1.06g) was shown from *Allamanda* cuttings treated by 2000ppm of IBA. Maximum number of leaves (66.62) and the highest shoot length (16.37 cm) were obtained from cuttings treated with 3000ppm of IBA but not statistically significant compared to stem cuttings treated with 1000 ppm of IBA. The untreated control was the least in all above mentioned growth parameters of roots and shoots (Gupta and Kher, 1989).

Shoot growth per cutting

The best shoot growth performances obtained in this study is a concentration of 1000ppm of IBA gave the best result in the propagation of *Allamanda* plants by cutting. As mentioned earlier the best result in most growth parameter of stem cuttings was observed by the lowest IBA concentration (1000ppm) used in this experiment. Hardwood cutting has showed the best shoot performance. The reason may be due to the fact

that hardwood cuttings contain stored foods such as hydrocarbons, nucleic acids, proteins and natural hormones (IAA and/or, cytokinins) that can be used for shoot growth and development (Shalini *et al.*, 2021).

Rooting and survival capacity of plant

Observation of the rooting and survival capacity of softwood, semi-hard and hardwood cuttings of Allamanda treated with 1000ppm IBA showed hardwood cuttings gave 73.3% rooting and the highest plant survival rate assessed 30 days after treatment (Zuairia Sultana *et al.*, 2005).

Effects of Stem Cutting Types on Growth Parameters of Allamanda Cuttings

The results of this study showed that, among different growth parameters only shoot length and leaf number of cuttings were significantly influenced by stem cutting types. Shoot length and leaf number of Allamanda from hardwood cuttings were significantly higher than those from softwood cuttings. Shoot length of Allamanda from hardwood cuttings was on an average of about 14.54 cm while the shoot length from softwood-cuttings was about 12.51 cm and that of semi-hardwood-cuttings was intermediate (13.21 cm). The maximum number of leaves produced by hardwood-cuttings was about 57.97 followed by semi-hardwood cuttings 51.77 and softwood cuttings 45.68. The other growth parameters such as number of roots, root length root fresh and dry weight were not significantly affected by Allamanda stem cuttings (Singh, 1980).

Number of roots per cutting

The results of the analysis of variance showed that there were no significant interaction effects of hormones and cutting types on the growth parameters of Allamanda cuttings. However, semi-hardwood cuttings treated with 4000ppm produced the highest number of roots (66.43) followed by hardwood cuttings (57.56) treated with 1000ppm IBA while the control showed the lowest root number in all cases (Gupta and Kher, 1989).

Root length per cutting

In case of root length, softwood cuttings produced the longest root (1.06 cm) followed by semi-hardwood cuttings (Halder *et al.*, 2002).

Shoot length per cutting

Shoot length of cuttings from hardwood treated with 4000ppm IBA was about 16.75 cm followed by cuttings from semi-hardwood cuttings treated with 2500ppm. The untreated controls have produced in all

cases the shortest shoot length. The results of this study showed that the application of IBA hormone and using different stem cuttings significantly affect rooting capacity and shoot characters of Allamanda. Among tested IBA concentrations, stem cuttings that received 1000ppm of IBA were ascribed with better rooting capacity and shoot system. The untreated stem cuttings have shown the least root and shoot performance. Among the three stem cutting tested, semi-hardwood and hardwood cuttings of Allamanda showed good result regarding to shoot characters. However, significant effect on shoot length and leaf number was obtained from hardwood cutting. Results from semi-hardwood cuttings showed an intermediate value in most growth parameter tested. On the contrary softwood cuttings showed the lowest results in most root and shoot characters. There were no interaction effects between IBA concentrations and stem cutting types on the rooting and shoot characters of the cuttings used in this experiment (Gupta *et al.*, 1991).

Conclusion

Auxin was used mostly for better rooting in stem cuttings for many flowers which increase survival percentage and better rooting. IBA was used to induce rooting has been practicing since earlier time to ensure success of rooting in cutting and better establishment of plants. This review will be useful for the professionals and researchers working on plant growth regulators to improve crop production through the use of IBA.

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