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Effect of IBA on Rooting and Growth of (*Ixora chinensis* L.) Terminal Cutting

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The experiment was conducted at College of Horticulture, Dapoli under Dr. Balasaheb Konkan Krishi Vidyapeeth, Dapoli, in 2023. It comes under tropical location with an average well distributed rainfall 3500-4000 mm during June to October. The soil is come under lateritic textural class varied with loam, clay, sandy loam. Ixora is popular ornamental but difficult to root plant was used for the experiment. The experiment was laid out in randomized block design with eight treatments and three replications. Mature terminal cuttings of size 10-15 cm length with 4-5 leaves are dip for 5 min in the solution consisting different Indole Butryic Acid concentrations i.e.

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(control) 250, 500, 1000, 1500, 2000, 2500, 3000 ppm solutions. The cuttings under study recorded significant variation with respect to all the parameters, The results showed that among all treatments survival percentage (60%) maximum plant height (18.17cm), maximum number of leaves (14.08), stem girth (3.91 mm), longest root length (9.03cm), number of secondary roots (17.93), fresh and dry weight of shoot (3.55, 1.03g), fresh and dry weight of root (1.40, 1.18g) was recoded in T_4 treatment consisting 1000 ppm IBA solution. However, for maximum number of primary roots (7.27) was observed in T_3 (500 ppm) treatment.

Keywords: Ixora; IBA; terminal cuttings.

1. INTRODUCTION

Ixora botanically referred to as *Ixora chinensis* L. this blooming plant is often used as a hedge element in landscape design and is a member of the Rubiaceae family. Plant originated in South East Asia's tropical and subtropical regions. Ixora also known as Rugmini (in India), and it goes by a number of common names in different regions including Chinese ixora, Jungle geranium, flame of the woods, jungle flame, West Indian Jasmine etc.

As space become scares in urban areas vertical garden and rooftop greenery are becoming popular solution, ixora is well-suited for both these application which makes it a viable option for urban settings. Ixora can withstand relatively high levels of drought in urban landscapes where construction and land development areas are prone to erosion and water conservation is crucial. It alluring appearance and adaptability in various landscapes settings also drive demand in in urbanization and support the cultivation of this species

In natural settings, plant root capacity is mediocre, primarily depends on physiological state of mother plant, time at which cuttings are taken, type of plant growth regulator used such factors influenc rooting success. Ixora propagation has numerous potential for generating profitable self- employment among small and marginal farmers, but seed propagation is unsuitable for the commercial output. As result ixora is vegetative propagated typically by means of layering and cuttings. Ixora is a medium-to-root plant and generally during cuttings propagation, hardwood cutting is used which gives very low survival, but effective use of plant growth regulator and controlled environmental conditions like growth chamber can also give positive results in terminal, apical and tip cuttings. In the realm of propagation application of growth regulator for root initiation play a crucial role in field and additionally the presence of natural (IAA) and synthetic (IBA, NAA) auxins are critical for root development. Among the growth regulators IBA is the most often utilized growth regulator. Understanding the optimal use of growth regulators and demand for ixora by refining the method of propagation one can guarantee a consistent supply of maximum planting material from single plant by using terminal section multiple times in one year rather than only single stem cutting in the year. All things considered, this research may result in useful application that advances nursery industry.

2. MATERIALS AND METHODS

The present study was carried out during the academic year 2023 at College of Horticulture, Dapoli, under Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharshtra. Among different ixora species 2-3 year old mother plant of chinese ixora is used for obtaining terminal cuttings. The cuttings are planted in medium soil+vermicompost 3:1 ratio, lateritic clay loam soil is preferred for the media. For the desired quantities of IBA, I t w a s dissolved in 10 ml of ethanol taking in volumetric flask and then the volume was made to one liter by adding sufficient amount of distilled water, similarly different IBA concentrations i.e T_1 (control), T_2 (250 ppm), T_3 (500 ppm), T_4 (1000 ppm), T_5 (1500 ppm), T_6 (2000 ppm), T_7 (2500 ppm) and (T_8 3000 ppm) solutions were prepared. Only mature terminal cuttings are used with ideal size of 10-15 cm, 3-4 node with leaves intact (4- 6) are dipped in IBA solutions for 5-6 min and are planted in prepared medium at 30, 60, and 90 days after planting of cuttings, observations are recorded viz. Survival percentage, plant height, number of leaves, stem girth, length of longest root, number of primary and secondary root, fresh and dry weight of shoot, fresh and dry weight of root. The current research data was statistically analyzed using the conventional method of analysis of variance in accordance with the method given by Panse and Sukhatme (1995).

3. RESULTS AND DISCUSSION

3.1 Survival %

At end of experiment 90 days after planting, treatment T_4 with 1000 ppm IBA concentration recorded statistically highest survival (60.00 %) which was at par with treatment T_3 (57.33 %) (i.e. 500 ppm). However lowest survival (36.00 %) was found in treatment T_8 (cuttings dip in 3000 ppm IBA solution). The reason for the highest survival in T_4 and T_3 may be that these roots have the greatest number of secondary and fibrous roots from the primary roots, which likely absorb more nutrients from the soil and aid in the growth of plants. The reason for the lowest survival could be attributed to the toxicity of IBA at higher treatment concentration. The similar findings are recoded by Lal et al., 2008 in henna cuttings and Tangawade, [1] in croton cuttings.

3.2 Plant Height (cm)

At 90 days after planting, there was significant variation seen in plant height due to different IBA concentration. The maximum plant height was recorded in T_4 (18.17cm) which was at par with T_3 (16.73 cm). However minimum plant height (13.30cm) was obtained in T_8. Rapid root initiation increase the surface area accessible for absorption of nutrients from the soil, and higher assimilation leads to increased metabolic activity which promotes shoot growth. Similar findings are reported by Gad [2] (*Tabernaemontana diverticata*) and Mejuri et al., [3] in (*Duranata erecta*) tip cutting.

3.3 Number of Leaves

At 90 days after planting the numbers of leaves are statistically influenced by IBA concentration. The treatment T_4 (14.08) produced more number of leaves which was on par with T_3 (13.90 mm) T_2 (13.57 mm) T_1 (13.07 mm). However treatment T_8 exhibited minimum number of leaves (11.99 mm) after cuttings. The result achieved could be attributed to cuttings treated with 1000 ppm IBA solution, which promotes shoot growth, resulting in an increased number of nodes and the formation of more leaves. The best result obtained for 1000 ppm IBA regards to number of leaves are in agreement with the results of Wazir, 2014 in camellia cuttings and Halder et al*.,* [4] in ixora cuttings.

3.4 Stem Girth

At 90 days after planting, significantly higher value for stem girth was recorded in T_4 (3.91 mm) containing 1000 ppm solution which was at par with T_3 (3.55 mm) stem girth. And minimum value for stem girth was recorded in T_8 treatment (2.81 mm). The maximum number of roots and longer roots may aid in the absorption of nutrients and water, increasing xylem and phloem width and overall plant vigour. Eventually helps in expanding the stem girth. The results obtained are in accord with the results of Gad, 2019 in *Tabernaemontana diverticata* tip cutting.

3.5 Length of Longest Root

At 90 days after planting statistically maximum length of root was recorded under T_4 (1000 ppm) IBA which was (9.03 cm) and was at par with treatment T_3 (8.31 cm) and T_2 (7.91 cm). While the minimum value for length of longest root (5.71 cm) was noted in T_8 treatment. The results can be attributed to the efficiency of suitable doses of rooting hormone in early stimulation of callus development, increased hydrolytic activity and faster emergence of roots from treated cuttings. This result is in close conformity with the findings of Ramtin et al., 2011 for poinsettia cuttings and Singh et al*.,* 2010 for Bougainvillea cuttings.

3.6 Number of Primary and Secondary Roots

At 90 days after planting the data for number of primary roots showed that T_3 (7.27) recoded statistically more number of primary roots which was at par with T_2 (6.47) and T_4 (6.73) While treatment T_8 shows lesser growth of primary roots (4.53). The reason behind the maximum growth of primary and secondary roots could be appropriate concentration of solution increases the rate of cell division and enlargement which further helps in early sprouting, increase in height of plant, number of leaves, stem girth which was recorded in T_4 followed by T_3 and T_2."More the source more the sink" leads to facilitating the number of primary and secondary roots.

3.7 Fresh Weight of Shoot

At the end of experiment 90 days after planting it is observed that T_4 treatment shows a significantly maximum fresh weight of shoot (3.55 g) which is on par with treatment T_3 (3.27 g) and treatment T_8 which showed poor result (2.11 g) for fresh weight. This result is in conformity with the results of Baldotto et al*.,* [5] concluded that increased size of root system affects in its ability to enhance optimal shoot development and growth, resulting in the increasing fresh weight of shoot.

Table 1. Effect of IBA on growth of ixora cuttings after 90 days of planting

Treatments	Survival (%)	Plant height (cm)	Number of leaves	Stem girth (cm)
T_1- Control	48.00	15.73	13.07	3.26
T_2- IBA @ 250 ppm	50.67	16.40	13.57	3.30
T_3- IBA @ 500 ppm	57.33	16.73	13.90	3.55
T_4- IBA @ 1000 ppm	60.00	18.17	14.08	3.91
T_5- IBA @ 1500 ppm	45.33	15.47	12.54	3.00
T_6- IBA @ 2000 ppm	43.33	15.20	12.47	2.96
T_7- IBA @ 2500 ppm	40.00	14.39	12.34	2.88
T_8- IBA @ 3000 ppm	36.00	13.30	11.99	2.81
Mean	**47.58**	**15.68**	**13.00**	**3.21**
SEm±	**2.7**	**0.5**	**0.5**	**0.1**
CD at 5%	**8.1**	**1.6**	**1.4**	**0.4**
F test	**SIG**	**SIG**	**SIG**	**SIG**

Table 2. Effect of different concentration of IBA on rooting characters of ixora cuttings after 90 days of planting

Treatments	Length of longest root (cm)	Root number		Shoot weight		Root weight	
		Primary	Secondary	Fresh (g)	Dry (g)	Fresh (g)	Dry (g)
T_1	7.51	6.20	14.67	2.82	0.66	1.07	0.94
T_2	7.91	6.47	16.80	3.07	0.86	1.34	1.07
T_3	8.31	7.27	16.60	3.27	0.68	1.37	1.23
T_4	9.03	6.73	17.93	3.55	1.03	1.40	1.18
T_5	7.12	5.67	12.73	2.61	0.55	0.98	0.83
T_6	6.72	5.53	10.20	2.48	0.53	0.90	0.78
T_7	6.51	5.07	8.20	2.20	0.44	0.83	0.72
T_8	5.71	4.53	9.93	2.11	0.32	0.76	0.66
Mean	**7.35**	**5.93**	**13.38**	**2.76**	**0.63**	**1.07**	**0.93**
SEm±	**0.4**	**0.3**	**1.0**	**0.1**	**0.1**	**0.1**	**0.1**
CD at 5%	**1.3**	**1.0**	**3.1**	**0.4**	**0.3**	**0.4**	**0.2**
F test	**SIG**	**SIG**	**SIG**	**SIG**	**SIG**	**SIG**	**SIG**

3.8 Dry Weight of Shoot

At 90 days after planting Treatment T_4 (1000 ppm) recorded statistically maximum weight (1.03g) which was at par with T_2 (0.86 g) and minimum result for dry weight was observed in T_8 than the control treatment which was (0.32 g). The result for dry weight of shoot is best at optimum concentration in T4 and shows poor results below and above the optimum concentration and therefore trend is in descending order as given below. Similar result was observed by Gad, 2019 in Terbernaemontana cuttings and Tangawade, [1] in croton cutting.

3.9 Fresh Weight of Root

The fresh weight was found maximum (1.40 g) in T_4 which was at par with T_3 (1.37 g) while minimum was observed in treatment T_8 (0.76 g) containing 3000 ppm IBA. This might be due to when IBA concentration is optimum it promotes uptake and production of food material in roots and cell density of root become high which increase root fresh weight. This finding is in accordance with the result of Singh et al*.,* [6] in duranta golden cuttings and Saudagar et al., [7] in ixora cuttings.

3.10 Dry Weight of Root

The significantly highest rate of dry weight of root (1.23 g) was found in T_3 which was at par with T_2 (1.07 g) and T_4 (1.18 g) while minimum value for dry weight found in T_8 (0.66 g) treatment. This might be due to cuttings treated with appropriate concentration of IBA helps in better mobilization and translocation downwards the primary metabolites for heather adventitious root formation and nutrient uptake ultimately results in maximum dry weight of roots. The results are partially supported by the reports of Manjunath et

al., [8,9] in chrysanthemum and Halder et al., [4,10] in ixora cuttings [11-13].

4. CONCLUSION

Based on the result obtained, it can be concluded that as compared to higher concentrations above 2000 ppm of IBA, lower concentration up to 1000 ppm can improve rooting characters as well as helps in improving the shoot characters in ixora. Optimum concentration of IBA usefull for easy and faster multiplication of ixora through terminal cuttings.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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