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To Study the Effect of Auxin Concentrations (IBA and IAA) on Growth Performance of Stem Cutting of *Hardwickia binata* (Roxb.)

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A B S T R A C T

The present studies on "Effect of Plant Growth Regulators on Growth Performance of Stem Cutting of *Hardwickia binata* Roxb" was carried out in the mist chamber of Institute of Forest Biodiversity, Dulapally, Kompally, Hyderabad, during January-April, 2021. The cuttings of *Hardwickia binata* Roxb were prepared from selected superior phenotypes from the surrounding environments of Kompally, Hyderabad. *Hardwickia binata* Roxb. is difficult to root and need auxin treatment and controlled environment to successful survival and rooting. The cuttings were treated with 0, 200, 500,1000, 1500, 2000 mg/l concentrations of IBA and IAA and planted in poly bags under mist chamber. The experiment was conducted in a completely randomized design. Analysis of variance was worked out to assess the variation in *Hardwickia binata* Roxb. for eight characters. Treatment with IBA at 2000mg was found to be the best treatment as it achieved maximum in survival percentage (52.64%), shoot length (31.92cm), rooting percentage (81.69%), number of roots per cutting (20.44) and root biomass (6.32g) followed by treatment with IAA at 2000mg/l (T10) achieved maximum. The performance increased with an increase in concentrations of both IBA and IAA. Among the two auxins treatments, IBA was found to be most effective, showed significantly higher values compared to IAA. It is possible to successfully multiply the *Hardwickia binata* Roxb. cuttings by treating with 2000 mg/l of IBA under controlled phyto-environmental condition. The study evolved an easy and efficient protocol for vegetative propagation of *Hardwickiabinata*Roxb.via stem cuttings to establish clonal forestry.

Introduction

Hardwickia binata Roxb is a medium to large sized deciduous tree of Indian origin and it belongs to the family Leguminosae, subfamily Caesalpinioideae (Luna, 1996). It is found growing naturally in semi-arid and arid regions of Central, Western and Southern India and is locally known as Anjan, Kamara and Aacha. Commercially in trade, it is called

as Indian Black wood or Anjan. Out of India, it has been reported to grow in countries like Pakistan, Bangladesh, Cambodia, Indonesia, Laos, Myanmar, Malaysia, Nepal, Papua New Guinea, Philippines, Thailand and Vietnam (Kundu, 2011). The genus *Hardwickia* is a monotypic genus represented by only one species *i.e., H. binata* (Seetharam and Kotresha, 1998).

Forest plantations are increasingly needed to meet the growing demands for wood and its products across the world. According to a recent estimate of FAO, the plantations occupy an area about 277.9 million hectares, which is about 6.95% of total global forest area (Payn *et al.,* 2015).The application of plant growth regulators triggers adventitious root formation, bud break and survival of stem cuttings. Auxins promote rooting, which can be either naturally occurring within the plant (endogenous) or applied to the plant (exogenous) during vegetative propagation. Wani, *et al.,* 2018 Several researches demonstrated that synthetic auxins like IBA and NAA were most effective rather than naturally occurring auxin IAA in induction of adventitious roots in cuttings (Swamy *et al.,* 2002, Hartmann *et al.,* 2011, Gehlot *et al.,* 2014).

Plant growth regulators, play a vital role in improving the rooting of stem cuttings in *Hardwickia binata* Roxb. the maximum rooting percentage found to increase the establishment of cuttings in nurseries. Growth regulators such as auxins enhances percentage of success and number of roots in *Hardwickia binata* Roxb. cuttings. This would improve the vigour of freshly transplanted plant material in the field, thus reduces the rate of mortality of plants and helps to maintain adequate crop stand in the field. Hence there is an immense need to increase the area under *Hardwickia binata* Roxb. to meet the domestic as well as export market of greater importance. Hence, there is a need for standardizing the type and concentration of growth regulators for high success rate in stem cuttings of *Hardwickia binata* Roxb.

Materials and Methods

The cuttings of *Hardwickia binata* Roxb were prepared from selected superior phenotypes from the surrounding environs of forest college, Hyderabad. Plus trees were selected on the basis of their phenotypically superior stems and crown characteristics and their size and stature in the stand. One year old branch cuttings were taken from25±5-year-old selected trees during November-December and February-March. The leafless cuttings about 15±2.5 cm length and 1-2 cm in diameter having 4-5 buds were taken. The sharp Secateurs were used for preparation of cuttings. Cuttings were immediately placed in 100C water top regent desiccation before treatment.

Mature cuttings were brought to laboratory and treated with 0, 200, 500, 1000, 1500and 2000 mg L^{-1} concentrations of Indole 3-Butyric Acid (IBA) and Indole 3- Acetic Acid (IAA). The different IBA and IAA concentrations were prepared by dissolving the appropriate amount of IBA and IAA in 5-10 ml of methanol and volume gradually made up to 1000 ml with distilled water. The care was taken to prevent the precipitation of IBA and IAA during the process of dilution. The IBA and IAA solutions were transferred separately in to ten containers for giving treatments. The cuttings were divided in to ten groups and each group contained 30 cuttings, which were dipped in these ten solutions. The basal cut ends up to 2.5-cm of cuttings was dipped in following concentrations of IBA and IAA for 24 hours duration.

The rooting medium was prepared by mixing with equal proportions of well-drained soil,

river sand and FYM in 1:1:1 ratio. The rooting medium was sterilized with 0.2% formalin and Carbendazim solution and subjected to solarization treatment for 10 days to prevent any attack from soil borne pathogens.

The sterilized rooting media was then filled in poly bags. The size of 20 poly bags varied from 15-20 cm in length and 6-18cm in diameter. The Polythene bags were arranged in the mist chamber according to the design of experiment.

Results and Discussion

Survival Percentage

IBA concentrations survival percentage ranged from 21.23% to 52.64% with the general mean of 38.52% Table 1.Among all the treatments, IBA 2000 mg/l has maximum survival percentage (52.64%) followed by IBA 1500 mg/l (47.37%), whereas control showed minimum survival percentage (18.00%) followed by IBA 200 ppm (21.23%). IBA treatment gave highest survival percentage on cuttings in *Morus alba*. The increase in percentage may be due to vigorous rooting induced by the growth regulator enabling the cutting to absorb more nutrient and thereby producing more survival (Stancato *et al.,* (2003), Singh *et al.,* (2014)).

Shoot Length (cm)

IBA 2000 mg/l has maximum shoot length (31.92 cm) followed by IBA 1500 mg/l (26.18 cm), whereas control showed minimum shoot length (5.76 cm) followed by IBA 200 ppm (6.78 cm) Table 1. The maximum shoot length with optimum IBA treatments might be ascribed to better root growth which augmented absorption and translocation of nutrients from soil which take active part in various plant metabolic processes (Mewar *et al.,* 2016).

Rooting percentage

Among all the treatments, IAA 2000 mg/l has highest rooting percentage (70.17%) followed by IBA mg/l (43.36%), whereas control showed minimum rooting percentage (10.73%) followed by IAA 200 mg/l (15.83%) Table 1. There is overwhelming evidence that auxins promote rooting, which can be either naturally occurring within the plant (endogenous) or applied to the plant (exogenous) during vegetative propagation (Gehlot *et al.,* 2014, Mewar and Naithani, 2016).

Number of roots per cutting

In IBA concentrations number of roots per cutting ranges from 6.19 to 20.44 with the general mean of 12.60 Table 1. Among all the treatments, IBA 2000 mg/l has maximum number of roots per cutting (20.44) followed by IBA 1500 mg/l (18.27), whereas control showed minimum number of roots per cutting (6.11) followed by IBA 200 ppm (6.19). Exogenous application of auxin treatments especially IBA and NAA enhanced rooting proliferation and as well as root number in several species (Babaie *et al.,* 2014, Siddique and Hussain, 2007).

Root biomass

The root biomass increased with an increase in concentrations of both IBA and IAA Table 1. However, there were no significant differences found between control and 200 mg/l, 500mg/l and 1000 mg/l, 1000mg/l and 1500mg/l of treatments of IBA whereas control and 200 mg/l, 500mg/l and 1000 mg/l, 1500 mg/l and 2000 mg/l treatments of IAA. cuttings were more responsive to rooting with IBA treatments, which enhanced a greater number of roots and better root growth that ultimately contributed for higher root biomass (Ingle, 2008, Swamy *et al.,* 2002).

Table.1 Effect of different concentrations of IBA and IAA on different growth parameter of stem cuttings in *Hardwickia binata*

Treatment combinations	Survival percentage	Shoot Length (60DAP)	Rooting %	No. of roots/cutting	Root biomass
Control	18.00	3.11	10.73	6.11	1.96
200 mg L^{-1}IBA	21.23	3.98	16.57	6.19	2.23
500mg L^{-1}IBA	27.56	8.35	23.24	7.69	3.49
1000mg L^{-1}IBA	43.79	11.58	29.17	10.43	4.72
1500mg L^{-1} IBA	47.37	15.49	61.34	18.27	5.31
2000mg L^{-1}IBA	52.64	20.16	81.69	20.44	6.32
200mg L^{-1}IAA	20.18	3.87	15.83	6.17	2.19
500mg L^{-1}IAA	25.27	9.68	23.48	6.23	3.43
1000 mg L^{-1}IAA	33.83	10.46	32.91	7.39	3.67
1500mg L^{-1}IAA	41.42	15.37	43.36	9.12	4.76
2000mg L^{-1}IAA	48.01	15.55	70.17	10.55	5.68
F test	S	S	S	S	NS
SEm(±)	0.15	0.08	0.03	0.08	0.11
CD (P=0.05)	0.45	0.25	0.07	0.25	0.34

Fig.1 Effect of auxins application on the sprouting percentage of *Hardwickia binata* Roxb. Cuttings.

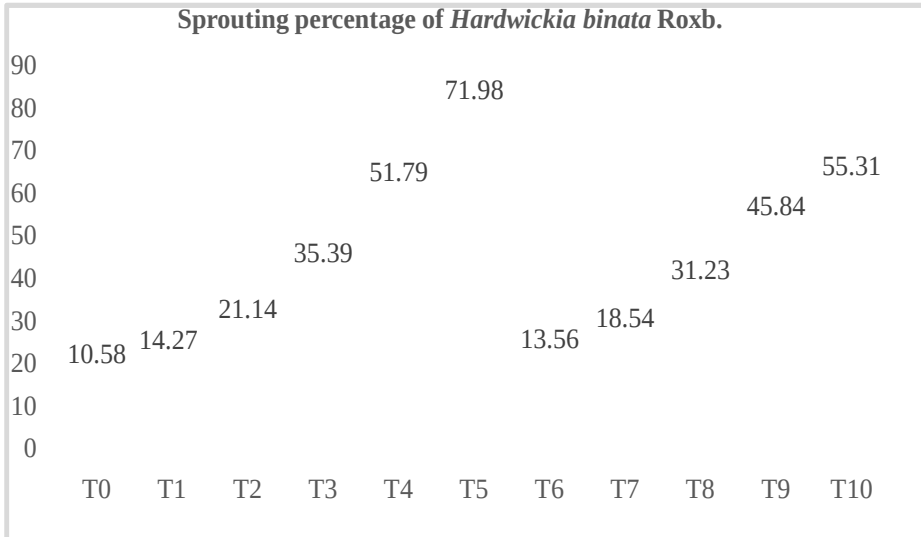

Fig.2 Effect of auxins application on the length of roots of *Hardwickia binata* Roxb. cuttings

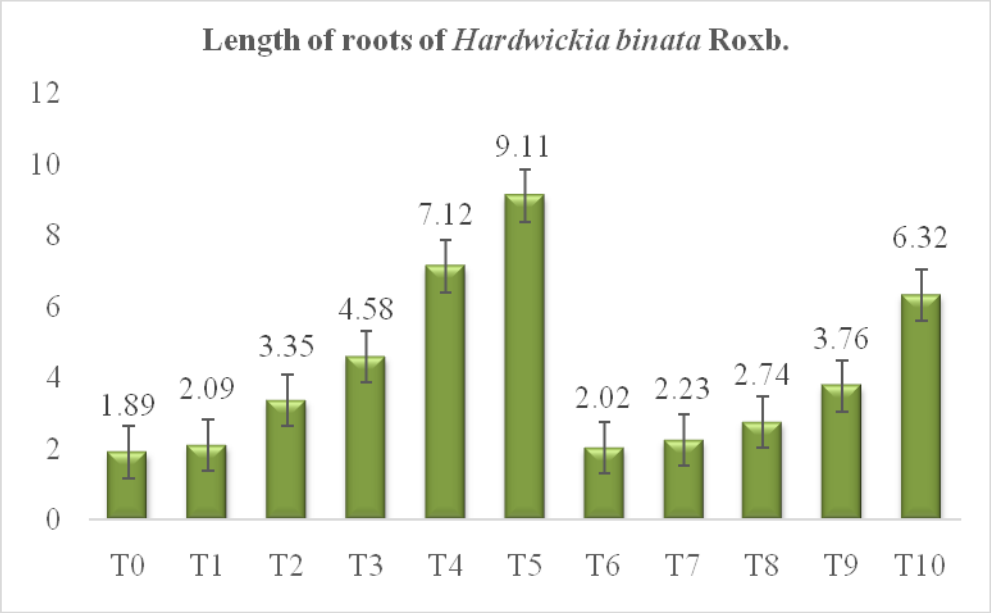

Fig.3 Effect of auxins application on the shoot biomass of *Hardwickia binata* Roxb. cuttings

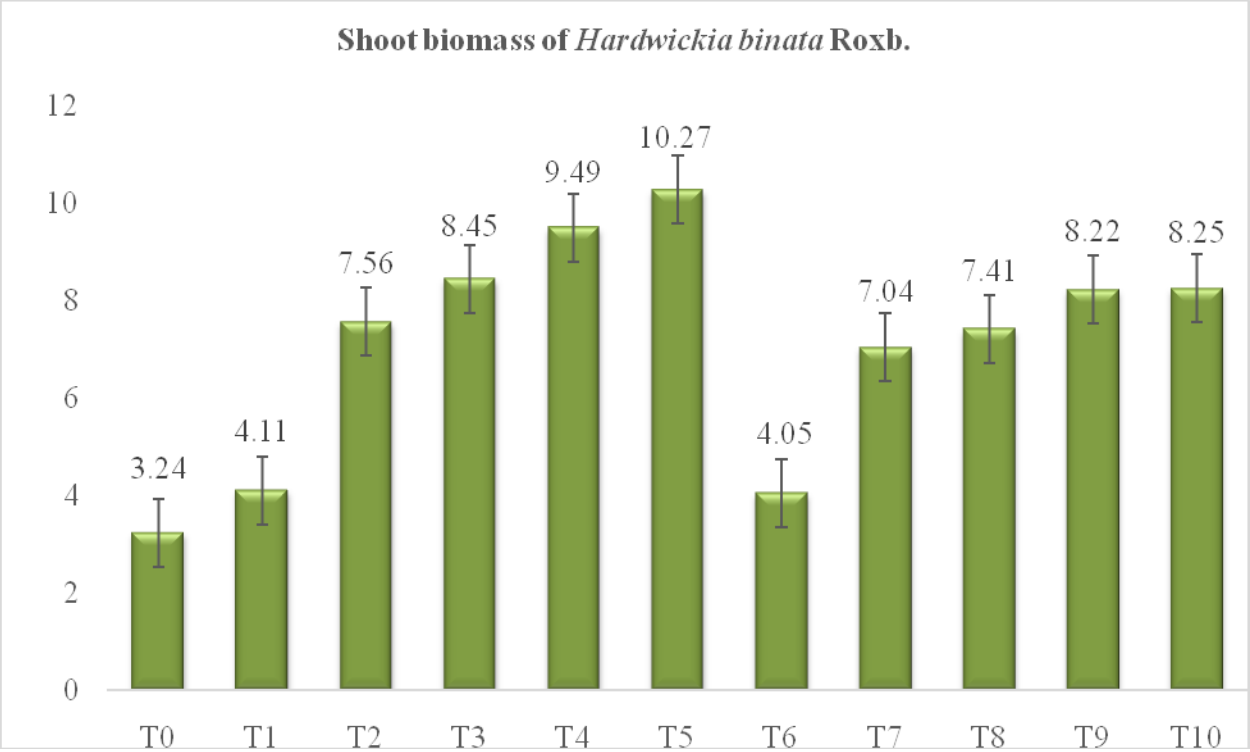

Plate.1 Comparison of rooting in stem cuttings of *Hardwickia binata* Roxb. under control, 200, 500 and 1000mg $L^{-1}$of IBA

Plate.2 Comparison of rooting in stem cuttings of *Hardwickia binata* Roxb.under 500, 1000, 1500 and 2000mg $L^{-1}$of IBA

Plate.3 Comparison of rooting in stem cuttings of *Hardwickia binata* Roxb.under control, 200, 500 and 1000mg $L^{-1}$of IAA.

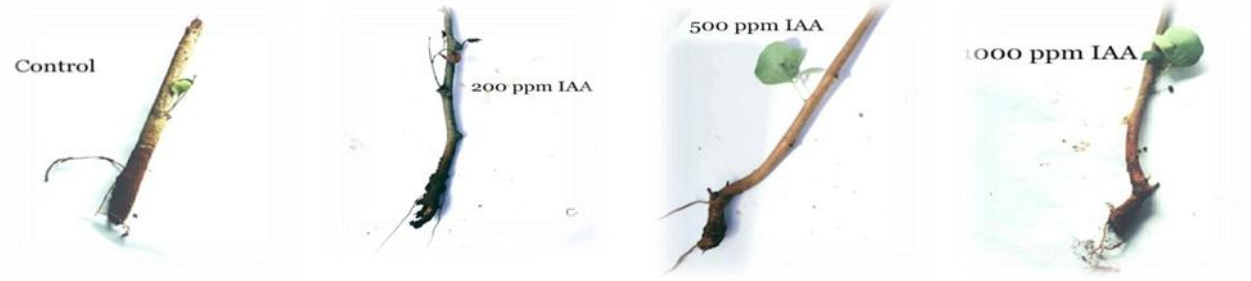

Plate.4 Comparison of rooting in stem cuttings of *Hardwickia binata* Roxb.under 500, 1000, 1500 and 2000mg $L^{-1}$of IAA

The results of the present study lead to the conclusion that *Hardwickia binata* Roxb. is difficult to root and need auxin treatment and controlled environment to successful survival and rooting. The results revealed that IBA and IAA treatments significantly increased survival percentage, shoot length, sprouting percentage, rooting percentage, number of

roots per cutting, length of roots, shoot biomass and root biomass. The performance increased with an increase in concentrations of both IBA and IAA. Among the two auxins treatments, IBA was found to be most effective, showed significantly higher values compared to IAA. The present study is limited to find out suitable concentrations of IBA and IAA on rooting for clonal multiplication of *Hardwickia binata* Roxb.

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