

Effect of Auxin on Vegetative Growth and Primary Metabolites of *Boerhaavia diffusa* Linn.

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ABSTRACT

Medicinally important plant *Boerhaavia diffusa*, commonly known as 'Punarnava' is a member of the family Nyctaginaceae of angiosperms. Effect of growth regulators, Indole acetic acid (IAA), Indole butyric acid (IBA) 10ppm, 50ppm and 100ppm were observed on vegetative growth, ability to rooting, chlorophyll content and primary metabolites of the plant. Effect on vegetative growth was studied through treating the stem cutting. 50ppm IBA treated cuttings showed best results in vegetative growth as plant height, number of leaves, number of node and internodes and number of branches, rooting response as number of roots and primary metabolites as total sugar, reducing sugar, total soluble protein and TCA precipitated protein. Root length was maximum with 100ppm IBA.

1. Introduction

Boerhaavia diffusa, commonly known as Punarnava is an important medicinal plant, belonging to the family Nyctaginaceae. Although, all parts of the plant are medicinally useful but roots are more important. Plant is pungent, bitter, astringent, laxative, stomachic, diuretic, diaphoretic, expectorant, antipyretic and cardiotoxic. The whole plant, fresh or dried, is the sources of drug "Punarnava". Roots are laxative and used in asthma, anemia, jaundice and as an antidote to snake venom and is also useful for restoration of virility in man. An alkaloid in the root has been shown experimentally to produce a distinct and persistent rise in blood pressure plus marked diuresis. Leaves are useful in dyspepsia, tumors, ophthalmia and joint pains and as appetizer. Seeds are tonic expectorant, carminative, lumbago, promising blood purifier and act against scabies. It helpful in arthritis as it reduces inflammation and pain in joints. (U. Kanagavalli *et al*, 2018) Punarnava plant has beneficial uses for treating all the disorders of the kidneys as it can very efficiently decreases the urea levels in the body. It has also found hepaoprotective, analgesic, antidiabetic properties and anticancerous properties. (Pranati Nayak, M Thirunavoukkarasu 2016). Punarnava is an important non-weed forest produce having routine demand in national and international drug markets. There is a fair demand of different parts of this herb in homeopathic pharmacies. This herb is present in Chhattisgarh since generations with a rich medicinal knowledge of natives and traditional healers about the plant.

2. Material and methods

Preparation of cuttings - Shoots were collected separately from the vegetative plant of *Boerhaavia diffusa* in the month of July from campus of Pt. Ravishankar Shukla University, Raipur. Leaves and apical soft portion of the plants were excised and cut in to 15-20cm long pieces.

Treatment and Planting - The cuttings were dipped in 0.1% water suspension of Bavistin for 15 minutes. These cutting were, then, treated with 10, 50 and 100 ppm of indole

acetic acid (IAA) and indole butyric acid (IBA). Control cuttings were treated with distilled water by dipping 2cm basal portion of the cutting for 24 hour's. After the treatment, cuttings were planted in earthen pots filled with soil and sand in 2:1 ratios. These were then kept under partial shade in net house and watered frequently to avoid desiccation. Observation for growth: height/length, node length, leaf number, root length and number of roots were recorded.

Estimation of Primary Metabolites

Plant extract was prepared by homogenizing 1 gm of plant tissue with 5 ml sodium-phosphate buffer (pH-7.2) with mortar and pestle and was centrifuged at 15,000 ppm for 20 min at 4°C. Finally, supernatant only was used for the estimation of total sugars, reducing sugars, soluble proteins and TCA precipitated proteins. Total sugar of plant tissue was estimated following Spiro (1966), reducing sugar of shoot and root tissues was estimated following Wood *et al*. (1988), total water soluble protein and TCA precipitated protein was estimated following Lowry *et al*. (1951).

3. Result and discussion

IBA 50ppm treated cutting showed maximum plant length (76.58 cm) number of leaves (497) number of nodes (129.2) number of inter nodes (128.2) and number of branch (35.8) and number of roots (14.0) followed by IAA 100ppm treated cuttings for plant height (58.84 cm), number of leaves (306), number (75.2), number of internodes (74.2) number of branches (25) and number of roots (6.2). But Root length was maximum with 100ppm IBA. Karoshi & Hegda (2001) in *Gymnema Sylvestre* found that the IBA at 100ppm and 200ppm concentrations gives best response for inducing rooting, while, Babitha *et al* (2002) found that the IBA at 300ppm concentration had highest rooting percentage, root number and root length in *Givotia rottliformis*. Jadhav *et al* found that the IBA at 500 ppm concentration had maximum number of roots, length of roots, fresh and dry weight of roots. Ramalu *et al* found that the 2000ppm concentration showed best rooting response. Nirnanjan and Farooqi (2001) found that 300ppm IBA produced best result with respect to the number of roots, fresh weight,

dry weight, field survival, number of sprouts, length of the largest sprout and number of leaves in *Ruta graveolens*. Root length was maximum with 100ppm IBA.

4. Estimation of primary metabolites

Total and reducing sugar:

50ppm IBA treated cuttings showed maximum amount of total sugar in root, leaf and stem with 17.2 mg/g, 13.8 mg/g, 11.9 mg/g, respectively followed by 50ppm IAA in root, leaf and stem were 16.8 mg/g, 12.6 mg/g and 11.7 mg/g.

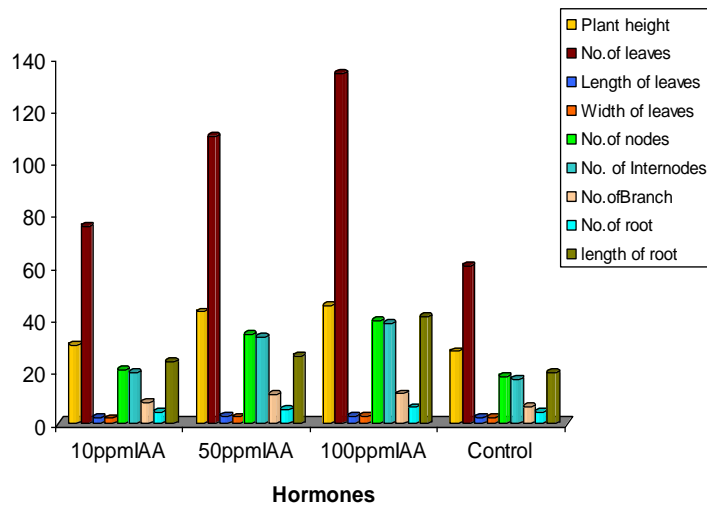
The amount of reducing sugar was also maximum in 50ppm IBA treated cutting in roots, leaf and stem were 2.63 mg/g, 2.0

mg/g, 1.76 mg/g followed by IAA 50ppm IAA treated cuttings in root, leaf and stem were 2.06 mg/g, 1.9 mg/g, 1.67 mg/g.

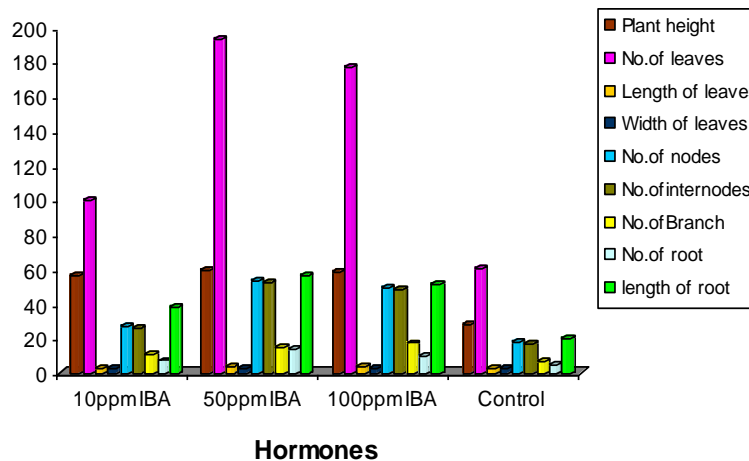
Total soluble and TCA precipitated proteins:

The amount of soluble protein maximum in 50ppm IBA treated cuttings in root, leaf and stem were 26.9 mg/g, leaf 21.26/ g and 13.93/ g followed by 50 ppm IAA treated cuttings showed in root, leaf and stem were 23.66 mg/ g, in leaf 15.96 mg/g and 11.9 mg/g.

The amount of TCA precipitate protein maximum in 50ppm IBA treated cuttings in root, leaf and stem were 5.46 mg/ g, 5.16 mg/g and 4.8 mg/g followed by 100 ppm IAA treated cuttings showed second highest amount in roots, leaf and stem 4.5 mg/g, 3.53 mg/g and 2.4 mg/g.



Vegetative growth in cuttings of *B. diffusa* treated with 10, 50 and 100ppm IAA.



Vegetative growth in cuttings of *B. diffusa* treated with 10, 50 and 100ppm IBA

Table 2: Estimation of Total Sugar in IAA and IBA treated cuttings of *Boerhaavia diffusa*.

Concentration	Root (mg/gm)	Leaf (mg/gm)	Stem (mg/gm)
10ppm IAA	15.5± 0.173	12.43± 0.176	11.3± 0.05
50ppm IAA	16.8± 0.57	12.76 ±0.688	11.76± 0.08
100ppm IAA	15.4± 0.251	12.2± 0.005	11.56 ±0.120
10ppm IBA	15.5± 0.907	12.36± 0.433	11.54 ±0.114
50ppm IBA	17.23± 0.383	13.8 ±0.688	11.9± 0.08
100ppm IBA	15.33 ±0.384	11.96 ±0.120	10. 8± 0.233

Control	11.7 ±0.984	8.23 ±0.296	10.66± 1.74
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Table 3: Estimation of Reducing Sugar in IAA and IBA treated cuttings of *Boerhaavia diffusa*.

Concentration	Root (mg/gm)	Leaf (mg/gm)	Stem (mg/gm)
10ppm IAA	2.03 ±0.003	1.83± 0.06	1.43± 0.06
50ppm IAA	2.06± 0.08	1.90 ±0.113	1.67 ±0.15
100ppm IAA	2.00 ±0.06	1.56± 0.06	1.23 ±0.03
10ppm IBA	2.03± 0.185	1.35 ±0.145	1.56 ±0.266
50ppm IBA	2.63± 0.166	2.0 ±0.57	1.76 ±0.133
100ppm IBA	1.66 ± 0.120	1.53±0.033	1.40 ±0.57
Control	1.33 ±0.145	1.1 ±0.03	1.46± 0.984

Table 4: Estimation of Total Soluble Protein in IAA and IBA treated cuttings of *Boerhaavia diffusa*.

Concentration	Root (mg/gm)	Leaf (mg/gm)	Stem (mg/gm)
10ppm IAA	23.33 ± 04.233	15.93 ± 0 3.15	10.43 ± 0.272
50ppm IAA	23.66 ± 0.480	15.96 ± 0 1.07	11.9 ± 0.351
100ppm IAA	18.33 ± 0.545	15.76 ±00.74	10.2 ± 0.253
10ppm IBA	24.06 ± 0.176	13. ±01 0.854	11.36± 0.783
50ppm IBA	26.9 ± 0 0.696	21.26±0 1.36	13.93 ± 0.405
100ppm IBA	21.33 ± 0 0.536	18.1±0 3.15	16.33 ± 01.185
Control	13.76 ± 0 0.63	10.73 ± 0 0.233	6.33 ± 0.956

Table 5: Estimation of TCA Precipitated Protein in IAA and IBA treated cuttings of *Boerhaavia diffusa*.

Concentration	Root (mg/gm)	Leaf (mg/gm)	Stem (mg/gm)
10ppmIAA	3.93 ± 0.581	2.83 ± 0.202	2.36 ± 0.417
50ppm IAA	3.66 ± 0.352	3.0 ±0.117	2.23±0.338
100ppm IAA	4.5 ± 1.75	3.53 ±0.001	2.4 ±0.233
10ppm IBA	4.23 ± 0.808	2.96 ± 0.008	3.1 ±0.577
50ppm IBA	5.46 ± 0.688	5.16 ± 0.338	4.8 ± 0.333
100ppm IBA	3.36 ±0.218	3.92 ± .763	2.56 ± 0.176
Control	3.26 ± 0.504	3.20 ± 0.173	2.8 ±0.173

5. Conclusion

IAA and IBA both have a good potential in improving accumulation of biochemical composition. Treating stem of *Boerhaavia diffusa* IBA is found to be more effective in improving total sugar content. The amount of total sugar was maximum found in leaf, stem and root respectively of 50 ppm treated cuttings on IBA. Maximum amount of reducing sugar

was found with leaf and stem respectively of IBA 50ppm treated cuttings but in root it was maximum in 100ppm treated cuttings of IBA. The maximum amount of total soluble protein was found with IBA 50ppm in root and leaf but in stem it was maximum in 100ppm IBA respectively. The maximum amount of TCA precipitated protein in root and leaf and stem respectively in 50 IBA treated. So, IBA and IAA hormone are the one of the best hormone for improving biomass and

metabolites content in *Boerhaavia diffusa*. So the medicinal plants cultivars may be applied these hormone for cultivation

and growth of medicinal plants.

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