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Influence of indole acetic acid and indole butyric acid on root development and status of *Andrographis elongata* (Vahl) T. and. – an endemic medicinal plant of india

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Abstract

Present investigation has been attempted to enumerate the rooting respond of stem cuttings of worthiness endemic medicinal species *Andrographis elongata* T. And. which is usually used for various medicinal purposes. Due to over exploitation this species is disappearing from natural habitat hence its multiplication on commercial scale is recommended. Stem cuttings of *Andrographis elongata* are convenient to root. Treatment with Indole-3-Acetic Acid and Indole-3-Butyric Acid upgraded rooting and increased shoot growth in greenhouse under intermittent misting. IAA and IBA treated cuttings performed better in all growth parameters compared to control. The Maximum percentage of rooting was noted in IBA 1500 ppm (64.08%). The Maximum root length was recorded in IBA 2000 ppm (9.74 cm). The roots were abundant and branched in nature. The percentage of rooting and root distance improved by using plant growth regulators, either individually or together. The present study determines that vegetative propagation of these an endemic medicinal plant is feasible through purpose of plant growth regulators.

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Introduction

Medicinal plants contain substances that can be used for therapeutic purposes or which are used as precursors for the synthesis of useful (Soforowa, 1993). The medicinal qualities of plants lies in their phytoconstituents such as flavonoids, alkaloids in addition to other phenolics that co-opt as to producing specific physiological activities to the body of man and animals (Taiwo *et al.,* 2000; Akinamoladun *et al.,*2007; Che Man, 2010). However, analysis of extract of *Andrographis elongata* was found to be wealthy in flavones to the expensive phytochemical properties of the plant. *Andrographis elongata* is therefore grown as a medicinal plant for the treatment of several diseases especially in India (Alagesaboopathi and Balu, 1999; Chinnappan Alagesaboopathi, 2010; Subramaniam *et al.,*1995). *Andrographis elongata* T. And. belongs to the plant family, Acanthaceae and has been largely used in health care traditions. Species of *Andrographis* Wallich ex Nees (Acanthaceae) are used in the Indian methods of drug such as Siddha, Ayurveda, Unani, Homeopathy, Naturopathy Modern and Amachi (Alagesaboopathi and Balu, 1999). The genus *Andrographis* as a complete is of potentialities importance to India. The genus presents antipyretic qualities (Kirtikar and Basu, 1975). This genus consists of forty species distributed in Tropical Asia (Anonymous, 1948). About twenty one species are distributed in India (Gamble, 1982) and all of them available in Tamilnadu (Henry *et al.,* 1987). Among the twenty one species eighteen species are reported to be endemic to India (Ahmedullah and Nayar, 1986). *Andrographis elongata* T. And. (Fig. 1) is an endemic medicinal plant (Ahmedullah and Nayar, 1986) found in wild in Pachamalai Hills (11°09′00″ to 11°27′00″ N latitude; 78°28′00″ to 78°49′00″ E longitude) (Salem and Tiruchirappalli districts).

The pharmaceutical industry is extensively dependent upon the wild populations for providing these plant species for extraction of their intrinsic phytoconstituents. Moreover, regional and forest dwellers often purpose these plant for medicinal applications. Due to the indiscriminate accumulation of the plant materials from forests and lacking experiments either to permit the replenishment or propagation, these essential flora are quickly vanishing. As a consequence, *A.elongata* reported as an endemic plant in India (Ahmedullah and Nayar, 1986). Therefore, there is an immediate demand to develop efficient cultivation manners for propagation of these notable medicinal floras which will extremely regulate to their conservation as well as produce for commercial purpose.

Fig. 1. *Andrographis elongata* T. in natural habitat.

It is used in the treatment of snake bite, antipyretic, antidiabetic, skin diseases, diabetes and also veterinary medicines have been attributed to this plant in that traditional practice of Indian medicine (Subramaninam *et al.,* 1995; Alagesaboopathi *et al.,* 2007; Alagasaboothi and Balu, 1999; Chinnappan Alagesaboopathi, 2010). It is used to manage antipyretic and earache (Subramaniam *et al.,* 1995; Neelima *et al.,* 2011). The new 2-oxygenated flavones were isolated from the whole plant extract (Jayakrishna *et al.,* 2001). There is no earlier report on use of auxins in vegetative propagation of this useful plant. The work was undertaken to outcome rooting response of *A.elongata* under greenhouse using growth regulators and conclusions reported. Rooting of stem

cutting through activity of growth regulators has been undertaken as a protocol for large scale propagation of this plant following the approach of Jayasankar *et al.,* 1990; Rao *et al.,* 1999; Chinnappan Alagesaboopathi, 2010; Tiwari and Kuntal Das, 2010 and Alagesaboopathi, 2011.

Auxins, a category of plant development substances are often called as plant hormones and play an indispensable role in coordination of various growth and behavioral method in the plant life cycle (Delker *et al.,* 2008; Hobbie, 1998; Tiwari and Kuntal Das, 2010). Indole-3-Butyric Acid (IBA), Indole-3-Acetic Acid (IAA) and α-Naphthalene Acetic Acid (NAA) are typically the leading auxins which are usable commercially and can be applied with liquid (liquid formulation) or in talc (Powder formulation) for rooting and sprouting of stem cuttings (Ercisli and Guleryuz, 1999; Hopkins, 1999).

Materials and methods

Andrographis elongata T. and. was used as trial plant in the present investigation. All the experiment was conducted at Department of Botany, Government Arts College (Autonomous), Salem (Tamilnadu), India. Disease free evenly matured *A.elongata* were collected from plants growing in Pachamalai Hills in November 2011. Stem cuttings were prepared two length sizes, that is, with two nodes and three nodes while each type maintained at two various diameters viz. thick (0.73 cm), thin (0.52 cm). Ten cuttings were taken for each treatment. These cuttings and treated with Indole-3-Acetic Acid (IAA) (500, 1000, 1500, 2000 and 2500 ppm) and Indole-3-Butyric Acid (IBA) (500, 1000, 1500, 2000 and 2500 ppm). The basal portions of cuttings were soaked in Indole-3-Acetic Acid and Indole-3-Butyric Acid solution for 24 hrs. Cuttings soaked in sterile distilled water and without any treatment (control) were included in the experiment for comparison. After 24 hrs the cuttings were planted in pots filled with garden soil, sand and farm yard compost (1:1:1) and the pots were kept in the greenhouse, frequently watered. After 30 days of planting the number of sprouted cuttings were counted whereas, their survival was accounted at 70 days of plantation. The data on root number, root length (cm), percentage of rooting, percentage of sprouting and shoot length (cm) were recorded. The experimental design was classified in randomized entire block design with five replications for each treatment and the information was analyzed for the variance.

Results and discussion

Results indicated a vast spectrum of efficacy of growth hormones on percent sprouted, percent of rooting, root number and root length of stem cuttings of *A. elongata* (Table 1). The effect of IAA and IBA on rooting of stem cuttings in *A. elongata* growth hormones of various concetrations of IAA 500, 1000, 1500, 2000 and 2500 and IBA 500, 1000, 1500, 2000 and 2500 ppm were used. Interpretation of *A. elongata* as medicinal plant, especially as a property for andrographolide and flavones is known to plant investigations for a extended time. As propagation through seeds is rather complicated, cuttings have been showed for the application. The growth hormones IAA and IBA had deep root inducing capacity. The results on respond of plant growth hormones for rooting and root length were recorded 60 days after planting (Table 1).

Fig. 2. Rooting of Andrographis elongata with IBA treatment.

Table 1. Effect of IAA and IBA on rooting of stem cuttings of *Andrographis elongata* T.

T	ppm	Survival (%)	Percent of rooting	Root number	Root length (cm)
IAA	500	37.10	29.45±0.16	6.42±0.38	7.30±0.49
	1000	48.25	36.11±0.42	6.96±0.76	6.80±0.17
	1500	74.26	45.19 ± 0.21	8.41 ± 0.42	8.42 ± 0.28
	2000	65.15	60.24 ± 0.25	8.90±0.86	8.45 ± 0.63
	2500	51.43	40.12 ± 0.54	8.65 ± 0.31	7.10 ± 0.79
IBA	500	36.47	32.62 ± 0.13	5.40 ± 1.00	6.82 ± 0.24
	1000	44.26	39.51 ± 0.14	6.12 ± 0.18	7.11 ± 0.72
	1500	53.10	64.08 ± 0.26	8.60±0.83	8.60 ± 1.20
	2000	83.15	48.13 ± 0.26	9.71 ± 0.76	9.74 ± 0.82
	2500	49.70	43.82 ± 0.78	7.33 ± 0.71	6.58 ± 0.43
Control	-	6.51	13.08 ± 0.16	1.85 ± 0.18	2.68 ± 0.45

T= treatments, ppm = concentration in parts per million. Data represents the mean±standard error of two independent, each with 10 cuttings per treatment.

The cuttings of *A. elongata* treated for IBA 1500 ppm were proved significantly effective for percent rooting while comparing with various growth hormones concentrations. Maximum number of leaves per cuttings was found for IBA 1500 ppm in *A. elongata* (Table 1). All the treatment of IBA and IAA indicatively the percentage of rooting in comparison to the control (Table 1). Among the IBA treatments maximum rooting percentage was noted with 1500 ppm (64.08) which was followed by 2000 ppm (48.13) 2500 (43.82), 1000 ppm (39.51) and 500 ppm (32.62) (Fig 2). The IAA treatments highest rooting percentage was recorded with 2000 ppm (60.24), which was followed by 1500 ppm (45.19), 2500 ppm (40.12), 1000 ppm (36.11) and 500 ppm (29.45) (Fig. 3). These treatments showed excellent effects than the control.

Fig. 3. Rooting of Andrographis elongata with IAA treatment.

The differential effects of various auxins on rooting of stem cuttings of different plant species have been ascribed to the chemical quality of auxin, the approach of treatment and the morpho-physiological condition of the cutting (Nanda, 1970; Hartmann and Kester, 1983; Pal, 1998; Nilanjana Das, 2006; Tiwari and Kuntal Das, 2010; Anyasi, 2011). All the treatment of IAA and IBA vitally enlarged the number of roots/ cuttings as compared to sterile distilled water (control). The maximum number of roots per cutting was noticed when cutting were treated with 2000 ppm IBA (9.71) followed by 2000 ppm IAA (8.90). IBA treatment significantly enhanced the number of roots/cutting as compared to 500 ppm IAA (6.42), 1000 ppm IAA (6.96), 1500 ppm IAA (8.41) and 2500 ppm IAA (8.65) respectively. Root length established maximum (9.74 cm) with 2000 ppm IBA followed by 1500 ppm IBA (8.60 cm) and 2000 ppm IAA (8.45 cm) treatments respectively. Maximum survival (83.15%)

was noted when the cuttings were treated with 2000 ppm IBA against least survival (6.51%) in untreated cuttings. Maximum survival (74.26%) was notable when the cuttings were treated with 1500 ppm IAA against minimum survival (6.51%) in control cutting. The IAA and IBA treatments demonstrated significantly lengthy shoots than the control (14.25 cm). The highest shoot lengths in 1500 ppm IBA and 2000 ppm IAA treatments could be due to the upgrade causes of the treatments.

Use of vegetative stem cuttings for the cultivation of plants have been found very efficient manner in number of plants like *Embelia tsjeriam, Caesalpinia bonduc, Jatropha curcas, Jatropha gossypifolia, Elaeocarpus venustus, Chromolaena odorata* (Tiwari and Kuntal Das, 2010; Rajesh Shrirangarao Gaikwad, 2011; Anyasi, 2011;Saravanan et al.,2011). The previous reports by Chinnappan Alagesaboopathi (2010) and Alagesaboopathi (2011) assure the significant of IBA and IAA to root stem cuttings of endemic medicinal plants of *Andrographis lineata* and *Andrographis ovata*. Sun and Chen (1998) reported the greater effects of plant growth hormones (IBA, IAA and NAA) on sprouting of rose buds. Growth regulators influences increased of plant cells, cell division, laterals branching of roots and shoots, vascular differentiation and early embryonic evolution (Hobbie et al.,2000). The existing reports on seed germination are not trustworthy in glance of their lesser germinability and delaying evolution (Vashistha *et al.,* 2009).

Medicinal plants popularly develop in uncultivated in regular habitat, but scientific mode would be beneficial to extend their biomass supply as well as andrographolide contents. Thus proliferation by means of stem cuttings is the highest saving suitable and wealthy manner of vegetative propagation. Moreover, to improve sprouting, rooting and survival of stem cuttings, plant development hormones can be wisely and extensively used. It is noticeable that *A.elongata* has got several uses. Due to over exploitation this plant is disappearing from original habitat hence its vegetative propagation on commercial scale is recommended. The present study laid a potent establishment for the conservation of this highly valued medicinal plant which are used world vast.

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