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Study of influence of different growth hormones on stem cutting propagation of Guggul [*Commiphora wightii* (Arn.) Bhan.]

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Abstract
An experiment on vegetative propagation through semi-hardwood stem cuttings of *Commiphora wightii* (Arn.) Bhan. Using different growth hormone at different concentration and their combination treatments was carried out under green shade house in the nursery of Department of Forestry, Dr. PDKV, Akola. Results showed that maximum sprouting percentage, rooting percentage, number of roots and root length were observed in IBA 500 ppm (85.00%, 76.67%, 7.36 and 13.87 cm, respectively). Number of sprouts and leaves and length of shoot were increased with concentration of 500 ppm for NAA auxin (7.17, 25.17 and 12.58 cm, respectively). This experiment showed that *Commiphora wightii* (Arn.) Bhandari can be propagated by semi-hardwood cuttings at 250 and 500 ppm concentration as a best source of planting materials for domestication and conservation purposes.

Keywords: *Commiphora wightii*, growth hormones, IBA, IAA, NAA

Introduction
Commiphora wightii is about 2.5-3m heighted medicinal plant and have sharp spines and papery bark belonging to Burseraceae family. It is reported to be an important component of the flora of tropical arid ecosystem (Kumar and Shankar, 1982) [11]. *Commiphora wightii* plant is known as Indian bdellium or Guggul and distributed in the arid, rocky tracts of Rajasthan, Gujarat, Karnataka, Rajputana, Bellari, Baluchistan, Assam, Berar and Mysore states of India, and Sindh and Baluchistan states of Pakistan (Atal 1975; Varier 1994) [2, 28].
Guggul is secreted form the bark as a result of wound or incision on the bark (Kirishnamurthy and Shiva 1977) [9]. The associated anatomical characteristics of the bark of *C. wightii* (Nair *et al*. 1981; Setia *et al*. 1977; Shah *et al.* 1982) [13, 18, 19] as well as the ultra-structural details of secretion, seasons of production and methods of enhancing the yield have been reported (Bhat *et al*. 1989) [3]. Guggulsterone (two isomers E and Z) is an effective anti-hyperlipidemic agent obtained from the gum resin of guggul tree, *C. wightii* (Dev 2006; Satayavati *et al*. 1969; Singh *et al*.1994; Tripathi *et al*. 1968; Wang *et al*. 2004) [5, 16, 20, 26, 29].
Guggul is an integral part of Ayurvedic treatment, also in used Unani and Siddha. Due its slow growth, poor seed setting and lower germination rate, religious prophets (Tajuddin *et al.*, 1997) [23] such high values and excessive demands, improper method of collection, uncontrolled forest destruction and poor knowledge of cultivation number of plants highly decrease therefore it is categorized as threatened plant (Thosar and Yande 2009) [25]. This plant has become endangered and reported in Data Deficient category of IUCN's Red Data list (Thomas *et al*. 2010) [24].
The major constraint in cultivation and domestication of this important medicinal plant is lack of availability of quality planting material due to delay in germination. Hence, there is need for alternative sources of planting materials. Vegetative propagation through stem cutting is most common and successful method (Kumar *et al*., 2006; Thosar and Yande 2009) [10, 25]. Auxins are play an essential role in coordination of plant growth and behavioral processes in the life cycle. While treatment of auxins given to the cuttings, mostly they enter through the cut surface. Role of some auxins IAA, IBA and NAA has been examined for their stimulatory effects on adventitious root formation in stem cuttings as well as on subsequent growth and survival of cuttings. It induces shoot apical dominance; the axillary buds are inhibited by auxin. When the apex of the plant is removed, the inhibitory effect is removed and the growth of lateral buds is enhanced. (Gehlot *et al*., 2014, Kenney *et al.* 1969 and Pop *et al*., 2011) [7, 8, 15].

The aim of this study to develop a suitable technique for large scale production of quality planting material in Guggul to achieve the required demand of material at minimum cost. Therefore, the present investigations were designed to evaluate the effect of IAA, IBA and NAA and their combination on the regeneration of sprouting and rooting in cuttings of Guggul.

Material and method

The experiment was conducted at forest nursery of Department of Forestry, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (M.S.) during the year 2016-17. The healthy planting material for experiment was collected from Nagarjun Medicinal Plant Garden, Dr. P.D.K.V., Akola. Semi-hard wood portion of the branches of vigorously growing and disease-pest free plant selected for vegetative propagation. The cuttings size of 8-10 mm diameter and 15-20 cm length were prepared by giving a slant cut at the bottom. The basal portion (2-3 cm) of the softwood cuttings were dipped for 24 hrs in freshly prepared solution of growth hormones and treatment details are as given below. Immediately after treatment of the growth hormones cuttings were planted into root trainers of size 80x60x45mm which were properly filled with potting media comprising of soil+sand+vermicompost. The cuttings were placed in green shade house to reduce direct desiccating effect of sunlight and watered regularly.

The experiment was laid out in a Completely Randomized Design (CRD) with three replications having 20 cuttings per replication. Data were recorded daily for days for sprouting, number for sprouts and sprouting percentage up to 30 days after planting. The other various shoot and root parameters were recorded when five observational cuttings were finally uprooted at 90 days after planting. The experimental data recorded on various parameters during the investigation are analyzed statistically. The experimental data recorded on various parameters during the investigation were statistically analyzed as per the method suggested by Panse and Sukhatme (1967) [14].

Treatment details			
T1	IAA 250 ppm	T6	NAA 500 ppm
T2	IAA 500 ppm	T7	IAA+IBA (250+250) 500 ppm
T3	IBA 250 ppm	T8	IAA+NAA (250+250) 500 ppm
T4	IBA 500 ppm	T9	NAA+IBA (250+250) 500 ppm
T5	NAA 250 ppm	T10	Control

Results and discussion

The statistical analysis of data evident that, different treatments of growth hormones had a significant effect on growth parameters of Guggul. Influence of different growth hormones on growth parameters of guggul stem cuttings are presented in Table 1. Results indicated that stem cutting treated with 500 ppm of IBA and NAA observed higher percentage of sprouting (85.00%). Rooting percentage was recorded highest i.e. 76.67 per cent when cutting treated with 500 ppm concentration of IBA followed by NAA and IAA 500 ppm (63.33% and 60.00%, respectively). The minimum sprouting percentage (63.48%) and rooting percentage (37.45%) was recorded in control. The formation of adventitious roots is a high energy requiring process, which involves cell division, in which predetermined cells switch from their morphogenetic path to act as mother cells for the root primordia; hence need more reserve food material for root initiation (Aeschabacher *et al*., 1994) [1]. Similar results were found by Singh *et al.* (2003) [21], who obtained the highest survival percentage with IBA at 500 ppm in *Piper longum* cuttings. Devarnavadagi *et al*. (2005) [6] studied on effect of growth regulator on induction of adventitious rooting in stem cutting of neem. 1000 ppm IBA treatment for 10 minutes recorded higher percent of sprouting and rooting.

Number of sprouts developed in guggul varied from range 3.00-7.17. The higher concentration 500 ppm of NAA, IBA and IAA showed maximum number of sprouts (7.17, 6.50 and 6.27, respectively) and minimum was recorded in control (3.00), whereas; both maximum number of leaves and length of shoot were observed in NAA 500 ppm (25.17 and 12.58cm, respectively) and was at par with IBA 500 ppm i.e. (22.37 and 11.44cm, respectively) and minimum was recorded in control (10.67 and 4.18cm, respectively). These findings may be due to effect of growth auxins, which would have triggered the activity of specific enzymes that promoted early sprouting. Early sprouting of cuttings will make the cuttings less dependent on stored food (Sen and Bose, 1967) [17]. The results are in conformity with Chandramouli (2001) [4] in Bursera, wherein cuttings treated with growth regulators have recorded early sprouting, and maximum number of sprouts, higher length and thickness of longest sprout as compared to control.

Significant differences were noted in number of roots and length of root. The maximum number of roots (7.36) was recorded in IBA 500 ppm and minimum was in control (2.84). The highest length of 13.84 cm of root was recorded in 500 ppm of IBA and was at par with 250 ppm of IBA (11.58 cm) and shortest length of root was recorded in control 3.97 cm. The combination of growth hormones at 500 ppm concentrations was not so effective in respect of growth parameters studied. But as compared with control, the maximum percentage of sprouting, number of sprouts, number of roots and length of root was recorded in IAA+IBA 500 ppm i.e. (80.00%, 5.50, 5.23 and 8.76 cm), maximum rooting percent was observed in NAA+IBA 500 ppm i.e. 60.19% and maximum number of leaves and shoot length was recorded in IAA+NAA 500 ppm i.e. (19.97 and 8.17 cm, respectively). Different portion of a single branch vary in their rooting and sprouting response depending on the seasonal, physiological conditions and age factor, thus their response will differ under same environmental conditions. The increase in number of roots in the cuttings treated with IBA, at 500 ppm can be attributed to the action of auxin activity which might have caused hydrolysis and translocation of carbohydrate and nitrogenous substances at the base of cuttings and resulted in accelerated cell elongation and cell division in suitable environment (Singh *et al.*, 2003) [21]. Similar inference was made by Mishra and Kumar (2014) [12] in Guggul and Shwetha (2005) [22] in Bursera. Tripathi *et al.*, (2014) [27], reported that the percentage of rooting and length of root was higher and increased in IBA treatment as compared to similar concentration of IAA in *Commiphora wightii*.

Table 1: Influence of different growth hormones on growth parameters of Guggul stem cuttings

Treatment		Sprouting percentage (%)	Rooting percentage (%)	Number of sprouts	Number of leaves	length of shoot (cm)	Number of roots	length of root (cm)
T1	IAA 250 ppm	71.71 (57.98)**	49.07 (44.44)**	4.33	13.07	5.43	3.84	7.70
T2	IAA 500 ppm	63.33 (52.75)	55.91 (48.43)	6.27	16.65	7.70	5.08	8.75
T3	IBA 250 ppm	83.33 (65.93)	60.00 (50.83)	5.33	16.50	7.08	4.22	11.58
T4	IBA 500 ppm	85.00 (67.38)	76.67 (61.19)	6.50	22.37	11.44	7.36	13.87
T5	NAA 250 ppm	81.67 (64.97)	51.67 (45.94)	4.50	14.33	10.03	2.91	5.56
T6	NAA 500 ppm	85.00 (67.38)	63.33 (52.72)	7.17	25.17	12.58	3.72	8.90
T7	IAA+IBA 500 ppm	80.00 (63.90)	58.33 (49.78)	5.50	16.50	5.38	5.23	8.76
T8	IAA+NAA 500 ppm	79.00 (62.75)	50.00 (44.98)	4.67	19.67	8.17	3.58	5.93
T9	NAA+IBA 500 ppm	75.07 (60.09)	59.19 (50.86)	4.00	18.00	6.63	4.34	7.87
T10	Control	63.48 (52.84)	37.45 (37.67)	3.00	10.67	4.18	2.84	3.97
Mean		76.76	56.16	5.13	17.29	7.86	4.31	8.29
SE (m)±		2.54	2.58	0.42	1.22	0.56	0.41	0.97
C.D. at 5%		7.54*	7.66*	1.26*	3.63*	1.66*	1.21*	2.89*

*values are significant at 5%,

** Figures in parenthesis are arc sign value

Conclusion

The experiment leads to represent that semi-hard wood cutting of *Commiphora wightii* could be rooted at 250 and 500 ppm concentration of growth hormones and had a significant effect on the growth and development parameters of *Commiphora wightii*. This study justify that cuttings need some physiological stimulation and favorable environment for better growth and rooting. IBA at 500 ppm had strong beneficial effect than other growth hormones under green shade condition which influenced on growth and survival of cuttings of Guggul (*Commiphora wightii*).

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