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International Journal of Current Research
Vol. 6, Issue, 12, pp.10946-10949, December, 2014

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

EFFECT OF VARIOUS CONCENTRATIONS OF IBA AND LENGTH OF CUTTING ON THE ROOTING IN STEM CUTTING OF *TICOMA STANS* L. UNDER MIST CHAMBER

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ARTICLE INFO

Article History:
Received 21st September, 2014
Received in revised form
04th October, 2014
Accepted 18th November, 2014
Published online 30th December, 2014

Key words:
Stem cutting, IBA,
Ticoma, Rooting percentage,
Mist chamber.

ABSTRACT

The experiment site was conducted under mist chamber at Horticulture Research Center, HNB Garhwal Central University, Chauras Campus Srinagar (Garhwal), Uttarakhand, India. The different length stems cuttings (20, 35 and 50 cm) of *Ticoma stans* L treated with IBA solutions at 500, 1000 and 1500 mg. L^{-1} by Quick dip method. Treated cutting were planted carefully in the root trainers. For preparing rooting media one part sandy soil and one part of FYM Were mixed thoroughly. Among all the treatments, highest number of sprouted cuttings (100%) was recorded under C_1L_2, C_2L_2, C_3L_2 (35 cm long cutting treated with 500 ppm, 1000 ppm and 1500 ppm concentration of IBA respectively) treatments, length of sprout (10.18 cm) was found under C_3L_3 (50 cm long cutting treated with 1500 ppm IBA) treatment. diameter of sprout (0.26), number of leaves on new growth (5.59), height of plant (72.44 cm), number of primary roots (18.66%), length of root (10.53 cm), diameter of root (0.11 cm), fresh weight of root (0.79 gm) and dry weight of root (0.094 gm) were found under C_3L_3 (50 cm long cutting treated with 1500 ppm concentration of IBA) treatment.

INTRODUCTION

The plant *Ticoma. stans* L. Kunth, belonging to the family Bignoniaceae, and commonly known as "pachagolta" is a diacotyledonous herb popularly grown for its flower as an ornamental / garden plant in normal garden and temples. It has been introduced to several other regions, tropical and subtropical areas such as Africa, Asia, the Pacific Island, the Philippines, Hawaii and Australia. Some tropical countries have reported *T. stans* being invasive and sometimes difficult to control, establishing naturalized colonies that might inhibit regeneration of other plant species (Arlete, 1993). *Tecoma stans* is a native to the tropical and subtropical regions of Central and South America. It is easily distinguished from *Tecoma stans* by its much narrower leaves and smaller height, reaching only 10 feet (~3 meters) in height. *T. stans* is a "shrub or small tree, much branched, It has sharply-toothed, lance-shaped green leaves and bears large, showy, twigs tan or reddish tan Linn is compound leaf, alternate, ovate, entire, glabrous. The leaf is compound trifoliate leaf having open is acute, ovate in shape, serrate margin, parallel pinnate types of venation, petiole is ling surface is glabrous, upper epidermis dark green in colour, lower epidermis lighter in colour and bitter taste; inflorescence an auxiliary or terminal raceme, pedicels short, irregularly curved or twisted bracts reduce to minute scales, the flowers are bright yellow in color; 2 inches long with trumpet shape and hang in showy clusters at the branch tips and forks, the twig are stout, slightly square, initially green but turning reddish brown with numerous lighter lenticels, bending the twigs into arches with their weight, hence the name Yellow Bells (Bailey and Bailey, 1976).

There are some certain medicinal properties and usages of *T. stans*. It can be used in fuel; like tree provide firewood and charcoal, and timber can be used in the construction of building. *Tecoma stans* requires bright light and warm temperature. It is propagated by softwood cutting under mist. It is generally use a 3000 ppm IBA quick dip to promote better rooting. And propagated through seed that can be planted directly into pots, and they require no pretreatment. Seedling requires 3 to 4 months in the nursery. Regeneration by cutting is also possible.

MATERIALS AND METHODS

Softwood cuttings of *Ticoma stans* were collected from 4 to 5 year old plants and 20 cm, 35 cm and 50 cm long stem cuttings with apical portion. For preparing the rooting media, sandy soil and farm yard manure (FYM) in ratio of 1:1 by v/v were mixed thoroughly, cleaned for stones and grasses, then the mixture was filled in root trainers. The basal ends of the cuttings were dipped in dilute solutions, 500 ppm, 1000 ppm and 1500 ppm,

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of indole-3-butyric acid by quick dip method for 10 seconds before planting them in the rooting medium. The treated cuttings were planted carefully in the root trainers. After the treatment, the cutting were immediately planted in 10x10 cm size of root trainer and inserted 7.5 cm in the rooting media, twenty root trainers were fitted in one frame. The experiment was replicated thrice with 10 cuttings in each treatment and a total of 360 cuttings were tested. Experiment was conducted in the mist house which had the arrangement for intermittent misting to 60 seconds at every 30 minutes interval between 8 am and 8 pm. The data recorded were subjected to statistical analysis for least significant difference (RBD) as described by Cochran and Cox (1992).

RESULTS AND DISCUSSION

A perusal of Table 1 shows that the effect of different concentrations of IBA significantly affected the various growth characters of leafy cuttings in *Lagerstroemia indica*. The highest number of sprouted cuttings (100%) was recorded under C_1L_2, C_2L_2, C_3L_2 (35 cm long cutting treated with 500 ppm, 1000 ppm and 1500 ppm concentration of IBA respectively) treatments. Bhatt and Tomar (2010) also reported that highest number of sprouted cuttings was observed in 500 ppm concentration of IBA in citrus auriantifolia Swingle (Kagzi-lime). Panwar and Gupta (1994) and Bijalwan and Thakur (2010) also in harmony with the highest number of sprouted cuttings in 1500 ppm concentration of IBA in bougainvillea cv. Alok; and *Jatropha curcas* L., respectively. It has been evident that IBA is more effective in case of *T. stans* L. which increased the number of sprouts per cutting. The maximum length of sprout (10.18 cm) was found under C_3L_3 (50 cm long cutting treated with 1500 ppm IBA) treatment followed by C_3L_2 (35 cm long cutting treated with 1500 ppm IBA) treatment. Singh (2001C) reported that application of IBA at right time gives beneficial effect on bougainvillea peruviana cutting. The present findings are similar to the findings of Panwar *et al*. (1999) with respect to average length of sprout per cutting. The maximum average diameter of sprout (0.26) was found under C_3L_3 (50 cm long cutting treated with 1500 ppm) treatment.

The maximum average diameter of root was recorded in 50 cm long cuttings which may probably supply more nutrients to shoots. These findings are more of less similar those reported by Singh, (2001) and Singh *et al*. (2011) with respect to average diameter of sprout per cutting. The highest number of sprout per cutting (10.33) was found under C_3L_3 (50 cm long cutting treated with 1500 ppm) treatment. The similar result was reported by Singh (2001b) in *Euphorbia pulcherrima* cv. Eckes. The maximum number of sprouts per cutting was recorded in 50 cm long cuttings on new growth as compare to 20 cm and 35 cm length of cutting. The maximum number of sprout per cutting treated with IBA in optimum time might to possible due to better root growth which augmented absorption and translocation of nutrients from soil which take active part in various plant metabolic processes (Singh 2001c). The maximum number of leaves on new growth (5.59) was found under C_3L_3 (50 cm long cutting treated with 1500 ppm IBA) treatment followed by C_3L_2 (35 cm long cuttings treated with 1500 ppm IBA) and C_0L_3 (35 cm long untreated cuttings) treatments. Mahros (2002) reported that the similar findings in respect to average number of leaves per cutting in *Bougainvillea glabra* cv. Variegate. 50 cm long cutting produced strong and more numbers of sprouts per cutting so this cutting was produced maximum number of leaves on new growth in combination of 1500 ppm concentration of IBA. It might be due to wood maturity of cutting which probably reserve high starch and sugar. Average height of plant per cutting was found significant. The maximum height of plant (72.44 cm) was found under C_3L_3 (50 cm long cutting treated with 1500 ppm IBA) treatment. These findings of present study are similar to the findings of Panwar and Gupta (1994) in bougainvillea cv. Alok. In 50 cm length of cutting produced maximum length of longest roots and secondary root was also found maximum under the 50 cm length of cutting so those maximum number of roots observed higher amount of nutrients in combination of 1500 ppm concentration of IBA while 35 cm and 20 cm long cutting may not perform better in combination with 1500 ppm concentration of IBA.

The highest number of primary roots (18.66%) was found under C_3L_2 (35 cm long cutting treated with 1500 ppm IBA) treatment. The present findings are similar to the findings of Bijalwan and Thakur (2010) reported that highest number of primary roots in 1500 ppm concentration of IBA in *Jatropha curcas* L. The cutting of 35 cm long formed highest number of sprouted may be due to higher amount of nutrient absorption in 1500 ppm concentration of IBA. According to Bose *et al*. (1968) cutting of Bougainvillea and other ornamental shrub species produced large number of roots, weight of fresh and dry root when treated with IBA at 3000-6000 ppm. Length of longest root per cutting was not found significant however the maximum average length of longest root (10.53 cm) was found under C_3L_3 (50 cm long cutting treated with 1500 ppm IBA) treatment. Panwar and Gupta (1994) also reported that maximum length of longest longest root was observed in 1500 ppm concentration of IBA in bougainvillea cv. Alok. Bijalwan and Thakur (2010) also reported that highest length of longest root with the treatment of 1500 ppm concentration of IBA in *Jatropha curcas* L. The maximum average diameter of longest root (0.11 cm) was found under C_3L_3 (50 cm long cutting treated with 1500 ppm IBA) treatment. The present findings are similar to the findings of Singh (2001b) in respect to average diameter of longest root per cutting in *Euphorbia pulcherrima* cv. Eckes. The highest number of cuttings produce profuse callus formation (44.44%) was found under C_3L_3 (50 cm long cutting treated with 1500 ppm IBA) treatment.

The maximum number of cuttings produces good callus formation (77.77%) was found under C_1L_2 (35 cm long cuttings treated with 500 ppm IBA) treatment. The maximum number of cuttings produce poor callus formation (66.66%) was found under C_0L_1 (20 cm long untreated cutting) control treatment. and the minimum number of cutting produce nil callus formation (0.00) was recorded under all treatments combination. The performance terminal cutting with respect to percentage of rooting, number of primary root, percentage of secondary rooting, and callus production was significantly superior over sub terminal cutting in *Bougainvillea Peruvians* cv. Thimma (Singh 2002).

Table 1. Effect of IBA concentrations and length of cutting on survival performance, vegetative growth and rooting of *Ticoma stans* L cuttings under mist

Treatment combinations	Number of sprouted cutting (%)	Number of sprout per cutting	Av. Length of sprouts(cm)	Av. Diameter of sprouts (cm)	Av. Number of new leaves on new growth	Height of plant(cm)	Number of primary root	Length of longest root(cm)	Diameter of longest root(cm)	Fresh weight of root()gm	Dry weight of root(gm)
C_1L_1	83.3	3.77	6.35	0.20	4.29	44.91	13.11	9.27	0.1	0.43	0.11
C_1L_2	100.0	6.22	7.73	0.24	4.69	53.55	16.77	8.12	0.1	0.65	0.089
C_1L_3	83.3	9.77	6.23	0.19	4.29	61.33	15.89	9.5	0.1	0.41	0.073
C_2L_1	76.6	3.44	6.58	0.20	2.18	34.24	9.44	6.2	0.1	0.15	0.023
C_2L_2	100.0	5.77	6.91	0.20	4.44	49.35	11.89	7.83	0.1	0.43	0.072
C_2L_3	96.6	8.00	6.04	0.18	3.66	65.11	12.66	7.25	0.1	0.26	0.088
C_3L_1	90.6	4.22	7.28	0.23	4.29	42.24	14.11	8.51	0.1	0.47	0.066
C_3L_2	100.0	6.53	8.10	0.20	5.07	55.12	18.66	8.68	0.1	0.34	0.065
C_3L_3	93.3	10.00	10.18	0.26	5.59	72.44	12.55	10.53	0.11	0.79	0.094
C_0L_1	83.0	4.33	6.73	0.19	3.88	40.01	12.22	7.61	0.1	0.2	0.036
C_OL_2	86.6	5.11	4.66	0.13	3.14	45.47	13.22	6.65	0.1	0.34	0.067
C_0L_3	90.0	8.22	5.56	0.13	4.96	68.64	18.44	8.2	0.1	0.36	0.062
S. Em	5.85	0.96	1.24	0.20	0.76	3.5	2.97	1.15	0.28	0.12	0.24
C.D. at 5%	17.16	2.86	3.63	0.59	2.22	10.22	8.69	3.37	0.84	0.35	0.71

Table 2. Effect of IBA concentrations and length of cutting on callus formation and secondary rooting of *Ticoma stans* L cutting under mist

Treatment	Callus formation				Secondry rooting			
	Profuse	Good	Poor	Nill	Profuse	Good	Poor	Nill
C_1L_1	11.11	66.66	22.22	0	44.44	11.11	44.44	0
C_1L_2	22.22	77.77	00.00	0	44.44	22.22	33.33	0
C_1L_3	11.11	55.55	33.33	0	44.44	11.11	44.44	0
C_2L_1	33.33	11.11	55.55	0	11.11	11.11	77.77	0
C_2L_2	33.33	44.44	22.22	0	22.22	44.44	33.33	0
C_2L_3	33.33	22.22	44.44	0	22.22	33.33	44.44	0
C_3L_1	11.11	66.66	22.22	0	22.22	44.44	33.33	0
C_3L_2	22.22	44.44	33.33	0	55.55	11.11	33.33	0
C_3L_3	44.44	44.44	11.11	0	55.55	33.33	11.11	0
C_0L_1	22.22	11.11	66.66	0	22.22	00.00	77.77	0
C_OL_2	33.33	11.11	55.55	0	22.22	22.22	55.55	0
C_0L_3	33.33	11.11	55.55	0	22.22	66.66	11.11	0
S. Em	17.7	15.07	15.86	0	14.94	13.05	12.61	0
C.D. at 5%	51.91	44.21	46.51	0	43.84	38.28	37.00	0

C_1 = 500 ppm C_2 = 1000 ppm C_3 = 1500 ppm C_0 = Control L_1 = 20 cm L_2 = 35 cm L_3 = 50 cm

The above findings are in symmetry with finding of Singh *et al*. (2003) in respect to average callus formation per cutting. The maximum number of cutting produce profuse secondary rooting (55.55%) was found under C_3L_2 and C_3L_3 (35 cm and 50 cm long cuttings treated with 1500 ppm IBA) treatments. The maximum number of cutting produce good secondary rooting (66.66%) was found under C_0L_3 (35 cm long untreated cutting) control treatment. The highest number of cutting produce poor secondary rooting (77.77%) was found in C_2L_1 and C_0L_1 (20 cm long cutting treated with 500 ppm IBA and control treatment) treatment and the minimum number of cuttings which do not produce secondary rooting (0.00%) was recorded under all the treatment combinations (Table 2). These findings are also closed to the findings of Panwar and Gupta (1994) and Singh (2001b) reported that higher secondary rooting in 1500 ppm concentration of IBA in bougainvillea cv. Alok and *Euphorbia pulcherrima* cv. Eckes respectively. The highest fresh weight of root per cutting (0.79 gm) was found under C3L3 (50 cm long cutting treated with 1500 ppm IBA) treatment. The similar results of fresh weight of root are in agreement with the findings of Singh (2001b) Euphorbia pulcherrima cv. Eckes. The maximum dry weight of root per cutting (0.094 gm) was found under C3L3 (50 cm long cutting treated with 1500 ppm IBA) treatments. These findings are agree with the findings of Singh *et al.* (2003) and Deo (2008) in respect to average dry weight of root per cutting in Bougainvillea.

Conclusion

Among various concentration of IBA, 1500 ppm concentration of IBA was shown best performance in terms on number of sprouted cuttings, number of unsprouted cuttings, number of sprouts per cutting average length of sprouts, average diameter of sprouts, average number of leaves on new growth, height of plant, number of primary root per cutting, longest root, average diameter of longest root, callus formation, number of secondary roots per cutting, fresh weight of roots per cutting, dry weight of roots per cutting while among the various length of cuttings of *T. stans* L., 50 cm long cutting was shown best result in present study. It is suggested that 50 cm long cuttings treated with 1500 ppm concentration of IBA give the overall best performance under mist to tallest plant of *T. stans* L. within a short time and recommended for commercial vegetative multiplication of *T. stans* L.

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