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Effect of Indole-3-butyric Acid and Maturity Level of Single Node Stem Cuttings on Propagation of Exacum ritigalensis

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ABSTRACT

A study was conducted to observe the effect of different concentrations of indole-3-butyric acid (IBA) and maturity levels of single node stem cuttings for vegetative propagation of *E. ritigalensis*. Branches of the plant were treated by 20% Clorox in 20 minutes and rinsed it two times using distilled water. Stems cuttings were grouped into three according to the diameter (20-30 mm, soft wood; 30-40 mm, semi hardwood and 40-50 mm, hardwood).Three different ways of leaves remaining in single node stem cuttings were used; half of single leaf, half double opposite leaves and without leaf. Stem cuttings were treated by IBA (0, 2, 2.5, 5, 10 and 15 mgL-1) for 15 minutes. Plant propagators were prepared by poly bags (150 gauges) and filled by sterilized coir dust. Thereafter, they were kept in two months and observed the survival rates of cuttings (greenish or not),number of roots, length of the lengthiest root, number of buds and number of leaves per bud. Experiments were arranged in three factor factorial completely randomized design (FCRD) with ten replicates. Statistical analysis was performed with Duncan's multiple range test using SAS software (version 9.1.3). It was observed that rooting was at initial stage of all cuttings after one month. Result were showed that the semi hardwood single node stem with half single leaf or double leaves treated by 10 mgL-1 and 15 mgL-1 IBA were best for rooting compare to other all treatments and control, showed 100% survival rate with three buds per cutting.

Keywords: *Exacum ritigalensis*, stem cutting, Indole-3-butyric acid, Vegetative propagation

INTRODUCTION

Many kinds of plants, both woody and herbaceous, are commonly propagated by cuttings. Propagation of *Exacum ritigalensis* is very important because its seedling growth rate is very low at the beginning and rare to find many plant s in the nature. A cutting is a vegetative plant portion which is detached from the parent plant that can be regenerated itself, thus forming a whole complete new plant. Cuttings should be taken by a tool with a sharp blade to reduce injury to the parent plant and cutting. Eliminate flowers and flower buds to tolerate the cuttings to use its energy and stored carbohydrates for root and shoot formation rather than fruit and seed production. Cuttings with large leaved are trimmed up to half the leaf length can increase efficiency, in addition to light and air circulation for all the cuttings (Relf, 2009). Tissue culture technique can be utilized for the propagation and in vitro conservation of vegetatively propagated crops (Jain and Yadav, 2016). Numerous plant species are propagated by hardwood, semi hardwood or softwood stem cuttings. A hardwood cutting is one which is taken from a completely mature stem which is most often used in propagation. Using hardwood cuttings are considered the easier method of vegetative propagation since slight to no special equipment is necessary to prepare them. Semi hardwood cuttings are generally prepared from partially matured wood of current season's growth. When preparing cuttings, leaves are removed from the lower section that will be inserted into the propagation substrate. Species with large leaves may need a trimming leaves to reduce the large leaf surface, which reduces transpiration water loss and allows for closer spacing of cuttings. Softwood cuttings of some species are easy to rooting and quicker than other cutting types, but require more attention. Lower leaves are removed and large leaves are trimmed. All flowers or buds should be removed and on some cases the terminals should be removed to decrease the possibility for desiccation.

IBA (indole-3-butyric acid) is naturally occurring form of auxin. Usually, IBA is found in salt form, which is water-soluble; otherwise it is only soluble in alcohol, which could burn sensitive cuttings. The positive effects of Indole Butyric acid in commercial vegetative propagation from cuttings have also been well established in other crops like Azaleas and Bougainvillea by Carville (1967), Brydon (1964) and Shepherd and Winston (2000).Exacum affine, Exacum or Persian violet which is a popular greenhouse-grown pot plant with fragrant flowers, multiple blooms, and good post harvest quality which can be propagated from seed or cuttings. Herbaceous stem cuttings root easily with bottom heat (22°C). Exacum can also be micropropagated (Torres and Natarella, 1984).Present study was conducted to observe the effect of different concentrations of indole-3-butyric acid (IBA) and maturity levels of single node stem cutting for vegetative propagation of *E. ritigalensis*.

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MATERIALS AND METHODS

Branches of the plant were treated by 20% Clorox in 20 minutes and rinsed it two times using distilled water. Stems cuttings were grouped into three according to the diameter (20-30 mm, soft wood; 30-40 mm, semi hardwood and 40-50 mm, hardwood). And also single node stem cuttings with 3 different ways of leaves remaining; half of single leaf, half double opposite leaves and without leaf were used. Stem cuttings were treated by IBA (0, 2, 2.5, 5 10 and 15 mgL-1) for 15 minutes. Plant propagators were prepared by poly bags (150 gauges) which were filled by sterilized coir dust. Thereafter, they were kept two months and observed the survival rates of cuttings (greenish or not), number of roots, length of the lengthiest root, number of buds and number of leaves per bud. Experiments were arranged in three factor factorial completely randomized design (FCRD) with ten replicates. Statistical analysis was performed with Duncan's multiple range testusing SAS software (version 9.1.3).

Fig. 1a **Fig. 1b** **Fig. 1c** **Fig. 1d**

Fig. 1: Treated with IBA10 mgL-1; a, half single cutting in polythene bag, b, double leaves cuttings, c, half single and d, callus forming of IBA treated survival cutting after two months.

RESULTS AND DISCUSSION

Many growers prefer to use IBA Quick Dip Immersion of basal ends for rooting of cuttings which uses are well documented in Plant Propagation Principles and Practices (Hartmann *et al*., 1990). After one month, thesemi hardwood single node stem with half single leaf and double leavestreated by 10 mgL-1 and the semi hardwood single node stem with double leavestreated by 15 mgL-1IBA gained three buds per cuttingwas significantly differentwith control and other treatments. The semi hardwood single node stem cuttings without leaves, with half single and double leavestreated by 10mgL-1; single node stem cuttings without leaves and double leaves treated by15mgL-1 IBAwere not significant different with number of leaves per bud (06).And also, IBA treated semi hardwood cuttings of 2, 2.5 and 5mgL-1 in half single leaf, 2mgL-1 half double leaves and softwood treated by 5mgL-1 IBA with single half leaf were not significant with leaves number (06).Except hard wood cuttings the most of the cuttings exposed to the IBA, showed greenish colour after two months which revealed the survive ability of cuttings are very high (Table 1, 2 and 3).

Table 1: Observations of Soft wood single node cuttings after one month and two months

Concentration	Initial leaves with half cut after one month	Number of leaves after one month	Number of buds after one month	Survival rate after one month (%)	Root length after two months	Number of roots initiated from cutting surface after two months
15	0	4^{b}	1^{c}	80	0.00^{c}	0^{c}
15	1	4^{b}	1^{c}	80	0.00^{c}	0^{c}
15	2	4^{b}	1^{c}	80	0.00^{c}	0^{c}
10	0	0^{c}	0^{d}	50	0.00^{c}	0^{c}
10	1	4^{b}	1^{c}	90	0.00^{c}	0^{c}
10	2	4^{b}	1^{c}	80	0.00^{c}	0^{c}
5	0	0^{c}	0^{d}	00	0.00^{c}	0^{c}
5	1	6^{a}	2^{b}	90	0.00^{c}	0^{c}
5	2	0^{c}	0^{d}	70	0.00^{c}	0^{c}
2.5	0	4^{b}	1^{c}	100	0.00^{c}	0^{c}
2.5	1	4^{b}	1^{c}	100	0.00^{c}	0^{c}
2.5	2	0^{c}	1^{c}	70	0.00^{c}	0^{c}
2	0	0^{c}	0^{d}	00	0.00^{c}	0^{c}
2	1	4^{b}	1^{c}	30	0.00^{c}	0^{c}
2	2	4^{b}	1^{c}	90	0.00^{c}	0^{c}
Control	0	0^{c}	0^{d}	00	0.00^{c}	0^{c}
Control	1	0^{c}	0^{d}	40	0.00^{c}	0^{c}
Control	2	4^{b}	1^{c}	40	0.00^{c}	0^{c}

Same letter are not significantly different as determined by Duncan's multiple range test (α=0.05).

Accordingly, root generation is one of the most important sapling quality indicators (Hakan and Kerim, 2013). According to the results of the study, an average length of root was 6.5-6.48 cm as shown in semi hardwood single node stem with half single and double leaveswhen the applied10mgL-1(Fig.1: a, b & c)and 15 mgL-1 IBA. Application of IBA with 10mgL-1developed eight roots in semi hardwood single node stem with half single and double leaves after two months.

Table 2: Observations of Semi-hard wood single node cuttings after one month and two months

Concentration	Initial leaves with half cut after one month	Number of leaves after one month	Number of buds after one month	Survival rate after one month (%)	Root length after two months	Number of roots initiated from cutting surface after two months
15	0	6^{a}	2^{b}	100	3.00^{b}	5^{b}
15	1	4^{b}	1^{c}	90	6.48^{a}	7^{a}
15	2	6^{a}	3^{a}	100	6.49^{a}	8^{a}
10	0	6^{a}	2^{b}	100	2.50^{c}	5^{b}
10	1	6^{a}	3^{a}	100	6.48^{a}	8^{a}
10	2	6^{a}	3^{a}	100	6.50^{a}	8^{a}
5	0	4^{b}	2^{b}	50	0.00^{c}	0^{c}
5	1	6^{a}	1^{c}	100	0.00^{c}	0^{c}
5	2	4^{b}	1^{c}	100	0.00^{c}	0^{c}
2.5	0	4^{b}	1^{c}	70	0.00^{c}	0^{c}
2.5	1	6^{a}	2^{b}	100	0.00^{c}	0^{c}
2.5	2	4^{b}	1^{c}	100	0.00^{c}	0^{c}
2	0	4^{b}	1^{c}	70	0.00^{c}	0^{c}
2	1	6^{a}	1^{c}	70	0.00^{c}	0^{c}
2	2	6^{a}	2^{b}	80	0.00^{c}	0^{c}
Control	0	4^{b}	1^{c}	50	0.00^{c}	0^{c}
Control	1	4^{b}	2^{b}	60	0.00^{c}	0^{c}
Control	2	4^{b}	2^{b}	80	0.00^{c}	0^{c}

Same letter are not significantly different as determined by Duncan's multiple range test (α=0.05).

Table 3: Observations of Hard woodsingle node cuttings after one month and two months

Concentration	Initial leaves with half cut after one month	Number of leaves after one month	Number of buds after one month	Survival rate after one month (%)	Root length after two months	Number of roots initiated from cutting surface after two months
15	0	0^{c}	0^{d}	40	0.00^{c}	0^{c}
15	1	0^{c}	0^{d}	50	0.00^{c}	0^{c}
15	2	0^{c}	0^{d}	50	0.00^{c}	0^{c}
10	0	0^{c}	0^{d}	70	0.00^{c}	0^{c}
10	1	0^{c}	0^{d}	50	0.00^{c}	0^{c}
10	2	0^{c}	0^{d}	50	0.00^{c}	0^{c}
5	0	0^{c}	0^{d}	00	0.00^{c}	0^{c}
5	1	0^{c}	0^{d}	00	0.00^{c}	0^{c}
5	2	0^{c}	0^{d}	40	0.00^{c}	0^{c}
2.5	0	0^{c}	0^{d}	00	0.00^{c}	0^{c}
2.5	1	0^{c}	0^{d}	00	0.00^{c}	0^{c}
2.5	2	0^{c}	0^{d}	00	0.00^{c}	0^{c}
2	0	0^{c}	0^{d}	00	0.00^{c}	0^{c}
2	1	0^{c}	0^{d}	00	0.00^{c}	0^{c}
2	2	0^{c}	0^{d}	00	0.00^{c}	0^{c}
Con trol	0	0^{c}	0^{d}	00	0.00^{c}	0^{c}
Control	1	0^{c}	0^{d}	00	0.00^{c}	0^{c}
Control	2	0^{c}	0^{d}	00	0.00^{c}	0^{c}

Same letter are not significantly different as determined by Duncan's multiple range test (α=0.05).

Semi hardwood single node stem with half single and double leaves treated with15 mgL-1was not significant difference fromstem cutting treated with 10mgL^{-1}IBA. IBA applications to semi hardwood cuttings treated with 10 mgL^{-1} and 15 mgL^{-1} IBA, not initiate roots. The results of Osama and Mostafain 1996 irrespective of IBA concentration, hard and semi-hard cuttings gave significantly high rooting percentages. On the other hand, best rooting was obtained when the stem cuttings propagation of GF677 Peach rootstock by stem cuttings dipped in high concentrations of IBA. But the saplings in the survival groups showed white colour callus formation as a signs of survival cuttings (Fig. 1:d).

In this experiment, it was not observed rooting in low concentration of IBA (2, 2.5 and 5 mgL-1), but some varieties such as shoot cuttings of Berberis, Cotoneaster, Lavandula, Lavender, Ficus, Prunus, Pyracantha and Viburnum were immersed two minutes in 1000 ppm IBA dissolved in water (Van Brash, 1976).

CONCLUSION

The semi hardwood single node stem with half single leaf or double leavestreated by 10 mgL-1and 15 mgL-1IBA were best for rooting compare to other all treatments and control, showed 100% survival rate with three buds per cutting.

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