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Influence of NAA on root promotion in vegetative propagation of *Duranta erecta* L.

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Abstract
The current study was aimed to find the effect of NAA on rooting of cuttings in *Duranta erecta* L. The experiment was laid out in Completely Randomized Block Design (CRD) with 3 replications, including six treatments of various concentration of Naphthalene Acetic Acid (NAA) solutions *viz*., 250 ppm, 500 ppm, 1000 ppm, 2000 ppm, 3000 ppm and control (without any treatment). Minimum days for sprouting (11.52 days), rooting percentage (85.63%), number of roots per cutting (8.15) and root length (9.56 cm) are recorded maximum NAA 3000 ppm. All the NAA treatments are on par with each other and significantly higher than control in survival percentage. From this experiment we conclude that, the rooting and survival capacity of hardwood stem cuttings of *Duranta erecta* under mist chamber conditions, can be improved by quick dipping of basal portion of cuttings on NAA with 3000 ppm concentration.

Keywords: NAA, Duranta, hardwood cuttings, rooting hormone, propagation

Introduction
Duranta erecta L. (Golden dewdrop) is an ornamental species grown as flowering shrub, belongs to the Verbenaceae family, originally native to Mexico, South America and the Caribbean (Okunlola, 2013) [1]. *D. erecta* otherwise called sky blossom, angels-whisper, additionally called Katamehedi. Duranta is an upright to hanging bush that occasionally takes the type of a scrambling bush or once in a while a little tree (Liogier, 1995; Little *et al.*, 1974) [2, 3].

The full cluster of fragrant, pale blue flowers followed by bunches of golden- orange berries are often found on the plant simultaneously which makes it very attractive (Rowezak, 2001) [4]. It is a popular ornamental used for accent plants and hedges in tropical and subtropical parts of the world because of its profuse display of flowers and fruits (Pipattanawong, 2008; Singh *et al.*, 2014; Said, 2016) [5, 6, 7]. *D. erecta* plays a significant role in environmental beautification and management; making public parks, gardens and houses more conducive for relaxation and enjoyment as an ornamental plant (Said, 2016) [7]. *D. erecta* increases the economic value of a property if properly placed in a landscape. The shrub offers a variety of noticeable effects such as screening, cooling, enhancement of architectural lines, enframement of views, soil erosion management, sun and wind control, sound deadening and horticultural focus (Okunlola, 2013) [1]. It is well known that *Duranta erecta* can either be propagated through seeds or stem cuttings (Robbins and Evans, 2006) [8].

Among the propagation methods, stem cutting is the easiest and cost effective method of multiplication to get true-to-type plants mainly for ornamental shrubs. The rooting ability and success percentage of cuttings depends on many factors. Among them, plant growth regulators play an important role in formation of roots and shoot growth in cuttings. Root commencement with the exogenous application of plant growth regulators occupies a significant role in the field of plant propagation (Mukherjee *et al.*, 1976) [8]. With this, current study was aimed to find the effect of NAA on rooting of cuttings in *Duranta erecta*.

Materials and Methods
The experiment was conducted at Institute of Agriculture, Tamil Nadu Agricultural University, Kumulur, Tiruchirappalli district of Tamilnadu, India. The experiment was laid out in Completely Randomized Block Design (CRD) with 3 replications, including six treatments of

various concentration of Naphthalene Acetic Acid (NAA) solutions *viz*., 250 ppm, 500 ppm, 1000 ppm, 2000 ppm, 3000 ppm and control (without any treatment). Hardwood cuttings of 20 cm length with minimum 3-4 nodes were collected from healthy mother plants, available in the institute. A slant cut was given at the basal end and a transverse cut at the top of each cutting. The basal end (2.5- 3.0 cm) of the cuttings was dipped for 30 seconds with NAA solutions of fixed treatment. Then, the treated cuttings were planted vertically in sterilized inert sand media under mist chamber condition to promote rooting. All cuttings were maintained under mist chamber and watered regularly. Relative humidity in the mist chamber was maintained at ≥ 85 % and temperature at 30±2^{0}C. Further observations were recorded at 30 days after planting (DAP) on various root parameters such as days taken for sprouting, rooting percentage (%), number of rooted per cutting and root length (cm). Survival percentage (%) of the rooted cutting was recorded at 60 DAP. The inference was drawn after comparing the calculated F values with the tabulated F values at 5 % (P= 0.05) level of significance. The estimates of mean, variance and standard error were done as per Panse and Sukhatme (1978) [10].

Table 1: Effect of different concentrations of NAA on rooting of *Duranta erecta*

Concentrations	Days for sprouting	Rooting percentage (%)	Number of roots per cutting	Root length (cm)	Survival percentage (%)
NAA 250 ppm	20.26	60.21	3.13	4.10	75.69
NAA 500 ppm	18.53	72.23	3.33	4.50	80.23
NAA 1000 ppm	16.89	79.90	5.76	7.55	85.64
NAA 2000 ppm	12.56	83.62	6.33	8.87	89.45
NAA 3000 ppm	11.52	85.63	8.15	9.56	91.00
Control	23.52	55.21	2.90	3.90	65.23
Mean	17.21	72.80	4.93	6.41	81.21
SE.d	1.77	7.37	0.53	0.68	8.17
CD	3.74	15.55	1.1	1.44	17.24

Result and Discussion

All the parameters showed significance among the treatment, which are shown in table 1. Minimum days for sprouting was recorded in the 3000 ppm (11.52 days), followed by 2000 ppm (12.56 days) which are on par with each other. On comparing with control, all the treatments have significant effect in early sprouting. It assures that the treatment of cuttings with NAA induce rooting of cutting much faster than untreated one. On examining after 30 DAP, higher rooting percentage was recorded in 3000 ppm (85.63%), followed by 2000 ppm (83.62%), 1000 ppm (79.90%) and 500 ppm (72.23 %) which are on par with each other. Number of roots per cutting (8.15) and root length (9.56 cm) are recorded maximum in 3000 ppm of NAA. Our findings are in line with experimental reports of Hossain and Urbi (2016) [12] on adventitious rooting of shoot cuttings in *Andrographis paniculata.* They stated that higher concentration of NAA resulted in an increased number of adventitious rooting per cutting. Similar reports were given by Raji and Osman (2012) [13] and Dash *et al*., (2011) [14] as that the higher dosages of auxins induced increased number of roots within a short time.

Shiri (2019) [11] reported on Duranta that IBA, an another rooting hormone, with increased concentration significantly increased root number in Duranta tip cuttings. The highest average number of roots was recorded at 5000 ppm, followed by 2500 ppm which was not different from 7500 ppm and the control. Cuttings grown with an IBA of 7500 ppm had the lowest average number of roots. With 5000 ppm giving higher root length than the control and 7500 ppm, however 5000 pm was not statistically different from 2500 ppm. With this report, we can come through a thought that, the increase in concentration of auxin more than 3000 will give increase in root length, though not significantly in effect. Also, it may induce more root length and root number in cuttings of Duranta. It may be experimented to find out the toxic level of NAA to hardwood cuttings of Duranta in further studies by increasing concentration of NAA.

Shenoy (1992) [15] in *Rosa damascena* reported that the increase in root length over control may be due to the enhanced hydrolysis of carbohydrates, metabolites accumulation and cell division induced by Auxin. These results were in line with the findings of Patil *et al.*, 1998 [16] in *Jasminum sambac* (Jasmine), Singh *et al.*, 2010 [17] in *Bougainvillea glabra* (bougainvillea), Grewal *et al.*, 2005 [18] in *Dendranthema grandiflora* cv. Snowball, Singh *et al.*, 2013 [19] in *Cestrum nocturnum* (night jasmine) and Sharma, 2014 [20] in *Tagetes erecta* (marigold) and Chowdhuri and Sadhukhan (2017) [21] on *Eranthemum bicolour* though the type of stem cutting utilized were varied.

On observing survival percentage after 60 DAP, all the NAA concentrations shows higher survival, significantly higher than control. The survival capability of the rooted cutting in an inert sand media might be due to the action of plant growth hormones on the stem cuttings and the growth of sprouted roots. This was supported by the statement Abidin and Baker (1984) [22] that plant growth hormones also have effects on cell elongation and cell division thereby boosting root length, thus enhancing overall growth of cuttings; which improves the survival capacity of the rooted cutting. Our findings are in line with Shiri (2019) [11] who reported the same experiment using IBA, that cuttings grown with an IBA concentration of 5000 ppm recorded the highest percentage survival with an average of 81.85%. The survival of cuttings grown using an IBA maximum concentration (7500 ppm) was not significantly different from the number of cuttings grown in the control treatment and the least concentration (2500 ppm). This ensures that, the increase in concentration upto 5000 ppm will not have deteriorated effect in rooting of cuttings. In all parameters control recorded the minimum value among the treatments. The production of roots in the control group may be caused by endogenous auxin, which might influence and play important role for root primordia formation in the cuttings (Hossain and Urbi, 2016) [12].

Conclusion

From this experiment we conclude that, the rooting and survival capacity of hardwood stem cuttings of *Duranta erecta* under mist chamber conditions, can be improved by quick dipping (30 seconds) of basal portion of cuttings on NAA with 3000 ppm concentration. Further study may be conducted to find out and standardize the maximum concentration of NAA, below toxic level, to be used to get

maximum effect of rooting and root promotion in *Duranta erecta*.

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