

Effect of Various Concentrations of IBA and NAA on the Rooting of Stem Cuttings of Mulberry (*Morus Alba* L.) under Mist House Condition in Garhwal Hill Region

K.K. SINGH*, T. CHOUDHARY, A. KUMAR

Received 23.3.2014, Revised 16.5.2014, Accepted 25.5.2014

ABSTRACT

Stem cuttings of *Morus alba* were treated with 1000, 1500 and 2000 mg.L⁻¹ IBA and NAA solutions by quick dip method. These cuttings were rooted in a rooting media of 1:1 mixture of sandy soil and farm yard manure in plastic root trainers inside a mist house. Among all the treatments, number of sprouted cuttings, length of the roots/cutting, percentage of rooted cutting, lengths of longest sprouts of root were higher in IBA 2000 mg.L⁻¹.

Keywords: *Morus alba*, IBA, NAA, Rooting percentage, Stem cutting

INTRODUCTION

Mulberry (*Morus alba*) belongs to the family Moraceae and Asia is considered to be the centre of origin for this species. There are more than 100 species under the genus *Morus*. It is perennial, fast growing fruit tree and thrives well under the tropical, subtropical, and temperate region.

The most important use of mulberry leaf is rearing of the silk worms for production of silk. The silk producers have traditionally fed mulberry refusals and leftovers from silkworm feeding to farm animal and to herbivorous carp in poly-culture fish ponds. It is also used for timber purpose such as making of table, chair, sports item as well as agricultural implements and the bark is also used for making good quality paper (Dinesh et al. 2006). Fruits of mulberry have some medicinal property, i.e. laxative, refrigerant in fevers, and used locally as a remedy for sore throat, dyspepsia, and melancholia. Roots and bark are purgative, anthelmintic, and astringent; leaves considered diaphoretic and emollient; a decoction of leaves being used as a gargle for inflammation of the throat (Reed 1976). Mulberry is commercially propagated

from hard wood cuttings because of distinct advantages like speedy multiplication of parent materials and maintenance of the desired characters of the plants.

MATERIAL AND METHODS

The experiment was conducted at the Horticultural Research Centre, Hemwati Nandan Bahuguna Garhwal University, Srinagar Garhwal, in a simple randomized block design. Each treatment had 3 replications, and each replication had 10 cuttings. Hardwood cuttings of *Morus alba* L. were collected from 6 to 7 year old plants. Six to eight months old mature shoots of 15-20 cm length, 10-12 mm in diameter with 3-4 healthy buds were selected for cuttings. Care was taken to ensure that the shoots were cleanly cut at an angle of 45° with a sharp knife without bark split. For preparing the rooting media, sandy soil and farm yard manure (FYM) in the ratio of 1:1 were mixed thoroughly, cleaned for stones and grasses and then the mixture was filled in root trainers. The basal ends of the cuttings were dipped in 1000 ppm, 1500 ppm and

2000 ppm, of solutions of indole-3-butyric acid and naphthalene acetic acid respectively along with control. The basal end of cuttings were quickly dip in solutions for 10 seconds, and then the treated cuttings were immediately planted in 10x10 cm size of root trainer and inserted at 7.5 cm depth 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. Cuttings were maintained in a mist house with intermittent misting to 60 seconds at every 30-minute interval between 8 am and 8 pm.

RESULTS AND DISCUSSION

The effects of different concentrations of IBA and NAA on the shoot cuttings (Fig. 1) are collated in Table 1. A perusal of Table 1 shows that the hormone and their doses significantly affected the studied growth characters.

The maximum (9.67) number of sprouted cuttings was recorded in 2000 ppm concentration

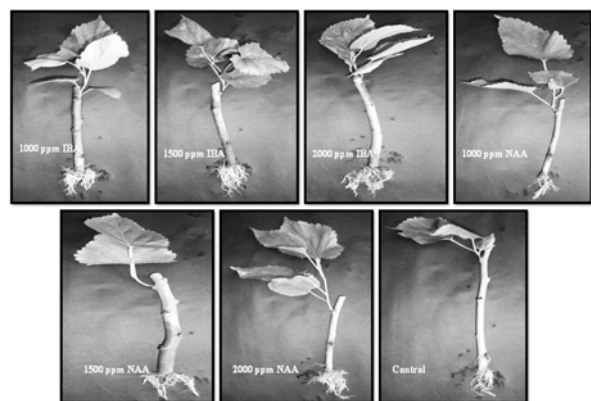


Fig. 1: Root formation in *Morus alba* (Mulberry) with IBA and NAA treatments.

of IBA treatment, followed by 1500 ppm concentration of IBA and 2000 ppm concentration of NAA. The minimum (2.67) number cuttings sprouted in control set. Similar findings were also observed by Dhua et al. (1983) in guava cuttings. According to Thimmappa and Bhattacharjee (1950), auxins naturally occurring or exogenously applied are required for initiation of adventitious roots on stems. It appears probable that the success of IBA is due to its low auxin activity and its slow degradation by auxin destroying enzyme. Leopold (1995) suggested that IBA is quite a strong auxin, while NAA is readily destroyed.

The maximum average length of sprout per cutting (15.27 cm) was recorded in 2000 ppm IBA followed by 2000 ppm NAA, while, the minimum average length of sprout per cutting (7.67 cm) was recorded in the control. The maximum average diameter of sprout per cutting (2.67 mm) was observed in 2000 ppm of IBA followed by 1500 ppm of IBA. The minimum average diameter of sprout per cutting (1.00 mm) was recorded in the control. The maximum number of sprouts per cutting with optimum IBA treatments might be ascribed to better root growth which augmented absorption and translocation of nutrients from soil which take active part in various plant metabolic processes (Singh 2001). These finding were similar to Singh (2013) in *Citrus limon* in respect average length and diameter of sprouts per cutting.

The number of leaves/cutting (7.67) was maximum in 2000 ppm of IBA, followed by 1500 ppm of IBA. The minimum (2.67) number of leaves/cutting was recorded in control. Increase in leaf number may be due to vigorous rooting induced by the growth regulator enabling the cuttings to absorb more nutrients and thereby producing more leaves as reported by Stancato et al. (2003). Among the

Table 1: Effect of IBA and NAA on vegetative propagation through stem cutting of *Morus alba*

| Treatments | Average number of sprouted cutting | Average length of sprout | Average diameter of the sprout | Average number of leaves per cutting | Percentage of rooted cutting | Avg no. of primary roots | Avg no. of secondary roots | Average length of roots per cutting |
|--------------|------------------------------------|--------------------------|--------------------------------|--------------------------------------|------------------------------|--------------------------|----------------------------|-------------------------------------|
| IBA 1000 ppm | 4.67 | 11.20 | 1.67 | 4.67 | 46.67 | 8.33 | 19.00 | 6.03 |
| IBA 1500 ppm | 5.67 | 9.70 | 2.00 | 5.67 | 56.67 | 10.67 | 27.33 | 7.40 |
| IBA 2000 ppm | 9.67 | 15.27 | 2.67 | 7.67 | 96.67 | 15.67 | 31.33 | 11.93 |
| NAA 1000 ppm | 5.33 | 8.10 | 1.33 | 4.33 | 53.33 | 8.33 | 16.67 | 6.00 |
| NAA 1500 ppm | 5.00 | 9.13 | 1.33 | 4.33 | 50.00 | 8.67 | 19.00 | 6.00 |
| NAA 2000 ppm | 5.67 | 11.87 | 1.33 | 4.67 | 56.67 | 9.67 | 22.00 | 8.83 |
| Control | 2.67 | 7.67 | 1.00 | 2.67 | 26.67 | 6.00 | 12.33 | 4.67 |
| CD 5% | 1.89 | NS | 0.83 | 1.29 | 18.95 | 3.23 | 4.54 | 2.48 |

concentrations, 2000 ppm concentration of IBA showed the highest percentage of rooted cutting (96.67), followed by IBA 1500 ppm (56.67) and NAA 2000 ppm (56.67) while, the minimum percentage of rooted cutting (26.67) was recorded in the control. These findings all agree with the finding of Panwar et al. (1994) and Singh et al. (2011) in *Bougainvillea*.

The highest number of primary root/cutting (15.67) was recorded at 2000 ppm concentration of IBA, while the lowest number of primary root/cutting (15.67) was recorded in control treatment (Table 1). 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. The enhanced hydrolytic activity in present of applied IBA coupled with appropriate planting time might be responsible for the increase number of primary root per cutting (Carlson 1929). The maximum number of secondary roots per cutting (31.33) was recorded under 2000 ppm concentrations of IBA followed by 1500 ppm concentration of IBA, while the minimum number of secondary roots per cutting (12.33) was recorded under control treatment. IBA treatment also shortened the time required for root formulation in hard to root species. The above findings also agree with the finding of Sulusoglu and Cavusoglu (2010) in Cherry laurel in respect of average number of primary and secondary roots per cutting.

The maximum average length of roots per cutting (11.93 cm) was recorded under 2000 ppm concentration of IBA followed by 2000 ppm concentration of NAA, while the minimum average length of roots per cutting (4.67 cm) was recorded under control treatment. Auxin application has been found to enhance the histological features like formation of callus and tissue and differentiation of vascular tissue (Mitra and Bose 1954). These findings all agree with the finding of Galavi et al. (2013) in Grape and Singh et al. (2013) in *Thuja compecta* with respect to average length of root per cutting.

CONCLUSION

Plants can be transplanted when they have rooted, but good results are often achieved if the plants do not have too many longer roots but have

more number of roots. Application of IBA higher concentration (2000 ppm) was more beneficial for over all parameters of *Morus alba* stem cuttings. Hence 2000 ppm concentration of IBA was found most effective for the rooting of *Morus alba* cutting and may be used in nurseries for its easy and faster multiplication.

REFERENCES

- Bose TK, Singh PK, Bose S (1968). Propagation of tropical ornamental plants from cutting under mist. *Ind J Hort* 27: 213-217
- Dhua RS., Mitra SK, Sen SK, Bose TK (1982). Effect of ethophon and IBA on, rooting of guava. *Sci Cult* 48: 444-445
- Galavi M, Karimian MA, Mousavi SR (2013). Effects of different auxin (IBA) concentrations and planting-beds on rooting grape cuttings (*Vitis vinifera*). *Annual Review & Research in Biology* 3(4): 517-523
- Singh KK, Rawat JMS, Tomar YK, Kumar P (2013). Effect of IBA concentration on inducing rooting in stem cuttings of *Thuja compecta* under mist house condition. *Hort Flora Research Spectrum* 2(1): 30-34
- Kumar, D., Pandey, V. and Chandra, A. (2006). *Mullberry (Morus spp.)* Advances in Arid Horticulture Vol. II pp. 333-358
- Leopold AC (1995). Auxins and plant growth substances. Berkeley and Los Angeles. Univ. California Press, California, pp 372-377
- Mitra GC, Bose N (1954). Rooting and histological responses of detached leaves to B- Indolebutyric acid with special reference to *Boerhavia diffusa* Linn. *Phytomorphology* 7: 370
- Panwar RD, Gupta AK, Sharma JR, Rakesh (1994). Effect of growth regulators on rooting in *Bougainvillea* var. Alok. *Int J Trop Agri* 12: 255-261
- Reed CF (1976). Information summaries on 1000 economic plants. Typescripts submitted to the USDA.
- Singh AK (2001). Effect of wood type and root promoting chemical on rooting of *Bougainvillea peruviana* L. *Adv Hort and Forestry* 8: 179-184
- Singh KK, Rawat JMS, Tomar YK (2011). Influence of IBA on rooting potential of Torch Glory *Bougainvillea glabra* During Winter Season. *J Hortl Sci Ornamental Plants* 3(2): 162-165
- Singh KK, Choudhary T, Kumar P (2013). Effect of IBA concentrations on growth and rooting of *Citrus limon* cv. Pant Lemon cuttings. *Hort Flora Research Spectrum*, Vol. 2(3): 268-270
- Singh N, Singh, BP (2011). Effect of different concentrations of indole butyric acid (IBA) on sprouting, rooting and callusing potential of *Bougainvillea* stem cuttings. *Asian J Hort* 6 (1): 229-230
- Snedecor GW, Cochran WG (1968). *Statistical Methods*. Oxford and IBH Pub. CO. Kolkata, p 469
- Stancato GC, Aguiar FFA, Kanashiro S, Tavares AR (2003). *Rhipsalis grandiflora* Haw. Propagation by stem cuttings. *Scientia Agricola* 56: 185-190

Sulusoglu M, Cavusoglu A (2010). Vegetative propagation of Cherry laurel (*Prunus laurocerasus* L.) using semi-hardwood cuttings. Afr J Agril Res 5(23): 3196-3202

Thimmappa DK, Bhattacharjee SK (1950). Standardization of propagation of scented geranium from stem cuttings. Indian Perfumer 31(1): 56-60