Int.J.Curr.Microbiol.App.Sci (2019) *8*(12): 1568-1574

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 8 Number 12 (2019)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2019.812.188

Vegetative Propagation through Air Layering of *Diospyros ebenum* J. Koenig: An Endangered Tree Species

Vilas Kumar*, V. Maheswarappa, Ramakrishna Hegde and Supriya K. Salimath

Department of Silviculture and Agroforestry, college of Forestry, Ponnampet, University of Agricultural and Horticultural Sciences, Shivamogga, India

**Corresponding author*

Keywords

Air layering, Concentration, Rooting

Article Info

Accepted:
12 November 2019
Available Online:
10 December 2019

A B S T R A C T

Diospyros ebenum Koenig belongs to family ebenaceae and commonly known as "Kari Mara" or ebony. It is a large evergreen tree with dense crown and clear bole. The species under threat is due to illicit felling and slow germination in natural condition. To overcome the germination problem an attempt was made at College of Forestry Ponnampet to get more sprouts through air layering with different concentration of IBA. The study revealed that the concentration of IBA in air layering technique have no significant effect for initial 30days, however the rooting initiated after 30 days and has a significant differences among the concentrations of IBA. The higher percentage of rooting (4.75%) found in 1000ppm IBA.

Introduction

Tropical forests contain much terrestrial biodiversity, provide food, shelter, health care, protect water and soil resources, store carbon in biomass and maintain the delicate composition of the atmosphere (Neuwinger, 2000). One very important material provided by forests is wood which is used in construction, as fuel, in making furniture and other implements. Tropical timbers are preferred as a source of wood because of their natural durability and good working properties (Miller and Wiedenhoeft, 2002). Despite these important uses, tropical forests are threatened by unsustainable land and resource use (De Capua, 2005). The greatest constraint to forest regeneration projects is the lack of good planting material. The common way by which plants regenerate naturally is propagation by seed. For research and rapid improvement of undomesticated species, however, artificial regeneration by vegetative propagation methods offers several advantages. Individuals may be recognized within a population that produces a higher quality of the desired products or services. It would therefore be advantageous to propagate these individuals

vegetatively to 'capture' the genetic variation expressed which may otherwise get lost or diluted during sexual propagation.

Vegetative propagation methods have been developed and used for centuries. Especially in temperate regions, vegetative propagation has been an important approach in the domestication of fruit species and particular methods have been developed for different species. Tropical fruit species have been subjected to vegetative propagation in a number of cases that have found a lucrative export market. Tropical timber species have also been cloned, mainly for plantations where uniform trees are needed. Many indigenous trees with potential high monetary benefits are only used from natural stands.

Diospyros is a large genus belongs to family Ebenaceae native to India and Srilanka. It is slow growing medium sized tree up to 30m tall and up to 90cm in diameter, bole straight, with buttresses up to 2m high. Crown dense, bark surface scaly, fissured, black to grey-black (Finkel *et al.*, 2002). Many tree of widely different affinities produce the heavy black hard wood is called ebony. The most important source of ebony was *Diospyros ebenum*, the first species of the genus to be recognized botanically in Ceylon and was described by Koenig in 1776. *Diospyros ebenum* Koenig belongs to family ebenaceae commonly called as "Kari Mara" or ebony. It is the large evergreen tree with a dense crown of dark green leaves and attains a height of about 25m, with a clear bole of about 8m and girth 2.50m. The species is under threat due to large scale illicit felling for its timber quality. The fruits are recalcitrant and germination is staggered found sparse distribution of its establishment in natural condition. In order to combat the problem of regeneration an attempt was made to get more sprouts through vegetative propagation techniques of air layering with different concentrations of IBA.

Materials and Methods

The experiment was conducted at college of Forestry Ponnampet Kodagu during the year 2017-18. Five healthy trees of *Diospyros ebenum* were selected and branched with pencil thickness middle branches were choosen for air layering. Different concentrations of IBA viz., 500ppm, 1000ppm, 1500ppm, 2000ppm were prepared in the form of paste and were used for the study. Selected branches were girdled upto 3-4 cm length with sharp knife (Fig. 1).

Scraping was done to ensure the complete removal of phloem and cambium to avoid pre mature healing later the following IBA treatment were given.

The different concentrations of concentrations of IBA were pasted on girdled portion and moistened coir pith was wrapped on to the portion and tied with tight rope (Fig. 2). The Air layered portions were daily moistened and observed for its rooting at monthly intervals. The observations on sprouting, rooting per cent, sprout length, root length number of leaves, number of root, and rooting success were observed (Fig. 3 and 4).

Observations taken were as follows

Average number of roots

Number of roots per area air-layered shoots was recorded by simple count method and average number of roots was calculated.

Average length of roots

Root length per air-layered shoots was measured by using 30 cm scale, and average root length was calculated.

Rooting percentage

Rooting percentage was calculated by using

the formula:

$$\text{Rooting percent} = \frac{\text{Number of air layered shoots rooted}}{\text{Total number of shoots air layered}} \times 100$$

Results and Discussion

The result of the study revealed that there was no effect of concentration of IBA with use of Air layering technique of production of sprouts and rooting percentage initially at 30 days of imposing treatments (Table 1). However rooting was initiated after30 days of imposing IBA and found significant differences among the concentrations. Higher percentage of rooting (4.75%) was found in treatment with 1000ppm IBA followed by 1500ppm IBA (Fig. 5). Lowest rooting percentage was recorded on branched treated with 500ppm of IBA where as control conditions yielded no rooting. The maximum number of roots were observed in branched treated with 1000ppm IBA (13.81) followed by 1500 ppm IBA (11.67) and least was in 2000 ppm IBA (9.62). However, at the end of 60 days, the branches indicated rooting were failed to produce new shoots (Fig. 6).

Growth, development and productivity of plant depend on interactions between different environmental factors and the genetic constitution of a particular plant. Among different environmental factors, temperature, light intensity and relative humidity are the prime factors which influence the growth and development of plants considerably. Temperature is the most important environmental factor for plant growth and development. Researchers have shown the complex interaction of temperature on the levels of indigenous auxins and other hormones. It plays an important role in the rooting of cuttings. At higher temperature growth of the root was found to be rapid. In general, the air temperature appears to play a role in case of rooting of cuttings. Light influences photosynthesis which may be related to carbohydrate accumulation resulting in better rooting of cuttings. Sufficient light is needed to maintain minimal endogenous auxin for rooting. On the contrary, high light intensity can cause photo destruction of auxin.

Humidity levels in the area surrounding the plants influence all important processes of plant growth i.e., transpiration, water balance and cooling of plants. Sufficient relative humidity plays a major role in the growth and development of plants by minimizing transpiration and maintaining the water balance by which substantial tissue water loss is avoided thereby adequate turgidity is maintained resulting in good initiation and development of roots (Hartmann *et al.*, 2002).

Vegetative techniques are used as indispensable tool for mass multiplication of superior phenotypes or genotypes and producing true to type uniform plants (Thakur *et al.,* 2008). Rooting of stem cuttings is easiest and economical methods of vegetative propagation usually exploited in many tree species. Only a limited success was achieved in rooting of stem cuttings of *Diospyros ebenum* species and concluded as difficult to root genus (Mewar and Naithani, 2016). Rooting of air layered and cuttings were affected by age of the ortet, season and exogenous application of root promoting hormones. It is essential to understand the critical factors in influencing the rooting (Siddiqui and Hussain, 2007). Therefore, an attempt was made in the present study to develop an efficient, economically viable and reproducible vegetative propagation protocol through air layering for commercial propagation of selected phenotypes of *Diospyros ebenum:* an endangered tree species.

Table.1 Rooting percentage and number of roots as influenced by growth regulator treatment in *Diospyros ebenum* by air layering

Sl No.	Treatment	Rooting Percentage		Number of Roots		Rooting success
		30 DAT	60 DAT	30 DAT	60 DAT	
1.	Control	0.00	0.00 (0.00)*	0.00	0.00 (0.00)	0.00
2.	IBA-500 ppm	0.00	3.50 (10.76)	0.00	5.12 (13.06)	0.00
3.	IBA-1000 ppm	0.00	4.75 (12.56)	0.00	13.81 (21.75)	0.00
4.	IBA-1500 ppm	0.00	3.88 (11.29)	0.00	11.67 (19.92)	0.00
5.	IBA-2000 ppm	0.00	3.87 (11.29)	0.00	9.62 (18.05)	0.00
	Mean	-	3.20 (9.18)	0.00	8.04 (14.55)	-
	SEm±	-	0.515	0.00	0.63	-
	CD@5%	-	11.20	0.00	1.96	-

DAT: Days After Treatment, Values in parentheses are angular transformed

Fig.1 Girdling of branches

Fig.2 Imposing of IBA treatment

Fig.3 Wrapping air layered branches with coir pith

Fig.4 Observation of rooting

Fig.5 Effect of different concentration of IBA on rooting percentage of *Diospyros ebenum*

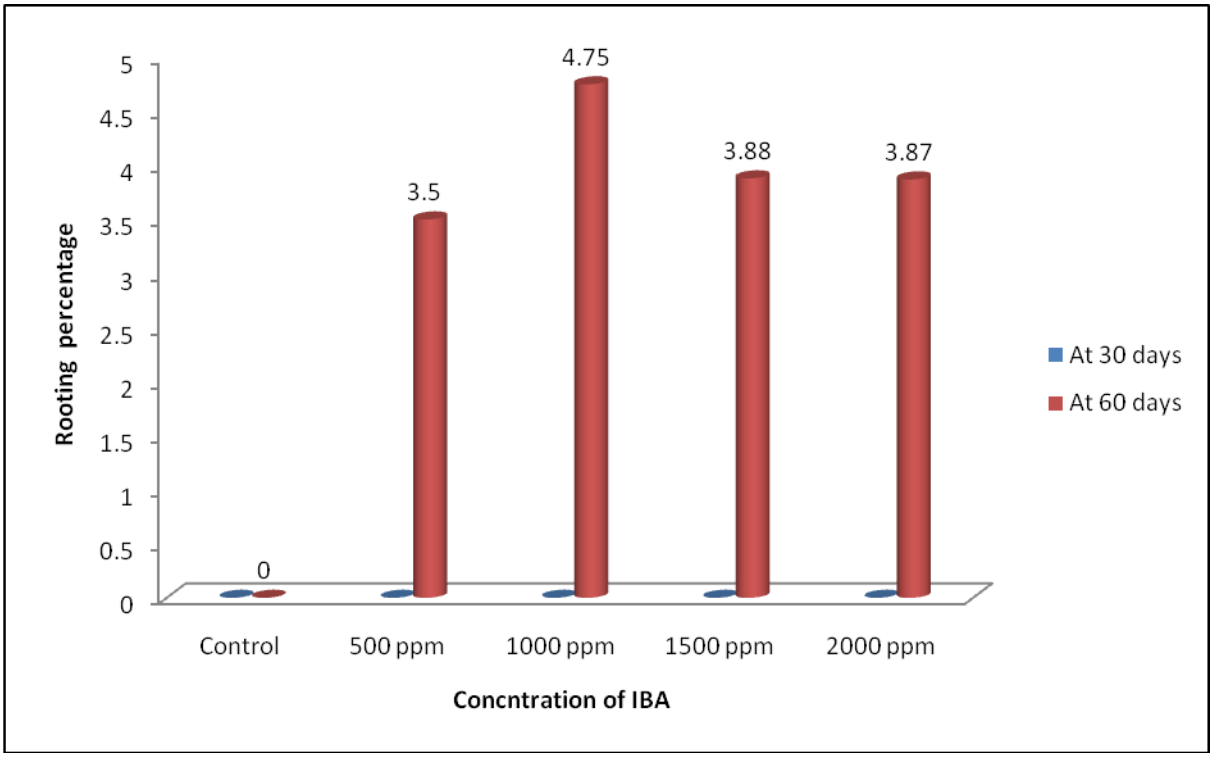
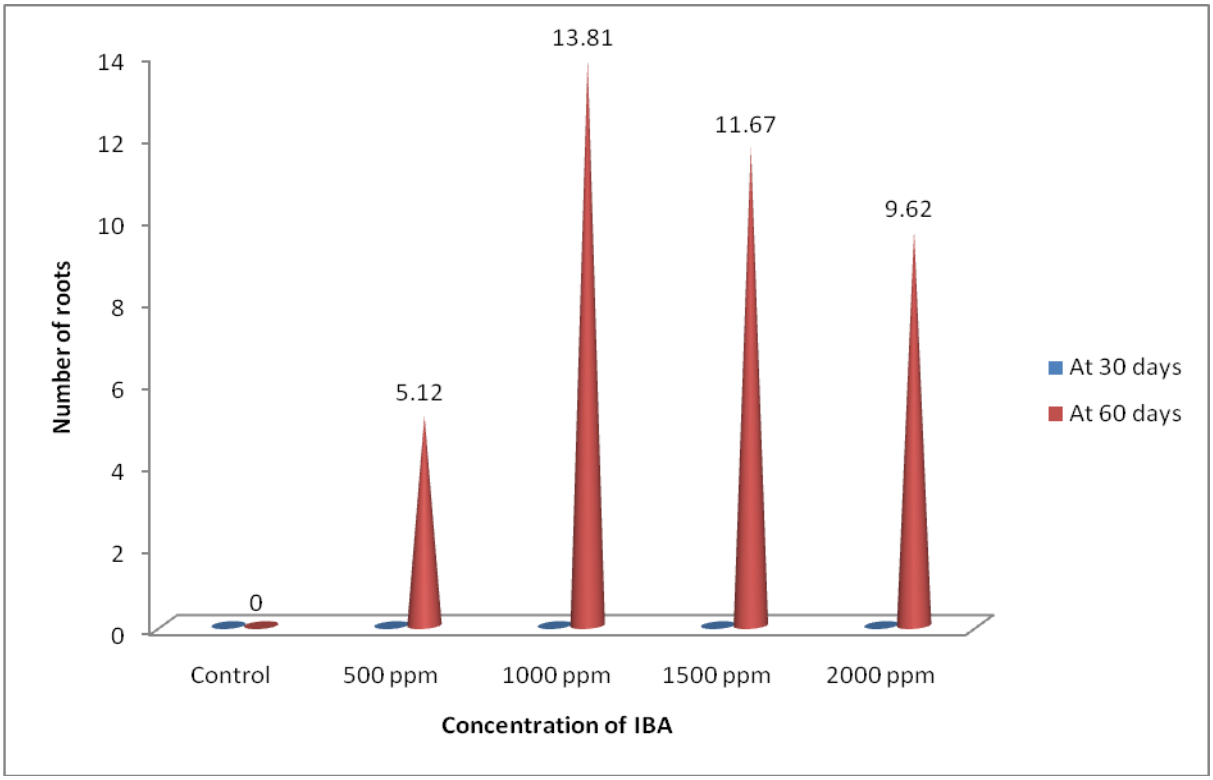


Fig.6 Number of roots as influenced by concentrations of IBA



The technique employed in the study *viz.*, air layering yielded valuable results. The different concentration of Indole Butryic Acid (IBA) was applied by dip smeared method to the air

layered parts and cuttings. Several authors documented rooting success of branch cuttings of different tropical forest trees (Leakey *et al.,* 1990; Husen and Pal, 2006; Husen and Pal, 2007; Baul *et al.,* 2010). IBA plays a significant role in rooting of various tropical forest tree species (Baul *et al.,* 2010). The use of IBA for rooting ability depends on the concentration of IBA among different species. The highest rooting percentage and number of roots of *Diospyros ebenum* were recorded in branches treated with 1000ppm of IBA. These results were on par with studies conducted by Uppal and Khosla (1997) where 1000ppm IBA showed higher rooting per cent in temperate shrubs of Himalaya (71.26 per cent). Similar results were also noticed by Eganathan *et al., (*2000) who compared the effect of different growth regulators on rooting of three mangrove species. The increase in number of roots in the branches treated with IBA than in control can be ascribed to enhanced hydrolysis of carbohydrates caused by auxin treatment (Rajarama, 1997). Further, Krishnamurthy (1981) opined that auxins would bring about various physiological changes, but the mechanism by which these changes are brought about is not fully understood except for the effect of auxin on cell elongation. The better response to IBA may be attributed to increased rate of respiration, accumulation of higher level of amino acids at their bases, 48 hours after the treatment than untreated cuttings.

However, it clear by the study that the establishment percentage and sprouting of rooted cuttings was less. This may be attributed to the lower percentage of rooting. The low percentage of rooting in most of the hardwoods was due to lesser movement of water molecules and food material in inner layer of bark and dead cells present in the bark or cambium portion of branches. Hence, air layering technique was not feasible for hardwoods which will not be success in sprouting or rooting percentage. However, we could find there were significant differences among the concentrations of IBA in production of roots and even though noticed, there was death of roots. The present study revealed that IBA treatments were more efficient in inducing rooting. The rooting percent steadily increased with an increase in concentrations of auxins. These results consistent and corroborated with the finding that IBA was most effective auxin in triggering rooting in air layering and cuttings (Jayaramkumar, 2006).

Plant growth regulators have been exploited profitably to alter plant archetype to achieve higher yields and mass production. These are the chemical substances which are needed in small quality for time turning of various physiological processes. The different groups of auxins were the first class of growth regulators have seen in use for initiation of rooting in horticultural crops. However, in forestry as soft wood species were responded to more effectively to the different concentration of auxins or growth regulators. Hence the study concluded that for hardy perennial components, vegetative propagation technique like air layering can be considered less for the commercial and restoration of the species..

Acknowledgement

We acknowledge the college of Forestry, Ponnampet and Karnataka Forest department for providing all the facilities to carry out the research.

References

Baul, A., Sharma, L. K., Ganie. S. A, Rather, M. M. Andrather, H. A. H., 2010, Effect of auxins on macro propagation of *Taxus buccata* Linn. through stem cuttings. The Indian Forester, 137(12): 1382-1384

De Capua J., 2005. The congo basin forest summit held February 4th and 5th in brazzaville. Report on congo basin Washington, Us. P. 11

Eganathan, P., Rao C. S. And Anand, A., 2000, Vegetative propagation of three mangrove tree species by cuttings and air layering. Wetlands Ecology And Management., 8: 281-286.

Finkel, T. And Holbrook N. J. 2002. Oxidants, oxidative stress and the biology of aging. Nature408, 239-47

Hartmann, H. T., Kester, D. E., Davies, F. T. And Geneve, R. L., 2002, Plant propagation, principles and practices, 6th edition, Prentice Hall Of India Pvt. Ltd., New Delhi, India.

Husen, A. And Pal, M., 2007, Effect of branch position and auxin treatment on clonal propagation of *Tectona grandis* Linn. F. *New Forests*, 34:223-233.

Jayaramkumar K. Effect of geographical variation on content of tannic acid, gallic acid, chebulinic acid, and ethyl gallate in *Terminalia chebula* fruits. Nat Prod. 2006; 2(3–4): 170–175.

Krishnamurthy, M.N., 1981, Plant Growth Substances. Tata Mcgraw Publishing Company Limited, New Delhi.

Leakey, R. R. B., J. F. Mesen, Z. Tchoundjeu, K. A. Longman, J. Mcp Dick, A. Newton, A. Matin, J. Grace, R. C. Munro and P. N. Muthoka (1990). Low Technology Techniques For The Vegetative Propagation Of Tropical Trees. Commonwealth Forestry Review, 69(3): 247-257.

Mewar D. And Naithani D.C. 2016. Plant Archives, 16(2), 959-962.

Miller R, Wiedenhoeft A.2002. Cites identification guide – tropical woods: guide to the identification of tropical woods controlled under the convention on international trade in endangered species of wild fauna and flora. Handbook. Usda Forest Service, animal, and plant health inspection service, Canada, P. 23.

Neuwinger, 2000. H.D. Neuwingerafrican Traditional Medicine. A Dictionary Of Plant Use And Applications, Role Of Biotechnology. Trends In Biotechnology, 207, 292-296.

Rajarama, H.A., 1997, Studies on propagation of pomegranate (*Punica Granatum* L.) by cuttings. *M.Sc. (Agri.) Thesis*, University of Agricultural Sciences, Dharwad (India).

Siddiqui, M. I. And Hussain, S. A., 2007. Effect of indole butyric acid and types of cuttings on root initiation of Ficus Hawaii. Sarhad J. Agri., 23(4): 141-145.

Thakur M, Rana Rc, Thakur S. 2008. Physio chemical evaluation of *Terminalia Chebula* fruits. J Non Timber Forest Prod. 2008; 15: 37–42.

Uppal, R. And Khosla, P. K., 1997, Vegetative propagation through branch cuttings in selected temperate shrubs of Western Himalaya. *Ann. For.*, 5(1): 80-83.

How to cite this article:

Vilas Kumar, V. Maheswarappa, Ramakrishna Hegde and Supriya K. Salimath. 2019. Vegetative Propagation through Air Layering of *Diospyros ebenum* J. Koenig: An Endangered Tree Species. *Int.J.Curr.Microbiol.App.Sci.* 8(12): 1568-1574.
doi: https://doi.org/10.20546/ijcmas.2019.812.188