International Journal of Scientific & Engineering Research Volume 7, Issue 8, August 2016

ISSN 2229-5518

Vegetative Propagation Potential of Moss (*Brownlowia elata* Roxb) by Stem Cutting from Young Stock Plant

Morgubatul Jannat and Mohammed Kamal Hossain, PhD

Abstract: The experiment was conducted to find out suitable vegetative propagation techniques for Moss (*Brownlowia elata* Roxb) a native threatened tree species of Bangladesh.

Juvenile shoots of Moss were collected from hedgerows established from seeds of phenotypically superior trees. One year old stock plants growing in hedgerows were topped leaving 50-60 cm stump above the ground. The effects of different concentration of IBA (Indole-3 Butyric Acid) hormones on the rooting ability of moss were investigated in a non-mist propagator. The study reveals that the species is amenable for vegetative propagation by young shoot cuttings. IBA application significantly enhanced the rooting percentage of the species. The species showed 67% rooting response with 1% IBA treatment after 87 days. There were significant differences among IBA treatments and control at 95% significant level. Maximum number of root (3) and the highest survival percentage (100%) were observed in 1% IBA treated cuttings while the highest root length (4.6 cm) was found in 0.6% IBA treated cuttings.

The results suggest that rooting of juvenile leafy stem cutting with IBA application may be an effective mean of rooting and suitable vegetative propagation technique for the species.

Keywords: Hedgebed, Stockplant, Stem cutting, IBA, Rooting ability

Introduction

Moss (*Brownlowia elata* Roxb) is a lofty tree and branches spreading. Leaves are 10-30 cm × 7-20 cm, flowers are 1.2-2.0 cm across, yellow & buds clavate-oblong. Seeds solitary, rarely 2, albumen absent, embryo erect & cotyledons 2. In Bangladesh, it is found in Chittagong and Cox's Bazar districts. (Ara *et al*. 2013). Moss has a great economic and ecological importance (Hossain and Ahmed 2008). The wood is soft, reddish-gray, pores moderate-sized and medullary rays short. The large leaves are inter-oven with bamboo sticks and made of the roof of thatched houses in Cox's Bazar. But the species is disappearing in an alarming rate due to forest fragmentation, deforestation, Jhum and so on (Hossain 2015). Only very few individual trees are found in the remnant natural hill forest. Scarce natural regeneration of the species is seen but recruitment is very poor. As a result availability of this species in natural forest is shrinking. Therefore a need may exists to develop suitable propagation techniques for this species.

Clonal forestry technique may solve the problems of seed unavailability of some species (Bhuiyan *et.al*. 2014, Hossain *et al*. 2012, Baul *et al*. 2011, Husen and Pal, 2006; Abdullah *et al* 2005, Hossain and Kamaluddin 2005, Hossain and Kamaluddin 2004, Husen 2003, Husen *et al*. 2003, Tchoundjeu and Leakey 2001, Leakey *et al*. 1990). Vegetative propagation techniques offer the opportunity to produce a reliable and adequate supply of superior planting stock locally, timely and quickly (Baul *et. al* 2010). Vegetative propagation is very important as it enables the faithful reproduction of plants that either do not breed for seed or are sterile. Clonal option is the key factor in domestication and production of plantation stock in clonal quantities in certain situation like sporadic seed setting, poor seed viability and periodic flowering cycle. Vegetative propagation techniques are also extremely useful for capturing gains from heterosis through cloning of outstanding individual hybrids for commercial planting. Clonal option definitely enables achievement of greater improvements in yield and quality output more rapidly compared to gains through provenance selection or breeding (Lal 1993).

A number of forest tree species i.e. Teak, Gamar, Garjan, Dakhijam, Mahgony, Toon, Silkoroi, Champa, Telsur, Kadam, Chickrassi, Keora and Baen have been propagated vegetatively with the application of rooting hormone in the Bangladesh Forest Research Institute (Rashid *et al*. 2000) but the information regarding the rooting ability of the cuttings obtained from hedgerows of young plants for Moss is very scarce and no clonal propagation technique were tried earlier. The present study was conducted with an aim to assess the rooting ability of Moss cuttings through juvenile shoots with the aid of IBA.

Materials and Methods

The study was conducted over a period of 2 years starting from August 2013 to June 2015 in the nursery of Institute of Forestry and Environmental Sciences in Chittagong University campus. Daily data of temperature inside the propagator house was recorded and minimum and maximum temperature were 26 °C and 35.4°C respectively (Table 1).

Table 1: Mean monthly temperature and maximum temperature inside the propagator house during study period.

International Journal of Scientific & Engineering Research Volume 7, Issue 8, August 2016

ISSN 2229-5518

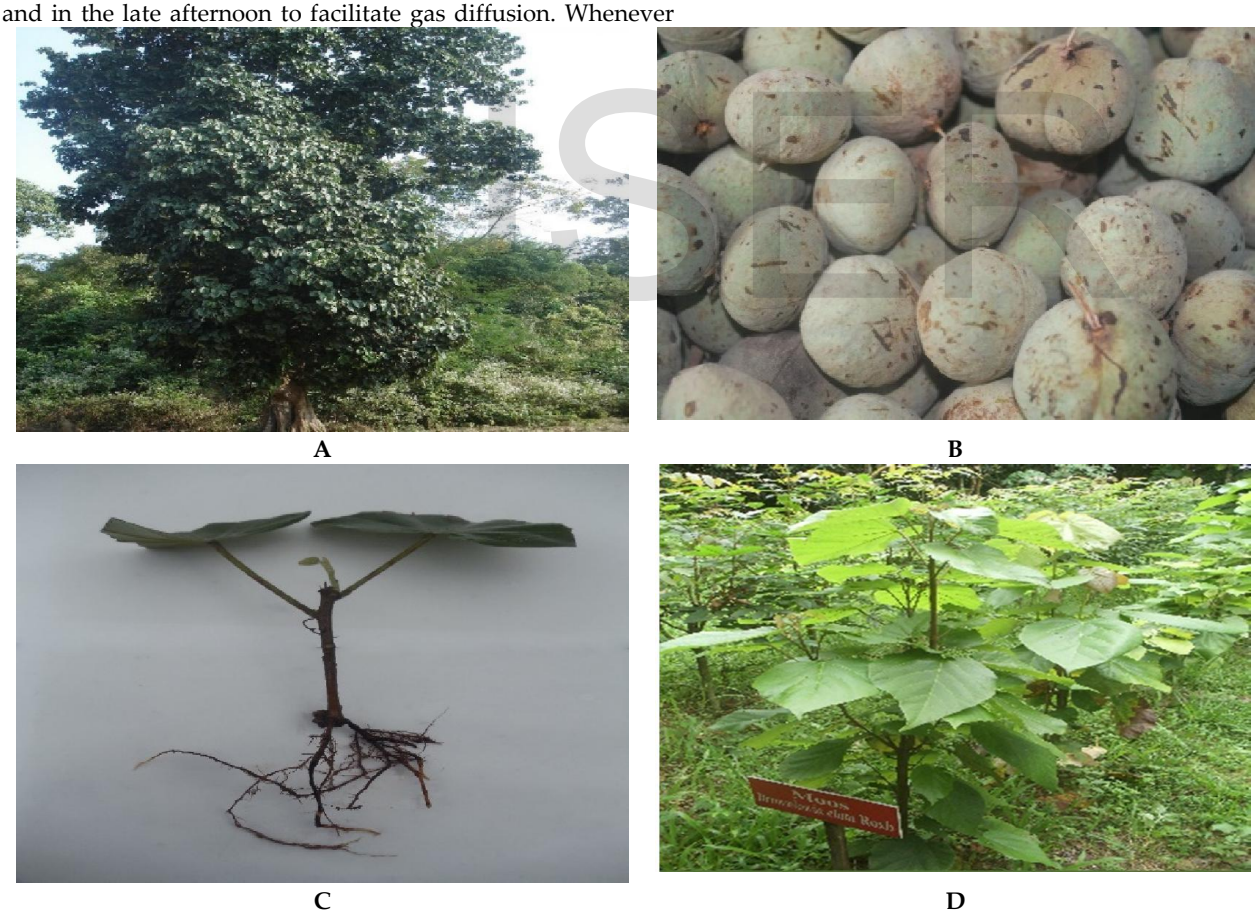
Months	Oct.'14	Nov.'14	Dec.'14	Jan.'15	Feb.'15	Mar.'15	Apr.'15	May'15	Jun.'15
Mean temperature ^{0}C	31.5	29.8	27	26	28	30.6	31.8	32.3	31.5
Record highest temperature ^{0}C	32	31.4	29	26.6	28.8	31	35.4	34	32

Non-mist propagator

Present study on vegetative propagation potential of Kusum was carried out in a low-cost non-mist propagator. It was constructed following the design described by Kamaluddin (1996). It was simply a wooden frame of 1.8 m length; 1 m width; height 60 cm at one end and 45 cm at the other end. It was covered tightly with a single sheet of transparent polythene. The base of the propagator was covered with a 10 cm thick layer of moist coarse sand mixed with successive layers of fine gravels and small stones. This layer supports rooting media. Mean maximum and minimum temperatures within the propagator during rooting period was maintained at 26 °C and 35.4°C respectively. The propagator was opened briefly in the morning and in the late afternoon to facilitate gas diffusion. Whenever the propagator lid was opened for observation, a fine jet of water spraying was applied to cuttings to maintain a low vapor pressure deficit inside the propagator. This resulted in a permanently humid environment throughout the propagation period.

Growing of hedgerows for cutting materials

During the study, juvenile shoots of Moss were collected from hedgerows established in IFESCU nursery. The hedgerows were established from seeds of phenotypically superior trees. Then, in order to continue the supply of cuttings for treatments one year old stock plants growing in hedgerows, were topped leaving 50-60 cm stump above the ground.



A **B**

C **D**

Photo-1: (A) Natural Moss tree (B) Fruit (C) Cuttings and (D) Rooted cutting of Moss

Preparation of cuttings

Shoots of 1-1.5 year's old tree that emerged after first shoot cutting were collected from hedge rows established in IFESCU nursery in August 2013. Then shoots were kept in moist medium (bucket with water) immediately. The shoots were then transported for further processing. Leaves, auxiliary branches and tops of the collected shoots were trimmed carefully. For propagation, cuttings were made with sharp scissor and blade

International Journal of Scientific & Engineering Research Volume 7, Issue 8, August 2016

ISSN 2229-5518

so that no splitting occurs at the cut end. The cutting length of the shoots were 10-12 cm. Leaves were trimmed to half in order to prevent excessive water loss. Cuttings were immersed immediately in water to avoid desiccation.

Preparation of IBA solutions

IBA solution was prepared by dissolving 0.1gm analytical hormone into 20 ml alcohol. Then a stock solution of 1000 ppm IBA was made by adding 80 ml distilled water to the solution. Finally 200 ppm, 400 ppm, 600 ppm and 800 ppm IBA were made by adding 80 ml, 60 ml, 40 ml and 20 ml water to the 20 ml, 40 ml, 60 ml and 80 ml of stock solution respectfully.

IBA treatments of the cuttings

Cuttings collected for propagation were treated with Indole 3-Butaric Acid (IBA) concentration (200 ppm, 400 ppm, 600 ppm, 800 ppm, 1000 ppm and 1200 ppm of IBA). The control comprised a comparable number of cuttings treated only with distilled water i.e. 0% concentration of IBA. The entire treatment was set up in randomized blocks, with each treatment replicated three times. Assessment of rooting success were carried out monthly. A cutting was considered as rooted when it had bud initiation. The root number and root length were recorded.

Weaning and transfer of rooted cuttings

The cuttings started rooting in about 1-6 months. The cuttings were subjected to weaning towards the end of rooting period during root lignification. The rooted cuttings were then transferred into polybags (25 x 15 cm) filled with soil and decomposed cow dung in the ratio 3:1. Rooted cuttings were allowed to grow in the nursery to assess the steckling capacity and growth performance. Observations on the rooting percentage, root number, and the length of the longest root of each cutting during transferring the rooted cuttings into polybags were recorded.

Propagator environment

It was possible to maintain about 85-90% humidity within the propagator. Every day the propagator was opened briefly in the morning and in the late afternoon to facilitate gas diffusion. During the study period mean maximum and minimum temperatures were 31.5ºC and 26.3ºC, respectively.

Data collection

Seedlings height were measured once a month after planting in hedge. After topping the hedgerows leaving 50-60 cm stump above the ground (at one years old) time period of shoot emersion, shoot number and shoot length of individual seedlings were measured. Then number of root developed and root length of each cutting were recorded.

Data analysis

All statistical analysis was carried out by using MS Excel 2013 and Statistical Package for Social Sciences (SPSS). Analysis of variance (ANOVA) procedures were used to test for significant effect of treatments, followed by Duncan's Multiple Range Test (DMRT) for comparison of different means of the various treatments. Correlation between root length and root number were also determined.

Results and Discussions

Seeds were collected from mature mother Moss trees and subjected to germinate in the hedge bed of IFESCU nursery. After germination height increment was observed and recorded in each month up to one year.

Height increment trend of the species in hedge bed: One year old seedlings of Moss attained a height of 90.5 cm (Fig 1).

International Journal of Scientific & Engineering Research Volume 7, Issue 8, August 2016

ISSN 2229-5518

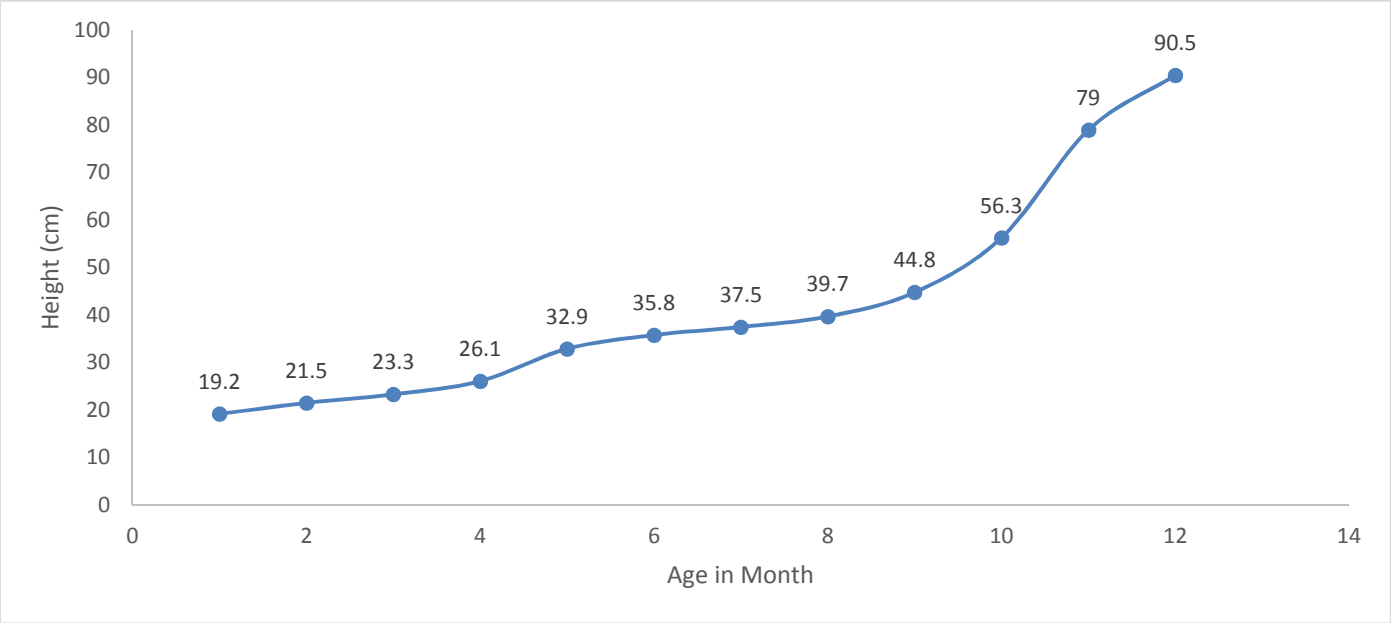


Figure-1: Height (cm) increment trend of Moss seedlings up to 1 years in the hedgerows

International Journal of Scientific & Engineering Research Volume 7, Issue 8, August 2016

ISSN 2229-5518

Study of shoot immersion after topping of seedlings in hedge bed: Shoot immersion started in 7 days. At 14th day 5 shoots were found. Shoot immersion remained steady from 3rd to 5th week. Maximum number of shoot produced by Moss seedlings was 7 up to 1 year (Fig 2).

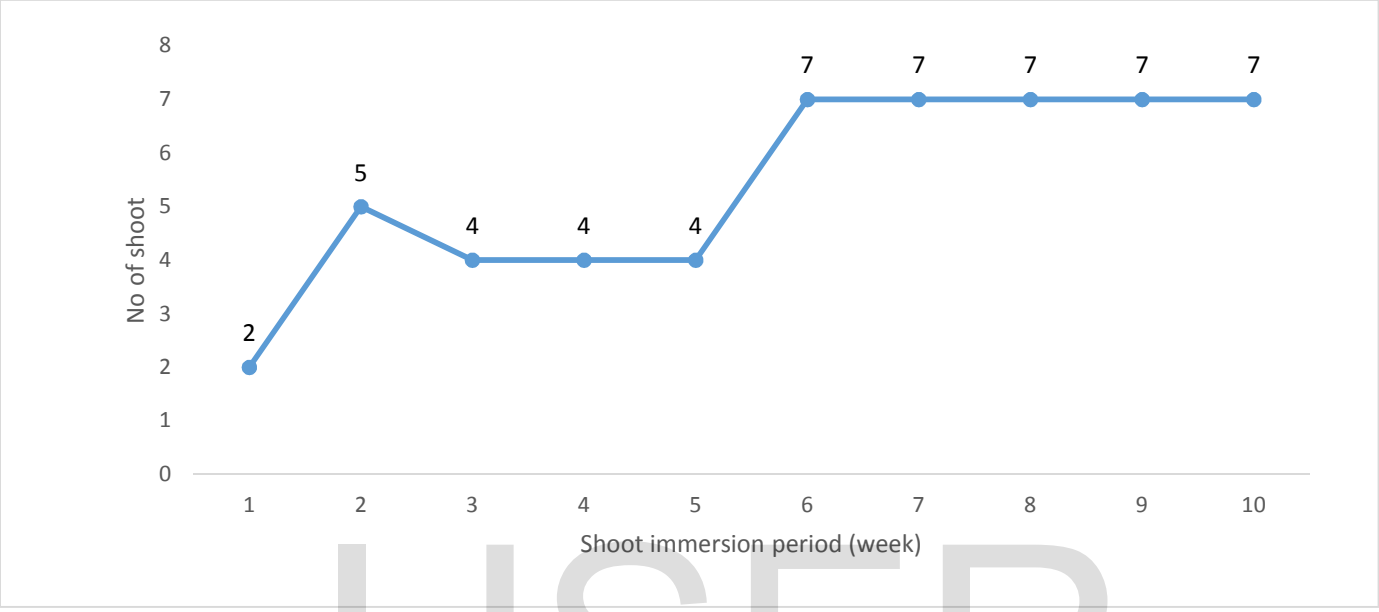


Figure-2: No of shoot produced after topping of Moss seedlings in hedge bed.

Rooting ability of Moss

Rooting percentage

The rooting percentage of the Moss (*B. elata*) cuttings varied from 0 to 67 under different treatments. The highest rooting percentage (67) was found in 1% IBA treated cuttings followed by 33% for remainig treatments (Fig 3). There were significant differences among IBA treatments and control at 95% significant level.

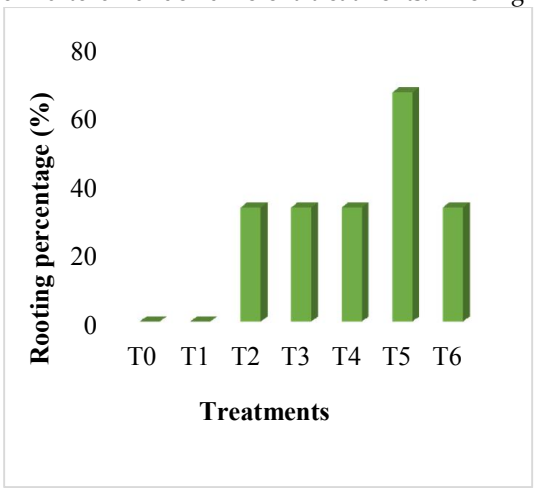


Figure-3: Rooting percentage of the Moss (*B. elata*) cuttings under different treatments.

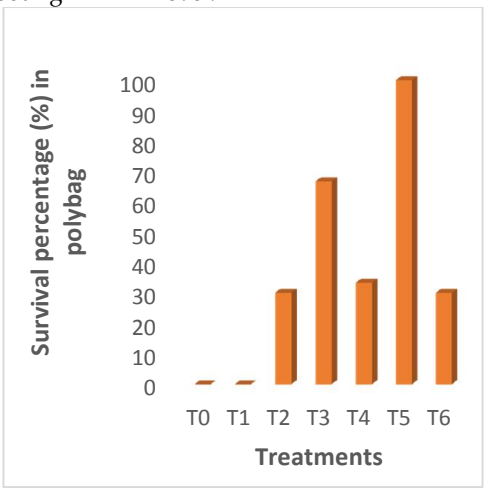


Figure-4: Survival percentage of the Moss (*B. elata*) cuttings in polybag under different treatments.

Survival percentage

100% survival percentage in polybag was found in 1% IBA treated cuttings (Fig 4).

Root number

The root number of Moss cuttings varied from 1 to 3 under

International Journal of Scientific & Engineering Research Volume 7, Issue 8, August 2016

ISSN 2229-5518

different treatments. Maximum root (3) was found in 1% IBA treated cuttings followed by 1, 1, 2 and 1 for 0.4%, 0.6%, 0.8% and 1.2% IBA treated cuttings respectively (Fig 5).

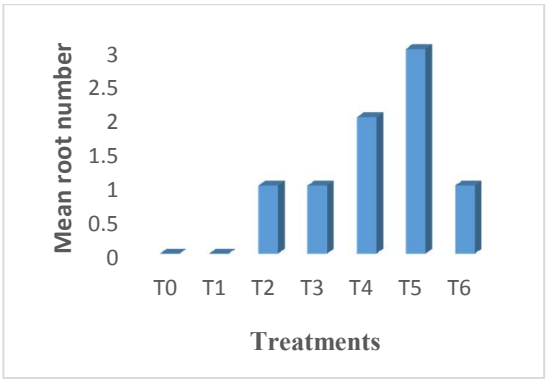


Figure-5: Mean root number found in Moss (*B. elata*) cuttings under different treatments.

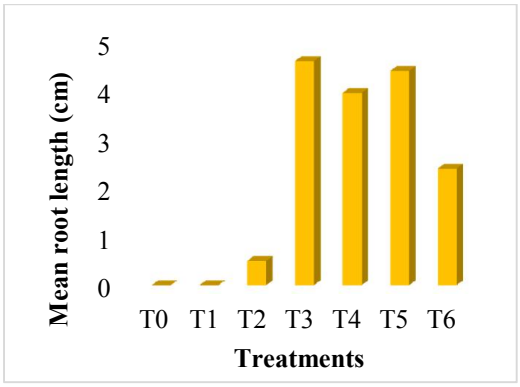


Figure-6: Mean root length (cm) found Moss (*B. elata*) cuttings under different treatments.

Root length

The mean root length of moss cuttings varied from (0.5 – 4.6) cm under different treatments. Maximum root length (4.6cm) was found in 0.6% IBA treated cuttings follwed by 4.4 cm, 3.95cm, 2.4 and 0.5 cm for 1%, 0.8%, 1.2% and 0.4% IBA treated cuttings respectively (Figure-6).

Discussions

The application of a rooting hormone for the rooting of leafly stem cuttings is widely recognized (Husen and Pal 2006, Abdullah *et al.* 2005, Hossain and Kamaluddin 2005, Hossain and Kamaluddin 2004, Husen 2003, Husen *et al.* 2003 ; Tchoundjeu and Leakey 2001, Leakey *et al.*1990) Although the rooting hormone used, i.e. IBA, has a very important role in rooting various tropical tree species (Ansari *et al.* 2000, Tchoundjeu *et al.* 2001) the different concentrations of IBA applied leading to rooting response varied for different species. Moss showed 67% rooting ability which is similar to the findings of Rashid *et al.* (2000) and that rooting success in clonal propagation is dependent upon optimizing many endogenous and exogenous factors and better response could be achieved by using juvenile stock, i.e., one to two year old seedling or 45-60 day old coppice shoots from less than six years old plants. Results of previous studies documented the suitable root responses at 100 mg (1%) for Moss which reveals the finding of Baul *et al.* (2010) where the percentage of rooting increased with increasing concentrations of IBA.

Conclusion:

Considering the rooting percentage, root formation and survival percentage in the cutting and their steckling capacity under different treatments, vegetative propagation of Moss by juvenile shoot cuttings with 1% IBA treatment may be used for plantation programs.

References

Abdullah, A. T. M., Hossain, M. A., and Bhuiyan, M. K. 2005. Propagation of Latkan (*Baccaurea sapida Muell. Arg.*) by mature stem cutting, Research journal of Agriculture and Biological Sciences 1(2): 129-134

Ansari, S. A., and Gupta, B. N. 2000. Tree Improvement Program at Tropical Forest Institute: A Status Report, Proceedings workshop on production of genetically improved planting materials for afforestation programs, 18-25 June, Coimbatore, India.

Ara, H., Khan, B. and Uddin, S.N. (eds.) 2013. Red Data Book of Vascular Plants of Bangladesh, volume 2. Bangladesh National Herbarium, Dhaka, Bangladesh. 280 pp.

Baul, T. K., Hossain, M. M., Mezbahuddin, M and Mohiuddin, M. 2011. Vegetative propagation of Litsea monopetala, a wild tropical medicinal plant: Effects of indole-3-butyric acid (IBA) on steam cuttings, Journal of Forestry Research.

Baul, T. K., Hossain, M. M., Mezbahuddin, M., and Mohiuddin, M. 2010. Vegetative propagation of *Holarrhena pubescens*, a wild tropical medicinal plant: Effects of indole-3-butyric acid (IBA) on steam cuttings, for. Stud. China, 12(4): 228-235

FAO, 1993. The challenge of sustainable forest management. What Future for the World's Forest? Conservation Guide, Publication Division, FAO, Rome. 128pp.

Hossain, M.K. 2015. Jibo Boichitrer Avoyaronno Bangladesher Paharhi Ban (in Bangla), National Tree Planting Campaign and Tree Fair, Souvenir, Bangladesh Forest Department, Dhaka.

Hossain, M. K. and Ahmed H.U. 2008. Biponnoprai Brikkho Projatir Nursery Manual, Aronnok Foundation, Bangladesh. Pp.95.

Hossain, M. A. and Kamaluddin, M. 2005. Lateral Shading of Stock plants Enhanced Rooting Performance of Guava (*Psidium guajava* L.) Cuttings, J. Appl. Hort., 7(2): 51-56

Hossain, M. A and Kamaluddin, M. 2004. Effects of lateral shading on growth and morphology of shoots and

International Journal of Scientific & Engineering Research Volume 7, Issue 8, August 2016

ISSN 2229-5518

rooting ability of jackfruit (*Artocarpus heterophyllus* Lam.) cuttings, J. Appl. Hort., 6(1): 35-38.

Husen A and Pal M. 2006. Variation in shoot anatomy and rooting behaviour of stem cuttings in relation to age of donor plants in teak (*Tectona grandis* Linn. f.). New Forest, 31: 57–73

Husen A. 2003. Effect of IBA and NAA treatments on rooting of *Rauvolfia serpentina* Benth. Ex Kurz shoot cuttings. Ann Forest, 11: 88 – 93

Husen A, Khali R, Nautiyal S, Bhandari H.C. S. 2003. Effect of phytohormones on rooting of nodal shoot cuttings of *Grewia optiva* Drummond. Ind Forest, 129: 1147–1152

Kamaluddin M. 1996. Clonal propagation of Eucalyptus and *Acacia* hybrid by stem cuttings. Chittagong: Institute of Forestry and Environmental Sciences, University of Chittagong.

Leakey R R B. 1990. *Nauclea diderrichii*: rooting of stem cuttings, clonal variation in shoot dominance, and branch plagiotropism. Trees (Berl), 4: 164–169

Rashid, M. H. U., Serajuddoula, M., Banik, R. L., and Matin, A. 2000. Vegetative propagation of Forest trees in Bangladesh, Bangladesh Forest Research Institute, Chittagong, 51 Pp.

Tchoundjeu Z and Leakey R R B. 2001. Vegetative propagation of *Lovoa trichilioides*: effects of provenance, substrate, auxins and leaf area. J Trop Forest Sci, 13: 116–129

Authors' details

1. Morgubatul Jannat*
   M.S in Forestry
   Institute of Forestry and Environmental Sciences, University of Chittagong, Bangladesh
   Mail: mjruhin33@gmail.com

2. Mohammad Kamal Hossain, PhD (UK)
   Professor, Institute of Forestry and Environmental Sciences
   University of Chittagong, Bangladesh
   Mail: mkhossain2009@gmail.com
   Phone: 0312606018
   Mobile: 01819837689