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Vegetative Propagation Potential of Kusum (*Schleichera oleosa* Lour) By Stem Cutting from Young Stock Plants

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Abstract: *The experiment was conducted to find out suitable vegetative propagation techniques for Kusum (Schleichera oleosa Lour) a native threatened tree species of Bangladesh.*

Juvenile shoots of Kusum 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 50% rooting response with 0.4% IBA treatment after 86 days. There were significant differences among IBA treatments and control at 95% significant level. Maximum number of root (3), highest root length (1.0 cm) and the highest survival percentage (100%) were also observed in 0.4% 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"

Schleichera oleosa Lour is a medium-sized to large tree, up to 40 m tall. Branches are terete, black when young, later yellowish-brown. Leaves are 2-4 jugate, young leaves deep purple, petioles terete, flattened or grooved above, 2-6 cm long. Flowers are pale yellow or pale green. Sepals are ovate to deltoid, 1.5 mm long. Fruits are broadly ovoid to sub-globular, 15 × 13 mm long. Seeds are sub globular, 12 × 10. Flowering & Fruiting occurs during March-November [9]. In Bangladesh, the plants occasionally occurs in some gardens and forests under cultivated condition. Over-exploitation is the present threat to this species. Kusum timber is very hard and durable and used for the roller of oil and sugar mills, rice ponders, agricultural implements. Wood is used for making charcoal. Ripe fruit is eaten raw. Leaves and twigs are lopped for cattle fodder. Oil is also used to cure skin diseases. But the species is disappearing in an alarming rate due to forest fragmentation, deforestation, Jhum and so on [3,8]. Ex-situ conservation measures have been proposed for this species [3]. Although ex-situ conservation measures have been taken to some extent, this conservation measure should be expanded. Destruction of natural habitat of plants, over exploitation of natural green cover due to increasing needs of human resulted in biodiversity loss and environmental deterioration in most tropical forests [6, 7, 18 and 19].

Although propagation by seed is possible, seeds of *Schleichera oleosa* are not abundant and germination from seed is uncertain and time consuming. Therefore, the preservation and domestication of *Schleichera oleosa*, a study on vegetative means of propagation is of great importance and clonal propagation technique can be a good suggestion which can solve the problem of seed scarcity. Although species differ in their rooting requirements [15] and rooting percentage varied with the varying concentrations of individual auxins [5,15,17] little effort has been taken to propagate *Schleichera oleosa* Lour which necessitates determining the suitable treatments for maximum rooting of this species for clonal propagation.

Mature stem cutting showed poor rooting response in many tropical trees [16]. So present study was designed to inspect the vegetative propagation potential of this species by exploring the effects of different IBA (Indole-3 Butyric Acid) concentrations on the rooting ability of juvenile shoots obtained from hedge bed.

"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.

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 [14]. 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 Kusum 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.

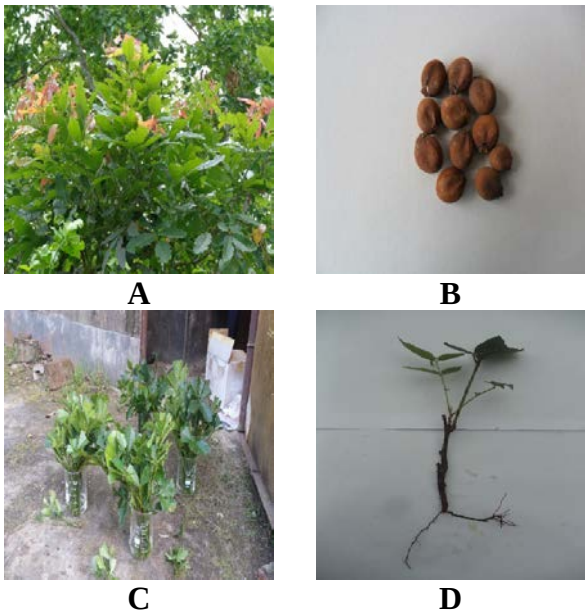

Photo-1: (A) Natural Kusum tree (B) Fruit (C) Cuttings and (D) Rooted cutting of Kusum

"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 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 Kusum 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 Kusum attained a height of 77.4 cm (Fig 1).

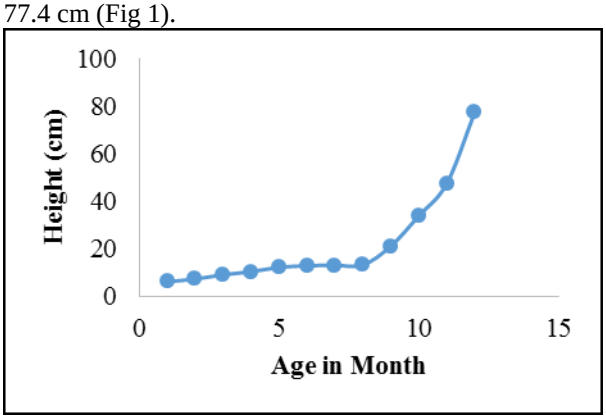

Figure 1: Height (cm) increment trend of Kusum seedlings up to 1 years in the hedgerow.

"Study of shoot immersion after topping of seedlings in hedge bed"

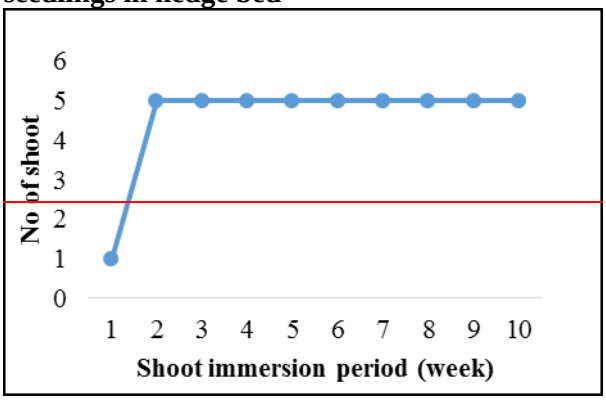

Figure-2: No of shoot produced after topping of Kusum seedlings in hedge bed.

Shoot immersion started in 7 days. At 14th day 5 shoots were found. Shoot immersion remained steady from 2nd to 12th week. Maximum number of shoot produced by Kusum seedlings was 5 up to 1 year (Fig 2).

"Rooting ability of Kusum"

Rooting percentage

In *Schleichera oleosa* (Kusum), 50% rooting response was observed with 0.4% IBA treatment which was significant compared to other treatments (Fig 3). There were significant differences among IBA treatments and control at 95% significant level.

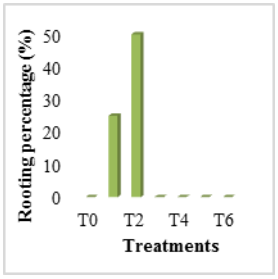

Figure 3: Rooting percentage of the Kusum (*Schleichera oleosa*) cuttings under different treatments

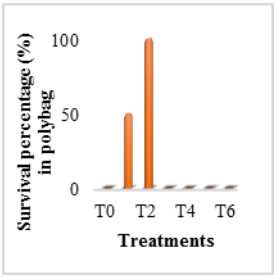

Figure 4: Survival percentage of the Kusum (*Schleichera oleosa*) cuttings under different treatments.

Survival percentage

100% survival percentage in polybag was found in 0.4% IBA treated cuttings (Fig 4).

Root number

Root number of Kusum (*Schleichera oleosa*) cuttings varied from 1 to 3 under different treatments. Maximum root (3) was found in 0.4% IBA treated cuttings (Fig 5).

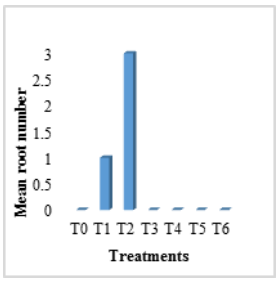

Figure 5: Mean root number of the Kusum (*Schleichera oleosa*) cuttings under different treatments

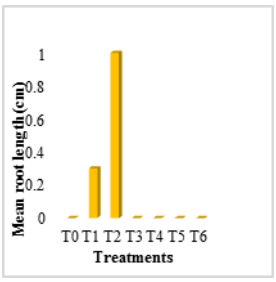

Figure 6: Mean root length of the Kusum (*Schleichera oleosa*) cuttings under different treatments.

"Root length"

Root length of Kusum (*Schleichera oleosa*) cuttings varied from 0.3 cmto 1 cm under different treatments. Maximum root length (1 cm) was found in 0.4% (400 ppm) IBA treated cuttings (Fig 6).

The application of a rooting hormone for the rooting of leafy stem cuttings is widely recognized [1, 9, 10, 11, 12, 15, and 17]. Although the rooting hormone used, i.e. IBA, has a very important role in rooting various tropical tree species [2, 17] the different concentrations of IBA applied leading to rooting response varied for different species. Kusum showed 50% rooting ability which is similar to the findings of [16] 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 40 mg (0.4%) for Kusum which reveals the finding of Baul [5] 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 Kusum by juvenile shoot cuttings with 0.4% IBA treatment may be used for plantation programs.

References

[1] 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

[2] 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.

[3] 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.

[4] 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.

[5] 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

[6] Chowdhury, M.S.H., and Izumiyama, 2014. Forest conservation in protected areas in BD, World Forests 20, DOI: 10.1007/978-3-319-08147-2_11@ Springer international publishing, Switzerland.

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

[8] Hossain, M. A and Kamaluddin, M. 2004. Effects of lateral shading on growth and morphology of shoots and rooting ability of jackfruit (*Artocarpus heterophyllus* Lam.) cuttings, J. Appl. Hort., 6(1): 35-38.

[9] 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

[10] Hossain, M. K. and Ahmed H.U. 2008. Biponnoprai Brikkho Projatir Nursery Manual, Aronnok Foundation, Bangladesh. Pp.95.
[11] Hossain, M.K. 2015. Jibo Boichitrer Avoyaronno Bangladesher Paharhi Ban (in Bangla), National Tree Planting Campaign and Tree Fair, Souvenir, Bangladesh Forest Department, Dhaka.
[12] 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
[13] 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
[14] Husen A. 2003. Effect of IBA and NAA treatments on rooting of *Rauvolfia serpentina* Benth. Ex Kurz shoot cuttings. Ann Forest, 11: 88 – 93
[15] Kamaluddin M. 1996. Clonal propagation of Eucalyptus and *Acacia* hybrid by stem cuttings. Chittagong: Institute of Forestry and Environmental Sciences, University of Chittagong.
[16] Leakey R R B. 1990. *Nauclea diderrichii*: rooting of stem cuttings, clonal variation in shoot dominance, and branch plagiotropism. Trees (Berl), 4: 164–169
[17] Leuschner C, Moser G, Hertel, D. 2013. Conservation of tropical moist forest into cacao agro forest, Consequences for Crbon pools and annual carbon sequestration, Agroforestry System 87: 1173-1187.
[18] 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.
[19] 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
[20] Watson, R.T., Heywood, V.H., Baste, I., Dias, B., Gamez, R., Jenetos, T., Reid, W. and Ruark, G. 2011. Global Biodiversity assessment: Summary for Policy – Makers. Cambridge University Press, Cambridge, Newyork, Melborn, Madrid, Cape Town, Singapur, Sao Paulo, Delhi, Tokyo, Mexico City.