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Propagation of Latkan (*Baccaurea sapida* Muell.Arg.) by Mature Stem Cutting

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Abstract: The study explores the scope of clonal propagation of latkan (*Baccaurea sapida* Muell. Arg.) by mature stem cutting. Cuttings were collected from matured stockplants and treated with 0%, 0.2%, 0.4% and 0.8% IBA solution. Steckling capacity of cutlings (the rooted cuttings) was assessed in propagator environment and open place for acclimatization. The study reveals that the species is amenable for clonal propagation by mature stem cutting. Applied auxin significantly enhanced the rooting ability of *B. sapida* cuttings. The highest rooting percentage of cuttings was 65 observed in 0.4% IBA treatment and the lowest was 15 in controlled cuttings. The highest number of root developed (2.63) in the cuttings treated with 0.8% IBA solution and lowest was in cuttings without (0% IBA) treatment. The maximum root length (3.17cm) and shoot number (0.80) was observed in cuttings treated with 0.4% IBA solution followed by 0.8%IBA and the lowest was in controlled cuttings. Survival percentage of cutlings was significantly affected by the acclimatization environment. The highest survival percentage (68) was observed in cutlings rooted with 0.4% IBA treatment and acclimatized in propagator environment.

Key words: Acclimatization, *Baccaurea sapida*, propagator, rooting ability, steckling capacity.

INTRODUCTION

Latkan (*Baccaurea sapida* Muell.Arg.) belongs to the Family Euphorbiaceae is native to Southeast Asian region and growing wild as well as under cultivation in Nepal, India, Myanmar, Bangladesh, South China, Indo-China, Thailand, the Andaman island and Peninsular Malaysia. In Bangladesh the species is grown in some pockets in Narsingdi, Manikgonj, Gazipur, Netrokona, Kishoregonj and Sylhet[4]. *B. sapida* is a small ever green tree up to 5m in height, with long branches from near the ground[5]. Flower is tomentose on short pedicels in simple bracteates spiciform densely fascicled racemes, from below the old wood. Fruit is yellow, velvety, 2-3 cm diameter, with leathery pericarp. Seeds are arillus, 3 in number, embedded in pale rose-coloured delicious pulp. The wood is pinkish-white, soft and even-grained. Latkan or Burmese grape is a commercially important fruit is very popular to people of all ages in Bangladesh. The trees are being cultivated chiefly for the production of valuable dye “annatto” from seeds. Seeds contain 4.8-6% annatto dye. Annatto is used for colouring silk, cotton and other textile materials for orange colour but now being replaced by synthetic dyes due to shortage of Latkan seeds in adequate quantity. The roots are used as flavouring for meats to which they impart the colour and flavour of saffron. Strong fibers are obtained from the bark, which is used for making ropes[5].

B. sapida is propagated either from seeds or by grafting. Plantations raised from seed need to attain a considerable height before flowering [5]. Again, the sex (maleness and femaleness) of *B. sapida* cannot be detected before flowering of plants at 4-5 years of planting. Most of the male plants need to cut off after confirmation of sex. This is wastage of money, time and space of fruit production. Vegetative reproduction could open up a new horizon for the multiplication of this species for large-scale plantations since the species is amenable for rooting in juvenile stem cuttings[3]. However, multiplication of the species through clonal propagation from juvenile materials is unable to avoid the difficulties of detecting the male and female trees developed from the juvenile cuttings. Therefore clonal propagation through mature stem cutting from female trees can be an important tool for resolving the problem of female tree identification. However, the research works on asexual regeneration from mature materials for the species is very scarce[3]. So, under the present circumstances the research work has been designed to explore the scope of clonal propagation of the species through mature stem cutting.

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MATERIALS AND METHODS

The study was conducted over a period of one year from June 2004 to May 2005 in the nursery of Institute of Forestry and Environmental Sciences in Chittagong University campus situated at the intersection of 22°30' North latitude and 91°50' East longitude. The campus enjoys typically tropical climate with hot humid summer and cold dry winter.

B. sapida cuttings were collected from the phenotypically superior mature female trees. Branches of the stockplants were trimmed for shoot production at the very beginning of the study. The sprouted shoots from the trimmed branches were collected for cutting preparation. Shoots were soaked in water immediately after cutting from the tree and brought to the nursery by wrapping with banana (*Musa* spp.) leaves. One node cuttings with one leaf trimmed to half were put into the non-mist propagator (Plate 1). The cuttings were then immersed briefly in a solution of fungicide, Diathane M45 (Rohm & Co. Ltd., France; 2g. per litre of water) to avoid fungal infection. Then they were rinsed and kept under shade for 10 minutes in open air.

Plate 1: Non-mist propagator: 1.8 m in length, 1 m in breadth with height of 60 cm on one side and 45 cm in other side.

Plate 2: Cuttings planted in the perforated plastic tray filled with coarse sand mixed with gravels (left) and cutting rooted seven weeks after setting into the propagator for rooting trials (right).

Effect of Indole 3-Butyric Acid (IBA) on rooting ability of cuttings was explored by treating the cuttings from each group with 0%, 0.2%, 0.4% and 0.8% IBA solution. For IBA treatment cutting base was briefly dipped into the solution. The cuttings were planted into perforated plastic trays (12 cm depth) filled with coarse sand mixed with fine gravel (Plate 2). Then the cuttings were placed into non-mist propagator for rooting in completely randomized blocks. A total of 180 cuttings were placed under four different treatments with three replications in non-mist propagator. Cuttings were planted in 12 trays, 3 trays for each treatment (0%, 0.2%, 0.4% and 0.8% IBA solution) and each tray containing 15 cuttings served as a plot. Thus the number of replicate cuttings per treatment was 45. The cuttings were watered once only just after the setting into the propagator. A light spray of water was done every morning with a hand spray till the transfer of rooted cuttings from the propagator. The cuttings in the propagator rooted seven weeks after setting into the propagator (Plate 2).

The cuttings were subjected to weaning before transferring them in to polybags, particularly towards the end of rooting period during root lignifications. For weaning, the propagator was kept open at night for three days and then at day and night for another three days. Weaning is usually done to harden the rooted cuttings in prevailing adverse environment outside the propagator. It increases the steckling capacity of the rooted cuttings. After weaning, all rooted cuttings were transferred into polybags filled with soil and decomposed cowdung at a ratio 3:1. Before planting into the polybag, rooted cuttings were measured for length and diameter. Number of roots and shoots developed in each cutting were recorded. The length of the longest root was also measured and recorded for each cutting.

Steckling capacity is the survival ability of the rooted cuttings after transferring them into polybags. To explore the effect of acclimatization environment on steckling capacity, half of the rooted cuttings were placed into the propagator again. Remaining half was kept in shade for a week. Then the cuttings from both the environments (propagator and open place) were placed under direct sunlight and allowed growing. Number of rooted cuttings survived was counted and recorded for survival percentage. All data were analyzed with the help of calculator, computer software Microsoft Word, Microsoft Excel and SPSS under IBM PC based Windows environment. Possible treatment variations were explored by Analyses of Variance (ANOVA) and Duncan's Multiple Range Test (DMRT). Rooting percentage values were adjusted accordingly using arc sign transformation formula before putting the data into analysis of variance.

$$Y = Sin^{-1} (X)^{1/2}$$

Where, Y = Arc sign transformed value, X= proportion of number of cutting rooted to the number of cutting planted and the value 100 percent were substituted (100-1/4n) where 'n' is the number of units upon which the percentage data is based i.e., the denominator used in computing the percentages.

RESULTS AND DISCUSSIONS

Rooting ability of cuttings:

Rooting percentage: The rooting percentage of *B. sapida* cuttings varied from 15 to 65 under different treatments. The highest rooting percentage 65 was found in 0.4% IBA treated cuttings followed by 56.67 and 55 for 0.8% and 0.2% IBA treated cuttings respectively (Figure 1). Rooting ability of cuttings of *B. sapida* was significantly affected by IBA treatment.

Root number of cuttings: The mean root number of *B. sapida* cuttings was varied from 1.55 to 2.63 across the cutting types. Root number was highest in 0.8% IBA treated cuttings and lowest in cuttings without (0% IBA) treatment. Auxin significantly increased the root number of cuttings of *B. sapida* (Figure 2).

Root length of cuttings: The mean root length of *B. sapida* cutting was not significantly affected with the IBA treatments. The highest mean root length was 3.17cm and the lowest was 2.02cm in cuttings treated with 0.4% IBA and without IBA treatment respectively (Figure 3).

Shoot number of cuttings: Auxin did not significantly affect the shoot number developed in *B. sapida* cuttings (Figure 4). However, maximum number of shoots was developed in cuttings rooted with 0.4% IBA treatment and the minimum was in cuttings rooted without treatment. The mean shoot number was varied from 0.53 to 0.80 in *B. sapida* cuttings.

Steckling capacity of rooted cuttings: The cutlings (rooted cuttings) were acclimatized in propagator environment shown better survival percentage than the cutlings kept in open place (Figure 5). Survival percentage of *B. sapida* cutlings was significantly affected by acclimatization environment but not by the IBA treatments. However, the highest survival percentage (68) was in cuttings rooted with 0.4% IBA treatment and acclimatized in propagator environment and lowest (40) was in cuttings rooted with 0.2% IBA treatment kept in open place (Plate 3).

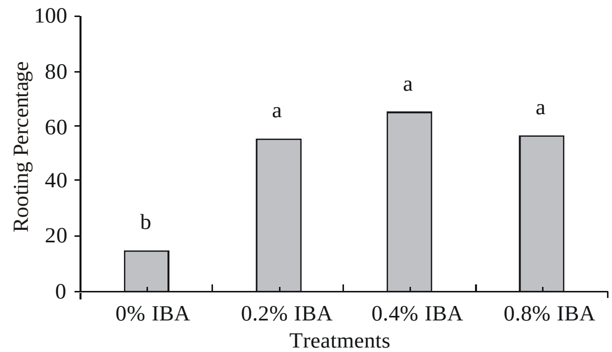

Fig. 1: Rooting percentage of *B. sapida* cuttings under various treatments. The same letters indicate no significant difference at $p<.05$ (ANOVA and DMRT).

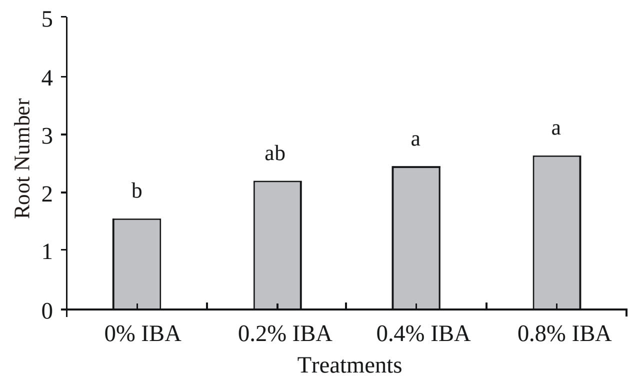

Fig. 2: Root number of *B. sapida* cuttings under various treatments. The same letters indicate no significant difference at $p<.05$ (ANOVA and DMRT).

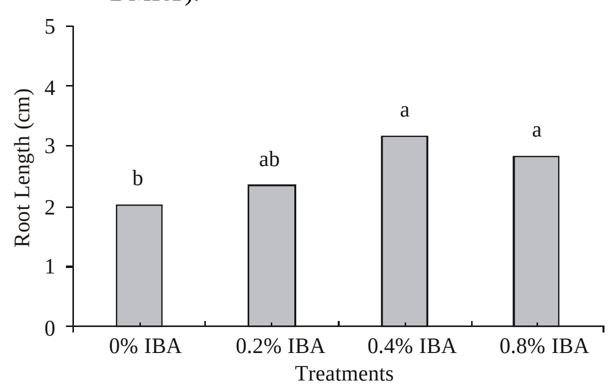

Fig. 3: Root length of *B. sapida* cuttings under different treatments. The same letters indicate no significant difference at $p<.05$ (ANOVA and DMRT).

Rooting percentage of *B. sapida* cuttings varied from

15 to 65 in the present study. The highest rooting percentage (65) was found in 0.4% IBA treated cuttings and lowest was in the cuttings without treatment. Rooting ability of cuttings of *B. sapida* was found to increase significantly by IBA treatment in the present study. However, Nath and Barooah reported 46.5% rooting when *B. sapida* (latkan) cuttings were dipped in 2500, 3000 or 3500 ppm IBA (in 50% ethanol)[16]. Thirunavonkkarasu and Saxena reported that rooting was highest (60%) in *Bixa orellana* cuttings treated with 100 ppm of IAA[19]. IBA was more effective than IAA at stimulating rooting of latkan with 0.05 mg/litre the optimum concentration[6]. Muller *et al*. reported that rooting in cuttings of *Bixa orellana* was best in intermediate cuttings treated with 2500 ppm IBA (70% rooting within 36 days) while the cuttings without IBA treatment took 100 days to give over 70% rooting[15].

Root number of cuttings of *B. sapida* was significantly affected by the auxin (Figure 2). Similar result was reported by Hossain *et al*. that mean root number of cuttings of *Swietenia macrophylla* and *Chickrassia velutina* significantly enhanced with IBA treatment[10]. Cuttings of jackfruit treated with 300 ppm NAA resulted in the highest root number[11]. Kamaluddin *et al.* observed that applied auxin significantly increased the root number of cuttings of *C. velutina*[13]. Again, Al-Obeed reported that the cuttings of guava treated with IBA in combination with catechol at 500 and 1000 ppm produced highest number of roots (31.1) while the control produced only 9.1 roots per cutting[1].

Root length of *B. sapida* cuttings was varied with the auxin treatments (Figure 3). It was observed that the longest root (3.17cm) obtained from the cuttings treated with 0.4% IBA solution. Similar result was reported by Mathew *et al.* and mentioned that the primary root number, root length and root dry biomass showed a significant (P=0.05) increase due to chemical treatments over the untreated cuttings[14]. These results also supported by the findings of the study of Pathak *et al*.[17] on plum and Avanzato *et al.* on peach[2].

However, average number of shoot per cuttings of *B. sapida* was not differed significantly with the IBA treatments (Figure 4). Similar result was reported by Hossain *et al.* and mentioned that shoots produced by the cuttings of *S. macrophylla* and *C. velutina* was indifferent to IBA treatments [10]. However, Debata and Pank reported the optimum bud break response was obtained with 0.1 mg IAA + 0.5 mg IBA/litre with 85% of explants producing an average of 2.3 shoots /explants in cuttings of mature *Bixa orellana*[6].

The highest survival (68%) of *B. sapida* cutlings was observed in the cutlings rooted with 0.4% IBA treatment and acclimatized in propagator environment and the lowest (40%) was in cuttings treated with 0.2% IBA and acclimatized in open place (Figure 5). However, Nath and Barooah recorded that survival

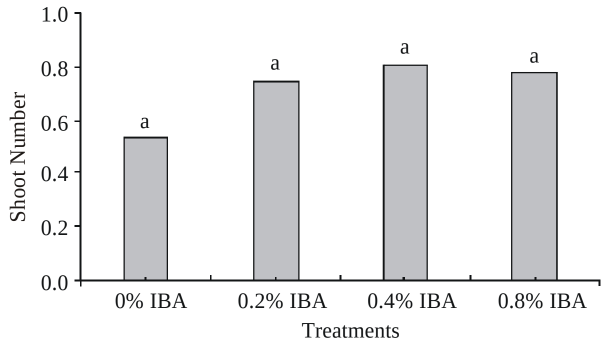

Fig. 4: Number of shoot developed in *B. sapida* cuttings under different treatments. The same letters indicate no significant difference at $p<.05$ (ANOVA and DMRT).

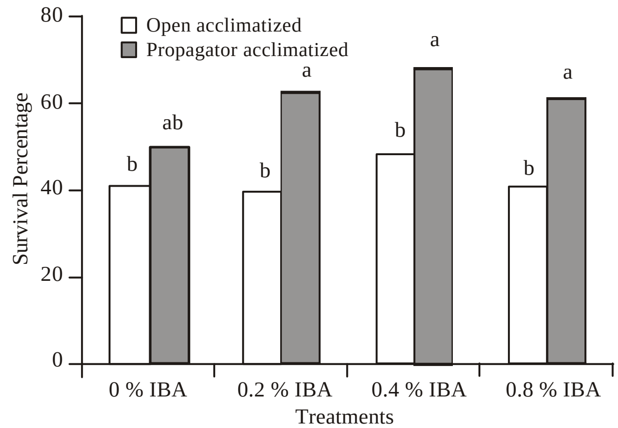

Fig. 5: Survival percentage of cutlings acclimatized in different environments. The same letters indicate no significant difference at $p<.05$ (ANOVA and DMRT).

Plate 3: Steckling capacity of *B. sapida* cutlings developed under different treatments.

of rooted cuttings were 62.3% in *B. sapida* cuttings treated with IBA[16].

Enhancement of rooting ability of cuttings by IBA application was reported by many scientists. For an example SRD reported the best rooting in cuttings of *S. macrophylla* treated with IBA[18]. Dias *et al.* reported the highest rooting ability when cuttings of *Platanus acerifolia* treated with IBA [7]. Kamaluddin *et al.* recorded significant increment both in percentage rooting and number of root with the application of IBA for *Artocarpus heterophyllus*[12]. Again, Hossain *et al*. reported the highest rooting ability of *A. heterophylla* cuttings treated with 0.4% IBA[9].

Applied auxin is known to intensify root-forming process in cuttings. Usually polysaccharide hydrolysis is activated under the influence of applied IBA, and as a result, the content of physiologically active sugar increases providing materials and energy for meristamatic tissues and later for root primordia and roots. Hassig examined the function of endogenous root forming components of plants and demonstrated that auxin component was required for development of callus in which root primordia initiated but for subsequent premordia development both auxin and non-auxin components are needed[8]. It may be possible that in cuttings with optimum amount of endogenous auxin content and increasing of root number reflects the effect of applied auxin.

Conclusion: The sex (male or female trees) of *B. sapida* cannot be detected before flowering of the plants at 4-5 years of planting. Most of the male trees need to cut off after confirmation of sex, which is wastage of money, time and space of fruit production. The present study on propagation of *B. sapida* by mature stem cutting provides us maximum rooting percentage (65), longest root length (3.17cm), maximum root number (2.63) and shoot number (0.8) with 68% steckling capacity (in propagator acclimatized environment) for Clonal propagation of the species. These information provides a suitable protocol of vegetative propagation of this species. However, field performance of the cuttings was not possible for the species due to some limitations of the present study. So, field trial of the rooted cuttings of the species for large-scale clonal multiplication could be an important aspect of future study.

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