Biomass partitioning and cutting success as influenced by indole butyric acid in softwood cuttings of Indian bdellium [Commiphora wightii (Arnot.) Bhand.]

Kumar, D. 1; Chandra, R. 2; Aishwath, O. P. 3
1,2,3 National Research Centre for Medicinal and Aromatic Plants, Boriavi – 387 310, Anand, Gujarat, India. nrcmap@wilnetonline.net

ABSTRACT: Biomass partitioning and cutting success as influenced by indole butyric acid in softwood cuttings of Indian bdellium (Commiphora wightii (Arnot.) Bhand.) is a large shrub of the family Burseraceae wildly growing in arid and semi-arid tracts of Rajasthan and Gujarat in India. The indiscriminate and faulty method of gum tapping led to destruction of the plants and consequently it is enlisted in category “A” of the endangered species. Its oleo-resin (gum) exudates from the deep incision(s) afflicted on the basal part of the stem, is used as a source of drug in Indian System of Medicine (ISM) since time immemorial to cure several ailments owing to its anti-inflammatory, antirheumatic, hypcholesteremic, hypolipidemic, and antifertility activities. For regeneration of softwood cuttings, the apical shoots (25 cm) were taken during first fortnight of June (premonsoon) and treated with various concentrations (0 – 3000 ppm) of Indolebutyric acid following quick dip method (5 seconds). The treated cuttings were planted in net shed having sandy loam textured soil (Fluventic Ustochrepts). The dry matter accumulation of leaves, twigs (newly emerged branches) and roots were recorded successively on 30, 60 and 90 days after planting. Medial concentrations of IBA (1500 or 2000 ppm) were found to be most effective in enhancing the cutting success and the dry matter accumulation (Table 1 and Figure 1). Softwood cuttings of Indian bdellium could be propagated successfully using IBA 1500 ppm.

Key words: Indolebutyric acid, biomass partitioning, softwood cuttings, Indian bdellium

INTRODUCTION: The Indian bdellium (Commiphora wightii (Arnott.) Bhand) is a well known herbal plant of Burseraceae family. It is used in the Allopathic, Ayurvedic and Unani systems of medicines due to its anti-inflammatory, antirheumatic, hypcholesteremic, hypolipidemic and antifertility activities (Satayavti, 1991; Tajuddin et al. 1997). It is reported to be an important component of the flora of tropical arid ecosystem (Kumar & Shankar, 1982). The oleo-resin (gum) called “Guggul” present in the ducts of secondary phloem exudates from the deep incisions afflicted on the basal part of the stem and main branches is used as a source of drug. The indiscriminate and faulty method of gum tapping has led to the destruction of the plants and coupled with inadequate replenishment; this species is now enlisted in category ‘A’ of the endangered plant (Tajuddin et al. 1997).

Commiphora wightii is propagated through stem cuttings (Mertia & Nagrajan, 2000; Chandra et al. 2001; Kumar et al. 2002). Earlier, one-meter long and 10 mm thick woody stem cuttings were reported suitable for raising of Commiphora wightii (Dalal & Patel, 1995). Thus requiring a large number of plant material for propagation. Indole-3-butyric acid (IBA) is still the most widely used auxin for rooting in stem cuttings and to increase the success percentage of cuttings (Gasper & Hofinger, 1989; Al-Saqri & Alderson, 1996). Recently, some efforts were made to enhance rooting in softwood cuttings of Alnus spp. with auxins (James & William, 2000; Thakur & Pant, 2002). As, no information is available on the regeneration of C. wightii by softwood cuttings. Therefore, it was felt to develop a rapid, convenient and economically viable method for raising planting material of C. wightii for domestication. The present investigation was designed to evaluate the influence of IBA on the regeneration of softwood cuttings of C. wightii.

MATERIAL AND METHOD

Net shade study was carried out at National Research Centre for Medicinal and Aromatic Plants, Anand, Gujarat (22.3° N latitude and 73°E longitude) during June – November of 2002. A promising clone ‘Asalio Rakhal’ of C. wightii was used in the present investigation. For regeneration of softwood cuttings, healthy dormant apical shoots (25 cm long) were taken from 8 – 10 months old branches of 3-year-old mother shrubs during first fortnight of June 2002. While preparing the cuttings, care was taken to make a straight cut 0.5 cm below a bud on the proximal end. The lower portion (5 – 7 cm) of the softwood cuttings were dipped for 5 seconds (quick dip) in freshly prepared aqueous solution of Indole-3-butyric acid (SRL, India) at 500, 1000, 1500, 2000, 2500 and 3000 ppm. 

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ppm. Whereas, cuttings dipped in distilled water for 5 seconds were considered as control. The experiment was laid out in a randomized block design (RBD) with three replications. After quick dip, cuttings were planted on raised beds (8-10 cm high) in the first fortnight of June. Uniform cultural practices were followed for raising the cuttings.

The soil was collected from the experimental site from 0 to 15 cm depth and was air dried and passed through 2 mm sieve for the analysis of physico-

**TABLE 1.** Influence of IBA on dry matter partitioning in softwood cuttings of Indian bdellium (*Commiphora wightii*)

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Leaf (g/cutting)</th>
<th>Twigs***(g/cutting)</th>
<th>Root (g/cutting)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30**</td>
<td>60**</td>
<td>90**</td>
</tr>
<tr>
<td>Control</td>
<td>0.03</td>
<td>0.25</td>
<td>0.35</td>
</tr>
<tr>
<td>500 ppm IBA</td>
<td>0.05</td>
<td>0.23</td>
<td>0.35</td>
</tr>
<tr>
<td>1000 ppm IBA</td>
<td>0.07</td>
<td>0.34</td>
<td>0.36</td>
</tr>
<tr>
<td>1500 ppm IBA</td>
<td>0.11</td>
<td>0.47</td>
<td>0.47</td>
</tr>
<tr>
<td>2000 ppm IBA</td>
<td>0.12</td>
<td>0.45</td>
<td>0.49</td>
</tr>
<tr>
<td>2500 ppm IBA</td>
<td>0.06</td>
<td>0.27</td>
<td>0.41</td>
</tr>
<tr>
<td>3000 ppm IBA</td>
<td>0.06</td>
<td>0.24</td>
<td>0.40</td>
</tr>
<tr>
<td>Mean</td>
<td>0.07</td>
<td>0.32</td>
<td>0.40</td>
</tr>
<tr>
<td>LSD (P=0.05)</td>
<td>0.03</td>
<td>0.09</td>
<td>0.05</td>
</tr>
<tr>
<td>SEM</td>
<td>0.01</td>
<td>0.05</td>
<td>0.02</td>
</tr>
</tbody>
</table>

*Days after planting ** woody portion without leaves

**FIGURE 1.** Response of IBA on cutting success
chemical properties. The processed soil was used for various analyses. The texture of soil was sandy loam (Fluentic Ustochrepts) having pH 7.6, organic carbon 0.26 % and EC \( \text{dSM}^{-1} \) 0.23 (1:25 (w/v) soil : water supernatant). Available nitrogen, phosphorus and potassium were 159.30, 12.94 and 168.50 kg per ha, respectively.

For biomass-partitioning study, the cuttings were uprooted with the help of shovel from the raised beds at 30, 60 and 90 days of planting. The leaves, twigs and roots were separated from rooted cuttings, washed thoroughly with water, oven dried at 60 °C for 72 hours and weighed to find the dry matter accumulation. Further, the cutting success was recorded at 90 days of planting. The data were analyzed (MSTATC computer package version 2.10) by ANOVA and treatment differences assessed for Least Significant Difference (LSD) at 5% probability (\( P<0.05 \)).

RESULT AND DISCUSSION

Biomass production of *Commiphora wightii* rooted cuttings in terms of leaf, twig and root dry matter was influenced by various concentrations of IBA (Table 1). In general, pretreatment with IBA significantly accelerated the leaf biomass accumulation at 1500 to 2000 ppm but not at lower (500 ppm) and higher concentrations (2500 to 3000 ppm) at 30, 60 and 90 days after the planting. A gradual increase in dry matter production of leaves was observed from 30- 90 days of planting with 1500 or 2000 ppm IBA. Almost, similar trend was also recorded with respect to dry matter accumulation in twigs at 1500 – 2000 ppm IBA. Irrespective of treatments, the dry matter production of twigs and roots increased throughout the study (30 – 90 days). At 30 days of planting, the root biomass production was significantly higher at 1500 or 2000 ppm IBA. While other concentrations could not bring positive response to this effect. Interestingly, 500 – 2000 ppm IBA was found to be effective in inducing the root biomass production at 90 days, which subsequently reduced beyond 2000 ppm IBA due to its toxic effect. It is very much evident that 1500 and 2000 ppm IBA were the most effective concentrations that enhanced the root and shoot biomass significantly however the response of both the concentrations was at par to each other. Thakur & Pant (2002) has also reported higher shoot biomass production of stem cuttings with 800 ppm IAA and 1600 ppm IBA in *Alnus nitida*.

As depicted in figure 1, the cutting success was also higher at 1500 - 2000 ppm IBA and their magnitude of success ranged from 60.00 – 65.33 %. Probably the higher success at these concentrations might be associated with higher production of root biomass. Similar observation was also made by James & William (2000) in *Alnus maritima* at 8000 ppm IBA. The rooting success in control and other IBA treated cuttings was correlated with leaves, twigs and roots dry matter production at 30, 60 and 90 days of planting. The biomass production (leaf, twig and root) showed significantly positive correlation (\( P<0.05 \)) with cutting success at all the three stages.

We conclude that soft wood-cuttings from matured plants are an effective way to regenerate clones of *C. wightii*, particularly when cuttings are collected early in the season (first fortnight of June) and treated with IBA at 1500 ppm.
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REFERENCE


