

## Root sucker technique for successful clonal multiplication of *Melia dubia* Cav. without sacrifice of mother tree

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***Melia dubia* Cav. is an important indigenous, short-rotation, multipurpose tree, advocated as a good raw material for pulp and plywood industries and high-quality timber for various purposes. Multiplication and conservation of its selected superior genotypes are prime challenges in commercial forestry. The present study was conducted to analyse root sucker ability. Roots sections collected during November–December and treated with indole-3-butyric acid @ 4000 ppm in nursery beds having soil : sand : vermicompost (in the ratio of 2 : 1 : 1) started juvenile shoots emergence after 30–35 days, with 90% shoot emergence and 85% establishment. No shoot emergence was observed from the root section collected during February–March. The clonal bank established in this process attained a diameter of 5–8 cm (10–12 cm above ground) in one year. The study shows that the *ex situ* detached root sucker protocol route can be adopted for cloning *M. dubia* without sacrificing the superior genotypes.**

**Keywords:** Clonal propagation, *Melia dubia*, mother tree, root sucker, superior genotypes.

SEVERAL tree species usually produce little or no viable seeds vis-à-vis some seeds that have poor germination capacity. Yet, in some tree species, poor and low germination multifaceted dormancy, quick loss of viability, etc. are bottlenecks for large-scale seedling production, and such trees can be easily propagated by vegetative means<sup>1</sup>. Vegetative or clonal propagation plays a major role in increasing the productivity of trees of commercial value as well as rare and threatened forest species, as it helps in maintaining true-to-type seedling production<sup>2</sup>. The prototype of this technique started in the early 1970s when tree cloning through stem cuttings reached the industrial level for large-scale multiplication<sup>3</sup>. Therefore, clonal selection and deployment received attention as rigorous forest management tools for increased wood production. In some cases, particularly commercial species like aspens, traditional stem cuttings do not yield successful result. Therefore, an alternative was adopted to force herbaceous shoots from root sections<sup>4</sup>. In fact, cloning of superior germplasm by means of root sucker had been practised in *Dalbergia sissoo*, *Populus* spp., *Albizia lebbek* and *Murraya* spp.<sup>5</sup>.

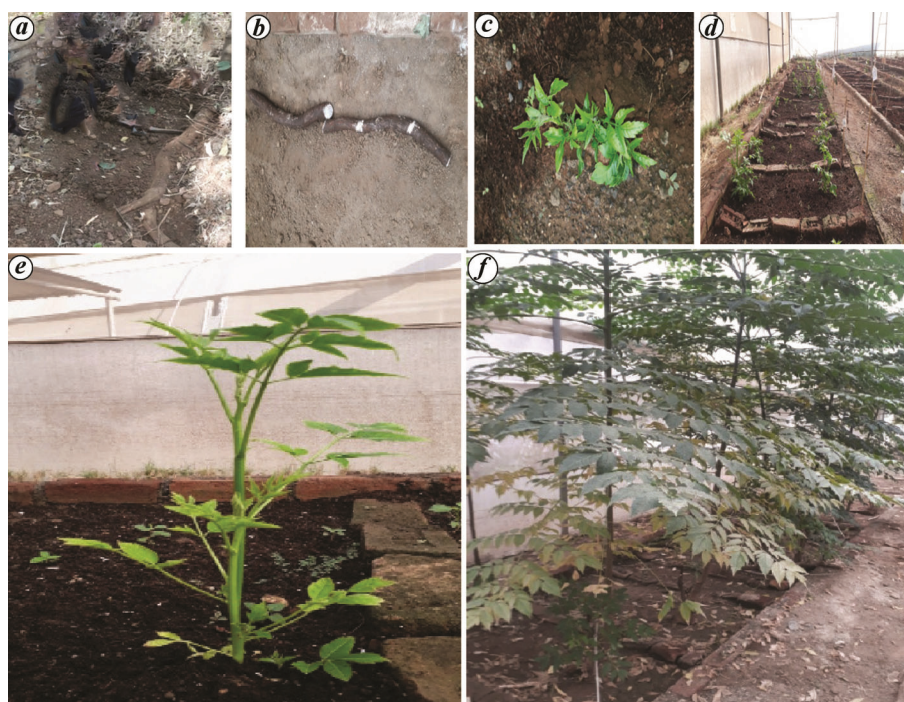
Clonal planting stocks of species like eucalypts, poplars, acacias and casuarinas were introduced to assure raw material supply. Nevertheless, inadequate availability of wood is a major constraint for feeding wood-based industries<sup>6,7</sup>. Hence, there is a need for clonally propagated species which could be utilized in several industries at various stages of development. One such species is *Melia dubia* Cav., an important short rotation, multipurpose tree, indigenous to the Western Ghats region of India (Tamil Nadu, Kerala, Karnataka and Gujarat). It is advocated as a good raw material for pulp and plywood industries and high-quality timber for various purposes<sup>8–10</sup>. Due to its non-allelopathic effect<sup>11,12</sup>, species is considered as an excellent tree component for agroforestry system<sup>13,14</sup>. Therefore, *M. dubia* has become popular among the farmers and large-scale plantations are being developed as the paper pulp and plywood industry has started utilizing the species<sup>15</sup>. However, there is a dearth of quality planting material of this species. Information on cloning technique for large-scale multiplication and conservation of *M. dubia* germplasm through stem cuttings and root suckers is scanty. In a Gujarat government-funded research project, more than 40 candidate plus trees (CPTs) of *M. dubia* were selected for their higher wood biomass and quality timber<sup>16,17</sup>. Multiplication and conservation of these selected genotypes are prime challenges for commercial use. While selecting CPTs in the Satpura ranges and northern Western Ghats region of Gujarat, we obtained a cue from personal observations of naturally induced suckering<sup>18</sup> from roots in response to superficial injury (Figure 1)<sup>18</sup>. Thus, the present study was conducted to analyse root sucker ability and its utility for clonal propagation.

Roots sections from CPTs having 20–40 cm diameter at breast height (DBH) and 12–26 m height were excavated during November–December and February–March



**Figure 1.** Naturally induced sucker from exposed roots in *Melia dubia*.

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**Figure 2.** *a*, Excavation and detachment of root section from selected genotype. *b*, Fungicide treated and superficial injury in root section while applying indole-3-butyric acid @4000 ppm in nursery beds. *c–e*, Juvenile shoot emergence from root suckers in nursery beds. *f*, Established root sucker and clonal bank of superior genotypes in polyhouse.

**Table 1.** Shoot formation and establishment success of root suckers of candidate plus trees (CPTs) of *Melia dubia* under naturally ventilated polyhouse

DBH (cm)	Height (m)	Season of collection	Number of CPTs used in the experiment	Root section diameter range (cm)	Root section length range (cm)	Days to shoot emergence	Shoot emergence	Establishment success
20–40	12–26	November–December	31	2–8	15–25	30–35	90%	85%
		February–March	11	2–8	15–25	No shoot emergence	Nil	Nil

DBH, Diameter at breast height.

**Table 2.** *Melia dubia* root cuttings shoot formation and establishment success in pots (cocopeat) under mist chamber conditions

Root cutting diameter range (cm)	Root cutting length (cm)	Season of collection	Number of root sections	Days to shoot emergence	Shoot emergence (%)	Establishment percentage
2.0–2.5	15.00	November–December	10 (girdled)	25–30	80	Nil (shoot growth sufficient to take juvenile cuttings)
			10 (bark patch removed)	25–30	80	Nil (shoot growth sufficient to take juvenile cuttings)

and brought to the nursery (Figure 2 *a* and Table 1). Root sections (2–8 cm diameter and 15–25 cm length, Table 1) were washed with tap water and treated with 0.1% *Bavistin* to avoid pathogens attack. The treated root sections were cut, and IBA (indole-3-butyric acid) @ 4000 ppm (powder form) was applied on the cut sections and terminal portions. The root sections were then placed in nursery beds having soil : sand : vermicompost @ 2 : 1 : 1 and

covered with half-an-inch layer of cocopeat above (Figure 2 *b*). They were watered regularly to keep the beds moist under polyhouse conditions. Root sections were placed in the nursery beds in such a way that their proximal end or middle portion with induced injury or distal end remained little exposed. The shoots started emerging after 30–35 days in root sections collected during November–December and resulted in 90% shoot emergence



**Figure 3.** *a*, Emergence of juvenile shoots around removed bark patch. *b*, Emergence of juvenile shoots from girdled root cuttings in pots filled with cocopeat under mist chamber conditions.

and 85% establishment (Figure 2 *c–e* and Table 1). No shoot emergence occurred in the root section collected during February–March. The suckers plants bank established in this process attained a diameter of 5–8 cm (10–12 cm above ground) in one year (Figure 2*f*). These established sucker plants could be successfully utilized for cloning of selected superior genotypes and also tested for their field performance.

Under mist chamber conditions, root cuttings treated with 4000 ppm IBA, having 2.0–2.50 cm diameter and 15 cm length (Table 2), were put in plastic pots containing cocopeat (Figure 3). These root cuttings were given round cut at the portion kept inside pot and slant cut at the top, which remained upside. Two batches (10 root cuttings in each batch) of root cuttings, i.e. one batch with half-inch square bark patch removed and second girdled at about 5 cm below the top slant cut were put for shoot emergence ability (Figure 3). Shoot emergence started after 25–30 days of initiation of treatment and shoot emergence percentage was 80 in both bark patches removed and girdled cuttings (Figure 3 and Table 2). Shoots from these cuttings persisted only for 40–50 days; however, shoot length was sufficient to get 2–3 cuttings to raise clonal seedlings. In case of polyhouse root section suckering study, shoot emergence took place irrespective of polarity, i.e. shoot emergence from proximal or distal or middle portion. In this study, shoots mostly emerged from proximal and distal ends of the root section.

Thus, the present study shows that both naturally induced suckering and *ex situ* detached root sucker protocol route can be adopted to clone *M. dubia* without sacrificing the selected genotypes (as practised for other commercial tree species)<sup>18,19</sup>, and the desired fast-growing clones can be developed for further testing and enhancing the productivity in farm and agroforestry land-use systems.

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