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VEGETATIVE PROPAGATION OF MULTIPURPOSE TREE- *ADANSONIA DIGITATA* L: - AN ENDANGERED TREE SPECIES OF JHARKHAND

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Abstract: The three basic necessities of human beings are food, shelter and clothing which we get from plants. Nowadays many multipurpose tree species of great genetic resources are on the verge of extinction due to anthropogenic activities. As population increases the demand of human also increased which led to exploitation from all ways such as land clearing for human settlement. It leads to global biodiversity loss. The present study is on conservation of endangered medicinal tree – *Adansonia digitata* L. well known as African Baobab and Kalpvriksha, through reliable and cost efficient approach that is vegetative propagation. The stems of length 20-25 cm were harvested from mother tree and were experimented for rooting and axillary shoot buds emergence.

Index Terms - Anthropogenic Activities, Kalpvriksha, Biodiversity Loss, Genetic Resources

I. INTRODUCTION

Adansonia digitata is generally known as African baobab. It is having mythological significance in India. The tree can grow up to 25 meters in height [1, 2, 3], 28 meters in girth and can live for several hundred years. The form of the trunk varies. In young trees, it is conical, in mature trees, it may be cylindrical, bottle shaped or tapering with branching near the base[4]. The branches are thick, angular, wide spread and a short; stout trunk which attains 10- 14m or more girth and often becomes deeply fluted. The Baobab tree was named *Adansonia* to honor the French surgeon Michel Adanson (1726-1806); the species name *digitata* meaning hand like, is in reference to the shape of the leaves. *Adansonia digitata* L. has high water holding capacity and its hollow trunk keeps the water potable for many years and serves as reservoirs during drought. It stores water about 400 gallons in medium sized tree and over 2000 gallons water in large size trees[5]. The leaves are simple and foliated[6] during the young stage and later turn into a palmately compound. Flowers are pendulous, showy, white[7] and with sulfur fragrance that particularly attracts bats which play the role of pollinators [8].The fruits are pendant and gourd like hanging downwards; the capsulated fruit contains numerous brownish hard seeds embedded in a yellowish white, floury acidic pulp[9]. It measure between 10-45 cm long and have often different forms (ovoid, spherical, fusiform, elongated) [10].

Almost all parts of the tree are used for medicinal purposes having an antioxidant, an antipyretic, an analgesic, an antiviral, an antimicrobial, an antitrypanosoma, an antidiabetic, as diuretic etc. and for that reason baobab is also named "the small pharmacy or chemist tree" [11,12, 13].

The plant has numerous medicinal and non medicinal uses in Africa. Every part of the baobab tree is reported to be useful[14]. The tubers, twigs, fruits, seeds, leaves, bark and flowers are all used as common ingredients in traditional dishes of rural and urban areas [15]. The leaves are said to be an important source of protein[16] rich in Vitamin C.

Currently the tree is suffering from drought and desertification and fear has been expressed about its regeneration. Natural regeneration of *A. digitata* (unaided germination) is poor. The main reasons could be browsing animals and uncontrolled bush fires. *Adansonia digitata* L. absorbs huge quantities of carbon dioxide from the atmosphere and is resistant to forest fires. *A. digitata* may stand some low temperature for short time. A severe frost will kill even mature trees [17, 18]. Seedlings and small trees are vulnerable to fire, but mature trees are fire resistant. The tree is present facing a crisis of survival and its is enlisted as an endangered species in the Red data Book with only 30 to 40 trees available in India.

Kalpvriksha seeds have very hard seed coats and germination is usually less than 20% [19]. Dormancy in seeds can be attributed partly to the testa and partly to the pulp and in nature the dormancy of seed is broken by the passage through the digestive tract of large mammals and in cultivation by immersing the seeds in hot water or by cutting the seed coat[20]. Several methods such as wet heat treatment, total or partial seed decoating and scarification of seeds with concentrated acids, herbicides, fungicides and growth regulators were tested in 1988 and it was found that the seed treated with herbicides and fungicides did not germinate[20] therefore vegetative propagation is reported to be advantageous. Both the depth of planting and soil affected seed germination[21]. Attempt to propagate it at vegetative level are reported to have failed and planting seed is only means of propagation. Despite the immense importance of this plant, not much is known about its *in vitro* propagation which is very crucial for seedling establishment and subsequent development of the plants. Propagating plants through tissue culture technique is an established area of research with huge scope but vegetative propagation is more reliable and cost efficient. The main advantage of vegetative propagation is to avoid a great deal of heterogeneity, which often results from seed propagation [22].

This multipurpose tree species with diverse genetic resources hold an important place for human welfare which need immediate conservation. The conservative method employed is vegetative propagation for its mass production. Vegetative propagation is the type of propagation that uses fragments of the vegetative system to propagate the plant. It can be divided into two groups: macropropagation and micropropagtion. The different forms of macropropagation are cuttings, layering and grafting[23].The micropropagation deals with *in vitro* culture techniques which mostly result true to type plants. However the high cost required in settings and technologies make not accessible to farmers when compared with macro-propagation techniques [24]. It practiced by horticulturists by means of grafting and budding to improve plants. Vegetative propagation by means of stem cutting is traditional, an inexpensive but convenient method of propagating most woody species [25]. Vegetative propagation, including micropropagation is also possible regeneration paths of the species [26].

Vegetative propagation in *Adansonia digitata* is burning topic. The desirable morphological and anatomical characteristics can be maintained. The stem cutting can easily be uprooted in nurseries. For grafting three months old seedlings can be used with fresh scions [27]. The two grafting methods were assessed in the months of October and November 2016 which were top cleft and side veneer, indicate that baobab was easily amenable to grafting when performed at right time with correct size of scions[28].

For juvenile stem cutting, the double node stem of four months old seedling, of *Adansonia digitata* L. was vegetatively propagated with IBA and IAA at 0, 50, 100 and 150 mg/L. The treated cutting were planted into three different sets of rooting media (top soil, river sand and saw dust) and replicated three times. The cuttings were watered twice a day. The data analyzed was based on percentage survival, numbers of roots, longest root length, total root length and number of leaves. Cutting dipped in IBA (150 mg/L) planted in saw dust media (SD/IBA/150 mg/L) showed the best result from all variable assesses and recommended for the vegetative propagation[29].

The growing of trees could be affected due to seed dormancy problems or unavailability of sufficient quantities of seeds, hence vegetative propagation using simple propagules like stem cuttings are recommended especially for resource poor farmers. The rooting potential of mature stem cuttings of *Gambeya albida, Irvingia gabonensis, Annona muricata, Garcinia kola* and *Triplochiton scleroxylon* their mature stem cuttings were investigated for their rooting potential, in a humid tent propagator without any artificial hormones. Propagation indicative parameters such as- highest root-ability indices with cutting survival rate, callus formation, leaf loss, days to axial bud sprout, days to leaf loss and number of new leaves produced at end of

study were estimated through percentages[30]. The stem cutting is more pronounced here for seeing the outcome. A vegetative propagation of *C. guianensis* was optimized with subsequent development of plants using stem cuttings as source material and was pre treated with different hormone concentration and planted under different growth media. The plants survived to about 92% under natural soil conditions raised from the stem cuttings[31].

MATERIAL AND METHODS

For vegetative propagation the cut stems of experimental plant, sterile razor blade, chemical rootex, *Aloe vera* raw leaves, sandy soil, clay pots, plastic bags, spray bottles were employed. The stems selected were of 20-25 cm in length with nine internodes and eight nodes. The leaves from bottom half of the cutting closer to the roots were removed, and also flower buds. The five branch/stems were cut in slanting manner from mother tree by sterile razor blade to avoid any infections. Once the cut stem harvested, it triggers many physiological and biochemical changes that need to be checked for attaining optimum quality and longevity (floralife.com) [32]. The water balance, nutrient balance and hormonal balance required for proper functioning, so for this, the cut stems soon dipped into water kept in collection bags to minimize or to overcome humidity loss.

The exposed tissue at the bottom of each cut stems treated with rooting hormone- rootex. It was little mixed with water and raw *Aloe vera* leaves completely to access good amount of oxygen. Each cut stems dipped into rooting hormone and stick to ½ inch -1 inch into it to maintain polarity during process. On the other hand the potting process was done, for it sandy soil was mixed with cocopeat. For root initiation, the growing media are generally considered to be one of the vital inputs [33]. It is mentioned that growth media plays vital role on success of cutting which influences the survival, shooting, rooting and other growth characteristics of any plant [34].The cuttings were planted into prepared growth media and were covered with plastic bag domes to check humidity which allow rooting. Routinely it is sprayed with little water to maintain the humid condition inside the plastic bag domes. Humidity is an important factor to be maintained around the plants. Cuttings were kept in fairly bright indirect light and environment was sanitized, a prerequisite condition for the propagation methods.

RESULT AND DISCUSSION:

The vegetative propagation method can be a powerful tool for reproducing the desirable phenotypic traits of baobab [35, 36].The rooting from stem cutting is a complex process involving physiological, biochemical as well as anatomical factors controlling root initiation and development on stem cutting [37]. It is understood that propagation through stem cutting depends upon the root formation when placed in favourable environment. The synthetic auxins were more effective than to the naturally occurring auxins which produced good rooting in many species [38]. In *Azadirachta indica*, branch cuttings successfully reported [39]. The trees like *Populus alba* [40] and in *Acer acuminatum* [41] also showed similar result. Here the stem cutting of experimental plant was compared with control. In Table 1, it showed good result when compared with control. The axillary shoot buds emergence in fifth week was eight in cut stems out of nine internodes and eight nodes. The root formation was seen and overall result was fruitful.

Table 1: Vegetative propagation through stem cutting in *Adansonia digitata* L.

Treatment	Number of axillary shoot buds per stem cutting developed after			
	2nd Week	3rd Week	4th Week	5th Week
Control	0	1	3	5
Treated with rootex	2	3	5	8

The stem cutting with 9 internodes, having 8 nodes measuring about 20-25 cm in length were used as material for vegetative propagation.

Fig. 1


Fig. 2


Fig. 3


Fig. 4


Fig. 5


Fig. 5

Vegetative propagation of *Adansonia digitata* L.
Fig. 1: Decayed stem used for vegetative micropropagation
Fig. 2: Cutting of stem and applying rootex
Fig. 3: Planting the stem cutting dipped in raw torned Aloe vera into sandysoil.
Fig. 4: Emergence of Shoots from nodes
Fig. 5: Enlarged view of nodal leaves
Fig.6: Enlarged view of nodal leaves (after 21 days)

Seasonal variations play important role of root initiaton in branch/ stem cutting of different woody species. Higher rooting (73.33%) in *Celtis australis* cutting during rainy season was reported [42]. The semi hardwood cutting during spring season found better than others cutting [43]. It was reported spring season as the best time for *Acer acuminatum* cuttings[41]. In the month of (January –April), *Pongamia pinnata* treated with IBA (800ppm) allowed suitable adventitious rooting and more root formation[44].

CONCLUSION

The conclusion drawn that vegetative propagation is more reliable and cost efficient where desirable morphological and anatomical characteristics can be maintained.

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