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Propagation of *Lagerstroemia speciosa* (A medicinal plant) using juvenile branch cuttings: A vulnerable species of Southeast Asia

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Abstract
The present study was carried out to investigate the rooting response of juvenile shoot cuttings of *Lagerstroemia speciosa,* a deciduous tree species of Southeast Asia. Highly significant variation at $P<0.001$ level was observed on mean rooting percentage in all treatments with maximum (93.33%) in untreated cuttings (control) followed by (80.70%) in IBA 2000 ppm and minimum (74.70%) in IBA 4000 ppm. Maximum number of roots and root length were recorded in IBA 4000 ppm treated cuttings.

Keywords: Propagation, *Lagerstroemia speciosa,* juvenile cuttings, Indole-3-butyric acid

Introduction

Lagerstroemia speciosa (or Banaba) is a deciduous tropical flowering tree that grows in India, Bangladesh, Malaysia, Thailand, Philippines, Indonesia, and Japan. This tropical flowering tree is one of the most outstanding summer bloomers. It is called Queen Crape Myrtle because it is the Queen of the Crape Myrtles dominating with larger crinkled flowers. This tree grows up to 50 feet in height but it can be kept smaller by trimming. The large leaves are also appealing as they turn red right before they drop in the winter. The main medicinal uses of this species are as; (i) Roots are used for stomach problems, (ii) The leaves are used to heal diabetes and for weight loss, (iii) The red orange leaves have high levels of corosolic (interpenoid glycoside) that can lower blood sugar hence, may have an influence on diabetes, (iv) Banaba also contains concentrations of dietary fiber and minerals such as magnesium and zinc, (v) It helps the body to handle glucose and as such it is also effective in weight loss, (vi) The hypoglycemic (blood sugar lowering) effect is similar to that of insulin (which induces glucose transport from the blood into body cells) and (vii) Its tea is therapeutic against ailments such as diabetes and kidney and urinary problems (Suzuki *et al.*,1999; Guy Klein *et al.*, 2007) [17, 4]. A decoction of the bark is used against diarrhoea and abdominal pains. A leaf poultice is used to relief malarial fever and is applied on cracked feet. A preparation from dried leaves, known as banaba, is widely used in the Philippines to treat diabetes and urinary problems (Unno *et al.*, 1997) [20].

Propagating plants is one of the most rewarding, easy and economical ways of increasing quality planting stock. Vegetative propagation is an irreplaceable tool for tree domestication and breeding and its advantages and implications have been widely mentioned in literature (Wright 1976; Zobel and Talbert 1984; Park *et al*. 1989) [21, 22, 11]. Although in forestry research most of the efforts were traditionally focused on propagation of timber species, a scenario of rapid climate changes (IPCC 2008) [5] with increasing land degradation and genetic diversity loss makes it necessary to focus also on species that are important for other functions, such as support of ecosystems and supply of non-timber products. Programs involving indigenous species and impoverished communities have become important in the last decades and the development of low cost vegetative propagation technologies is one of its most relevant aspects (*e.g.* Tchoundjeu *et al*. 2004, Atangana *et al*. 2006) [19, 1]. The low cost macro-propagation methods continue to be the most convenient approaches even when human and financial resources were not scarce. Has already studied the seed morphology and effects of pre-sowing treatments of *Lagerstroemia speciosa* and observed that average length, breadth and thickness were found to be 1.32±0.02 cm, 0.55±0.04 cm and 0.11±0.002 cm in

Lagerstroemia speciosa L., respectively. The highest germination rate (79%) was found in H_2SO_4 treatment followed by 64%, 62% and 25% in treatments with hot water, scarification and control.

Vegetative propagation techniques are increasingly being applied due to the domestication of tree species as a means of producing planting stock and capturing genetic variation. However, cost-effective knowledge for vegetative propagation is not common and has shown down domestication in many of tree species. In the current scenario of rapid climate change and increasing land degradation in many countries, certain multi-purpose tree species are becoming rare and threatened with local extinction. Thus, knowledge and efforts to develop low cost vegetative propagation technologies to the people are necessary. The reasons for its decline are varied, the population explosion and probably global warming and deforestation all play a role in its decline. Another reason is the widespread aggressive medicinal use of this species for various medicinal uses by the local population. Propagating plants through cuttings is one of the most rewarding, easy and economical ways of increasing plant stock. Thus efforts were made to propagate this important medicinal species through juvenile branch cuttings.

Material and methods

Plant material and design of the experiment

The experiment was conducted in the nursery of Plant Physiology Discipline, Botany Division, Forest Research Institute, Dehradun Uttrakhand (30^0 20' 40" N Latitude, 77^0 52' 12" E Longitude and 640.08 mls Altitude) during June, 2011.

Juvenile cuttings were collected from the coppice shoots (20-30 cm) of a tree growing in Botanical Garden of Forest Research Institute, Dehradun in the month of June 2011. The cuttings collected were dipped in plastic bucket filled with water to avoid desiccation. These cuttings were divided into three groups of 60 each (20 cuttings per replicate) out of which two groups were treated with IBA 2000 (0.2% IBA) and 4000 ppm (0.4% IBA) in the form of powder and one group of cuttings were treated only with telicam powder (control). The basal portion of these cuttings was dipped in the phytohormones (powder form) and were planted in plastic trays filled with vermiculite.

Design: The summary of the experiments followed was designed as:

(a)	Number of species	:	One
(b)	Auxin treatments	:	IBA and control
(c)	Concentrations	:	Two (2000 ppm and 4000 ppm)
(d)	Replications	:	Three (R_1, R_2 and R_3)
(e)	Ramets	:	20 per replicate
(f)	Designs	:	Randomized Block Design (RBD)
(h)	Planting medium	:	Vermiculite

Planting of cuttings:

The cuttings were planted horizontally in plastic trays filled with vermiculite and placed in mist chamber.

Observations and collection of Data

The cuttings rooted were carefully uprooted from the rooting medium after 60 days of planting and observations were made on rooting percentage, number of roots, root length, number of shoots and shoot length.

Statistical analysis

Statistical analysis was carried out in SPSS Version. The mean values of studied parameters were estimated by using ANOVA for comparing mean difference among the treatments. The critical difference (CD) were calculated based on student's t test at $P<0.05$ level. CD value was calculated by Schiff's method and is based on F-Statistics (Schiff's, 1959) which is the minimum variance permissible between the means of treatments for grouping them as statistically same.

Results

Rooting percentage

Highly significant ($P<0.001$) variation was observed on mean rooting percentage in both concentrations as well as control (Table 1).The maximum (93.33%) rooting was discernible in untreated cuttings (treated with telicam powder only) followed by cuttings treated with IBA 2000 ppm (80.7) while as minimum (74.7%) rooting has been observed in cuttings treated with IBA 4000 ppm (Fig 1).

Mean number of roots

The mean number of roots among the different treatments showed significant ($P<0.05$) differences (Table 1). Maximum (4.87) number of roots were noticed in the cuttings treated with IBA 4000 ppm followed by (4.17) in the cuttings treated with IBA 2000 ppm, while minimum (3.50) number of roots were observed in untreated cuttings.

Mean root length

The present observations based on the statistical test of ANNOVA revealed that the variation in root length among different concentrations of the treatment was not significantly ($P>0.05$). Maximum (16.6 cm) root length has been noticed in the cuttings treated with IBA 4000 ppm followed by (14.4 cm) in the cuttings treated with IBA 2000 ppm., minimum (14.3 cm) root length was recorded in untreated cuttings.

Mean number of shoots

The number of sprouts per cutting showed significant variation at ($P<0.05$) among both the concentrations and control. Maximum (1.5) shoots being noticed in untreated cuttings followed by (1.0) in IBA 2000 and 4000 ppm treated cuttings respectively.

Mean sprout length

The results showed non-significant variation in mean sprout length with relation to both the concentrations and control. However, maximum (11.43 cm) sprout length was recorded in untreated cuttings followed by (12.02 cm) in IBA 2000 ppm and minimum (10.11cm) in IBA 4000 ppm treated cuttings (Fig 1).

Table 1: Effect of IBA on rooting parameters of *Lagerstroemia speciosa*

Treatments	Allied rooting parameters				
	Rooting %	Mean No. of roots ±SE	Mean root Length (cm) ±SE	Mean No. of Sprouts ±SE	Mean sprout Length (cm) ±SE
Control	93.33	3.50±0.23	14.3±0.74	1.5±0.12	11.43±0.71
IBA 2000 ppm	80.70	4.17±0.21	14.4±0.25	1.0±0.05	12.07±0.30
IBA 4000ppn	74.70	4.87±0.16	16.6±0.68	1.0±0.10	10.11±0.21
Significance	***	*	NS	*	NS
CD	6.10	0.75		0.57	

***=Significant at 0.01, *=Significant at 5%, NS= Not significant, ±SE=Standard error

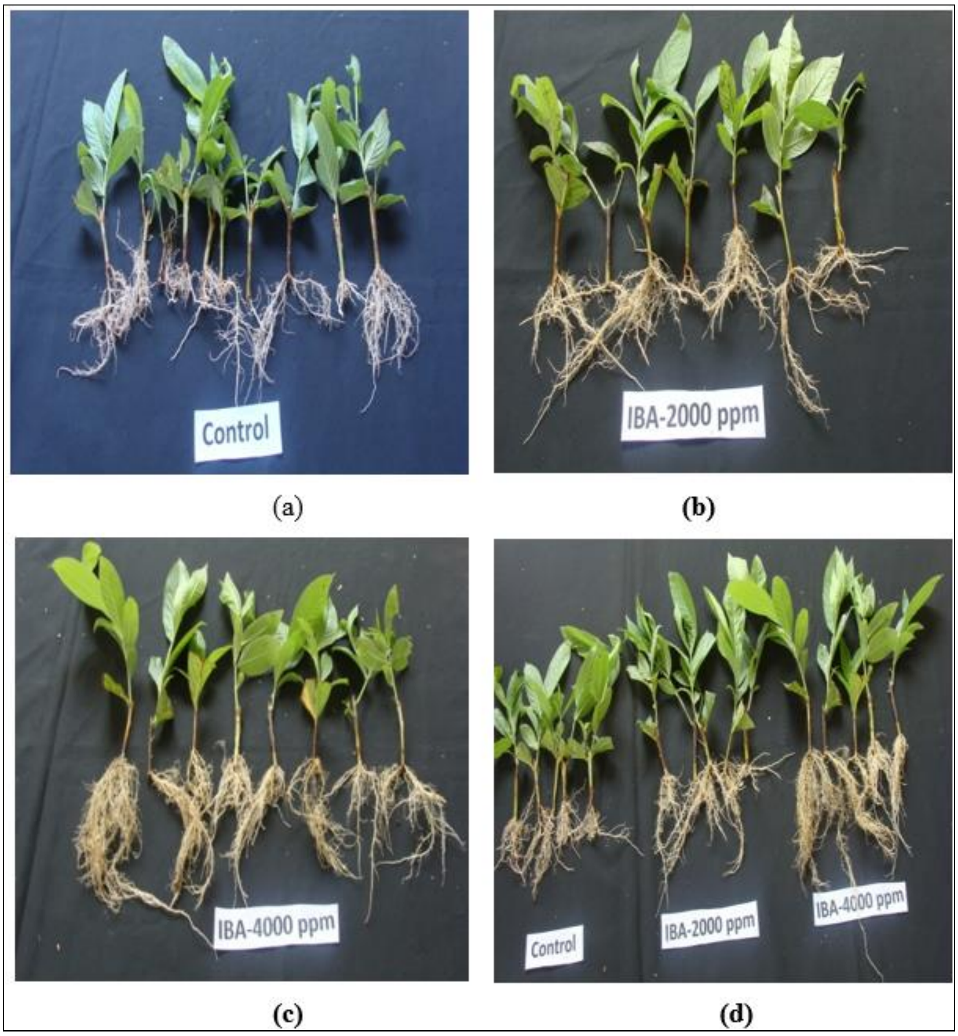

Fig 1: Rooting of juvenile cuttings of *Lagerstroemia speciosa* (a) Rooted cuttings when treated with water only (control) (b) rooted cuttings treated with IBA 2000 ppm. (c) Rooted cuttings treated with IBA 4000 ppm (d) Rooted cuttings treated with control (water only) IBA 2000ppm and IBA 4000 ppm.

Discussion

Several attempts were made earlier by Nautiyal *et al*., 1991 [8]; Sorin *et al*., 2005 [16] on rooting behavior of cuttings. It is well established fact that all auxins IAA, IBA and NAA generally stimulated adventitious roots formation but in our study, it was interesting to note that maximum rooting was observed in untreated cuttings followed by IBA. Maximum rooting in juvenile cuttings of Lagerstroemia speciosa indicates that there is enough quantity of endogenous auxins available in cuttings of this species that respond to good rooting percentage. Similar results were also observed in other studies by Nautiyal *et al*., (2007) [9] in Dendrocalamus giganteus, Razvi and Nautiyal (2009) [12] in Bumbusa vulgaris var. striata, Razvi *et al*., (2011) [13] in Bumbusa vulgaris cv wamin and Ghosh and Singh (2010) [2] in Jatropha curcas. Mishra *et al*., (2010) [7] also reported that IBA significantly increased sprouting, rooting and root length as compared to control and other auxins (IAA and NAA) in mature cuttings of Tinospora cordifolia.

The effectiveness of various auxins varies with the species as well as type of parent material. Many studies compared the effectiveness of IBA, IAA and NAA in inducing optimum rooting. In Ulmus wallichiana IAA was found to be more effective than IBA or NAA Sharma (1991) [15]. Gurumurti *et al*., (1992) [3] reported that cuttings of Acacia nilotica rooted best when treated with IBA than IAA or NAA. In Teak, IBA at 100 and 200ppm was most effective than NAA and IAA (Nautiyal *et al*., 1992) [10]. Swamy *et al*., (2004) [18] reported that NAA was more effective than IBA in Robinia pseudocacia and Grewia optiva. In our study it is clearly proven that no auxin treatment is required for rooting, however application of additional rooting hormones showed significant effect on rooting of juvenile shoot cuttings of this species.

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