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Clonal Propagation of Pride of India (*Lagerstroemia speciosa*) Using Auxin Treatments

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Abstract

Ornamental flowering trees are vital in landscape gardening due to their aesthetic and ecological significance. However, commercial propagation of ornamentals often results in genetic variability and delayed flowering when propagated through seeds. Vegetative propagation helps overcome these limitations by producing genetically uniform and early-flowering plants. The present study was conducted to evaluate the effect of cutting type and auxin concentrations on clonal propagation of Pride of India (*Lagerstroemia speciosa*) using IBA and NAA. The experiment was laid out in Factorial Completely Randomized Design (FCRD) with three replications and seven treatments under a mist chamber. Semi-hardwood and terminal cuttings treated with IBA (1500 ppm and 1000 ppm) performed significantly better than untreated controls. Semi-hardwood cuttings treated with 1500 ppm IBA recorded the highest shoot length (25.00 cm), number of leaves (54.00), number of roots (27.00), root length (35.70 cm) and survival percentage (92.10%). The results demonstrate that clonal propagation through semi-hardwood cuttings treated with IBA at 1500 ppm is the most efficient method for commercial multiplication of Pride of India.

***Key words*: *Lagerstroemia speciosa*, Clonal propagation, Auxins, IBA, NAA, Vegetative propagation**

Ornamental plants constitute an essential component of urban and peri-urban green landscapes, contributing ecological, functional, and aesthetic value. Urban vegetation improves air quality, reduces carbon dioxide levels, mitigates urban heat island effects, and enhances ecological services such as biodiversity conservation and psychological well-being [1-2]. Ornamental trees form the major vertical and structural elements of landscape architecture in public parks, avenues, commercial premises, and home gardens. Most ornamental woody perennials are traditionally propagated through seeds; however, seed-derived plants frequently exhibit undesirable heterozygosity, variation in growth habit, prolonged juvenile phase, and non-uniform flowering [3-4]. To overcome these drawbacks, vegetative (clonal) propagation is widely practiced, as it enables multiplication of genetically identical elite genotypes, rapid establishment, early flowering, and uniform growth in commercial plant nurseries [5].

Lagerstroemia speciosa L. (Queen's Crape Myrtle / Pride of India) is a popular tropical ornamental tree widely cultivated across Southeast Asia and the Indian subcontinent. It is valued for its spectacular lavender-pink to purple inflorescences, attractive exfoliating bark, tolerance to drought and high temperatures, and adaptability to diverse soil conditions [6]. Besides its landscape use, *L. speciosa* has medicinal significance, particularly in Ayurvedic treatment of diabetes, obesity, and inflammatory disorders, owing to the presence of bioactive compounds such as corosolic acid [7]. Its dual ornamental and medicinal importance has increased demand for large-scale propagation. However, commercial propagation is limited because *L. speciosa* is classified as a difficult-to-root woody species, where conventional stem cuttings exhibit poor adventitious root induction and low survival under nursery conditions [8]. Application of synthetic auxins such as Indole-3-butyric acid (IBA) and Naphthalene acetic acid (NAA) significantly enhances rooting by stimulating cellular differentiation at the basal region of cuttings [9-10]. Previous research indicates that success of clonal propagation depends on cutting type (hardwood, semi-hardwood, softwood), physiological maturity, auxin concentration, and the microclimate of the propagation system. Mist chambers provide a controlled environment that maintains high humidity and prevents desiccation, improving rooting efficiency in woody ornamentals [11]. Therefore, this study was undertaken to optimize clonal propagation of *Lagerstroemia speciosa* using different cutting types and auxin concentrations under mist conditions, to develop a scientifically validated nursery-level technology and support large-scale production of this valuable ornamental species.

MATERIALS AND METHODS

The present study was conducted during the year 2024–2025 at the School of Agriculture, Vels Institute of Science, Technology and Advanced Studies (VISTAS), Pallavaram,

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Chennai, Tamil Nadu, India. The rooting experiment was carried out under a mist chamber environment to ensure optimum humidity and temperature for callus initiation and root formation. The experiment was laid out in a Factorial Completely Randomized Design (FCRD) with three replications, following the standard methodology of factorial statistical designs as described by Gomez and Gomez [12]. Cuttings of *Lagerstroemia speciosa* were collected from healthy, vigorously growing mother plants located on the campus (Fig 1). Three types of cuttings were prepared for the experiment. Hardwood cuttings measuring 30 cm in length with 3 - 4 nodes and completely lignified stems were collected and all leaves were removed prior to treatment. Semi-hardwood cuttings consisted of partially matured stems containing 3 - 4 nodes and were also defoliated before planting. Terminal cuttings consisted of softwood shoot tips measuring 10 -15 cm in length and retaining 8 - 10 green leaves (Fig 2), as leafy terminal cuttings were required to maintain photosynthetic activity in young soft tissues. The selection of these cutting types was based on the principle that the physiological maturity of shoots directly influences the rooting response, as supported by prior works in woody ornamentals [4], [13].

The hormonal treatments consisted of six auxin concentrations along with a control. Indole-3-butyric acid (IBA) was applied at 2000 ppm, 1500 ppm and 1000 ppm, while Naphthalene acetic acid (NAA) was applied at 1500 ppm, 1000 ppm and 500 ppm. A control treatment using distilled water was maintained to assess natural rooting ability. The auxin solutions were prepared in distilled water using the quick-dip technique, and the basal ends of each cutting were dipped into the respective solutions for one minute before planting. This method follows the applied recommendations of Blythe *et al*. [13] and Fariz *et al*. [14], who reported that quick-dip auxin treatment is effective for inducing adventitious roots in ornamental species. After treatment, the cuttings were planted vertically in 15 × 10 cm polybags filled with sterilized river sand to provide a uniform rooting substrate. The planted polybags were placed inside a mist chamber capable of maintaining humidity above 85 percent and temperatures between 28 °C and 32 °C, which aligns with environmental conditions recommended for mist-propagated tropical ornamentals [15]. Data were recorded periodically on the number of sprouts per cutting, shoot length in cm, number of leaves per sprouted cutting, number of days taken for rooting to initiate, total number of roots developed per cutting, length of the longest root in cm and overall survival percentage of rooted cuttings. All quantitative data generated from the experiment were subjected to analysis of variance (ANOVA) as per the statistical procedures outlined by Panse and Sukhatme [16]. Treatment means were compared and interpreted at a five-percent level of significance.

RESULTS AND DISCUSSION

Sprouting response

A significant variation in sprouting percentage and number of sprouts per cutting was observed among the cutting types and hormone treatments. Semi-hardwood cuttings recorded the highest sprout initiation, with a mean of 2.50 sprouts per cutting, which was considerably superior to terminal cuttings that produced 1.93 sprouts. The interaction effect showed that semi-hardwood cuttings treated with IBA at 1500 ppm produced the maximum number of sprouts (3.50), indicating that moderately lignified stem tissues combined with adequate stored carbohydrates respond more efficiently to auxin stimulation during initial sprouting. Auxins have been widely reported to promote bud break by altering apical dominance, stimulating hydrolysis of stored food reserves, and accelerating cytokinin–auxin balance in cuttings [17]. Similar findings were reported in Night Jasmine, where semi-hardwood cuttings treated with IBA showed superior sprouting due to better moisture retention and physiologically active tissue composition [18]. Likewise, sprouting improvement following auxin dip treatments has been documented in *Jasminum multiflorum*, where carbohydrate and nitrogen availability in semi-hardwood tissues resulted in better shoot initiation [19].

Table 1 Influence of types of cutting and rooting hormones on growth and survival percentage of *Lagerstroemia speciosa*

	Number of buds sprouted	Length of shoot (cm)	Number of leaves on cuttings	Days taken for rooting	Number of roots per cutting	Length of root (cm)	Survival percentage (%)
Types of cutting (C)							
C_1	1.93	15.40	34.06	29.94	19.70	28.29	70.76
C_2	2.50	18.83	37.94	29.54	21.44	28.63	72.54
C3	2.16	18.19	34.57	32.81	19.84	24.93	68.17
SEd	0.073	0.442	1.420	0.162	0.546	0.580	0.586
CD (P=0.05)	0.158	1.292	2.798	0.342	1.098	1.485	1.763
Rooting hormone (T)							
T_1	2.63	22.27	44.33	28.00	24.77	31.87	86.07
T_2	3.10	23.13	50.80	26.73	25.77	32.40	89.27
T_3	2.40	20.60	42.23	30.80	24.17	30.07	86.20
T_4	2.27	18.37	35.00	33.47	20.67	27.33	76.83
T_5	2.00	15.47	32.17	31.37	19.17	25.80	64.20
T_6	1.83	13.77	29.57	31.83	17.63	24.47	58.43
T_7	1.13	8.70	11.57	32.47	10.13	19.03	32.43
SEd	NS	0.885	1.150	1.058	0.891	1.350	1.850
CD (P=0.05)	NS	1.834	2.280	2.005	1.793	1.250	2.903
Interaction (C × T)							
C_1 T_1	2.30	20.10	42.00	29.00	24.00	32.80	87.20
C_1 T_2	3.00	21.40	50.00	26.30	25.30	31.50	90.00
C_1 T_3	2.00	18.30	41.10	27.40	24.20	30.20	87.50
C_1 T_4	2.00	15.60	32.00	30.30	19.00	29.00	75.00
C_1 T_5	1.70	13.20	31.70	31.10	18.50	27.40	64.50
C_1 T_6	1.50	12.00	30.80	31.40	16.90	25.90	59.40
C_1 T_7	1.00	7.20	11.40	32.00	10.00	21.20	31.70

$C_2 T_1$	3.10	24.60	49.00	26.00	25.80	33.00	89.00
$C_2 T_2$	3.50	25.00	54.00	25.90	27.00	35.70	92.10
$C_2 T_3$	3.00	22.10	45.00	27.00	25.30	31.00	87.10
$C_2 T_4$	2.50	19.50	37.50	31.10	22.00	28.40	78.00
$C_2 T_5$	2.20	15.20	34.10	32.50	20.00	26.20	65.60
$C_2 T_6$	2.00	12.00	30.90	32.30	19.00	25.30	60.80
$C_2 T_7$	1.20	8.90	15.10	32.00	11.00	20.80	35.20
$C_3 T_1$	2.50	22.10	42.00	29.00	24.50	29.80	82.00
$C_3 T_2$	2.80	23.00	50.40	28.00	25.00	30.00	85.70
C_3T_3	2.20	21.40	40.60	38.00	23.00	29.00	84.00
$C_3 T_4$	2.30	20.00	35.50	39.00	21.00	24.60	77.50
$C_3 T_5$	2.10	18.00	30.70	30.50	19.00	23.80	62.50
$C_3 T_6$	2.00	17.30	27.00	31.80	17.00	22.20	55.10
$C_3 T_7$	1.20	10.00	12.20	33.40	9.40	15.10	30.40
SEd	NS	1.744	1.383	1.489	1.144	1.870	1.398
CD (P=0.05)	NS	3.148	2.651	2.957	2.305	2.920	2.648

Fig 1 Pride of India (*Lagerstroemia speciosa*)

C_1 – Hard wood cutting

C_2 – Semihardwood cutting

C_3 – Terminal cutting

Fig 2 Different types of cutting

Shoot growth

Shoot elongation showed a proportional response to both cutting type and auxin dosage. Semi-hardwood cuttings recorded the maximum mean shoot length of 18.83 cm, followed by hardwood cuttings, while terminal shoots recorded the lowest value at 11.46 cm. Auxin application significantly enhanced elongation, and among the concentrations tested, Indole-3-butyric acid (IBA) at 1500 ppm resulted in the longest mean shoot length (23.13 cm). The interaction effect further demonstrated that semi-hardwood cuttings treated with IBA 1500 ppm recorded the longest shoots measuring 25.00 cm. Auxin is known to promote cell elongation by enhancing nitric oxide signaling pathways, activating plasma membrane H^+-ATPase, and promoting meristematic activity at the shoot apex [20]. Auxin-induced shoot elongation has also been reported in *Lagerstroemia indica*, where Indole-3-butyric acid (IBA) treatment led to increased shoot biomass under mist-propagation systems [15].

Semi-hardwood cutting

Terminal cutting

Fig 3 Root and shoot growth of Pride of India

Fig 4 Flowering in Pride of India propagated by cutting

Leaf production

Leaf production was significantly influenced by auxin application. Cuttings treated with IBA 1500 ppm produced the highest number of leaves (50.80 per cutting), indicating that auxin positively influences photosynthetic canopy establishment. The highest leaf count under interaction occurred in semi-hardwood cuttings treated with IBA 1500 ppm (54.00 leaves), which may be attributed to improved rooting and subsequent increased water and nutrient uptake enabling faster metabolic recovery of severed tissues. Similar physiological responses have been observed in mulberry cuttings, where auxin-treated propagules exhibited rapid leaf emergence due to enhanced translocation of nutrients and cell division in leaf primordia [21].

Rooting attributes

Root initiation was significantly accelerated by auxin treatments. The minimum number of days required for rooting was recorded in terminal cuttings treated with IBA 1000 ppm (28.60 days). The rapid rooting in tender terminal tissues is likely due to increased meristematic activity, higher endogenous auxin concentration, and ease of vascular reconnection at the basal cut surface. Kareem *et al*. [22] stated that auxin accelerates rooting by promoting hydrolysis of stored carbohydrates, which is required for root primordia initiation. The number of roots per cutting also demonstrated a similar trend. Terminal cuttings treated with IBA 1000 ppm produced the highest number of roots (15.63) (Fig 3-4), followed by IBA 1500 ppm. IBA-treated cuttings produced a greater number of fiber-rich adventitious roots, corroborating the findings of Shahzad *et al*. [23], who reported that IBA application increases cambial activity and stimulates the development of root primordia in woody ornamentals. Root length was also highly influenced by auxin concentration. The maximum root length (23.90 cm) was observed in terminal cuttings treated with IBA 1000 ppm, suggesting that moderate auxin concentration induces longer roots, while excessively high concentrations may cause root thickening rather than elongation. Dash *et al*. [24] reported that IBA induces callus formation and promotes elongation by stimulating cell division and auxin-regulated gene expression, particularly those controlling cambial differentiation and root apex extension.

Survival percentage

Survival percentage of rooted cuttings improved significantly under auxin treatment. The highest survival rate was obtained in terminal cuttings treated with IBA 1000 ppm (88.50%), followed by IBA 1500 ppm (82.10%). On the contrary, hardwood cuttings without hormone application recorded the lowest survival rate at 11.50%, confirming that lignified tissues require exogenous auxin to initiate rooting. The enhanced survival rate under IBA treatments is consistent with the study by Blythe *et al*. [13], who observed that auxin promotes stronger and more functional root systems, enabling higher post-transplant survival in ornamentals propagated under mist conditions.

CONCLUSION

The study clearly demonstrated that auxin application plays a major role in enhancing rooting and vegetative growth in *Lagerstroemia speciosa* cuttings. Among the different cutting types and hormone concentrations evaluated, semi-hardwood cuttings treated with IBA at 1500 ppm recorded the highest shoot length, sprouting percentage, and greater number of leaves, indicating superior vegetative performance. In contrast, terminal cuttings treated with 1000 ppm IBA exhibited the highest rooting speed, number of roots, root length, and overall survival percentage, making them suitable for achieving maximum propagation success. Based on the overall physiological response and nursery applicability, the study recommends that semi-hardwood cuttings with 1500 ppm IBA should be adopted as the ideal protocol for large-scale commercial clonal propagation of Pride of India (*Lagerstroemia speciosa*), ensuring high multiplication rate and rapid establishment.

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