Rapid In-Vitro Propagation of *Plumbago indica L.*: A Sustainable Approach for Conservation and Commercial Production

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Abstract

Plumbago indica L., commonly known as Indian leadwort, is a perennial shrub belonging to the family Plumbaginaceae. Native to Southeast Asia, it is widely cultivated for its ornamental appeal and medicinal uses. The primary bioactive compound of plumbagin, which gives the plant its pharmaceutical value, is predominantly found in the roots. Unfortunately, the plant is rapidly declining in its natural habitats due to over-harvesting and unsustainable collection practices. Conventional propagation methods are challenging due to the plant's slow growth rate and lack of viable seeds. Therefore, this study aimed to establish an efficient and rapid in-vitro propagation technique to meet the growing commercial demand. Nodal segments were collected from mature plants and sterilized using 0.3% Carbendazim and 10% Clorox with different exposure times (5 and 10 min). After a seven-day incubation period, the healthy explants were transferred to MS medium supplemented with 1.0–5.0 mg/L BAP for shoot induction. Shoot elongation was further optimized by transferring the induced shoot buds to MS medium with 1.0–5.0 mg/L GA3 and root induction was achieved by transferring shoots to half-strength MS medium containing 0.2–0.8 mg/L IBA. Fully developed and well-rooted plantlets were acclimatized in coir pellets before being transferred to a soil (1:1) potting mixture. Completely Randomized Design (CRD) was used in all experiments, there were fifteen replicates in each treatment and all the cultures were randomized weekly. MINITAB 17 was used for the statistical analysis, Analysis of variance (ANOVA) was performed and pair-wise comparisons were carried out using Tukey's test. Results showed that the optimal sterilization method was 0.3% Carbendazim for 10 minutes followed by 10% Clorox for 10 minutes, resulting in the highest survival rate (83.34%). The highest number of shoots (3.4 ± 0.91) and the longest shoot length (2.41 ± 0.21 cm) were obtained in MS medium containing 2.0 mg/L and 3.0 mg/L BAP, respectively and the highest shoot length increment (1.03 ± 0.45 cm) was observed with 4.0 mg/L GA3. MS medium supplemented with 0.4 mg/L IBA which resulted in the highest mean number of roots (26.5 ± 3.54) and longest mean root length (2.49 ± 0.31 cm). This study established an efficient in-vitro propagation protocol for P. indica, addressing slow growth and seed scarcity, and recommending scaling up for sustainable cultivation to reduce pressure on wild populations.

Keywords: *Acclimatization, direct organogenesis, Plumbago indica, rooting, shoot induction*