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RESEARCH ARTICLE

WATER CULTURE IN *CASUARINA EQUISETIFOLIA* FOR MASS CLONAL PROPAGATION

***Kannan C. S. Warrier and Suganthi, A.**

Institute of Forest Genetics and Tree Breeding, Indian Council of Forestry Research and Education, Forest Campus, PB 1061, R.S. Puram, Coimbatore – 641 002, Tamil Nadu, India

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ABSTRACT

Though *Casuarina equisetifolia* is amenable for vegetative propagation, large scale operational clonal forestry programmes of this species are in its early stages of development in India. Since *C. equisetifolia* is a poor coppicer, getting juvenile materials for vegetative propagation or maintenance of juvenility is a serious problem. Development of a suitable cloning technique and induction of juvenility in this species will go a long way in establishing large scale plantations of end use specific clonal materials. A cost effective water culture technique of rooting could be developed for *C. equisetifolia* during the current study. Both phylloclad cuttings and individual 'needles' treated with 100 mgl^{-1} of IBA for 12 hours could be rooted in ordinary drinking water using this method. The success of rooting was up to 100 per cent for 'needles' and 80 per cent for sprigs. Plantlet development from rooted sprigs and individual 'needles' was 95 and 65 per cent respectively.

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INTRODUCTION

India is the largest *Casuarina* growing country in the world with an estimated 800,000 ha of plantations (Pinyopusarerk and Williams, 2000). Nicodemus (2009) estimated that about 500,000 ha are planted with *Casuarina* in the states of Andhra Pradesh, Orissa, Tamil Nadu and the Union Territory of Puducherry. This species has been the farmers favourite in south India as they fit well in agrarian ecosystems. It is being used for construction, pulpwood, fuelwood and for ecorestoration activities. It is also highly preferred for planting in various agroforestry systems. Its usefulness in environmental protection has been fully realized after the tsunami and is now a major component in any coastal afforestation programme in India. Though it is a preferred species of the coastal tracts, growing *Casuarina* is steadily increasing in inland areas also. Considering the heterozygosity of most of the forest tree species, cloning permits immediate capture of genetic traits (Franclet *et al*, 1987). Clonal strategy is an excellent approach to eliminate inbreds, provide adapted clones, mass produce valuable genotypes, control genetic diversity and more importantly, help in predicting yield in plantation programmes. Clonal forestry has been proved to be successful in increasing the productivity of species like Eucalypts, Acacias, Poplars and Paulownia in different parts of the world. Since considerable variations are observed in plantations raised through seeds, most of the pulp and paper industries look forward to get uniform materials suited to their requirement. Though *Casuarina equisetifolia* is amenable for vegetative propagation, large scale operational clonal forestry programmes of this species are in its early stages of development in India. Since *C. equisetifolia* is a poor coppicer, getting juvenile materials for vegetative propagation or maintenance of juvenility is a serious problem. Development of a suitable cloning technique and induction of juvenility in this species will go a long way in establishing large scale plantations of end use specific clonal materials.

Realising the potential of clonal forestry for yield improvement of plantations, systematic studies have been in progress at the Institute of Forest Genetics and Tree Breeding (IFGTB), Coimbatore, Tamil Nadu, India for over two decade and is a focal point for *Casuarina* research in India. The Institute has released 7 high yielding clones of *C. equisetifolia* for operational planting programmes. Rooting of phylloclad cuttings is the most common method of vegetative propagation in this species. An attempt was made at IFGTB to propagate

****Corresponding author: Kannan C. S. Warrier***
Institute of Forest Genetics and Tree Breeding, Indian Council of Forestry Research and Education, Forest Campus, PB 1061, R.S. Puram, Coimbatore – 641 002, Tamil Nadu, India

C. equisetifolia through water culture technique to scale up the clonal production of quality planting stock.

MATERIALS AND METHODS

Collection of plant materials: Phylloclad (branchlet) cuttings (5 to 7 cm in length) or individual 'needles' collected from a hedge garden of *C. equisetifolia* were treated with 0.1 per cent Bavistin for 10 minutes to avoid fungal attack. Secateurs and scissors used for collection of cuttings were kept clean. Rectified spirit was used to sterilize the cutting edges.

Water culture: Cut end of the phylloclads or individual needles, treated with the fungicide were dipped in indole-3-butyric acid (IBA) solution (100, 200, 500, 1000 & 2000 mgl^{-1}) for 12 hours. Subsequently, the treated cuttings or individual 'needles' were placed in ordinary plastic tea cups with plain water. Water in the cups was changed every day. They were maintained under shade house (75% shade) conditions.

Statistical design: All the rooting experiments were conducted in Completely Randomized Design with 4 replications with 50 sprigs or 'needles' per replication. For rooting data in percentage, arcsine transformed values were used for analysis.

Transplanting: Rooted cuttings or individual branchlets were transplanted to polybags (10x20cm) filled with potting medium containing sand, soil and farmyard manure (2:1:1).

RESULTS AND DISCUSSION

A cost effective water culture technique of rooting could be developed for *C. equisetifolia* during the current study. Both sprigs and 'needles' could be rooted in ordinary drinking water using this method. The success of rooting was up to 100 per cent for 'needles' and 80 per cent for sprigs. Table 1 gives the details of rooting data for different concentrations of IBA.

Table 1. Rooting in *Casuarina equisetifolia* for different concentrations of IBA

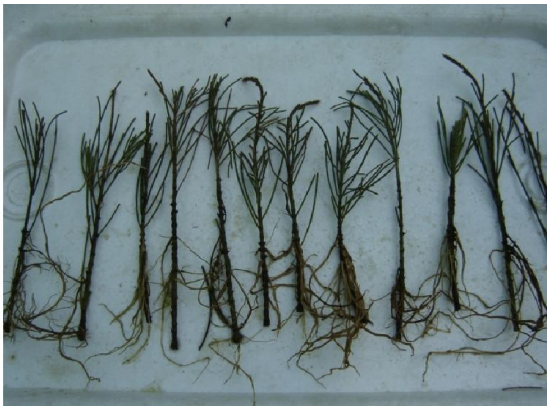
IBA Concentration (mgl^{-1})	Rooting Percentage *	
	Sprigs (%)	'Needles' (%)
100	80 [a]	100 [a]
200	60 [b]	70 [b]
500	30 [c]	50 [c]
1000	20 [d]	30 [d]
2000	0 [e]	0 [e]

*Means with the same letter in a column do not differ significantly as per Duncan's Multiple Range Test ($P \leq 0.05$).

Among the different concentrations of IBA attempted, dipping the cut end of the plant material for 12 hours in 100 mgl^{-1} gave the best results with 100 and 80 per cent rooting for 'needles' and sprigs (phylloclad) respectively. A decreasing trend in rooting percentage could be observed with increase in the IBA concentration. The auxin at 2000 mgl^{-1} failed to induce any rooting in 'needles' or sprigs. Water culture technique of rooting was found to be more suited for 'needles' than the sprigs. Lundquist and Torrey (1984) successfully rooted *Casuarina equisetifolia, C. cunninghamiana, C. montana, C. suberosa, and Gymnostoma papuanum* in Hoagland's solution.

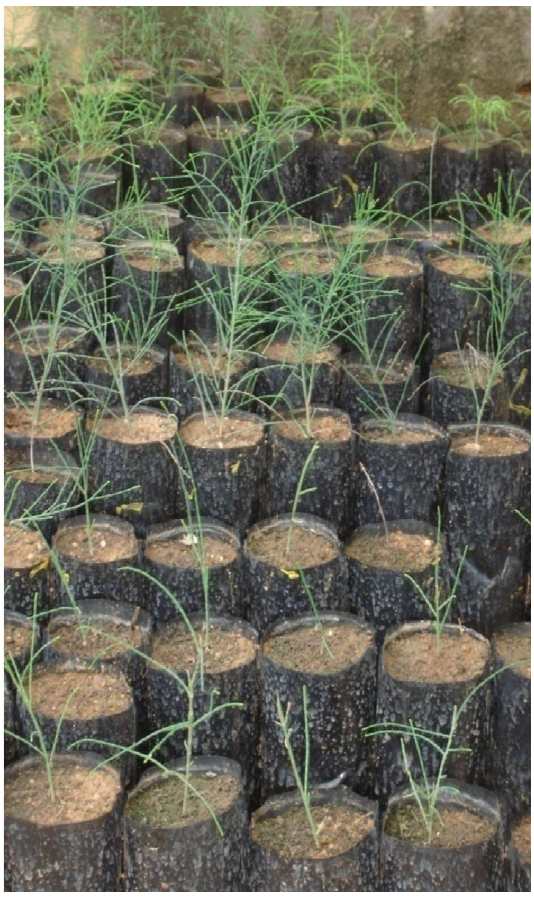
Rooting of sprigs in plain water

Rooting of individual 'needles' in plain water



Rooted sprigs using water culture

Rooted individual branchlets using water culture



Rooted sprigs and 'needles' transplanted to polybags

A plantlet derived from individual 'needle'

Greatest success (60%-100%) was achieved with mature softwood stem cuttings using auxin treatment (50 mg/liter indole-3-butyric acid for a 3-h soak) followed by water culture in 1/4-strength Hoagland's solution minus nitrogen. Water culture is widely being used for clonal propagation of casuarina cuttings in China and this technique has been extended to country foresters and farmers (Zhong *et al*., 2011). Rooted cuttings or individual branchlets were transplanted to polybags (10 x 20 cm) filled with potting medium containing sand, soil and farmyard manure (2:1:1). They were irrigated daily. Rooted sprigs developed into plantlets in 3 months period whereas it took 6 months for the rooted 'needles' to develop into individual plantlets. Plantlet development from rooted sprigs and individual branchlets or 'needles' was 95 and 65 per cent respectively. *Casuarina equisetifolia* is a poor coppicer. Development of plantlets from individual branchlets shall help in mass multiplication of the limited rejuvenated plant material obtained by coppicing thereby scaling up the production of quality planting stock.

REFERENCES

Franclet, A., Boulay, M., Bekkaoui, F., Fouret,Y., Martovzet, V.B. and Qwalker, N. 1987. Rejuvenation. In: Bonga, J.M. and Durzan (eds) Cell and Tissue Cultrure in Forestry Vol I, Nijhoff, The Hague, Dordrecht, pp 232-248.

Lundquist, R. and Torrey, J.G. 1984. The propagation of Casuarina species from rooted stem cuttings. *Botanical Gazette,* 145(3): 378-384.

Nicodemus, A. 2009. *Casuarina – A Guide for Cultivation*. Institute of Forest Genetics and Tree Breeding (Indian Council of Forestry Research and Education) Coimbatore, India, 16 p.

Pinyopusarerk, K. and Williams, E.R. 2000. Range-wide provenance variation in growth and morphological characteristics of *Casuarina equisetifolia* grown in Northern Australia. *For. Ecol. Manage*., 143: 219-232.

Turnbull, J.W. 1990. Taxonomy and genetic variation in casuarinas. In: El-Lakany, M.H., Turnbull, J.W. and Brewbaker, J.L. (eds) Advances in Casuarina Research and Utilization, Desert Development Centre AUC, Cairo, pp. 1-11.

Zhong, C., Zhang, Y., Chen, Y., Jiang, Q., Chen, Z., Wu, C., Pinyopusarerk, K., Franche, C. and Bogusz, D. 2011. Casuarina research and development in China. In: Zhong, C., Pinyopusarerk, K., Kalinganire A. and Franche, C (eds) Improving Smallholder Livelihoods through Improved Casuarina Productivity, Proceedings of the 4th International Casuarina Workshop, Haikou, China 21-25 March 2010. China Forestry Publishing House, pp 5-10.

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