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In Vitro Micropropagation of Dendrocalamus Strictus: Review

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Abstract

The review of papers are showing the diffrent stage of microprapogation and seedlings of dendrocalamus strictus on murashige and skoog's medium supplemented with diffrents growth hormons. a rapid and highly effective method for micrprapogation of dendrocalamus strictus was established. seeds of dendrocalamus strictus were inoculated on diffrents MS medium and nodal segment were proved to be the best region comprison to the shoot tips having high rate of shoot induction and more number of shoots multiplication.

Introduction

Plant tissue culture:-

Plant tissue culture is the technique of growing plant cells, tissues and organs in an artificial, prepared nutrient medium, static or liquid, under aseptic conditions.
Some notable points are:-

- The production of exact copies of plants that produce particularly good flowers, fruits or have other desirable traits.
- The process quickly produces mature plants.
- The production of multiples plants in the absence of seeds or necessary pollinators to produce seeds.
- The regeneration of whole plants from plant cells that have been genetically modified.
- The production of plants in sterile containers than allows them to be moved with greatly reduced chances of transmitting disease, pets and pathogens.
- The production of plants from seeds that otherwise have very low chances of germinating.

Dendrocalamus strictus:-

- Bamboo is a vernacular term for the members of subfamily *Bambuso ideae* of the family Poaceae. *D. strictus* is deciduous densely tufted bamboo.
- Bamboo an important non-wood forestry product is one of the most important agricultural plants worldwide.
- It is one of the fast growing world's greatest natural and renewable resources gaining approximately 75-400 mm per day, whose rate of biomass generation is unsurpassed in the plant kingdom.
- Almost 99% of natural Bamboo production in the country comes from the natural stand in the forest and only 1% is derived from plantation
- Research on tissue culture of bamboo is fairly recent. Extensive research on micropropagation of bamboo species had carried out using juvenile (zygotic embryo, seed or seedling) and mature clump derived (nodal buds) tissues with more than 40 species of bamboo.

Chemical composition:-

- The main constituents of bamboo culms are cellulose, hemi-cellulose and lignin, which amount to over 90% of the total mass.
- The minor constituents of bamboo are resins, tannins, waxes and inorganic salts.
- Bamboo contains other organic composition in addition to cellulose and lignin. It contains about 2-6% starch, 2% deoxidized saccharide, 2-4% fat, and 0.8-6% protein.
- The carbohydrate content of bamboo plays an important role in its durability and survivival.
- The ash content of bamboo is made up of inorganic minerals, primarily silica, calcium and potassium.
- Manganese and magnesium are two other common minerals. Silica content is the highest in the epidermis with very little in the nodes and internodes.
- The internode of solid bamboo has significantly higher ash.

Micropropagation:-

- Conventional methods of propagation of bamboo are based on seeds and vegetative methods.
- The propagation is done vegetatively by using different parts of the bamboo like off-set and rhizome planting, branch & culm cuttings, marcotting and layering but, vegetative propagation through cuttings, offsets and rhizomes are bulky and not available in sufficient number, expensive and also cumbersome to handle and liable to desiccation.
- Micropropagation not only ensures the supply of quality planting material on regular basis but storage of germplasm in the form of *in vitro* cultures has been an additional advantage.
- Micropropagation via tissue culture attracted a lot of attention since it was believed that this method could solve most or at least many problems in propagation of bamboo.

- Micropropagation of bamboo species has been carried out using juvenile and mature clump derived tissues with more than 40 species of bamboo.
- The shoots were collected from about 3 year's old clumps of *D. Strictus* and they were cut into single node segments.

The basal sheath covering the auxiliary bud was removed. These nodal explants were thoroughly washed under running tap water then washed in labolene solution with few drops of tween-20 for 5 minutes and rinsed with distilled water. Further surface sterilization of the explants was done under laminar air flow by the following two methods.

1. The explant was treated with 0.2% $hgcl_2$ solution for then washed with sterile distilled water and dip in 70% ethanol.
2. The explants was treated with [ca $(ocl_2)_2$] solution with few drops of tween-20. After treatment explants was washed with sterile distilled water and dip in 70% ethanol. Then explants were inoculated on solidified MS basal medium 0.75% agar with sucrose and 2 mg/l BAP. The culture incubated under controlled temperature (272°C), light (2000 lux) and humidity (70% RH) in a culture room.

Result :-

Research paper title	**Research paper result**
Micropropagation of Dendrocalamus strictus Nees from Mature Nodal Explants	The effect of different hormonal treatment for shoots multiplication is shown as follows. 3mg/l BAP produced 1.33 fold shoots multiplication. 4mg/l BAP produced 2.33 fold shoots multiplication. 5mg/l BAP did not increase shoots multiplication. The addition of 15mg/l adenine + 4 mg/l BAP produced maximum shoots multiplication (3.33 fold) and 3mg/l BAP gave maximum shoot length (3.53 cm).
A Micropropagation System for Cloning of *Bambusa tulda roxb.*	The maximum aseptic culture establishment (79%) was found under above growth conditions Winter–summer exhibited the highest bud break (67%). The autumn recorded significantly low aseptic culture establishment (46%) and bud break (42%).

A Two Step Method for Accelerated Mass Propagation of *Dendrocalamus asper* and Their Evaluation in Field	Maximum multiple shoot formation was observed when *in vitro* generated axillary shoots were transferred to liquid MS medium containing 5 mg/l BAP and 40 mg/l adenine sulphate. A maximum of 93.33 % shoots were effectively rooted when transferred to liquid MS medium supplemented with 1 mg/l indole-3-biutyric acid (IBA).
Effect of certain Plant Growth Regulators on the Seedling Survival, Biomass Production and Proline content of Bambusa arundinacea.	Seedling survival percentage was increased 50, 42 and 38% by 10µM IAA, Similarly dry weight was increased 56, 35 and 26% by 10µM IAA, IBA and 2,4-D respectively. and 47, 40 and 37% by 100µM IAA, IBA and 2,4-D respectively. Proline content decreased over the control by 27, 04, and 21% by 10µM IAA, IBA and 2,4-D respectively. And 35, 76 and 21% by 100µM IAA, IBA and 2,4-D respectively.
In Vitro Propagation of Arundinariacallosa Munro-an Edible Bamboo from Nodal Explants of Mature Plants.	On basal medium, the frequency of bud-break was very low and statistical analysis showed that in the presence of BAP, early bud-break response was observed in 8.9-13.3µM BAP within 8-15 days. 62 % cultures showed bud-break within 7-10 days, with over 3 shoots per explants in MS medium containing BAP at an optimum level of 13.3 µM BAP.
In Vitro Propagation of Bambusa tulda An Important Plant for Better Environment.	Highest shoot multiplication is found in corporation with BA (1.0 mgl). The shoot multiplication rate was 25.0±1.0 with shoot length 4.00±1.0. Maximum number of rooting was recorded in the MS medium in NAA (5.0 mgl) with 22.6±3.2 numbers of roots. This result was followed by NAA (4.5mgl) with 16.7±1.53 root numbers and 93 percent rooting and NAA (4.0 mgl) with 12.6±2.5 no. of root numbers (83 percent rooting).

Plant growth regulators as effective tool for germination and seedling growth for Bambusa arundinaceae	The effect of PGRs in the germination of bamboo seeds in Bambusa arundinaceae was studied. Under controlled conditions bamboo seeds showed only 30% germination. Maximum shoot length was observed by GA3 at 10µM concentration.
Rapid and Mass Propagation of Economically Important Bamboo Dendrocalamus hamiltonii	A maximum germination of 37.50% was recorded at a concentration of 35 µM BAP supplemented in the MS medium where 9-10 shoots were produced within 3 weeks of culture BAP . In vitro, rooting shoot clusters of 3-4 shoots (2-3 cm in length) were cultured on in vitro rooting medium. Initially, less percentage of rooting was obtained.
In Vitro Propagation of Gigantochloa atroviolaceae Widjaja through Nodal Explants	MS medium supplemented with BAP at 20 µM concentrations gave a maximum multiplication rate of 1.94 ± 0.15 fold with average shoot number 5.82 ± 0.04 and shoot length of 2.23 ± 0.15 cm. The best response of only 1.32 ± 0.05 fold multiplications with mean shoot number 3.95 ± 0.16 and mean shoot length 1.88 ± 0.11 cm was obtained on MS medium supplemented with 20µM Kn.

Discussion

- Bamboo trees the success is achieved either by shoot formation or embryo formation by only zygotic embryo and seedling explants for micro propagation.
- The role of auxins in root development is well established *in vitro* propagation of *Gi. atroviolaceae*via axillary shoot proliferation from nodal segments derived from field-grown material.
- The method can be used for rapid and mass propagation of this important bamboo species. Suitability of IBA for *in vitro* rhizogenesis is well established in many bamboo species. 100% rooting in microshoots of *Thamnocalamus spathiflorus* on IBA supplemented medium
- Shoot multiplication and proliferation, excised and separated axillary shoots were inoculated on both liquid and semisolid MS medium fortified with BAP and ADS. BAP has been found the best cytokinin for shoot multiplication of the given bamboo, *D. strictus.*
- The plant growth regulators exert far reaching effects on germination and plant growth, the precise action depending on the concentrations of the substances.

PGRs in minute quantities enhance the germination percentage and reduce the germination time.

- Shoot also showed simultaneous shoot elongation, this is due to "cytokinin-carry over effect" in the shoots as there is sufficient residual cytokinin in shoots. IBA was found to be the most favourable root inducer compared to NAA and IAA.
- The researches carried out on micro propagation of bamboo showed variation in species in response to levels of BAP for shoot multiplication as in the case of *Dendrocalamus longispathus*, *Dendrocalamus giganteus*and *Bambusa bambos*.
- Young mini clumps with two-five shoots each were divided into two three parts and each are carefully planted for further proliferation in the proliferated beds and then planted in poly bags filled with soil: sand: cowdung mixture (1:1:2) for storage.
- Rooted shoots after acclimatization showed 100% survival, and grew well in greenhouse before planting in the fields. One of the most important mechanisms exerted by higher plants under environmental-stress conditions is the accumulation of compatible solutes such as proline.

Conclusion

- Bamboo has several advantages in terms of sustainability and carbon fixing capacity compared to the other fast growing species.
- Bamboos are versatile, arbores cent, perennial and non-wood forest trees with tremendous eco-sociological and commercial importance.
- Different propagation techniques are available for bamboo, such as seed propagation, clump division, rhizome and culm cuttings, but these classical techniques suffer from serious drawbacks for large or mass scale propagation.
- The potential of micropropagation for mass scale propagation of bamboo has raised high hopes and a lot of research has been focused on the development of protocols for large and rapid scale propagation.
- *In vitro* propagation was achieved from nodal explants from field grown culms of *Bambusa balcooa* were used to induce multiple shoots on Murashige and Skoog medium supplemented with auxins and cytokinins.
- The rooted and acclimated shoots were successfully transferred into the field with 100% of plantlets survival.
- This review briefly provides the state-of-the-art information on tissue culture mediated biotechnological interventions made in bamboo for large scale micropropagation.

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