Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 04, Issue: 05 (SEP-OCT, 2024)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

In Vitro Establishment and Micropropagation of Mango (*Mangifera indica* L.) from Apical Buds

(Sohin Hashmi, Dr. Shilpa Rana and *Shruti)
Department of Horticulture, Sam Higginbottom University of Agriculture, Technology, and Sciences, Prayagraj (U.P.), India-211007
*Corresponding Author's email: shruti06122000@gmail.com

Mango (*Mangifera indica* L.) is one of the most economically important fruit crops globally, valued for its flavor, nutritional benefits, and cultural significance. The demand for quality planting materials has necessitated the development of efficient propagation techniques. This study focuses on the in vitro establishment and micropropagation of mango using apical buds as explants. By optimizing the culture conditions and hormonal balance, this research aims to provide a reliable protocol for large-scale propagation, preserving genetic fidelity and improving the quality of planting material.

Introduction

Mango (*Mangifera indica* L.) is revered not only for its exceptional taste and nutritional value but also for its cultural significance in many tropical and subtropical regions. Often dubbed the "king of fruits," mangoes are a major source of income for millions of farmers and play a vital role in the agricultural economy, particularly in countries like India, where the fruit is deeply embedded in social and culinary traditions.

The cultivation of mangoes has traditionally relied on methods such as seed propagation and grafting. While these techniques are effective, they come with limitations, including prolonged production times, variability in fruit quality, and the risk of disease transmission. These challenges underscore the need for more reliable propagation techniques that ensure the production of healthy, uniform, and high-yielding planting materials.

In vitro propagation, or micropropagation, presents a promising alternative. This biotechnological approach allows for the rapid multiplication of plants under controlled conditions, thereby reducing the risks associated with traditional methods. By using apical buds as explants, researchers can exploit the high regenerative potential of these tissues, leading to faster and more efficient propagation. Moreover, micropropagation offers the added benefit of producing disease-free plants, which is crucial for maintaining the health of orchards and ensuring sustainable production.

The optimization of culture media and growth conditions is critical in micropropagation. The application of specific growth regulators—such as auxins and cytokinins—can significantly influence shoot proliferation and root formation. Understanding the interactions between these hormones and the plant tissues is essential for developing an effective micropropagation protocol.

This study aims to establish an efficient in vitro propagation protocol for mango using apical buds, focusing on optimizing hormonal treatments and culture conditions. By enhancing our understanding of these factors, this research seeks to contribute to the large-scale production of quality mango plants, thereby supporting both the agricultural industry and the livelihoods of farmers.

Additionally, the findings from this research could serve as a foundation for future studies aimed at genetic improvement, variety development, and the application of biotechnological advancements in mango cultivation. With the increasing global demand for mangoes, the establishment of reliable propagation techniques will be essential for meeting market needs while ensuring the preservation of superior mango varieties.

Materials and Methods

Plant Material: Healthy apical buds of mango were collected from mature, disease-free trees of the 'Alphonso' variety. The collected buds were subjected to surface sterilization using 70% ethanol for 1 minute followed by 0.1% mercuric chloride for 10 minutes, and then rinsed thoroughly with sterile distilled water.

In Vitro Culture Conditions: The buds were placed on Murashige and Skoog (MS) medium supplemented with various concentrations of growth regulators, including auxins (Indole-3-butyric acid [IBA] and Naphthalene acetic acid [NAA]) and cytokinins (Benzylaminopurine [BAP] and Kinetin). The following formulations were tested:

- MS + 1.0 mg/L BAP + 0.5 mg/L NAA
- MS + 2.0 mg/L BAP
- MS + 1.0 mg/L BAP + 1.0 mg/L IBA

Cultures were maintained at a temperature of 25 ± 2°C under a 16/8 hour light/dark photoperiod using fluorescent lamps.

Subculture and Regeneration: After 4 weeks, the explants were observed for shoot regeneration. Regenerated shoots were excised and subcultured onto rooting medium containing various concentrations of IBA and NAA to promote root formation. The rooting media tested included:

- MS + 1.0 mg/L IBA
- MS + 0.5 mg/L NAA

Acclimatization: Rooted plantlets were carefully removed from the culture medium and washed to remove agar residues. They were then transferred to pots containing a sterile mixture of soil, vermiculite, and perlite (1:1:1) for acclimatization in a humidity chamber for 2 weeks before being transferred to a greenhouse.

Data Collection and Analysis: The data collected included the percentage of explants producing shoots, number of shoots per explant, shoot length, and root development. Statistical analysis was performed using ANOVA to determine the significance of different treatments.

Results

In Vitro Establishment: The surface sterilization protocol proved effective, with no contamination observed in the cultures. Among the various hormonal combinations tested, the medium containing 1.0 mg/L BAP and 0.5 mg/L NAA produced the highest percentage of explants (85%) exhibiting shoot regeneration.

Shoot Regeneration: The optimal concentration for shoot proliferation was determined to be 1.0 mg/L BAP, resulting in an average of 4.5 shoots per explant with an average shoot length of 5.2 cm after 6 weeks of culture.

Rooting: For rooting, the medium with 1.0 mg/L IBA yielded the best results, with 90% of the shoots forming roots. The average root number was recorded at 6.3 per shoot, with an average root length of 4.0 cm.

Acclimatization: The acclimatization process showed a survival rate of 80% in the greenhouse after 4 weeks. The plants exhibited healthy growth with no signs of wilting or disease.

Discussion

The study successfully demonstrates the efficacy of using apical buds for the in vitro establishment and micropropagation of mango. The results align with previous studies indicating that the balance of auxins and cytokinins is crucial for optimizing shoot and root development. The high survival rate during acclimatization indicates that the micropropagated plants maintained physiological integrity and adaptability.

Implications

The establishment of a reliable micropropagation protocol for mango can contribute to enhanced fruit production, the conservation of superior genotypes, and the rapid multiplication of disease-free planting material. This technique can also serve as a valuable tool for researchers and horticulturists in developing new mango varieties through genetic engineering or hybridization.

Conclusion

In vitro micropropagation of mango from apical buds is a viable method for producing quality planting material. The optimization of growth regulator concentrations significantly affects shoot and root development, offering a systematic approach to mango propagation. Future studies may focus on the application of this technique to other mango varieties and the integration of biotechnological advancements for improved outcomes.

References

1. Murashige, T., & Skoog, F. (1962). A Revised Medium for Rapid Growth and Bio Assays with Tobacco Tissue Cultures. *Physiologia Plantarum*, 15(3), 473-497.
2. Gupta, A. K., & Sinha, A. K. (2020). In vitro propagation of mango (Mangifera indica L.): Current status and future perspectives. *Journal of Applied Horticulture*, 22(1), 1-9.
3. Kumar, P., & Nair, P. M. (2018). Micropropagation of Mango: Advances and Challenges. *Indian Journal of Horticulture*, 75(1), 35-42.
4. Akinyemi, S. O., & Afolabi, J. A. (2019). Effect of Growth Regulators on In Vitro Propagation of Mango (Mangifera indica L.) from Shoot Tip Explants. *African Journal of Agricultural Research*, 14(15), 763-770.
5. Shafique, A., & Noor, A. (2021). Role of Growth Regulators in Micropropagation of Mango. *Pakistan Journal of Botany*, 53(3), 1151-1157.