A Cytotaxonomical Study Of Some Sundarban Mangrove Species In The Light Of Interspecific Hybridization

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Abstract

Natural hybridization plays an important role in plant evolution by increasing genetic variability and facilitating speciation. Mangrove species exhibit synchronized flowering and overlapping ecological distribution, thereby enhancing the possibility of interspecific hybridization. The present investigation aimed to establish cytotaxonomical relationships among selected mangrove species of the Sundarbans with special emphasis on Avicennia species. Adventitious root tips and immature floral buds were used for mitotic and meiotic chromosome preparations respectively. Pretreatment, fixation, hydrolysis and staining techniques were optimized to obtain suitable chromosome spreads. Preliminary cytological observations indicated the occurrence of individuals showing intermediate morphological characteristics, suggesting possible natural hybridization among closely related mangrove taxa. The study contributes baseline cytotaxonomic information regarding Sundarban mangroves and highlights the significance of hybridization in mangrove evolution and biodiversity conservation.

Keywords: Cytotaxonomy, Mangroves, Hybridization, Avicennia, Sundarbans, Chromosome study

1. Introduction

Mangrove forests are unique intertidal ecosystems distributed along tropical and subtropical coastlines. These plants possess specialized morphological and physiological adaptations that allow survival in saline and waterlogged environments. Natural hybridization is widely recognized as an important evolutionary process in plants and has been reported in several mangrove genera including Rhizophora, Sonneratia, Bruguiera and Avicennia.

The Sundarbans represent the largest mangrove ecosystem in the world and harbour several Avicennia species including Avicennia marina, A. alba and A. officinalis. Several individuals exhibiting intermediate morphological characters have been observed in the Patharpratima region of the Sundarbans, indicating possible natural hybridization. Cytological studies therefore provide an important approach for understanding genomic relationships among these taxa.

2. Materials and Methods

Young adventitious root tips were collected for mitotic studies while immature floral buds were collected for meiotic investigations. Root tips were pretreated in a half-saturated mixture of paradichlorobenzene and aesculine for 3.5 hours at 14°C and fixed overnight in freshly prepared propionic ethanol (1:3). Hydrolysis was carried out using 5N HCl followed by staining with 2% propionic orcein. Squash preparations were observed under a high-resolution binocular microscope equipped with CCD imaging software.

For meiotic studies, immature floral buds were fixed in acetic alcohol and stained using aceto-carmine. Various stages of pollen mother cell divisions were examined carefully to identify suitable stages for meiotic chromosome observation.

3. Results and Observations

Repeated modification of pretreatment duration, hydrolysis time and staining procedures gradually improved chromosome preparation quality. Well-scattered mitotic chromosome plates were obtained in Bruguiera gymnorrhiza. Meiotic observations demonstrated that only specific floral bud stages contain actively dividing pollen mother cells suitable for chromosome analysis.

Several individuals belonging to Avicennia species exhibited intermediate morphological characters. Preliminary cytological observations suggest the possibility of natural interspecific hybridization among closely related mangrove taxa in the Sundarbans.

4. Discussion

Hybridization is considered an important evolutionary force in plants. In mangroves, overlapping flowering periods and sympatric distribution facilitate interspecific gene flow. However, identification based solely on morphology is often unreliable because environmental factors significantly influence phenotypic expression.

The present study successfully standardized cytological methods for difficult mangrove tissues and generated preliminary evidence supporting possible hybridization within Avicennia species. Further investigations involving karyotype analysis, chromosome pairing behaviour and molecular markers are necessary to conclusively establish hybrid origin and genomic relationships.

5. Conclusion

The present investigation standardized chromosome preparation techniques for selected mangrove species of the Sundarbans and generated preliminary cytological evidence suggesting interspecific hybridization among closely related taxa. The study highlights the importance of integrating cytological, morphological and molecular approaches for accurate identification of mangrove hybrids and understanding their evolutionary significance.

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References

1. Abbott R. et al. Hybridization and speciation. Journal of Evolutionary Biology, 2013.
2. Arnold M.L. Natural Hybridization and Evolution. Oxford University Press, 1997.
3. Duke N.C. Australia's Mangroves. University of Queensland, Brisbane, 2006.
4. Duke N.C. A systematic revision of the mangrove genus Avicennia in Australasia. Australian Systematic Botany, 1991.
5. Doyle J.J. and Doyle J.L. A rapid DNA isolation procedure for small quantities of fresh leaf tissue. Phytochemical Bulletin, 1987.

Figures

Representative cytological observations and meiotic stages of selected Sundarban mangrove species are included below as per IJCRT manuscript formatting requirements.

Figure 1. Mitotic chromosome preparations of Bruguiera gymnorrhiza at different magnifications.

Figure 2. Floral bud developmental stages suitable for meiotic studies and cytological observations in Avicennia species.

Figure 3. Cytological observations of Aegiceras corniculatum, Bruguiera gymnorrhiza, Ceriops sp. and Sonneratia sp.