

Micropropagation of Medicinal Plants: Techniques for Thyme (*Thymus Vulgaris*) and Rosemary (*Rosmarinus Officinalis*)

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Abstract

Micropropagation is a vital biotechnological tool for the rapid and efficient multiplication of medicinal plants, ensuring the conservation of genetic traits and the production of high-quality plant material. This review focuses on the micropropagation protocols developed for *Thymus vulgaris* and *Rosmarinus officinalis*, two aromatic and medicinal species of significant economic importance. The paper discusses the selection of explants, the composition of culture media, the role of plant growth regulators, and the acclimatization processes, providing a comprehensive overview of the methodologies employed in the *in vitro* propagation of these plants.

Keywords: Micropropagation, *Thymus vulgaris*, *Rosmarinus officinalis*, tissue culture, plant growth regulators, acclimatization, genetic stability, essential oils.

Introduction

Thyme (*Thymus vulgaris*) and rosemary (*Rosmarinus officinalis*) are perennial herbs belonging to the Lamiaceae family, renowned for their aromatic properties and medicinal applications. The demand for these plants in the pharmaceutical, cosmetic, and food industries necessitates the development of efficient propagation methods. Traditional propagation techniques often face limitations such as low multiplication rates and genetic variability. Micropropagation offers a solution by enabling the rapid production of genetically uniform and disease-free plantlets.

2. Micropropagation of *Thymus vulgaris*

2.1 Selection of Explants

Research indicates that nodal segments are more effective than shoot tips for shoot regeneration in thyme. For instance, a study found that nodal segments cultured on Murashige and Skoog (MS)

medium supplemented with 2 mg/L 6-benzyladenine (BA) resulted in higher shoot proliferation rates compared to shoot tips .jpp.journals.ekb.eg+4jpp.journals.ekb.eg+4SpringerLink+4



2.2 Culture Media and Plant Growth Regulators

The composition of the culture medium and the type and concentration of plant growth regulators (PGRs) are crucial for successful micropropagation. An optimized protocol for thyme involved culturing shoot tips on MS medium supplemented with 1 mg/L kinetin and 0.3 mg/L gibberellic acid (GA_3), achieving a 97% shoot regeneration rate . jpp.journals.ekb.eg+3SpringerLink+3jpp.journals.ekb.eg+3

2.3 Rooting and Acclimatization

Rooting of thyme shoots was successfully achieved on MS medium supplemented with 0.05 mg/L 2,4-dichlorophenoxyacetic acid (2,4-D), resulting in a 92.5% rooting rate . Acclimatization of in vitro plantlets was performed by gradually reducing humidity, with a survival rate of 100% observed in the greenhouse .SpringerLink+1SpringerLink+1

3. Micropropagation of *Rosmarinus officinalis*

3.1 Selection of Explants

For rosemary, single-node stem segments have been identified as superior explants for in vitro culture. A study demonstrated that these segments, when cultured on MS medium supplemented with 0.2 mg/L BA, produced up to 14 shoot buds per explant within 30 days . jpp.journals.ekb.eg+5SpringerLink+5jpp.journals.ekb.eg+5

3.2 Culture Media and Plant Growth Regulators

The use of BA as a cytokinin was found to be more effective than kinetin in inducing shoot proliferation in rosemary. Further growth of isolated shoots was achieved by treating them with 0.25 mg/L indolepropionic acid for 7 days, leading to 80% rooting . jpp.journals.ekb.eg+3SpringerLink+3jpp.journals.ekb.eg+3

3.3 Rooting and Acclimatization

Rooting of rosemary shoots was successfully induced on MS medium supplemented with 0.25 mg/L indolepropionic acid. Acclimatization was carried out by transferring rooted plantlets to soil, where they were successfully established, with the potential to produce approximately 5,000 plants from a single nodal segment within a year .
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4. Comparative Analysis of Micropropagation Protocols

Aspect	<i>Thymus vulgaris</i>	<i>Rosmarinus officinalis</i>
Explant Type	Nodal segments	Single-node stem segments
Shoot Induction	2 mg/L BA + 0.3 mg/L GA ₃	0.2 mg/L BA
Rooting Hormone	2,4-D (0.05 mg/L)	Indolepropionic acid (0.25 mg/L)
Acclimatization	Gradual reduction of humidity	Transfer to soil
Survival Rate	100%	80%
Multiplication Rate	8.6 shoots/explant	14 shoot buds/explant

5. Applications and Future Perspectives

The micropropagation techniques developed for thyme and rosemary have significant implications for their commercial cultivation. The ability to produce large numbers of genetically uniform and disease-free plantlets ensures a consistent supply of high-quality material for essential oil production, pharmaceutical applications, and ornamental purposes. Future research may focus on optimizing protocols for large-scale production, improving acclimatization processes, and exploring the genetic stability of in vitro propagated plants.jpp.journals.ekb.egSpringerLink

Conclusion

Micropropagation offers a promising approach for the rapid and efficient propagation of medicinal plants such as thyme and rosemary. By optimizing culture conditions and understanding the role of plant growth regulators, it is possible to achieve high rates of shoot regeneration, rooting, and acclimatization. These advancements contribute to the sustainable production of these valuable species, meeting the growing demand in various industries.SpringerLink

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