

Research Insight

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Technical Pathways for Tissue Culture Rapid Propagation and Improvement of Transplant Survival Rate in *Dendrobium officinale*

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Abstract *Dendrobium officinale* is an important medicinal orchid plant in China with both medicinal and food uses. It has high medicinal value, health-care value, and industrial development potential. However, its wild resources are limited, and the efficiency of conventional propagation is relatively low, making it difficult to meet the demand for large-scale and standardized seedling production. Tissue culture rapid propagation provides an important technical pathway for the rapid multiplication of high-quality *D. officinale* seedlings and the conservation of germplasm resources. This study explored technologies for tissue culture rapid propagation and improvement of transplant survival rate in *D. officinale*, with emphasis on key links including explant selection, establishment of an aseptic culture system, optimization of culture media and nutritional conditions, protocorm induction and subculture proliferation, multiple shoot differentiation, rooting and strong seedling cultivation, seedling grading before bottle removal, hardening-off acclimatization, and transplant management. The results indicate that the rapid propagation efficiency of *D. officinale* is jointly affected by explant type, basal medium, plant growth regulators, organic additives, activated carbon, and subculture cycle. Meanwhile, transplant survival rate is closely related to root quality, seedling vigor, acclimatization intensity, substrate formulation, temperature and humidity management, and beneficial microbial interactions. By constructing a continuous technical chain of “induction-proliferation-rooting-strong seedling cultivation-hardening-off-transplanting,” seedling uniformity, transplant adaptability, and production stability can be effectively improved. In the future, further efforts should be made to strengthen research on the standardization of *D. officinale* tissue culture systems, seedling quality evaluation, intelligent management, and microbial synergistic regulation, thereby providing technical support for the industrialized, standardized, and sustainable development of *D. officinale*.

Keywords *Dendrobium officinale*; Tissue culture rapid propagation; Protocorm; Strong seedling cultivation; Transplant survival rate

1 Introduction

Dendrobium officinale Kimura et Migo, also known as *Dendrobium catenatum*, is a precious medicinal plant of Orchidaceae that occupies an important position in traditional Chinese medicine, functional foods, and the modern health industry (Li et al., 2024; Wei et al., 2024). It has been used in China for thousands of years, and its dried stems are officially recorded in the Chinese Pharmacopoeia and included in the catalogue of substances with both medicinal and food uses, reflecting both long-standing traditional application and broad consumption potential (Zhang et al., 2023; Wei et al., 2024). Traditional records describe its functions in nourishing yin, benefiting the stomach, promoting fluid production, and supporting general health, while modern studies further show that *D. officinale* contains diverse bioactive constituents including polysaccharides, bibenzyls, flavonoids, phenanthrenes, alkaloids, and other phenolics (Duan et al., 2022; Zhang et al., 2023). Reviews have reported that these constituents are associated with antioxidant, anti-inflammatory, immunomodulatory, gastrointestinal protective, hepatoprotective, hypoglycemic, neuroprotective, and antitumor activities, which explains why *D. officinale* has become one of the most intensively studied medicinal species in the genus (Xu et al., 2022). At the broader genus level, China has abundant *Dendrobium* resources, with dozens of medicinally valuable taxa and at least 78 species reported nationally, but *D. officinale* remains one of the most prominent research and development targets because of its recognized medicinal value, edible potential, and market appeal. In addition, the plant has expanding value beyond stems alone: recent work indicates that leaves and flowers also contain numerous active compounds and