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Isolation and Characterization of Endophytic Fungi from Barleria prionitis (L.) and Their Potential Biotechnological Applications

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Abstract:

Barleria prionitis (L.), a medicinal plant widely recognized for its therapeutic properties, harbors diverse endophytic fungi with potential biotechnological applications. This study aimed to isolate and characterize fungal endophytes from B. prionitis collected in the Amravati region. A total of 400 plant tissue segments were processed, leading to the isolation of 11 distinct fungal species: Aspergillus niger, Aspergillus flavus, Aspergillus terreus, Alternaria alternata, Curvularia lunata, Fusarium oxysporum, Fusarium solani, Nigrospora oryzae, Colletotrichum dematium, Penicillium notatum, and Chaetomium globosum. The diversity of these endophytes suggests their potential role in enhancing the plant's medicinal value through the production of bioactive secondary metabolites. Further research may elucidate their ecological significance and applications in pharmaceuticals and sustainable agriculture.

Keywords: Endophytic fungi, Barleria prionitis, secondary metabolites, pharmaceuticals, sustainable agriculture

Introduction:

Endophytic fungi are symbiotic microorganisms that colonize plant tissues without causing apparent harm, playing a crucial role in plant health and productivity (Tan & Zou, 2001). These fungi are known to produce bioactive secondary metabolites that have pharmaceutical, agricultural, and industrial applications (Strobel, 2003). *Barleria prionitis* (L.), a well-known medicinal plant in traditional medicine, has been reported to possess antimicrobial, anti-inflammatory, and antioxidant properties (Rahman et al., 2018). However, its associated endophytic fungal community remains largely unexplored. This study aims to isolate and characterize endophytic fungi from *B. prionitis* and assess their potential biotechnological applications.

Materials and Methods:

Collection of Plant Samples:

Healthy plant samples of *Barleria prionitis* were collected from the Amravati region of India. The samples were transported to the laboratory under sterile conditions for further processing.

Isolation of Endophytic Fungi:

Plant tissues were surface-sterilized using a modified protocol (Schulz et al., 1993). The sterilized segments were plated on Potato Dextrose Agar (PDA) and incubated at 25°C for 7-14 days. Fungal growth was monitored, and pure cultures were obtained through successive sub culturing.

Colonization Frequency:

The colonization frequency (CF) of endophytic fungi was determined to assess the prevalence of fungal species in *B.*

prionitis. CF was calculated using the following formula (Petrini, 1986):

CF% = No. Segments colonized by an endophyte X 100.

Total Number of segments analysed

This method provides insight into the abundance and distribution of fungal endophytes within plant tissues, which is crucial for understanding their ecological roles and potential applications

Morphological and Molecular Identification:

Fungal isolates were initially identified based on macroscopic and microscopic characteristics (Barnett & Hunter, 1998). Further identification was conducted using molecular techniques, including PCR amplification of the ITS rRNA gene region followed by sequencing (White et al., 1990).

Results and Discussion:

A total of 400 plant tissue segments yielded 11 distinct fungal species: *Aspergillus niger, Aspergillus flavus, Aspergillus terreus, Alternaria alternata, Curvularia lunata, Fusarium oxysporum, Fusarium solani, Nigrospora oryzae, Colletotrichum dematium, Penicillium notatum*, and *Chaetomium globosum*. The diversity and prevalence of these fungi suggest their symbiotic role in plant health and secondary metabolite production.

Several studies have reported that endophytic fungi associated with medicinal plants exhibit significant antimicrobial, anticancer, and enzyme-producing capabilities (Pimentel et al., 2011). For example, *Fusarium* spp. are known for their bioactive compounds with antifungal and antibacterial properties (Suryanarayanan et al., 2009). *Aspergillus* spp. have been extensively studied for their potential in enzyme production and industrial applications (Radhakrishnan et al., 2013).

Biotechnological Applications:

Pharmaceutical Potential:

Endophytic fungi produce diverse bioactive compounds with pharmaceutical significance, including antimicrobial, anticancer, and immunomodulatory agents (Sharma et al., 2017). The presence of species like *Fusarium oxysporum* and *Penicillium notatum* in *B. prionitis* suggests their potential as sources of novel therapeutic agents.

Agricultural Applications:

Endophytic fungi enhance plant growth, induce systemic resistance, and produce biocontrol agents against pathogens (Hyde & Soytong, 2008). *Fusarium* spp., for instance, have been utilized for biocontrol purposes in sustainable agriculture (Singh & Gaur, 2016).

Industrial Applications:

Fungi such as *Aspergillus* and *Penicillium* produce enzymes like cellulases, proteases, and amylases, which are widely used in industrial processes (Gomes et al., 2001). The enzyme-producing capabilities of isolated endophytes warrant further investigation.

Conclusion:

This study highlights the diversity of endophytic fungi in *Barleria prionitis* and their potential biotechnological applications. The presence of bioactive fungi suggests their role in pharmaceutical, agricultural, and industrial sectors. Further research focusing on metabolite profiling and functional characterization can lead to the development of novel bio-based products.

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