Proceedings International
Open-Access Journal (ISSN: 2668-6384)

Proceedings, Abstract
Volume 7, Issue 1, 2025, 32
https://doi.org/10.33263/Proceedings71.032

Exploration and Valorization of the Cave Mycobiota Potential in the Medical and Biotechnological Fields

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Received: 7.08.2025; Accepted: 21.09.2025; Published: 16.11.2025

Abstract: Caves are the most common landforms of karst systems and are considered unique ecosystems in terms of the diversity of life forms, especially microorganisms, which have adapted their metabolic activity and developed close mutualistic relationships to survive under limited environmental conditions. Cave habitats provide stability and specificity for hundreds or even millions of years after the speleogenesis process ends, thus becoming model systems for studying the microbial universe. This study contributes to the understanding of the cave mycobiota in Romania by characterizing the diversity of cultivable filamentous fungi from Isverna Cave in the Mehedinți Mountains, with an emphasis on identifying potentially new fungal species. The study revealed 18 species of microfungi, with a predominance of the genus *Penicillium*, the species diversity confirming the adaptability and success of filamentous fungi in competition with other microorganisms in subterranean ecosystems. Species potentially pathogenic to humans, such as *Syncephalastrum racemosum*, and entomopathogenic species, such as *Isaria farinosa*, were isolated. Characterizing the enzymatic activity of microfungal strains from extreme environments can lead to the development of new applications in the medical, biotechnological, or ecological fields. In the food industry, fungal cellulases could contribute to the biodegradation of packaging and the reduction of environmental pollution. Thus, another objective of our study was to identify cellulase-producing fungal strains for potential use in the biodegradation of cellulose-based packaging. The data obtained allowed for the selection of a fungal strain (*Penicillium chrysogenum*), whose cellulolytic activity could be enhanced to improve its biodegradation capacity. Although numerous studies focus on microfungal metabolism, the diversity of cave mycobiota remains poorly known, highlighting the importance of continued research to better understand the specific adaptations to the extreme conditions offered by cave habitats. The development of innovative biotechnological technologies and applications could have a positive impact on the environment and life in general, providing solutions to current challenges such as limited resources and the pollution of various ecological niches, in pursuit of the goal of sustainable development. Future studies could benefit from optimized experimental models to perform screening of filamentous fungi from extreme environments with significant degradative capacity.

Keywords: Cave Mycobiota; Filamentous Fungi; Isverna Cave; Cellulolytic Strains; Biotechnological Potential.

Acknowledgments

The financial support was provided through the National Research Development and Innovation Plan core program, 2022–2027, Ministry of Research, Innovation and Digitalization (MCID), Project no. 23020101, Contract no. 7N / 3 January 2023.