RETASTE Conference Abstracts
RETASTE-APP-1264-In-person Oral
Rethymno, September 16-18, 2026
© Author(s) 2026 CC BY 4.0 License
DOI:10.5281/zenodo.23678111

Submerged Fermentation of Local Edible Fungal Mycelium as a Sustainable Protein Source

Ben Shahar[1,*], Lena Rotaman[2], Amiel Sharchaton[2] and Eyal Kurzbaum[2]

[1]*The Department of Blue Biotechnologies and Sustainable Mariculture, University of Haifa, Israel*
[2]*Shamir Research Institute, Israel*

ACCEPTED

Abstract

The demand for alternative protein sources is increasing due to climate change, depletion of natural resources, population growth, and the environmental impacts of intensive agriculture. Animal based protein production requires extensive land and water resources and contributes significantly to environmental pollution. Although plant based proteins offer environmental advantages, they typically rely on a limited number of resource intensive field crops. These challenges have intensified interest in fungal mycelium, the vegetative tissue of filamentous fungi, as a sustainable protein source. Liquid fermentation of fungal mycelium enables rapid biomass production, high protein content, efficient resource use, and independence from arable land. While industrial scale mycelium based protein production is advancing, most existing initiatives focus on a small number of species, while thousands of edible fungal species remain underexplored and may offer improved nutritional or process related traits. This study investigates edible fungal species native to the northern region of Israel as potential protein sources. This region is characterized by high climatic variability and rich biodiversity, providing a unique basis for identifying promising local strains. Twenty edible mushroom species were collected, isolated, and cultivated in liquid culture. The strains were evaluated based on biomass accumulation and protein content. Nearly half of the tested species exhibited protein concentrations exceeding 25% of dry weight, with one species reaching above 30%. After one week of incubation, substantial variation in biomass density was observed, ranging from 4 to 10 grams of dry biomass per liter. Integrating biomass yield with protein concentration enabled the identification of promising candidates producing more than 2 grams of protein per liter. Ongoing optimization experiments focus on carbon to nitrogen ratios, pH, and temperature. Increasing glucose concentration to 60 grams per liter combined with temperature optimization resulted in biomass densities of up to 12 grams per liter. In parallel, the study examines the use of by products from local food processing industries as nutrient sources for mycelium cultivation. This approach aims to promote resource recovery, strengthen regional industrial collaboration, and support circular economy principles. The findings are expected to facilitate the development of a novel, sustainable raw material, reducing reliance on conventional protein sources. The use of local fungal biodiversity and food industry by products contributes to reduced waste, improved resource efficiency, and enhanced food security. This low water and land demanding technology is particularly relevant for arid and semi-arid regions and can support environmental policy goals related to greenhouse gas emission reduction, natural resource conservation, and the development of innovative and sustainable food systems.

Keywords: Fungal mycelium, Submerged fermentation, Alternative protein, Edible mushrooms, Sustainable food systems, Protein production, Liquid culture, Circular economy, Food industry by products, Biodiversity based bioprocessing

References

Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. Science, 360(6392), 987–992. https://doi.org/10.1126/science.aaq0216

Matassa, S., Boon, N., Pikaar, I., & Verstraete, W. (2016). Microbial protein: Future sustainable food supply route with low environmental footprint. Microbial Biotechnology, 9(5), 568–575. https://doi.org/10.1111/1751-7915.12369

Zwinkels, J., van Oorschot, S., van Mastrigt, O., & Smid, E. J. (2025). The potential of mycelium from mushroom producing fungi in alternative protein production: A focus on fungal growth, metabolism, and nutrition. Current Research in Food Science, 8, 101278. https://doi.org/10.1016/j.crfs.2025.101278

Acknowledgments: This work was supported by the Good Food Institute (GFI) Israel and the Israeli Ministry of Technology and Innovation.

ACCEPTED