



## Editorial Fungal Diversity in the Mediterranean Area

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**Abstract:** The Special Issue entitled "Fungal Diversity in the Mediterranean Area" aimed at highlighting the role of various organisms in the Mediterranean habitat. The role of fungi at the root and phyllosphere level; the biodiversity in small island territories and the sea; rare forms of fungi never previously found; the commercial, food, and therapeutic value of some ascomycetes and basidiomycetes; the diversity related to fungi associated with galls on plants; and the important role of culture collection for the ex situ conservation of fungal biodiversity are the topics dealt with in this Special Issue.

**Keywords:** fungal diversity; mycorrhiza; Mediterranean forest; medicinal mushroom; bioprospecting; marine fungi; phylogenetics; galls; basidiomycetes; ascomycetes; culture collection

Fungi are extremely heterogeneous organisms characterized by high levels of species diversity and are widespread in all environments. Research on fungal diversity cannot be considered exhaustive, given the continuous discovery of new species and the variability of environments where fungi can be harvested, including the seabed. The fields of application are also varied and range from agriculture, forestry, food, medical, and pharmaceutical sectors. If compared to the central and northern European regions, the Mediterranean environment is a reservoir of continuous discoveries which, in addition to having a taxonomic, environmental, and biogeographical interest, allow researchers to highlight peculiar contents of nutritive elements and uncommon therapeutic applications. This Special Issue includes eight research articles dealing with the fungal biodiversity of the Mediterranean area from various points of view.

Mahmoudi et al. compare samples of roots and rhizospheric soils from arid areas of Tunisia characterized by intensive grazing [1]. The mycorrhizal frequency and the intensity and density of spores varies between plants at the same site and, for each plant, between sites.; Mahmoudi et al. have shown a positive effect of mycorrhizal plants on the microbial activity of the soil. The authors conclude that Arbuscular Mycorrhizal Fungi (AMF) improves soil biological properties, supporting the hypothesis that mycorrhiza and grazing compete for plant photosynthates. Besides, under arid conditions, mycorrhizal symbiosis plays a decisive role concerning soil functionality.

The importance of mycorrhizae is even more evident in the case of species of high historical, gastronomic, and commercial value. *Tuber magnatum* Pico, the most prized truffle in the world, has been studied by Belfiori et al. who examined white truffles from Italy, Hungary, Serbia, Romania, Bulgaria, and Greece and characterized them from a genetic point of view. This study is of fundamental importance for application purposes and to allow the better traceability of white truffles for commercial use and also to prevent the erosion of the biodiversity of white truffles [2].

The biodiversity of macromycetes in Mediterranean forests is the theme of the scientific contributions of Polemis et al. and Gargano et al. In the first article, the authors analyze the fungal diversity of the basidiomycetes associated with *Alnus glutinosa* L. in a restricted environment such as the island of Andros in the Cyclades (Greece). In a long term study, the authors analyze from a morphological, ecological and genetic point of view several macromycetes, of which 21 species are first

national records and 68 are reported for the first time from Greek *Alnus glutinosa* forests, including some rare species [3].

Gargano et al. investigated a rare species of albino maitake (*Grifola frondosa* (Dicks.) Gray) collected for the first time in a forest ecosystem of Sicily (southern Italy) [4]. The article highlights the potential application of the albino maitake concerning its nutritional value, particularly high in certain mineral elements and vitamins, and medical value about the ability of its extracts to reduce the production of biofilm by *Staphylococcus aureus* ATCC 43300.

Lazarević and Menkis also highlight how the phyllosphere is expressive of high species diversity. In the case study of the phyllosphere of the endemic forest tree *Pinus heldreichii* H.Christ., a huge number of fungal species were isolated, and mainly constituted Ascomycota [5]. The variability of the fungal community detected at different study sites and altitudes highlights the influence of environmental conditions on the presence/absence of fungal species. There is also a significant correlation between the presence of pathogenic fungi on the leaves, exalted by biotic and abiotic stress factors, and the composition of the fungal community.

The Special Issue also includes an investigation into the diversity of marine fungi by Poli et al. These authors reported the presence of new genera and species isolated from seagrass and algae of the Mediterranean Sea and highlighted how the families Roussoellaceae and Thyridariaceae, until now associated with terrestrial plants, are well represented also in the marine environment [6].

Zimowska et al. contributed to a particular aspect of fungal diversity related to fungi associated with galls on plants of the family Lamiaceae. The results showed full identity with *Botryosphaeria dothidea* (Moug.) Ces. & De Not. of isolates from galls collected from Lamiaceae, while a possible separation from this species should be verified for isolates recovered from *Acacia* in Australia and South Africa [7].

Finally, an interesting contribution to the ex situ conservation of wood decay fungi has been published by Girometta et al. The strains, kept in the MicUNIPV Research Culture Collection of the University of Pavia (Italy), include some species of environmental and medicinal interest closely related to the Mediterranean environment sensu stricto, together with others typical of environments characterized by continental temperate climates [8].

The articles published in this Special Issue reaffirm the importance and role of fungi in different ecosystems. The characterization of fungal biodiversity is of fundamental importance both from an environmental and applicative point of view. Further studies should be conducted in the future to highlight the importance of the in situ and ex situ conservation of fungal diversity for future generations.

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