

Chapter:

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Ecology and Diversity of Edible and Medicinal Mushrooms Across Different Habitats

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Abstract

Edible and medicinal mushrooms represent a unique intersection of biodiversity, ecology, culture, and biotechnology. This chapter explores their taxonomic and ecological diversity across habitats, emphasizing both their functional ecosystem roles and socioeconomic relevance. The taxonomic spectrum of mushroom-forming fungi spans Basidiomycota and Ascomycota, with major orders such as Agaricales, Boletales, and Russulales encompassing many key edible and medicinal taxa. Methods of identification, ranging from traditional macroscopic observation to molecular phylogenetics and genomics, are discussed as essential tools for reliable classification and sustainable utilization. Ecologically, mushrooms function as mycorrhizal symbionts, saprotrophs, and parasites, driving nutrient cycling, soil fertility, and forest regeneration. Their habitat-specific distribution is illustrated through case studies from temperate, tropical, alpine, grassland, and urban ecosystems, each characterized by emblematic species and unique ecological dynamics. Environmental drivers, including climate, soil properties, host plant associations, and disturbance regimes, are identified as key factors shaping fungal diversity patterns. From a human perspective, mushrooms are valuable resources for nutrition, food security, and healthcare. Cultivated species, such as *Agaricus bisporus*, *Pleurotus ostreatus*, and *Lentinula edodes*, exemplify sustainable production systems, while wild species sustain local economies, cultural traditions, and ethnomedicinal practices. Medicinal fungi, including *Ganoderma lucidum* and *Cordyceps sinensis*, highlight the pharmacological potential of bioactive compounds with antioxidant, immunomodulatory, and anticancer properties. Finally, this chapter addresses future perspectives in fungal genomics, biotechnology, and integration into agroforestry and ecosystem restoration. Remaining challenges, such as research gaps, threatened species conservation, and risks of toxicity or misidentification, remain crucial for interdisciplinary collaboration. Overall, mushrooms emerge as ecological keystones and socioeconomic assets essential to both planetary health and sustainable development.