

1 Fungal Siderophores: Structure, Functions and Regulation

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1.1 Introduction

Fungi are eukaryotic, nonphotosynthetic organisms, and most are multicellular heterotrophs. Classically, the following groups of fungi have been considered:

- 1) **Slime molds** have a feeding phase of the life cycle (the trophic phase) that are motile and lack cell wall. Foods particles are ingested.
- 2) **Aquatic fungi** have cell wall and absorb nutrients rather than ingest them. The sex cells and spores of aquatic fungi are motile (zoospores).
- 3) **Terrestrial fungi** have cell wall and absorb nutrients rather than ingest them. The sex cells and spores are not motile (zoospores). Three major groups of fungi recognized are Zygomycetes (e.g., black bread mold, animal dung fungi), Ascomycetes (e.g., cup fungi, truffles) and Basidiomycetes (e.g., mushrooms or toadstools, puff balls, rusts, smuts). For details see Table 1.1; c.f. Giri et al. (2005)

1.1.1 Significance of Terrestrial Fungi

Fungi play important roles in the environment. Most fungi are either saprophytes or decomposers that break down and feed on decaying organic mate-

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Table 1.1 Major groups of soil fungi

| Group and representative members | Distinguishing characteristics | Asexual reproduction | Sexual reproduction |
|--|---|--|---|
| Zygomycetes <i>Rhizopus stolonifer</i> (black bread mold) | Multicellular, coenocytic mycelia | Asexual spores develop in sporangia on the tips of aerial hyphae | Sexual spores known as zygospores can remain dominant in adverse environment |
| Ascomycetes <i>Neurospora</i> , <i>Saccharomyces cerevisiae</i> (baker's yeast) | Unicellular and multicellular with septate hyphae | Common by budding, conidiophores | Involves the formation of an ascus on specialized hyphae |
| Basidiomycetes <i>Agaricus campestris</i> (meadow mushroom), <i>Cryptococcus neoformans</i> | Multicellular, uninucleated mycelia, group includes mushrooms, smuts, rusts that affect the food supply | Commonly absent | Produce basidiospores that are born on club shaped structures at the tips of hyphae |
| Deuteromycetes (Fungi Imperfecti) <i>Penicillium</i> , <i>Aspergillus</i> | A number of these are human pathogens | Budding | Absent or unknown |

rial or dead organisms. Fungi obtain nutrients to absorb by secreting digestive enzymes onto the food source. The enzymes break down, or digest, the food. The breakdown, or digestion, of organic material can also be called decomposition. Any organism that causes decomposition can be called a decomposer. They are vital links in food webs, primarily as decomposers and pathogens of both plants and animals. They are excellent scavengers, breaking down dead plant and animal tissues, recycling elements back into food webs. Some fungi can establish mutualistic relationships with other organisms in nature. For example, some fungi form mycorrhizae with the roots of plants. The fungus supplies water and minerals and the plant provides carbohydrates and other organic compounds. Mycorrhizal fungi protect the root of plant against attack by parasitic fungi and nematodes. Other fungi grow with algae and cyanobacteria forming lichens. Lichens play an important role in soil formation.

1.1.2 Mycorrhiza

These are fungi which exhibit mutualistic relationships with plant roots; 90% of trees probably have them. Their presence significantly increases the roots' effective absorptive surface area and provides for a direct link between the process of decomposition (which yields raw materials) and the absorption of these materials by plants. Mycorrhizae are beneficial both in nature and agriculture. Plants colonized with them tend to grow better than those without them. Groups of mycorrhizae are given in Fig. 1.1.



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