B.Sc. Botany – 3rd SEM

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Nutrition in Fungi

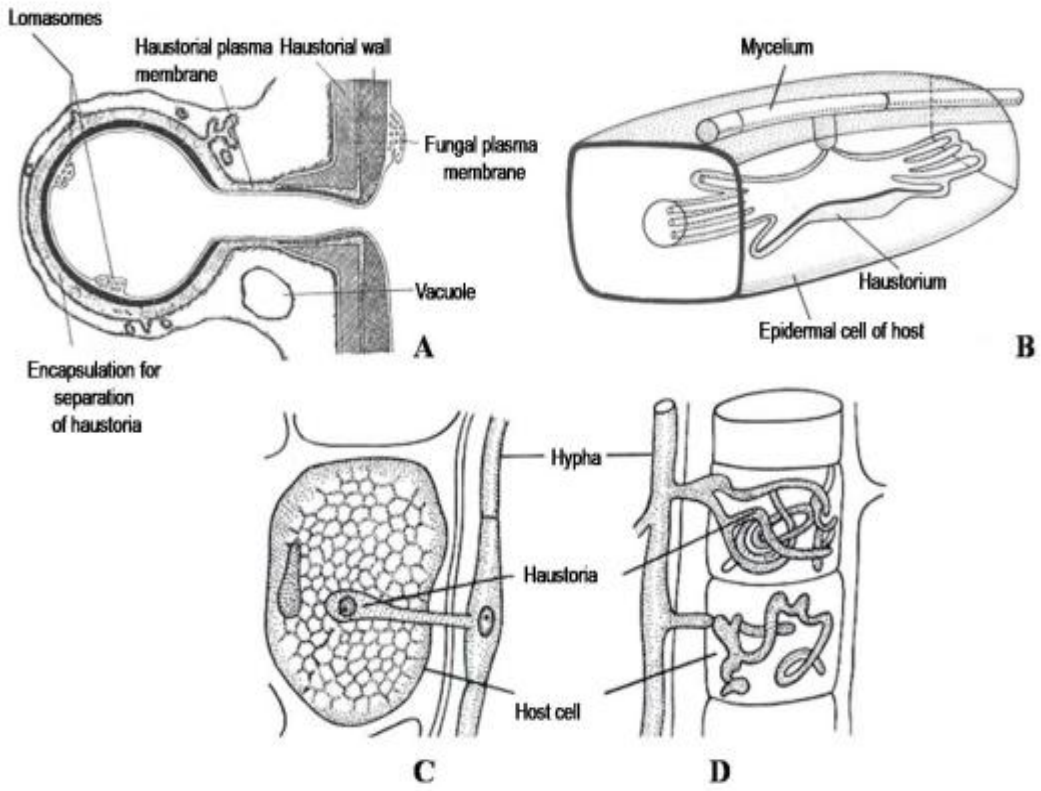
Unlike green plants, fungi are non-chlorophyllous and cannot synthesize their own food. Their structure is so simple that they even cannot obtain their inorganic food directly from the soil. Additionally, a universal character of fungi is that they lack plastids and is completely heterotrophic. Therefore, they must obtain their nutrition from environment, or from living, dead and dying organism. On this basis of this fungi are of below mentioned types.

Biotrophs:

These are the group of fungi which obtain their food directly from living host tissues only. Biotrophs secrete chemicals which increases the permeability of membranes to sugars and amino acids. The host cell starts leaking sugars and amino acids which is absorbed by the fungi. During this type of interaction, fungal cells remain confined to the intercellular spaces and obtain nourishment through **haustoria** (pl. **haustorium**). Haustoria are the outgrowth of vegetative hyphae which increase the absorptive surface area of the parasitic fungus. They penetrate the host cell and with a miniature pore and come in contact with the plasma membrane of the host cell. Haustoria can be knob like (*Albugo*), elongated or branched (*Peronospora*) and highly branched (*Erysiphe*). A special group of fungi are **biotrophic mycoparasites** which have the ability to parasitize mycelia of other fungi, but do not cause any damage to the host cell, as they are not able to grow on dead organic substrata. Some of the common examples are *Piptocephalisvirginiana* (Zygomycetes) that can parasitize *Mucor* hypha.

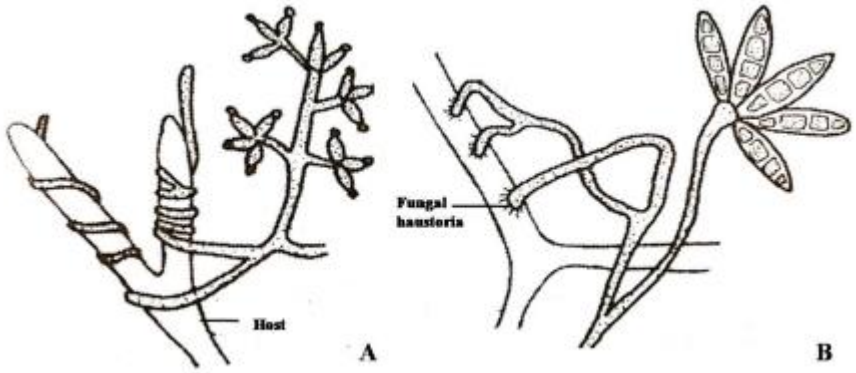
This interaction is **also known as parasitic interaction** since one partner is benefitted (fungi) while the other is in loss. The parasites which survive only on the living host are known as **obligate parasite**; for example *Melampsora*, *Peronospora*, *Puccinia*. These cannot be grown on dead organic culture media. However, the parasites which usually thrive on living material but depending upon the need can adopt saprophytic mode of life for a short period of time are known as **facultative saprophytes**; for example *Taphrina deformans* and other smuts. While there are some fungal species which usually pass saprophytic mode of life cycle but under certain environmental conditions these parasitize some suitable host and are called **facultative parasites**; for example *Fusarium*, *Pythium* etc. Different parasites absorb nutrition in their respective hosts in different ways. Those fungi which have mycelium outside the substratum or host are called **ectoparasite** (*Erysiphe*); however, fungus having their mycelium embedded

in host tissue are known as **endoparasite**. Both these type of fungus develop haustoria for better nutrient absorption. A special category of plant pathogenic species are **hemibiotrophs**. These are those fungi which initially require living cells but cause the death of the host as their hyphae advances. A few carefully documented examples of hemibiotrophs are *Colletotrichum lindemuthianum* (anthracnose fungus) and *Cercosporidium personatum* (peanut leaf spot pathogen).



Types of haustoria. A: Knob-like in *Albugo*, B: Highly branched in *Erysiphe*, C: Elongated capitate in *Peronospora*, D: Elongated digitate in *Peronospora*

Necrotrophs or Perthotrops: These are those fungi which attack living cells so virulently that they kill those cells in early course of parasitism and thereafter feed on dead tissue. They may also secrete toxins which can damage plasma membrane of the host cell, causing nutrients to leak out of the cell and be willingly available to the fungus. **Necrotrophic mycoparasites** can parasitize other fungi and kill them. For example, *Trichoderma viride* can coil around the living hypha of various other fungi such as *Rhizoctonia solani* and kills them.



Diagrammatic representation of Necrotrophs feeding on other fungi. A: *Trichoderma viridae* coiled around hyphae of *Rhizoctonia solani*, B: Biotrophic mycoparasite has formed haustoria on hyphae of *Mucor*.

There are certain groups of fungi which use eelworms, rotifers or protozoa and have developed special mechanisms for capturing these organisms. One of the most interesting mechanisms involves formation of a rapidly constricting ring around a nematode. This ring keeps the nematode captive till the hypha forms haustoria in the body of the nematode. The haustorium absorbs food from the body of the victim and ultimately victim dies. Fungi of the genus *Arthrobotrys*, *Dactylella* and *Dactylaria* employ this method.

Saprotrophs:

These fungi secrete digestive/extracellular enzymes through their wall on the dead organic material. These enzymes act on the substrate polymers and convert them into monomers (monosaccharides, amino acid and sugars) which can be easily absorbed by the vegetative hyphae of the Saprotrophs by penetrating deep into the substratum. Some of the good examples of saprophytes are *Aspergillus*, *Agaricus*, *Morchella*, *Penicillium*, *Rhizopus* and *Saprolegina*. In case of saprophytic fungi, the mycelium can be **ectophytic** (rhizoid is on the substratum; *Rhizopus*) or **endophytic** (rhizoid remain embedded in the substratum).

Mutualistic symbionts:

Mutualistic symbiosis is a positive interaction and is beneficial for both the partners. Some of the fungal species are involved in mutualistic partnership with other organisms and get benefitted nutritionally in the relationship for example **lichen** and **mycorrhiza**. Lichen is the result of symbiotic association between algae and fungi. Algal partner synthesizes organic food and the fungal partner helps in absorption of inorganic nutrients and water. Some of the fungal species develop in the roots of higher plants and mycorrhiza formation occurs. A fungus helps

in better absorption of nutrients from the soil. Mycorrhiza may be external or internal. **External mycorrhiza** or **ectophytic mycorrhiza** is confined to outer region of roots. However, internal mycorrhiza has its mycelium embedded deeply in the root cells.