

FUNGI

Fungi have a great diversity of impacts on plants: They cause **DISEASE** (Potato blight, Rusts, Smuts, *Armillaria*), they feed many trees through **MYCORRHIZAL** associations, they **CYCLE** nutrients by breaking down leaf litter and wood, they are necessary for **ORCHID** seed to germinate. They are also of major economic importance to humans: they cure DISEASE (Antibiotics), they produce useful enzymes (Yeasts, Cheese production), and they can be **POISONOUS** or **EDIBLE**.

Fungi are characterised by:

- **Heterotrophy** (self feeding)
- **Lack of plastids**
- Formation of **Spores**
- **Presence of chitin** in the cell walls.

They are distinguished from plants because they are not photosynthetic.

They are distinguished from animals because they don't ingest food.

Possibly they evolved from Red Algae, with which they share many biochemical characteristics.

The fungal body is basically a tube of cells, known as **hyphal cells**. It feeds by secreting enzymes and absorbing the digested food. Hyphal cells can contain hundreds of nuclei per cell, or 1 or 2. A given fungus may contain many different nuclei. Sexual and Asexual life cycles are common. Hyphal cells can join together, and exchange nuclei – **Plasmogamy** (fusion of cell contents) – but nuclei do not fuse unless spore production is about occur – **Karyogamy** (fusion of nuclei). Fruiting bodies (Mushrooms) are formed by aggregations of hyphae, and spores are produced in these - Up to 1 billion spores from one mushroom.

Some are capable of anaerobic respiration (Sugar --> water + CO₂). Because they digest their food externally, they have to protect the products chemically - Antibiotics.

There are two fungal Kingdoms: they are probably of different origins.

The microscopic fungi don't concern us: they are 'fungal' because they have chitin (and cellulose) in their cell walls, but they also have motile cells with flagella. Most are 1-celled, and usually found in aquatic systems - Water moulds.

Some are filamentous, and cause important diseases: *Plasmopara viticola* of grapes
Phytophthora infestans (Blight) of potatoes.

The **true fungi**. These have no cellulose in their cell walls

They are divided into 2 divisions:

'**Lower fungi**' (600 spp. non-septate fungi): the hyphae are large, don't have cell wall divisions, and therefore have numerous nuclei. Examples are moulds on bread or jam (*Rhizopus*, *Mucor*).

'**Higher fungi**' (100,000 spp., septate fungi) Growth either Filamentous, then the hyphae have numerous cross walls, with 1-2 nuclei per cell; or unicellular (Yeasts).

there are 2 subdivisions of the higher fungi:

ASCOMYCETES: The spore shooters. The fruiting bodies are somewhat insignificant.

BASIDIOMYCETES: The spore droppers. The fruiting bodies of this subdivision are the familiar mushrooms, toadstools, and puffballs.

The **ASCOMYCETES** (cup fungi, yeasts) 56,000 species.

- Septae with a central pore, through which a nucleus can migrate
- Spores 8 (1 meiotic division followed by 1 mitotic division)
- Produced in an **ascus**.

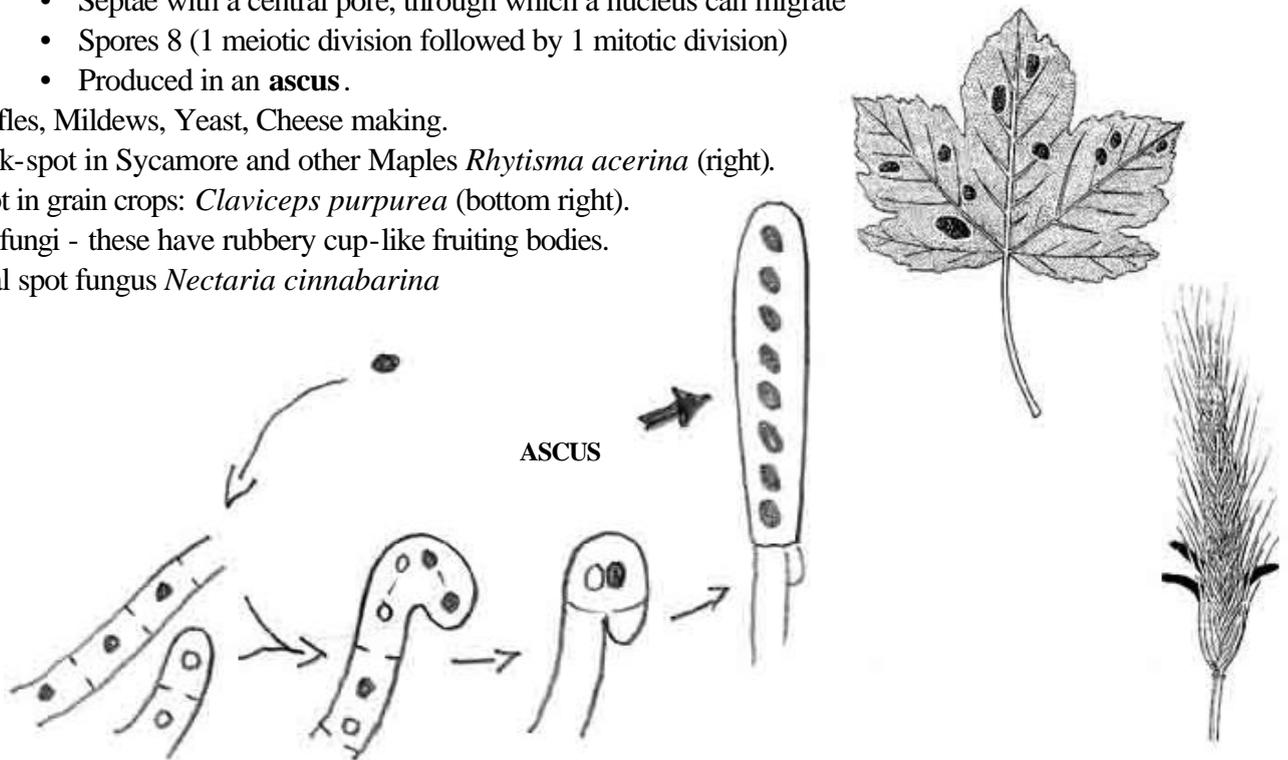
Truffles, Mildews, Yeast, Cheese making.

Black-spot in Sycamore and other Maples *Rhytisma acerina* (right).

Ergot in grain crops: *Claviceps purpurea* (bottom right).

Cup fungi - these have rubbery cup-like fruiting bodies.

Coral spot fungus *Nectaria cinnabarina*

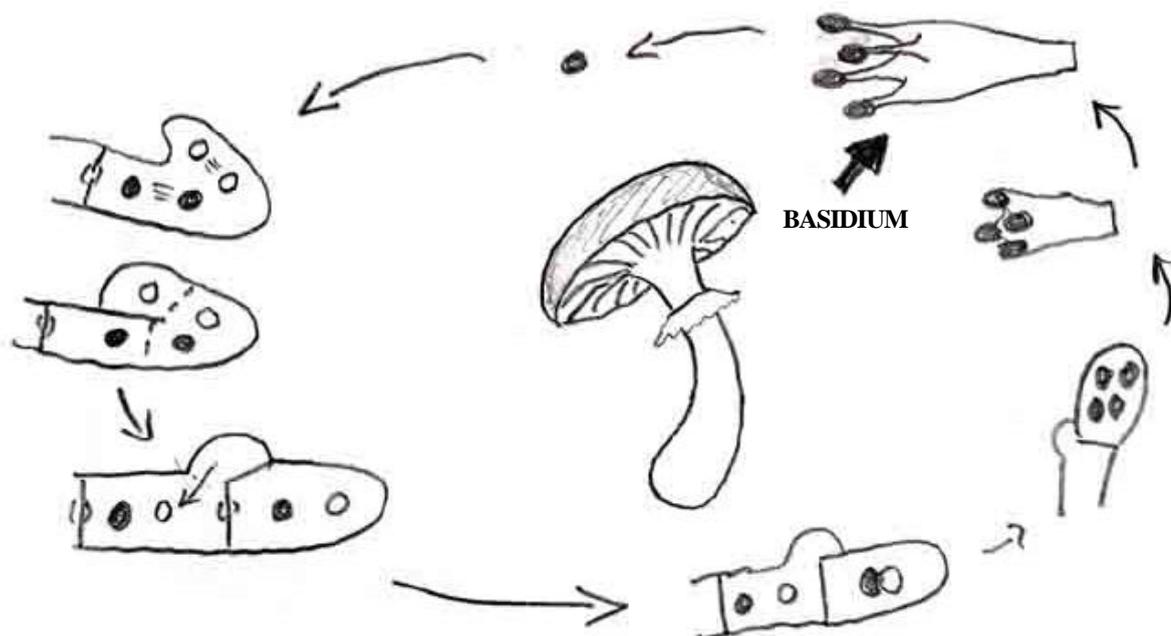


The **BASIDIOMYCETES** (Toadstools, club fungi, rusts and smuts) 25,000 species.

- Septae with a blocked pore, nucleus cannot migrate
- Hyphae with **clamp connections**
- Spores 4
- produced in a **basidium**

Toadstools, Puffballs, Rusts and Smuts.

MYCORRHIZA. Over 80% of all vascular plants have mycorrhizal associations. Ectomycorrhiza (Trees), Endomycorrhiza (Ericaceae, Orchidaceae).



LICHENS: Association between algae (sometimes a cyanobacterium or blue-green algae) and fungi. 13,500 “species”. Formerly treated separately, but now usually treated as members of the respective fungal groups. Thus the majority are Ascomycete fungi, a few tropical species are Basidiomycetes.