

**References:** Webster, J., & Weber, R. (2007). *Introduction to fungi*. Cambridge, UK: Cambridge University Press.

## **GENERAL FEATURES OF CHYTRIDIOMYCOTA**

Chytridiomycota, also known as chytrids, is a division of zoosporic organisms in the kingdom Fungi. Members of the division occur mainly in aquatic or moist habitats where they live as parasites on plants, insects, or amphibians, while others are saprobes. Like other fungi, chytrids have chitin in their cell walls, but one group of chytrids has both cellulose and chitin in the cell wall. Most chytrids are unicellular; a few form multicellular organisms and hyphae, which have no septa between cells (coenocytic). They produce gametes and diploid zoospores that swim with the help of a single flagellum. Over 900 described chytrid species are currently exist.

Sexual reproduction of most Chytridiomycota members is not known. Asexual reproduction occurs through the release of zoospores derived through mitosis. Sexual reproduction is common among members of the Monoblepharidomycetes. They practice a version of oogamy: the male is motile and the female is stationary. This is the first occurrence of oogamy in kingdom Fungi.

## **HABITATS**

Zoospores require free water in which to swim many occur in aquatic habitats, also found in soil water. Many species are saprotrophic – grow on a variety of substrates, most are aerobic, some anaerobic. Some are parasitic on algae, other fungi, aquatic animals, some parasitic on higher plants (crops)

## **SYSTEMATICS OF CHYTRIDIOMYCOTA**

**Division:** *Chytridiomycota*

The division *Chytridiomycota* contains 1 class and 5 orders, distinguished on basis of habitat, zoospore ultrastructure, other characteristics.

**Class:** *Chytridiomycetes*: It is the major class of the phylum Chytridiomycota, which includes a number of parasitic species.

**Order:** *Chytridiales*

Members of the order are primarily aquatic, saprotrophs growing on variety of substrates and parasites of algae, fungi, animals, higher plants. It is difficult to characterize members of the Chytridiales because they lack any specific features by which species have been assigned to the other four orders. The classification of the Chytridiales has traditionally been based on thallus morphology. But this is unsatisfactory because of the great variability in thallus organization shown by the same fungus growing on its natural substratum and in culture. Future systems of classification will be based on zoospore ultrastructure and the comparison of several different types of DNA sequences, but too few examples have yet been studied to provide a definitive framework (Webster & Weber, 2007).

**Genus:** *Synchytrium*

In this genus the thallus is endobiotic and holocarpic, and at reproduction it may become converted directly into a group (sorus) of sporangia, or to a prosorus which later gives rise to a sorus of sporangia. Alternatively the thallus may turn into a resting spore which can function either directly as a sporangium and give rise to zoospores, or as a prosorus. The zoospores are of the characteristic chytrid type. Sexual reproduction is by copulation of isogametes, resulting in the formation of thalli which develop into thickwalled resting spores. *Synchytrium* includes about 120 species which are biotrophic parasites of flowering plants. Some species parasitize only a narrow range of hosts, e.g. *S. endobioticum* on Solanaceae, but others, e.g. *S. macrosporum*, have a wide host range (Karling, 1964). Most species are not

very destructive to the host plant but stimulate the formation of galls on leaves, stems and fruits (Webster & Weber, 2007).

**Species:** *Synchytrium endobioticum* *Synchytrium endobioticum* is an obligate parasite that infects several plants of the genus *Solanum* and it causes the potato wart disease, or black scab (Webster & Weber, 2007).

**Genus:** *Rhizophydium*

*Rhizophydium* is a large, cosmopolitan genus of about 100 species (Sparrow, 1960) which grow in soil, freshwater and the sea. The thallus is eucarpic, with a globose epibiotic zoosporangium which develops from the zoospore cyst, and endobiotic rhizoids which penetrate the host. Whilst some species are saprotrophic, others are biotrophic pathogens of algae and can cause severe epidemics of freshwater phytoplankton (Webster & Weber, 2007).

**Species:** *Rhizophydium planktonicum*

This species is the best-studied chytrid phytoplankton parasite. It is a biotrophic pathogen of the diatom *Asterionella formosa*, an inhabitant of eutrophic lakes. This alga forms cartwheel-like colonies, the diatom frustules making up the spokes, cemented together by mucilage pads at the hub of the Wheel (Webster & Weber, 2007).

**Species:** *Cladochytrium*

There are about a dozen species of *Cladochytrium* which are widespread saprotrophs, mostly of aquatic plant debris. The thallus is eucarpic and polycentric and the vegetative system may bear intercalary swellings and septate turbinate cells. The sporangia are inoperculate. *Cladochytrium replicatum* is a common representative in decaying pieces of aquatic vegetation and can be distinguished from other chytrids by the bright orange lipid droplets found in the sporangia (Webster & Weber, 2007).

**Species:** *Nowakowskiella*

Species of *Nowakowskiella* are widespread saprotrophs in soil and on decaying aquatic plant debris (Webster & Weber, 2007).

**Species:** *Spizellomyces*

Members of this order differ from the Chytridiales in possessing zoospores which contain more than one lipid droplet and are capable of limited amoeboid movement. Thalli are generally monocentric (Webster & Weber, 2007).

**Genus:** *Olpidium*

About 30 species of *Olpidium* are currently exist. Typical species are holocarpic. Some are parasitic on fungi and aquatic plants or algae, or saprotrophic on pollen. Others parasitize rotifers nematodes and their eggs moss protonemata or leaves and roots of higher plants (Webster & Weber, 2007).

**Genus:** *Rhizophlyctis*

There are about 10 known species of *Rhizophlyctis* with monocentric eucarpic thalli, growing as saprotrophs on a variety of substrata in soil, freshwater and the sea (Webster & Weber, 2007).

**Order:** *Neocallimastigales*

A very interesting and unusual group of zoosporic fungi inhabits the rumens (foreguts) of ruminants (herbivorous mammals which regurgitate and masticate previously ingested food) like cows, sheep and deer. They have also been found in some non-ruminants such as horses and elephants and probably occur in the guts of many large herbivores. These fungi are obligate

anaerobes which can flourish in the rumen because oxygen is depleted there by the intense respiratory activity of a dense population of protozoa and bacteria, some of which are facultative anaerobes capable of scavenging free oxygen (Webster & Weber, 2007).

**Order:** *Blastocladales*

Species belonging to the Blastocladales are mostly saprotrophs in soil, water, mud or aquatic plant and animal debris, and some are pathogens of plants, invertebrate animals or fungi. The zoospore of Blastocladales has a single posterior flagellum of the whiplash type (Webster & Weber, 2007).

**Genus:** *Allomyces*

Species of *Allomyces* are found in mud or soil of the tropics or subtropics, including desert soil, and if dried samples of soil are placed in water and 'baited' with boiled hemp seeds, the baits may become colonized by zoospores (Webster & Weber, 2007).

**Genus:** *Blastocladella*

About a dozen species of *Blastocladella* have been isolated from soil or water, and one is parasitic on the cyanobacterium *Anabaena*. The form of the thallus is comparatively simple, resembling that of some monocentric chytrids. There is an extensive branched rhizoidal system which is attached either to a sac-like sporangium or to a cylindrical trunk-like region bearing a single sporangium at the tip.

**Order:** *Monoblepharidales*

This group includes about 20 species and is represented by 5 genera, namely *Monoblepharis*, *Monoblepharella*, *Gonapodya*, *Oedogoniomyces* and *Harpochytrium*. Fungi belonging to this order can be isolated from soil samples or from twigs or fruits submerged in freshwater, sometimes under anoxic conditions.

**Genus:** *Monoblepharis*

Species of *Monoblepharis* occur in quiet silt-free pools containing neutral or slightly alkaline water on waterlogged twigs on which the bark is still present. Twigs of birch, ash, elm and especially oak are suitable substrata, and although samples taken at varying times throughout the year may yield growths of the fungus, there are two main periods of vegetative growth, one in spring and another in autumn, with resting periods during the summer and winter months. Low temperatures appear to favour asexual development and good growth can be obtained on twigs incubated in dishes of distilled water at temperatures around 3 °C. The mycelium is delicate and vacuolate. The hyphae are multinucleate. During the formation of a sporangium, a multinucleate tip is cut off by a septum. The cytoplasm cleaves around the nuclei to form zoospore initials which are at first angular and then later pear shaped. The ripe sporangium is cylindrical or club-shaped and may not be much wider than the hypha bearing it. A pore is formed at the tip of the sporangium through which the zoospores escape by amoeboid crawling. The free zoospores swim away. On coming to rest, a zoospore encysts and germinates by emitting a germ tube. The single nucleus of the zoospore cyst divides and further nuclear divisions occur as the germ tube elongates.

## **REFERENCES**

Webster, J., & Weber, R. (2007). *Introduction to fungi*. Cambridge, UK: Cambridge University Press.