

Division 3: Amastigomycota

This division is divided according to **the sexual spore** in to sub divisions:

Subdivision1: Zygomycotina (produce thick- wall resting spores called **zygospores**).

Subdivision2: Ascomycotina (the spores are formed inside sac like structure called **ascus** and the spore called **Ascospore**; the sac contain 4 or more of ascospores).

Subdivision3: Basidiomycotina (the spores are formed on structure with 4 sterigmata; each sterigma with one **basidiospore**).

Subdivision4: Deutromycotina (these fungi are with no sexual spores; they reproduce asexually).

Subdivision1: Zygomycotina

Class1: Trichomycetes

The Trichomycetes are a group of fungi which grow commensally in the guts of terrestrial, freshwater and marine arthropods such as insects, millipedes and crustaceans. In most cases there is little evidence that the host is harmed by their presence, although it has been shown that some species may extend parasitically into the ovarian tissue to form chlamydospores (cysts) in place of eggs. These are deposited amongst egg masses laid by uninfected females.

Class2: Zygomycetes

General characteristics:-

- 1- Most zygomycetes produce a well- developed mycelium consisting of coenocytic hyphae with chitinchitosan in hyphal wall.
- 2- Producing a thick- wall resting spore called a zygospore that develops within a zygosporangium formed as a result of complete fusion of two equal or unequal gametangia.

3- Asexual reproduction by production sporangiospores or aplanospores.

4- Most of zygomycetes are saprobes, such as bread-mold, others are parasites such as Fly fungi, and some are obligate parasites in other zygomycetes or facultative parasites in plants.

Classification of class zygomycetes:

Traditionally, most authors have divided this class into three orders:

Order 1: Mucorales

Order 2: Entomophthorales

Order 3: Zoopagales

Order 1: Mucorales

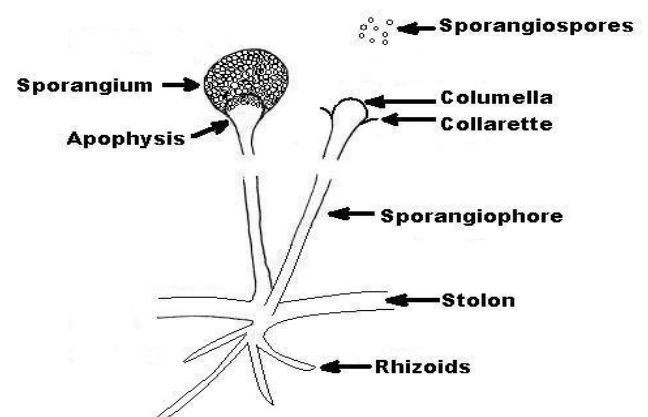
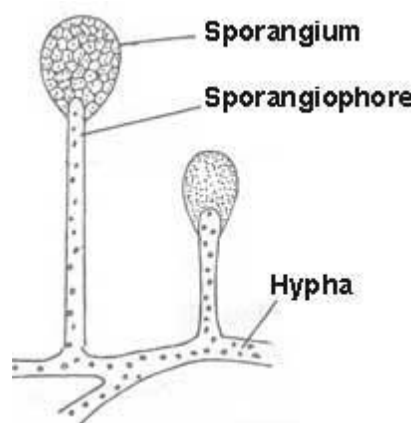
General characteristics:-

1- Most of Mucorales are saprobes, living on decaying plant or animal matter.

2- Some of zygomycetes produce organic acids such as oxalic, lactic and succinic acids.

3- Few of zygomycetes are parasites such as *Rhizopus stolonifer* or saprobes in fruits during the storage. *Mucor* and *Rhizopus* are causing mucormycosis.

4- classified in to genera according to asexual sporangium.



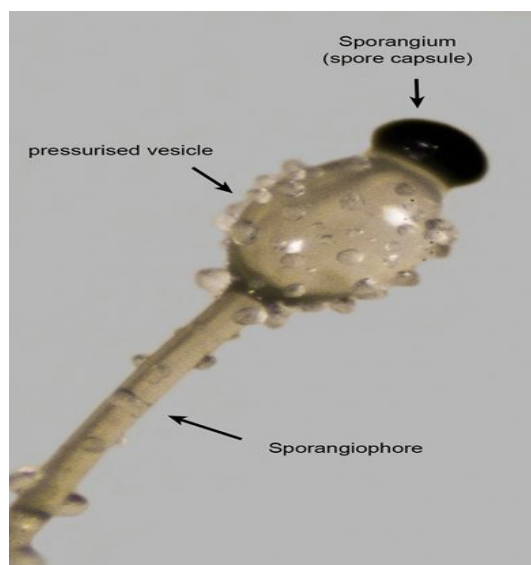
Mucor sp Rhizopus stolonifer

Asexual Reproduction:

The Mucorales reproduce a sexually by aplanospores that are produced in sporangia. The sporangia are borne on simple or branched sporangiophores. Such sporangium is formed at the tip of a sporangiophore as globose swelling into which nuclei and cytoplasm have moved from the somatic hyphae below. The part of sporangiophore within sporangium is called columella. Sporangium contains many thousands of sporangiospores.

Genus: *Pilobolus*

life cycle of *Pilobolus* begins with a black sporangium that has been discharged onto a plant substrate such as grass. A herbivorous animal such as a horse then eats the substrate, unknowingly consuming the sporangium as well. The *Pilobolus* sporangium survives the passage through the gastrointestinal tract without germinating, and emerges with the excrement. Once outside its host, spores within the sporangium germinate and grow as a mycelium within the excrement, where it is a primary colonizer. Later, the fungus fruits to produce more spores. The asexual fruiting structure (the sporangiophore) of *Pilobolus* species is unique. It consists of a transparent stalk which rises above the excrement to end in a balloon-like subsporangial vesicle. On top of this, a single, black sporangium develops. The sporangiophore has the remarkable ability of orienting itself to point directly towards a light source. The subsporangial vesicle acts as a lens, focusing light via carotenoid pigments deposited near the base of the vesicle. The developing sporangiophore grows such that the maturing sporangium is aimed directly at the light.



Pilobolus

In this order the sporangia are developed toward decreasing in size and in the number of sporangiospores and in some cases reach to one spore - conidium-. We can distinguish two groups:-

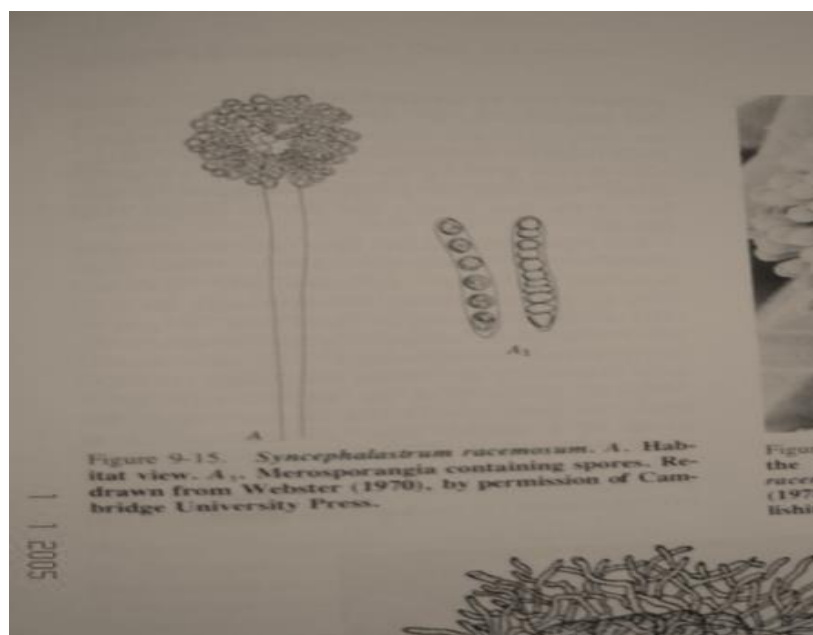
Group 1:- Which contains globose form called sporangiola as in genus *Thaminidium*, the sporangiophore is branched dichotomously, first branch bearing normal sporangium and the other bearing sporangiola which contains a few numbers of spores between 6-10 and it does not contain columella also it is small in size.

In *Choanephora* there are three types of sporangia:

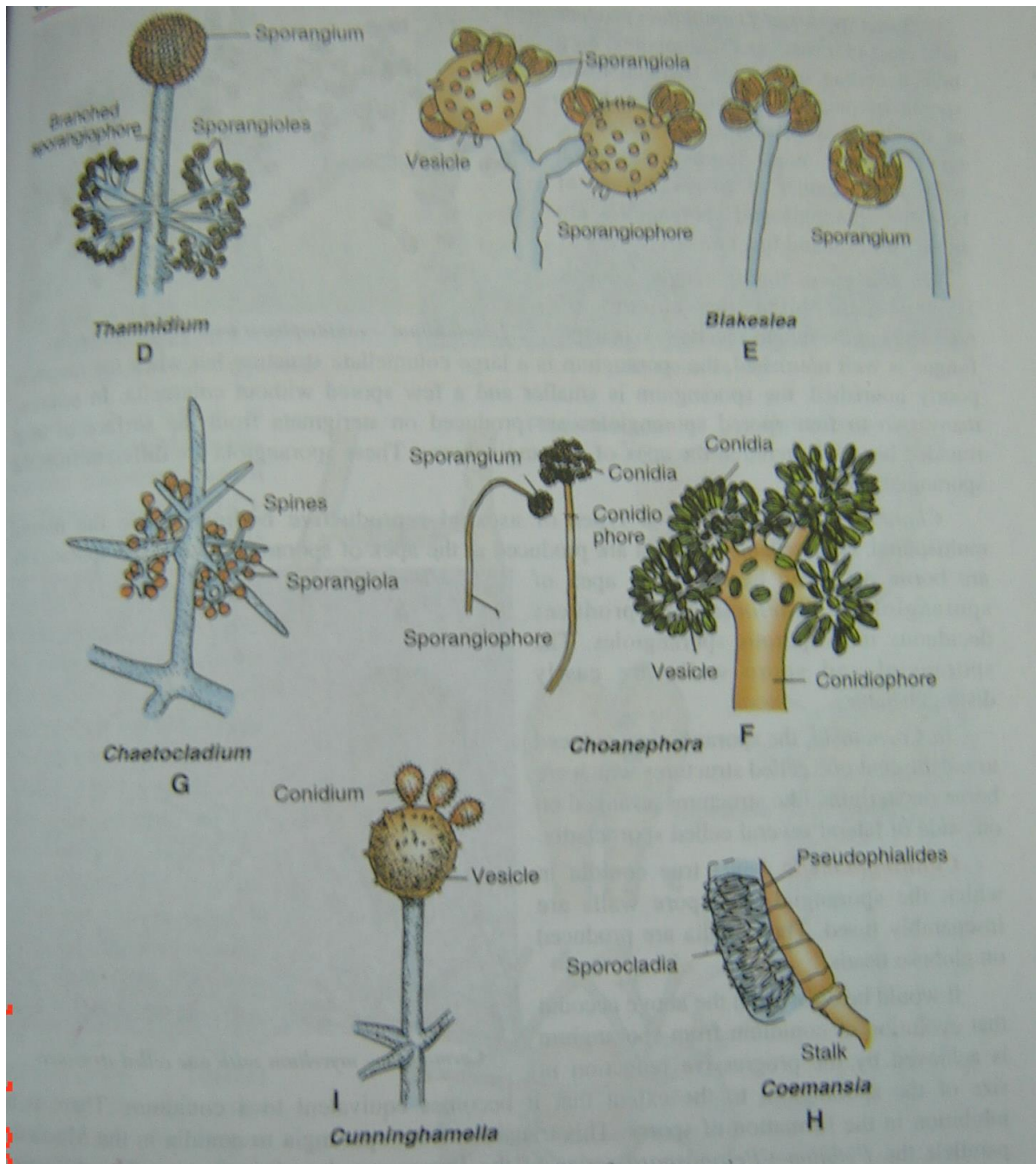
- Large multisporous sporangium with columella.
- Smaller, few spored sporangium lacking columella.
- Sporangiola with only three spores and there is no columella.

The monosporous sporangiola of some species are extremely difficult to distinguish from true conidia such as in *Cunninghamella*.

Group 2: A number of Mucorales produce their spores in cylindrical sporangiola that we call merosporangia. Merosporangia may be borne on the surface of an inflated sporangiophore tip and radiate out or they may be formed on sporocladia such as in *Syncephalastrum*. While, in *Kickxella*, the merosporangia contain only one spore bearing on pseudophialides.



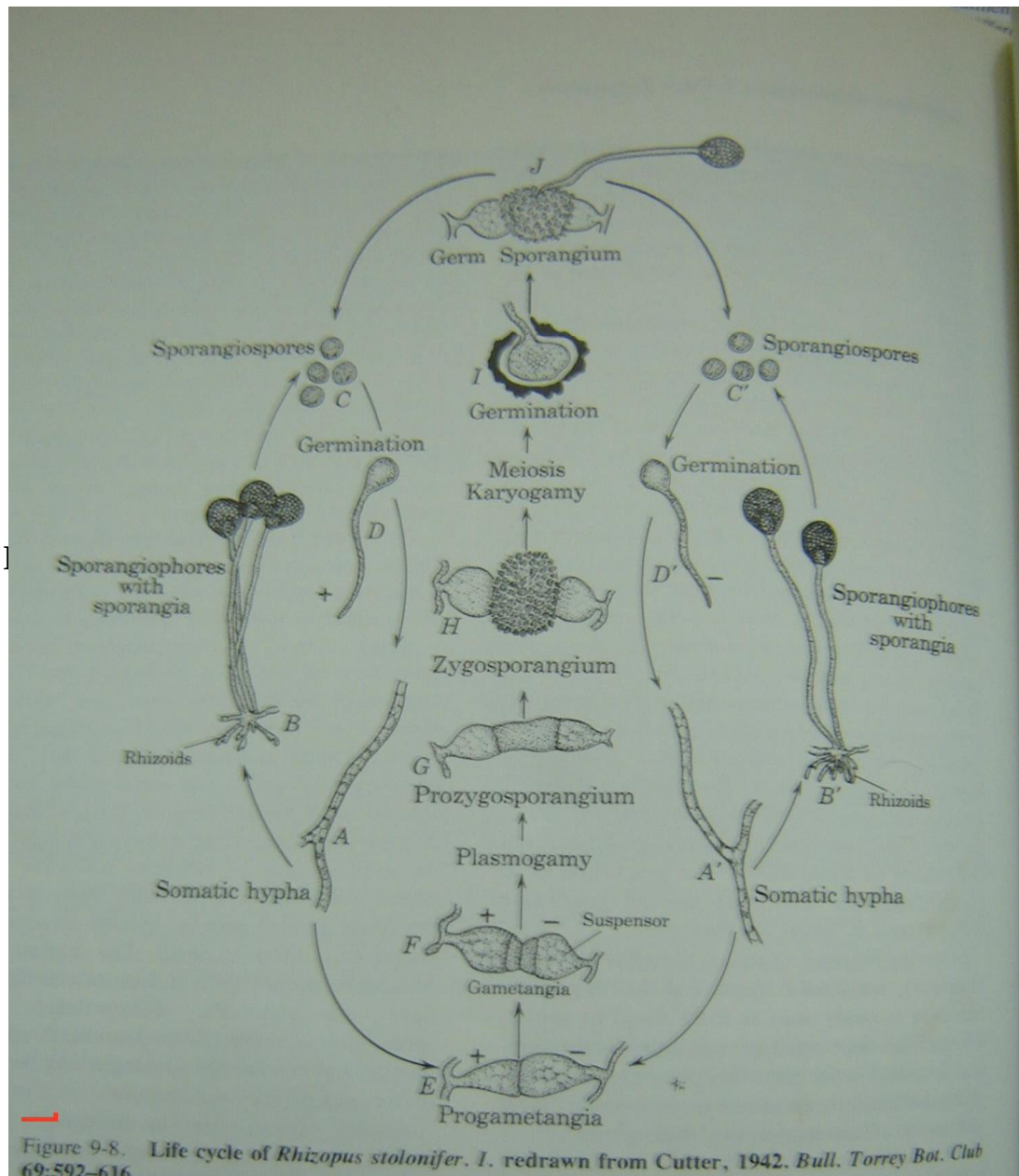
Merosporangium



Type of asexual sporangium of some Mucorales genera

Sexual reproduction:

Sexual reproduction in the Mucorales takes place by the copulation of two multinucleate gametangia that are mainly similar in structure, but that may differ in size. The first step leading to the formation and fusion of these gametangia involves the formation of special hyphae called zygomorphs of sporangia in order Mucorales. The tips of the two zygomorphs as well as those from progametangia.



Life cycle of *Rhizopus stolonifer*

A septum termed the gametangial septum then forms near the tip of each progametangium, separating it into two cells, a terminal gametangium and a suspensor cell.

The fusion septum then dissolves; plasmogamy and Karyogamy are take place forming prozygosporangium. It enlarges, develops a thick multilayered wall, and becomes the zygosporangium in which single zygospore develops.

Order 2: Entomophthorales

Many of these fungi are parasites in insects. The most familiar species is *Entomophthora muscae* commonly called the fly fungus, which is often found on the dead bodies of house flies clinging to long unwashed window panes in attics, garages, and university classrooms. If you examine such a fly you will find a wide, white, halo –like zone on the glass surrounding the dead fly. The white zone consists of spores -conidia- that have been shot off the sporogenous cells growing out of the body of the fly.

The spores, which are produced singly at the tips of unbranched sporogenous cells, are covered by a mucilaginous substance and adhere to any object. If this spore contacts another fly, it quickly germinates and penetrates the cuticle of the body. Infected fly usually die within a week or so after infection and the sporulation process is repeated.

Sexual reproduction in *Entomophthora* takes place when hyphal bodies acting as gametangia, copulate and develop a zygosporangium containing a zygosporangiospore.