Ch-5

Phylum Zygomycota

Phylum zygomycota consists of two classes.

1- Zygomycetes:-

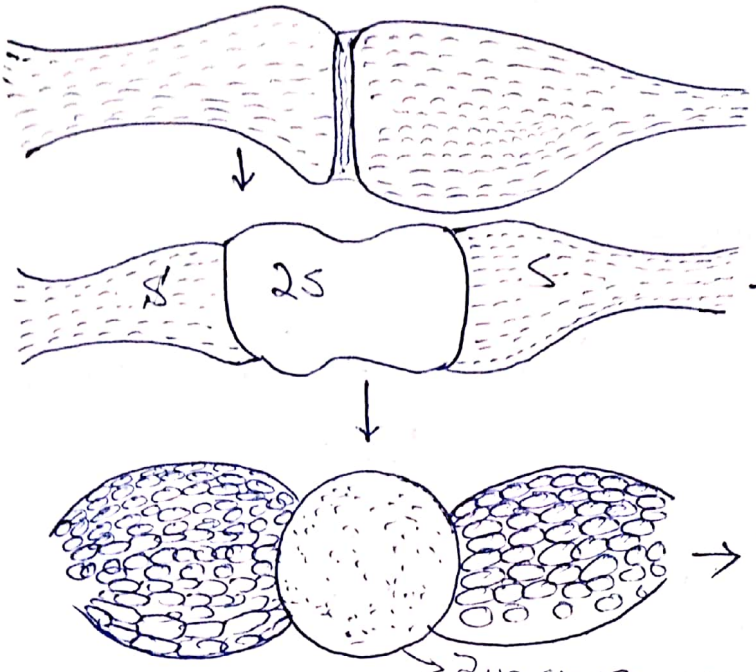
2- Trichomycetes: these are ecologically and morphologically different from all other fungi.

The principle characteristic that distinguishes class zygomycetes from all other fungi is the production of thick-walled resting spore called zygospore. Zygospore has been taken from two greek words i.e. zygos = yolk; + spora = seed or spore. Three main characters are the principal distinguish factors, these are;

1- Presence of coenocytic mycellium.
2- Asexual reproduction of sporangiospore.
3- Absence of flagellated cells and centrioles.

Some species having the capacity to grow as either mycelia or yeasts as said to be dimorphic.

Asexual reproduction in zygomycetes may be by means of sporangiospores and in Entomophthorales, by conidia. Some species may produce chlamydospores, oidia and arthrospores in addition. Typical zygomycete sporangia are a relatively large, usually columellate structure (a sterile structure within the sporangium; typically an extension of the sporangiophore) that is borne terminally on a specialized hyphs termed as sporangiophore. The entire contents of the sporangium eventually is divided by a cleavage process into individual uninucleate segments that secrete walls around themselves and develop into spores.



→ Progametangia: (Two compatible zygophores contact one another, their tips swell to form a transverse septum)

→ Young zygosporangium and suspensors (Septum then form to wall off a gametangium at the tips of each gametangium the remainder of which is suspensor)

→ Mature zygosporangium and suspensor

Zygosporangium.

Sporangium may contain from as few as 50–100 spores to possibly as many as 100,000. Some time zygomycetes produce small zygosporangi-um which are called sporangiola (they have maximum of 30 spores). Sporangiola are cylin-drical to elongate in shape. Uniseriate sporangiola are referred as merosporangia.

Zygomycetes fungi can be isolated from soil, dung, fruits, flowers, stored grains, fleshy plant organs, mushrooms, invertebrates and vertebrates, including humans. Zygomycetes range from saprob-es to obligate parasites. Some species of zygomycetes are called "sugar fung;" because these species/fungi do not have enzymes that could not break complex carb-hydrates. Some fungi of zygomycetes are called "fungus shotgun" of pilobo-lus, they are called as, because they forcefully discharge the zygospore.

classification

According to some classification systems, zygomycetes have

three orders; Mucorales, Entomophthorales and Zoopagales. However, new classification system refer four more orders of this class.

Mucorales

This has largest number of species Mucoralean species have a well-developed mycelium that is generally aseptate. The members of this order are differentiated from other orders on the basis of asexual and sexual reproductive structures as well as by their relatively nonspecialized associations with other organisms. most species of mucoralean are saprobes in soil, dung, humus and other organic debris. Mucorales has important group of fungi having importance in the industry and agriculture. For example, Rhizopus stolonifer is destructive pathogen of strawberries during shipping and marketing, and may damage sweet potatoes during storage, causing soft rot condition. Mucor racemosus is another species that causes storage rots of a variety of fruits and vegetables. Some species of Rhizopus and mucor are pathogenic to humanbeings. However, some species are pathogen to mushroom. From industrial point of view, Rhizopus stolonifer is being used in the production of many industrial products.

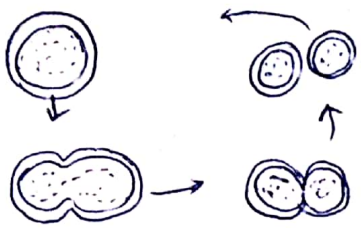
These products are; amylases, rennins, organic acids, and various secondary metabolites. Among organic acids, fumeric acid, lactic acid, citric acid and succinic acid are important produced from Rhizopus and Mucor fungi of order Mucorales. Cheese and flavours are also produced from Mucorales.

Somatic Structure:-

is well developed, and with coenocytic hyphae. Anastomoses (Hyphal fusion of particular species with each other) is rare in Mucorales. Multinucleate, Gametangium is present. Delimiting septa are present in a number of species. Rhizoids are present in Mucorales. Rhizoids are connected by intervening hyphs called "Stolon", therefore, particularly R. stolonifer is called stolonifer because it has stolon. Dimorphism is common in the Mucorales i.e. presence in the form of both yeast and mycellium (dimorphism).

Asexual Reproduction

Spores are produced in large sporangia or smaller sporangiola. sporangia or sporangiola are produced on the sporangiophore, at their tips. When the asexual reproduction starts, the spore starts invagination or cleavage occurs endogenously. Afterthat, spore devides into two new spores. cleavage membrane becomes the plasma membrane of newly borne spore. Through asexual reproduction, zygomycetes produce arthrospores, chlamydospores and yeast cells.



Asexual Reproduction

Sexual Reproduction :-

Mucorales contain both Homothallic and Heterothallic species that produce zygospores. Sexual reproduction starts from the germination of Gametangia that arise from regular somatic hyphae. Gametangia are also produced from zygophores. The production of zygophore is triggered by chemicals. These chemicals are just like Pheromones. When compatible zygophore or somatic hypha (having opposite mating types) fuse together, they form progametangia. The tips of progametangia fuse with each other and form fuse septum. After sometime, fuse septum is dissolved off and two progametangia mix their protoplast (plasmogamy). After plasmogamy, karyogamy takes place, and ultimately zygosporangium is formed. Zygosporangium then burst and zygospores are discharged. zygospores in the zygosporangium may be Homothallic or may be Heterothallic or both Homothallic and Heterothallic. Meiosis occurs with in the zygospore or upon germination. zygospore again germinates, form the germ tube, which then converted to Hyphs or zygophore and so on.

Families of order mucorales

order mucorales have (14) families.

Order Entomophthorales:-

The fungi belong to this order are insect Pathogens. They attack mites, nematodes and other invertebrate animals. The fungi of this order usually live in the warmer climate. The organism of this order are usually motile and forcibly discharge propagules. Asexual reproduction is by means of propagules (spores or conidia). This order has one important family i.e. Entomophthoraceae, of which members are insect-pathogens.

Order Zoopagales:-

This order comprised of fungi with interactions that involve a variety of small animals and other fungi, although the mycoparasitic species are observed most often. While at least three species of animal associated families are extremely common, few mycologists have seen them, probably because these fungi are quick to sporulate, ~~emp~~ ephemeral, very small, and difficult to culture. This order has three families.

order Glomales:-

Members of order Glomales are often referred to as "VAM fungi" because they form so called vesicular-arbuscular mycorrhizae, also

Sometimes known as endomycorrhizae. It has been estimated that Vesicular-arbuscular mycorrhizae can be found in about 70% of all plant families. Members of order Glomales form mycorrhizal relationships with most agronomically important angiosperms, some gymnosperms, as well as certain bryophytes and pteriodophytes and even a few algae. VAM fungi do not change the external morphology of the roots of their higher plant partners and produce neither a mantle nor a Rarting networks. The hyphae grow both between and into cortical cells by penetrating the wall and causing invagination of the plasma membrane. They produce coils, highly branched haustorium-like structures called arbuscules and in some cases terminal swellings called vesicals. Vesicals are formed either between or within host cell walls and are thought to function as energy stores for use by the fungus when the supply of host metabolites is low. Arbuscules are highly branched hyphae that extended through through host cell wall, greatly invaginating the host cell plasma membrane. The branches of these specialized hyphae create a large surface area between the fungus and the host cell plasma membrane and appear to be involved in the bidirectional transfer of metabolites

and nutrients by the two mycorrhizal part-
ners. However, arbuscules remain alive only for
a few days before disintegrating and being
digested by the cells of the plant. Consequ-
ently, in a Realthy mycorrhizal relationship
there is a continuous sequence of development
and disintegration of arbuscules.

In return for a source of carbohydr-
ates, VAM fungi appear to provide significant
benefits for their partners. Their hyphae
extended into the soil away from roots and
greatly increase the potential for the abs-
orption of water and the uptake of phos-
phorous and other nutrients by the plant.
It also has been suggested that hyphae
of VAM fungi may absorb and transfer
metabolites from other fungi, bacteria,
actinomycetes, algae and cyanobacteria in
the rhizosphere, to their associated plants.
There is evidence to suggest that endomyc
rrRizal associations contribute to the resis
tance to certain root pathogens including
various fungi and nematodes by production
of antibiotic substances. The order Glomal
Res six endomycorrhizal genera. All
fungi of this order ~~belong to~~ reproduce
through asexual reproduction. Because the
fungi belonging to order Glomales are
endomycorrhizal with many agronomically
important hosts, they have received considerable attention in recent years. Glomales
species are common soil fungi, but since
species produce their spores underground,
therefore, larger sporocarps of these fu
have been seen in soils, leaf litter
wet sieving and decanting of soil samples.

Glomalean are classified on the basis of somatic hyphae and arbuscles and vesicles. Methods of germination of spore is also used for the classification of Glomalean.

class-Trichomycetes

Fungi belong to class trichomycetes are morphologically and ecologically are distinct from all other fungi. All members of this class are associated with living arthropods, including insects, millipedes, and crustaceans. Most of the species of this class grow in the gut of their hosts; only one species occurs on the outer surface of arthropodes Most species of trichomycetes are also found in the ~~mid~~hindgut of organisms. The larger thalli of certain species may be so densely aggregated as to give the inside of the gut a furry or hairy appearance, hence the name Trichomycetes or "hairy fungi" given to these organisms. These fungi obtain their food from the gut-lumen in which they are bathed. On the other hand, because these fungi take their food from insect-pest, therefore can be used to control i.e. entomopathogenic, insect-pests. In simple words, these fungi kill the insect-pests (entomopathogenic). 40 genera of this class has been identified, thus far.

Morphology, life cycle, and classification

Trichomycetes are microscopic and macroscopic (can be seen with naked eye). septation may and may not be present in Trichomycetes. Asexual reproduction is by ambiod cells, arthrospores and Trichospore.

Asexual reproduction is completed into the tissues of the host in which Trichomycetes were associated or living. Hence, Trichospores are also produced in the tissues of ~~cell~~ host. Appendages of Trichomycetes are fused with each other (their appendages fused with each other at their tips) and produce the trichospores. In some other Trichomycetes spores are produced not at their tips, but are produced between the secreted holdfast, and spore is released from the side of the thallus.

Trichomycetes are capable of selecting their host. To protect from arthropod molting, Trichomycetes produce special type of structure/spore.

Sexual reproduction also takes place in Trichomycetes via conjugation process. Thick-walled sexual spores are produced over the zygosporophore. From, zygospore, thalli are produced. Zygospores are only produced in order Harpellales.

The End