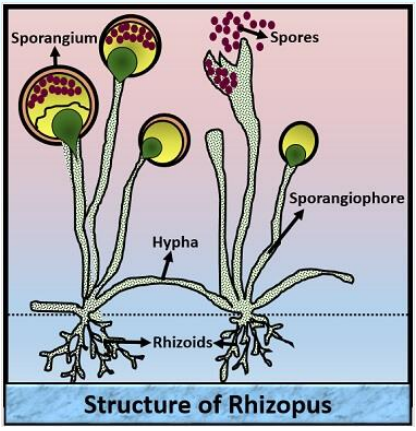
MYCOLOGY PART-4

3. ZYGOMYCOTA

- Derives its name from the thick-walled resting spores, the zygospores formed as a result of the complete fusion of the protoplasts of two equal or unequal gametangia.
- Comprises the first group of fungi which lacks any motile stage.
- The hyphal walls are chiefly composed of chitinchitosan.
- Most of them are saprobes.
- Some are soil saprophytes and others coprophilous (growing on dung).
- Septa also appear in connection with development of reproductive bodies or to seal off injuries.

- A few mycelia produces rhizoids (root like hyphal branches penetrate the substrare) and stolon (horizontal connenction hyphae).

  Eg., *Rhizopus*, *Mucor*, and *Phycomyces*



REPRODUCTION

- Asexual reproduction

ENTRI

- Sexual reproduction

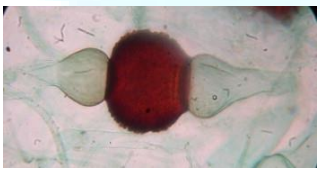
Asexual reproduction

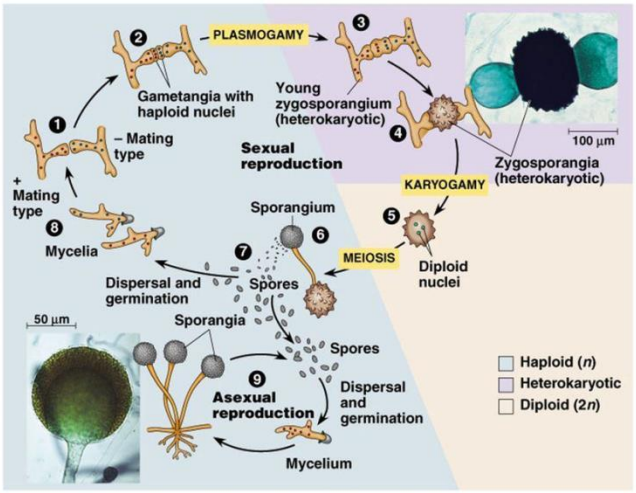
By means of non-motile sporangiospores commonly produced in large numbers within sporangia

- Sometimes the entire sporangium functions as a single spore in the same manner as the conidium.
  - Through chlamydospores- most frequent
  - Trichospores

Sexual reproduction

- Isogamous
- Sexual fusion involves gametangial copulation.
- The thick-walled sexually produced zygospore formed by the complete fusion of the protoplasts of two gametangia is a resting structure.
- Zoospore formation is absent.
- The zygospore germinates to produce a hypha, the promycelium which bears a terminal sporangium.
- **Zygospore** formation is the key feature of members of Zygomycota and it contain sporopollenin, a complex polymer found in outer layer of pollen grains.





CLASSIFICATION

Two classes:

i. Zygomycetes
ii. Trichomycetes

Zygomycetes

- Saprobs on plants or animal debris
- Parasite or symbiont
- Zygospores, sporangiospores or conidia are produced.
- E.g., *Rhizopus, Mucor*
- Pilobus is a genus of fungi that commonly grows on herbivore dung.

Trichomycetes

- Parasites or commensals or obligate symbionts of terrestrial, freshwater and marine arthropods.
- Holdfast present
- Produce trichospores

- E.g., *Smittium species*

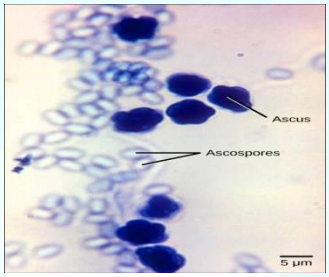
ECONOMIC IMPORTANCE OF ZYGOMYCOTA

- Active decomposers
- Known as "sugar fungi", due to saprobs on carbohydrates.
- Mycorrhizal association
- Some members active producers of organic acids, such as fumaric acid, lactic acid etc..
- *Rhizopus oryzae* – fermentation for production of rice wine.
- Causes disease in plants, animals and insects.

4. ASCOMYCOTA

- Commonly known as sac-fungi.
- They are produced in a sac-like structure known as an ascus. Each ascus contains 4-8 ascospores
- Produce sexual non-motile spores known as ascospores.
- One of largest phylum of kingdom fungi, with around 64,000 species.
- Mostly they are terrestrial, parasitic or coprophilous.
- They are unicellular or multicellular fungi
- The mycelium is made up of septate and branched hyphae.
- The cell wall is made up of chitin or β-glucans.
- There is cytoplasmic continuity due to septal pores.
- Asexual reproduction is by the formation of conidia exogenously on conidiophores.
- Yeast reproduces asexually by budding.
- Sexual reproduction is by conjugation between two gametangia. They are either homothallic or heterothallic

- The fruiting body is known as ascocarp.
- There are four types of ascocarps:
  i. Cleistothecium- The fruiting body is spherical and remains tightly closed, e.g. Aspergillus
  ii. Perithecium- The fruiting body is flask-shaped with one external opening, e.g. Neurospora
  iii. Apothecium- The fruiting body is cup-shaped and asci are present in hymenium, e.g. Peziza
  iv. Ascostroma- There is no differentiated fruiting body. Asci are present in the stroma, e.g. Mycosphaerella



REPRODUCTION

- Vegetative reproduction
- Asexual reproduction
- Sexual reproduction

Vegetative reproduction

- Fragmentation
- Fission
- Budding

Asexual reproduction

1. Conidia

2. Oidia
3. Chlamydospores

Conidia

- Exogenously produced.
- Non-motile spores.
- They are typically formed at the ends of specialized hyphae, the conidiophores.
- Conidiospores commonly contain one nucleus and are products of mitotic cell divisions and thus are sometimes called as mitospores, which are genetically identical to the mycelium from which they originate.
- The diverse conidia and conidiophores sometimes develop in asexual sporocarps with different characteristics (e.g. *acervulus, pycnidium, sporodochium*)
- Some species of Ascomycetes form their structures within plant tissue, either as parasite or saprophytes. These fungi have evolved more complex asexual sporing structures, probably influenced by the cultural conditions of plant tissue as a substrate. These structures are called the sporodochium. This is a cushion of conidiophores created from a pseudoparenchymatous stroma in plant tissue.
- The pycnidium is a globose to flask-shaped parenchymatous structure, lined on its inner wall with conidiophores.
- The acervulus is a flat saucer shaped bed of conidiophores produced under a plant cuticle, which eventually erupt through the cuticle for dispersal.
- Synnemata is elongated fruiting body in which the conidiophores remain very closely applied to each other.

Oidia

- A single celled asexual spores produced by fragmentation of fungal hyphae

Chlamydospores

- Thick walled resting spores

SEXUAL REPRODUCTION IN ASCOMYCETES

- Two different mating types hyphae come together and fuse.
- Plasmogamy takes place, but it does not follow karyogamy immediately
- The fused structure contains two haploid nuclei from each parent, i.e. dikaryon
- New hyphae are produced with dikaryotic cells.
- At the tip of the hyphae, asci develop in the ascocarp
- In each ascus, two nuclei fuse together (karyogamy) to form a diploid zygote
- Formation of Ascospores: The diploid zygote undergoes meiosis to form 4 haploid nuclei, which undergo mitotic division to form 8 haploid nuclei. Each of the nuclei accumulates cytoplasm and a thick cell wall surrounds it. These are known as ascospores
- Ascospores are released from asci through pore, slit or hinged lid and dispersed by air currents

Under favourable conditions, ascospores germinate to form new mycelia.

ECONOMIC IMPORTANCE OF ASCOMYCETES

- Entire brewing, bread and cheese making industry depends on yeast for fermented products.
- Who doesn't know about antibiotic, Penicillin, which we get from *Penicillium chrysogenum*.
- *Ciclosporin*, an immunosuppressor is derived from the fungus *Tolypocladium niveum*. It is used in organ transplants and autoimmune diseases
- Many organic acids and enzymes are produced by ascomycetes, e.g. citric acid, gluconic acid, amylases, proteases, etc.
- *Claviceps purpurea* (Ergot) is used as medicine to stop excessive bleeding during menstrual periods and to speed up labour

- Different kinds of cheese are prepared from different *Penicillium species*, e.g. Camembert, Brie, Roquefort, etc.
- *Aspergillus* is used to prepare soy sauce and to prepare other Asian alcoholic beverages
- Morels, Truffles and lobster mushroom are used as fungal delicacies
- *Neurospora*, *Saccharomyces*, etc. are widely used to study genetics