

Fungi

Mycology (mykos=mushroom; logos=discourse): Branch of science that deals with the study of fungi is called mycology.

Definition of fungi: “a group of those plants whose form is a thallus, build up of single cell or cells that possess definite cell wall and nucleus but lack of chlorophyll”.

General characters of Fungi:

1. Fungi is a large group that includes more than 1,00,000 species distributed the world. They are ubiquitous.
2. They lack chlorophyll and cannot synthesize their foods.
3. The most usual habitat of fungi is wet soil rich in humus. A few forms are aquatic.
4. Fungi exhibit heterotrophic mode of nutrition.
5. They either parasites or saprophytes.
6. The parasites may be ectoparasites or endoparasites.
7. Some fungi are symbiosis. Eg. Lichen and Mycorrhiza
8. Parasitic fungi produces haustoria to absorb their nutrient from living protoplast.
9. The plant body is thalloid . The thallus may be unicellular or multicellular.
10. In most of the cases, thallus consists of long, tubular, branched filaments called hyphae, the mass of hyphae is called mycelium.
11. Fungal hypae made up of definite cell wall. The cell wall composed of fungal cellulose, chitin, pectose or any related materials.
12. The cell wall encloses protoplast which is differentiated into plasma membrane, cytoplasm, nucleus and vacuoles. Besides, there are other cytoplasmic inclusions such as mitochondria, endoplasmic reticulum, golgi apparatus and ribosomes.
13. The reserve food material is glycogen or oil droplets.
14. In some fungi, the cytoplasm is continuous in the entire mycelium and the cross wall (septa) are not formed. Such condition is called aseptate. The aseptate mycelium is usually multinucleate and this condition is called **coenocytic**. If the cytoplasm of mycelium is divided by cross walls, the condition is called septate and multicellular.
15. The septa possess pores. Pores may be simple pore or complex (dolipore).

16. Each cell of the multicellular mycelium may be uninucleate, binucleate (dikaryotic) or multinucleate.
17. Presence of flagella in motile bodies is the characteristic feature of some lower fungi. The motile bodies are called zoospores. They may be unflagellate (with one flagellum) or biflagellate (with two flagella). Flagella may be tinsel and whiplash type.

Reproduction in Fungi:

Fungi reproduce by asexual and sexual methods:

If the plant body is unicellular, the complete vegetative body transformed into reproductive body it is called **holocarpic**. If a portion of vegetative thallus is transformed into reproductive structure, the condition is called **eucarpic**.

A. Asexual reproduction: The kind of reproduction which does not involve meiosis and fusion is called asexual reproduction. It occurs by the following methods:

1. **Fragmentation:** The fungal mycelium gets broken into small pieces or fragments accidentally or through external force. Each piece or fragment develops into new individual. This type of reproduction is very common in fungi.
2. **Budding:** The parent cell produces one or more bud-like protuberances or outgrowths which detach from parent cell and grow into new individual. Such type of reproduction is very common in Yeast.

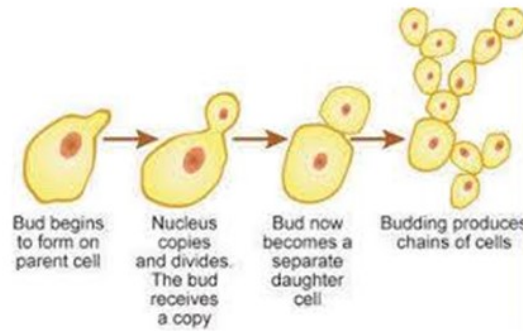


Fig: Budding in Yeast

3. **Fission:** The parent cell splits into two equal halves by a constriction and formation of cell wall and each half develops into a new individual. Example: Yeast.

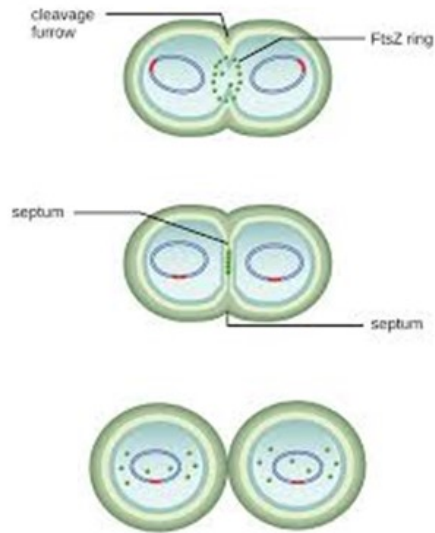
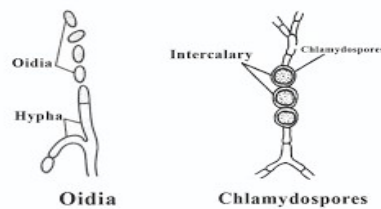


Fig: Fission

4. **Oidia:** The hypha breaks up into its component cells or small pieces which behave like spores. These are called oidia. The oidia are generally thin walled and do not store reserve food materials. They germinate immediately after liberation and cannot survive under unfavourable conditions.



5. **Chlamydospores:** These are thick walled resting spores produced in the same manner as oidia. But they can store reserve food materials and are capable of withstanding long unfavourable conditions.

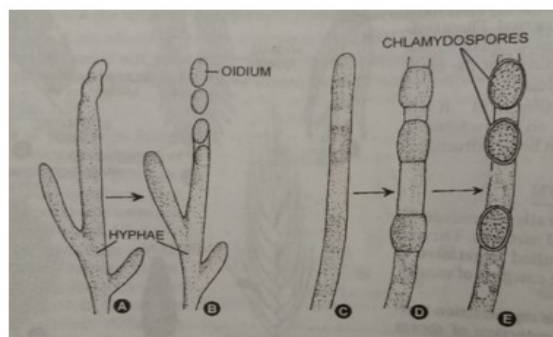


Fig: A-B Formation of Oidia; C-E Formation of Chlamydospores

6. **Spores:** Fungi reproduce most commonly by production of spores. These are minute propagating units which serve in the production of new individuals. They vary in size, shape and colour in different individuals. The asexual spores are of two types: (a) Sporangiospores and (b) conidia.

(a) **Sporangiospores:** These spores are produced inside the sac-like structures, called sporangia. Sometimes these spores are termed as endospores. If the sporangiospores are non-motile then they are called aplanospores (eg Mucor, Rhizopus etc.). If the sporangiospores are motile then they are called zoospores. The zoospores may uniflagellate or biflagellate.

(b) **Conidia:** These are non-motile spores produced singly or in chains by constrictions at the tip or lateral side of special hyphal branches called conidiophores. They are produced exogenously (not enclosed within sac like structure). The conidia germinate directly by giving out germ tubes. Sometimes the conidia behave like sporangia and called conidiosporangia.

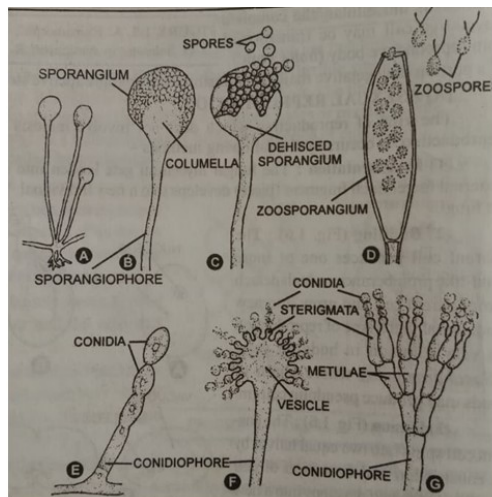


Fig A-C: Aplanospores; D: Zoospores; E-G: Conidia

B. Sexual Reproduction:

Sexual reproduction occurs in almost all the groups of fungi except in 'fungi imperfecti' or 'Deuteromycetes'. It involves union of two compatible nuclei of opposite sex at a definite stage in the life cycle of fungi. The sexual reproduction completed in three phases: i) plasmogamy, ii) karyogamy and iii) meiosis

1. **Plasmogamy:** it is the fusion of two protoplasts which brings the two compatible nuclei close together in a single cell. The resulting cell becomes dikaryon. The phenomenon is termed as dikaryotization.

2. **Karyogamy:** it is the fusion of two compatible nuclei brought together as a result of plasmogamy. The resulting diploid nucleus is called synkaryon.
3. **Meiosis:** The diploid nucleus divides by meiosis resulting in the formation of haploid nucleus. Usually meiosis occurs immediately after karyogamy.

Fungi may monoecious (bisexual) or dioecious (unisexual). The monoecious species produce the two sex organs on the same thallus (homothallic) whereas the dioecious species produce them on different thalli.

The sex cells are called gametes which are usually produced in sex organs called gametangia. If the male and female gametes are morphologically indistinguishable, they are called isogametes. If the male and female gametes are morphologically different then they are called heterogametes. The isogametes are produced in isogametangia and heterogametes are in heterogametangia, i. e. male and female gametangia. The male gametangium is usually called **antheridium** and the female gametangium is called **oogonium**. They are also known by different names in different group of fungi. In some cases, sex organs are not formed and the sexual fusion occurs between two vegetative cells.

Modes of Sexual Reproduction:

There are various modes of sexual reproduction in fungi, which can be categorised into the following types:

1. **Planogametic copulation:** The motile gametes are called planogametes. In this category of sexual reproduction either one or both the fusing gametes are motile (flagellated). Planogametic copulation may further be grouped under three categories:- (i) Isoplanogametic copulation: when both the fusing gametes are flagellated and morphologically similar; (ii) Anisoplanogametic copulation: when the two fusing gametes are flagellated and morphologically similar but differ in size and (iii) Ooplanogametic copulation: when the male gametes are flagellated (called sperms) and the female gamete is non-flagellated (called ovum or egg).

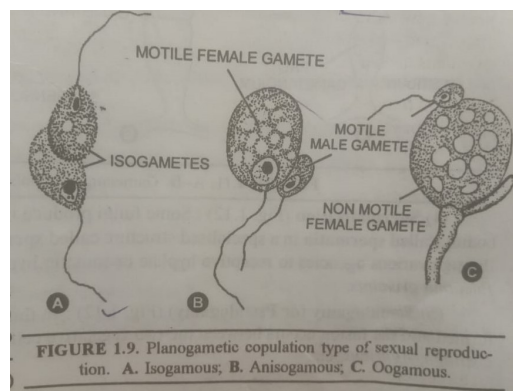


Fig: Planogametic copulation (a) Isogamous, (b) Anisogamous (c) Oogamous

2. **Gametangial contact:** it is a kind of oogamous reproduction where the male gametangia are called antheridia and female oogonia or ascogonia. The gametes are non-motile aplanogametes which are never released from gametangia. The male and female gametangia come in contact with each other. The male gametangium sends a tubular outgrowth, called fertilization tube that pierces through the wall of the female gametangium. Male nucleus or gamete enters into the female gametangium through this tube. In this mode of reproduction the two gametangia do not fuse with each other. Examples: *Albugo*, *Phytophthora*, *Pythium* etc.

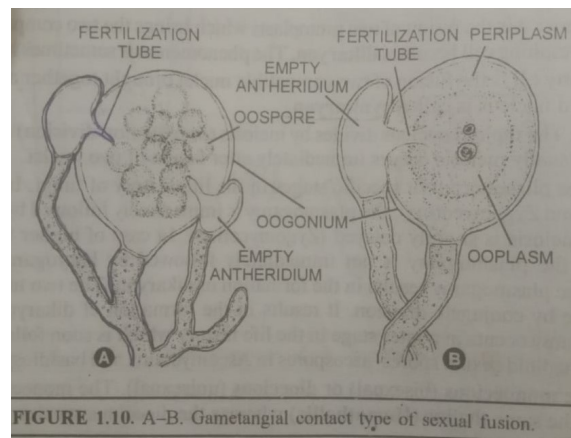


Fig: Gametangial contact

3. **Gametangial copulation:** In this mode of reproduction, the two gametangia fuse with each other and lose their identity in their sexual act. Example: *Rhizopus*, *Mucor*.

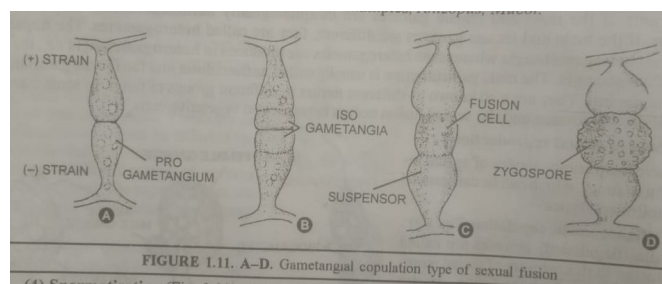


Fig: Gametangial copulation

4. **Spermatization:** Some fungi produce numerous, minute, uninucleate spore-like male bodies, called spermatia in a specialised structure called spermogonia (or pycnidia). These are transferred through various agencies to receptive hyphae or somatic hyphae treated as female gametangia. Example: *Puccinia graninis*.

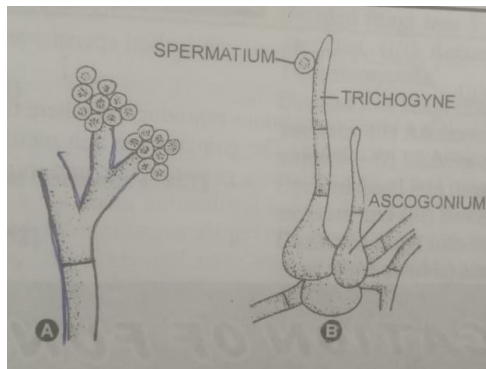


Fig: Spermatization

5. **Somatogamy (Pseudogamy):** In this mode of reproduction, the sex organs are not formed and the fusion occurs between the two vegetative cells resulting dikaryotization. Example: *Peziza*, *Agaricus* etc.

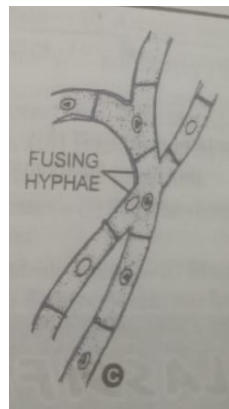


Fig: Somatogamy