ZYGOMYCOTINA

Rhizopus

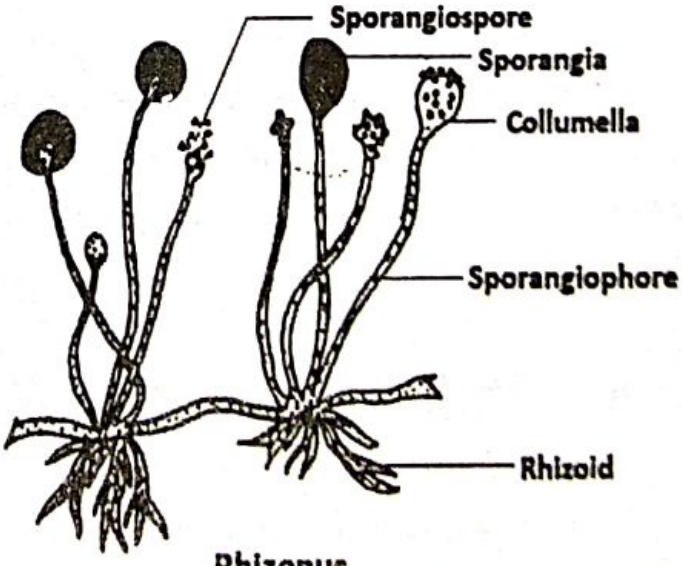
Classification

Kingdom	Fungi
Division	Eumycota
Subdivision	Zygomycotina
Class	Zygomycetes
Order	Mucorales
Family	Mucoraceae
Genus	*Rhizopus*

It is commonly called bread mould.

Thallus: The vegetative plant body is eucarpic and consists of white cottony, much branched mycelium. The mycelial plant body is differen-tiated into nodes and internodes . The internodal region is the aerial and arching hyphae, known as stolon, which when touches the substratum forms the nodal region. The nodal region bears much branched rhizoid grows downward, inside the substratum for anchorage and absorption of food.

Cell: The hyphal wall is microfibrillar and consists mainly of chitin-chitosan. In addition to chitin- chitosan, other substances like proteins, lipids, purines and salts like calcium and magnesium are also present in the hyphal wall.Inner to the cell wall, cell membrane is present which covers the protoplast.The protoplast contains many nuclei, mitochondria, endoplasmic reti-culum, ribosome, oil droplets, vacuoles and other substances. The size of the vacuole enlarges with age by coalescence of smaller vacuoles.



Rhizopus

Reproduction

Rhizopus Stolonifer reproduces by vegetative, asexual and sexual means.

Vegetative Reproduction:

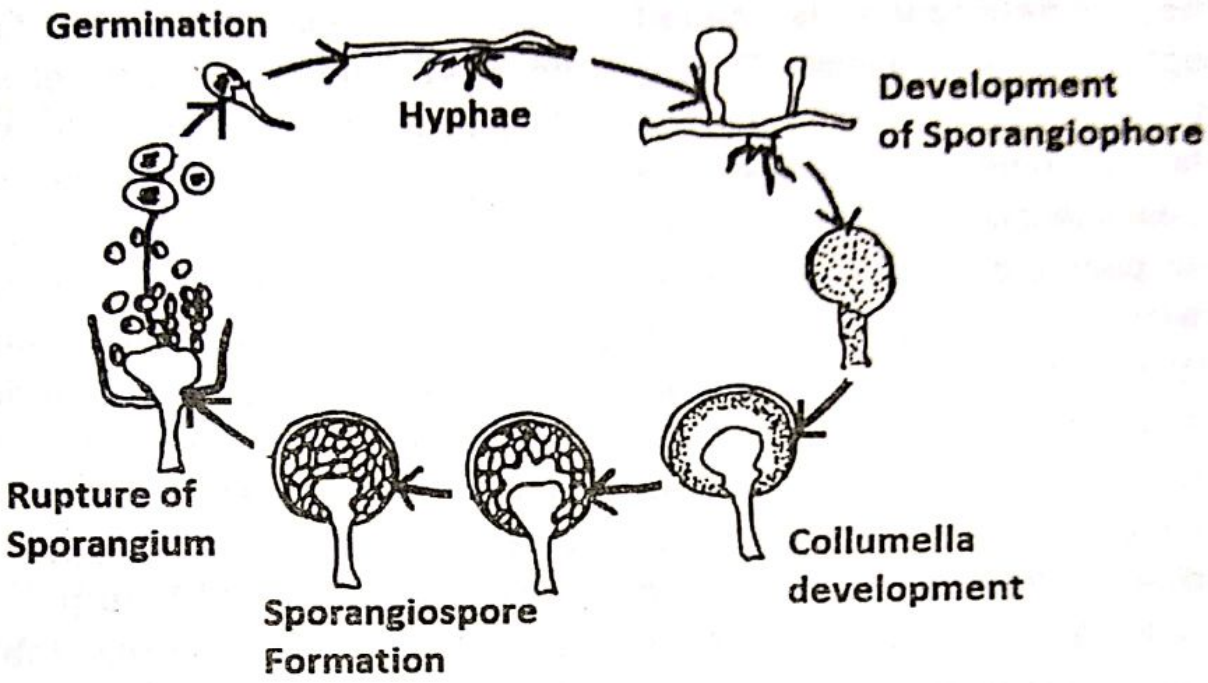
It takes place by fragmentation. Due to accidental breakage the stolon may break up into two or more small units. Each unit is capable of growing as mother mycelium.

Asexual Reproduction:

It takes place by the formation of sporangiospore and chlamydospore.

(a) Sporangiospore Formation:

During favourable condition, the non-motile spores such as sporangiospores or aplanspores are formed inside the spo-rangium. The sporangium develops singly at the apex of sporangiophore. The sporangiophore develops in tuft from the upper side of node opposite to the rhizoidal hyphae. Initially, a number of elon-gated hyphae develop aerially from the upper- side of the node which elongate upto a certain height.The nuclei and cytoplasm push more and more towards the apical side, consequently the apex of the aerial hyphae swells up. The swollen part enlarges and develops into a large round sporangium.With matu-rity, the protoplast inside the sporangium is differentiated into a thick dense layer of multi-nucleate cytoplasm towards the peripheral region just inside the sporangial wall, called the sporoplasm and a vacuolated portion with a few nuclei towards the centre, called columellaplasm. A series of small vacuoles then appears between the sporoplasm and columellaplasm. These vacuoles become flattened and coalesce to form a continuous cleavage cavity. This is followed by the formation of a septum towards innerside of the cavity. With further development, the septum becomes dome-shaped and pushes its way into the sporangium. Protoplast of the sporoplasm then undergoes cleavage to produce many small multinucleate (2-10 nuclei) segments. These segments are transformed into globose non-motile sporangiospores. After the maturation of spores, the wall of sporangium dries and columella collapses like an inverted cup with irregular surface. The sporangial wall breaks in different fragments leaving a portion as collar on the sporangiophore. The powdery mass of spores are exposed to the atmosphere. In ideal moisture and temperature, if the spores fall on suitable substratum, they germinate by germ tube to form new mycelia.



Asexual Reproduction

(b) Chlamydospore:

During unfavourable condition, thick-walled, nutrition-rich, intercalary mycelium segments arise by septation of mycelium, termed as chlamydospores. They get separated from each other when the connecting mycelium dries up. With the onset of favourable condition, the chlamy-dospore germinates and gives rise to a new mycelium.

Sexual Reproduction:

Sexual reproduction takes place during unfavourable condition by means of gametangial copulation. The gametangia look alike, but equal or unequal in size and, by conjugation, they give rise to zygospore. Most of the species of Rhizopus are heterothallic (*Rhizopus stolonifer*), but few species (*R. sexualis*) are homothallic. In heterothallic species, zygospores are pro-duced by the union of two gametangia deve-loped from mycelia of compatible strains,whereas, in homothallic species, the uniting gametangia develop from mycelia that derived from a single spore. When heterothallic species are cultured, two mycelia of compatible strain come near to each other, the mycelia produce small out-growth, called progametangia. The apical region of the two progametangia come in close contact. Nuclei and cytoplasm of each progametangium push more and more towards the apical region which swell up with dense protoplasm.The rear region becomes vacuolated. A septum is laid down separating the apical region, which is called gametangium; and the basal region, is called suspensor. The undifferentiated multi-nucleate protoplast

of the gametangium is called aplanogamete or coenogamete. There is much variation in size of the gametangium pairs. In some pairs, the uniting gametangia are equal in size, but in other pairs they are unequal. After maturation of gametangia, the common wall at the point of their contact dissolves and the protoplast of both the gametangia unite to form zygospore. The nuclei of opposite gametangia fuse together to form diploid (2n) nuclei and unpaired nuclei gradually degenerate. The young zygospore enlarges and probably secretes five layered (two in exospore and three in endospore) thick wall, which undergoes a period of rest. After resting period, the zygospore germi-nates. On germination, the innermost layer comes out after cracking the outer walls and produces a promycelium. With further develop-ment, the promycelium is differentiated into a lower stalk like germsporangiophore and an upper spherical germsporangium. Meiosis occurs during zygospore germi-nation and the haploid nuclei form haploid spores like sporangiospores inside the germsporangium. These spores are also known as meiospores. Each meiospore after liberation germi-nates like sporangiospore, and forms new myce-lium like mother thallus. Sometimes failure of gametangial copulation results in parthenogenic development of zygo-spore, by any one gametangium, called azygospore or parthenospore. It is however haploid in nature and its nuclei do not undergo meiosis before spore formation.