

RHIZOPUS - REPRODUCTION

Rhizopus reproduces by all the three means i.e. vegetative, asexual and sexual.

1. Vegetative: - The vegetative reproduction takes place through fragmentation. The actively growing mycelium is broken into fragments by an external agency. Each fragment grows into a new mycelium through apical growth.

2. Asexual Reproduction: - It multiplies asexually by producing 3 kinds of spores.

(i) Chlamydo spores - Chlamydo spores are produced during the unfavourable conditions of the environment, these are thick walled resting and highly resistant spores. The protoplasmic contents round off and develop thick walls around them. They are produced in intercalary positions in the hyphae. These are means for perennating the adverse conditions of the environment. On the onset of favourable conditions, they germinate to produce new mycelia. They have not been reported from R. stolonifer.

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(ii) Oidia: - Septum is developed in the mycelium which grows inside the liquid ~~me~~ medium such as sugar solution. It forms multinucleate segments which later on separate from each other. Each segment rounds off and ~~become~~ become oidia. The oidia grows in size and multiplies by budding like yeasts. This is known as "Torula stage" of Rhizopus. The oidia germinates to produce new mycelia. The oidia formation has been reported in R. oryzae.

(iii) Sporangiospores: - These are bluish black spores produced during the favourable conditions which are globose multinucleate and non-motile. These are enclosed by a thick, rigid single layered wall. The ~~outer~~ surface of the wall bears numerous ridges. Inside the cytoplasm, numerous nuclei, along with mitochondria, endoplasmic reticulum, ribosomes and dense membrane bound inclusions termed as cytosomes etc are present. These spores are also called aplanospores. The sporangiospores or aplanospores are produced inside the sporangia borne at the tip of

sporangiophore. The tufts of sporangiophores arise from each node opposite to the rhizoids. The tip of the sporangiophore inflates into a knob like vesicle. The inflated tip accumulates dense cytoplasm with cellular inclusions and grows in size. At this stage, the inflated tip is called as young sporangium and it is hyaline in colour.

The protoplasmic contents of the young sporangium differentiate into two zones. The outer peripheral zone is having dense cytoplasm with large number of nuclei and organelles and the inner zone is highly vacuolated with few nuclei. A layer of vacuoles appear between the two zones. These vacuoles flatten and fuse laterally to form a cleft between the two zones. A wall is laid down in this cleft which divides the sporangium into peripheral, denser, multinucleate zones called sporiferous zone and inner, central vacuolated, dome shaped zone, the columella. The protoplast of the columella is continuous with that of the sporangiophore and hyphae. The contents of the sporiferous zone cleave into numerous numerous multinucleate segments. Each segment rounds off and develops its

own wall to become sporangiophore or aplanospore.

The sporangia appears black in colour due to the colour of spores as the spores mature. The less water content in the spore sac than the columella exerts pressure in the columella towards the spore sac. At the same instance, the outer sporangial wall dries and cracks into small fragments, exposing the dry spore mass. The spores are dispersed by the air currents to distant places.

The sporangiophores settling on a suitable substratum, germinate immediately in suitable temperature, humidity and if starchy matter in the substratum are present. The spores absorb water and swell. A germ tube comes out rupturing the outer spore wall. It elongates and branches to form the internal feeding new mycelium.

Sexual Reproduction → The species of ~~Rhizopus~~ Rhizopus are heterothallic i.e they require two different strains or mating types (+ and - strains). The reproductive organs are called as gametangia which are multinucleate and morphologically ~~same~~ similar in

both (+) and (-) strains. The gametes are multinucleate and non-motile and are never released from the gametangia. These types of gametes are called as aplanogametes or coenogametes. The sexual reproduction takes place through gametangial copulation.

At certain degree of maturity the growing apices of the somatic hyphae of opposite strains (+ and - strains) growing near to each other become zygothores. The zygothores are special reproductive branches induced by a diffusible hormone telestic acid. Another diffusible zygotrophic hormone induces the zygothores of opposite strains to bend towards each other and adhere laterally. The copulating branches arise at the point of contact. They accumulate dense cytoplasm along with many nuclei and grow in size. These are now known as progametangia. The progametangia are still in contact with each other when they develop a wall called as fusion wall or septum at the point of contact. The progametangia develop cross walls or septa which demarcates the terminal gametangia from the basal vacuolated suspensor. The densely granular

multinucleate protoplast of the gametangia is called the aplanogamete. The cross wall increase in thickness but they all always remain perforated by plasmodesmata. This probably helps in providing nutrients to the developing zygospores. The fusion wall starts disintegrating from the centre towards the periphery.

The adjoining gametes mix with each other in the fusion cell called as prozygosporangium. All the nuclei pair with that of the opposite strain and finally fuse to form the zygospores. The unpaired nuclei ultimately degenerate. The prozygosporangium increase in size and develops a thick multilayered wall around it to become a zygosporangium. All the zygospores except one degenerates. The zygospore develops its own wall inside the wall of the zygosporangium. It is differentiated into an outer warty and black layer called exine or exospore and inner thin endospore or intine. The zygosporangium is set free after the withering of the suspensors. Now it undergoes a period of rest ~~lasting~~ ranging from 5-9 months.

Germination of Zygospor → During favourable conditions, the diploid zygospor nucleus undergoes a meiotic division. Out of the four haploid daughter nuclei formed, 2 are of (+) and two are of (-) strain. Only one of them survives. The surviving nucleus divides mitotically to produce many nuclei of its type. At the same time, the zygospor protoplast absorbs water and swells. The exospore ruptures and the endospore comes out in the form of a germ tube or promycelium which grows for some distance on the surface of the substratum. It then ~~and~~ bends upwards. All the contents of the zygospor move towards tip of the germ tube, which swells into a spherical body called as germ sporangium. The protoplast of the germ sporangium undergoes cleavage to produce non-motile spores called as germ spores or meiospores. They belong to either (+) or (-) strain depending upon the strain of the surviving nucleus after meiosis. Sometimes nuclei of both the strains are able to survive, and such germ sporangia will produce both kind (+ ~~and~~ and - strain) of germ spores. The promycelium dies after the

liberation of the germ spores from the germ sporangia. The germ spores germinate under favourable conditions to produce new mycelia.

Questions

- Q1. Give an illustrated account of the life history of Rhizopus
- Q2. Give an account of asexual reproduction in Rhizopus.
- Q3. With the help of suitable diagrams, explain the asexual reproductive bodies of nutrition.

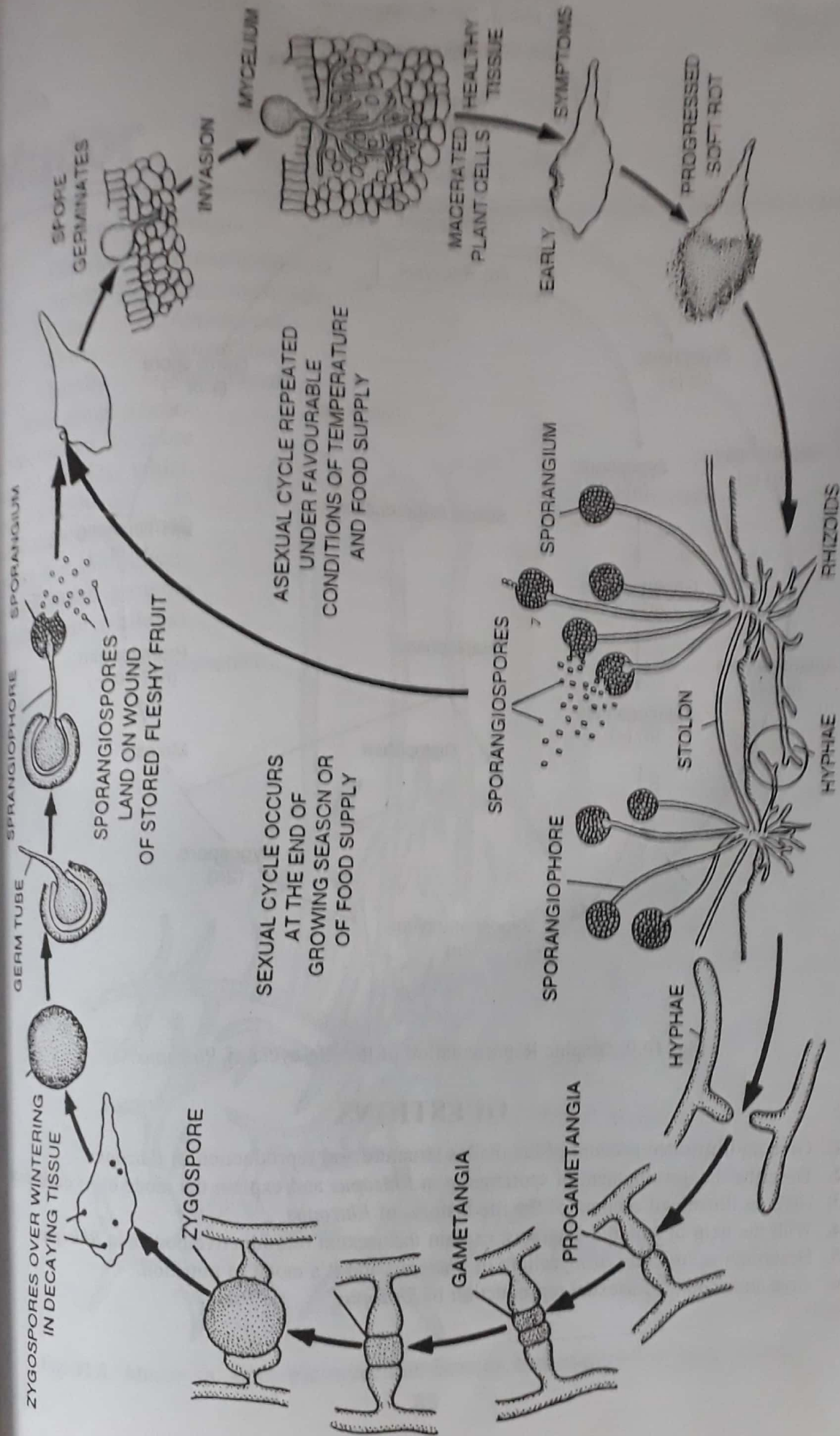


Fig. 10.8. Diagrammatic life-cycle of *Rhizopus*.