

Albugo

By- Dr. Ekta Khare

Albugo

Classification

Kingdom: **Fungi**

Phylum: **Oomycota**

Class: **Oomycetes**

Order: **Peronosporales**

Family: **Albuginaceae**

Genus: **Albugo**

Species: *Albugo candida*

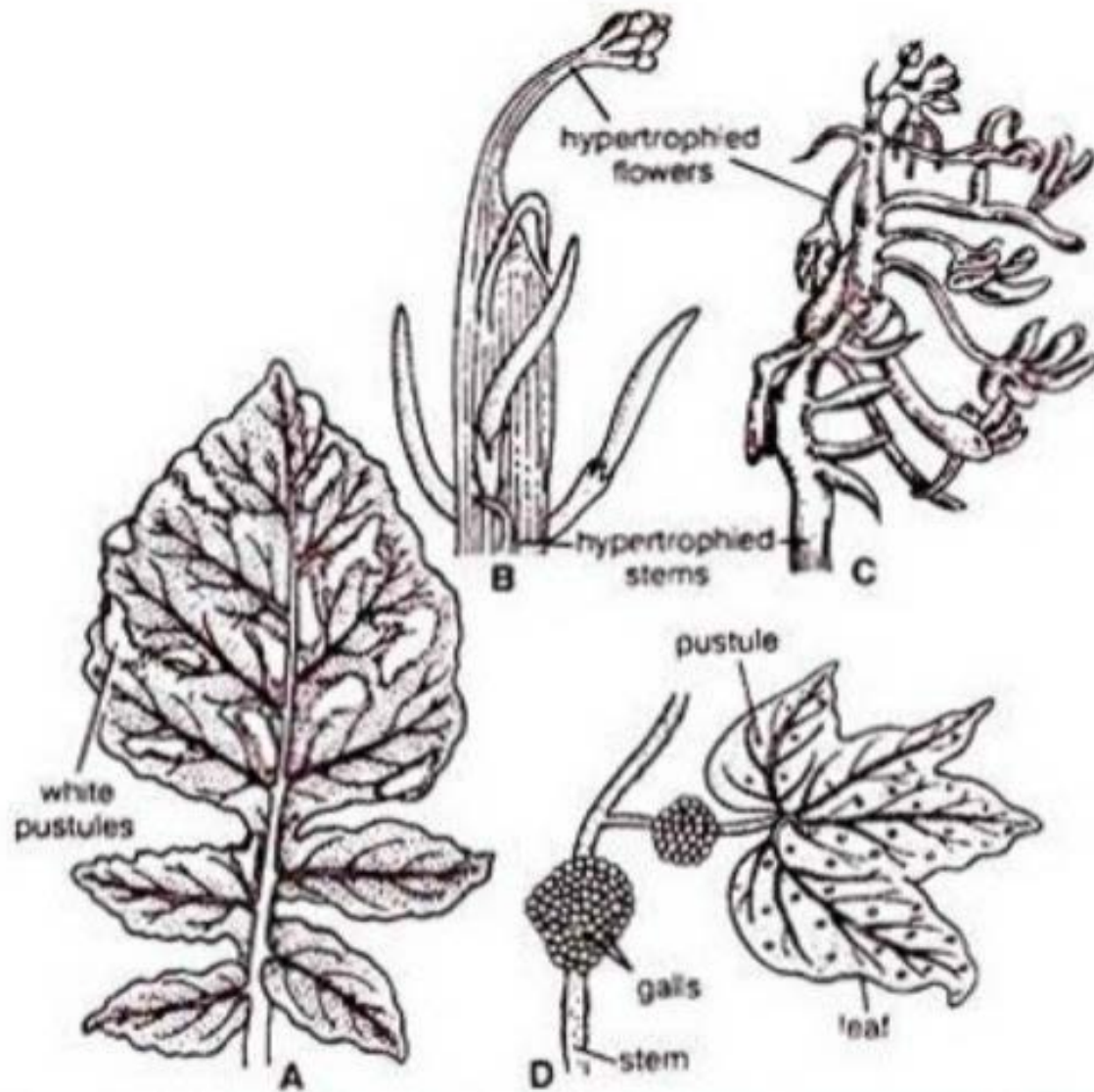


Distribution

- This genus is represented by 25 species distributed all around the world
- They are all plant parasite.
- *Albugo candida* also known as *Cystopus candidus* is the most important pathogen of Brassicaceae/ Crucifereae members, causing white rust.
- Other families that are prone to attack of this fungi are Asteraceae, Convolvulaceae and Chenopodiaceae.

Signs and Symptoms

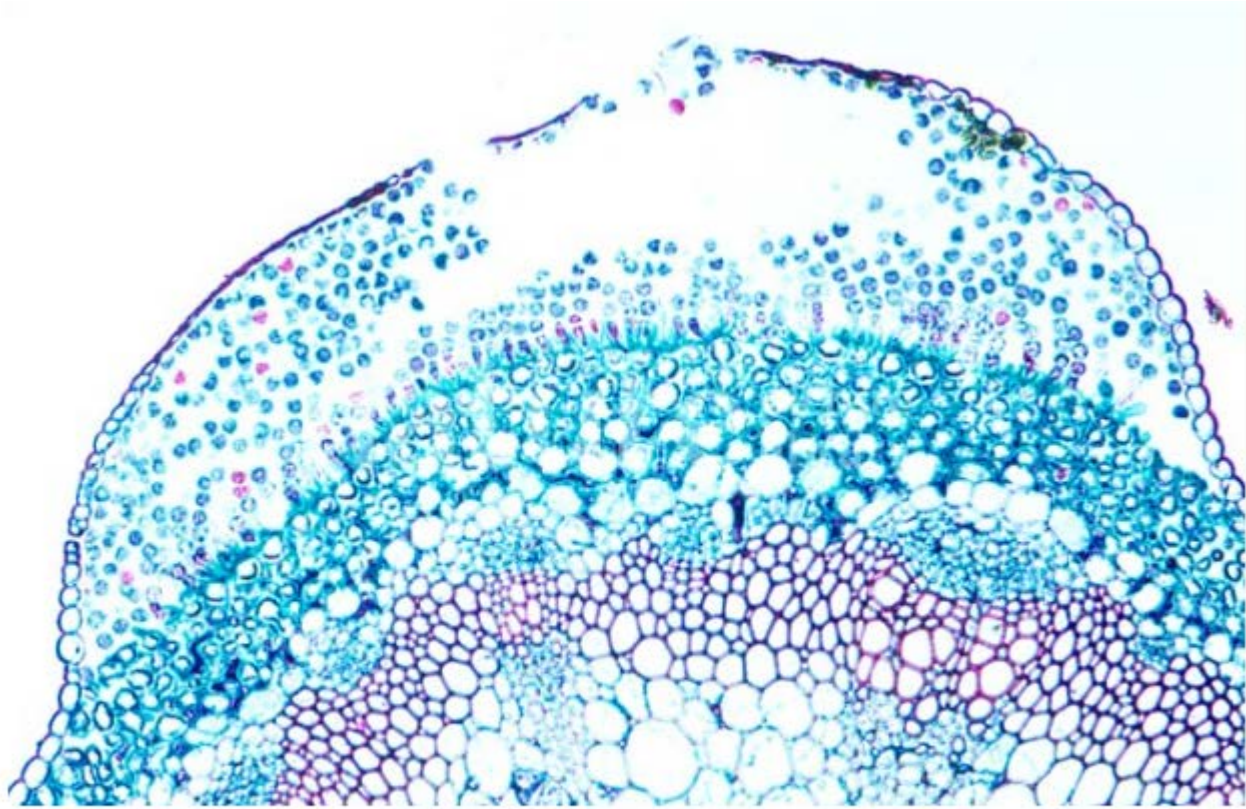
- This pathogen attack all the above ground parts.
- The infection occurs through stomata.
- The disease results in the formation of shiny white irregular patches on leaves or stems.
- In the later stages, these patches turn powdery.
- The flowers and fruits get deformed.
- Hypertrophy (increase in size of the cells and organs) is also a symptom of the disease.



1. (A-D). *Albugo* : Symptoms. (A) Infected radish leaf showing pustules; (B-C) Hypertrophied flowers and stem; (D) Galls on stem

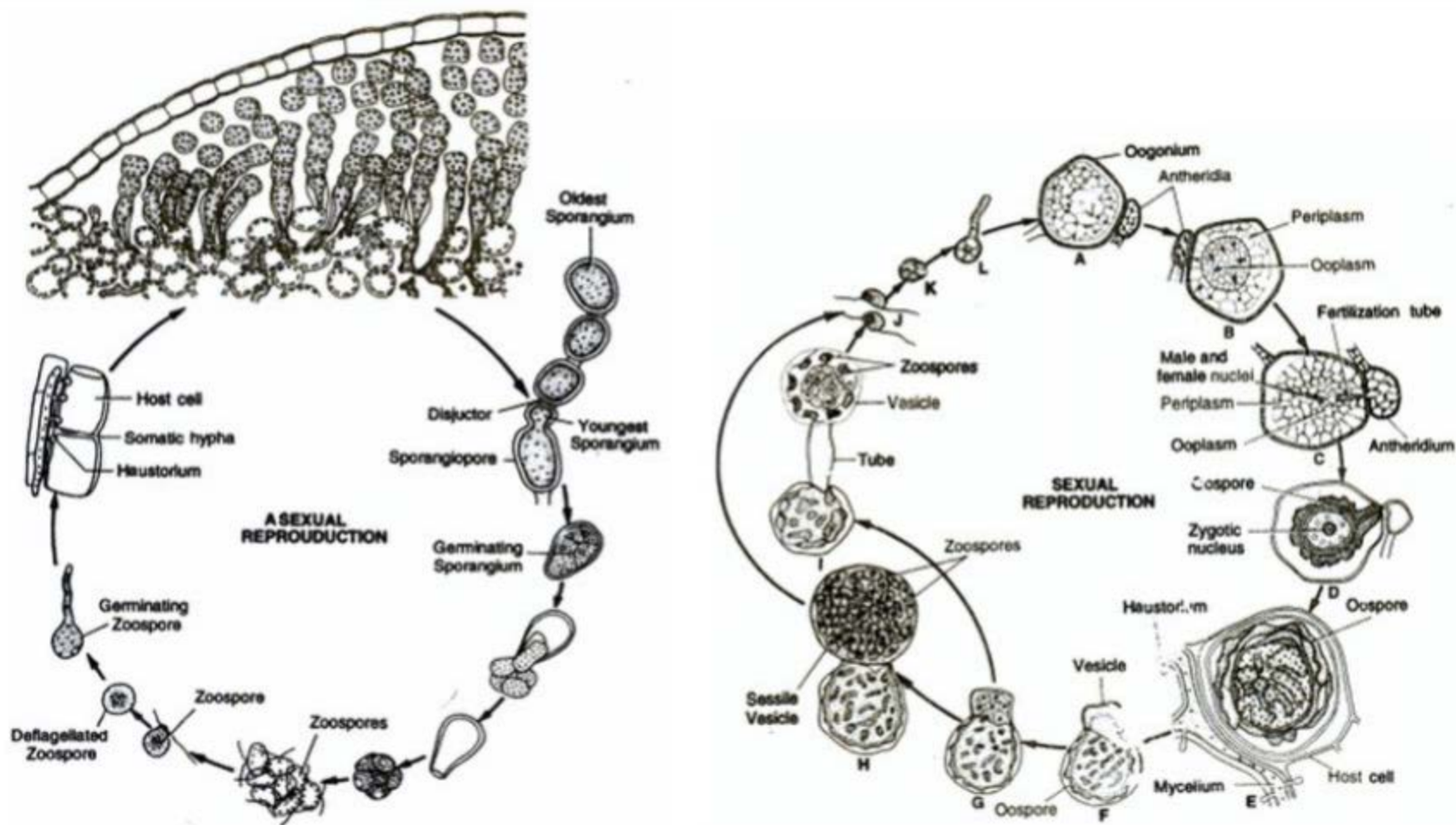
Reproduction in Albugo

- The fungus reproduces both by asexual and sexual methods.
- **Asexual Reproduction:**
- The asexual reproduction takes place by conidia, condiosporangia or zoosporangia.
- These are produced on the sporangiophores.
- Under suitable conditions the mycelium grows and branches rapidly.
- After attaining a certain age of maturity, it produces a dense mat like growth.
- In the mat like growth, just beneath the epidermis of the host and some of the hyphae start behaving as sporangiophores or conidiophores.
- These sporangiophores contain dense cytoplasm and about a dozen nuclei.
- Later, the apical portion of sporangiophore gets swollen and a constriction appears below the swollen end and results in the formation of first sporangium.
- A second sporangium is similarly formed from tip just beneath the previous one.
- Similarly, a chain of sporangia or conidia in basipetal succession (youngest at the base and oldest at the tip) is formed above each sporangiophore.



Cross-section of a leaf with conidia of *Albugo candida*.

- After maturity, the sporangia are set free due to dissolution of separation disc.
- Under suitable environmental conditions when they are blown away by wind or by rain water and falling on a suitable host, sporangia germinates within 2 or 3 hours.
- The sporangia germinate to give rise to zoospores and these zoospores on coming in contact with host germinates and enters inside through stomata.



Life cycle of *Albugo candida* with (left) asexual reproduction and right (sexual reproduction).

Sexual Reproduction

- It takes place when the growing season comes to an end.
- The mycelium penetrates into the deeper tissues of the host.
- The sexual reproduction is oogamous type.
- The male sex organ is called antheridium and oogonium represent the female sex organ.
- **Antheridium:** It is elongated and club shaped structure.
- It is multinucleate, in some cases, only one nuclei remain functional but in some many can remain functional.
- **Oogonium:** It is spherical and multinucleate containing as many as 65 to 115 nuclei.
- All nuclei are evenly distributed throughout the cytoplasm.
- As the oogonium reaches towards the maturity the contents of the oogonium get organised into an outer peripheral region of periplasm and the inner dense central region of ooplasm or oosphere or the egg.
- However, at the time of maturity, all nuclei disintegrate, except single functional nucleus.

Fertilization

- Before fertilization a deeply staining mass of cytoplasm appears in the center of the ooplasm.
- This is called coenocentrum.
- The functional female nucleus attracted towards it and becomes attached to a point near it.
- The oogonium develops a papilla like out grow that the point of contact with the antheridium.
- This is called as receptive papilla, soon it disappears, and the antheridium develops a fertilization tube.
- It penetrates through receptive papilla, oogonial wall and periplasm and finally reaches upto the ooplasm.
- It carries a single male nucleus.
- The tip ruptures to discharge the male nucleus near the female nucleus.
- Ultimately the male nucleus fuses with the female nucleus (karyogamy).

- **Oospore:** The oosphere along with the fusion nucleus is called oospore.
- The oospore on maturity secretes a two to three layered wall.
- The outer layer is thick, warty or tuberculated and represents the exospore.
- The inner layer is thin and called the endospore.
- **Germination of oospore:** With the secretion of the wall, the zygotic nucleus divides repeatedly to form about 32 nuclei.
- The first division is meiotic.
- At this stage the oospore undergoes a long period of rest until unfavorable conditions are over.
- Mean while its host tissues disintegrate leaving the oospore free.

- After a long period of rest the oospore germinates.
- Its nuclei divide mitotically and large number of nuclei are produced.
- A small amount of cytoplasm gathers around each nucleus.
- Protoplasm undergoes segmentation and each segment later on rounds up and metamorphoses into a zoomeiospore or zoospore.
- The exospore is ruptured and the endospore comes out as a thin vesicle.
- The zoospores move out into the thin vesicle which soon perishes to liberate the zoospores.
- The zoospores after swimming for sometime encyst and germinate by a germ tube which again infects the host plant.

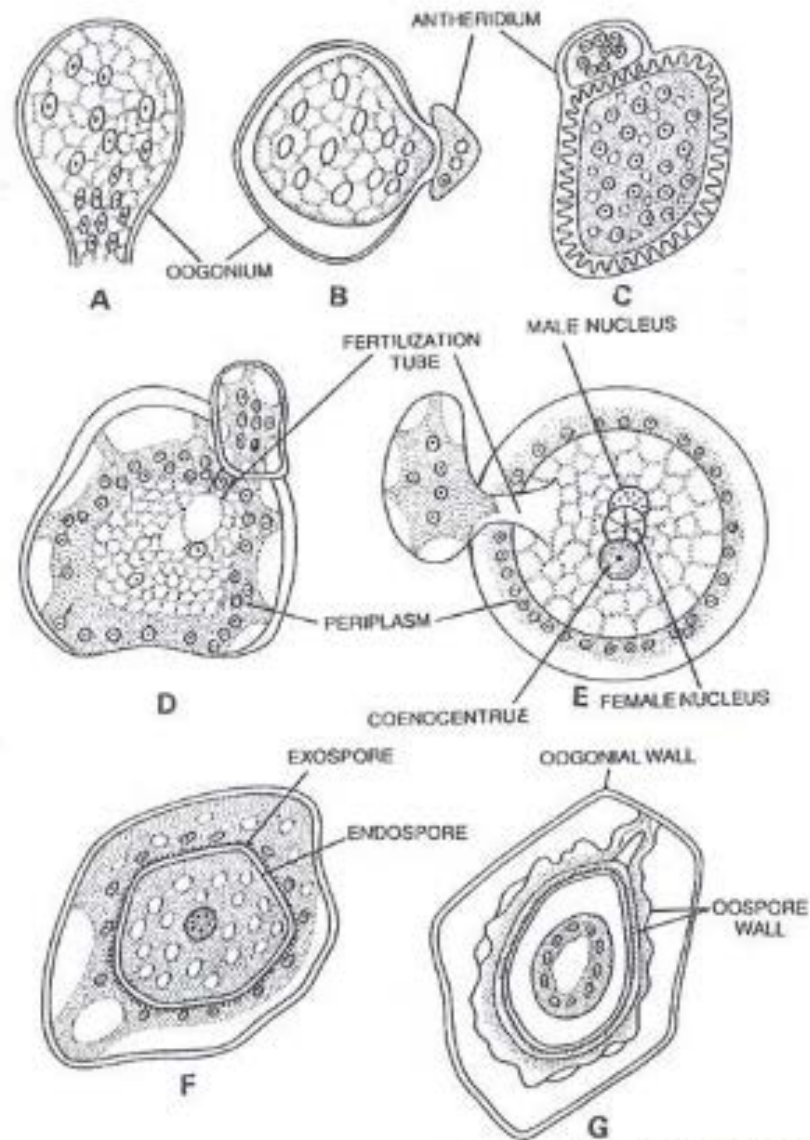


Fig. 10.22. *Albugo Candida*. A, oogonium with many nuclei; B, formation of the receptive spot towards the attached antheridium; C, nuclei in antheridium and oogonium; D, formation of fertilization tube and migration of the nuclei of oogonium in the peripheral region leaving single female nucleus in the centre of oogonium; E, fusion of male and female nuclei; F, oospore formation and karyogamy; G, mature oospore.

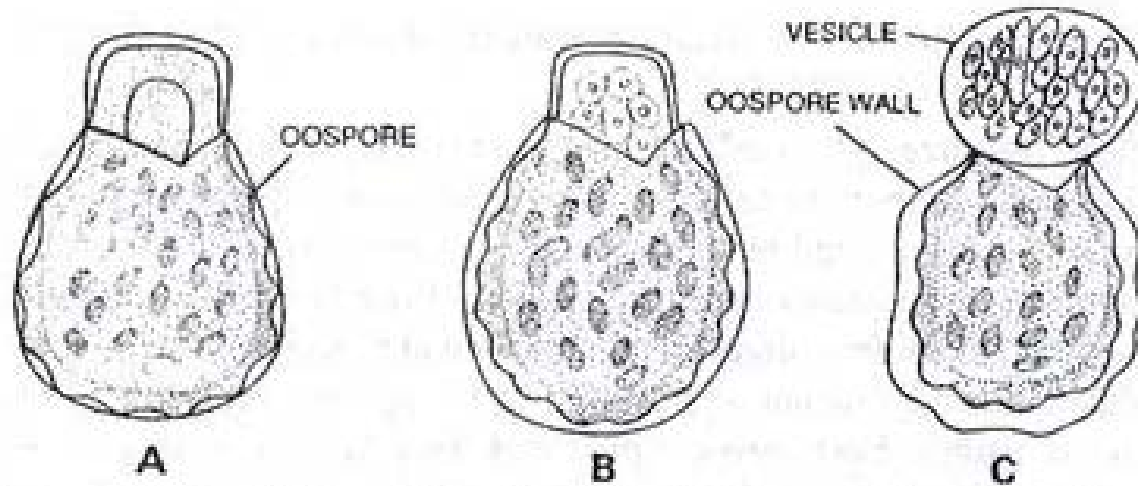


Fig. 10.23. *Albugo* sp. A-B, germination of oospore; C, the zoospores are being formed in the vesicle