Life Cycle of Pythium

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The genus *Pythium* (Gr. pythein — to cause to rot) is represented by 92 species, of which 28 species are reported from India.

Several species of *Pythium* grow as sapro-phytes in soil, in water; on decaying matters, but some are facultative parasites causing root rot (root tips), fruit rot (watery fruits) and damping off of both pre-emergent and post-emergent seedling of numerous angiospermic plants.

*P. debaryanum*, *P. ultimum*, *P. aphanidermatum* and *P. irre’gulare* cause damping off of seedling, of which *P. debaryanum* is very common and causes damping-off of seedling of tobacco, chilli, tomato and mustard. *P. gracilis* grows as parasite on *Vaucheria*. 

- **Kingdom- Fungi**
- **Division- Eumycota**
- **Sub Div-Mastigomycotina**
- **Class –Oomycetes**
- **Order- Peronosporales**
- **Family- Pythiaceae**
- **Genus- Pythium**
Pre-emergence damping-off: Seeds may rot before germinating or seedlings may die prior to emergence.

Post-emergence damping-off: Young seedlings develop a rot at the crown; later, the tissue becomes soft and constricted and the plants wilt and fall over.
List of the pathogens along with diseases caused by them is given in Table 4.1:

<table>
<thead>
<tr>
<th>Causal Organism</th>
<th>Disease</th>
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<tbody>
<tr>
<td><em>Pythium debaryanum</em></td>
<td>“Damping-off” of tobacco, tomato, castor, chilli and cress (<em>Lepidium</em>).</td>
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<tr>
<td><em>P. aphanidermatum</em></td>
<td>“Rhizome rot” of ginger, “Foot rot” of papaya (<em>Carica papaya</em>), “Damping off” of potato and “Fruit rot” of cucurbits.</td>
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<tr>
<td><em>P. myriotylium</em></td>
<td>“Rhizome rot” of ginger.</td>
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<td><em>P. graminicolum</em></td>
<td>“Rhizome and root rot” of turmeric.</td>
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<td><em>P. indicum</em></td>
<td>“Fruit rot” of lady’s finger (<em>Hibiscus esculentus</em>).</td>
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<td><em>P. butleri</em></td>
<td>“Fruit rot” of cucurbits.</td>
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Vegetative structure

- The mycelium represents the vegetative or somatic phase of the fungus.
- It is well developed, and coenocytic. It presents a white, fluffy appearance and consists of long rather slender, hyaline much branched.
- Septa are formed at the time reproduction.
- The hyphae which lie within the host tissues are both intracellular and intercellular.
- Hyphal wall consists of cellulose.
- The hyphal cytoplasm contains numerous small randomly dispersed nuclei, mitochondria and dictyosomes.
- The endoplasmic reticulum, and cytoplasm ribosome are abundant and in the young hyphae.
- The reserve food is in the form the glycogen and there oil globules in addition.
- No haustoria are developed.
Fig. 4.19: Vegetative mycelium of *Pythium debaryanum*

Fig. 4.20: Different types of sporangia of *Pythium* and their germination: A-A'. Filamentous sporangia, B-B'. Globose sporangia, C-C'. Lobulated sporangia.
Reproduction in Pythium

Asexual Reproduction

• It takes place by means of zoospores which are produced in small, globular or oval, sac-like sporangia.
• The sporangia are formed singly and terminally at the ends of somatic hyphae which project into the damp atmosphere from the mycelium within the host tissue.
• The sporangium is multinucleate.
• During zoospore formation, the clevage of cytoplasm starts in the thin-walled bubble like vesicle at the tip of long tube that produced from the sporangium.
• After maturation, wall of the vesicle bursts and the zoospores are liberated.
• The zoospores are of secondary type (i.e., kidney-shaped) having two lateral flagella attached at the concave region.
• After swimming for sometimes, the zoospores come to rest, encyst and then germi-nate by germ tube to form new mycelium.
Fig. 4.20: Different types of sporangia of *Pythium* and their germination: A-A’. Filamentous sporangia, B-B’. Globose sporangia, C-C’. Lobulated sporangia.
Sexual Reproduction

- It is of **Oogamous** type and takes place by **gametangial contact** at the end of the growing season.

- The sex organs are formed within the dead tissues of the host.

- The male sex organ is antheridium and female sex organ is oogonium.

- Antherium and oogonium are developed in close proximity on separate short, lateral hyphae arising from the same mycelium.

Antheridium structure

- Antheridium is an elongated, **club-shaped structure** much smaller in size than the oogonium.

- The cell organelles (ribosomes, endoplasmic reticulum, nuclei, mitochondria and dictyosomes) are randomly packed in the cytoplasm of antheridium.

- At maturity the antheridial protoplast becomes differentiated into a central uninucleate portion which functions as the male gamete and the outer periplasm.
- The tip of the female hypha inflates to form a globular swelling.
- Finally the terminal swelling is cut off from the parent hypha by a basal hyphal plug or septa usually after, but sometimes before antheridial contact.
- The separated terminal swelling functions as the young oogonium.
- During fertilization, the mature oogonium its protoplast is differentiated into two zones, outer periplasm and inner ooplasm.
Fertilization

- By **gametangial contact**, tip of the antheridium applies itself closely to the oogonial wall and becomes flattened at the point of contact.

- Before fertilisation, a fertilisation tube develops by the antheridium at the contact wall of oogonium through which one of the male nuclei passes and fertilises the egg.

- The fertilised oosphere develops into a thick walled, smooth **oospore or zygote**.

- The oospore germinates after a period of rest.

- The pattern of oospore germination depends on the variation of environmental temperature. At high temperature (**28°C**), the oospore germinates by **germ tube**, while at low temperature between **10-1 7°C**, the germ tube elongates at a length of 5-20 µm, then swells up at the tip and forms a vesicle in which **zoospores develop**.

- The zoospores come out of the vesicle after bursting the vesicle wall. After swimming for some time, the zoospores become encysted and take rest. After rest, it germinates by germ tube, which develops like the mother mycelium.
Fig. 6.24. *Pythium*. Word diagram of life cycle with zygotic meiosis.
Fig. 4.21: Life cycle of *Pythium debaryanum*
Thank you!