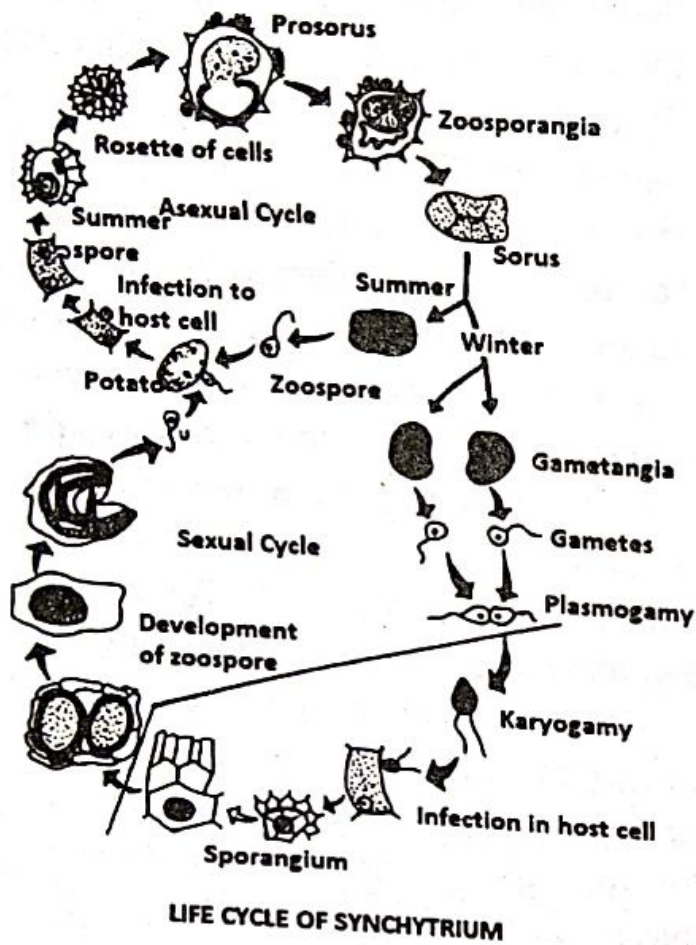


many mitotic divisions. The protoplast, along with a single nucleus, divides into many uni-nucleate segments. After absorbing water, the wall of resting sporangium bursts open and releases the zoospores. The zoospores are like the asexual zoospores, which on coming in contact with a suitable host cause infection and repeat the cycle again on host.



## Phytophthora

### Classification

Kingdom	Fungi
Division	Eumycota
Subdivision	Mastigomycotina
Class	Oomycetes
Order	Peronosporales

Family Pythiaceae  
Genus *Phytophthora*

**Symptoms:** *Phytophthora infestans* causes late blight of potato. Responsible for Irish famine. Infection appear as small black or purplish black areas at the margins and tips of the leaf. These patches gradually enlarge and soon the entire crown may rot. Under favourable conditions all parts of the host undergo browning and rotting. If the soil is very moist, tubers are also affected and may rot completely.

**Thallus:** The mycelium is coenocytic, aseptate, and branched. The cell wall consists of glucan. Chitin is not present. Cytoplasm contains many nuclei, mitochondria, endoplasmic reticulum, ribosomes, dictyosomes, vacuoles and many oil globules. The mycelium is intracellular. However, in some cases it is intercellular, present in the intercellular spaces of the host tissue. Some of the species develop haustoria to absorb their food material. In *P. infestans* the haustoria are slender and finger like.

### Reproduction of Phytophthora:

The fungus reproduces by Vegetative, asexual and rarely by sexual methods.

### Vegetative Reproduction:

Many species of *Phytophthora* (*P. colocasiae* and *P. parasitica*) reproduce

by means of Chlamydospores. These vegetative reproductive bodies may be terminal or intercalary. They germinate by giving rise to 3-11 germ tubes which develop sporangia at their tips.

### **Asexual Reproduction:**

The asexual reproduction takes place by means of sporangia which are borne on aerial sporangiphores. The sporangiophores arise directly from the internal mycelium and emerge out of the host singly or in clusters through stomata or by piercing through the epidermal wall. Each branch of sporangiophore bears, sporangium at its tip. The sporangia may vary in shape (i.e. lemoni form, ovoid or elliptical). It is hyaline to light yellow in colour, terminally papillate and has a basal plug. The sporangia are deciduous and are disseminated by water or are blown by the wind. At the place of detachment of sporangia, the sporangiophores bear nodular swellings which are typical for this fungus. On falling upon a suitable host, the sporangia germinate. The germination of sporangium is governed by two main factors i.e., moisture and temperature. The protoplasm of the sporangium is cut off into many uninucleate polyhedral pieces Each polyhedral piece later rounds up and metamorphoses into zoospore. Zoospores are kidney shaped, biflagellate and possess flagella on lateral side. Of

the two flagella one is of whiplash type and the other of tinsel type. The zoospores are liberated by the bursting of the sporangial wall. After swimming for some time they come to rest, encyst and germinate by a tube. The germ tube adheres on the epidermis of the host and produces a flattened pressing organ i.e., appresorium, at its tip. From the appresorium a fine tubular, peg like outgrowth arises. It is the infection hypha. It penetrates the host tissue through stomata or epidermal cells.

### **Sexual Reproduction:**

The sexual reproduction in Phytophthora is oogamous. The fungus is heterothallic i.e., requires two opposite strains, + and – for sexual reproduction. The male and female reproductive organs are called antheridia and oogonia, respectively.

### **Antheridium:**

The antheridium arises earlier than the oogonium showing a protandrous condition. It develops as a terminal, more or less club shaped structure on a short lateral hypha of one strain. The mature antheridium is funnel shaped and forms a collar like structure at the base of the mature oogonium. The two nuclei divide mitotically and forms 12 nuclei. All nuclei disintegrate except one in mature antheridium.

## Oogonium:

It is initiated laterally or below the antheridium on a hypha from other strain. The young oogonium pierces the developing antheridium from below and swells above it into a pear shaped or spherical structure. When young, it is multinucleate. On maturity it becomes vacuolated and differentiated into an outer multinucleate periplasm and a central uninucleate ooplasm. The nucleus of the ooplasm divides mitotically and out of the two one survives and it functions as an egg or oosphere nucleus.

## Fertilization:

The oogonial wall bulges out at one point inside the antheridium and forms the receptive papilla. Later on the wall at the receptive spot dissolves and the antheridium pushes a short fertilization tube towards the oogonium. It penetrates the periplasm and passes into the ooplasm. It's tip opens and liberates a male nucleus and some of the cytoplasm. The male nucleus passes into the oogonium through papilla and brings about fertilization.

## Oospore:

During fertilization, first of all the plasmogamy takes place. The fertilized oospore secretes a wall and undergoes rest. Fusion of the two nuclei (karyogamy) is very late. A mature oospore consists

of an outer thick wall called exospore and an inner thin wall endospore. Exospore is made up of pectic substances and endospore is composed of cellulose and proteins.

## Germination of Oospore:

The fusion nucleus divides meiotically and later on successive divisions result in the formation of few or many nuclei in the oospore. The exospore cracks and the endospore comes out in the form of a germ tube which develops a sporangium at the tip. The contents of sporangium may divide to form zoospores or sometimes may directly develop into a mycelium.

