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Synchytrium (Causal Organism of Black Wart Disease of Potato)

Classification- (Alexopoulos and Mims,1979)

Division-	Mycota
Sub division-	Eumycotina
Class-	- Chytridiomycetes
Order-	Chytridiales
Family-	Synchytriaceae
Genus-	Synchytrium
Species-	endobioticum

Synchytrium is a soil borne fungus which do not possess mycelium and is designated as holocarpic. It is placed under the order **Chytridiales**, series **Uniflagellatae** of Class **Phycomycetes** (Lower fungi) as classified by **Sparrow (1960)**. It is worldwide in distribution, occurring in tropical, temperate and arctic zones. It has been found present even at higher altitudes of above 11000 ft.

All the species are parasitic and infect algae, mosses, ferns and most commonly flowering plants. It causes Black wart disease in Potato. As a result potato tubers are affected and become malformed due to formation of warts on them. There are 200 species of Synchytrium, but about 60 species have been reported from India. The most common species is *S. endobioticum*, well known for disease on potato. It mainly infects solanaceous plants. Some important species are *S. anemones*; *S. cajani*; *S. phaseoli-radiati*; *S. cyperi*; *S. fistulosus*; *S. luffae*; *S. indicum*; *S. meliloti* etc.

Somatic structure- The body of the fungus is composed of a single uninucleate cell with definite cell wall. The fungus resides in the potato tuber in most part of its life cycle and produces many uniflagellate motile zoospores. These zoospores are the carrier of fresh infection in healthy tubers. The fungus induces the host tissue to multiply in number and to grow in size. Due to this, many warts develop in the tubers; hence the disease is known as wart disease. Although, this is more common disease in Europe. Fortunately, it is not found in our country, but it has been reported from Darjeeling district of W. Bengal. Warts on infected tubers burst at later stage and release putrid liquid as exudates. This liquid contains zoospores in large number having single posterior flagellum. They swim in the film of water and move to other potato tubers.



Fig. Black Wart disease of potato (Courtesy: Plant Pathology, Agrios G.N., Elsevier Acad.Press, New York)

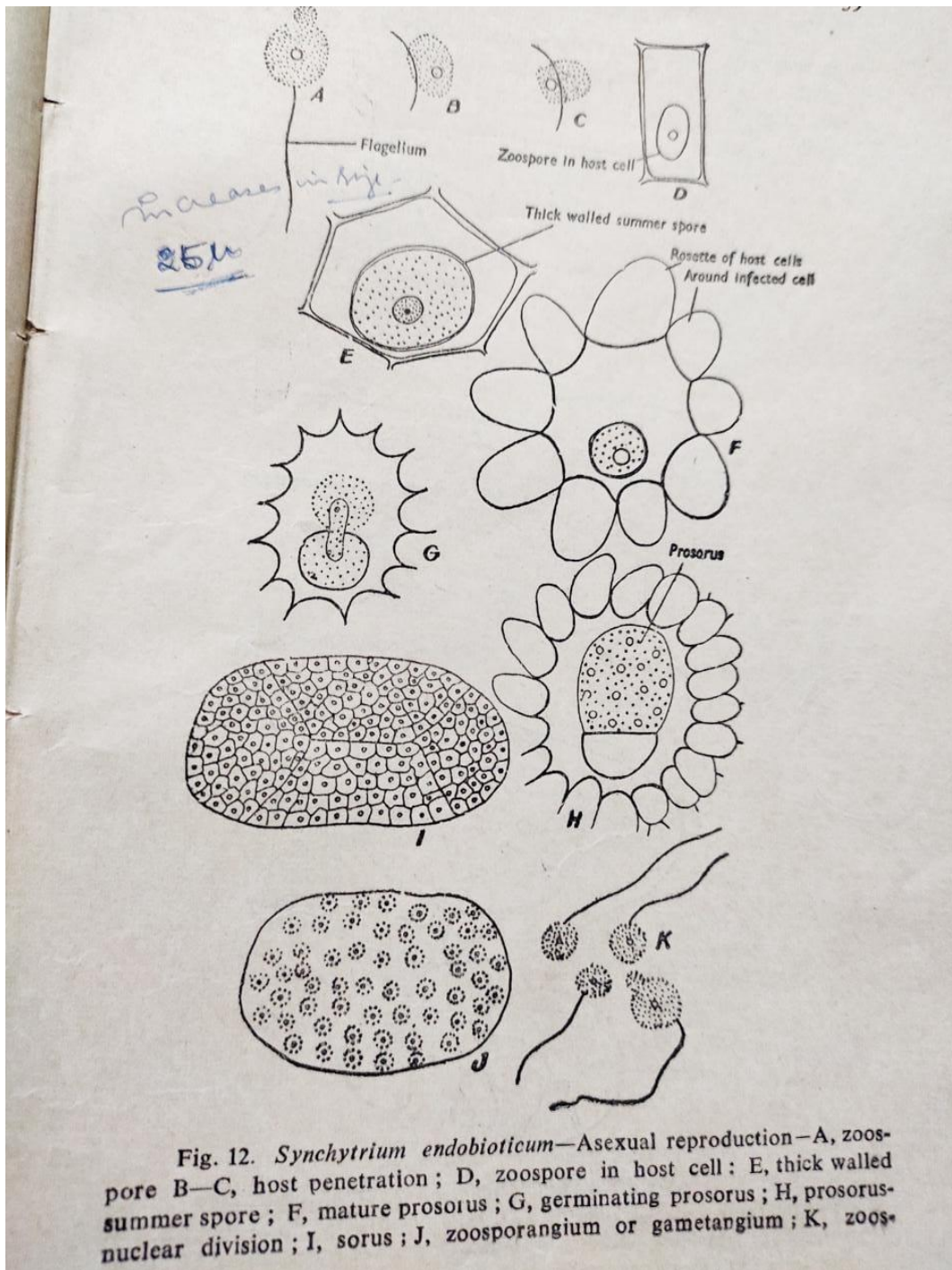


Fig. 12. *Synchytrium endobioticum*—Asexual reproduction—A, zoospore B—C, host penetration ; D, zoospore in host cell ; E, thick walled summer spore ; F, mature prosorus ; G, germinating prosorus ; H, prosorus-nuclear division ; I, sorus ; J, zoosporangium or gametangium ; K, zoospores

Fig. Life cycle- *Synchytrium endobioticum* (courtesy: A Text Book of Botany, B.P.Pandey, K.Nath & Co.Publ., Meerut)

Life Cycle- The fungus completes its life mostly in host tissue in the form of resting sporangium. It remains in the soil for a very little period. In the spring season, uniflagellate zoospores are released from the infected tubers and swim to healthy tubers through water. The zoospores come in contact with the new host epidermal cell and dissolve the wall. They enter into the host epidermal cell leaving their flagellum outside. In the host cell, the protoplasm of the zoospore increases in size with large nucleus. Now, it becomes rounded having thick brown wall. This is called as **summer spore**. The host cell becomes enlarged and hypertrophied. The surrounding cells of infected cell form a rosette of cells around the infected cell. The summer spore now comes

to the lower half of the cell and germinates. Its nucleus divides mitotically into 32 small nuclei. This multinucleate structure is called **prosorus**.

Prosorus at the later stage becomes segmented into 4-9 multinucleate chambers, each having many nuclei. Now, the nuclei of each segment divides repeatedly into about 200-300 nuclei. Each segment of the prosorus develops into a sporangium. This may act as gametangium also in adverse dry conditions. The protoplast of the each sporangium with a nucleus metamorphoses into a zoospore with a single posterior flagellum. These zoospores are released outside the tuber.

Under dry weather when water is scarce, the sporangium behaves like a gametangium. Many uninucleate uniflagellate gametes are produced from each segment. These are called as planogametes, which are similar to zoospores but, smaller in size.

Sexual reproduction- Uniflagellate planogamete, when comes out from gametangium, meet with another gamete and fuses with it. Fertilization takes place by karyogamy and zygote is formed. Each zygote has two flagella, shared by two individual mating gametes. The biflagellate zygote swims in the water film for some time and then it withdraws flagella. Now it settles on the host surface. Then it pierces the host wall by dissolving it and enters into the host epidermal cell. The protoplast of the zygote settles in the bottom of the cell. It enlarges and becomes thick walled and converts into a resting sporangium. The surrounding cells of the infected cell get activated to divide repeatedly giving rise to a rosette of cells. The resting sporangium becomes dormant in the winter. It becomes active in the next spring season. In the spring season, large numbers of granules appear which act as zoospore primordia. Meiosis was not observed, by Curtis ((1921), but it is assumed that there is reduction division during the formation of zoospores. Zoospores are released outside the host cell.

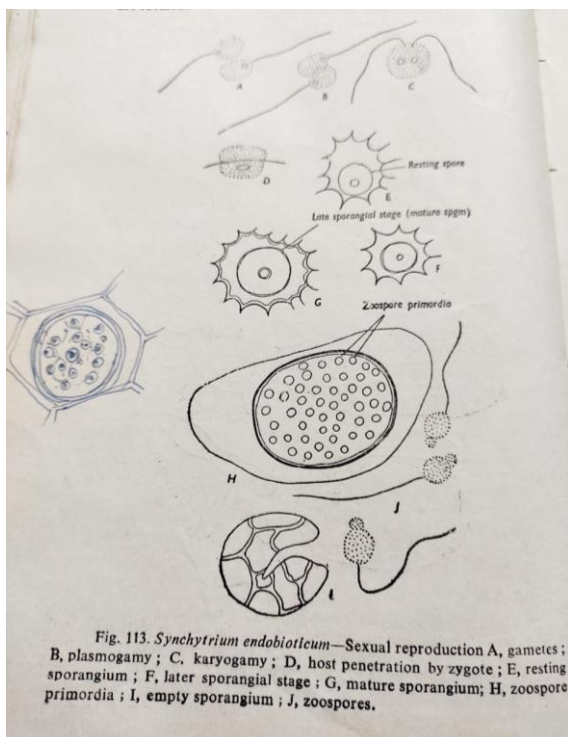


Fig. 113. *Synchytrium endobioticum*—Sexual reproduction A, gametes; B, plasmogamy; C, karyogamy; D, host penetration by zygote; E, resting sporangium; F, later sporangial stage; G, mature sporangium; H, zoospore primordia; I, empty sporangium; J, zoospores.

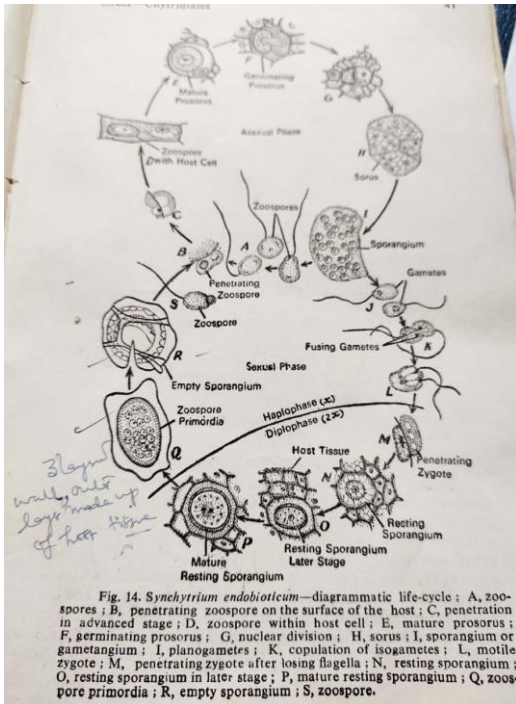


Fig. 14. *Synchytrium endobioticum*—diagrammatic life-cycle: A, zoospores; B, penetrating zoospore on the surface of the host; C, penetration in advanced stage; D, zoospore within host cell; E, mature prosorus; F, germinating prosorus; G, nuclear division; H, sorus; I, sporangium or gametangium; J, planogametes; K, copulation of isogametes; L, motile zygote; M, penetrating zygote after losing flagella; N, resting sporangium; O, resting sporangium in later stage; P, mature resting sporangium; Q, zoospore primordia; R, empty sporangium; S, zoospore.

Figs. Courtesy: A text book of Botany, B.P.Pandey, K.Nath & Co. Publ. Meerut)

Disease management-

It is very difficult to control the disease after onset of disease in the crop. Since, one cannot escape from irrigation and water in the crop field, It is advised to use certified seed tubers from known source.

Quarantine measures should be followed to prevent the entry of diseased tubers.

Field sanitation before planting tubers should be done by burning the residual plant debris.

Soil treatment with steam or any chemical, such as ammonium sulphocyanate, mercuric chloride, copper sulphate, formalin has been recommended to eradicate resting spores.

Use of disease resistant varieties- Many wart immune cultivars have been developed at Central Potato research Institute at Kufri (Shimla, H.P.) Some wart resistant varieties are Kufri Jyoti, K. Sherpa, K.Kumar, K. Muthu, K. Khasi Garo, K. Bahar, K. Kanchan and Kufri Swarna.

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