Synchytrium:

Synchytrium is represented by about 200 species reported from all over the world, occurs as parasite on aquatic alga, bryophytes (mosses), pteridophytes (ferns) and mostly on flowering plants.

About 80 species have been reported from India, of which S. rytzii on the members of Lamiaceae, S. trichosanthoides and S. laginariae on the members of Cucurbitaceae, S. taraxicola on Taraxacum officinale, S. sisamicola on Sesamum indicum and S. endobioticum is a well-known species which causes wart disease or black wart of potato, available in the main potato growing regions of the world, mostly in mountains with moist and cold climate. In India, this disease was first recorded at Rangbul in Darjeeling district of West Bengal in 1953.

Symptoms of Disease Caused by Synchytrium:

The disease is characterised by cauliflower-like black warty growth on tubers (Fig. 4.16), stolons and stem bases (Fig. 4.15). Sometimes, the size of the warts is more than the size of the tuber.

Life History of Synchytrium:

The life history of the most common species i.e., S. endobioticum has been studied by Miss K. M. Curtis, 1921; followed by Kohler (1923, 1931). The representation of the life cycle has been given in the Fig. 4.17.

Vegetative Structure of Synchytrium:

The vegetative body of Synchytrium consists of minute endobiotic holocarpic thallus, represented by naked uniflagellate zoospore with whiplash flagellum.

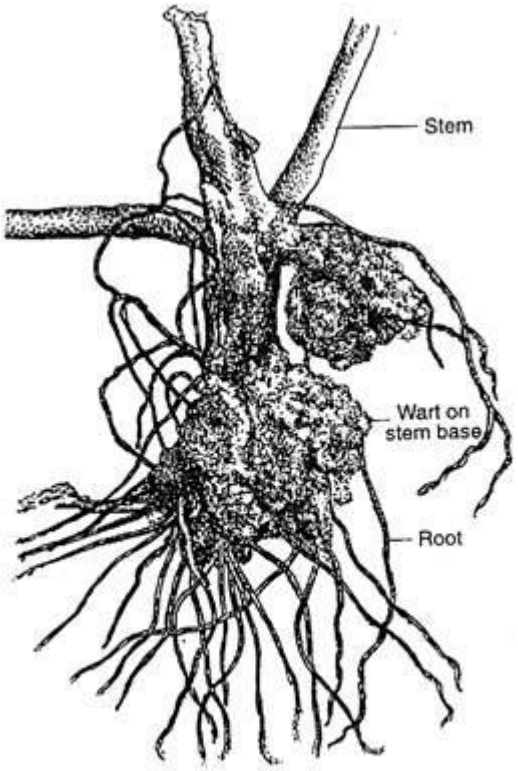

Fig. 4.15 : Symptom on stem base and stolon of potato

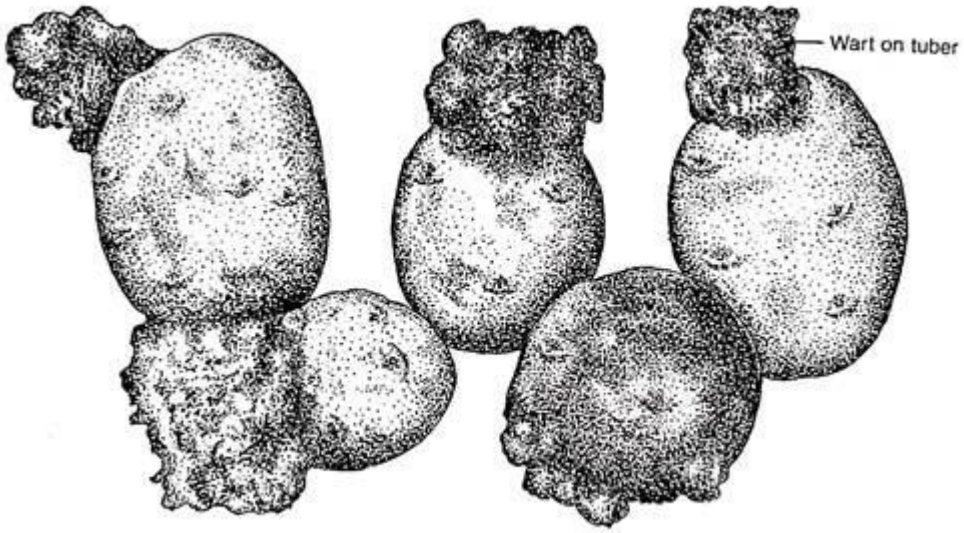

Fig. 4.16 : Wart on potato tubers

Reproduction in Synchytrium:

Synchytrium endobioticum reproduces both asexually and sexually. Vegetative reproduction is absent. During reproduction, the entire thallus transforms into a reproductive unit i.e., holocarpic.

1. Asexual Reproduction:

Asexual reproduction generally occurs during favourable condition, i.e., in spring season. Duiing this period, minute naked uninucleate and uniflagellate zoospores (Fig. 4.17U) ire released from the resting sporangium (which torms during unfavourable condition i.e., in winter season) after water soaking (Fig. 4.17T).

The zoospores are capable of swimming for about two hours. After coming in contact either with the potato 'eye' or stolon or young tuber (Fig. 4.17B), they come to rest and withdraw their flagella (Fig. 4.17C). The content of the zoospore cyst enters into the host cell through the wall by minute pore in amoeboid movement, keeping the cyst membrane outside (Fig. 4.17D).

The protoplast of zoospore, after entry in the host epidermal cell, absorbs food and becomes spherical in shape. The infected host cell also enlarges in volume. The host cell surrounding the infected cell becomes stimulated and starts swelling (hypertrophy) resulting into the formation of tumour or wart-like structure.

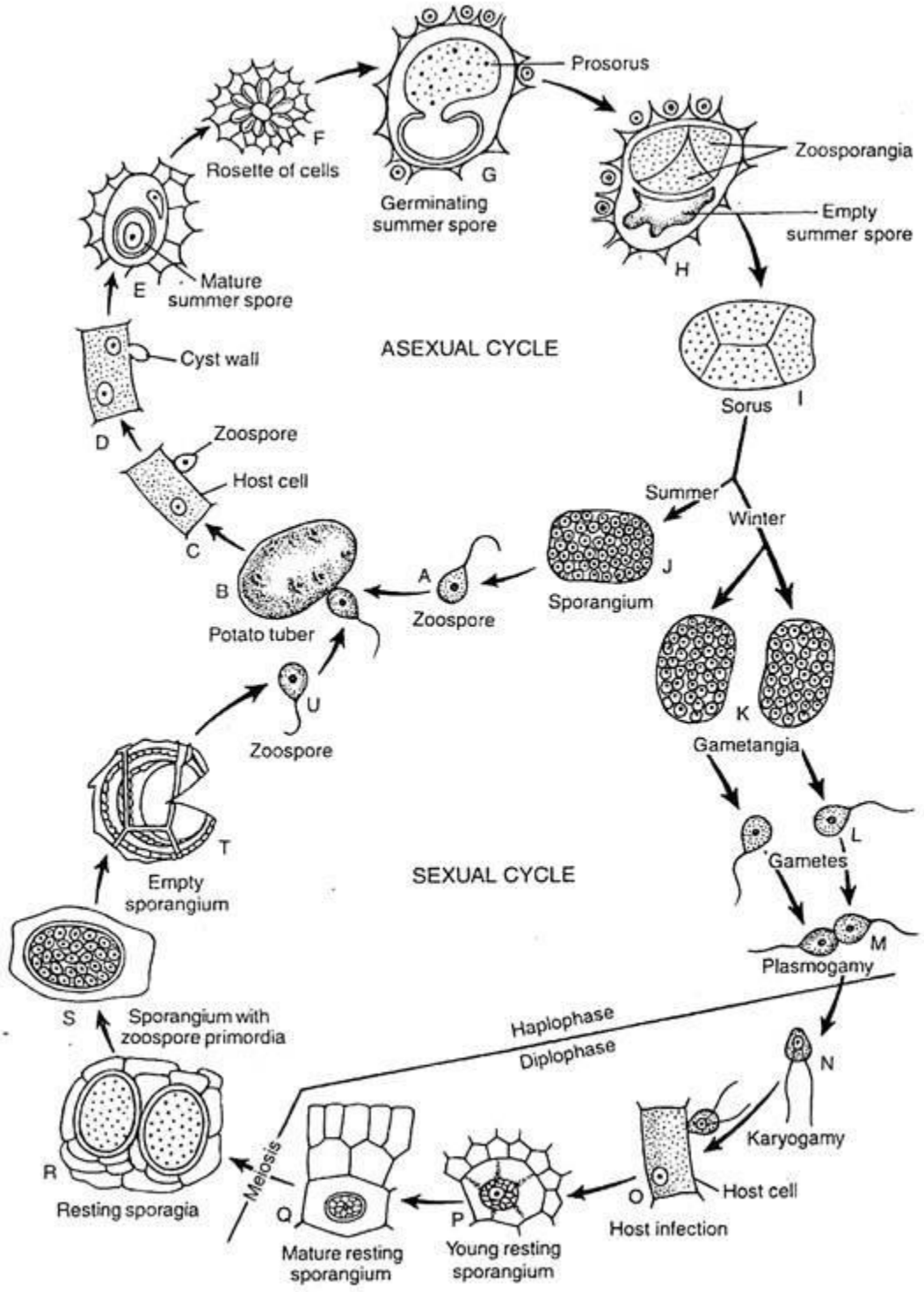

Fig. 4.17 : Life cycle of *Synchytrium endobiotium*

The infected cell dies and remains in the middle of the wart. The pathogen along with its nucleus enlarges considerably, rounds off and develops two layered walls, consisting of a

thick golden brown exospore and a thin hyaline endospore. This is the summer spore (Fig. 4.17E).

The summer spore germinates within the infected host cell. Before germination, the nucleus enlarges and the inner wall protrudes out through a minute pore on the outer wall and forms a vesicle towards the upper portion of the infected host cell. The total content of the summer spore is transferred to the vesicle.

The nucleus of summer spore then undergoes repeated mitotic divisions and forms about 32 nuclei. This multinucleate vesicle is known as prosorus (Fig. 4.17G). The protoplast of the vesicle becomes cleaved into 4-9 segments, covered by thin hyaline wall. Each segment is known as summer sporangium or zoosporangium (Fig. 4.1 7H). The total aggregated structure of the zoosporangia is known as Sorus (Fig. 4.1 71).

The nuclei of each zoosporangium undergo repeated mitotic divisions and form generally 200 to .300 nuclei (their number may go up to 500 or more in large sporangium). The protoplast then divides into many uninucleate segments (Fig. 4.17J).

The mature sporangium swells up by absorbing water and creates pressure on the host wall to burst. After bursting, the zoospores get released through a small slit on the sporangial wall. The zoospores are uninucleate and uniflagellate (Fig. 4.17A). They swim actively in water and infect again the new host or different regions of the same host.

The behavior of the zoospore varies with the environmental condition. If the condition is favourable (i.e., summer continues), the zoospore causes infection to a new host or different region of the same host and continues the asexual cycle again. During unfavourable condition they behave as gamete and undergo sexual reproduction.

2. Sexual Reproduction:

During unfavourable condition (if winter comes), the multinucleate segment of prosorus instead of behaving as zoosporangium behaves as gametangium (Fig. 4.17K) which produces many gametes (Fig. 4.1 7L), those are smaller in size than the zoospores.

The gametes coming from different gametangia of a same or different sorus may fuse, but not from same gametangia of a sorus. The planogametes after union form diploid biflagellate zygote (Fig. 4.17N). The planogametes are similar in size and shape therefore, copulation is isogamous.

The zygote swims for sometime and encysts on the surface of the host epidermis and penetrates the host cell by a process similar to zoospore penetration (Fig. 4.17O). The surrounding host cell then undergoes hyperplasia i.e., repeated cell division. The infected cell is then buried into the deeper layer of host cells (Fig. 4.17P).

The effect on the surrounding tissue varies between zoospore and zygote infection. Hypertrophy (i.e., enlargement of cells) takes place on zoospore infection, but the zygote infection causes Hyperplasia (i.e., repeated cell division).

During this development, the zygote enlarges and becomes surrounded by two layered wall formed by itself (Fig. 4.17Q) and then a third wall is developed from the host content after its death. It is now called winter sporangium or resting sporangium (Fig. 4.14R). The resting sporangium remains dormant throughout the winter season.

The resting sporangia are released into the soil after decaying the host tissue and are capable to germinate within about two months.

With the onset of favourable condition i.e., in spring season, the resting sporangium becomes active and its nucleus undergoes repeated nuclear division of which first one is meiotic, followed by many mitotic divisions. The protoplast, along with a single nucleus, divides into many uninucleate segments (Fig. 4.14S).

After absorbing water, the wall of resting sporangium bursts open (Fig. 4.14T) and releases the zoospores. The zoospores are like the asexual zoospores (Fig. 4.14U), which on coming in contact with a suitable host cause infection and repeat the cycle again.

Indian Species:
Synchytrium endobioticum, S. brownii, S. ajrekari, S. colapsum, S. cookii.

Life Cycle of of Synchytrium:
The schematic representation of life cycle of S. endobioticum has been given in Fig. 4.18.

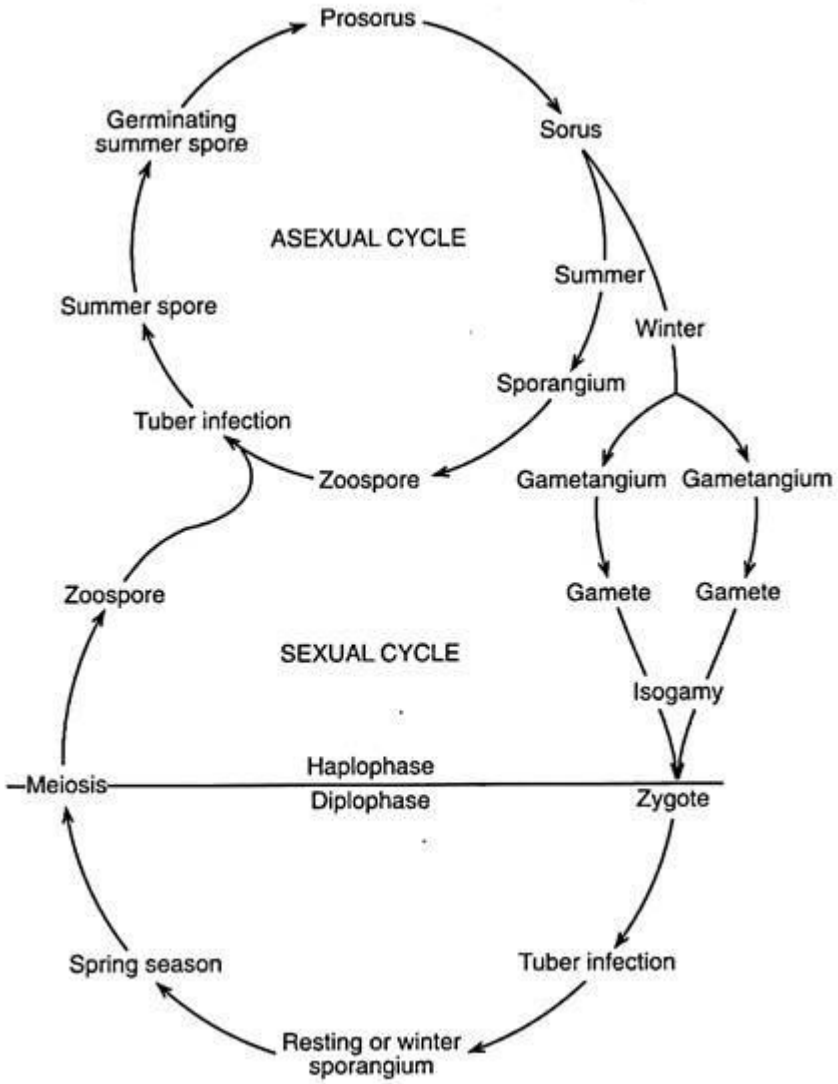

Fig. 4.18 : Schematic representation of Life cycle of *Synchytrium endobioticum*