Lecture 5

Class 3: Oomycetes

General characteristics:-

1- They produce biflagellate zoospores; one flagellum is tinsel and the second is whiplash.

2- Most of them are living in water so they called as water mold.

3- Some of them are obligate parasites on higher plant caused downy mildew diseases. Others are parasites on algae or small animals such as fishes.

4- Sexual reproduction is gametangial contact produce oospore.

5- Their cell walls consist of mainly glucan, but also contain cellulose. In most species there are no chitin.

Order 1: Saprolegniales

General characteristics:-

1- Some species such as Saprolegnia parasitica causes diseases of fish and fish eggs.

2- Mycelium is coenocytic, we can see septum only in the bases of reproductive organs-sporangia or gametangia-.

3- Asexual reproduction by biflagellated zoospores. There are two types of zoospores:

A- Pyriform zoospores, they called also primary zoospores.

B- Reniform zoospores: they called also secondary zoospores.

Species that produce only one type of zoospore are monomorphic , while these which producing two types are dimorphic.

According to the swarming period, fungi in this order divided into:

1- Monoplanetic fungi: Those that have only one swarming period and only one type of zoospore ex: *Pythiopsis*.

Pyriform zoospore →Swarming→ encystment → germination →new thallus

2- Diplanetic fungi: Those that have two swarming period and two types of zoospores ex: *Saprolegnia*.

Pyriform zoospore →Swarming→ encystment → reniform zoospore

Swarming→ encystment → germination →new thallus

3- Polyplanetic fungi: Those that have more than two swarming period, the zoospore which is repeated is secondary zoospore ex: *Dictyuchus*.

Pyriform zoospore →Swarming→ encystment → reniform zoospore

Swarming→ encystment → reniform zoospore→ encystment → germination → new thallus

4- Aplanetic fungi: Those that have no swarming period and so there is no motile spores ex: *Geolegnia*.

Family: Saprolegniaceae

Ex: *Saprolegnia parasitica*:-

Life cycle:

* The sporangia are elongated, tapering structures borne at the tips of somatic hyphae and separated from them by a septum.* An opening develops at the tip of the sporangium, and the primary zoospores escape into surrounding water, they swim about for some time, come to rest and encyst.* After a short resting period, a thin papilla develops on the cyst, its tip dissolves, and a reniform zoospore with two lateral flagella creeps out.* The encysted spore now germinates that develops into a new thallus.* By internal proliferation; sporngia continue to be formed, with several a sexual generations following one anther -Asexual cycle-.

*When conditions favorable to sexual reproduction, the somatic hyphae give rise to oogonia and antheridia.*Meiosis now takes place in gametangia, producing haploid oospheres in oogonia and haploid gamete nuclei in antheridia.* The antheridia are much smaller than the oogonia,

and they are often borne on the same hypha that bears the oogonia.*Fertilization tubes originating in the antheridium penetrate the oogonial wall and reach the oospheres.* One male nucleus enters each oosphere through the fertilization tubes forms a diploid zygote nucleus.*Then a thick wall develops around each oosphere, converting it into oospore.* After rest period, the oospores are liberated from oogonial wall and germinated to give rise a new thallus. Figure 18.

Order 2: Peronosporales

The peronosporales are the most specialized of the oomycetes. This large order of fungi includes aquatic, amphibious, and terrestrial species as a group of highly specialized obligate parasites that cause:

1- Witting or Damping off diseases.

2- White rust diseases.

3- Downy mildew diseases.

General characteristics:-

1- The mycelium is branched and coenocytic, the hypha of parasitic species are intercellular or intracellular. Those of the most parasites growing between host cells and producing haustoria.

2- Sporangia are separated from mycelium after maturation – Spores are released after the separation of sporangia-.

3- In some species, sporangia act as conidia and germinated into a new thallus.

4- Asexual reproduction occurs by reniform zoospores with only one swarming period.

5- Sexual reproduction occurs by gametangial contact.

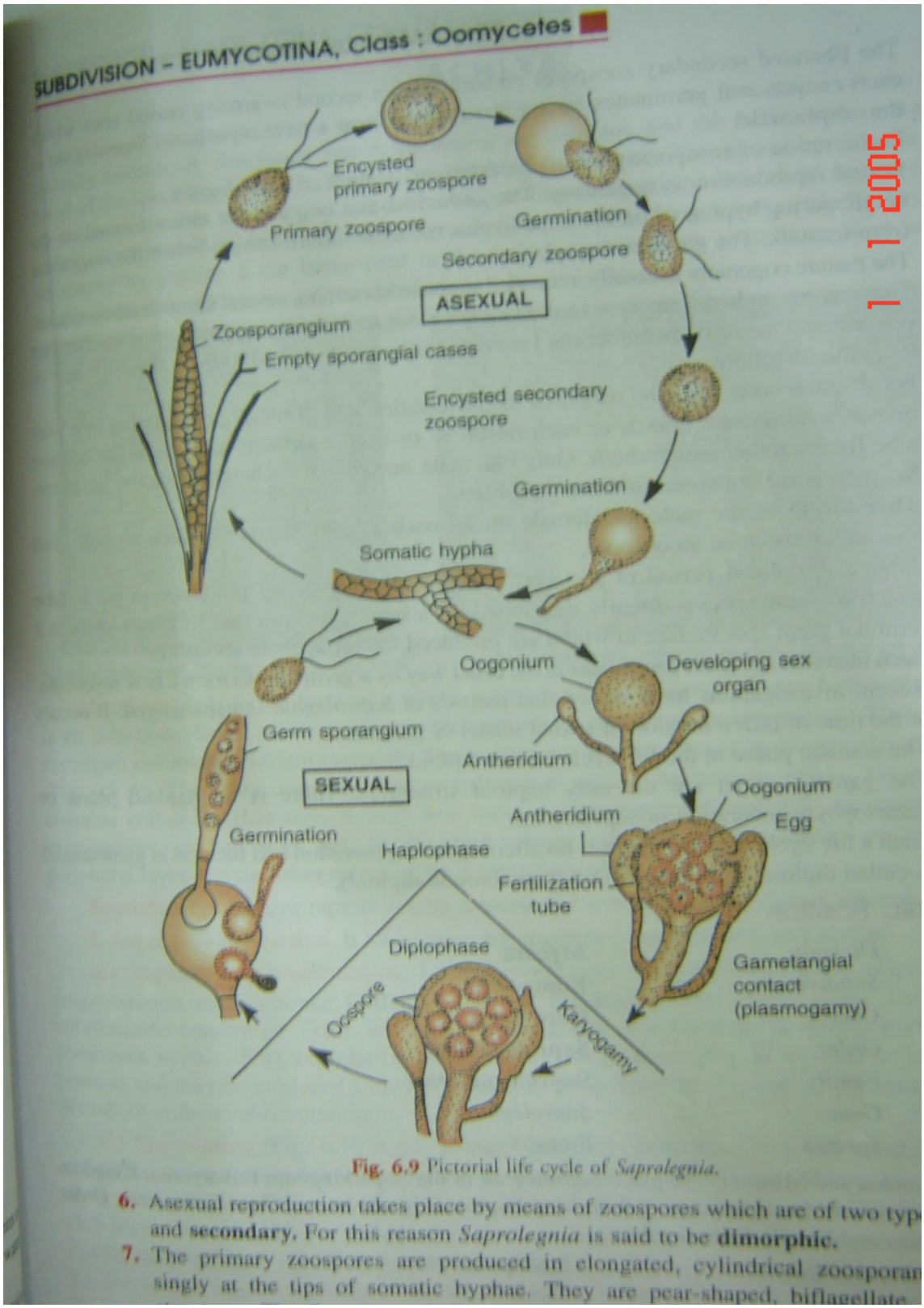

Fig. 6.9 Pictorial life cycle of *Saprolegnia*.

6. Asexual reproduction takes place by means of zoospores which are of two typ and **secondary.** For this reason *Saprolegnia* is said to be **dimorphic.**
7. The primary zoospores are produced in elongated, cylindrical zoosporan singly at the tips of somatic hyphae. They are pear-shaped, biflagellate

Figure 18: Life cycle of *Saprolegnia parasitica*

This order was classified into three families according to the type of sprangiophores:-

Family 1: - Pythiaceae: Sporangia on somatic hyphae or on sporangiophores of indeterminate growth, periplasm a thin layer or absent; facultative, or saprobes.

Family2: - Peronosporaceae: - Sporangia borne on sporangiophores of determinate growth; periplasm is conspicuous; obligate parasites of plants; sporangia are wind- borne.

Family 3: - Albuginaceae: - Sporangia borne in chain; periplasm is conspicuous; obligate parasites of plants.

Family 1: Pythiaceae

Genus 1: *Pythium*:

General characteristics: -

1- This fungus causes damping off seedling. Some species are saprobes, other are parasites.

2- mycelia are coenocytic, sporangia are globose to oval and either terminal or intercalary on somatic hyphae.

3- Production of zoospores is preceded by the formation of a bubble-like vesicle.

4- Zoospores are biflagellated- reniform.

5-This fungus does not form haustorium.

Genus 2: *Phytophthra*

General characteristics:-

1- This fungus causes Late blight disease on Potato.

2- Mycelia are coenocytic but more brnching than the mycelia in *Pythium*.

3- Sporangia are smaller and lemon-shaped with terminal papillae.

4- It does not form vesicle.

5- Producing haustorium.

-Notice Figure 19 and 20-

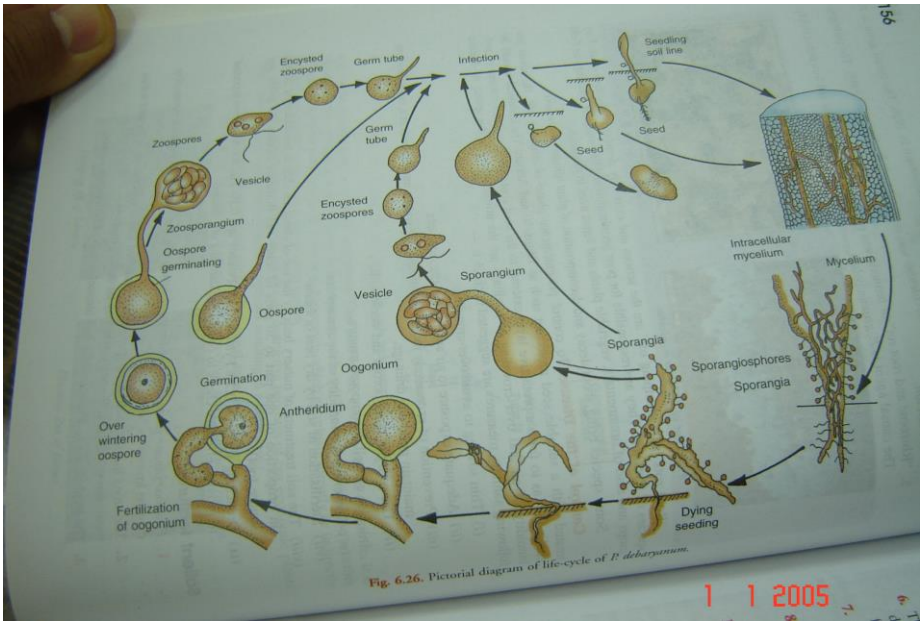

Figure 19: Life cycle of *Pythium debaryanum*

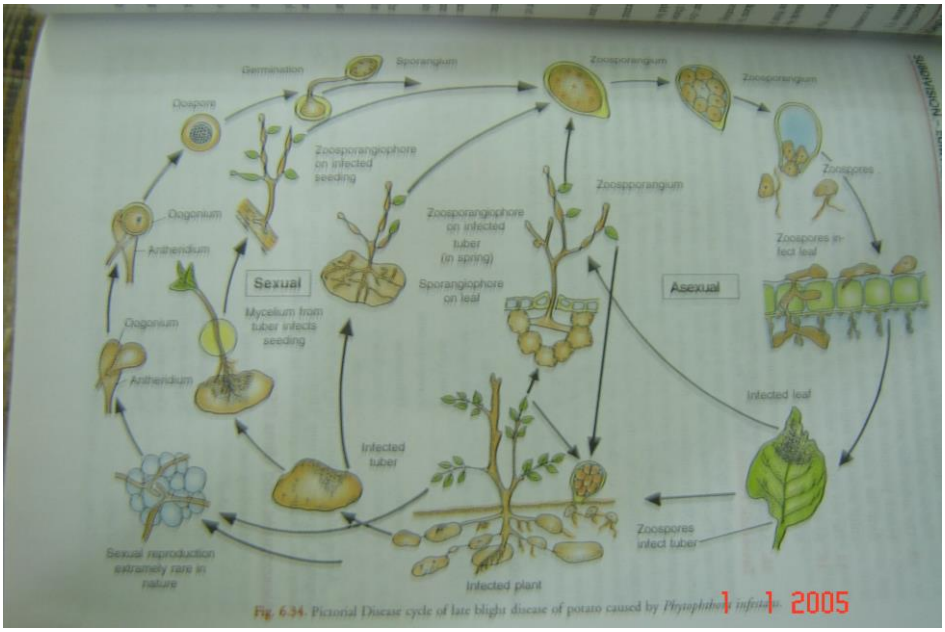

Figure 20: Life cycle of *Phytophthore infestans*

Family 2: Peronosporacea

This is most highly specialized family in the order peronosporales. All species are obligate parasites of vascular plants causing diseases called downy mildew. The family includes a number of common genera differentiated chiefly by the branching of their sporangiophores as follows:

Genus 1: - *Peronospora:*

The sporangiophores are dichotomously branched at acute angles with curved pointed tips on which sporangia are borne. This genus causes D.M. on Radish.

Genus 2:- *Plasmopara:*

The branches and their subdivision occur at right angles. This genus causes D.M. on Grape.

Genus 3:- *Bremia:-*

Is similar to *peronospora* except that the tips of branches are expanded into cup-shaped apophyses with four sterigmata each bearing the sporangia. This genus causes D.M. on Lettuce.

Genus 4:- *Basidiophora*

The sporangiophore is club-shaped with swallen head over which the sporangia are borne in minute sterigmata. This genus causes D.M. on Onion.

Genus 5:- *Sclerospora*

The sporangiophore is a long-stout hypha, with many upright branches near the end, bearing sporangia at the tips. This genus causes D.M. on Mongra.

-Notice Figure 21-

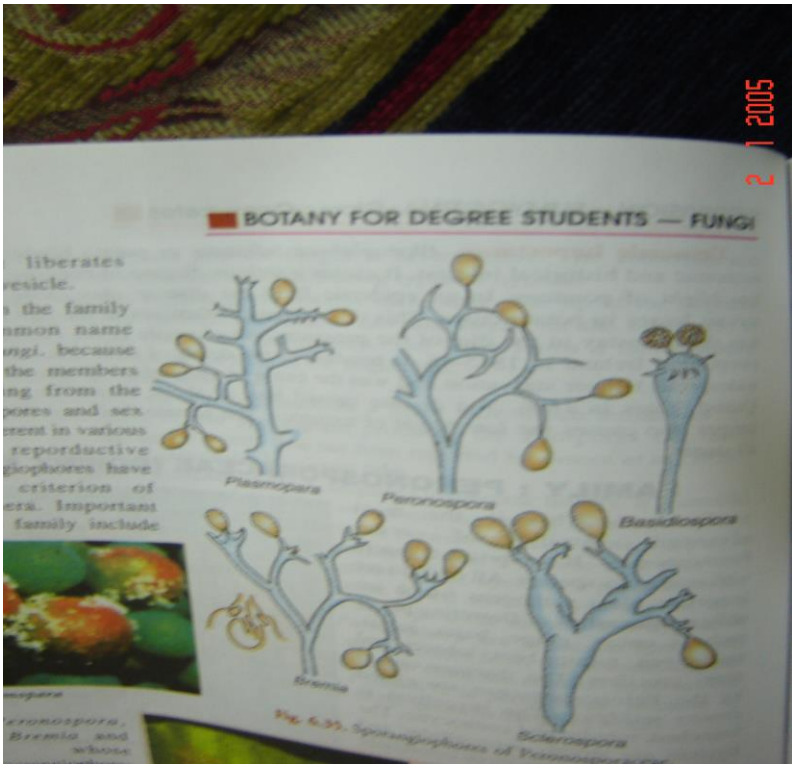

Figure 21

Family 3:- Albuginaceae:-

This family includes the fungi known as white rusts. All are obligate parasites causing diseases of vascular plants.

Genus: ***Albugo***:- There are several species of *Albugo*, the only one genus in this family. The more important species is *A. candida* which attack Crucifers.

Life cycle of *Albugo candida*:

The mycelium is intercellular and feeds by means of hausturia. * The maturity mycelium produces short, club-shaped sporangiophores from the tips of a large number of hyphal branches below the epidermis of the host.* Each sporangiophore give rise to several sporangia that it produces in succession, one below the other, so that a chain of sporangia is formed with oldest at the tip of the chain.* Both the growth of the mycelium and the production of numerous sporangia exert a pressure from below on the host epidermis, causing rupture. *So, the sporangia are released and form

a white rust on the surface of the host. *Zoospores are released from sporangia, Encystment, and then germinated and infects the host.

-Asexual cycle-

Oogonia and antheridia are formed within the tissues of the host, both organs are mulltinucleate at the start, but only one nucleus in each is finally functional. They are formed near each other and borne terminally on somatic hyphae.* They soon contact, the antheridium then forms a fertilization tube, a single male nucleus passes through it together with some cytoplasm, and fuses with the egg nucleus.

*The resulting zygote nucleus divides several times mitotically as the oospore develops a thick ornamented wall. The oospore germinates to form zoospores that encyst and germinate by germ tubes to complete the life cycle. Figure 22.

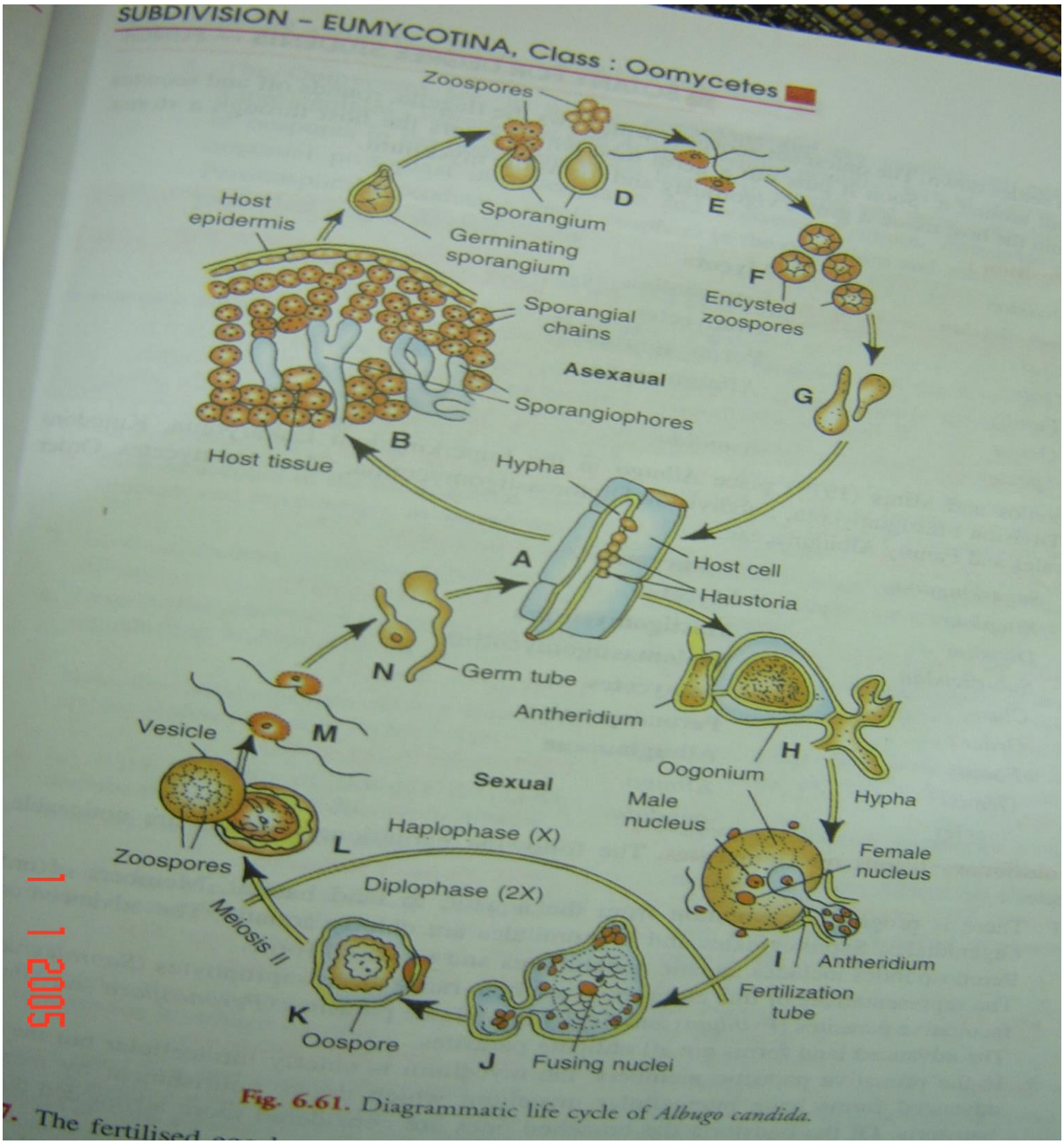

Figure 22: Life cycle of *Albugo candida*.

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