Lecture 7:

Division 2: Eumycota

Class 5: Ascomycetes:-

General characteristics:-

1- The one character distinguishing the ascomycetes from all other fungi is ascus, a sac-like cell containing usually definite number of ascospores formed by free cell formation after karyogamy and meiosis. Eight spores are typically formed within the ascus, but this number may vary from one to over thousand according to the species.

2- Mycelia are septate.

3- The absence of any type of flagellate cells.

4- Ascomycetes have two reproductive phases: the ascus or sexual stage, often called perfect stage, and the conidial or asexual stage –imperfect stage-

5- Fungi somatic structure either unicellular such as yeast or multicellular like other ascomycetes.

6- Sexual reproduction by gametangial contact, gametangial copulation, somatogamy, and spermatization. The female gametangia called ascogonium and the male are antheridia. Male nucleus passes from the antheridium into the ascogonium through a pore developed at the point of contact between the two gametangia. The ascogonium is often Provided with a trichogyne that receives the male nucleus. Some times the male and female nuclei do not fusion directly, resulting a binucleate cell which called dikaryon.

7- There are two types of asci: unitunicate and bitunicate. In the so called unitunicate ascus the two layers are closely adherent and the spores are released through a terminal pore -operculum-. In the bitunicate ascus the endotunica – endoascus – separating from the exotunica –exoascus- at the time of spore release, while the exotunica remains as originally

formed. Sterile, elongated hairs, arising between the asci often form a part of the hymenium, those hairs are called paraphyses – sin: paraphysis-.

8- With few exceptions, ascomycetes produce their asci in fruiting bodies called ascocarps. In general there are five major categories of ascomycetes, separated according to the way they bear their asci:-

A- Those that bear naked asci without any fruiting bodies.

B- Those that produce their asci inside a completely closed ascocarp called a cleistothecium.

C- Those whose ascocarp, the perithecium, is more or less closed, but at maturity is provided with a pore – ostiole- through which the ascospores escape.

D- Those that produce their asci in an open ascocarp, called apothecium.

E- Those that form their asci directly in a cavity –locule- within stroma. The stroma itself thus forms the wall of the ascocarp in such species. We call such a structure an ascostroma. Figure 26.

Classification of Ascomycetes:

According to the type of ascocarps, Ascomycetes can be classified into three subclasses:-

Subclass 1: Hemiascomycetidae:- Asci arising naked, no ascogenous hyphae or ascocarp produced.

Subclass 2: Euascomycetidae:- Asci produced within ascocarp – Cleistothecium, Apothecium, or Perithecium.

Subclass3: Loculoascomycetidae: Asci form within Ascostroma.

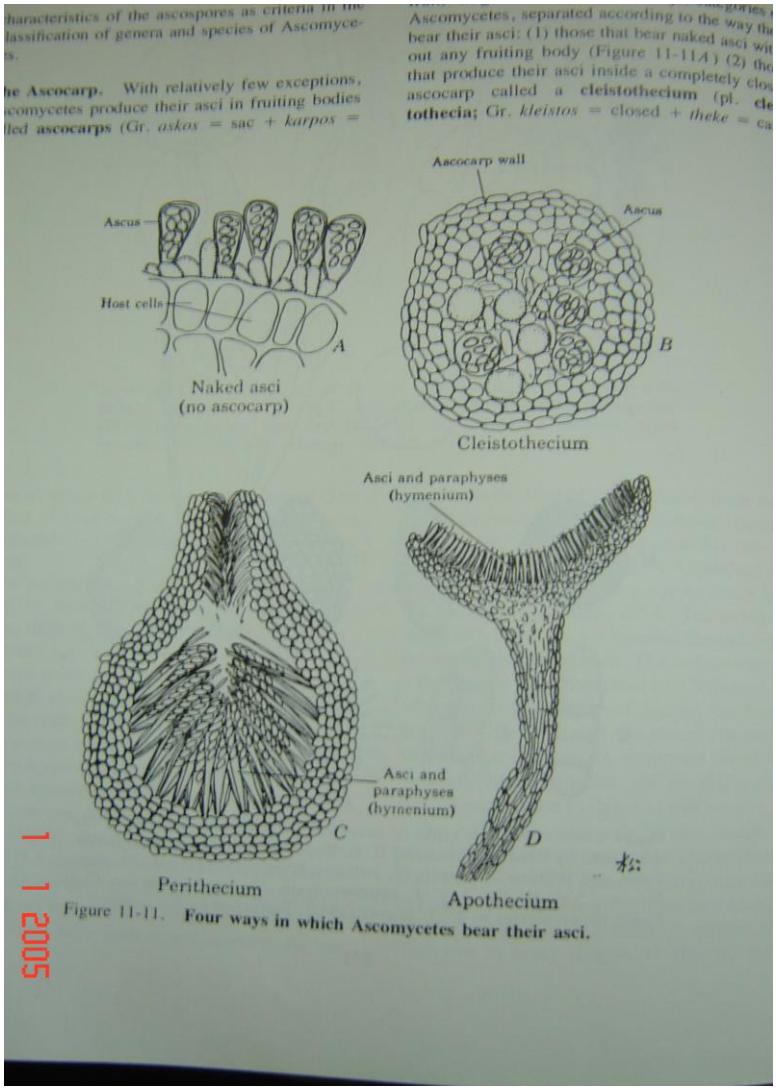

Figure 26: Four ways in which Ascomycetes bear their asci.

Subclass 1: Hemiascomycetidae:-

This subclass involves fungi do not form ascocarp, so there is no ascogonium and antheridium.This subclass consists of two orders:

Order 1: Endomycetales

Order 2: Taphrinales

Order 1: Endomycetales:- The asci in this order formed directly from zygote such as in Yeast which is very important in alcoholic

fermentation, bread preparation, and production of vitamin B complex.This order involves two families:-

Family 1:- Endomycetaceae:

This family involves many genera and many species, but the most important one is ***Schizosaccaharomyces octosporus***, this species growing well on honey and others materials and on solid and liquid media forming mature asci during three days.

The single cell is globose or cylinder in shape, uninucleus, 1n chromosome.* During asexual reproduction, the nucleus divides and a septum is formed between the two nuclei. Cleavage at the septum results in two uninucleate cells*. So this yeast called –Cleavage yeast- Sexual reproduction occurs by union of two daughter cells, *the fertilization tube is formed in adhering region between two cells, then plasmogamy and karyogamy happened to produce zygote,* which undergo meiosis resulting a young ascus with four nuclei.,* then mitosis occurs to give rise eight nuclei, each nucleus will converting to the ascospore which gives somatic cell.- Homothalic.Figure 27.

Family 2: Saccharomycetaceae:-

Ex; ***Saccaharomyces cerevisiae*** which it is heterothallic. The single cell is oval. * Asexual reproduction occurs by budding.* Sexual reproduction need two mating type (a and ά).* It has been shown that, when (a) cells are near, but not in contact, with (ά), they elongate and enlarge toward the cells of opposite mating type in response to a sex hormone.* After cell fusion, the zygotes being to bud and several generations of diploid cells are formed which undergo meiosis to form young ascus with four nuclei, two are (a) and two are (ά),* then mature ascus is formed with four ascospore. Figure 27.

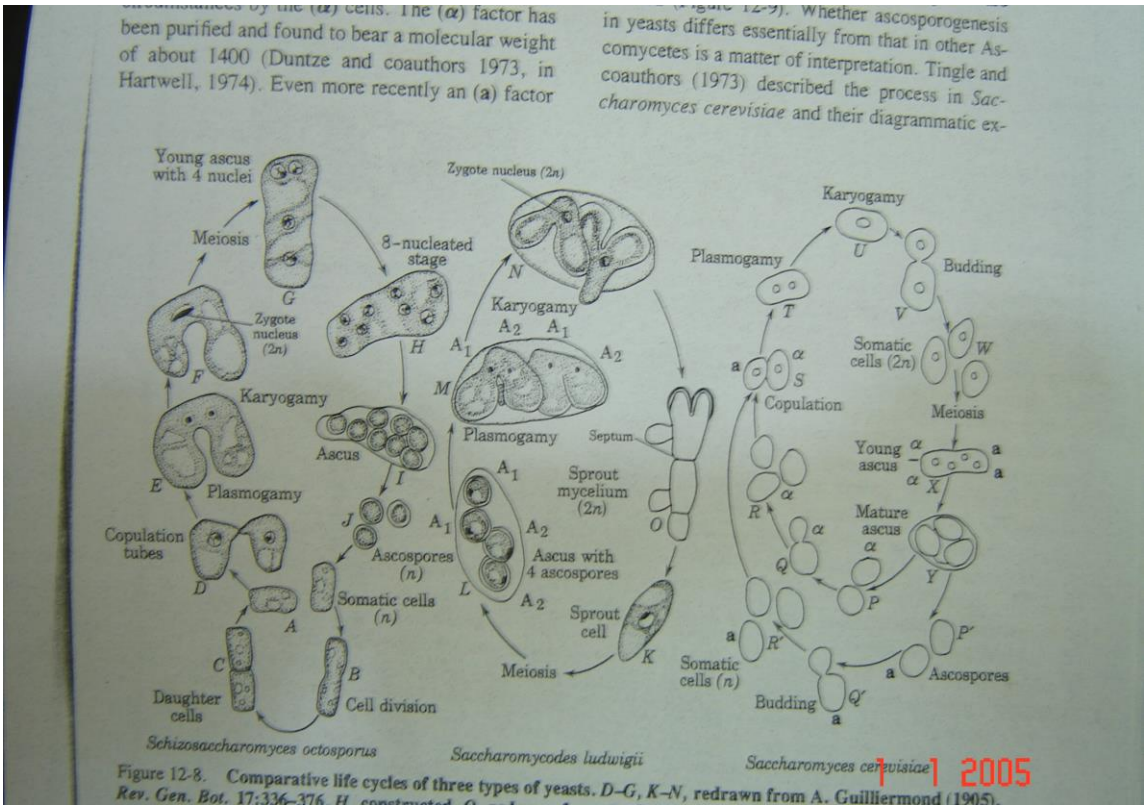

Figure 27: Life cycle of ***Schizosaccaharomyces octosporu*** and ***Saccaharomyces cerevisiae***

Order 2: Taphrinales

General characteristics:-

1- The fungi in this order are obligate parasite. Ex: *Taphrina deformans* causes Leaf curl disease.

2- Asci are arising naked, no ascocarp.

3- Asexual reproduction occurs by budding from the ascospore within ascus or out of it.

Life cycle of *Taphrina deformans:-*

The ascospores, soon after they are formed, produce small, round or ovoid blastospores by budding. * The blastospores, like the ascospores, are uninucleate, and haploid.* On the surface of host, the blastospores may continue to bud, producing secondary blastospores or may germinate by germ tubes that infect the host and produce the mycelium.* At the time of germination, the conidial nucleus divides, and resulting pair of nuclei migrate into germ tube (C).* The mycelium grows and branches, spreading between the cells and penetrating the tissues of the host.* Hyphal strands become more or less massed in the subcuticular region, and here break up into their component binucleate cells- ascogenous cells- or called –chlamydospores-.(D)* Karyogamy occrs within each ascogenous cell, and about this time the cell begins to elongate.(E)*While this elongation is proceeding, the diploid nucleus divides mitotically, and one daughter nucleus remains near the base of the cell while the other moves towards the growing tip.(F)* A septum then develops between these two nuclei, separating the cells into a basal stalk cell and an upper ascus mother cell.(G)* The protoplast of the basal cell soon disintegrates, leaving the cell empty, while the upper cell is being converted into ascus.* Meiosis and a subseqent mitotic division result in the formation of eight nuclei (H&J)* Each nucleus is source of ascospore.Figure 28.

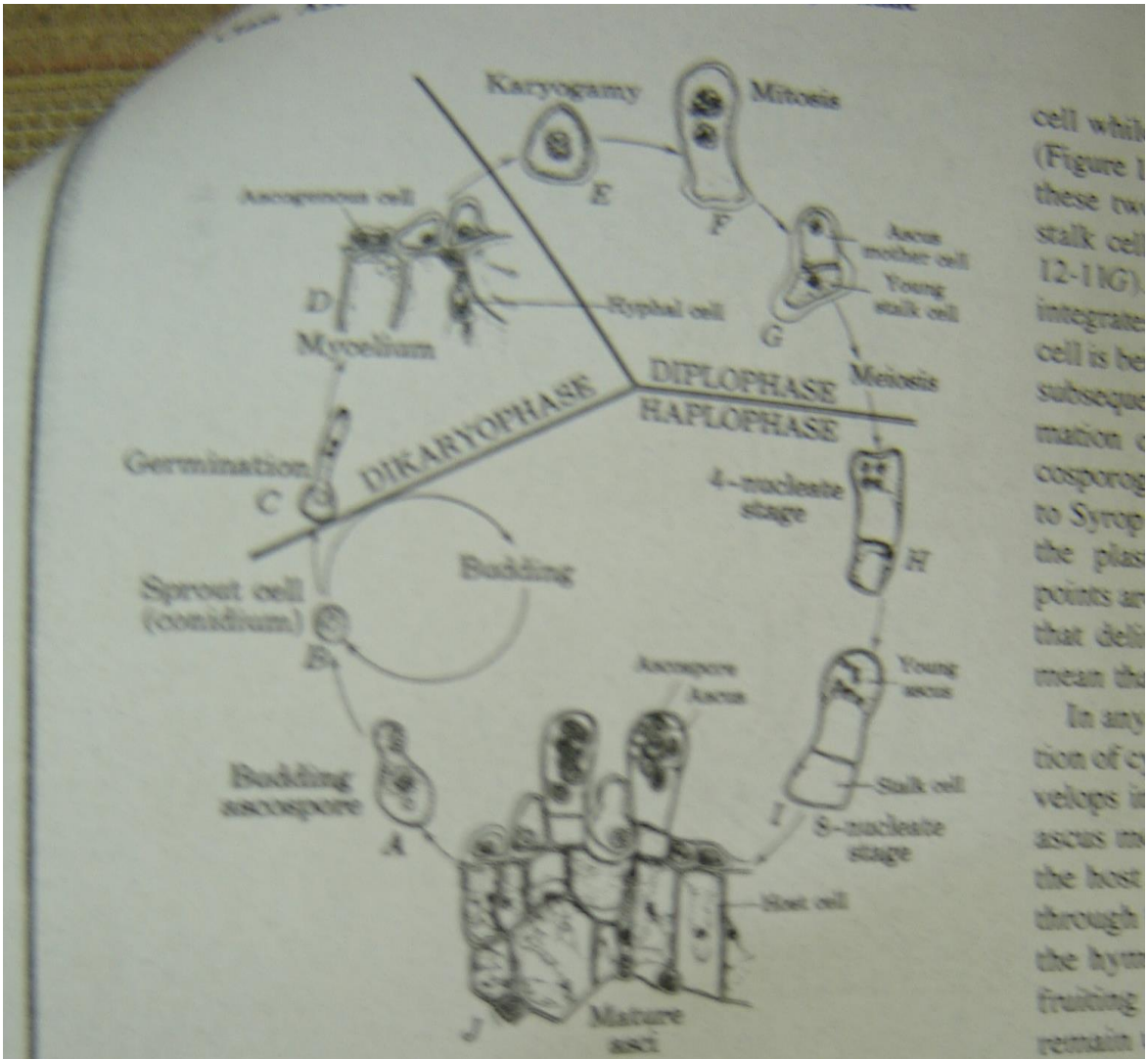

Figure 12-11. Life cycle of *Taphrina deformans*. Redrawn from Martin (1940). *Am. J. Bot.* 27:743–751.

the binucleate condition of the hyphal cells (Figure 12-11*D*).

The mycelium grows and branches, spreading between the cells and penetrating the various tissues of the host. Hyphal strands eventually become

Figure 28: Life cycle of *Taphrina deformans*