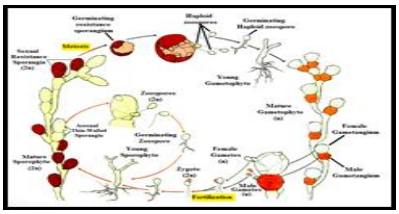
Ministry of Higher Education and Scientific Research
University of Baghdad
College of Science
Department of Biology

Practical mycology

الفطريات العملي

قسم علوم الحياة-المرحلة الثالثة-الدراستين الصباحية والمسائية

الفصل الدراسي الثاني



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Lab 1

What are fungi?

Biologists use the term fungi (plural) – fungus (single), to describe an-eukaryotic, spore-bearing, achlorophyllous organisms that generally reproduce sexually and asexually, and usually are filamentous, branched in shape. Somatic structures are typically surrounded by cell wall containing chitin, cellulose or both.

Fungi have no chlorophyll. There are some species of fungi that are single celled organisms, and there are other kinds of fungi that are multi-cellular organisms.

Fungi are made up of filaments called hyphae that are stacked together from end to end. There are two types of hyphae:

1. Septate hyphae: these hyphae have cross wall. ex: *Aspergillus*
2. Non-septate hyphae: these hyphae have no cross wall. ex: *Mucor*

Some kinds of fungi live on land and other types of fungi live in water environments.

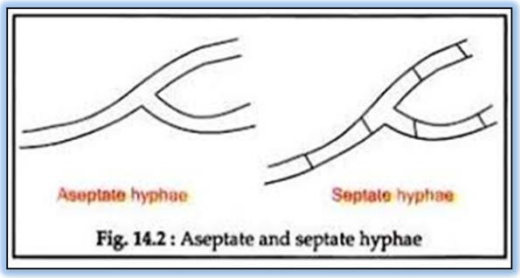
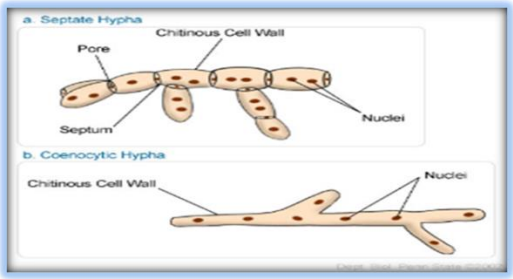


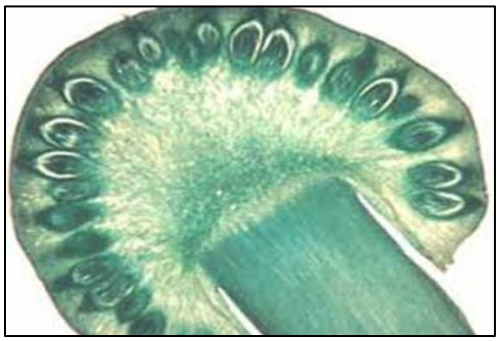
Fig. 14.2 : Aseptate and septate hyphae

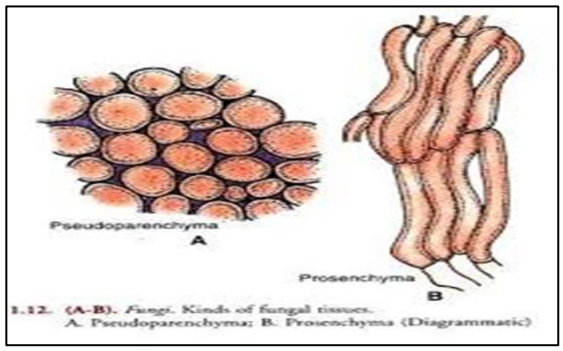


Fungal tissue (plectenchyma)

During certain stages of the life cycle of most fungi, the mycelium becomes organized into loosely or compactly woven tissues. These organized fungal tissues are called plectenchyma. There are two types of plectenchyma: prosenchyma and pseudoparenchyma. When the tissue is

loosely woven and the hyphae lie parallel to one another it is called prosenchyma, these tissues have distinguishable and typical elongated cells. Pseudoparenchyma consists of closely packed, more or less isodiametric or oval cells resembling the parenchyma cells of vascular plants. In this type of tissues hyphae lose their individuality and are not distinguishable. Ex :*Claviceps*





1.12. (A-B). Fungi. Kinds of fungal tissues.
A. Pseudoparenchyma; B. Prosenchyma (Diagrammatic)

How do fungi feed?

Fungi cannot make their food from sunlight, water and carbon dioxide as plants do, in the process known as photosynthesis. This is because they lack the green pigment known as chlorophyll, which plants use to capture light energy. So, like animals, they must obtain their food from other organisms. They do this in three ways.

1. **Saprophytes:** They may break down or 'rot' dead plants and animals. Organisms which obtain their food this way ar known as 'saprophytes'.
2. **Parasites:** They may feed directly off living plants, animals and human as 'parasites'.
3. **Symbiosis:** They are associated with the roots of plants in what are termed mycorrhizae.

Uses of Fungi: Fungi have a wide variety of uses and they represent a vital part of the ecosystem

- **Food:** Fungi have been used as a source of food throughout the history. A variety of mushrooms are used for cooking such as portabella, oyster, shiitake, and truffles. They add unique flavors and textures to many dishes.
- **Food Manufacturing:** Fungi are often used in the manufacturing of food such as yeast, which is used in the fermentation of fruit juice to produce wine. Yeasts are also used to produce beer and are use in the process of making bread.
- **Antibiotics:** Fungi play an important role in producing antibiotics such as penicillin and cyclosporine. These antibiotics are used to cure many diseases.
- **Environmental:** Fungi are also used in environmental cleansing as a detoxifying agent. The treatment bioremediation, for instance, uses fungi to detoxify polluted soil and water.
- **Pest Control:** Fungi have been effectively utilized in insect control and to fight roundworm and a range of fungi pathogens and other organisms.

Harm of fungi: Fungi cause plenty of diseases, and thus cause very large economic losses.

- Cause serious diseases to humans and animals, including systemic diseases [lung, liver,…inner organs], they also infect other parts like skin, hair, and nails.
- Caused losses in the tanning industry, where the fungi infecting a leather lead to a bad product or impossibility of use.
- Produce toxins called (mycotoxin) when growing on fruit, vegetables and grains. Such as aflatoxin which produce by *Aspergillus* and this toxin cause cancer and many diseases.

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Fungal isolation:

Fungi need to grow to the sources of energy, it may be the source or nitrogen Carbone, as well as fungi need for their growth to the minerals, and vitamins, salts and other factors.

Culture media: Media generally contain a source of carbon, nitrogen and vitamins. Glucose (dextrose) is the most widely utilizable carbon source, and hence is the most commonly used in growth media. Fructose and mannose are the next most commonly utilized sugars by fungi and are found in media from natural sources. Sucrose (table sugar) may be used in some media. Nitrogen sources include peptone, yeast extract, malt extract, amino acids, ammonium and nitrate compounds.

Culture media are divided depending on the type of information to be obtained to:

1. Solid media: Solid media consist of liquid media that have been solidified with an agent such as agar. These media used for diagnostic purposes, where the fungi help the formation of spores easily.

2. Liquid media: liquid media consist of liquid materials without agar. These media used for the purposes of extracting secondary metabolic products (such as enzymes and DNA).

Culture media are divided depending on the manufacturing process to:

1. Synthetic media: These media are consisting only of known mixtures of chemical compounds (as salts, sugars) such as Czapeks solution agar.

2. Semi- Synthetic media: These media are consisting of a mixture of natural and synthetic substances. Such as Potato dextrose agar, Sabourauds agar.

3. Natural media: Natural culture media composed of natural materials in full or in part, may be composed of parts of the plant or animal, and can be added Agar, to make a solid culture media. And disadvantages of these culture media that the elements included in its composition unknown concentration and quantity Such as Potato agar

Fungal Isolation Sources:

1. Isolate the fungus from plant parts.
2. Isolate the fungus from water.
3. Isolate the fungus from soil.
4. Isolate the fungus from human.
5. Isolate the fungus from food.
6. Isolate the fungus from other many places…..

Lab 2

Reproduction of fungi

There are two types of reproduction:

I. **Asexual reproduction**

II. **Sexual reproduction**

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Asexual reproduction: In general, asexual reproduction is more important for the propagation of the species because it results in the production of numerous individuals, and the asexual cycle is usually repeated several times during the season, whereas the sexual stage of many fungi is produced only once a year. The asexual methods of reproduction commonly found in fungi may summarized as follows:-

I. **Fragmentation**: Each fragment growing into a new individual. Some fungi employ fragmentation of hyphae as a normal means of propagation. The hyphae may break up into their component cells that behave as spore. These spores are known as Arthrospores. If the cells become enveloped in a thick wall before the separate from each other or from other hyphal cell, they are often called Chlamydospores, Figure 1.

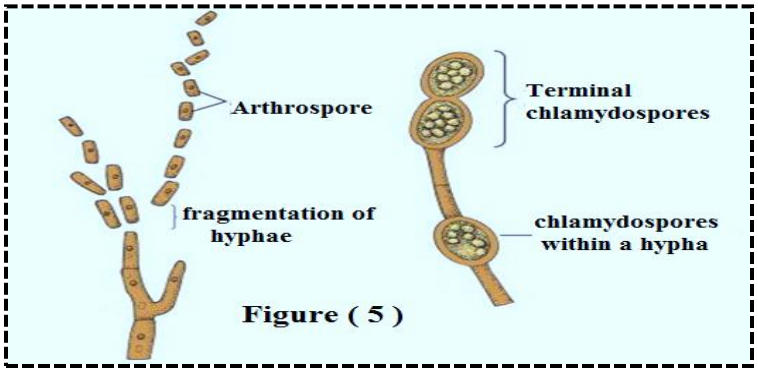


Figure (5)

II. **Simple fission of somatic cells into daughter cells:** Fission, the simple splitting of a cell into two daughter cells by constriction and formation of a cell wall, is characteristic of a number of simple organisms including some yeast.

III. Budding of somatic cell or spores: Each bud producing a new individual. As the bud is formed, the nucleus of parent cell divides and one daughter nucleus migrates into the bud. The bud increases in size while still attached to the parent cell and eventually breaks off and form a new individual, Figure2.

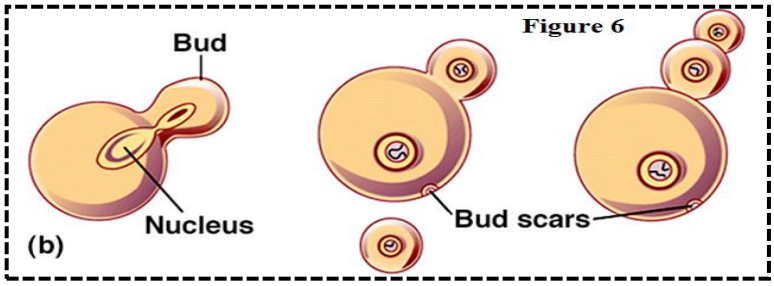


Figure 6

IV. Spore formation: The most common method of asexual reproduction in fungi is by means of spores. Spores vary in color, in size, in shape in number of cells, in the arrangement of cells; and in the way in which the spores borne, Figure.3

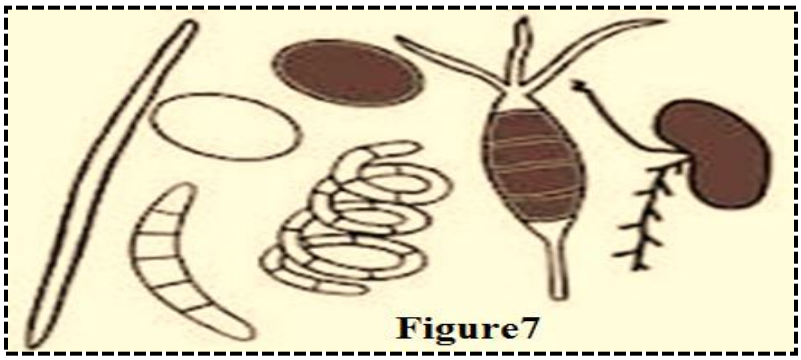


Figure7

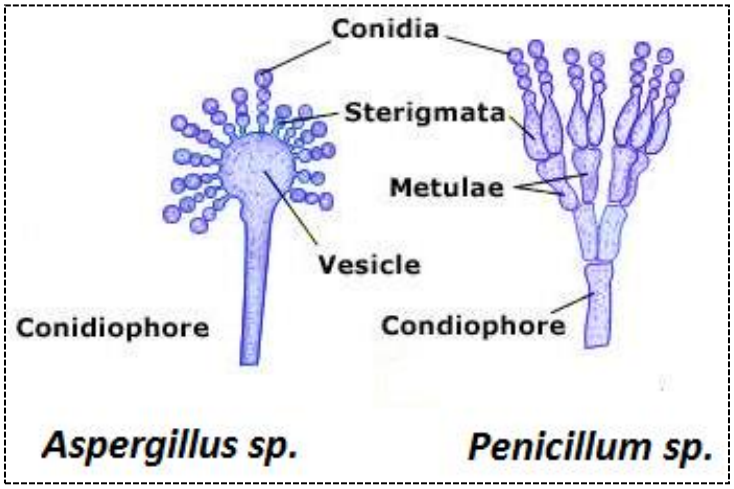
Spores are born in the following methods:

a. Sporangiospores: An asexual spore borne in a sporangium. There are two kinds of Sporangiospores, **(Zoospores)** an asexual sporangial spore, capable of independent motion usually by means of one flagella or more.

(Simple spore) an asexual sporangial spore unable to move.

b. Conidia: Is a single spore is surrounded by a wall. These spores exist (either individually or in chains) on **Conidiophore**, and this is either a simple, single, septate, and may swell the end of conidiophore made up **vesicle**. Such vesicle may covers with many sterigmata, and each sterigmata bears a series of conidia, as in ***Aspergillus***.

The conidiophore may be a simple, branched and septate. At the end of each branch there are a number of sterigmata (without vesicle) and each sterigmata bears a series of conidia, as in ***Penicillium***. Figure.4



**NOTE: Both of sporangiophore and conidiophore are simple-sporophore.

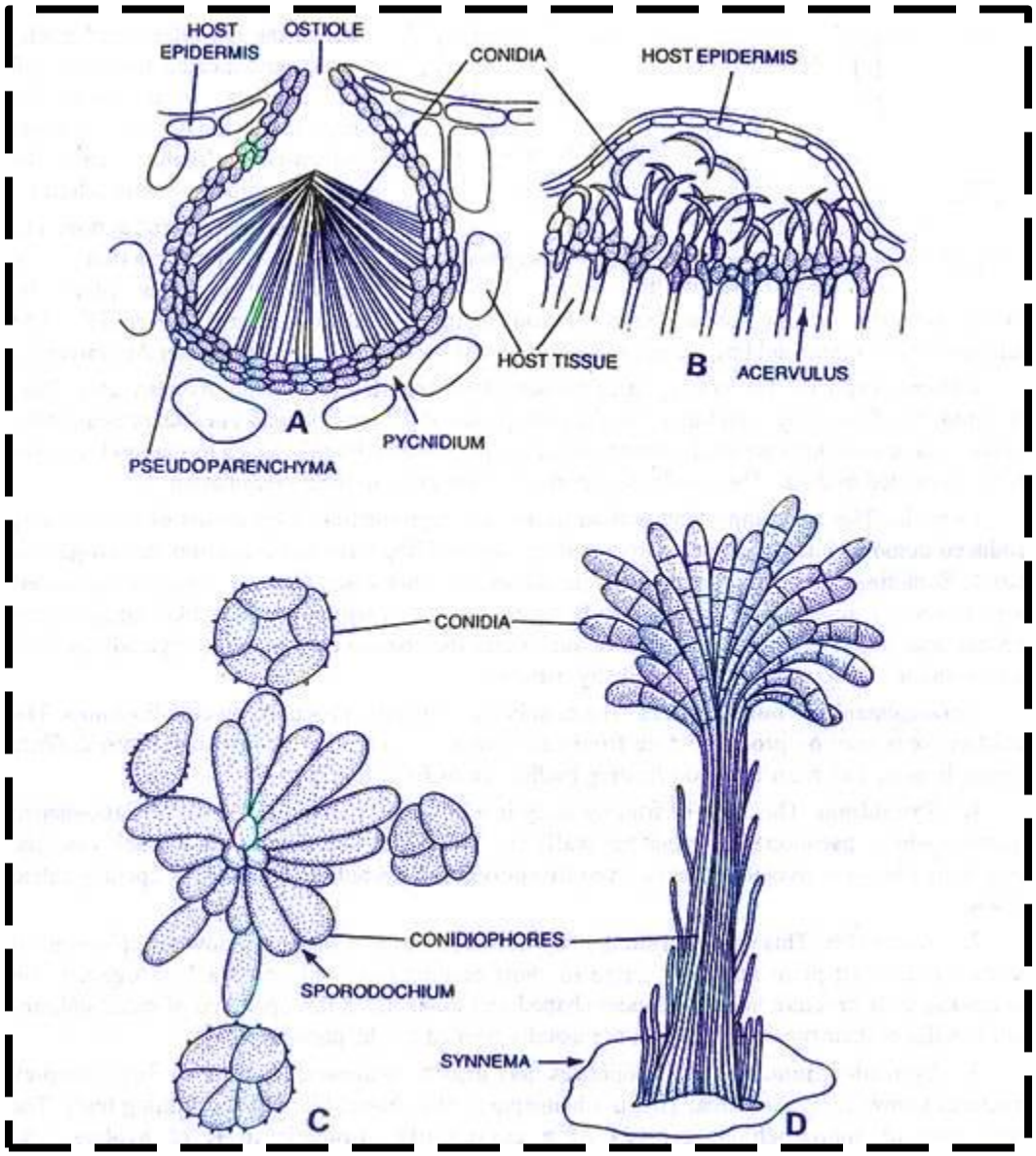
Compound sporophores: In general, they are a group of simple-sporophores which organized in various forms as follows:

1. Synnema: In general, is a gathering of simple sporophores in parallel, so that they appear as a plexus with a mass of conidia that produce from the top of simple sporophores, the ***Cercospora***.

2. Sporodochium: A sporodochium (pl. **sporodochia**) is a small, compact stroma (mass of hyphae) usually formed on host plants parasitised by mitosporic fungi of the form order Tuberculariales (Deuteromycota, Hyphomycetes). This stroma bears the conidiophores on which the asexual spores or conidia are formed.

3. Pycnidium: Flask-shaped cavity (asexual structure) located inside the plant tissue and the inner wall is lined with a row of the simple condiophores that bear the conidia in their ends and at maturity opens this cavity from the top to release conidia, as in the *Septoria*.

4. Acervulus: Is a flat dish-like structure which carry spore-bearing parts called conidophores. There are structures between these conidiophores called **Seta.** These acervuli are usually found under cuticle of plant, as in ***Colletotrichium***



Compound sporophores

Lab 3

II Sexual reproduction:

Sexual reproduction occurs in all groups of fungi except the imperfect fungi or (Dueteromycetes)**.** It may involve fusion of gametes, gametangia or hyphae. The process may involve:

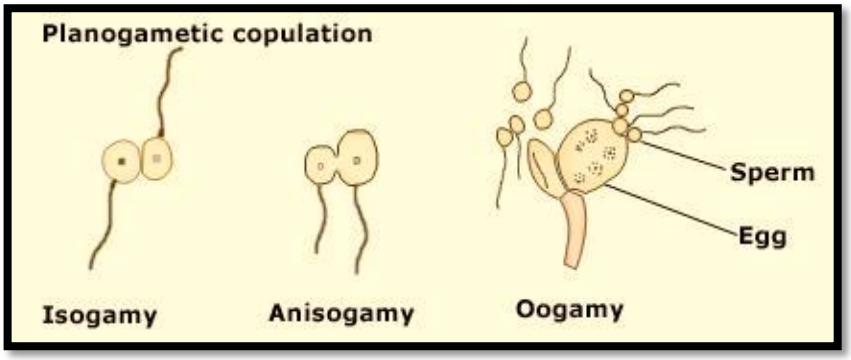
a. **Plasmogamy,** fusion of cytoplasm.
b. **Karyogamy,** fusion of nuclei.
c. **Meiospores,** production of meiotic spores.

In most of the lower fungi plasmogamy is immediately followed by karyogamy and meiosis.

In higher fungi karyogamy is often delayed so that the hyphae remain dikaryotic. This phase of fungal life cycle is called **dikaryophase.** Such fungi complete their life cycle in three phases a haplophase, a dikaryophase and a diplophase.

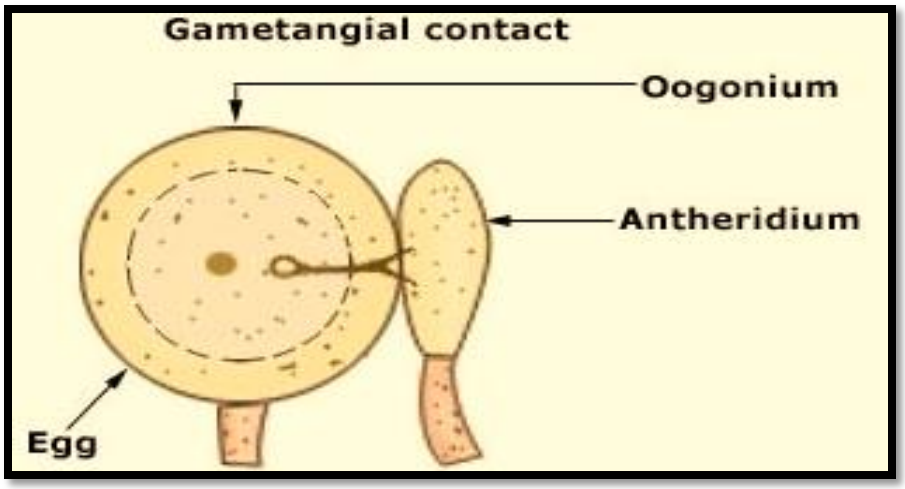
Types of sexual reproduction:

1. Planogametic copulation: involves the fusion of two naked gametes one or both of them are motile. Motile gametes are called planogametes. The most primitive fungi produce **isogamous planogametes (isogamy)** which morphologically similar in shape and size. Another type is **Anisogamous planogametes (anisogamy)** which morphologically similar but differ in size, they produced only by one group of lower fungi belonging to the genus *Allomyces.* In a related group, Monoblepharidales, the female gamete is non-motile whereas the male gamete is motile. The latter enters the oogonium and fertilizes the egg it's called **(Oogamy)**.



2. Gametangial contact:

In a large number of fungi, the gametangia of both male and female have been reduced to undifferentiated protoplasts consisting mainly of a nucleus. In this case the gametes are never released from the gametangia to outer environment, but are transferred directly from one gametangium into the other. In this method, two gametangia of opposite sex come in contact, and one or more gamete nuclei migrate from the male to the female. The male nuclei, in some species, enter the female gametangium through a pore developed by the dissolution of the gametangial walls at the point of contact; in other species, an especially developed fertilization tube serves as a passage for the male nuclei. After the passage of the nuclei has been accomplished the Oogonium continues its development in various ways, and the antheridium eventually disintegrates. **Ex:** ***Phytophthora*** and ***Albugo.***

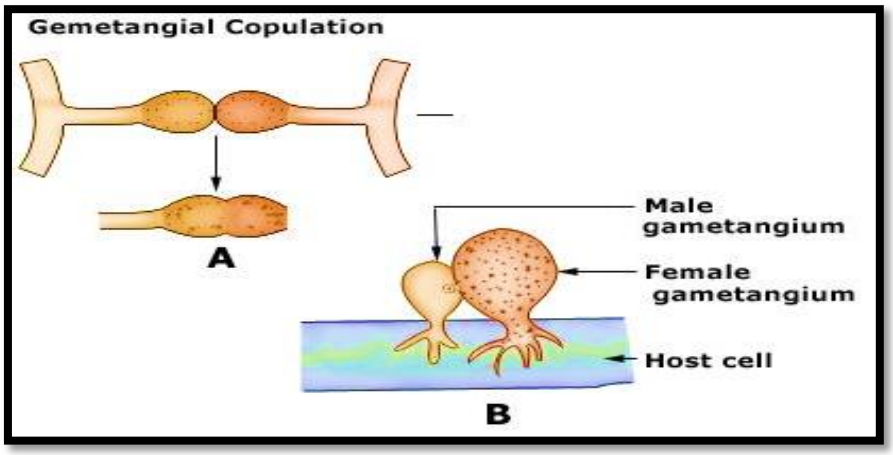


3. **Gametangial copulation**:

Is characterized by the fusion of the entire contents of two contacting gametangia. Such fusion takes place in one of the following methods:

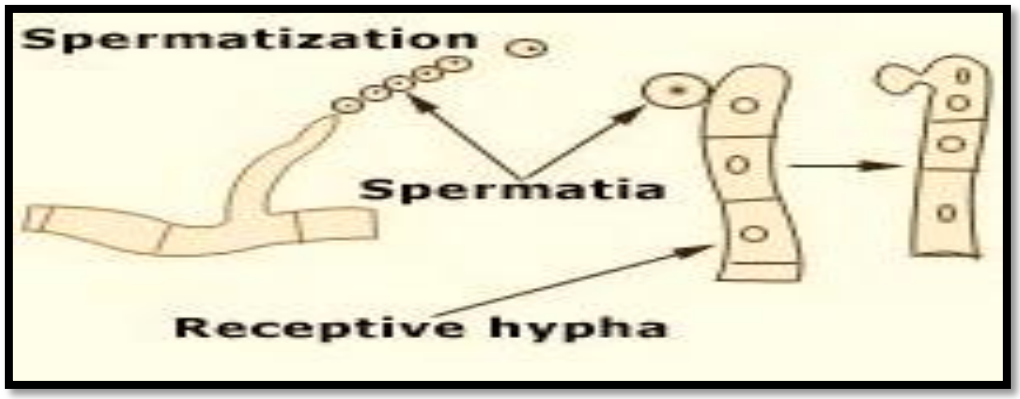
A. Direct fusion of the two gametangia of opposite sex into one. This takes place by the dissolution of the contacting walls of the two gametangia, resulting in a common cell in which the two protoplasts mix. *Ex:* ***Mucor*** and ***Rhizopus.***

B. Passage of the contents from one gametangium into the other through a pore developed in the gametangial walls at the point of contact. This method is typical of some holocarpic forms in which the entire thallus acts as a gametangium, the male thallus attaching itself to the female thallus and emptying its entire content inside it.



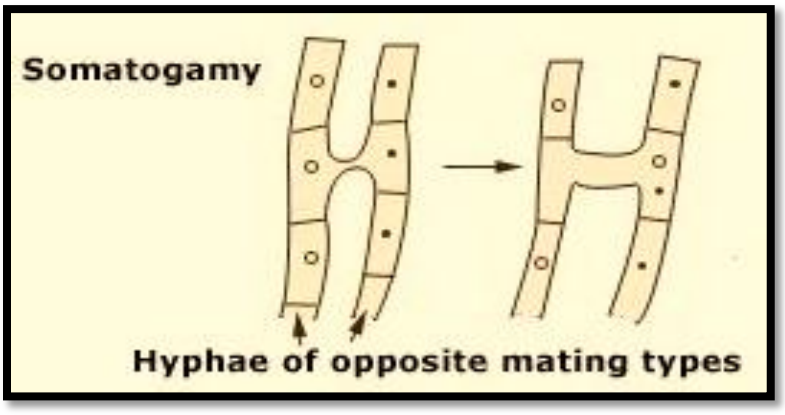
4. Spermatization:

Some fungi bear numerous, minute, uni-nucleate, spore-like, male structures termed **spermatia** which produced in various ways. The spermatia are carried by insects, wind, water, or in some other ways, to the female gametangia with special receptive hyphae, or even to somatic hyphae, to which they become attached. A pore develops at the point of contact, and the contents of the spermatium pass into the particular receptive structure that serves as the female organ. ***Ex: Puccinia***



5. Somatogamy:

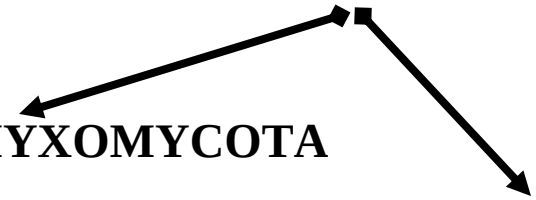
Is found especially in the higher fungi where no sex organs are produced, like in ***Agaricus***, fusion occurs between two somatic cells and involves only plasmogamy. This leads to formation (dikaryotic hyphae).



Lab 4

CLASSIFICATION OF FUNGI

KINGDOM MYCETAE



Division I: **MYXOMYCOTA**

Division II: **EUMYCOTA**

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1- Division: Myxomycota

1. Class : Myxomycetes

A. Sub class : Ceratiomyxomycetidae

Order: Ceratiomyxales

Ex: *Ceratiomyxa*

B. Sub class: Myxogastromycetidae

a. Order : Liceales ex: *Lycogala*

b. Order : Trichiales ex: *Arcyria, Hemitrichia*

c. Order : Stemonitales ex: *Stemonitis, Diachea*

d. Order : Physarales ex: *Physarum, Didymium*

##########

2. Class: Plasmodiophoromycetes

Order: Plasmodiophorales

Ex: *Plasmodiophora brassicae*

Causes: Club-root disease in *Cruciferae*

Ex: *Spongospora subterranean*

Causes: powder scab of potato

Division Myxomycota :

It is the most primitive type of fungi, their individuals are characterized by the presence of Plasmodium which represents the vegetative phase.

Plasmodium: is a mass of multi nucleated protoplasm, mobile phase, its feeding and movement are in somehow similar to Amoeba, that's why it's known as a free living . at maturity it turns into a proliferative phase (fruit bodies).

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1.Class: Myxomycetes :

This class is classified into two subclasses according to **the method of sporulation.**

A. Sub-class : Ceratiomyxomycetidae

Spores are produced directly on the structures (like thorns) are present on the body of fungus. Here spores are called **exospores**.

Ex: *Ceratiomyxa*.

B. Sub-class: Myxogastromycetidae

Spores are produced inside the structures (fruit bodies) are called sporangia. Here spores are called **endospores**.

The sub-class Myxogastromycetidae is classified into four orders according to:

1. Spores color
2. The presence or absence of capillitium.
3- Presence or absences of lime.

Capilitium: are sterile filamentous structures that usually develop with spores within sporangia. Their function is retention of spores in the sporangia. By retaining spores the capillitium will allow gradual dispersal of spores over a long period of time. Capillitia have been used in identification of some Myxomycetes.

a. Order: Liceales

1. Spore-bearing body light colored
2. The absence of capilitium and lime.

Ex: ***Lycogala***

Fruit body in this order called **Aethalium** (A group of sporangia that have not separated into individual units. In some aethalia the wall of the individual sporangia are quite evident, in other they are difficult to see**.**

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b. Order: Trichiales

1. Spores are bright colors as red and pink
2. The presence of capilitium
3. The absence of lime.

Ex: ***Arcyria,*** and ***Hemitrichia***

****

c. Order: Stemonitales

1. Spores are dark colors as black and brown
2. The presence of capilitium
3. The absence of lime.

Ex: ***Stemonitis,*** and ***Diachea.***

****

d. Order: Physarales

1. Spores are dark colors as black and brown
2. The presence of capilitium
3. The presence of lime.

Ex: ***Physarum*****, and** ***Didymium.***

2. Class: Plasmodiophoromycetes:
This family includes a group of endoparasitic fungi, so they produce two types of spores (Zoospores and resting spores).

Order: Plasmodiophorales:
Ex: *Plasmodiophora brassicae*

(Causes: Club-root disease in *Cruciferae*)
C.S. in host tissue showing resting spores and plasmodium

Ex: *Spongospora subterranea*

(Causes: powder scab of potato)
C.S. in host tissue showing spore balls

Spore balls: spherical, hollow, and grouped resting spores, it appears in area of injury as a powder.

Lab 5

Division II: Eumycota

This division characterized by the absence of plasmodium, the fungal body is composed either of real mycelium or reduced to a single cell, and is divided into sub divisions depending on

1. the type of the mycelium (septate or not)
2. the presence or absents of motile spores

This division consists of five subdivisions:

Sub division 1: Mastigomycotina:

The main characteristics of this class are:

1. Swarm cells contain (posterior or anterior or both) whiplash flagellum.

2. No mycelium (in most individuals) or Mycelium is presence but coenocytic.

Sub division 2: Zygomycotina:

1. Fungi with a septate mycelium.

2. Asexual reproduction by aplanospores.

3. Sexual reproduction – gametangial contact- resulting in the formation of zygospores

Sub division 3: Ascomycotina:

1. Fungi with septate mycelium.

2. Producing ascospores in sac-like cells –asci-, usually eight ascospores.

Sub division 4: Basidiomycotina:

1. Fungi with septate mycelium and forming -clamp connections- .

2. Basidium bearing usually four basidiospores.

Sub division 5: Deutromycotina:

1. Fungi with septate mycelium.

2. Usually producing conidia.

3. Sexual reproduction unknown.

Sub Division: 1- Mastigomycotina (has two classes)

1- Class: Chytridiomycetes

A- Order: Chytridiales

Family: Synchytriaceae

Ex: *Synchytrium endobioticum*

(Cause black wart disease on potato tubers).

B- Order: Blastocladiales **(water mold)**

Ex: *Allomyces* **…….** has two phases

a. **Sporothallus** produce (zoosporangium, resting sporangium)

b. **Gametothallus** produce (male and female gametangium)

****

1. Sub Division: Mastigomycotina:

These fungi are characterized by the presence of motile spores with one flagellum or more. This subdivision is classified to classes depending on the number, type and location of flagella.

1. Class: Chytridiomycetes:

Is characterized by the presence of motile spores with single, posterior, whiplash flagellum, mycelium a septate, the individuals are more prevalent in aquatic habitats, however,many of them, may inhabit the soil, some of them are parasites.

Prosorus: is formed by increase in size of zoospore with the production of two chitinous layers around itself.

Sorus: is formed by the germination of prosorus, in which the prosorus increase in size, and mitosis is started to give 32 nuclei, then cytoplasmic septa are formed to form 4-9 sporangia in one sac.

Order: Blastocladiales: water mold
Ex: *Allomyces allomyces*
Species of the genus *Allomyces* exhibit phenomenon [ALTERNATION of GENERATIONS] in which haploid gametothallus alternating with diploid sporothallus.

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Sporothallus includes two types of sporangia:
A. Zoosporangium – Mitosporangia: thin walled, elongated, and colorless sporangia.
B. Resting sporangium –Meiosporangi: thick-walled, pitted, and colored sporangia.

Gametothallus: The gametothallus produce colorless female gametangia and orange male gametangia usually in a 1:1 ratio.

*The male gametangia are smaller than female and borne on the later such as in *A. macrogynus* or below them such as in *A. arbuscula*.

Lab 6

2. Class: Oomycetes

a. They produce biflagellate zoospores, one flagellum is tinsel and the second is whiplash.
b. Most of them are living in water so they called as water mold.
c. Some of them are obligate parasites on higher plant caused downy mildew diseases. Others are parasites on algae or small animals such as fishes.
d. Sexual reproduction is gametangial contact, to produce oospore.

****

This class has two orders:

A- Order: Saprolegniales

Family: Saprolegniaceae

Ex: *Saprolegnia parasitica* (Water mold).

Internal proliferation: it's an important phenomenon that represent a distinguish character in this order. The sporangium is elongated, tapering structures born at the tips of somatic hyphae and separated from them by a septum. Multiple sporangia will continue to be formed, with sexual a sexual generations following one another from the same initial point. An opening develops at the tip of the sporangium, and the zoospores of all the formed sporangia will escape from it into the surrounding environment.

Gemmae bodies: these bodies represent one type of asexual reproduction. They arise from the tip of mycelium, at maturity they separated and grow to a new mycelium.

B-Order: Peronosporales

1. Family: Pythiaceae

Ex: *Phytophthora infestens* (Cause: late blight of potato and tomato).
Ex: *Pythium debaryanum* (Cause: damping off seedlings)

2. Family : Peronosporaceae

Ex: *Peronospora spp.* (Cause: downy mildow on radish)
Ex: *Plasmopara viticola* (Cause: downy mildow on grape)
Ex: *Bremia lattucae* (Cause: downy mildow on lattucae)

3. Family: Albuginaceae

Ex: *Albugo candida* (Cause: white rust on Crucifers)
****

This order (peronosporales) is the most specialized fungi of the class Oomycetes. This large order of fungi includes aquatic, amphibious, and terrestrial species as a group of highly specialized obligate parasites that causes several diseases like:
1- Wilting or Damping off diseases.
2- White rust diseases.
3- Downy mildew diseases.

Sporangia are separated from mycelium after maturation – Spores are released after the separation of sporangia. In some species, sporangia act as conidia and germinated into a new thallus.

The order Peronosporales is classified in to three families according to the type of sprangiophores. It has three families:

1:- Pythiaceae

a) Sporangia on somatic hyphae or on sporangiophores of indeterminate growth
b) Sporangiophores cannot be distinguished from the mycelium.

2:- Peronosporaceae

a) Sporangia borne on sporangiophpres of determinate growth
b) Obligate parasites of plants.
c) Cause downy mildow disease

3:- Albuginaceae

a) Sporangia borne in chain.
b) Obligate parasites of plants.

Lab 7

Division: Eumycota

Sub division 2: Zygomycotina

Class: Zygomycetes

Order 1 : Mucorales

Ex : Rhizopus spp (Bread mold)
We see : Sporangium, Rhizoid, stolon, sexual reproduction „ Zygospore „ (young & mature)

Ex : Mucor spp
We see : Sporangium , sexual reproduction „ Zygospore „ young & mature)(

Ex : Cunninghamella
We see : monosporous sporangiola

Ex : Syncephalastrum
We see : merosporangia (cylindrical sporangiola)

Order 2 : Entomophthorales

Ex : Entomophthora muscae
We see : Conidia , conidiophore

General characteristics:-

1. Most zygomycetes produce a well - developed mycelium consisting of coenocytic hyphae.

2. Produce a thick-walled resting spore called **zygospore** that develops within a zygosporangium formed as a result to complete fusion of two equal or unequal gametangia.
3. Reproduce asexually by production of sporangiospores or aplanospores.
4. Most zygomycetes are saprobes, such as bread-mold, others are parasites such as Fly fungi, and some are obligate parasites, or facultative parasites in plants.
5. Sexual reproduction is gametangial copulation

This class has more than one type of sporangium such as:

- ✓ Sporangium
- ✓ Monosporous sporangiola
- ✓ Merosporangia
- ✓ Conidia

The class zygomycetes has two orders:

1- Order: Mucorales

Ex: *Rhizopus spp* (Bread mold)

Ex: *Mucor spp*

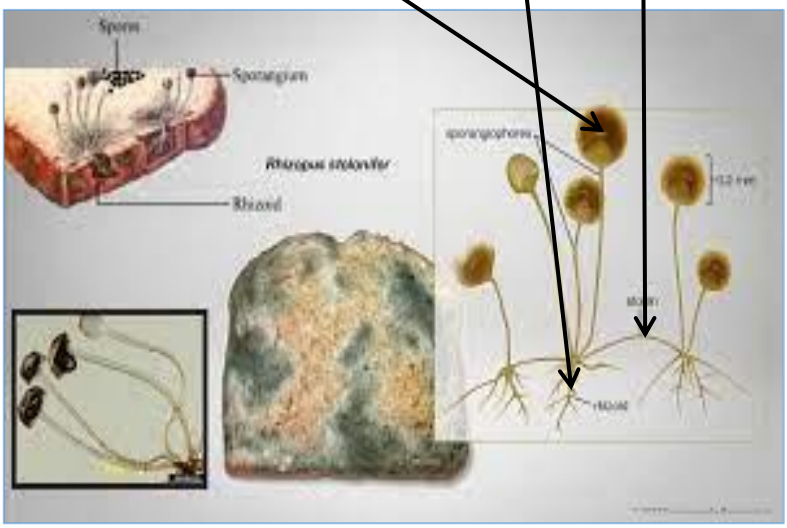
Ex: *Cunninghamella*

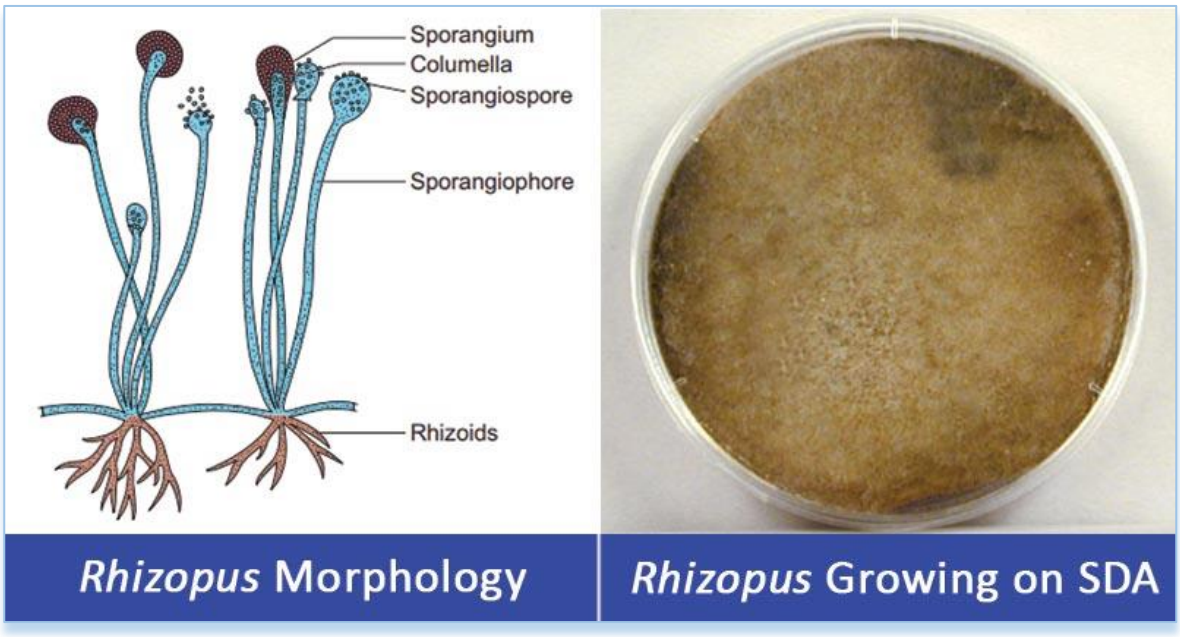
Ex: *Syncephalastrum*

2- Order: Entomophthorales

Ex: *Entomophthora muscae*

Rhizopus spp **(Sporangium, Rhizoid, stolon)**

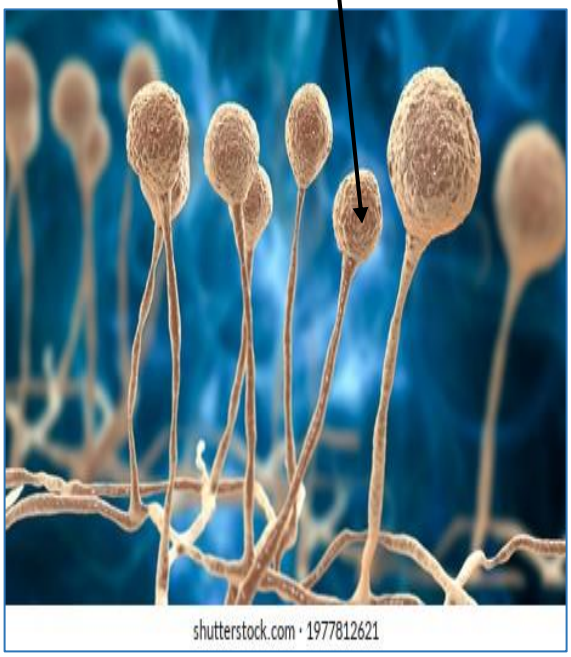




***Rhizopus spp* ,,Zygospore,, (young & mature))**

Mucor spp

(Sporangium)

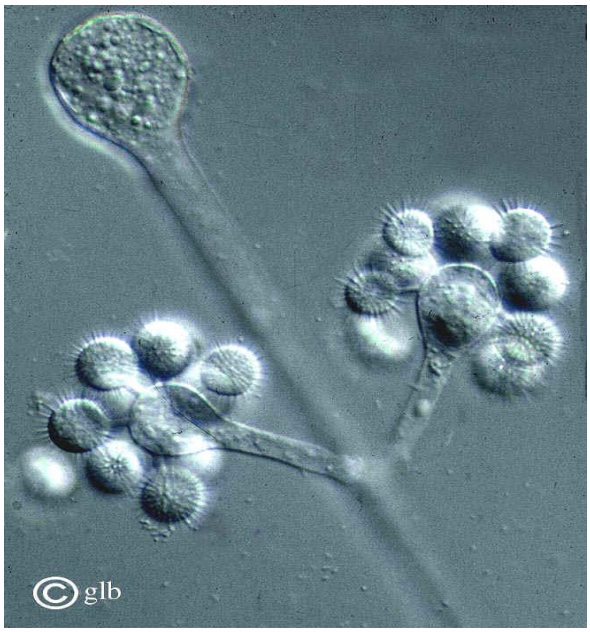


Mucor spp

Zygospore (young & mature)

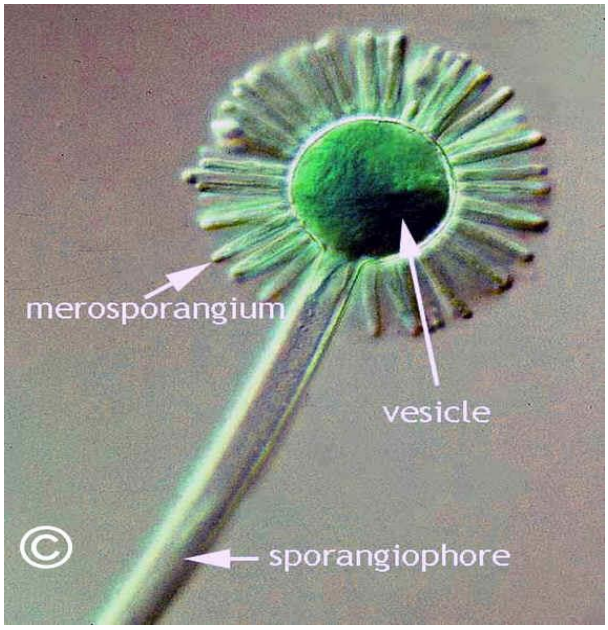
Cuninghamella

(monosporous sporangiola)



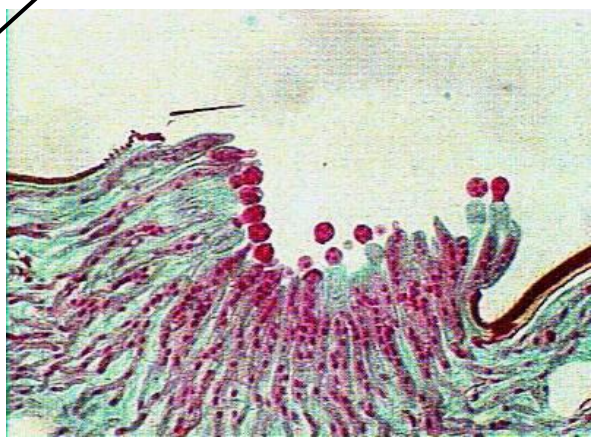
Syncephalastrum

merosporangia (cylindrical sporangiola)



Entomophthora muscae

Conidia , conidiophore



Lab 8

Division 2: Eumycota

Sub division 3 : Ascomycotina

Fruiting bodies

1. naked asci ***Taphrina deformans***

2.Cleistothecium ***Aspergillus sp.***

3. Perithecium ***Claviceps***

4. Apothecium ***Sclerotinia***

5. Ascostroma (Pseudothecium) ***Venturia***

Class 1: Hemiascomycetes (naked asci)

Order 1: Endomycetales

Family1: Endomycetaceae

Ex 1: *Schizosaccaharomyces octosporus*

We see : ascus (8) ascospores & asexual rep. (fission cell)

Family 2: Saccharomycetaceae

Ex 2: *Saccaharomyces cerevisiae*

We see : Budding , ascus (4) ascospores

Order 2: Taphrinales

Ex : *Taphrina deformans* (causes: Peach Leaf curl disease)

We see : ascus with ascospores

General characteristics:-

1. The first character is the presence of ascus, (a sac-like cell) containing usually definite number of ascospores.
2. Fungal somatic structure has either unicellular type such as yeast or multicellular type like other ascomycotina.
3. Reproduce sexually by gametangial contact, gametangial copulation, somatogamy and spermatization.
4. The absence of flagellated cells.

This Sub division has five classes:

1: Class : Hemiascomycetes

2: Class : Plectomycetes

3: Class : Pyrenomycetes

4: Class : Discomycetes

5: Class : Loculoascomycetes

Fruiting bodies:

- **Naked asci:** asci without any fruiting bodies. E.g. ***Taphrina deformans***
- **Cleistothecium** asci inside a completely closed ascocarp. E.g. ***Aspergillus sp.***

- **Perithecium** like flask shape inside it the asci arranged with paraphysis and at the tip contain ostiole with periphysis. E.g. ***Claviceps***
- **Apothecium** an open ascocarp like cup shape and the asci arranged on its surface with paraphsis. E.g. ***Sclerotinia***
- **Ascostroma (Pseudothecium)** (a single locule or cavity in the stroma and containing bitunicate asci)**.** E.g. ***Venturia***

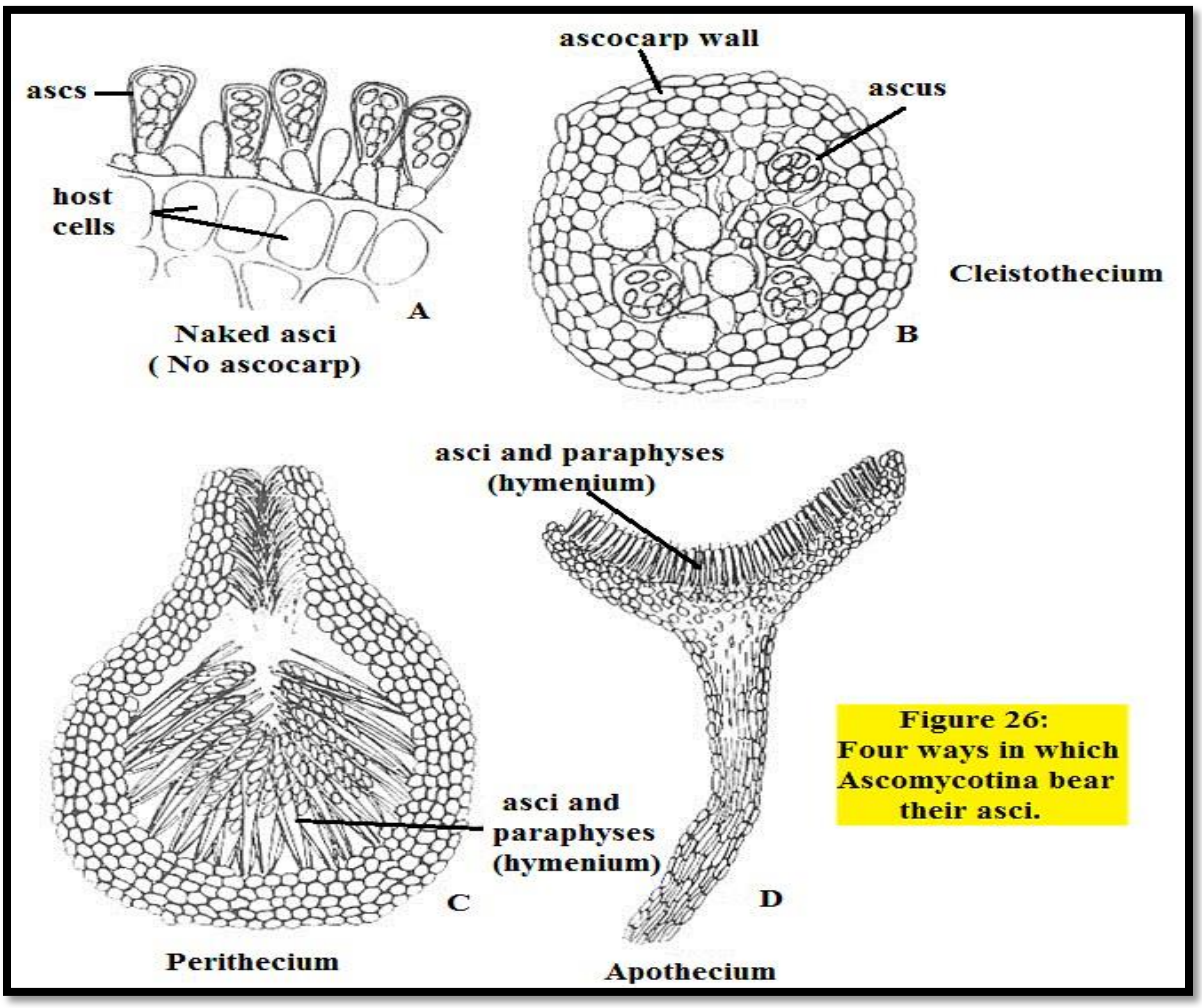
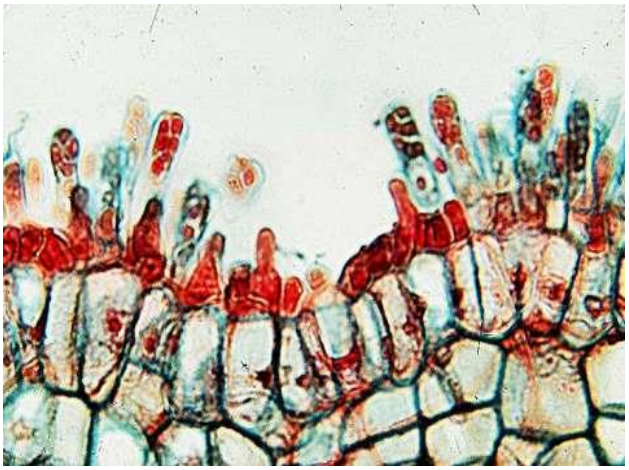


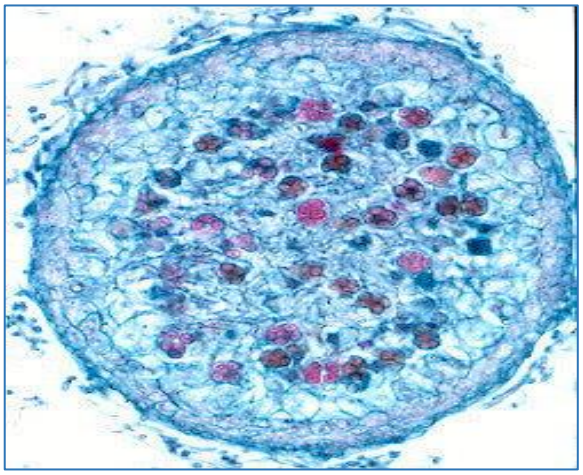
Fig (1) Fruiting bodies

Naked asci :asci without any fruiting bodies

Taphrina deformans

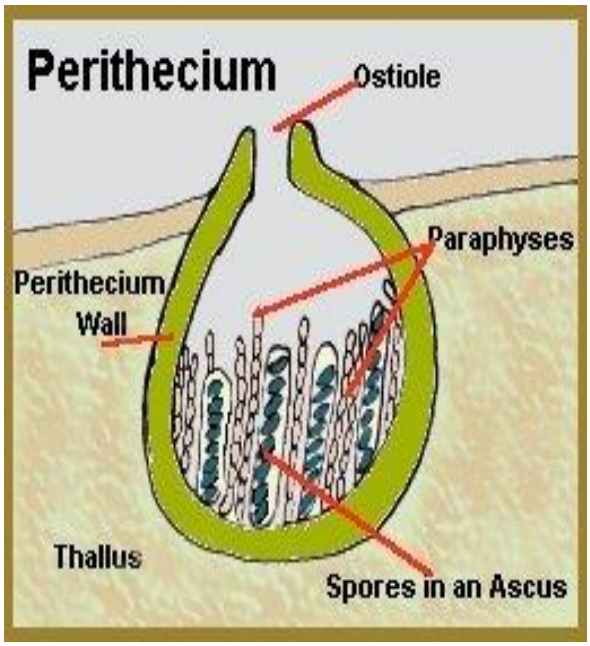


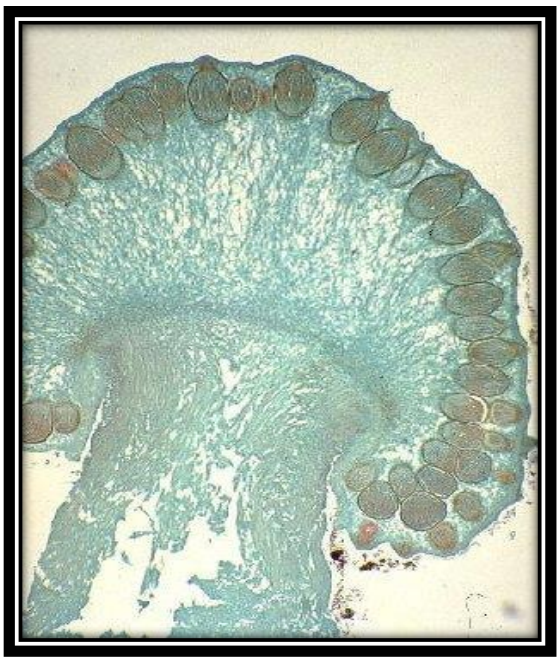
Cleistothecium (asci inside a completely closed ascocarp) ***Aspergillus sp.***



Perithecium (like flask shape inside it the asci arranged with paraphysis and at the tip contain ostiole with periphysis)

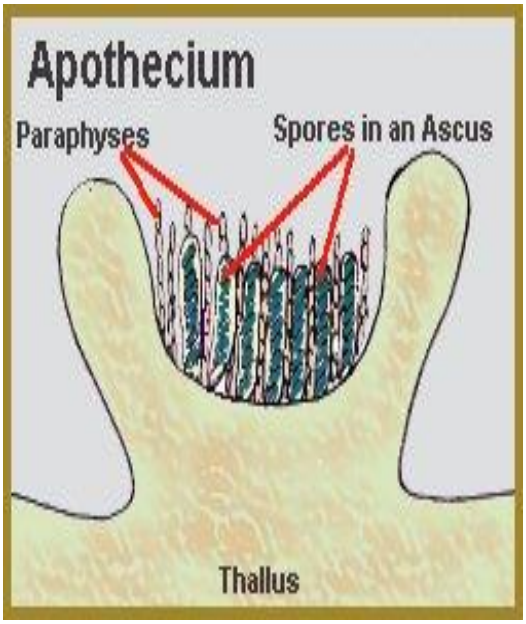
ex: *Claviceps*

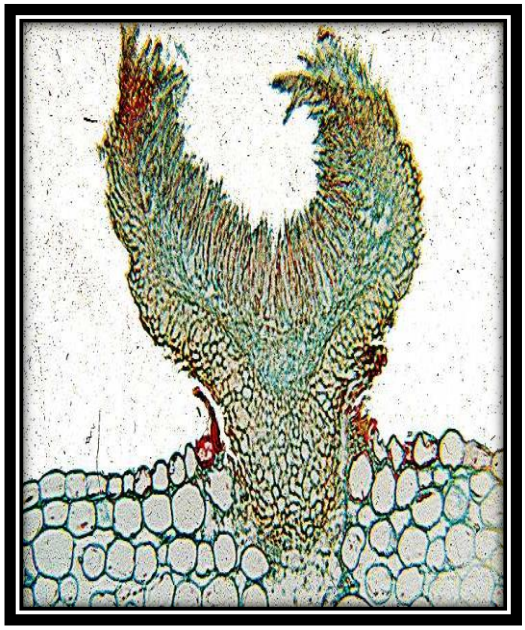




Apothecium : an open ascocarp like cup shape and the asci arranged on its surface with paraphsis

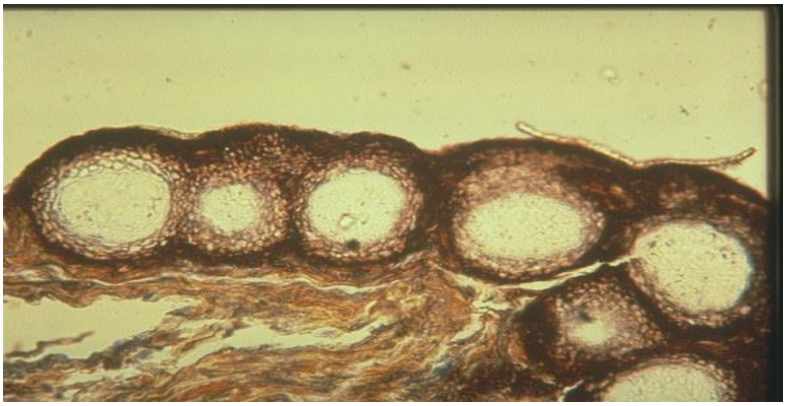
ex: *Sclerotinia*





Ascostroma (Pseudothecium) (a single locule or cavity in the stroma and containing bitunicate asci)

ex:*Venturia inaequalis*



Class 1: Hemiascomycetes (naked asci)

This class involves fungi do not form ascocarp, so there is no ascogonium and antheridium.

Order 1: Endomycetales:

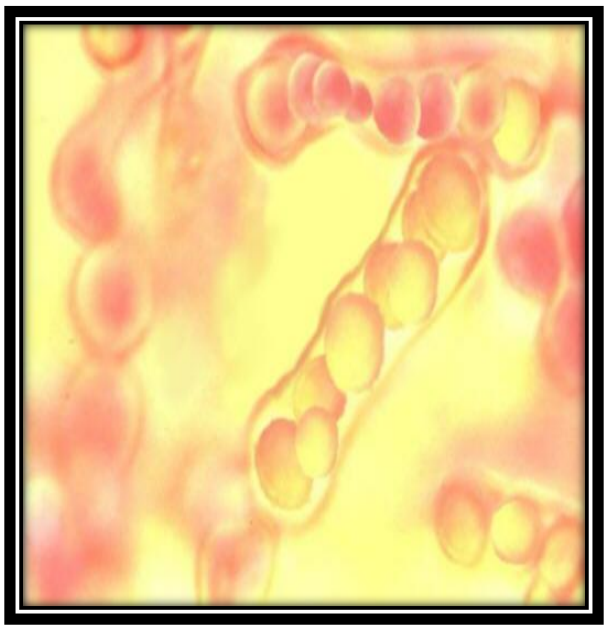
The asci in this order formed directly from zygote such as in Yeast , This order involves two families:

Family 1: Endomycetaceae:

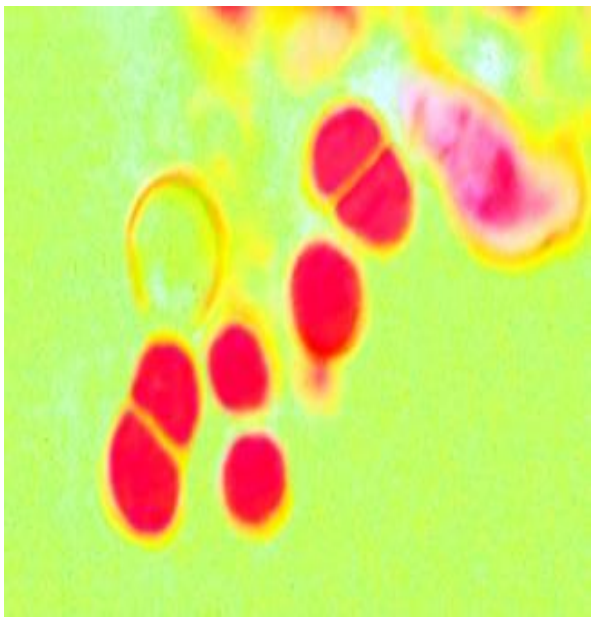
This family involves many genera and many species, but the most important one is *Schizosaccaharomyces octosporus*,

this species growing well on honey and others materials and on solid and liquid media forming mature asci during three days.

Schizosaccaharomyces octosporus
We see : ascus (8) ascospores

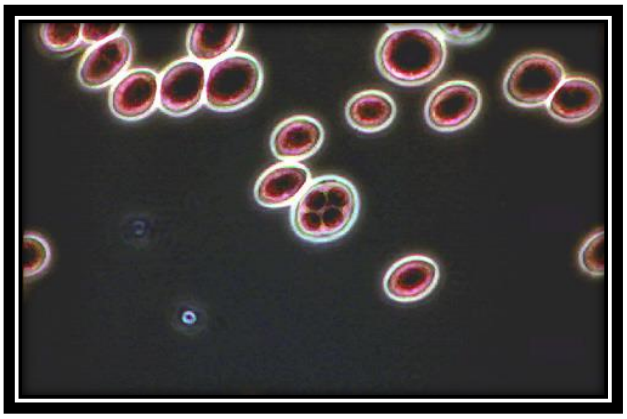


Schizosaccaharomyces octosporus
Asexual reproduction (Binary fission)

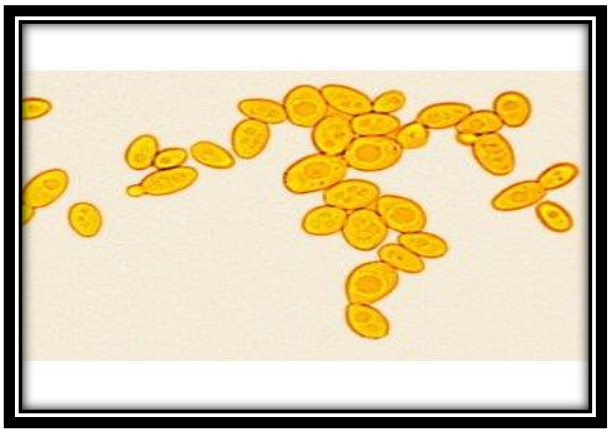


Family 2: Saccharomycetaceae

Saccaharomyces cerevisiae
ascus with (4) ascospores



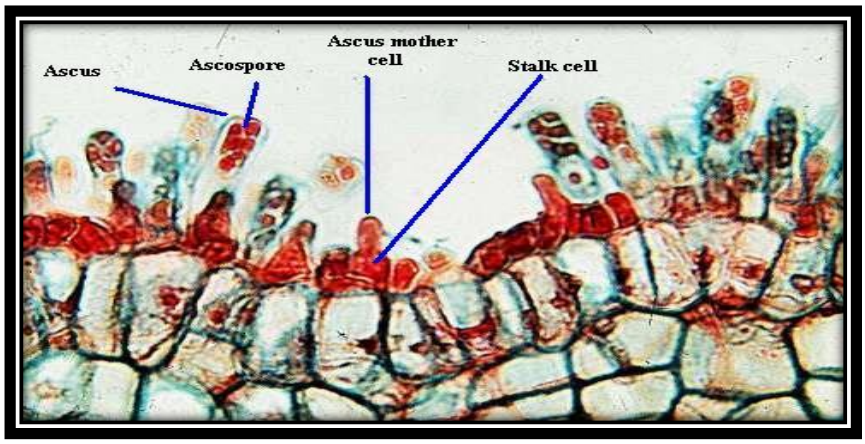
Saccaharomyces cerevisiae
Asexual reproduction (Budding)



Order 2: Taphrinales

Taphrina deformans

(cause: Peach Leaf curl disease)
ascus with ascospores



Lab 9

Division: Eumycota

3: Sub division: - Ascomycotina

2: Class: Plectomycetes

General characteristics:-

1. Asci are unitunicate.
2. Producing cleistothecium ascocarp.
3. Has two orders.

A: Order: Eurotiales

Family: Eurotiaceae

Ex: *Aspergillus*, Ex: *Penicillium*

B: Order: Erysiphales

Ex: Erysiphe …… (Cause powdery mildew on Gramineae)

Ex: Sphaerotheca ……. (Cause powdery mildew on roses)

Ex: Microsphaera …… (Cause powdery mildew on lilacs)

Ex: Podosphaera …… (Cause powdery mildew on apple)

Ex: Uncinulla …… (Cause powdery mildew on grape)

Ex: Phyllactinia …… (Cause powdery mildew on Berries)

****

3. Class: Pyrenomycetes

Order: Hypocreales

Family: Claviceptaceae

Ex: *Claviceps purpurea* (cause ergot disease on rye)

Characters of order [Erysiphales]

1. They are obligate ectoparasites which grow on the surface of the host plant.
2. These fungi are called powdery mildews because of the powdery appearance of their white conidiospores, which coat the host surface, and they cause powdery mildew
3. Sexual reproduction occurs by antheridium and ascogonium.
4. The ascocarps are spherical cleistothecia with pseudoparenchymatous perdium disease.
5. They are dark in colour and bear hyphal appendages which serve to anchor the cleistothecia to the host and assist in their dispersal**.**

Erysiphe cause P.M. on gramineae
Cleistothecium with many asci and myceloid appendages

Sphaerotheca cause P.M. on roses
Cleistothecium with one ascus and mycelioid appendages

Microsphaera cause P.M. on lilacs
Cleistothecium with many asci and Dichotomous appendages

Podosphaera cause P.M. on apple
Cleistothecium with one ascus and Dichotomous appendages

Uncinula cause P.M. on grape
Cleistothecium with many asci and Hook-shaped appendages

Phyllactinia cause P.M. on Berries
Cleistothecium with many asci and Bulbous appendages

Lab 10

Division: Eumycota

3: Sub division: - Ascomycotina

4: Class: Discomycetes

General characteristics:

1. Asci produced in apothecia.
2. The class (Discomycetes) classified into two groups according to its habitat.
3. Sexual reproduction occurs by spermatization.

****

1: Epigean group: which presence on the surface of soil, and they involved
operculate and inoperculate asci.

A: Epigean inoperculate discomycetes

1. Order: Helotiales
Family: Sclerotinaceae
Ex*: Sclerotinia* (*Monilinia*) *fructicola*
(Causes: the brown rot of peach and other stone fruits).

2. Order: Phacidiales
Family: Phacidiaceae
Ex: *Rhytisma acerinum* (Causes: Tar spot of maple)

3. Order: Lecomorales (Lichen)
Ex: *Xanthoria*

B: Epigean operculate discomycetes

Ordre: Pezizales
1: Family: Pezizaceae
Ex: *Peziza spp.*

2: Family: Morchellaceae
Ex: *Morchella*

2. Hypogean group: which presence under the surface of soil.

Order: Tuberales

Ex: *Terfezia*

****

****

5: Class: Loculoascomycetes

General characteristics:

1. The asci are bitunicate.
2. The ascocarps are ascostroma in which the asci are borne in locules.

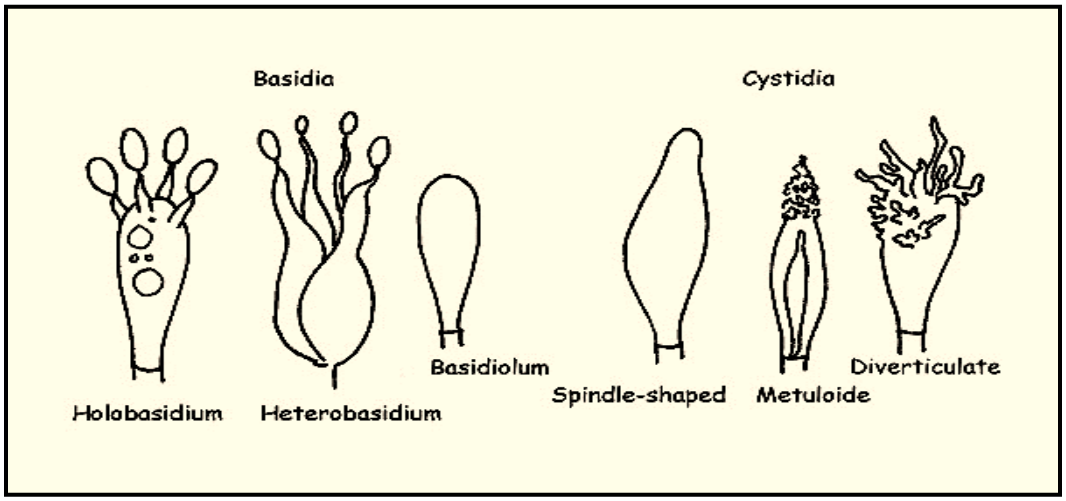
Order: Pleosporales
Family: Venturiaceae
Ex: *Venturia inaequalis* (Cause apple scab disease)

Lab 11

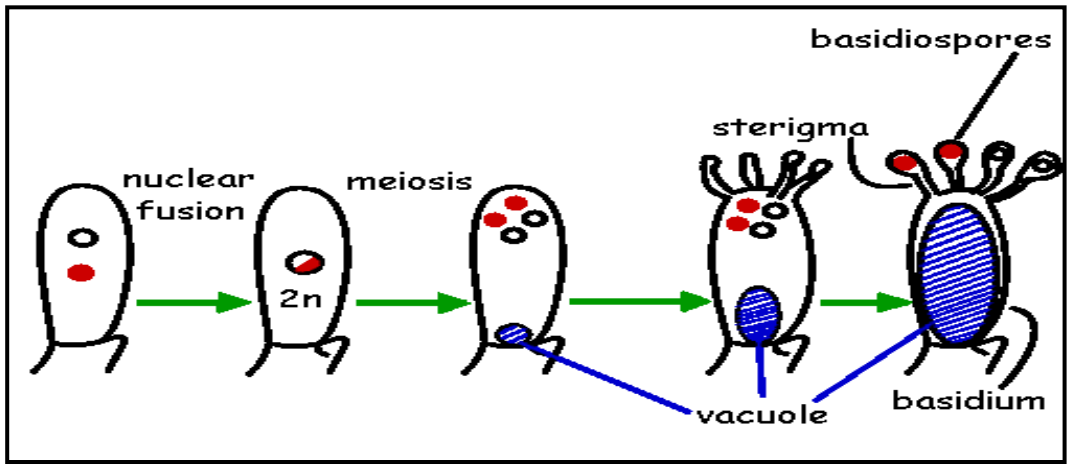
Division: Eumycota
4:Sub-division : Basidiomycotina

General characteristics:

1. Some individuals of this subdivision are saprobes such as mushrooms, others are parasites which causes smut and rust diseases.
2. Their spores, called (basidiospores) they born to the outside of a specialized, spore-produced structure, called basidium.
3. The sexual reproduction occurs by spermatization or somatogami.



Types of Basidium



Stages of Basidium and Basidiospores Formation

1: Class: Teliomycetes
A: Order: Termellales
Ex: *Auricularia*

B: Order: Uridinals (Rust fungi)
1-Family: Puccinaceae
Ex: *puccinia graminis* (Causes Rust on graminae)
Ex: *Gymnosporangium* (Causes Rust on Juniper)
Ex: *Phragmidium* (Causes Rust on Rose)
Ex: *Uromyces faba* (Causes Rust on *Vicia fabae*)

2- Family: Melampsoraceae
Ex: *Melampsora* (Causes Rust on *Euphorbia*)
Ex: *Cronartium ribicola* (Causes Rust on Pine)

C: Order: Ustilaginals (Sumt fungi)
1-Family: Ustilaginaceae
Ex: *Ustilago hordei* (C auses Covered Smut of Barley)
Ex: *Ustilago nuda* (Causes Loose Smut of Wheat)
Ex: *Sphacelotheca sorghi* (Causes Covered Smut of sorghum)

2-Family: Tilletiaceae
Ex: *Tilletia foetida*
Ex: *Tilletia caries* (Causes Bunt Smut of Wheat)
Ex: *Urocystis cepulae* (Causes Flag Smut of Wheat)
Ex: *Urocystis agropyri* = = = = = = = = =

Lab 12

4: Sub-division: Basidiomycotina
2: Class: Hymenomycetes
General characteristics:

1. This class involves edible mushroom and other saprophytic fungi.
2. The main characteristic of these fungi is the club-shaped basidium which bears four basidiospores on sterigmata.

A: Order: Agaricales
Family: Agaricaceae
Ex: *Agaricus bisporus* ……..(White color)
Ex: *Agaricus campestris* …… (Brown color)
Ex: *Agaricus xanthodermus* ……(Yellow staining fungus)
Ex: *Inocybe* ……(Red staining fungus)
Ex: *Coprinus* ……..(Black liquid like ink)
Ex: *Amanita muscaria* ...Its scales are red in color and called fly fungus
B: Order: Polyporales
1-Family: Polyporaceae
Ex: *Polyporus* ……. (Pore fungi)
2-Family: Clavariaceae
Ex: *Clavaria* ..... (Coral fungi)
3-Family: Telephoraceae
Ex: *Sternum* ……. (Shelf fungi)
4-Family: Hydnaceae
Ex: *Hydnum* ……. (Tooth fungi)

3: Class: Gasteromycetes
A: Order: Lycoperdales
Family: Lycoperdaceae Ex: *Lycoperdon* (Puff ball)
Family: Gasteraceae Ex: *Gasterum* (Earth star)
B: Order: Nidulariales Ex: *Cyathus* (Bird's nest)
C: Order: Hymenogasterales Ex: *Podaxis*