

DEUTEROMYCOTINA

Anamorphic fungi, Mitosporic fungi, Fungi Imperfecti

Deutero = Second class

General features

- True mycelium, well developed, well branched, septate
- Inter or intra cellular growth with appresoria, haustoria and nematode traps
- Simple or dolipore septa
- Clamp connection is rare
- Asexual reproduction mainly by exogenous conidis
- Conidia may be thalic or blastic, developed directly on conidiophores or arranged in special fruit bodies like synnemata, sporodochia, acervuli, pycnidia, sclerotia or bulbils
- Conidia hyline or pigmented, one to many celled and various shape and sizes
- Most of the members are plant parasitic or facultative saprophytic

Subdivision: Deuteromycotina

(Imperfect fungi)

- **Sexual spores absent**

Form Classes –

1. Blastomycetes –

- **Budding cells with or without pseudomycelium**
- **True mycelium absent or underdeveloped**

2. Coelomycetes

- **Spores produced in pycnidia or acervuli**

3. Hyphomycetes

- **Mycelium sterile, spores developed directly on mycelium or special branches**

Morphological groups of Imperfect fungi

Taxon	Characters of conidia
Blastomycetes	Sterile mycelium, may produce chlamydospores, sclerotia but no conidia (Rhizoctonia, Sclerotium)
Celomycetes	Conidia in Pycnidia (Diplodia, Phoma, Phyllosticta, Septoria) Or Acervuli (Colletotrichum, Gloeosporium)
Hyphomycetes	Conidia on separate hyphae or aggregates as Synnemata, Sporodochia
➤ Monilliaceous Hyphomycetes	Hyphae and Conidia hyaline or pale in colour (Botrytis, Helminthosporium, Fusarium)
➤ Dematiaceous Hyphomycetes	Hyphae and Conidia both or either darkly pigmented (Alternaria, Cladosporium, Cercospora, Dreschlera)
➤ Stillbaceous Hyphomycetes	Conidia produced on synnemata (Graphium, Epicoccum)

Class: Coelomycetes

- **The members are found both in tropical and temperate regions**
- **They are commonly found in cultivated and uncultivated soils, leaf litter organic debris, fresh water and saline water, they may found on other fungi and lichens**
- **They are also pathogens of plants, insects and vertebrates**

Coelomycetes is divided into two orders

1 Conidia produced in acervuli – Melanconiales

2 Conidia produced in pycnidia –Sphaeropsidales

Order: Melanconiales:

- **The fructifications are acervuli**
- **Acervuli may develop subepidermally or subcuticularly**
- **Conidia may be hyaline to cream, pink, orange or black**
- **Acervuli develop by simple meristogenous, compound meristogenous or sympogenous methods**
- **More than 120 genera are included in this family and they cause plant disease known as anthracnose**
- **The important genera: Colletotrichum, Coryneum, Cylindrosporium, Entomosporium, Melanconium, Monochaetia, Pestalotia, Pestalotiopsis, Gloeosporium, Septogloeum**

Order: Sphaeropsidales:

- **The conidia and conidiogenous cells or conidiophores are produced in pycnidia**
- **Mycelium may be immersed in the substrate or superficial**
- **Conidia are produced in several ways from phialides or annellides**
- **Conidia are solitary, sympodial or catenate**

Sphaeropsidales is divided into four families based on the colour, shape and texture of the pycnidia

They are Sphaeropsidaceae ,Nectrioidaceae (Zythiaceae), Leptostromataceae and Excipulaceae (Discellaceae)

Family Sphaeropsidaceae:

- **This is a large family consisting of both saprobes and a stroma**
- **These are tough, leathery to brittle, globose, ostiolate and dark coloured**
- **The spores are hyaline spherical or oval and often exude from the ostiole in damp weather in a worm like mass or citrus**

Genera: Macrophomina, Ascochyta, Septoria

Class: Hyphomycetes

- **The orders have been separated on the basis of presence of absence of conidia and the degree of aggregation of the conidiophores into specialized structures such as synnemata or sporodochia**
 - 1. Order Agonomycetales or Mycelial sterilia- Conidia absent except for chlamydospores**
 - 2. Order Hyphomycetales (Moniliales) - Conidia present Conidiophores are not organized as synnemata or sporodochia**
 - 3. Conidiophores are organized as synnemata or sporodochia**
 - **a. Synnemata formed – Order Stilbellales**
 - **b. Sporodochia formed – Order Tuberculariales**

Order: Agonomycetales or Mycelia sterilia:

The fungi included in this order are referred as Mycelia sterilia as they lack even the imperfect state (spores) and reproduce only by fragmentation of mycelium. They do form sclerotia or chlamydospores

- 1. Leaf parasites and forming sclerotia that are immersed in leaf tissue –
Dactuliphora**
- 2. Sclerotia not immersed in leaf tissue, if leaf parasites:**
 - (a) Sclerotia formed of loosely woven hyphae; irregular in shape -
Rhizoctonia**
 - (b) Sclerotia formed of compact hyphae; large - Sclerotium**
 - (c) Compact cells arranged in cluster like forms; true sclerotia absent –
Populaspora**

Genera - Aegerita, Arbuscula, Dactuliophora, Papulaspora, Rhizoctonia and Sclerotium

Order: Hyphomycetales (Moniliales):

- **This order has important saprobes used in decomposition of organic matters**
- **It has pathogens on plant, animal and human beings**
- **The conidiogenous cells are produced on the conidiophores, which may be either micronematous. i.e morphologically similar to vegetative hyphae or macronematous. i.e. which are morphologically very different from purely vegetative hyphae but are always mononematous i.e. they are sporodochia**
- **The order is divided into two families**
 - 1. Conidia and conidiophores hyaline or brightly coloured -Moniliaceae**
 - 2. Conidia or conidiophores or both with distinct dark pigment – Dematiaceae**

Genera: *Alternaria, Bipolaris, Helminthosporium, Curvularia, Cercospora*

Order: Tuberculariales:

- **The characteristic features of this order is the production of sporodochia (sing. sporodochium; Gr. spora = seed + dochien = container) in which the spore mass is supported by a superficial, cushion -like (pulvinate) mass of conidiogenous cells or short conidiophores**
- **The order contains a single family, Tuberculariaceae that has more than 160 form-genera.**

Following genera are important: Fusarium, Tubercularia, Volutella, Epicoccum and Exosporium

Genetic Recombination in Duteromycetes

Parasexual Cycle:

- Mechanism discovered by Pontecorvo and Roper (1952) in septate, mycelial fungi by which genetic recombination is not based on sexual reproduction

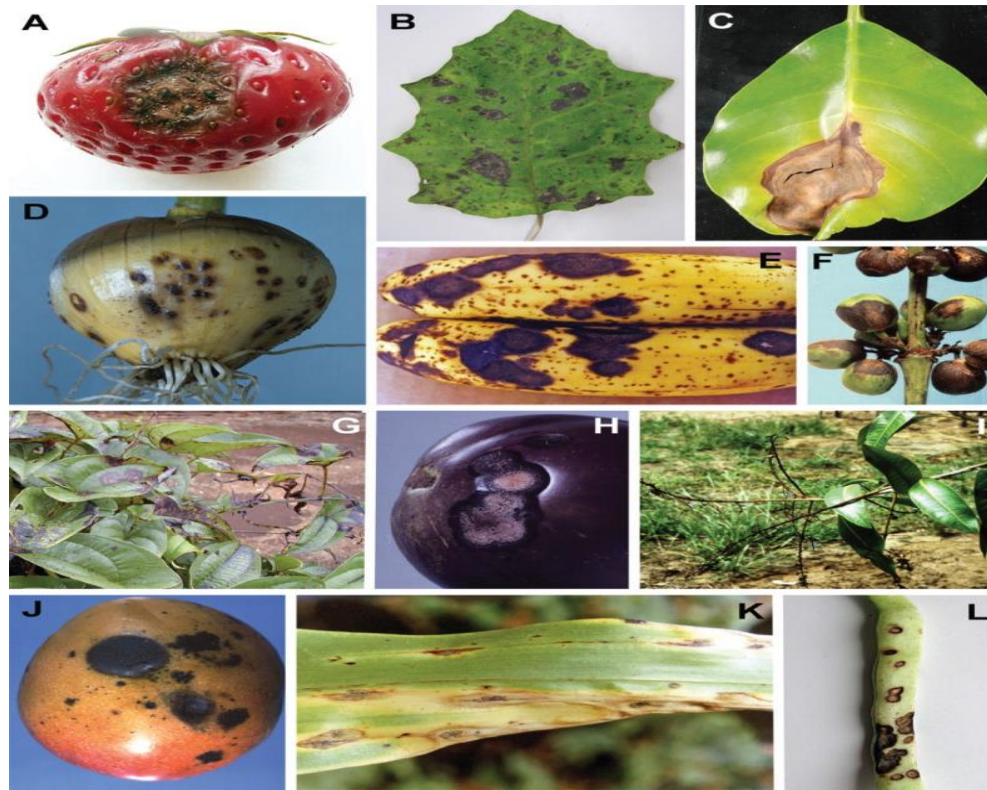
Essential features of process:

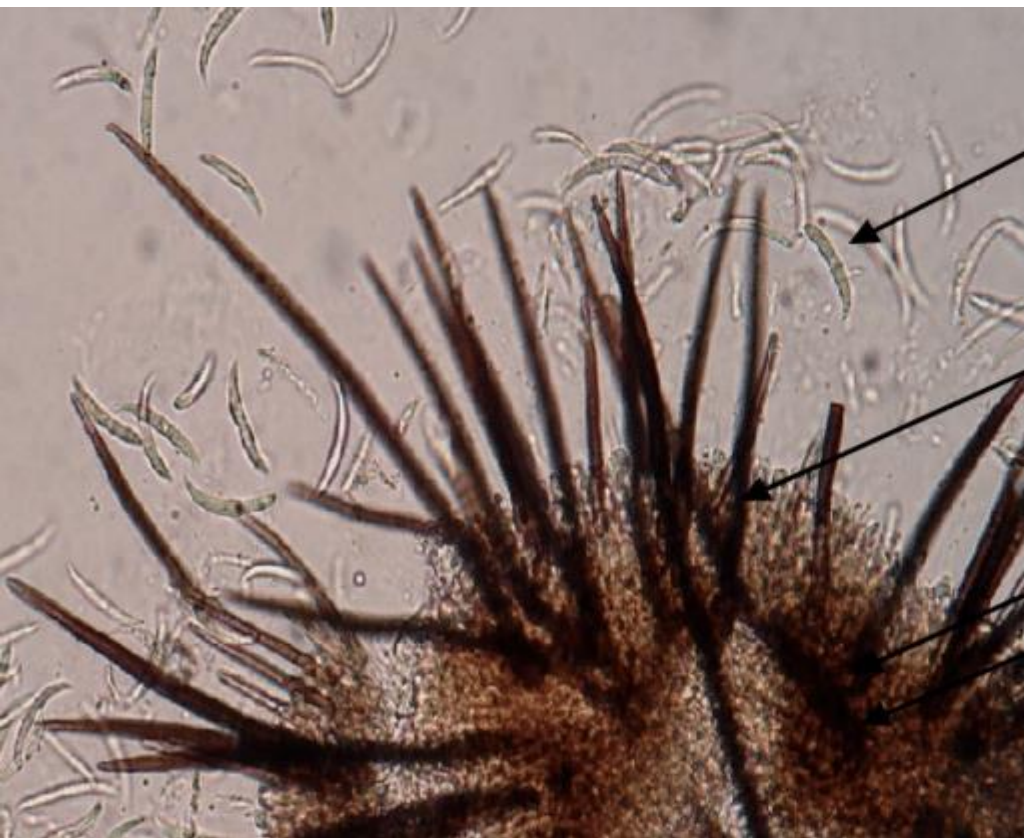
- Heterokaryon formation
- Diploidization
- Mitotic Crossing-over
- Haploidization

EXAMPLES

Collitotrichum – Conidia in black acervuli, host tissue erumpent at maturity and released in droplets of mucilage, conidia hyaline, one celled, cylindrical or falcate(curved)

➤ Plant diseases- Red rot of Sugarcane, Ripe fruit rot and die back of Chilies, Bean Anthracnose



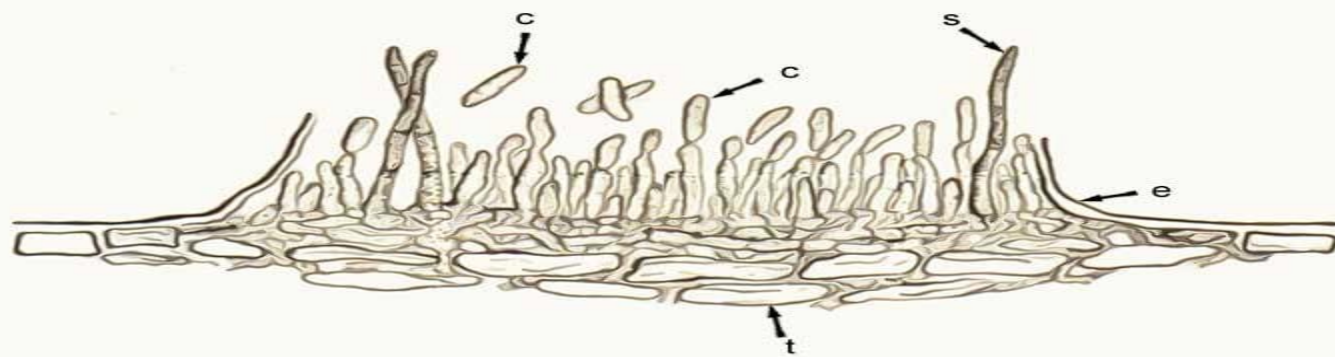
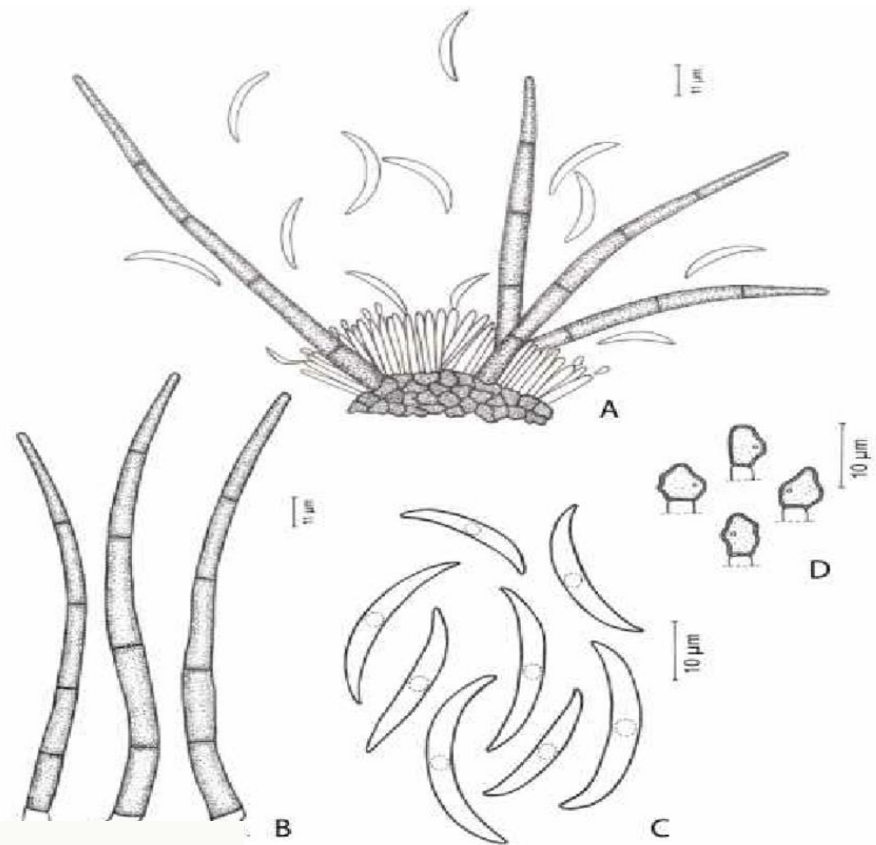


Conidia

Setae

Conidiophore

Acervulus

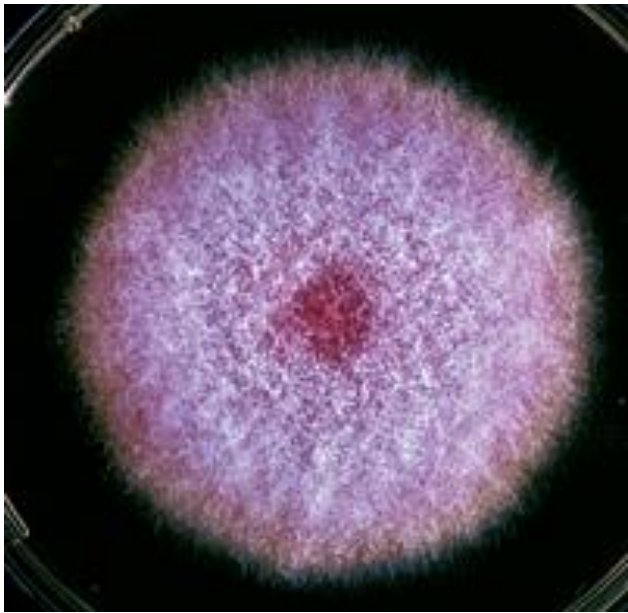


Fusarium – Mycelium occurs saprophytically in soil, invades vascular tissue along with conidia and blocks xylem vessels resulting in clogging, also produce toxin, conidia hyaline, two size, macro and micro, generally born on orange pink sporodochium

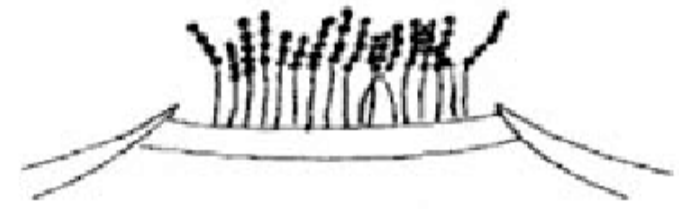
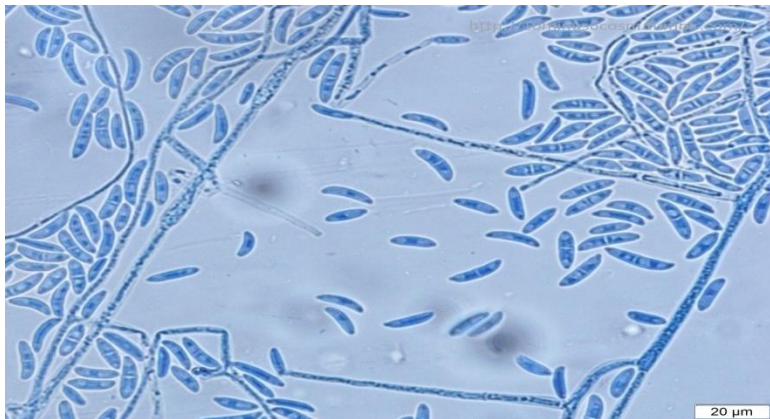
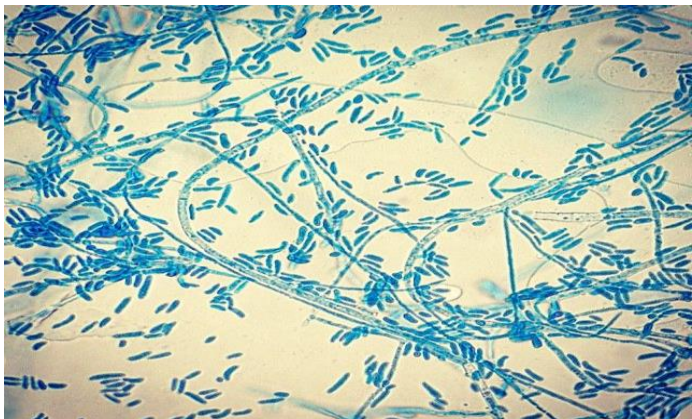
- **Plant diseases – Wilts of vegetables and cotton, yellows, foot rot, Panama disease of banana**
- **Human diseases- Kiratomycosis of cornea, skin infections, onychomycosis of nail, ulcers, necrosis and infections of internal organs**
- **Mycotoxin – Fumonisin (Food born infection Fusarium infested corn)**
- **Biological Insecticide**
- **High quality mycoprotein**
- **Gibberelic acid**



Fusarium sp.



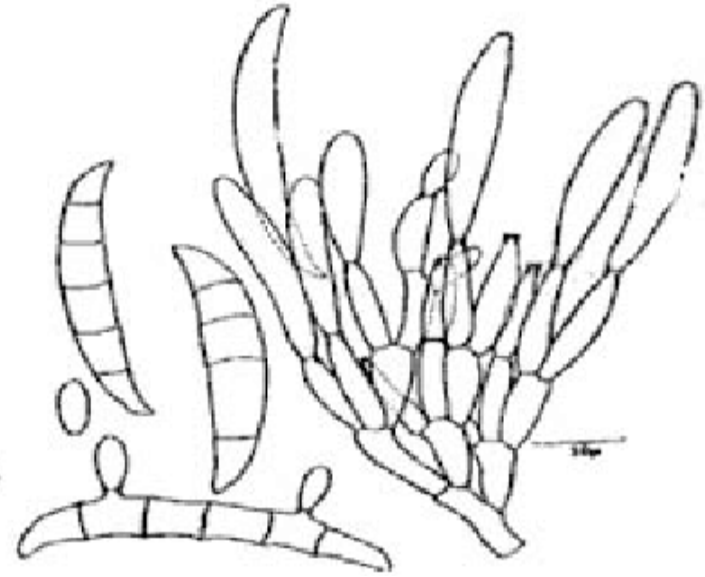
Cultures of *F. oxysporum* showing purple pigmentation and *F. subglutinans* showing pink pigmentation.



'Sporodochia' formed, closely packed conidiophores.

Fusarium culmorum

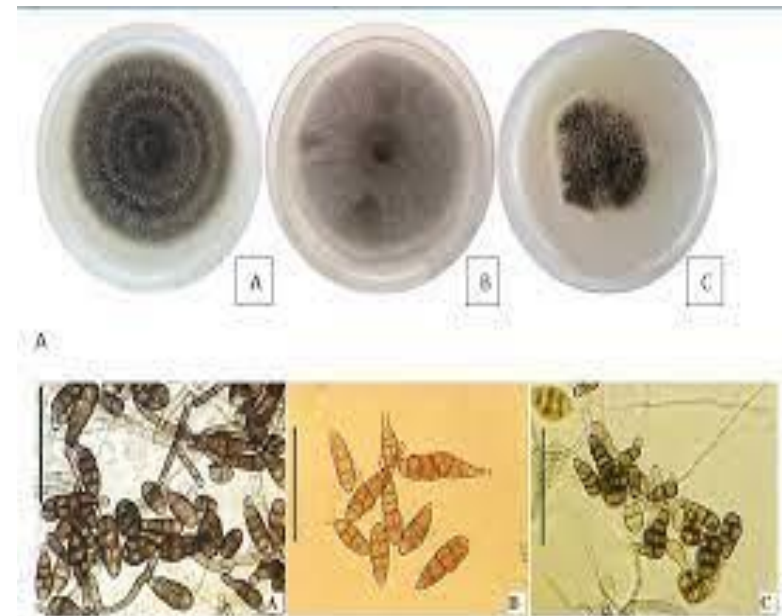
Points to note:
Careful examination of colony under the microscope may show phialides.

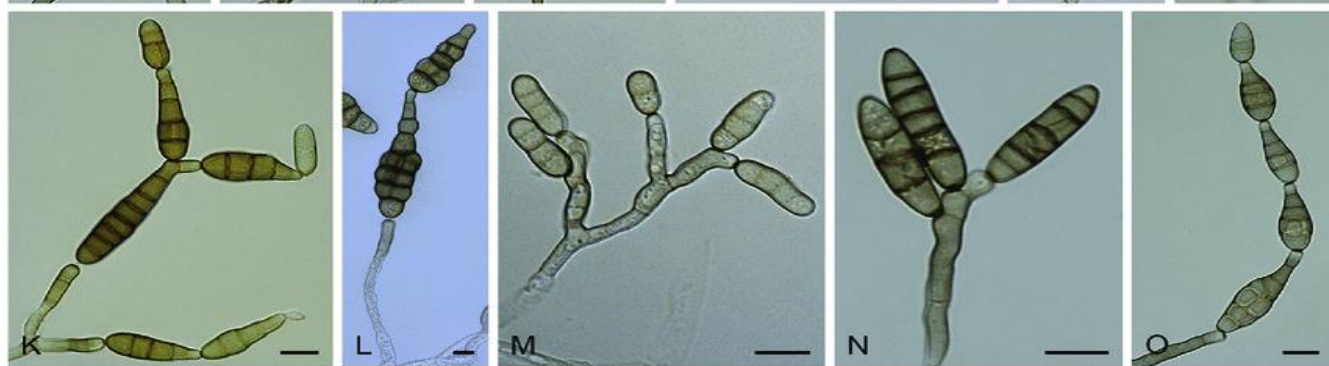
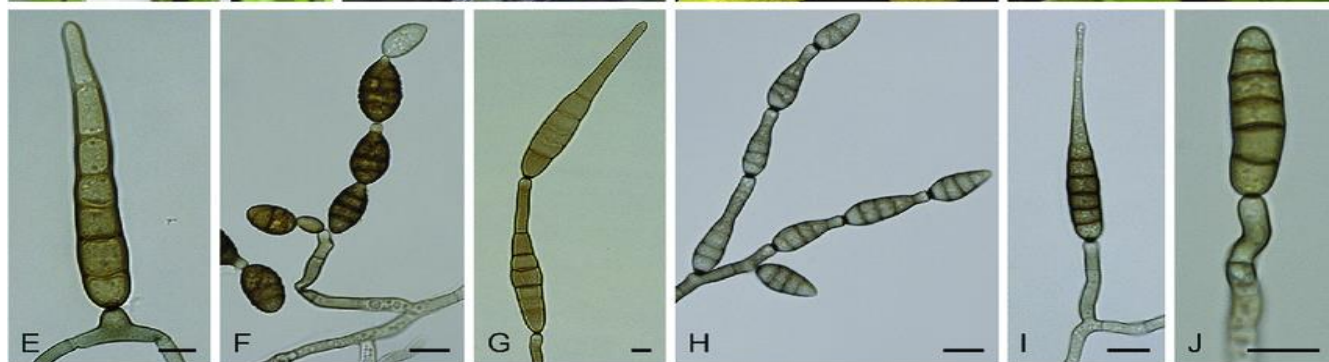


multiseptate spores

Alternaria – Conidia dark coloured, multi celled with both longitudinal and transverse septa, tapering beak of apical cell, produced singly or in chains

- **Plant diseases – Early blight of Potato, Wheat, Papaya, Tomato, Chilly, Leaf spot of Brassica, Raddish, Cotton, Citrus rot, leaf blight of Carrot, core rot of Apple, Seed blight of linseed**
- **Host specific phytotoxin**
- **Post harvest infestation mycotoxins**
- **Human diseases – Allergies, skin infections**





Cercospora – Conidia hyaline or pale yellow, obclavate, cylindrical, septate with blunt ends, produced on pigmented aerial hyphae, conidiophores developed on a dense stroma, one or two septa, unbranched

➤ Plant diseases – Leaf spot of crop plants like beans, vegetables and ornamental plants, coffee, Tikka disease of ground nut, Blight of leaves

➤ Photosensitising toxin – Cercosporin

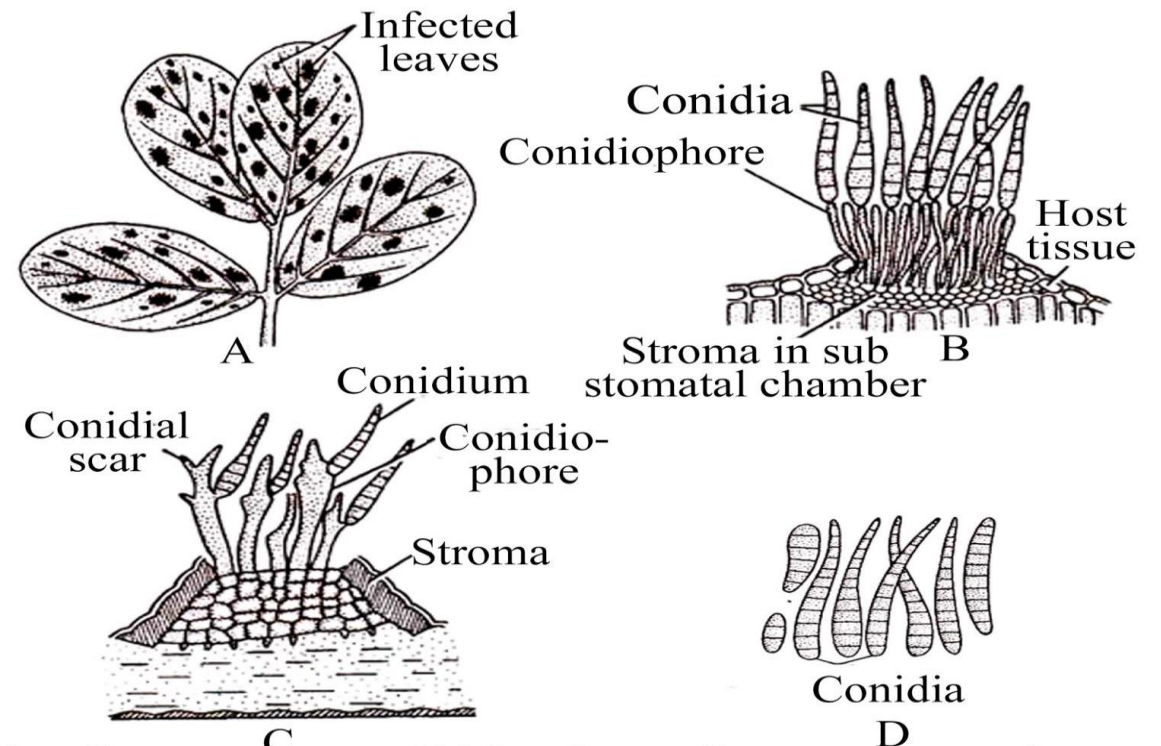
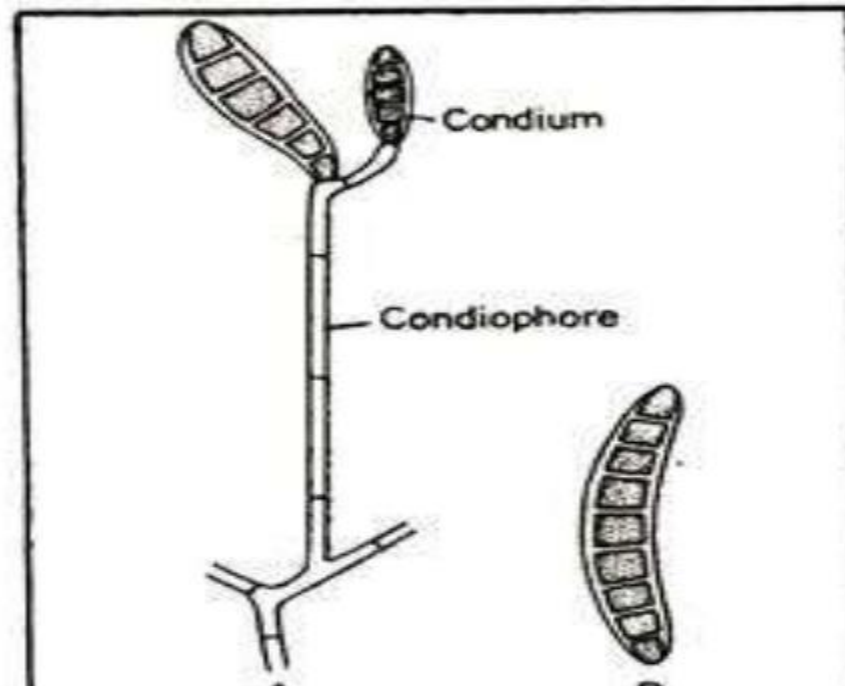
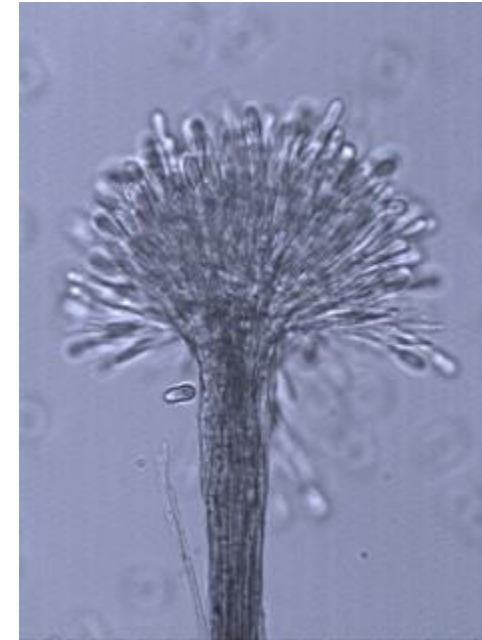
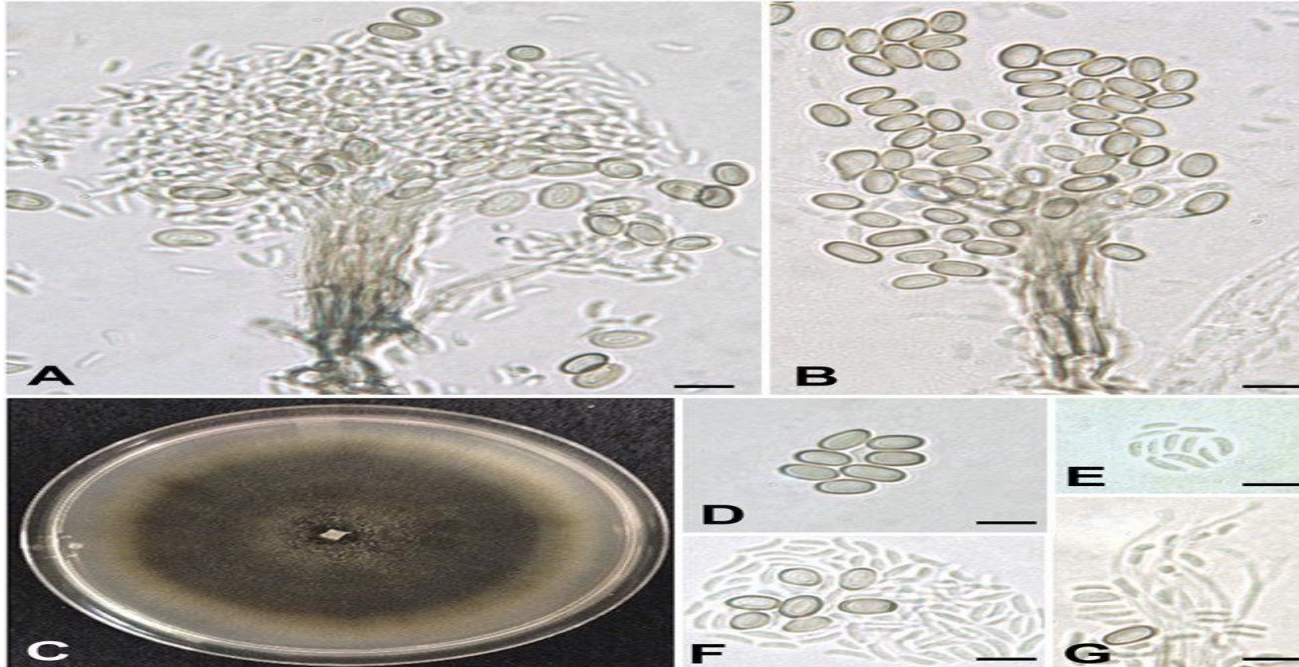


Fig: *Cercospora* spp. (A) Leaf spot disease of ground nut;

Helminthosporium – Mycelium is septate, branched and multinucleate, Sex organs and sexual reproduction absent, reproduces primarily by conidia borne on conidiophores, Conidiophore- is dark-coloured, erect, branched and septate, conidiophores are not united together to form sporodochia, synnemata, acervulus or pycnidium. Conidiophores are grey to olive colored which form in the group of 3-5. Conidia are long, slender, three to 3-7 celled, tapering upward, hyaline to dark colored and straight or slightly curved. Conidia are measuring 15 – 30 μm in length and 4 – 10 μm in breadth.



Graphium – Many species are known as plant pathogens, they are found in soil, plant debris, woody substrate, manure, and polluted water. The sporulating structures of *Graphium* form synnema, which are a gathering of conidiophores into a sort of flower bouquet. *Graphium* spp. are recognized by their distinctive, erect, black synnemata, each bearing a single, terminal, ball of one-celled, hyaline conidia produced from annellides



Rhizoctonia – Rhizoctonia has about 15 species. They are facultative necrotrophs i.e. they are capable of prolonged existence as saprophyte in the soil. Under suitable conditions they cause diseases like damping off and root rots. Important characters of this are the formation of sclerotia of irregular size and shape but of uniform texture brown or black, more or less loosely packed. The cells of the hyphae are barrel shaped, anastomosing frequently, branching more or less at right angles, and pale brown to brown in colour

➤ **R. bataticola** - Dry root rot of pulses, cotton etc.

➤ **R. solani** - Root rot of cotton

