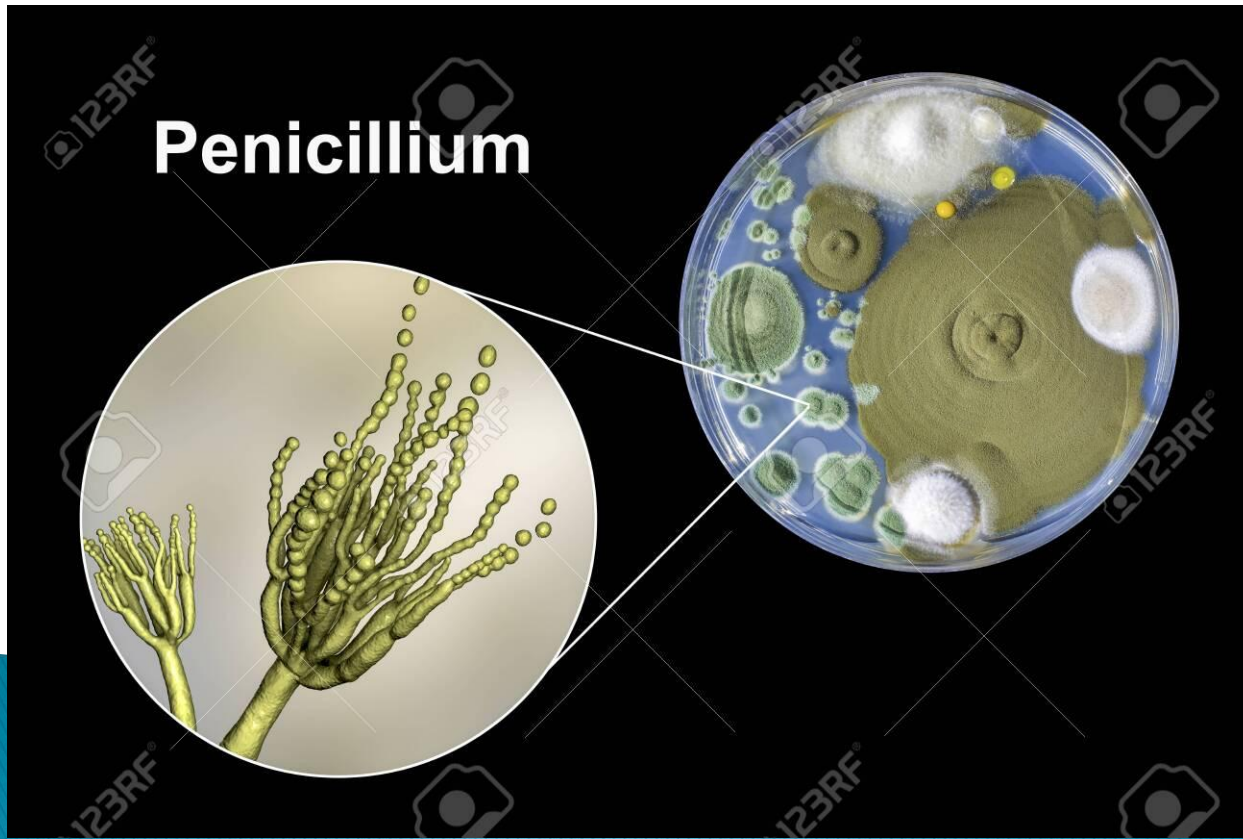


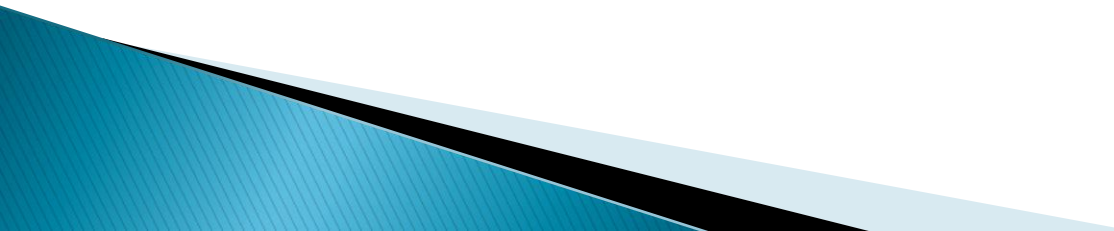
PENICILLIUM



Dr. Poonam Shakya

Introduction

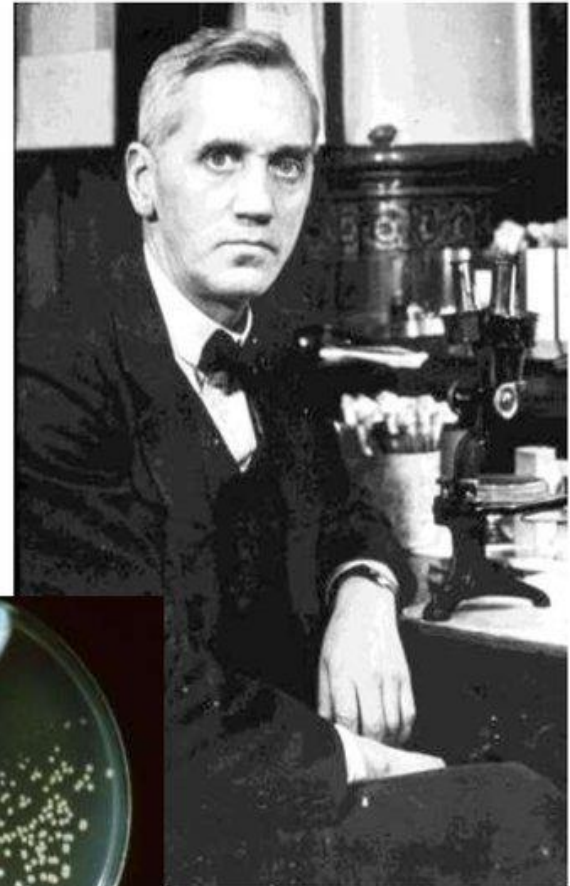
- ▶ Penicillium is a saprophytic fungus, commonly known as blue or green mold.
- ▶ Genus includes approx. 136 species, distributed throughout the world.
- ▶ They are present in soil, in air, on decaying fruits, vegetables, meat, etc.
- ▶ **Penicillium fungi** are microscopic organisms that are used in the production of foods and in the pharmaceutical industry.

- ▶ The “wonder drug” penicillin was first discovered by Sir Alexander Fleming in 1928; during his work with *Staphylococcus aureus*, he got contaminated with mold spore (*Penicillium notatum*) which after proper growth causes death of *S. aureus* showing lytic zone around itself.
 - ▶ He isolated and called this anti-microbial compound as Penicillin. Later it was found that a strain of *P. chrysogenum*, is more efficient than *P. notatum*, in the production of penicillin.
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Penicillin - the first antibiotic

- Penicillin was the first antibiotic to be discovered.
- It was discovered in 1928 by Alexander Fleming, a Scottish scientist working in St Mary's Hospital London.
- Fleming discovered that mould from a *Penicillium* fungus had antibacterial properties. The antibiotic was named penicillin after the fungus.



CLASSIFICATION

Kingdom: **Fungi**

Phylum: **Ascomycota**

Class: **Euascomycetes**

Order: **Eurotiales**

Family: **Trichomaceae**

Genus: *Penicillium*



Species

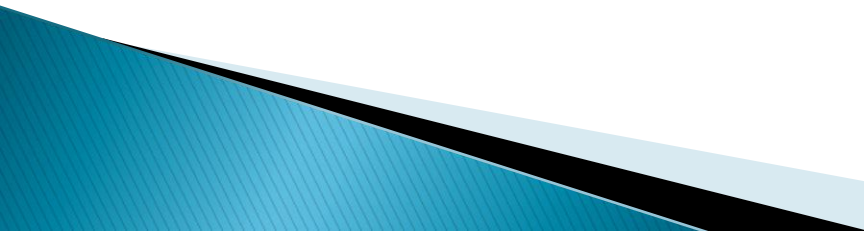
- ▶ *Penicillium chrysogenum*
- ▶ *Penicillium citrinum*
- ▶ *Penicillium janthinellum*
- ▶ *Penicillium marneffe*
- ▶ *Penicillium purpurogenum*

- ▶ Identification to species level is based on macroscopic morphology and microscopic features

Table 4.6 : Importance of *Penicillium*

Species of <i>Penicillium</i>	Importance
<i>Harmful</i>	
1. <i>Penicillium divaricatum</i>	Causes decay of wood.
2. <i>P. purpurogenum</i>	Causes spots on papers, books, etc.
3. <i>P. expansum</i>	Rotting and spoilage of fruits like apple, orange, grapes etc.
<i>Useful</i>	
1. <i>P. notatum</i> , <i>P. digitatum</i> <i>P. italicum</i> and <i>P. crysogenum</i>	Source of antibiotic <i>penicillin</i>
2. <i>P. griseofulvum</i>	Source of antibiotic <i>griseofulvin</i> .
3. <i>P. roqueforti</i> and <i>P. camemberti</i>	Used in the hydrolysis of fat and flavouring of cheese.

Vegetative Structure of Penicillium

- ▶ The vegetative body is mycelial
 - ▶ The mycelium is profusely branched with septate hyphae, composed of thin-walled cells containing one to many nuclei
 - ▶ Each septum has a central pore, through which cyto-plasmic continuity is maintained.
 - ▶ The reserve food is present in the form of oil globules.
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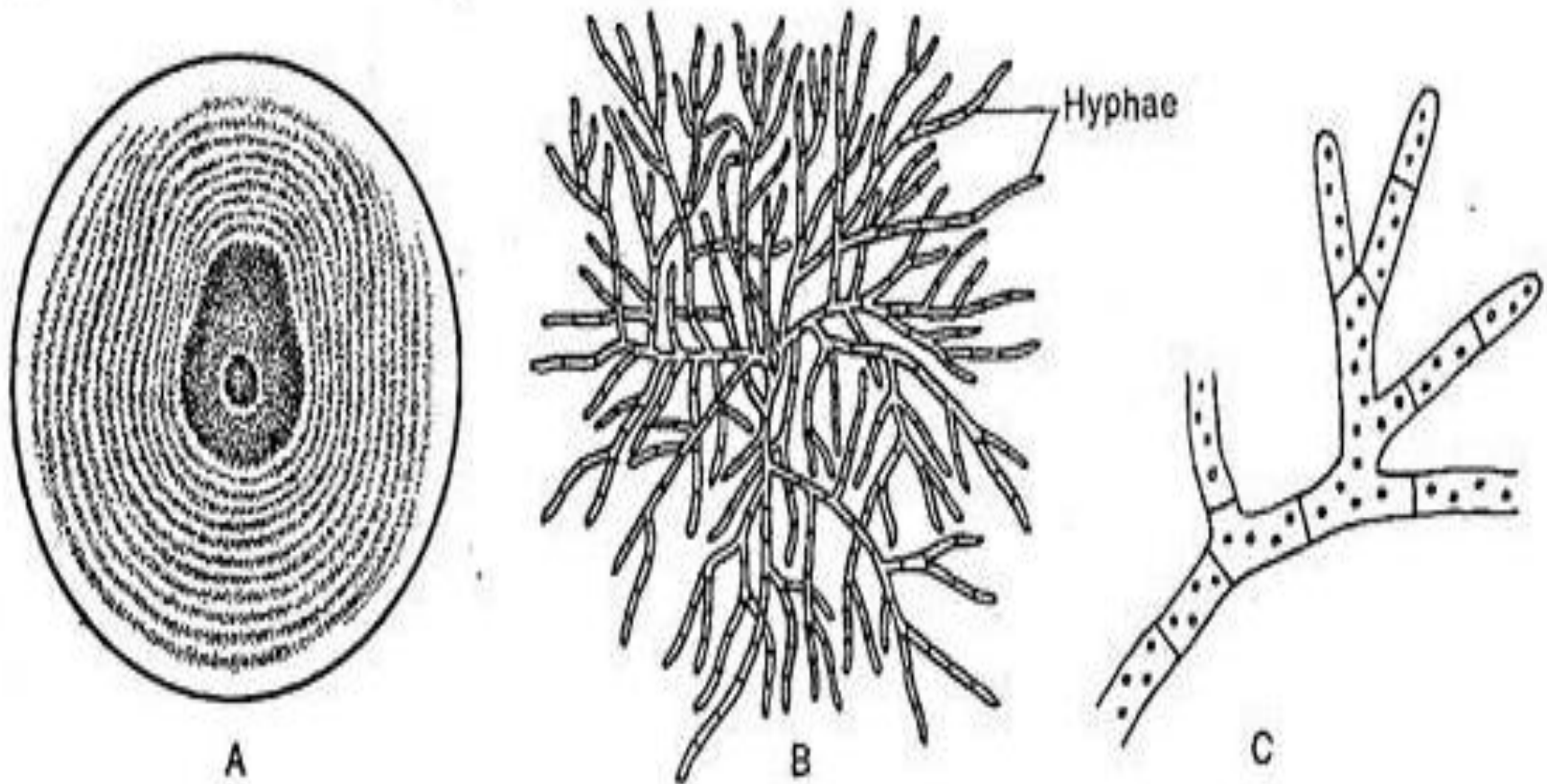
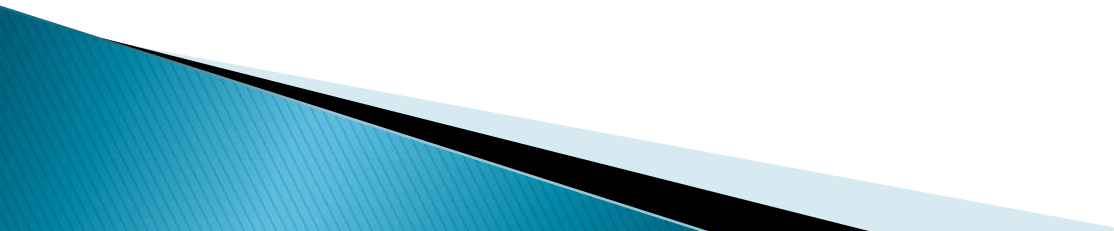
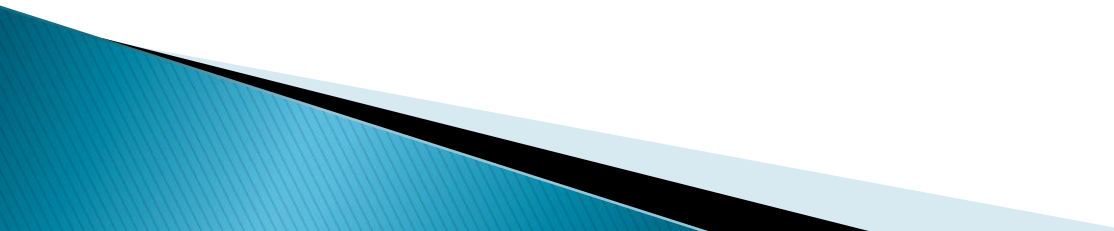


Fig. 4.42 : *Penicillium* : A. A colony, B. Mycelium of *Penicillium*, C. Mycelium, enlarged view

- ▶ Penicillium reproduces by vegetative, asexual and sexual means.
 - ▶ **Vegetative reproduction:**
 - ▶ It takes place by accidental breaking of vegetative mycelium into two or more fragments. Each fragment then grows individually like the mother mycelium.
- 

2. Asexual Reproduction

- ▶ Asexual reproduction takes place by unicellular, uninucleate, nonmotile spores, the conidia; formed on conidiophore
- ▶ The conidiophore develops as an erect branch from any cell of the vegetative mycelium.
- ▶ The branch of the conidiophore is known as ramus (plural rami) which further becomes branched known as metulae. A number of flask-shaped phialid or sterigmata develops at the tip of each metulae.
- ▶ Each sterigmata develops at its tip a number of conidia

- ▶ During the development of conidium, the tip of the sterigma swells up and its nucleus divides mitotically into two nuclei, of which one migrates into the swollen tip and by partition wall the swollen region cuts off from the mother and forms the uninucleate conidium.
 - ▶ The tip of the sterigma swells up again and following the same procedure second conidium is formed, which pushes the first one towards the outer side. This process repeats several times and thus a chain of conidia is formed.
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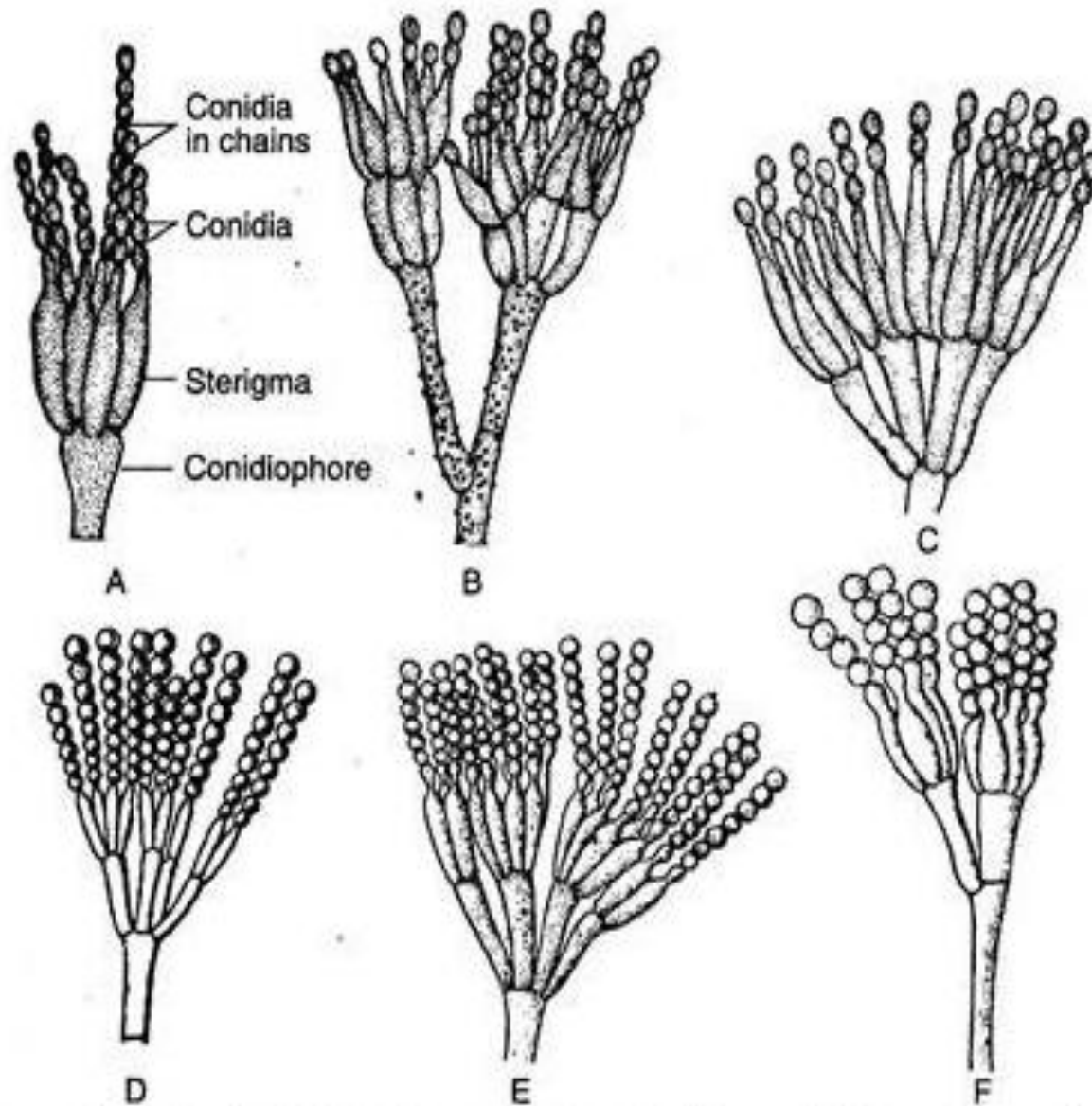
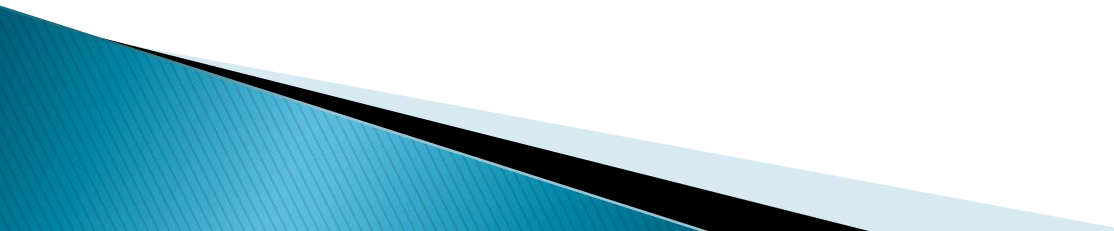
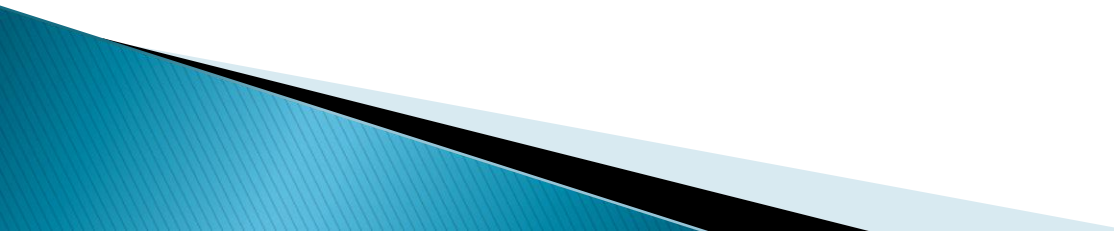
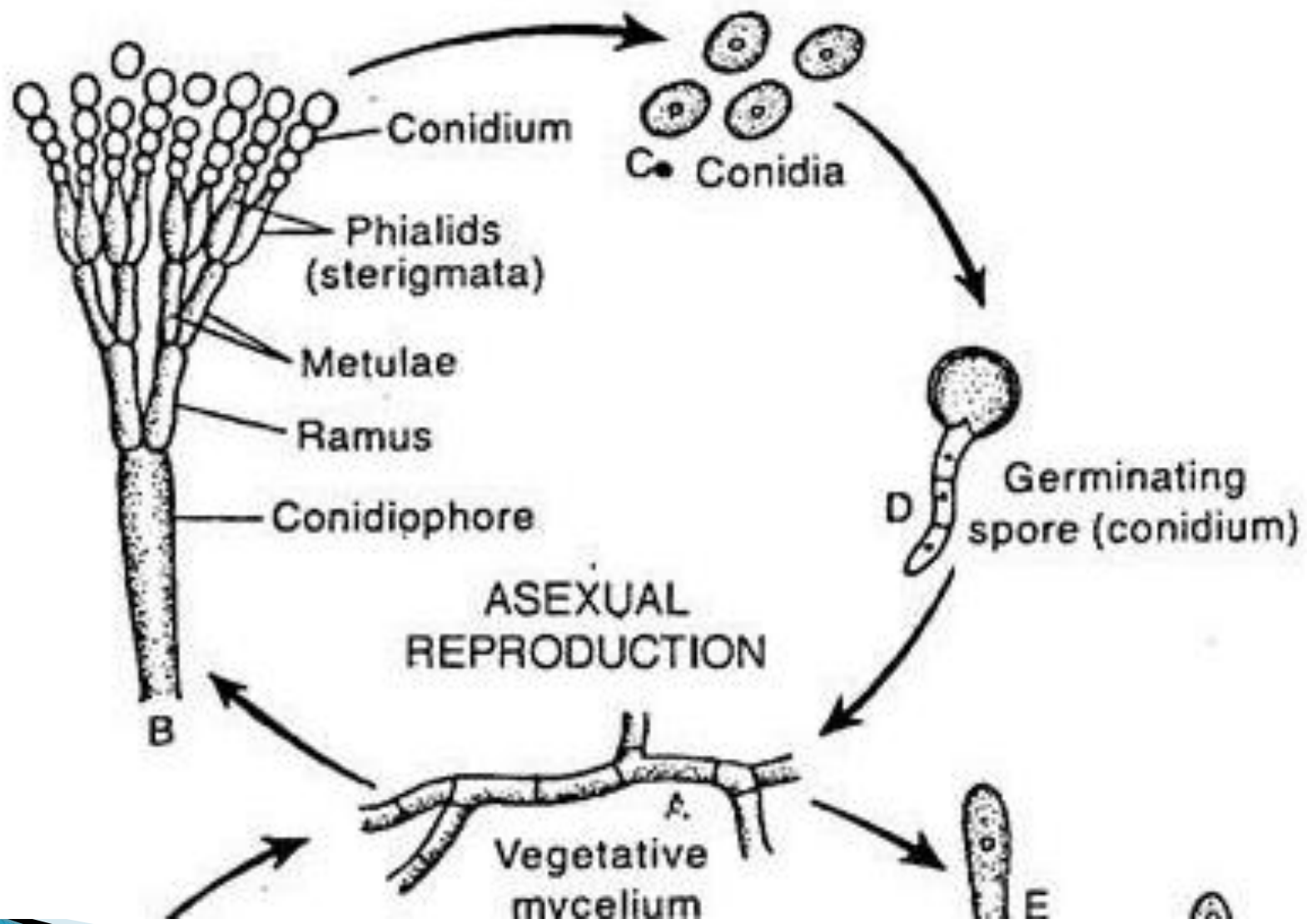


Fig. 4.43 : Different types of conidiophore of *Penicillium* species : A. *P. thomii*, B. *P. lanoso-caerulium*, C. *P. verniculatum*, D. *P. glaucum*, E. *P. herquei* and F. *P. chrysogenum*

- ▶ The conidia are oval, elliptical or globose in structure having smooth, rough, and of various colourations like green, yellow, blue etc.
 - ▶ After maturation, the conidia get detached from the mother and are dispersed by wind.
 - ▶ On suitable substratum, they germinate by developing germ tube.
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3. Sexual Reproduction

- ▶ **By means of Ascospores**
 - ▶ The ascospores are released by the dis-solution of ascus and cleistothecium wall. The ascospore germinates on a suitable substratum by developing germ tube and ultimately into a mycelium like the mother.
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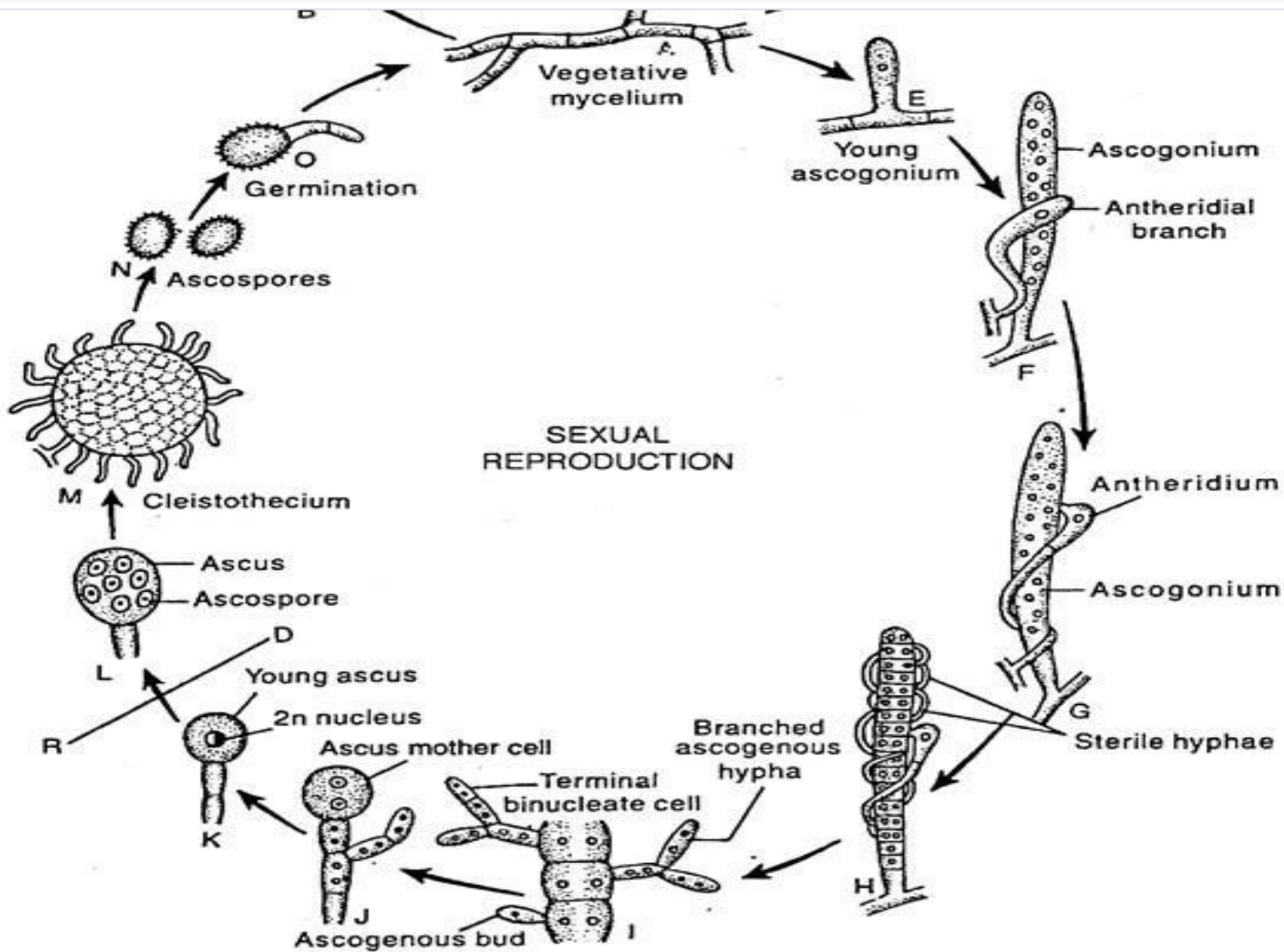
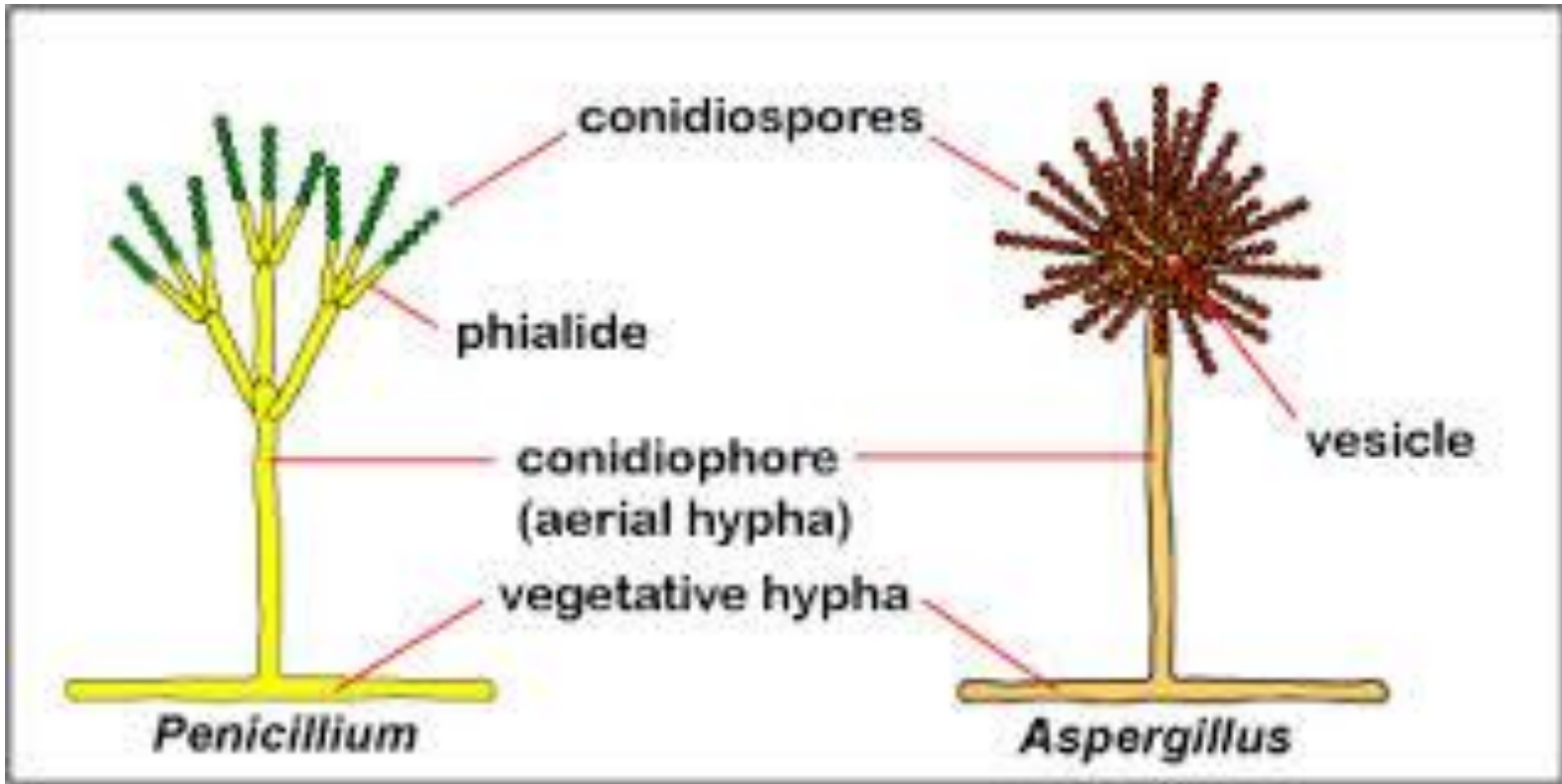


Fig. 4.44 : Life cycle of *Talaromyces vermiculatus* (*Penicillium vermiculatum*) .

Distinction between Penicillium and Aspergillus

1. The conidiophore in *Aspergillus* is unseptate and unbranched. It arises from a specialized, T-shaped thick-walled foot cell. In *Penicillium* it is long, slender, septate and branched. It arises from any vegetative cell of the mycelium. There are no foot cells.
2. In *Aspergillus* the conidiophores enlarge into a vesicle at its tip which bears the finger-like sterigmata. The whole structure has the form of a spherical head. The conidiophore in *Penicillium* ends in a whorl of branches which give it a broom-like appearance.



Pathogenicity and Clinical Significance

- ▶ *Penicillium* spp. are occasional causes of infection in humans
- ▶ resulting disease is known as penicilliosis.
- ▶ *Penicillium* has been isolated from patients with keratitis , endophthalmitis, otomycosis, necrotizing esophagitis, pneumonia, endocarditis, peritonitis, and urinary tract infections.

- ▶ Most *Penicillium* infections are encountered in immunosuppressed hosts.
- ▶ In addition to its infectious potential, *Penicillium verrucosum* produces a mycotoxin, ochratoxin A, which is nephrotoxic and carcinogenic. The production of the toxin usually occurs in cereal grains at cold climates

Penicillium marneffeii

- Penicillium present in environment various substrates like bread, jam, fruit & cheese.
- Are common airborne contaminant of culture media.
- Unique among penicillium, true pathogen & dimorphic.
- Causes skin lesions, disseminated infections in immunocompromised.

Penicillium marneffe

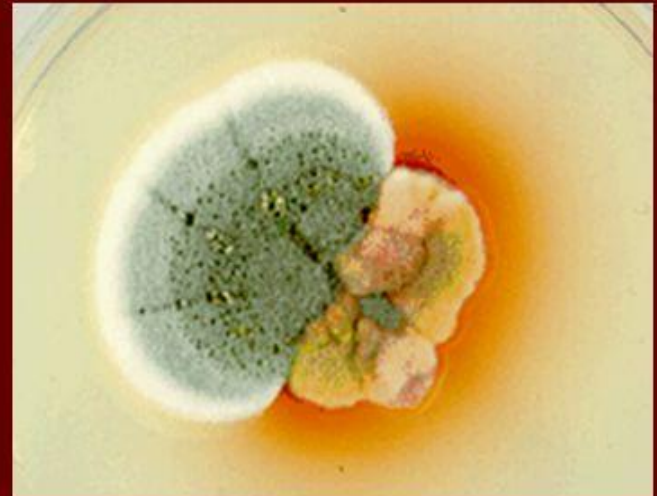
Laboratory diagnosis

- Direct examination
 - Wright or Giemsa stain, PAS, H&E
 - Oval yeastlike cells and multiply within histiocytes in tissue (or within monocytes in blood or BM)

Penicillium marneffe

Mycelial form

- Colony is flat powdery to velvety, gray-green in the center
- A deep-reddish soluble pigment diffuses into the medium



Culture showing a common green saprophytic *Penicillium* sp. and the typical reddish yellow with a yellow or white edge colony with distinctive red diffusible pigment of *Penicillium marneffe*