

# PENICILLIUM

Class- Ascomycetes

Order- Aspergillales

Family -Aspergillaceae

Genus - Penicillium notatum

Penicillium is a saprophytic fungus, commonly known as blue or green mold., the genus includes 136 species, distributed throughout the world. They are present in soil, in air, on decaying fruits, vegetables, meat, etc.

The “wonder drug” penicillin was first discovered by Sir Alexander Fleming at Sant Mary’s Hospital, London, in 1929; during his work with a bacterium *Staphylococcus aureus* responsible for boil, carbuncle, sepsis in wounds and burns etc.,

## **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 simple pore, through which cytoplasmic continuity is maintained. Some mycelia grow deeper into the substratum to absorb food material and others remain on the substrate and grow a mycelial felt. The reserve food is present in the form of oil globules.

## **Reproduction in Penicillium:**

Penicillium reproduces by vegetative, asexual and sexual means.

### **1. 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.

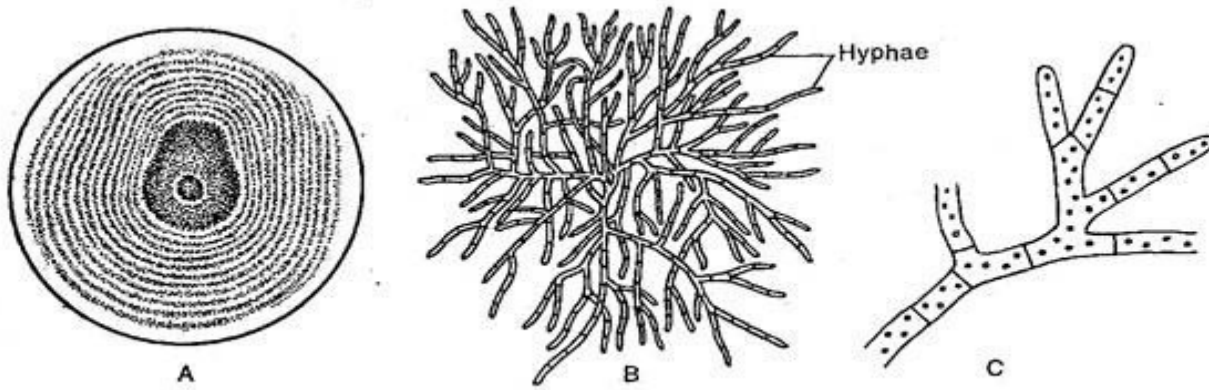


Fig. 4.42 : *Penicillium* : A. A colony, B. Mycelium of *Penicillium*, C. Mycelium, enlarged view

## 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 conidiophore may be unbranched - Monoverticillate (*P. spinulosum*, *P. thomii*) or becomes variously branched - Biverticillate (*P. expansum*). The branch of the conidiophore is known as ramus which further becomes branched the ultimate branches are called as metulae. Each metula at its tip bears a number of bottle shaped cells called sterigmata or Phialides.

Each sterigmata develops at its tip a number of conidia arranged basipetally (younger one near the base and older one at the tip). 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. Branched conidiophores along with chains of conidia appears like a broom or brush hence the name penicillus (Latin -*Penicillus* = brush)

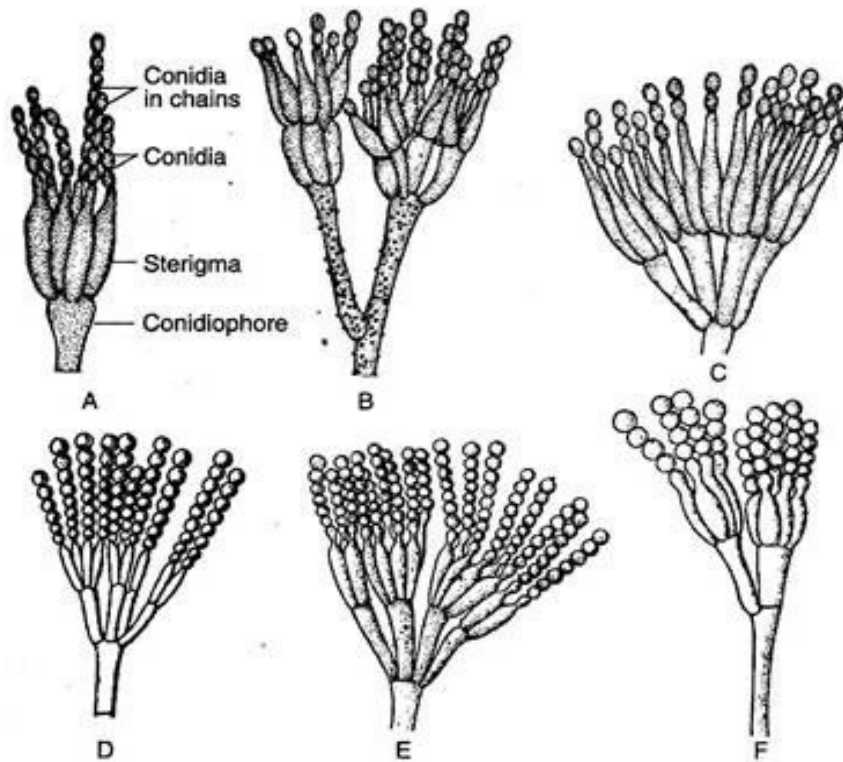


Fig. 4.43 : Different types of conidiophore of *Penicillium* species : A. *P. thomii*, B. *P. lanoso-caerullum*, C. *P. vermiculatum*, D. *P. glaucum*, E. *P. herquei* and F. *P. chrysogenum*

The conidia are oval, elliptical or globose in structure having smooth, rough, echinulate outer surface 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. The nucleus undergoes repeated mitotic division and all nuclei enter into the germ tube. The septa formation continues with the elongation of germ tube and finally a new septate branched mycelium develops.

### 3. Sexual Reproduction:

Sexual reproduction has been studied only in few species.

*Penicillium vermiculatum* was described by Dangeard (1907). This species shows oogamous type of sexual reproduction. The female sex organ is ascogonium and male sex organ antheridium. The ascogonium develops from any cell of the vegetative filament as an erect uninucleate and unicellular body. The nucleus then undergoes repeated mitotic divisions and produces 32 or 64 nuclei.

The antheridium develops simultaneously with the ascogonium from any neighbouring hypha. It is also an uninucleate and unicellular branch which coils around the ascogonium. The apical region of

antheridial branch cuts off by septum and forms a short, somewhat inflated unicellular and uninucleate antheridium . After maturation of both ascogonium and antheridium, the tip of the antheridium bends and touches the ascogonial wall. The common wall at the point of contact dissolves and the two cytoplasm then intermixes.

The nucleus of the antheridium does not migrate into the ascogonium . Later, the pairing of nuclei into the ascogonium takes place by the ascogonial nuclei only. The ascogonium then divides by partition wall into many binucleate cells, arranged uniseriately . Some of the binucleate cells of the ascogonium project out by the formation of multicellular ascogenous branched hyphae, whose cells are also dikaryotic. The apical cells of the dikaryotic mycelia swell up and function as ascus mother cells .

Both the nuclei of ascus mother cell undergo karyogamy and form diploid ( $2n$ ) nucleus. The nucleus then undergoes first meiosis, then mitosis, results in the formation of 8 nuclei; those after accumulating some cytoplasm form 8 ascospores . With the development of ascogonium and antheridium, many sterile hyphae gradually entangle with them and finally after the formation of ascospores, the total structure becomes a round fruit body i.e., cleistothecium . The asci arrange irregularly inside the cleistothecium. The ascospores may be globose, elliptical or lenticular in shape with smooth, echinulate, pitted or branched outer wall like a pulley-wheel in lateral view.

The ascospores are released by the dissolution of ascus and cleistothecium wall. The ascospore germinates on a suitable substratum by developing germ tube and ultimately into a mycelium like the mother.

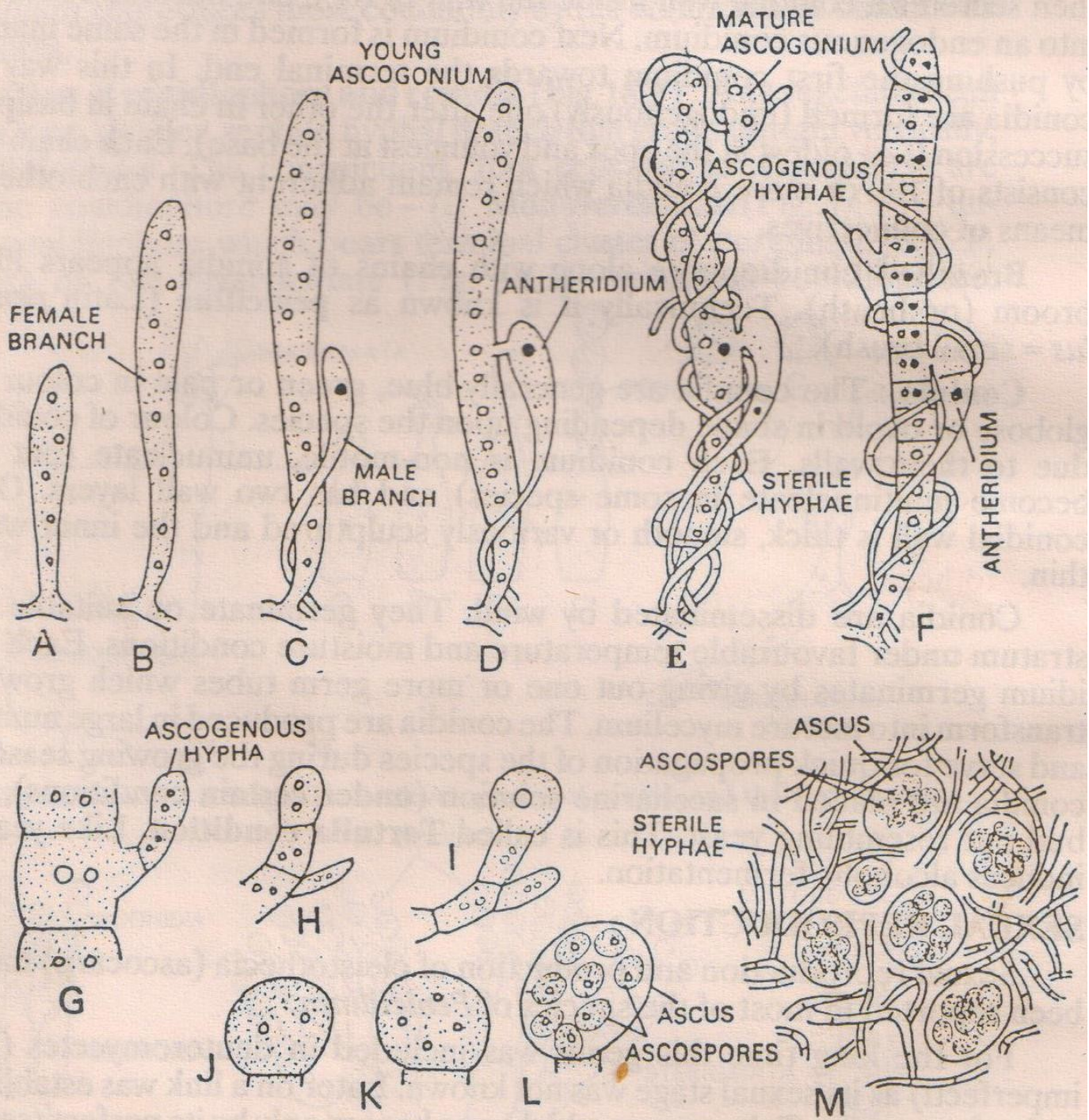


Fig.18.4. *Penicillium vermiculatum*. A – M. Stages in the sexual reproduction, formation of ascus and ascospores; M. Mature cleistothecium.