



Bhagalpur National College, Bhagalpur

(A Constituent unit of Tilka Manjhi Bhagalpur University, Bhagalpur)

PPT Presentation for B.Sc. I- PINUS: Structure, Reproduction and Life cycle



Presented by - Dr. Amit Kishore Singh
Department of Botany
B.N. College, Bhagalpur

Distribution and Occurrence

- Widely distributed in the Northern Hemisphere, mostly in temperate areas.
- Of the 90 species, 6 species are Indian- *P. excelsa*, *P. longifolia*, *P. gerardiana*, *P. insularis*, *P. armandi*, forms dense evergreen forests in hilly regions (Himalayas).



P. longifolia



P. roxburgii



P. insularis

Systematic Position of Pinus

- Gymnospermae
 - Division: Coniferophyta
 - Class: Coniferopsida
 - Order: Coniferales
 - Family: Pinaceae
 - Genus: Pinus



External morphology of Pinus

- Plant body is **sporophytic**

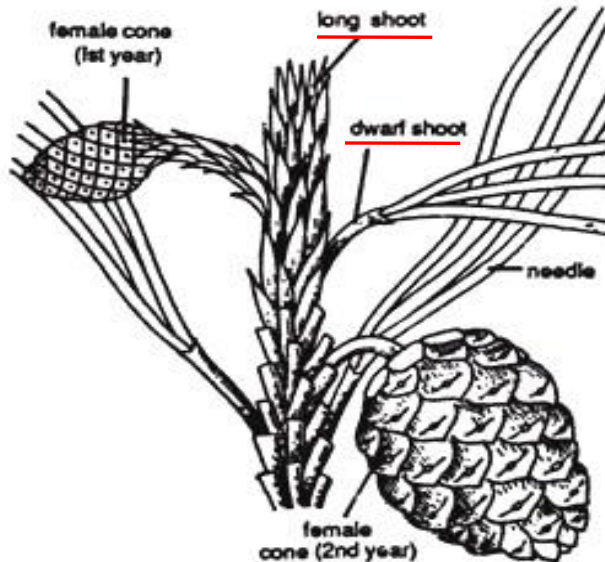
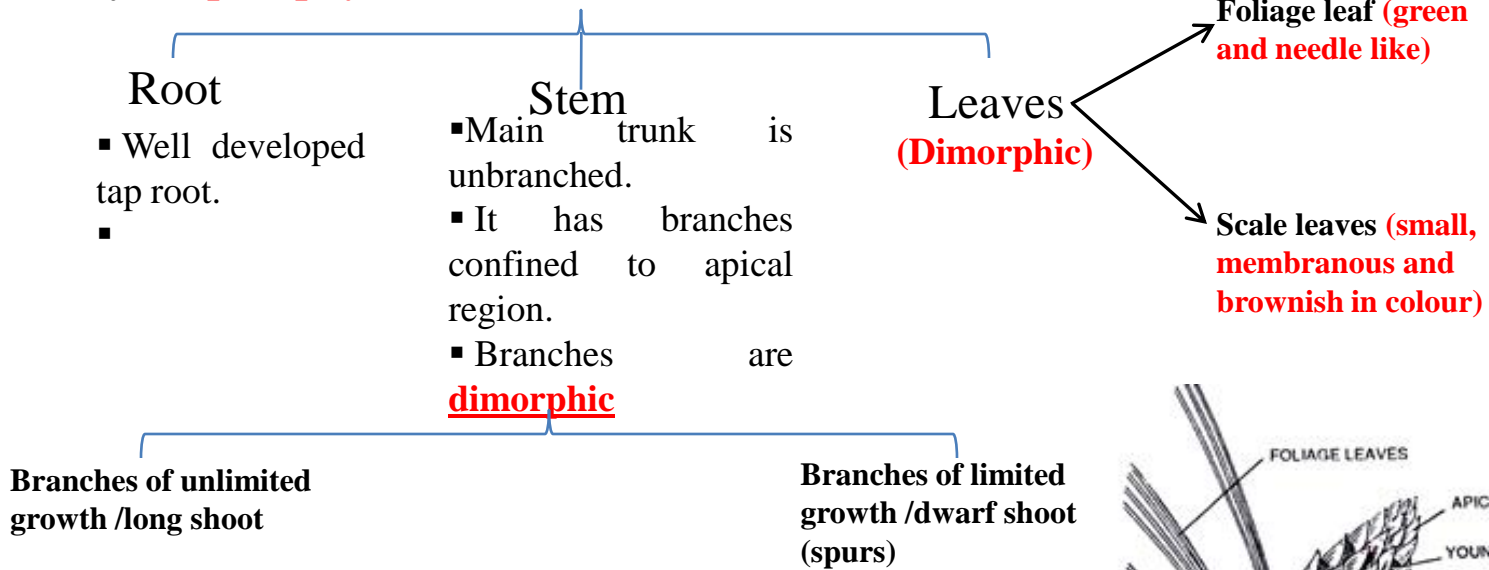


Fig. 43. Pinus. A fertile long shoot bearing 1st and 2nd year female cones.

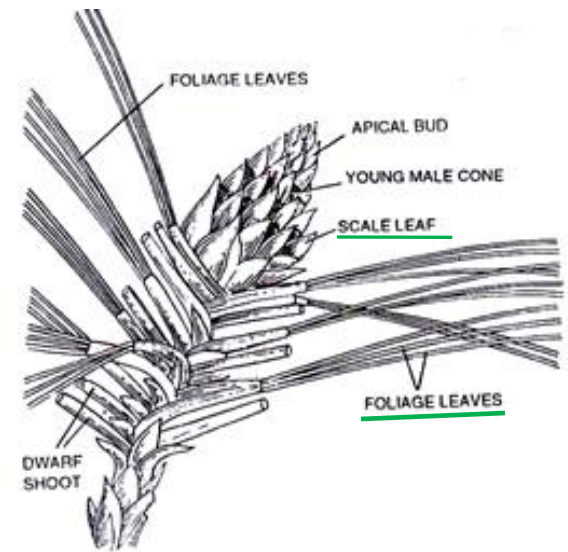
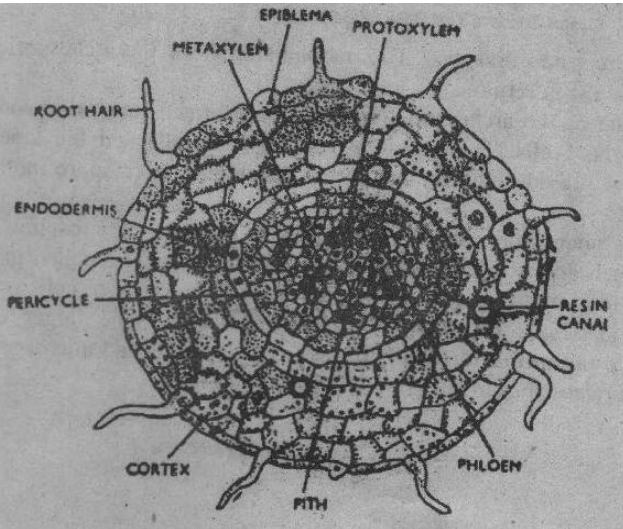


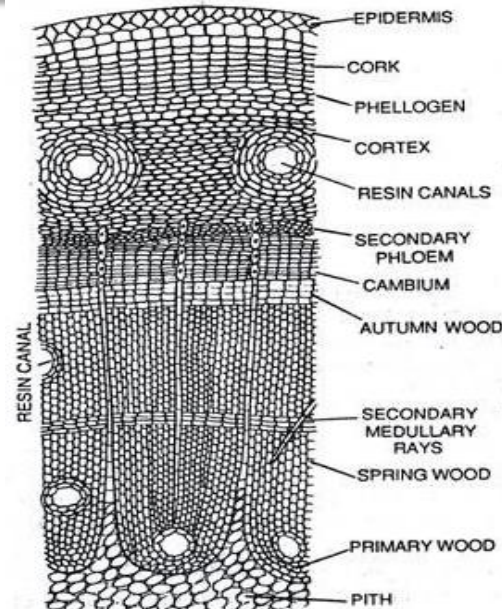
Fig. 4.27. Pinus roxburghii. A, cluster of very young male cones.

Internal morphology of Pinus



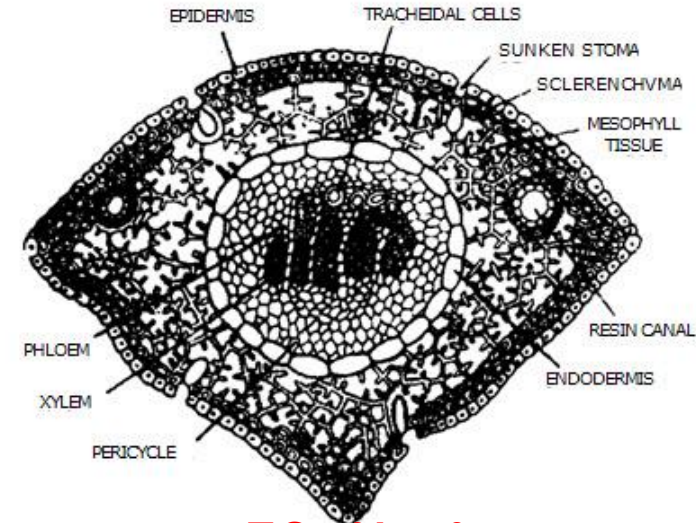
T.S of Root

- Piliferous epiblema bear unicellular root hair (seen only in young roots).
- Broad parenchymatous cortex follows.
- Endodermis and pericycle layers seen next.
- Vascular tissue is radially arranged in 2-6 groups of xylem and phloem.
- This tissue lacks true vessels and companion cells.
- Resin canals present in xylem patch making it **Y-shaped**.
- Old roots show secondary growth.



T.S of Stem

- Cuticularized epidermis at the outermost layer encloses hypodermis layer below.
- Inner cortex is thin walled parenchyma containing chloroplasts and resin canals.
- Vascular bundles are conjoint, collateral, endarch, open and form a ring around the pith.
- Medullary rays are narrow.
- Mesophyll is parenchymatous, not differentiated into palisade and spongy cells.
- Vessels in xylem and companion cells in phloem are absent.
- Ring of vascular cambium develops.
- Pinus wood is dense and massive with few parenchyma cells – **pycnoxylic**.
- Cork cambium (phellogen) formed in outer cortical layer.
- Forms secondary cortical cells (phellderm) towards inner side and cork (phellem) on outer side.



T.S of Leaf

- **Xeromorphic**
- Outermost epidermal layer has thick-walled cells which are cuticularized.
- Stomata are sunken in below surface of epidermis.
- Mesophyll is parenchymatous, not differentiated into palisade and spongy cells.
- Resin canals with secretory tissue present.
- Two vascular bundle with conjoint tissue present in the middle.
- **Albuminous cells** in pericycle is present.

Reproduction in Pinus

- Sporophytic plant body is **monoecious**, but the male and the female cones are produced on separate branches of the same plant.

Male cone

- Borne on the lower branches in the axils of scale leaves.
- Appear in the month of January (in plains) and March (in hills) reaching maturity within 2-3 months.
- Can be seen in clusters just behind the shoot – apex.

Female cone

- Borne on the upper branches of the tree, in axils of scale leaves either singly or in groups of 2-4.
- Female cones are seen in February and get pollinated within 3-4 months.
- Complete maturation and seed dispersal takes place in the 3rd year of development.

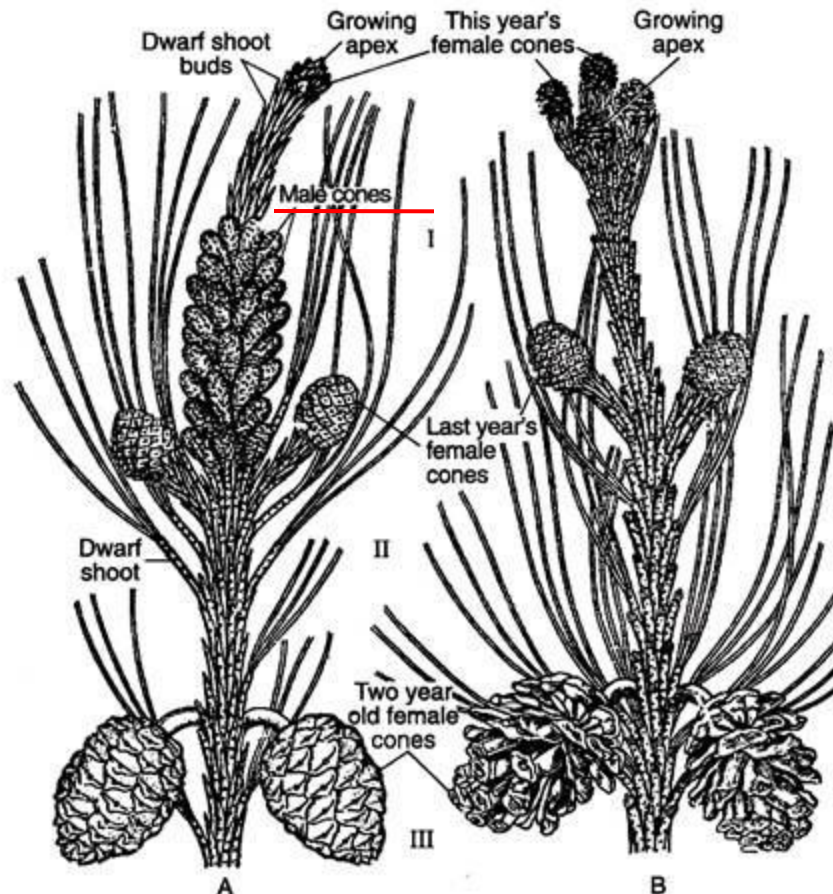


Fig. 1.61 : *Pinus* : Male and female cones : A. At early spring, B. At the end of spring (rains)

Microsporogenesis and male gametophyte

- Each male cone has 60-100 spirally arranged microsporophylls.
- Two microsporangia are present on the underside of each microsporophyll.
- Development of microsporangium is eusporangiate type.
- Within the microsporangium, the microspore mother cells undergo meiotic divisions to form haploid microspores.

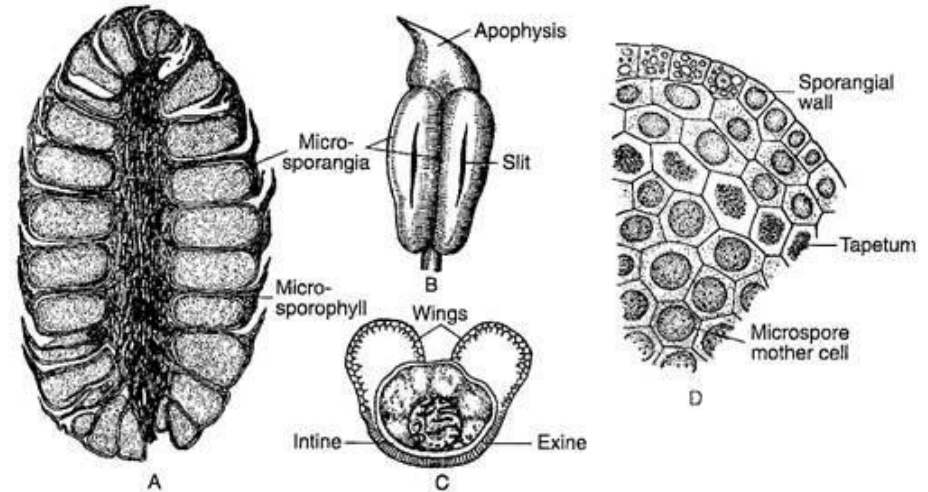
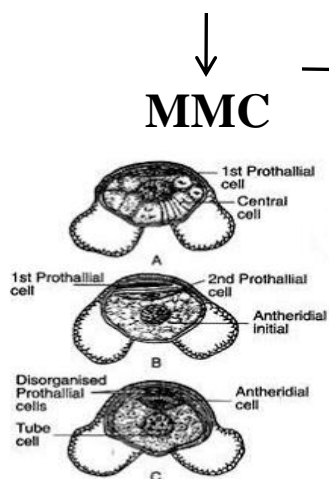


Fig. 1.62 : *Pinus* : A. Median L.S. of male cone, B. A microsporophyll, C. A pollen, D. T.S. of a microsporangium

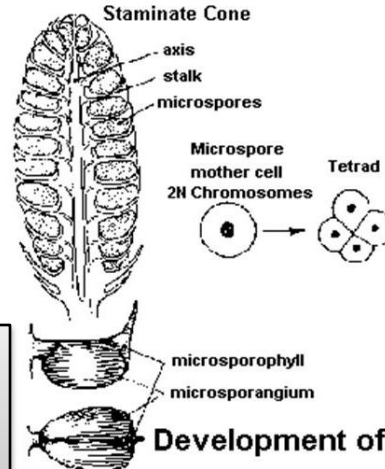
Microsporogenesis (Microsporophyll, Microsporangium)

Microsporangia



Meiosis

Released from sporangium and set on ovule through wind for pollination



4 Haploid microspores

Pollen tetrad

Development of *Pinus* microspore

Megasporogenesis and female gametophyte

- Cone on maturity is usually cylindrical and 15-20cms in length.
- Each cone consists of central axis bearing spirally arranged ovuliferous scales (60-70).
- On young cones a small thin & leathery bract scale can be below the ovuliferous scale.
- Each ovuliferous scale has two ovules on its upper surface.

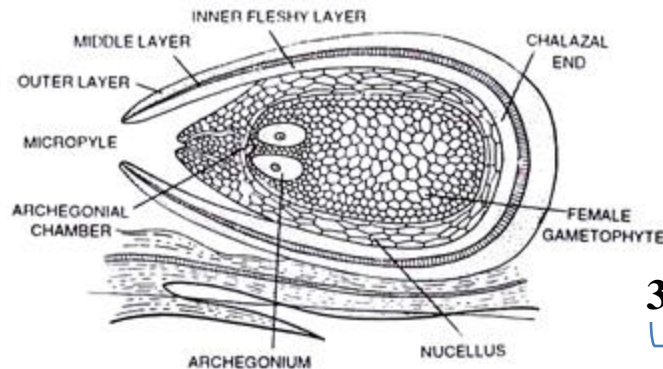
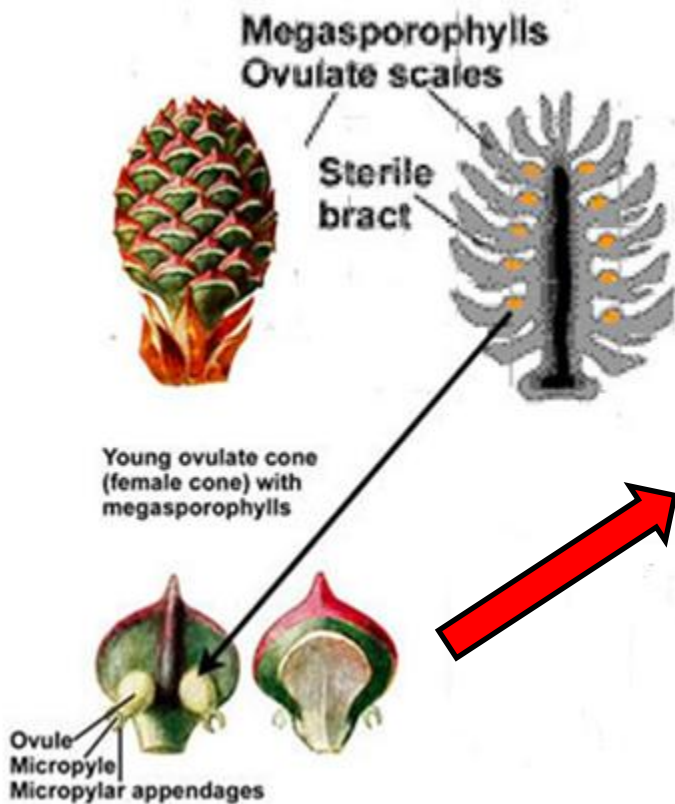
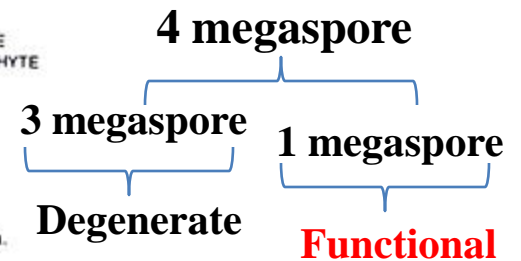


Fig. 4.39. *Pinus roxburghii*. L.S. of mature ovule showing archegonia.

Inside Ovule

- Nucellus differentiated into **Megaspore mother cell (MMC)**.

Meiosis

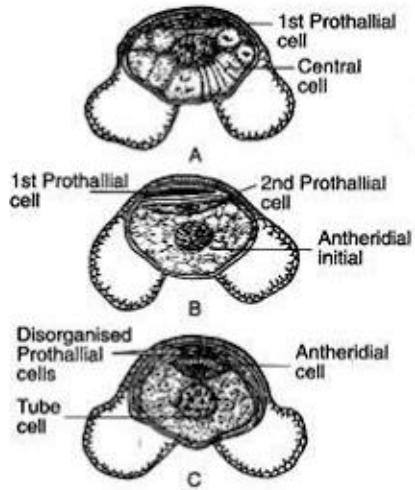


Endosperm
(Female gametophyte)



Pollination and Fertilization

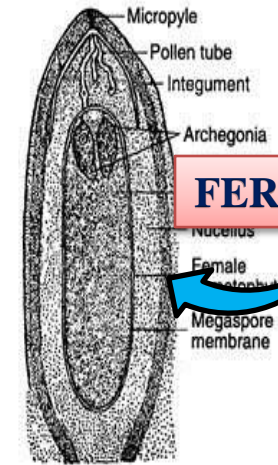
- Inside endosperm, development of archegonia takes place.
- Archegonia consists of venter cell and a short neck.
- Egg is very large. It is surrounded by prothallial cells.
- The neck is without neck canal cells.



Released from sporangium and set on ovule through wind for pollination

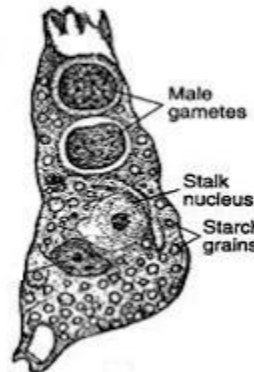
Ready for pollination

Wind pollination



FERTILIZATION

Matured ovule structure)



FERTILIZATION

EMBRYO

Numerous divisions

ZYGOTE

PROEMBRYO

Alternation of generation in Pinus

Sporophytic phase

Gametophytic phase

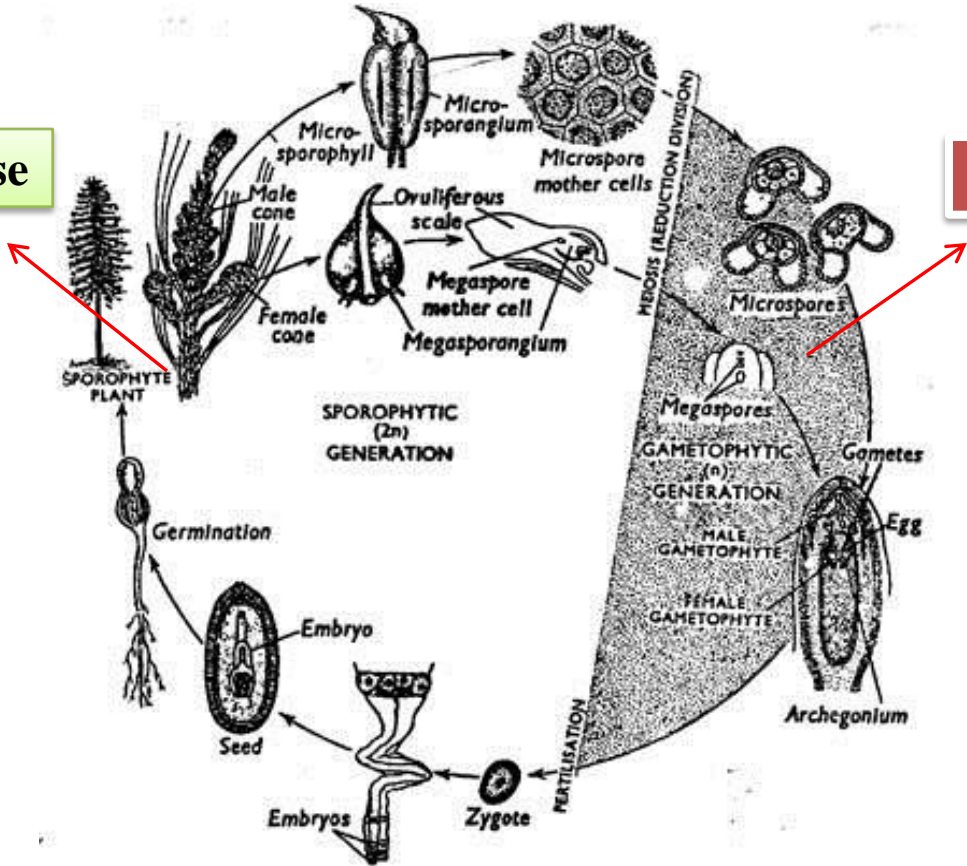


Fig. 1.70 : Life cycle of *Pinus*

Economic importance of Pinus

- Pine tree wood is very strong and it is extensively used to manufacture doors, electric poles, window panes, boats, railway sleepers, musical instruments, boards, boxes, veneers and plywood, building construction, paneling, etc. due to its durability.
- Turpentine oil is produced from the pine tree which is used as a solvent for varnishes, paints and in perfumery industry.
- It is also used for producing disinfectants, synthetic pine oil, denaturants, and insecticides, etc.
- Pine oil from the pinewood is used in pharmaceutical industries, textile industries, leather industries, etc.

THANK YOU