VIVEKANANDA COLLEGE

THAKURPUKUR

KOLKATA-700063

NAAC ACCREDITED 'A' GRADE

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Name of the Department:	Botany (Morning)

Male and female cone of Pinus

Pinus reproduces sexually-

- It is monoecious, but the male and the female cones are produced on separate branches of the same plant. The male cones develop on the lower branches, while the female cones are formed on the upper branches.
- The male cones, which replace the dwarf shoots, develop in clusters on the base of the current year's long shoot at early spring (Fig. 1.61 A).
- The number of male cones in a cluster varies considerably from 15 (*P. wallichiana*) to 140 (*P. roxburghii*).
- At the onset of spring, the male cones fall off and simultaneously the young female cones are borne in pairs or in clusters round the tip of the long shoot (Fig. 1.61 B).
- The female cones grow very slowly and the growth may persist for several years. Thus, the female cones of different ages may be seen in acropetal succession in the long shoot (Fig. 1.61B).

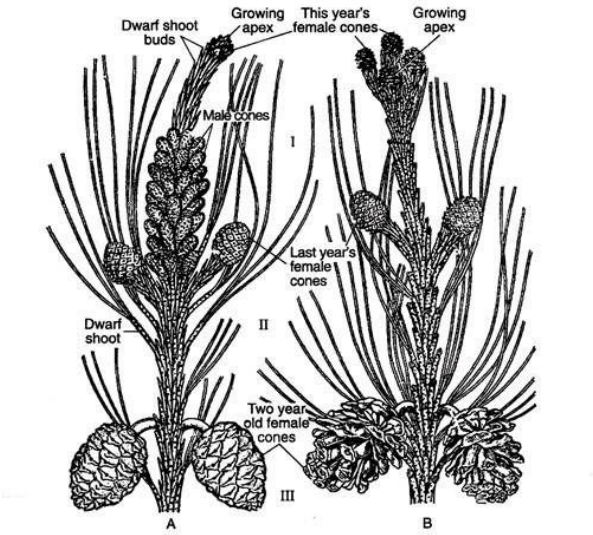

Fig. 1.61 : *Pinus* : Male and female cones : A. At early spring, B. At the end of spring (rains)

i. Male Cone:

- The **male cone** is small (2-4 cm in length) and oval in shape
- It develops in the axil of scale leaves.
- The male cone has a central axis on which 60-150 microsporophylls are spirally arranged around the axis (Fig. 1.62A).

MICROSPOROPHYLL:

- A single microsporophyll is a membranous stalked structure .
- It has a distal expanded roughly triangular sterile part called **apophysis** (Fig. 1.62B).
- Each microsporophyll bears two sac-like microsporangia on the abaxial surface.

MICROSPORANGIA:

- The development of microsporangia is of eusporangiate type.
- A mature microsporangium consists of a multilayered wall, tapetum and microspore mother cells (Fig. 1.62D).
- Each microspore mother cell — by meiotic division — produces four microspores of pollen grains.
- Thus, at maturity, a single microsporangium contains numerous pale yellow pollen grains.

MICROSPORE:

- The pollen grains are boat-shaped with monosulcate apertures and are bounded by two concentric wall layers: the outer thick exine and the inner thin intine (Fig. 1.62C).
- The exine on the lateral sides of the pollen is expanded to form **two wings** (sacci).
- The dehiscence of sporangia takes place by longitudinal slit in dry and warm environment.

Pinus is wind-pollinated (anemophilous). The pale-yellow pollen grains are released into the air in a large quantity, so that a pine forest appears yellow at the time of pollination. This is popularly called '<u>sulphur showers</u>' which occurs

especially in the spring when pine trees are shaken by strong winds.

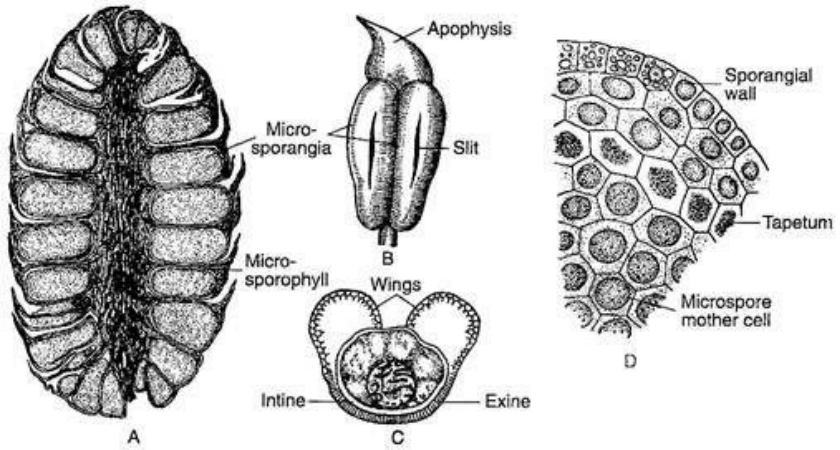

Fig. 1.62 : *Pinus* : A. Median L.S. of male cone, B. A microsporophyll, C. A pollen, D. T.S. of a microsporangium

ii. Female Cone:

- Female cones are produced in pairs or in clusters in the axil of the scale leaves.
- The female cones mature very slowly.
- The first year young cone (Fig. 1.61 A, B) is small (1-2 cm in length), soft, compact and red-green in colour. The second year cone (Fig. 1.61 A, B) is comparatively large (5-8 cm in length), woody, compact and green in colour.
- The fully matured third year cone is much larger (15-60 cm in length), woody, loose and brown in colour. Megasporophylls are separated from each other due to the elongation of the cone axis.

MEGASPOROPHYLL:

The female cone is composed of a central axis on which 80-90 megasporophylls, axillary to bract scale/scale leaves, are arranged spirally (Fig. 1.63A).

A single megasporophyll consists of two types of scales:

(a) a large woody **ovuliferous scale or seminiferous scale** bearing two ovules on the adaxial surface, and

(b) a **bract scale or cone scale** on the abaxial surface (Fig. 1.63B,C).

Initially, the **ovuliferous scale** is

- ➢ much smaller than that of bract scale,
- ➢ but after pollination it becomes larger than the bract scale.
- ➢ It is a **thick, large, woody, roughly triangular and brownish structure. Its upper thick exposed part is known as apophysis**.
- ➢ In the mature cone, the tip of the apophysis becomes the **'umbo'** (Fig. 1.63C). There are two separate vascular traces, one supplies to the ovuliferous scale and the other to the bract scale (Fig. 1.63B). There is no separate vascular trace for ovule.

Bract scale /cone scale/carpellary scale:

- This kind of scale is **thin, dry, membranous, brown colored, having a fringed upper part.**

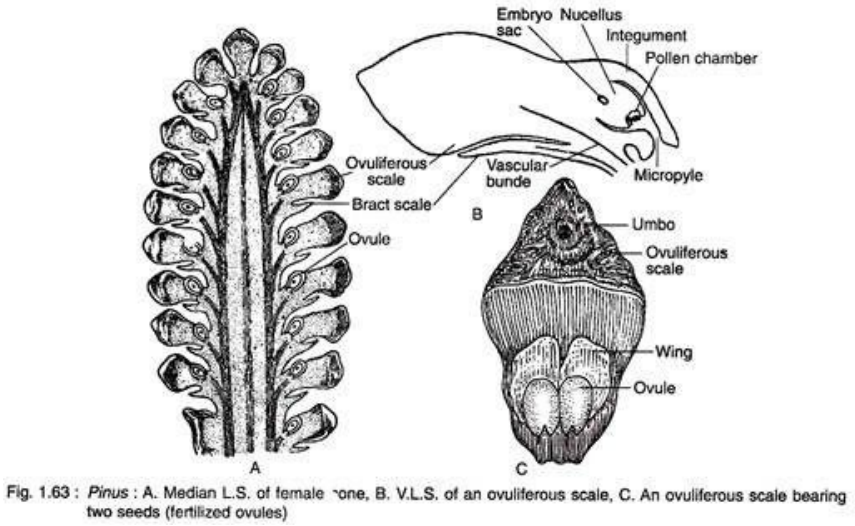

Fig. 1.63 : *Pinus* : A. Median L.S. of female cone, B. V.L.S. of an ovuliferous scale, C. An ovuliferous scale bearing two seeds (fertilized ovules)

Ovule (Megasporangium):

- The development of megasporangium (ovule) is of eusporangiate type i.e., an ovule develops from a group of superficial cells of the ovuliferous scale.
- The ovules are anatropous, unitegmic and crassinucellate. The single integument is free from the nucellus except at the chalazal end.
- There is a fairly broad micropylar tube which becomes inwardly curved during pre-pollination stages and becomes outwardly curved at the time of pollination.

- The integument is three-layered, the outer fleshy, the middle stony and the inner fleshy.

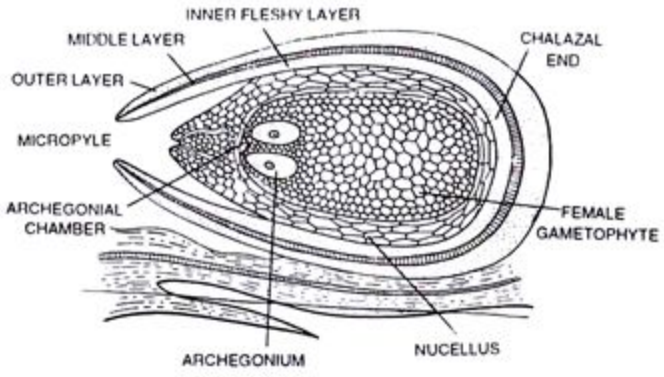

Fig. 4.39. *Pinus roxburghii.* L.S. of mature ovule showing archegonia.

Megasporogenesis:

- A hypodermal cell in the nucellar tissue at the micropylar end is differentiated into an archesporial cell.
- It divides periclinally to form an upper parietal cell and a lower megaspore mother cell.
- The parietal cell further divides to form the tapetal layer.
- The megaspore mother cell undergoes meiotic division to form a linear tetrad of four megaspores.
- The outer three megaspores degenerate, while the lowermost megaspore becomes functional .
- The upper free opening of the integument forms the micropyle and a concavity in between the integument and nucellus in the upper part of the ovule forms the pollen chamber.

- After pollination the pollen grains are stored in the pollen chamber and further development of pollen grains takes place in the nucellar tissue.