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. A, B) is small (1-2 cm in length), soft, compact and red-green in colour. The second year cone (Fig. 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. Here megasporophylls are separated from each other due to the elongation of the cone axis.

Refer to the 2\textsuperscript{nd} slide figure provided to you in class/lecture/e-mail/whatsapp group.
The female cone of Pinus represents a compound shoot; it is a complicated structure. The female cone is composed of a central axis on which 80-90 megasporophylls, axillary to bract scale/scale leaves, are arranged spirally (Fig. A).

Refer to the 3rd slide figures provided to you in class/lecture/e-mail/whatsapp group

two seeds (fertilized ovules)
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. B, C). Initially, the ovuliferous scale is much smaller than that of bract scale, but after pollination it becomes larger than the bract scale.

Refer to the 4th slide figure provided to you in class/lecture/e-mail/whatsapp group

The ovuliferous scale is a thick, large, woody, roughly triangular and brownish structure. Its upper thick exposed part is known as apophysis, the tip of which is called ‘Umbo’.

The development of megasporangium (ovule) is of eusporangiate type i.e., an ovule develops from a group of superficial cells of the ovuliferous scale.
Two to four cells of the female gametophyte at the micropylar end enlarge in size and have dense cytoplasm and prominent nuclei. These cells function as archegonial initials. Each archegonial initial divides periclinally to form an outer small primary neck initial and a large central cell. The central cell enlarges very rapidly and its cytoplasm becomes vacuolated. The nucleus of the central cell divides into an upper ephemeral ventral canal cell and a large egg cell. A nutritive layer called archegonial jacket is differentiated around the archegonium. The
Refer to the 6th slide schematic figure provided to you in class/lecture/e-mail/whatsapp group
Ovule:
The ovules of Pinus are anatropous, unitegmic and crassinucellate (Fig. 1.64).

Anatropous ovule - a completely inverted ovule turned back 180 degrees on its stalk.

An integument is a protective cell layer surrounding the ovule. Gymnosperms typically have one integument (unitegmic) while angiosperms typically have two (bitegmic).

Crassinucellate refers to the ovule in which two or more layers of the cells is present between megasporophyte and epidermal cells during megasporophyte development.

Refer to the 7th slide ovule figure provided to you in class/lecture/e-mail/whatsapp group
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.

**Megasporogenesis:**
A hypodermcd 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 tapetal layer. The megaspore mother cell undergoes meiotic division to form a linear tetrad of four megaspores.

Refer to the 7th slide schematic figure and ovule figure provided to you in class/ lecture/ e-mail/whatsapp group.
The outer three megaspores degenerate, while the lowermost megaspore becomes functional (Fig.A). 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.

Refer to the 8th slide schematic figure, megasporopogenesis and archegonium figure provided to you in class/lecture/e-mail/whatsapp group.
Next Lecture: Reproduction in Pinus-Part 3