VIVEKANANDA COLLEGE

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NAAC ACCREDITED 'A' GRADE

Topic:	PTERIDOPHYTES
Course Title:	PLANT DIVERSITY II
Paper:	BOT-G-CC-2-2-TH
Unit:	1
Semester:	II
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Name of the Department:	Botany (Morning)

LIFE CYCLE OF *Pteris*

Reproduction in *Pteris*:

Pteris reproduces by means of spores.

Spore-Producing Organ:

- *Pteris* is a homosporous fern. The **sorus** of *Pteris* is called **coenosorus** (Fig. 102C).
- Coenosori are marginal, borne continuously on a vascular commissure connected with vein ends.
- Thus the sporangia of *Pteris* form a continuous linear sorus along the margin, hence the individuality of sori is lost.
- The coenosorus are **protected by** the reflexed margin (**false indusium**) of the pinnae.
- Sori are of mixed type **intermingled with many sterile hairs in between the sporangia** (Fig. 7.104).

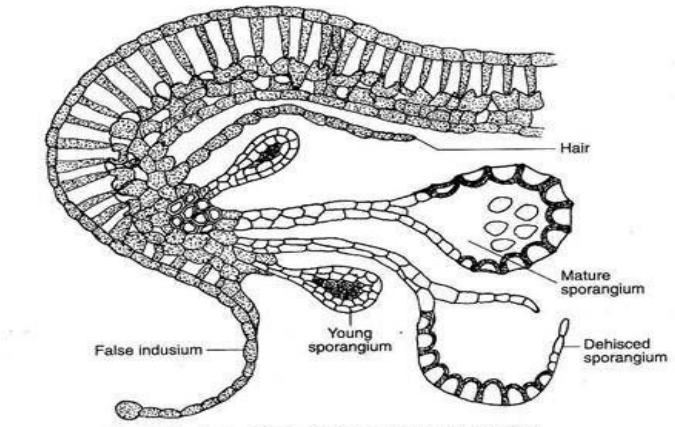


Fig. 7.104 : *Pteris* : T.S. of pinnule showing sorus (a portion)

***Development of Sporangium*:**

- The development of sporangium in *Pteris* is of **leptosporangiate type** (Fig. 7.105A-G).
- A single superficial cell of the receptacle functions as the **sporangial initial** which **divides transversely** to **produce an upper cell and a lower cell.**
- The **lower cell does not take part** in sporangium development, while **the upper cell**, by intersecting oblique walls, gets d**ifferentiated into an apical cell with three cutting faces.**
- The **apical cell cuts off two segments** along each of its three cutting faces.
- The apical cell divides periclinally to form an **outer jacket initial** and **an inner tetrahedral archesporial cell**.
- The **jacket initial divides**, anticlinally to form a single-layered **jacket of the sporangium**.
- The **archesporial cell further divides** periclinally to form an **outer tapetal initial** and **an inner primary sporogenous cell.**
- The **tapetal initial** by one periclinal and several anticlinal divisions **forms two-layered tapetum**.
- The **primary sporogenous cell divides to form** 12 **spore mother cells**.

- The **spore mother cells divide meiotically** to produce ha**ploid spores**, while the tapetal cells disorganise and provide nutrition to the spores.

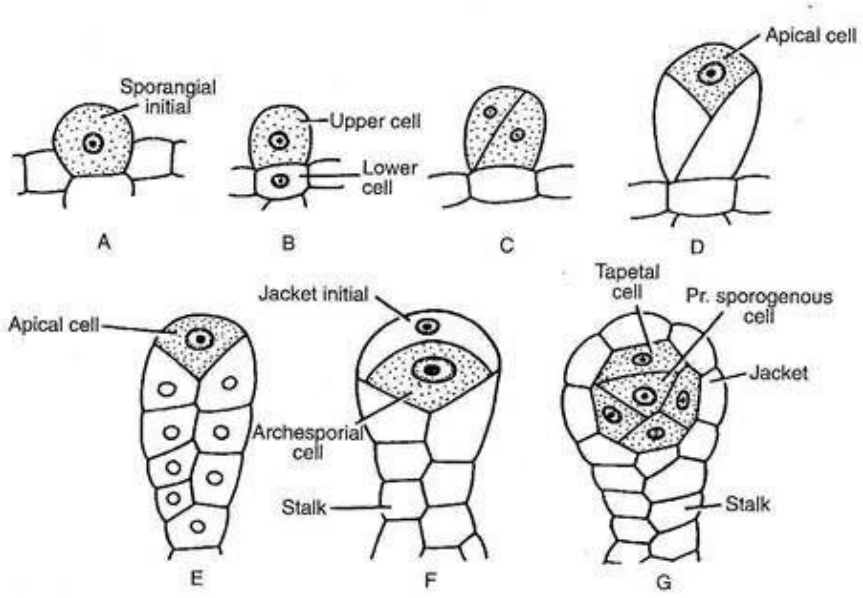


Fig. 7.105 : *Pteris* : A–G. The successive stages in the development of sporangium

Structure of a Mature Sporangium:

A mature sporangium has a--

1. **long stalk** that terminates in

2. A capsule.

The jacket of the capsule is single-layered, but with three different types of cells:

(1) **A thick walled** vertical **annulus** incompletely overarches the sporangium,

(2) **A thin-walled** radially arranged **stomium**, and

(3) **Large parenchymatous cells with undulated walls**.

The **capsule contains many spores**. All spores are structurally and functionally alike; hence *Pteris* is a **homosporous** pteridophyte. Spores are triangular in shape with trilete aperture, bounded by two walls. The outer wall, exine, is variously ornamented.

The sporangium **dehisces transversely along the stomium due to the shrinkage of annular cells** . The spores are dispersed through air to a moderate distance.

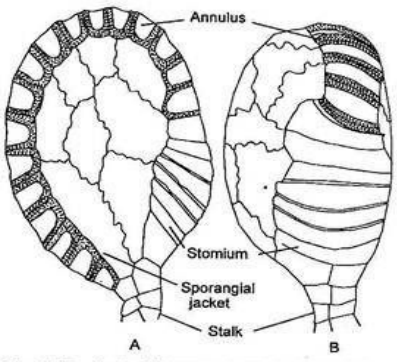


Fig. 7.106 : *Pteris* : Mature sporangium. A. Front view, B. Side view

GAMETOPHYTIC GENERATION:

Germination of spores:

- The spores germinate after falling on a suitable substratum.
- Initially the **spore wall (exine) ruptures** and the inner contents come out in the **form of a germ tube** and subsequently by a transverse division in the germ tube forms the **first rhizoid** and **the first prothallial cell**.
- The **prothallial cell divides** to **form** a small filament having an **apical terminal cell** with two cutting faces.
- The **apical cell** further **divides** and a **spathulate prothallus** is formed first.
- **Finally a mature prothallus** is formed.

Structure of prothallus :

- Prothallus is c**ordate, dorsiventrally flattened, aerial** and **photosynthetic** (Fig. 7.107).
- The prothallus is **made up of parenchymatous cells** which are single-celled thick towards the margin and many-celled thick towards the centre.
- The growing points are located in the apical notch.
- **Rhizoids are formed over the ventral surface**.

- The prothallus is **monoecious, protandrous. Antheridia** appear first and are **confined to the basal central or lateral regions among the rhizoids.**
- **Archegonia develops near the apical notch.**

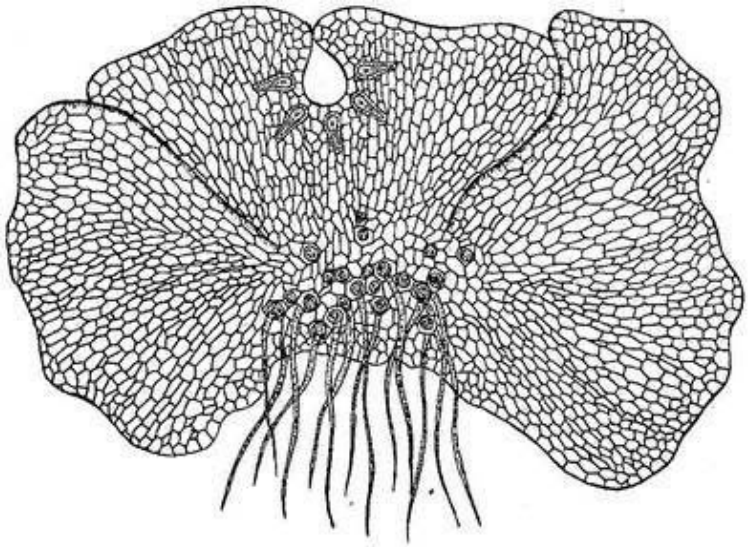


Fig. 7.107 : *Pteris* : Gametophyte

Development and Structure of the Antheridium:

- A superficial cell on the ventral surface of the prothallus functions as an antheridial initial (Fig. 7.108A-I).
- This divides transversely to form an outer upper cell and an inner lower cell (first ring cell).
- Due to the higher turgor pressure in the upper cell, the cross-wall between these two cells bulges down and as a result the upper cell becomes dome-shaped.

- Then the upper cell divides by an arched periclinal wall to form a dome cell and the primary androgonial cell.
- The dome cell further divides transversely forming a cover cell and a second ring cell.

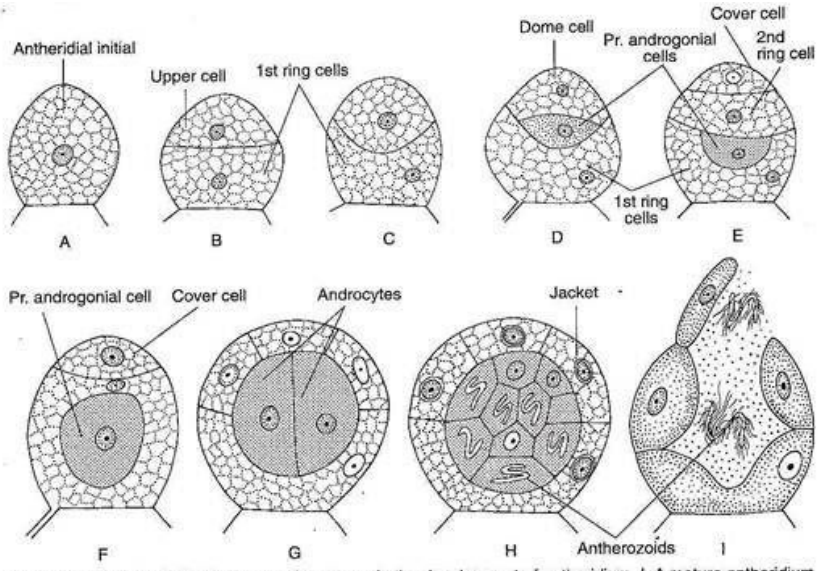
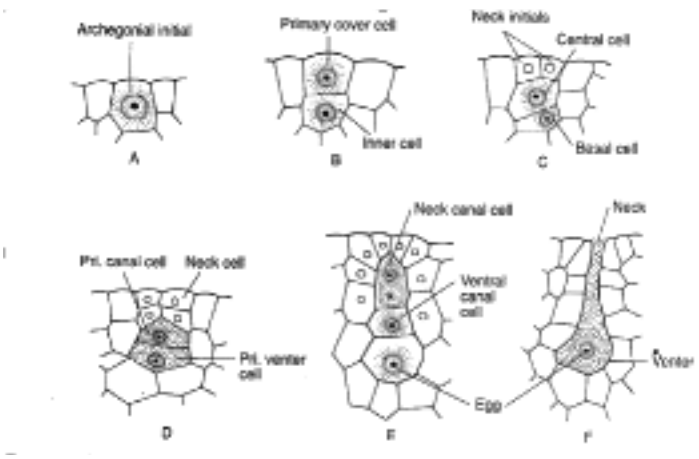


Fig. 7.108 : *Pteris* : A–H. The successive stages in the development of antheridium, I. A mature antheridium

- Then the cover cell and two ring cells by anticlinal divisions form a single-layered jacket of the antheridium.
- The primary androgonial cell divides repeatedly to form 20-25 androcytes and eventually each androcyte metamorphoses to form a multiflagellated coiled antherozoid.

Development and Structure of the Archegonium:

- One of the superficial cells functions as an **archegonial initial** which, on periclinal division, forms **an outer primary cover cell** and **an inner cell**.
- The **primary cover cell**, by two vertical divisions at right angles to each other, **forms** a **quadrant of neck initials**.
- Further anticlinal divisions of **neck initials form** the **neck of the archegonium**. The neck barely protrudes out of the thallus.
- The i**nner cell**, on the other hand, **divides** periclinally (transverse) **to form a basal cell and a central cell**.
- The **central cell divides** transversely **into a primary canal cell and a primary venter cell.**
- The **primary canal cell** directly **functions** as a **neck canal cell**.
- The **primary venter cell**, however, **divides** transversely and **forms a ventral canal cell and a large egg**.



Successive stages of development of archegonium

- At maturity, the ventral canal cell, the neck canal cell and the neck cells at the top are well- disorganised, they thus form an open passage for the antherozoids to come towards the egg .
- A mature archegonium of Pteris consists of a 5-6 celled projecting curved neck, a neck canal cell, a ventral canal cell and an egg.

Fertilisation:

The antheridium at maturity absorbs water and swells. Due to the increase in pressure within the antheridium the cover cells split apart releasing the antherozoids in a thin film of water present on the surface of the prothallus.

At the same time the ventral canal cell, the neck canal cell and the neck cells at the top disintegrate forming an open passage for the

antherozoids to come towards the egg and, eventually, one of the antherozoids fuses with the egg to form the zygote.

SPOROPHYTIC GENERATION (Embryo):

- Like other leptosporangiate ferns, in *Pteris* the first division of the zygote is vertical (Fig. 7.109A) followed by a second transverse division resulting in the formation of a quadrant (Fig. 7.109B).
- Further a 32-celled embryo is formed due to further divisions of the quadrant.
- The differentiation of embryos begins at this 32-celled stage.
- No suspensor is formed;
- The hypobasal cells form stem apex and foot, while epibasal cells form cotyledon and root (Fig. 7.109C).
- With the development of embryos, the venter of the archegonium forms a protective layer, called calyptra, around the embryo.
- In the young embryo the root and cotyledon grow more rapidly than the shoot. The root pierces the prothallus and establishes the sporeling in the soil. Later, the first leaf develops.

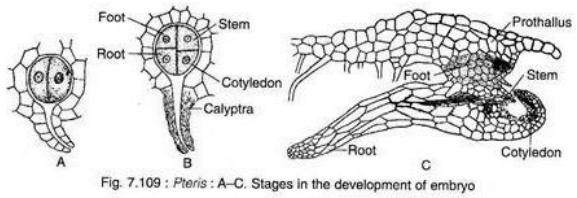
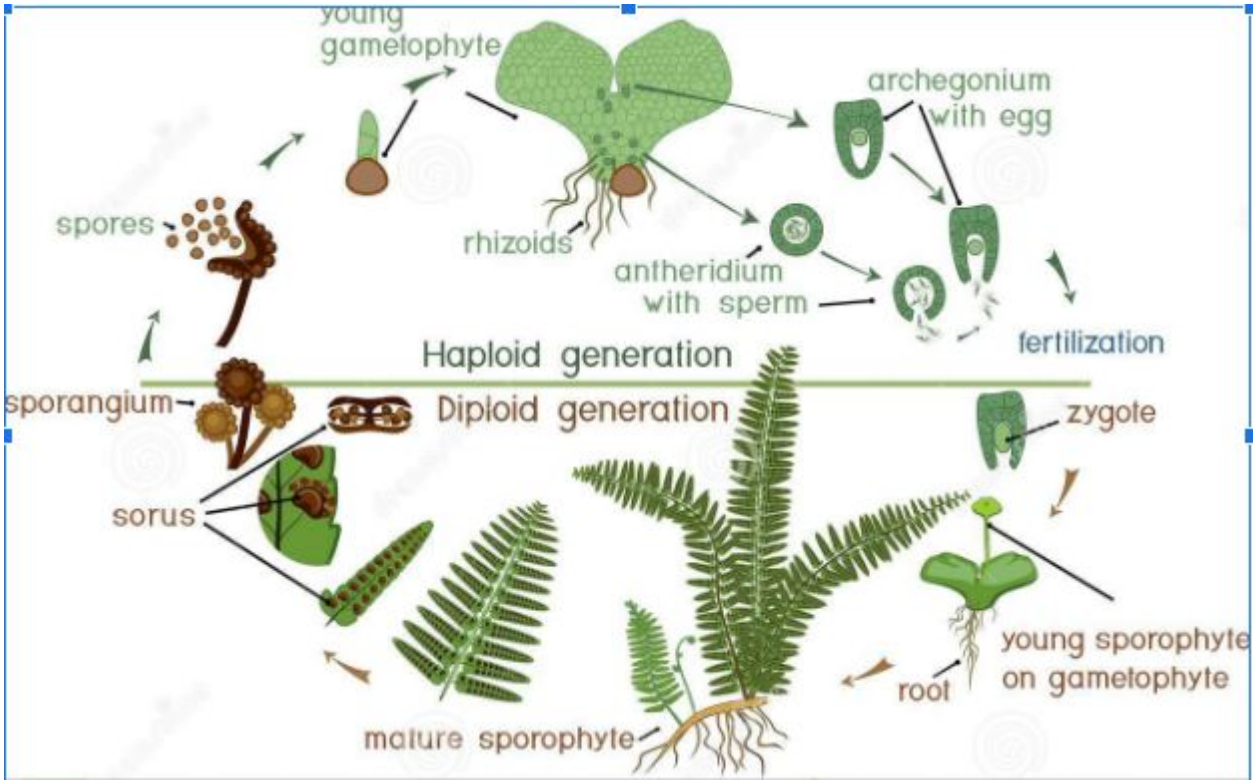


Fig. 7.109 : *Pteris* : A–C. Stages in the development of embryo



LIFE CYCLE OF Pteris IS SHOWN ON THE PICTURE