# Topic: Ophioglossum; Reproduction
# B.Sc. Botany (Hons.) I
# Paper: II Group: B

By
Dr. Sanjeev Kumar Vidyarthi
Department of Botany
Dr. L.K.V.D. College, Tajpur, Samastipur
L.N. Mithila University, Darbhanga

## Reproduction in *Ophioglossum*:

Majority of *Ophioglossum* species reproduces by means of spores. Spores are of same size and shape i.e., *Ophioglossum* is homosporous pteridophyte. However, some species e.g., *O. pendulum, O. vulgatum, O. reticulatum, O. nudicaule* and *O. aitchisonii* reproduce vegetatively by means of adventitious buds formed on roots.

## Spore-Producing Organ:

The spores are present in sporangia. The sporangia are produced in two rows on a fertile segment that arises at the junction of the petiole and the sterile lamina. This sporangia-bearing fertile segment is known as sporangiferous spike. Generally, a single spike is associated with a leaf but in *O. palmatum* several spikes are present on a Single leaf.

## Structure of the Sporangiferous Spike:

The spike is a simple more or less cylindrical and stalked structure. It bears two rows of embedded sporangia on either side, except at the apical region. The length of the spike

and the number of sporangia in each spike varies according to the species. A number of vascular strands run longitudinal along the axis and from these strands many lateral branches develop which lead to the sporangia.

The fertile spike has been considered as an aerial complex by many scientists. A convincing evidence for this interpretation has been provided by the vascular traces.

According to U. Sen (1968), the single leaf trace at the base of each aerial complex splits into three before entering the base of the stalk.

Then the three traces again split up into 12 traces at levels where the stalk divides into fertile and sterile lobes. Out of the 12 traces, 9 enter the sterile lobe (lamina) and do not anastomose, 'whereas the rest 3 pass on to the base of the fertile spike where they divide and anastomose in the axial region.

From this axial system, small traces extend horizontally into the sterile tissue in-between the sporangia. Then the tips of each of these traces bend sharply towards the respective sporangia and frequently branch into two or more strands.

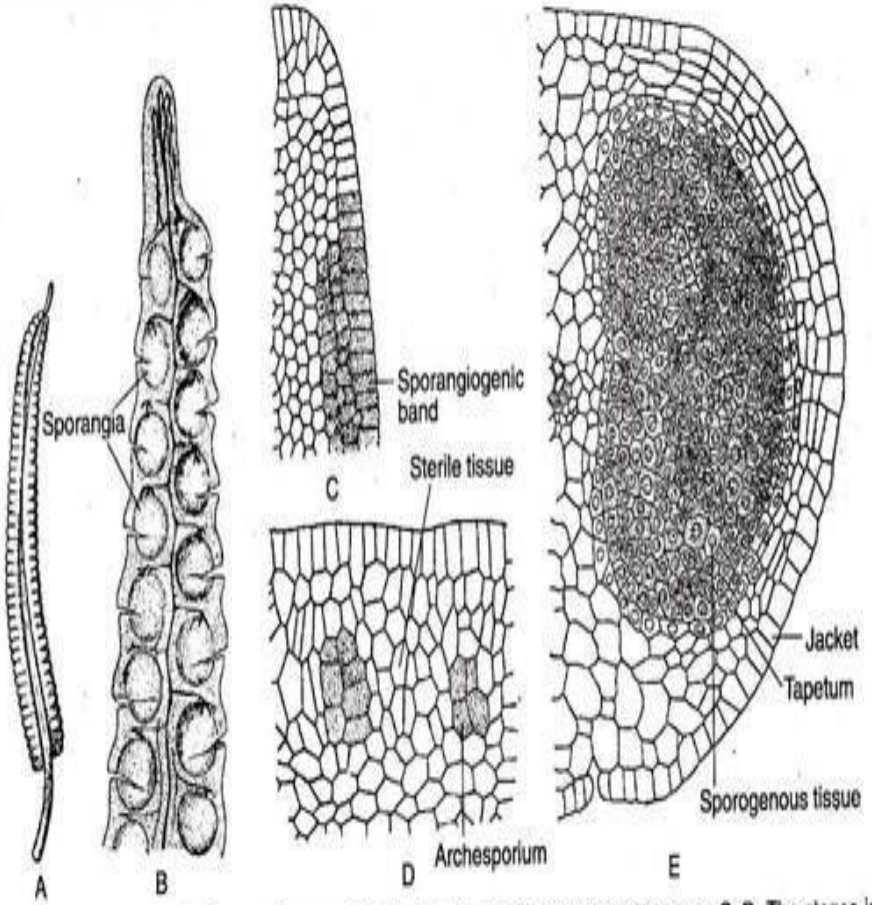


Fig. *Ophioglossum* : A. Sporangiferous spike, B. A mature spike showing dehiscence, C–D. The stages in the development of sporangium, E. A nearly mature sporangium

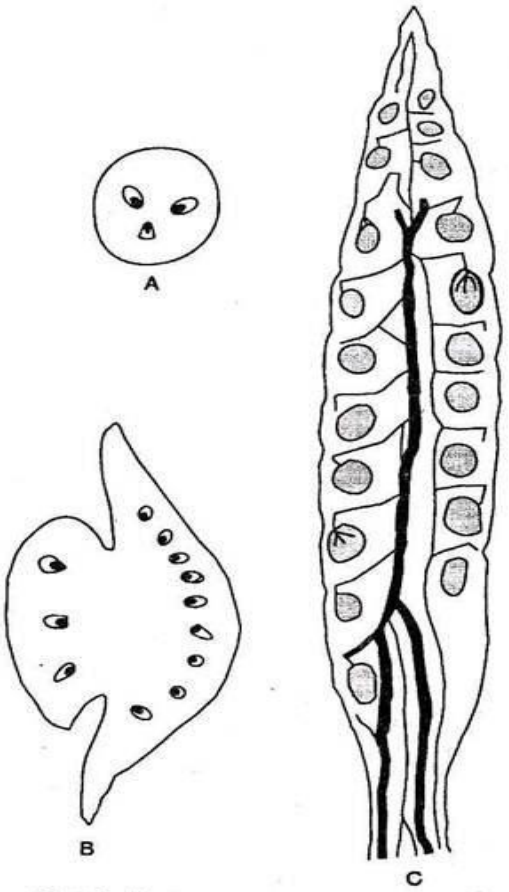


Fig. *Ophioglossum vulgatum* : A. T.S. of base of aerial complex stalk showing 3 vascular bundles, B. T.S. at the junction of fertile and sterile lobes showing 3 + 9 bundles, C. L.S. of sporangiferous spike showing courses of vascular bundles (after U. Sen, 1968)

Only one of these ultimate strands enters the sporangial wall, the others end blindly. Thus, the aerial complex is represented by a condensed dichotomous branch system where fertile spike and lamina are the two limbs of the dichotomy.

**Structure of the Sporangium:**

The development of a sporangium in *Ophioglossum* is of eusporangiate type. At the very young stage, the primordium of spike differentiates on the lateral side into two vertical strips of cells in the epidermal layer.

Each strip is known as sporangiogenic band; the hypodermal cells of each band now differentiate into alternate groups of fertile (archesporial) and sterile cells. The archesporial cells mature into sporogenous cells, thus representing a future sporangium.

Each mature sporangium is spherical or oval in shape and remains embedded in the tissue of the fertile spike.

The size ranges between 0.5 to 3 mm in diameter. It remains surrounded by multi- layered wall of which the innermost wall layer functions as tapetum. The sporangial cavity is filled with many spore mother cells. Usually, all the spore mother cells are functional and eventually develop into spote tetrads. The number of spores per sporangium varies from 1500 to 15,000.

**Dehiscence of the Sporangium:**

The sporangia have no specialized dehiscence mechanism. The annulus, a characteristic structure of other fern sporangia are absent in *Ophioglossum*. The dehiscence takes place by means of a transverse slit or simply by drying out and shrinking of the sterile tissue within the spike.

**Gametophyte Generation**

**Spores:**

*Ophioglossum* is homosporous and the haploid spores are the mother cells of the gametophytic generation. The spores are small, round, with an outer sculptured

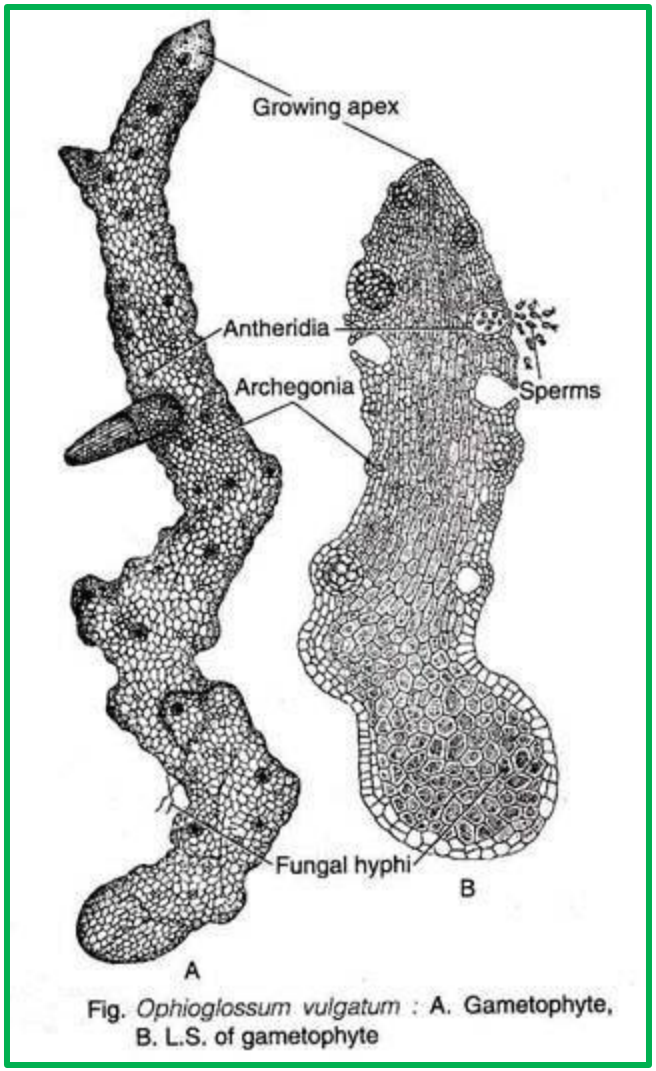


Fig. *Ophioglossum vulgatum* : A. Gametophyte, B. L.S. of gametophyte

exine and inner thin intine which germinate shortly after dispersal.

**Development of Gametophyte:**

The spores, on germination, produce a subterranean gametophyte. Ophiglossales is the only order under ferns showing subterranean gametophytes. The spore absorbs water and enlarges considerably.

The first division is transverse to form a lower and an upper cell. The lower cell divides vertically resulting into a 3-celled stage. Further development only proceeds if it gets infected with mycorrhizal fungi.

The gametophytes are non-green and contain an endophytic fungus that enters gametophytic cells soon after germination and is necessary for sustained growth. The mature gametophytes may be irregularly cylindrical to conical and unbranched (e.g., *O. nudicaule, O. vulgatum*) or branched (e.g., *O. palmatum, O. pendulum*).

There is considerable size variation in the gametophytes. The gametophyte of *O. crotalophoroides* is globose or approximately hemispherical.

The size ranges from 2 mm to 6 cm in length and less than 1 mm to 3 mm in diameter.

## Sex Organs of Ophioglossum:

The gametophytic prothallus of *Ophioglossum* is homothallic (monoecious) i.e., the prothallus bears both male (antheridia) and female (archegonia) sex organs. The antheridia and archegonia in most species are scattered and intermingled over the entire surface of the gametophyte.

## Antheridia:

The antheridia are embedded in the tissue of the prothallus. The antheridium develops from a single superficial cell of the derivatives of apical meristem called antheridial initial. The antheridial initial divides periclinally (transverse) to form an outer jacket initial and an inner primary androgonial cell.

The derivatives of jacket initial form jacket with a triangular opercular cell which, on disintegration, forms an opening. The primary androgonial cell (spermatogenous initial) divides repeatedly to form androcyte mother cells.

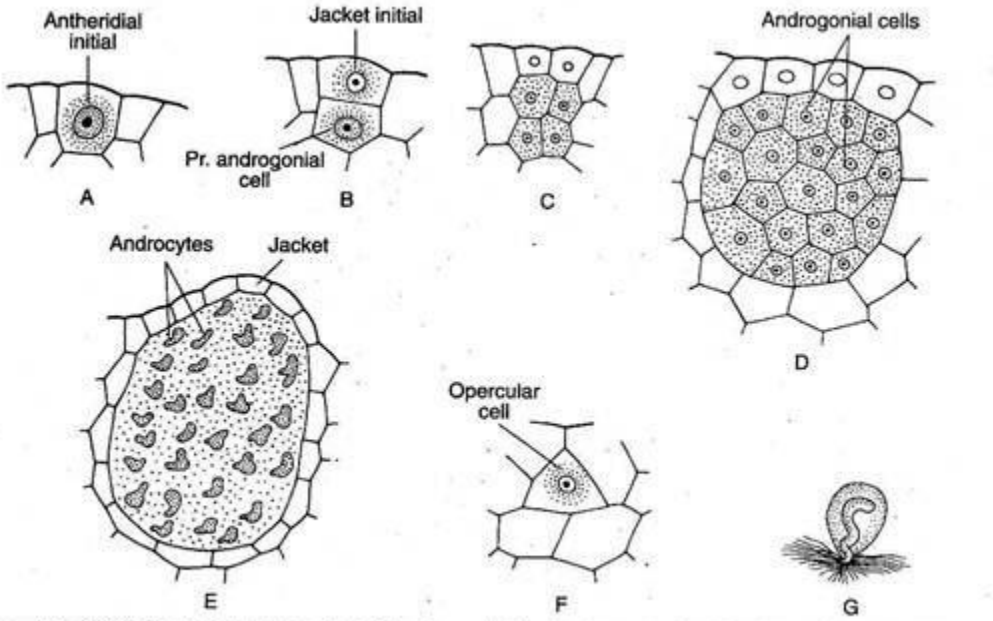


Fig. *Ophioglossum vulgatum* : A–F. The stages in the development of antheridium, G. An antherozoid

An androcyte mother cell divides to form two androcytes, each of which ultimately metamorphoses into an antherozoid or sperm. Each antherozoid has a large basal vesicle and the terminal part bears numerous flagella.

**Archegonia:**

The archegonium is also initiated in the derivates of apical meristem. One of the superficial cells functions as 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 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 inner 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 neck canal cell. The primary venter cell, however, divides transversely and forms a ventral canal cell and a large egg.

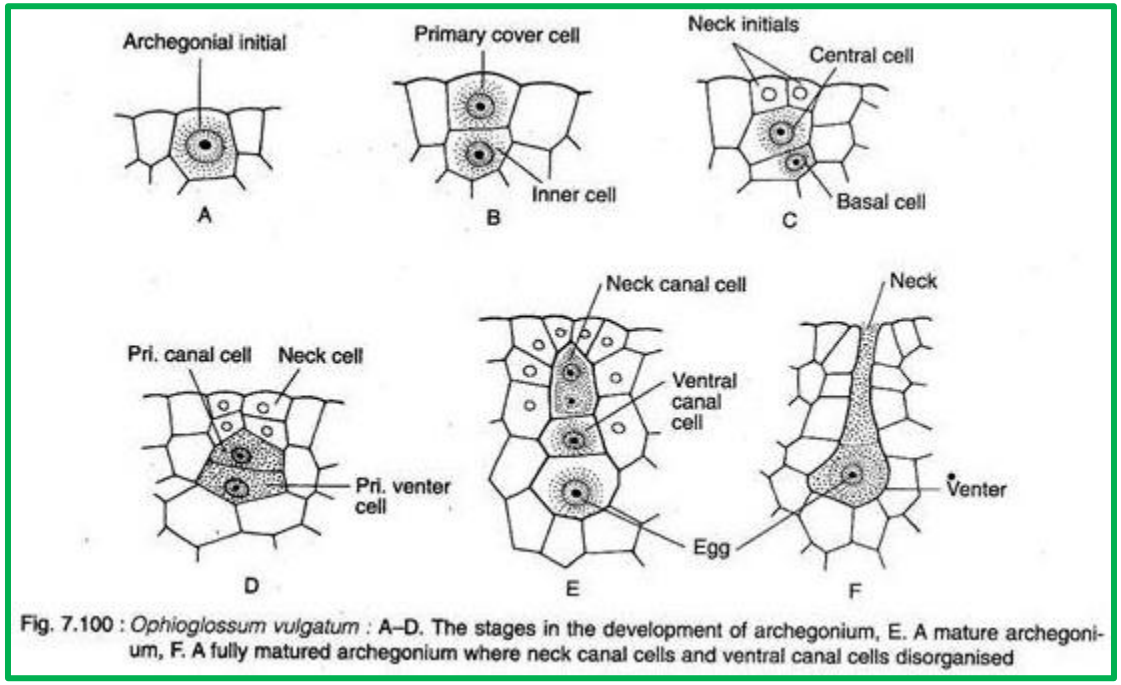


Fig. 7.100 : *Ophioglossum vulgatum* : A–D. The stages in the development of archegonium, E. A mature archegonium, F. A fully matured archegonium where neck canal cells and ventral canal cells disorganised

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.

**New Sporophyte:**

As usual the zygote is the mother cell of the next sporophytic generation. The first division of the zygote is transverse i.e., perpendicular to the long axis of the archegonium, giving rise to an epibasai and a hypobasal cell. The embryo is exoscopic in polarity i.e., the apical cell projects towards the neck of the archegonium.

Both the cells are embryonic. A cell division (vertical) of the apical and the basal cells results in the formation of four cells, the quadrant stage of embryogeny. Subsequent cell divisions are irregular and indefinite.

There is no suspensor in the embryo and it takes a long time for further differentiation of organs. The root is the first and the prominent organ which arises

near the middle of the embryo (from derivates of epibasal cell) and enlarges rapidly. The first leaf and future shoot apex derive from the epibasal region of the embryo and the foot derives from the hypobasal region.

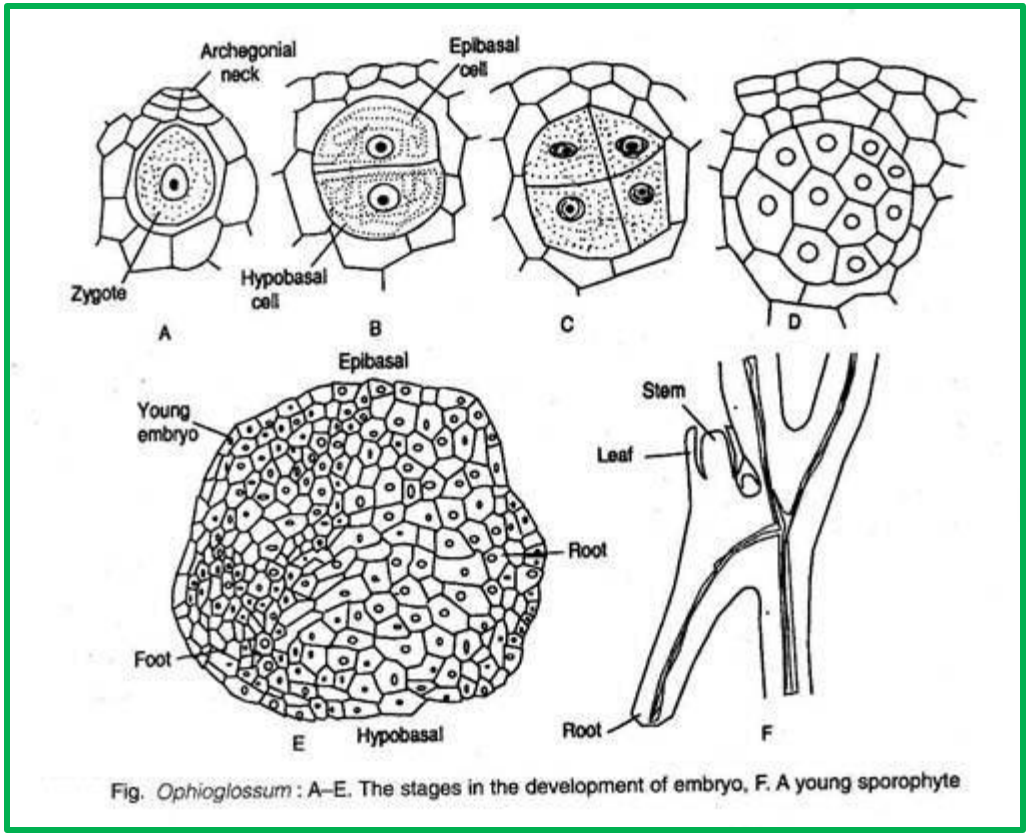


Fig. *Ophioglossum* : A–E. The stages in the development of embryo, F. A young sporophyte