

Topic: Structure and Development of Sporophyte of Anthoceros

B.Sc. Botany (Hons.) I

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The Structure of Mature Sporophyte (Sporogonium)

The mature sporophyte consists of a bulbous foot, a smooth, slender, cylindrical capsule which is 2-3 cms. In height and projects above the surface of the thallus like bristles or horns, hence the common name 'hornworts'. The seta is not present and this portion is occupied by meristematic zone. At the base the sporophyte is surrounded by tubular outgrowth of thallus which forms the protective sheath around it and is known as involucre. The bulbous foot is deeply rooted in the gametophytic thallus and absorbs food and water from thallus for developing the capsule.

Development of Sporophyte

The fertilized zygote increases in size till it fills the whole venter completely and then secretes a cellulose wall around it. Now it divides vertically to form two equal cells. The second division is transverse and thus four unequal

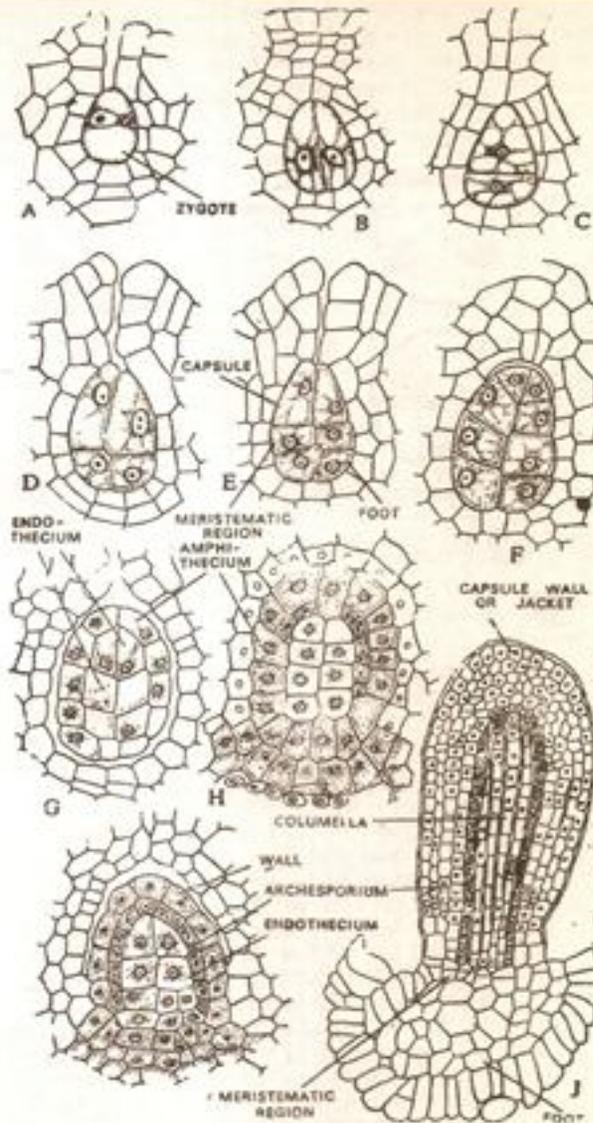


Fig. (A-J), *Anthoceros*. Development of sporophyte (Sporogonium). A—F, early stages in the development of embryo ; G—J stages in the differentiation of amphithecium, endothecium and archegonium ; J young sporophyte differentiated into foot, meristematic zone and capsule. The capsule shows differentiation into capsule wall, archesporium and columella. (D, E after Campbell, C. F., J after Phardiwaj)

cells are formed. The two basal cells are smaller and two upper cells are larger. The third division is vertical at right angles to the first vertical division. The embryo now consists of eight cells (octant stage) arranged in two tiers of four cells. The four cells of upper tier are larger and the rest four cells of lower tier are smaller. In majority of the species the cells of upper tier undergo next transverse division. In this way the embryo becomes 12 celled structures consisting of three tiers of four cells. The uppermost tier forms the capsule, the middle tier gives rise mainly to the intermediate meristematic zone and a part of foot. The lower tier forms the major part of foot.

The lower most foot tier divides repeatedly in all directions and ultimately a rounded bulbous parenchymatous foot is formed.

The upper most tiers of four cells which forms the capsule divides by one or two transverse divisions to form two or three tiers of cells. Now it

divides by a periclinal wall separating peripheral layer of amphithecium from the central endothecium. The entire endothecium forms the columella which is composed of 16 vertical rows of cells. The amphithecium soon divides by a periclinal wall into an outer sterile jacket layer initials and an inner fertile primary sporogenous layer, the archesporium. The jacket layer initials divide by periclinal wall and forms wall of the capsule which is 4-6 layers in thickness. The outer layer of cells become strongly cutinized and forms epidermis of the capsule. The epidermis contains pores at its surface.

In the young sporophyte the archesporium overarches the rounded apex of the columella in the dome like manner. The archesporium may remain a single layer or it may become three to four layers thick. As the archesporium matures it soon differentiates into sterile pseudoelater mother cells and fertile spore mother cells. The pseudoelater mother cells by two successive divisions form elongated filamentous four celled pseudoelaters.

The spore mother cells divide meiotically to form four haploid spores in tetrad.

Dehiscence of capsule

Change in the colour of the tip of sporophyte to brown or black is the indication of the readiness of dehiscence. In dry season the tip of capsule loses water and gradually shrinks and the wall of capsule meets with the resistance of the solid mass of spores and pseudoelaters in fertile region. At the level a longitudinal slit appears on the wall of capsule. The slit gradually widens and extends towards the base keeping pace with the progressive formation of spore mother cells and the maturation of spores. When the spores mature, the spore mass is exposed and pseudoelaters start twisting among the spore mass with the prevalent dry weather, the pseudoelaters are under tension and this causes a back pressure of the spore mass and the

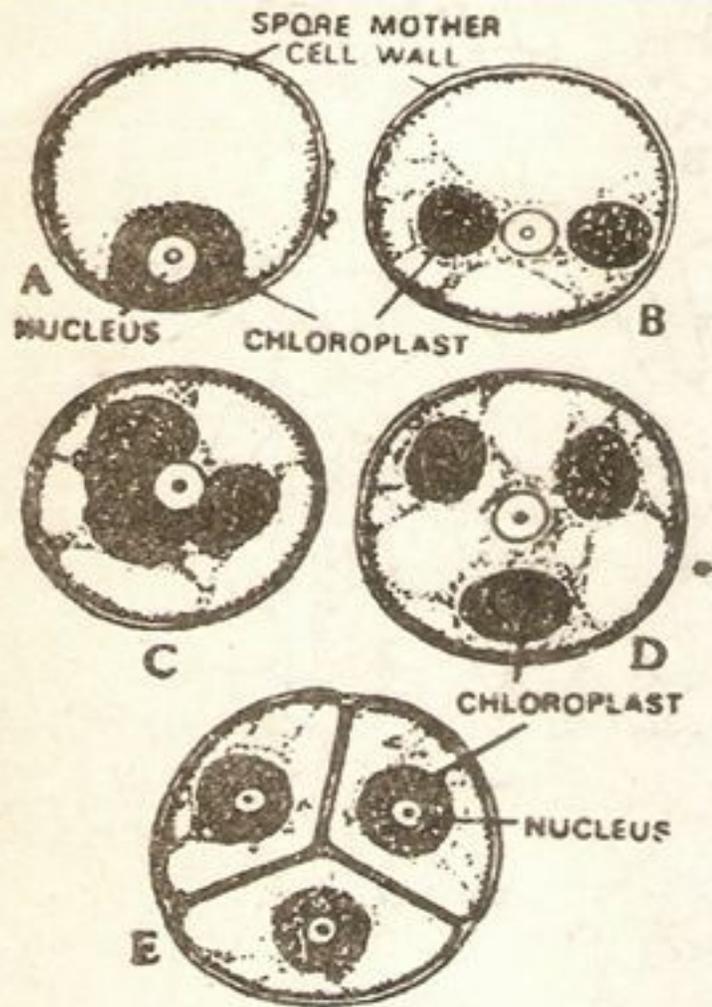


Fig. (A—E) **Anthoceros**. Stages in sporogenesis. Explanation in the text (After Campbell).

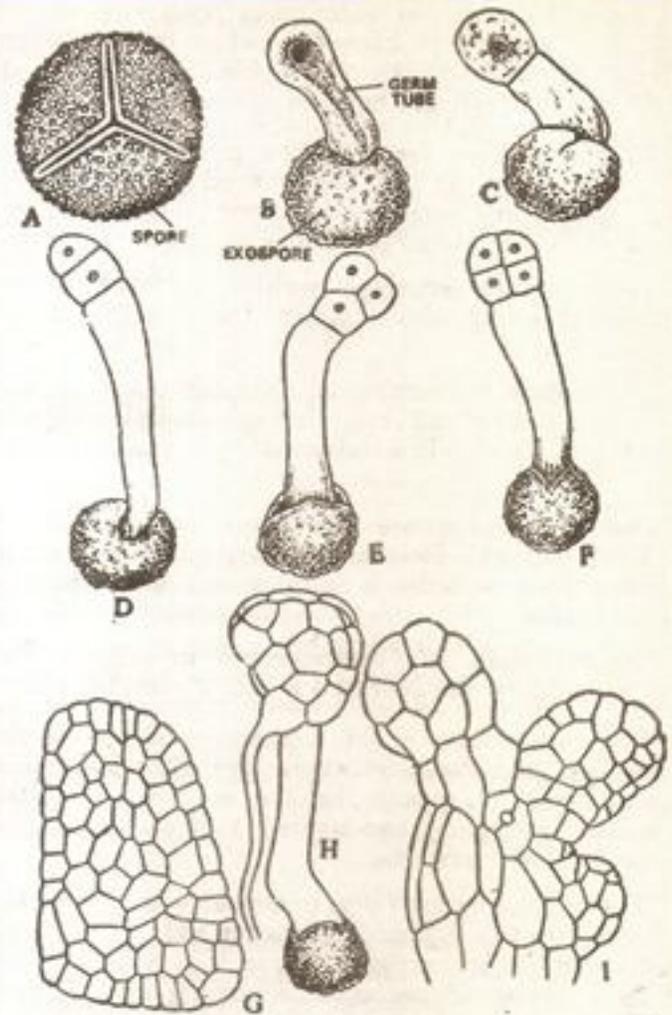


Fig. (A—I). **Anthoceros**. A, spore of *A. laevis* with a triradiate ridge; B—G, Stages in the germination of spore of *A. erectus*; H—I, later stages in the formation of thallus. (A after Wetstein; B—G after Mehra and Kachroo, H—I after Campbell).

elaters on the jacket. The spores are thus dispersed from open capsule by pseudoelaters with the help of air current.

Germination of spore and the formation of young gametophyte

The spores are tetrahedral in outline and enveloped by a thick exospore and a thin endospore. The exospore is dark brown or smoky or black in color. Inside the endospore the spore contains one nucleus – a single colorless plastid, oil globules and other food contents.

The spore may germinate immediately or may go under rest for a few weeks or months. Under favorable environment at the time of germination the exospore ruptures and the endospore comes out as a papilla which elongates into a germ tube. The germ tube enlarges and develops into a new gametophytic thallus by repeated divisions of the germ tube.