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ANTHOCEROS

Systematic Position: KINGDOM PLANTAE
DIVISION BRYOPHYTA
CLASS ANTHOCEROTOPSIDA
ORDER ANTHOCEROTALES
FAMILY ANTHOCEROTACEAE
GENUS ANTHOCEROS



DESCRIPTION :

Anthoceros is the largest genus of the class Anthocerotopsida comprising about 200 species. They grow in very moist, shady places by banks and ditches or in the crevices of rocks. Common species are *A.erectus*, *A.himalayensis*, *A.halii*, *A.crispulus*, etc.

THE GAMETOPHYTE :

The gametophyte is very simple, small, prostrate, dorsiventral thallus of dark-green colour. They are scarcely branched usually dichotomously lobed. Thallus bears no definite midribs. Lower ventral surface bears numerous rhizoids (only smooth-walled), no scales and trabecular rhizoids present. T.S. of thallus tissue shows no differentiation. It is composed of uniform, thin-walled, parenchymatous cells (many cells deep in the middle). Each cell shows a single oval and flattened chloroplast with a central pyrenoid. The nucleus remains very near

to the chloroplast. There are no air chambers and pores in the thallus tissues. Lower ventral surface of the thallus shows small, rounded opaque bluish-green spots which are intercellular cavities filled with mucilage and opening on the ventral side by means of narrow slits. They contain colonies of endophytic Nostoc.

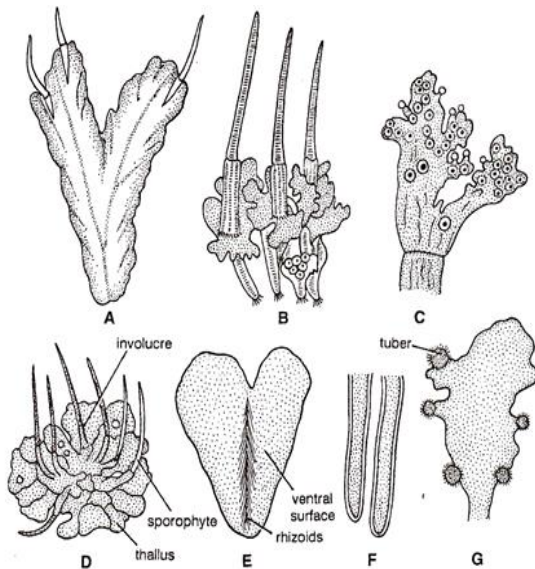


Fig. 1. (A-F). *Anthoceros*. External features (A) *A. himalayensis*, (B) *A. erectus*, (C) *A. gemmulosus*, (D) *A. crispulus* (dorsal surface), (E) Ventral surface, (F) Smooth-walled rhizoids, (G) Thallus with tubers.

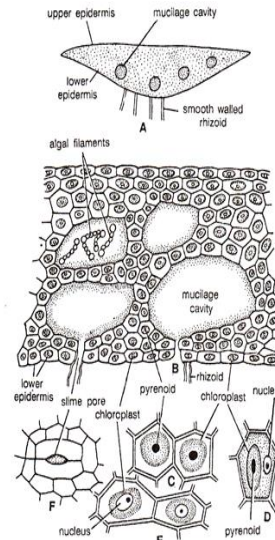


Fig. 2. (A-F). *Anthoceros*. Internal structure of the thallus. (A) Vertical transverse section (V.T.S.) of thallus (diagrammatic), (B) V.T.S. of thallus (a part cellular), (C) Cells showing chloroplast and pyrenoid, (D) Cells showing chloroplast, pyrenoid and nucleus, (E) Parenchymatous cells with chloroplast and nucleus, (F) Surface view of slime pore.

VEGETATIVE REPRODUCTION :

- 1. Death and Decay** The older portion of the thallus starts rotting due to ageing or draught but remaining part develops the whole thallus.
- 2. Tubers** Under unfavorable condition or prolonged draught the marginal tissues of the thallus gets thickened and form the perennating tubers (may be stalked). On resuming favorable condition tubers produce new thallus.
- 3. Gemma** Though uncommon but present in some species. Gemmae develops on the margin and germinate into new thalli.

SEXUAL REPRODUCTION

Anthoceros is dioecious or monoecious. Male gametophyte produces antheridium and female gametophyte produces archegonium, which are embedded in the dorsal surface of the thallus.

Development of Antheridium

Antheridium develops from a hypodermal cell. A superficial dorsal cell divides by a periclinal wall. The upper daughter cell becomes the roof initial which divides and redivides forming a multicelled roof

The lower cell is the antheridial initial which may develop a single antheridium or may divide and give rise to several antheridia (2 or 4 up to 25).

A mature antheridium has slender stalk bearing club-shaped or spherical antheridium.

All antheridia are enclosed within antheridial chamber filled with mucilage.

Each jacket cell contains a plastid which develops chlorophyll and becomes green as the antheridium matures.

Each androcyte forms a biflagellate antherozoid.

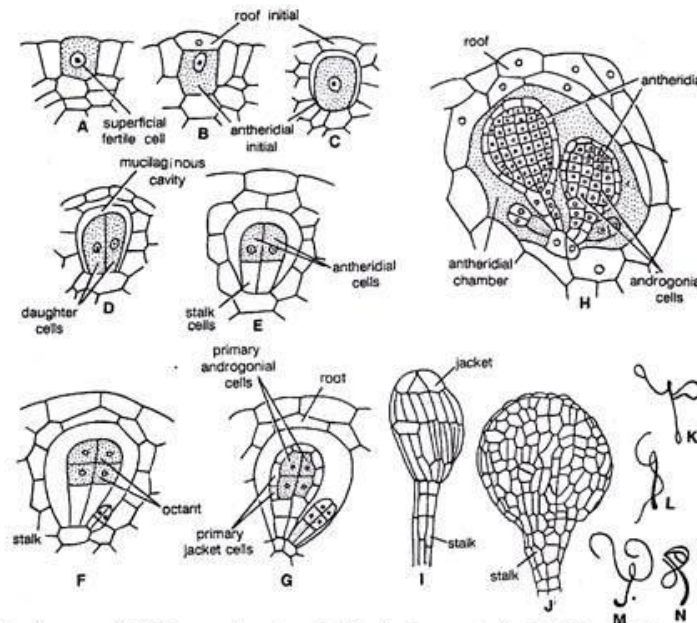


Fig. 3. (A-N) *Anthoceros*. (A-H) Successive stages in the development of antheridium, (I) Mature antheridium of *A. punctatus* (J) Mature antheridium of *A. laevis*, (K, L) Antherozoids of *A. laevis*, (M, N) Antherozoids of *A. punctatus*.

Development of Archegonium

The archegonia develop singly and are embedded in the gametophyte.

The archegonial initial functions directly as the primary archegonial cell. Three vertical walls cut off three outer jacket initial cells.

This axial cell now divides transversely, the lower one becomes primary ventral cell and the upper divides again forming a top cover initial and a lower primary neck canal cell.

The cover initial forms four cover cells and primary neck canal cell forms a vertical row of 4 to 6 neck canal cells and the primary ventral cell which forms ventral canal cell and the egg.

There is usually a mucilage mound covering the growing archegonium.

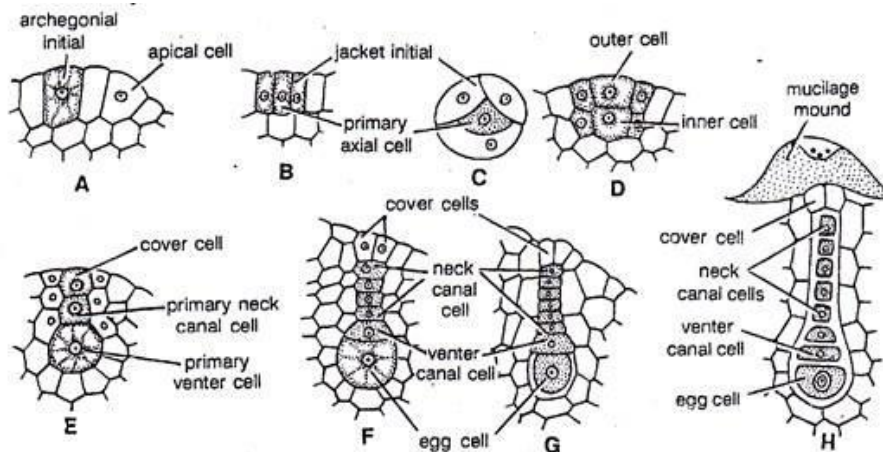


Fig. 6. (A-H). *Anthoceros*. Development of archegonium. (A-H). Successive stages in the development of archegonium.

Fertilization

At maturity the roof of the antheridia chamber breaks exposing the antheridia which on absorbing water rupture and androcytes come out into the covering film of water where the antherozoids soon get liberated. The mature archegonium, whose cover cells are protruding, also bursts. The neck canal cells and the ventral cells disintegrate and the cover cells are thrown off so the egg becomes directly exposed within the mound. Thus fertilization takes place.

THE SPOROPHYTE

The zygote / fertilized egg increases in size and completely fills up the venter. Development of sporophyte starts from this diploid cell. Zygote secretes a cellulose wall round itself and becomes four-celled by successive walls at right angles to one another. Another series of vertical walls forms an 8-celled stage.

The lower tier of cells forms the sterile foot. The lowermost cells of the foot grow rhizoid-like projections for sucking food from the gametophyte.

The upper tier of cells form intermediate part which later on develops into an inner endothecium and outer amphithecium.

The endothecium gives rise to the sterile columella.

The amphithecium cells divide periclinally and the outer layer forms jacket and the outermost layer of jacket becomes epidermis. The inner cells of the jacket are parenchymatous and contains chloroplasts.

The inner cell of the amphithecium become archesporium which becomes spore mother cells and sterile cells.

The SMC forms the spore tetrads while the sterile cells join end to end forming simple or branched pseudoelaters.

The mature sporophyte shows a bulbous foot which are haustorial. Above the foot is the slender, erect, cylindrical capsule standing out like a horn. The capsule bears different stages of growth from the base (embryonic stage at the base and very mature at the tip).

The centre of the capsule has columella and around it is jacket with a regular epidermis and stomata. At the top there are regular spores and pseudoelaters.

When mature the top of the capsule becomes black or brown.

A split appears below the tip and gradually widens upwards. Hygroscopic movement of the pseudoelaters releases the mature spores.

GERMINATION OF THE SPORE

The spore germinates on a suitable substratum. The exospores bursts and the endospore comes out as a germinal tube which develops into a new gametophytic thallus.

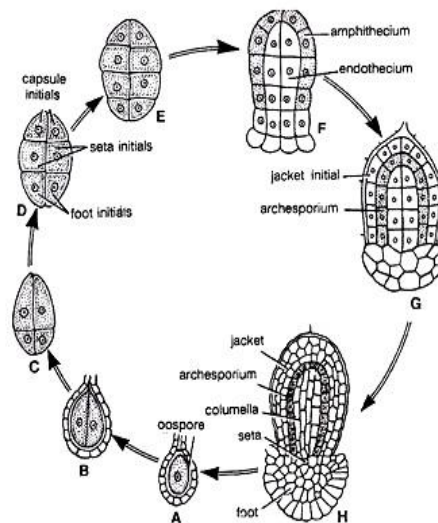


Fig. 7. (A-H). *Anthoceros*. Successive stages in the development of sporophyte.

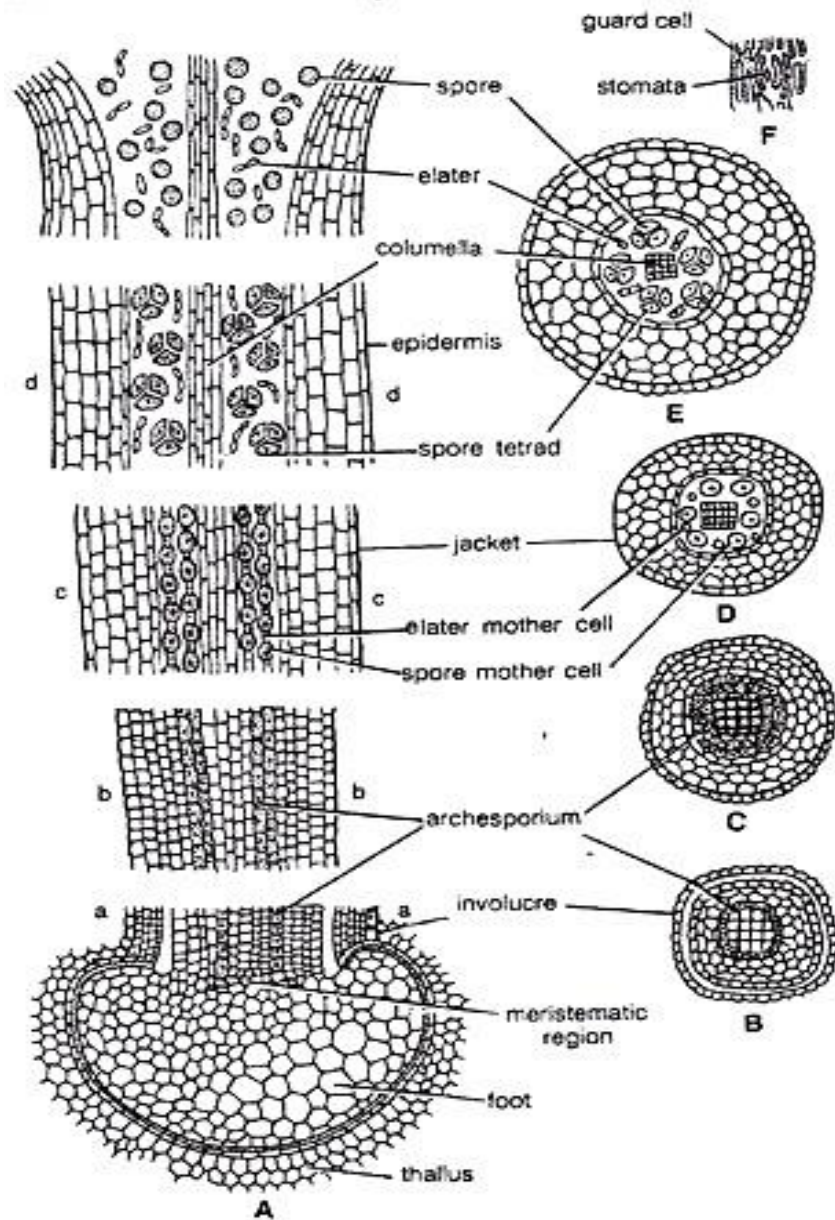


Fig. 8. (A-F). *Anthoceros*. Internal structure of the sporogonium (A) Longitudinal Section (L.S.) through the mature sporogonium. (B) Cross section of the sporogonium at a-a level, (C) cross section of the sporogonium at b-b level, (D) cross section of the sporogonium at c-c level, (E) Cross section of the sporogonium at d-d level, (F) Structure of stomata from the epidermis of sporogonium wall.

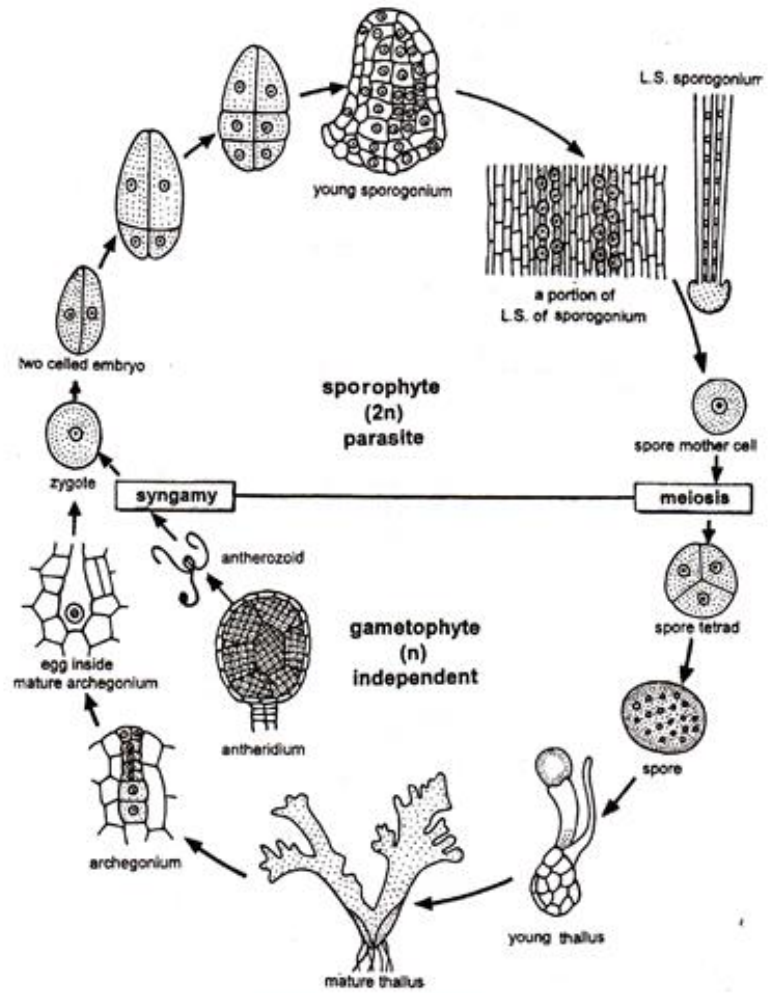


Fig. 11. *Anthoceros*. Diagrammatic life cycle.

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