EVOLUTION OF SPOROPHYTE IN BRYOPHYTES

(= Progressive Sterilization of Sporogenous tissue in Bryophytes / Progressive reduction and Simplification of Sporophyte in Bryophytes)

PAPER-I
Group-B

TDC Part-I (Hons)
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Introduction:

Bower (1890) formulated the hypothesis that the sporophyte (spore-producing generation) in archegoniates is an entirely new phase derived from the progressive elaboration of zygote, and is interpolated within the gametophytic generation as a result of adaptation to land habit. This proposition was later supported by Chamberlain (1935), Smith (1938) and others. Further elaboration of the sporophyte resulted in progressive sterilization of potentially sporogenous tissue.

Theories regarding the evolution of sporophyte in Bryophytes:

There are two opposing theories regarding the evolution of sporophyte —

(A) Theory of Progressive evolution
(B) Theory of Retrogressive (Regressive) evolution.

(A) Theory of Progressive Evolution:

(i) Advocated by Bower (1908–1935) and supported by Cavers (1916) and Campbell (1940)

(ii) According to this theory the primitive sporophyte of bryophytes was simple and most of the sporogenous tissue was fertile (e.g., Riccia) and from such a sporophyte, the more complex sporophytes (e.g., Mosses) are thought to have evolved by progressive sterilization of potentially sporogenous

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tissue.

(iii) The successive stages of progressive sterilization of sporogenous tissue from the simple sporophyte of Riccia to the most complex type of Funaria may be arranged through the following series:

First Stage:

(i) Simplest sporophyte found in Riccia consists of a single-layered sterile jacket enclosing sporogenous cells with a very few abortive nurse cells (nutritive in function).

(ii) Nurse cells are possibly the forerunner of elaters.

(iii) Such a simple sporophyte is nearest to the hypothetical ancestors of more complex forms.

Second Stage:

(i) Here the zygote divides transversely to form a hypobasal and an epibasal cell.

(ii) A small foot develops from the hypobasal cell. The epibasal cell derivatives differentiated into an outer amphithecium and an inner endothecium.

(iii) The amphithecium forms a single-layered sterile jacket of the capsule, while the endothecium differentiates into fertile sporocytes and long sterile elater-like nurse cells without the bands of thickenings.

(iv) Thus the zygote more sterilization of sporogenous cells (Nurse cells + Foot).

eg., Corsinia

Third Stage:

(i) There is more sterilization of sporogenous tissue than that in Corsinia.

(ii) The sporophyte has a sterile bulbous foot, a narrow sterile seta developed from

hypobasal cell and a fertile capsule developing from endothecium containing sporocytes and sterile nurse cells. e.g., Sphaerocarpus.

Fourth Stage:

(i) The sporophyte consists of a sterile bulbous foot, a sterile narrow seta and a fertile capsule.

(ii) About half of the endothecial cells produce fertile sporogenous tissue, while the remaining half gives rise to sterile elaters with 2-3 spiral thickenings.

(iii) Thus more sterilization of sporogenous tissue is observed. e.g., Targionia

Fifth Stage:

(i) Further sterilization of sporogenous tissue is observed in the sporophyte of Marchantia.

(ii) Here sterile tissue consists of a broad foot, a massive seta, a single-layered jacket of capsule, sterile apical cap at the apex of capsule and many elongated elaters with spiral thickenings.

Sixth Stage:

(i) Further sterilization of sporogenous tissue is observed in some members of Jungermanniales, e.g., Pellia, Riccardia, etc.

(ii) Sporophyte is differentiated into foot, seta and capsule having a multi-layered jacket.

(iii) Sporogenous tissues produce mass of sterile elaterophores and diffuse elaters.

Seventh Stage:

(i) There is a further marked reduction in the sporogenous tissue.

(ii) Multilayered capsule wall is differentiated into epidermis with stomata and

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chlorophyllose cells.

(iii) Central columella derived from the endothecium is composed of 16 vertical rows of sterile cells

(iv) Elongated 3-4 celled simple or branched pseudoelaters represent further sterilization of sporogenous tissue. eg., Anthoceros

Eighth Stage:

(i) Members of Bryopsida (eg., Funaria, Polytrichum, Pogonatum, etc.) exhibit the highest degree of sterilization of sporogenous tissue.

(ii) Sporophyte is differentiated into a foot, a long seta and a capsule.

(iii) Sterile tissues/components of the capsule consist of the apophysis, operculum many-layered jacket, columella, trabeculae, wall of spore sac and the peristome.

(iv) Sporogenous tissue is restricted to the spore sacs only and represents a negligible proportion of the sporophyte.

(B) **Theory of Retrogressive evolution:**

(i) This theory considers evolution of sporophytes due to progressive reduction or simplification.

(ii) Supporters include Church (1919), Kashyap (1919), Goebel (1930), Evans (1931), etc.

(iii) According to these workers the simplest sporophyte of Riccia is the most advanced type evolved as a result of simplification or progressive reduction of the complex sporophytes

(iv) The significant steps in the reduction series are: simplification of the dehiscence apparatus, reduction of the photosynthetic tissue in the capsule wall, disappearance of stomata and intercellular spaces, increased thickness of the capsule wall, gradual elimination of seta and foot, elimination of sterile cells and elaters, etc. Evidences from comparative morphology support this view.

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