MBOTCC-6
Unit-V

M.Sc. Sem-II
(2018-20)

DEVELOPMENT OF THE ENDOSPERM

Introduction:

Endosperm is a nutritive tissue essentially nourishing the developing embryo, or even the germinating seed, if found in the latter. Angiospermic endosperm, save a few exceptions, is a triploid (3n) tissue as it is the product of triple fusion involving double fertilization. It is thus distinct from the endosperm of gymnosperms and heterosporous pteridophytes where endosperm is a simple haploid tissue of the gametophyte. In the families Orchidaceae and Podostemonaceae, the product of triple fusion soon disintegrates and endosperm development is completely suppressed. In other angiosperms, three kinds of endosperm development (Nuclear, Cellular & Helobial) are reported.

Kinds of Endosperm Development:

(1) Nuclear Endosperm Development

(i) Most common type of endosperm development

(ii) Primary endosperm nucleus undergoes repeated free nuclear divisions without accompanying wall formation and cellularization.

(iii) Nuclei remain peripherally in the embryo sac cytoplasm surrounding a large central vacuole.

(iv) Cell wall formation around the nuclei occurs at a later stage, if nuclei are not absorbed by the developing embryo.

(v) Such cellularization starts from the basal periphery. These cells soon organize into an endospermic tissue. Cell wall formation gradually proceeds towards the centre and finally the whole endosperm may become cellularized. eg.- Capsella bursa-pastoris

(vi) In some cases, the central vacuole may not be filled up even in the mature seed. eg. Coconut. Here the central cavity filled with coconut water is the original embryo sac vacuole while the nuclei around it forms the peripheral endosperm kernel.

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(2) Cellular Endosperm Dev.

(i) Division of the primary endosperm nucleus is immediately followed by wall formation and all subsequent divisions are accompanied with cell wall formation.

(ii) Thus the endosperm becomes cellular from the very beginning.

(iii) However some cells may enclose more than one nucleus (Multinucleate) e.g., Anonaceae, Gentianaceae, Adoxa, Peperomia, Villarsia, etc.

Fig. (a)-(f): Nuclear endosperm development

Fig. (a)-(d): Cellular endosperm development

(3) Helobial Endosperm Dev.

(i) This pattern of endosperm development is intermediate between the nuclear and cellular types.

(ii) Commonly found in the members of the order Helobiales, eg., Vallisneria, Eremurus, Limnophyton, etc.

(iii) Here a partition will develope between the two nuclei resulting from the first division of the primary endosperm nucleus so that the embryo sac is divided into two compartments.

(iv) A large number of free nuclei are now formed in the upper chamber while the nucleus of

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the lower chamber either undergoes only a few divisions or remains undivided.

Evolutionary Aspects: Evolutionary origin of this unique embryo-nourishing entity has remained largely unresolved. Subsequent to the divergence of the angiosperm lineage from its closest relatives (Gnetales), modification of the development of a supernumerary embryo derived from triple fusion led to the establishment of an embryo nourishing endosperm. Comparative analysis of the patterns of embryogeny within Gnetales and angiosperms established that embryo development in the ancestors of flowering plants (with a rudimentary process of double fertilization) was ab initio cellular and not free nuclear. Thus, it is likely that the earliest flowering plants displayed a cellular pattern of endosperm development, whose expression was inherited from that of the supernumerary embryo of the ancestors of flowering plants.

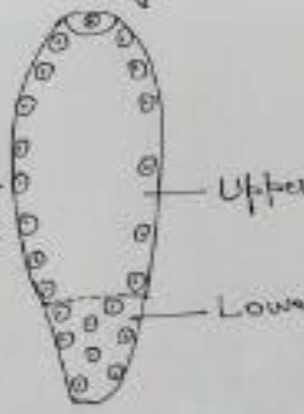

Fig.: Helobial endosperm development