Course- B.Sc. (Honours), Part -II

Subject- Botany, Paper-IV (Group-A)

Topic- Endosperm

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ENDOSPERM

The endosperm makes the main source of food for the embryo. In gymnosperms, the endosperm is haploid (n) and forms a continuation of the female gametophyte. On the other hand, in angiosperms it is formed mostly as the result of a fusion of the two polar nuclei and one of the male gametes. Since all the three nuclei taking part in the fusion are haploid, the endosperm becomes triploid (3n).

In normal cases, the endosperm is triploid but haploid, tetraploid and polyploid endosperms are also known. Generally the endosperm nucleus divides after the division of the oospore, but in several cases the endosperm is formed to a great extent even before the first division of the oospore. However, endosperm formation is suppressed in two angiospermic families, the Orchidaceae and Podostemonaceae.

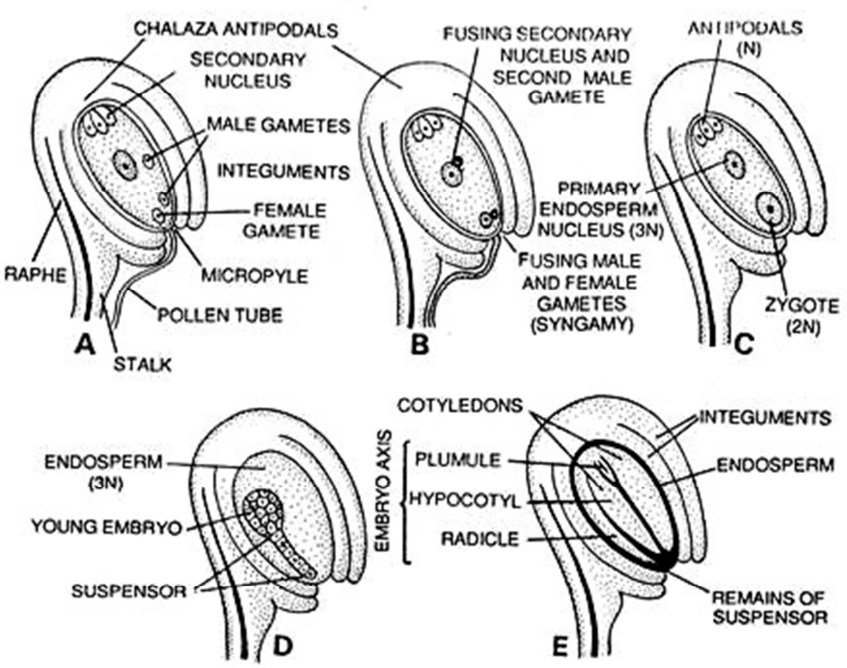

Fig. 46.38. Fertilization and post-fertilization changes. A, two male gametes discharged in the embryo sac; B, syngamy and double fertilization; C, formation of zygote (2n) and primary endosperm nucleus (3n); D-E, post fertilization changes.

Types of Endosperm Formation:

There are three general types of endosperm formation:

(a) Nuclear type,

(b) Cellular type and

(c) Helobial type.

Nuclear Type:

In this type, the first division and usually several of the following divisions are unaccompanied by wall formation. The nuclei may either remain free or in later stages, they may become separated by walls.

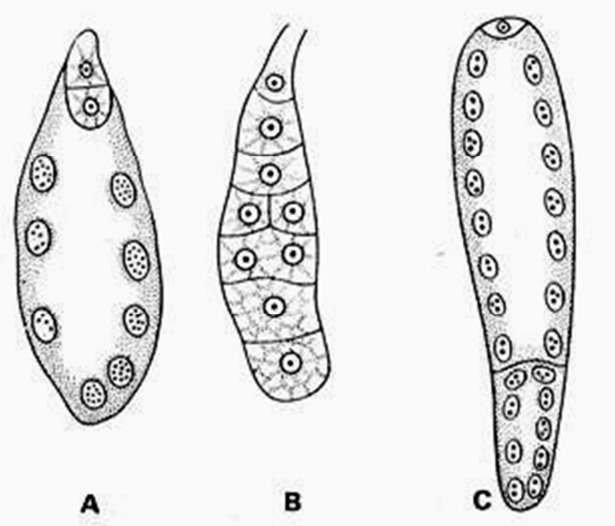

Fig. 46.39. Development of endosperm. A, nuclear type; B, cellular type and C, helobial type.

As divisions progress, the nuclei are being pushed towards the periphery, thus a large central vacuole is formed. Often the nuclei are especially aggregated at the micropylar and chalazal ends of the sac and form only a thin layer at the sides.

Generally the endosperm nuclei in the chalazal part of the embryo sac have been observed to be larger than those in the micropylar end. The number of free nuclear divisions varies in different plants.

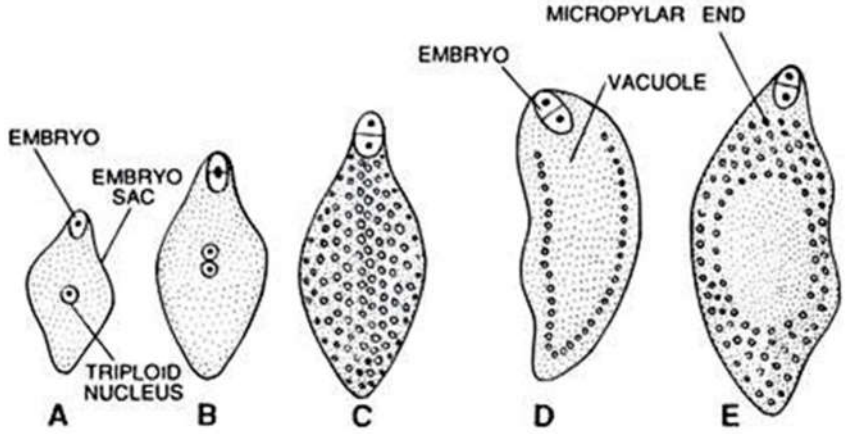

Fig. 46.40. A-E, stages in the development of nuclear type of endosperm.

The development of the endosperm of Cocos nucifera of Palmae deserves special mention. Here the primary endosperm nucleus undergoes a number of free nuclear divisions.

When the fruit is about 50 mm long the embryo sac remains filled with a watery fluid or milk containing free nuclei and fine cytoplasmic particles.

At a later stage when the fruit becomes about 100 mm in length the liquid shows in addition to free nuclei, several cells each enclosing variable number of nuclei. Gradually these cells and free nuclei set at the periphery of the cavity, and layers of cellular endosperm are formed, and this becomes the coconut meat.

On maturity of coconuts the endosperm does not have free nuclei or cells. In Areca nut the development of the endosperm is like that of coconut but the embryo sac cavity is small and it is completely filled up by the growth of the endosperm, and later becomes very hard.

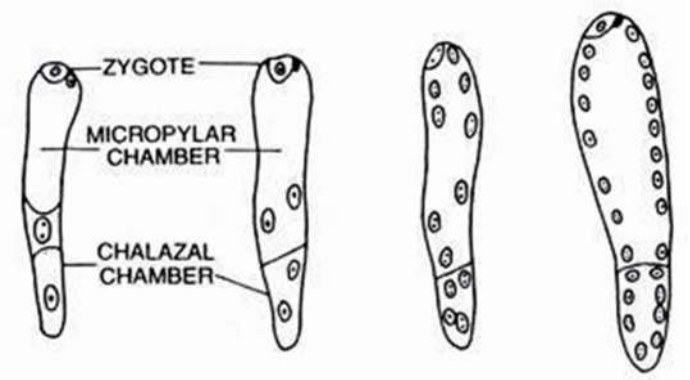

Fig. 46.41. Development of helobial type of endosperm in *Eremurus*.

The nuclear type of endosperm formation is the most common type and found in maize, wheat, rice, sunflower, etc.

Cellular Type:

In this type, the first and most of the following divisions are accompanied by wall formation and thus the sac is divided into several chambers, some of which may contain more than one nucleus. The first wall is usually transverse but sometimes vertical or oblique, and in some other cases, the plane of division is not constant.

On the basis of the orientation of walls following the first two or three divisions, this type of endosperm has been further divided into several subtypes.

Helobial Type:

This type is frequently found in the members of the order Helobiales. This type is intermediate between the nuclear and the cellular types. In this type the first division is followed by a transverse wall resulting in a micropylar and chalazal chamber. Further divisions are generally free nuclear and may be formed by the micropylar chamber only.

Eremurus is an example of a typical Helobial endosperm. Here the primary endosperm nucleus divides tranversely forming two chambers, a large micropylar and a small chalazal. Free nuclear divisions occur in both but are more rapid in micropylar chamber. Thus, when four nuclei are formed in the chalazal chamber, eight nuclei are produced in the micropylar chamber.

When the chalazal chamber has eight nuclei, the micropylar chamber contains sixteen nuclei, and when there are 30 to 32 nuclei in chalazal chamber the micropylar chamber has considerably a large number of nuclei.

In older ovules, the chalazal chamber begins to degenerate. Finally, when cell formation takes place in the micropylar chamber, the chalazal chamber is almost crushed and shows only a few disorganized nuclei.