POST-FERTILISATION: STRUCTURES AND EVENTS

Endosperm

Development Of Endosperm

- Endosperm development precedes embryo development.
- The PEC divides repeatedly and forms a triploid endosperm tissue.
- The cells of this tissue are filled with reserve food materials and are used for nutrition of the developing embryo.
  The endosperm is of three types on the basis of development :-

1. nuclear endosperm or free nuclear endosperm

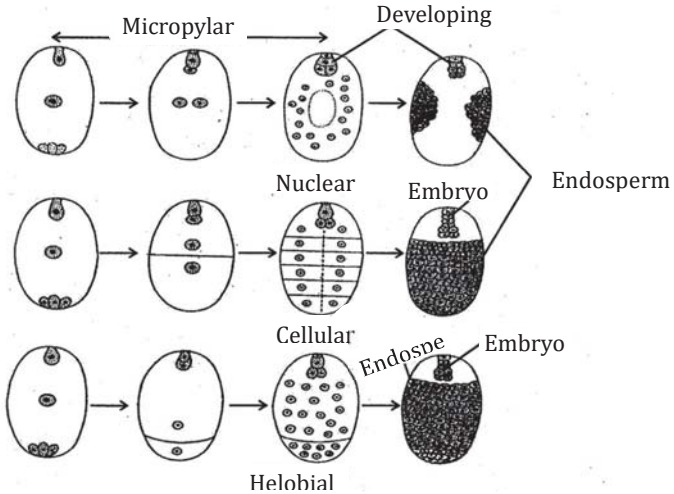
- This type of endosperm is found in Dicotyledon (Polypetalae). Nuclear endosperm is also present in Capsella .
- Such type of endosperm develops by free nuclear divisions in PEC .
- The PEN undergoes successive nuclear divisions to give rise to free nuclei. Thus a multinucleated endosperm is formed. Later on cytokinesis (cell wall formation) takes place, so that endosperm becomes cellular at maturity.
- The number of free nuclei formed before cellularisation varies greatly .
- The coconut water of tender coconut is free nuclear endosperm (made up of thousands of nuclei)
- This type of endosperm is the most common in Angiosperms.

2. cellular endosperm

- This type of endosperm is found in Gamopetalae group.
- During the development, each division of primary endosperm nucleus is followed by cytokinesis. So that endosperm remains cellular from the beginning.

3. helobial endosperm

- This type of endosperm is found in order helobiales (Monocots).
- During the development of this type of endosperm, first division of primary endosperm nucleus is followed by unequal cytokinesis so that two unequal sized cells are formed (Cell towards the micropyle is large). Now free nuclear divisions take place in each cell, results it becomes multinucleated. Eventually cytokinesis takes place so that it is changed into a cellular endosperm.
- It is intennediate type of endospern.



Different types of endosperms in Angiosperms

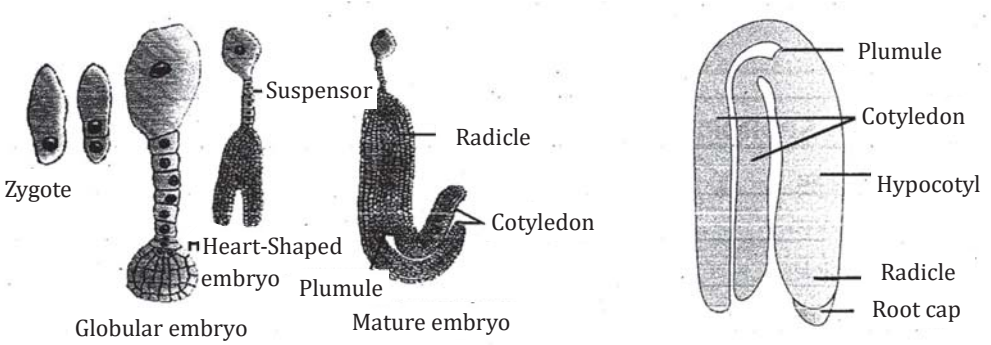
Special Points

- Endosperm is absent in some of Angiosperms e.g. In Orchidaceae, Podostemaceae and Trapaceae.
- Maize and Tomato have mosaic endosperm in which patches of different colours are present.
- The endosperm in Betelnut or Arecanut (Arecaceae) and Annonaceae family is rough surfaced. It is known as "ruminate endosperm".
- The drinking portion (coconut water) is nuclear endosperm and edible portion (white kernell is the cellular endosperm in Coconut.
- Starchy endosperm is found in rice, wheat, maize etc.

Embryo

1. Development Of Embryo In Dicot

- The process of development of embtyo from the zygote is called embtyogenesis or embtyogeny.
- Development of embryo in Capsella was discovered by "Hansteini'.
- Embtyo develops at the micropylar end of the embryo sac where the zygote is situated.
- Most zygote divides only after certain amount of endosperm is formed. This is an adaptation to provide assured nutrition to the developing embryo.
- The first division of Oospore is transverse, results two cells are formed. One cell lies towards micropyle is called basal cell or suspensor cell. The other cell lies towards chalaza is called apical cell or terminal cell or embryonal cell.
- The basal cell (suspensor cell) and embryonal cell divide simultaneously.
- The embtyonal cell divides by mitotic divisions to gives rise to the proembtyo and subsequently to the globular, heart shaped and mature embryo.
- The suspensor cell divides by transverse divisions forming a 6-10 celled long filament like structure which is termed suspensor.
- The main function of suspensor is to push the developing-embryo into food laden endosperm to provide nutrition.
- The micropylar cell of the suspensor swells up. This cell of suspensor is known as haustorial-cell.
- In capsella due to curved positian of body of ovule embryo becomes curved. This curved position of the embryo is called Torpedo (Mature embcyo).
- A typical dicot embryo consists of an embryonal axis and two cotyledons.
- Axis present between plumule and radicle is called embryonal axis. It is also called Tigellum [main embryonal axis].
- The portion of embryonal axis above the level of cotylodons is known as epicotyl which terminates with the plumule or stem tip.
- The portion of emrbyonal axis below the level of cotyledons is known as hypocotyl. Hypocotyl terminates in the radicle or root tip. Root tip or radicle is covered by root cap.
- Both the cotyledons are present at lateral position of embryonal axis and plumule is formed in terminal position in Dicotyledon embryo.
- This type of development of embryo is known as Crucifer type or Onagrad type. It is the most common type of embryo development in Dicots.
- Crucifer type of embryo development is found in Capsella .



Stages in embryo development (embryogeny) in a dicot

2. Monocot Embryo

Though the seeds differ greatly, the early stages of embryo development (embryogeny) are similar in both dicots and monocots.

Grass Embryo

- In the grass family the cotyledon is called scutellum (shield shaped) that is situated towards one side (lateral) of the embryonal axis.
- At its lower end. the embryonal axis has the radical and root cap enclosed in an undifferentiated sheath called coleorrhiza.
- The portion of the embryonal axis above the level of attachment of scutellum is the epicotyl.
- Epicotyl has a shoot apex and a few leaf primordial enclosed in a hollow foliar structure, the coleoptiles.

Seed

The fertilized ovule forms seed. The study of seed is called spermology.

Types of seeds

On the basis of absence or presence of endosperm, the seeds are of two types.

i. Non endospermic or exalbuminous seeds:

Endosperm is completely consumed during development of the embryo, thus the seeds are called nonendospermic or exalbuminous Eg: Dicots – Gram, Pea, Groundnut, Mango, Sunflower. The seed coat is formed by integuments. The outer seed coat forms testa and inner seed coat forms tegmen. The food is stored in the cotyledons.

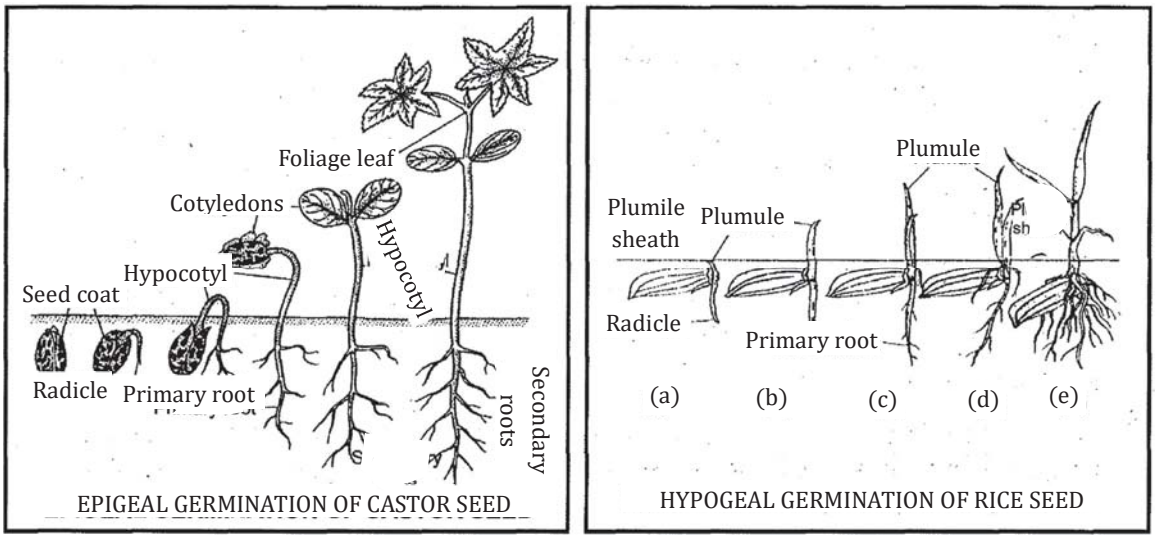
ii. Endospermic or Albuminous Seeds:

In Wheat, Maize, Rice, Onion a Castor, Pinus embryo does not consume all endosperm. So it persists in the mature seed. Such seeds are called endospermic or albuminous seeds. In these seeds food is stored in endosperm.

- Perispermic seeds. Mostly nucellus is consumed after fertilization due to absorption of food by the endosperm and embryo. The remains of nucellus in the seed is called perisperm. Such seeds are called perispermic seeds Eg: Piper nigrum (Black pepper) Pinus and castor.
- In monocot seeds, the membranous covering around radicle is called coleorrhiza and around plumule is called coleoptile, Absent in Dicot Seeds.

Seed germination

Seed germination is of two types



(i) **Epigeal germination:** When cotyledons come out on soil due to elongation of hypocotyl, Eg: Castor, Cotton etc.

(ii) **Hypogeal germination:** When epicotyl elongates and cotyledons are left in the soil, Eg: Pea, Gram, Groundnut, Mango etc.

Fruit

- True / False fruit: In most plants, by the time the fruit develops from the ovary, other floral parts degenerate and fall off. However, in a few species such as Apple, Strawberry, Cashew and Pear etc., the thalamus also contributes to fruit formation. Such fruits are called false fruits.
- Most fruits however develop only from the ovary and are called true fruits.
- Parthenocarpy: There are a few species in which fruits develop without fertilization. Such fruits are called parthenocarpic fruits. Banana is one such example.
- Parthenocarpy can be induced through the application of growth hormones and such fruits are seedless.

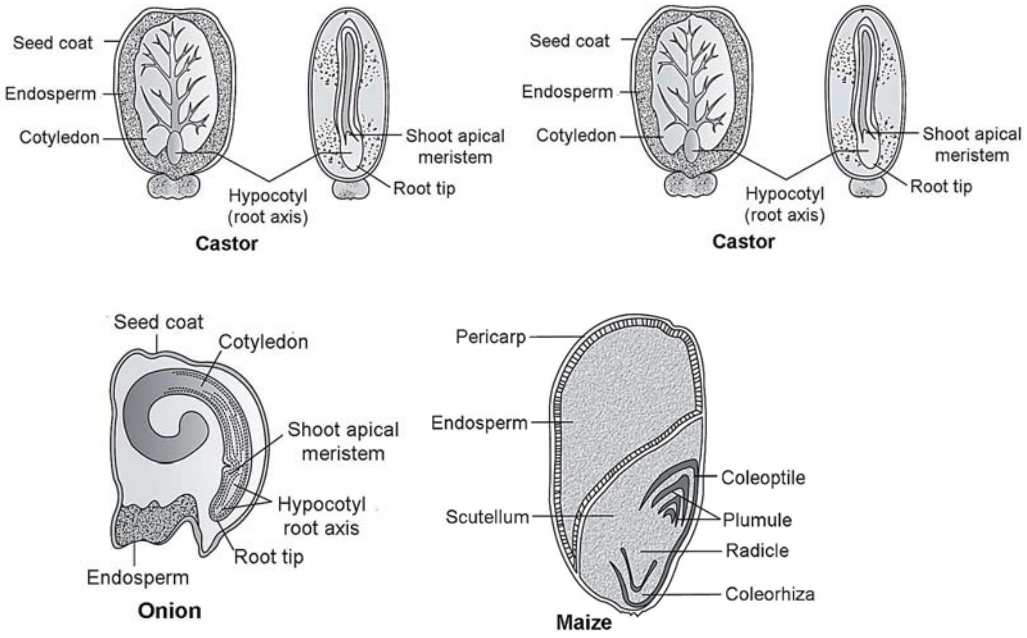


Fig. : Structure of some seeds

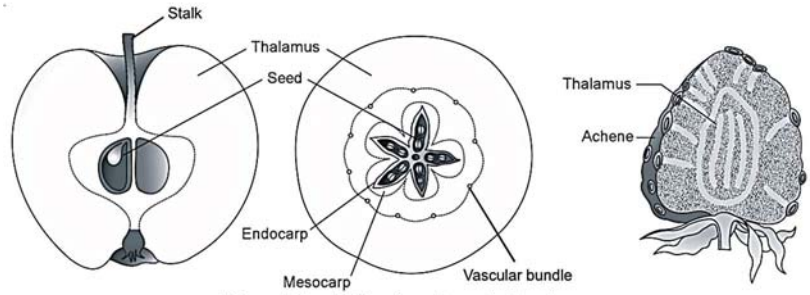


Fig. : False fruits of apple and strawberry

Note: The oldest seed is that of a lupine, Lupinus arcticus excavated from arctic tundra. The seed germinated and flowered after an estimated record of 10,000 years of dormancy. A recent record of 2000 years old viable seed is of the date palm (Phoenix dactylifera) discovered during the archeological excavation at King Herod's palace near the Dead Sea.