Quadrant II – Transcript and Related Materials

Programme: Bachelor of Science (Second Year)

Subject: Botany

Course Code: BOC 103

Course Title: Plant Anatomy and Embryology

Unit 5: Structural Organization of Flower

Module Name: Ultrastructure of mature embryo sac

Module No: 38

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Notes

INTRODUCTION

ULTRA STRUCTURE OF MATURE EMBRYO SAC

Embryo sac is an oval multicellular structure which is embedded in the nucellus.

Embryo sac is also known as female gametophyte.

The mature embryo sac is a 7 celled and 8 nucleate structure.

The 7-cells include:

3 antipodal cells at chalazal end.

Egg apparatus (1 egg cell+2 synergids) at micropylar end.

One central cell.

EGG APPARATUS

The 3 cells of the egg apparatus are arranged in the triangular manner.

Three cells of the egg apparatus include one **egg cell** and **two synergids**.

Egg shows the common wall with the two synergids and the central cell.

It has a wall similar in structure and extend to the synergids.

Wall is thicker in the micropylar region and becomes thinner towards the chalazal side.

It is absent at the chalazal end in cotton and maize.

At the micropylar end the lateral walls of the egg cell appear to join the central wall.

End wall of the egg is the wall of the central cell.

Egg cell becomes highly polarised early in its development.

Polarity is expressed by the aggregated cytoplasmic element at the chalaza end of the cells.

Micropylar end of the cell is occupied by a large vacuole.

Young cells have many organelles.

However organelles becomes scarce indicating poor physiological activity.

Mitochondria show only a few cristae.

Egg may contain small or large amount of starch that is consumed during fertilization.

Egg cytoplasm is rich in ribosomes.

In egg cell the nucleus and most of the cytoplasm lie at the lower part of the cell and the vacuole is present at the upper side.

SYNERGIDS

Synergids are elongated cells present at the micropylar end of the embryo sac.

When two synergids are present they lie in contact with each other.

Pointed or hooked towards the micropyle end with the wall around the synergid is incomplete.

There is a distinct wall around the micropylar one third of the cell wall becomes thinner towards the chalaza end and finally disappear.

Synergids are ephemeral structures in embryo sac with two synergids one disappear before the entry of the pollen tube into the embryo sac whereas the

other one often called as the persistent synergid degenerates shortly after the embryo sac has received the pollen tube discharged.

Cytoplasm of the synergid is strongly polarised.

Chalazal region of the cell is occupied by large or many small vacuoles.

Cytoplasm is rich in different organelles such as mitochondria, endoplasmic reticulum and dictyosomes.

FUNCTIONS OF SYNERGIDS

Synergids are metabolically active.

Play an important role in directing the pollen tube growth by secreting some chemotropically active substances.

Degenerating synergids forms the seat for pollen tube discharge in the embryo sac.

Absorption and transport of nutrients into embryo sac from nucellus.

FILLIFORM APPARATUS

Filiform apparatus is a prominent structure present at the micropylar end.

It is the mass of finger like projections of the wall into the cytoplasm.

Each projection of the filiform apparatus has a core of tightly packed

microfibrils enclosed by the non-fibrillar sheath.

Rich in polysaccharides.

ANTIPODALS

There are 3 antipodals at the chalazal end of the embryo sac.

Antipodals exhibits the greatest variation among all the cells of the embryo sac.

May degenerate before or soon after fertilization.

In the Sapotaceae (except *Mimusops*) and Thismiaceae the antipodals nuclei

degenerate even without organizing into cells.

Highest number of antipodal cells known is 300 recorded in *Sasa paniculata*.

In *Zea mays* the number is about 20 and each cells contains 1-4 nuclei.

Multinucleate condition of the antipodal cells has also been recorded in *Tagetes*.

Antipodal cell in Maize has abundant mitochondria, plastids, and multicisternal dictyosomes.

Antipodals are also rich in ascorbic acid, oxidases and sulfhydril compounds.

Starch, lipids and proteins also occurs in abundance but they show very low concentration of RNA.

FUNCTION OF ANTIPODALS

Antipodal cell provides nutrition specifically where they are persistent in the embryo sac.

May also store large quantities of starch, lipids and proteins which are utilized by the developing endosperm and embryo.

They produce and secrets large amount of substances that controls the growth and development of the endosperm.

CENTRAL CELL

Large cell of the embryo sac.

Enlargement of the embryo sac after the last nuclear division is due to the inflation of the large central vacuole of the central cell.

Vacuole in the central cell is a reservoir of sugars, amino acids and inorganic salts.

Nuclei of the central cell called the polar nuclei are very large and has nucleolus.

Are present either in the centre of the cell suspended by cytoplasmic strand or in the cytoplasm close to the egg apparatus.

Two polar nuclei fused and form the secondary nucleus.

Cytoplasm of the central cell is rich in all cell organelles.

Plastids contain starch and protein.

Contain numerous mitochondria and ribosomes.

Wall of the central cell is highly variable from one part of the embryo sac to another.

Thicker in the region near the nucleolus where the central cell is in contact with the egg and synergid.

Shows the common features of parietal cell walls.

It thins towards the chalazal end of the egg and finally in the chalazal region there is no wall between the plasma membrane of the central cell and those of the eggs and synergids.

Central cell is connected with the egg, synergid and the antipodal through plasmodesmata connection.

There is a presence of cell wall projection in the micropyle or chalazal region which shows the central cell draws nutrition from the surrounding nucellus or integuments.

HAUSTORIAL BEHAVIOUR OF EMBRYO SAC

Normally the entire surface of the embryo sac is absorptive in function but in certain cases the ends of the embryo sac show more active growth and convert into haustoria which absorbs the food not only from the nucellus and also from the placental tissue.

In the family Loranthaceae the embryo sac shows sufficient elongation of the micropylar end where it enters into the tissue of the style and grows into it.

Another example the embryo sac grows downward near the chalazal end of the embryo sac as a haustoria and digest its ways to the nucellus.

FOOD RESERVE IN THE EMBRYO SAC

First it was assumed that in the angiosperms the embryo sac is devoid of any food reserves but now there are several records of the occurrence of starch in the embryo sac.

Found in the family of Tiliaceae and Asclepiadaceae.

Few cases which have been recorded starch occurs also in the cells of egg apparatus and rarely in the antipodal cells.

Starch grains stored during the development of the embryo sac is utilised at the time of development of the endosperm and embryo.