

# S.Y.B.sc Botany CBCS Pattern

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BO241 PLANT ANATOMY & EMBRYOLOGY 2 CREDITS

CHAPTER NO 8



## **Structure of the ovule---**

Ovule is a multicellular body consist of with stalk ie funiculus attached to the body of the ovule by the hilum .The basal portion of the ovule is chalaza and upper end of is called as micropyle. The body of mature ovule shows following regions .

### **a) Integuments ---**

It is covering of a ovule .It is two layer in polypetalae ie and one layered in Asteraceae .Integuments cover the body of an ovule leaving a small opening at the apex known as micropyle .The main function of the integument is protection and after fertilization it develops into the seed coat known as testa .

### **b) Nucellus –**

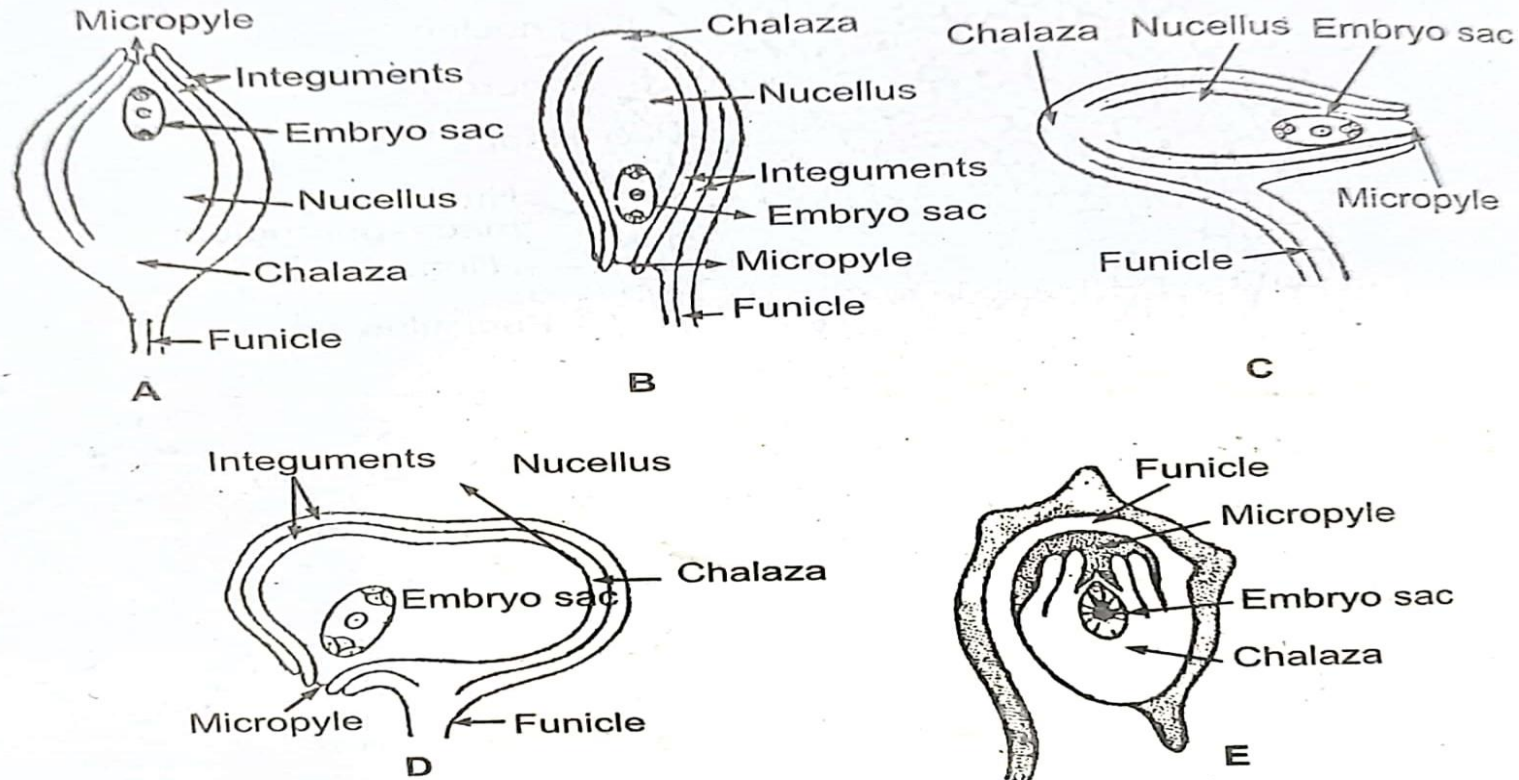
It is a mass of diploid tissues covered by the integuments .It is parenchymatous and makes up the main body of an ovule.It develops a megaspore mother cell at the center which producers megaspores .

### **c) Embryo sac-**

It is the female gametophyte developed from the haploid megaspore .It is a sac with eight cells arranged in a cavity .Hence known as 8 celled embryo sac .Out of the 8 cells ,three cells remain at the chalazal end and are known as antipodal cells .,two at the center known as polar nuclei and there at micropylar end .Out of the three micropylar cells ,one is the egg and on other side of it ,two synergids are present .All three cells are known as egg apparatus .Two polar nuclei fuse to form secondary nucleus .

## 8.2) Types of ovules—

On the basis of the direction of the micropylar region and chalazal region of the mature ovule, ovules are categorized into the following five types .



**Fig. 8.2: Types of Ovules: A – Orthotropous, B – Anatropous, C – Amphitropous, D – Campylotropous, E – Circinotropous**

### 1) **Orthotropous**—

It is an erect ovule in which micropyle ,chalaza and funicle lie in straight line i. e. micropyle is directed upwards.ex.polygonaceae, piperaceae .

### 2) **Anatropous** –

It is inverted ovule having bent funiculus. Micropylar end is directed downward and the chalaza end is directed upward .It is the most common type of the ovule .It is most common type of ovule in monocots and dicots .

### 3) **Amphitropous**—

In this case ,ovule is horizontal in position ie at right angle to its stalk ie micropyle and chalaza are lateral in position .ex Lemna .

### 4) **Campylotropous** –

It is a curved embryo placed transversely in the ovary .An ovule is bent like a horse shoe shaped so that micropylar end and chalazal ends come close to each other .ex Fabaceae , cruciferae , capparidaceae .

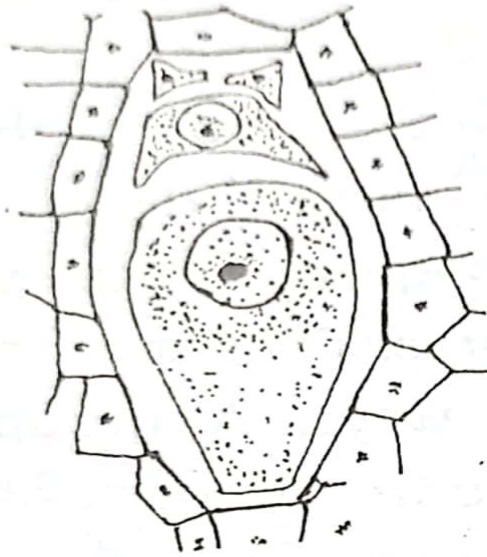
### 5) **Circinotropous** –

It is an ovule with coiled body due to the rapid growth of the ovule on one side . At the initial stage ,ovule remains straight ,then turns down and again turns up ,so that micropyle again get directed upward .ex opuntia and Plumbago .

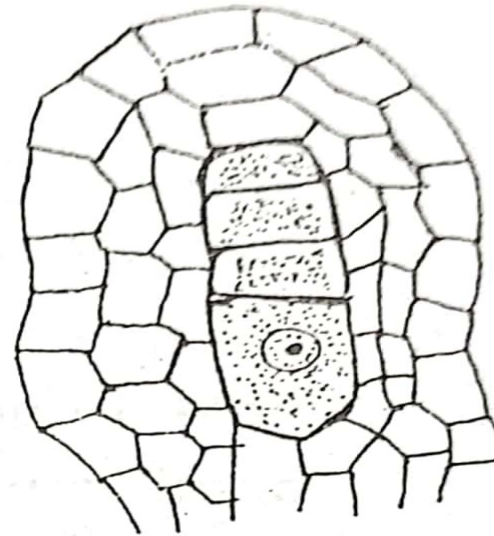
## Megasporogenesis-

It is a process of development of megaspores from the megaspore mother cell originated from the archesporial cell .

### Types of megaspore tetrad –



(a) T-shaped tetrad



(b) Linear tetrad

**Fig. 8.5: Types of Megaspore Tetrad**

## **TYPES OF MEGASPORE TETRADS—**

Megaspore mother cell undergoes meiosis and form four haploid megaspores .A group four megaspore developed from single megaspore mother cell is known as a megaspore tetrad .



**a) T-Shaped tetrad –**

Here dyad formed after meiosis –I show transverse division in lower cell and vertical division in the upper cell.The result is the formation of T-shaped tetrad .Ex Rumex and Rheum.

**b) Linear tetrad --**

In this case ,megaspore mother cell divides by meiosis –I To produced a dyad .Each of the dyad ,further divides by transvers division to produce a row of four megaspores known as linear tetrad .ex Elytraria .

**FEMALE GAMETOPHYTE: STRUCTURE OF TYPICAL EMBRYO SAC---**

Female gametophyte is a embryo sac developed from the functional megaspore in the nucellar tissue of the ovule .

**Typical embryo sac –**

A typical embryo sac of the angiosperm is 8 –celled ,having three celled at the chalaza end ,three cells with the egg at the micropylar end and two cells at the central region .Three cells are present at the chalazal end are known as antipodal cells. A group of three cells possessing the functional egg at the micropylar end is known as egg apparatus and the central two fused cells are known as the central cell with polar nuclei or secondary nucleus.

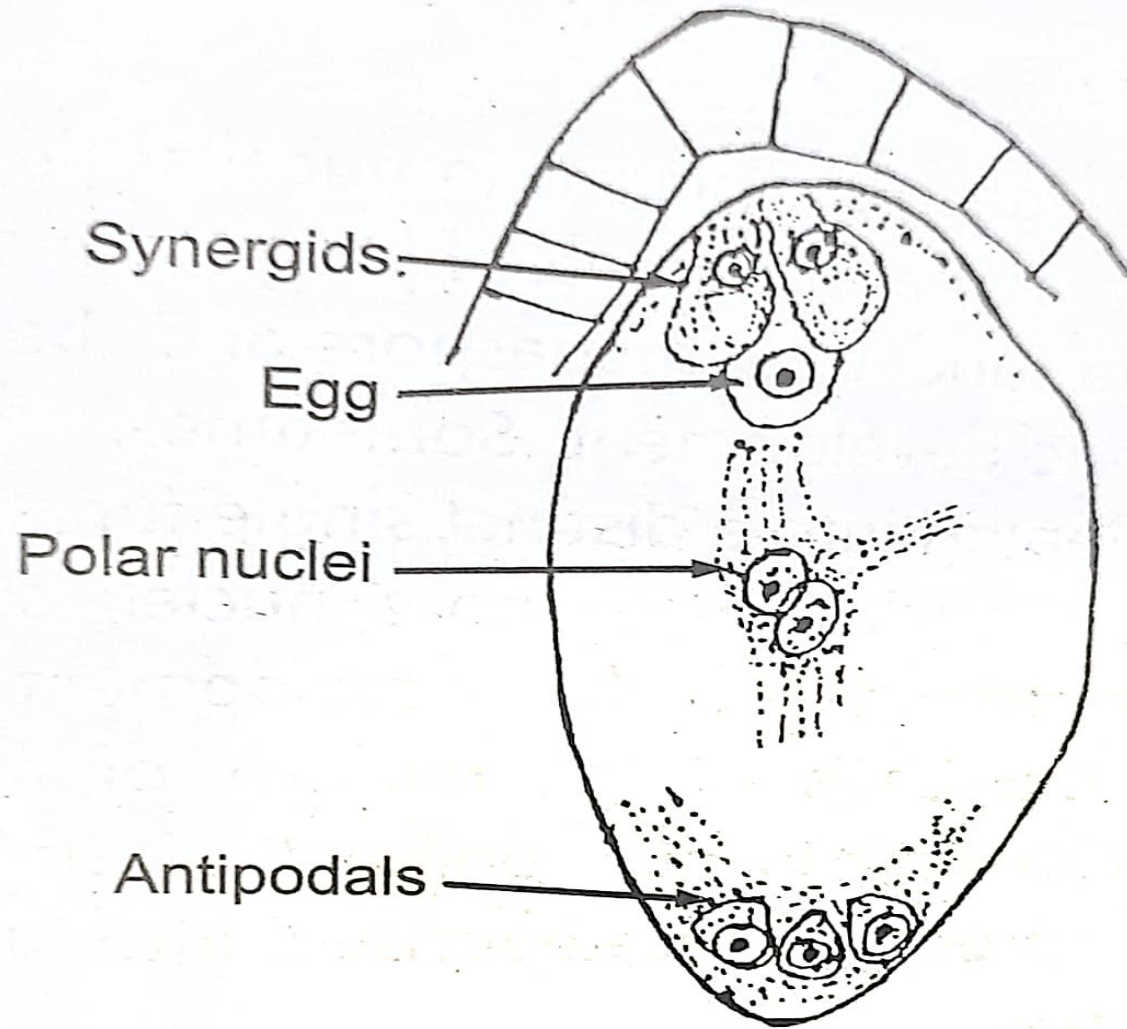
**a) Antipodal cells –**

These are normally three cells present at the chalazal end of the embryo sac arranged in various ways .Each cell is usually uninucleate .Antipodal cells are rich in ascorbic acid,oxidases,lipids, starch ,and proteins. These cells are associated with the nutrition of the embryo sac .

**b) Central cell—**

It is the largest cell of the embryo sac with a central vacuole and it contains sugars, amino acids, and inorganic salts .It posses two polar nuclei which are large in size ,with conspicuous nucleus and remain suspended by cytoplasmic strands at the centre of the cell .The two nuclei are fuse to before or during fertilization to form the secondary nucleus .The central cell with the secondary nucleus after fertilization gives rise to the endosperm tissues .





**Fig. 8.6: A Typical Embryo Sac**

### c) **Egg apparatus—**

The egg apparatus at the micropylar end of the embryo sac is composed of two synergids and an egg .Synergids disappear after fertilization .Egg cell is the functional female gametophyte cell present in between the synergids .Haploid nucleus is located in central of the egg cell .

### **Types of embryo sac-----**

The functional megaspore placed in tissue develops into an embryo sac .On the basis of the number of megaspore nuclei participating in development of embryo sac (Female gametophyte ) ,the process is cauterized into three basic types which are listed below .

#### **1) Monosporic Embryo sac development –**

A single functional megaspore is involved in the development of the embryo sac.

On the basis of the position of the functional megaspore involved in embryo sac development , monosporic embryo sacs are categorized into two types .

##### **1) Polygonum type—**

In this case ,amongst the four megaspores from the megaspore tetrad, the megaspore placed at the Chalazal end is functional and involved in embryo sac development .The other three megaspore degenerate .This megaspore embryo sac is reported in *Polygonum divaricatum* by Strasburger (1878 ) hence it is named as Polygonum type .

##### **2) Oenothera type –**

In this case the ,the micropylar megaspore of the megaspore tetrad is functional and involved in the development of the embryo sac .Megaspore nucleus divides twice to produce a quadrate of nuclei at the micropylar end and it gives rise to a normal egg apparatus and a single polar nucleus .One polar nucleus and the antipodal cells are absent .This type of embryo sac development is characteristics of family Onagraceae .

Archesporeal initial cell divides transversely and gives rose to the outer partial cell and the inner MMC.

Out of the four nuclei of the micropylar tetrad, three get organized into an egg apparatus and one migrates into the center and function as a second polar nucleus.

The mature embryo sac is 8-celled and possesses egg apparatus, 3 antipodal cells and two polar nuclei.

### **2) Bisporic Embryo sac –**

It is 8 nucleated and develops from two functional megaspore nuclei. Megaspore mother cell divides by meiosis first to produce dyad of haploid cells. Out of these only one dyad remains functional and participate in embryo development. Functional dyad further divides mitotically and it possesses two tetrads i.e. micropylar and chalazal tetrad. Thus mature embryo sac becomes 8-nucleated.

### **3) Tetrasporic Embryo sac –**

This is a unique type of embryo sac development in which all four megaspore nuclei are functional and involved in embryo sac development.

