DEVELOPMENT OF THE EMBRYO

MBOTCC-6
Unit-V

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

Q. Give an outline of the various patterns of embryo development in angiosperms. Describe in detail the development of a typical dicot embryo.

Key Points: (i) Zygote or the oospore develops into the embryo.

(ii) Embryo development proceeds similarly both in monocots and dicots in the early stages. Differences start in later phases.

(iii) In all angiosperms, zygote divides to develop a two-celled proembryo.

(iv) Most commonly, the first wall between the two cells is transverse; in a few cases (e.g., Peperomia, Balanophora, etc.) the first wall is more or less vertical.

(v) Of the two cells the one near the micropyle is called the basal cell while one pointing towards the centre of the embryo sac is known as the terminal cell.

(v) Basal cell usually forms the suspensor and may or may not contribute towards the future development of the embryo.

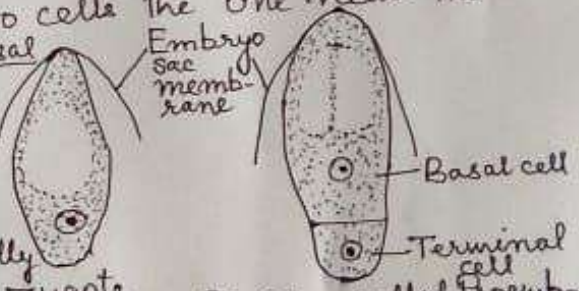


Fig.- Zygote

Fig.- Two-Celled Proembryo

(vi) Terminal cell predominantly participates in embryo development.

(vii) Based on the pattern of differentiation of the basal and terminal cells, Johansen (1950) recognized six types of embryo development among the angiosperms.

Outline of the various patterns of Embryo Development

A. Zygote divides by a more or less vertical wall ... 1. Piperad type
eg, Peperomia, Balanophora

B. Zygote divides by a transverse wall,

... contd. P. 2

I. Terminal cell divides by a vertical wall forming a ⊥-shaped proembryo

(a) Basal cell plays little or no part in the formation of the embryo

... 2. Onagrad or Crucifer type

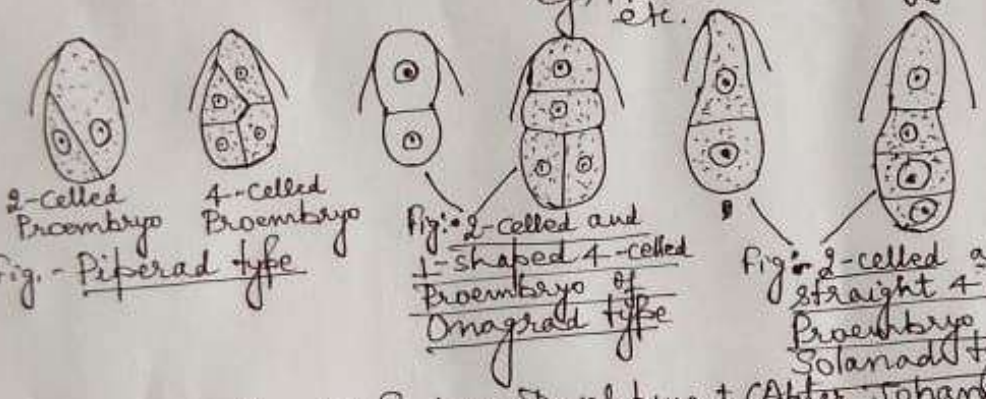
eg., Onagraceae, Brassicaceae, Ranunculaceae, Rutaceae, Liliaceae, Juncaceae, etc.

- may be considered as the typical mode of embryo development

(b) Both basal and terminal cells contribute to the formation of the embryo

... 3. Asterad type

eg., Asteraceae, Polygonaceae, etc.



2-Celled Proembryo | 4-Celled Proembryo

Fig. - Piperad type

Fig: 2-celled and ⊥-shaped 4-celled Proembryo of Onagrad type

Fig: 2-celled and straight 4-celled Proembryo of Solanad type

Types of Embryo Development (After Johansen, 1950)

II. Terminal cell divides by a transverse wall forming a straight proembryo

(a) Basal cell plays little role in the future embryo

(i) Basal cell undergoes no further division but becomes a large suspensor cell

4. Caryophyllad type

eg., Caryophyllaceae (Saxifraga, Medicago, Myriophyllum, etc.)

(ii) Basal cell forms suspensor of 2 or more cells

5. Solanad type

eg., Solanaceae & Papaver, Linum etc.

(b) Both basal and terminal cells contribute to the formation of the embryo

6. Chenopodiad type

eg., Chenopodiaceae, Myosotis, etc.

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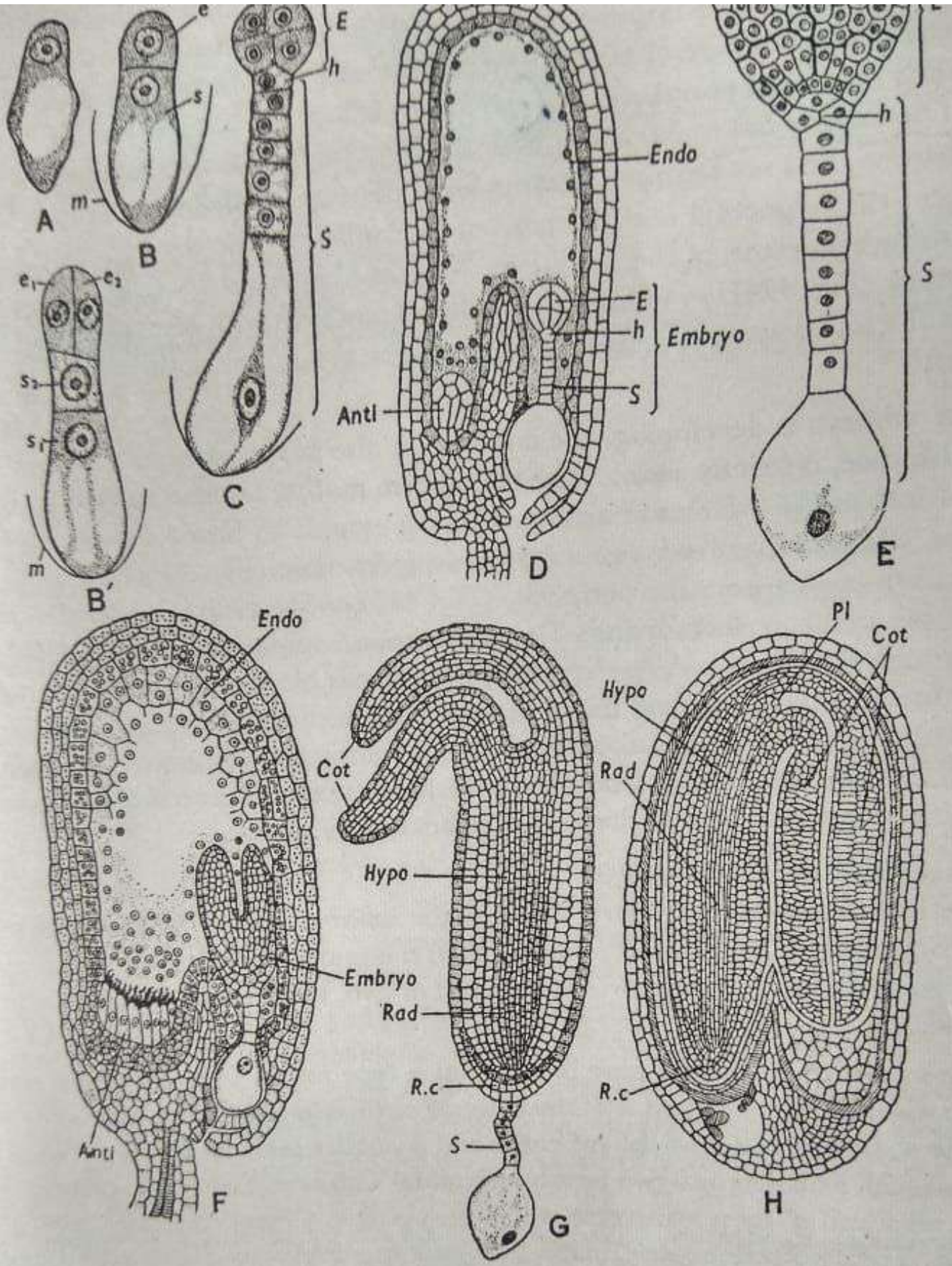

FIG. 424. Embryogeny in *Capsella bursa-pastoris* of Cruciferae (Dicot). A. The oospore. B. Transverse division of oospore forming 2-celled proembryo. *e*=terminal cell; *s*=basal cell; *m*=embryo sac membrane. B′. 4-celled ⊥-shaped proembryo; e_1, e_2 are from terminal cell; s_1, s_2 are from basal cell. C. Further development of embryo. *S*=suspensor; *h*=hypophysis; *E*=embryonal mass. D. L.s. of ovule. *Endo*=endosperm in free-nuclear stage. *Anti*=antipodal tissue. *Embryo*=developing embryo. E. Embryo showing further development of embryonic octants and hypophysis. F. L.s. of ovule. Endosperm becoming cellular. G. Embryo. *Cot*=cotyledons; *Hypo*=hypocotyl; *Rad*=radicle; *R.c*=root-cap. H. Mature seed. *Pl*=plumule. Endosperm has been consumed almost completely.

There is no essential difference between the embryogeny of monocots and that of dicots in the early stages. Differences between them become prominent only during later phases of development.

Development of a typical dicot embryo

(i) Onagrad or Crucifer type of embryo development as represented by Capsella bursa-pastoris is a typical case of embryo development in dicots.

(ii) Here the ovule is campylotropous so that the embryo sac and the later developed embryo are horseshoe-shaped.

(iii) Micropyle being pointed downwards, embryo looks upside down.

(iv) Oospore divides by a transverse wall forming a large basal cell and a smaller terminal cell.

(v) Basal cell now divides transversely while the terminal cell divides vertically developing a T-shaped 4-celled proembryo.

(vi) Second basal cell quickly divides by several transverse walls giving rise to a row of cells called suspensor.

(vii) Lowest (micropylar) cell of the suspensor remains disproportionately large.

(viii) As the suspensor increases in length, it pushes down the terminal embryonal cells deeper into the embryo sac.

(ix) Meanwhile the embryonal cells divides by three walls at right angles to each other giving rise to an octant (group of 8 cells). This is called the embryonal mass.

(x) Lowest cell of the suspensor is called the hypophysis.

(xi) Embryonal mass, along with the hypophysis, divides further.

(xii) Finally the mature embryo with the plumule developed also out of the four terminal octants.

(xiii) Suspensor gradually withers with the development of the radicle.

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