MALE AND FEMALE GAMETOPHYTES OF GNETUM & EMBRYOGENY OF THE NEW SPOROPHYTE

Dr. M Roy

PAPER-III
Group-A

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MALE GAMETOPHYTE:

(i) Microspore (= Pollen) is the pioneer structure of the male gametophyte.
(ii) It has a roughly spherical shape in young condition.
(iii) Microspore is uninucleate and is enveloped by a thick and spiny exine and a thin intine.
It is wingless and is released in a three-nucleate condition.
Karstein (1893) reported two-nucleate pollen grains in Gnetum at the time of their release.
(iv) The pollen grain nucleus divides to form a generative nucleus and a tube nucleus. The former divides into a stalk nucleus and a body nucleus. The body nucleus divides further to form two male nuclei, which migrate into the pollen tube formed by the intine (Thompson, 1916).
(v) Pearson (1912-1914) reported a naked prothallial nucleus in addition to the tube and generative nuclei, but it soon disintegrates.
(vi) Nagi and Madhulata (1959), however, have shown that in G. gnemon and G. ula, a prothallial cell is cut off at the end of the first division of the microspore nucleus and a tube and generative nucleus occur as usual. This is the current view.

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Female Gametophyte:

(i) In *G. gnemon*, the 4-nucleate functional megaspore undergoes the usual free nuclear division (256 nuclei) with a vacuole formation at the centre.

(ii) The female gametophyte at this stage elongates towards the chalazal end and appears almost spathulate in outline. It has a big central vacuole and the free nuclei are distributed in the peripheral layer of cytoplasm.

(iii) Further development usually takes place only in one female gametophyte and the others completely degenerate.

(iv) The female gametophyte appears to differ markedly in different species. It may appear like an inverted flask or spindle-shaped.

(v) No archegonium is formed in *Gnetum*. This is an angiospermic condition.

— A cellular tissue develops at the lower end, the cells of which are freely multinucleate at first but becomes uninucleate later on. This is interpreted as homologous with the antipodal cells of angiosperms. This tissue is also called the 'primary endosperm'. Its cells undergo further division and in due course of time fill up the entire gametophyte, either before or after fertilization is effected. Below the antipodal end of the embryo sac a remarkable nutritive (glandular) pavement tissue is developed.

Fertilization: (i) No archegonia are formed

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and apparently any of the nuclei of the female gametophyte may be fertilized.

(ii) Several pollen tubes may penetrate through the micropylar chamber and nucellus and then enter the female gametophyte.

(iii) When the pollen tube ruptures by a terminal pore, each of the two male nuclei unite with a female nucleus (double fertilization) so that many zygotic nuclei are produced, which enlarge and begin embryo development.

Embryogeny:

(i) Each zygote nucleus surrounds itself with a cell wall and divides to form a two-celled proembryo.

(ii) Upper cell of the proembryo grows into a long, tubular suspensor with a terminal embryonal cell, which is pushed down into the antipodal cells (endosperm) of the female gametophyte by the suspensor.

(iii) From its terminal embryonal cell, a multicellular embryo is formed as a result of free nuclear division.

(iv) Some unfertilized female nuclei now divide to form bulk of prothallial tissue (endosperm).

(v) Most of the endosperm tissue is formed after fertilization.

(vi) The developing endosperm soon invades upon the nucellus and destroys it except for an apical residue below the micropyle.

At this stage the ovule is shed and further development of embryo takes place on the ground but its details are yet unknown.

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(vii) Although there are many ovules, the seeds are not many.

(viii) The seed is albuminous and dicotyledonous.

— The perianth becomes fleshy and takes up orange-red colour.

(5 Figs. below)

—X—

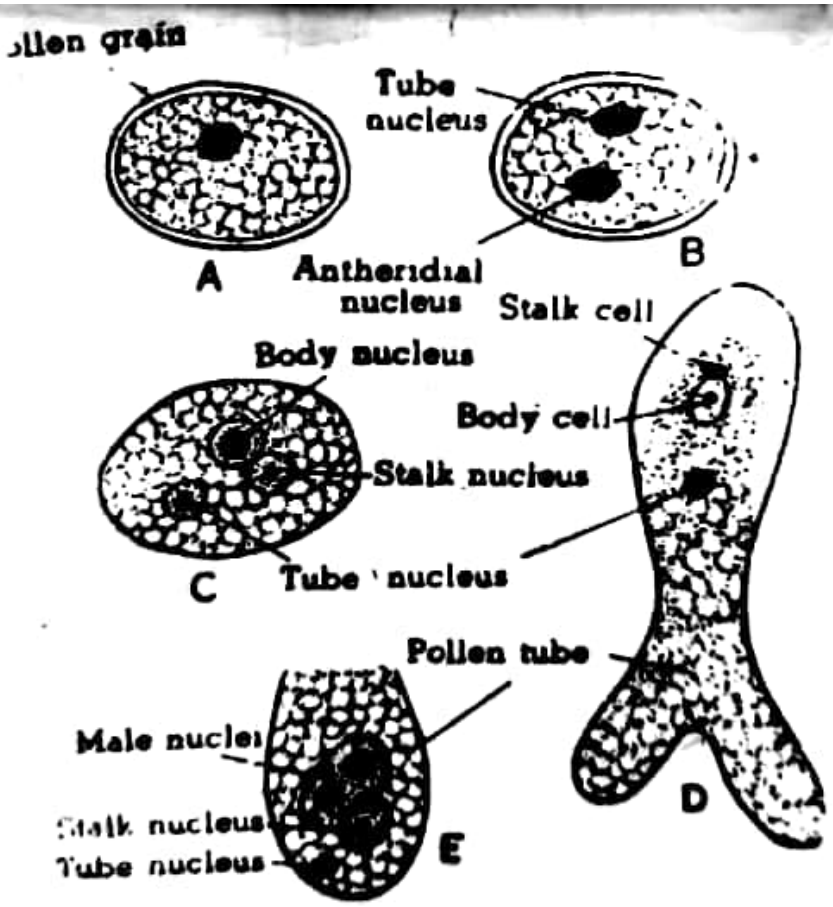

Fig. 13.16. *Gnetum gnemon*. Stages in the germinating microspore (pollen-grain) and development of microgametophyte (*After Thompson*).

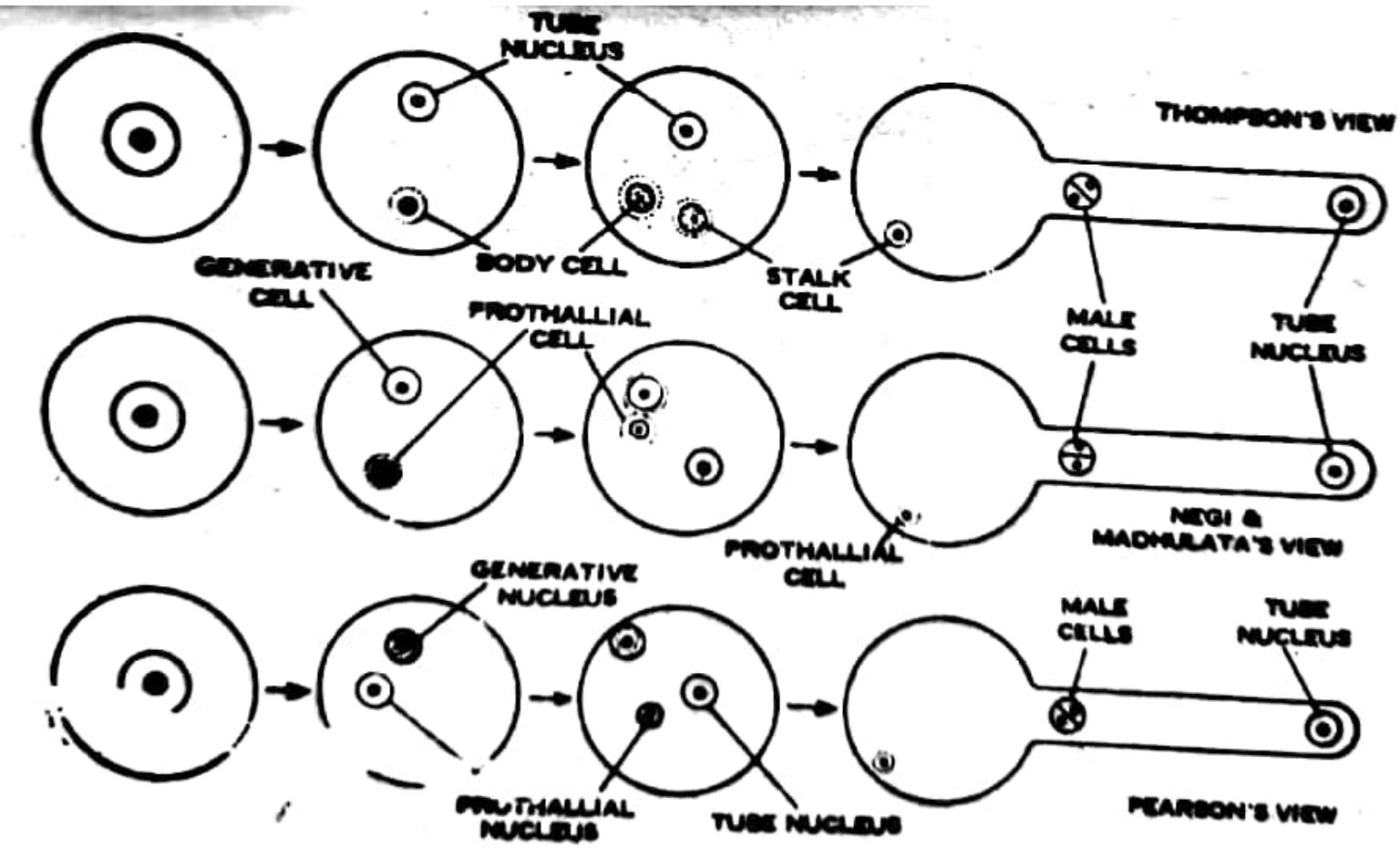

Fig. 13.17. *Gnetum.* **The views about the development of the male gametophyte.**

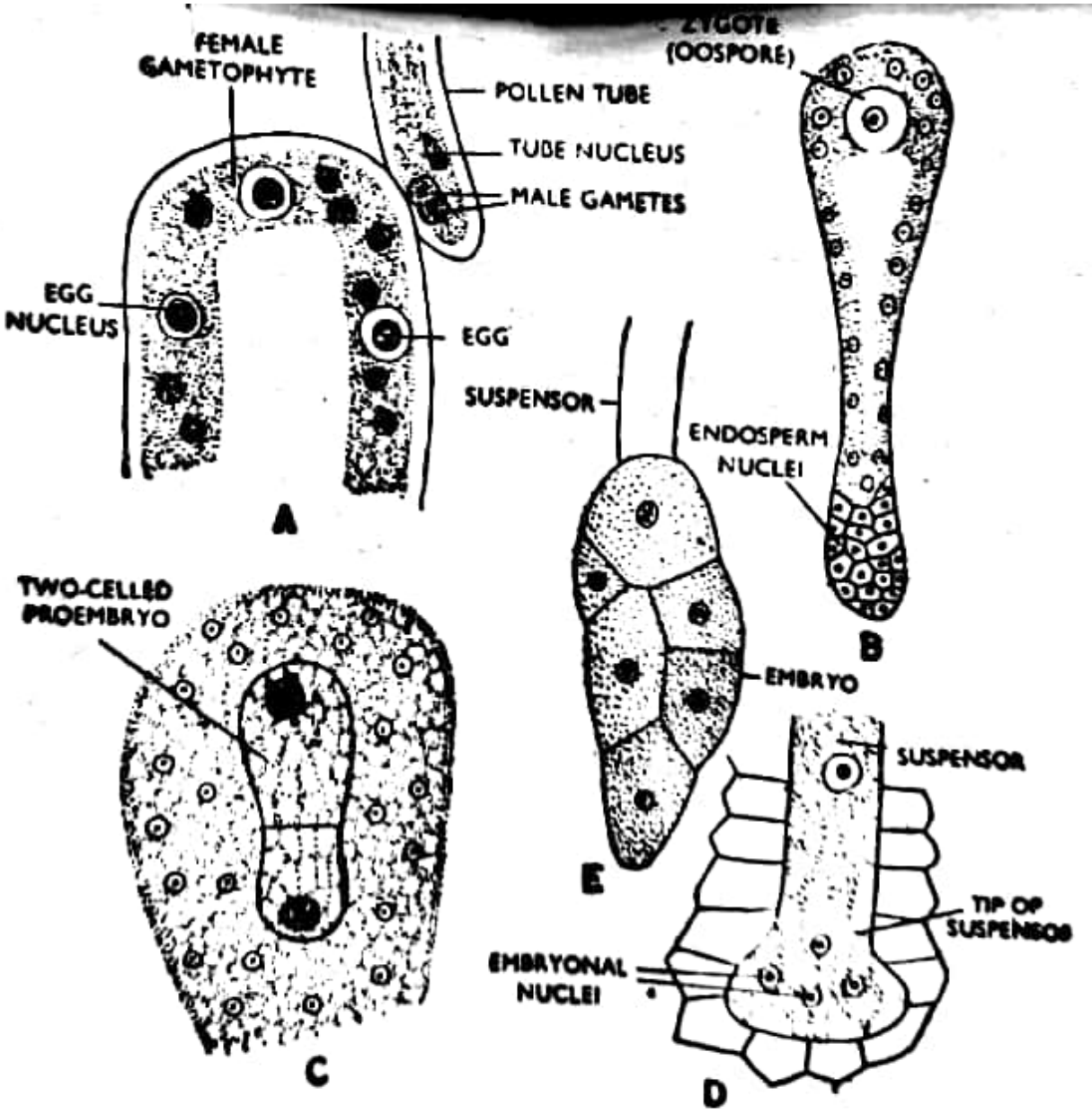

Fig. 13.18. *Gnetum*. Fertilization and post-fertilization stages (*After Thompson*).

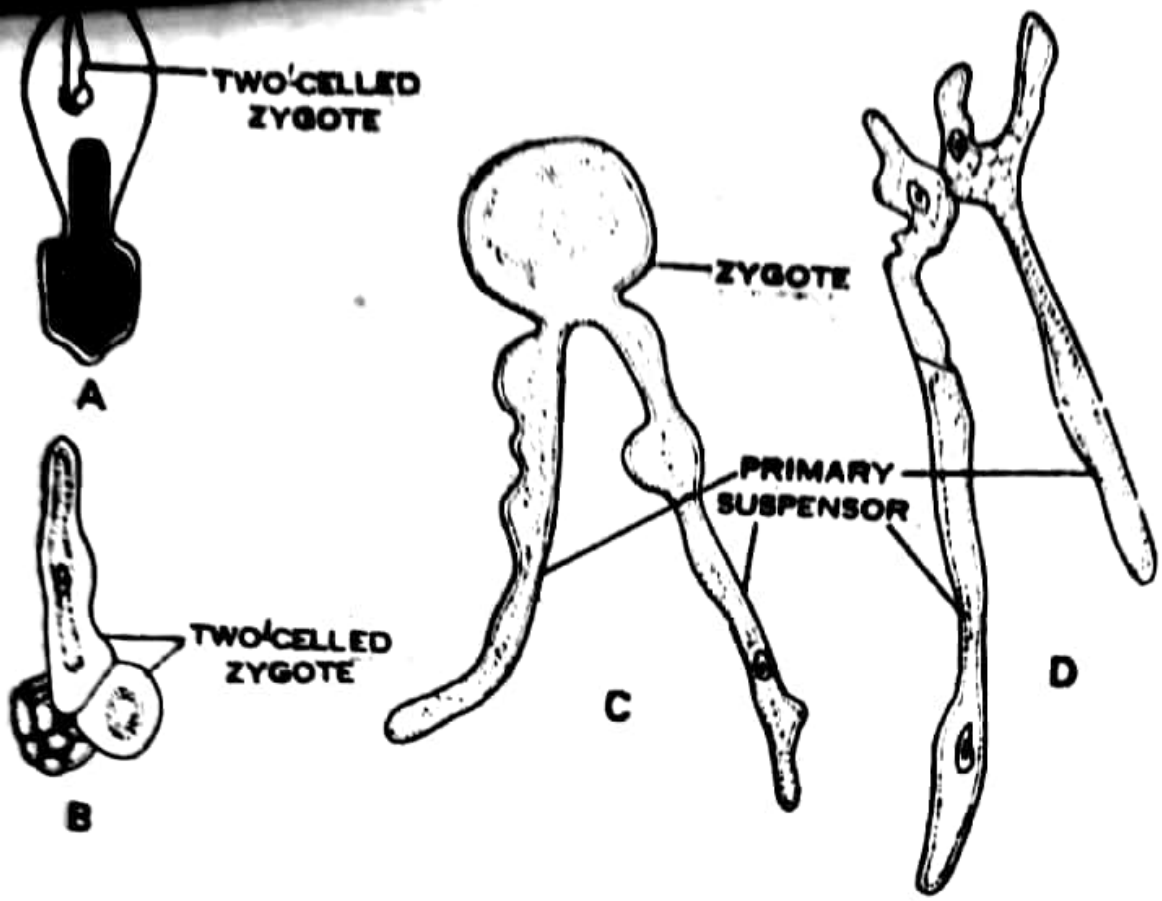

Fig. 13.19. *Gnetum*. Development of embryo.

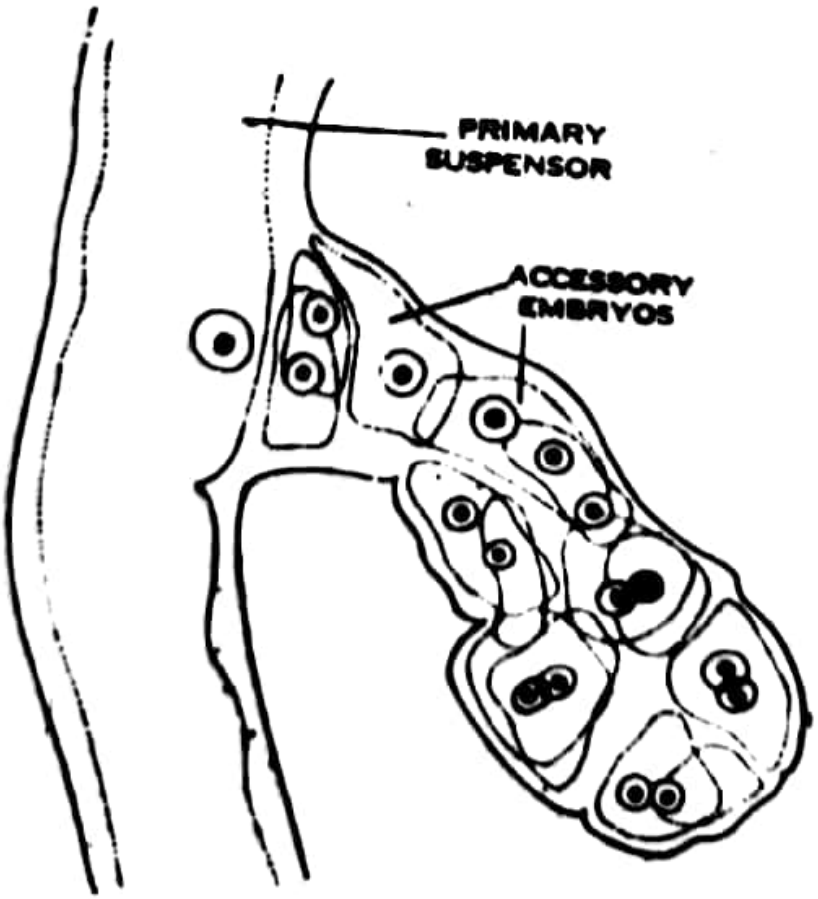

Fig. 13.20. *Gnetum*. Polyembryony.