

# MALE AND FEMALE GAMETOPHYTES OF TAXUS & EMBRYOGENY OF THE NEW SPOROPHYTE

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PAPER - III  
Group - A

TDC Part-II(H)

## Male Gametophyte:

(i) Uninucleate pollen grains are the pioneer structures of male gametophyte. They are spheroidal and uniaperturate bitemic entities.

(ii) Pollen is released in uninucleate condition and starts germination on the nucellus.

(iii) It divides transversely into a lower tube cell and an upper generative cell. No prothallial cells are formed.

(iv) The intine protrudes out through the germ pore and grows into a short pollen tube, which penetrates the nucellus.

(v) Tube nucleus moves into the pollen tube and lies at its tip.

(vi) Generative cell remains in the pollen grain and divides into a stalk cell and a body cell.

Meanwhile the exine ruptures and tube cell elongates into a pollen tube.

(vii) Nucleus of the body cell divides into <sup>two</sup> followed by wall formation. Thus two daughter cells or spermatocytes are produced, which are unequal.

- Unlike Cycas, no blepharoplasts appear; hence no ciliated sperms are produced.

(viii) Out of the two spermatocytes only the larger one is functional and

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develops into a <sup>functional</sup> single / non-motile ♂ gamete.

(ix) The <sup>nuclei of the</sup> two unequal gametes namely, the large functional gamete and the small abortive gamete, reach the tip of the pollen tube.

(x) Pollen tube grows into the apex of the nucellus where it destroys a number of cells to create a hollow.

At this stage it rests till the archegonia have been formed.

(xi) Later the pollen tube enters the neck of the archegonium; its tip ruptures and all the four nuclei (two of the functional ♂ gamete and two of the abortive one) pass into the archegonium, where the larger of the two functional ♂ nuclei unites with the egg to form the oospore and the other three abort.

(xii) The male gamete being non-motile, the pollen tube acts as a carrier of the male gametes to the egg.

### Female Gametophyte:

(i) The functional megaspore outgrows others, enlarges considerably and its nucleus undergoes repeated free nuclear divisions to form 128 or 256 nuclei. Number of free nuclei varies with the species.

(ii) Due to the appearance of a central vacuole, parietal shifting of nuclei occurs, and subsequent wall formation begins at the micropylar end.

(iii) Tapetum does not develop.

(iv) Tentacle appears on a flask-shaped cellular structure from the apex of the gametophyte and persists till it becomes cellular.

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(v) Central vacuole gradually disappears and centrifetal wall formation occurs by the appearance of alveoli. This makes the whole tissue cellular. It is the female gametophyte enveloped within the megaspore membrane. Reserve food materials are filled in its cells.

(vi) During its development the female gametophyte penetrates upon the surrounding nucellar tissue and consumes much of it so that it forms only a thin layer.

(vii) Some of the cells in the female gametophyte remain elongated and form a longitudinal strand. It may be regarded as the conducting strand.

(viii) Archegonia appear late when the gametophyte has become quite extensive. Their number ranges from 10 to 25. They develop from the cells two or three cells deep from upper cells of the prothallus and may be grouped together in a mass or lie scattered in the prothallial tissue.

— Cells of the prothallus often grow above them so that archegonia are left at the bottom of a deep pit or archegonial chamber.

(ix) Each archegonium is very simple. Neck consists of 2-4 cells while the venter contains an egg or oosphere, but no ventral canal cell. Ventral canal cell is represented only by a nucleus.

(x) There is no well defined archegonial jacket nor is there special digestive zone around the megaspore.

Hence nutritive provision is not differentiated in taxus.

Fertilization:

(i) Fertilization occurs one or two months after pollination.

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(ii) Fertilization takes place about the middle of March.

(iii) Pollen tube, due to the absence of pollen chamber, traverses the nucellus before reaching the archegonia. Thus pollen tube serves both as a haustorium and a sperm carrier because of the non-motile male gametes.  
- In some cases, pollen tube does not reach the archegonia till the next season.

(iv) On reaching the archegonium, tip of the pollen tube bursts, and the male gamete enters the archegonium, where the fusion of male and female nuclei takes place resulting in the formation of oospore.

### Embryogeny:

(i) Oospore nucleus undergoes free nuclear divisions to produce 32 nuclei.

(ii) Wall formation takes place, thus leading to the formation of proembryo.

(iii) Proembryonal cells are arranged in three tiers. The lowest tier forms the embryo.

(iv) Cells of the middle and upper tiers elongate to push down the terminal cell.

(v) Middle tier forms the suspensor.  
- suspensor elongated and pushes the embryonal tier out of the archegonium deep into the food laden tissue of the female prothallus.

(vi) Embryo in T. cuspidata is dicotyledonous.

(vii) Simple polyembryony is there besides cleavage polyembryony.

(viii) Mature embryo is straight with a radicle towards the microphyllar end, a hypocotyle comes next, and then the plumule concealed in between the two cotyledons.

(ix) Only one embryo matures in one ovule. Embryo consumes the entire prothallus so that the seed is non-endospermic.

(Figs. below)

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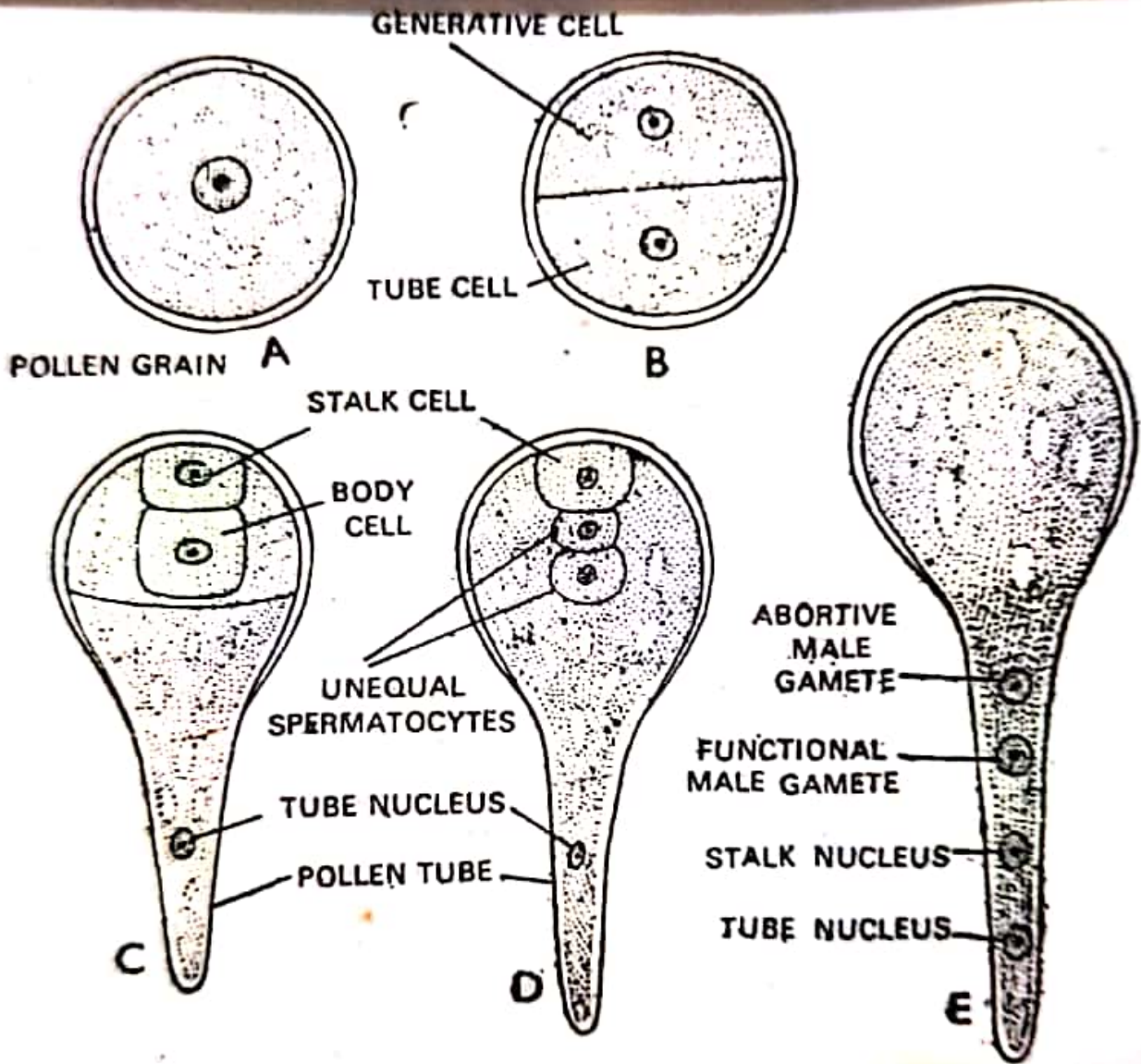


Fig. 11.10. *Taxus*. Germination of pollen-grain (microspore).

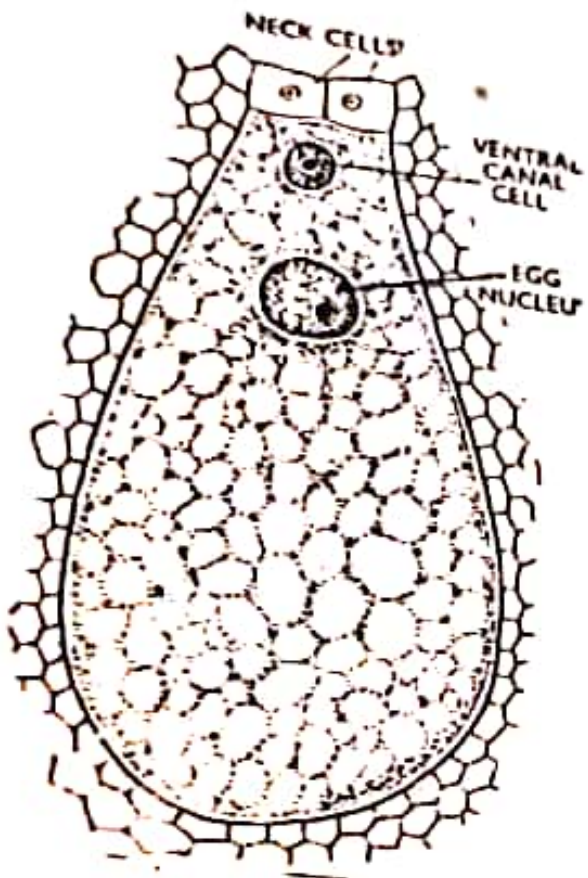


Fig. 11-18. A mature archegonium of *Taxus baccata*.

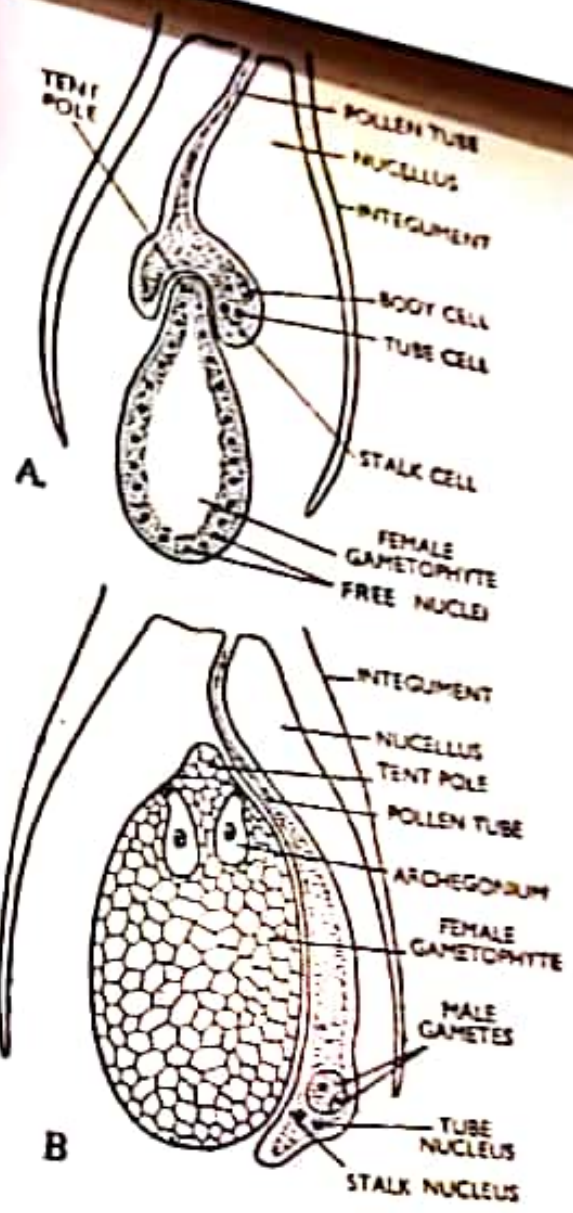


Fig. 11-19. *Taxus baccata* A. usual method of pollen tube approach in *T. canadensis*; B. Abnormal condition of pollen tube approach in *T. baccata* The pollen tube pierces through the chalazal end: (After Sargent)

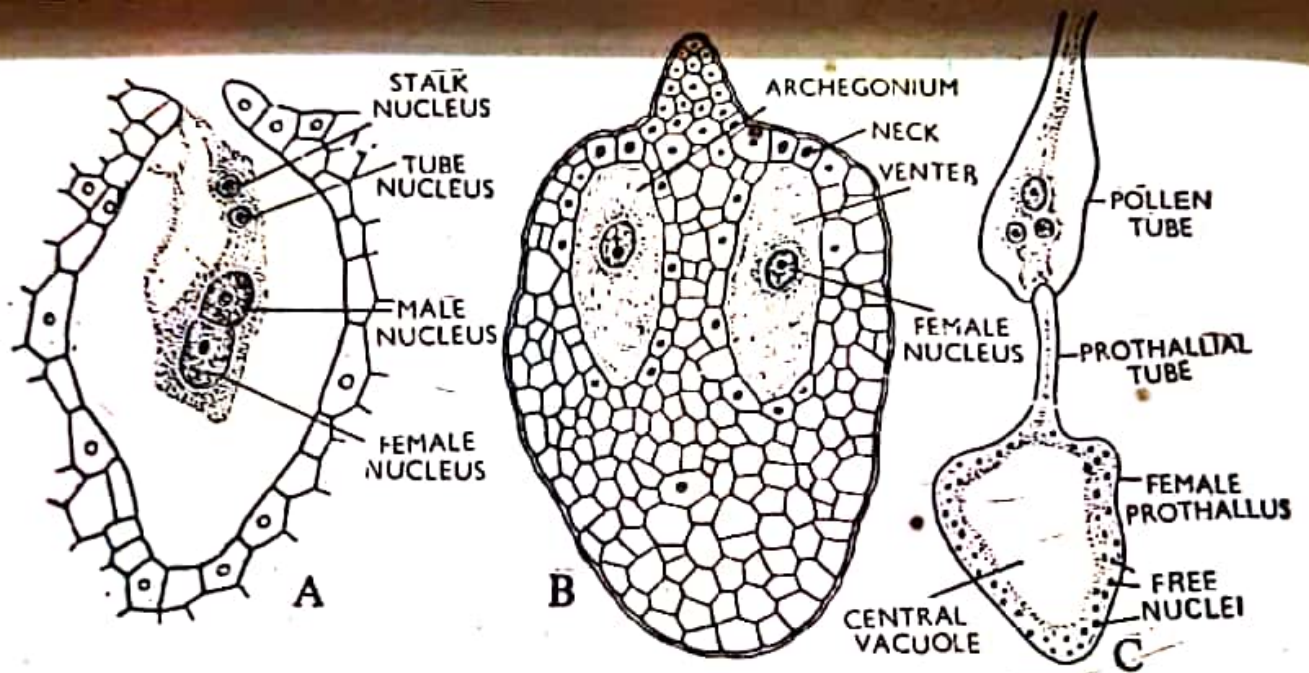


Fig. 11-20. *Taxus baccata*. A. Fertilized archegonium. B. Female gametophyte with two archegonia. C. Process of fertilization. (After Saxton)

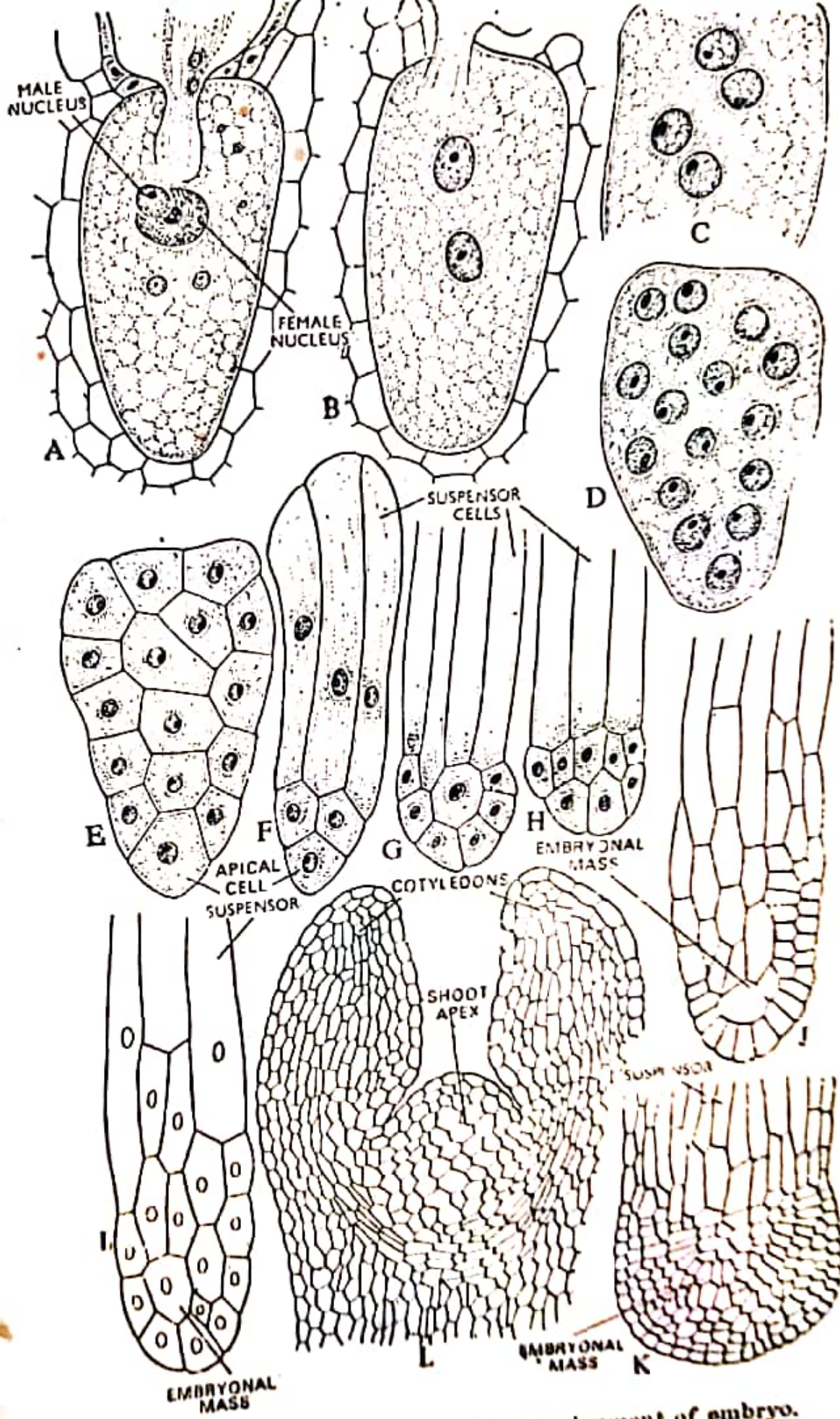


Fig. 11-21. *Taxus baccata*. Stages in the development of embryo. (After Saxton and Dupler)