GNETUM

Gnetum

Systematic Position:

DIVISION : GNETOPHYTA
CLASS : GNETOPSIDA
ORDER : GNETALES
FAMILY : GNETACEAE

Distribution:

Represented by 40 species; confined to tropical & humid regions.

According to Bhardwaj (1957), mainly 5 gnetum species in India.

- G.gnemon : Shrubby plant; found in Assam's Naga Hills region.
- G.contractum : Scandent scrub; found in Kerala & Nilgiri Hills.
- G.latifolium : Climber; found in Andaman & Nicobar Islands.
- G.ula: Woody climber with swollen nodal branches.

  Locality: Regions of Kerala, Andhra Pradesh, Orissa.
- G.montanum : Climber with slender branches; woven at nodes.

  Locality : Assam, Sikkim & Parts of Orissa.

Characteristic Features Of Gnetum

- Most Species are climbers except few being shrubs & trees.
- Branches 2 types: Branches of limited growth

  Branches of unlimited growth

- *Climbing Species* have branches of limited growth (short shoots)

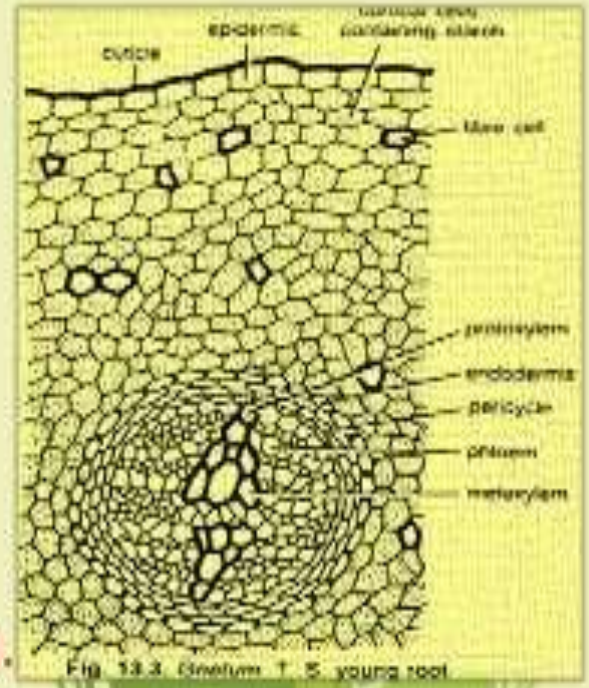
  and unbranched with foliage leaves.
- Leaves: Dicot like scaly leaves; large & oval with entire margins

  9-10 in pairs arranged in decussate fashion with

  reticulate venation.

Anatomy Of Gnetum

(a) Roots

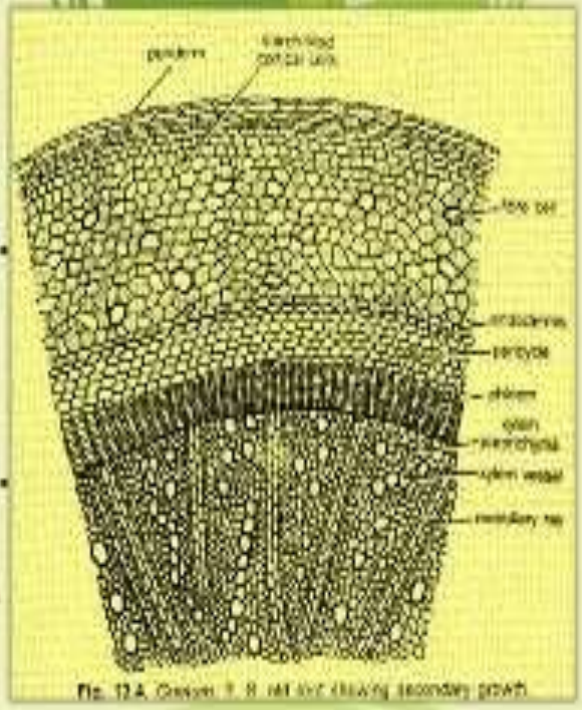


In Young Roots :

1) Layers of starch filled cortical cells.

2) 4-6 layers of pericycle; primary xylem visible.

3) Roots may be Di-arch and Ex-arch (Angiospermic Ch.).



In Older Roots :

1) Primary xylem indistinguishable due to 2ndry growth.

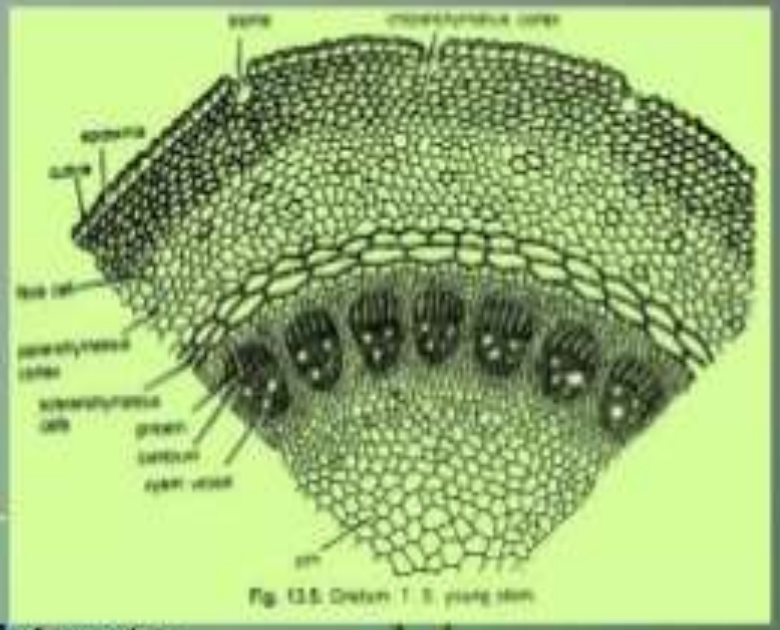
2) Consists of tracheids, vessels & xylem parenchyma.

3) Phloem consists of sieve tubes & phloem parenchyma.

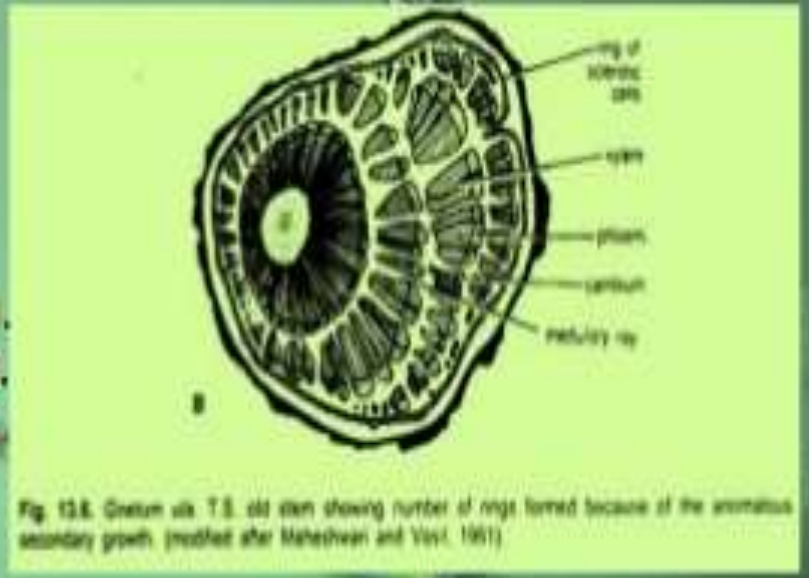
4) "Bars of Sanio" present in tracheids; absent in vessels.

b) Stem

In Young Stem : 1) Resembles typical Dicot Stem.
2) Sunken Stomata Present.
3) Cortex : i) 1st few layers – Chlorenchymatous cells.
ii) 2nd few layers – Parenchymatous cells.
iii) 3rd few layers – Sclerenchymatous cells.
4) Endodermis & Pericycle indistinguishable.
5) Vascular Bundles Conjoint, Collateral Open & End-arch in a ring.
Xylem : Comprises Tracheids & Xylem Vessels.
Phloem : Comprises Sieve cells & Phloem Parenchyma.

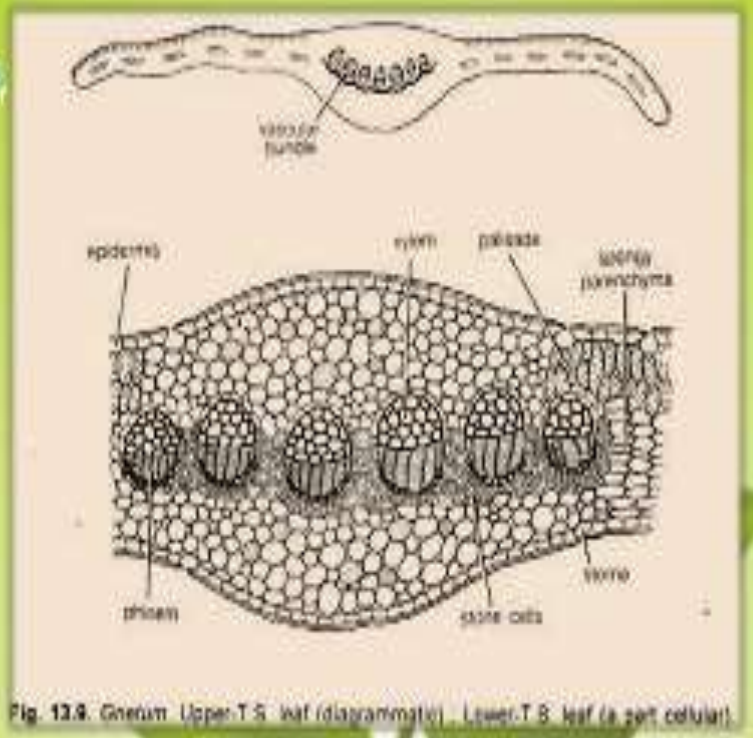


In Old Stem : 1) Primary Cambium short-lived.
2) Sclerotic cells present.
3) 2ry cambium in diff. parts of cortex form rings.
4) 2ry wood comprises tracheids & vessels.
5) Phloem Sieve cells have oblique, perforated sieve plates.
6) Medullary Rays consist of Polygonal Parenchyma cells.



c) Leaves

- They resemble dicot leaves with cuticularised epidermis, stomata on both side except on veins.
- Mesophylls differentiated into single layered palisade, well-developed spongy parenchyma.
- Stone cells & latex tubes present in mid-rib regions.
- Vascular bundles : i) arch/curve form in mid-rib region.
  ii) conjoint, collateral type.
  iii) Xylem: tracheids vessels &xylem parenchyma.
  iv) Phloem: sieve cells & phloem parenchyma.



Reproduction In Gnetum

- Gnetum : Dioecious; cones/strobili reproductive structure.
- Cones : i)Cone axis with 2 opposite bracts.

  ii)flower like structure in collars, formed of bracts.

✓ Male Cone: i)Flowers arranged alternatively in definite rings.

ii)Each flower contains 2 coherent bracts form perianth.

iii)At maturity, stalk elongates such that anther comes out of perianth sheath.

✓ Female Cone: i)4-10 ovules above collars.

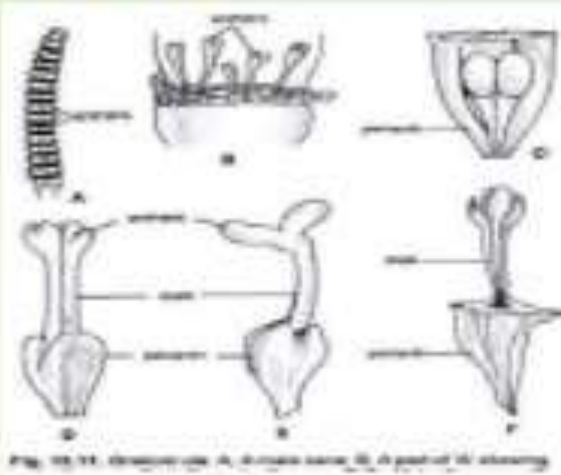
ii)Ovule consists of nucellus surrounded by 3 envelopes.

iii)Nucellus consists of central mass of cells.

iv)Inner envelope elongates to form micropylar tube.

v)Stomata, sclereids & lactiferous cells formed in other 2 envelopes.

vi) Ovule is *atropous*. Angiospermic Character.



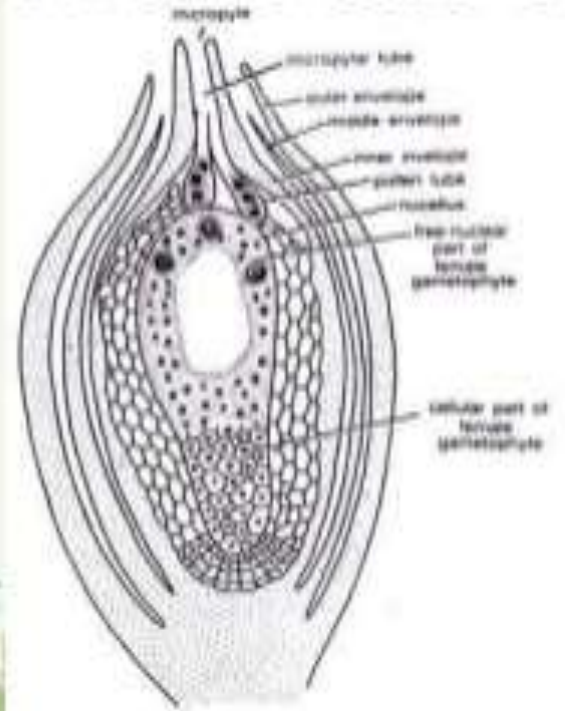
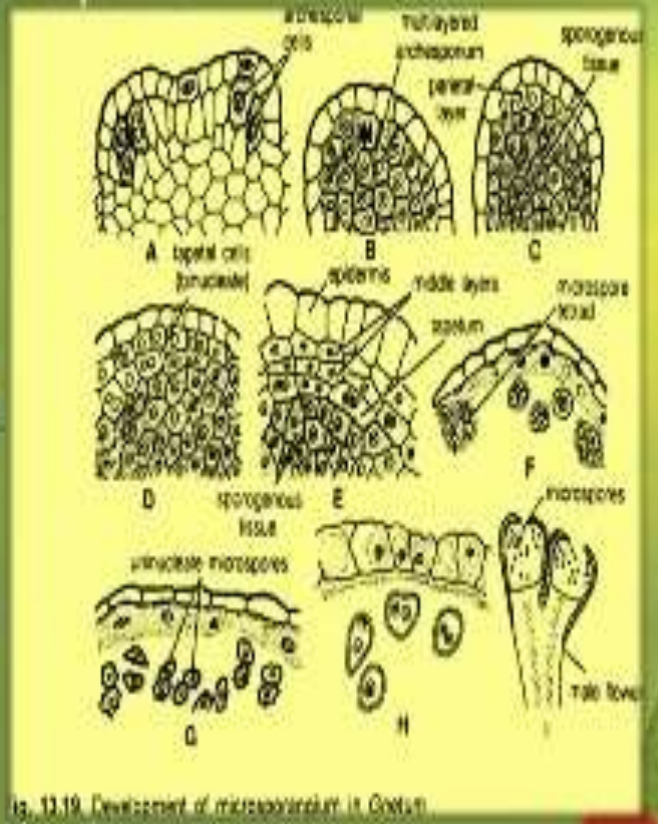


Fig. 13.16. Gnetum: L.S ovule

Microsporangium : Microsporogenesis

1) 2 archesporial cells divide to form multi-celled archesporium.
2) Archesporium divide periclinally forming:
   Outer Layer: Parietal cells
   Inner Layer: Sporogenous cells
3) Parietal cells form tapetal cells periclinally
4) Sporogenous cells divide irregularly forming MMC.
5) Tapetal cells get bi-nucleated.
6) MMC form haploid microspores by meiosis; soon, wall cells & tapetal cells of tapetum disorganise
7) As soon as the anthers dehisce(along the double row of small cells which extends from tip towards the base), the microspores are released.



Megasporangium : Megasporogenesis

- 2 archesporial cell divide periclinally forming outer parietal cells & inner sporogenous cells.
- Primary Parietal Cells & Epidermal Cells divide periclinally & anticlinally many times forming nucellus
- Sporogenous cells by repeated division form MMC.
- MMC by meiosis form tetrasporic embryo sacs (out of which 1 remains functional, others degenerate)
- Finally, ♀ gametophyte is formed which is broader at micropylar end and tapering at chalazal end.

Note: In Gnetum, Normal Archegonia & Megaspore tetrad are absent.

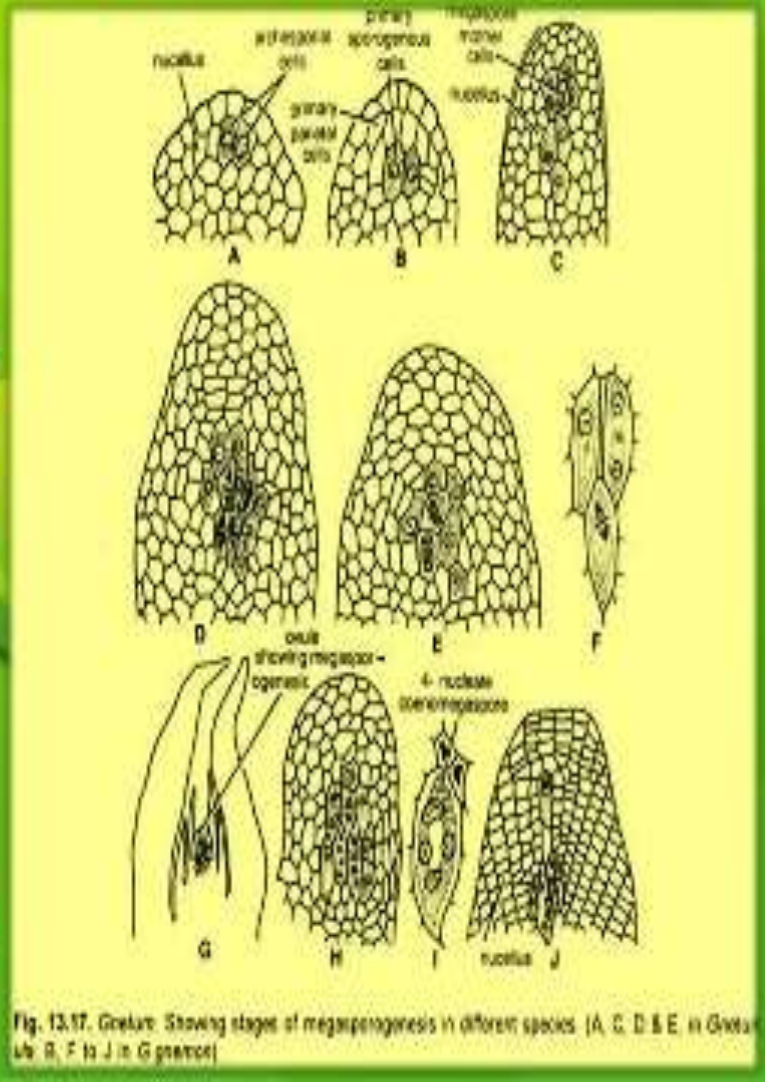


Fig. 13.17. Gnetum: Showing stages of megasporogenesis in different species. (A, C, D & E, in *Gnetum ula*; B, F to J in *G. gnemon*)

Pollination, Fertilization And Post Fertilization

- **Pollination** : Pollens pollinated by anemophily; get entangled to fluid secreted by micropylar tube thereby male gametes reach egg chamber.
- **Fertilization** : Pollen tube breaks into ovule releasing male cells. 1 cell enters egg cell. Male and Female nuclei, lie side by side for sometime, then fuse to form zygote.
- **Endosperm Formation** : In Gnetum, cellular endosperm formed after fertilization although cell formation starts after fertilization (usually in gymnosperms endosperm develop before fertilization) After fertilization, wall formation starts from base and proceeds upward such that cytoplasm divides into many compartment containing many nuclei, which fuse to form a single nucleus. The upper (B) portion usually remains free- nuclear while lower (A) portion becomes cellular having multi nucleated compartment. The vice-versa may also be possible and in some rare cases no wall formation may take place. Triple Fusion found in angiosperm) is absent

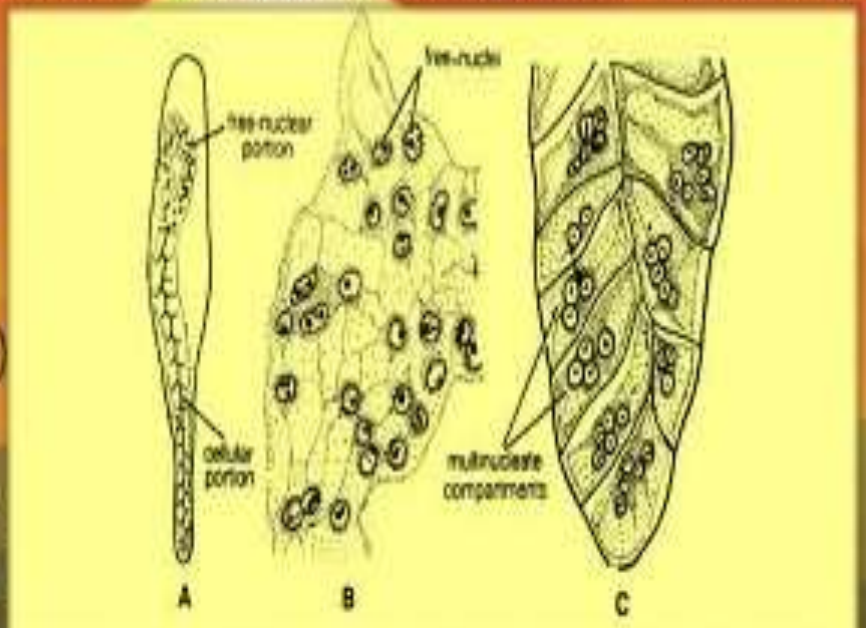


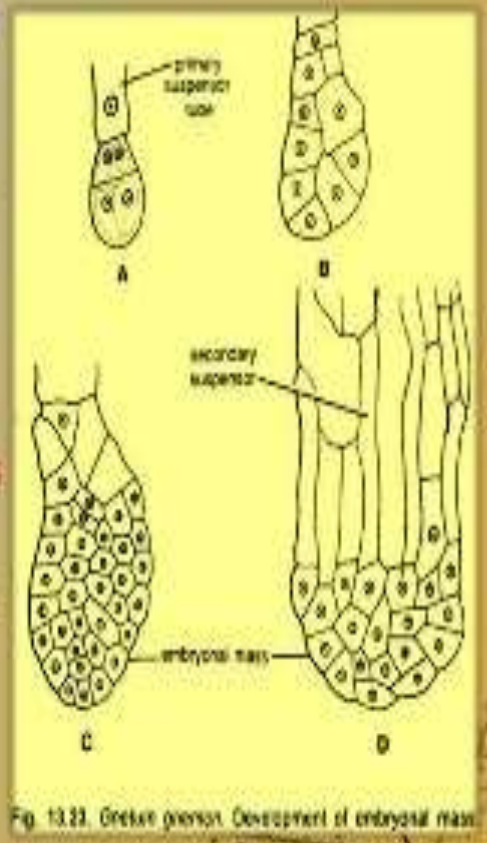
Fig. 13.21. Gnetum ula. A, Female gametophyte showing the development of endosperm; B, A part of upper portion of 'A'; C, A part of lower portion of 'A' (modified after Vasil, 1959)

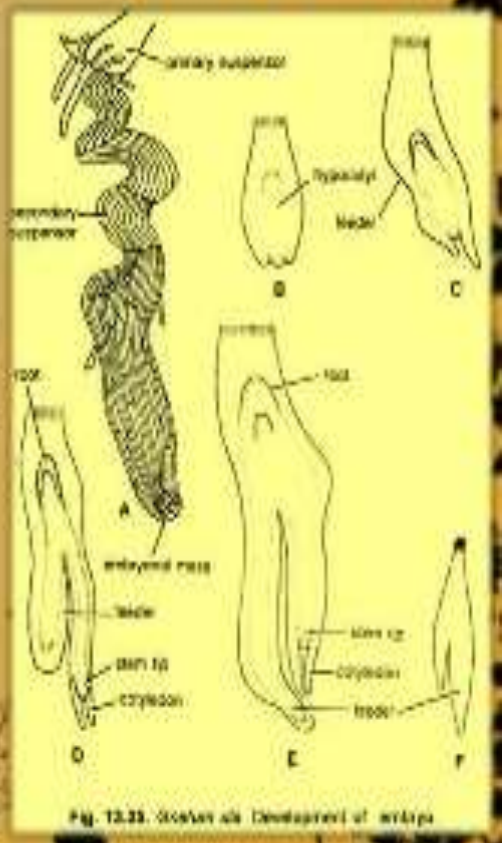
Embryo In Gnetum

- ***In Gnetum***, different species show variable embryonal development.

(Acc. to Maheshwari & Vasil, the first division of zygote in angiosperms is accompanied by wall formation while in gymnosperms (except Sequoia spp.), free nuclear division. Thus, Gnetum in this respect forms a link b/w gymnosperms and angiosperms as it shows both free nuclear division & cell division.)

- ***Acc. to Madhulata (1960)***, in G.gnemon: out of 2-4 zygotes, 1 remains functional and develops 1 or 2-3 small tubular outgrowths, out of which only 1 receives nucleus while other disintegrates. The surviving outgrowths or PST primary suspensor tubes coil around each other. A small cell cuts off at the tip of PST, divides 1st transversely & then longitudinally giving 4 cells which divide to form cell mass. Some of it's cells elongate/divide to form SST or Secondary Suspensor Tube while other cells form EM i.e. Embryonal Mass. The Primary and Secondary Suspensor helps in pushing embryo to endosperm. At the end of pushing, stem tip with 2 lateral cotyledons is formed at tip of EM while root tip with root cap is formed at opp. side; thereafter feeder develops b/w the root & shoot portion such that the resultant Mature Embryo consists of stem tip, cotyledons, root tip & root cap in respective sequence.





Germination Of Seed In Gnetum

- Seeds in Gnetum i) Oval shaped, green to red in colour
  - ii) Surrounded by 3-layered envelope enclosing Embryo & Endosperm:
    - # Inner Envelope Parenchymatous
    - # Middle Envelope Hard Protective
    - # Outer Envelope Fleshy, parenchymatous coloured
- Seed Germination i) Epigeal Type
  - ii) Hypocotyl elongates bringing cotyledons out of soil
  - iii) First pair of foliage leaves produced by developing plumule

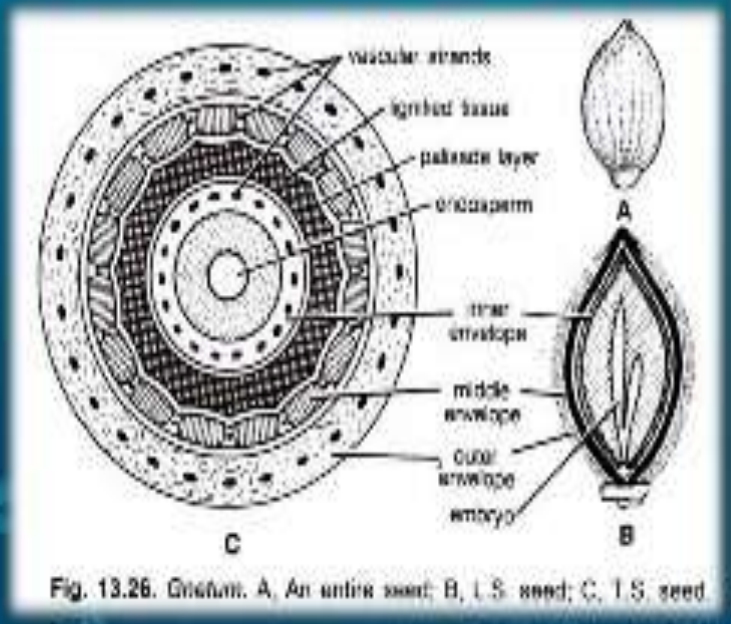


Fig. 13.26. Gnetum. A, An entire seed; B, L.S. seed; C, T.S. seed

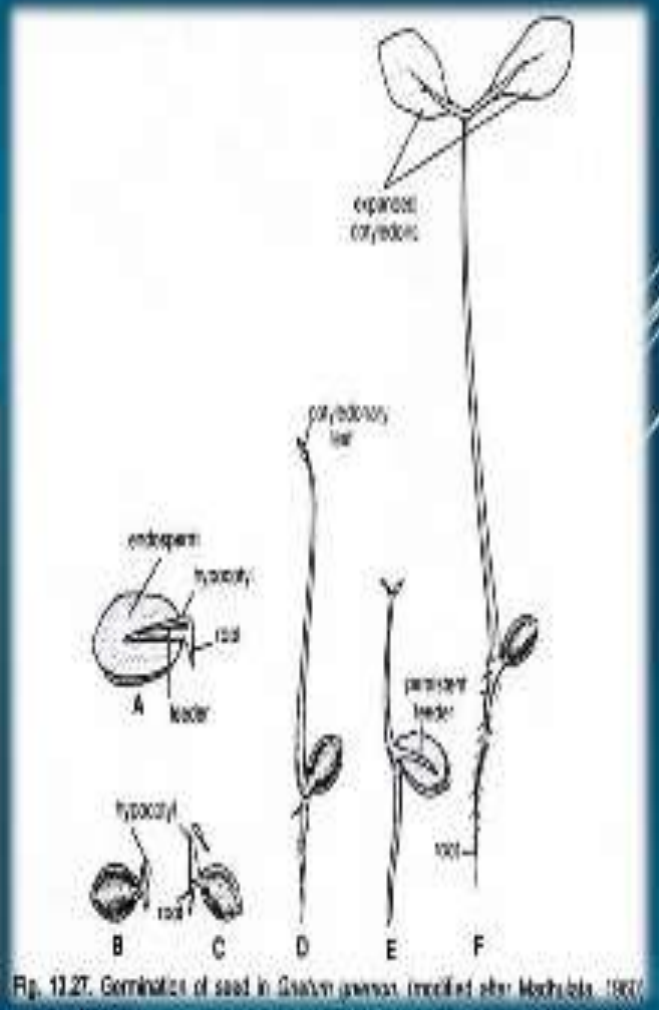


Fig. 13.27. Germination of seed in Gnetum gnemon (modified after Maheshwari, 1963)

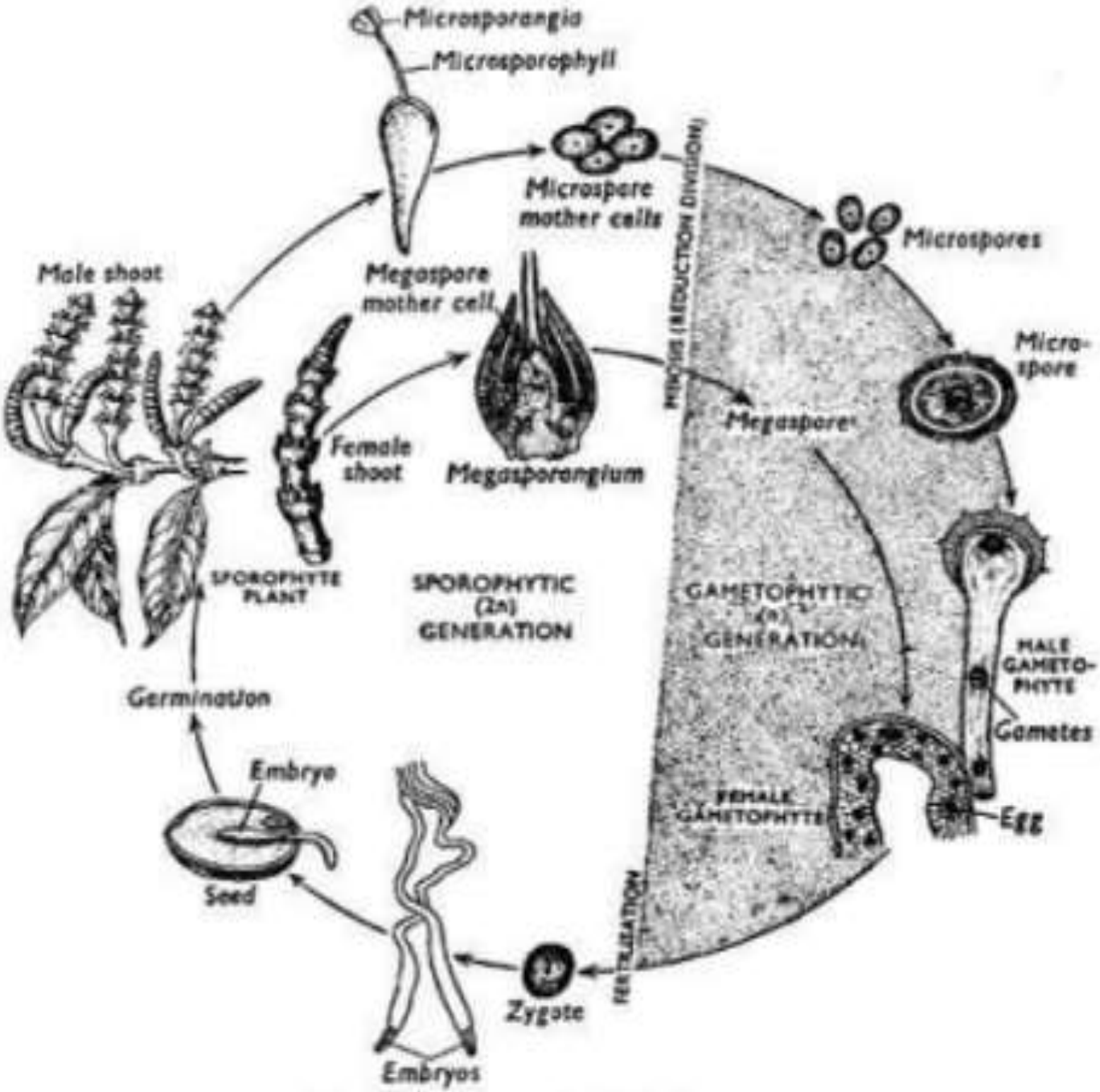


Fig. 1.82 : Life cycle of *Gnetum*