



Bhagalpur National College, Bhagalpur

(A Constituent unit of Tilka Manjhi Bhagalpur University, Bhagalpur)

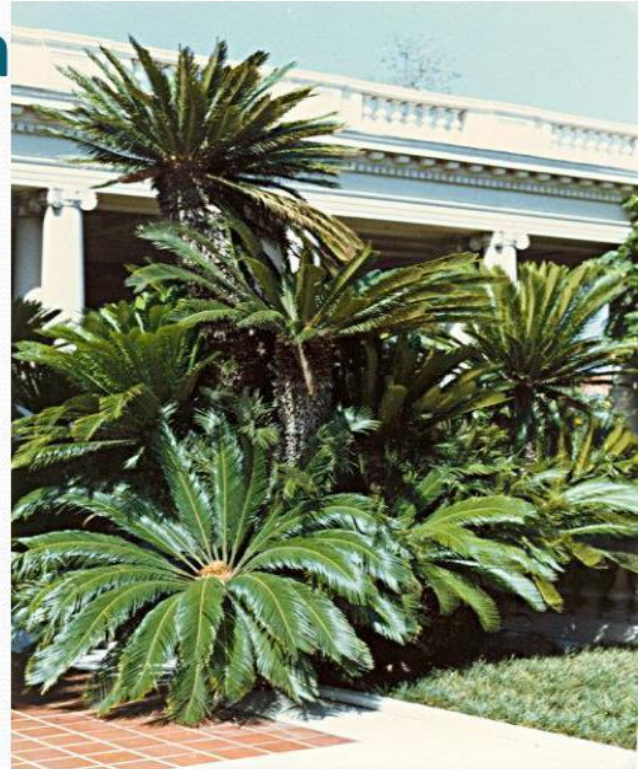
PPT Presentation for B.Sc. I- CYCAS: Structure, Reproduction and Life cycle



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Systematic Position

- GYMNOSPERMAE
 - Division: CYCADOPHYTA
 - Class: CYCADOPSIDA
 - Order: CYCADALES
 - Family: CYCADACEAE
 - Genus: CYCAS
- (Greek word Kycas = Cocopalm)



Distribution and Occurrence

- It includes 20 species.
- Occurs wild or cultivated in tropical and sub-tropical regions.
- South of Eastern Hemisphere • e.g. S. Japan, India, China, N. Australia, E. Coasts of Africa, Myanmar, Bangladesh, Mauritius, Nepal, etc.
- It is evergreen plant in India represented with 6 species- *Cycas revoluta*, *C. pectinata*, *C. siamensis*, *C. beddomei*, *C. rumphi* and *C. circinalis*.
- The plants grow in xerophytic conditions.
- It is cultivated as ornamental plant in the garden.
- *Cycas* is called a living fossil.



***Cycas revoluta* (sago palm)**



***Cycas rumphi* (false sago)**



***Cycas circinalis* (queen sago)**



Cycas siamensis



Cycas pectinata



Cycas beddomei

Morphology

- Sporophyte is **dioecious** i.e. male and female plants are separate.
- Plant body is differentiated into **roots, stem and leaves**.

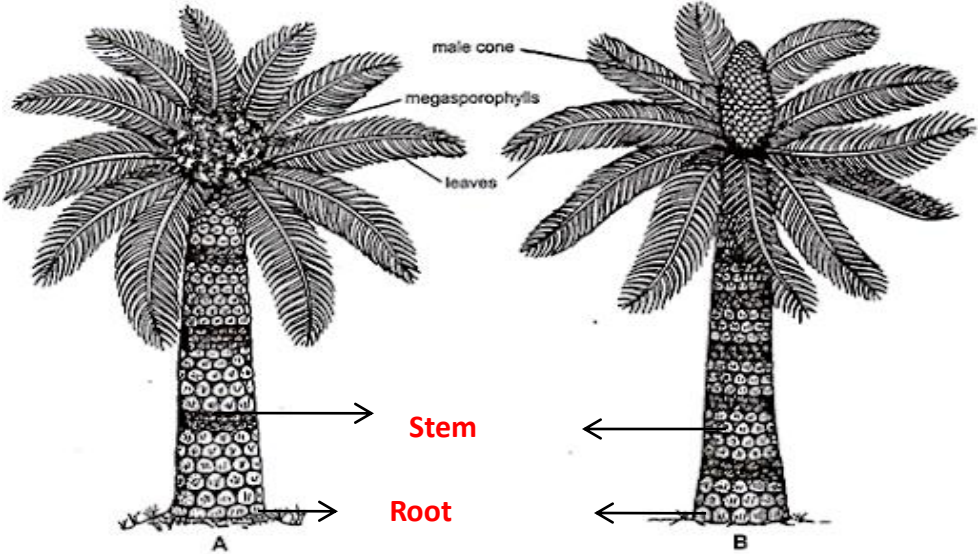
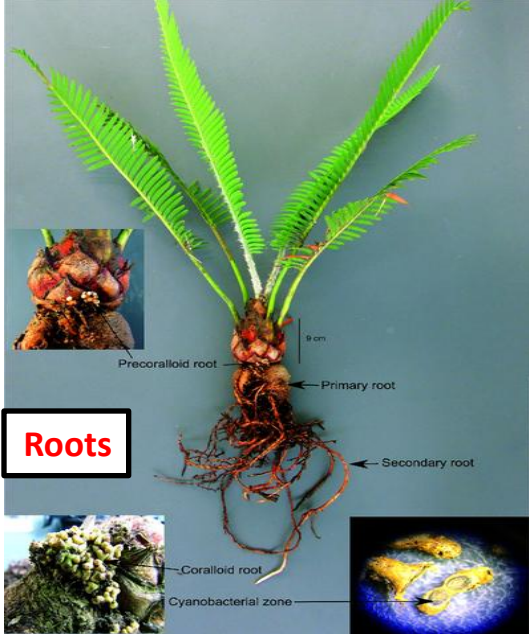
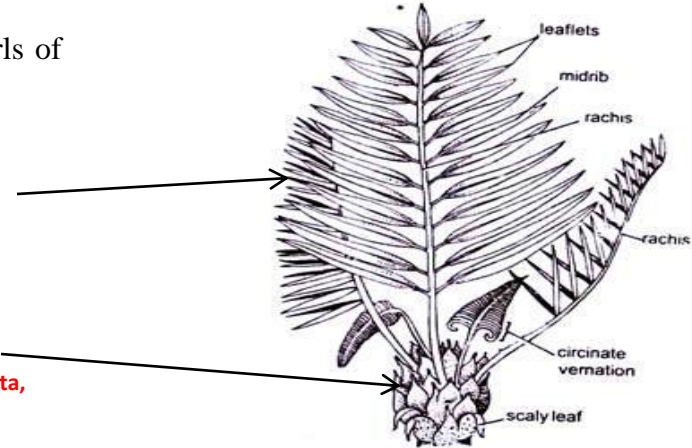
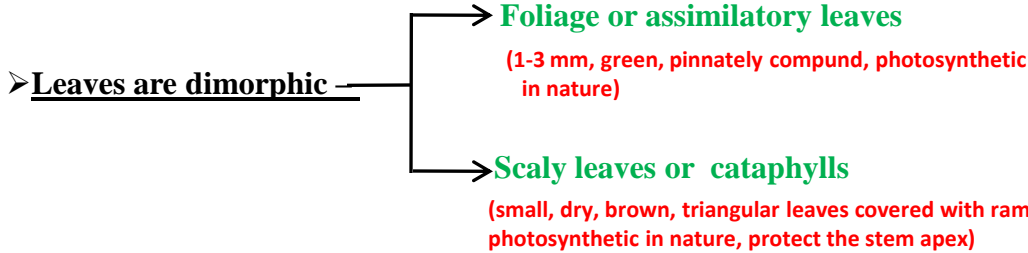


Fig. 1 (A, B), Cycas. External morphology (A) female plant of *C. Circinalis*, (B) Male plant of *C. Circinalis*.



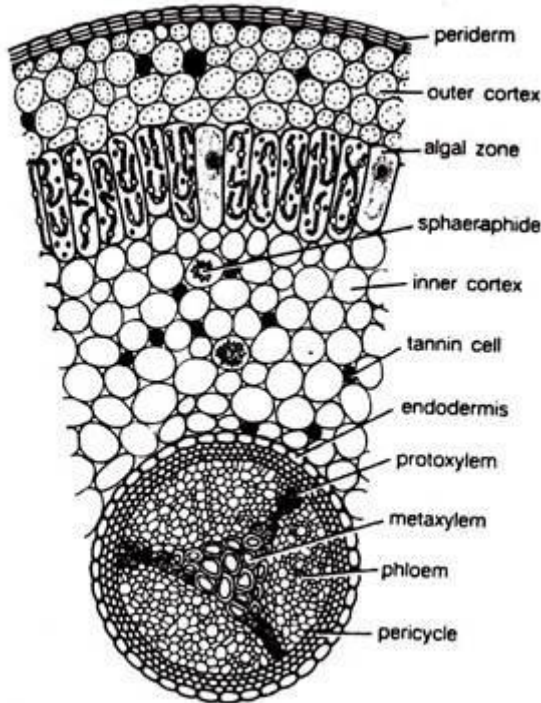
- Roots are of two types – **normal root and coralloid roots**.
- Root hairs and rot cap are absent.
- **Normal roots** helps in absorption and anchorage.
- **Coralloid roots** helps in nitrogen fixation.

➤ Stem is erect, columnar, woody and unbranched, covered with alternate whorls of leaf bases of foliage and scaly leaves.



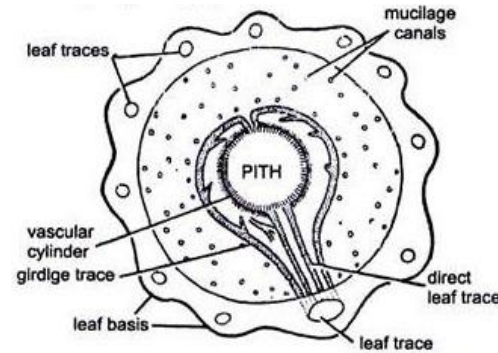
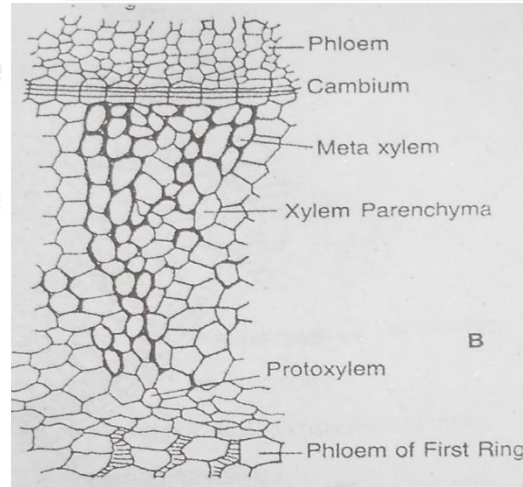
Cycas leaf

Internal structure

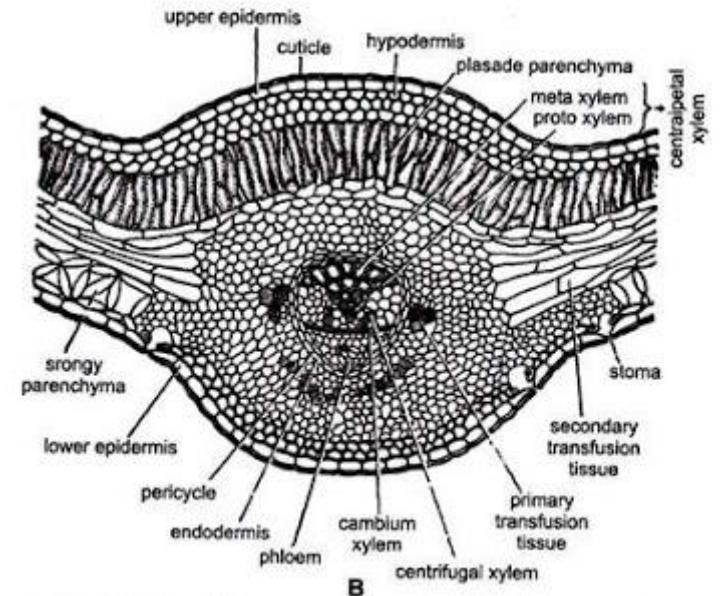
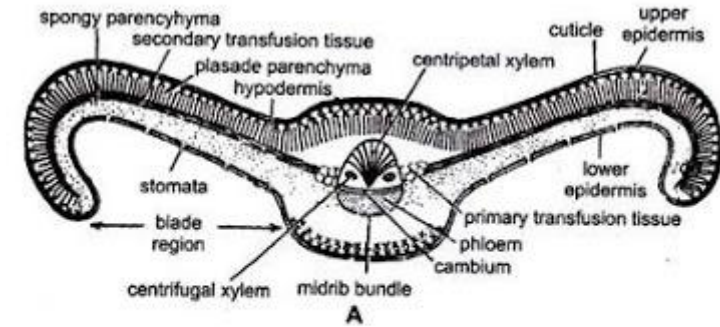


T. S of coralloid roots

1. It is circular in outline and the outermost layer is epiblema. But at maturity cork as well as cork cambium develops. Root hairs are normally absent.
2. Cortex is parenchymatous and divisible into outer cortex and inner cortex having a middle algal zone.
3. Secondary growth is very rare and absent.
4. Vascular bundles are rare. Xylem is triarch and exarch.



1. Epidermis forms the outermost layer, followed by large cortex containing numerous mucilaginous ducts and leaf traces.
2. Vascular bundle is open, collateral and endarch.
3. Vascular bundles lie in a ring separated by medullary rays.
4. Secondary growth takes place in old stems.



T. S of leaflet

1. Presence of cutinized epidermis in upper and lower region indicate xerophytic character.
2. Mesophyll is differentiated into upper palisade layer and lower spongy layer.
3. In between these layers, transfusion tissue is present. They play role in lateral conduction.
4. Vascular bundle are surrounded by pericycle and endodermis.

Reproduction in Cycas

Sexual

Strictly dioecious plant

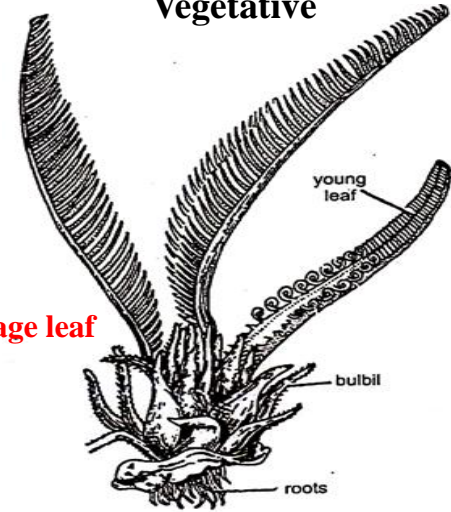
Vegetative



Male plant

* Female cone is absent in Cycas

Female plant

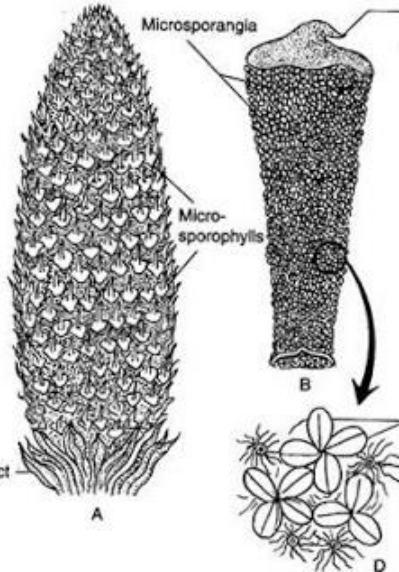


Male cone – borne singly at the apex of trunk (reproductive organ)

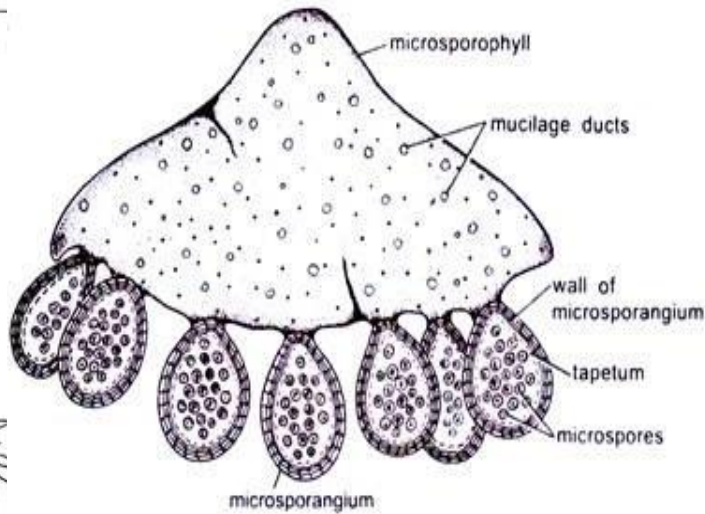
Megasporophyll – resemble foliage leaf (reproductive organ)

Bulbil

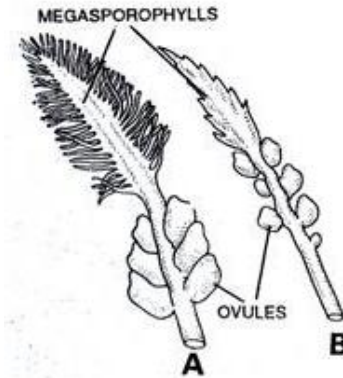
New plant



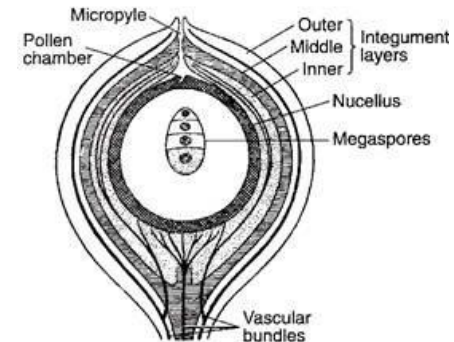
A. Adaxial surface view of microsporophyll



B. T.S of microsporophyll of Cycas

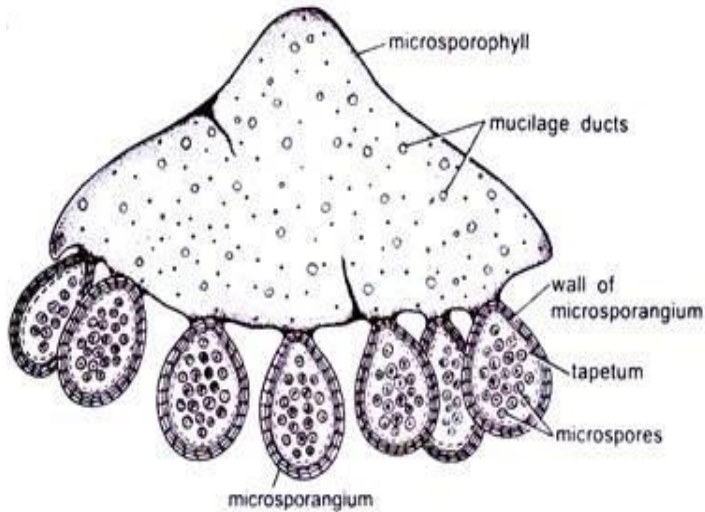


10-23 cm long

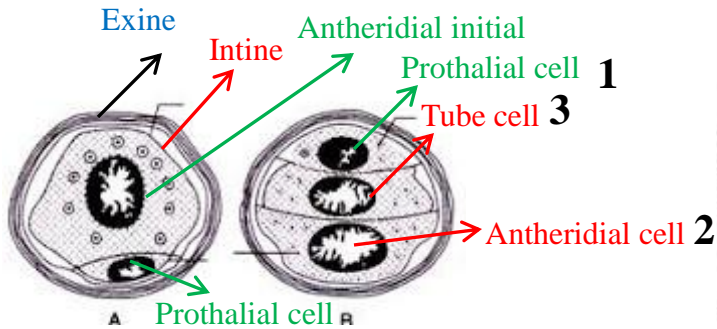


New plant

Microsporogenesis (Development of microspore / pollen grains)



- Development of sporangia is eusporangiate type.
- Microsporangia is multilayered structured layer with a thickened epidermis and a ill-defined tapetum enclosing numerous microspore (pollen) mother cells.
- The microspore undergoes meitic division to form **four microspores** or **pollen grains**.
- Each pollen grain represents as the **male gametophyte** which is bounded by two concen-tric wall layers; the outer thick **exine** and the inner thin **intine**. In side the layer, there is larger **antheridial initial** and smaller **prothailial cell**.
- This pollen during germination, the prothailial cell does not divide but antheridial initial divide to form **antheridial cell** and **tube cell**.
- The pollen grains are released further from the microsporangium at 3-celled stage (prothailial cell, antheridial cell and tube cell).



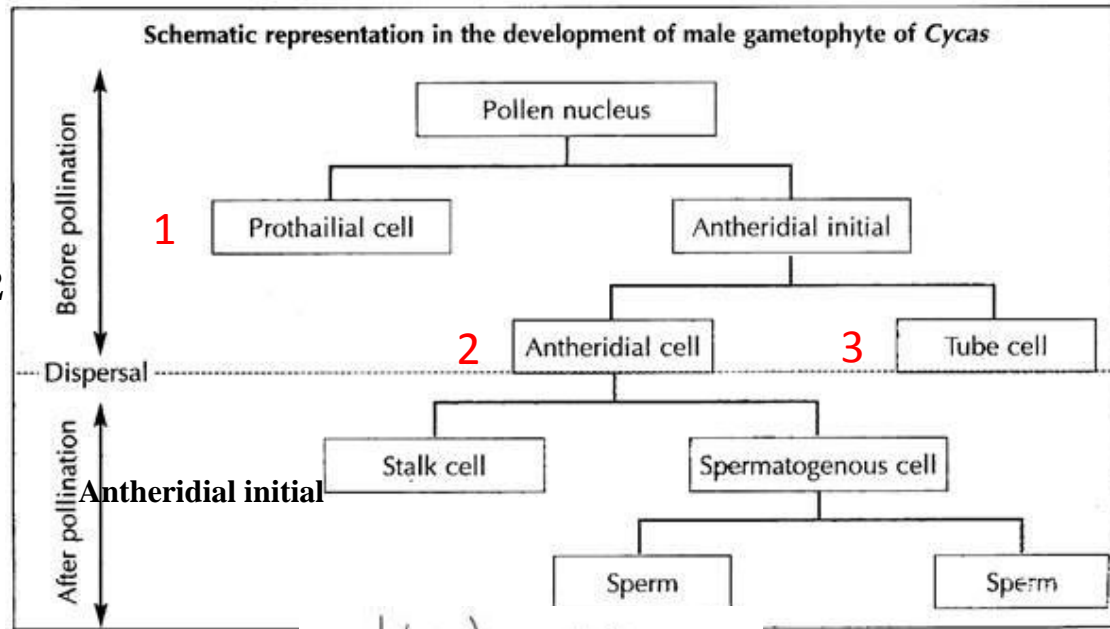
Matured gametophyte



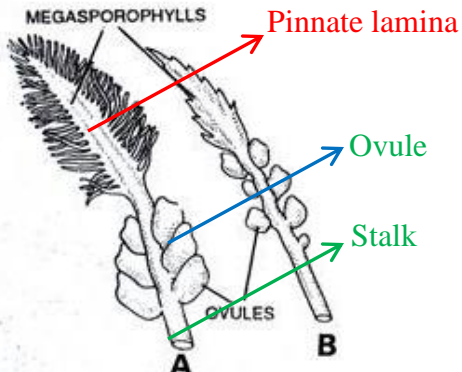
Released from sprorangium and set on ovule through wind for pollination



Ready for pollination



Megasporogenesis (Development of megaspore)



Structure of Megasporophyll

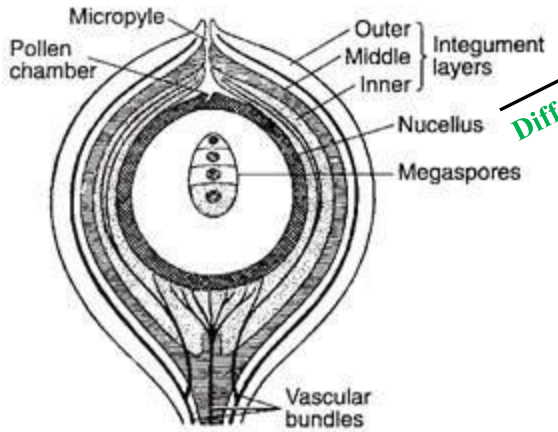
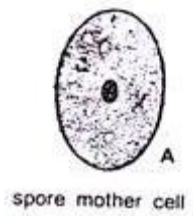
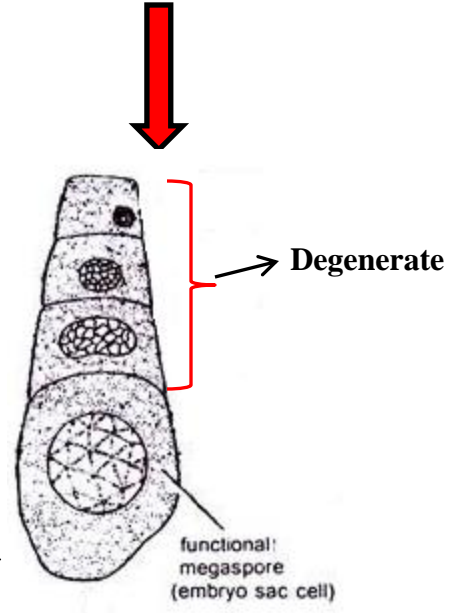


Fig. 1.19 : Vertical median section of Cycas ovule

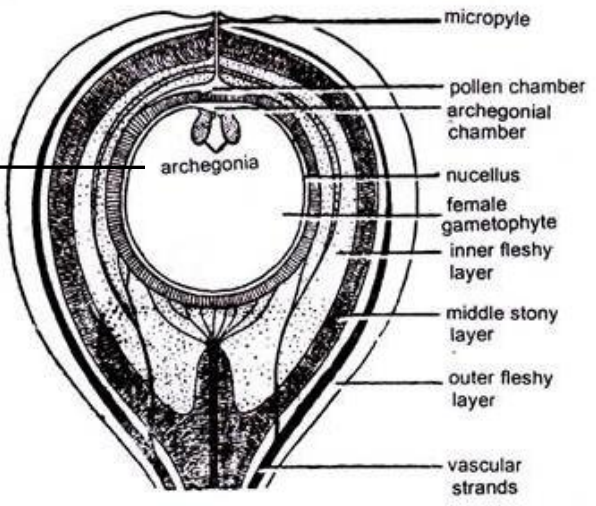
Differentiated into



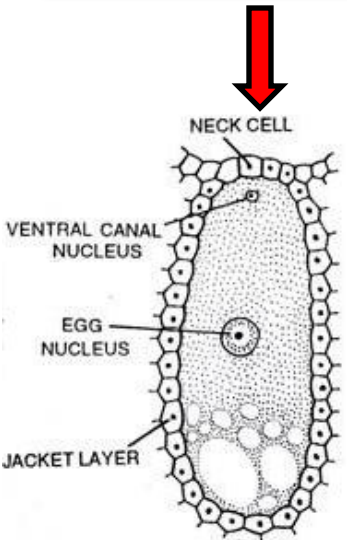
spore mother cell



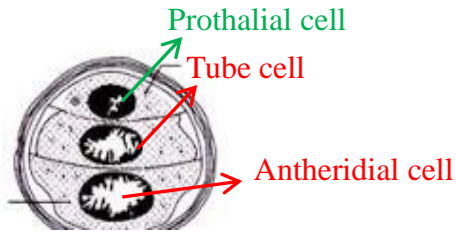
Develops into matured Archegonia



Matured gametophyte (Endosperm)



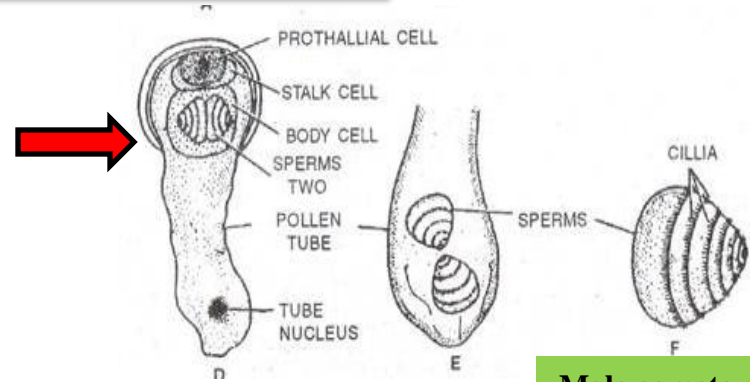
Pollination and Fertilization



Matured gametophyte

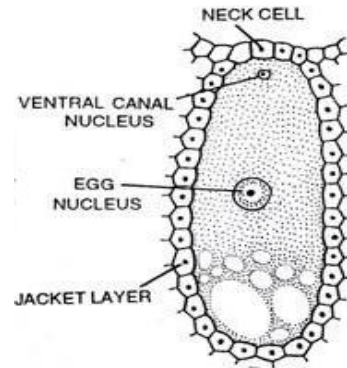
Moved to pollen chamber of ovule through air and transformed into body cell, stalk cell and two sperms.

Wind pollination



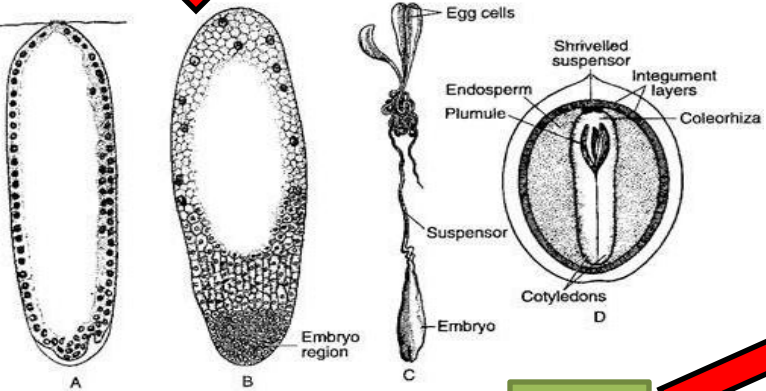
Male gamete of Cycas

EMBRYO ← Numerous divisions ← **ZYGOTE**



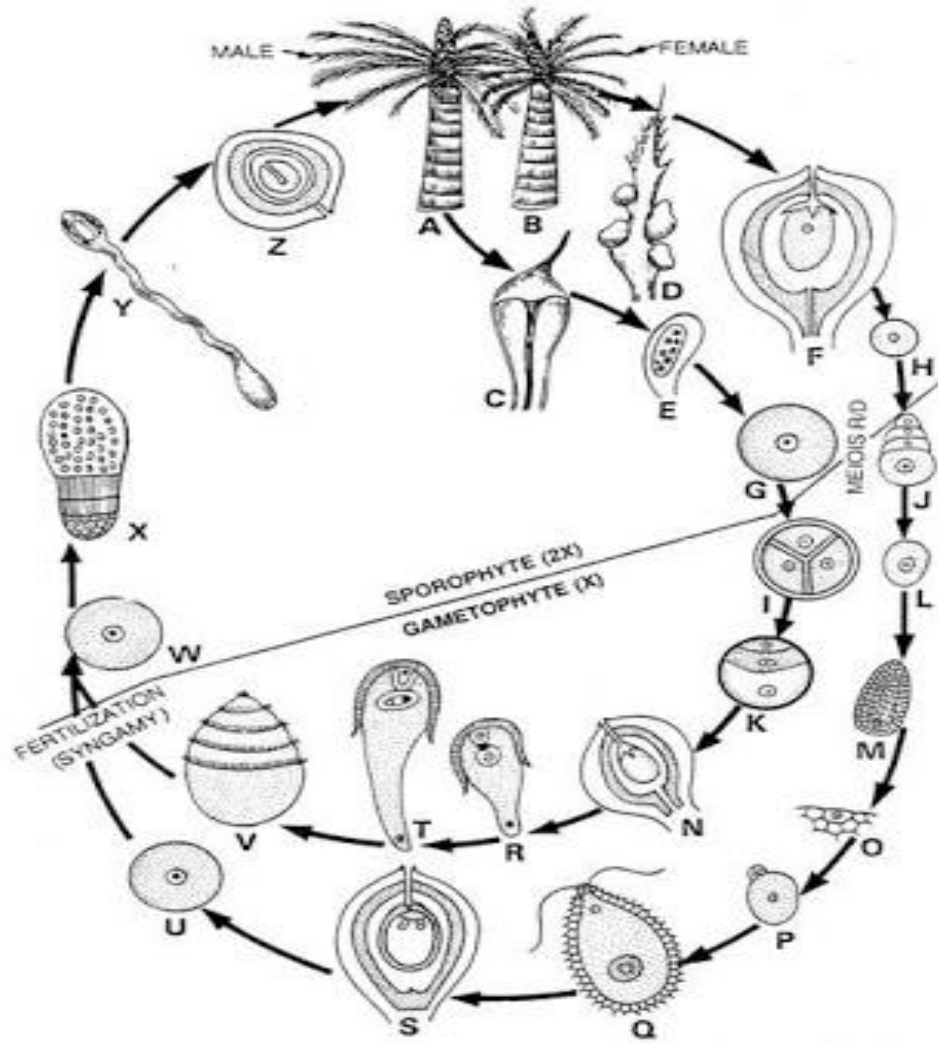
FERTILIZATION

NEW SPOROPHYTIC CYCAS PLANT



SEED

Alternation of generation in Cycas



Economic importance of Cycas

- Cycas is used as a source of food in Japan, Australia, South East Asia, southern and eastern parts of India and some other countries. It is used in the preparation of starch and alcoholic drinks. The starch, extracted from its stem, is called 'sago'.
- The juice obtained from young leaves of *Cycas circinalis* is used in skin diseases, vomiting of blood and stomach disorders.
- The decoction of young red seeds of *C. circinalis* is used as a purgative and emetic.
- To relieve the headache, giddiness and sore throat, the seeds of *Cycas revoluta* are prepared in the form of a tincture and used.
- In Japan, seeds and stem of *Cycas revoluta* are used for preparing wine.
- *Cycas revoluta* and *C. circinalis* plants are grown for ornamental purposes in various parts of the world.
- The wood of *Cycas revoluta* is used for preparing small boxes and dishes.
- Cycas leaves, being very large, are used for preparing baskets, mats, etc.
- *Cycas circinalis* seeds are used in Democratic Kampuchea as a fish-poison.