CYCAS

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Classification :-

Division :- Cycadophyta
Class - Cycadopsida
Order - Cycadales
Family - Cycadaceae
Genus - Cycas

Occurrence :-

The genus Cycas includes about 20 species distributed wildly or cultivated in tropical and subtropical regions of the world. They mostly occur in the Eastern Hemishere, particular in the southern part of Japan, India, China, Australia, Eastern coasts of Africa and Islands of Indian and Pacific oceans.

Some species of Cycas in India :-

- Cycas circinalis :- It grow wild in forests of western Ghats of South India and hills of Orissa.
- Cycas Pectinata :- Plants grow wild in Sikkim, Someshwar hills of Bihar, plains of Assam, Manipur.
- Cycas Rumphii :- This species grows wildly in Andaman, Nicobar.

The Plant Body

External Features:-

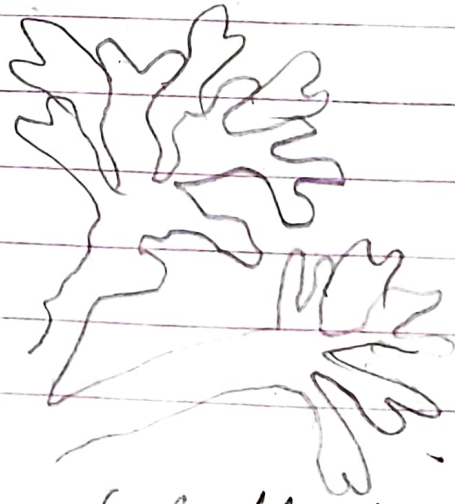
- The Cycas plants are evergreen slow-growing small trees.
- They are differentiated into root, stem and leaves.
- The average height of plants is 3 to 5 metres.
- They are long lived and can live up to 100 years.
- They grow wildly in xerophytic habitats.

The external features of root, stem and leaves are as follows:—

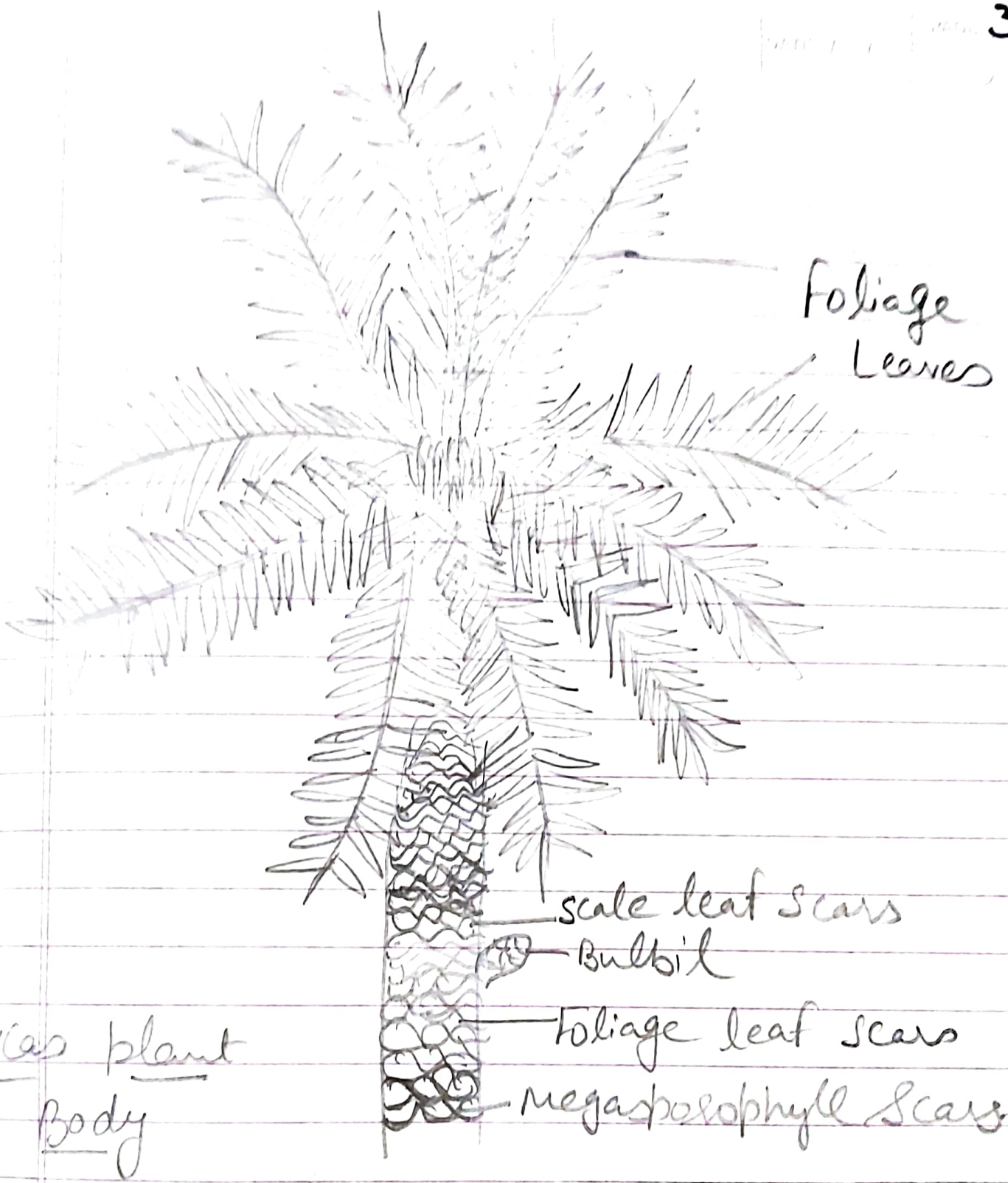
1.) **Root:-** There are two types of roots in Cycas:- (i) Normal tap roots and (ii) Coralloid roots.

(i) **Normal Roots:-** The primary root that originates from radicle is called normal tap root. It grows into the soil and develops lateral branches. The main normal tap root is thick and short but its lateral branches are thin and long.

Normal Tap root



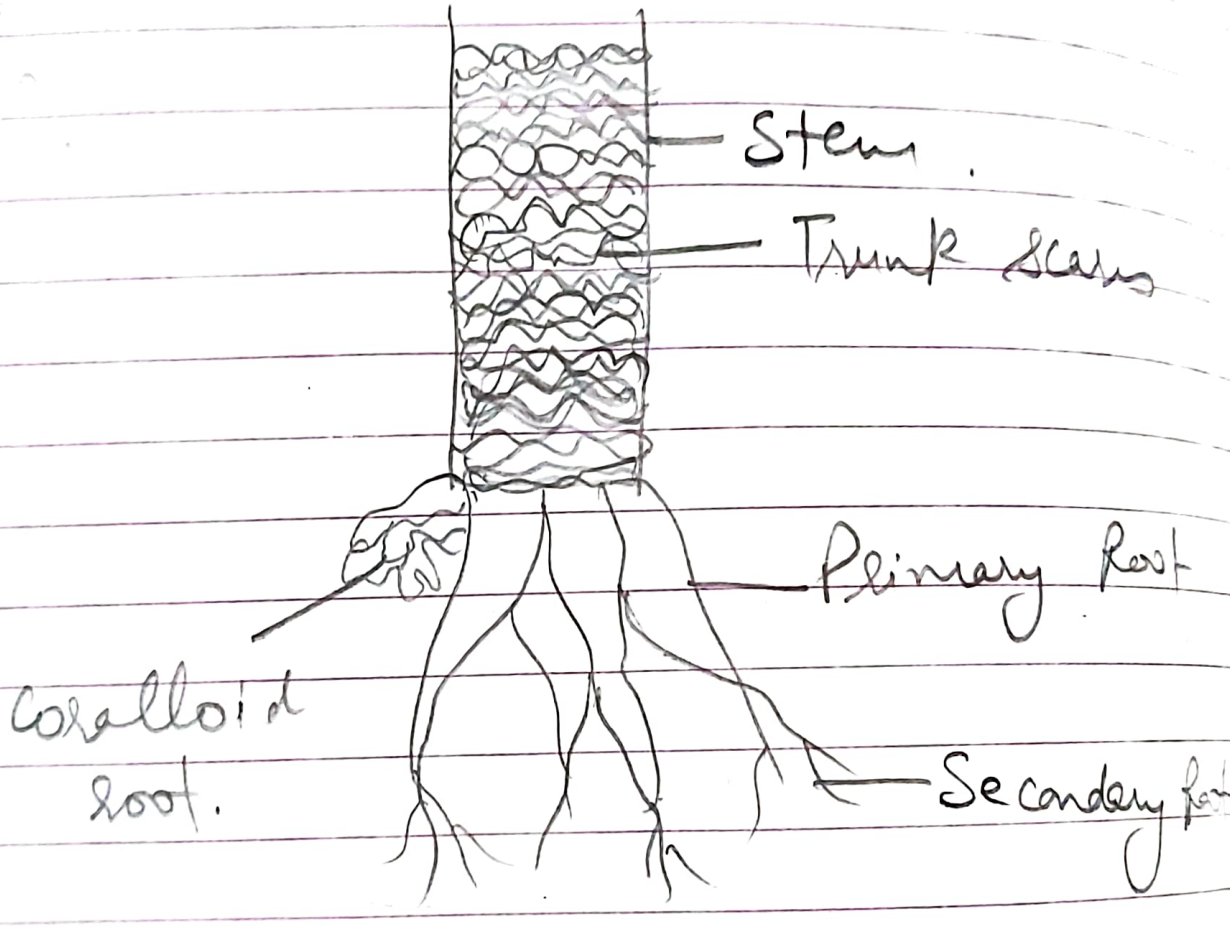
Coralloid root



Cycas plant Body

(ii) Coralloid Roots :- Some of the lateral branches of roots grow apogeobtropically towards the surface of soil. They get repeatedly dichotomously branched and become coral like in appearance. They donot bear root caps.

The cluster of these branches soon becomes greenish brown in colour due to entry of blue-green algae.



Cycas Stem with Normal Root and Coralloid Root.

2.) Stem :-

- The stem of young plan is short, tuberous.
- Later on, when the plant matures, the stem becomes woody, erect, stout, columnar and arborescent (bear a crown of leaves).
- The stem usually remains unbranched but occassionally small branches may be produced.
- The branching, if occurs, is sympodial in male plants and monopodial in female plants.
- Sometimes, branching may occur due to injury.
- The entire surface of stem is covered with hard armour of leaf bases.

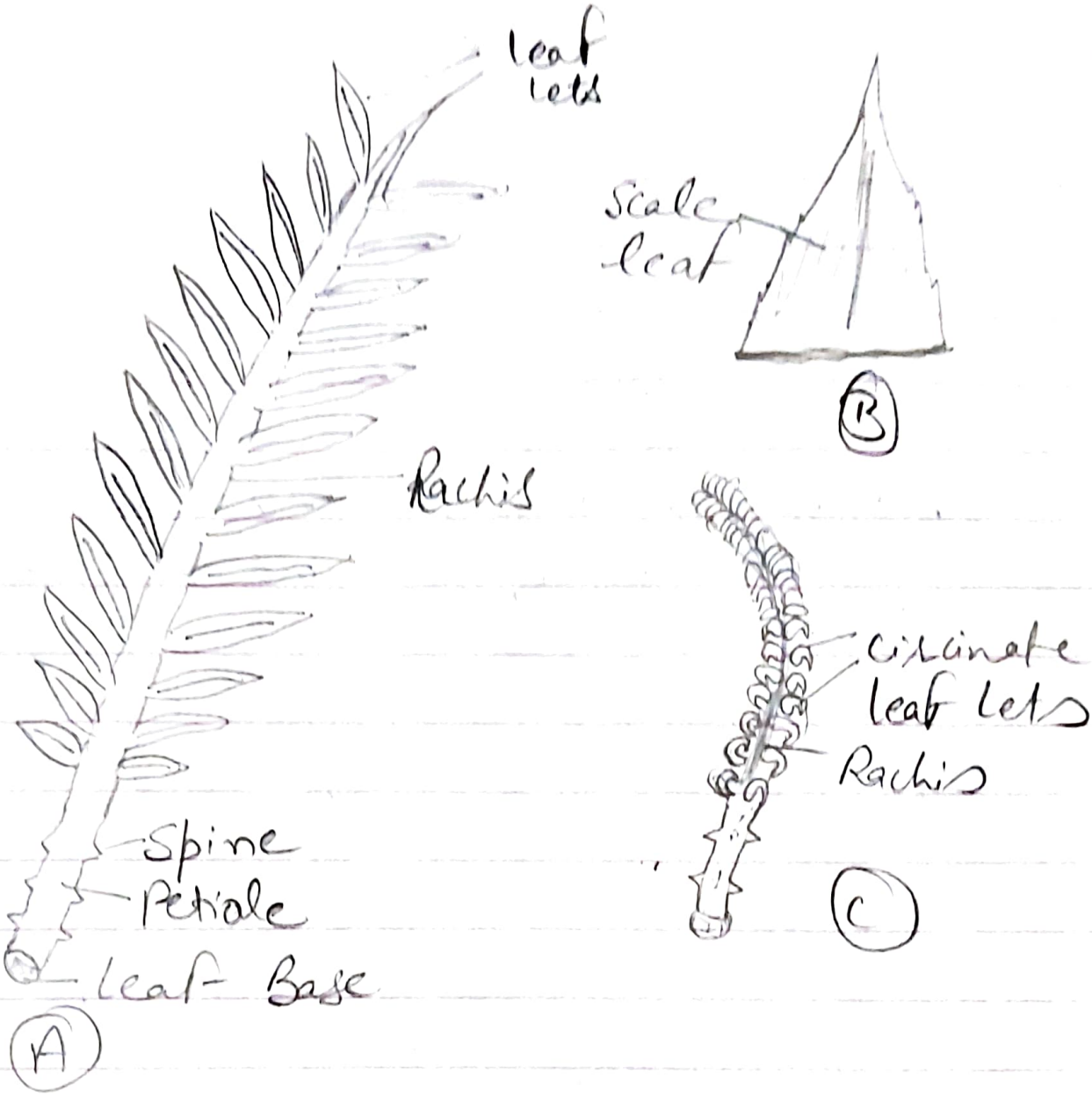
Stem of cycas plant.

3). Leaves :- The stem bears, at its apex, a crown of spirally arranged leaves.
The leaves are dimorphic (of two types):-

a.) foliage leaves.
b.) Scale leaves.

a.) Foliage leaves :-
- The foliage leaves are very large and measure about 1-3 metres in size.
- The are pinnately compound.
- In young condition, the foliage leaves are circinately coiled.
- Each leaf of cycas consists of three parts — leaf base, rachis and leaflets.
- The leaflets are thick and leathery in texture, elongate or ovate in shape and photosynthetic in function.

b) Scale leaves. - -The scale leaves are comparatively very small, rough and dry.
- They are triangular in shape and brown in colour.
- The scale leaves arise in close spirals around the stem.
- The main function of scale leaves is to provide protection to the growing apex.



Cycas revaluta :- A. Foliage leaf
B. Scale leaf
C. Young foliage leaf.

Life Cycle (Reproduction)

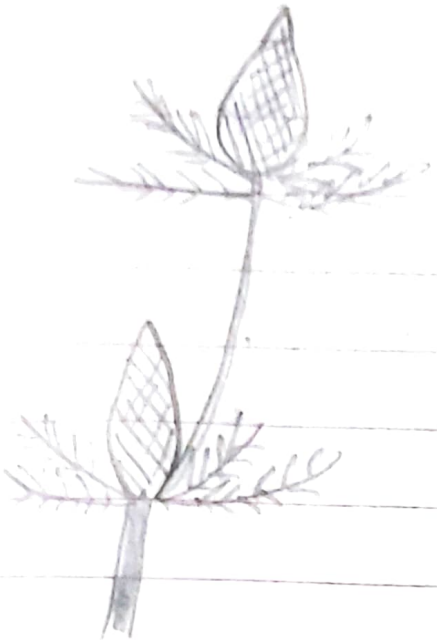
1. Vegetative reproduction:- The most common vegetative reproduction in Cycas occurs by the formation of adventitious buds, called bulbils. They are produced all over the stem, usually in the lower basal part of stem.

2) Sexual Reproduction:-

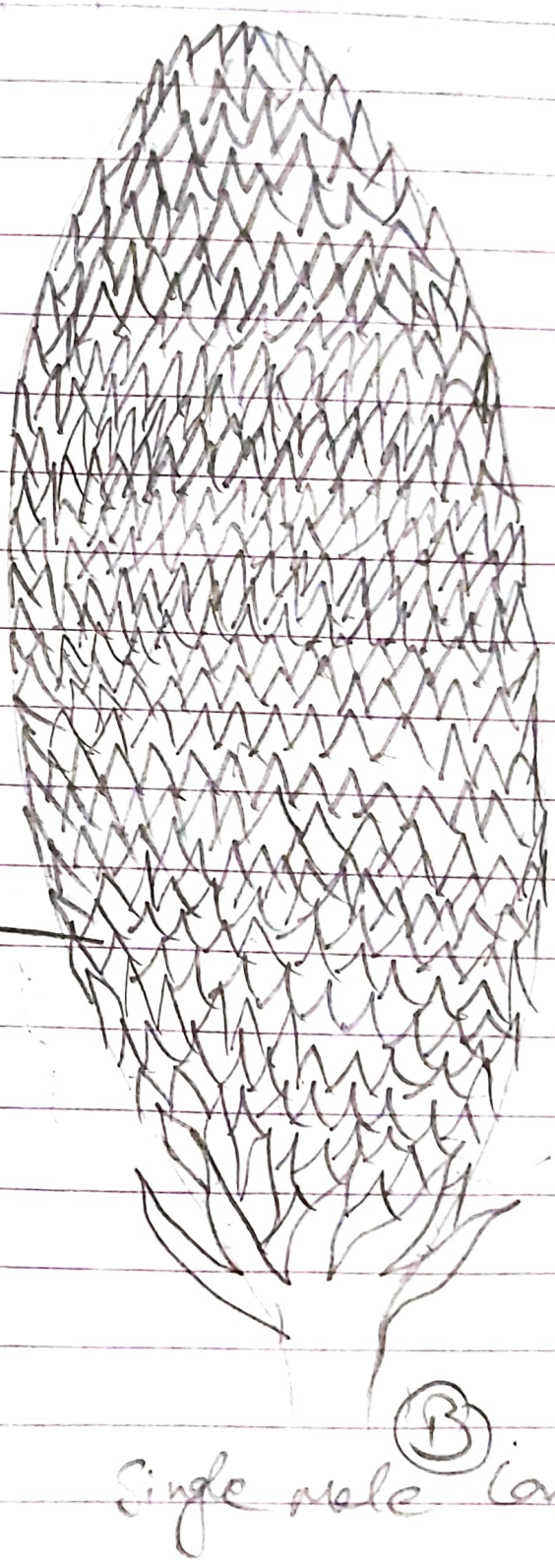
The plants of Cycas are heterosporous (i.e. produce two kinds of spores the male microspores and the female megaspores) and are strictly dioecious (i.e. the male and female spores are produced on separate plants).

Male Cone:-

- The male cone of Cycas develops singly at the apex of male plants.
- It is terminal in position.
- The male cone is shortly stalked, large, compact and oval in shape.
- It measures about 20-60 cm in length.
- It bears numerous microsporophylls arranged spirally on a central axis in acropetal succession i.e. youngest at the top and oldest at the base.



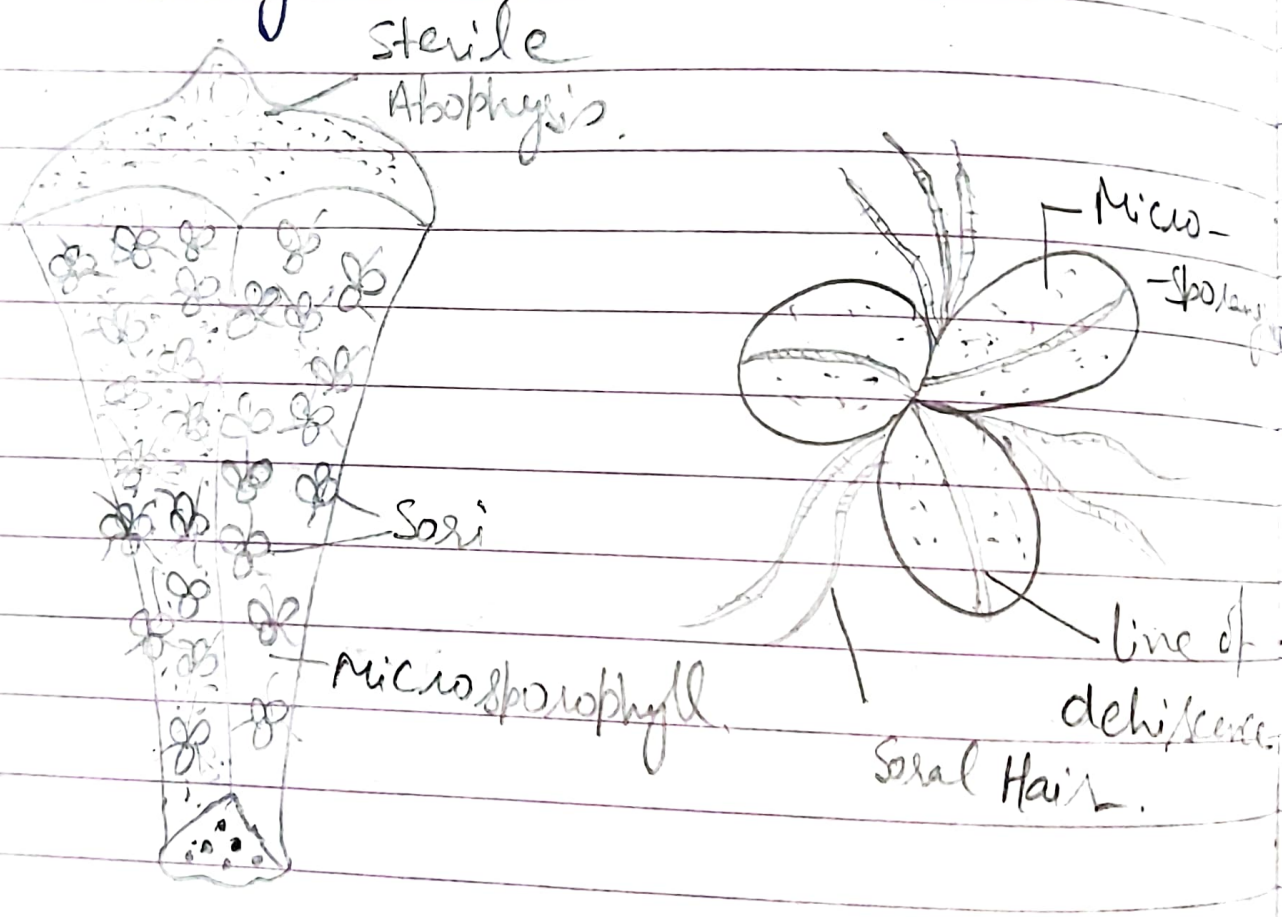
(A) Diagram showing male cones



(B) Single male cone

Microsporophylls:-

- The microsporophylls, present at the base and apex of cone, remain sterile whereas those present in the middle are long and fertile.
- Young microsporophylls are soft and fleshy but as they mature they become hard and woody.

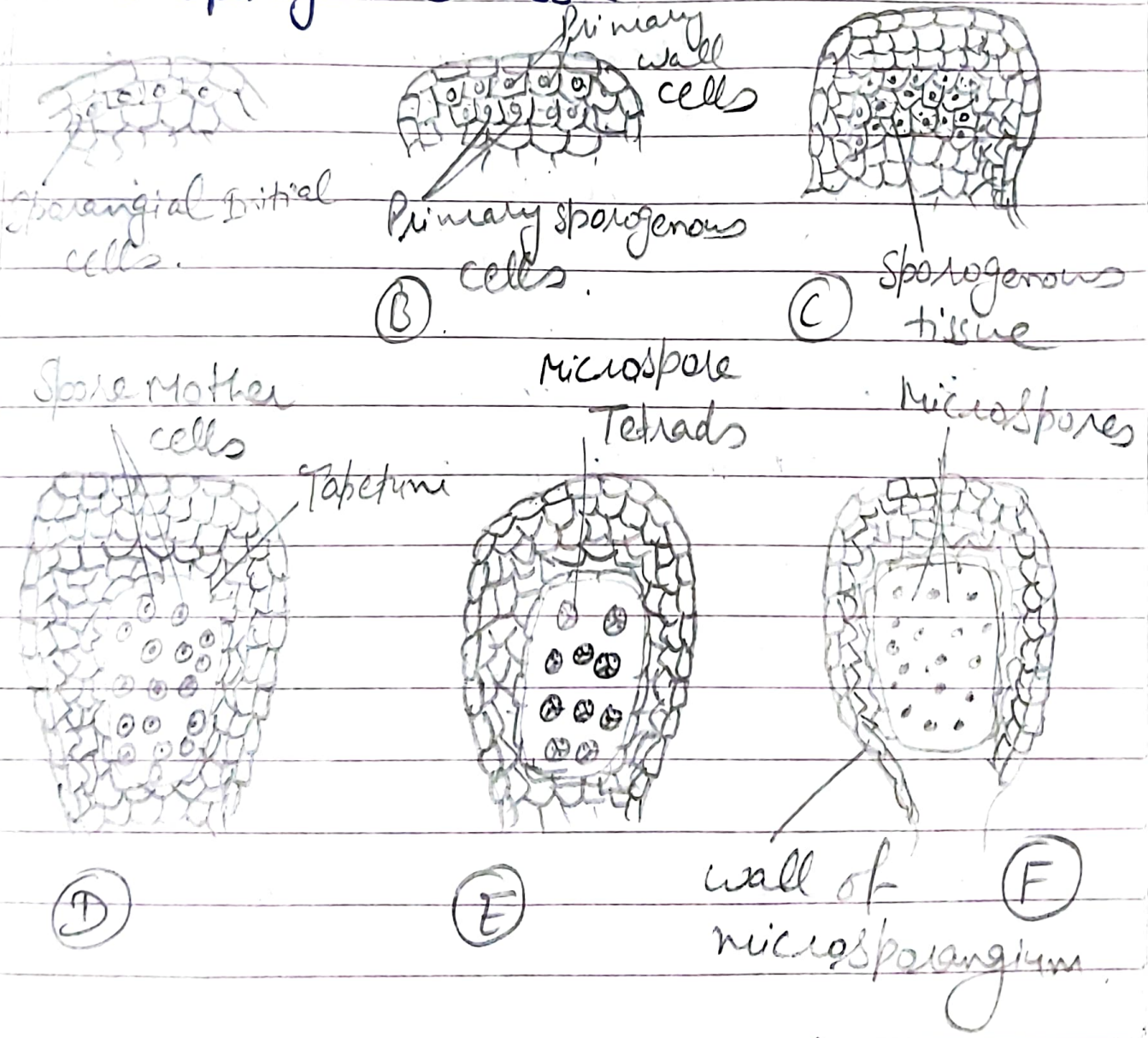


A. Microsporophyll with Sori

B. Sori Enlarged.

Development of microsporangium :—

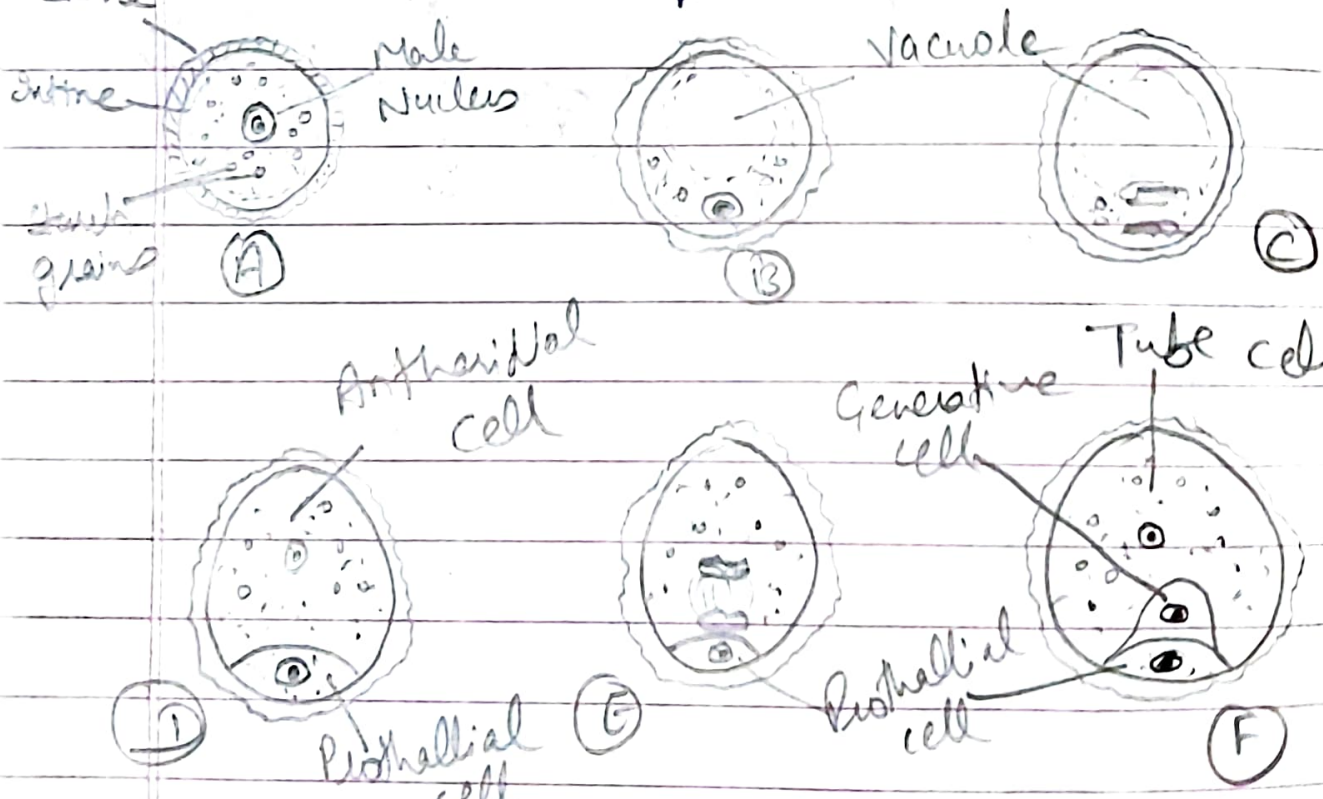
- Microsporangium develops from a group of hypodermal initial cells (archesporium).
- The archesporium cells divide by periclinal division to form outer primary wall cells and inner sporogenous tissue.



A-F :- Stages in the development of microsporangium.

Development of Male Gametophyte:- (Before Pollinating)

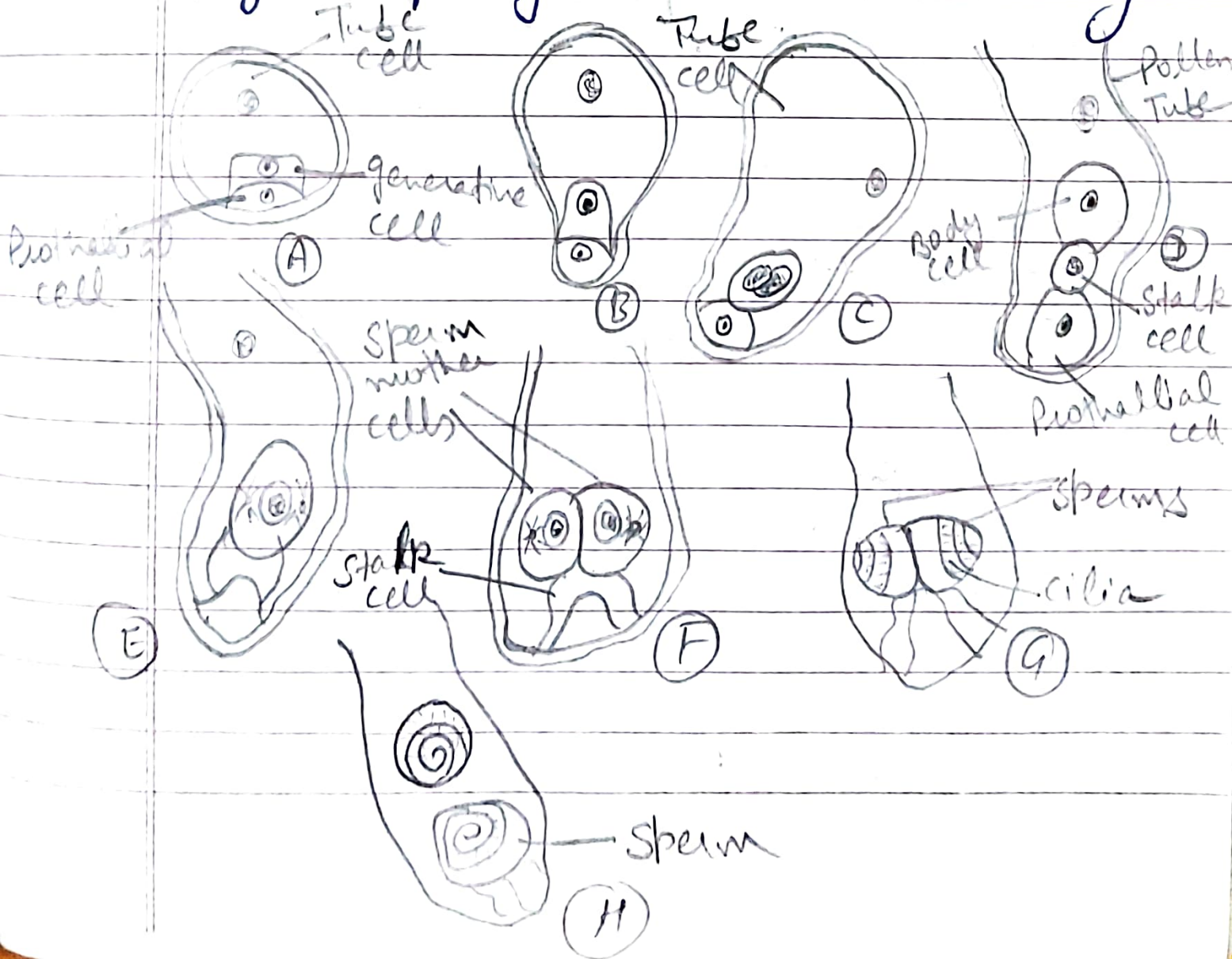
- The microspore starts dividing when it becomes about three weeks old. The nucleus divides mitotically into two daughter nuclei.
- The cell wall is laid down between the two daughter nuclei cutting a small lenticular prothallial cell towards the proximal end and a large antheridial cell.
- The large antheridial cell divides by transverse division forming a small generative cell and a large tube cell.
- The generative cell has small nucleus and lies in close contact with prothallial cell.



Stages of development of male gametophyte before Pollination

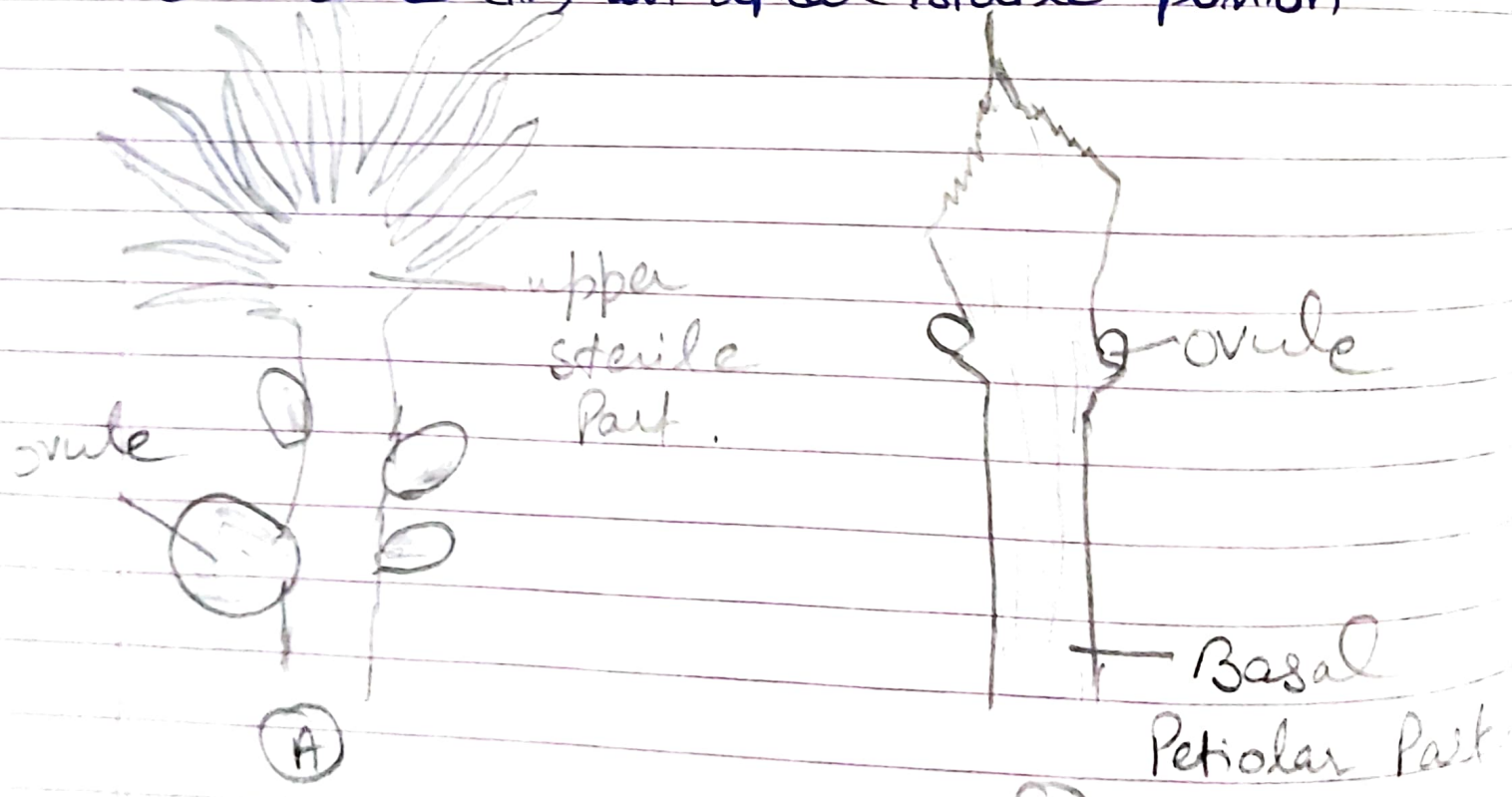
Development of Male gametophyte after pollination-

- The pollen grain absorbs water and swells. It results elongation of tube cell so that the intine grows out of exine and forms a pollen tube.
The tube nucleus migrates into the pollen tube.
- The generative cell divides to form a stalk cell and a spermatogenous cell.
- Just before fertilization, the body cell divides into two sperm mother cells each with a nucleus.
They are spirally coiled which have so many cilia.



⇒ Female Cone or Megasporophylls :-

- The Cycas plants do not produce definite female cones.
- The megasporophylls are loosely arranged in close spirals around the apex of columnar trunk resembling the foliage leaves.
- They are collectively termed as female strobilus.
- It is differentiated into three parts— (i) narrow, petiolar portion (ii) middle portion which bears ovules (iii) an apical sterile portion.



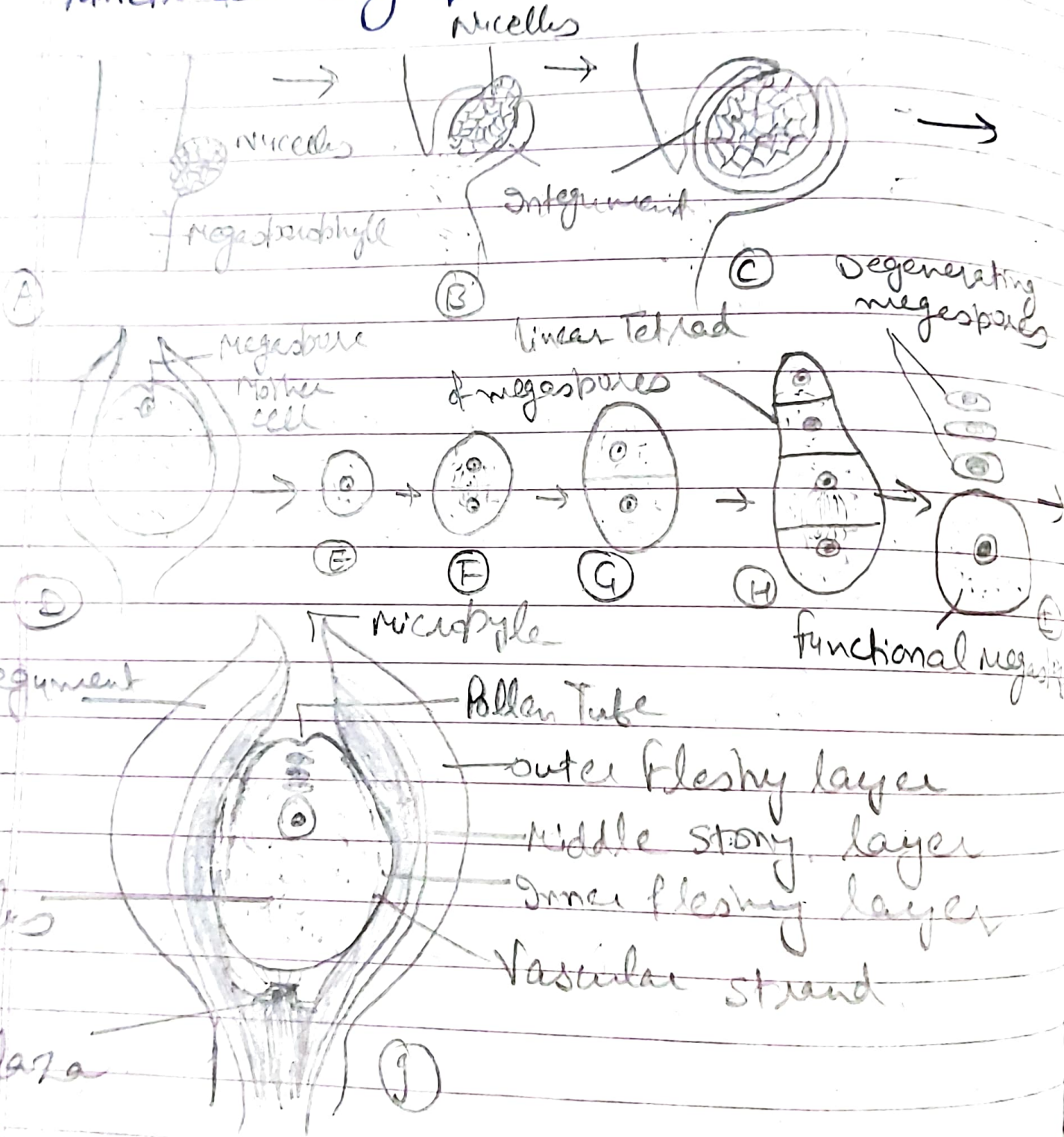
Megasporophylls of Cycas revoluta

Cycas rumphii

Development of Ovule:-

- The development of Ovule is exoarangiate type i.e. it develops from a group of hypodermal intial cells.
- A group of initial cells, begins to divide. These cells divide and redivide to form a small outgrowth which gradually increases in size & forms the nucellus.
- The neighbouring cells of nucellus becames meristematic. They grow around the nucellus and form a ring like outgrowth, called integument.
- The integument does not completely covers the nucellus, but leaves a small opening at the top. The opening is called micropyle.
- The integument fuses with the nucellus at the chalazal end but remains free towards micropylar end.
- The integument differentiates into three distinct layers - a) outer fleshy layer b) middle stony layer c) inner fleshy layer.
- megaspore mother cell divides firstly by meiosis, which the second meiosis is also transverse and form a linear row of four haploid cells.
- The upper three cells get degenerated and

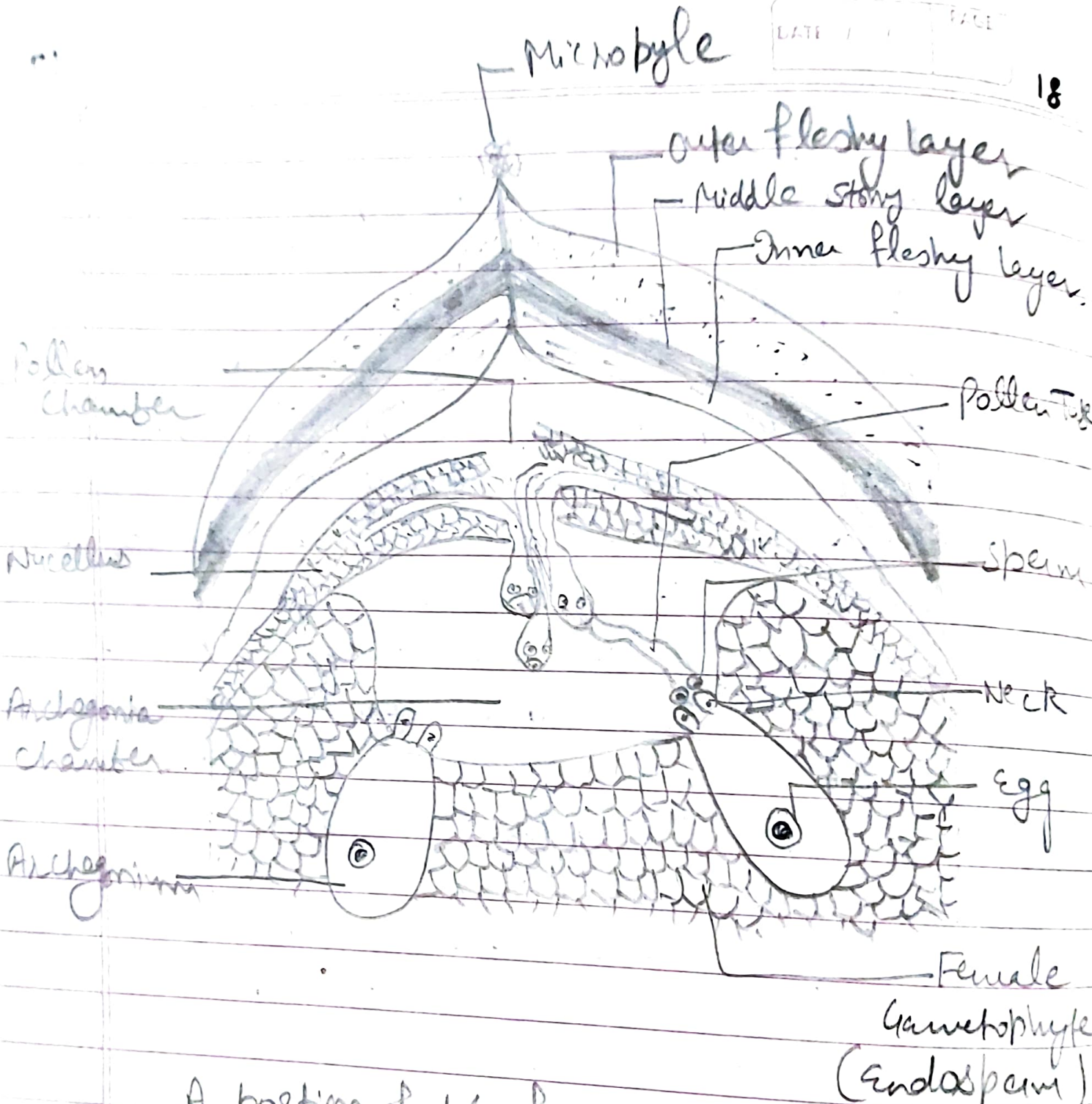
provides nourishment. The lowermost becomes functional megaspore.



Stages A-J = Stages in the development of ovule and megasporogenesis.

Fertilization:-

- The fertilization in Cycas is siphonogamous (via pollen tube)
- The pollen tube enters into archegonial chamber.
- As soon as it reaches into the fluid of archegonial chamber, it experiences a change in osmotic concentration and bursts to discharge its fluid and sperms.
- The sperms swims toward the neck of archegonia and force their entry into the egg.
- The naked protoplast is drawn towards the egg by chemotaxis.
- The sperm nucleus finally fuses with the egg nucleus resulting in the formation of diploid (2n) zygote.



A portion of L.S of ovule at the time of Fertilization

→ The Young Sporophyte :- (Development of embryo)

- The zygote enlarges in size and reaches upto 2-3 mm in length.
- The zygote becomes dense and develops many small vacuoles.
- The diploid nucleus divides by free nuclear divisions to form about 200 to 300 free nuclei.
- The free nuclei are thus pushed towards the periphery.
- The vacuole gradually reduces in size. This cellular stage of developing embryo is called proembryo.
- The proembryo gets differentiated into three regions – (i) the upper portion, which remains in contact with the nutritive material, is called haustorial region.

(ii) the middle portion of elongating cells is called suspensor.

(iii) The basal group of meristematic cells is called embryonal region.

- The complete development of embryo takes about one year. The mature embryo continue to elongate.

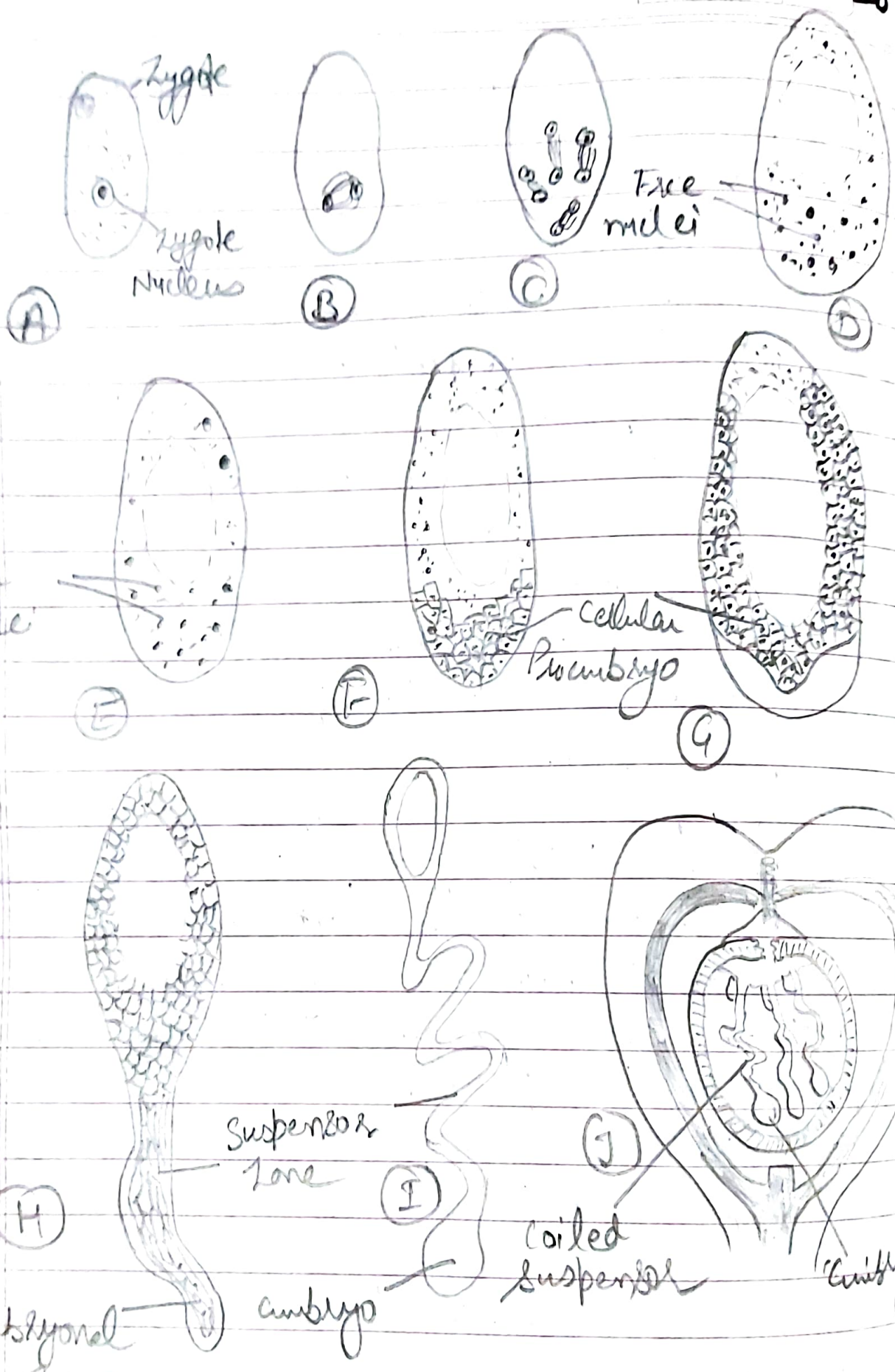
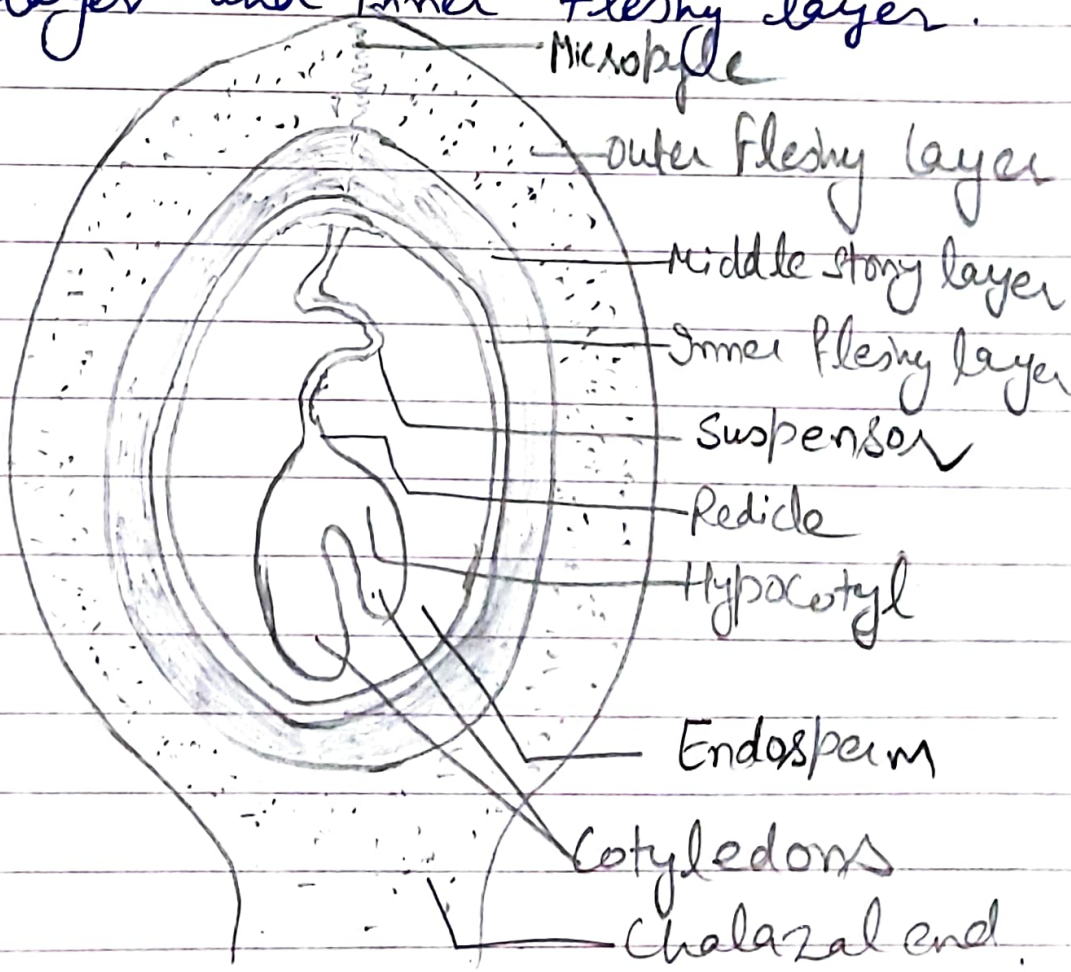


fig A-J → stages in the development of embryo

- A mature embryo of Cycas is straight and positioned upright inside the seed.
- It has short hypocotyl.
- The axis of embryo has plumule on one end and radicle on the other.
- The embryo have two to three cotyledons but they are unequal in size.
- It has outer fleshy layer, middle stony layer and inner fleshy layer.



Cycas L.S. of seed