0Model Answer
M.Sc. I Semester (Botany)
Paper II (AS-2178)
Algae, Bryophytes, Pteridophytes

A-S - 2178

Ans. 1.

i. C. both of the above
ii. B. *Cephaleuros*
iii. A. r-RNA genes
iv. B. Carposporophyte is always depend on gametophyte
v. D. Four rows of neck cells and twisted neck
vi. C. both (a) and (b)
vii. C. both (a) and (b)
viii. B. Holloway
ix. C. Sphenopsida
x. D. *Salvinia*

Ans. 2.

i. Spores of red algae:

a. **Monospores:** Asexual reproductive cells which is released as a single cell from a differentiated cell called monosporangium ae called monospores. Monospores are always pigmented and larger than male gamete or sprematia.
It is an important method of multiplication in memners of order Nemalinales.

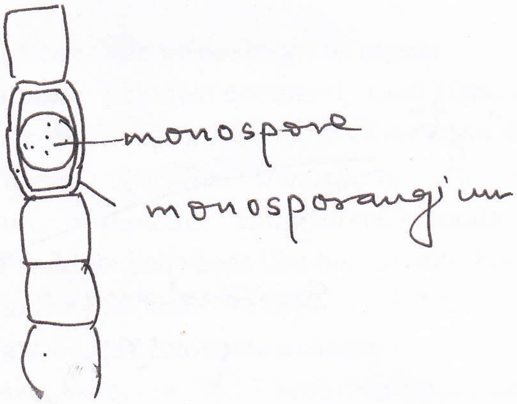
b. **Bisprores:** In family Corallinaceae and Ceramiaceae only 2 spores are formed in each sprorangium. At the time of liberation bispores re uni or binucleate. They are considered to be homologous with tetrasporangia because in both meiosis takes place.

c. **Polyspore or Paraspore:** They contain more than 4 spores. In polysporangia meiosis occurs at the time of spore formation eg. *Pleonosporium* while in paprasporangia meiosis doesnot occur therefore this structure is not homologous with tetrasporangium eg. *Ceramium*

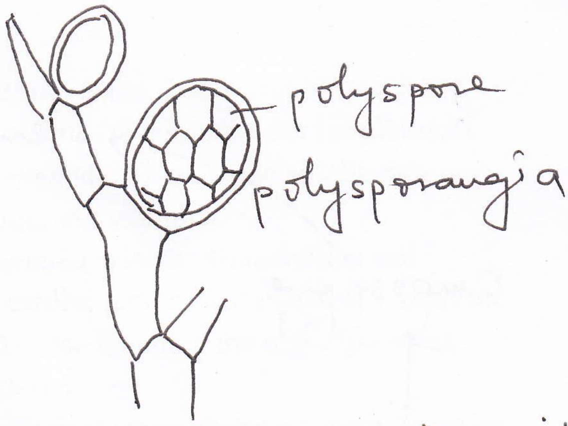
d. **Seirospores:** In Seirospora, famly Ceramiaceae there is a direct transformation of vegetative cells in terminal series of sirosprangia. The seirosporangia individually release thericontents in catenate series of seirospores.

e. **Carpospores:** Carpospores are formed in carposporangia of gonimoblast filament which together form the Carposporophyte generation. These may be haploid or diploid depending on the stage of occurrence of meiosis. Carpospores develop into gametophyte or tetrasporophyte.

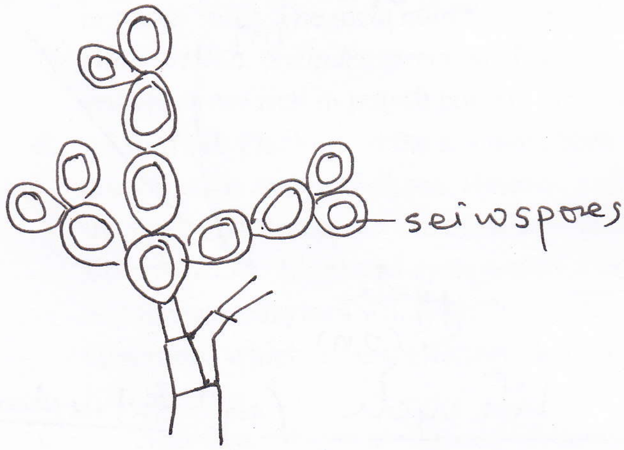
f. **Tetraspores:** These spores are formed in tetrasporangia of tetrasporophyte generation and are formed after meiosis hence, haploid spores. These spores produce gametophyte.
Life cycle found in red algae: It may be haplobiontic or diplobiontic.



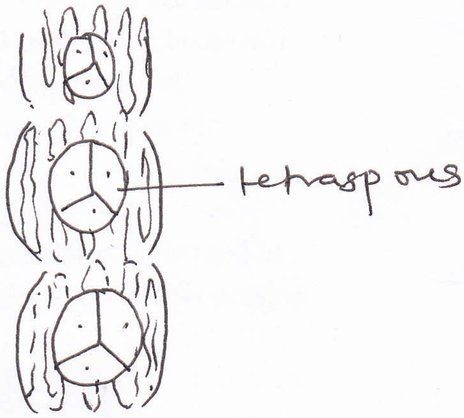
Monospore



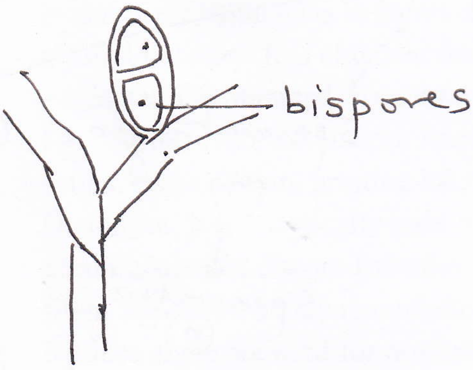
Polysporangia with polyspores.



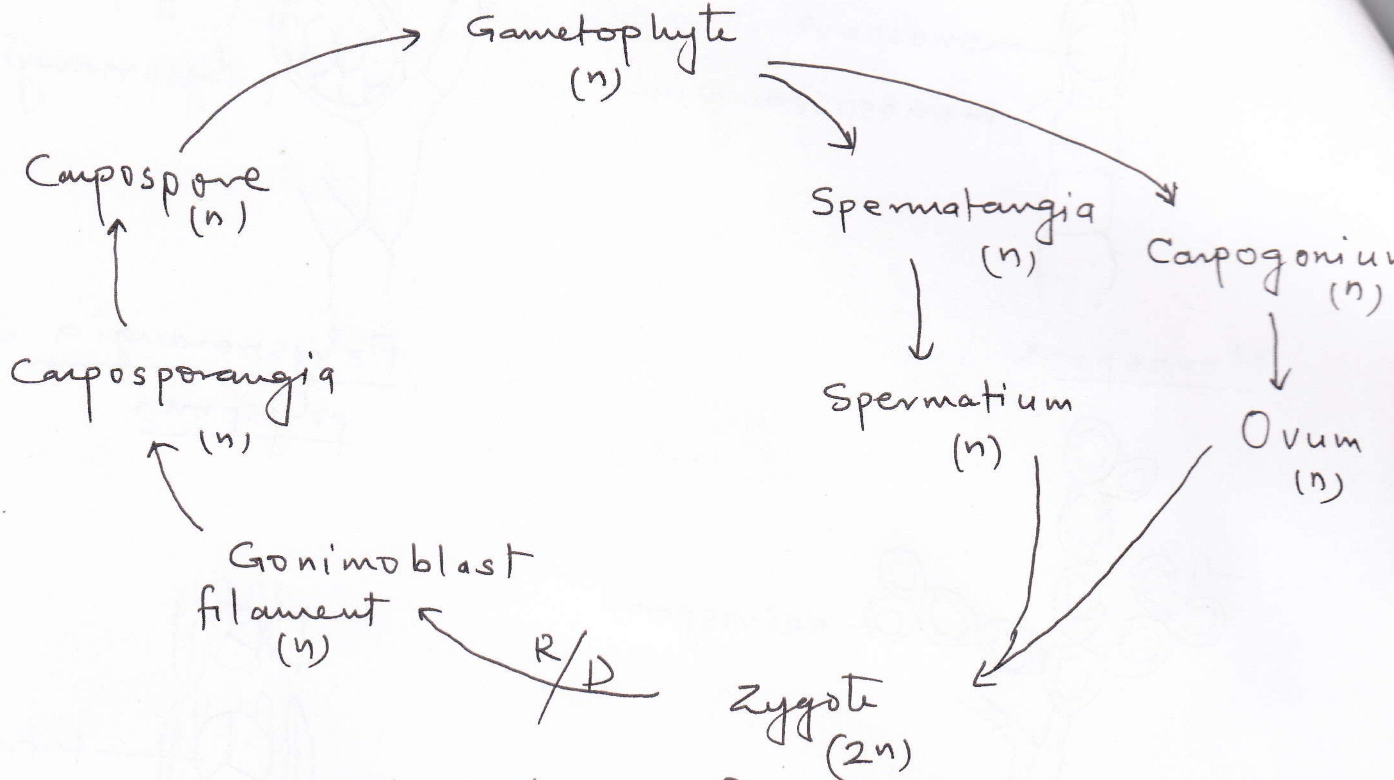
seirosporangia with seirospores



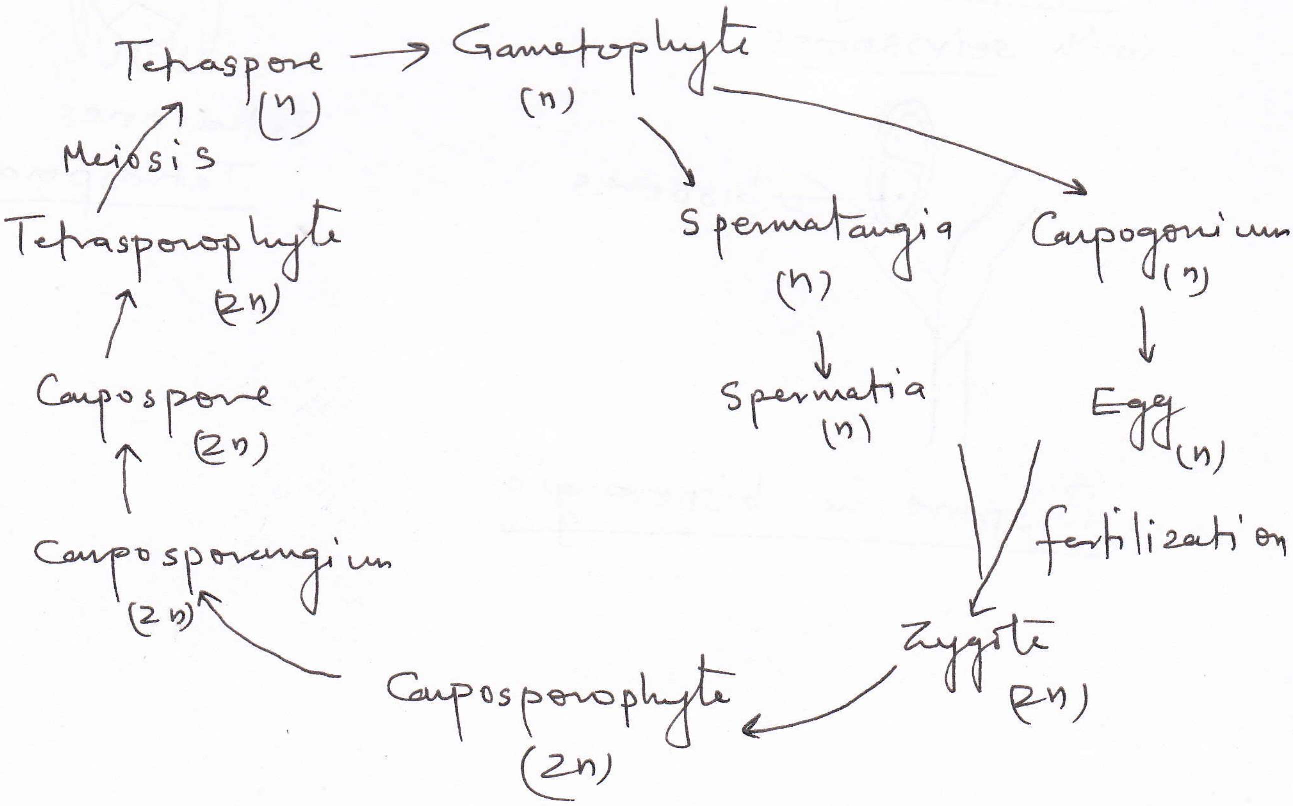
Tetraspores in Tetrasporangia



Bispore in bisporangia.



Haplobiontic Lifecycle (eg. Batrachospermum)



Diplobiontic life-cycle (eg. Polysiphonia)

Ans. 2 (ii) Economic importance of algae:

a. **As food:** The most commonly used algae as a food source are *Porphyra* (Nori in Japan, Laver in Europe), *Laminaria* (Kombu), *Chondrus crispus*, *Caulerpa*, *Ulva* (sea lettuce), *Chlorella, Spirulina, Monostroma, and Nostoc communae*. These algae are the rich source of proteins, carbohydrate, essential fatty acids, and vitamins.

b. **As fodder**: Seaweeds like *Sargassum, Fucus, Laminaria, Alaria, Ascophyllum* and *Rhodymenia* thalli are used as a fodder to feed the cattles, poultry and piggery. The edible seaweeds are known to enhance the milk yield and cause fattening the pigs. *Spirulina, Haematococcus*, and *Thallassiosira* are used as fish feed.

c. **As fertilizer**: Heterocystous blue-green algae are efficient atmospheric nitrogen fixers in aerophilic condition. This capacity of blue-green algae is used as biofertilizer particularly in paddy field. The most common taxa are *Nostoc, Anabaena, Tolypothrix, Aulosira, Gloeotrichia, Cylindrospermum*. These strains are also used to reclaim the usar soils. The seaweeds are rich in potash content and are used as fertilizer in coastal areas.

d. **As biofuel**: Plankton in the sea have been the source of fossil fuel (oil and gas) in the coastal areas and in high sea. Besides, various strains of algae are known to accumulate the lipid in different environmental conditions and particularly in stress like *Dunaliella, Botryococcus*. Algae and cyanobacteria are known to possess hydrogenase and nitrogenase enzymes which are utilized to produce the Hydrogen gas in anaerobic conditions which is very efficient clean fuel.

e. In industry:

i. Agar-agar: It is commercially obtained from Gelidium and Gracilaria. It is used in tissue culture, bacterial culture, pharmaceutical industries, dairy and food processing industry.

ii. Carrageenan: It is a phycocolloid similar to agar but with high ash content. It is used in stabilizer, emulsions in paints and cosmetics and as a clearing agent in sugar and alcohol industry. It is obtained from Chondrus crispus, and Gigartina.

iii. Alginate: It is obtained from the cell wall of the brown algae particularly members of Laminariales like Laminaria, Ascophyllum, Fucus, etc. It is used as a thickner in soups, sauce, cream, printing ink, emulsifier and as a gelling agent.

iv. Diatomite: It is chemically inert and thermally stable material which is formed by accumulation of diatom frustules. It is used for making heat resistant layering, as a filter, absorbant and in manufacturing of paints, toothpaste, phonograph.

v. Besides algae are used for production of Iodine, high value compounds like essential fatty acids (omega 3 fatty acid, linolenic acid, linolic acid, DHA etc.) and pigments like phycocyanin and phycoerythrine.

Harmful role: Algal nuisance is apparent in form of algal blooms which produce obnoxious odor and toxins in water bodies; they choke the water filters, cause hindrance in navigation, corrosion of the statues, and slips in rainy seasons.

Ecological services: Algae are the primary producers in major aquatic ecosystem and support the vast food chain. More than fifty percent of the global oxygen production is carried out by algae alone which support the life on the earth. Algae are the important sink of the CO2 in the aquatic ecosystem which utilize it for the photosynthesis and also contribute their role in biogeochemical cycle.

Ans. 2. iii. The origin of algae is a central theme in the study of evolution. It can be studied under following heads –

a. Origin of prokaryotes and photoautotrophs: It was the major event in the evolution of the primitive earth and life forms. The prokaryotes evolved between 4.5-3.5 Ga ago when atmosphere was reducing and with virtually no free oxygen. The earliest prokaryotes were probably aquatic anaerobes and were dominant life forms in the earth. The first autotrophic prokaryote were cyanobacteria which originated about 2.6 Ga. in Precambrian period. They produced oxygen during photosynthesis and led to the formation of ozone layer in the stratosphere which protected the life forms from the harmful UV rays. They were predominant on earth for more than 2 billion years.
b. Origin of eukaryotes: It is yet not clear that when eukaryotes originated from the prokaryotes. One school of thought suggests that double membrane bound organelles like chloroplast and mitochondria were formed by the process of a series of endosymbiosis events (Mereschkowsky, Margulis) and another theory suggest the autogenous process for the formation of double membrane bound organelles by invagination and compartmentation of the cell by the membranes. But today, the endosymbiosis theory holds the strong support from the different workers based on the molecular data.
c. Evolution of meiosis, syngamy and alternation of generation: The origin of sexuality was the major step in the evolutionary pathway of the vascular plants. The evolution of diverse eukaryotes became possible through the process of segregation, recombination and natural selection. Precisely when sexuality arose in unclear but the biogeological evidence shows that it must have predated 700 Ma ago when the metazoans first appear in the fossil record. Groups like Euglenophyta which lack sexual reproduction must have arose before sexual reproduction evolved. The development of sexuality led into formation of haploid and diploid generation and evolution of different types of alternation of generations in algae.
d. Evolution of land plants: The précis evolution of land plants (embryophytes) are obscure but it is agreed that land plants were derived from phragmoplastic chlorophytes. The formation of ozone layer paved the way to the transition of aquatic plants from water to the land. The hypothetical ancestral alga is most likely to have been filamentous, heterotrichous, with oogamous reproduction. The bryophyte line was derived from those forms in which the diploid sporophyte generation developed wile remaining attached to the gametophyte the embryophyte line evolved from those ancestral forms in which the zytoe ultimately separated from the gametophyte and continued as an independent.

Ans. II (iv) Theories related with the origin of Bryophytes:

a. Algal ancestry of the Bryophtes: This theory suggests that bryophytes were derived from the algal ancestors especially the green algae.
   Frye an Clark suggested that bryophytes have originated from Charophytes because of the presence of sterile jacket over the reproductive structures in latter. But later it was realized that male and female gametangia amongst the bryophytes are onogenetically different.
   Ewans thought that the Ulotricales may be the possible nearest ancestor of bryophytes especially the Anthoceros because of the presence of single large plate like chloroplast with pyrenoids in both.
   Fritsch considered the heterotrichous Chaetoporlaes as the possible ancestors of bryophytes because of the presence of heterotrichous habit in both. He thought that the aquatic ancestor kike Chaetophorales some how migrated to land as represented by the terrestrial genus *Fritschiella tuberosa*.
   Davis suggested that the evolutionof antheridia and archegonia form a structure similar to the pleruilocual sproragnia of the members of Phaeophyceae. He suggested that after migration to land habit superfecial cell of the pleurilocular sproangia lost the gamete producing capacity because of unfavourable situation of atmosphere thus a sterile jacket enclosing the fertile cell have evolved from the pleuriolocular sporangia.
b. Pteridophytic ancestry of the Bryophytes: Bryophytes especially sporophytes of *Anthoceros* show a very great similarity with the sporophyte of lower vascular plants. Leafless axis of *Rhynia, Horneophyton* and presence of stomata and columella in the sporophyte of *Anthoceros* and members of Psilophytales indicate a very close affinity. Kashyap pointed out similarity in the radially symmetrical erect gametophyte of *Lycopodium cernuum* with those of erect gametophyte of *Anthoceros erectus*.
   Campbell demonstrated that the sporophyte of *Anthoceros jujiformis* could grow for a considerable time of length provided the nutrition is available to the plant. He proposed that there would be shifting of the intercalary meristem to the apical position and conversion of the columella into a conducting strand during the evolution. There is also possible in similar way but opposite direction evolution from *Rhynia* to *Anthoceros*.

Ans II. (v) **Gametophyte of *Marchantia*:**

Plant body is thalloid flat dorsiventral with a distinct mid rib, an apical notch is present at the apex of each lobe. Thallus is dichotomously branched. Rhizoids are of two types smooth and tuberculated. Multicellular ventral scales are present in 2-3 rows on either side of midrib. Internally the thallus is differentiated into storage and photosynthetic regions. The upper epidermis is well defined with well developed apical pores which project partly above the surface of the thallus. The photosynthetic chambers have branched and unbranched photosynthetic filaments. Oil bodies are present in the cells.

Plants are mostly dioecious. The antheridia borne on the lobes of the terminal peltate disc of antheridiophores. Antheridia are stalked and conical club-shaped. Antherozoids are curved and biflagellated. Archegonia develop on the dorsal surface of terminal disc of archegoniophore. Neck of archgonia is 6 celled.

Sporophyte of *Marchantia*:

It is differentiated into foot seta and capsule. Foot is well defined, seta is small in young but elongates rapidly after maturity, capsule is oval. Capsule wall single layered. Archesporium develops from endothecium. Elaters are long, spindle shaped, with two spiral thickening bands. Columella is absent. Sporophyte is protected by calyptras, perigynium and perichaetium. Capsule dehisces longitudinally into many valves.

Gametophyte of *Anthoceros*:

Thallus is flat, dorsiventral, irregularly lobed with indistinct midrib. Rhizoids are unicellular smooth type only. Scales are absent. Internally the thallus is undifferentiated. Upper epidermis is not distinct. Apical pores are absent. Each cell contain one large disc like chloroplast with pyrenoids.

Plants are monoecious or dioecious, antheridia develop endogenously in to the chambers embedded into the thallus in groups. Antheridia are club-shaped. Root of antheridial chamber break irregularly to release the mass of androcytes. Antheridia are rod shaped with 2 flagella. Archegonia are embedded into the thallus on dorsal surface with 6 rows of neck cells.

Sporophyte of the *Anthoceros:*

Sporophyte is differentiated into foot and capsule, seta is absent. A meristematic zone is present between the two. Foot is bulbous, capsule is horn-like. Capsule wall 4-6 layered, persistent. Archesporium develops from the inner layer of the amphithecium. Elaters are 2-3 celled, absent or pseudoelaters without spiral thickening. Columella is present. Young sporophyte is covered by the calyptras.

Ans - 2 · (vi)

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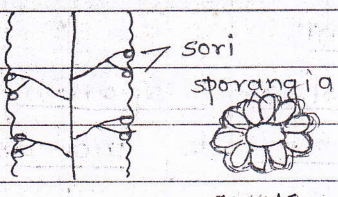
Evolution of Sorus

In ferns ~~sporf~~ sporophyll are similar to ordinary foliage leaves & are photosynthetic.

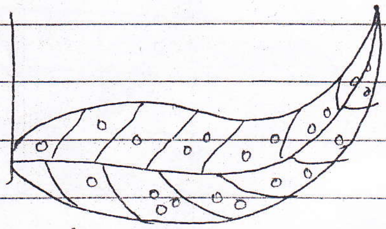
In ferns sporangia are aggregated in a groups. k/as sori.

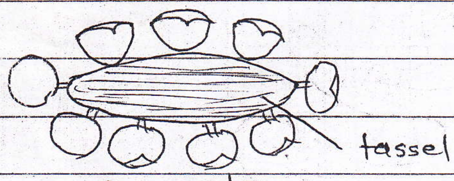


sorus

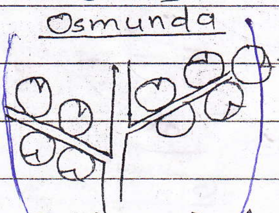
Shape, size, number & position of sori are imp. for distinguishing the different genera & families.

If sporangia do not form the sori, then they are scattered all over the lower surface of the leaf as in Acrostechium or form margin tassel over the surface of leaf division as in Osmunda or solitory ~~along~~ close to the margin of leaf segment as in Schizaea Anemia


Acrostechium



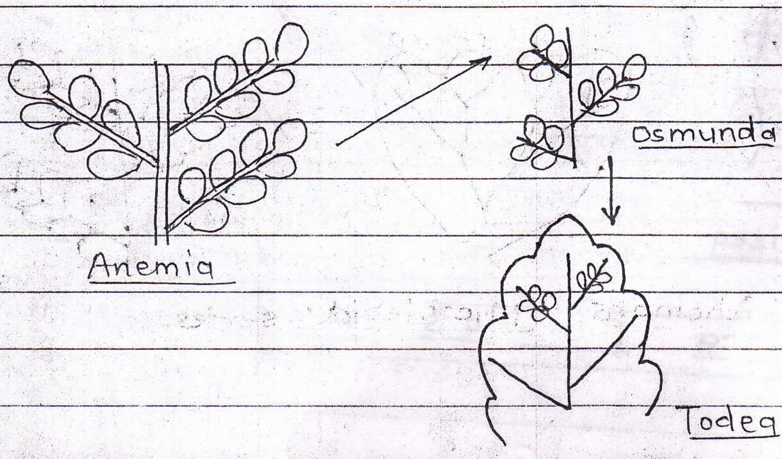
Osmunda


Schizea & Anemia

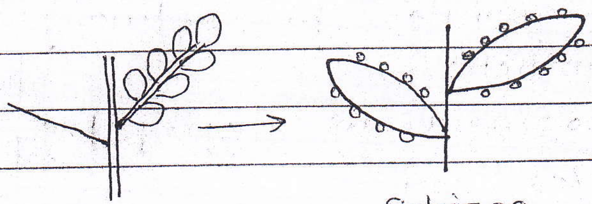
The tassel condition is regarded as primitive where as Acrostechoid condition is regarded as advanced.

Eames (1936) proposed 3 ways in c sori are obtained from marginal tassel.

In first system — superfecial sori can be obtained from tassel condition by the formation of the blade on the axis Osmunda Todea series

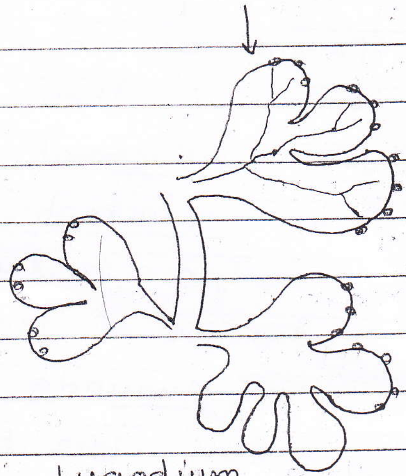


In 2nd system the monosporangial sori can be obtained by similar expansion as in Osmunda Todea series but along the axis of sporangial attachment.

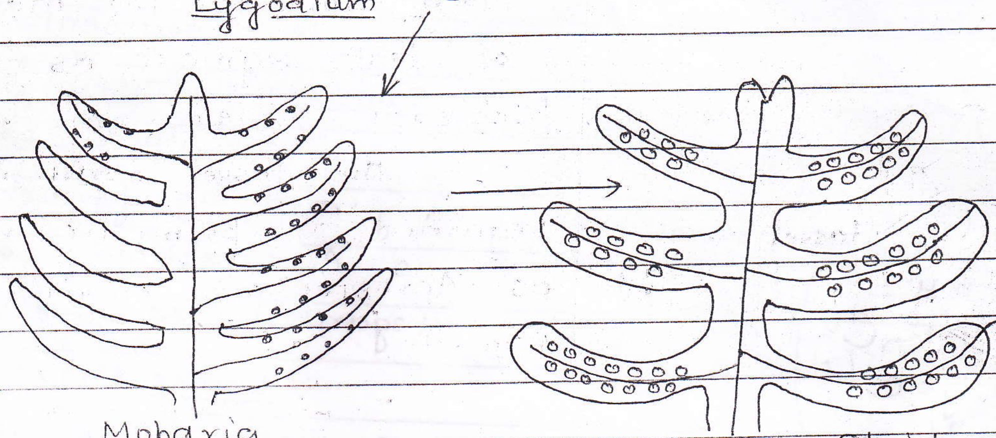


Anemia Schizea dichotoma

Solitory sporangia form sori by increase number. This can be seen in Lygodium Moharia Gleichenia series.



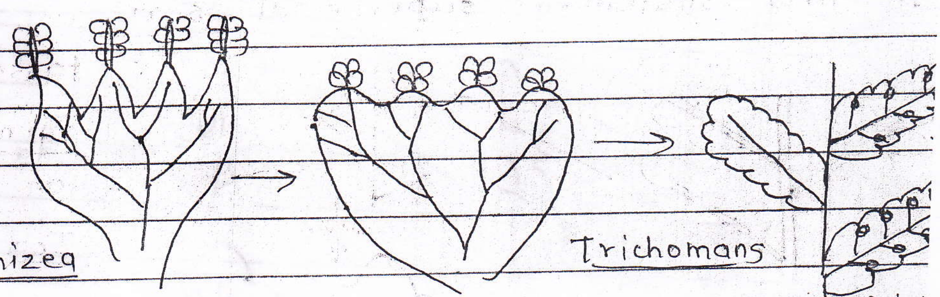
Lygodium



Moharia Gleichenia

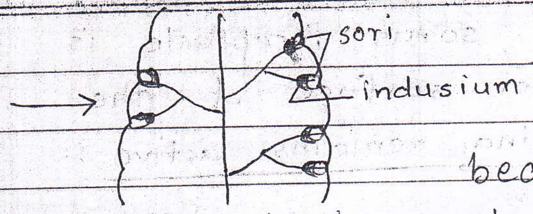
In third way - the marginal sori can be obtained from tassel condition by webbing of sterile stalk of fertile

Anemia →



Schizea Trichomans Dicksonia

tip as in Schizea Trichomans Microlepid series.



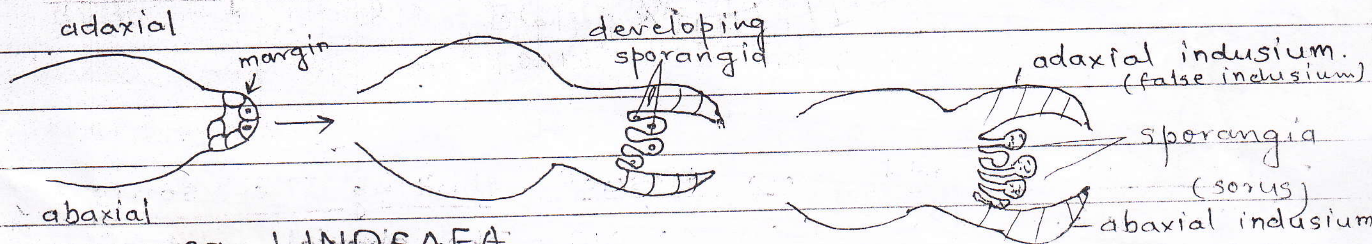
Microlepia

The portion of leaf lamina bearing sporangia are k/a receptacle sporangia are formed from superficial cell of receptacle.

⇒ On the basis of ontogeny the sori are classified into 3 groups :

Sori (Origin)
- Marginal
- Intramarginal
- Superfecial

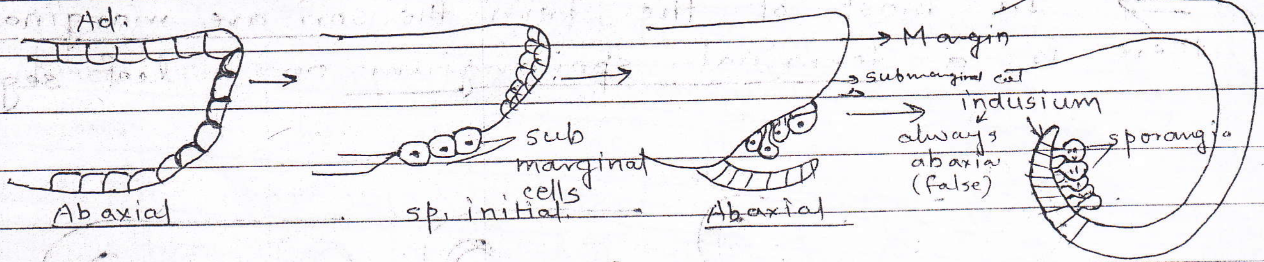
<u>Marginal sorus</u> – In marginal sorus <u>receptacle</u> & <u>its sporangia</u>



eg. LINDSAEA

originate from the margin of pinnae or pinnules. <u>Indusium</u> if formed is <u>submarginal outgrowth</u> around the receptacle & is <u>funnel shaped</u> or <u>two lip shaped</u>. The two parts of indusium may be equal or unequal.

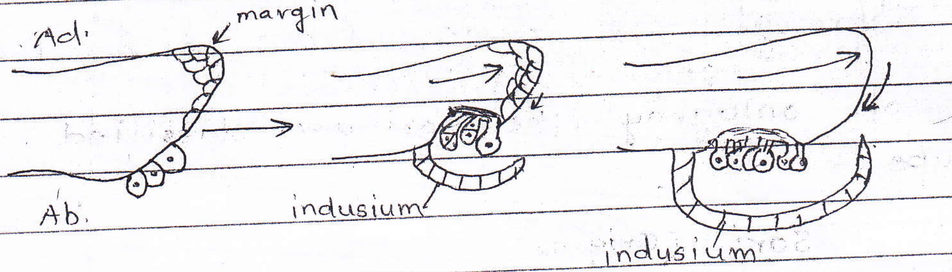
<u>Intramarginal sorus</u> – In many ferns sori appears to be marginal but they are <u>submarginal</u> in <u>origin</u>. The <u>margin</u>

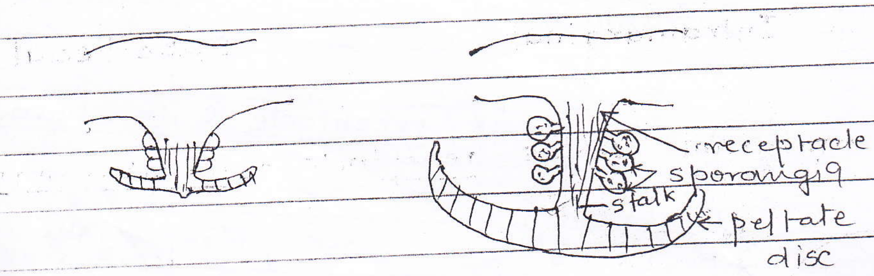


of the <u>lamina</u> <u>form</u> thin <u>extension</u> and <u>loose its meristem-atic activity</u>. The <u>submarginal cell</u> on <u>lower surface of lamina</u> <u>become meristematic</u> & <u>form receptacle</u>. <u>Abaxial indusium</u> <u>is formed</u> from the <u>surface cell</u> <u>near</u> the <u>meristem</u> or <u>receptacle</u>. eg. <u>Cryptogramma</u>, <u>Pteris</u>, <u>Pteridium</u>

⇒ True indusium always dev. from superfecial cells of receptacle.

Superfecial sorus :- In superfecial sorus receptacle is submarginal in origin, On the lower surface of the lamina. The margin of the lamina remains active



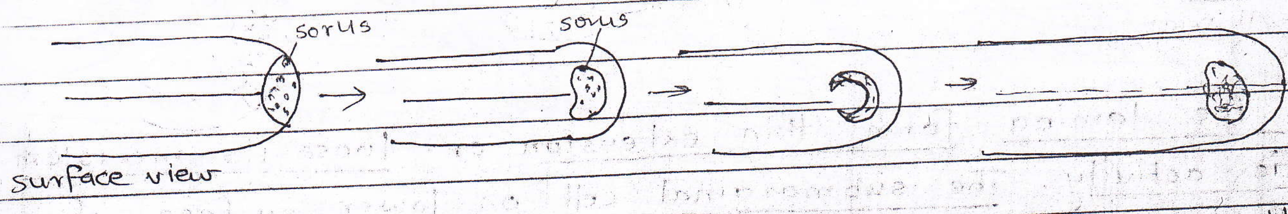


& continue to add new tissue shifting the sorus further away from the margin. The abaxial indusium is formed from the superfecial cell of the receptacle & overarches the sorus. eg. Cystopteris

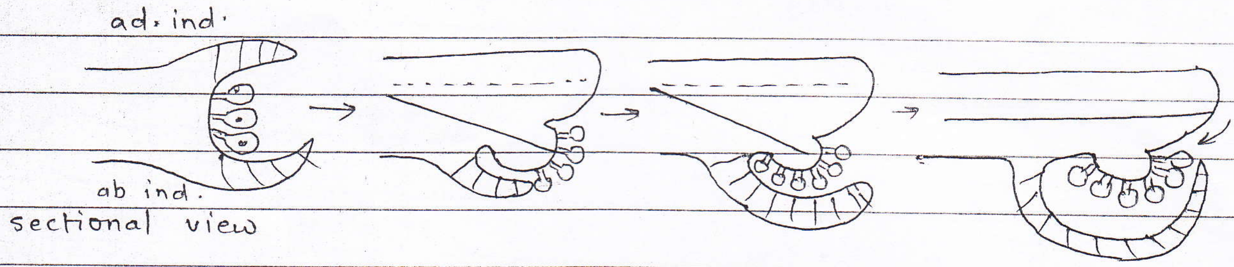
In some spp. the indusium is formed from the top most cell of the receptacle forming a stalk & a peltate disc. eg. ~~Cystopteris~~ eg. Polystichum

~~In most th~~

⟹ In most of the fern the sori are marginal or there is a terminal sporangium on a leaf segment



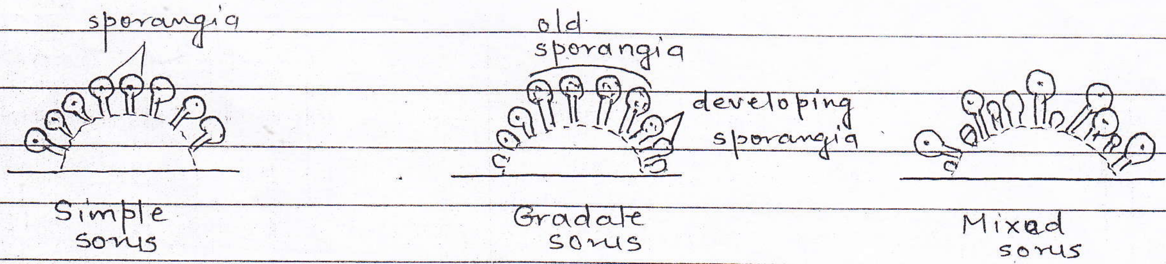
This type of sporangia are characteristic of primitive fern. From this position to superfecial position of the sorus has been acquired due to the migration of sporangia on the lower surface of the leaf. Th change has been observed in different group of fern at different time. This change from margin to superfe position is explained by Bower (1936) & a hypothesis or theory has been proposed named as 'Phyletic slide'



With the change from marginal sorus to superfecial sorus. one of the lip of the indusium was lost either being transformed into the margin of the leaf lamina ~~are~~ or merging with expanding blade or the lamina

⇒ On the basis of maturation of sporangia in a sorus the sori are classified into 3 groups.

(i) Simple sorus (ii) Gradate sorus (iii) Mixed sorus.



⇒ When all the sporangia of a sorus develop, grow and mature at the same time, the sorus is k/as Simple

⇒ If the sporangia in a sorus develop over a period of time in c̄ the oldest sporangia in the centre & successive younger sporangia at the base the sorus is k/as Gradate

⇒ In a sorus sporangia of all the ages are interming the sorus is k/as Mixed.

Ferns are classified into 3 grps. on the basis of maturation of sporangia.

① Simiplices – (primitive)

② Gradatae

③ Mixatae – (advanced)

Ans- 2 (vii)

~~surface at some distance from base of the sporophyll.~~

~~- In these 2 genera spore were again homosporous.~~

Order- Lepidodendrales –

- Lepidodendrales are the best known fossil lycopods plants. They are the most specialized & diverse group of the plants. They apparently evolved during Upper Devonian, increased in abundance & complexicity during the Carboniferous, reaching the climex of its phylogenetic development during this period.
- Arborescent lycopods were dominent & covered the entire terrestrial flora at that age. They present unique aspect of morphology & growth that are unparalleled amongst the plants of the present.
- These forms declined during the Permian and at the end of Permian. They were vertically extinct.

Characters –

- The plants were tree like
- The leaves were small and ligulate.
- Stem had well developed vascular tissue with large amount of secondary xylem.
- Surface of the axis had distinct leaf cushions and leaf scars.
- The plants were heterosporous.

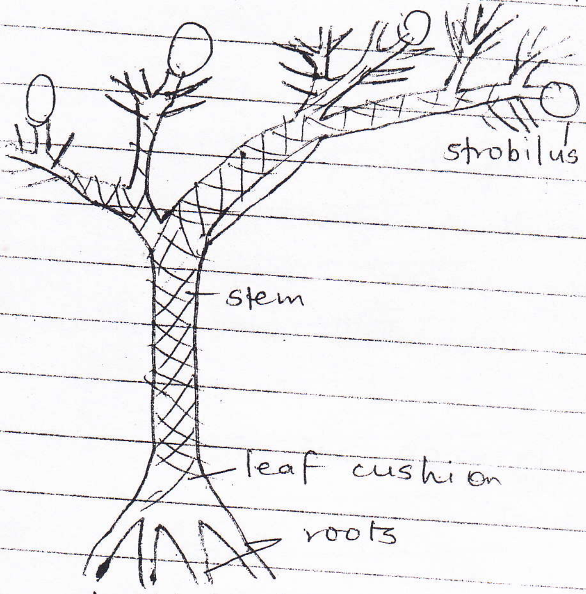
Plants were found as compression as cast, as petrifactie in coal balls. The plants c are included in this orde are numerous but imp. ones are –

Stem:-	Cones –	Seed –
Lepidodendron	Lepidostrobus	Lepidocorpon
Lepidophloios	Sigillariostrobus	Mazocorpon
Bothrodendron	Bothrodendrostrobus	Miadesmia
Sigillaria	Leaves –	
Paurodendron	Lepidophylloides	
Root- ⇒ Stigmaria	Lepidophyllum	

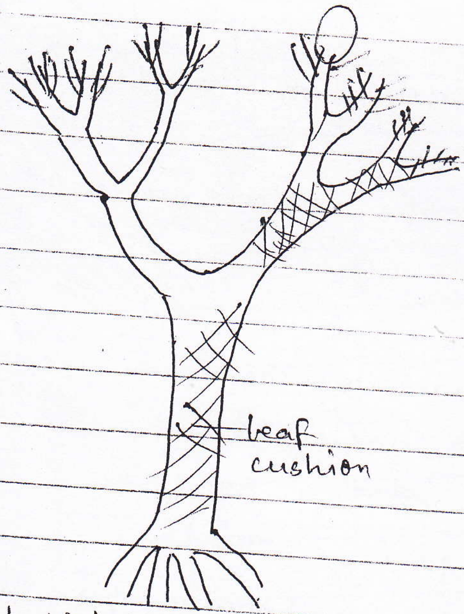
The plants were tree like attaining a height o
20 metres or more with a dia. of about 2 metre
The branching system was typical dichotomous, tho
there is a variation of branching at each dichoto
Some of the genera are highly branched. At the
upper half of plant, as in Lepidodendron and i
Lepidophloios. The other spp. are
unbranched or branched to a
lesser extent as in Sigillari

The root system consis
of 4 major axes. The roots
c̄ dichotomise, several tim
ultimate subdivisions were
spirally arranged. They are
k/as Stigmarian rootlets.

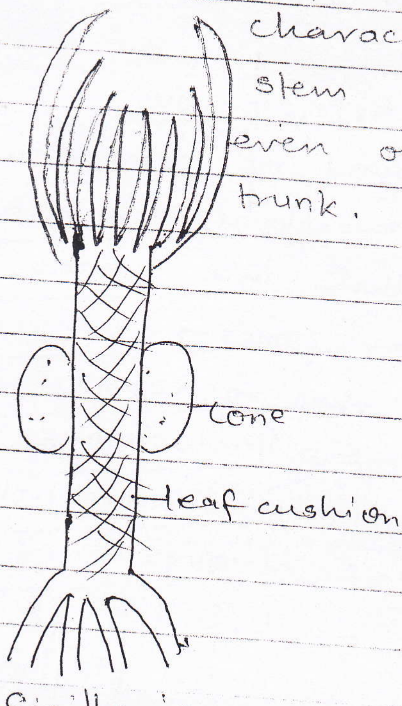
Leaves - were both towards
the terminal portion of the
branches. They were linear gras
like varied in length & arrang-d
in close spirals. Upon falling
from the stem, they form
characteristic pattern on the
stem c̄ retain its identity,
even on the oldest part of the
trunk.



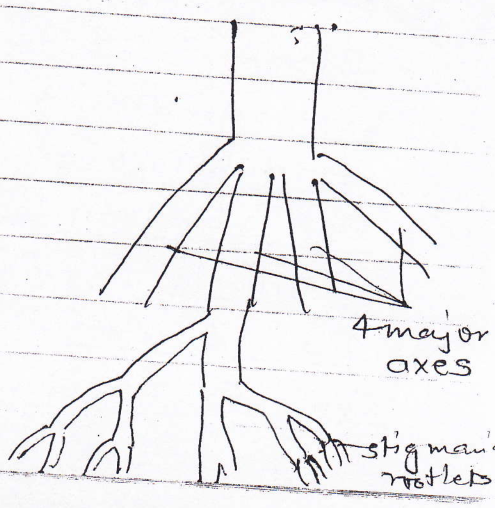
Lepidodendron



Lepidophloios



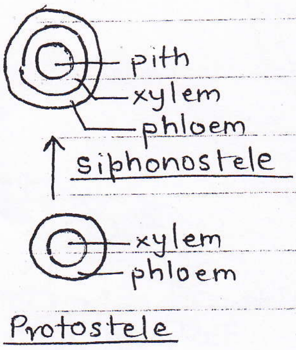
Sigillaria

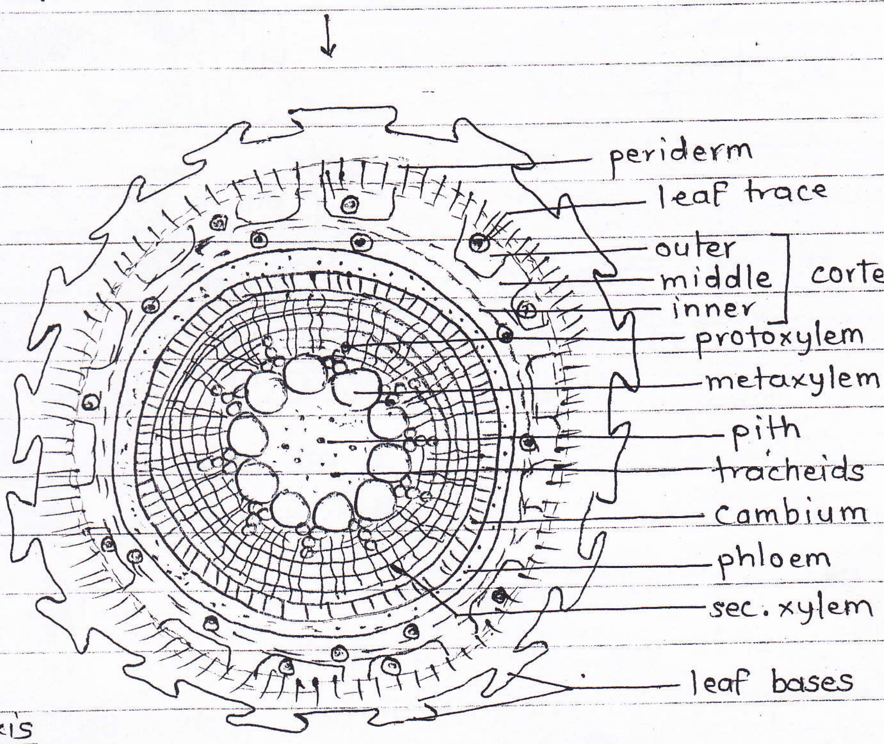


Genus - Lepidodendron (Latin - Lepido - scale, dendron - tree)

Anatomy -

Axis - There was a considerable variation in the steler anato of the main trunck from sps. to sps. & also from different part of the same sps. or the plant ranging from simple pro - stele to siphonostele with complete series of intermediat stage. In all the sps. the protoxylem was exarch & polyarch. In Lepidodendron vasculare there was a





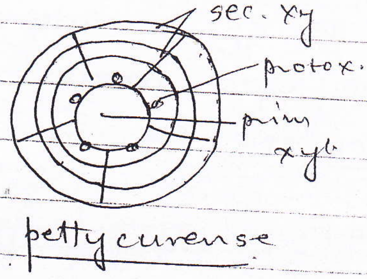
T.S. of axis

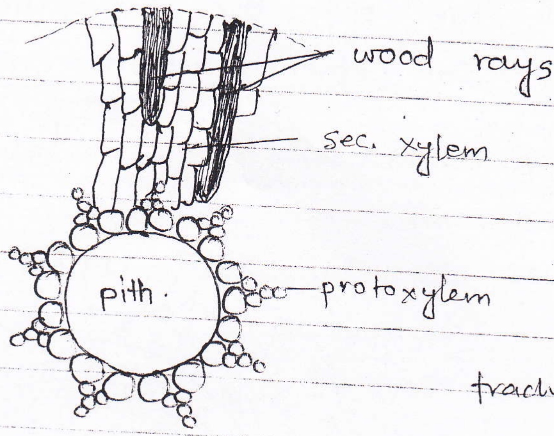
mixed pith ie. pith ~~constiste~~ consisted of tracheid & parench The primary xylem was exarch & polyarch. The primary xylem was surrounded by a considerable amount of secondary xyle Outside the primary xylem there was a phloem separated by a cambium layer. The great bulk of axial tissue was the periderm or secondary cortex c was laid down round the periferi of the trunck. The secondary cortical tissue was t main supporting tissue of the large arborescent lycop Secondary cortical tissue or periderm consisted of rad arranged cells are formed by periderm cambial cells.

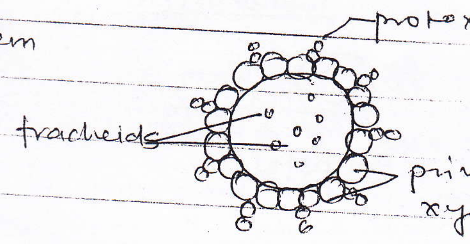
Periderm cambium cut off sec. tissue both inward & ou direction. The max^m development of sec. tissue was toward the inner side of periderm cambium. The cortex was

differentiated into 3 zones outer, middle & inner & ...
y-ted of simple parenchyma cells. The cortex have numer...
leaf traces.

In Sigillaria the str. of the axis is almost similar a...
in Lepidodendron i.e. the primary xylem was surrounded



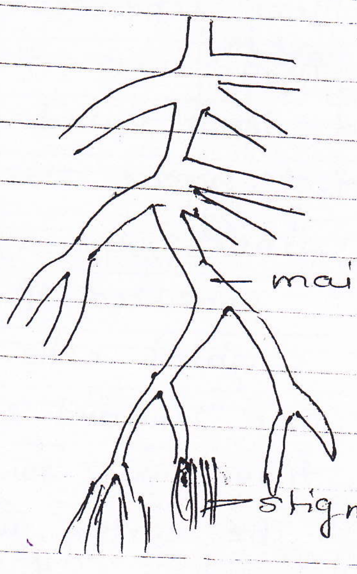




sec. xylem. Sec. xylem was consisted of radially arranged
tracheids & narrow xylem rays. In this genus there was w...
developed parenchymatous pith. So the axis of sigillaria was
siphonostelic.

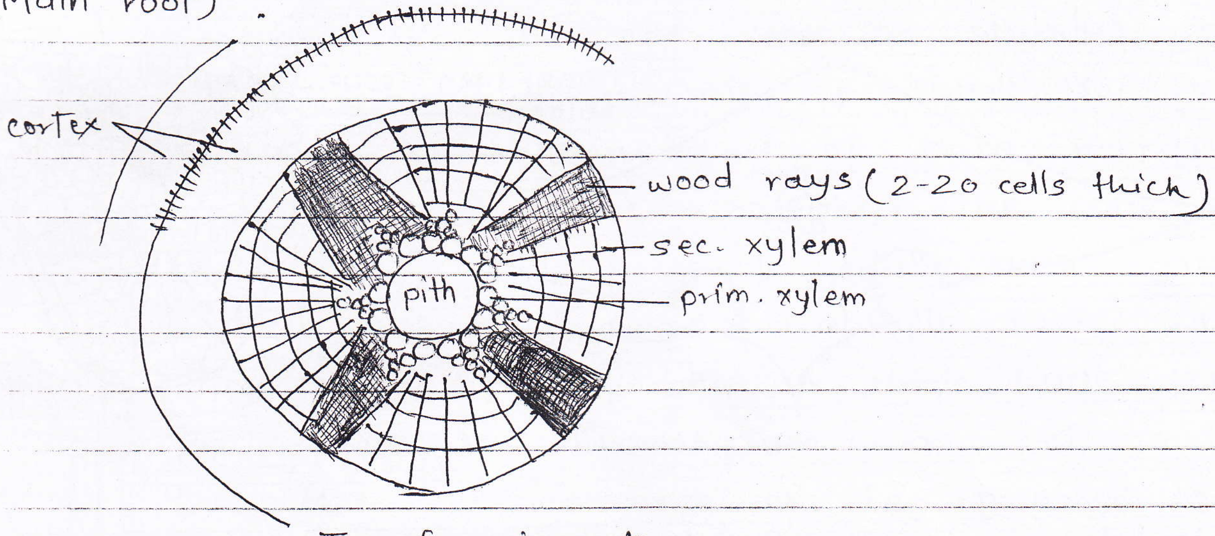
Structure of root -

In Lepidodendron there are 4 major axes & these axes dichotomise several times & ultimate subdivisions it were spirally arranged & forming rootlets k/as stigmarian rootlets.



Stigmarian roots — excentric & exarch.

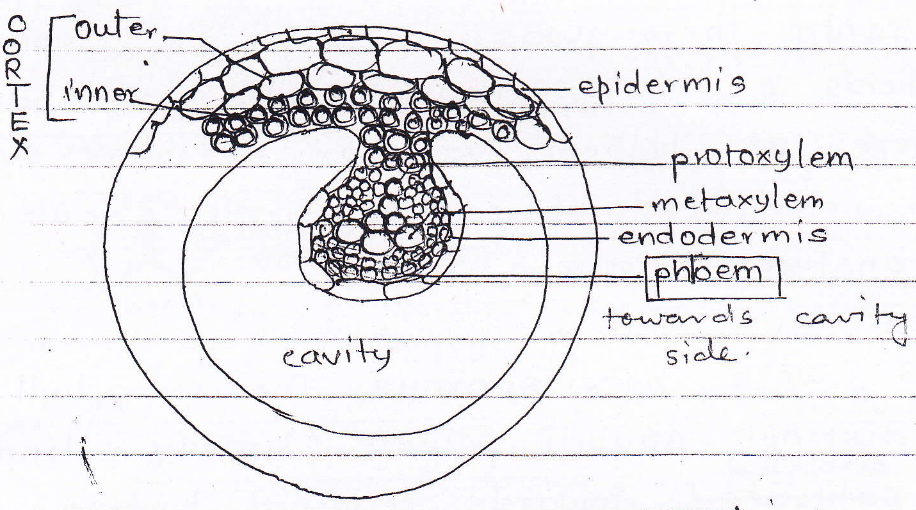
Root axis- (Main root). Anatomically the main root is almost similar



T.S. of main root

to that of main trunk ie. the primary xylem was surround by a considerable amount of sec. xylem. But in root wood rays were very very wide. In some cases a parenchymato pith was well defined while in others there was a pith cavity.

Stigmarian rootlets In stigmarian rootlet there was well defined parenchymato epidermal layer. This layer was followed by broad cortex & was differentiated into two zone outer & inner. B outer & inner cortex consisted of parenchyma cells.

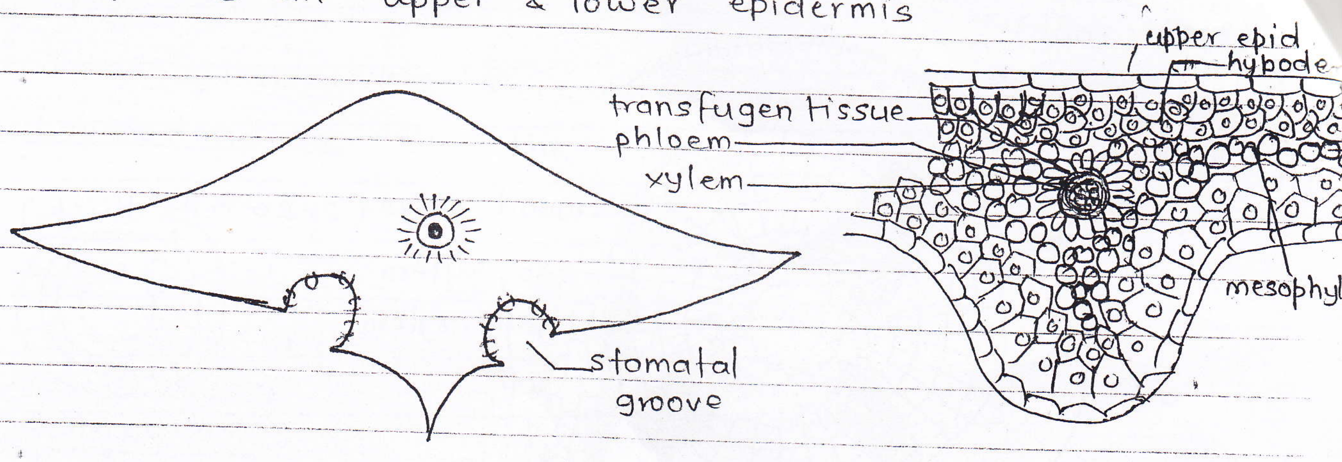


T.S. of stigmarian rootlet [excentric, exarch.]

In stigmarian root stele was excentric & exarch. The phloem was tnt around the metaxylem toward the cavity side. Vascular str. were enclosed in a well defined endodermal layer.

Structure of the leaf –

The leaf has an upper & lower epidermis



T.S. leaf

The stomata were confined to stomatal grooves on abaxial surface of the leaves. Below the epidermis there was a zone of thick walled cells forming distinct ~~to~~ hypodermal layer ie. there was upper & lower hypodermal layer. This type of hypodermis is characteristic of the plants growing under extrem xerophytic condition. Between the upper & lower hypodermis there was a zone of loosely arranged parenchyma cells. the mesophyll c was mos probably photo-synthetic. In the centre there was a small V.B. consisted of few xylem tracheids c were surrounded by small parench-yma cells referred as phloem. Vascular str. were surrou-nded by peculiar elongated parenchyma cells c were considered as transfusion tissue.

Reproductive structures–

The Lepidodendrales were heterosporous. The sporophyll were aggregated into distinct strobili c were usually cylindrical & were normally ~~saturated~~ situated towards terminal portion of ultimate branches. The strobili were referable to form genera.

(i) Lepidostrobus & Lepidocarpon referable to Lepidodendron & Lepidophloios.

(ii) Bothrodendrostrous referable to Bothrodendron

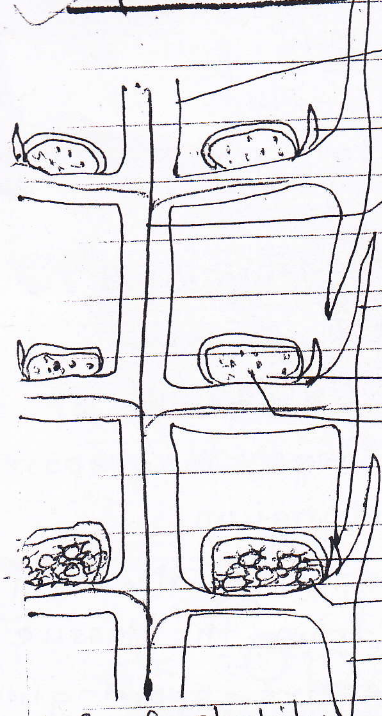
★ Fructification on Lepidodendrales

- Sigillariostrobus & Mazocarpon referable to Sigillaria

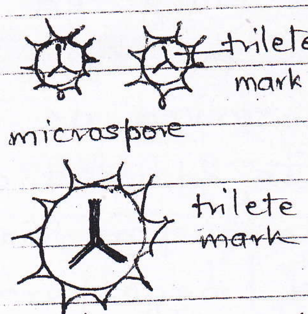
In most of the sps. the cone or stobilus consisted of either megasporophyll or microsporophyll. But several sps are know in s cone consisted of both megasporophyll & microsporophyll.

Lepidostrobus

The cone consisted of thick cone axis around c megasporophylls were arranged spirally. A single, large, massive, sporangium was tnt on the adaxi surface of the sporophyll. In many sps. a legule was tnt c was situa between the end of sporang & upturn portion of the blade of sporophyll.



L.S. of strobilus

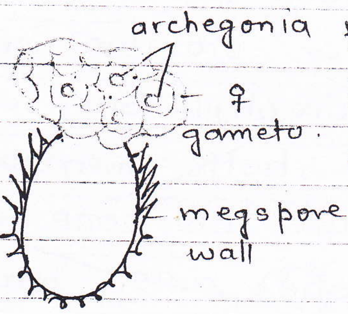


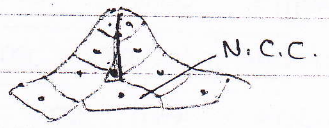
Microsporangia conta numerous small microspores The megasporangium contai large megaspores. However no. of megaspores per sporangium v considerably but

In 1 sps. Lepidostrobous monospora there was a sinde large developed megas

The sporangial wall was usually multilayered. Both micro & megaspores were characterised by distinct trilete mar

In Bothrodendrostrobus the megaspore had ruptured at triradiate mark & the gametophytic tissu had protruted in irregular lobes with indication of several sunken archegonia The archegonia had neck cell & a ne canal cell

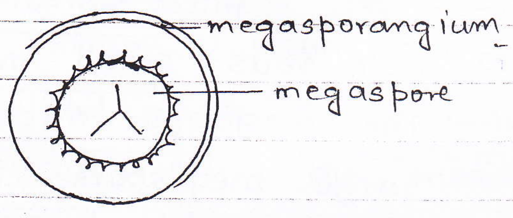


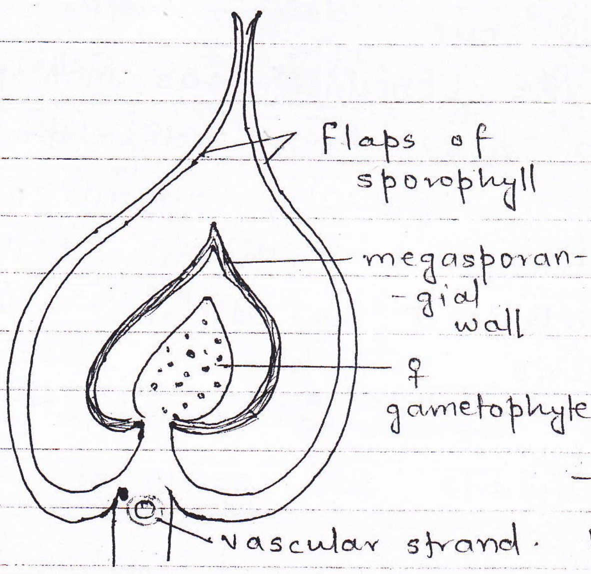


Archegonia

Lepidocarpon –

Lepidocarpon is a seed genus and is a genus of m -sporangiate cone. There was a single large megaspore in each megasporangium.





L.S. seed of Lepidocarpon

In this genus the 2 lateral fla originating from the tissue enclosing entire sporangium leaving an elongated slit opening at the top of spora c probably served as crude micropyle. In addition a sing functional megaspore was ret with in the megasporangiun develop a ♀ gametophyte archegonia.

At mariity with a single s -phyll with its megasporangiu megaspore & contained mega etophyte or ♀ gametophyte as an unit from the parent plant and according to some botanists evolution of s from heterosporous condition was nearly attained this group of lycopods. However it can not be considered as true seed because -

(i) No true ovule

(ii) No true integument.

The so called integument is merely an upturn portion of the sporophyll. The true integument is a ring like outgrowth from below the nucellus of the ovule. No trace of embryo has been reported in any member of the Lepidodendrales.

Sigillariostrobus and Mazocarpon -

These 2 form genera have megasporangiate & micro-sporangiate cones.

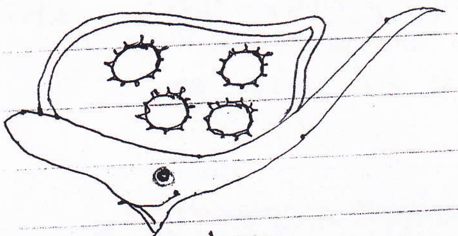
In Mazocarpon the sporophylls were arranged in cone axis in low spiral or verticillo order.

Sporophylls were distinguished by the tnce of the conspicuo heel. There were normally 8 megaspores in a megasporangi

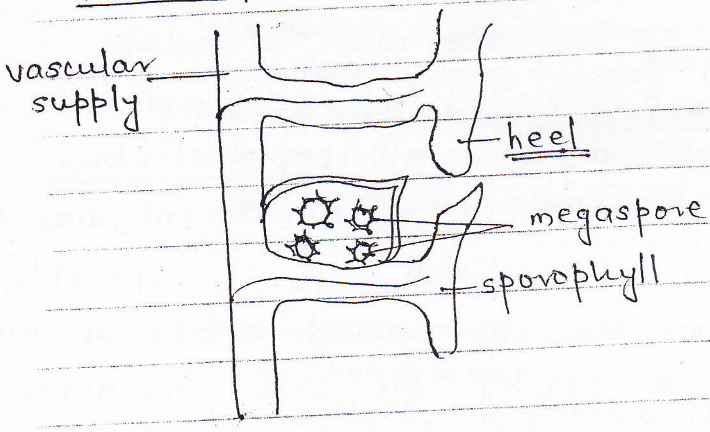
In Sigillariostrobus there were 12 megaspores in a megasporangium.

Microsporangia of microspo-ngiate cone contain numer small microspores.

Several megaspores: have be reported representing. fema gametophyte with in the megaspore wall as in Lepidostrobus.



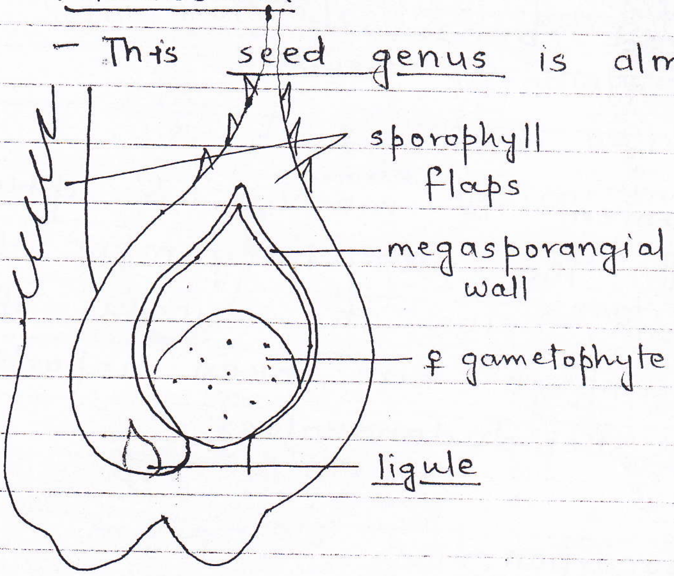
Mazocarpon



L.S. cone

Miadesmia –

– This seed genus is almost similar to that of Lepidoca



but here the megasporangium enclosed in a much branched sporophyll flaps & sporangium was attached by a narrow re & was bend outward along sporophyll.

The seed genus Miadesmia it not certain that this seed ger was born on arborescent Lyco

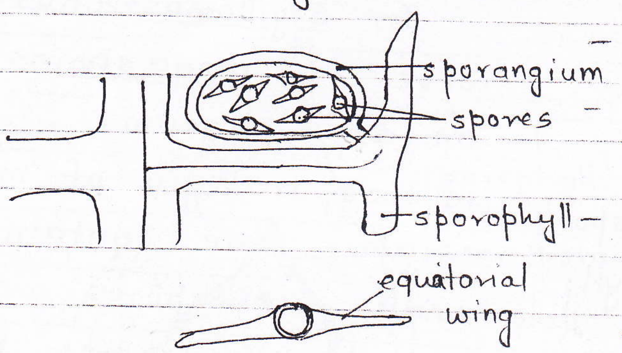
One cone genus described by Pant and Walton (1961) as

Lycostachys –

This cone genus is almost similar to that of Lepidos -bus except it was eligulate but the other structures were exactly similar.

– Another genus Spencerites –

- This cone genus had some peculior character –



- The cone was eligulate.
- The str. of cone axis was simila to that of Lepidostrobus.
- Sporangial attachment was towar the distal end of sporophyll an the spores had equatorial wings.

- Sporophylls were thick & flashy on this character the cone resembles to Cycades particularly Zamia.