

Pteridophytes

Pteridophytes: → seedless tracheophyte.

- term derived from 'Pteron' means feathers.
- termed by Ernst Haeckel.
- originated in carboniferous period of late palaeozoic era.
- study of pteridophytes: Pteridology

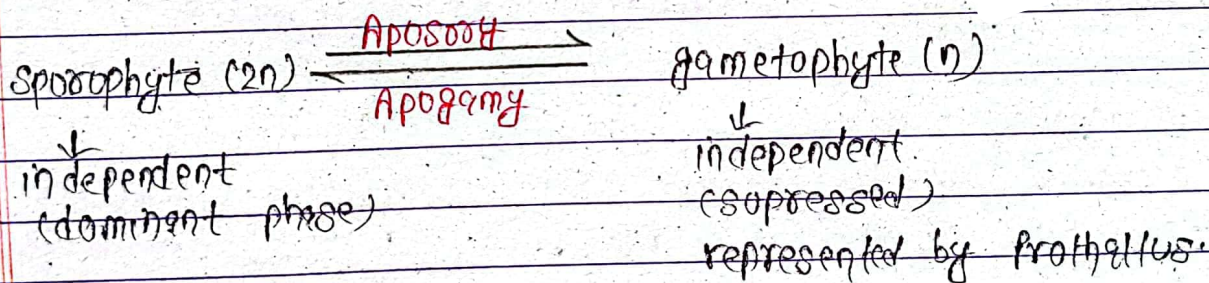
→ first vascular plant and seedless plant so called vascular cryptogams.

→ first sporophytic plant - produces spores.

→ also known as snakes of plant kingdom or botanical snakes.

→ true alternation of generation. by Hofmeister

→ independent sporophyte.



largest pteridophytes: - Cyathea

largest pteridophytes: - Alsophila (Tallest)

smallest pteridophyte: - Azolla (aquatic)

also called tree fern.

→ considered as biofertilizer in the rice field due to symbiotic association with Anabaena (BGA)

→ first plant to become sporophytic is Pteridophyte.

spores — Homosporous @ Holo
Eg, lycopodium, Dryopteris.
Heterosporous Eg, Salvinia, Azolla, Marsilea, Selaginella

Leaf — bearing spore :- sporophyll
without spore :- Tropophyll (photosynthesis)
brown colored, flattened leaf :- calophyll
↓
helps in protection

Sporangium :- 2 types of development

a) Leptosporangiate (advanced)

→ sporangia develops from single cell.

Eg, Salvinia, Azolla, Marsilea, Ferns, Dryopteris @ SAM EQ.

b) Eusporangiate (primitive).

→ sporangia develops from group of cell.

Eg, Selaginella, Lycopodium, Psilotum, Equisetum.

Similarities between bryophytes and pteridophytes.

→ terrestrial habitat

Note:- aquatic pteridophyte: Eg, Salvinia, Azolla, Marsilea @ SAM.

→ water is necessary for fertilization.

→ heteromorphic alternation of generation.

→ asexual spore absent.

→ biflagellated antherozoids or spermatozooids

→ seed development is absent

characters

Main plant body

gametophyte (n)
→ sporophyte is dependent on gametophyte

sporophyte ($2n$)
→ sporophyte is independent

vascular tissue

absent

Xylem $\xrightarrow{\text{made of}}$ tracheid only

phloem $\xrightarrow{\text{made of}}$ sieve cell only

gametophytic phase

dominant phase

represented by prothallus (reduced, short lived)

Sporophyte of pteridophyte

→ root, stem, leaf

★ Root :- adventitious root, primary root, ephemerals short lived.
→ protostele.

★ Stem :- Rhizome $\rightarrow$ erect prostrate, with/without segments. brown scales.

→ vascular tissue is absent.

→ Xylem - lacks fibres and vessels.
(except selaginella, dryopteris)

→ Cambium - absent

→ Phloem - lacks companion cells and sieve tube cells.

NOTE:- similar to gymnosperm - replaced by sieve cells.

Stelar system

Stele :- vascular tissue + pith (if present) + pericycle

Stele in pteridophytes - protostele.

Stele in ferns/dryopteris - dictyostele.

Types of stele in plants:- 3

a) protostele :- stele with^{out} pith

Eg. Selaginella.

b) Siphonostele - stele with pith, no leaf gap.

Eg. Mosses.

c) Solenostele - stele with pith and leaf gap.

Its types are:-

★ Dictyostele - leaf gap + vascular tissue.

Eg. ferns, dryopteris.

meristele.

★ Eustele :- VB arranged as a broken ring.

Eg. dicot stem.

★ Atactostele - scattered arrangement of VB.

Eg. monocot stem.

② MAADF

★ Polycyclic stele - many circles of VB

Eg. Pteridium.

Classification of Pteridophytes:-

a) Psilopsida

- most primitive and oldest land inhabiting plants.
- total fossils plant and only 2 living genera.
- Psilotum → ~~living~~ fossil.

Eg, Cocksonia, Rhynia.

b) Lycopsidea

- living, primitive and present near to moss.
- commonly known as club moss or spike moss. ~~reply~~

Eg, Lycopodium, Selaginella

c) Sphenopsida

- intermediate in advancement
- deposition of silica in stems, so they are rough in touch.

Eg, Equisetum (horse tail)

d) Pteropsida

- advanced pteridophytes, which lie near to cycas.
- fan like leaves - frond is present.
- plant is well developed and stem is usually rhizome.

Eg, Dryopteris, Pteris, Adiantum (walking fern), etc.

→ cycas is originated from pteropsida.

Lifecycle of Selaginella

- commonly known as spike moss / little club moss / coniferous moss / birds nest moss / resurrection plant.
- shade and damp place (sciophyte) habitat.
- Selaginella bryopteris is commonly known as *eterna* (immortality)

Plant body

* Sporophyte :- root, stem, rhizophore, leaf.

a) Root :- adventitious root, primary root, ephemeral.
- without xylem
- protostele.

b) Stem - erect, prostrate called rhizome.
- vascular tissue is present (with vessels)
- protostele, without xylem

c) Rhizophore :- dual character $\rightarrow$ root / stem

→ Rhizophore is originated from unknown. i.e. called *new* organ / organogenesis.

→ it has evolutionary significance.

d) Leaf :- small, not bearing stoma.
- contain ligule.

ligulated fern :- as ligulated flower
by ligulated plant

Glossopodium helps in water retention in plant

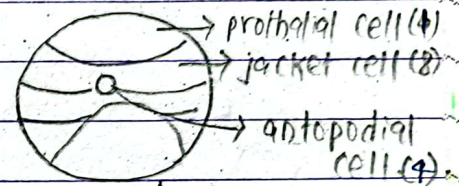
Reproduction:- in Selaginella:-

By strobilus / cone:-

→ heterosporous, bisexual, eusporangiate (primitive).

→ microsporangium → MMC (2n) $\xrightarrow{\text{meiosis}}$  tetrad → o o o o microspores (n)

↓ 5 times division



16 celled stage
male gametophyte

prothallial cell - 1

jacket cell - 8

androgonial cell - 4

↓ mitosis
water

antherozoids

(2, 3 coiled, biflagellated)

* Megasporengium → MMC (2n) $\xrightarrow{\text{meiosis}}$  tetrad → o o o o megaspore

↓ 3 die

such type of development which occurs inside maternal body.

← In situ development

archegonial cell

somatic cell



Archegonial cell

Archegonia is flask, erect.

NCC + VCC → malic acid + mucilage

(1)

(1)

female gametophyte

Egg:- oosphere (n)

chemotactic movement

egg + antherozoids → fertilization → zygote

oospore (2n)

(sporophytic)

embryo

@ HB NewsIn situ areas:-

Herbarium, ^{hotspot} biosphere, national park, wild life sanctuary, sacred grooves.

- embryonic development of selaginella occurs inside archegonia.
- young sporophyte gets support with gametophytic structure.

Economic importance of selaginella

asthma, cancer, stomach disease, cardiovascular disease, pneumonia, skin protection, anti-ageing, anti-hair loss, antioxidant

Lifecycle of Dryopteris

- commonly known as ferns.
- found in moist, shady and cool place - sciophyte
- advanced character - leptosporangiate
- primitive character - homosporous.

Systematic position

Division - Filicophyta

Class - leptosporangiospida

Order - Filicales

Family - Polypodiaceae

Genus - Dryopteris.

Sporophyte :- root, stem, leaf

Note: Fern *Dryopteris filix-mas* is commonly known as male shield fern / big scented fern.

Plant body:-

★ **Root** :- adventitious root arises from rhizome.

→ primary root

→ ephemeral (short lived)

★ **Stem** :- erect, prostrate

→ covered by **Ramenta** (brownish scale helps in protection).

→ bearing leaves and roots.

→ **Xylem** :- with vessels and metaxylem

→ **Dictyostele**

★ **leaf** :- large leaf commonly known as **Fronds**.

Frond - [**Trophophyll** :- photosynthesis + transpiration.

[**Sporophyll** :- spore formation + photosynthesis + transpiration.

2 portions in the leaf :- **Rachis** and **leaf lamina**.

★ **Young leaf** - circinate ptyxis

★ **Mature leaf** - sessile and

[**unipinnate** - **Pteris**

[**bipinnate** - **Dryopteris**

[**tripinnate** - **Pleocidium**

Leaf lamina $\left\{ \begin{array}{l} \text{upper epidermis} \\ \text{lower epidermis} \end{array} \right.$ contains chloroplast and stomata.

Reproduction in Dryopteris:-

* Vegetative reproduction

axil of leaves $\xrightarrow[\text{to}]{\text{gives rise}}$ adventitious bud $\xrightarrow{\text{on separation}}$

give rise to new fern plants.

* Spore formation

Sporangia $\rightarrow$ sporophyll $\rightarrow$ spore $\rightarrow$ homosporous

$\downarrow$ are arranged in group.

Sori (plural) $\rightarrow$ present on lower / ventral surface /
adaxial surface. (down)

Sorus :- each sorus is covered by a kidney shape (reinform) structure is called **Indusium**.

Types of indusium:- on the basis of origin

a) True indusium - arises from placenta.

Eg Dryopteris

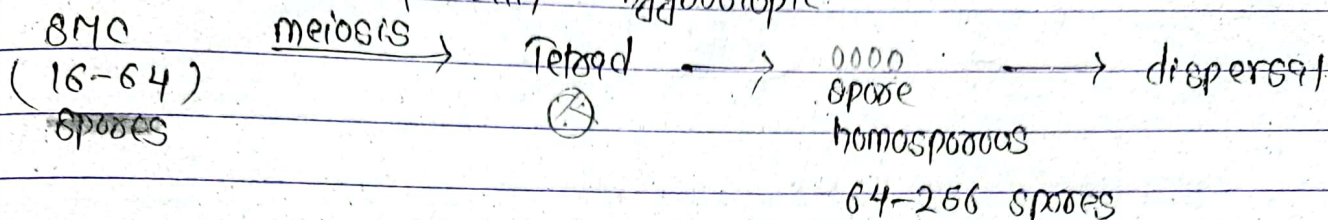
b) False indusium - arises from leafy margin

Eg Pteris.

Sporophyll - fertile leaves having sori or sporangia on them.

Structure of Sporangium

★ Annulus - thick wall, hygroscopic

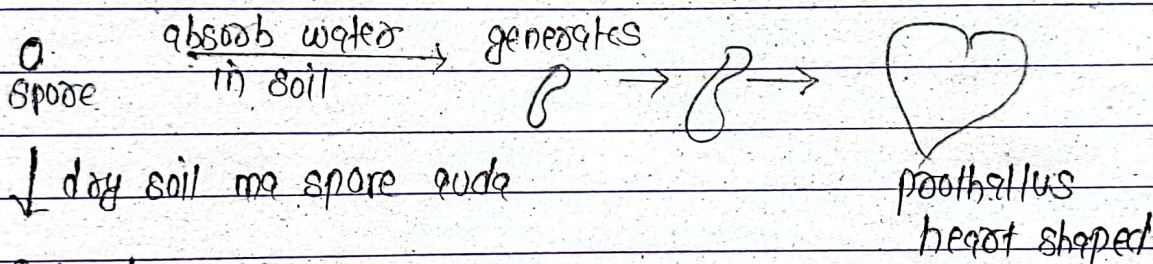


dispersal → occurs on dry condition (xerochasy).

→ by annulus.

→ through stomium (thin walled, non hygroscopic).

→ on indusium / dry soil.



99% die
1% survive } green

Gametophytic generation:- Prothallus

→ haploid spore on germination produces prothallus (heart shape).

→ prothallus is monoecious.

→ prothallus is gametophytic phase.

→ ~~fern~~ prothallus is homothallic. (both antheridia and archegonia are present in same body on lower surface).

prothallus — Rhizoid — unicellular
 — Body — antheridium
 archegonium

Antherozoids of fern:-

- spirally coiled and multiflagellated.
- archegonia of fern : slightly curved with single binucleated neck canal cells.

Archegonia — flask or bent shape.
 — present on upper side

Antheridia — dome, sessile shape.

AMC $\xrightarrow{\text{mitosis}}$ antherozoids
(androcyte mother cell) 2-3 coiled multiflagellated

Archegonium of Dryopteris

- flask and bent / curved shape.
- large egg cell (n)
- Nuc (1) + UCC (1) $\Rightarrow$ malic acid

$\downarrow$
2 nuclei
binucleated

$\downarrow$
chemotactic movement
antherozoids are attracted towards archegonium.

Pteridophyte

common name

Selaginella

Spike moss, little club moss

Lycopodium

Club moss

Equisetum

horse tail

Adiantum

maiden hair fern

Adiantum caudatum

walking fern

Oryopteris

Fern, male shield fern, long scented form.

Special points:-

- Coal is formed by Pteridophytes.
- first plant to appear after forest fire is fern (due to Rhizome).
- aquatic fern:- Salvinia, Azolla, Marsilea @SAM