Characters of Pteridophytes

Some of the most important characters of Pteridophytes are as follows:

1. Habit:

All Pteridophytes are annual and herbaceous, e.g. Azolla, Selaginella but a few are perennial woody tree fern e.g. Alsophila, Angiopteris.

2. Habitat:

They are basically terrestrial plants grow in moist shady cool places.

3. Life Cycle:

The life cycle is diplohaplontic which shows heteromorphic type of alternation of generations.

4. The sporophyte is the dominant plant body which differentiated into roots, stem and leaves.

i. Roots:

Primary root short lived and replaced by adventitious roots. But Psilopsids are rootless plants having rhizoids.

ii. Stem:

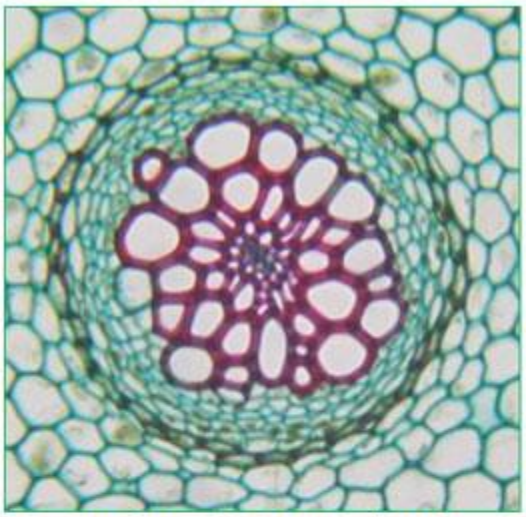
Herbaceous or woody and branched.

iii. Leaves:

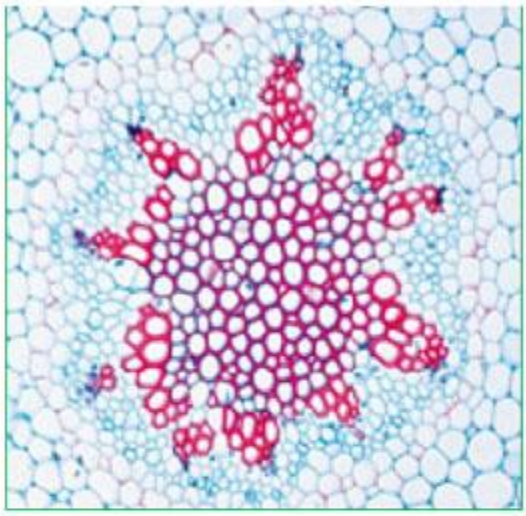
Leaves may be microphyllous (e.g. Lycopodium, Selaginella, and Isoetes) or megaphyllous. (e.g. ferns). The leaves bearing sporangia are called sporophylls. In some cases sporophylls for compact structures called cones or strobili (e.g. Selaginella, Equisetum)

5. Vascular tissues present throughout the sporophyte except in reproductive parts and in gametophyte. Xylem consists of tracheid's (vessels and fibers absent). Phloem consists of sieve cells only.

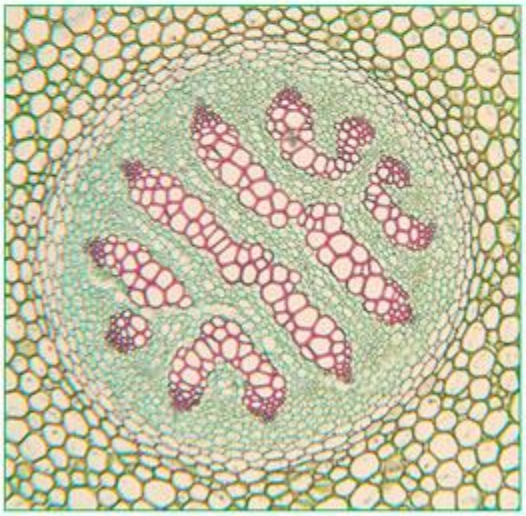
Stele:



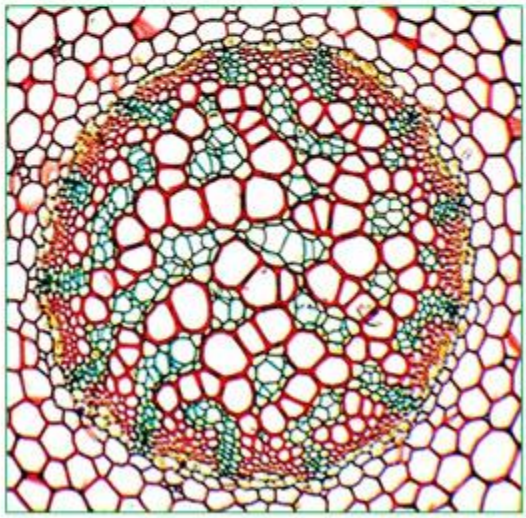
Haplostele (*Lygodium*)



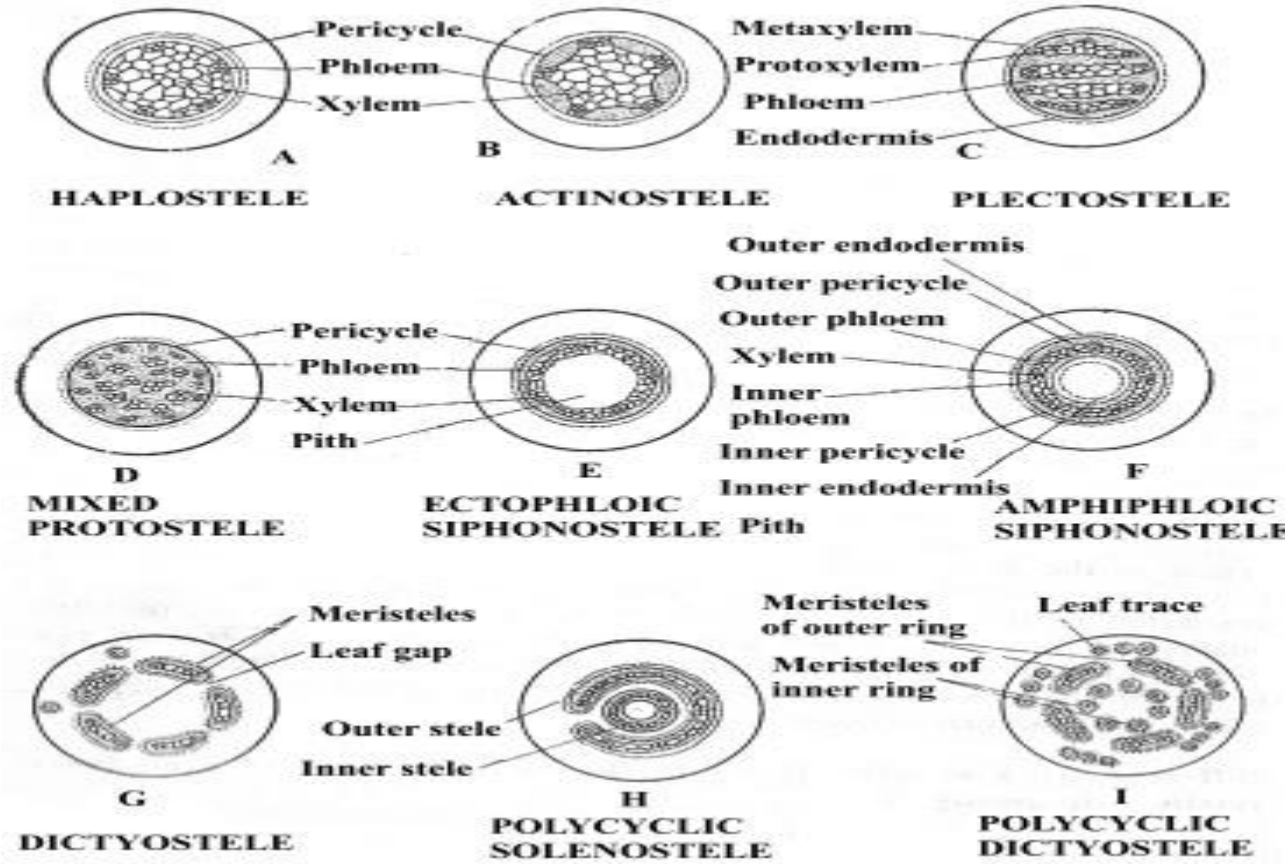
Actinostele (*Psilotum*)



Plectostele
(*Lycopodium clavatum*)

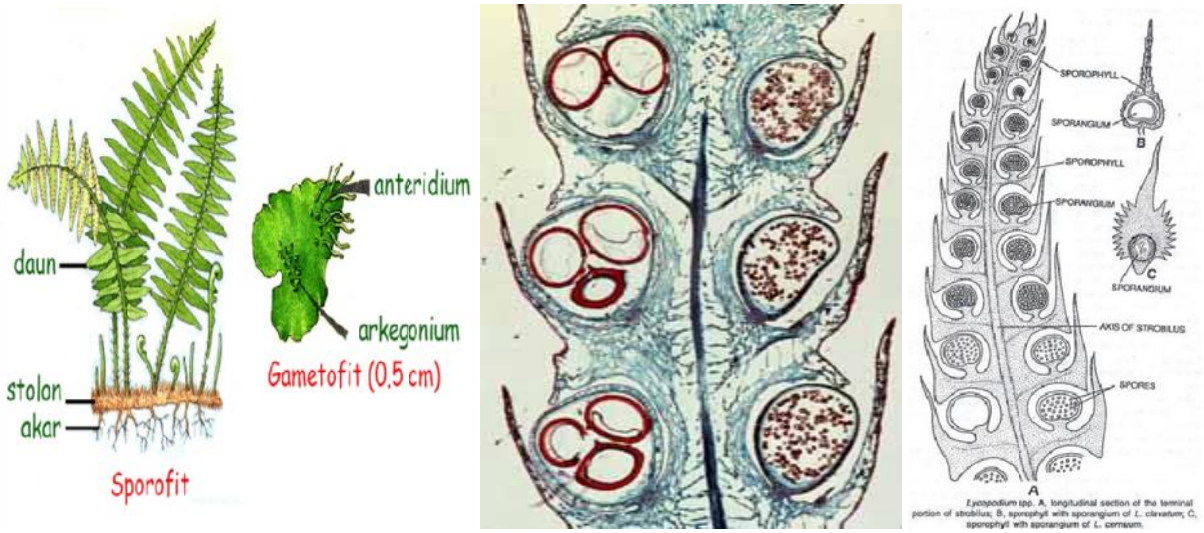


Mixed Protostele
(*Lycopodium cernuum*)



6. Secondary Growth absent except in Isoetes.

7. The sporophyte produces meiosopres inside sporangia. The development of sporangia may be eusporangiate (from a group of cells, e.g. Selaginella, Equisetum, Ophioglossiim etc.) or leptosporangiate (form a single cell, e.g, Azolla, Marsilea, Pterium etc.)



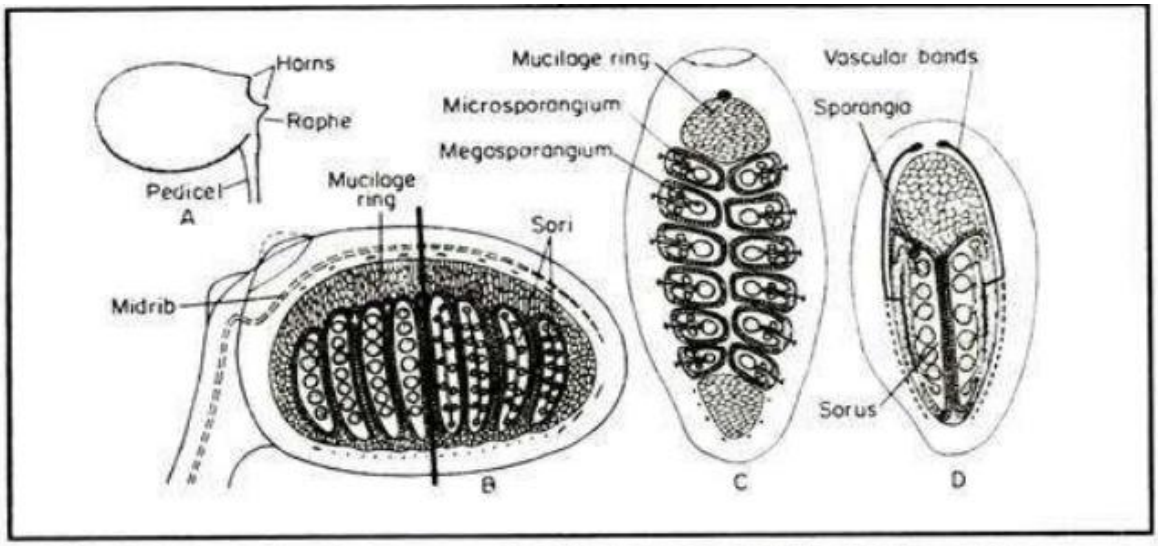
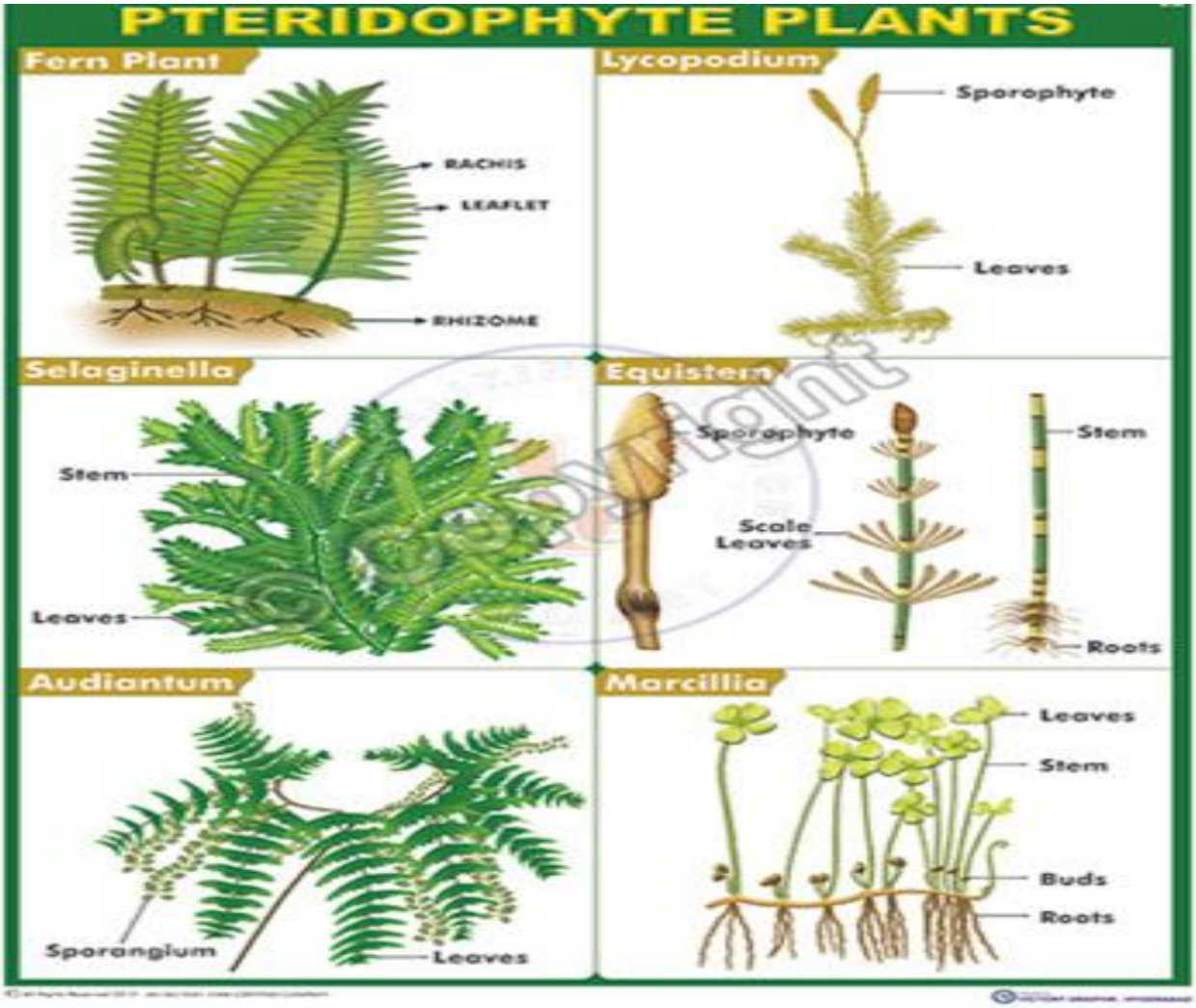


Fig 6.35. Marsilea Sp. : A – A sporocarp, B – V.S. through sporocarp, C – T.S. through sporocarp, D – L.S. through sporocarp.



8. The sporophyte may be homosporous (e g. Dryopteris) or heterosporous (e.g. Selaginella, Marsilea, Azolla etc.) In heterosporous forms, 2 types of spores develop i.e. microspores and megaspores.

9. The spore germinates into an inconspicuous, free-living, photosynthetic thalIoid gametophyte called prothallus.

10. The gametophytes develop sex organs like antheridia (male sex organs) and archegonia (female sex organs).

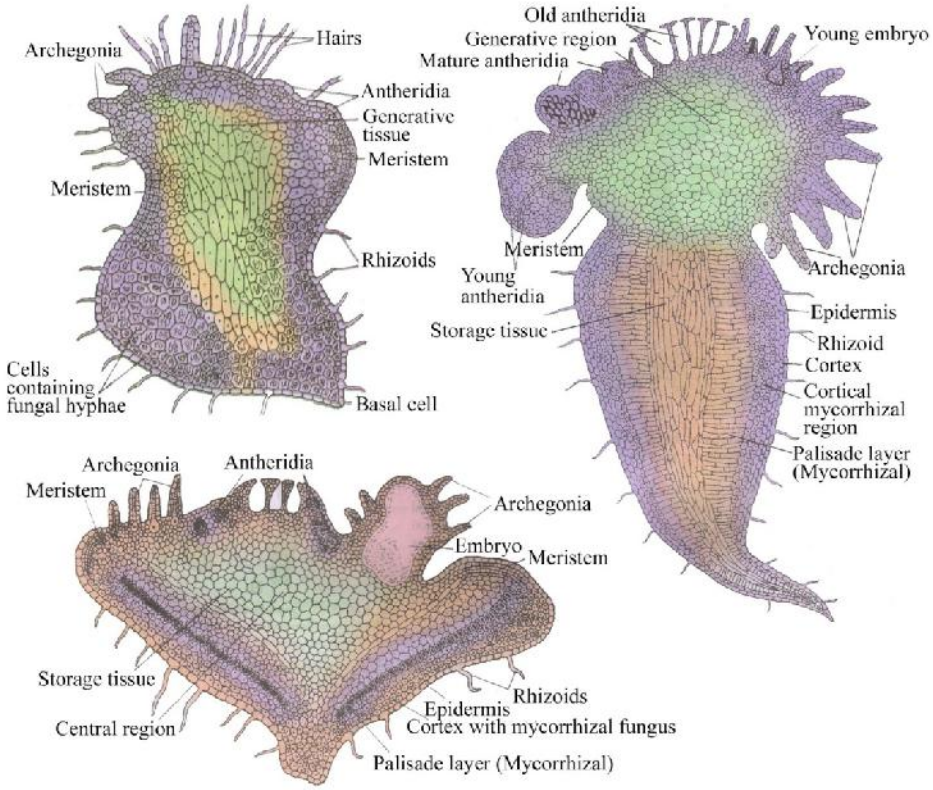
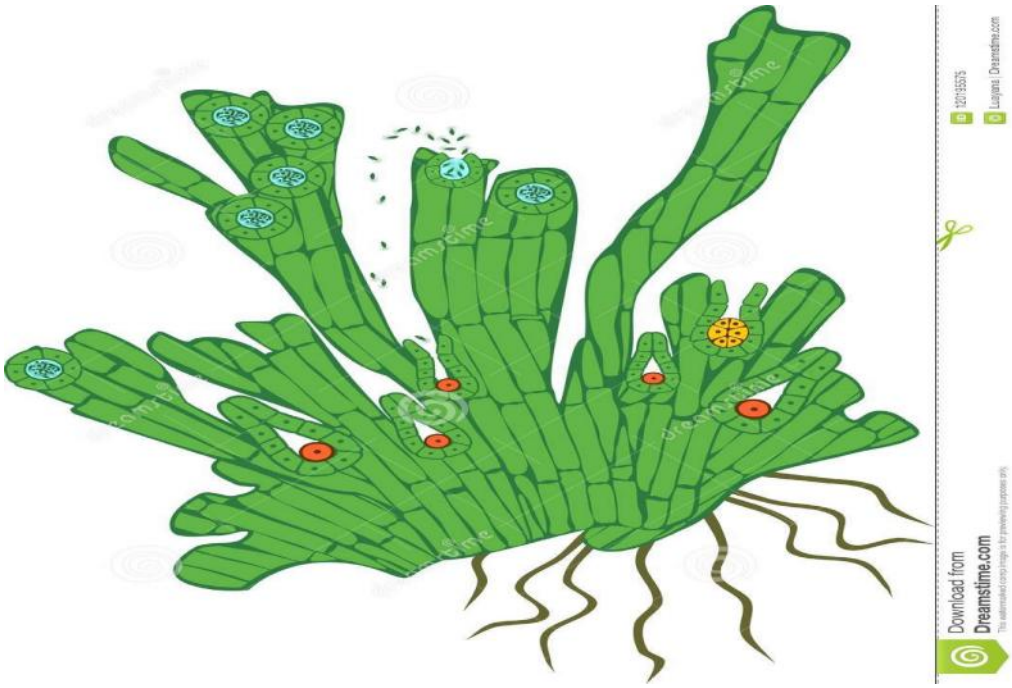


Fig: *Lycopodium*. Three different types of prothallus.



11. Fertilization requires water for transfer of antherozoids to the egg of archegonium.

12. Zygote develops into embryo within the archegonial venter.

13. Apogamy and Apospory: Sometimes deviation in the regular alternation if generations are noticed in the form of apogamy and apospory.

Apogamy is the development of an unusual haploid sporophyte from the gametophyte without the fusion of gametes. The cause of apogamy include ageing of the prothallus, failure of sex organ formation and normal fertilization, prothallus growing under bright light and high temperature etc. Natural apogamy is common in ferns like Dryopteris, Adiantum, Osmunda, Pteris etc.

Apospory is the development of unusual diploid gametophyte from the vegetative parts of sporophyte and not from the spores. The cause of apospory involves deficiency of mineral nutrition, development of leaves under dim light etc., e.g. Pteris, Nephrolepis, Drynaria etc.

NEPHROLEPIS (FERN)

Plant Body of Ferns:

Most of the ferns are small perennial herbs. Tree ferns with long pillar-like stem and a crown of leaves at the top are found only in tropical countries. The plant body is differentiated into steam, roots and leaves with well-developed vascular bundles. The stem is usually a creeping underground rhizome bearing many adventitious roots. It remains covered by a large number of persistent leaf-bases.

Pinnately compound leaves, often called fronds, spring up from the rhizome. The leaves, when young, remain coiled inwards, thus exhibiting circinate vernation (Fig. 208).

The underground rhizome, young leaves and rachis of adult leaves remain covered by brown hairy scales called ramenta (singular— ramentum). This is a safeguard against drought. Circinate arrangement of young leaves and presence of ramenta are characteristic features of ferns.

Fig. 208. A fern plant with underground stem, adventitious roots, adult leaf and a young leaf showing circinate vernation.

Reproduction of Ferns:

Unlike moss, the fern plant is the spore-bearing generation or sporophyte. The leaflets bear some brown kidney-shaped dots, called sori (sing, sorus), on the under surface (Fig. 209). They are usually present directly on the veins or vein-endings.

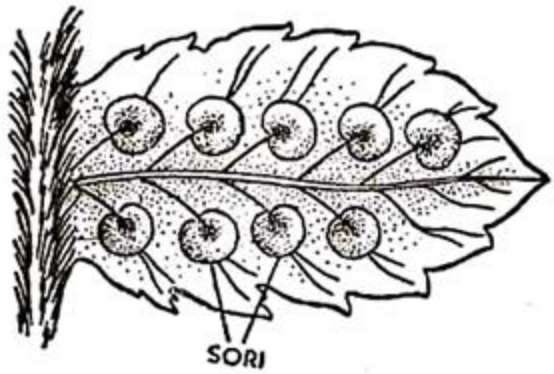


Fig. 209. A leaflet of fern bearing kidney-shaped sori.

A section of a leaflet passing through a sorus shows that it (sorus) is a collection of sporangia, which develop from the soft parenchymatous cushion-like outgrowth called placenta.

The sporangia, when young, remain protected by a curved outgrowth of the leaf-tissue, called indusium (Fig. 210). Each sporangium has two parts, viz. a multicellular stalk surmounted by the swollen body called the capsule. The capsule has the outer wall made up of one layer of cells. It encloses a definite number of large cells called spore-mother cells.

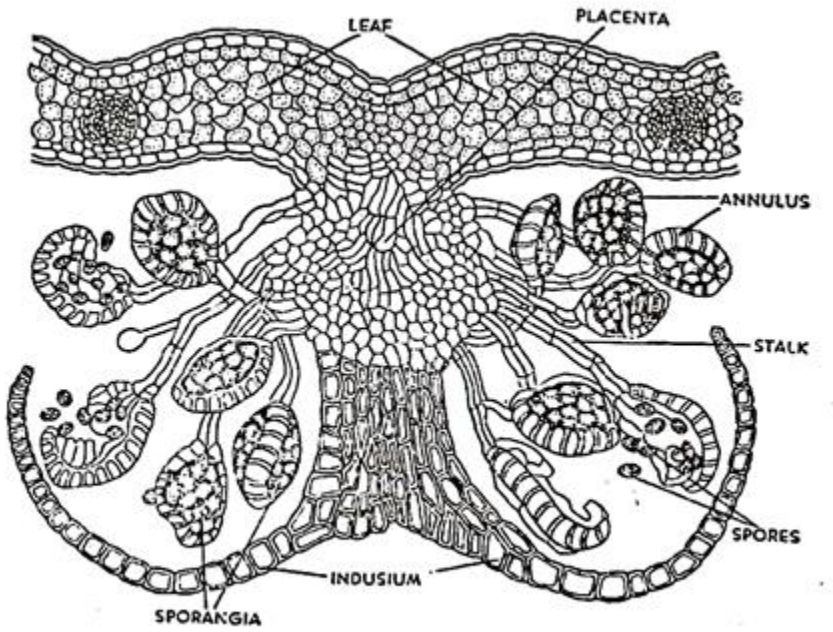


Fig. 210. Cross-section of a fern leaflet through a sorus.

The number is usually sixteen; in some cases it may be twelve. Every spore-mother cell undergoes reduction division to produce a tetrad of spores. Reduction division with subsequent formation of spores, marks the beginning of gametophytic generation.

Along the margin of the capsule wall there is a row of cells with inner and radial walls cuticularised. This row covering the major part of the capsule is called annulus. A few thin-walled cells forming the weak spot, so to say, on the capsule wall constitute, what is known as stomium (Fig. 211).

After formation of spores the annulus straightens up in response to atmospheric changes in humidity, and the capsule bursts at the stomium liberating the spores, which are easily carried away by wind.

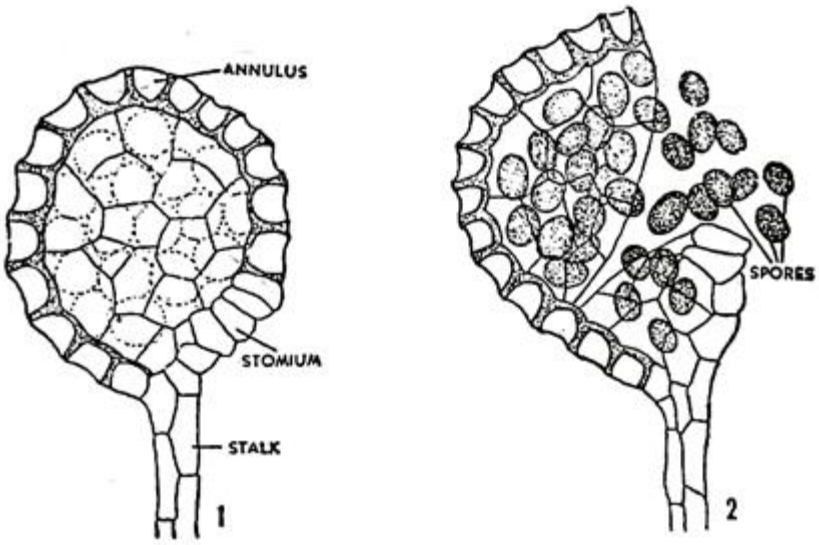


Fig. 211. Fern; 1—a spo..ugium; 2—bursting of the capsule at stomium and liberation of spores.

Spore is a unicellular body with two coats, outer thick exine and thin inner coat, intine. Under suitable conditions spore germinates. Exine bursts and intine comes out in form of tube which, by repeated cell division, gives rise to a green flat heart-shaped thalloid body called pro-thallus.

It develops unicellular hairs, called rhizoids, from the under surface for fixation and absorption of water and mineral matters. Thus the small pro-thallus, barely TO cm in size, is an independent body. Pro-thallus bears the sex organs, and so represents the gametophyte of fern. Antheridia are located at the basal part amongst the rhizoids and archegonia near the apical notch (Fig. 212).

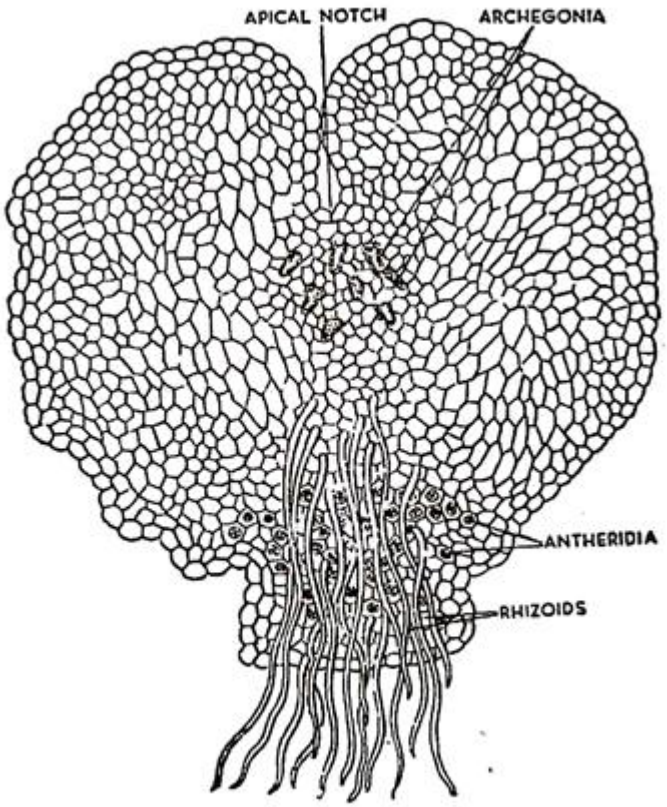


Fig. 212. Mature prothallus (gametophyte) of fern viewed from below.

An antheridium is a spherical structure with an outer jacket of sterile cells. It encloses a good number of spermatozoid-mother cells; each of them produces a spermatozoid or antherozoid (male gamete).

In presence of water sperms, surrounded by remnants of the mother cells, are liberated from the antheridium through an apical opening. The spermatozoids are naked spirally twisted multi-ciliate bodies (Fig. 213, left). They swim freely in surrounding film of water.

Archegonium is a flask-shaped body with the basal swollen portion, venter, and the short slightly curved neck. Venter remains embedded in the body of the pro-thallus, only neck projects out. Venter contains the female gamete, egg or ovum, and a ventral canal cell; and the neck contains a bi-nucleate neck canal cell (Fig. 213, right).

At maturity of the archegonium, all the cells excepting the egg dis-organise, an opening is formed at the tip, thus establishing a thorough passage to the egg. Besides mucilage, archegonia secrete chemicals, malic acid and salts of malic acid, which attract the sperms.

Quite a good number of them move towards the archegonium. One passes down the canal and fertilizes the egg. The oospore, thus formed, soon secretes a wall around itself. By repeated cell division oospore gives rise to the multicellular embryo, which develops into a new fern plant, thus completing the life-history.

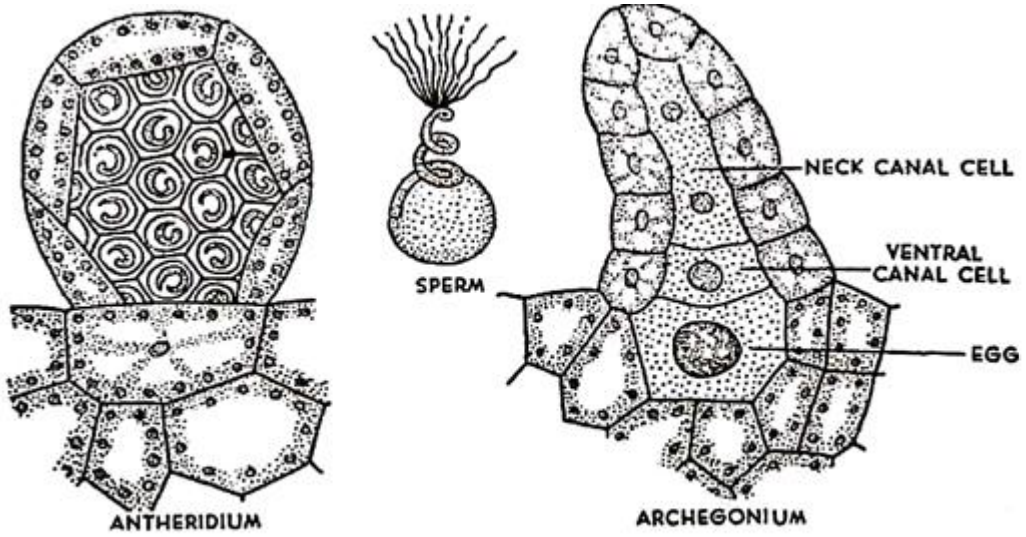


Fig. 213. Antheridium and archegonium of fern.

Life-Cycle of Ferns:

The above life-history shows that it has two distinct parts, the plant itself reproducing asexually by spores and the pro-thallus reproducing sexually by gametes. Sporophyte and gametophyte, as they are called, regularly alternate in the life-history, establishing 'alternation of generations'.

Sporophyte, the more prominent generation, contains, diploid or '2n' number of chromosomes in the nuclei of the cells. Fertilization is the starting point of this generation and continues up to spore-mother cells.

As soon as there is reduction division of the spore-mother cell, number of chromosomes is reduced to half and gametophyte begins. So spore is the starting point of gametophyte, which continues right up to male and female gametes before their union.

The gametophyte, though much smaller and inconspicuous, is independent of the sporophyte. The two cardinal points, fertilization and reduction division, determine the limits of the two generations (Fig. 214).

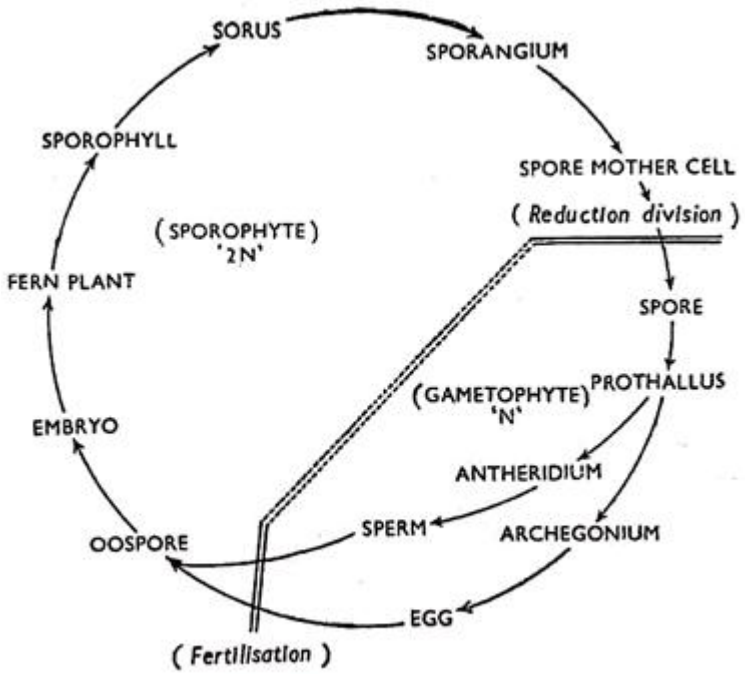
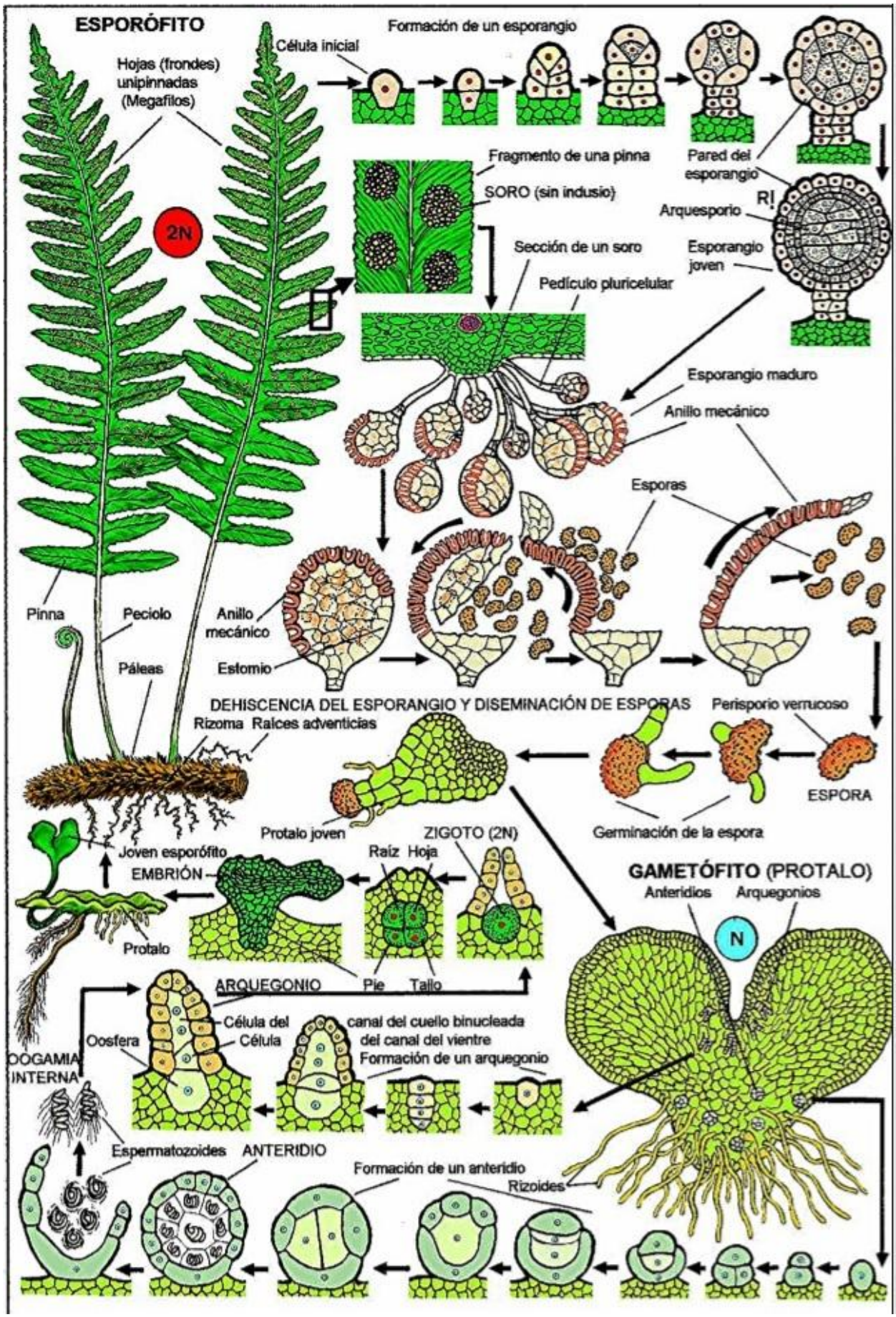


Fig. 214. Life-cycle of fern.


ESPORÓFITO
Hojas (frondes) unipinnadas (Megafilos)
2N
Pinna
Peciolo
Páleas
Rizoma
Raíces adventicias
Célula inicial
Formación de un esporangio
Fragmento de una pinna
SORO (sin indusio)
Sección de un soro
Pedículo pluricelular
Pared del esporangio
Arquesporio
R!
Esporangio joven
Esporangio maduro
Anillo mecánico
Esporas
Anillo mecánico
Estomio
DEHISCENCIA DEL ESPORANGIO Y DISEMINACIÓN DE ESPORAS
Perisporio verrucoso
ESPORA
Germinación de la espora
Protalo joven
ZIGOTO (2N)
Raíz
Hoja
Joven esporófito
EMBRIÓN
Protalo
ARQUEGONIO
Pie
Tallo
GAMETÓFITO (PROTALO)
Anteridios
Arquegonios
N
Célula del canal del cuello
Célula binucleada del canal del vientre
Oosfera
OOGAMIA INTERNA
Formación de un arquegonio
Espermatozoides
ANTERIDIO
Formación de un anteridio
Rizoides