

Pteridophytes

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Apospory

(Apo – without, Spore – Production)

Development of Gametophyte without the spore formation is called – Apospory. Druery coined the term and discovered this phenomenon in *Athyrium filix ferina var. clarissima* – Prothalli / Gametophyte develop from certain regions of sporophyte (a diploid structure) as follows:

Stalk of sporangium – *Athyrium*

Head of Sporangium – *Athyrium*

Leaves, floral and apical regions in *Trichomonas*.

In *Osmunda javanica*, Aposporous gametophytes developed only antheridia and no archegonia were produced.

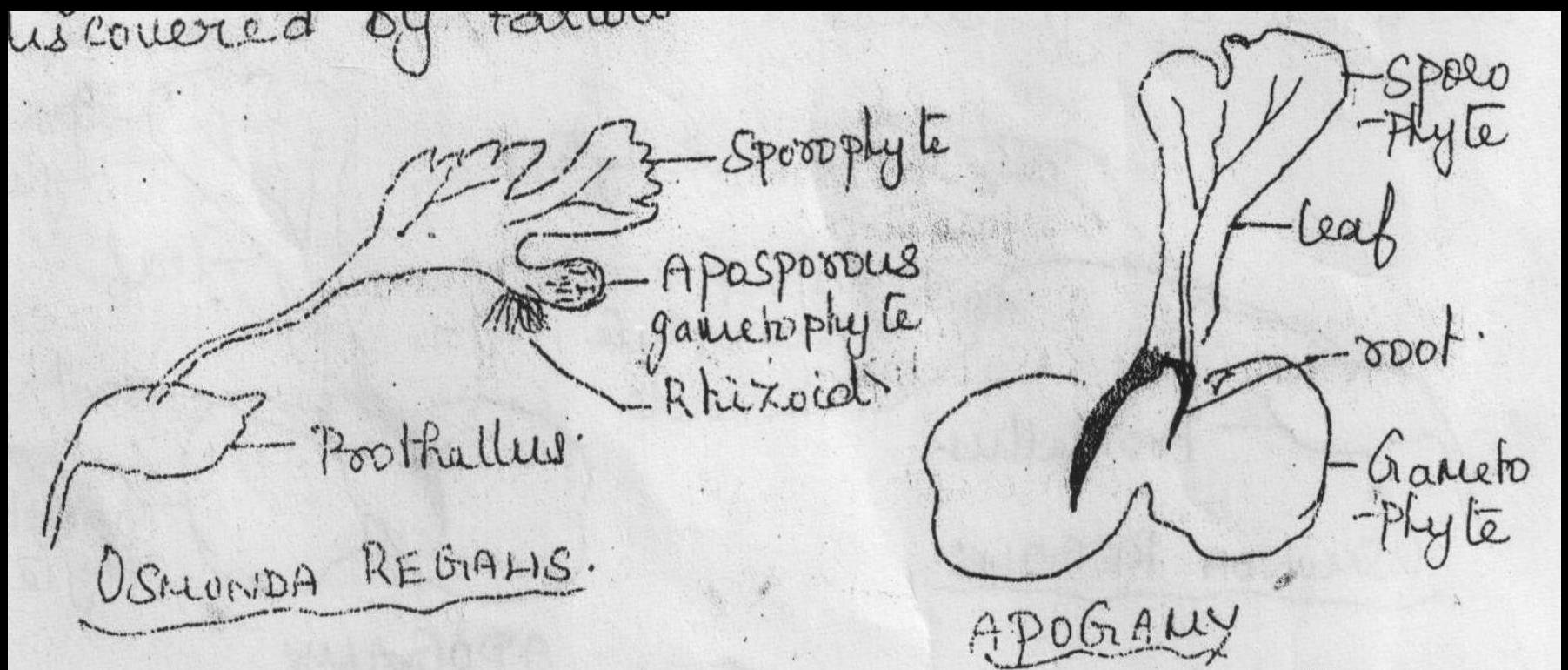
Apospory is not a phenomenon of regular occurrence. It can be induced under cultural conditions (*Pteris*).

Causes of Apospory – mineral nutrition is responsible for apospory in *Pteris cretica* as reported by Bristow (1962).

In *Drynaria* and *Polypodium*, development of prothallus (Aposporous gametophyte) is affected by dim light.

Apogamy – Development of sporophyte directly from the gametophyte without sexual union of gametes. It was first discovered by Farlow.

An interesting noteworthy feature of apogamy that vascular sporophyte develop from non-vascular gametophyte first of all a 1 – 3 celled meristematic zone originates in the most thickened part of the gametophyte.



It divides in various planes and form a meristematic wound of cells. Shoot apices differentiate on this wound. First root arises adventitiously from the stem.

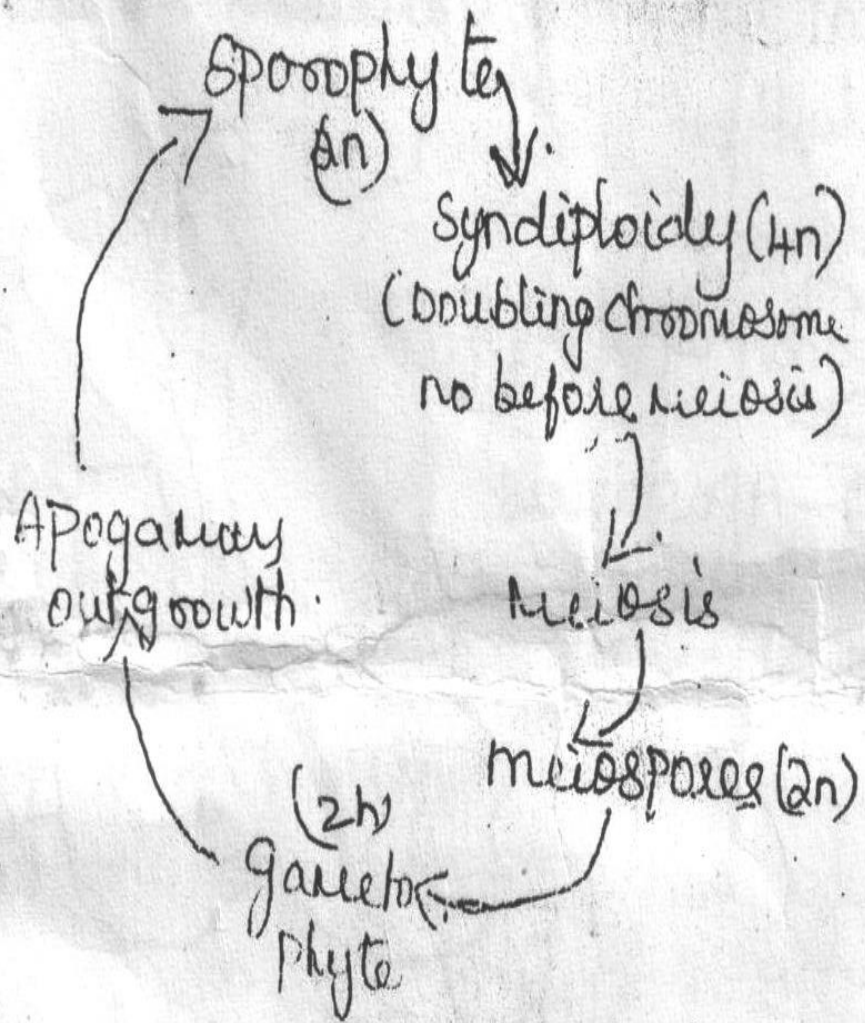
Types of Apogamy – Obligate Apogamy – In some, Pteridophytes, the occurrence of apogamy is a **constant feature**. In such cases it may be due to the non-functional nature of ♂ / ♀ sex organs or due to absence of sex organs.

Induced Apogamy – In the above said species, apogamy can be induced on the gametophyte having both the sex organs (functional). Exposing the gametophyte to direct illumination induced apogamy successfully.

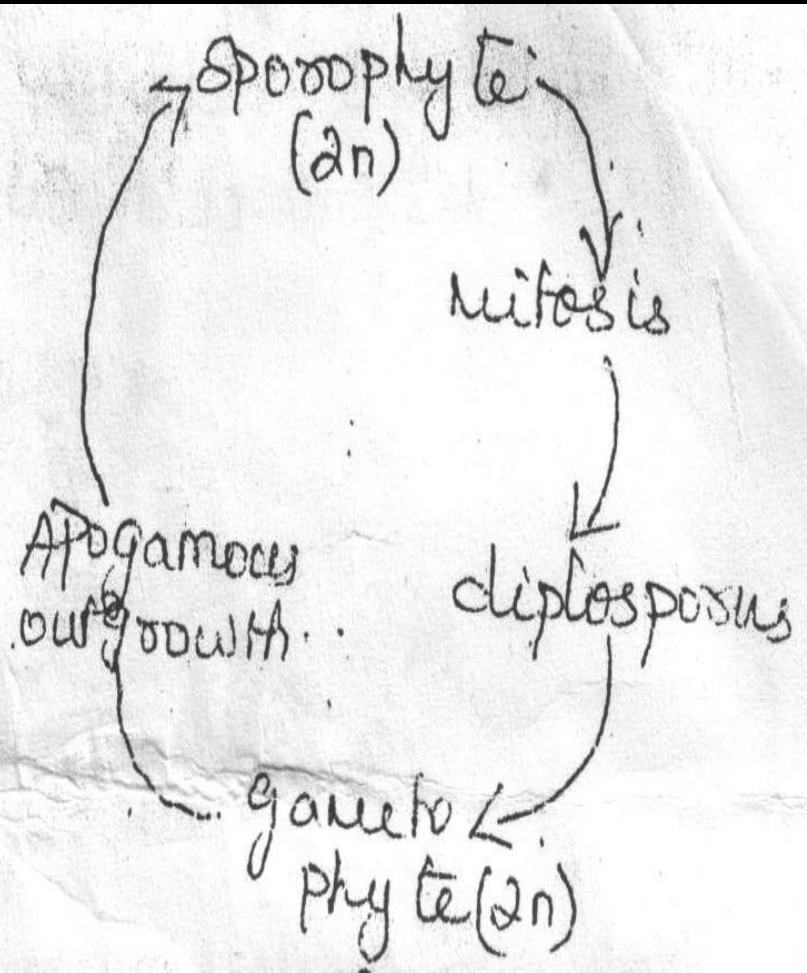
Causes of apogamy –

1. Sufficient illumination / high light intensity in summer causes apogamy.
2. In sufficiency of water for fertilization results in apogamy in Lycopodium.
3. Addition of coconut milk and sucrose in the nutrient medium.
4. Addition of Gibberellic acid, IAA, tryptophane or yeast extract promotes apogamy.

Thus, carbohydrates, mineral nutrition, gene dosage, quality of light and hormones are the main factors that regulate apogamy.



occurrence of Syndiploidy
 (EVANS).



Non-occurrence of
 Meiosis
 (Verma, Evans etc).

Sporangial Organization in Pteridophytes

Pteridophytes are polysporangiate unlike Bryophytes. In fossil (primitive) Pterido, sporangia are foliar in nature and those leaves with sporangia are called sporophylls. In lower pterido, sporophylls aggregate to form compact strobilus.

Development of sporangium – On the basis of sporangial development they are classified as 3 types. (a) Eusporangiate (b) Leptosporangiate (c) Transitional type as reported by Bower in osmundaceae.

Eusporangiate – sporangium develops from a layer of initials and sporangium is covered by a multilayered (3 – 5 layers) wall. Eg. Lycopodium, Selaginella & Equisetum etc. The multilayered wall may disappeared at maturity as in Lycopodium or remain multilayered as in Psilotum. Spore output is more in this type.

Leptosporangiate type – Here sporangium originates from a single superficial and the mature sporangium has a wall made up of single layer. Sporangial initial divides to form outer and inner cell. Entire sporangium develops from the outer cell. Inner cell remains inactive in most ferns. Spores output is less compared to Eusporangium.

Tapetum – During the ontogeny of sporangia, a special nutritive tissue, the tapetum, differentiate on the periphery around the sporocytes. Plasmodial type in Equisetum and Secretary type of tapetum in Lycopodium. Plasmodial type of Tapetum is characterised by the break down of cell wall and the intrusion of protoplasts between sporocytes and spores. In secretory type of tapetum, the cell wall remain intact and the contents secrete out of cells and nourish the spores. The origin of Tapetum is variable. In Lycopodium the tapetum is the inner most wall of sproangium and in sellaginella and other leptosprangiate ferns. Tapetum develops from the outer most layer of sporogenous tissue.

Evolution of sorus – Sorus is a group of sporangium. They are produced on the abaxial / adaxial surface of sporophylls in ferns. Sometimes sporangia are either scattered over the lower leaf surface forming a feet or form marginal tassels over the surface of slender leaf division as in *Osmunda*. Sori are circular, reniform / linear. They originate in different ways.

- a) Marginal sorus
- b) Intra-marginal
- c) Superficial / abaxial sorus

Sori are covered by a superficial modified leaf margin called Indusium. Non Indusiate sori are also found.

- a) Indusiate – *Nephrolepis* – *Marsilea*
- b) Non-Indusiate - *Gleichenia*

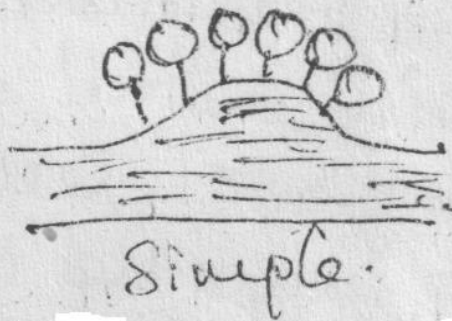
In some other fern there are false - indusium as in *Adiantum*.

Maturation of sporangia – There are 3 types of sori based on the pattern of maturation of sporangia.

a) Gradate sori (Gradatae) – Acropetal / Basipetal arrangement

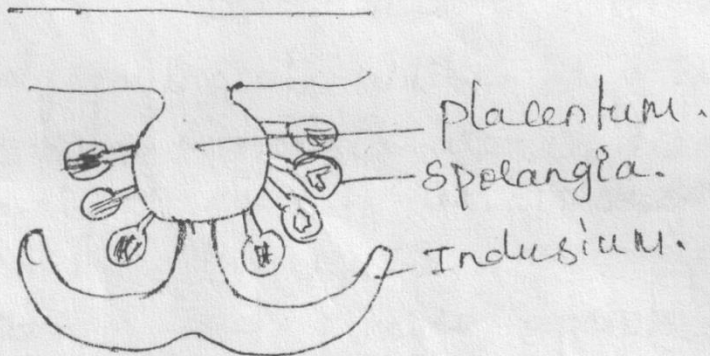
b) Simple sori (Simplices) – Sporangia mature at the same time.

c) Mixed sori (Mixtae) – Young and old are found on the receptacle.

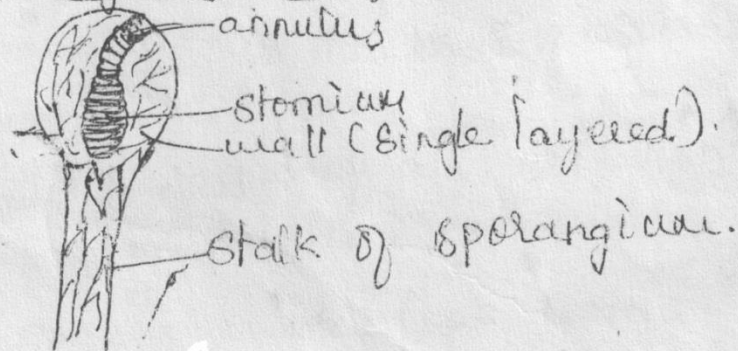


Structure of Mature Sporangium – Primitive fossil Pteridophytes had larger sporangium. In primitive ferns also, the sporangia are large, but in advanced forms the size is reduced. The dehiscence in primitive sporangia is by a longitudinal slit. But in advanced forms there is a specialized structure like annulus and stomium. In *Nephrolepis*, the annulus is single layered and thick walled from one end to the other end vertically over the wall of sporangium. The end of annulus, there is a row of thin walled cells forming stomium. Stomium breaks due to the contraction of the cells of annulus and the spores released.

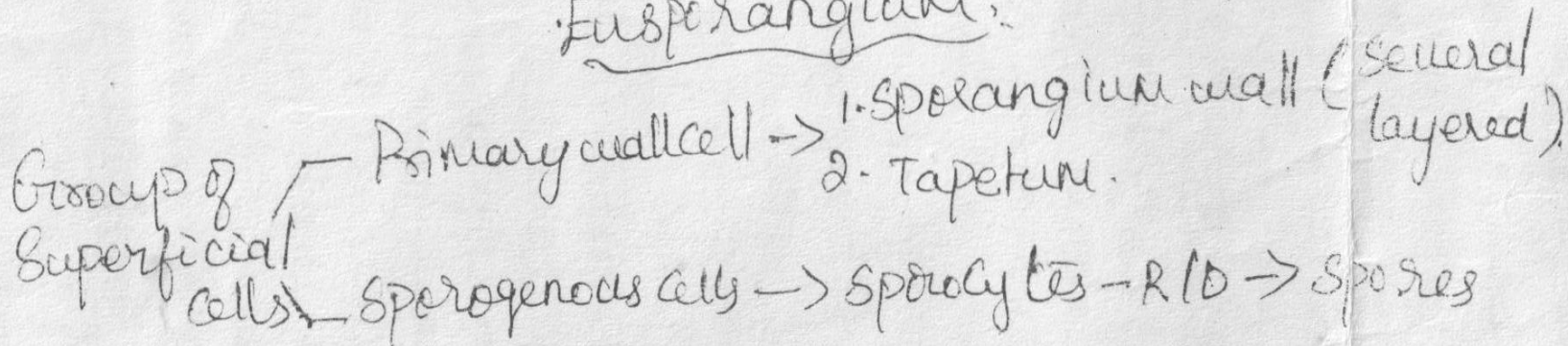
T.S of Sorus.



Structure of Sporangium in Aspidium -



Eusporangium:



Leptosporangium:

