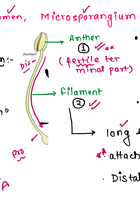
(→The Male Reproductive Organ = stamen)

Stamen, Microsporangium and Pollen Grains

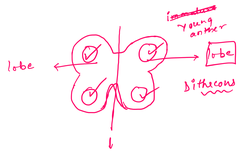


"Diagram:- "A Typical Stamen"

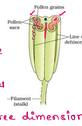
- Stamen is the male reproductive organ or microsporophyll of a flower
- Stamen made up of ② parts.
  - ① Anther (Fertile terminal part)
  - ② Filament → long & slender stalk
    - attached proximally to thalamus, petal or tepal.
    - Distal end bear generally bilobed anther.

* The number and length of stamens are variable in flower of different species.

Structure of Anther :- A typical angiosperm is bilobed with each lobe having two theca i.e. they are dithecous. often a longitudinal grooves runs lengthwise separating theca.



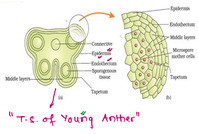
* The two anther lobe are separated in the anther region by deep groove but are attached to each other on back side by a fertile parenchymatous tissue called connective.



"Three dimensional cut section of an anther"

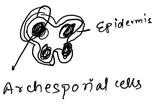
"connective" possesses a "vascular strand" (theca = cavity)

* Bilobed nature of an anther is very distinct in the transverse section of the anther.
* The two chambers of an anther lobe possess long and cylindrical pollen sacs or microsporangia.
* Anther is four sided (Tetragonal structure) structure consisting of ④ microsporangia located at the corners, two in each lobe
* microsporangia develop further and become pollen sac. They extended longitudinally all through the length of anther and are packed with pollen grains.



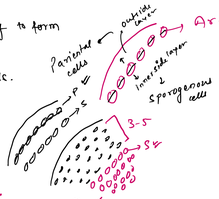
"T.c. of Young Anther"

* All microsporangia are covered outside by a well defined common epidermis of the anther.
* The microsporangia develop hypodermally in anther from the strips of Archesporial cells i.e. development is eusporangiate.



Archesporial cells

* Archesporial cells divide periclinally to form
  - outer Sub epidermal (Parietal cells) → divide periclinally → Produce 3-5 layered microsporangial wall
  - inner sporogenous cells.

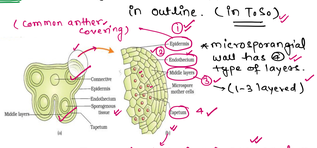


consists of endothecium, middle layer and Tapetum.

Microsporangium :→ * cylindrical sac appears circular in outline. (In T.S.)

Structure

consists of ② parts
- * Outer wall
- * central Homogenous sporogenous tissue



* microsporangial wall has ④ type of layers. (1-3 layered)

Enlarged view of microsporangium showing wall layers.

* The outer three layers perform the function of protection and help in dehiscence of anther to release the pollen.
* The innermost wall layer is tapetum. It nourishes the developing pollen grains. / PMC
* cells of the tapetum possess dense cytoplasm and generally have more than one nucleus. It is ble of endomitosis. (They are either multinucleated or their nucleus becomes polyploid due to endoploidy)

Microsporogenesis :→

* Sporogenous tissue fills whole interior of a microsporangium. PMC (2n) —meiosis→ ④ tetrad (n)
* As the anther develops, the cells of the sporogenous tissue undergo meiotic divisions to form microspore tetrads. (ploid of tetrad is "n")
* usual arrangement of microspore in tetrad is tetrahedral or isobilateral (most common)
* As each cells of the sporogenous tissue is capable of giving rise to microspore tetrad.
* Each one is a potential pollen or microspore mother cell (PMC or MMC).
* Process of formation of microspores from PMC through meiosis is called microsporogenesis.
* Microspore arranged in cluster of four cells - the microspore tetrad.

* As the anthers mature and dehydrate, the microspore dissociate from each other and develop into pollen grains. Inside each microsporangium several thousands of pollen grains are formed that are released with dehiscence of anther

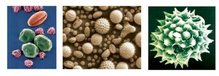
=> "mature anther dithecous"

(A Mature dehisced Anther)

Pollen Grain :→ (Male gametophyte)

* Pollen grains are observed under microscope. They variety of architecture - size, shape, colors and designs - seen on the pollen grains of different species

DPP-2		
0.1 → 4	0.5 — 3	0.9 - 1
0.2 → 4	0.6 — 2	0.10 - 2
0.3 → 1	0.7 - 2	
0.4 → 3	0.8 - 2	



** "scanning electron micrographs of a few pollen grains"

* Shape → Generally spherical
* Diameter → 25-50 μm
* Wall (sporoderm) → Two layered
* cytoplasm of pollen grain cell rich in starch and unsaturated oil & surrounded by plasma memb.
* Protoplast is uninucleated in the beginning but at the time of liberation it become 2-3 celled.

Plant cell → Exut cell wall

* sporoderm (wall)
  - outer layer (exine)
  - Inner layer (Intine)

Exine :→
- Hard layer, made up of sporopollenin which is one of the most resistant organic material (fatty substance)
- Sporopollenin can withstand high temp, strong acids and alkali
- Because of sporopollenin Pollen grains well preserved as fossils.
- No enzyme can degrade sporopollenin
- Exine exhibit fascinating array of patterns and designs. It can help experts to identify the pollen grains and refer them to their family, genus or species.

Exine protect pollen grain

Germ pore is part from where pollen tube arises.

- The study of external morphology of mature pollen grains is called Palynology. In pollen grains
- At certain place exine is absent. They are called Germ Pores (Pores) → Pollen tube
- Pollen grains are generally Tricolpate (with 3 germ pores) in dicots and Monocolpate (with single germinal furrow) in monocots.

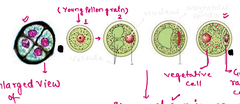
Intine :- Inner thin and continuous layer made up of cellulose + Pectin (Pecto-cellulose)

Development of male gametophyte :→

* Pollen grains or microspore is the first cell of male gametophyte and represent immature male gametophyte
* Its development is precocious, that is, it begins inside the microsporangium.
* when first formed the microspore or young pollen grain has a centrally placed nucleus embedded in dense cytoplasm covered by Plasma membrane.
* It grows in size with inflow of nutrients. Vacuoles develop and bring the rapid growth of pollen grain. Vacuole push the nucleus of pollen grain to one side near the wall.
* The protoplast then divides mitotically to form unequal cell because of asymmetric spindle formation.
  - small generative cell
    - small, spindle shape, dense cytoplasm and a nucleus
    - Float in cytoplasm of vegetative cell.
  - large tube or vegetative cells.
    - Bigger, has abundant food reserve and a large irregular shaped nucleus
    - vacuolated cytoplasm.

→ mature Pollen grain)

* In >60% of angiosperm, pollen grains are shed at this 3-celled stage
* In remaining species, generative cell divides mitotically (<40%) to give rise to two non-motile male gametes. before pollen grains are shed (3-celled stage)



Enlarged view of "Pollen grain Tetrad"

Stages of a microspore maturing into a pollen grain

Pollen Viability

* It is the period for which Pollen grains retain the ability to germinate
* This period is highly variable and to some extent depends on prevailing temp & humidity.
* In some cereals such as rice and wheat, pollen grains lose viability within 30 min. of their release.
* In some members of Rosaceae, Leguminosae, and Solanaceae, (SOL) maintain viability for month.
* It is possible to store pollen grains for years in liquid nitrogen (-196°C) in pollen banks for later use in plant breeding Programmes. (cryopreservation)

Pollen Allergy :- Pollen grains of many species cause severe allergy and bronchial afflictions in some people often leading to chronic respiratory disorders - like asthma, Bronchitis. (Hay fever) "IgE"

* The major contributor to pollen allergy is Carrot grass, Parthenium.
* It entered India as contaminant with imported wheat.

Pollen allergy → disease

Pollen Products :→

* Pollen grains are rich in nutrients. It has become a fashion in recent years to use pollen tablets as food supplements.
* In western countries, a large number of pollen products are available in market in form of Pollen Tablets, Pollen syrupe.
* Pollen consumptions has been claimed to fix the performance of athletes and race horses. (Honey bee)