



### Topics:

1. Difference between pollen grains & spores

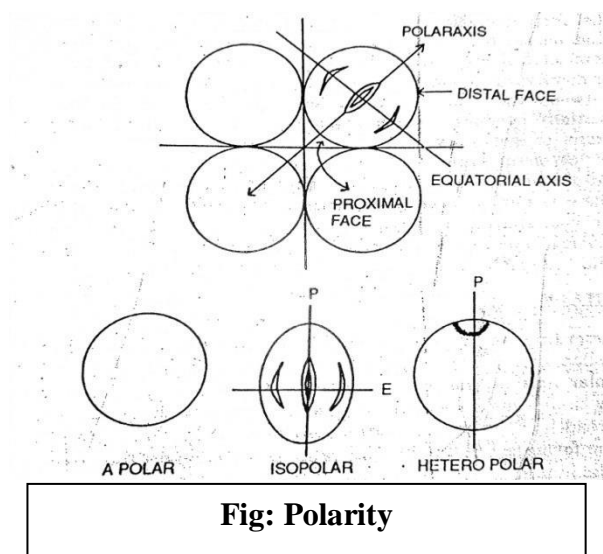
2. Polarity of pollengrain

3. Aperture of pollen grain

## PALYNOLOGY

### DIFFERENCE BETWEEN POLLEN GRAINS & SPORES:

POLLEN GRAIN	SPORE
1. Pollen grain/ microspores found in phanerogames (angiosperms & gymnosperms) Grains are also known as microspore, Chromosome no- n	1. Micro and macrospores found in cryptogams.
2. After germination produces germ tube.	2. After germination produces prothallus bearing gametangia.
3. Aperture always present distally (away from centre).	3. True aperture are absent in pteridophytes when present it placed proximally (actually these are attachment scars).
4. Always aperture single or multiple.	4. Single aperture.
5. Exine is divided into: a. inner nexine, b. outer sexine (a thin area without sporopollenin deposition is aperture).	5. Here the division absent, whole structure is entire (more than tetrad polyad).



- In case of angiosperms aperture is distal and in case of pteridophytes aperture is proximal.
- Pollen grains are always in tetrad condition.
- In case of pollen grain apertures are distal and in case of spore apertures are proximal (but there are not true apertures) rather than aperture scar.
- If tetragonal shaped, then attachment scar (thin layer) is monolete.
- If tetrahedral shaped, then aperture scar is trilete.
- Palynology is the science that means the study of spores and pollen grains particularly those of vascular plants.
- The term was introduced by Hyde & Williams in 1944.
- Palynology word comes from palynin.
- The spores and pollen grains are the 1<sup>st</sup> cell of gametophyte and the product of meiosis. So these are produced in distinct tetrad.
- Various types of tetrad are:
  - (i) Tetrahedral (example: Lycopsid member, Leguminosae & Acanthaceae).
  - (ii) Tetragonal (example: majority of the monocots and some pteridophyta)
  - (iii) e.g. -*Polypodium sp.*
  - (iv) Rhomboidal.
  - (v) Linear tetrad (whole spore arranged in a line e.g. -*Aristolochia sp.*



## **POLARITY OF POLLENGRAIN:**

Being the 1<sup>st</sup> cell of gametophyte both spores and pollen grains are product of meiosis and therefore form in distinct tetrad. The face of the spore of the pollengrain towards the centre of tetrad is the proximal pole and the face away from the centre is the distal pole.

The imaginary axis connecting the centres of the proximal and distal spores of the pollen axis. The axis that turns at right angle to the polar axis through the equator is the equatorial axis.

In case of bilaterally symmetrical spore of pollen, there will be a 2<sup>nd</sup> equatorial axis. A radially symmetrical spore of pollen has 1 polar axis but many equatorial axis.

## **SYMMETRY :**

### **Radially symmetrical isopolar -**

More than two vertical plain of symmetry and 1 horizontal or equatorial plain of symmetry.

### **Billateral symmetry -**

Two vertical plain of symmetry and one horizontal plain of symmetry.

## **APERTURE OF POLLEN GRAIN:**

Aperture are thin or missing area of the exine through which internal content of spores or pollen grain comes out at the time of their germination.

A pollen grain have more than one aperture (aperturate) or may be devoid of any aperture inaperturate. In case of pteridophyte spores are generally aperturate excepting (*Equisetum*) with a single proximal aperture, which is either trilete or monolete. However the letemark (tri or monolete) commonly known as Lesura dosent constitute an aperture in strict sence rather it is tetrad attachment scar and the commesure situated centrally to the letemark might be consider as the aperture proper because along with the liner slit the exine of the spore crack open to at the time of germination.

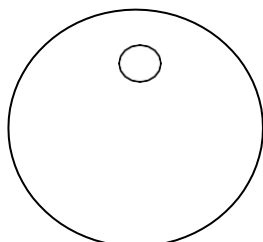
In gymnosperm the pollen grain are in generally uniaperturate and the aperture is distal. Inaperturate pollen grain of gymnosperm found in *Araucaria* and *Laxix*. In *Ephedra* apertures are polyPLICATE i.e. more than one aperture present on the surface. In angiosperms pollen grain may be inaperturate(Euphorbiaceae) or with a single distal aperture(majority of the monocot and Ranonial dicot) or may be with several or many aperture, either equatorial position or distributed throughout the surface as found in majority of advanced dicot.

## TYPES OF APERTURE:

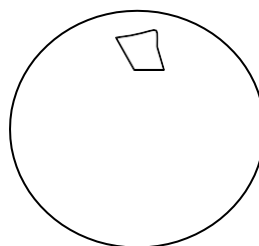
**i. Letemark:** In case of pteridophyte spores are generally aperturate (excepting *Equisetum*) with a single proximal aperture, which is either trilete or monolete. However the letemark (tri or monolete) commonly known as lesura does not constitute an aperture in strict sense rather it is tetrad attachment scar and the commesure situated centrally to the letemark might be considered as the aperture proper because along the linear slit.

**ii) Ulcus or leptoma:** These are rather unqualified aperture. This is a more or less distal circular aperture. Ulcus means “wound” and like a wound an ulcus has either (psilate or ragged margin). Thus in poaceae and pandanaceae the ulcus is psilomarginate. In some cases of Restionaceae the margin is  $\pm$  ragged.

In case of Leptoma outline of the thin area is uniform. Pollen grain of some taxodiaceae are with leptoma.



Psilomarginate



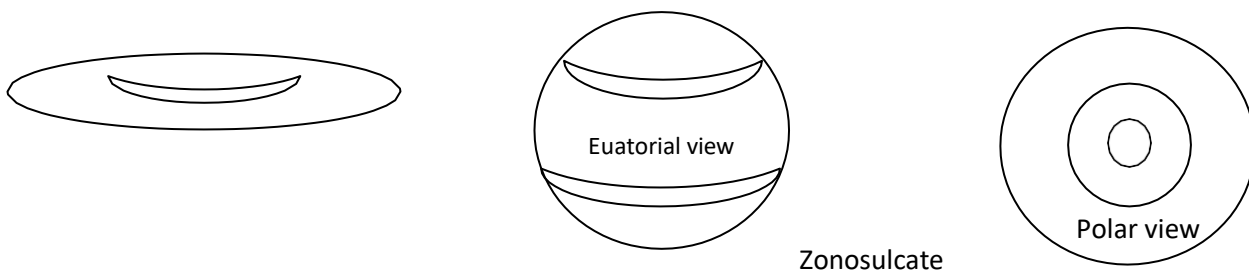
Ragged

**iii) Sulcus:** (Furrow like aperture) right angle to the polar axis.

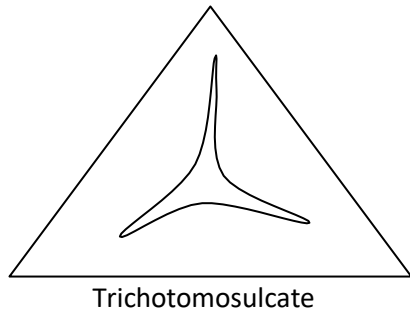
Sometimes a gutter shaped furrow like aperture is found to be present at the equatorial or subequatorial position of the pollen grain such a pollen grain is called Zonosulcate pollen grain.

Eg.-*Nymphaea*.

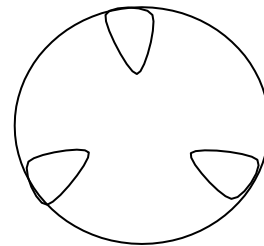
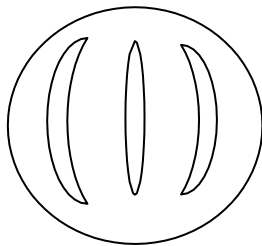
Sometimes the distal sulcus is found to be trichotomously forked. Such pollen grains are termed trichotomosulcate. Members of Nymphaeaceae show trichotomosulcate pollen grain.



Zonosulcate



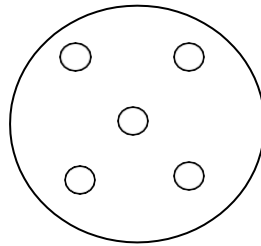
**iv) Colpus:** Colpus is elongated furrow like aperture parallel to the polar axis. In Zonocolpate pollen grains colpi are distributed along the equator.



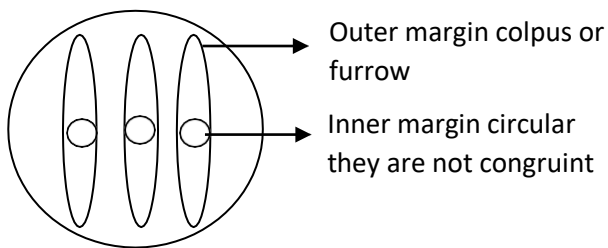
v) **Pore:** More or less circular aperture is known as pore.

e.g. Poaceae, Malvaceae.

In pore the inner or outer margin of the aperture are congruent. Such apertures are known as simple aperture. In case of compound aperture outer or inner margin of aperture are not congruent.

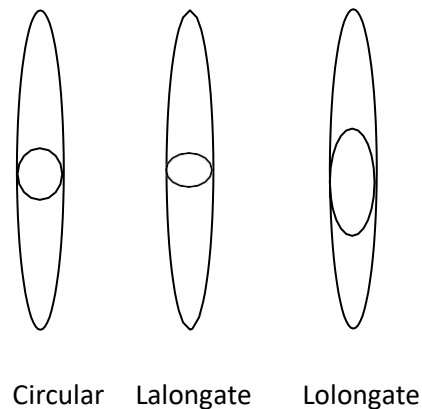


vi) **Colporate:**



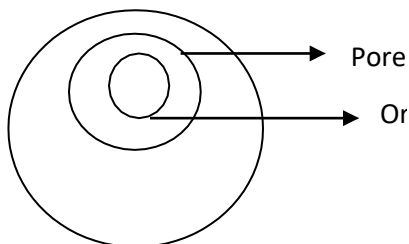
**Colpi + Pore = Colporate**

Eg. Rubiaceae, Fabaceae, Anacardiaceae



Circular    Lalongate    Lolongate

vii) **Pororate:**



e.g.: Poaceae, Amaranthaceae,



**viii) Syncolpate/Syncolporate:** In case of zonocolpate or zonocolporate pollen grains, the colpi are either of the two or both the poles may get fused with each other at the poles leaving no apocolpium. This is syncolpate or syncolporate.

Eg: *Saraca ashoka*.

**ix) Parasyncolpate/Parasyncolporate:** It is an aperture less area at the polar view forming branch.

e.g.: *Eucalyptus*.

In some cases instead of fusing directly the colpi ends first get dichotomously branched near the pole and then the branches of adjacent colpi get fused with each other leaving a distinct apocolpal area at the pole. Such grains are known as parasyncolpate/parasyncolporate depending on the aperture.

e.g.: *Eucalyptus*

In some members of solanaceae eg: *Solanum*.

In case of Trizonocolpate pollen grains with a longate endoaperture the end of the adjacent colpi get fused with each other giving rise to a gutter like or a encircling the pollen grain equatorial. Such pollen grains are known as synorate.

**xi) Aspidate/Gulet:** Sometimes the aperture may be situated on an elevation over the exine. Such elevations are known as aspids or Gula.

e.g.: *Cryptomeria japonica*

**xii) Spiraperturate:** Some times pollen grains are provided with a furrow like aperture spirally disposed all over the surface.

Such pollen grains are termed as spiraperturate.

**xiii) Anguloaperturate**

**xiv) Planaperturate:** Between the angles. Eg: *Bombax*.



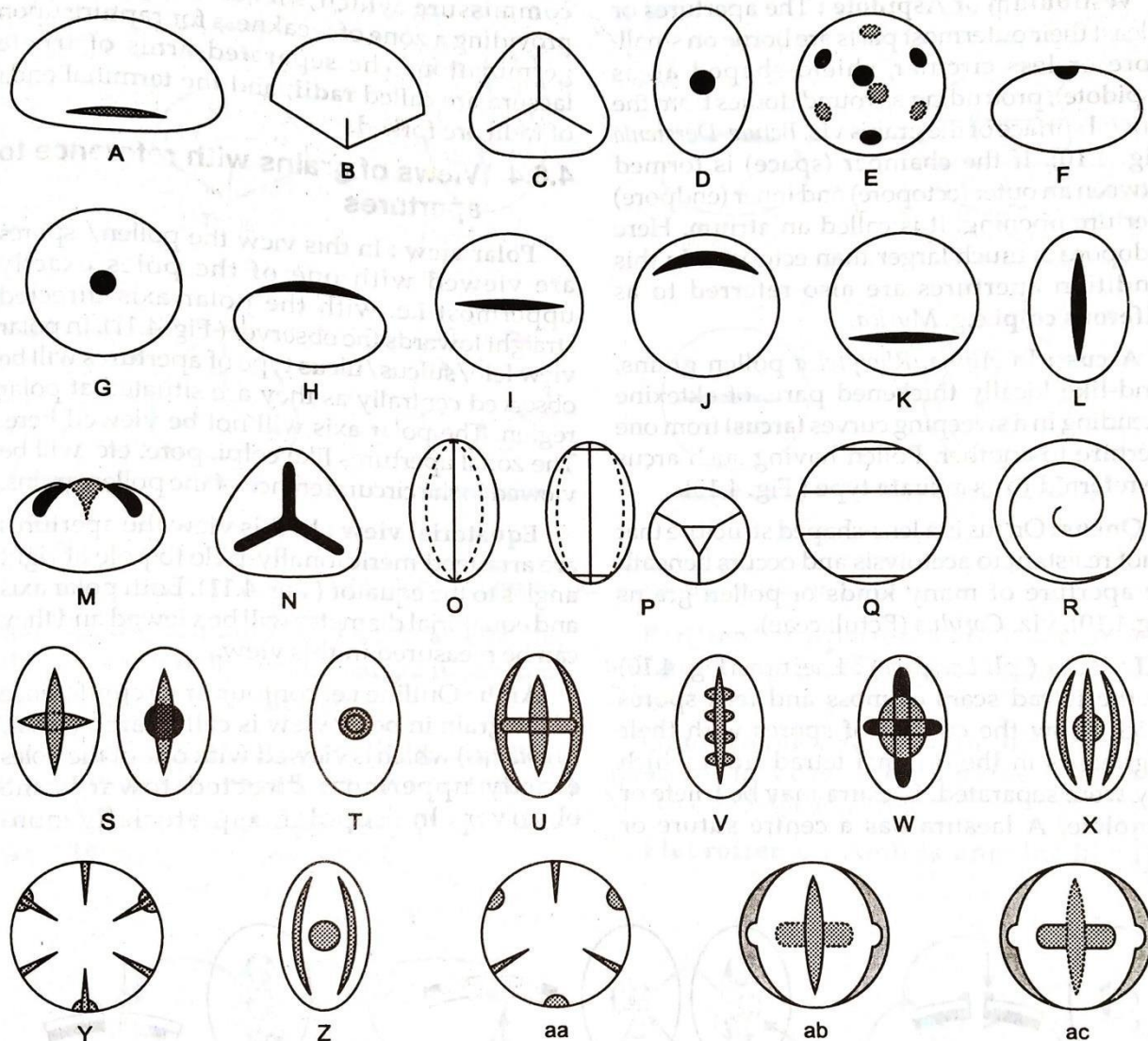


Fig. : Pollen apertures [A=Monolete, B&C=Trilete, D=Porus, E=Periporus, F&G=Ulcus, H&I=Sulcus, J&K=Sulculus, L=Colpus, M&N=Trichotomosulcate, O=Syncolpate, P=Parasyncolpate, Q&R=Spiraperturate, S =Colporus, T=Pororate, U=Synorate, V=Multirate, W=Colpororate, X&Y=Heterocolpate, Z&aa=Porocolpate, ab=Colporoidate, ac=Colpoidate]

### References:

1. A Text Book of Palynology (Basic & Applied), Kashinath Bhattacharya, Manas Ranjan Majumdar, Swati Gupta Bhattacharya, New Central Book Agency (P). Ltd., 2006, ISBN: 81-7381-500-3.
2. Palynology A Treatise, M.R. Saxena. Oxford & IBH Publishing Co. Pvt. Ltd., 1993, ISBN: 81-204-0803-9

(All the above mentioned information including the figures are collected from the above references and will be solely used for teaching and learning purposes).