I SEMESTER MSC BOTANY
PALYNOLOGY

Pollen morphology

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POLLEN MORPHOLOGY

1. Pollen Units:

- The pollen grains are produced within the anther of the flower. Pollen mother cells originate from the sporogenous tissue of the anther which later divide meiotically to form four pollen grains called tetrad.
- The pollen grains do not remain united at maturity, and are dissociated into single pollen grain called monad. Sometimes rarer types like dyads (two pollen grains), Octads (eight pollen grains) and Polyads (many pollen grains) are also observed

- Morphological characteristics of pollen grains have been categorised into different groups:
- 1. Pollen Units
- 2. Polarity
- 3. Symmetry
- 4. Shape
- 5. Size
- 6. Apertures

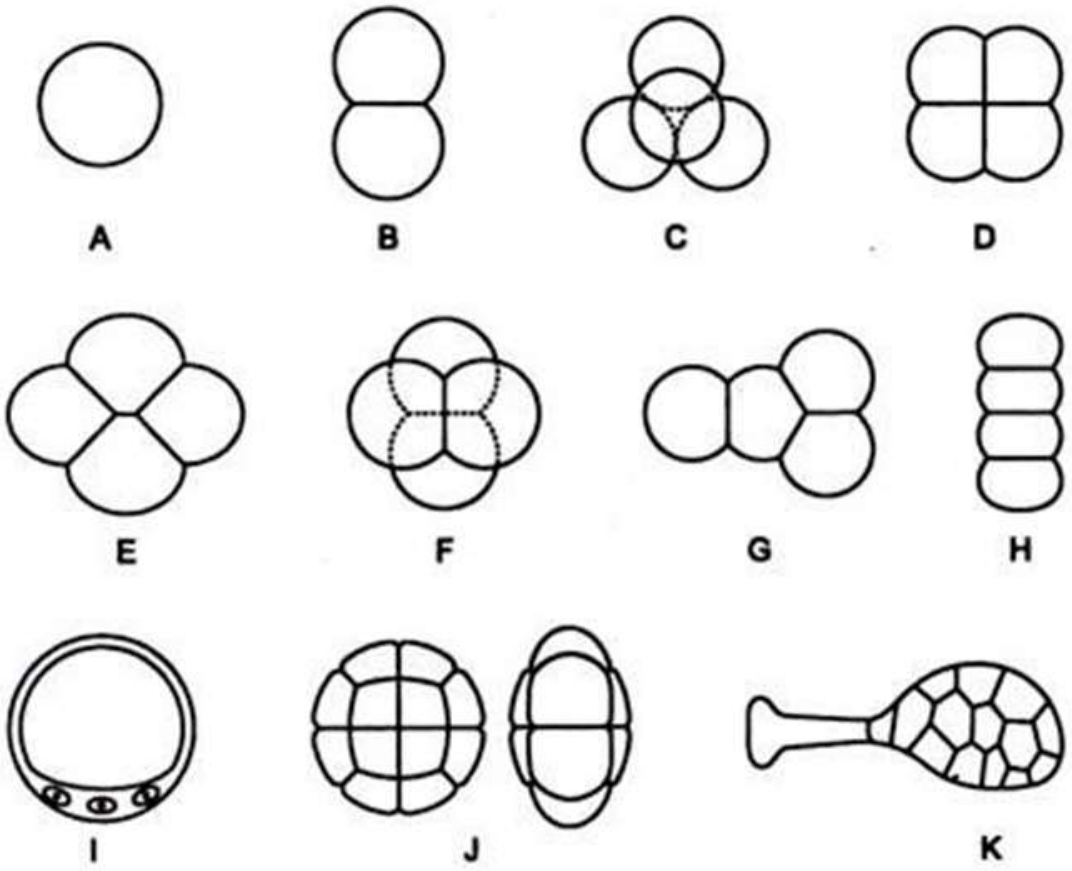


Fig. 4.1 : Pollen units (A = Monad, B = Dyads, C = Tetrahedral tetrad, D = Tetragonal tetrad, E = Rhomboidal tetrad, F = Decussate tetrad, G = T-Shaped tetrad, H = Linear tetrad, I = Cryptotetrad, J = Polyads, K = Pollinia)

2. Polarity:

- The orientation of polarity is an important criterion in identification and description of pollen grains, as apertural position is of primary phylogenetic and functional significance.
- All pollen grains are in tetrad stage during development and the polarity is determined in this stage, prior to their separation.

Polarity contd..

- The part of the pollen grains which is nearest to the centre of the tetrad is the proximal pole and that towards the opposite side is the distal pole
- The imaginary line between the proximal and distal pole of the grain is called the Polar Axis (PA) which passes through the centre of the spore to the centre of the tetrad.

- The plane perpendicular to the polar axis through the middle of the grain is the equatorial plane (equatorial diameter).

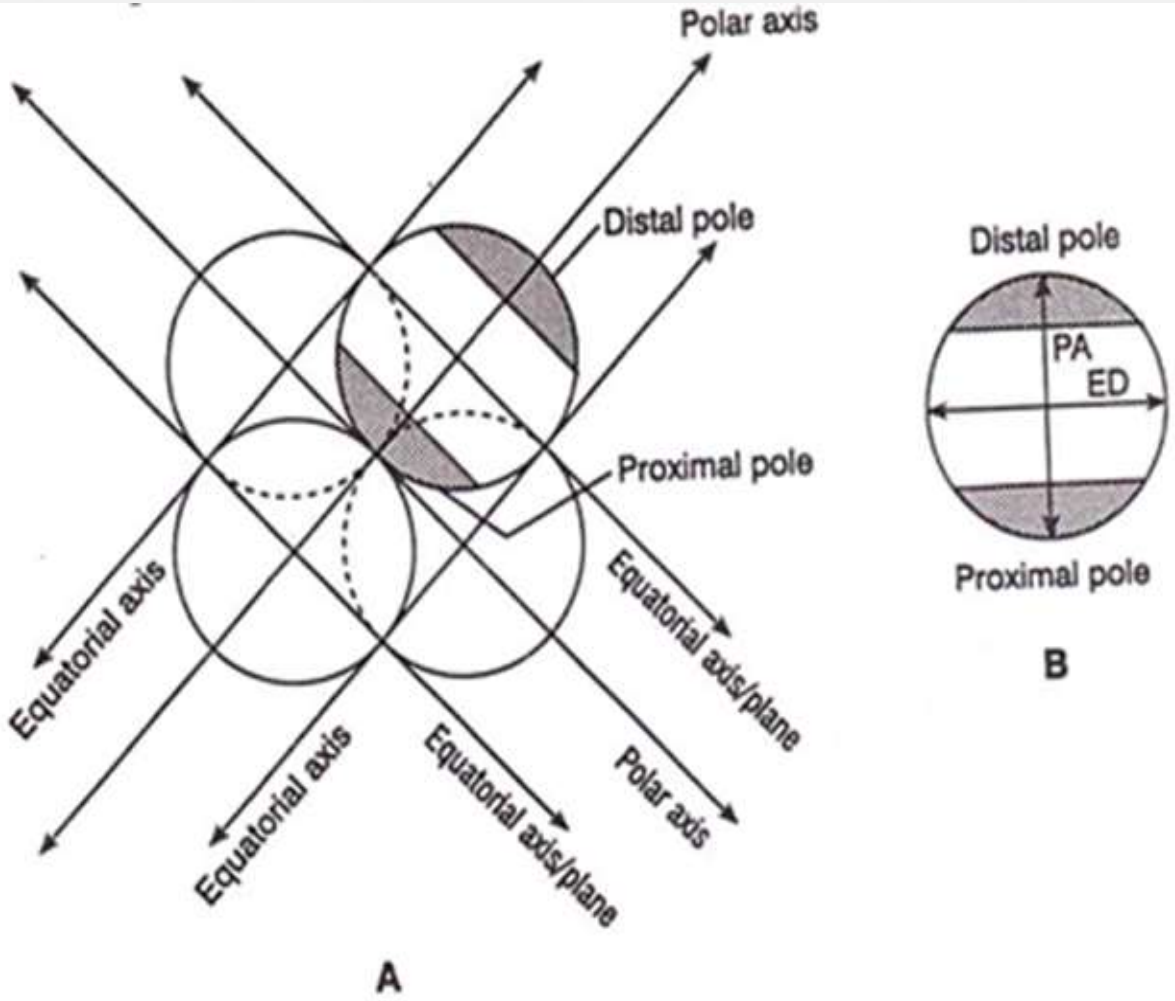
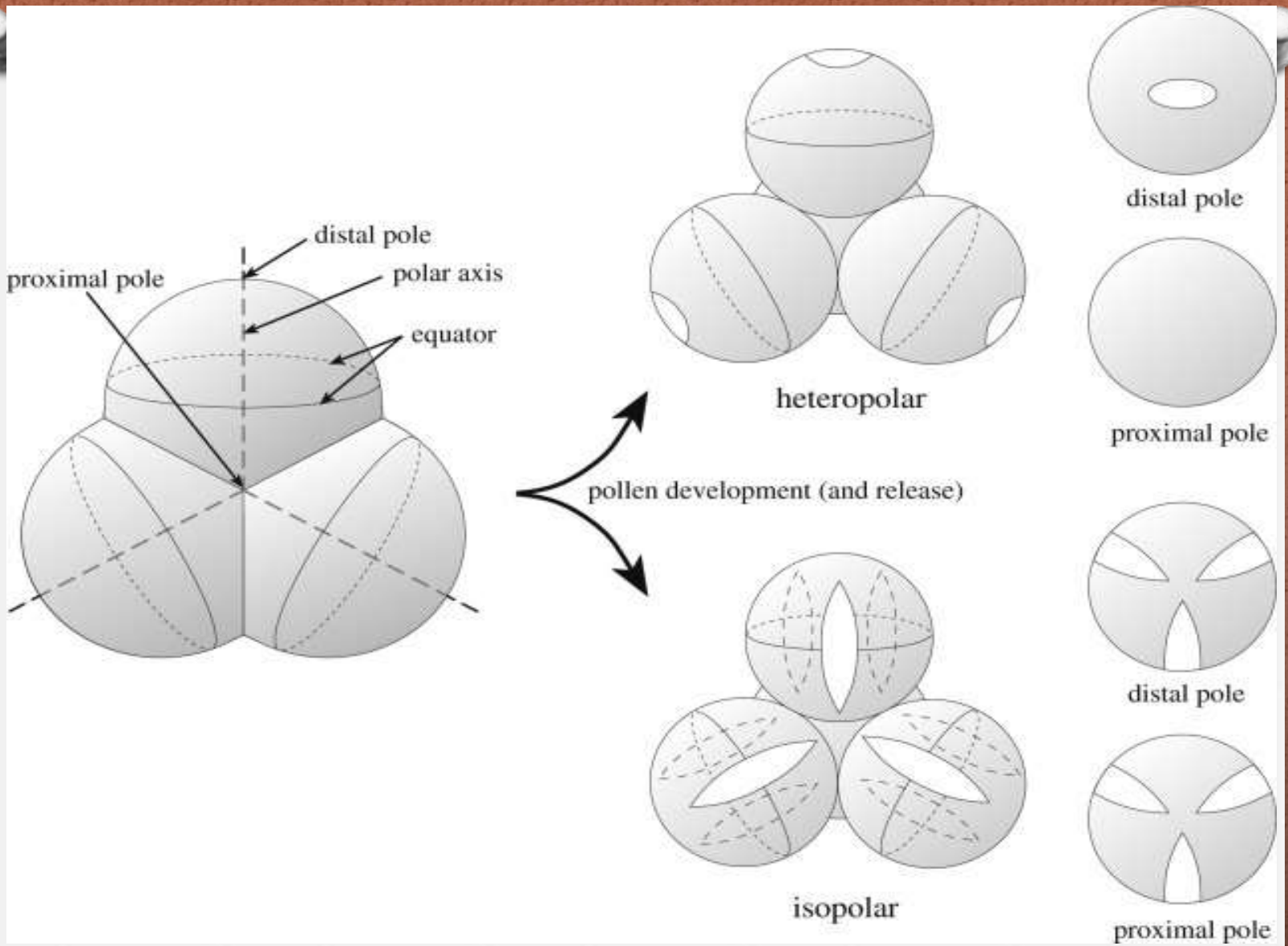


Fig. 4.2 : Polarity (A = Showing polarity in terad stage; B = Showing the length of polar axis (PA) and breadth of equatorial diameter (ED) in a monad grain)

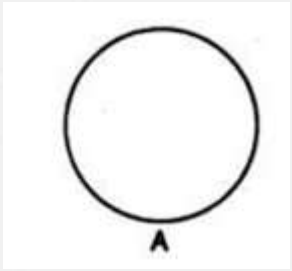

distal pole
proximal pole
polar axis
equator
pollen development (and release)
heteropolar
isopolar
distal pole
proximal pole
distal pole
proximal pole

- The pollen grains maybe either apolar or polar.
- In apolar spores, poles or polar regions cannot be distinguished in individual spore (monad) after separation from tetrad. Among the polar types the pollen grains are either isopolar or heteropolar depending upon the demarcation between two equal or unequal polar faces, respectively

In isopolar grains the distal and proximal faces (above and below the equatorial plane) look alike.

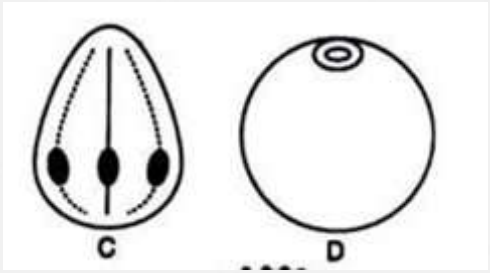
In heteropolar grains the two faces are distinctly different, either in shape, ornamentation or apertural system. Thus one face may have an opening (aperture) and the other not.

Fig. 4.3 : Polarity (A = Apolar;



F

C&D = Heteropolar,



isopolar

- The pollen grains showing slight differences between the distal and proximal faces are also called paraisopolar or subisopolar
- Say for example, one face (distal) is convex and the other face (proximal) is plane or concave or vice versa

3. Symmetry:

- Pollen grains or spores are symmetric or asymmetric.
- The asymmetric grains are either non- fixiform (without fixed shape) or fixiform (with fixed shape). Asymmetrical grains have no plane of symmetry. They are rare in occurrence.

The Symmetric grains are either radiosymmetric (radially symmetrical) or bilateral (having a single plane of symmetry) In radiosymmetric grain the shape is such that any plane including the polar axis that passes through will produce identical halves

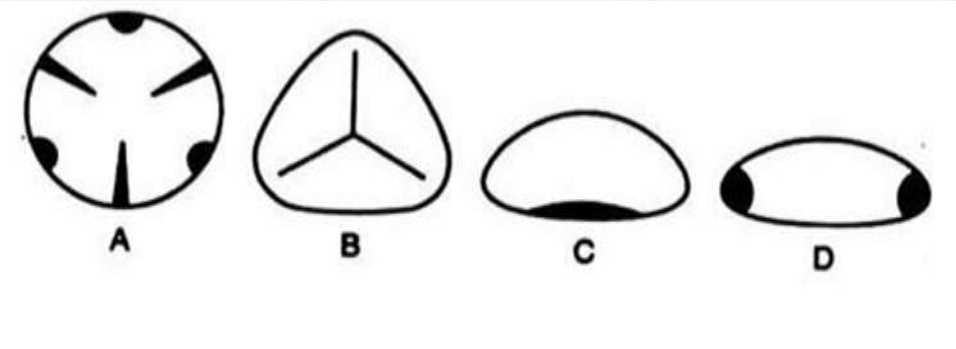


Fig. 4.4 : Symmetry (A & B = Radially symmetric, C & D = Bilateral)

4. Shape:

- The shape of the pollen grains varies from species to species. Shape of the grains is found to be useful in spore/pollen identification. However, the shape may vary considerably within one grain type or even within one species.
- The shape of the pollen/spores may be circular, elliptical, triangular, rectangular, quadrangular or in other geometrical shapes

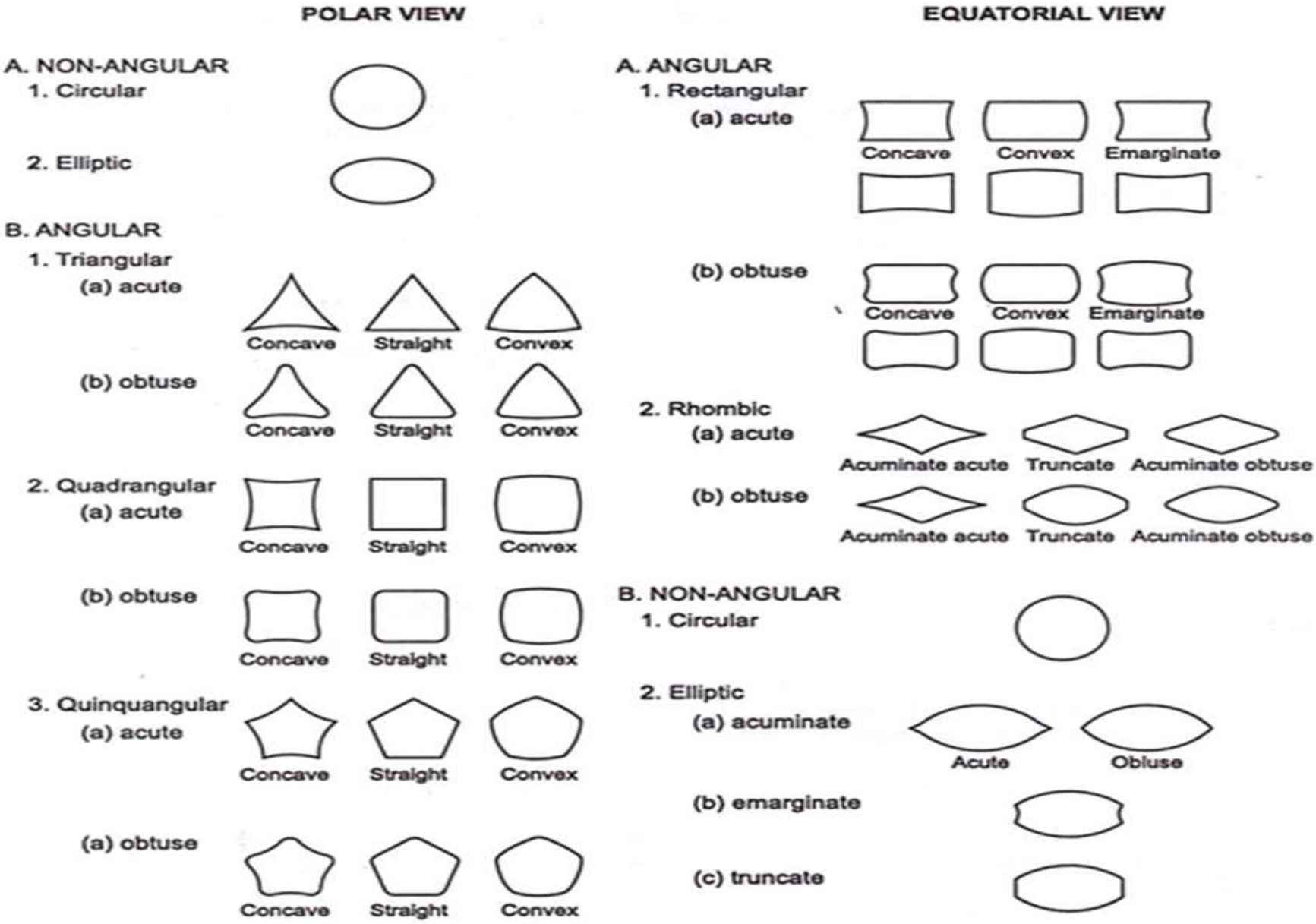


Fig. 4.5 :Shapes of grains in polar and equatorial views

G. Erdtman (1952) categorized eight shape classes based on the ratio of polar axis (PA) and equatorial diameter (ED). In the equatorial view, the ratio between the PA and ED, multiplying by 100 gives the indication of the shape.

Various PA/ED ratios are divided in it to different shape classes, e.g., Prolate, Prolate-spheroidal, Spheroidal, Sub-prolate, Perprolate, Oblate, Oblate-spheroidal, Sub-oblate, Peroblate

Table 4.1: Pollen shape classes (*after* Erdtman, 1952).

Shape classes	(PA/ED) x 100
Per-oblate	<50
Oblate	50-75
Sub-oblate	75-88
Oblate-spheroidal	88-99
Spheroidal	100
Prolate-Spheroidal	101-114
Sub-prolate	114-133
Prolate	133-200
Per-prolate	>200

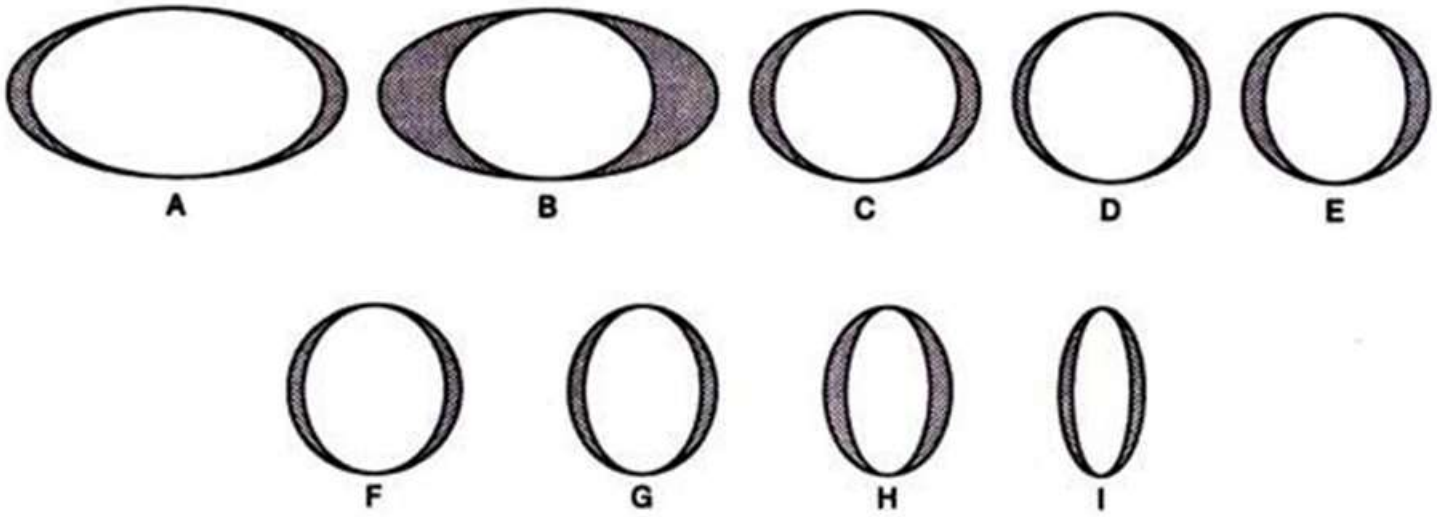


Fig. 4.6 : Shape classes (A = Peroblate, B = Obtate, C = Sub-oblate, D = Oblate-spheroidal, E = Spheroidal, F = Prolate-spheroidal, G = Sub-prolate, H = Prolate, I = Perprolate)

5. Size

- Pollen grains show a great variety in their sizes. Smallest pollen grains of about 5 x 2.4 µm is noted in *Myosotis palustris* and some members of Boraginaceae, while the largest pollen grains (> 200 µm in diameter) are observed in Curcurbitaceae, Nyctaginaceae

Erdtman (1945) categorized the different pollen size classes based on the size expressed as length of the longest axis

Table 4.2 : Pollen size classes (*after* Erdtman, 1945).

	Pollen size class	Length of longest axis
1.	Very small grains (*Sporae perminutae*)	<10µm
2.	Small grains (*Minutae*)	10 - 25 µm
3.	Medium sized grains (*Mediae*)	25 – 50 µm
4.	Large grains (*Magnae*)	50 – 100 µm
5.	Very large grains (*Permagnae*)	100 – 200 µm
6.	Gigantic grains (*Giganteae*)	> 200 µm

6. Apertures:

- Morphologically aperture is an opening or thinning of the exine where the intine is usually thick; physiologically it is a germination zone

- With regard to their position the apertures are polar, global or equatorial. The polar apertures are either monopolar (either in proximal or in distal pole) or bipolar (both in proximal and distal face). Global apertures are uniformly distributed over the pollen/spore surface.
- Some taxa have ‘atreme’ (trema, a Greek word means aperture) pollen/spore, i.e., they seem to have no special aperture, are termed as ‘inaperturate’ or non-aperturate.


THANK YOU