Palynology as taxonomic evidence:

i. **Stenopalynous:**
ii. In many taxon, the type of pollen is characteristic and constant. Such a taxon is termed stenopalynous or unipalynous e.g., Asclepiadaceae, Cruciferae, Poaceae, Labiatae, etc. Stenopalynous taxa are generally considered to be very natural.

ii. Eurypalynous:

The taxon in which the types of pollen may vary considerably in size, aperture, stratification of exine, etc., are termed eurypalynous or multipalynous e.g., Acanthaceae, Rubiaceae, Verbenaceae. Eurypalynous taxa are heterogeneous, at least in certain instances. Palynological data are particularly useful in the delimitation of eurypalynous taxa e.g. Acanthaceae, Asteraceae, Euphorbiaceae, Gentianaceae, Saxifragaceae, etc.

Palynological features used in plant taxonomy:

1. Pollen nucleus number
2. Pollen storage products
3. Pollen units
4. Polarity
5. Apertures
6. Shape
7. Size
8. Sculpture
9. Wall structure

Pollen nucleus no.
Binucleate
Families- commelinaceae(*Tradescantia virginia*),Liliaceae(*Smilacina stellata*), rosaceae,Asteraceae(*Chrysanthemum*)
Trin- Caryophyllaceae
Storage: starch- poaceae , Rhizophoraceae
Oil- sonneratiaceae
Units:
Monad(single pollen unit)- malvaceae, arecaceae
Dyad- chloranthaceae
Tetrad(four pollen grain)- - tetrahrdral-ericaceae
tetragonal- philydraceae
Decussate tetrad- haemodoraceae
T-shaped tetrad
Linear tetrad
Polyad(multiple of 8)- fabaceae
Pollinium- Asclepiadaceae, Orchidaceae

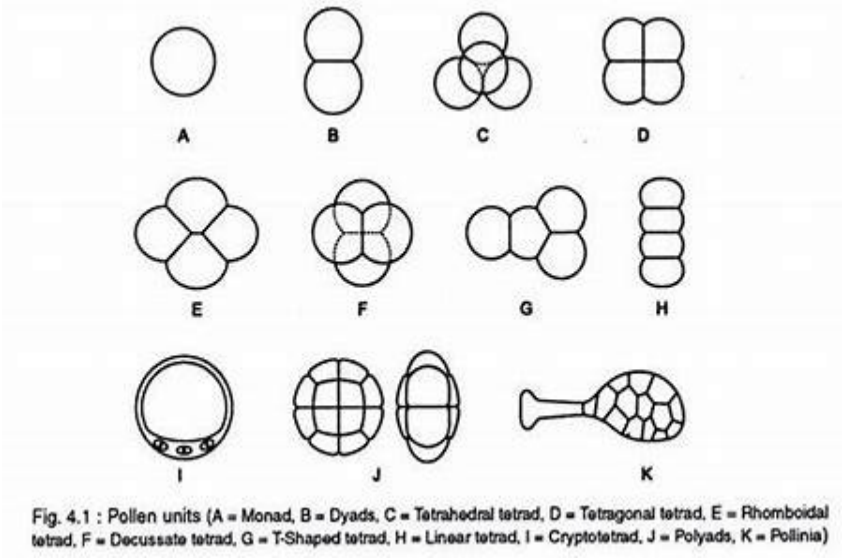


Fig. 4.1 : Pollen units (A = Monad, B = Dyads, C = Tetrahedral tetrad, D = Tetragonal tetrad, E = Rhomboidal tetrad, F = Decussate tetrad, G = T-Shaped tetrad, H = Linear tetrad, I = Cryptotetrad, J = Polyads, K = Pollinia)

Polarity
Apolar- typha
Isoploar- cucarbitaceae
Heteropolar- lilium

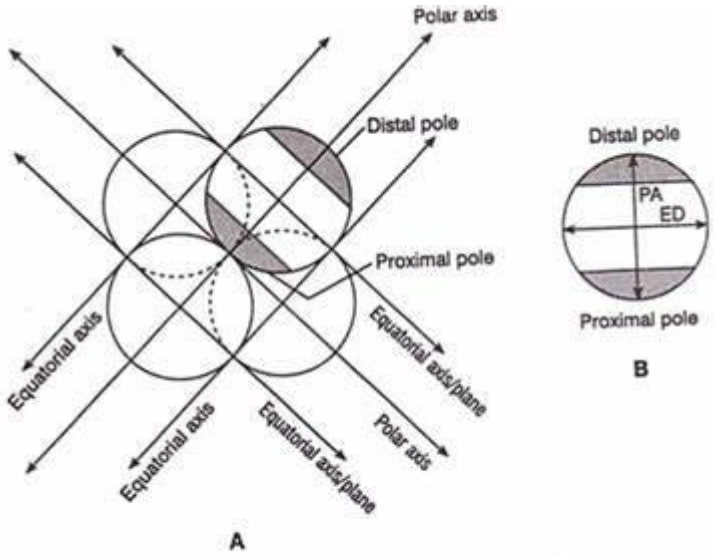


Fig. 4.2 : Polarity (A = Showing polarity in terad stage; B = Showing the length of polar axis (PA) and breadth of equatorial diameter (ED) in a monad grain)

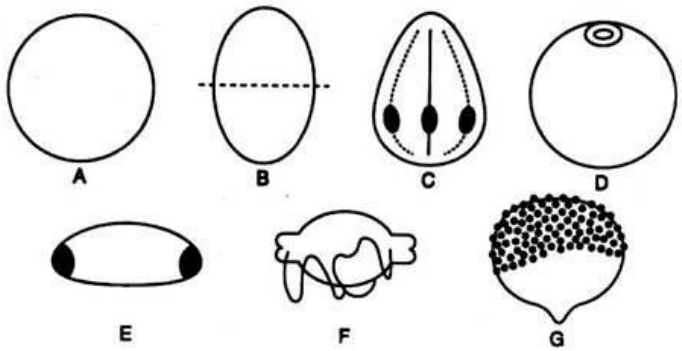


Fig. 4.3 : Polarity (A = Apolar; B = Isopolar, C&D = Heteropolar, E&F = Paraisopolar, G = Cryptopolar)

Aperture: opening present in pollen, roud shape pore, elongated shape colpus.
Colpus- mono, di, tri, tetra, penta, hexa, poly.
Pores-
Monocolpate- Asteraceae, magnoliaceae
Tricolpate- acanthaceae
Monoporate – poaceae
Triporate- cucarbitaceae
Polyporate- amaranthaceae

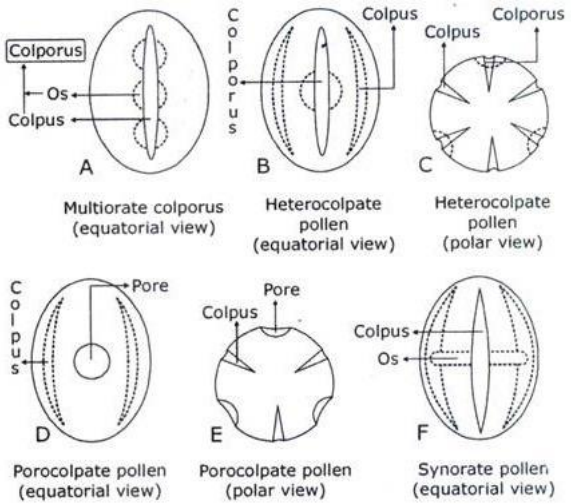


Figure 4.22
Diagrammatic representation of different types of aperture.

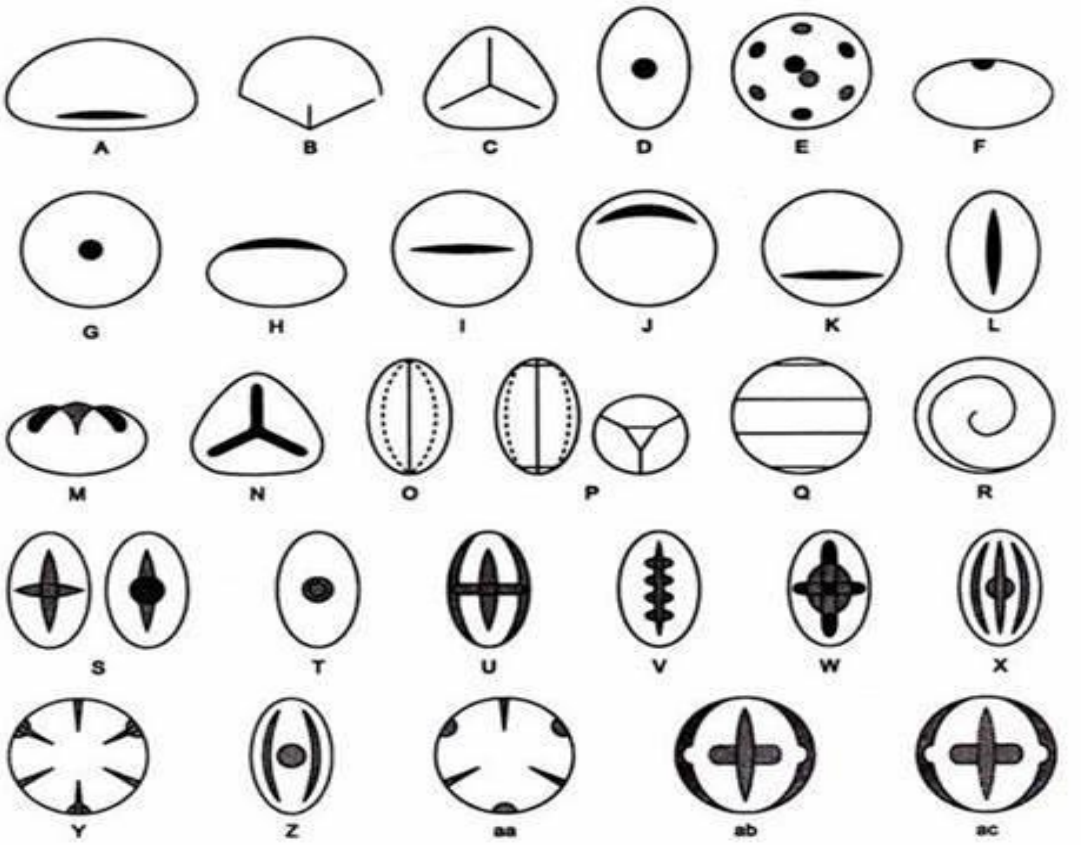
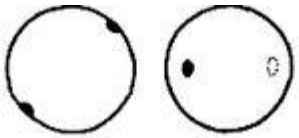
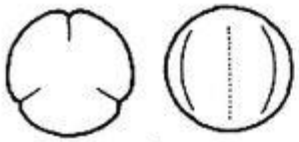


Fig. 4.9 : Pollen apertures [A=Monolete, B&C=Trilete, D=Porus, E=Periporus, F&G=Ulcus, H&I=Sulcus, J&K=Sulculus, L=Colpus, M&N=Trichotomosulcate, O=Syncolpate, P=Parasyncolpate, Q&R=Spiraperturate,S =Colporus, T=Pororate, U=Synorate, V=Multiorate, W=Colpororate, X&Y=Heterocolpate, Z&aa=Porocolpate, ab=Colporoidate, ac=Colpoidorate]

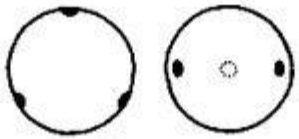
dicolpate



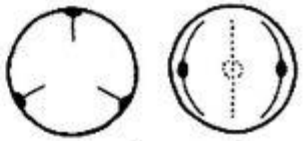
diporate



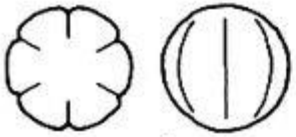
tricolpate



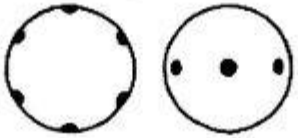
triporate



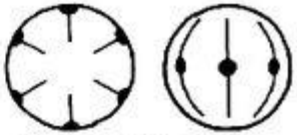
tricolporate



zonocolpate



zonoporate



zonocolporate

Pollen size;
Shape: spheroidal- cucarbitaceae
Oblate- apocynaceae, euphorbiaceae
Prolate- euphorbiaceae

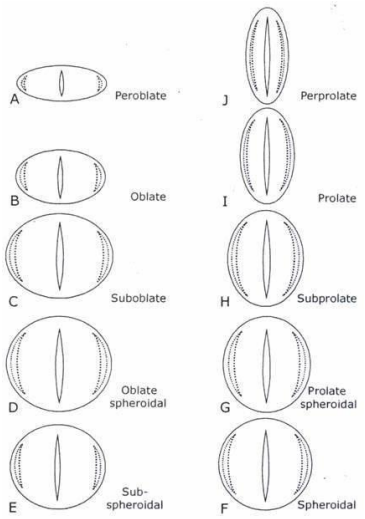
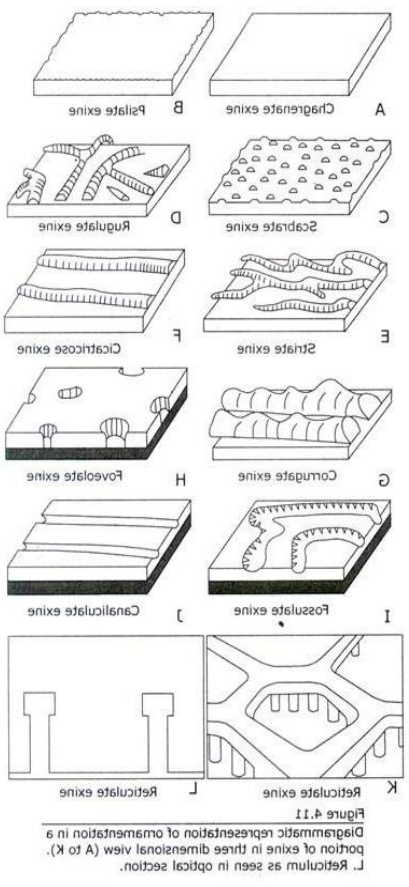


Figure 4.33
Diagrammatic illustrations of the different shape classes of pollen. All pollen grains are tricolpate with equatorial view. Dotted lines indicate different plane of focus.

Sculp
Echinate- asterace
Verrucate- caryophyllace
Regulose-(brainlike)
Faveolate-(pitted)
Reticulate-(netlike)
Striate-(with stripes)



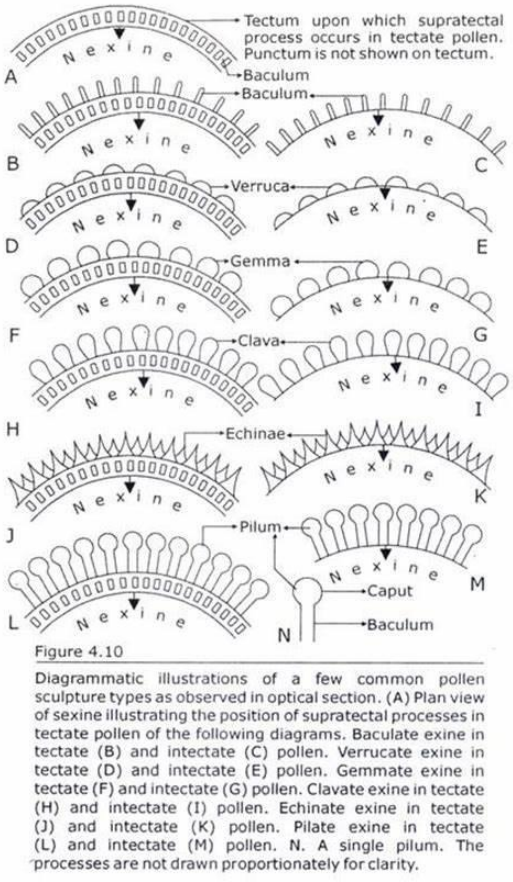


Figure 4.10

Diagrammatic illustrations of a few common pollen sculpture types as observed in optical section. (A) Plan view of sexine illustrating the position of supratectal processes in tectate pollen of the following diagrams. Baculate exine in tectate (B) and intectate (C) pollen. Verrucate exine in tectate (D) and intectate (E) pollen. Gemmate exine in tectate (F) and intectate (G) pollen. Clavate exine in tectate (H) and intectate (I) pollen. Echinate exine in tectate (J) and intectate (K) pollen. Pilate exine in tectate (L) and intectate (M) pollen. N. A single pilum. The processes are not drawn proportionately for clarity.

Wall struc;

A few examples of the use of pollen characters in the taxonomy of some families and tribes are given below:

I. The family Berberidaceae has been variously circumscribed by different taxonomists. Recently based on pollen characters, Podophyllum where the pollen grains remain united, has been removed to a separate family Podophyllaceae. The pollen grains are free in the other members of Berberidaceae.

II. Several families have distinctive pollen types. For example, Poaceae have smooth sulcate pollen, Malvaceae and Asteraceae have typically spinulose exine, and Plumbaginaceae have verrucate exine.

III. The two families, Araceae and Lemnaceae under the same order Arales of Hutchinson are characterized by stenopalynous, 1-2-4-colpate, 3-porate or inaperturate and Arecaceae exine sculptured pollen in the former, while the latter is characterized by eupalynous, 1- porate and spinose pollen.

IV. The palynological studies support the treatment of the tribe Bombaceae of the family Malvaceae as a separate family Bombacaceae. Palynological studies reveal that the exine is reticulate in the Bombaceae, whereas it is spinose in most of the Malvaceae.
V. Palynological evidences have also supported the Separation of Faeoniaceae from Ranunculaceae, Fumariaceae from Papaveraceae, and Nelumbonaceae from Nymphaeaceae.

Generic Level:

Following are few examples of the taxonomic significance of palynology at the level of genus:

I. Pollen Characters have been extensively employed in classifying the genera of the Acanthaceae and the Primulaceae.

II. The two genra Phytolacca and Rivinia of the Phytolaccaceae, can be recognized on the basis of palynological characters. The pollen of Phytolacca is 3-zonocolpate, whereas that of Rivinia is pantocolpate.

Herberg (1946) has suggested the division of the genus Polysonum into seven genera baed on pollen morphology viz. Koenigia, Persicaria, Polygonum, Pleuropteropyrum, Bistoria, Tiniaria and Fagapyrum which are distinct in their pollen types, and is accepted by several recent taxonomists.

IV. In the family Betulaceae, the thickening of exine around the pores make a distinguishing character for different genera, which is knob-like in Betula, club-shaped in Corylis, unexpanded in Caprinus, and an arcus is present between adjacent pores in Alnus.

V. The genera Salix and Populus under Salicaceae can be distinguished on the basis of pollen characters. Salix has long and narrowed 3-furrowed pollen, while populus has spherical pollen without distinct apertures.

Phylogenetic Considerations:

Palynological studies have also been helpful in the elucidation of phylogenetic relationships. Following are a few examples:

Pollen morphology does not support sharp demarcation between the dicotyledons and the monocotyledons as suggested by most systems of classification, because dicotyledonous pollen characters occur in some monocotyledons and vice versa.

I. Palynological data suggest two distinct phylogenetic stocks in the dicotyledons – monocolpate, represented by the Magnoliaceae and tricolpate represented by the Ranunculaceae. Due to the presence of monocolpate element, the monocotyledons, are considered to be more closely related to the magnolian stock.

Furthermore, both the monocotyledons and the magnolian dicots have monocolpate elements characteristic of the preangiospermous archegoniates and are considered more ancient palynologically than the ranalian dicots where monocolpate elements are completely absent and new apertural forms are present.

II. Based on pollen morphological studies in the monocotyledons, Kuprianova (1948), proposed that the Helobiae are not related to the other monocotyledons but are specialized Polycarpiceae with ranalian affinities. Kuprianova is also of the view that most monocotyledonous families could be considered to have evolved from Arecaceae or Liliaceae.

Species and Infra Specific Level:

Pollen characters have also proved helpful in distinguishing the species within a genus. Following are a few examples:

I. Sharma (1987) investigated the pollen morphology of 16 Indian species of Cyperus, and prepared a key to differentiate all of them on the basis of pollen characters.

Of the 16 investigated species, the pollen grains of six species (C. iria, C. difformis, C. squarosus, C. triceps, C. flabelliformis and C. paniceus var. roxburghianus) are predominantly 1-colpate, two species (C. exaltatus and C. pumilus) are predominantly 2-colpate, four species (C. rotundus, C. laevigatus, C. alulatus and C. bulbosus) are predominantly 4 aperturate with 3 cplpi and 1 pore, three species (C. compactus, C. kyllingia and C. globosus) are predominantly pantoaperturate, and one species (C. digitatus) is predominantly 1-porate.

II. Species of Anemone can be distinguished on the basis of germinal aperture of pollen. It is 3-zonocolpate in A. obtusiloba, pantoporate in A. alchemillaefolia, pantocolpate in A. rivularis and spiraperturate in A. fulgens.

III. The exine pattern has been useful in recognizing different species of Bauhinia. According to Nair (1974), pollen are psilate in B. acuminata, striate in B. krugii, spinulate in B. malabarica, reticulate tuberculate in B. purpurea, reticulate in B. racemosa, and verrucate in B. retusa.

IV. Pollen size is helpful in distinguishing two species of Malva, M. rotundifolia (pollen 74- 84 µm) and M. sylvestris (pollen 105-126 µm).

References: