Quadrant II – Transcript and Related Materials

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Notes

Study of pollen character has been proved to be very useful in solving taxonomic disputes. Palynological evidences appeared very effective in plant taxonomy and Phylogeny since the pollen grains possess distinctly unique characters which are genetically controlled. Palynology is the science which deals with Pollen grains. The term is derived from Greek verb Palynein means to scatter. Pollen grains are often easily disseminated by wind etc., Pollen grains are found in every nook and corner, e.g., in glacier ice, in the air over the poles and over the oceans. Fossil spores are found in peat and other sediments, in lignite, coal and shales. They are evident since Pre-Cambrian times hundreds of millions of years ago. Pollen grains morphology plays an important role in classification.

Pollen grains may be vesiculate (with air sacs); saccate or non saccate (to describe plant parts that are shaped like a pouch or sack), fenestrate or non-fenestrate (having small window-like perforations or transparent areas), colpate (furrows or colpi present) or porate (apertures present at the poles).

According to position of apertures six subdivisions are made e.g.,

- ceta (down, inwards in a tetrad),
- ann (up; outwards in a tetrad),
- zone is the zonal position i.e., at the equator
- panto is uniform distribution all over the spore surface.

Palynologically plant families can be segregated into two groups –

1. Stenopalynous – where taxa of the family display more or less same type of pollen grains. e.g., Poaceae, Chenopodiaceae, Amaranthaceae etc.
2. Eurypalynous – where the taxa of the family shows obvious difference in pollen types. e.g., Asteraceae, Rubiaceae, Acanthaceae, Verbenaceae, Solanaceae, Convolvulaceae, Fabaceae etc.

Some families such as Asteraceae show different types of pollen grains – Eurypalynous
Several others have a single morphological pollen type – Stenopalynous
Such stenopalynous groups are of considerable significance in systematic palynology

Several pollen features are useful in taxonomic delimitation like – Pollen grain shape, aggregation, grain symmetry, wall architecture, sculpturing; pollen aperture its type, number, shape, position, structure etc. Basic evidentiary characters are Pollen unit type, Pollen grain polarity, Pollen grain shape, Pollen grain symmetry, Pollen grains nuclear state, Pollen wall architecture, Exine stratification, Exine structure, Exine sculpture, Aperture type, Aperture number, Aperture position, Aperture shape, and Aperture structure

- In Magnoliidae the pollen is binucleate.
- In Caryophyllidae the pollen is trinucleate.
- In Ericaceae the pollen is in tetrads.
- In Asclepiadaceae pollen remain in Pollinia.
- In Taraxaccurn the pollen wall is echinate.
- In Quercus the pollen wall is scabrate.

The pollen grain wall is made of two principal layers, outer exine and inner intine.

- Exine – 1. ektexine or sexine
  2. Endexine or nexine
- Sexine – basal foot layer – baculum (columella)
  - Tectum

The exine may be inaperturate or aperturate. Aperturate may be monoporate, monocolpate or monosulcate, If pore and slit then three pores (triporate) three slits each with a germinate pore in middle (tricolporate) or with many pores (multiporate) accompanied by a variety of surface ornmentations. Monocolpate condition is widely spread in primitive dicots and a majority of monocots. The pollen of anemophilous plants is usually small, rounded, smooth, rather thin walled and dry with shallow furrows. eg Poaceae, Cyperaceae. Insect and bird pollinated pollen on the other hand is large sculptured and often coated with adhesive waxy or oily substance.

Depending upon palynological studies two distinct phylogenetic stocks in the dicots have been suggested.
Magnoliaceae with monocolpate type
Ranunculaceae with tricolpate type of pollen grains

Monocots are considered to be closely related to magnolian stock on the basis of Monocolpate element.

- monocolpate pollen - pollen grains having a single furrow.

The Magnolian dicots are considered to be ancient palynologically as compared to Ranalian dicots where new apertural forms are present (monocolpate totally absent).

Family level

On the basis of Palynological character Fumariaceae is separated from Papavaraceae and Nelumbonaceae from Nymphaeaceae. Malvaceae and Bombacaceae are separated on the basis of exine characters, Malvaceae shows spinous exine and Bombacaceae shows reticulate exine in pollen grains. The family Berberidaceae consists of 12 genera. Modern taxonomists removed genus Podophyllum from Berberidaceae and placed it in a separate family Podophyllaceae on the basis of pollen aggregation. The pollen grains of Podophyllum remains united but they are free in other genera. This shows the role of palynology in taxonomic delimitation at the family level.

Among the examples of role of pollen grains in systematics is *Nelumbo* whose separation from Nymphaeceae in to a distinct family Nelumbonaceae is largely supported by the tricolpate pollen of *Nelumbo* as against the monosulcate condition in Nymphaeaceae.
Pollen grains of Linaceae and Plumbaginaceae (Plumbagineae-Aegtality) are approximately of same type. The similarity in pollen morphology between Linaceae at Plumbagineae is greater than that of Plumbaigineae and Staliceae. In Plumbagineae the pollen grains are zonotreme (3—colpate) or pantotreme (e.g.,Linum heterosepalum); Pantotrenre is found in Plumbagella micrantha. The evolution is traced from arboreces Linaceae to the Plumbagineae and to herbaceous Staliceae. Seven genera of Polygonaceae i.e., Koenigia, Persicaria, Polygonum, Pleuropteropyrum, Bistoria, Tiniaria and Fagopyrum are different in their Pollen morphology. In family Salicaceae Salix has long narrowed 3-furrowed pollen, Populus has spherical pollen without apertures.

In Berberidaceae the Pollen grains aperturate; 3 aperturate; spiraperturate; 2-celled. Spiraperturate pollen grains have one to several colpi. The colpi are fused giving the appearance of a set of spirals surrounding the whole pollen grain. The apertures may be irregular in outline, irregularly spaced and spiral around the pollen grain.

Based on exine pattern different species of Bauhinia (Fabaceae) can be differentiated.
Pollen size played a vital role in demarcating different species of Malva (Malvaceae). Podophyllum is separated from Berberidaceae as it has united pollen grains. Some families are recognized on the basis of pollen sculpture e.g., Malvacae and Asteraceae has spinuous exine; Plumbaginacae has verrucate exine and Poaceae has smooth sulcate exine of pollen grain. On the basis of Palynological characters Fumariaceae is separated from Papaveraceae and Nelumbonaceae from Nymphaeaceae. Hutchinson kept Araceae and Lemnaceae under Arales. However, Arecaceae has sculptured exine and Lemnaceae has spinous exine in Pollen grains. Malvacae and Bombacaceae are separated on the basis of palynological studies where Malvaceae shows spinose exine and Bombacacee shows reticulate exine in Pollen grains.

Genus level
The role of Palynology in delimitation at genus level is evident in Salicaceae. Salicaceae consist of 2 genera, Salix and Populus that can be distinguished on the basis of pollen characteristics. The genus Populus has spherical pollen grain without distinct aperture, whereas there is long narrowed 3-furrowed pollen in Salix. The pollen characteristics help in differentiating species within a single genus.

Species Level
Based on germinal aperture the different species of Anemone can be distinguished.
At specific level in Anemori

- A. obtusifolia the pollen grains are 3-zonocolpate,
- A. rivularis is pantocolpate,
- A. alchemillaefoliath, is pantoporate, and
- A. fulgen is spiraperturate.