

# **Role of palynology, embryology and cytology in Taxonomy.**

Palynology deals with plant spores and pollen that are both ancient and modern and is also valuable in evolutionary and taxonomic research and can help to delineate/establish phylogenetic relationships between fossilized and extant plants and thus helps in the taxonomic identification of many plant groups .

Recent advances in techniques for study of pollen development and comparative ontogeny and functional role the following points highlight the top five roles of palynology in taxonomy.

The roles are:

1. Stenopalynous and Eurypalynous Taxon
2. Family and Tribal Level
3. Generic Level
4. Species and Infra Specific Level
5. Phylogenetic Consideration

## **1.Stenopalynous and Eurypalynous Taxon:**

### **i. Stenopalynous:**

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.

Like families, genera may be stenopalynous or eurypalynous. For example, the acanthaceous genera such as *Strobilanthus*, *Justicia*, etc. have been split up by Bremekamp (1944) and more natural groupings have been proposed.

## **2. Family and Tribal Level:**

The families may be stenopalynous or eurypalynous.

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.

### **3. 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 genera *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.

III. Herberg (1946) has suggested the division of the genus *Polygonum* into seven genera based on pollen morphology viz. *Koenigia*, *Persicaria*, *Polygonum*, *Pleuropteropyrum*, *Bistoria*, *Tiniaria* and *Fagopyrum* 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.

#### **4.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. irtia*, *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 colpi 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  $\mu\text{m}$ ) and *M. sylvestris* (pollen 105-126  $\mu\text{m}$ ).

## **5. 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.