

# SUBJECT - BOTANY

## Paper-3

CLASS- Bsc.- 3 year

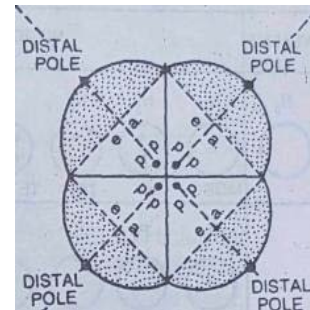
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### PALYNOLOGY

#### MORPHOLOGY, VIABILITY AND GERMINATION OF POLLEN

The study of external morphological features of mature pollen grains is referred to as palynology. Since the first use of the term palynology by Hyde and Williams in 1845, several important contributions have been made in this area, and it has now emerged as an important discipline of fundamental and applied interests. In India the chief centres of research, in this field are : National Botanical Research Institute (Lucknow), Birbal Sahni Institute of Paleobotany (Lucknow), Osmania University (Hyderabad) and Bose Institute (Calcutta).

Pollen grains are initially formed in groups of four (tetrads). Each pollen grain has two poles at opposite ends of what is commonly described as the polar axis. The proximal pole (P.P.) is at the centre of proximal face' (toward the centre of the tetrad), whereas the distal pole is at the centre of the distal face (away from the centre of the tetrad). The polar axis must always be perpendicular with the distal pole at the apex and proximal pole at the base. The pollen grains are said to be heteropolar if their two faces are different and isopolar if similar. In heteropolar grains one face has an aperture while the other has none. The equator runs round the surface of isopolar pollen grains midway between the poles. In order to illustrate the pollen grains in a uniform way and to facilitate comparison these terminologies and their definitions are essential. A schematic illustration of a pollen grain is called 'Palynogram'.



#### Apertures :

An aperture is any weak area on the pollen surface which is directly or indirectly, associated with its germination. Long apertures are called colpi and short ones pores. The apertures may be simple or compound. Pollen grains with simple apertures are either colpate (with colpi) or porate (with pores). A compound aperture consists of a central region called oral and an outer region called colpal in colpate pollen (with compound colpi) and poral in porate pollen (with compound pores).

## **NPC System :**

NPC refers to Number (*N*), Position (*P*) and Character (*C*) of aperture. Under this system the usage of the term 'treme' has been recommended in place of 'aperture' for purposes of preparing

and biological degradation. Because of this property of the exine, pollen grains are well preserved for long periods in fossil deposits.

### **Exine stratification :**

Morphologically the exine is divisible into two *distinct* layers-keys for the classification of pollen grains. Pollen grains without aperture are called atreme, also represented as  $N_0$ . Depending upon the number of apertures the pollens are monotreme ( $N_1$ ), ditreme ( $N_2$ ), tritreme ( $N_3$ ), tetratreme ( $N_4$ ), pentatreme ( $N_5$ ) or hexatreme ( $N_6$ ). Pollen grains with more than 6 apertures (7 or more) are said to be polytreme and represented as  $N_7$ . When apertures, irrespective of their number, are irregular or irregularly spaced, the pollen grain are described as anomotreme ( $N_8$ ).

With regard to the position (*P*) of aperture, there are seven groups ( $P_0$ - $P_6$ ). The pollen are designated as catatreme when the aperture is on the proximal face and anatreme if it is on the distal face. When the centres of apertures are located on the equator, the pollen grains are referred to as zonotreme. The condition is said to be pantotreme when the apertures are more or less uniformly distributed all over the pollen surface.

The character-groups like the position-groups, are also seven ( $C_0$ - $C_6$ ) pollen are designated  $C_0$  (0 stands for a query) when the character of the aperture is not known.  $C_1$ , pollen have an aperture-like thin area, or leptoma. Pollen with one leptoma are called monolept. They may be catalept (leptoma on proximal face) or analept (leptoma on distal face). The grains *with* a 3-slit colpus belong to Category, and are called trichotomocolpate. The remaining character groups *viz.*,  $C_2$ ,  $C_4$ ,  $C_5$  and  $C_6$  comprise colpate, rate, colporate and pororate pollen grains, respectively.

## **Shape and Size :**

The shape of pollen grains can vary from very flat (peroblate) where equatorial diameter is more than twice the length of the polar axis, to very elongate (perprolate) where the diameter is less than half length of the polar axis. Although the variations in the shape of pollen are quite characteristic for taxonomic and phylogenetic considerations, these are less important than apertures.

The size of pollen grains varies from nearly 10  $\mu\text{m}$  in *Myosotis* to as 200  $\mu\text{m}$  in some Cucurbitaceae and Nyctaginaceae.

### **Pollen Wall Features :**

It has been proposed by Walker and Doyle (1975) that pollen wall architecture should include pollen wall stratification, exine structure and sculpturing.

The two principal layers of the pollen wall are the intine and exine. Of these, the intine is the inner, more or less uniform layer. It is pecto-cellulosic in nature and usually destroyed during acetolysis. The exine, is the outer, acetolysis-resistant layer. It is also resistant to physical

- (a) an outer sculptured layer called sexine,
- (b) an inner non sculptured layer, nexine.

The sexine further comprises an internal layer of upright rod-like elements, the columellae (bacula) covered over by a roof like layer the tectum. The exine is, thus, typically 3-layered consisting of tectum, columellae and nexine. The tectum may be smooth, or have various reprocesses.

Light microscopy as well as electron microscopy have revealed that, chemically the exine is differentiated into two layers : an outer layer called *ektexine* an inner layer, endexine. These two layers may not always correspond morphologically recognised layers, namely, sexine and

Sometimes, the outer layer of nexine, called foot layer, is chemically similar to sexine. In acetolysed pollen is stained red with alcoholic fushsin. In such case the tectum would include the sexine and the foot-layer.

### **Exine structure :**

Structurally, the exine is of three basic type tectate, semitectate and intectate. In tectate and semitectate type the exine consists of nexine, columellae and tectum. Whereas in the former type the tectum is continuous and roof-like in the latter it is perforated, the diameter of perforation is greater than the breadth of pollen wall between them resulting in an open reticulum. If there is no tectum, and the columellae are free and exposed representing the sexine, the pollen are called intectate

## Exine sculpturing :

The exposed surface-details of the pollen was constitute the sculpturing. Some of the more important types are :Psilate(smooth) foveolate (pitted), fossulate (grooved), scabrate (very fine projections), verrucate (wart), baculate (rod-like elements) pilate (rod like elements with swollen tips), gemmate (sessile pilar), echiate (spiny)rugulate (elongate elements irregularly distributed tangentially over the surface), punctuate (minute perforations) and reticulate (elements forming an open network).

## LO-Analysis:

The details of sporoderm patterns, which appear clean in thin sections, can also be demonstrated by LO-analysis of entire pollen grains. The sporoderm pattern, at a high plane of focus of the microscope appear as bright islands separated by dark channels. On a lower adjustment it shows

dark islands separated by bright channels. It clearly indicates that the picture at high adjustment is just the reverse of what is visible at the lower plane of focus. A comparative appraisal of the views under low and high planes of microscope adjustments is referred to as LO-pattern.



LO-Pattern in *costus speciosus*.

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