

## Fascinating pollen – A taxonomist view

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Palynology is a fascinating science with a multidimensional approach covering almost all branches of botanical sciences. It is segregated into many sub-branches viz., aeropalynology, palaeopalynology, melissopalynology, forensic palynology etc. Pollen morphology is also used as an important tool for plant identification and classification. Here, I will concentrate my discussion on the taxonomic use of pollen morphology with especial reference to the family Ericaceae.

The cosmopolitan family Ericaceae is the 8th largest family of angiosperms. It comprises eight subfamilies, twenty tribes, ca. 125 genera and 4100 species. In the recent phylogenetic classification of Ericaceae (Kron et al. 2002), the relationship among the subfamilies is well defined, but relationships among the tribes are not fully understood. Therefore, it appeared timely to study in detail the pollen morphology of Ericaceae with the hope of identifying new characters that could add new insight into future analyses of the family.

For this palynological investigation, 275 taxa of 270 species representing 57 genera and 6 subfamilies were studied with light (LM) and scanning electron microscopy (SEM), and 31 species with transmission electron microscopy (TEM). The systematic significance and evolutionary trends of palynological characters have been discussed in the light of the recent phylogenetic classification of the Ericaceae.

Pollen grains are dispersed as monads, tetrads or polyads, commonly of medium (30 – 50  $\mu\text{m}$ ) size and 3-colpor(oid)ate. Viscin threads are present only in a few genera of the subfamily Ericoideae (*Bejaria* and other eight genera). With SEM, exine sculpture varies from finely verrucate to psilate, and twelve major exine sculptural types have been recognized. Two dichotomous keys to the pollen of Ericaceae were prepared with the characters observed under LM, and exine sculpture with SEM. With TEM, the exine structure of ericaceous pollen is basically the same, and composed of ectexine; tectum, columellae and foot layer, and endexine. Two unique exine structures, granular columellae and canalized tectum, were observed in the monad pollen of two *Erica* species, *E. barbigera* and *E. recurvifolia*, and the canalized tectum also observed in *Rhododendron japonicum* and *Oxydendrum arboreum*. The TEM observations were also found useful to confirm some critical palynological observations with LM and/or SEM: heterodynamosporus tetrads, different types of exine sculpture, tetrads without septa, presence of pollenkit and pollenkit ropes, causes of pollen shrinkage, and identification and realignment of taxa.

The family Ericaceae is eurypalynous enough to clarify the differentiation of species and genera, but has limited potential for clarification of the demarcation and relationships of higher taxa (e.g. tribes). Generally, the recent classifications and relationships among the genera of Ericaceae were supported by results of the present study. Qualitative palynological characters (e.g., exine sculpture) were found to be taxonomically more important than quantitative characters (e.g., tetrad diameter), and various palynological characters important for different taxonomic levels. Palynological features were also found to be significant in some infrageneric classifications (e.g., *Enkianthus*, *Arctostaphylos* etc.), and to identify the monophyly of taxa (e.g., *Dimorphantha*).

Moreover, some taxonomic problems were presented, and realignments of some taxa have been suggested from the palynological view point, e.g. tribal limits of the tribe Bejarieae. Individual generic status of the following three taxa has been proposed: *Erica recurvifolia* E.G.H. Oliv. as *Eremia recurvata* Klotzsch; *Rhododendron tsusiophyllum* Sugim. as *Tsusiophyllum tanakae* Maxim.; and *Vaccinium japonicum* Miq. as *Hugeria japonica* (Miq.) Nakai. At least one misplaced species was also identified; *Enkianthus sikokianus* (Palibin) Ohwi should be recognized as a separate species, but it has been incorporated into *E. campanulatus* (Miq.) Nicholson.

The present study revealed a number of evolutionary trends in different palynological features viz., pollen dispersal units, compactness of tetrads, pollen size and shape, aperture number and exine sculpture, within the family Ericaceae as well as within a genus (e.g. *Enkianthus*), and suggestions were made concerning the selective value of some of these trends. There is no clear correlation between pollen features of the family Ericaceae and either pollinators or geographical distributions, but present in lower taxa (e.g. *Rhododendron*, *Erica*).

In the course of the pollen survey the following interesting discoveries were made: the first unique palynological feature – pollen tetrads without septa for the Ericaceae (e.g. *Ceratostema*) as well as other angiosperm families; the parallel evolution of pseudomonad pollen tetrad development in the subfamily Styphelioideae and Vaccinioideae; and pollenkit ropes were found on the dried herbarium specimens (e.g. *Notopora*).