A Study of Some Pollen Grains of Canpanulaceae
by Scanning Electron Microscopy

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Özden İNCEOĞLU

Faculté des Sciences de l'Université d'Ankara
Ankara, Turquie
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A Study of Some Pollen Grains of Campanulaceae by Scanning Electron Microscopy

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Özden İNCEOĞLU

(Biology Institute, Faculty of Science, Hacettepe University, Ankara, Turkey)

SUMMARY

Comparative light and scanning electron microscope studies of pollen morphology of four species of Campanulaceae have been carried out. Whereas, light microscopy suggests granulate, faintly granulate or reticulate ornamentation of sexine surface of Campanula juncea Wett., Campanula rapunculoides O., Mindium thysoides Boiss et et Heldr. and Specularia pentagonia L. Scanning electron microscope reveals details of sexine ornamentation and allows its characterization as rugulate or slightly protruded on the plane surface. Other scanning electron microscope observations permitted clarification of the structure of operculum and pore margin complexes and classification of the pollen grains as either subectate or perectate.

INTRODUCTION

In accordance with the observations from previous palynological studies by the author using light microscopy, the ornamentation of pollen grains of eighty two species belonging to the Campanuloideae subfamily of the Campanulaceae is echinate and scabrate. Spinules and spines of these pollen grains protrude from the surface of the sexine which is generally characterized by rather obscure ornamentation. Only limited details of sexine surface morphology can be discerned with light microscopy, however can be characterized generally as faintly or finely granulate, rugulate, or psilate (İNCEOĞLU, 1975).

TARNAVSCHI and RADULESCU (1959) have also reported the obscure sexine ornamentation of some pollen grains belonging to the Campanulaceae family.
Scanning electron microscopy study has been undertaken with the aim of clarifying the obscure ornamentation of sexine in pollen grains of *Campanula juncea* Wetts., *Campanula rapunculoides* L., *Mindium thyrsoides* Boiss et Heldr., *Specularia pentagonia* L. and indistinct pore margin and operculum of *Campanula juncea* pollen grains which could not readily discerned with light microscopy. Furthermore, the present palynological investigation presents comparative data on morphology of pollen grains of these four species obtained by light microscopy and scanning electron microscopy.

**MATERIALS AND METHODS**

Pollen grains for this study were obtained from herbarium specimens from following sources: *Campanula juncea* and *Mindium thyrsoides* (Collectors; Quezel, Contandriopoulos and Pamukçuoğlu, Marsey University, St. Jerome), *Campanula rapunculoides* (Collector; Bağda, ANK), *Specularia pentagonia* (Collector; Pamukçuoğlu, 13 HUH).

For electron microscopy pollen grains of the four species were mounted on specimen holders, and 200-500 Å gold were evaporated onto the grains as they were rotated under high vacuum. Subsequently, the specimens were examined and photographed with scanning electron microscope (Cambridge, Stereoscan, Mark II) at Honeywell Corp., Phoenix, Arizona, U.S.A.

**OBSERVATIONS**

When pollen grains of the four species under investigation were examined with conventional light microscopy, ornamentation of sexine surface was observed to be reticulate in *Mindium thyrsoides*, granulate in *Specularia pentagonia*, in *Campanula juncea* and faintly granulate in *Campanula rapunculoides* (İNCEOĞLU 1975).

Examination of the above mentioned species of pollen grains with scanning electron microscopy revealed more details of the ornamentation of the sexine and of the pore margin and oper-
culum complexes. The sexine surface was observed to be rugulate in pollen grains of *Campanula juncea*, *Mindium thyrsoides*um and *Specularia pentagonia* (Plates 1: 2-3, 2: 5-6, 3: 9-10), to be small protruded on the plane surface in pollen grains of *Campanula rapunculoides* (Plate 4: 12).

A network of many cavities were observed on the sexine surface of *Mindium thyrsoides*um. These cavities were formed by anastomoses and dichotomies of the valli (Plate 2: 5-6). The valli in the pollen grains of *Campanula juncea* and *Secularia pentagonia* were more compact than those in the pollen grains of *Mindium thyrsoides*um (Plates 1: 2-3, 3: 10). Occasional fusion of valli were observed on the sexine of these three species of pollen grains (Plates 1: 2, 2: 6, 3: 7).

Acicular spinules were distributed irregularly over the sexine surface of *Campanula juncea* (Plate 1: 2) but were rather regular on the other species of pollen grains (Plates 2: 4, 3: 8, 4: 2). In addition to the spinules, manifested protrusions were also observed on the valli of the pollen grains displaying the rugulate ornamentation of the sexine (Plates 1: 3, 2 5-6, 3: 9-10).

Prominent operculum was easily observed on the pollen grains of *Mindium thyrsoides*, *Specularia pentagonia* and *Campanula rapunculoides* (Plates 2: 4, 3: 7-9, 4: 11-12) but the operculum appeared shapeless in the pollen grains of *Campanula juncea* (Plate 1: 1-2).

**DISCUSSION**

Previous studies with light microsoyyp (İNCEOĞLU 1974, 1975) have established that it is difficult to distinguish sexine ornamentation of pollen grains of *Campanulaceae*. The present study employing scanning electron microscopy has revealed a number of heretofore obscure details of the sexine surface.

As seen in the photomicrographs of pollen grain of *Mindium thyrsoides*um (Plate 2: 6), there is a large network of cavities
Plate 2. *Mindium thyroideum*. – 4. Low magnification view of general features showing pores, opercula and spines. X 1175. – 5. A pollen grain showing the ornamentation of sexine and spines. Upper portion of pollen grain shows separation of sexine (s) and nexine (n) from part of columella. Small, granule-like structures are columellae on outer surface of nexine (arrow 1) and inner surface of sexine (arrow 2). X 2200. – 6. Higher magnification shows rugulate sexine and small protrusions of valli (arrow). X 5000.
between the valli. If the light microscope is focused on the valli, because of the network of cavities, the sexine surface appears to be reticulate, if focused on the small protrusions of the valli, sexine ornamentation seems granulate. The regions of valli fusion, the sexine appears granulate also. This may help to explain why light microscopic studies of pollen grains of this species and other in the Campanulaceae have described the sexine surface as both reticulate and granulate.

Since the valli are closer or more compact in the sexine of pollen grains of Campanula juncea and Specularia pentagonia, the resulting network of cavities are small and fewer in number, making the reticulate nature of the grain surfaces nearly impossible to detect. However, the small protrusions on the valli make the sexine appear granulate (Plates 1: 3, 3: 10).

When the sexine of some other pollen grains of Campanuloideae species appear granulate or reticulate under the light microscopy, these should be observed to be rugulate when examined with the scanning electron microscope. However, the sexine which appears faintly granulate when examined with light microscope, this may appear as very small protrusions on the plane surface in the photomicrographs taken by scanning electron microscope.

Light microscopy shows vague the pore margins of the pollen grains of Campanula juncea (INCEOĞLU 1975) due to the fact that the shapeless operculum extends to the sexine level and is thus interspersed with sexine surface ornamentation. This, in return, either partly obscures the definite appearance of the pore margin (Plate 1: 2) or causes the margin to disappear obscure completely in the pollen grains (Plate 1: 1).

According to ERDTMAN (1969) pollen grains are either pertainpact or subtectate. Scanning electron microscopy of the four species studied herein reveals both kinds of tecta. The deep cavities in the sexine of Campanula juncea, Specularia pentagonia and Mindium thyrsoidem indicate that these species of pollen grains are subtectate, owing to their discontinuous nature (Plates 1: 3, 2: 5-6, 3: 10).

As seen in the scanning electron photomicrographs of Mindium thyrsoidem pollen grain (Plate 2: 5), the sexine are
separated from each other and from part of the columnella. Granule like structures are columnella on the outer surface of the nexine and inner surface of the sexine. Holes in the inner surface of the further substantiata its subectate or discontinuous structure. In contrast. Scanning electron microscope shows clearly a continous tectum in pollen grain of *Campanula rapunculoides*, suggesting a pertectate structure. (Plate 4: 12).

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**REFERENCES**


**ÖZET**


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