

## POLLEN FLORA OF PAKISTAN - III. ELATINACEAE

ANJUM PERVEEN AND M. QAISER

Department of Botany,  
University of Karachi, Karachi-75270, Pakistan.

### Abstract

Pollen morphology of 3 species of the genus *Bergia* L., from Pakistan belonging to the family Elatinaceae has been examined by light and scanning electron microscope. Pollen grains are generally radially symmetrical, isopolar, oblate - spheroidal to prolate - spheroidal, often sub-oblate, tricolporate, zono-aperturate with fossulate - reticulate tectum. On the basis of shape, colpal membrane and exine pattern, 2 distinct pollen types viz., *Bergia aestivosa* - type and *Bergia suffruticosa* - type are recognized.

### Introduction

Elatinaceae, a small aquatic and semi-aquatic family comprising of 40 species belonging to 2 genera viz., *Elatine* L., and *Bergia* L., is distributed in tropical and temperate regions of the world (Willis, 1973; Mabberley, 1987). The family exhibits a combination of common characters of the orders Myrtales and Theales. However, morphological and anatomical characters such as absence of internal phloem, vested pitting, difference in interpetiolar stipules and flower type strongly support its exclusion from Myrtales (Takhtajan, 1969; Dahlgren & Thorne, 1984). In Pakistan, it is represented by a single genus *Bergia* L., with 3 species (Ghafoor & Ali, 1972).

*Bergia* L., is a diffusely branched erect or decumbent herb with the exception of *B. suffruticosa* Fenzl., which is partly suffrutescens. The leaves are opposite and verticillate, with small interpetiolar stipules. The flowers are solitary or aggregated in cyme (Tobe & Raven, 1983; Dahlgren & Thorne, 1984).

Pollen morphology of the family Elatinaceae have been studied by Cranwell (1942), Huang (1968, 1972) and Roland (1968). Ramayya & Rajagopal (1974), Moore & Webb (1978) and Moore *et al.*, (1991) reported trizonocolporate pollen in the genus *Elatine* L., while Erdtman (1952) reported 3-colpor (oid) ate, sub-prolate pollen, with sexine as thick as nexine in *B. anagalloides*. The present paper gives an account of the pollen morphology of the 3 species of the genus *Bergia* as observed under light and scanning electron microscope.

### Materials and Methods

Polliniferous materials of 3 species were collected from Karachi University herbarium (KUH) list of specimens investigated is given in Appendix-1.

For preparation of Pollen grain slides, pollen materials were processed by standard acetolysis method of Erdtman (1952). The slides were examined using Nikon Type-102, under (E,40,0.65) and Oil immersion (E 100, 1.25) using 10 eye piece. For S.E.M. the Pollen material was mounted on metallic stub, coated with gold in

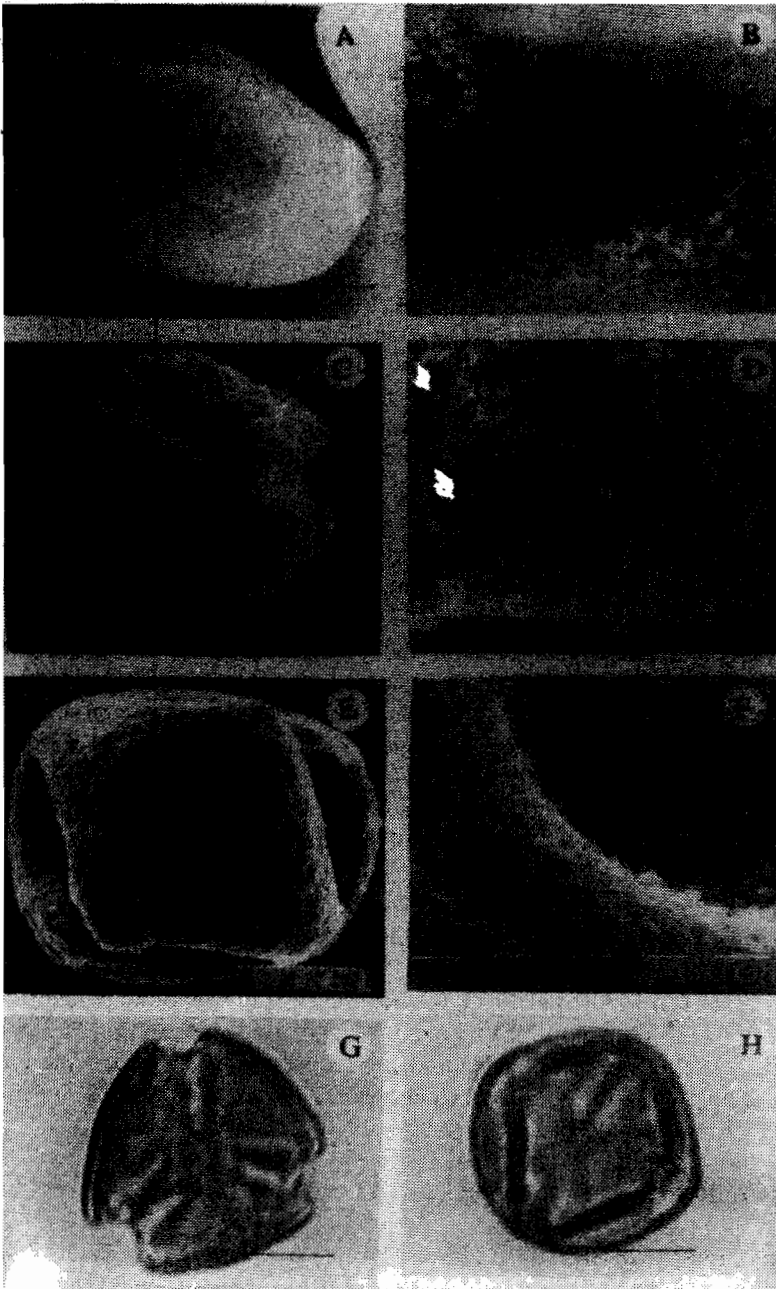


Fig.1. Scanning Electron micrographs = A-F, light micrographs = G-H. *Bergia aestivosa*:

A) Equatorial view; B) Exine pattern. *B. suffruticosa*; C) Polar view; D) Exine pattern; E) Equatorial view. *B. ammanioides*; F) Exine pattern. *B. suffruticosa*; G) Polar view; H) Equatorial view. (Scale bar A,C & E = 10  $\mu\text{m}$ ; B,D & F = 1  $\mu\text{m}$ ; G & H = 20  $\mu\text{m}$ .)

sputtering chamber (Ion-sputter JFC - 1100). S.E.M. examination were carried out using Jeol (JSM-J-200) microscope.

The terminology used is in accordance with Erdtman (1952), Kremp (1965), Faegri & Iversen (1964) and Walker & Doyle (1975).

### POLLEN CHARACTERS OF THE FAMILY ELATINACEAE

Pollen grains generally radially symmetrical, isopolar, prolate - spheroidal to oblate - spheroidal rarely sub-oblate, tricolporate, zonoaperturate, triangular - trilobed, sexine slightly thicker than nexine. Tectum fossulate - reticulate.

In the present study, 2 distinct pollen types are recognized on the basis of shape, colpal membrane and exine pattern of pollen grains viz., 1) *Bergia aestivosa* - type  
*Bergia suffruticosa* - type.

#### Key to the pollen types

- + Pollen grains prolate - spheroidal, tectum medium reticulate, colpal membrane finely scabrate ..... *Bergia aestivosa* type
- Pollen grains oblate-spheroidal to sub-oblate, tectum fossulate, colpal membrane psilate to sub-psilate..... *Bergia suffruticosa* type

#### Description of the pollen types

*Bergia aestivosa* - pollen type (Fig.1 A & B).

Pollen class: 3-zonocolporate

P/E ratio: Suberect

Apertures: Ectoaperture - colpus, sunken, long narrow, margins irregular, end rounded. Endoaperture - Ora circular or slightly lo-longate.

Exine: Sexine slightly thicker than nexine.

Ornamentation: Tectum medium reticulate with irregular pattern of muri, luminae variable in size and shape, 0.14-2.32  $\mu\text{m}$  in diam., colpal membrane scabrate.

Outlines: Equatorial view - Elliptic, pole side slightly truncate, isopolar. Polar view - trilobed, with apertures on the angles of the outline of the grain in polar view.

Measurements: Polar axis (P) 21.5 (22.02) 25.1  $\mu\text{m}$ . Equatorial diameter (E) 17.9 (19.9) 21.5  $\mu\text{m}$ . P/E ratio: 1.10. Colpus length 14.3 (19.0) 25.2  $\mu\text{m}$ . Mesocolpium 11.4 (15.4) 17.8  $\mu\text{m}$ . Apocolpium 1.79 (2.39) 3.54  $\mu\text{m}$ . Exine 0.71 (1.07) 1.79  $\mu\text{m}$  thick, P.A.I. 0.77.

Species: *Bergia aestivosa* Wight & Arnott

Comments: Single species of (*Bergia aestivosa* Wight & Arnott) *Bergia aestivosa* - type is characterized by having reticulate tectum, scabrate colpal membrane and prolate - spheroidal shape of pollen.

*Bergia suffruticosa* - type (Fig.1C & H).

Pollen class: 3 - zonocolporate.

P/E ratio: Sub-transverse to semi-transverse.

Apertures: Ectoaperture - colpus, long, not sunken, margins  $\pm$  distinct, end  $\pm$

rounded. Endoaperture  $\pm$  circular, rarely slightly la-longate.

Exine: Sexine as thick as nexine or slightly thicker than nexine.

Ornamentation: Tectum fossulate, densely breached by distinct perforations,  $\pm$  subpsilate towards colpi forming  $\pm$  distinct colpal margins, colpal membrane psilate - sub-psilate.

Outlines: Equatorial view - elliptic. Pole side slightly acute, isopolar. Polar view - triangular, with apertures on the sides of an angular grains in polar view.

Measurements: Polar axis (P) 15.4 (21.6) 26.8  $\mu\text{m}$ . Equatorial diameter (E) 16.8 (24.8) 36.8  $\mu\text{m}$ . P/E ratio: 0.82-0.93. Colpus length 14 (19.7) 24.4  $\mu\text{m}$ . Mesocolpium 11.2 (17.6) 22.4  $\mu\text{m}$ . Apocolpium 1.4 (1.98) 2.8  $\mu\text{m}$ . Exine 1.4 (1.44) 2.1  $\mu\text{m}$  thick. P.A.I. 0.68-0.72.

#### Species included

*Bergia suffruticosa* (Del.) Fenzl. *B. ammanioides* Roth

#### Key to the species

- + Pollen grains 19.4x20.8  $\mu\text{m}$  in size, colpi length 14-18  $\mu\text{m}$ , P/E ratio: 93.....*B. ammanioides*  
 Pollen grains 23.8x29.0  $\mu\text{m}$  in size, colpi length 19.4 - 24.4  $\mu\text{m}$ , P/E ratio: 83 .....*B. suffruticosa*

Comments: This pollen type is readily recognized by its oblate - spheroidal to sub-oblate pollen with fossulate tectum and psilate to sub-psilate colpal membrane. Two species of this pollen type can easily be delimited on the basis of size, colpi length and P/E ratio.

On the basis of shape, colpal membrane and exine pattern 2 distinct pollen types are recognized viz., *Bergia aestivosa* - type and *Bergia suffruticosa* - type. Pollen of Elatinaceae (*Bergia*) resemble with the other families of Theales like Ochnaceae, Theaceae, Pentaphylacaceae and Quiinaceae. On the basis of trizonocolporate pollen (Tobe Raven, 1983). Pollen grains in the order Myrtales are quite distinct tri-aperturate in Onagraceae, dicolpate in Crypteroniaceae and mostly heterocolpate in Lythraceae. It would suggest that with similar morphological and anatomical characters pollen morphology also supports the inclusion of Elatinaceae in the order Theales.

#### Acknowledgements

We are thankful to the National Scientific Research Development Board (NSRDB), University Grants Commission Pakistan for providing financial support. We are also grateful to the Director of Biological Research Centre for providing facilities of scanning electron microscope.

## Appendix-1

Species	Locality	Collector
<i>Bergia aestivosa</i> Wight & Arnott	Near Primary Health Centre, Mianwali, Dist. Rahimyar Khan	Sultan-ul-Abedin & Abrar Hussain 9743 (KUH)
	Near Sakrand, Dist. Nawabshah	A Ghafoor & Tahir Ali 4389 (KUH)
<i>B. ammanioides</i> Roth	Karachi Univesity Campus, Near Science Canteen	Miss. Zaibunnisa & Abdulla s.n. (KUH)
	KDA water pump near Suigas, Karachi.	Abrar Hussain s.n. (KUH)
<i>B. suffruticosa</i> (Del.) Fenzl.	Clifton, Karachi	Abrar Hussain s.n. (KUH)

## References

- Cranwell, L.M. 1942. New Zealand pollen studies-1. Key to the pollen grains of families and genera in the native Flora. *Rec. Auckland Inst. Mus.*, 2: 280-308.
- Dahlgren, R. and R.F. Thorne. 1984. The order Myrtales; Circumscription variation and relationships. *Ann. Mo. Bot. Gard.*, 71: 633-669.
- Erdtman, G. 1952. Pollen Morphology and Plants Taxonomy. Angiosperms. In: *Introduction to palynology*, vol.1. Almqvist and Wiksell, Stockholm.
- Faegri, K and J. Iversen. 1964. *Text book of Pollen analysis* 2nd ed. Munks gaard, Copenhagen.
- Ghafoor, A and S.I. Ali. 1972. Elatinaceae. In: *Flora of Pakistan*. (Eds.) E. Nasir & S.I. Ali No.19, pp 5.
- Huang, T.C. 1968. Pollen grains of Formosan Plants (4). *Taiwan*, 14: 133-270.
- Huang, T.C. 1972. *Pollen Flora of Taiwan*. National Taiwan University, Botany Dept. Press. 297 pp.
- Kremp, G.O.W. 1965. *Encyclopedia of Pollen morphology*. Univ. Arizona Press, Tux Tuscon, U.S.R.
- Mabberley, D.J. 1987. *The plant book*. Camb. Univ. Press, Cambridge, New York.
- Moore, P.D. and J.W. Webb. 1978. *An Illustrated Guide to Pollen Analysis*. Hodder and Stoughton, London.
- Moore, P.D., J.W. Webb. and M.E. Collinson. 1991. *Pollen Analysis*. Blackwell Scientific Publications, London.
- Ramayya, N. and T.B. Rajagopal. 1974. Systematics, distribution and anatomy of the two Indian species of the genus *Elatine* L. *Bull. Bot. Survey, India*, 13: 328-337.
- Roland, F. 1968. Etude de 1 ultrastructure des aperture. II pollen a sillon. *Pollen et Spores*, 10: 479-519.
- Takhtajan, A. 1969. *Flowering Plants* (Origin and dispersal). Oliver & Boyd, Edinburgh.
- Tobe, H. and P.H. Raven. 1983. An embrological analysis of Myrtales: its definition and characteristics. *Ann. Mo. Bot. Gard.*, 70: 71-94.
- Walker, J.W. and J.A. Doyle. 1975. The bases of Angiosperm Phylogeny: Palynology. *Ann. Miss. Bot. Gard.*, 62: 664-723.
- Willis, J. C. 1973. *A Dictionary of the Flowering Plants and Ferns*. Univ. Press. Cambridge.

(Received for Publication 2 February 1995)