

POLLEN FLORA OF PAKISTAN – XXXIX. PLUMBAGINACEAE

ANJUM PERVEEN AND M. QAISER

*Department of Botany,
University of Karachi, Karachi, Pakistan.*

Abstract

Pollen morphology of 10 species representing 4 genera of the family Plumbaginaceae from Pakistan have been examined by light and scanning electron microscope. Plumbaginaceae is a eurypalynous family. Pollen grains are generally free, radially symmetrical, isopolar, colpate. Shape of pollen grains are sub-oblate to oblate-spheroidal. Sexine thicker or as thick as nexine. Tectum reticulate or bacculate.

The pollen morphology of the family Plumbaginaceae is significantly helpful at specific level. On the basis of exine ornamentation, 2 distinct pollen types viz., *Plumbago zeylanica* - type and *Limonium stocksii*- type are recognized.

Introduction

Plumbaginaceae is a small family of 22 genera and 440 species, distributed throughout the world, mostly in dry areas with saline soils, such as salt flats and sea coasts, especially in the Mediterranean and western Asia (Mabberley, 1987). Takhtanjan (1969) placed the family Plumbaginaceae under the separate monotypic order Plumbaginales. Cronquist (1981) however, referred the family Plumbaginaceae in the order Centrospermae. Dahlgren (1989) recognized two distinct families viz., Plumbaginaceae (s.str.) and Limoniaceae. In Pakistan it is represented by 4 genera and 13 species (Bokhari, 1972). The Plumbaginaceae are a small group of Caryophyllid flowering plants, closely related to the Polygonaceae. It is non-betalains family of Caryophyllids. In the family Plumbaginaceae mostly herbs and small shrubby plants are found. Many species have clustered leaves at the base of the plant. Erdtman (1952) examined pollen morphology of the family Plumbaginaceae. The pollen morphology and the relationship of the Plumbaginaceae, Polygonaceae and Primulaceae to the order Centrospermae has been examined by Nowicke & Skvarla (1977). Turner & Blackmore (1984) studied the palynology of some North West European species of the family Plumbaginaceae. Pollen morphology of family Plumbaginaceae has also been examined by Chanda (1963), Praglowski & Erdtman (1969), Roa & Shukla (1975), Nowicke & Skvarla (1979), Moore & Webb (1978). There are no reports on the pollen morphology of the family Plumbaginaceae from Pakistan. Present study is based on pollen morphology of the 10 species of family the Plumbaginaceae by light and scanning Electron microscope.

Materials and Methods

Pollen samples were obtained from Karachi University Herbarium (KUH) or collected from the field. The list of voucher specimens are deposited in KUH. The pollen grains were prepared for light (LM) and scanning microscopy (SEM) by the standard methods described by Erdtman (1952). For light microscopy, the pollen grains were

mounted in unstained glycerin jelly and observations were made with a Nikon Type-2 microscope, under (E40, 0.65) and oil immersion (E100, 1.25), using 10x eye piece. For SEM studies, pollen grains suspended in a drop of water was directly transferred with a fine pipette to a metallic stub using double sided cello tape and coated with gold in a sputtering chamber (Ionsputter JFC-1100). Coating was restricted to 150A. The S.E.M examination was carried out on a Jeol microscope JSM-T200. The measurements are based on 15-20 readings from each specimen. Polar length, equatorial diameter, pore diameter and exine thickness are given in Table 1.

The terminology used is in accordance with Erdtman (1952); Faegri & Iversen (1964); Kremp (1965) and Walker & Doyle (1976).

Observations

General pollen characters of the family Plumbaginaceae

Pollen grains usually radially symmetrical, isopolar, sub-oblolate to oblate-spheroidal, tricolpate. Sexine thicker or as thick as nexine. Tectum generally reticulate rarely baculate.

Key to the pollen types

- 1. + Tectum baculate *Plumbago zeylanica* -type
- Tectum reticulate *Limonium stocksii* - type

Plumbago zeylanica- type

Pollen class: Tricolpate.

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

Shape: Oblate-spheroidal to sub-oblolate

Aperture: Small to long elliptic, acute ends.

Exine: Sexine thicker than nexine.

Ornamentation: Tectum baculate.

Outline: More or less circular.

Measurements: Polar axis (P) 16 (31.7 ± 1.0) 47.5 μm long, Equatorial diameter (E)19 (47.0 ± 1.25) 75 μm , colpi 5 (23.7 ± 0.31) 42.5 μm long. Sexine thicker than nexine. Exine 1- (3.3) 5 μm thick.

Species included: *Plumbago capensis* Thumb., *Plumbago zeylanica*. L.

Key to the species

- 1. + Polar length of pollen grains 16-24 μm *Plumbago capensis*
- Polar length of pollen grains c.75-24 μm *Plumbago zeylanica*

Limonium stocksii- type (Fig. 1 A-F, & Fig. 2 A-E).

Pollen class: Tricolpate.

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

Shape: Oblate-spheroidal rarely sub-oblolate.

Aperture: Small to long elliptic, acute ends.

Table 1. General pollen characters of taxa studied in the family Plumbaginaceae.

| Name of taxa | Shape | P/E ratio | Polar Length in μm | Equatorial diameter in μm | Colpus length | Exine thickness μm | Tectum |
|---|--------|-----------|-------------------------------|--------------------------------------|--------------------|-------------------------------|---------------------|
| <i>Plumbago zeylanica</i> L. | Sub-Ob | 0.63 | 47.5 | 75 | 35 (40) 42.5 | 3.75 (4.32) 5 | Bacculate |
| <i>P. capensis</i> Thumb. | Ob-Sp | 0.95 | 16 (22) 24 | 19 (19.9) 20 | 5 (5.4) 6 | 1 (1) 1.1 | Bacculate |
| <i>Acantholimon lycopodioides</i> Girard | Sub-Ob | 0.75 | 47.5 | 62.5 | 0.45 | 5 (6.31) 7.5 | Coarsely reticulate |
| <i>A. longiflorum</i> Boiss. | Ob-Sp | 0.94 | 50 (61.3) 67.5 | 62 (65) 67 | 27.5 (28.7) 30 | 5 (7.87) 10 | Coarsely reticulate |
| <i>H. munroanum</i> Aitch et Hemsl. | Sub-Ob | 0.64 | 40 | 62.5 | - | 5 (5.99) 7.25 | Coarsely reticulate |
| <i>Limonium cabulium</i> (Boiss.) O. Kuntz. | Ob-Sp | 0.84 | 40 (41.25) 52.75 | 47.5 (48.7) 50 | 25 (28.33) 35 | 5 (4.74) 7.5 | Coarsely reticulate |
| <i>L. macrorhabdon</i> (Boiss.) O. Kuntz. | Ob-Sp | 0.86 | 47.5 (48.77) 50 | 55 (56.25) 57.5 | 29 (30) 32 | 5 (6.87) 7.5 | Coarsely reticulate |
| <i>Psylliostachys beludhistamia</i> Roshk | Ob-Sp | 0.90 | 27.5 (30.0) 32.5 | 31.2 (33.1) 37.5 | 15 (15.20) 16.2 | 3.6 (4.75) 5.25 | Reticulate |
| <i>L. gillessi</i> Hemsl. Rechif. & Koeie | Ob-Sp | 0.89 | 50 (53.5) 62.6 | 50 (59.5) 62.5 | 20 (25.0) 30 | 7.5 (9.53) 11 | Coarsely reticulate |

Abbreviations: Sub-Ob= Sub-Oblate, Ob-Sp= Oblate-Sphaeroidal

Fig. 1. Scanning micrographs: *Acantholimon. longiflorum* A , Pollen grain. B, *A. lycopodioides*: Exine pattern. *A. munroanum*: C, Polar view, D, exine pattern. *Limonium cabulicum*: D, Exine pattern; F, Polar view.
Scale bar = A, C, E & F = 10; B & D= 1 μ m.

Fig. 2. Scanning micrographs: *Limonium macrorhabdon*: A, Equatorial view; B, Exine pattern. *Psylliostachys beludshistanican*: C, polar view, D, Equatorial view, E, exine pattern. Scale bar = A, C & D = 10; B, E= 1 μ m.

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

Ornamentation: Tectum fine-coarsely reticulate

Outline: More or less circular.

Measurements: Polar axis (P) 27.5 (47.5 ± 1.1) 67.5 µm long, Equatorial diameter (E) 31.5 (49.2.1 ± 2.5) 67 µm, colpi 15 (24.75 ± 0.4) 45 µm long. Sexine thicker than nexine or as thick as nexine. Exine 3.1- (6.5) 10 µm thick.

Species included: *Acantholimon lycopodioides* (Girard) Boiss, *A. longiflorum* Boiss., *A. munroanum* Aitch. et. Hemsl., *Limonium cabulicum* (Boiss) O. Kuntze, *L. gilessii* (Hemsl.) Rech. f. & Koeie, *L. macrorhabdon*, (Boiss.) O. Kuntze *L. stocksii* (Boiss.) O. Kuntze, *Psylliostachys beludshistanica* Roshk.

Key to the species and species group

1. + Polar length of pollen grains 27-32 µm *Psylliostachys beludshistanica*
- Polar length of pollen grains more than 32 µm 2
2. + Tectum medium reticulate group-1
(*Acantholimon lycopodioides*, *A. munroanum*)
- Tectum coarsely reticulate group-2
(*Acantholimon longiflorum*, *Limonium cabulicum*, *L. gilessii*, *L. macrorhabdon*, *L. stocksii*)

Discussion

Plumbaginaceae is europalynous family (Erdtman, 1952). Pollen data is based on 4 genera viz., *Acantholimon* Boiss., *Limonium* Miller, *Plumbago* L., and *Psylliostachys* (Jaub. et Spach) Nevski., distributed in 10 species. Pollen grains generally isopolar tricolpate with reticulate tectm. However, most striking variation is found in the tectum types and on the basis of tectal surface family can easily be divided into 2 distinct pollen types viz., *Plumbago zeylanica*-type and *Limonium stocksii*-type. Two types of pollen in Plumbaginaceae i.e., verrucate *Plumbago* type and the reticulate *Armeria* type have been reported by Faegri & Iversen (1964); Nowicke & Skvarla (1979) and Turner & Blackmore (1984).

Pollen type: *Plumbago zeylanica* is easily distinguished by its bacculate tectum. Two species are included in this type, these species are easily distinguished on the basis of polar length (see key to the species). Pollen type: *Limonium stocksii* is delimited by its reticulate tectum. In this type 3 genera included are: *Acantholimon* Boiss., *Limonium* Miller and *Psylliostachys* (Jaub. et Spach) Nevski. However, the genus *Psylliostachys* (Jaub. et Spach) Nevski., is readily distinguished by its polar length (27-32 µm), while the remaining genera have more than 32 µm in polar length. The species of this pollen type are further divided into two groups on the basis of tectum. In *A. longiflorum* (Boiss.) O. Kuntze. tectum is medium reticulate. *Limonium cabulicum* (Boiss.) O. Kuntz., *L. macrorhabdon* Boiss O. Kuntz., and *L. gilesii* (Hemsl.) Rech. & Koeie have coarsely reticulate tectum. Palynological data clearly favors the separation of the family Plumbaginaceae (s.l.) into two distinct families viz., Plumbaginaceae (s.str.) and Limoniaceae as done by Dahlgren (1989).

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