Pak. J. Bot., 33(3): 223-227, 2001.

POLLEN FLORA OF PAKISTAN -XXIII. POLYGALACEAE

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Abstract

Pollen morphology of 6 species belonging to a single genus *Polygala* of the family *Polygalaceae* has been investigated using light microscope and scanning microscope. It is a stenopalynous in nature. Pollen grains usually radially symmetrical, isopolar, prolate-spheroidal to oblate-spheroidal or sub-prolate, polycolporate. Tectum psilate to subpsilate or scabrate often punctate. On the basis of polar length, 2 distinct pollen types are recognized viz., *Polygala arvensis* - type and *Polygala erioptera* - type.

Introduction

Polygalaceae is a family of 12 genera, represented by 800 species distributed mostly in temperate and tropical regions (Willis, 1973; Mabberley, 1987). In Pakistan it is represented by one genus *Polygala* and 8 species (Dar, 1973). The comparative pollen morphology of the family *Polygalaceae* has been examined by Braga (1961). Larson & Skvarla (1963) examined pollen morphology and fine structure of *Polygala alba* Nutt., and *P. incarnata* L. However, the pollen morphology of the family *Polygalaceae* has also been examined by Erdtman (1952); Graham (1963); Jain & Nanda (1966); Gonzalez Quinteno (1969); Rao & Shukla (1975) and Moore & Webb (1978). There are no reports on the pollen morphology of the family *Polygalaceae* from Pakistan. The present paper is the continuation of the series of "Pollen Flora of Pakistan" where pollen morphology of 6 species belonging to genus the *Polygala* L., from Pakistan were examined 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 is 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 glycerine 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 and directly transferred with a fine pipette to a metallic stub using double sided cellotape and coated with gold in a sputtering chamber (Ion-sputter JFC-1100). Coating was restricted to 150A. The S.E.M examination was carried out on a Jeol microscope JSM-T200. The measurements were based on 15-20 readings from each specimen. Polar length, equatorial diameter, colpus length and exine thickness were measured (Table 1).

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

Observations

General pollen characters of the family Polygalaceae

Pollen grains usually radially symmetrical, isopolar, prolate-spheroidal to sub-prolate, polycolporate, zonoaperturate, colpus forming complete equatorial band, sexine thicker or thinner than nexine. Tectum psilate-subpsilate.

Key to the pollen types

+ Polar length 25.4-43.08 μm	*Polygala arvensis* - type
- Polar length 19-25.21 μm	*Polygala erioptera* - type

Pollen type - I: *Polygala arvensis* - type (Fig.1 A-H).
Pollen class: Polycolporate, zonoaperturate.
P/E ratio: Suberect to semi-erect rarely subtransverse.
Shape: Prolate-spheroidal to sub-prolate rarely oblate spheroidal.
Apertures: Ectoaperture-colpus long, narrow, not sunken. Colpal membrane densely granulated.
Exine: Sexine thicker or thinner than nexine or as thick as nexine.
Outline: 12-24 lobed in polar view and elliptic in equatorial view.
Ornamentation: Tectum of the mesocolpium psilate. Tectum towards apocolpium area subpsilate-punctate.
Measurements: Polar axis P(25.6-) 34.3 ± 0.67 (-43.08) μm. Equatorial diameter E(21.7-) 27.9 ± 0.40 (-34.10) μm, P/E ratio: 1.05-1.29, 14-24-colporate, ± circular 14-24 lobed ± flate, colpus (21.8-) 30.6 ± 0.42 (-39.49) um long, with costae, ora forming completely equatorial band (endocingulus ?). Mesocolpium (2.8-) 3.34 ± 0.09 (-3.94) um. Apocolpium (3.59-) 6.94 ± 0.44 (-10.4) μm. Exine (0.7-) 2.14 ± 0.108 (-3.59) μm thick. P.A.I: 8.18.
Species included: *Polygala arvensis* Willd., *Polygala abyssinica* R.Br. ex Fresen, *Polygala hohenackeriana* Fisch. & Mey, *Polygala irregularis* Boiss., *Polygala sibirica* L.

Key to the species

1.	+	Pollen prolate-spheroidal to subprolate	**2**
	-	Pollen oblate-spheroidal	*Polygala arvensis*
2.	+	Pollen sub-prolate	*Polygala irregularis*
	-	Pollen prolate-spheroidal	**3**
3.	+	Pollen 17-20-colporate	*Polygala sibirica*
	-	Pollen 22-24-colporate	**4**
4.	+	Apocolpium 1.79 μm	*Polygala hohenockeriana*
	-	Apocolpium 3.59-7.18	*Polygala abyssinica*

Pollen type - II: *Polygala erioptera* - type (Fig.1 I; Fig. 2A-D).
Pollen class: Polycolporate, zonoaperturate.
P/E ratio: Subtransverse.
Shape: Oblate-spheroidal.

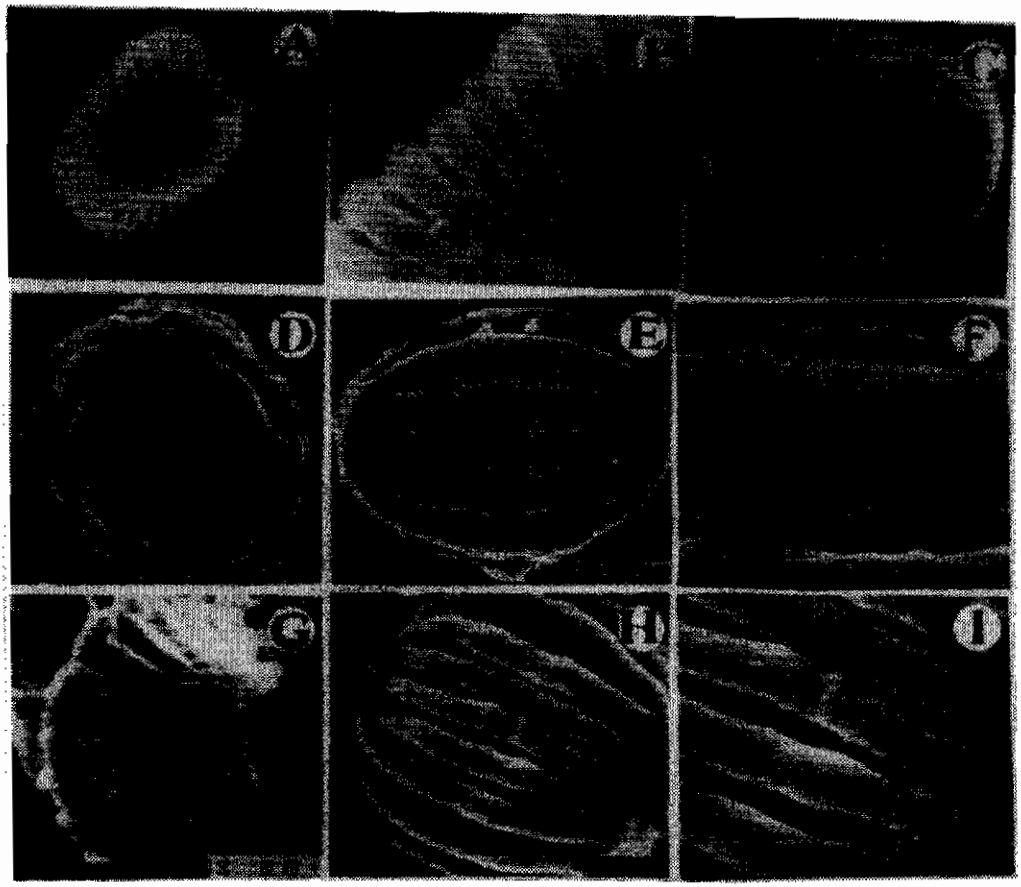

Fig. 1. Scanning Electron micrographs of pollen grains. *Polygala abyssinica*: A, polar view; B, Exine pattern. *P. arvensis*: C, Equatorial view; D, Exine pattern. *P. irregularis*: E, Polar view; F & G, Equatorial view; H, Exine pattern. *P. erioptera*: I, polar view.

Scale bar = A, C, E, F, G & I = 10 μm; B & H = 1 μm.

Apertures: Ectoaperture-colpus long, narrow, not sunken. Colpal membrane densely granulated.
Exine: Sexine thinner than nexine.
Outline: 18-22 lobed in polar view and elliptic in equatorial view.
Ornamentation: Tectum of the mesocolpium psilate tectum towards apocolpium area rugulate.
Measurements: Polar axis P(19.6-) 22.6 ± 0.67 (-25.2) μm. Equatorial diameter E(21.7-) 24.05 ± 0.40 (-25.2) μm, P/E ratio: 0.942 18-22 colporate, ± circular 18-22 lobed ± flat, colpus (16.8-) 17.8 ± 0.42 (-20.3) μm long, with costae, ora forming completely equatorial band. Mesocolpium (2.8-) 2.94 ± 0.093 (-3.5) μm. Apocolpium (5.6-) 7 ± 0.44 (-8.4) μm. Exine (1.4-) 1.0 ± 0.108 (-2.1) μm thick. P.A.I: 8.18
Species included: *Polygala erioptera* DC.

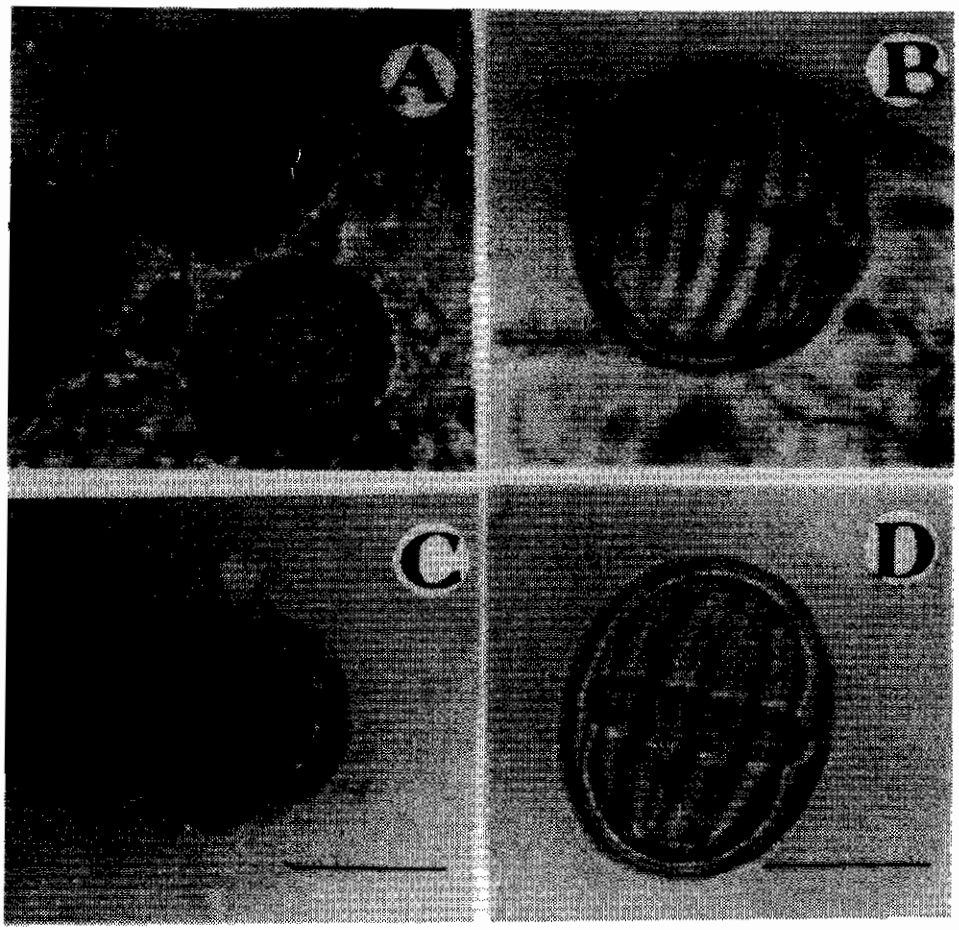

Fig. 2. Scanning Electron micrographs: A & B; Light micrographs of pollen grains: C & D. *Polygala erioptera*: A & D Equatorial view; B, Exine pattern; C, Polar view.

Scale bar = A = 10; B = 1; C & D = 10 μm.

Discussion

Polygalaceae is a stenoplynous family (Erdtman,1952). Pollen grains usually radially symmetrical, isopolar, prolate-spheroidal to subprolate, polycolporate, zonoaperturate, ora forming complete equatorial band, sexine thicker or thinner than nexine. Tectum psilate to subpsilate (Qaiser & Perveen, 1997). However, pollen morphology of the family is significantly helpful at the specific level. On the basis of polar length 2 distinct pollen types are recognized viz., *Polygala arvensis* type and *Polygala erioptera* - type. Pollen type - I: *Polygala arvensis* is easily recognized by its 25.443.08 μm polar length. Five species are included in this pollen type. However, these species show little variation in their pollen shape. Such as, *Polygala arvensis* (L.) Ser, has oblate-spheroidal pollen, whereas in the remaining species prolate-spheroidal to sub-prolate pollen are found.

Species of this pollen type are further classified on the basis of exine thickness, number of apertures and apocolpium. Pollen type-I, which is represented here by a single species viz., *Polygala erioptera* is characterized by 19-25.20 µm in polar length. Larson & Skvarla (1963) also reported similar type of grains in other species of the genus *Polygala* L.

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(Received for publication 20 May 2001)