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Research Article

Pollen Flora of Pakistan -XIX. Aizoaceae

Anjum PERVEEN, Mohammad QAISER
Department of Botany, University of Karachi, Karachi-PAKISTAN

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Abstract: The pollen morphology of 7 species belonging to the 7 genera of the family *Aizoaceae* was investigated by light microscope and scanning microscope. It is stenopalynous in nature. Pollen grains are usually radially symmetrical, isopolar, oblate-spheroidal to prolate-spheroidal, rarely sub-prolate, tricolpate, colpi long, with tapering ends, colpal membrane granulate. Sexine slightly thinner or thicker then nexine, rarely thicker at the polar reqion than at the equator. Tectum scabrate-punctate or spinulose. On the basis of exine ornamentation 2 distinct pollen types are recognized, namely, the *Zaleya pentandra* type and the *Aizoon canariense* type.

Key Words: Pollen morphology, Aizoaceae, Pakistan Flora

Pakistan'ın Polen Florası -XIX. Aizoaceae

Özet: *Aizoaceae* familyasından 7 cinse ait 7 türün polen morfolojisi ışık mikroskobu ve taramalı elektron mikroskobu kullanılarak incelenmiştir. Familya stenopalinoz özelliktedir. Polenler genellikle radyal simetrili, izopolar, oblat-sferoyid ile prolat-sferoyid, nadiren sub-prolattır. Trikolpat olan bu polenlerde kolpusların sivrilen uçları ve granulat membranları vardır. Sekzin nekzinden biraz daha ince ya da kalındır, kutup bölgesinde ekvator bölgesindekine göre nadiren daha kalındır. Tektum skabrat-punktat ya da spinulozdur. Ekzin süslenmesine bağlı olarak 2 polen tipi belirlenmiştir. *Zaleya pentandra* - tip ve *Aizoon canariense* - tip.

Anahtar Sözcükler: Polen morfolojisi, Aizoaceae, Pakistan Florası.

Introduction

Aizoaceae are a small family of c. 128 genera and c. 1170 species, many of which are cultivated, distiributed in South and tropical Africa, South America, the West Indies, the Mediterranean and tropical Asia [1, 2]. This family is represented in Pakistan by 8 genera [3]. Hunziker & Coccaci [4] studied the pollen morphology of the genus *Trianthema* L. The pollen morphology of few genera of the family *Molluginaceae* and *Aizoaceae* from America has been examined by Bogren [5]. Narayan [6] studied the embryology of *Limeum indicum* Stocks. Mitriou-Radulscu [7] examined the pollen of the family *Aizoaceae.* Nowicke [8], Skvarla & Nowicke [9], Nowicke & Skvarla [10, 11] also described the pollen morphology of some members of the family *Aizoaceae,* while studying the pollen of the order *Centrospermae.* The pollen morphology of family *Aizoaceae* has also been examined by Erdtman [12], Behnke [13], Buxbaum [14], and Moore & Webb [15].

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 [15]. For light microscopy, the pollen grains were mounted in unstained glycerine jelly and observed with a Nikon Type-2 microscope, under (E40, 0.65) and oil immersion (E100, 1.25), with a 10x eye piece. For SEM studies, pollen grains were 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 axis, equatorial diameter, colpi length and exine thickness were measured (Table 1-2).

Table 1. General pollen characters of species found in pollen type *Aizoon canariense*

Name of taxa	Shape	Polar length (P) in µm	Equatorial diameter (E) in µm	Colpus length in µm	Mesocolpium in m	Apocolpium in m	Exine thickness in m	Tectum
Aizoon canariense	Pr-sph	22.5(25.71 ± 0.72)	20.11(24.38 ± 1.10)	17.51(21.2 ± 1.23)	15.11(16.75 ± 0.61)	2.51(3.18 ± 0.60)	1.25(2.26 ± 0.08)	
L.		29.75	25.11	27.50	20.12	5	2.5	
Trianthema triquetra	Ob-sph	17.71(20.9 ± 1.80)	17.51(20.12 ± 1.58)	15.21(17.58 ± 0.72)	10.11(14.31 ± 1.01)	2.5(5.01 ± 2.50)	1.25(1.75 ± 0.14)	Sp/pun
Rottl. & Gill..		22.51	25.11	20.11	16.25	7.51	2.25	
Sesuvium sesuvioides	Pr-sph	22.51(24.38 ± 1.49)	22.51(24.10 ± 0.51)	17.71(20.59 ± 0.14)	15.01(16.51 ± 0.31)	2.25(2.72 ± 0.31)	1.5(2.08 ± 0.81)	Sp/puc
(Fenzl) Verde		27.51	25.11	22.5	46.62	29.97	6.66	

Table 2. General pollen characters of species found in pollen type *Zaleya pentandra*

Name of taxa	Shape	Polar length (P) in µm	Equatorial diameter (E) in µm	Colpus length in µm	Mesocolpium in m	Apocolpium in m	Exine thickness in m	Tectum
Gisekia pharnaceoides	Ob-sph	19.75(20.71 ± 0.72)	20.11(22.54 ± 0.39)	15.71(17.72 ± 0.74)	12.51((14.51 ± 0.47)	1.25(2.81 ± 0.59)	2.25(2.42 ± 0.04)	Scb
L.		22.51	25.01	20.11	17.51	3.75	2.75	
Corbichonia	Pr-sph	25.75(28.9 ± 1.05)	21.51(27.12 ± 1.14)	21.51(22.71 ± 0.65)	21.5(22.2±0.41)	1.79(3.4±0.19)	0.72(1.25±0.12)	
decumbens (Forssk) Exell.		34.11	32.31	26.91	25.13	3.94	1.79	
Limeum indicum	Pr-sph	16.8(19.6.38 ± 0.45)	16.81(19.6 ± 0.36)	12.61(15.33 ± 0.71)	11.21(13.31 ± 0.47)	1.54(2.26 ± 0.46)	1.41(1.63 ± 0.07)	Punct-scb
Socks		22.4	21	19.6	16.81	3.03	2.24	
Zaleya pentandra	Sub-pr	35.91(38.41 ± 0.71)	28.75(30.91 ± 0.88)	28.71(31.4 ± 1.13)	23.08((25.31 ± 0.42)	3.59(3.61 ± 0.05)	0.361(1.22 ± 0.03)	Scb-punct
L. Jellrey		41.21	35.9	35.9	28.7	3.95.8	1.43	

The terminology used is in accordance with Erdtman [15]; Kremp [21]; Faegri & Iversen [22] and Walker & Doyle [23].

Observations

General pollen characters of the family Aizoaceae

Pollen grains are usually radially symmetrical, isopolar, prolate-spheroidal to sub-prolate, tricolpate, amb trilobed, fossaperturate, colpi long, with tapering ends, colpal membrane granulated. Sexine slightly thinner than nexine or slightly thicker at the polar region than at the equator. Tectum scabrate-punctate.

Pollen type - I: *Aizoon canariense* - type (Fig.1 E-G)

Pollen class: Tricolpate, zonoaperturate.

P/E ratio: Suberect, subtransverse.

Shape: Prolate-spheroidal to oblate-spheroidal.

Apertures: Ectoaperture-colpus long, narrow, not sunken, colpi with vestibuli. Colpal membrane scabrate.

Exine: Sexine thicker than nexine.

Outline: ± triangular in polar view and elliptic in equatorial view.

Ornamentation: Tectum scabrate, sparsely punctate.

Measurements: Polar length P(17.7-) 23.75 ± 0.45 (-29.75) µm. P/E ratio: 1.08. Colpi (15.25-) 21.41 ± 0.56 (-27.51) µm long. Meso-colpium (10.1-) 15.05 ± 0.32 (-20.5) µm. Apocolpium 2.25 (6.11 ± 0.12) 7.5 µm. Exine (1.25-) 1.75 ± 0.35 (-2.25) µm thick.

Species included:

Aizoon canariense L., *Trianthema triquetra* Rotll. and Willd., *Sesuvium sesuvioides* (Fenzl) Verde

Key to the species

+ Polar length 17.7-22.4 µm .*Trianthema triquatra*

- Polar length 22.5-29.5 µm . . . . . .*Aizoon canariense* - group

(*Aizoon canariense, Sesuvium sesuvioides*)

Pollen type - II: *Zaleya pentandra* - type Fig.1 A-D)

Pollen class: Tricolpate, zonoaperturate.

P/E ratio: Semierect to suberect.

Shape: Subprolate to prolate-spheroidal.

Apertures: Ectoaperture - colpus long, narrow, not sunken, colpi with vestibuli. Colpal membrane scabrate.

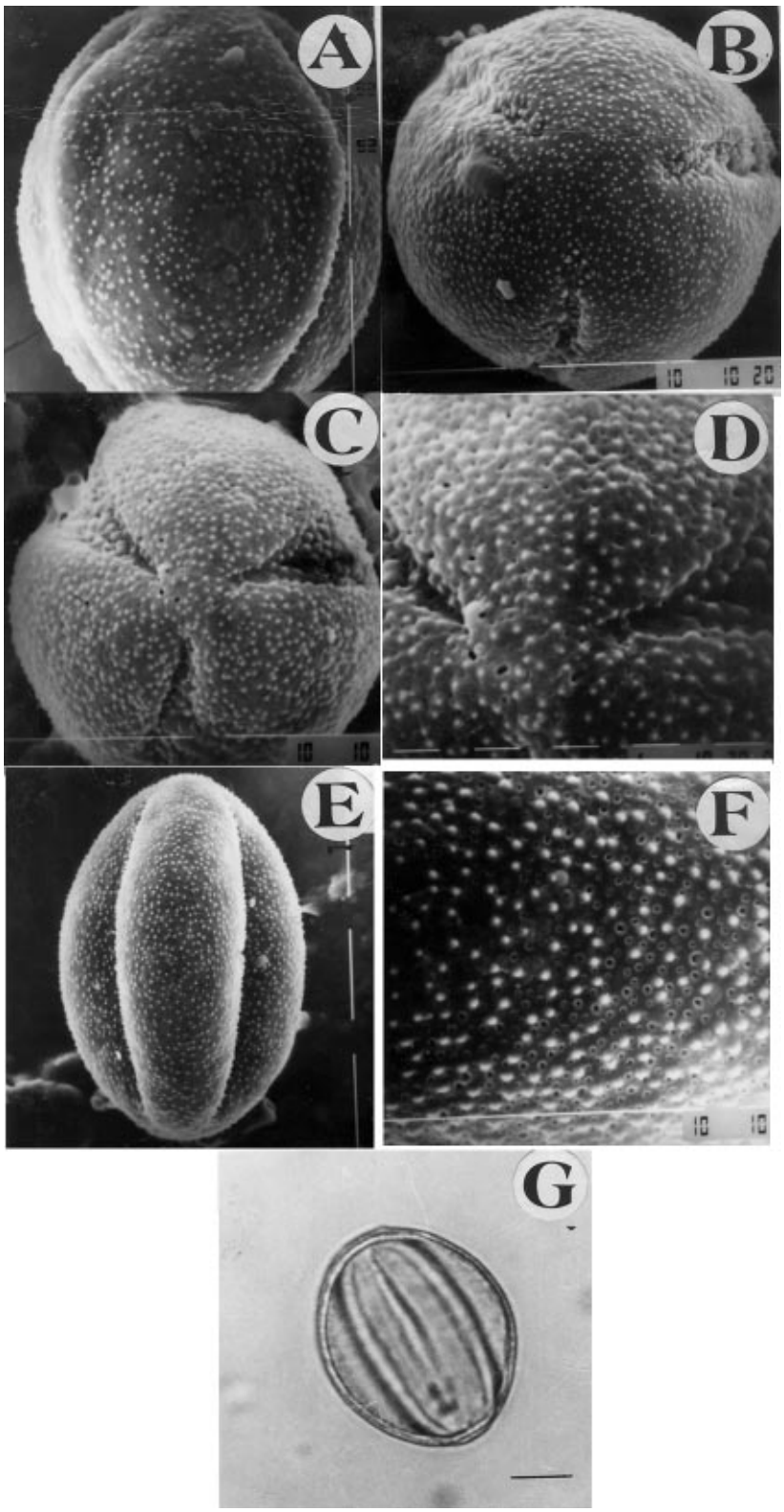

Figure 1. Scanning Electron and Light micrographs of pollen grains. Corbichonia decumbens: A, Equatorial view; B, Polar view. Limeum indicum: C, polar view; D, Exine pattern. Aizoon canariense: E, Equatorial view; F, Exine pattern; G, Equatorial view (Light micrograph). Scale bar=A-C, E-G=10 μm D=1 μm.

Exine: Sexine thicker than nexine.

Outline: ± triangular in polar view and elliptic in equatorial view.

Ornamentation: Tectum spinulate.

Measurements: Polar length L P(16.81-) 37.35 ± 0.45 (-41.11) μm, and equatorial diameter E(16.81-) 26.35 ± 0.56 (-35.90) μm. P/E ratio: 1.08. Colpi (12.61-) 24.25 ± 0.56 (-35.9) μm long. Meso-colpium (11.1-) 20.05 ± 0.32 (-28.5) μm. Exine (0.36-) 1.55 ± 0.35 (-2.75) μm thick.

Species included:

Corbichonia decumbens (Forssk.) Exell., *Limeum indicum* Stocks *Gisekia pharnaceoides* L., *Zaleya pentandra* (L.) Jeffrey.

Key to the species

1. + Polar length of pollen 25.5-41.2 μm 2
   - Polar length of pollen 16.8-22.5 μm 3
2. + Colpi length 21.5-26.9 μm . . . . . .*Corbichonia decumbens*
   - Colpi length 28.7-35.9 . . . . .*Zaleya pentandra*
3. + Tectum finely scabrate . .*Gisekia pharnaceoides*
   - Tectum punctate-scabrate . . *Limeum pentandra*

Conclusion

The *Aizoaceae* are stenopalynous family [11]. They are fairly uniform in pollen morphology, generally oblate-spheroidal prolate-spheroidal, tricolpate with scabrate-punctate to sPinoluse tectum. On the basis of exine patterns, 2 distinct pollen types are recognized, viz., *Aizoon canariense* - type and *Zaleya pentandra* - type. Pollen type-I: *Aizoon canariense* is readily distinguished by its spinulose tectum [11, 12]. Three genera each representing a single species, are included in this type, namely, *Aizoon* L., *Trianthema* L., and *Sesuvium* L. These genera are similar in their tectum but they show little variation in their polar length, which is helpful for delimiting the species into one group the *Aizoon canariense* group (*Aizoon canariense* L., *Sesuvium sesuvioides* (Fenzl) Verde) and a single species, *Trianthema triquetra* Rotll.

Pollen type II: *Zalyea pentandra* is characterized by scabrate tectum. Four genera are included in this pollen type, each representing a single species, namely, *Corbichonia* Scop., *Limeum* L., *Gisekia* L. and *Zaleya* Burm. f. These species are easily delimited by their tectal surface and colpi length (See key to the species).

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