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POLLEN FLORA OF PAKISTAN–LXX: CHENOPODIACEAE

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Abstract

Pollen morphology of 40 species representing 13 genera of the family Chenopodiaceae from Pakistan has been examined by light and scanning electron microscope. Chenopodiaceae is a stenopalynous family. Pollen are usually radially symmetrical, apolar pantoporate, spheroidal. Sexine slightly thicker or thinner than nexine. Tectum sparsely to densely punctate rarely spinulose. However, on the basis of apertural numbers and exine ornamentation family is divided into four pollen types viz., *Arthrocnemun indicum*-type, *Atriplex stocksii*-type, *Chenopodium album*-type, *Haloxylon persicum*-type. Pollen morphology of the family is significantly helpful at specific and generic level.

Introduction

A family of about 102 genera and 1400 species of world wide in distribution, but commonly in xerophytic and saline habitats. In Pakistan it is represented by 35 genera and c. 106 species (Freitag *et al*., 2001). Plants of Chenopodiaceae are mostly succulent, halophyte or xerophytes, with well developed or much reduced leaves. Family is important as a source of beet sugar, the garden vegetable beet and *Chenopodium quinoa* is a food plant in South America.

The family Chenopodiaceae is divided into four sub families viz., (1) Chenopodioideae with 6 tribes: *Atripliceae, Beteae, Camphorosmeae, Chenopodieae, Corispermeae, Sclerolaeneae* (2) Polycnemoideae: with a single tribe *Polycnemeae,* (3) Salicornioideae: with 2 tribes: *Halopeplideae, Salicorneieae* (4) Salsoloideae: with 2 tribes *Salsoleae* and *Suaedeae* (Kuhn *et. al.,* 1993).

The family is fairly intricate with little characters differences. In view of the absence of distinct macromorphological characters, palynological characters were used from time to time to strengthen the generic and specific delimitation. Pollen morphology of the family Chenopodiaceae has been examined by several workesr such as Wodehouse (1965); Nair & Rastogi (1966-67); Tsukada (1967); Frankton & Bassett (1970); Uotila, (1974). Nowicke (1975);Nowicke & Skvarla (1979, Basset *et al*., (1983); Chu (1987),Gomez & Pedrol(1987);Hao *et al*., (1989) Flores Olvera (1992). Youngjae & Lee (1995); Qaiser & Perveen (1997); Toderich *et al*., (2000; 2010). There are no detailed reports on pollen morphology of the family Chenopodiaceae from Pakistan. Present investigations are based on the pollen morphological studies of 40 species representing 13 genera of the family Chenopodiaceae by light and scanning electron microscope.

Materials and Methods

Polleniferous material was obtained from the specimens of Karachi University Herbarium (KUH). In few cases fresh material 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 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 were directly transferred with a fine pipette to a metallic stub using double sided cello tape and coated with gold in a sputtering chamber (Ion-sputter JFC-1100). Coating was restricted to 150 A°T he S.E.M examination was carried out on a Jeol microscope JSM-2. The measurements are based on 15-20 readings from each specimen. Pollen diameter (P), aperture size and exine thickness were measured (Tables 1-3).

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

Table 1. General pollen characters of species found in pollen type-*Atriplex stocksii*.

Name of species	Pollen diameter in µm	Pore diameter in µm	Exine thickness in µm	Tectum
Atriplex pamirica lljin	39.52(43.42)47.32	1.20(1.47)1.23	4.0(5.20)5.49	Densely scabrate
Atriplex canescens Boiss. (Pursh)Nutt.	20.00(20.10).20.11	1.00(1.08)1.08	1.0(1.08)1.08	Densely scabrate
Atriplex lasiantha Boiss.	13.91(14.76)15.18	1.00(1.08)1.80	1.22(1.26)1.2	Densely scabrate
Atriplex stocksii (Wt.)	15.41(20.10)21.11	0.98(1.34)1.54	2.66(2.78)2.81	Densely scabrate
Atriplex tatarica L.	11.38(11.80)12.65	1.20(1.2)1.23	2.0(2.53)2.81	Densely scabrate
Bassia dasyphylla (Fisch. & C.A. Mey) O.Kuntze	15.21(15.55)15.86	1.66(1.671)1.68	2.0(2.53)2.81	Densely scabrate
Bassia eriophora (Schrad.) Aschers	60.84(60.92)61.00	2.11(2.39)2.67	2.70(2.75)2.81	Densely scabrate
Camphorosoma monspeliaca L.	27.32(27.61)28.11	2.00(2.05)2.11	2.70(2.75)2.81	Densely scabrate
Cerotocarpus arenarius L.	27.00(27.45)27.90	2.51(2.69)2.87	2.0(2.30)2.61	Densely scabrate
Halostachys belongerana (Moq.) Botsch.	40.56(40.50)41.0	0.90(0.95)1.00	1.41(1.98)2.66	Densely scabrate
Salsola richter (*Moq.*) Karel.ex Litv.	17.06(18.36)18.41	2.00(2.20)2.70	1.00(1.08)1.08	Densely scabrate
Salsola imbricata Frossk	14.01(17.50)18.21	1.44(1.56)1.68	1.41(1.66)2.12	Densely scabrate

Table 2. General pollen characters of species found in pollen type- *Chenopodium album*.

Name of species	Pollen diameter in µm	Pore diameter in µm	Exine thickness in µm	Tectum
Atriplex aucheri Moq.	19.41(21.10)22.77	1.01(1.5)1.54	2.01(2.53)2.5	Sparsely scabrate
Atriplex dimorphostegia Kar. & Kir.	17.28(18.25)18.36	1.62(2.05)2.16	2.16(2.51)2.71	Sparsely scabrate
Atriplex griffithii Moq.	19.44(19.10)20.52	1.62(1.89)2.16	1.5(1.62)1.62	Sparsely scabrate
Atriplex leucoclada Boiss.	13.91(14.76)15.18	1.0(1.2)1.2	2.0(2.5)2.5	Sparsely scabrate
Atriplex schugnanica Iljan	21.41(22.77)22.71	2.0(2.53)2.5	2.0(2.53)2.5	Sparsely scabrate
Chenopodium album L.	15.41(17.90)21.01	112(1.20)1.26	1.41(1.62(2.61	Spinules
Chenopodium novopokrovskyanum (Allen) Uotile	25.75(27.93)27.01	1.12(1.26)1.26	2.5(2.53)2.61	Sparsely scabrate
Chenopodium ambrosioides L.	23.41(24.06)24.71	1.12(1.26)2.61	2.51(2.53)2.61	Sparsely scabrate
Chenopodium atripliciforme Murr.	25.75(27.83)27.01	1.12(1.26)1.26	2.51(2.53)2.61	Sparsely scabrate
Chenopodium badachschanicum Tzvelve.	20.05(20.75)21.01	1.12(1.26)1.26	2.51(2.53)2.61	Sparsely scabrate
Chenopodium ficifolium Sm.	20.61(20.5)21.01	1.12(1.26)1.26	2.51(2.53)2.61	Sparsely scabrate
Chenopodium glaucum L.	31.95(31.95)32.01	1.12(1.26)1.26	2.51(2.53)2.61	Sparsely scabrate
Chenopodium karoi (Murr) Aellen	25.75(27.83)27.01	1.12(1.26)1.26	2.51(2.52)2.61	Sparsely scabrate
Chenopodium murale L.	13.61(13.81)14.01	0.60(0.62)0.64	0.51(0.88)1.61	Sparsely scabrate
Chenopodium nepalense Colla	25.75(27.83)27.01	1.12(1.26)1.26	2.51(2.53)2.61	Sparsely scabrate
Chenopodium pamiricum Iljin	30.90(35.8)40.8	0.8(0.85)0.98	2.5(2.53)2.61	Sparsely scabrate
Chenopodium strictum Roth	20.06(20.50)21.01	0.8(0.85)0.98	2.51(2.50)2.61	Sparsely scabrate
Corispermum korovinii Iljin	15.2(15.65)16.11	1.51(1.52)1.54	1.41(1.98)2.66	Sparsely scabrate
Halocharis hispida (Schrenk ex C. A. May) Bunge	35.8(21.07)47.3	2.22(2.38)2.54	1.11(1.08)2.66	Sparsely scabrate
Halothamnus auriculus (Moq.) Botsch.	17.21(17.51)18.12	1.41(1.44)1.54	1.41(1.98)2.66	Sparsely scabrate
Salsola nitraria Pall.	14.01(15.01)16.20	1.5(2.37)2.71	2.0(2.10)2.30	Sparsely scabrate
Salsola tragus L.	21.9(22.68)22.66	2.5(2.16)2.5	1.15(2.16)2.5	Sparsely scabrate
Suaeda nudiflora (Willd.) Moq.	18.21(20.50)23.81	2.10(2.66)2.81		Sparsely scabrate
Suaeda monoica Forssk exJ.F.Gmelia	19.44(19.30)20.52	2.16(2.70)3.24	2.16(2.70)3.24	Sparsely scabrate
Suaeda fruticosa Forssk. ex J.F.	18.21(21.07)23.12	1.41(1.44)1.54	1.41(1.98)2.66	Sparsely scabrate

Table 3. General pollen characters of species found in Pollen type- *Haloxylon persicum*.

Name of species	Pollen diameter in µm	Pore diameter in µm	Exine thickness in µm	Tectum
Haloxylon persicum Bunge ex Boiss. & Buhse	13.80(14.00)14.61	c. 3.01	1.50(1.65)1.80	Densely scabrate
Haloxylon salicornicum (Moq.)Bunge ex Boiss.	13.9(15.18)15.0	c. 2.6	2.0(2.53)2.54	Sparsely scabrate
Haloxylon stocksii (Boiss.) Benth. & Hook.	16.80(18.06)19.6	3.01	1.41(2.25)2.94	Densely scabrate

Results and Observations

General pollen characters of family Chenopodiaceae: Pollen usually radially symmetrical, apolar, spheroidal, pantoporate, pores ± circular, pore plate scabrate or spinulose to spinulate. Exine thick, sexine thicker or slightly thinner than nexine or as thick as nexine. Tectum generally sparsely to densely scabrate, rarely spinulate. On the basis of number and size pores and exine ornamentation four types are recognized viz., *Arthrocnemun indicum*-type, *Atriplex stocksii*-type, *Chenopodium album*-type, *Haloxylon persicum*-type key to pollen is given below.

Key to the pollen types

1. + Pores large and fewer …….…….. *Haloxylon persicum*-type
   - Pores small and numerous …….……. 2
2. + Pollen >47 µm in diameter ……...…….. *Arthrocnemum indicum*-type
   - Pollen <47 µm in diameter ……...…….. 3
4. + Tectum densely scabrate ……..……... *Atriplex stocksii*-type
   - Tectum sparsely scabrate to spinulose ……..……..…….. *Chenopodium album*-type

Pollen type: *Arthrocnemum indicum*–type (Fig. 1A & B).
Pollen class: Pantoporate
P/E ratio: 100
Shape: Spheroidal
Apertures: more or less circular
Exine: Sexine thicker than nexine
Ornamentation: densely scabrate
Measurements: Size: Pollen = (47.00-) 47.5 (-48.22) µm. Pore 1.12-1.46 µm in diameter. Exine 1.41 (2.02 ± 0.48) 2.61 um thick, sexine thicker than nexine, pantoporate, pores ± circular, pore plate with scabrae, sunken. sexine thicker than nexine. Tectum densely scabrate, unevenly distributed on subpsilate surface

Species included: *Arthrocnemum indicum* (Willd.) Moq. and *Arthrocnemum macrostachyum* (Moric.) C. Koch

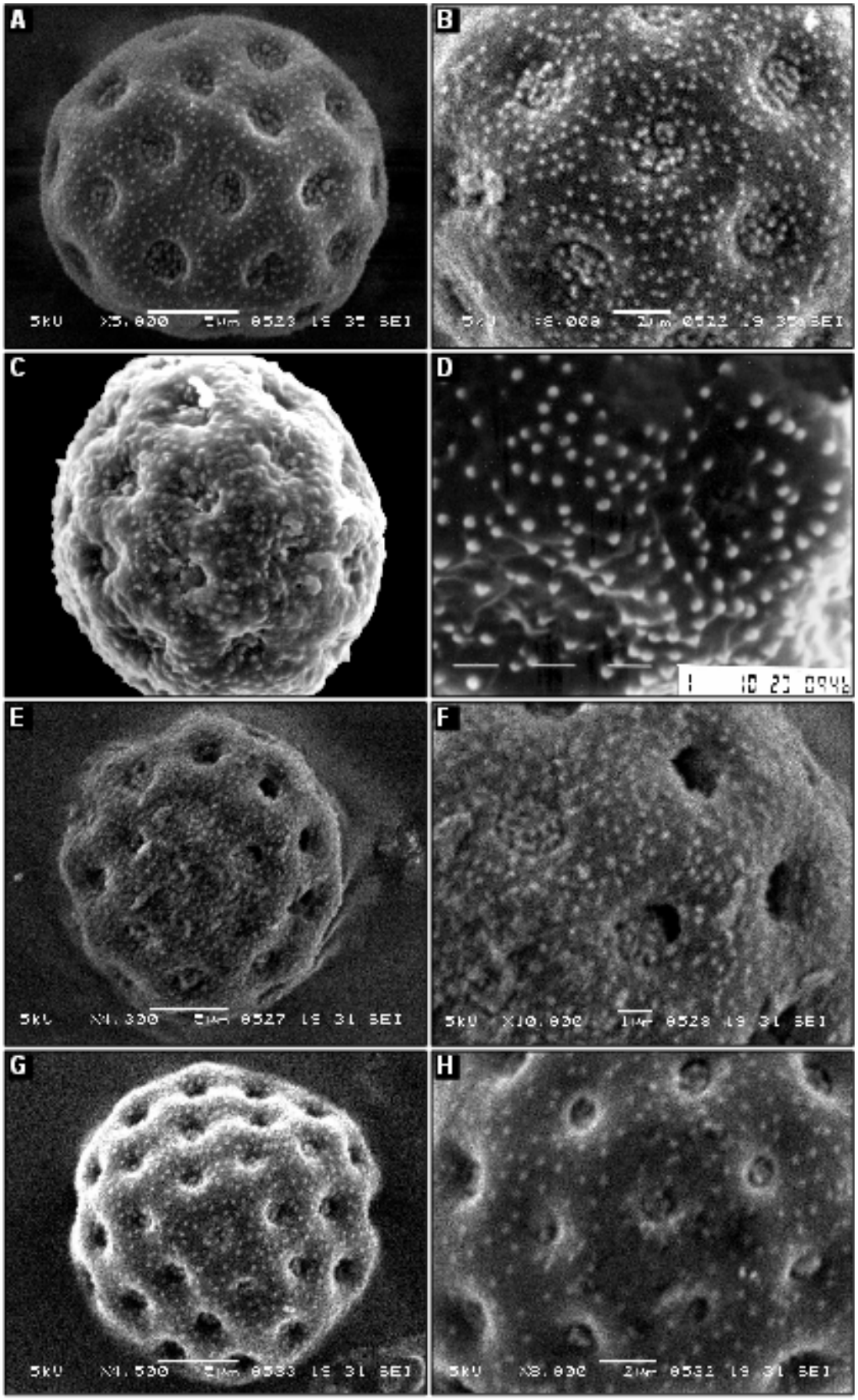

Fig. 1. Scanning Electron Microscope: *Arthrocnemum macrostachyum:* A, Pollen grain, B, Exine pattern. *Atriplex stocksii:* C, Pollen grain, D, Exine pattern. *Bassia eriophora*: E, Pollen grain, F, Exine pattern. *Camphorosoma monspeliaca*: G, Pollen grain, H. Exine pattern.

Key to the species

1. + Pollen operculate …….…….. *Arthrocnemum macrostachyum*
   - Pollen non-operculate …….…… *Arthrocnemum indicum*

Pollen type: Atriplex stocksii-type (Fig.1C-H; Fig.2 A & B).
Pollen class: Pantoporate
P/E ratio: 100
Shape: Spheroidal
Apertures: more or less circular
Exine: Sexine thicker than nexine.
Ornamentation: Densely scabrate
Measurements: Size: Pollen diameter = (11.38-) 29.31± 2.31 (-47.38) µm. Pore 1.12-2.71 µm broad. Exine 1.00 (1.41 ± 0.48) 5.49 µm thick, sexine thicker than nexine , pantoporate, pores ± circular, pore plate with scabrae, sunken. sexine thicker than nexine. Tectum densely scabrate, unevenly distributed on subpsilate surface

Species included: *Atriplex stocksii* (Wt.) Boiss., *Atriplex canescens* (Pursh) Nutt., *Atriplex lasiantha* Boiss., *Atriplex tatarica* L., *Atriplex pamirica* Iljin, *Bassia dasyphylla* (Fisch. & C.A. Mey.) O. Kuntze, *Bassia eriophora* (Schrad.) Aschers. *Camphorosoma monspeliaca* L., and *Cerotocarpa arenarius* L., *Halostachys belangerana* (Moq.) Botsch., *Salsola imbricata* and *Salsola richteri* Moq.

Key to the species

1. + Pollen diameter 39-61 µm in diameter ……... 3
   - -Pollen diameter less than 39 µm ……..…….. 2
2. + Exine 2.7-2.81 µm thick ..…….. *Bassia eriophora*
   - Exine 4-5.49 µm thick ……..……. *Atriplex pamirica*
3. + Pore 0.98-1.68 µm ……..…….. 6
   - Pore 2-2.87 µm ……..…….. 4
4. + Pollen diameter 17-18.4 µm ...……..…… *Salsola richteri*
   - Pollen diameter more than 27.2 µm ...…… 5
5. + Exine 1.4-2.6 µm thick ……. *Cerotocarpa arenarius, Halostachys belangerana*
   - Exine 2.7-2.8 µm thick …….. *Camphorosoma monspelia*
6. + Pollen diameter 11-12.65 µm ……...……..…. *Atriplex tatarica*
   - Pollen diameter 13.91-20 µm ..…….. 7
7. + Exine 2.6-2.81 µm thick ..... *Atriplex stocksii*
   - Exine 1.0-2.12 µm thick ……..…… 8
8. + Sexine thinner than nexine ……...…… *Salsola imbricate*
   - Sexine thicker than nexine ……..…. 9
9. + Granules unevenly distributed ……..……... *Atriplex canescens*
   - Granules evenly distributed ……..……..…… *Atriplex lasiantha*

Pollen type: *Chenopodium album* (Fig. 2C-H; Fig. 3A-H)
Pollen class: Pantoporate
P/E ratio: 100
Shape: Spheroidal
Apertures: More or less circular
Exine: Sexine thicker or thinner than nexine
Ornamentation: Sparsely scabrate
Measurements: Size: Pollen = (13.91-) 26.92 ± 2.31 (-47.38) µm. Pore 0.6-1.5 µm in diameter. Exine 1.40 (2.1 ± 0.48) 2.8 µm thick, sexine thicker or thinner than nexine , pantoporate, pores ± circular , pore plate with scabrae, sunken. Tectum sparsely scabrate, unevenly distributed on subpsilate surface.

Species included: *Atriplex aucheri* Moq., *Atriplex dimorphostegia* Kar. Kir., *Atriplex griffithii* Moq., *Atriplex leucoclada* Boiss., *Atriplex schugnanica* IIjin *Chenopodium album* L., *Chenopodium ambrosioides* L.., *Chenopodium atripliciforme* Mur., *Chenopodium badachschanicum* Tzvelev, *Chenopodium ficifolium* S, *Chenopodium glaucum* L., *Chenopodium karoi* (Murr) Aellen, *Chenopodium murale* L., *Chenopodium nepalense* Colla, *Chenopodium novopokrovskyanum* (Aellen) Uotila, *Chenopodium pamiricum* Iljin, *Chenopodium strictum* Roth , *Corispermum korovinii* IIjin, *Halocharis hispida* (Schrenk ex C. A. Mey.) Bunge, *Halothamnus auriculus* Moq.) Botsch. subsp. *acutifolius* (Moq.) Kothe-Heinr. *Salsola nitraria* Pall. *Salsola tragus* L., *Suaeda nudiflora* (Willd.) Moq., *Suaeda monoica* Frossk**.** ex J.F, *Suaeda fruiticosa* Forssk. ex J.F

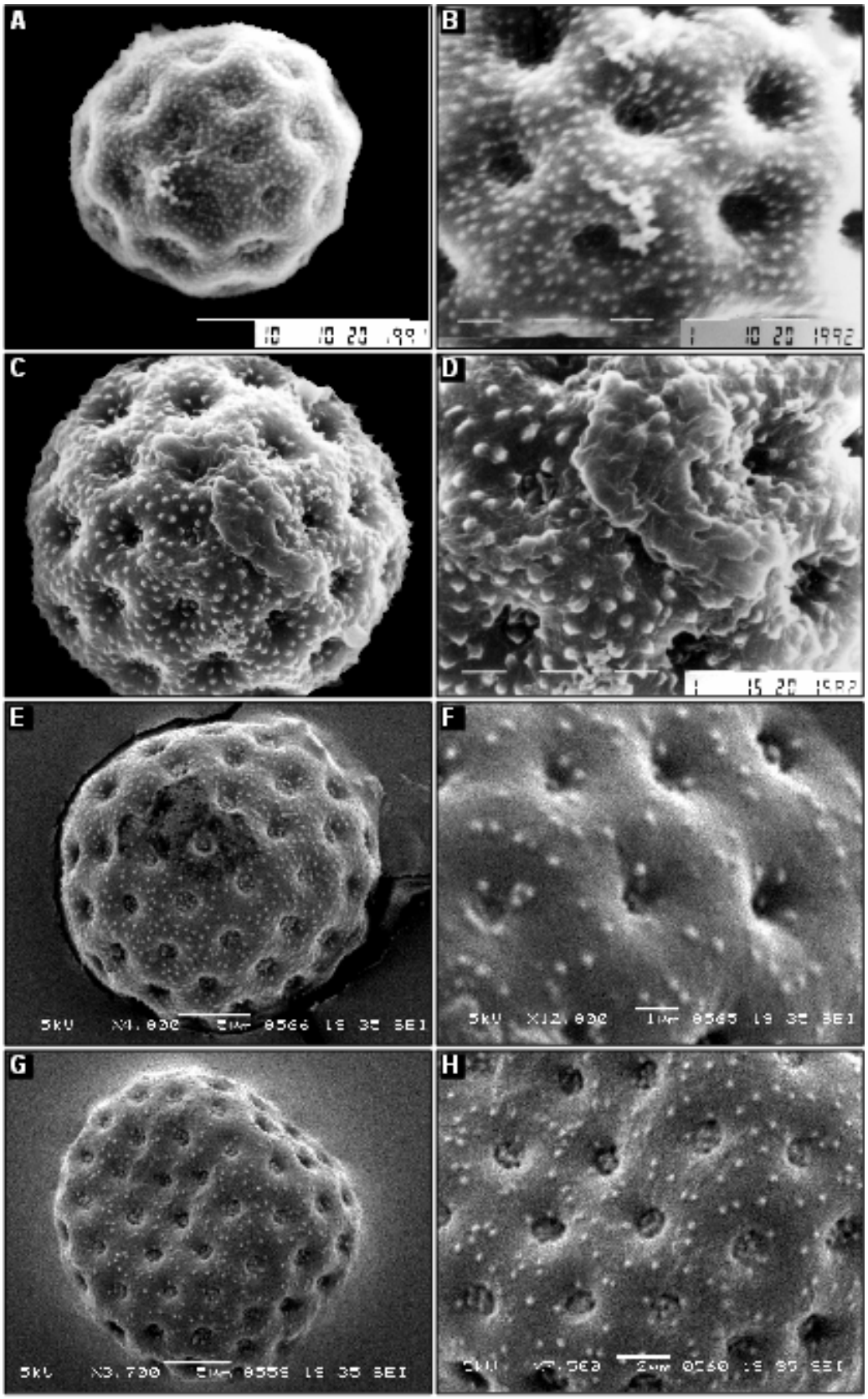

Fig. 2. Scanning Electron Microscope: *Salsola imbricate*: A Pollen grain, B, Exine pattern. *Chenopodium album:* C, Pollen grain, D, Exine pattern. *Chenopodium atripliciforme:* E, Pollen grain, F, Exine pattern. *Chenopodium karoi:* G, Pollen grain, H, Exine pattern.

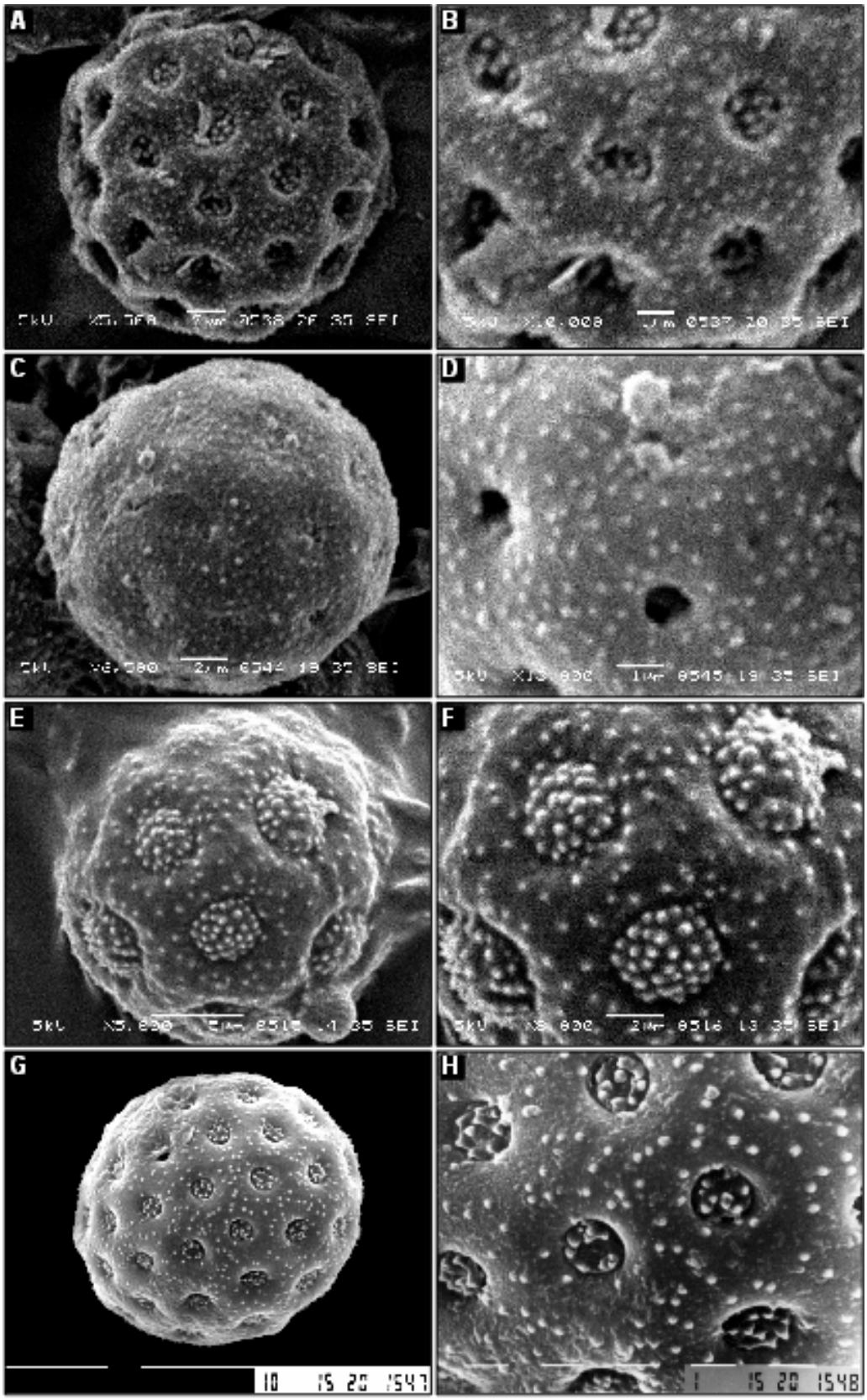

Fig. 3. Scanning Electron Microscope: *Corispermum korovinii*: A, Pollen grain, B, Exine pattern. *Halocharis hispida:* C, Pollen grain, D, Exine pattern. *Halothamnus auriculus:* E, Pollen grain, F, Exine pattern. *Suaeda nudiflora:* G, Pollen grain, H, Exine pattern.

Key to the species and species groups

1. + Pollen diameter 13.2 - 22.0 µm …… 2
   - Pollen more than 23-40 µm in diameter …… 3
2. + Tectum spinulose …… *Chenopodium album*
   - Tectum scabrate …… group-1 (*Atriplex aucheri* Moq., *Atriplex dimorphostegia* Kar**.** Kir., *Atriplex griffithii* Moq., *Atriplex leucoclada* Boiss., *Atriplex schugnanica* IIjin, *Chenopodium badachschanicum* Tzvelev, *Chenopodium ficifolium* Sm, *Chenopodium murale* L., *Chenopodium strictum* Roth, *Corispermum korovinii* IIjin, *Halothamnus auriculus* Moq.) Botsch. subsp. *acutifolius* (Moq.) Kothe-Heinr., *Salsola nitraria* Pall., *Salsola tragus* L., *Suaeda nudiflora* (Willd.) Moq., *Suaeda monoica* Frossk**.** ex J.F, *Suaeda fruiticosa* Forssk. ex J.F
3. ± Pollen 30-40 µm in diameter …… group-II (*Chenopodium glaucum* L., *Chenopodium pamiricum* IIjin, *Halocharis hispida* (Schrenk ex C. A. Mey.) Bunge,
   - Pollen 23-27 µm …… Group-III (*Chenopodium ambrosioides* L.., *Chenopodium atripliciforme* Mur., *Chenopodium karoi* (Mur.) Aellen, *Chenopodium nepalense* Colla , *Chenopodium novopokrovskyanum* (Aellen) Uotila)

Pollen type: ***Haloxylon persicum*** –type **(**Fig.4A -D).
Pollen class: Pantoporate
P/E ratio: 100
Shape: Spheroidal
Apertures: more or less circular
Exine: Sexine as thick as nexine or thicker than nexine
Ornamentation: densely scabrate
Measurements: Size: Pollen diameter = (13.38-) 16.0 ± 2.31 (-19.9) µm, Spheroidal, pantoporate, pore 5-12, ± circular, c.3.01 µm in diameter, pore plate with densely scabrate. Exine undulated (1.41-) 2.25 ± 0.17 (-2.94) µm thick, sexine as thick as nexine or thicker than nexine. Tectum densely scabrate, with puncta.

Species included: *Haloxylon persicum* Bunge ex Boiss. & Buhse, *Haloxylon salicornicum* (Moq**.)** Bunge ex Boiss., *Haloxylon stocksii* (Boiss.) Benth. & Hook.

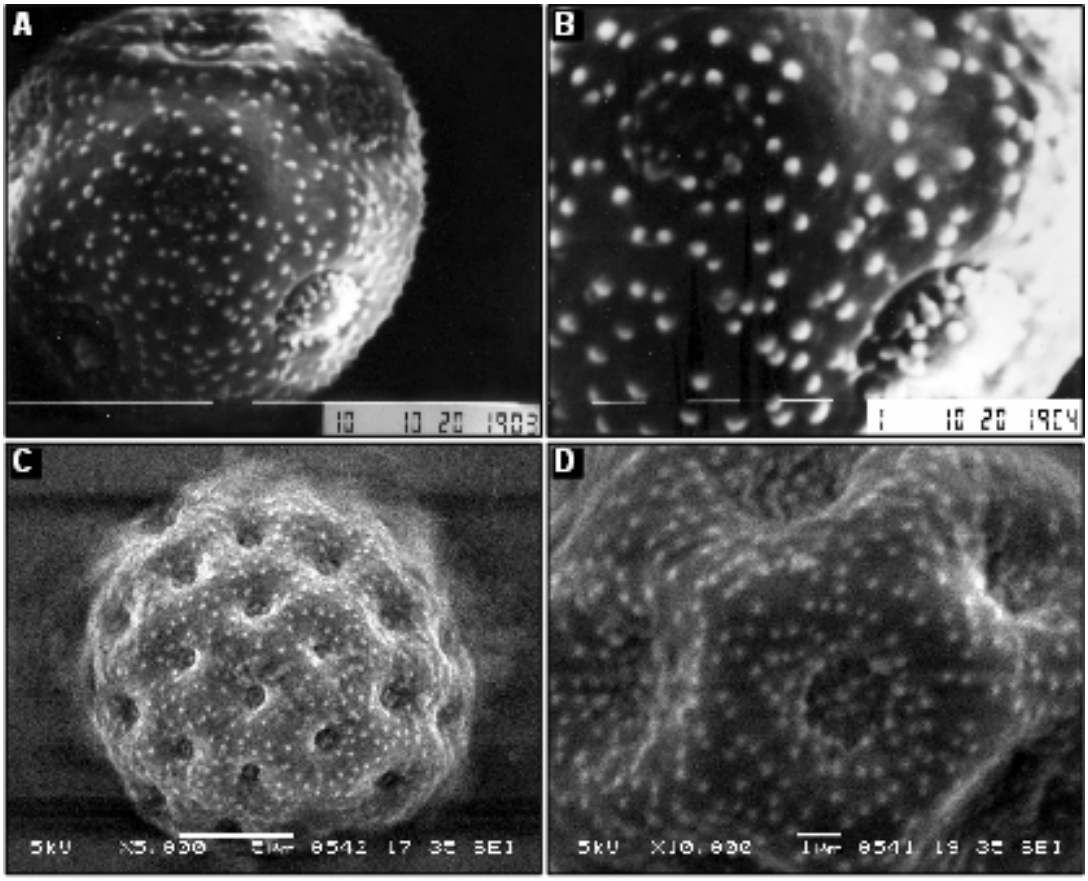

Fig. 4. Scanning Electron Microscope: *Haloxylon persicum*: A, Pollen grain, B, Exine pattern. *Haloxylon stocksii*: C, Pollen grain, D, Exine pattern.

Key to the species

1. + Pollen grain diameter 13-15 µm ..... *Haloxylon salicornicum*
   - Pollen diameter more than 15 µm 2
2. + Pore more than 12 ..... *Haloxylon persicum*
   - Pore 5-12 ..... *Haloxylon recurvum*

Discussion

Chenopodiaceae is a stenopalynous taxon. However, considerable diversity in different characters especially in shape, exine sculpturing and tectum was observed. Pollen grains are usually symmetrical, apolar, subspheroidal-spheroidal, sparsely to densely scabrate tectum, granules evenly to unevenly distributed on pollen surface, commonly pantoporate (more than 6).

Pollen data is based on pollen morphology of 40 species representing 13 genera i.e., *Arthocnemum, Atriplex, Bassia, Camphorosoma, Cerotocarpus, Chenopodium, Corispermum, Halocharis, Halostystachys, Halothamus, Haloxylon, Salsola* and *Suaeda.* On the basis of number of pores, pollen diameter and exine pattern 4 pollen types are recognized viz., *Arthrocnemun indicum*-type, *Atriplex stocksii*-type, *Chenopodium album*-type and *Haloxylon persicum*-type.

Haloxylon persicum-type is easily distinguished by having 6-15 pores, while remaining species have more than 20 pores. Pollen type: *Arthrocnemum indicum* is readily delimited on the basis of pollen diameter which is more than 47 um. Two species belonging to genus *Arthrocnemum* are examined from this type and both are separated on the basis of operculum (see key to the species). *Atriplex stocksii*-type is recognized by its densely scabrate tectum, scabrae are evenly and unevenly distributed on subpsilate tectum, these species are further delimited on the basis of pollen diameter, pore diameter, exine and sexine thickness and distribution of scabrae on surface. *Chenopodium album*-type has sparsely scabrate tectum. However, species of this type are divided in two groups on the basis of pollen diameter and exine pattern (see key to the species and species groups). Nowicke (1975); Skvarla & Nowicke (1976) reported pantoporate pollen with a spinulose and punctate tectum in Amaranthaceae and Chenopodiaceae. Pollen of Chenopodiaceae appear to vary most in the number of apertures and size, and frequency of spinules on punctate in the ectexine. Tsukada (1967) pointed the importance of spinules and puncta density, and spinule puncta ratio in the identification of Chenopodiaceae at generic level. In the present study 11 species of *Atriplex* are investigated for palynology, on the basis of pollen character species are divided into two major groups. In group-1 tectum is sparsely scabrate (*A. schugnanica, A. leucoclada, A. griffithii, A. dimorphostegia*) where as in group-II: *A. tatarica, A. canescens* and *A. lasiantha.* tectum is densely scabrate. In both the groups species are further classified on the basis pore diameter, pollen diameter. Exine thickeness, distribution of granules on pollen surface respectively. Frankton & Basset (1970) suggested that pore size, pore number and spinules shape are useful pollen characters in the genus *Atriplex.* Within the genus *Chenopodium* 12 species are examined for pollen morphology, these species are divided in two groups, on the basis of pollen size and not much variation was found. In exine structure our results are in agreement with Monewar *et al*., (1999) and Pinar & Inceoglu (1999) who also observed considerable variation in pollen size but not in exine structure in Turkish *Chenopodium* species. From *Haloxylon* 3 species are examined viz. *H. persicum, H. stocksii* and *H. salicornicmn,* which have deeply sunken pores.

Four species i.e., *Salsola tragus, S. richteri, S. nitraria* and S. *imbricata* are studied from *Salsola* and classified on the basis of operculum, shape and exine pattern. From *Suaeda* 3 species are studied viz., S. *fruticosa S. monoica* and *S. nudiflora.* Toderich *et al*., (2010) examined pollen morphology 27 species of some Asiatic species of the genus *Salsola.* They recognized three pollen types on the basis of number of pores, size and shape of pores and exine thickness. In the present investigation only four species of the genus Salsola viz., *Salsola tragus, S. richteri, S. nitraria* and S. *imbricata* have been studied which are included in two different Pollen type- *Chenopodium indicum* and *Atriplex stocksii*-type. As only 4 species of *Salsola* are investigated in the present study, it is rather difficult to substantiate their findings.

The present study does not correspond with the tribal classification of family Chenopodiaceae and not with generic even infrageneric classification as most of the genera of the same tribe or even different species belonging to the same genus are accommodated under different pollen types. Species belonging to genus *Atriplex* are placed under two pollen types viz., *Atriplex stocksii* pollen type and *Chenopodium album*- pollen type. Similarly, two species of *Salsola* belong to *Chenopodium* album-pollen type and two belong to *Atriplex stocksii*-pollen type. Present pollen data shows stenopalynous nature of the family Chenopodiaceae. Most of the pollen characters such as shape, size, aperture and exine thickness, pore diameter, distribution of granules play a little role in the delimitation of the various taxa of the family Chenopodiaceae within a genus. Flores Olvera *et al*., (2006) suggested the strong phylogenetic signals of some pollen characters and current ideas on classification highlight not only need to review the classification of Atripliceae and perhaps the entire family (Flores & Davis, 2001) but also importance of continuing to gather the pollen data for the Chenopodiaceae.

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