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 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., Arthrocnemum 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, Betaeae, Camhorosmeae, Chenopodioeae, Corispermeae, Sclerolaeneae (2) Polycnemoidae: with a single tribe Polycnemaceae, (3) Salicornioideae: with 2 tribes: Halopeplideae, Salicornioeae (4) Salsoloideae: with 2 tribes Salsoleae and Suaedaeae (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 works 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 & Pedro(1987);Hao et al., (1989) Flores Olvera (1992). Youngiae & 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° the 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).

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

<table>
<thead>
<tr>
<th>Name of species</th>
<th>Pollen diameter in µm</th>
<th>Pore diameter in µm</th>
<th>Exine thickness in µm</th>
<th>Tectum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atriplex pamirica Iljin</td>
<td>39.52(43.42)47.32</td>
<td>1.20(1.47)1.23</td>
<td>4.05(2.05)5.49</td>
<td>Densely scabrate</td>
</tr>
<tr>
<td>Atriplex canescens Boiss.</td>
<td>20.08(20.10)20.11</td>
<td>1.00(1.08)1.08</td>
<td>1.01(1.08)1.08</td>
<td>Densely scabrate</td>
</tr>
<tr>
<td>Atriplex lasiantha Boiss.</td>
<td>13.91(14.76)15.18</td>
<td>1.00(1.08)1.80</td>
<td>1.22(1.26)1.2</td>
<td>Densely scabrate</td>
</tr>
<tr>
<td>Atriplex stocksii (Wt.)</td>
<td>15.4(20.10)21.11</td>
<td>0.98(1.34)1.54</td>
<td>2.6(2.78)2.81</td>
<td>Densely scabrate</td>
</tr>
<tr>
<td>Atriplex tatarica L.</td>
<td>11.38(11.80)12.65</td>
<td>1.20(1.2)1.23</td>
<td>2.02(2.53)2.81</td>
<td>Densely scabrate</td>
</tr>
<tr>
<td>Bassia dasyphylla (Fisch. &amp; C.A. Mey) O.Kuntze</td>
<td>15.21(15.55)15.86</td>
<td>1.66(1.67)1.68</td>
<td>2.02(2.53)2.81</td>
<td>Densely scabrate</td>
</tr>
<tr>
<td>Bassia eriophora (Schrad.) Aschers</td>
<td>60.84(60.92)61.00</td>
<td>2.11(2.39)2.67</td>
<td>2.70(2.75)2.81</td>
<td>Densely scabrate</td>
</tr>
<tr>
<td>Camphorosoma monspeliaca L.</td>
<td>27.32(27.61)28.11</td>
<td>2.00(2.05)2.11</td>
<td>2.70(2.75)2.81</td>
<td>Densely scabrate</td>
</tr>
<tr>
<td>Cerococarpus arenarius L.</td>
<td>27.00(27.45)27.90</td>
<td>2.51(2.69)2.87</td>
<td>2.02(2.30)2.61</td>
<td>Densely scabrate</td>
</tr>
<tr>
<td>Halostachys belengeraena (Moq.) Botsch.</td>
<td>40.56(40.50)41.0</td>
<td>0.90(0.95)1.00</td>
<td>1.41(1.98)2.66</td>
<td>Densely scabrate</td>
</tr>
<tr>
<td>Salsola richter (Moq.) Karel.ex Litv.</td>
<td>17.06(18.36)18.41</td>
<td>2.00(2.20)2.70</td>
<td>1.00(1.08)1.08</td>
<td>Densely scabrate</td>
</tr>
<tr>
<td>Salsola imbricata Frossk</td>
<td>14.01(17.50)18.21</td>
<td>1.44(1.56)1.68</td>
<td>1.41(1.66)2.12</td>
<td>Densely scabrate</td>
</tr>
</tbody>
</table>
Table 2. General pollen characters of species found in pollen type- *Chenopodium album*.

<table>
<thead>
<tr>
<th>Name of species</th>
<th>Pollen diameter in µm</th>
<th>Pore diameter in µm</th>
<th>Exine thickness in µm</th>
<th>Tectum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atriplex aucheri Moq.</td>
<td>19.41(21.10)22.77</td>
<td>1.01(1.5)1.54</td>
<td>2.01(2.53)2.5</td>
<td>Sparserly scabrate</td>
</tr>
<tr>
<td>Atriplex dimorphostegia Kar. &amp; Kir.</td>
<td>17.28(18.25)18.36</td>
<td>1.62(2.05)2.16</td>
<td>2.16(2.51)2.71</td>
<td>Sparserly scabrate</td>
</tr>
<tr>
<td>Atriplex griffithii Moq.</td>
<td>19.44(19.10)20.52</td>
<td>1.62(1.89)2.16</td>
<td>1.5(1.62)1.62</td>
<td>Sparserly scabrate</td>
</tr>
<tr>
<td>Atriplex leucocladia Boiss.</td>
<td>13.91(14.76)15.18</td>
<td>1.0(1.2)1.21</td>
<td>2.0(2.5)2.5</td>
<td>Sparserly scabrate</td>
</tr>
<tr>
<td>Atriplex schugnanica Iljan</td>
<td>21.41(22.77)22.71</td>
<td>2.0(2.53)2.5</td>
<td>2.0(2.53)2.5</td>
<td>Sparserly scabrate</td>
</tr>
<tr>
<td>Chenopodium album L.</td>
<td>15.41(17.90)21.01</td>
<td>1.2(1.20)1.26</td>
<td>1.41(1.62)1.62</td>
<td>Spinules</td>
</tr>
<tr>
<td>Chenopodium novopokrovskyanum (Allen) Uotile</td>
<td>25.75(27.93)27.01</td>
<td>1.12(1.26)1.26</td>
<td>2.51(2.53)2.61</td>
<td>Sparserly scabrate</td>
</tr>
<tr>
<td>Chenopodium ambrosioides L.</td>
<td>23.41(24.06)24.71</td>
<td>1.12(1.26)1.26</td>
<td>2.51(2.53)2.61</td>
<td>Sparserly scabrate</td>
</tr>
<tr>
<td>Chenopodium atripliciforme Murr.</td>
<td>25.75(27.83)27.01</td>
<td>1.12(1.26)1.26</td>
<td>2.51(2.53)2.61</td>
<td>Sparserly scabrate</td>
</tr>
<tr>
<td>Chenopodium badachschanicum Tzvelve.</td>
<td>20.05(20.75)21.01</td>
<td>1.12(1.26)1.26</td>
<td>2.51(2.53)2.61</td>
<td>Sparserly scabrate</td>
</tr>
<tr>
<td>Chenopodium ficifolium Sm.</td>
<td>20.61(20.5)21.01</td>
<td>1.12(1.26)1.26</td>
<td>2.51(2.53)2.61</td>
<td>Sparserly scabrate</td>
</tr>
<tr>
<td>Chenopodium glaucum L.</td>
<td>31.95(31.95)32.01</td>
<td>0.60(0.62)0.64</td>
<td>2.5(2.53)2.61</td>
<td>Sparserly scabrate</td>
</tr>
<tr>
<td>Chenopodium karoi (Murr) Aellen</td>
<td>25.75(27.83)27.01</td>
<td>1.12(1.26)1.26</td>
<td>2.51(2.53)2.61</td>
<td>Sparserly scabrate</td>
</tr>
<tr>
<td>Chenopodium murale L.</td>
<td>13.61(13.81)14.01</td>
<td>0.8(0.85)0.98</td>
<td>2.5(2.53)2.61</td>
<td>Sparserly scabrate</td>
</tr>
<tr>
<td>Chenopodium nepalense Colla</td>
<td>25.75(27.83)27.01</td>
<td>1.12(1.26)1.26</td>
<td>2.51(2.53)2.61</td>
<td>Sparserly scabrate</td>
</tr>
<tr>
<td>Chenopodium strictum Roth</td>
<td>20.06(20.5)21.01</td>
<td>0.8(0.85)0.98</td>
<td>2.5(2.53)2.61</td>
<td>Sparserly scabrate</td>
</tr>
<tr>
<td>Corispermum korovinii Iljin</td>
<td>15.2(15.65)16.11</td>
<td>1.51(1.52)1.54</td>
<td>1.41(1.98)2.66</td>
<td>Sparserly scabrate</td>
</tr>
<tr>
<td>Halocharis hispida (Schrenk ex C. A. May) Bunge</td>
<td>35.8(21.07)47.73</td>
<td>2.22(2.38)2.54</td>
<td>1.11(1.08)2.66</td>
<td>Sparserly scabrate</td>
</tr>
<tr>
<td>Halothamnus auriculus (Moq.) Botsch.</td>
<td>17.21(17.51)18.12</td>
<td>1.41(1.44)1.54</td>
<td>1.41(1.98)2.66</td>
<td>Sparserly scabrate</td>
</tr>
<tr>
<td>Salsola nitria Pall.</td>
<td>14.01(15.01)16.20</td>
<td>1.52(1.57)2.71</td>
<td>2.0(2.10)2.30</td>
<td>Sparserly scabrate</td>
</tr>
<tr>
<td>Salsola tragus L.</td>
<td>21.92(22.68)22.66</td>
<td>2.5(2.16)2.5</td>
<td>1.15(2.16)2.5</td>
<td>Sparserly scabrate</td>
</tr>
<tr>
<td>Suaeda nudiflora (Willd.) Moq.</td>
<td>18.21(20.50)23.81</td>
<td>2.10(2.60)2.81</td>
<td>1.41(1.98)2.66</td>
<td>Sparserly scabrate</td>
</tr>
<tr>
<td>Suaeda monoica Forsk ex.J.F.Gmelia</td>
<td>19.44(19.30)20.52</td>
<td>2.16(2.70)3.24</td>
<td>2.16(2.70)3.24</td>
<td>Sparserly scabrate</td>
</tr>
<tr>
<td>Suaeda fruticosa Forsk. ex J.F.</td>
<td>18.21(21.07)23.12</td>
<td>1.41(1.44)1.54</td>
<td>1.41(1.98)2.66</td>
<td>Sparserly scabrate</td>
</tr>
</tbody>
</table>

Results and Observations

General pollen characters of family Chenopodiaceae:

Pollen usually radially symmetrical, apolar, spheroidal, pantoporate, pores ± circular, pore plate scabrate or spinulose to spinululate. 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., *Arthrocnemum indicum*-type, *Atriplex stocksii*-type, *Chenopodium album*-type, *Haloxylon persicum*-type key to pollen is given below.

<table>
<thead>
<tr>
<th>Pollen type: <em>Arthrocnemum indicum</em>-type (Fig. 1A &amp; B).</th>
<th>Pollen class: Pantoporate</th>
</tr>
</thead>
<tbody>
<tr>
<td>P/E ratio: 100</td>
<td>Shape: Spheroidal</td>
</tr>
<tr>
<td>Apertures: more or less circular</td>
<td>Exine: Sexine thicker than nexine</td>
</tr>
<tr>
<td>Ornamentation: densely scabrate</td>
<td>Measurements: Size: Pollen = (47.00-) 47.5 (48.22) µm.</td>
</tr>
</tbody>
</table>

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

3. + Tectum densely scabrate .......................................................... *Atriplex stocksii*-type
   - Tectum sparsely scabrate to spinulose .................................. *Chenopodium album*-type

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


### 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 monspeliaca*
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 imbricata*
   - 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
- **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 than nexine, pantoporate, pores ± circular, pore plate with scabrae, sunken. Tectum sparsely scabrate, unevenly distributed on subpsilate surface.

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 .................................................................
     Atriplex schugnanica Ilijin, Chenopodium badachschanicum Tzvelev, Chenopodium ficifolium Sm, Chenopodium
     murale L., Chenopodium strictum Roth, Corispermum korovinii Ilijin, Halothamnus auriculus Moq.) Botsch.
     subsp. acutifolius (Moq.) Kothe-Heimr., Salsola nitritaria Pall., Salsola tragus L., Suaeda nudiflora (Willld.) Moq.,
     Suaeda monoica Frossk. ex J.F, Suaeda fruticosa Forssk. ex J.F

3. ± Pollen 30-40 µm in diameter .............................................................. group-II
   (Chenopodium glaucum L., Chenopodium pamiricum Ilijin, 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 .............................. 2. + Pollen diameter more than 15 µm .............................................. **Haloxylon salicornicum**
   - Pore 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, subprospherical, 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., *Arthrocnemum, Atriplex, Bassia, Camphorosoma, Cerotocarpus, Chenopodium, Corispermum, Halocarhis, Halostachys, Halothamnus, Haloxylon, Salsola* and *Suaeda*. On the basis of number of pores, pollen diameter and exine pattern 4 pollen types are recognized viz., *Arthrocnemum 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 µm. 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, scabreae are evenly and unevenly distributed on subpsilate tectum, these species are further delimited on the basis of pollen diameter, pore diameter, exine and seneine thickness and distribution of scabreae 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-I tectum is sparsely scabrate (*A. schugnagiana, A. leucocladia, 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 thickness, 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. salicornicum*, which have deeply sunken pores.

Four species i.e., *Salsola tragus, S. richteri, S. nitaria* 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. nitaria* 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 *Atriplexaceae* and perhaps the entire family (Flores & Davis, 2001) but also importance of continuing to gather the pollen data for the Chenopodiaceae.

**References**


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