POLLEN FLORA OF PAKISTAN–LXV. BERBERIDACEAE

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Abstract

Pollen morphology of 12 species representing 2 genera of the family Berberidaceae from Pakistan has been examined by light and scanning electron microscope. Pollen grains usually radially symmetrical, isopolar or apolar, spheroidal or sub-prolate. Spiroaperturate rarely colpate (3- more), sexine thicker than nexine. Tectal surface mostly foveolate-fossulate or sub-psilate, often rugulate - reticulate. On the basis of apertural types and exine ornamentation four distinct pollen types are recognized, viz., Berberis calliobotrys-type, Berberis jaeschkeana-type, Berberis kunawurensis-type and Epimedium elatum-type.

Introduction

Berberidaceae is a small family of c. 13 genera, approximately 650 species, widely distributed in the world but more in North Hemisphere and South America (Mebberley, 1987). It is represented in Pakistan by 3 genera and c. 20 species (Jafri, 1975).

The family is characterized by perennial herbs and shrubs, leaves alternate or basal simple or compound often spiny, exstipulate. Flowers bisexual, actinomorphic. Calyx 3-6, corolla 3-6., regular, with isomerous stamens attached to the corolla tube and inferior ovary having two or more locules with axile placentation. The family is economically important as a source of garden ornamentals like Berberis thunbergii (Japanese barberry), the common barberry (Berberis vulgaris) is the host of wheat stem rust. The important genera of Berberidaceae are Berberis, Nandina and Mahonia. Pollen morphology of the family has been examined by Erdman (1952), Kosenko (1980), Nowicke and Skvarla (1982). Nowicke & Skvarla (1981) examined pollen morphology and phylogenetic relationships of Berberidaceae. Blackmore & Heath (1984) examined the pollen morphology of northwest European species of the family Berberidaceae. There are no reports on pollen morphology of the family Berberidaceae from Pakistan. Present investigations are based on the pollen morphology of 12 species representing 2 genera of the family Berberidaceae by light and scanning electron microscope.

Materials and Methods

Polliniferous material was obtained from Karachi University Herbarium (KUH) or fresh material was collected from the field. The list of voucher specimens is deposited in KUH. The slides were prepared for light (LM) by the standard method described by Erdman (1952) and the pollen grains were mounted in unstained glycerine jelly. 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 15 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 length (P) and equatorial diameter (E), and exine thickness were measured (Tables 1-2).
Table 1. General characters of pollen found in pollen type *Berberis jaeschkeana*.

<table>
<thead>
<tr>
<th>Name of taxa</th>
<th>Diameter of pollen in µm</th>
<th>Exine thickness in µm</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Berberis baluchistanica</em> Ahrendt.</td>
<td>31.72 (33.5±0.57) 36.50</td>
<td>1.72 (1.27±0.13) 1.79</td>
</tr>
<tr>
<td><em>Berberis brevissima</em> Jafri</td>
<td>21.11 (22.5±0.12) 24.51</td>
<td>1.22 (1.37±0.14) 1.41</td>
</tr>
<tr>
<td><em>Berberis jaeschkeana</em> Schneid</td>
<td>38.75 (41.5±0.41) 45.01</td>
<td>2.25 (2.71±0.36) 2.53</td>
</tr>
<tr>
<td><em>Berberis orthobotrys</em> Bien, ex Aitch.</td>
<td>48.12(49.12±0.21)49.50</td>
<td>c. 2.6</td>
</tr>
<tr>
<td><em>Berberis pseudumbellata</em> Parker</td>
<td>31.33 (33.6±0.51) 35.9</td>
<td>c.2.11</td>
</tr>
<tr>
<td><em>Berberis ulicina</em> Hook.f. &amp; Thoms.</td>
<td>32.50(33.1±0.25) 33.5</td>
<td>1.34 (2.10.12±0.17) 1.07</td>
</tr>
<tr>
<td><em>Berberis vulgaris</em> L.</td>
<td>21.81 (23.6±0.18) 25.16</td>
<td>c.2.23</td>
</tr>
</tbody>
</table>

Table 2. General characters of pollen found in pollen type *Berberis kunawurensis*.

<table>
<thead>
<tr>
<th>Name of taxa</th>
<th>Diameter of pollen in µm</th>
<th>Exine thickness in µm</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Berberis lycium</em> Royle</td>
<td>38.71 (41.5±0.57) 45.5</td>
<td>2.25 (2.42±0.34) 2.59</td>
</tr>
<tr>
<td><em>Berberis kunawurensis</em> Royle</td>
<td>37.51 (41.51±0.44) 45.8</td>
<td>2.10 (2.17±0.26) 2.25</td>
</tr>
<tr>
<td><em>Berberis pachyacantha</em> Koehne</td>
<td>40.5 (40.05±0.12) 41.55</td>
<td>2.00 (2.4 ±0.1 6) 2.85</td>
</tr>
</tbody>
</table>

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

General pollen characters of the family Berberidaceae

Pollen grains usually radially symmetrical, apolar rarely isopolar. Mostly spheroidal, often sub-prolate. Spiroaperturate rarely tricolpate to pantacolpate, sexine thicker than nexine. Tectum foveolate-fossulate or sub-psilate often rugulate- reticulate. On the basis of exine ornamentation and apertural types four distinct pollen types are recognized viz., *Berberis calliobotrys*-type, *Berberis jaeschkeana*-type, *Berberis kunawurensis*-type and *Epimedium elatum*-type.

Key to the pollen types

1 + Pollen grains isopolar………………………………*Epimedium elatum*-type
   - Pollen grains apolar ................................................................. 2

2 + Pollen grains pantocolpate ............................ *Berberis calliobotrys*-type
   - Pollen grains spiroaperturate .................................................3

3 + Tectum sub-psilate ........................................... *Berberis kunawurensis*-type
   - Tectum foveolate-fossulate ........................................... *Berberis jaeschkeana*-type
**POLLEN FLORA OF PAKISTAN–LV. BERBERIDACEAE**

**Pollen type:** *Berberis calliobotrys*-type (Fig. 1 A & B).
**Pollen class:** Pantocolpate
**P/E ratio:** 100
**Shape:** Spheroidal
**Apertures:** Colpi small, acute ends.
**Exine:** Sexine thicker than nexine.
**Ornamentation:** Foveolate-fossulate
**Measurements:** Size: Pollen diameter = (42.5-) 48.6±0.2 (-54.8) μm, Exine 2.25 (2.30±0.5) 2.5 μm thick, sexine thicker than nexine. Tectum foveolate-fossulate.

**Species included:** *Berberis calliobotrys* Aitch.

**Pollen type:** *Berberis jaeschkeana*-type (Fig. 1C-E; Fig. 2 A-D).
**Pollen class:** Spiroaperturate
**P/E ratio:** 100;
**Shape:** Spheroidal
**Apertures:** Spiral long.
**Exine:** Sexine thicker than nexine.
**Ornamentation:** Foveolate-fossulate.
**Measurements:** Size: Length = (35.5-) 47.1 2±0.2 (-58.75) μm, Exine 2.25 (4.0±0.5) 5.75 μm thick, sexine thicker than nexine. Tectum foveolate-fossulate often scabrate.

**Species included:** *Berberis jaeschkeana* Schneid., *Berberis baluchistanica* Ahrendt, *Berberis brevissima* Jafri, *Berberis orthobotrys* Bien, ex Aitch., *Berberis vulgaris* L., *Berberis ulicina* Hook.f. & Thoms., and *Berberis pseudumbellata* Parker

**Key to the species**

1 + Pollen 21-25 μm in diameter ......................................................... group-I
   (Berberis vulgaris L., and Berberis brevissima Jafri)
   - Pollen 31-49 μm in diameter ......................................................... group-I1


**Pollen type:** *Berberis kunawurensis*-type
**Pollen class:** Spiroaperturate.
**P/E ratio:** 100
**Shape:** Spheroidal
**Apertures:** Spiral, long
**Exine:** Sexine thicker than nexine.
**Ornamentation:** Sub-psilate
**Measurements:** Size: Length = (37.5-) 45.15±0.2 (-52.8) μm, Exine 2.10 (2.34±0.5) 2.91 μm thick, sexine thicker than nexine. Tectum subpsilate.

**Species included:** *Berberis lycium* Royle, *Berberis kunawurensis* Royle and *Berberis pachyacantha* Koehne.

Scale bar = A & B = 10 μm; C&D = 5 μm; E = 2 μm; B&F = 1 μm
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Fig. 2. Scanning Electron micrographs of pollen grains. *Berberis brevissima*: A, Pollen grain, B, Exine pattern. *Berberis orthobotrys* C, Pollen grain. D, Exine pattern. Scale bar = A = 10 μm; D = 2 μm; BC = 5 μm.

**Pollen type**: *Epimedium elatum* - type (Fig. 1 F).

**Pollen class**: Tricolpate  
**P/E ratio**: 1.21  
**Shape**: Sub-prolate.  
**Apertures**: Colpus long sunken with acute ends.  
**Exine**: Sexine thicker than nexine.  
**Ornamentation**: Rugulate-fossulate.  
**Measurements**: Size: Polar axis $P = 32.75$ (35.48±1.2) 38.25 and equatorial diameter $E = 28.5$ (30.22±2.1) 31.25 μm. colpi 30.61 (31.66±1.4) –35.25 μm long. Exine 1.75-2.75 μm thick, sexine slightly thicker than nexine. Tectum rugulate-fossulate.  
**Species included**: *Epimedium elatum* Morr., & Decne.

**Discussion**

Berberidaceae is a eurapalynous family. Meacham (1980) recognized four generic groups viz., *Leontice*-group, *Berberis*-group, *Epimedium*-group and *Podophyllum*-group. Loconte (1993) divided the Berberidaceae into two subfamilies: Nandinoideae and Berberidoideae, he further divided the subfamily Berberidoideae in to two tribes i.e., Leontieae and Berberideae. Both the studied genera i.e., *Berberis* and *Epimedium* are placed into two separate subtribes Berberidineae and Epimiidineae of the tribe
Berberideae. In the genus *Berberis* most of the species (10 out of the 11 studied species) have spiroaperturate pollen. Whereas in the *Berberis calliobotrys*-type pollen are pantocolpate. In the genus *Epimedium* pollen are tricolpate, thus indicating close link with the *Berberis*. Pollen grains generally spiroaperturate rarely colpate (tri-pantocolpate).

In the present study on the basis of exine ornamentation and apertural types four distinct pollen types are recognized viz., *Berberis calliobotrys*-type, *Berberis jaeschkeana*-type, *Berberis kunawurensis* -type and *Epimedium elatum*-type. However, Blackmore and Heath (1984) divided the family Berberidaceae in three pollen types such as, *Berberis vulgaris*-type, *Epimedium alpinum*-type and *Mahonia aquifolium*-type. Loconte & Stevenson (1991) indicated the close relationship of Berberidaceae, Menispermaceae, Papaveraceae and Ranunculaceae on the basis of shared possession of nuclear endosperm development.

Palynologically Berberidaceae also shows its relationship with these families by sharing common types i.e., tricolpate and pantocolpate in some genera of Berberidaceae such as *Epimedium* and even few species of *Berberis*.

References


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