

POLLEN FLORA OF PAKISTAN–LXVI: ANACARDIACEAE

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Abstract

Pollen morphology of 7 species of the family Anacardiaceae belonging to 3 genera viz., *Cotinus* Miller, *Pistacia* L. and *Rhus* L., has been investigated using light and scanning electron microscope. Pollen grains are usually radially symmetrical, isopolar, sub-prolate to prolate-spheroidal rarely oblate-spheroidal, tricolporate rarely porate. Tectum striate (coarse-fine), reticulate-rugulate with spinulose. On the basis of exine ornamentation 3 distinct pollen types have been recognized viz., *Cotinus coggyria*-type, *Rhus javanica*-type and *Pistacia chinensis*-type.

Introduction

Anacardiaceae is a tropical family, represented by 55 genera and c. 500 species mostly distributed in the Mediterranean region, South West and Central East Asia and America (Mabberley, 1987). It is represented in Pakistan by 8-9 genera and 23 species (Nasir, 1983). The family is characterized by having mostly trees and shrubs, often with a resinous bark and a milky sap, leaves alternate, simple or compound, without stipules, flowers bisexual or unisexual actinomorphic, stamens usually 5-10 arising from beneath a disc, fruit usually drupe. The chief genera of the family are *Rhus* (lacquer tree), *Pistacia* (china turpentine, pistachio nuts), *Magnifera* (mango), *Anacardium* (cashew nut), *Schinus* (pepper tree) and *Cotinus* (smoke tree).

Pollen morphology of the family Anacardiaceae has been studied by a number of workers viz., Erdtman (1952, 1971), Faegri & Iverson (1964), Haddad (1969), Moore *et al.*, (1991) and Davarynejad *et al.*, (1995). Heimsch (1940) described the pollen morphology of *Rhus* and allied genera. Baksi (1976) studied the pollen of few members of the family Anacardiaceae. Pollen Morphology of the family Anacardiaceae from Northeastern America has been studied by Ralph & Robert (1979). Belhadj *et al.*, (2007) examined pollen morphology and fertility of *Pistacia atlantica* Desf. There are no information on the pollen morphology of family Anacardiaceae from Pakistan. The present palynological investigations are based on the study of 3 genera representing 7 species of the family Anacardiaceae.

Materials and Methods

Polleniferous material was 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 microscope (LM) by the standard methods described by Erdtman (1952) and scanning microscopy (SEM). 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 were and 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 Å. 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. Polar axis (P) and equatorial diameter (E), aperture size, apocolpium, mesocolpium and exine thickness were measured (Table 1).

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

General pollen characters of the family Anacardiaceae

Pollen grains usually radially symmetrical, isopolar, sub-prolate rarely prolate-spheroidal or oblate-spheroidal, sexine thicker or thinner than nexine, colpal membrane granulate to spinulose. Tectum is mostly striate, striae coarse to fine rarely reticulate-rugulate with spinulose. On the basis of apertural types and exine ornamentation three pollen types viz., *Cotinus coggyria*-type, *Rhus javanica*-type and *Pistacia chinensis*-type are recognized.

Key to the pollen types

- 1 + Pollen colpate (short colpi) *Pistacia chinensis*-type
- Pollen tricolporate 2
- Tectum medium-coarse striate with perforations *Cotinus coggyria*-type
- Tectum medium-fine striate *Rhus javanica*-type

Pollen type: *Cotinus coggyria*-type (Fig. 1. A & B).

Pollen class: Tricolporate

P/E ratio: 1.20-1.39.

Shape: Sub-prolate or prolate

Apertures: Colpus long sunken with acute ends.

Exine: Sexine thinner than nexine.

Ornamentation: Striate with perforations.

Measurements: Size: (22.5-) 26.66 ± 0.51 (-30.75) μm . Equatorial diameter (18.50) 19.8 ± 0.12 (21.25). Colpi (18.75-) 21.91 ± 0.40 (-25.12) μm long, \pm trilobed in polar view and elliptic in equatorial view, 3-colporate, Mesocolpium (15-) 21.25 ± 0.23 27.5 μm . Apocolpium (1.25-) 1.87 ± 0.06 (-2.05) μm . Exine (1.25-) 1.62 ± 0.61 (-2.00) μm thick, sexine thicker than nexine. Tectum Striate with perforations.

Species included: *Cotinus coggyria* Scop.

Pollen type: *Pistacia chinensis*-type (Fig. 1C-E).

Pollen class: 6-8 rugate (short colpi)

P/E ratio: 0.99.

Shape: Oblate-spheroidal

Apertures: Rugate

Exine: Sexine thicker than nexine.

Ornamentation: Reticulate-rugulate with spinules.

Table 1. General characters of pollen found in pollen type *Rhus javanica*

Name of taxa	Polar length in μm	Equatorial diameter in μm	Colpus length in μm	Exine Thickness in μm
<i>Rhus javanica</i> L.	27.5 (30.35 \pm 1.11) 33.75	22.50 (23.78 \pm 0.43) 25.51	20.11 (24.28 \pm 1.05) 27.2	1.15 (1.57 \pm 0.06) 2.00
<i>Rhus punjabensis</i> J.L. Stewart ex Brandis	25.75 (26.11 \pm 0.296) 27.0	17.5 (21.87 \pm 0.59) 25.3	20.5 (21.25 \pm 0.72) 22.53	1.25 (1.75 \pm 0.05) 1.75
<i>Rhus mysturensis</i> Heyne ex Wight	21.12 (23.6 \pm 0.51) 25.91	18.21 (19.61 \pm 0.49) 23.81	17.5 (21.87 \pm 0.59) 25.3	1.41 (1.44 \pm 0.29) 1.54
<i>Rhus succedanea</i> L.	33.5 (35.40 \pm 0.25) 36.75	24.34 (25.10 \pm 0.17) 26.9	32.00 (33.82 \pm 0.17) 34.11	1.10 (1.55 \pm 0.04) 2.00

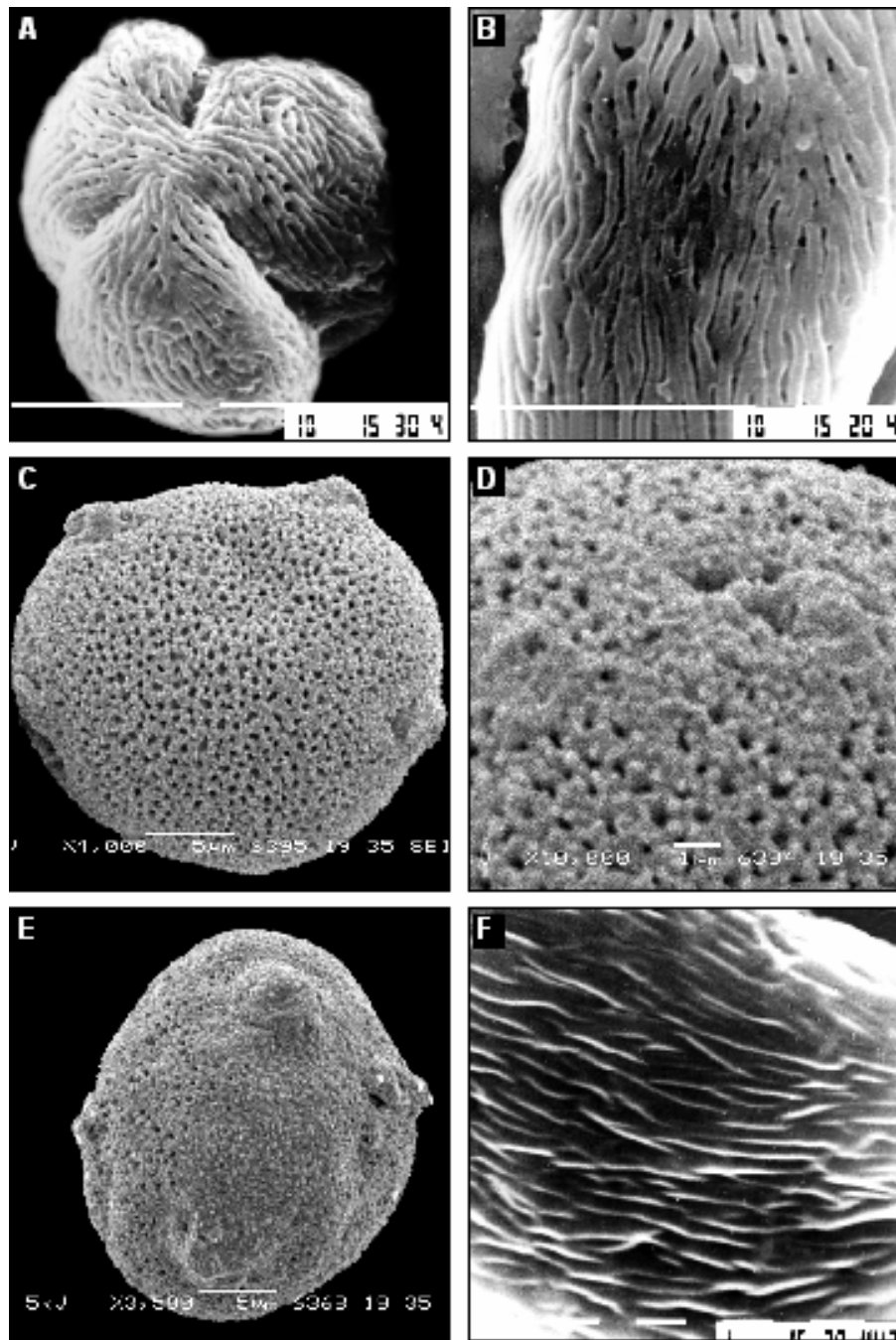


Fig. 1. Scanning Electron micrographs of pollen grains: *Cotinus coggyra*: A, Polar view, B, Exine pattern. *Pistacia chinensis*: C, Polar view; D, Exine pattern, *Pistacia khinjuk*: E, Equatorial view, F, Exine pattern.

Scale bar: A,B = 10 μ m; C, E = 5 μ m; D, F = 1 μ m.

Measurements: Size: Polar length (26.11-) 32.31 ± 0.471 (-38.51) μm , and equatorial diameter E(17.5) 21.52 ± 3.54 (-25.25) μm , pore (4.11-) 4.64 ± 0.89 (-5.17) μm in diameter. Exine (1.25-) 2.00 ± 0.16 (-2.5) μm thick, sexine thinner than nexine. Tectum reticulate-rugulate with spinules muri.

Species included: *Pistacia chinensis* Bunge and *Pistacia khinjuk* Stocks

Pollen type: *Rhus javanica*-type (Fig. 1F)

Pollen class: Tricolporate

P/E ratio: 1.20-1.33.

Shape: Sub-prolate or prolate.

Apertures: Colpus long sunken with acute ends.

Exine: Sexine thicker than nexine.

Ornamentation: Fine-medium striate

Measurements: Size. Polar length P (21.01-) 28.06 ± 1.36 (-36.12) μm and equatorial diameter E (17.15-) 21.32 ± 7.84 (-26.50) μm . Colpi (17.51-) 26.65 ± 0.8 (-34.5) μm long, trilobed, tricolporate. Mesocolpium (12.5-) 18.80 ± 0.47 (-25.11) μm . Apocolpium 1.15- 2. 6 μm . Exine (1.11-) 1.80 ± 0.28 (-2.5) μm thick, sexine thicker than nexine. Tectum striate with lirae.

Species included: *Rhus punjabensis* J.L. Stewart ex Brandis, *Rhus javanica* L., *Rhus mysurensis* Heyne ex Wight., and *Rhus succedanea* L.

Key to the species

- 1 + Pollen prolate *Rhus succedanea*
- Pollen sub-prolate group-1
- (*Rhus punjabensis*, *Rhus javanica*, *Rhus mysurensis*)

Discussion

Anacardiaceae is a more or less eurypalynous family. Significant variation in exine pattern and apertural types has been observed. Pollen grains are sub-prolate to prolate-spheroidal rarely oblate-spheroidal. Within the family two types of apertures i.e., colpate (short colpi or rugate) and colporate are found. Exine ornamentation is commonly striate (coarse-fine striation) or reticulate-rugulate with spinules. All the three genera i.e., *Cotinus*, *Pistacia* and *Rhus* are clearly separated on the basis of exine ornamentation. The genus *Cotinus* has medium-coarsely striate tectum with perforations in between lirae, whereas, in the genus *Rhus* tectum is simply striate. Pollen grains of the genus *Pistacia* is recognized by having reticulate-rugulate tectum with spinulose muri. On the basis of tectum and exine pattern family has been divided into three pollen types viz., *Cotinus coggyria*-type, *Rhus javanica*-type and *Pistacia chinensis*-type.

Takhtajan (1997) divided the family Anacardiaceae into two subfamilies viz., Anacardioidae (including tribes Anacardiaceae, Dobineae, Rhoeae, and Semecarpeae) and Spondioidae (including tribe Spondiadeae). Adanson (1763) treated the genus *Pistacia* as a separate family Pistaciaceae. Pell (2004) distinguished the genus *Pistacia* morphologically from other Anacardiaceae members by its reduced flower structure, plumose styles, and different pollen morphology. However, because of the presence of a

single apotropous ovule per locule, *Pistacia* is placed within the family Anacardiaceae. This treatment is also supported by recent molecular data by Pell (2004) and Yi *et al.*, (2004, 2007).

The present palynological studies also support the placement of the genus *Pistacia* under a separate family due to presence of short colpi (rugate pollen) whereas in the other genera the pollen are tricolporate.

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(Received for publication 8 January 2010)