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POLLEN FLORA OF PAKISTAN–LVII. VITACEAE

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Abstract

Pollen morphology of 6 species representing 4 genera of the family Vitaceae from Pakistan has been examined by light and scanning electron microscope. Pollen grains usually radially symmetrical, isopolar, tricolporate. Mostly sub-prolate or prolate to prolate-spheroidal, sexine much thicker or thinner than nexine. Tectum foveolate or reticulate. On the basis of exine ornamentation three distinct pollen types are recognized. Viz., *Vitis parvifolia*–type, *Vitis jacqumontii* and *Ampelopsis vitifolia* subsp. *Hazaraganjiensis*-type.

Introduction

The family Vitaceae of c. 13 genera and 700 species is distributed in tropical and subtropical regions also extending to north and south temperate regions (Mebberely, 1987). In Pakistan it is represented by 6 genera and 12 species (Nazimuddin & Qaiser). Plant mostly lianas or creeper, rarely trees, erect shrubs or herbs, with copious watery juice. Leaves mostly petiolate, alternate, stipulate or exstipulate, simple or palmately lobed or compound or rarely pinnately compound. Flowers small, bisexual or unisexual (plants then dioecious or polygamomonoecious), actinomorphic, tetra-or pentamerous, hypogynous, bracteolate, sepals (3-) 4-5 (-7), united. Carpels 2, rarely 3-6 (-8) syncarpous; ovary superior, 2-(3-6) loculed. Fruit a 1-4 seeded berry. The chief genera of the family Vitaceae are Vitis (grape), *Ampelocissus, Ampelopsis* (pepper vine), *Cissus* and *Parthenocissus* (Virginia creeper).

Pollen morphology of family has been examined by Erdtman *et al.*, (1961, 1963), Bamzai & Randhawa (1965), Reille (1967), Kuprianova & Alyoshina (1978), Lombardo *et al*., (1978), Nema & Sharma (1981) and Arobba *et al*., (1984).

Moore *et al*., (1991) examined pollen morphology of few species of Vitaceae. Punt *et al.*, (2003) studied pollen morphology of the family Vitaceae for Northwest pollen Flora. There are no reports on pollen morphology of the family Vitaceae from Pakistan. Present investigations are based on the pollen morphology of 6 species representing 4 genera of the family Vitaceae by light and scanning electron microscope.

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) by the standard methods described by Erdtman (1952) and scanning microscopy (SEM). 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, polar axis (P) and equatorial diameter (E), aperture size and exine thickness were measured (Tables 1-2).

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

General pollen characters of the family Vitaceae

Pollen grains usually radially symmetrical, isopolar rarely apolar. Mostly sub-prolate, prolate or prolate-spheroidal. Tricolporate, sexine thicker or thinner than nexine. Tectal surface foveolate or foveolate-reticulate. On the basis of exine ornamentation three distinct pollen types are recognized viz., *Vitis parvifolia*-type, *Vitis jacqumontii* and *Ampelopsis vitifolia* subsp. *hazaraganjiensis*-type.

Key to the pollen types

1 + Tectum reticulate ...…….… *Ampelopsis vitifolia* subsp. *hazaraganjiensis*–type
- Tectum not as above ……. 2

2 + Pollen grains prolate-spheroidal …….. *Vitis jacqumontii*
- Pollen grains prolate-sub-prolate …… *Vitis parvifolia*

Pollen type: *Ampelopsis vitifolia* (Boiss.) Planch. subsp. *hazaraganjiensis*-type (Fig.1 A & B)
P/E ratio: 1.13
Shape: Prolate-spheroidal
Apertures: Ectocolpus long narrow with acute ends.
Exine: Sexine thicker or thinner than nexine.
Ornamentation: Reticulate.
Measurements: Size: Length = (27.5-) 32.51 ± 0.89 (-37.5) um and breadth (27.31) 27.5 ± 0.48 (27.69) um, colpi (23. 69-) 27.54 ± 0.42 (-32.31) um in long. Mesocolpium (21. 5-) 24. 21 ± 0. 27 (-26. 9) μm. Apocolpium (16. 5-) 17.2 ± 0.42 (-17.95) μm. Exine 2.51-3.21 μm thick, sexine thinner than nexine. Tectum reticulate.
Species included: *Ampelopsis vitifolia* (Boiss.) Planch. subsp. *hazaraganjiensis* Nazim & Qaiser and *Vitis vinifera* L.

Pollen type: *Vitis jacquemontii*-type (Fig. 1 C & D).
Pollen class: Tri-colporate.
P/E ratio: 1.12.
Shape: Prolate-spheroidal.
Apertures: Ectocolpus long narrow with acute ends.
Exine: Sexine thicker than nexine.
Ornamentation: Rugulate-reticulate at polar region and rugulate-striate at mesocolpium region.
Measurements: Size: Length = (21.5-) 31.51 ± 1.24 (-23.5) μm and breadth (18.15) 37.5 ± 0.90 (23.5) μm, colpi (16. 5 -) 17.2 ± 0.42 (-19.25) μm in long. Mesocolpium 13.2-16.5 μm. Apocolpium c. 2.5 μm. Exine 2.5 μm thick, sexine thicker than nexine. Tectum rugulate-reticulate at polar region and rugulate-striate at mesocolpium region.
Species included*: Vitis jacquemontii* Parker.

Table 1. General pollen character found in pollen types *Vitis parvifolia*-type.

Name of species	Shape	Polar length in µm	Equatorial diameter (E)	Colpus length in µm	Exine thickness
Ampelopssi vitifolia (Boiss.) Planch. Subsp. *vitifolia*	Pr.	35.9 (42.03 ± 0.491) 49.18	26.92 (29.65 ± 0.34) 32.31	28.72 (32.95 ± 0.53) 41.28	2.8 (3.31) 3.54 32.31.
Vitis parvifolia Roxb.	Sub-Pr	23.1 (24.5 ± 0.27) 26.4	18.3 (19.3 ± 0.16) 19.80	16.5 (18.15 ± 0.35) 21.54	1.65 (1.71 ± 0.03) 1.98
Parthenocissus semicordata (Wall ex Roxb.) Planch.	Pr.	41.2 (44.17 ± 0.37) 46.2	23.1 (24.35 ± 0.36) 28.72	29.7 (35.06 ± 0.52) 37.95	2.15 (2.62 ± 0.10) 2.97

Table 2. General pollen character found in pollen types *Ampelopsis vitifolia* subsp. *hazaraganjiensis*.

Name of species	Shape	Polar length in µm	Equatorial diameter (E)	Colpus length in µm	Exine thickness
Ampelopsis vitifolia subsp. *hazaraganjiensis*	Pr – Sp	35.9 (39.03 ± 0.481) 43.18	32.31 (34.75 ± 0.34) 37.69	23.33 (28.95 ± 0.53) 32.32	2.5 (2.9 ± 0.47) 3.23
Vitis vinifera L.	Pr-sp	27.91 (32.80 ± 0.27) 34.40	27.9 (32.40 ± 0.16) 34.50	17.5 (19.15 ± 0.35) 23.32	1.64 (1.82 ± 0.03) 2.0

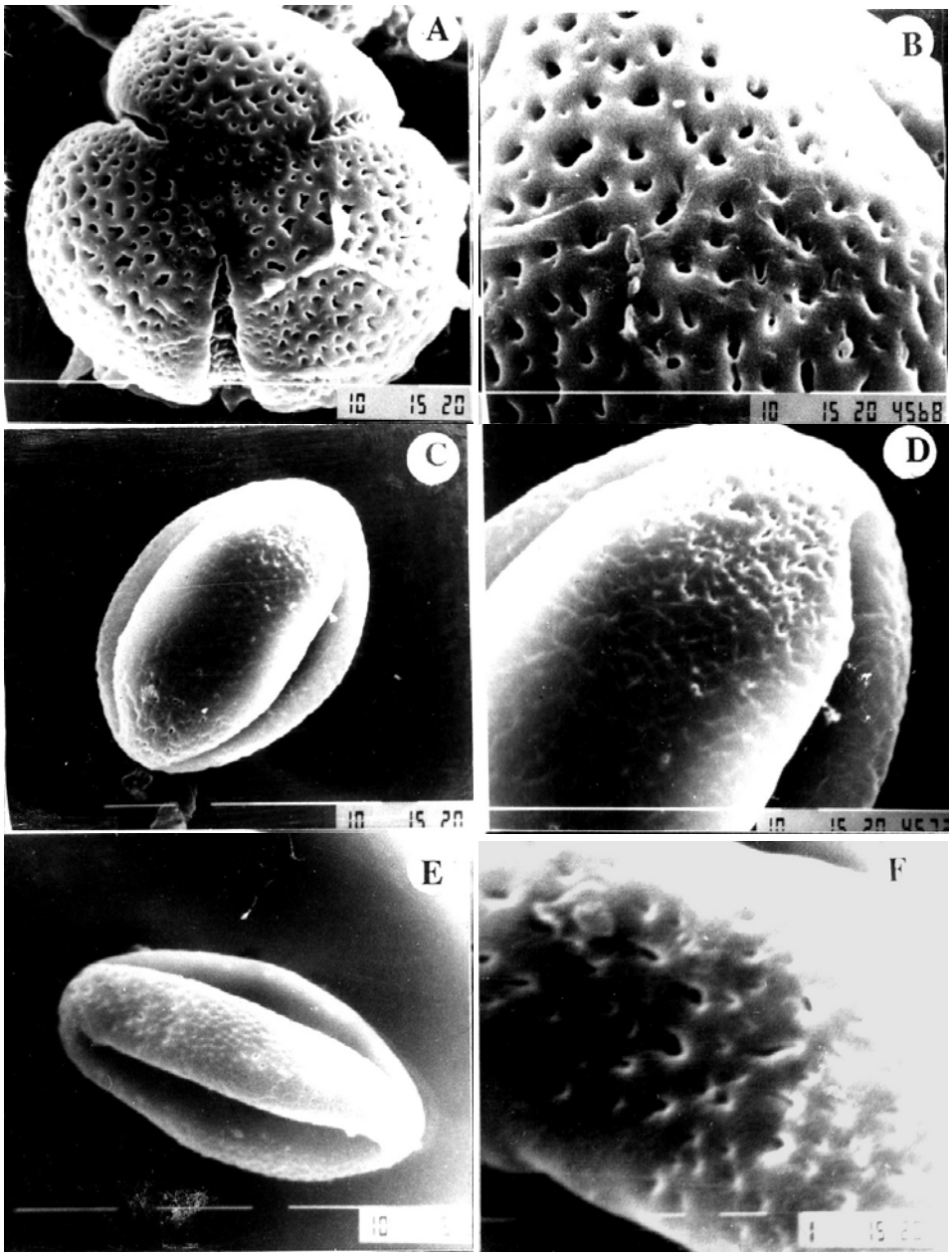

Fig. 1. Scanning Electron micrographs of pollen grains. *Ampelopsis vitifolia* subsp. *hazaraganjiensis*: A. Polar view, B. Exine pattern. *Vitis jacqumontii*: C. Equatorial view, D. Exine pattern. *Parthenocissus semicordata*: E. Equatorial view, F. Exine pattern.
Scale bar = A-E = 10 μm; F = 1 μm

Pollen type: *Vitis parvifolia*-type (Fig. 1E & F).
Pollen class: Tri-colporate.
P/E ratio: 126-181.
Shape: Sub-prolate or prolate.
Apertures: Ectocolpus long narrow with acute ends.
Exine: Sexine thicker or thinner than nexine.
Ornamentation: Foveolate.
Measurements: Size: Length = (23.25-) 32.37 ± 0.2 (-41.5) μm and breadth (18.5) 23 ± 0.11 (29.5) μm, colpi (16.5-) 22.11 ± 0.42 (28.5) μm in long. Mesocolpium 13 .6 (17.12 ± 0.25) 23.6 μm. Apocolpium 3.25 (5.6 ± 1.24) 8.02 μm. Exine 1.6- 3.5 μm thick, sexine thicker than nexine. Tectum foveolate.
Species included: *Ampelopsis vitifolia* (Boiss.) Planch. subsp. *vitifolia, Vitis parvifolia* Roxb., and *Parthenocissus semicordata* (Wall.) ex Roxb.) Planch.

Key to the species

1 + Pollen grains sub-prolate ….……... *Vitia parvifolia*
- Pollen grains prolate .....…….…… 2

2 + Mesocolpium c. 14.0 μm .....…….. *Parthenocissus semicordata*
- Mesocolpium 19-23.3 μm …..……..… *Ampelopsis vitifolia* subsp. *vitifolia*

Discussion

Vitaceae is more or less stenopalynous in nature. This family is characterized by it's 3-colporate grains. However, sufficient variation is found between pollen shape class and exine pattern, shape of pollen grains varies from prolate-spheroidal or prolate to sub-prolate. Tectum is reticulate or foveolate (except in *Vitis jacquemontii*). The pollen grains of *Vitis jacquemontii* has two different types of tectal surface. At the poles it is rugulate-reticulate while at the mesocolpal region it is rugulate-striate. On the basis of exine pattern and pollen shape class family is divided in to three pollen types. Viz., *Vitis parvifolia*-type, *Vitis jacqumontii* and *Ampelopsis vitifolia* subsp., *hazaraganjiensis*-type. Cronquist (1981) placed the family Vitaceae near the family Rhamnaceae in the order Rhamnales. However, Dahlgren (1989) treated Vitales as a monotypic order having only one family Vitaceae, Recent phylogenetic analyses support Vitaceae as the sister-group to all other rosids (Jansen *et al*., 2006). Pollen grains of *Vitis* are reported from the Tertiary (Ingwersen, 1954) and the Holocene (Godwin, 1975).

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