

Studies on the Pollen Morphology of the Genus *Kickxia*, *Scrophularia* and *Veronica* (Scrophulariaceae) from Dir Valley, Pakistan

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Abstract—Pollen grains of 7 species belonging to 3 genera viz., *Kickxia*, *Scrophularia* and *Veronica* (Scrophulariaceae) from Dir valley, Pakistan were studied by light microscope. Pollen grains are usually radially symmetrical, isopolar, tricolpate, oblate-spheroidal or prolate. On the basis of exine ornamentation two distinct Pollen types are recognized. *Scrophularia* pollens type with scabrate sculpturing and *Veronica* pollen type with psilate sculpturing. Palynological data has been useful at generic and specific level.

Keywords—*Kickxia*, *Scrophularia*; *Veronica*; Pollen morphology; Dir valley

I. INTRODUCTION

Scrophulariaceae is a large cosmopolitan family [2] with about 222 genera and 4480 species [7] and are mainly distributed throughout the temperate areas of the Northern hemisphere [15]. It is an eurypalynous family [6]. The pollen morphological characters of the family were previously examined by many researchers all over the world. A pollen-morphological study of the whole family Scrophulariaceae has been conducted, as in [14]. Reference [13] shows the study of the Pollen morphology of 17 species of the genus *Veronica* (Scrophulariaceae) in Iran. The earlier works report data of pollen morphological characters of genus *Veronica* [5], [12]. Scrophulariaceae have been examined with light and electron microscopy ([16], [3], [4], [10]).

In the present study 7 species belonging to 3 genera of the family Scrophulariaceae have been taken to study the pollen morphology. This contribution aims to explicate the variation between species. The palynological data is an addition parameter taken to delimit the taxa along with other parameters.

II. MATERIALS AND METHODOLOGY

The studies were conducted during 2010-2011 in Experimental Taxonomy Laboratory of Quaid-i-Azam University of Islamabad. Pollen studies were confined to pollen morphology of 7 species of Family Scrophulariaceae. Pollen material of dried herbarium specimens collected from Quaid-i-Azam University Herbarium (ISL), Islamabad were used.

The pollen grains were prepared by the standard method described by [11]. For light microscopy, the pollen grains were mounted in glycerine jelly which was prepared according to modified method, as in [8] and observations were made with a Meiji light microscope (MX 5200H,

Japan). Pollen characters such as type, shape in polar & equatorial view, polar and equatorial diameter, P/E ratio, length & width of colpi and exine thickness of selected species were studied (Table 2). Microphotographs of pollen were taken by binocular Leica Microscope (Model DM 1000) with the help of Leica FX-35 camera equipped with photomicrograph system Japan (fig 1 and 2).

III. RESULTS

A. General Pollen Characters of the Genera *Kickxia*, *Scrophularia* and *Veronica*.

Pollen grains are usually radially symmetrical, isopolar, oblate-spheroidal or prolate-spheroidal or sub-prolate, and tricolpate (Table 1). On the basis of exine ornamentation two distinct Pollen types are recognized.

P/E Ratio: ± 1

Colpi: Tricolpate

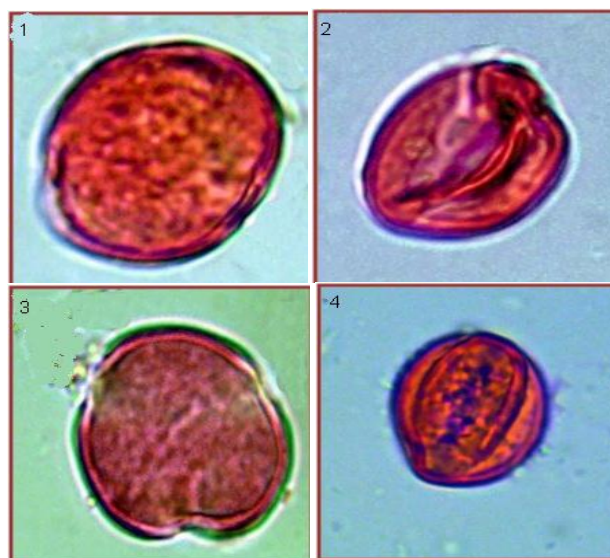


Fig. 1 Microphotograph of pollen. 1 & 2: Polar & Equatorial view of *Scrophularia robusta*, 3 & 4: Polar & Equatorial view of *Scrophularia scabiosaefolia*.

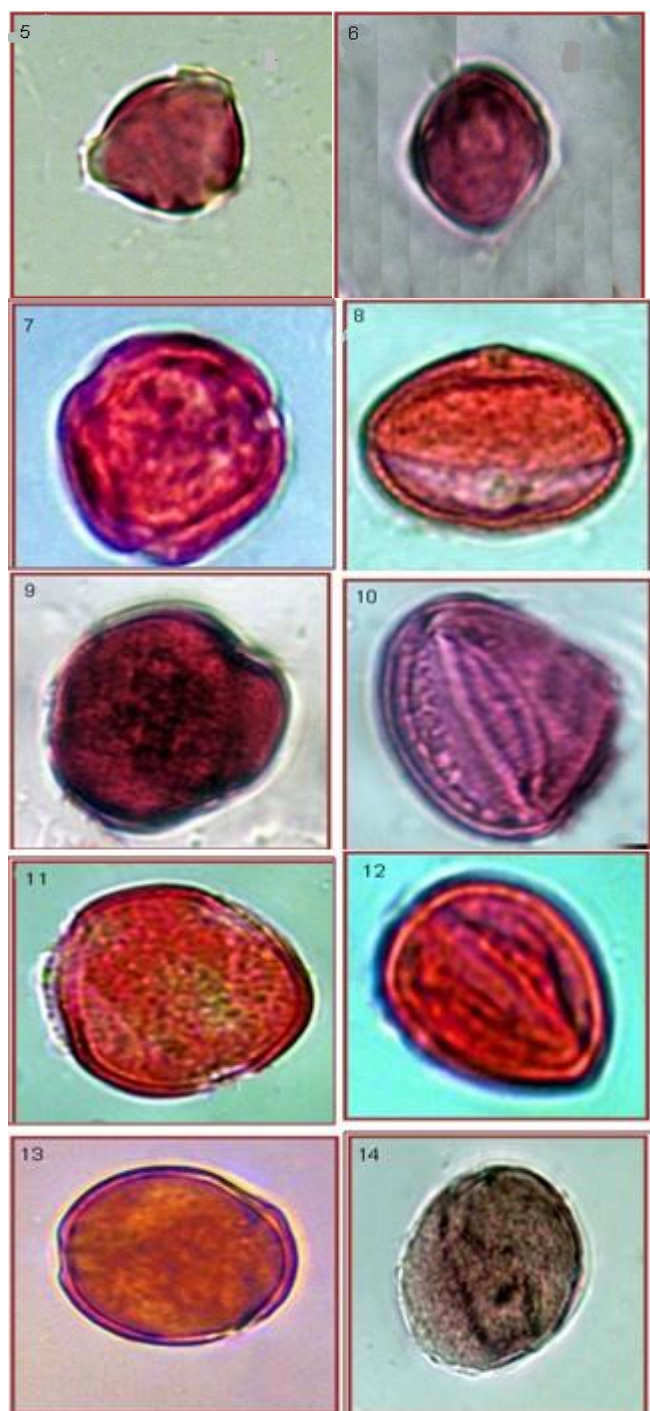


Fig. 2 Microphotograph of pollen. 5 & 6: Polar & Equitorial view of *Kickxia incana*, 7 & 8: Polar & Equitorial view of *Kickxia ramosissima*, 9 & 10: Polar & Equitorial view of *Veronica anagalis-aquatica*, 11 & 12: Polar & Equitorial view of *Veronica persica*, 13 & 14: Polar & Equitorial view of *Veronica melissifolia*

B. Key to the Pollen Types

1+Pollen grain Scabrate.....Group-I

- Pollen grain Psilate..... Group-II

1) Pollen Type: *Scrophularia* Type

Pollen class: Scabrate

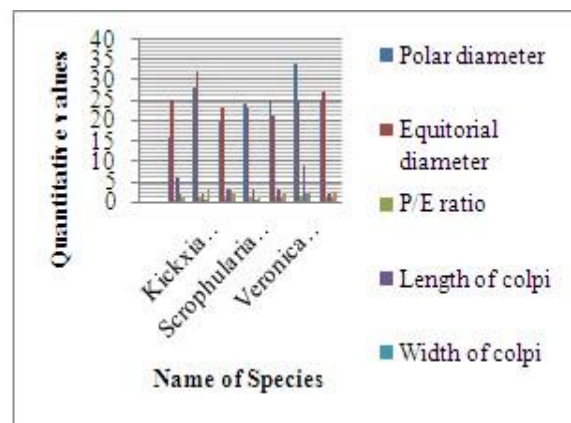


Fig. 3 Graphical representation of Quantitative results

Pollen shape: Circular- Spheroidal

P/E Ratio: 0.84-1.5

Aperture: Ora small

Colpi: Tricolpate

Exine: Exine thicker than intine or both are thin.

Measurement: Polar diameter 20-24 μm , Equitorial diameter 23 μm , Length of colpi 3 μm , Width of colpi 1 μm , Exine thickness 2 μm .

Species included: *Scrophularia robusta*, *Scrophularia scabiosaefolia* (Fig. 1).

2) Pollen Type: *Veronica* Type

Pollen class: Psilate

Pollen shape: Angular- Oblate/ Prolate

Exine: Exine and intine thin.

Measurement: Polar diameter 15-35 μm , Equitorial diameter 20-32 μm , Length of colpi 2.5-5 μm , Width of colpi 1-2 μm , Exine thickness 1-3 μm .

Species included: *Kickxia incana*, *kickxia ramosissima*, *Veronica anagalis-aquatica*, *Veronica melissifolia*, *Veronica persica* (Fig. 2).

IV. DISCUSSIONS

The results of the present work reveal the utility of the palynological characters for distinguishing the examined genera in Scrophulariaceae. The results clearly demonstrate that palynological characters are useful in recognition of taxa at specific level and agreed with all the previous researches which offering similar results concerning shape, apertures and sculpturing of pollen grains. Present study showed the usefulness of both qualitative and quantitative characters in taxonomic studies.

In the current study, an account was made, which was impound to the detailed palynological studies of 3 genera and 7 species of family Scrophulariaceae. Scrophulariaceae is a eurypalynous family [6] and most of its pollen are radially symmetrical, isopolar, oblate-spheroidal or sub-spheroidal or sub-prolate, tricolporate rarely tetracolporate [1].

TABLE 1 QUALITATIVE RESULTS

S #	Name of species	Shape in Polar view	Shape in Equatorial view	Type	Sculpturing
1	<i>Kickxia incana</i>	Circular	Oblate	Tricolpate	Psilate
2	<i>Kickxia ramosissima</i>	Angular	Oblate	Tricolpate	Psilate
3	<i>Scrophularia robusta</i>	Circular	Sub-oblate	Tricolpate	Scabrate
4	<i>Scrophularia scabiosaefolia</i>	Circular	Prolate-spheroidal	Tricolpate	Scabrate
5	<i>Veronica anagalis-aquatica</i>	Circular	Sub-prolate	Tricolpate	Psilate
6	<i>Veronica persica</i>	Angular	Oblate-spheroidal	Tricolpate	Psilate
7	<i>Veronica melissifolia</i>	Angular	Prolate	Tricolpate	Psilate

TABLE 2 QUANTITATIVE RESULTS

S #	Name of species	Polar diameter (µm)	Equatorial diameter (µm)	P/E ratio	Colpi length (µm)	Colpi width (µm)	Exine thickness (µm)
1	<i>Kickxia incana</i>	16.25 (15-17.5)	25 (30-35)	0.65	6.25 (5-7.5)	2.75	1.87
2	<i>Kickxia ramosissima</i>	28.75 (25-32.5)	32.5 (30-35)	0.88	2.5	0.625	3 (2.5-3.75)
3	<i>Scrophularia robusta</i>	20 (17.5-22.5)	23.75 (22.5-25)	0.84	3.75	3.75	2.12
4	<i>Scrophularia scabiosaefolia</i>	24.37 (20-30)	23.12 (22.5-23.75)	1.05	3.12	0.625	1.56 (1.25-1.87)
5	<i>Veronica anagalis-aquatica</i>	25 (15-32.5)	21 (19-23)	1.2	3	1	2.12
6	<i>Veronica melissifolia</i>	34.5 (27.5-42.5)	25	1.38	9.37 (8.75-10)	2.43 (2.75-2.12)	2.31 (2.12-2.5)
7	<i>Veronica persica</i>	25.83 (20-35)	27.5	0.93	2.5	1.25	2.56 (2.5-3.12)

The present study showed that there is a great diversity in pollen morphology of scrophulariaceae. The variation mostly found in size, shape, exine thickness and sculpturing. On the basis of sculpturing 2 types of pollen were recognized i.e., *Scrophularia* pollen type with scabrate sculpturing and *Veronica* pollen type with psilate sculpturing. Among these pollen classes a considerable variation of various pollen characters have been seen.

Reference [1] gave a rough idea that Scrophulariaceae do not show much pollen diversity. Pollen are mostly tricolporate. However sufficient variations are observed within the shape and exine thickness by which these genera can be separated. Our results regarding palynology of veronica are in accordance with the findings of [13], [9] that used colpus shape, colpus membrane together with three subtypes based on grain shape as distinguishing taxonomic characters in palynology of family Scrophulariaceae.

V. CONCLUSIONS

This data could provide sufficient information that supports the relation character between the species. The data derived from palynological characters of the examined species could also contribute to the taxonomy of the family scrophulariaceae. These studies will be supportive for assembling such work and identifying the flora according to their pollen morphology for broader circulation.

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