

**POLLEN MORPHOLOGY AS AN AID TO THE IDENTIFICATION
OF *SCORZONERA* (CICHORIEAE-COMPOSITAE)
FROM PAKISTAN**

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Abstract

Pollen morphological characters of 5 species of *Scorzonera* have been investigated from Pakistan by light microscopy. Pollen grains are usually radially symmetrical, isopolar, prolate-spheroidal in equatorial view, semi-angular to inter-semi-angular in polar view, trizonocolporate, non-lacunate and echinate. Pollen characters such as size, shape, colpi and exine thickness, and aperture type are found considerably important. *Scorzonera hondae* can be distinguished due to its sub-prolate shape whereas *S. picridioides* has oblate-spheroidal subprolate P/E ratio (0.95). The pollen spine character is a diagnostic character in this genus. *S. hondae* has the highest spine length (4.8 μm) and *S. laciniata* can be distinguished due to lowest spine length 2.5 μm . There is a great range of variation in exine thickness which has proved useful at specific level. On the basis of exine thickness 3 groups viz. Group I: *S. virgata*, *S. laciniata*, Group II: *S. picridioides*, Group III: *S. ammophila*, *S. hondae* are recognized.

Introduction

Palynology is the science of pollen and spore morphology. The knowledge of palynology can be used as an instrument of multiple research for systematic botany, paleobotany, paleoecology, pollen analysis, aeropalynology, criminology, allergy, stratigraphic correlation of oil bearing rocks and coalfields, drugs and improvement of honey. It is used as a means of tracing the history of cultivated cereals (Erdtman, 1954).

The family Compositae is a typical example of eupalynous group and most of its genera possess trizonocolporate pollen (Sachdeva & Malik, 1986). The pollen grains of Compositae have been characterized as basically helianthoid, spherical or slightly flattened, tricolporate, echinate with variation in size and colpus number (Wodehouse, 1930, 1935; Skvarla *et al.*, 1977). The family is one of the largest among the angiosperms with a world-wide distribution having over 20,000 species in over 1000 genera (Heywood *et al.*, 1977). Various workers viz., Selling (1948), Ikuse (1956), Nair (1965), Jain & Nanda (1966), Rao & Shukla (1975), Chopra & Nair (1965), Srivastava (1976), Feuer & Tomb (1977), Vincent & Norris (1989), Cillier (1991), Hodalova & Martonfi (1995), Nakajima & Monteiro (1995), Heslop-Harrison (1969), Stanley & Linsken (1974), Reitsma (1970), Mascarenhas (1975), Ferguson & Muller (1976), Manten (1970) published pollen morphology of Compositae on various lines in their respective flora. Skvarla *et al.*, (1977) have provided critical review of pollen morphology in relation to taxonomy and evolution. Nair (1972a,b) and Walker (1976) placed the highly advanced position of the Compositae in evolutionary hierarchy. The research work of (Bhutta, 1968, Malik, 1964, Siddiqua 1964, Zahur *et al.*, 1975-78; Meo *et al.*, 1988a b, 1989; Meo, 1999; Nasreen and Khan 1998; Mumtaz *et al.*, 2000; and Dawar *et al.*, 2002) have provided a commendable quantity of basic and applied information on palynology by

describing different species. The pollen morphology of *Scorzonera* have not been palynologically studied in Pakistan. Stewart (1977) has reported 22 species of *Scorzonera* from Pakistan. However, pollen morphology or description of these species is not available from Pakistan. Nair & Lawrence (1985) described pollen morphology of *Scorzonera divaricata* from India. Pollen morphology of some *Scorzonera* species of the family Compositae from Pakistan is presented herein.

Materials and Methods

The polliniferous material for the present investigation was obtained from the herbarium of Quaid-i-Azam University (ISL), Islamabad. Mature, unopened buds were removed from the herbium specimen. The pollen preparations have been made by the acetolysis methods for light microscopic study according to the procedure outlined by Erdtman (1966). Florets were treated in acetic acid for five minutes. Pollen grains were prepared for light microscopic study by mounting in glycerine jelly and observed under Nikon Labophot microscope using oil immersion. Polar axis (P), equatorial diameter (E), P/E ratio, exine thickness, shape in polar view, shape in equatorial view, spine length, number of spine rows between colpi and aperture type were examined. Permanent slides for pollen reference collection has been deposited in the Department of Biological Sciences, Quaid-i-Azam University, Islamabad, Pakistan.

The terminology used are after Erdtman (1952), Faegri & Iversen (1964), Kremp (1965), Huang, (1972), Punt *et al.*, (1994) and Walker & Doyle (1975).

Results

A list of specimens investigated is given in the Appendix-I. The palynological data using light microscopy have been recorded for each species (Table 1). Light microscopic micrographs of *Scorzonera* species are presented in Figs. 1-3. Quantitative and qualitative characters are tabulated from the taxa examined.

Size: The size of the pollen grains (polar-equatorial diameter excluding spines of the *Scorzonera* species ranges from 30.7-31.7 μm to 51.0-48.9 μm . There is great variation in the size of the pollen grain (Table 1).

Symmetry and shape: Pollen grains are radially symmetrical and isopolar. Outline is prolate-spheroidal in equatorial view and semi-angular to inter-semi-angular in polar view (Table 1).

Aperture: Pollen grains are trizonocolporate. The ora are circular. Aperture is non-lacunate in all the species examined (Table 1, Figs. 1-3).

Exine: Tectum is microperforate. Exine thickness ranges from 2.1-10.2 μm . Highest exine value (10.2 μm , 6.5 μm) are recorded in *S. ammophila* *S. hondae* and lowest values (2.1 μm , 2.4 μm) in *S. virgata* and *S. laciniata* with intermediate values (4.3 μm) in *S. picridioides*.

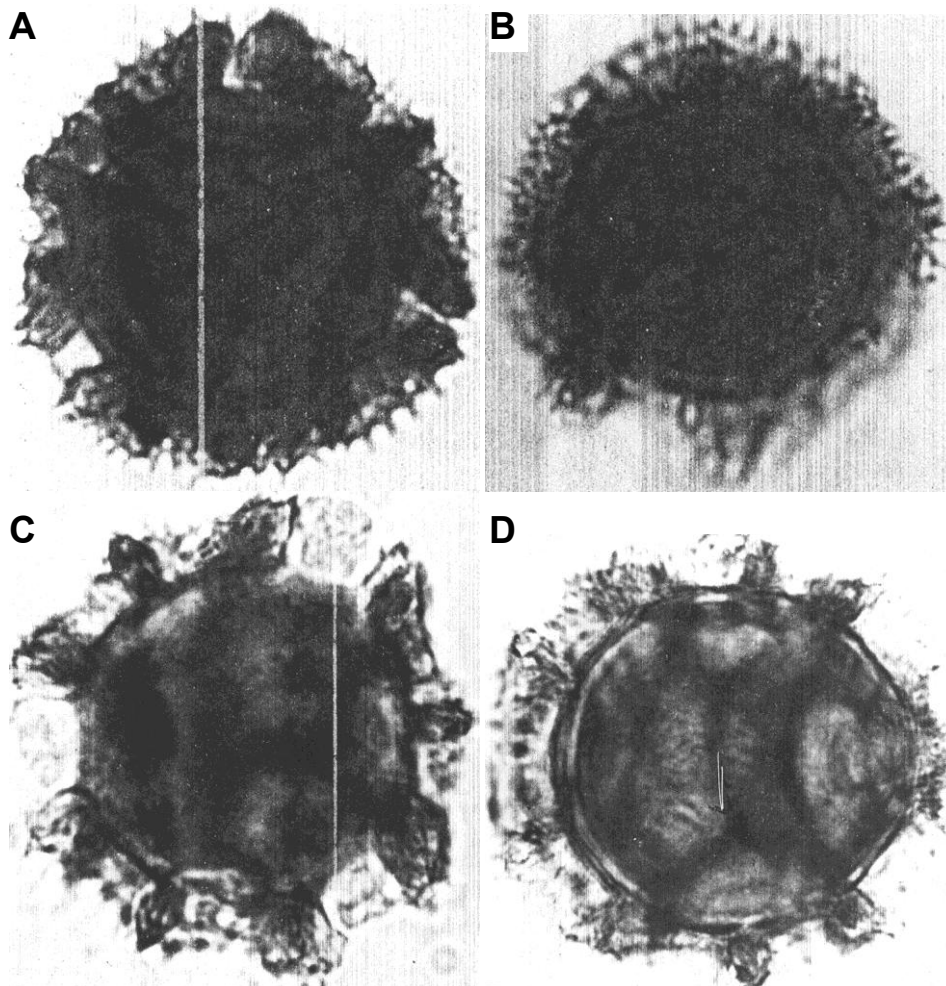


Fig. 1A-D. Light micrographs of pollen grains (X1000). *Scorzonera ammophila*: A, Polar view; B, Equatorial view. *S. hondae*: C, Polar view; D, Equatorial view.

Spine: Spines are conical with broad base. Spine length varies between 2.5 μm to 4.8 μm among the taxa. *S. hondae*, *S. ammophila* showed highest value. *S. virgata*, *S. picridioides* showed intermediate values. *S. laciniata* showed lowest value. The number of spine rows between colpi varies from 10-16. Highest number of spines found in *S. laciniata* and the lowest values are recorded in *S. ammophila*, *S. picridioides* respectively showing a great range of variation among the *Scorzonera* species. In *S. ammophila*, *S. hondae* spines surrounding the colpi are large while small spines are found between the large spines. Colpi are long in *S. virgata*, *S. hondae*, *S. picridioides* and *S. ammophila* while short colpi has been observed in *S. laciniata*. A key to the species of *Scorzonera* (Cichorieae) is presented for identification.

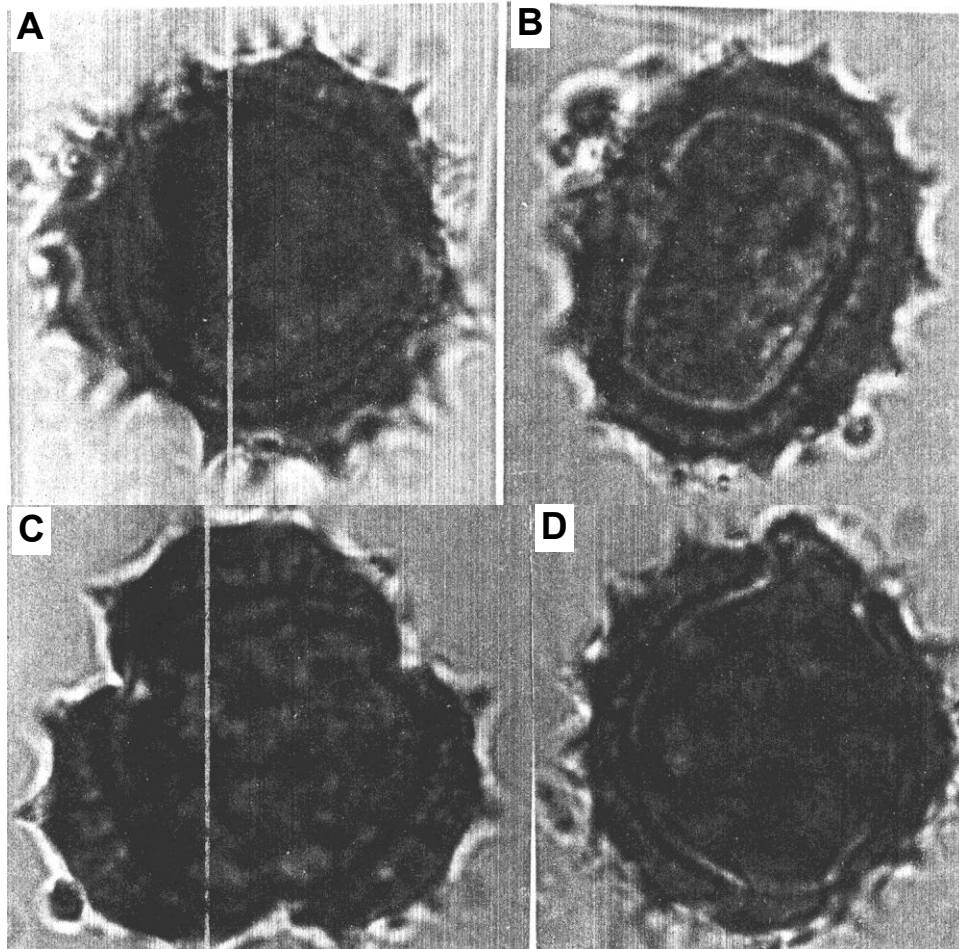


Fig. 2A-D. Light micrographs of pollen grains (X1000). *Scorzonera laciniata*: A, Polar view; B, Equatorial view. *S. picridioides*: C, Polar view; D, Equatorial view.

Key to the species of *Scorzonera*

1. P/E ratio 1.20 *Scorzonera honda*
1. P/E ratio 0.95-0.97 2
2. Pollen spine length 2.5µm *S. laciniata*
2. Pollen spine length 4.4-4.8µm 3
3. Pollen shape inter semi-angular in polar view *S. virgata*
3. Pollen shape semi-angular in polar view 4
4. Exine thickness 4.3 µm *S. picridioides*
4. Exine thickness 10.2 µm *S. ammophila*

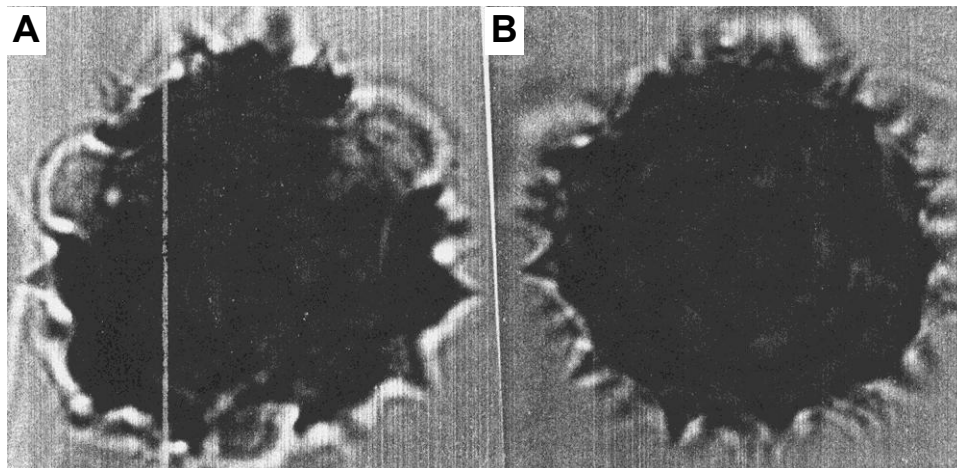


Fig. 3A-B. Light micrographs of pollen grains (X1000). *Scorzonera virgata*: A, Polar view; B, Equatorial view.

Discussion

Pollen morphology can be useful in supporting taxonomic suggestions (Clark *et al.*, 1980). Application of palynology is very diverse and multidisciplinary. However, the role of pollen morphology is of significance in taxonomic debate for classification. Pollen characters have proved useful for systematic purposes in various plant families. Tomsovic (1997) utilized pollen character as an additional information for systematic studies. Huang (1972) also used pollen characters for systematic purposes. In the genus *Scorzonera*, pollen shape, exine width, P/E ratio, spine length and number of spine rows between colpi have proved useful diagnostic characters to identify the species of this genus.

S. picridioides can be distinguished due to lowest P/E ratio 0.95 (Table I). The character of pollen spine is very characteristic in the family Compositae. Hall (1928) and Clark *et al.*, (1980) studied tribe Astereae (Compositae) and distinguished some genera on the basis of pollen size, spine length and number of spine rows between colpi. These characters indicate a potential for utilizing pollen characters in systematic studies in Astereae. There is a range of variation in spine length. *S. hondae* has the long spine (4.8 μm) while *S. laciniata* has short spine length (2.5 μm). Number of spine rows between colpi is also a variable character in this genus. *S. laciniata* and *S. virgata* can be placed in the same group due to similar number (12-16) while *S. hondae*, *S. ammophila* and *S. picridioides* can be placed in same group (10-12 or 14 number). It is concluded that the character of spines have great potential to distinguish further taxonomic group in this genus for further taxonomic studies of the genus *Scorzonera*. Tomb *et al.*, (1974) utilized spine length as an important diagnostic character in Cichorieae (Compositae) and reported that *Glyptopleureae marginata* showed a considerable reduction in spine height in comparison with *G. setulose* and other Stephanomeriinae. Dawar *et al.*, (2002) applied spine length along with other pollen characters and recognized three major pollen types in *Inula* L., and its allied genera. Keeley & Jones (1977) concluded that wide variety of distinctive pollen in *Vernonia* would help to understand the basic patterns within the

genus and developed a meaningful classification at the infrageneric level. Similarly Pinar & Dönmez (2000) recorded that spine cavities of pollen exine can be regarded as diagnostic characters in the genera of Compositae. Variation in exine thickness is also prominent in this genus. The character of exine thickness in this genus can be useful at specific level since almost all the species have different exine thickness (Table 1). *S. virgata* and *S. laciniata* can be palced in the same group and *S. picridioides* can be separately placed in the second group. However, *S. ammophila*, *S. hondae* can be placed in the third group due to highest value of exine thickness.

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