



Pollen Morphology of *Pyrethrum tatsiense* (Compositae) from Pakistan

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Abstract

Palynological studies of *Pyrethrum tatsiense* (Bur et French) hing (Compositae) was carried out with light microscope. Pollen grains are trizonocolporate, lacunate to non-lacunate and echinate. Pollen diameter in equatorial view is oblate-spheroidal, spheroidal to suboblate and circular to semi-angular in polar view. Colpi long and broad. Columella branched and well developed. Pollen characters such as polar and equatorial diameter, exine thickness, spine length and number of spine rows between colpi are taxonomically important. Pollen data of *Pyrethrum tatsiense* closely relates with *Chrysanthemum* and *Tanacetum* species.

Key words: Palynology, Compositae, *Pyrethrum tatsiense*, Pakistan

1. Introduction

Pyrethrum tatsiense (Bur et French) hing (Compositae) is an important medicinal plant and act as insecticide (Heywood, 1978). Stewart (1972) has placed it in *Chrysanthemum*. In symbolic Afghanicac No.2. Rechinger places *Pyrethrum* and *Tanacetum* under *Chrysanthumum*. Kitamura does the same (Stewart, 1972). The family Compositae is one of the largest among the angiosperms with a world-wide distribution and comprises of \pm 1535 genera and C.2300 species distributed in 3 sub-families and 17 tribes (Ghafoor, 2002). It is a cosmopolitan family, which in term of size is the largest in Pakistan, comprising of C.650 species distributed in tribes including those in cultivation (Nasir and Rafiq, 1995; Ghafoor, 2002). It includes perennial, annual or biennial herbs. The pollen grains of Compositae are helianthoid, spherical or slightly flattened, mainly tricolporate, echinate with variation in size and colpus number (Wodehouse, 1930, 1935; Skvarla *et al.*, 1977). The study of pollen morphology, an effective aid to plant taxonomy and phynology has been demonstrated through a large volume of publications (Erdtman, 1952, Ferguson and Muller, 1976; Nair, 1979). Stix (1960) and Skvarla *et al.*, (1977) have added considerably to establish to uniqueness of exine architecture in the family, providing useful information towards the taxonomy and phylogeny of the group. A critical review of the pollen morphology in relation to taxonomy and evolution of the family has been provided by Skvarla *et al.*, (1977) and Heywood *et al.*, (1977). The analytical studies of pollen morphology in relation to taxonomy and phylogeny of angiosperms (Nair, 1979; Walker, 1976) have served to indicate the highly advanced position of Compositae in the evolutionary hierarchy of dicotyledonous angiosperms, in conformity with the conclusion of systematists and phylogeneticists alike (Nair and Lawrence, 1985). Compositae is unique in its morphological patterns, both of the vegetative and floral parts, pollination ecology, chemical constitution and phytogeography and pollen and provide a replica of uniqueness of the taxa of Compositae. The family is remarkable in many aspects. It has the maximum number of species, its worldwide distribution, its variety of forms and its very effective mechanism for cross-pollination. (Dutta, 1974). Since there is no reports on the pollen morphology of the genus *Pyrethrum tatsiense* from our area, the present paper gives an account of palynological information for pollen flora of Pakistan.

2. Materials and methods

The polliniferous material for present investigation has been obtained from herbarium of Quaid-i-Azam University (ISL), Islamabad. The slides were prepared by acetolysis method (Erdtman, 1952). Florets were treated for

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five minutes in acetic acid. Pollen grains for LM (light microscopy) were mounted in glycerin jelly. Polar axis, equatorial diameter, P/E ratio, exine thickness, spine length, number of spine rows between colpi, shape in polar and equatorial view and aperture type were recorded. The data was statistically analyzed. The terminology is in accordance with Erdtman (1952), Huang (1972) and Punt *et al.*, (1994).

Specimens investigated: Chitral District: Najdar Hills, 2288 Muqarrab Shah and Dilawar; Lashtabrum Hills, 2326, Muqarrab Shah *et al.*

3. Results

Pollen morphology can be useful in supporting taxonomic suggestions (Clark *et al.*, 1980). The role of pollen morphology is of significance in taxonomic debate for classification. Pollen grains have an important part in the modern issues of plant taxonomy (Bashir and Khan, 2003). Huang (1972), Tonnsovic (1997) used pollen characters as an additional information for systematic purpose. Clark *et al.*, (1980) distinguished some genera on the basis of pollen characters in *Astereae* (Compositae). Mbagwu *et al.*, (2008) used pollen characters for the establishment of interspecies relations among five species of Asteraceae. They reported that the differences and similarities in pollen morphology are significant and could be exploited for biosystematic purpose. Similarly, Edeoga and Gomina (2001) and Mbagwu and Edeoga (2006) have utilized pollen attributes to establish probably evidence of relationships among certain groups of flowering plants in Nigeria. The pollen data of *Pyrethrum tatsiense* is in close affinity with *Chrysanthemum* and *Tanacetum* as detailed below.

Size: Pollen grain size (polar – equatorial diameter, spines excluded) ranged from 28.3 (26.3 μ m – 30.0 μ m) to 25.9 (25.0 μ m – 27.5 μ m). There is variation between polar and equatorial diameter. P/E ratio is 1.09. Meo (2005), Meo and Khan (2006) observed similar sized pollen in *Chrysanthemum parthenium* (Compositae) while Zahur *et al.*, (1978) in the same way reported pollen size as 27(30) 33 μ in *C. indicum* which corroborate with present findings. Wodehouse (1965) believed that *Chrysanthemum murifolium* is an admixture of *C. indicum* due to closeness in size range. Similarly, Meo (2005) recorded similar type of pollen size in 4 species of *Tanacetum*.

Symmetry and Shape: The pollen grains are radially symmetrical and isopolar. Equatorial diameter is oblate – spheroidal, spheroidal to suboblate while polar view is circular to semi-angular.

Aperture type: Pollen grains are trizonocolporate. Aperture type is lacunate to non-lacunate. Apertural membrane is echinate. Colpi long and broad (Figure 1 A).

Exine: Exine is tectate. Exine thickness is 5.8 (5.0 μ m – 7.0 μ m). Our findings correspond with Meo (2005), Meo and Khan (2006) who recorded 5.8 μ m thick exine in *Chrysanthemum segatum* Meo (2005) observed 6.0 μ m thick exine in *Tanacetum tomentosum*. Sexine is prominent and much thicker than exine. Branch and well developed columella. Meo and Khan (2006) described somewhat aggregated and granulated columella in seven *Chrysanthemum* species which slightly differ with present findings. Exine and intine well differentiated (Figure 1 B).

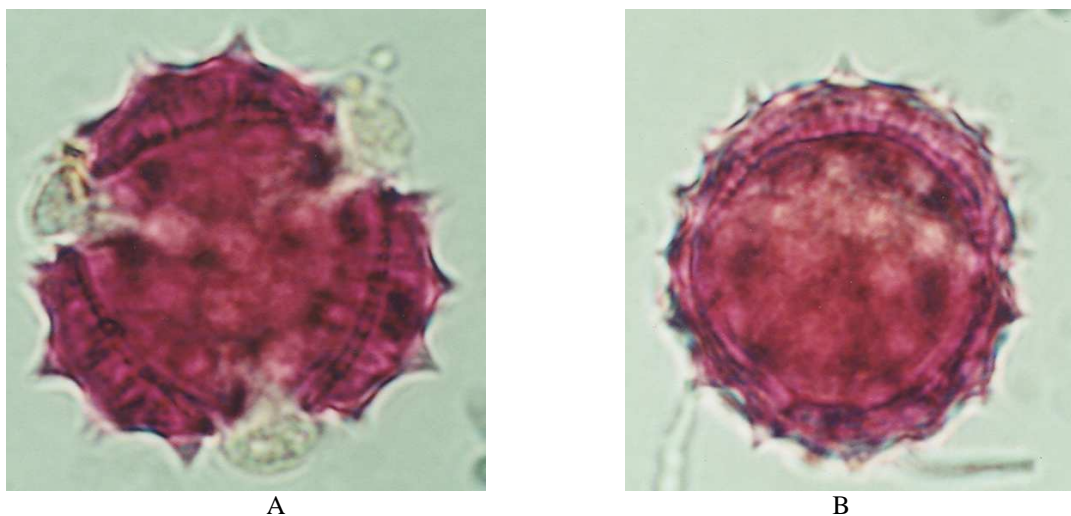


Figure 1. Light micrographs of pollen grains of *Pyrethrum tatsiense* (x100) (A:Polar view; B:Equatorial view)

Spines: Short and thick spines in mesocolpium region. Spines flattened at the base and abruptly pointed tip. Spine length value is 4.8 (4.0 μ m – 6.0 μ m). Number of spine rows between colpi varied from 3 – 4. Meo (2005), Meo and

Khan (2006) noted 3 – 4 number of spine rows between colpi in *Chrysanthemum tibeticum* which relates with present findings. Furthermore, Meo (2005) recorded 3 – 4 number of spines row between colpi in 3 species of *Tanacetum* viz *T. nubigenum*, *T. robustum*, *T. senecionis* which correspond with present findings.

4. Conclusions

It is concluded from the available pollen data that *Pyrethrum tatsiense* who tribe is not known relates with *Chrysanthemum* species (Compositae – Anthemideae). Stewart (1972) on the basis of morphological data placed *Pyrethrum* and *Tanacetum* under *Chrysanthemum*. It is recommended that SEM (Scanning electron microscopy) of the pollen could be approached for further studies as light microscopy could not explain exine pattern.

References

- Bashir, S. and Khan, M.A. 2003. Pollen morphology as an aid to the identification of Medicinal Plants: *Trianthema portulacastrum* L., *Boerhaavia procumbens* Banks. Ex Roxb. and *Alternanthera pungens* kunth, J. Hamdard Medicus, XIV1 :7-10
- Clark, W.D., Brown, G.K. and Mays, R.A. 1980. Pollen morphology of *Haplopappus* and related genera (Compositae – Astereae). Amer. J. Bot., 67 (9): 1391 – 1393.
- Dutta, A.C. 1974. Botany for Degree Students. Calcutta, Oxford University Press, Delhi, Bombay, Madras.
- Edeoga, H.O. and Gomina, A. 2001. Nutritional values of some non-conventional leafy vegetables of Nigeria. J. Econ. Tax. Bot., 20: 7 – 15.
- Erdtman, G. 1952. Pollen morphology and Plant Taxonomy – Angiosperm (An introduction to Palynology 1: Almqvist and Wiksell. Stockholm.
- Erdtman, G. 1954. An introduction to pollen analysis. Stockholm : Almqvist and Wiksell.
- Ferguson, I.K. and Muller, J. 1976. The evolutionary significance of the exine. Linnean Soc. Symp. No.1. Academic Press, New York.
- Ghafoor, A. 2002. Asteraceae – Anthemideae in Flora of Pakistan (edit. Ali, S.I. & Qaiser, M. No. 207. Jointly published by Department of Botany, University of Karachi and Missouri Botanical Press, Missouri Botanical Garden, St. Louis, Missouri, U.S.A.
- Heywood, V.H. 1978. Flowering Plants of the World. Oxford Uni. Press, Oxford, London, Melbourne.
- Heywood, V.H., Harborne, J.B. and Turner, B.L. 1977. The Biology and Chemistry of the Compositae Vol.1. Academic Press, London & New York.
- Huang, T. 1972. Pollen flora of Taiwan. National Taiwan University Botany Department Press.
- Mbagwu, F.N. and Edeoga, H.O. 2006. Palynological studies on some Nigerian species of *Vigna savi*. J. Biol. Sci., 6: 1122 – 1125.
- Mbagwu, F.N., Chime, E.G. and Unamba, C.I.N. 2008. Palynological studies of five species of Asteraceae. J. Pl. Sci. 3(1): 126 – 129.
- Meo, A.A. 2005. Palynological studies of selected genera of the tribes of Asteraceae from Pakistan. Ph.D. Thesis, Deptt. Bio. Sci., Quaid-i-Azam University, Islamabad.
- Meo, A.A. and Khan, M.A. 2006. Pollen morphology as an aid to the identification of *Chrysanthemum* species (Compositae – Anthemideae) from Pakistan. Pak. J. Bot., 38(1): 29 – 41.
- Nair, P.K.K. 1979. The palynological basis for the triphyletic theory of Angiosperms. Grana, 18: 141 – 144.
- Nair, P.K.K. and Lawrence, R. 1985. Pollen morphology of Indian Compositae. Adv. In Pollen Spore Res. 2: 106 – 201.
- Nasir, J. J. and Rafiq, R.A. 1995. Wild flowers of Pakistan. Oxford Univ. Press.
- Punt, W.S. Blackmore, S. Nilsson and le Thomas, A. 1994. Glossary of Pollen and Spore Terminology. LPP foundation, Utrecht, LPP contribution series No.1.
- Skvarla, J.J., Pastel, V.C. and Tomb, A.S. 1977. Pollen morphology in the Compositae and in related families. In: Biolgy and Chemistry of the Compositae. (Eds.): V.H. Heywood, J.B. Harbrone, H.L. Turner. Academic Press, London.
- Stewart, R.A. 1972. An annotated catalogue of vascular plants of West Pakistan. Fakhri Printing Press Karachi.
- Stix, E. 1960. Pollen morphologische untersuchungen and Compositae. Grana Palynol., 2: 41 – 114.
- Tomsovic, P. 1997. Some palynological observations on the genus *Echinops* (Asteraceae) and their taxonomic implications. Preslia Praha, 69: 31 – 33.
- Walker, J.W. 1976. Evolutionary significance of exine in pollen of primitive Angiosperms: In: The Evolutionary Significance of the Exine (Ed.) I.K. Ferguson and J. Muller, Academic Press, London, pp. 251 – 308.
- Wodehouse, R.P. 1930. Pollen grains in identification and classification of plant *V. haplopappus* and other Asterae: the origin of their furrow configuration. Bull. Torrey Bot. Club, 57: 21 – 46.
- Wodehouse, R.P. 1935-1965. Pollen grains. McGraw Hill, New York.
- Zahur, M.S., Bhutta, A.A., and Ashraf, M. 1978. (a) Palynological studies of the plants growing in Punjab. (b) Seasonal variation in the frequency of air-borne pollen and spores which causes allergies and asthma with special reference to Central Punjab. Pak. Sci. Foundation. Final Research report.

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