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PALYNOLOGICAL STUDIES OF SOME WEEDS OF ASTERACEAE FROM PAKISTAN

Akbar Ali Meo and Mir Ajab Khan[1]

ABSTRACT

The paper is an account of pollen morphology of the some Pakistani weeds of Asteraceae by light microscopy. Pollen grains are usually isopolar, symmetrical, trionocolporate, non-lacunate and echinate in the studied species. The major palynological characters which proved useful to distinguish all the taxa of the Pakistani weeds are polar and equatorial diameter, spine length, number of spine rows between Colpi, exine width, pollen shape, P/E ratio, shape in polar and equatorial view, pollen class and aperture type. Exine thickness varies considerably among the weeds studied. This variation would prove to be a taxonomic criteria in the classification of weeds.

Key words: Weeds, pollen morphology, Asteraceae, Palynnological.

INTRODUCTION

Palynology is the science of pollen and spore morphology and has found application in plant taxonomy, plant geography, climatology, aeropalynology, criminology, allergy, stratigraphic correlation of oil bearing rocks and coal field, phar macopalynology. Pollen analysis has also been tried as a means of tracing the history of cultivated cereals. This analysis helps in qualitative analysis of drug powder and in correct identification of drug. The term palynology includes all the work dealing with both fossil and living pollens and spores.

In Pakistan, the earliest reference dates back to early sixties. Several workers like Malik et al., 1964; Bhutta, 1968; Ashraf 1973; Zahur et al., 78; Meo et al., 1988 (ab); 1989; 1999; Nasreen and Khan 1998; Mumtaz et al., 2000; Dawar et al., 2002; Parveen 2002 and Khan, 2003 have provided a commendable quantity of basic and applied information in palynology. Moreover, at international level there has been an explosion of information published on many aspects of pollen and spores. Compositae is a eurypalynous family (Erdtman, 1952) and most of its genera posses zonocolporate pollen (Sachdeva and Malik, 1986). Wodehouse (1926) published some aspects of pollen morphology in Compositae. The pollen grains of Compositae are tricolporate, flattened or spherical and echinate with variation in size and colpus number (Wodehouse, 1935). The pollen of Astereae, Inuleae, Heliantheae, and a taxa of Anthemideae, Cynareae and Senecioneae revealed spinsose exine while those of Vernonieae and Cichorieae possess lophate or spinolose–lophate pattern (Sachdeva and Malik, 1986). Compositae is highly evolved family among angiosperms. It is generally regarded as occupying the highest position in plant kingdom due to its great preponderance and cosmopolitan range. About 206 weed species important to human being have been recorded on a world wise scale. Forty three percent of these belong to only four families; the Gramineae and Compositae

1 Department of Biological Sciences, Quaid-e-Azam University, Islamabad – Pakistan.
E-mail:mirajabdr@yahoo.com

alone contain no fewer than 76 weed species. The weeds of this family are wide-spread in Pakistan. Khalid (1995) taxonomically described 40 species of weeds of Compositae in Pakistan.

Materials and Methods

The florets from mature capitula were obtained from the herbarium of Quaid-e-Azam University, Islamabad (ISL). Mature, unopened buds were removed from the herbarium specimen. The grains were acetolysed for light microscopy (LM) by using the conventional procedure of Erdtman (1966) and slides were prepared by using 1% safranin mixed in glycerin jelly (commonly called Gel Safranin). Florists were treated in acetic acid for five minutes. Pollen grains were mounted in glycerin jelly and observed under Nikon Labophot microscope using oil immersion. Following measurements were undertaken (1) Polar diameter (2) Equatorial diameter (3) P/E ratio (Polar/Equatorial diameter) (4) Exine thickness (5) Spine length (6) Number of spine rows between colpi (7) Shape in polar view (8) Shape in equatorial view (9) Sculpturing (10) Aperture type.

The terminology for pollen description was adopted from Erdtman (1952), Huang (1972), Traverse (1988) and Moore *et al.* (1991).

Results And Discussion

Table-1 summaries the light microscopic measurements of pollen grains from the examined taxa.

Size: The size of the pollen grain (polar–equatorial diameter excluding spines) ranged from 22.5 – 22.7µm to 31.3 – 33.3µm. There is great variation in the size of the pollen grain. *Gamolepis tagetes* and *Syndrella nodiflora* have almost similar sized pollen while rest of the species are variable. P/E ratio ranged from 0.94 to 1.30.

Symmetry and Shape: The pollen grain are radically symmetrical, isopolar. Pollen shape in equatorial view is prolate, spheroidal, prolate–spheroidal to oblate–spheroidal. Pollen shape in polar view is circular, semi-angular to semi- lobate.

Aperture: The pollen grains are trionocolporate in all the species except *S. nodiflora* where pollen grains are tetrazono-colporate. Aperture shape is lacunate in *Artemisica indica* and *S. nodiflora* and non-lacunate in rest of the species. Apertural membrane is echinate except *Centaurea concifolia* and *A. indica* where sculpturing is scabrate.

Spine: There is great variation in the spines in these genera. In *A. indica* and *C. concifolia* spines are absent while in rest of all the species spines are present. Spine length ranged from 2.1 to 5.7µm among the taxon. The number of spine rows between colpi ranged from 4 to 8 among the taxon.

Exine: Exine has proved a useful distinguishing character. Exine thickness ranged from 2.0 to 6.4 µm among the species.

Pollen morphological characters have proved useful to improve the classification of the taxa of the family Compositae. These characters play a key role in taxonomic debate. Tomsovic (1997) utilized pollen character as an additional information for systematic studies. He noted that species of *Echinops* are similar in their main characters. However, one of them is an exception *E. strigosus* L. distributed in Mediterranean. On the basis of all available characters he considered this species as a separate genus *Psectra* containing one species only.

The present study showed that maximum pollen size 31.3 μm is recorded in *Launia capitata* in polar view and the minimum pollen size 22.5μm is observed in *A.adnata*. Similarly the maximum pollen size in equatorial view is 33.3 in *L. capitata* while the minimum size of 22.7 μm in *Anaphalis adnata*.

P/E ratio plays an important role in Palynological debate. The genera like *L. capitata, C. concifolia*, and *A. adnata* showed lowest P/E ratio (0.94–0.99). *Aster falconeri, Pterothica falconeri* and *A. indica* possessed highest P/E ratios (1.11–1.30). Intermediate value of P/E ratio (1.02–1.08) was recorded in *C. flexurea, G. tagetes* and *S. nodiflora*. Exine thickness recorded highest (5.4 – 6.4μm) value in *A. adnata, L. capitata, A. indica* and *Pterothica falconeri* while the lowest value of exine thickness (2.0 – 2.2) was recorded in *G. tagetes* and *A. falconeri*. The intermediate values of exine thickness (3.2–4.6 μm) has been observed in genera like *C. flexurea, C. concifolia* and *S. nodiflora*. These results correspond with Dawar *et al.* (2002) who utilized exine thickness for systematic purpose in *Inula* (Compositae).

The character of pollen spine is of significance at specific and generic level in classification of family Compositae. Spines and spineless pollen are important in Compositae in the present study. *C. concifolia* and *A. indica* are spineless genera while all other genera have spinate pollen showing that the feature of spine is useful at specific level. These finding are in agreement with that of Keeley and Jones (1977) who reported spinate and spineless pollen in some *Vernonia* species and observed that both pollen and vegetative character indicate a divergence due to independent line of evolution in isolation. Wodehouse (1935) outlined the principles of morphological evolution of spine form in Compositae and suggested the reduction series from long to minute spines. The peculiar spine character represents a climax in the apertural evolution. The species with spinate pollen is a primitive character as compared to the species with spineless pollen which is considered as primitive feature due to reduction of spines within the family Compositae.

Spine length ranged from 2.1 to 5.7μm among the genera. Maximum spine length values (5.7μm) is observed in *S. nodiflora* and the minimum values (2.1 – 2.9μm) have been recorded in *P. falconeri, A. falconeri, Crepis flexurea, L. capitata*. Intermediate values (3.3 – 4.1μm) have been recorded in *Gamolepis tagetes, A. adnata*. In a similar fashion, the number of spine rows between colpi ranged from 4 – 8. Highest number of spine rows (7-8) have been observed in *A. falconeri* and lowest number (4-5) recorded in *A. adnata*.

The rest of the genera showed intermediate values. These results are in accordance with the findings of Clark *et al.* (1980), Tomb *et al.* (1974) and Dawar *et al.* (2002) who used spine length and number of spine rows between colpi in distinguishing taxonomic and pollen group in Astereae, Cichorieae and *Inula* in family Compositae.

Table-1. Summery of Pollen measurements, shapes and sculpturing features in some Asteraceae Weeds.

Taxon	Pole.dia. (µm)	Eq.dia. (µm)	P/E Ratio	Exine width (µm)	Spine length (µm)	No.of spine rows bet.colpi	Shape in Polar view	Shape in Equatorial view	Aperture type	Pollen class	Sculpturing
Pterothica falconeri	25.8 (25-26)	23.2 (21-25)	1.11	6.4 (6-7)	2.1 (1.5-2.5)	5-6	Semi-lobate	Spheroidal	Non-lacunate	Tri	Echinate
Centaurea concifolia	25.7 (22.5-27.5)	26.6 25-29)	0.97	4.3 (3.5-5)	Spines absent	Spine absent	Circular	Oblate-spheroidal	Non-lacunate	Tri	Scabrate
Aster falconeri	27.4 (25-290	30.4 (26-35)	1.17	2.2 (1.5- 2.5)	2.3 (1.5-3)	7-8	Circular	Subprolate	Non-lacunate	Tri	Echinate
Crepis flexurea	29.3 (27.5-30)	28.6 (25-31.5)	1.02	3.2 (2.5-4)	2.9 (2.5-3.5)	5-8	Semi-lobate	Prolate	Non-lacunate	Tri	Echinate
Launia capitata	31.3 (29-320	33.3 (31.5-35.5)	0.94	5.5 (4-7.5)	2.3 (1-4)	4-7	Semi-lobate	Prolate	Non-lacunate	Tri	Echinate
Anaphalis adnata	22.5 (21-24)	22.7 (21-24)	0.99	5 4 (5-6)	4.1 (2 5-5)	4-5	Circular	Spheroidal	Non-lacunate	Tri	Echinate
Artemisica indica	29.8 (26.5-32.5)	23.0 (20-27.5)	1.30	5.8 (5-6.5)	Spines absent	Spines absent	Semi-angular	Subprolate	Lacunate	Tri	Scabrate
Gamolepis tagetes	26.2 (24-27.5)	24.7 (22.5-26)	1.06	2.0 (1.5-2.5)	3.5 (2.5-4)	6-7	Semi-angular	Prolate-spheroidal	Non-lacunate	Tri	Echinate
Syndrella nodiflora	28.0 (26-30)	26.0 (24-27.5)	108	4.6 (4-5)	5.7 (5-6.5)	4-6	Circular	Prolate-spheroidal	Lacunate	Tri	Echinate

Pol.Polar Eq: Equitorial Dia.= Diameter Tri.=Trizonocolporate Tet.= Tetrazonocolporate

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REFERENCES CITED

Ashraf, M. 1973. Pollen morphology of certain medicinal plants of Punjab Plains. M.Sc. Thesis, Pb. Univ., Lahore.

Bhutta, A.A, 1968. Palynological studies of pollen and spores. Horion 104749.

Clark, W.D. G.K.Brown and R.A.Mayes. 1980. Pollen morphology of *Haplopappus* and related genera (Compositae – Astereae). Amer. J. Bot., 67: 1391 – 1393.

Dawar, R., M.Qaiser and A.Perveen. 2002. Pollen morphology of *Inula* L. (S. STR.) and allied genera (Inuleae-Compositae) from Pakistan and Kashmir, Pak. J. Bot., 34(1): 9-22.

Erdtman, G. 1952. Pollen morphology and Plant Taxonomy-Angiosperm (An Introduction to Palynology. Vol.1). Almqvist and Wiksell. Stockholm.

Erdtman, G. 1966. Handbook of Palynology, Munksgaard, Copenhagen. pp. 21-77.

Huang, T. 1972. Pollen flora of Taiwan, National Taiwan University Botany Department Press.

Keeley, S.C. and S.B.Jones. 1977. Taxonomical implications of external pollen morphology to *Vernonia* (Compositae) in the West Indies. Amer. J. Bot. 64: 576-584.

Khalid, S. 1995. Weeds of Pakistan – Compositae, NARC, Islamabad.

Khan, R. 2003. Studies of the Pollen morphology of the genus Alyssum (Brassicaceae) from Pakistan. Pak. J. Bot., 35(1): 7-12.

Malik, N.A., A. Saddiqa, A. Rehman and A.J.Ahmad. 1964. Pollen morphology of some Pakistani Medicinal Plants. Pak. J. Sci. Ind. Res., 7: 130-136.

Meo, A.A., H.M.I.Hafiz, F. Baig, and N.A. Baig. 1988a. Studies of Pollen morphology of some Gramineous (Poaceae) species. Sarhad J. of Agric., 4: 99 – 103.

Meo, A.A., H.M.I.Hafiz, F. Baig, and N.A. Baig. 1988b. Pollen morphology and Systematic relationships among Graminaceous (Poaceae) species. J. Pure and Applied Sci., 7(2): 15-20.

Meo, A.A., H.M.I Hafiz, and N.A.Baig. 1989. Pollen grain description of 13-non-allergic and 4-allergic Graminaceous (Poaceae) species. J. Pure and Applied Sci., 8(2): 19-26.

Meo, A.A. 1999. Impact of Pollen and intergeneric crosses between Graminaceous (Poaceae) plants. Pak. J. Biological Sci., 2(3): 809 – 812.

Meo, A.A. and M.A.Khan. 2003. Diversity of Pollen morphology in the family Compositae (Asteraceae) from northern areas of Pakistan. International Symposium on Biodiversity in Northern Areas of Pakistan. Sept. 8-10, 2003.

Moore, P.D., J.A.Webb, J.A. and M.F.Collision. 1991. Pollen analysis, second edition, Oxford. Black Well Scientific Publications. London Edinburgh Boston, Melbourne, Paris, Berlin, Vienna.

Mumtaz, A.S., M.A.Khan, and T.Akhtar. 2000. Palynological Studies of *Artemisia* L. from Murree and Hazara. Pak. J. Forestry 50(1-2): 57-65.

Nasreen, U. and M.A.Khan. 1998. Palynological Studies of *Matricaria chamomilla* L.(Babuna) and its related genera. Hamdard Medicus 4: 94-97.

Perveen, A and M.Qaiser. 2002. Pollen Flora of Pakistan – XXXIV. Sapotaceae. Pak. J. Bot., 34(3): 225 – 228.

Sachdeva, S.K. and C.P. Malik. 1986. Experimental Plant Taxonomy. Kalyani Publications, New Delhi.

Tomsovic. 1997. Some Palynological observations on the genus *Echinops* (Asteraceae) and their taxonomic implications. Preslia Praha, 69: 31-33.

Tomb, S.A., D.A.Larson, and J.J.Skvarla. 1974. Pollen morphology and detailed structure of family Compositae tribe Cichoriea I. Subtribe Stephanomesiinae. Amer. J. Bot. 61: 486 – 498.

Traverse, A. 1988. Paleopalynology. Department of Geo-sciences, College of Earth and Mineral Sciences. The Pennsylvania State University, Boston Unwin Hyman, London, Sydney, Wellington.

Wodehouse, R.P. 1926. Pollen grain morphology in the classification of Anthemideae. Bull. Torrey Bot. Club 53: 479 – 485.

Wodehouse, R.P. 1935. Pollen grains. McGraw Hill. New York.

Zahur, M.S., A. A. Bhutta and M. Ashraf. 1978. Palynological studies of the Plants growing in Punjab. Seasonal variation in the frequencies of air-borne pollen and spores which cause allergies and asthma with special reference to "Central Punjab". Pakistan Science Foundation (PSF). Final Research Report.