POLLEN MORPHOLOGY OF SOME MEMBERS OF FAMILY COMPOSITAE FROM SINDH, PAKISTAN

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Abstract

Pollen morphological study of four tribes of the family Compositae viz: *Astereae, Anthemideae, Ambrosieae* and *Cichorieae,* occurring in Sindh region, reveal variations in exine sculpturing. Echinolophate, the advanced exine surface pattern is present in the pollen grains of the tribe *Cichorieae,* while echinate pollen were found in the tribe *Astereae,* vestigial spines in the *Ambrosieae* and echinate, vestigial to altogether non- echinate in the tribe *Anthemideae.* Almost all species reveal crassitegillate, crass-exinous and baculiferous sexines except in *Launaea, Lactuca* and *Sonchus* where no typical baculation is observed. Pollen grains with compound apertures show the colpus–like ectoaperture while the endoaperture is either "circular" or "lalongate" with smooth membrane.

Introduction

The family Compositae, the largest among the flowering plants, consisting of 950 genera with 19,000 species, is cosmopoliton, growing in nearly every conceivable habitat. The members of this family are mostly herbs but a small number of genera are shrubs and occasionally trees. The genus *Senecio* with about 15,00 species, exhibits all possible habitat and range from herbs to small sized trees.

Economically also the family Compositae is fairly well known. A number of important drugs are extracted from various members of this family: for example, anthelminitics and haemostatic, drugs used in pectoral complaints, night blindness and inflamation of eyes and intestinal disorders are some of the well known ones. An insecticide named as "Pyrethrum" is obtained from dried flower heads of *Chrysanthemum*

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cinerariefolium. A number of species are used for food and ornamental purposes. However, some serious and harmful ailments such as hay-fever, sinusitis and skin rashes are also caused by the pollen of various species belonging to this family.

Erdtman (1952, 1954,and 1966) has worked on pollen morphology of approximately 400 species belonging to 155 genera of this family. His study was based on preliminary survey of pollen characters on optical microscope. Hyde and Adams (1958) described in detail the pollen morphology of various species of different genera, viz: *Achillea millefolium* L., *Ambrosia artemisifolia* L., *Artemisia vulgaris* L., *Aster novi-belgii* L., *Cardus tenuiflours* Curt, *Centaurea nigra* L., ssp. *nemoralis* (Jord.) Gugl., *Senecio jacobaea* L., *Taraxacum officinale* Wiggers, and *Tusilago farfara* L., on optical microscope. Wodehouse (1935) has described in detail the pollen morophology of the tribes *Cichorieae, Astereae, Anthemideae* and *Ambrosieae*. However most of the species described by him under these tribes do not occur in this region.

Tomb (1975) studied the pollen morphology of 50 genera of the tribe Lactuceae (Cichorieae of Wodehouse 1935, Erdtman 1966) on optical microscope as well as on SEM and TEM. He suggested the evolutionary trend of echinolophate pollen from echinate reduction in size in some advanced genera viz: *Lygodesmia* and *Stephanomeria* Tomb 1970, and in the length of spine and internal complexity in certain advanced taxa viz: *Scolymus grandiflorus*, *Tolpis virgata*, *Leontodon autumnalis*, *Launaea acanthoclada*, *Lactuca lessertiana*, *Glyptopleura marginata*.

The authors have extanded the work and have described in detail the pollen morphology of 20 species of four tribes of the family Compositae, occurring in the province of Sindh.

Material and Method

Polleniferous material of 20 species belonging to this family was collected from fresh plants and herbarium sheets. The vouchers are deposited in Sindh University herbarium (SUH).

Pollen samples were acetolyzed according to Erdtman's method (1966). Glycerine jelly (Kisser, 1935) was used as the embedding medium for making the permanent slides.

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SUMMARY OF POLLEN MORPHOLOGY DATA
ALL MEASUREMENTS ARE TAKEN IN MICRON (μ M)

Tribes	Avg = Size Polar axis Equatorial diameter	Shape	Type of Aperture	Exine Thickness	Apocolpium	Mesocolpia	Colpus Length	Exine Sculpturing	Sp.L	Sp.G	Voucher Specimen.
Aster novae-angliae L.	25 x 23 Rather small	Os	3-Colporate	3.3	5.0	14	16.5	Echinate	2.5	6	Sind University Campus, Jamshoro. S. Soomro. S.n. 1974 (SUH)
Blainvillea acmella (L) Philipson	22 x 19 Small	Ps	3-Colporate	2.2	4.4	15	14.3	Echinate	3	6	Thatta, National Highway S. Soomro. S.n. 1974 (SUH)
Conyza aegyptica Ait.	23 x 19 Small	Sp	3-Colporate	3.3	4	16.5	14.0	Echinate	3.3	4	Miani Forest, District Hyderabad. S.Soomro 45 (SUH)
Eclipta prostata (L) L.	23 x 22 Rather Small	Os	3-Colporate	4.4	5.5	14	14.0	Echinate	3.3	4	Sind University Campus, Jamshoro, S.Soomro 49 (SUH)
Enhydra fluctuans Lour.	28 x 26 Rather Small	Os	3-Colporate	2.2	5.5	14.3	13.2	Echinate	3.3	4	Tando Jam, along Mirpur Khas road. S.Soomro S.n. 1974 (SH)
Pluchea lanceolata Clarke	28 x 26 Rather Small	Ps	3-Colporate	2.2	5.5	18	16	Echinate	5.5	4	Mirpur Khas, Fruit Form. S. Soomro. S.n. 1974 (SUH)
Pluchea arguta Boiss.	26 x 23 Rather Small	Ps	3-Colporate	2.2	5	16	16	Echinate	5.5	4	Sind Agricultural University Campus, Tando Jam. S. Soomro. 92 (SUH)
Pulicaria crispa (Forssk.) Benth	21 x 16 Small	Sp	3-Colporate	2.2	4.4	15	14.5	Echinate	3.3	4	Miani Forest, District Hyderabad. S. Soomro 27 (SUH)
Pulicaria boissieri Hook.	28 x 25 Rather Small	S	3-Colporate	2.2	5.5	15.4	14.5	Echinate	2	4	Malir Karachi. S.Soomro. S.n. 1974 (SUH)
Pulicaria hookeri Jafri	28 x 21 Rather Small	Sp	3-Colporate	2.2	5.5	15	14.5	Echinate	3	4	Coastal hillocks near Karachi. S.Soomro. S.n. 1974 (SUH)
Tridax procumbens L.	31 x 25 Medium	Sp	3-4-Colporate	2.2	5.5	16.5	16.5	Echinate	2	4	Thatta, National Highway, S.Soomro. 1974 (SUH)
Amberboa ramosa (Roxb.) Jafri	32 x 28 Medium	Ps	3- Colporate	4	5.5	20	23	Spines Vestigal	—	—	Sind University Campus, Jamshoro. S.Soomro. 36 (SUH)
Chrysanthemum indicum L.	27 x 24 Small	Os	3-Colporate	6	5.5	14.3	13.2	Echinate	3.3	4	Sind University Campus, Jamshoro. S.Soomro. 93 (SUH)
Dicoma tomentosa cass.	43 x 36 Rather Large	Sp	3-Colporate	4	7.5	24	26.0	Spines Absent	—	—	Thatta, National Highway S.Soomro. S.n. 1974 (SUH)
Xanthium strumarium L.	35 x 29 Medium	S	3-Colporate	3	4.4	15	8	Spines Vestigal	—	—	Sind University Campus, Jamshoro. S.Soomro. S.n. 1972 (SUH)
Lactuca remotiflora DC	33 x 31 Medium	S	3-Colporate	7	7	16	16.5	Echinolophate	1.2	—	Sind University Campus, Jamshor. S.Soomro. S.n. 1972 (SUH)
Launaea procumbens (Roxb.) Ramayya & Rajagopal	30 x 29 Medium	S	3-Colporate	7	6	14.5	16.5	Echinolophate	1.56	—	Sind University Campus, Jamshoro. S.Soomro. 39 1972 (SUH)
Launaea residifolia (L.) O. Ktze.	36 x 33 Medium	S	3-Colporate	8	6	14.5	16.5	Echinolophate	1.56	—	Kazi Ahmed, National Highway. S.Soomro. 74 1972 (SUH)
Sonchus oleraceus L.	40 x 36 Rather Large	Os	3-4-Colporate	10	7	16	18.0	Echinolophate	1.2	—	Tando Jam, along Mirpur Khas road. S.Soomro 75 SUH)
Sonchus asper (L.) Hill	42 x 38 Rather Large	Os	3-4-Colporate	10	7	16	18.0	Echinolophate	1.2	—	Sind University Campus, Jamshoro. S.Soomro. 79 (SUH)

Abbreviations: Ps= Prolate spheriodal Sp= Subprolate, Os= Oblate spheriodal, S= Spheriodal, Sp.L= Spine length, Sp.G= Spine grouping.
SUH Sind University Herbarium, Botany Department.

Microscopy and Photography

The optical microscopic study of pollen grains were carried out with ORTHOLUX-II (Leitz, Wetzlar), microscope, using oil immersion (X 100, X 40 objectives) and X 10 eyepiece.

The shape and size (Polar axis and Equatorial diameter) measurements recorded are based on the mean of 10 pollen grains of each species. Photographs were taken using Lieca-D Camera on ORTHOLUX-II microscope.

Terminology and Classification

For the detailed pollen morphological description and classification, Erdtman's (1954, 1966) terminology has been used; however, some terms of Wodehouse (1935), Faegri and Iversen (1964) and Kremp (1965) have also been used.

Description

The pollen morphological characters of the species investigated are summarised in Table1. Detailed description of the characters noted in each tribe are given here under. For illustrations, refer to plates 1-4 at the end.

Tribe *Astereae*

Pollen grains of the tribe *Astereae* are 3-colporate except in *Tridax procumbens* where 3-4 colporate grains are also found. Amb roughly triangular to circular, spheridoal, prolate spheriodal, subprolate, oblate spheriodal, small, rather small to medium sized, apocolpia 4-5.5 μm in diameter and mesocolpia 14-18 μm. Colpi 13.2-16.5 μm long, abruptly narrowing towards apices, mostly have smooth membrane, but *Aster nova-angliae*, a cultivated species, has colpal membrane with small warts unevenly distributed over the surface. Endoaperture $\pm$ lalongate or circular with smooth membrane.

Exine 2.2-4.4 μm thick, pertectate, crass-exinous, crassitegillate with baculiferous sexine. Exine sculpturing is echinate. In almost all the species the spines are broadly conical, sharply pointed 2-5.5 μm long and 2.2-5.5 μm broad at the base, whereas in *Aster nova-angliae* the exine surface is beset with finely

pointed spines 1.75 μm long and 1.5 μm broad at the base; the spines occur i groups of 4-6 over the grain periphery . Nexine is very thin.

Tribe *Anthemideae*

Pollen grains of the tribe *Anthemideae* are 3 colporate. Amb roughly circular to inter-subangular, prolate, oblate spheriodal to subprolate; small, medium to rather large sized, apocolpia 5.5-7.5 μm in diameter and mesocolpia 14.3-24 μm. Colpi 13.2- 26.0 μm long, gradually tapering towards apices with smooth membrane. Endoaperture either circular or lalongate with smooth membrane. (Lalongate endoaperture forming endocingulus with smooth membrane in *Amberboa ramosa*).

Exine 4-6 μm thick, pertectate, crass-exinous, crassitegillate with baculiferous sexine. Exine thickest in the middle in P.V., gradually tapering in sweeping curves to the edges of the furrows.

Three exine sculpturing patterns are observed among the pollen grains of this tribe viz: *Amberboa ramosa* shows vestigial spines, while in *Dicoma tomentosa* the spines are absent altogether but *Chrysanthemum indicum*, a cultivated species, has broadly conical and sharply pointed spines 3.5 μm long and 4.0 μm broad at the base, arranged in groups of 4 spines over the periphery of the pollen grains. Nexine 0.55-1.1 μm thick.

Tribe *Ambrosieae*

Pollen grains of *Xanthium strumarium* member of the tribe *Ambrosieae* are 3-colporate. Amb roughly triangular to circular, spheriodal, medium sized, apocolpia 4.4 μm in diameter and mesocolpia 15.0 μm. Colpi short 7.0 μm long, gradually tapering towards apices with smooth membrane. Endoaperture $\pm$ circular with smooth membrane.

Exine 3.0 μm thick, pertectate, crass-exinous, crassitegillate with baculiferous sexine; spines vestigial. Nexine 1.1 μm thick.

Tribe *Cichorieae*

Pollen grains are mostly 3-colporate but in genus *Sonchus* 3-4 colporate grains are also found. Spheriodal to prolate spheriodal, medium to rather large

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sized. Apocolpia 6-7 μm in diameter and mesocolpia 14.5-16 μm. Colpi 14.5-16 μm long with smooth membrane, containing a lalongate endoaperture with smooth membrane.

Exine 6-8 μm thick pertectate, crass-exinous, crassitegillate with psilate sexine. Exine surface raised into a number of ectexinous ridges vertically striate; 15 large depressions 3 in each hemisphere (15-20, 3-4 in each hemisphere in *S. oleraceus* and *S. asper*) connected with poral depressions by narrow longitudinal gaps and abutting on the sides of a triagular cap, and 3 pairs (3-4 pairs in *S. oleraceus* and *S. asper*) alternating with poral depressions; members of each pair separated from each other by an equatorial ridge (Polar thickenings being absent in Lactuca).

Sculpturing echinolophate, the ridges and polar caps are thick and beset with very fine, sharp spinula 1.5-1.2 μm long. Nexine is very thin.

Discussion

The pollen characters observed in this study show a great degree of variation in shape, size and apertures, their number position and exine sculpturing.

Pollen grains are spheriodal, prolate spheriodal, subprolate and spheriodal with small, rather small, medium, rather large size classes. Apertures in the pollen grains are 3-colporate and 3-4 colporate. The compound apertures are usually with colpus-like ectoapertures while the endoapertures are either circular or lalongate with smooth membrane.

The tribe *Cichorieae* exhibited the advanced echinolophate exine sculpturing; tribe *Astereae* has echinate spines which are isometric and uniformaly arranged in groups of 4-6 all over the periphery of the grains. The tribe *Ambrosieae* is characterised by vestigial spines whereas in the tribe *Anthemideae* echinate, vestigial and non-echinate type of exine patterns have been observed.

The advanced echinolophate exine sculpturing exhibited in the species of the *Cichorieae*, reduction in spine length in some species of the tribe *Anthemideae* and *Ambrosieae* and reduction in pollen size found in most of the species of the tribe *Astereae* and *Anthemideae* manifest that the Compositae is the most highly evolved family.

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The present investigation also confirms the conclusion of Tomb (1975), Bentham (1873, cited in Wodehouse 1935), Rendle (1956) and Shukla & Misra (1979) that the Compositae is a highly evolved family amongst dicotyledons.

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References

Erdtman, G., 1954. An Introduction to pollen Analysis. Waltham, Mass., U.S.A. Chronica Botanica Stockholm.

——— 1966, Pollen Morphology and Plant Taxonomy of Angiosperms; (An Introduction to palynology-I); Hafner, London.

Faegri, K. and Johs, Iversen, 1964. Text Book of Pollen Analysis. Blackwell, Oxford.

Hyde, H.A. and Adams, K.F., 1958. An Atlas of Airborne pollen grains. Macmillon, London.

Kisser, J.1935. Bemorkungan Zum Einschluss in Glyserin Gelatine, Z.Wiss. Mikr, 51.

Kremp, G.O.W., 1965. Morphologic Encyclopedia of palynology. Univ. Arizona Press. Tuscon.

Rendle, A.B., 1956. The Classification of Flowering plants; Cambridge Univ. Press.

Shukla., P. and Misra, S.P., 1979. An Introduction to Taxonomy of Angiosperms. Vikas, Ghaziabad, India.

Tomb, A.S., 1975. Pollen Morphology in Tribe Lactuceae (Compositae). Grana, **15** (1-3): 79-89.

Wodehouse, R.P., 1935. Pollen Grains, their Structure, Identification and Significance in Science and Medicine. Hafner, London. (Reprinted 1965).

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PLATE-II
8a
9b
11a
12b
7b
9a
10b
12a
7a
8b
10a
11b

PLATE-I
2a
3b
5a
6b
1b
3a
4b
6a
1a
2b
4a
5b

Plate I Figs. 1a–6b Tribe *Asteraeae Aster Novae– angliae* 1a P.V, 1b E.V., *Blainvillea acmella* 2a P.V, 2b E.V, *Conyza aegyptica* 3a P.V, 3b E.V., *Eclipta prostrate* 4a P.V, 4b E.V., *Enhydra fluctuans* 5a P.V, 5b E.V., *Pluchea lanceolata* 6a P.V, 6b E.V.,

Plate II Figs. 7a–12b Tribe *Asteraeae: Pluchea arguta* 7a P.V., 7b E.V., *Pulicaria Crispa* 8a P.V, 8b E.V., *Pulicaria boissieri* 9a P.V, 9b E.V., *Pulicaria hookeri* 10a P.V, 10b E.V., *Tridax procumbens* 11a P.V, 11b E.V.,

Tribe *Anthemideae: Amberboa ramosa* 12a P.V, 12b E.V.

Plate III Figs. 13a–19b *Tribe Anthemideae: Chrysantheum indicum* 13a P.V, 13b E.V., *Dicoma tomentosa* 14a P.V, 14b E.V.

Tribe *Ambrosieae: Xenthium strumarium* 15a P.V, 15b E.V.

Tribe *Cichorieae: Lacutca Remtiflora* 16a P.V, 16b E.V., *Launaea procumbens* 17a P.V., *Launaea residifolia* 18a P.V., *Sonchus oleraceus* 19a P.V, 19b E.V.

Plate IV Figs. 20a–20b Tribe *Cichorieae: Sonchus asper* 20a P.V, 20b E.V.