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POLLEN MORPHOLOGY OF RARE TAXA *LAGGERA ALATA* AND ITS RELATED SPECIES *PLUCHEA LANCEOLATA* OF TRIBE PLUCHEEAE (ASTERACEAE)

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Abstract

Pollen morphology of rare taxa *Laggera alata* and its related species *Pluchea lanceolata* has been investigated. The pollen grains are trizonocolporate with spines broad at the base with short blunt tip. Aperture is lacunate to non-lacunate in *Laggera alata* and non-lacunate in *Plucheae lanceolata*. They are spheroidal in equatorial view and circular to semi-angular in polar view. Distinct columella is of much systematic value; double layered exine with prominent piller like columella is found in *Laggera alata* of Plucheeae which distinguishes the pollen of this tribe from Inuleae which is characterized by single columellate sexine.

Introduction

Laggera alata (D. Don). Sch. Bip. (syn. *Erigeron alatum* D. Don) is a rare species in Pakistan and is only found in Garhi Habibullah, District Hazara in N.W.F.P., Pakistan (Chaudhri & Qureshi, 1991). There are two species of *Laggera* in Pakistan (Stewart, 1972). However, *Laggera aurita* is distributed in Sind and Punjab (Stewart, 1972). Palynology of *L. aurita* was described by Zahur *et al*., (1978) while pollen morphology as well as taxonomy of *L. alata* was not previously reported in Pakistan. *Pluchea lanceolata* Clark (Syn. *Berthelotia lanceolata* DC.) is a large cosmopolitan species in Pakistan. There are 7 species of Pluchea in Pakistan (Stewart, 1972). Pollen morphology of tribe Plucheeae was neglected till Meo (2005) who palynologically studied the tribe.

In his synopsis of classification, Ghafoor (2002) placed *Laggera* and *Pluchea* species in tribe Plucheeae (Asteraceae). Anderberg (1989) recognized the former subtribe Inuleae-Plucheinae Benth, and described as the new tribe Plucheae (Benth.). A. Anderb. The Plucheinae always have the basic chromosome number x=10. The Pluchea group (Plucheinae) was included in the substribe Inulinae by Merxmiller *et al*., (1977) but it only distinctly related to this subtribe. The fact that Plucheinae and the Gnaphaliinae also deserve to be treated at a tribal rank is evident, since they are both monophyletic group that cannot be included in either the Inuleae proper or any other tribe.

The present reports gives an account of the pollen morphology of rare species *Laggera alata* and its related species *Pluchea lanceolata* which would be helpful in the classification of the genera in their respective tribe in the family Asteraceae.

Materials and Methods

The polleniferous material was obtained from the herbarium of Quaid-i-Azam University (ISL), Islamabad. A list of the specimen used and the Herbarium data are presented. The pollen grains were prepared for light microscopy (LM) using the method of Erdtman (1966) and embedded in glycerin-jelly. For LM, the pollen grains were

mounted in glycerin-jelly-fuchsin mixture and observations were made with a Nikon Labophot microscope (1000 X) under oil immersion. Florets were treated in acetic acid for five minutes. Pollen data such as (1) Polar axis (2) Equatorial diameter (3) P/E ratio (4) Exine thickness (5) Spine length (6) Number of spine rows between colpi (7) Shape in polar view (8) Shape in equatorial view (9) Aperture type and (10) Pollen class were recorded. Data is based on measurements of 20 pollen grains for each species. In addition, the data was statistically analyzed (Table 1). Terminology followed here is that of Erdtman (1952), Faegri & Iverson (1964), Huang (1972) and Punt *et al*., (1994). Morphological examinations of the examined pollen along with mean values of measurements and standard error (±), are given in Table 1.

Results

A summary of pollen morphological data is presented in Table 1. Micrographs of selected species of tribe Plucheeae are represented in Fig. 1 A-B. Fig. 2 represents spine variation in the genera of tribe Plucheeae. Pollen morphology of the tribe is recorded as follows:

Size: The size of the pollen grains (polar axis–equatorial diameter) of the genera of the tribe is in the range 25.2-23.7μm to 26.6-26.2μm (spines excluded). *Pluchea lanceolata* appears to be the smallest in size while *Laggera alata* are the largest (Table 1).

Symmetry and shape: The pollen grains are radially symmetrical, isopolar and isodiametric. Outline is circular to semi-angular in polar view while spheroidal in equatorial view showing a little variation in pollen size. The P/E ratio (polar axis-equatorial diameter) varied from 1.02 to 1.06. *Laggera alata* appears to be the lowest in P/E ratio while *Pluchea lanceolata* is slightly the largest (Table 1) indicating that pollen shape varied slightly among the taxa.

Aperture: The pollen grains are trizonocolporate. Aperture is non-lacunate in *Pluchea lanceolata* and lacunate to non-lacunate in *Laggera alata*. Apertural membrane is echinate and spines are present (Table 1).

Spines: The spines are 4.6μm to 5.4μm in length among the taxa and they are generally conical and sharp with broad base. The apices of the spines are blunt or pointed. Spines are, however, rudimentary. The number of spine rows between colpi are similar and varied from 4-6 in the two species (Table 1).

Exine: Tectum is microperforate. Exine thickness ranged from 4.5μm to 5.4μm among the two genera. *Pluchea lanceolata* appears to be the lowest in exine thickness while *Laggera alata* is the largest (Table 1) showing a little variation between two genera. Exine and intine are prominent and well differentiated. Exine thick with characteristic pillar like branched columella in *Laggera alata*.

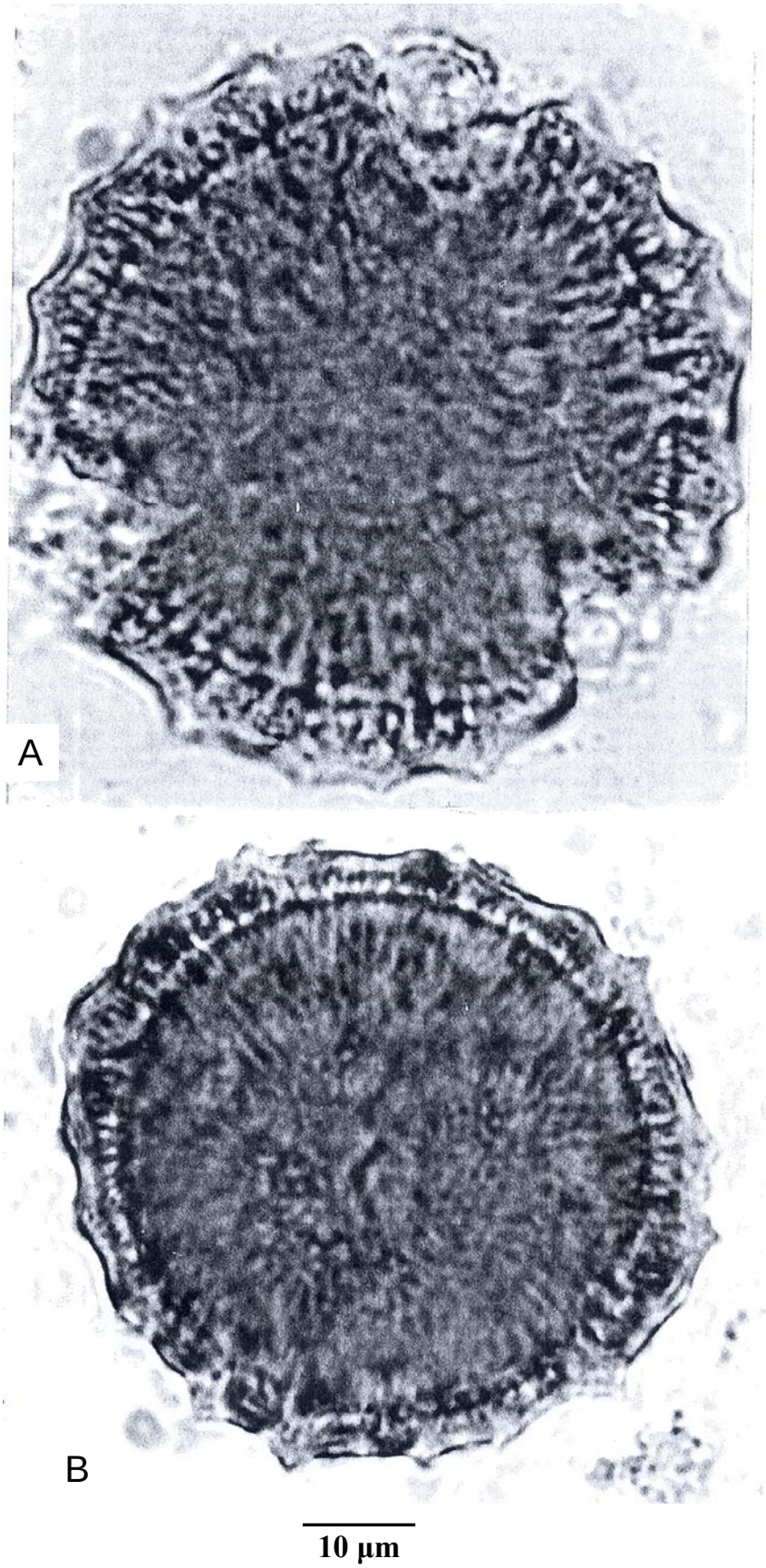

Fig. 1. A-B: Light micrographs (L.M) of the pollen grains of tribe *Pluchecae* (X1000). *Laggera alata*: A. Polar view, *L. alata*: B. Equatorial view (scale bar A-B = 10µm).

Table 1. Summary of pollen measurements, shape and sculpturing features in tribe Plucheeae (All measurements are in µm).

S. No	Taxon	Equatorial diameter (µm)	Polar diameter (µm)	P/E	Exine thickness (µm)	Spine length (µm)	Number of spine rows between colpi	Shape in polar view	Shape in equatorial view	Aperture type	Pollen class	Sculpturing
1.	*Laggera alata* (D.Don) Sch.Bip.	*26.2 ±1.05 (22.5-32.5)	26.6±0.96(24-30)	1.02	5.4±0.22 (5-6)	4.6±0.49 (4-5)	4 – 6	Semi-angular	Spheoridal	Non-lacunate to lacunate	Trizono-colporate	Echinate
2.	*Pluchea lanceolata* Clarke.	23.7±0.79 (21-26)	25.2±0.33(24-26)	1.06	4.7+0.39 (3.5-6)	5.4±0.43 (4-6.5)	4 – 6	Circular to semi-angular	spheroidal	Highly non-lacunate	Trizono-colporate	Echinate

*Mean values followed by min-max. in parentheses. P = Polar, E = Equatorial, ± = standard error.

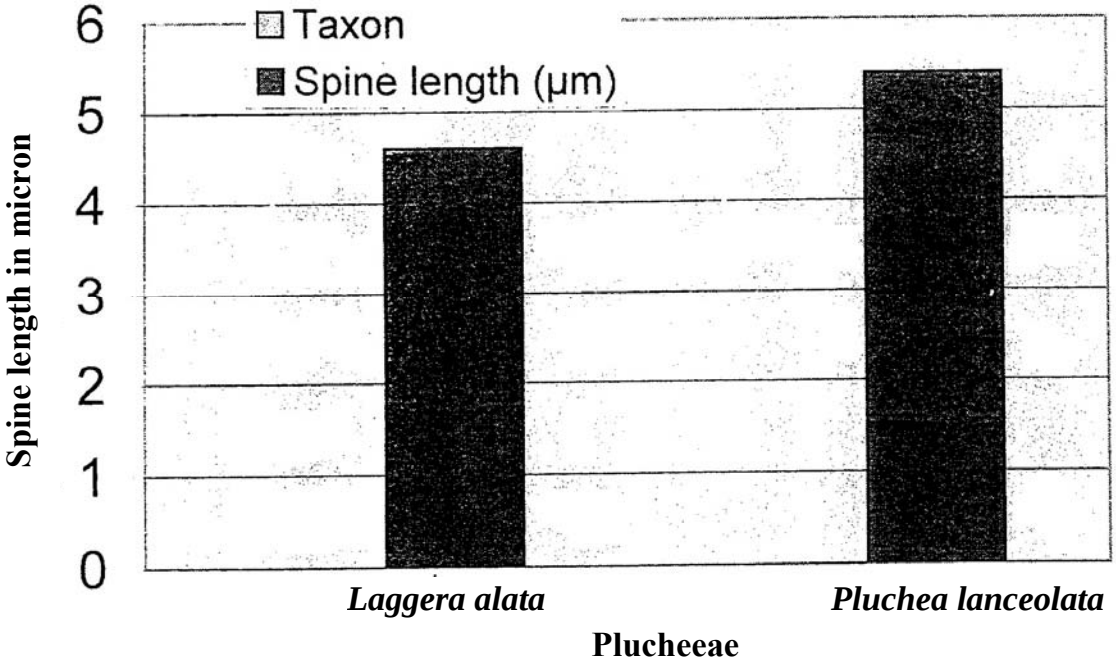

Fig. 2. Variation of spine length in the taxa of tribe Plucheeae.

Discussion

The pollen morphology of tribe Plucheeae has been described by Anderberg (1989); Leins (1971); Anderberg (1991b) and Meo (2005). There is little variation in pollen size of the two taxa of the tribe Plucheeae. Diameter of the polar axis ranged from 25.2µm (*Pluchea lanceolata*) to 26.6µm (*Laggera alata*) and the equatorial axis varied between 23.7µm (*P. lanceolata*) to 26.2µm (*L. alata*) indicating that this character has little systematic value in this group. Huang (1972) gave pollen size as 24-33 x 22-33µm in *Laggera alata* and 18-30 x 19-30µm in *Pluchea indica*. He described the grain of these species as 3-colporate and subspheroidal which is near to our findings. Zahur *et al*., (1978) reported the pollen size as 20(22) 24µm in *Laggera aurita*, 22(24) 26µm in *Pluchea arguta* and 20(22) 24µm in *P. ovalis*. They described the grains as subtriangular-subspherical in *Laggera aurita* and spherical prolate in *Pluchea arguta, P. ovalis*. P/E ratio varied between 1.02 (*Laggera alata*) to 1.06 (*Pluchea lanceolata*) which prove that there is little variation in pollen size in the tribe. Exine thickness ranged from 4.7µm (*Pluchea lanceolata*) to 5.4µm (*Laggera alata*). Similarly, there is little variation in exine thickness and spine length. Huang (1972) reported exine thickness as 2µm in *Laggera alata* and 1.5µm in *Pluchea indica* which are quite different from our findings in the present study in the tribe. Spines are present in both the genera. Spine length ranged from 4.6µm (*Laggera alata*) to 5.4µm (*Pluchea lanceolata*). Zahur et al. (1978) reported pointed spines having 4µm spine length in *Laggera aurita*, 6.0µm in *Pluchea arguta* and 3.0µm in *P. ovalis* which is in agreement with present findings. Number of spine rows between colpi is similar in the two species. Aperture type is dissimilar in both genera. It is highly non-lacunate in *Pluchea lanceolata* and lacunate to non-lacunate in *Laggera alata*. The presence of lacunate to non-lacunate pollen in *Laggera alata* is a distinguishing feature of apertural diversity in this species.

However, Columella is a distinct in this group which is of much systematic value. A double layered exine with prominent pillar like columella is found in *Laggera alata* which was studied by Anderberg (1991a) in *Cratsytylis* pollen and that of Sternachaenin (Plucheeae) indicating that double layered sexine with more or less pronounced internal tectum is characteristic feature of the pollen of Plucheeae which distinguishes the pollen

of this tribe from Inuleae which is characterized by single Columellate sexine (Leins, 1971; Anderberg 1991b). Anderberg *et al*., (1992) reevaluated the systematic position of the genus Cratystylis (Asteraceae) on the base of available data from morphology, palynology and phytochemistry. *Cratystylis* is removed from the vicinity of Inuleae S.I and a new tentative position among the tribes of paraphyletic "Cichoriodieae" is proposed for this isolated genus.

Specimens examined

Laggera alata
Islamabad district: Near Japan Embassy, 537, Nisar *et al*.

Pluchea lanceolata
Jhelum district: Kalar Kahar, 1340, Manzoor & Javed.
Lahore district: Changa Manga, 778, Samina.
Rawalpindi district: Panjor, 251, Nisar & Ashraf.
Khyber agency: Saidana Kile, 1340, Tanveer & Dilawar.
South Waziristan: Data Khel, 506, Hafizullah & Ayaz.

References

Anderberg, A.A. 1989. Taxonomy and reclassification of the tribe Inuleae (Asteraceae). *Can. J. Bot*., 67: 2277-2296.

Anderberg, A. 1991a. Taxonomy and phylogeny of the tribe Inuleae (Asteraceae). *Plant Systematics and Evolution*, 176: 75-123.

Anderberg, A. 1991b. Taxonomy and phylogeny of the tribe Plucheeae (Asteraceae). *Plant Systematics and Evolution*, 176: 145-177.

Anderberg, A.A., P.O. Karis and G. El-Ghazaly. 1992. Cratystylis, an isolated genus of the Asteraceae-Cichorioideae. *Aust. Syst. Bot*., 5: 81-94.

Chaudhri, M.N. and R.A. Qureshi. 1991. *Pakistan's Endangered* Flora-II. 5(1-2): 1-84.

Erdtman, G. 1952. *Pollen morphology and plant taxonomy (an introduction to Palynology-I, Angiosperms*). Almgvist and Wicksell, Stockholm.

Erdtman, G. 1966. *Pollen morphology and plant taxonomy. Angiosperms*. New York.

Faegri, K. and J. Iversion. 1964. *Textbook of Pollen analysis*. Hafner Pub. Co., New York, 245.

Ghafoor, A. 2002. Asteraceae-Anthemideae in *Flora of Pakistan* (Eds.): S.I. Ali & M. Qaiser. No.207. Jointly published by Department of Botany, Uni. of Karachi and Missouri Bot. Press, Missouri Bot. Garden, St. Louis, Missouri, U.S.A.

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

Leins, P. 1971. Pollen systematische studies an Inullen 1. Tarchonanthinae, Plucheinae, Inulinae, Buphthalminae. *Bot. Jahrb. Syst. Pflanzengesch. Aflanzengeogr*, 91: 91-146.

Meo, A.A. 2005. *Palynological studies of selected genera of tribes of Asteraceae from Pakistan*. Ph.D. Dissertation, Quaid-i-Azam University, Islamabad, Pakistan.

Merxmiller, H., P. Leins and H. Roessler. 1977. *The Biology and Chemistry of the Compositae 1*. (Eds.): V.H. Heywood, J.B. Harborne and B.L. Turner. pp. 577-602, Academic Press: London.

Punt, W., S. Blackmore, S. Nilsson and le A. Thomas. 1994. *Glossary of pollen and spore terminology*, - LPP foundation, Utrecht, LPP contribution series No.1.

Stewart, R.R. 1972. *An annotated catalogue of vascular plants of West Pakistan*. Fakhri Printing Press Karachi.

Zahur, M.S., A.A. Bhutta and M. Ashraf. 1978. *(a) Palynological studies of the plants growing in Punjab. (b) Seasonal variation in the frequency of air-borne pollen and spores which cause allergies and asthma with special reference to Central Punjab*. Pak. Sci. Foundation. Final Research Report.

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