



Palynological studies of *Gazania longiscapa* DC. (Arctoteae–Compositae) from Pakistan

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Abstract

Gazania longiscapa DC. (Arctoteae – Compositae) is perennial scapigerous herb. Pollen grain is radially symmetrical, isopolar, trizono-colporate, lacunate to non-lacunate and echinate. Outline is circular to semi-angular in polar view and circular to spheroidal in equatorial view. Colpi long and broad. Spines are broad at the base and abruptly narrow at the tip. Palynological characters such as equatorial and polar diameter, exine thickness, spine length, number of spine rows between colpi are taxonomically important. The presence of lacunate to non-lacunate pollen is a distinguishing feature of apertural diversity. Pollen data of *Gazania longiscapa* closely relates with *Pluchea lanciolata*.

Key words: Palynology, Arctoteae, Compositae, *Gazania longiscapa*, Pakistan

1. Introduction

Palynology is the science of pollen and spore morphology. Pollen grains carry the male gametes of seed plants (Wanger et al., 1990). The term was suggested by Hyde and William (1945) and includes both fossil and living pollen and spores. It has found application in plant taxonomy, plant geography, climatology, aeropalynology, criminology, mellitopalynology, iatropalynology, allergy, pharmaco-palynology, forensic palynology, copropalynology, stratigraphic correlation of oil-bearing rocks and coal field. It is also applicable in gas, coal and oil industries. Pollen analysis has been tried as a means of tracing the history of cultivated cereals (Erdtman, 1954). Pollen biology have a strong impact in agriculture, bio-technology, forestry, and plant breedings and genetics. Meo et al., (1988b) stated that pollen, size increases corresponding with ploidy level. Mbagwu et al., (2008) observed that nature of pollen grants in Asteraceae determine the mode of pollination. This analysis helps in qualitative analysis of drug powder and in correct identification of drugs. The Palynological attributes of plants have attracted the attention of many scientists in recent time. According to Nyananyo (1985), palynology provide useful data for intergeneric classification. A pollen atlas is, of course, a fundamental reference for the identification of fossil pollen (Sowunmi, 1995). Evidence for early agriculture can be obtained from pollen profile indicating forest clearance (Hamilton, 1982). The significance of pollen morphology attributes “NPC” data in solving taxonomic problems. Wodehouse (1935), Erdtman (1969) and Jaffery (1962) emphasized typical pollen characters in taxonomy. Diez et al. (1999) concluded that palynological study supports the taxonomic separation of prenanthes -Lactuca line and Launaea – Sonchus line. The size of polar area in pollen morphology is taxonomically useful (El-Ghazaly, 1980).

Asteraceae is a eurypalynous family (Erdtman, 1952) and most of its genera possess Zonocolporate pollen (Sachdeva and Malik, 1986). It is an extremely natural taxon with unique floral theme and pollen grains. 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). Due to many characters, Asteraceae is assigned an advanced position, the highest-according to Engler, in systematic botany. The family is one of the largest among the angiosperms with a world-wide distribution and has attracted and fascinated botanist for over two centuries (Heywood et al., 1978). It comprises of \pm 1535 genera and C.2300 species distributed in 3 subfamilies and 17 tribes (Ghafoor, 2002). The number of genera is rather increasing as more than 10 genera are described each year and several are resurrected from or reduced to synonymy (Bremer, 1994). It is also the largest plant family in Pakistan, represented by

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over 650 species distributed in 15 tribes (Ghafoor, 2002). Twenty eight plants of the family Asteraceae are medicinally important. (Khalid, 1995).

Gazania longiscapa DC. of family Asteraceae, tribe Arctoteae is a perennial scapigerous herb with a woody rootstock. The genus comprises almost 40 species mostly occurring in Southern, South-Western and tropical Africa. It is represented by one species in Pakistan and is a new addition to Stewart's Catalogue (Akhtar 1981). Its taxonomy has been reported by Akhtar (1981) and Ghafoor (2002) placed the genus *Gazania* Gaertn and *Gundelia* L. in tribe Arctoteae. The tribe Arctotideae resemble Anthemidae in that the heads have ligulate ray-florets, but has the style Cynareae with a ring of hairs below the bifurcation (Clapham *et al.*, 1962). There are no native members, but *Gazania* spp. and *Arctotis stoechodifalium* are commonly grown in gardens. The purpose of present study is to provide pollen morphology of the genus for pollen flora of Pakistan, which is new report.

2. Materials and methods

Pollen materials were obtained from Quaid-i-Azam University Herbarium (ISL), Islamabad. Mature, unopened buds were removed from the herbarium specimen. The pollen grains were prepared for light microscopy (LM) by mounting in glycerin jelly. The pollen grains were processed by using conventional procedure of Erdtman (1966). Florets were treated in acetic acid for five minutes and observations were made under Nikon Labophot microscope using oil immersion. The measurements are based on 20 readings. Polar axis, equatorial diameter, P/E ratio, exine thickness, spine length, number of spine rows between colpi, shape in polar view, shape in equatorial view, aperture type, sculpturing and pollen class were recorded. The data was statistically analyzed for sample statistics including range, mean and standard error (\pm) using MS Excel. The terminology used is after Erdtman (1952), Huang (1972) and Punt *et al.* (1994).

Specimen examined: Islamabad District: Islamabad, 5.3.1975, Arif & Nisar 69 (ISL).

3. Results

***Gazania longiscapa* DC.** (Figure A – B).

Size: Pollen grain size (polar – equatorial diameter excluding spines) ranged from 26.5 ± 0.42 ($25.0\mu\text{m} - 27.5\mu\text{m}$) to 26.8 ± 0.61 ($25.0\mu\text{m} - 29.0\mu\text{m}$). There is variation between equatorial and polar diameter. P/E ratio i.e. polar and equatorial diameter is 0.99.

Symmetry and Shape: The pollen grains are radially symmetrical and isopolar. Equatorial diameter is circular to spheroidal and 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 (Fig. A).

Exine: Exine is tectate. Exine thickness is 5.0 ± 0.28 ($4.0\mu\text{m} - 6.0\mu\text{m}$). Sexine is prominent and much thicker than nexine. Columella weakly developed.

Spines: Spines are prominent, sharp and conical. They are broad at the base and abruptly narrow at the tip. Spine length value is 4.5 ± 0.28 ($3.5\mu\text{m} - 5.0\mu\text{m}$). Number of spine rows between colpi varied from 4 – 5.

Caveat pollen also is found in Arctoteae and some Lactuaceae, and may be more basal on trees. Indeed, Blackmore *et al.* (1984) noted that it is evident early in development in *Gerbera* (Mutisieae), but not later, and suggested that pollen grains of Asteraceae might all be basically caveat.

Pollen morphology can be useful in supporting taxonomic suggestions (Clark *et al.*, 1980). Palynological application is very diverse and multidisciplinary. However, the role of pollen morphology is of significance in taxonomic debate for classification. Pollen grains have an important part in the modern issue of plant taxonomy (Bashir and Khan, 2003). Tomsovic (1997) utilized pollen character as additional information for systematic studies. Huang (1972) also used pollen characters for systematic purposes. Mbagwu *et al.*, (2008) used pollen characters for the establishment of interspecies relationships among species of Asteraceae. They viewed 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 probable evidence of relationships among certain groups of flowering plants.

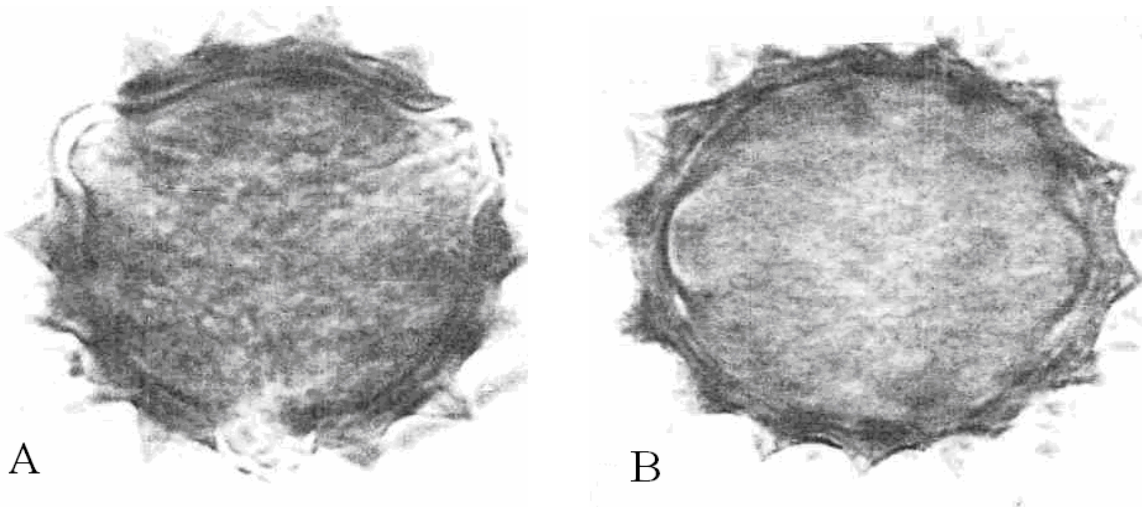


Figure 1. Light micrographs of pollen grains of *Gazania longiscapa* (X 1000) (A. Polar view; B. Equatorial view)

Present findings corroborate with *Pluchea lanciolata* (Pluceae – Compositae) where polar axis-equatorial diameter ranged from 25.2 – 23.7 μ m to 26.6 – 26.2 μ m, spine length ranged from 4.6 μ m to 5.4 μ m and the exine thickness ranged from 4.7 μ m to 5.4 μ m (Meo, 2005). It meant that there is close affinity of tribe pluceae with Arctoteae. Our results are also in conformity with findings of Wodehouse (1935) who recorded echinate and spheroidal grains in *Berkheya heterophylla* (Arctotidae – Compositae). Wodehouse (1935) further reported that lophate character (outstanding feature of Cichorieae) is also characteristic of pollen grains of the tribe of Vernonieae, of *Barnadesia* in the tribe Mutisieae, and of *Berkheya* in the tribe of Arctotideae. Among Arctotideae, the grains of *Berkheya heterophylla* have a lophate pattern consisting of 29 lacunae of a quite distinctive form. Lophate pattern is however, not recorded in present study. The presence of lacunate and non-lacunate pollen in *Gazania longiscapa* is a distinguishing feature of apertural diversity. Similar type of results were recorded by Meo (2005) in *Laggera alata* (Pluceae).

4. Conclusions

It is concluded from that pollen data *Gazania longiscapa* relates with *Pluchea lanciolata*. It is recommended that SEM (Scanning electron microscope) of the pollen could be approached for further studies as light microscopy could not explain exine pattern.

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