



Research Article

Palynological studies on some medicinal mallows from Punjab, India.

Paramjeet Cheema

IAS & Allied Services Training Centre, Punjabi University, Patiala-147002, India

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Abstract: Seven plant species belonging to family Malvaceae were subjected to standard palynological studies in order to generate data for pollen characterization and identification of medicinally important mallows from Punjab, NW India. Pollen grains of this family are unique being porate and echinate having isolated spines. Pollen grains are either 3-porate, 6-7 porate or polyaperturate with oblate spheroidal shape and reticulate or semireticulate reticulate exine. Based on various palynological parameters like the range in size, shape, aperture, exine thickness, ornamentation, etc. key to identification of presently studied taxa has been evolved.

Key words: Echinata, Malvaceae, Palynology, Pollen grain, Oblate spheroidal, Reticulate.

Introduction

The Malvaceae or mallow family is a cosmopolitan family of herbs, shrubs, climber and small trees with a wider distribution in the tropical regions. This family comprises some 110 genera and over 2000 species, divided into six tribes: Maloepae, Malveae, Hibiscieae, Abutilieae, Ureneae and Decaschistieae (Hutchinson, 1967; Bates, 1968; Fryxell, 1975 & 1988; La Duke & Doebley, 1995; Krebs, 1994, a & b).

The study of pollen is an important area of research because the pollen morphological characters such as the shape, apertural pattern and exine configuration are very conservative features for the taxonomic assessment of the plants (Perveen 2006, Bera *et al.*, 2007, Keshavarzi *et al.*, 2012). According to Adekanmbi (2009) more often these characters are species specific and are used to identify the source plants during various studies. Owing to the high economic value of some genera of the Malvaceae, several studies from different perspectives have been carried out in this family. Pollen morphology of selected genera of *Hibiscus* and *Abutilon* from Pakistan have been investigated by Perveen *et al.*, (1994), Bibi *et al.*, (2008) and Shaheen *et al.*, (2009).

This paper aims to analyse some members of the family using LM techniques. Various parameters such as the pollen shape, range in pollen size, exine ornamentations, apertures, etc. have been of considerable help in identification of the taxon. Based on these features a key to identification of the presently studied species has been evolved. The

data generated alongwith other morphological characters will be helpful in the identification of these species.

Materials and Methods

For the present investigation plants at flowering stage were collected from various localities representing different habitats like boundaries of the fields, crop fields and waste places in Punjab, NW India (Table 1). Pollen morphology was studied by acetolysis method (Erdtman 1952). The mature anther lobes were crushed in 70% ethyl alcohol and then centrifuged. Acetolysis of pollen grains was done with 9 parts acetic anhydride with 1 part concentrated sulfuric acid. Then these were washed with glacial acetic acid followed by mounting on slide in glycerol. Range in pollen size was determined by making observation on unacetolysed pollen grains. Medicinal importance of the species mentioned is based on the available literature.

For Pollen terminology Erdtman (1952), Erdtman *et al.*, (1961), Nair (1965, 1966) and Reitsma (1970) have been followed. Shape of the pollen grains is based on measurements of polar axis (P) and equatorial diameter (E) and the resulting P/E ratio. Voucher specimens of the plants have been deposited in the Herbarium, Department of Botany, Punjabi University, Patiala (PUN). Photographs are at magnification $\times 1080$ taken with Olympus light microscopes.

*Corresponding Author:

Paramjeet Cheema,

Associate Professor,

IAS & Allied Services Training Centre,

Punjabi University, Patiala, India.

E-mail: dr_paramjeet@rediffmail.com



Table 1. Investigated taxa with their common name, habitat, habit, flowering period and accession number (PUN)

Name of the species	Common name/s	Locality/Habitat	Habit/ Flowering period	Accession number
<i>Abutilon indicum</i> (Linn.) Sweet.	Indian mallow, Atibala, Kantika, Kangi, Pili booti	Patiala/ Waste places	Shrub/ March - May, September - November	33741, 33742
<i>Hibiscus vitifolius</i> Linn.	Grape leaved mallow, Van kapus, Jangali kapah	Sangrur/ Waste places	Perennial herb/ July - October	33743, 33744
<i>Malva parviflora</i> Linn.	Cheese weed mallow, Panirak	Sangrur/ Waste places	Annual herb/ February - April	34431, 34432
<i>Malvastrum coromandelianum</i> (Linn.) Garcke	False mallow, Broom weed, Clock plant, Kharenti	Bathinda/ Waste places, crop fields	Perennial herb/ February - April	32046, 32047
<i>Sida acuta</i> Burm.f.	Common wireweed, Bala, Kharenti	Patiala/ Waste places	Perennial herb/ September - November	33745, 33746
<i>Sida cordata</i> (Burm.f.) Borss.	Country mallow, Bhumibala, Faridbuti	Faridkot/ Along hedges	Perennial herb/ March - April, August - October	33747, 33748
<i>Sida cordifolia</i> Linn.	Country mallow, Bala, Kungyi, Simak	Barnala/ Waste places	Perennial herb/ March - April, August - November	33749, 33750

Results and Discussion

Data on pollen size, shape, aperture, exine and other pollen characters pertaining to 7 species belonging to family Malvaceae has been provided in Table 2. Pollen grains in presently studied 7 species are oblate spheroidal, porate (except for *Malvastrum coromandelianum*), with reticulate exine (except for *Sida cordifolia*) and are echinate.

Abutilon indicum has been used extensively as a home remedy in traditional Chinese and Indian medicine. The medicinal properties of *Abutilon indicum* include anti-inflammatory, lipid lowering, analgesic, antioxidant, antibacterial, antidiabetic, hepato protective, antimycotic, anti-diarrhoeal and anti-convulsant. Pollen grain is oblate spheroidal, 3-porate with biggest pore size $9.09 \times 6.55 \mu\text{m}$ (Figs. 1-2). For the same species from Pakistan Shaheen *et al.*, (2009) recorded the pollen grains with suboblate shape and 3-zonoporate nature of pores. Jain & Nanda (1966-67) reported pollen grains for the species from Pillani as spheroidal, 3-colporate with small sized spines ($3.80 \mu\text{m}$).

Hibiscus vitifolius roots are used for the treatment of jaundice in the folklore system of medicine in India (Samuel *et al.*, 2012). It has biggest pollen ($151.16 \times 149.45 \mu\text{m}$) with longest spines

($24.85 \mu\text{m}$) among the presently studied species (Fig. 3).

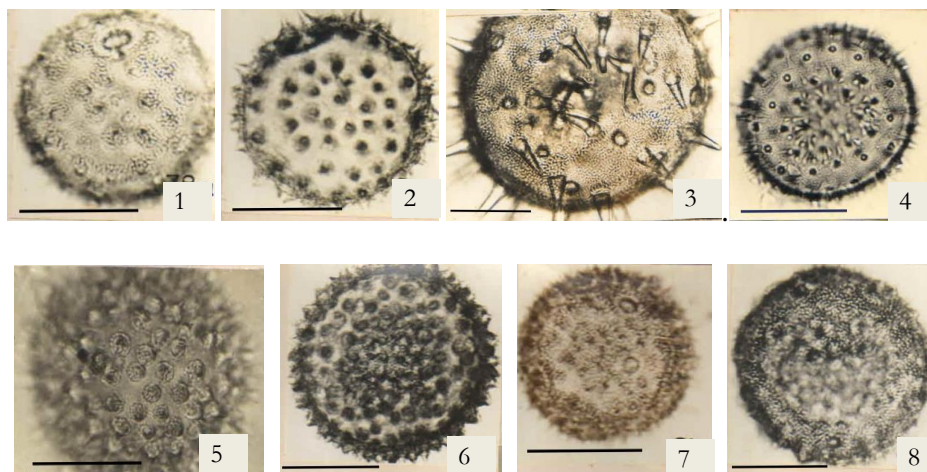
Malva parviflora leaf extracts possess anti-inflammatory and antioxidant activities. Plant has oblate spheroidal, polyantoporate pollen grains with smallest pores ($2.94 \times 2.94 \mu\text{m}$) and reticulate exine pattern (Fig. 4). The studies by Naggar (2004) for the species from Egypt revealed pollen grains as polyantoporate but exine pattern as verrucate. Studies by Rao & Shukla (1975) reported pollen bigger ($84.0 \mu\text{m}$) in diameter with wider pore ($4.0 \mu\text{m}$) but smaller spines ($6.0 \mu\text{m}$) as compared to the presently studied species. What are the inferences..?

Malvastrum coromandelianum plant parts are used by numerous tribal populations throughout the world. In Indian system of medicine the plant is reported as an anti-inflammatory, analgesic, and antidysenteric (Sanghai *et al.*, 2013). The pollen are inaperturate, oblate spheroidal with reticulate exine having second largest spines ($12.12 \mu\text{m}$) among the presently studied species (Fig. 5).

Sida acuta whole plant decoction is used as a treatment for fever and the juice of the plant is used to treat indigestion. It has 6-7 pantoporate pollen grains with pollen size $87.74 \times 84.41 \mu\text{m}$ (Fig. 6).

Table 2. Pollen morphological details of the investigated taxa

Name of species	Average size (μm)	Shape	Aperture	Pore diameter (μm)	Exine ornamentation	Spine size (μm)	Exine thickness(μm)/ Figure
<i>Abutilon indicum</i> (Linn.) Sweet.	65.54×63.94	Oblate spheroidal	3-porate	9.09×6.55	Reticulate	6.13	1.68/1-2
<i>Hibiscus vitifolius</i> Linn.	151.16×149.45	Oblate spheroidal	Polyantoporate	6.74×6.74	Reticulate	24.85	4.54/3
<i>Malva parviflora</i> Linn.	74.95×72.48	Oblate spheroidal	Polyantoporate	2.94×2.94	Reticulate	8.52	5.25/4
<i>Malvastrum coromandelianum</i> (Linn.) Garcke	67.05×67.05	Oblate spheroidal	Inaperturate	-	Reticulate	12.12	4.04/5
<i>Sida acuta</i> Burm.f.	87.78×84.41	Oblate spheroidal	6-7 pantoporate	5.12×3.87	Reticulate	5.62	2.02/6
<i>Sida cordata</i> (Burm.f.) Borss.	71.94×70.68	Oblate spheroidal	6-7 pantoporate	4.00×3.68	Reticulate	5.68	1.68/7
<i>Sida cordifolia</i> Linn.	81.80×83.91	Oblate spheroidal	3-pantoporate	6.74×6.74	Semitectate reticulate	8.42	3.37/8



Figs. 1-8. Acetolysed pollen grains. 1-2. *Abutilon indicum*, 3. *Hibiscus vitifolius*, 4. *Malva parviflora*, 5. *Malvastrum coromandelianum*, 6. *Sida acuta*, 7. *Sida cordata*, 8. *Sida cordifolia*.

Sida cordata roots are used as diuretic, astringent, stomachic, febrifuge and demulcent and seeds are used as a laxative (Shah 2017). It has 6-7 pantoporate pollen grains with pollen size $71.94 \times 70.68 \mu\text{m}$ (Fig. 7).

Sida cordifolia plant is analgesic and anti-inflammatory. It is used as tonic which effects the nervous system and provides relief from anxiety (Jain *et al.*, 2011). It has 3-pantoporate pollen grains with semitectate reticulate exine (Fig. 8). Jain & Nanda (1966-67) reported the pollen grains for this species as spheroidal and cryptoaperturate whereas Selling (1946-47) recorded 3-porate and oblate spheroidal to suboblate shaped pollen grains.

Detailed pollen morphology has been of considerable help in preparing key to the identification of the species as follows:

Key to identification of investigated species

- 1a. Pollen grains inaperturate...*Malvastrum coromandelianum*
- 1b. Pollen grains aperturate
- 2a. Pollen grains 3-porate
- 3a. Exine reticulate.....*Abutilon indicum*
- 3b. Exine semitectate*Sida cordifolia*
- 2b. Pollen grains 6-7 porate
- 4a. Pollen size $87.74 \times 84.41 \mu\text{m}$*Sida acuta*
- 4b. Pollen size $71.94 \times 70.68 \mu\text{m}$*Sida cordata*
- 2c. Pollen grains polyaperturate
- 5a. Pollen size $151.16 \times 149.45 \mu\text{m}$...*Hibiscus vitifolius*
- 5b. Pollen size $87.74 \times 84.41 \mu\text{m}$...*Malva parviflora*

The pollen grains of the presently studied species are echinate in nature which supports the earlier reports by Perveen & Qaiser (2009). The spines in the family Malvaceae are isolated in nature and stand conspicuously apart. Pollen size, number of apertures, spine characteristics and exine patterns help in accessing the evolutionary level of any taxa. As reported by Karna Mallick (2017) the circular,

echinate, large and triporate pollen which are recorded in taxa of Malvaceae are primitive ones. Earlier Vaidhya (2005) considered the triporate pollen grains as most primitive one.

Conclusion

The study reveals morphologically differentiating characters in the pollen of presently studied taxa. It is concluded that palynological markers are useful in the identification and classification of the plant taxa.

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