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PALYNOMORPHOLOGICAL STUDIES ON FAMILY MIMOSACEAE

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ABSTRACT

Pollen morphology of eight genera belonging to sub-family Mimosaceae of Leguminosae have been examined by Light and Scanning Electron Microscope (SEM). The Sub-family Mimosaceae is referred to as eurypalynous family because of the great variety of pollen types found in its members. Pollen morphological characters are found to be significantly helpful at generic or species level. The morphological variation in size, shape, surface structure and surface pattern occurs in all studied acetolysed and unacetolysed pollen grains. The present reports gives an account of pollen morphological variations in eight genera of Mimosaceae growing in Amravati University campus.

KEY WORDS: Pollen morphology, Mimosaceae, LM, SEM.

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INTRODUCTION

The study of morphology of pollen grains is basic necessity of Palynology branch because of its fundamental value in the recognisation and identification of grains found in various conditions (Arora and Modi, 2008). Palynology involves the study of pollen and encompasses the structural and functional aspect of pollen. Mimosaceae is one of the sub-family of Leguminosae which include 58 genera and 3100 spp. (Mabberley,1990). Erdtman (1952) had mentioned Mimosaceae is eurypalynous taxon as it showed great variation in their pollen structure. The family Mimosaceae is well established and widespread due to the highly effective reproductive system, capable of producing enormous number of viable seeds (Panicker and Sreedevi, 2004). The tremendous morphological diversity in the pollen of Mimosaceae and its practical value for systematic studies were reviewed by Guinet (1981), Guinet and Furgusun (1989), El-Ghazali *et al*. (1997) and Caccavari and Dome (2000) indicate that the apertural type, structure of exine tectum, and its ornamentation and the high frequency of compound grains (Polyad and tetrads) are all parameters useful in the systematic studies of the Mimosaceae thus being morphological heterogenous (Tantawy *et al.* 2005). Though there are some reports on morphological aspects of pollen of Mimosaceae from India (Nair, 1960; Nayar, 1990; Panicker and Sreedevi, 2004 and Bera *et al.* 2007), meager work is found to be reported from central India. Hence, The present study was undertaken to reveals the pollen morphological variations using LM and SEM so as to understand palynological characteristics within same or different taxa.

MATERIALS AND METHODS

The Polliniferous material of eight genera of Mimosaceae was collected from Amravati University campus and stored in 70% alcohol. The studied taxa were identified from Flora of Marathwada (Naik, 1998). The collected material was crushed with a glass rod in plastic centrifuge tube and crushed material was filtered through fine meshes to isolate pollen grains. The pollen grains were prepared for light and scanning electron microscopy by the standard method described by Erdtman (1960) and Arora and Modi (2008). For light microscopy, the pollen grain were mounted in stained glycerine jelly and observations were made with Trinocular Fluroscence Microscope (Axiostar HBO 50/AC Carl zeiss). For SEM studies, pollen grain were suspended in a drop of ethanol and directly transpired with a fine pipette to a metallic stubs using double sided cello tape and coated with gold palladium in a sputtering chamber (POLARON SPUTTER COATER). The SEM examination was carried out on a LEO electron microscope (LEO 430). The measurements are based on 10 readings from each pollen type by ocular micrometer and the pollen grain size, colpi size, pore size was measured. The terminology used in accordance with Erdtman (1971), Faegri and Iverson (1964), Bhattacharya *et. al.* (2006), Agashe (2006) and Punt *et. al.* (2007).

OBSERVATIONS AND RESULTS

The pollen unit of all studied pollen grains was found to be united (Polyad), octad and monad. In *Acacia nilotica, Acacia leucophloea*, *Acacia chundra*, *Albizia lebbeck*, *Albizia procera* and *Pithecellobium dulce* polyads with 16 pollen grains were observed. Polyad with 8 units in *Mimosa hamata* and single pollen unit in *Prosopis juliflora* were observed. The detailed morphological characters are as follows:

Description of pollen types

1) Mimosa hamata Willd.

Pollen grains are 13-14µm, polyads, rarely in tetrads, 8 monad in polyad complex, outline circular, Polyads with 8 grains arranged four on one side and four in other side. Radially symmetrical, polar outline circular, equatorial outline elliptic, monad size 5-6 µm, individual grain quandrangular in shape but few are

triangular, monads with hemisperical outer and conical inner portion, inaperturate, sculpturing foveolate (Table 1, Fig. 1 and 2).

2) Albizia lebbeck (L.) Willd.

Pollen grains are 53-57 µm across , polyads, rounded, 16 monads in polyad complex, 8 grains in the centre with an arrangement of 4 upon 4 in two planes, one directly above the other surrounded by eight peripheral grains. monad size 18.56-22.13 µm, individual grain having depression in the centre, squarish-rectangular in shape, inaperturate, sculpturing psilate- foveolate (Table 1, Fig. 3 and 4).

3) Albizia procera (Roxb.) Benth.

Pollen grains are 52.08-57.72 µm across , polyads, outline semi circular, 16 monads in polyad cluster, 8 grains in the centre with arrangement of 4 upon 4 in two planes, one directly above the other surrounded by eight peripheral grains, monad size 18.30-21.12 µm, individual grain squarish-rectangular in shape, inaperturate, sculpturing psilate (Table 1, Fig. 5 and 6).

4) Pithecellobium dulce (Roxb.) Benth.

Pollen grains are 62.24-63.06 µm across , polyads, outline ovoid, 16 monads in polyad complex, eight monad arranged in two tiers in the centre surrounded by eight peripheral grains, monad size 17.19-20.47 µm, individual grains are rectangular while few are wedge shape forms, inaperturate, sculpturing foveolate- regulate (Table 1, Fig. 7 and 8).

5) Acacia nilotica (L.) Del.

Pollen grains are 39.98-40.93 µm across, polyads, circular to ovoid in shape, 16 monads in polyad complex, polyads arranged in eight by eight, eight grains in the centre arranged in two layers of four each and surrounded by eight peripheral grains in single turn, monad size 10.94-12.37µm, monads squarish to rectangular in shape whereas few are likes brick, individual grain having depression in the centre , inaperturate, sculpturing psilate (Table 1, Fig. 9 and 10).

6) Acacia leucophloea (Roxb.) Willd.

Pollen grains are 28.5-30 µm across, polyads, circular to rectangular in shape,16 monads in polyad complex, eight grains in the centre arranged in two layers of four upon four surrounded by eight peripheral grain, monad size 08-12 µm, central monads are squarish to rectangular in shape whereas peripheral grains having grooves in centre forms two ridges at terminal ends, inaperturate, sculpturing granulate (Table 1, Fig. 11 and 12).

7) Acacia chundra (Roxb. ex Rottl.) Willd.

Pollen grains are 32.87-39.45 µm, polyads, outline circular to ovoid, 16 monads in polyad cluster, eight monad arranged in two tiers in the centre surrounded by eight peripheral grains, monad size 18.56-22.13 µm, individual grain squarish, inaperturate, sculpturing psilate (Table 1, Fig. 13 and 14).

8) Prosopis juliflora (Sw.) DC. Prodr.

Pollen grains are PA 31.12 (32.96) 33.16µm, EA 32.16 (34.48) 36.35, radially symmetrical, outline triangular , trizonocolporate, colpi 15-24 µm long, colpi tapering towards the ends, sculpturing psilate (Table 1, Fig. 15 and 16).

Table No. 1
Pollen Grain Characteristics.

Sr. No.	Name of taxa	Pollen unit	Size (µm)	Shape	Monad size (µm)	Monad shape	Exine ornamentation
1	*Mimosa hamata*	Octad	13-14	Circular	5-6	Quadrangular	foveolate
2	*Albizia lebbeck*	Polyad	53-57	Rounded	18.56-22.13	Squarish-rectangular	Psilate-foveolate
3	*Albizia procera*	Polyad	52.08-57.72	Semi circular	18.30-21.12	Squarish-rectangular	Psilate-foveolate
4	*Pithecellobium dulce*	Polyad	62.24-63.06	Ovoid	17.19-20.47	Rectangular	Foveolate-rugulate
5	*Acacia nilotica*	Polyad	39.98-40.93	Circular to ovoid	10.94-12.37	Squarish to rectangular	Psilate
6	*Acacia leucophloea*	Polyad	28.5-30	Circular to rectangular	08-12	Squarish to rectangular	Granulate
7	*Acacia chundra*	Polyad	32.87-39.45	Circular to ovoid	18.56-22.13	Squarish	Psilate
8	*Prosopis juliflora*	Monad	32.96-34.48	Triangular-elliptic	31.12-33.16	Triangular	Psilate

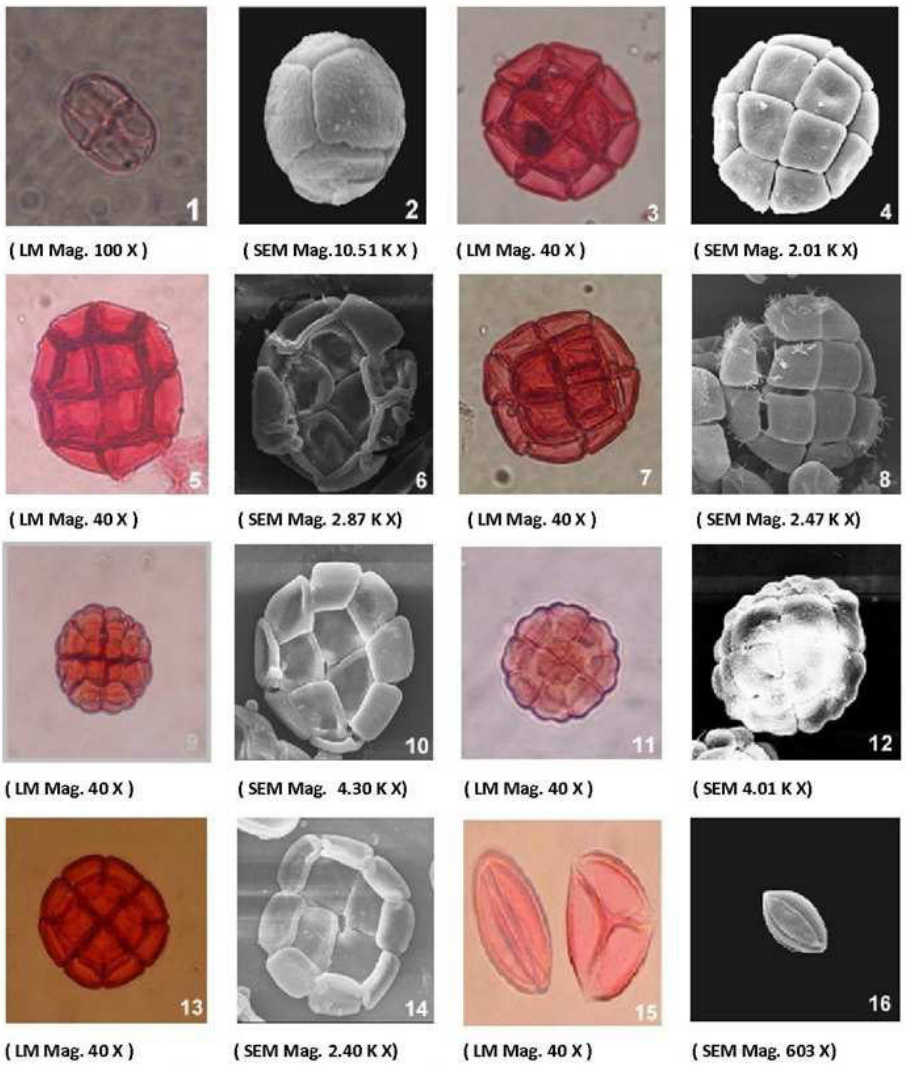

Fig.1-16 Light (LM) and Scanning Electron Micrographs (SEM) showing pollen structure, Fig.1-2 *Mimosa hamata*., Fig.3-4 *Albizia lebbeck*., Fig.5-6 *Albizia procera*., Fig. 7-8 *Pithecellobium dulce* Fig. 9-10 *Acacia nilotica* Fig.11-12 *Acacia leucophloea* Fig. 13-14 *Acacia chundra* fig. 15-16 *Prosopis juliflora*

Key to the Pollen types

1. + Pollen grain in polyads----------2
   - Single pollen grain---------- *P. juliflora*
2. + Pollen grains 16 celled----------3
   - Pollen grains 8 celled----------4
3. + Polyad with psilate, foveolate granulate tectum……4
   - tectum psilate ----------5
4. + foveolate tectum ---------- *M.hamata*
   - Faveolate –rugulate tectum ------- *P. dulce*
5. + Psilate tectum---------- *A.nilotica*
   A. chundra
   - Psilate-foveolate---------- *A.lebbeck*
   A. procera
6. Granulate tectum---------- *A. leucophloea*

DISCUSSION

The investigated species illustrated morphological variation in size, shape, surface structure and surface pattern occurs in all studied acetolysed and unacetolysed pollen grain having a broad range of pollen association. In *Pithecellobium dulce* and *Albizia lebbeck* polyads with 16 pollen grains was observed which showing slight fluctuation from Rukshinda Aftab and Anjum Perveen, (2006) study mentioning 12 and 14 celled polyad. Of the two species of *Albizia*, the polyad are nearly the same size (in between 53-57 µm) and no far difference were observed in other characters. In earlier study by Nayer (1990), association of 4-6 monads in *Mimosa hamata* using LM was reported, whereas, present findings reveals association of 8 pollen grains (octad) using SEM. This shows the advantage of SEM over LM in pollen morphological study. The present findings on *Prosopis juliflora* are matching with earlier studies (Perveen and Qaiser, 1998; Panicker and Sreedevi, 2004 and Tantawy *et al.* 2005) having individual pollen grain. Kenrick and Bruceknox (1979) had extensively studied the development of polyad as in different species of *Acacia* and suggested that the 16 microspore are held within the callose special wall at tetrad stage with cytoplasmic connection. The occurrence of association of 8 graing in the centre (4 upon 4) and 8 grains at periphery in the present studied polyad taxa tend to support this view as it showed multiple of tetrad and formation of 16 celled polyads.

Diameters of polyads varies from 29.5 to 62.24 µm across, octads 13.36 to 14.52 µm whereas, individual grains are 10.94 to 20.41 µm across. Meo and Khan (2004) used pollen size and exine thickness as an important feature for taxonomic distinction and mentioned pollen size is useful in palynological investigations. The compound pollen grains are circular to ovoid in shape while individual grain having triangular, squarish or rectangular in shape. Nature of the tectum is quite variable ranging from psilate-foveolate-finely granulate. The three species of *Acacia* are easily distinguished by their tectal surface (See key to the pollen types) *A. nilotica* and *A. chundra* showed psilate tectum while *A. leucophloea* having granulate tectum. In *Acacia nilotica* and *A. chundra* the central as well as peripheral pollen grain was found to be rectangular (Perveen and Qaiser, 1998) but in case of *A. leucophloea* the central eight grains are rectangular but the surrounding peripheral pollen grains having a small notch in the centre forming ridges at their terminal ends.

Monads are considered the simplest in the evolutionary line while polyads are most advanced (Panicker, 2004).The evolution of pollen grains form monads-tetrads-polyad appears to have coincided in part with the

development of bird and bat pollinated flowers (Elias,1981). The present finding supports the view of pollen and pollinator co-evolution. From the above study, SEM based pollen character are found to be useful in identification and discrimination of taxonomically related genera and species as it's going to reveal more number and minute characters. The key to identify pollen type given in present investigation can be an additional tool for taxanomic identification.

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