

Comparative Study of Some Selected Members of The Families Malvaceae and Sterculiaceae

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ABSTRACT

Present study aims to compare some selected members of Malvaceae and Sterculiaceae by giving special emphasis on their pollen morphology. The different taxa under investigation were *Thespesia populena* L., *Sida cordifolia* L., *Hibiscus schizopetalus* Dyer., *H.rosasinensis* Linn. of Malvaceae and, *Melochia corchorifolia* Linn., *Kleinhovia hospita* Linn. of Sterculiaceae. Pollen morphological analysis was done using Scanning electron micrographs. The structural features of pollen grains are regarded as a more dependable tool in studies of comparative morphology. Although these families show some degree of similarities, they differ in many features such as: axillary and solitary flowers in Malvaceae while terminal and inflorescence in Sterculiaceae; Presence of epicalyx in Malvaceae and absence of this in Sterculiaceae; anthers strictly monothealous in Malvaceae while dithealous in Sterculiaceae. numerous stamen in Malvaceae and definite on Sterculiaceae.

Keywords: Malvaceae, Sterculiaceae, Pollen morphology.

Introduction

The present study aims to compare the selected members of the families Malvaceae and Sterculiaceae with a special attention on their pollen morphology. Plants were collected from in and around the college campus which were available during that period. Comparison was carried out based on their morphological and palynological characters. The present study also discuss the inclusion of both these families together in the order Malvales of APG III system of classification. Bentham and Hooker(1862) also considered these as closely related families.

The Malvaceae is a cosmopolitan family of about 80 genera and nearly 1500 species of herbs, shrubs, and trees. Many members of this family are useful to mankind such as *Gossypium*, *Sida*, *Hibiscus* etc. The Sterculiaceae family has about 50 genera with about 750 species distributed in the tropics. According to Bentham and Hooker's classification(1862) Malvaceae and Sterculiaceae comes under class: Dicotyledonae, sub class : Polypetale in the series of Thalamiflorae under the order Malvales. In the APG III classification Malvaceae has been placed under the order Gentianales which is included under the Eurosids II clade of Rosids.

There are many morphological characters which are used for classification of pollen and impart great value in angiosperm taxonomy. The position, shape, structure and number of aperture are of taxonomic significance. The exine of pollen is endowed with such stable morphological characters which are genetically fixed and do not get influenced by the Environmental fluctuations (John and Skvarla, 2000). These characters are specific for different genera and may vary from species to species.

The study of pollen morphology has assumed great significance in the realm of morphological and comparative botany. In the present study pollen morphological characters are invariably used to substantiate taxonomic revisions and to draw systematic conclusions.

Material and methods

Fresh, healthy open flowers and young flower buds of different age groups were collected and their floral characters were studied using a hand lens or dissection microscope. Based on these observations, diagrams were drawn. Micro-tip pen (ROTRING VARIANT) equipped with 0.1 & 0.2 point were used for the preparation of illustrations.

For pollen morphological studies pollen grains were collected from mature flower buds. Pollen grains were examined by both light microscope (LM) and scanning electron microscope (SEM) for all specimens. For categorizing pollen grains according to shape and size the terminology used was that of Walker and Doyle, (1975).

Table I: Pollen size & shape classes according to Walker and Doyle (1975)

Size classes	Longest axis	Shape classes	P/E x 100
1. Minute grain	<10µm	Peroblate	<50
2. Small grain	10-24µm	Oblate	50-75
3. Medium sized grain	25-49µm	Sub oblate	75-88
4. Large grain	50-99µm	Oblate spheroidal	88-100
5. Very large grain	100-199µm	Spheroidal	100
6. Gigantic grain	>200µm	Prolate spheroidal	100-114
7.	Sub prolate	114-133
8.	Prolate	133-200
9.	Perprolate	>200

P: Polar diameter, E: Equatorial diameter

For SEM, pollen samples were washed with distilled water, dehydrated in an ethanol series and mounted and air dried on Aluminium stubs from 70% ethanol and sputter coated with Platinum – Palladium or Gold by a HITACHI E102 ion sputter. Subsequently these were examined and photographed with a JOEL JSM-5310 LV scanning Electron Microscope operated at 15V.

Results and Discussion

Members of Malvaceae possess flowers in the axillary position while Sterculiaceae it is terminal. Most of the members in Malvaceae shows solitary flowers, but in Sterculiaceae it is always inflorescence. Most of the members of the family Malvaceae possess epicalyx but in the case of Sterculiaceae, it is absent in all the members. Anthers were monotheucus in all the members of Malvaceae investigated during the study, but it was dithecus in Sterculiaceae members. Staminodes were all together absent in Malvaceae but it was present in Sterculiaceae. Stamens were numerous in Malvaceae while they were definite in Sterculiaceae (Table II).

TABLE II MPORTANT TAXONOMIC CHARECTERS OF MALVACEAE & STERCULIACEAE

Name of Taxon	Position of flower	Presence of epicalyx	anther	presence of staminodes	stamen	Arrangement of stamens	Androgynophore
<i>Thespesia populena</i>	axillary	present	monotheclus	absent	numerous	Single whorls	absent
<i>Sida cordifolia</i>	axillary	absent	monotheclus	absent	numerous	Single whorls	absent
<i>Hibiscus schizopetalus</i>	axillary	present	monotheclus	absent	numerous	Single whorls	absent
<i>Hibiscus rosasinensis</i>	axillary	present	monotheclus	absent	numerous	Single whorls	absent
<i>Melochia corchorifolia</i>	terminal	absent	ditheclus	absent	Definite number	Two whorls	absent
<i>Guazuma ulmifolia</i>	terminal	absent	ditheclus	present	Definite number	Two whorls	absent
<i>Klenhovia hospita</i>	terminal	absent	ditheclus	absent	Definite number	Two whorls	present

TABLE III MPORTANT POLLEN MORPHOLOGICAL CHARACTERS OF MALVACEAE & STERCULIACEAE

Families	Sl. No.	Name of Taxon	Shape	Aperture	Exine ornamentation	Diameter (µm)
<i>Malvaceae</i>	1	<i>Thespesia populena</i>	spheroidal	Pantoporate	spinata	70.31
	2	<i>Sida cordifolia</i>	spheroidal	zonoporate	spinata	41.30
	3	<i>Hibiscus schizopetalus</i>	spheroidal	Pantoporate	spinata	134.81
	4	<i>Hibiscus rosasinensis</i>	spheroidal	Pantoporate	spinata	125.28
<i>Sterculiaceae</i>	5	<i>Melochia corchorifolia</i>	Oblate-sphere	3-zonocolporate	porate	20.28
	6	<i>Guazuma ulmifolia</i>	Oblate-sphere	3-zonocolporate	porate	12.80

	7	<i>Kleinhovia hospita</i>	<i>oblate</i>	3- <i>zonocolporate</i>	<i>porate</i>	19.48
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The structural features of pollen grains are regarded as a more dependable tool in studies of comparative morphology that leads to conclusion in plant taxonomy, phylogeny and evolution than those of other vegetative characters (SaadS.J., 1972; NairP.K.K., 1974a). There are many morphological characters which are used for classification of pollen and impart great value in angiosperm taxonomy. The position, shape, structure and number of aperture are of taxonomic significance.

A new approach to determine the primitive and advance nature of angiosperms has been proposed by different workers (Erdtman1952; Bhoj Raj, 1961; Brewbaker, 1967). Pollen morphology is not only a significant factor for taxonomy but also very informative in the field of the study of phytogeny, paleobotany and aeropalynology. From the work of Wodehouse (1935), Erdtman (1952) and a host of others, it is now known that the exine is the projectile of the essential aspects of pollen morphology. The structure and surface sculpturing of the exine are very complex but specific for the various taxa of plants.

In the presently investigated species of the family Malvaceae, the pollen grains were spheroidal in shape, but it was oblate sphere to oblate to oblate-sphere in Sterculiaceae members. Most Malvaceae members have pantoporate pollen aperture, while Sterculiaceae members frequently shows 3-zonocolporate pollen aperture (Table III).

The sculpturing (ornamentation) on the outer surface of exine is of considerable phylogenetic importance. Generally exine sculpturing is of two broad categories, the exerscence type and depression type. The exerscence type (spinulose, spinose, baculate, clavate, verrucate, tuberculate, granulate) which is less specialized, while the latter is advanced (psilate, reticulate, foveolate, scrobiculate, fossulate, striate) (Nair, 1970, 1985). A critical observation of the scanning electron micrographs of the exine surface of the different members of these families showed distinguishable variations. Malvaceae member were spinate and majority of Sterculiaceae members were porate (Table III).

The size and shape may be affected by process of acetolysis, so this cannot be considered as a reliable character (Nair, 1970). But size and shape are considered in many families either in generic or species level for correct placement in the group. Pollen size classes were suggested by Walker and Doyle (table I) used in the present study, the Malvaceae members show comparatively larger pollen than Sterculiaceae members. Its diameter is about 40-136 µm in Malvaceae and 12-32µm in Sterculiaceae. (Table III). Large size of pollen grains may be considered to be more primitive to the smaller (Nair, 1965). Pollen grains are found to be varying in size and shape. Some times the size or shape of the pollen grains may be useful in identification.

Conclusions

On the basis of the present investigation of selected members of Malvaceae and Sterculiaceae, it was evident that these families have clear distinguishing morphological features such as Position of flower, epicalyx, nature of anther, staminode, stamen number and arrangement and androgynophore etc (Table II). Members of the family under present investigation show distinct variation in pollen morphology also such as shape of the pollen, aperture type of pollen, exine ornamentation and diameter of pollen (Table III). Hence from the it has been understood that the families Malvaceae and Sterculiaceae are two distinct taxa which can be clearly identified on the basis of morphological characters including pollen morphology.

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