

# Comparative Study Of Some Selected Members Of The Families Apocynaceae And Asclepiadaceae

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**Abstract-** Present study aims to compare some selected members of Apocynaceae and Asclepiadaceae by giving special emphasis on their pollen morphology. The different taxa under investigation were *Catharanthus roseus* L., *Tabernaemontana divaricata* L., *Nerium oleander* L., *Allamanda cathartica* L., *Cryptostegia grandiflora* R.Br., *Calotropis gigantea* R.Br. and *Marsdenia volubilis* T. Pollen morphological analysis was done using Scanning electron micrographs. Although these families show some similarities, they differ in many features such as phyllotaxy, inflorescence type, presence or absence of staminal corona, presence or absence of gynostegium, adhesion of stamen to stigma, pollinia formation and nature of pollen grain-monomer in Apocynaceae and tetrad in Asclepiadaceae.

**Indexed Terms** Apocynaceae, Asclepiadaceae, Pollen morphology.

## I. INTRODUCTION

The family Apocynaceae has got affinities with Asclepiadaceae, Oleaceae and Gentianaceae. It has been placed under the order Gentianales by Bentham and Hooker (1862-1883) and in the order Contortae by Engler and Prantl (1886). Hutchinson (1973) included the family in his order Apocynales and considered it to have been derived from stalk ancestral to Loganiaceae. Armen Takhtajan (1997), Rolf M.T Dahlgren (1980), Arthur Cronquist (1988) and Robert F. Thorne (1992) placed the family in the order- Gentianales.

The family Asclepiadaceae has been considered by most phylogeneticists as closely allied to Apocynaceae. Bentham and Hooker placed the family along with Apocynaceae and Loganiaceae under the order Gentianales in the series Bicaepellatae of Gamopetalae. Engler and Prantl included in Contortae of Sympetalae (1886). Hutchinson treated the subfamily Periplocoideae as distinct family Periplocaceae (1973). He classified Asclepiadaceae

along with Apocynaceae in the order Apocynales. Thorne (1992) and Takhtajan (1997) treated Asclepiadaceae as sub family of Apocynaceae.

Hutchinson's classification (1969) shows that Asclepiadaceae and Apocynaceae are closely related families by having exstipulate leaves, presence of corona, epipetalous stamens, partially syncarpous ovary, marginal placentation, nuclear endosperm, winged hairy seeds. However, Apocynaceae differ from Asclepiadaceae in the absence of formation of pollinia, absence of translator mechanism and gynostegium.

In the APG III classification Apocynaceae has been placed under the order Gentianales which is included under the Euasterid I clade of Eudicots. According to APG III, the family Asclepiadaceae is treated as subfamily of Apocynaceae in the name of Asclepiadoideae along with Rauvolfioideae, Apocynoideae, Periplocoideae and Secamonoideae. Apocynaceae is commonly called the "Dogbane family", after the American plant known as dogbane, *Apocynum cannabinum*. The members of this family show variable habit, from magna trees to climbing vines or small herbs. Yet, they can be easily recognized by the presence of latex and by a bicarpellary gynoecium, in almost all cases separated at the ovary level, but distally merging to form an organ called the style-head. The carpels are usually separated at the apex, forming the apical appendices, sometimes inconspicuous. The fruit is a drupe, a berry, a capsule, or a follicle.

The family Asclepiadaceae is commonly known as "Milkweed family" because of containing milky juice (latex) in its stem. The name Asclepiadaceae came from *Asclepias* genus which in turn is named for Asklepias, the God of healing in Greek mythology.

They form a group of perennial herbs, twining shrubs, lianas or rarely trees but notably also contain a significant number of leafless stem succulents. Members of the family Asclepiadaceae are unique due to the association of pollen grains that form a sac-like definite structure called pollinia (Singular: Pollinium).

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 (Erdtman 1952; 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 phytoeny, 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.

## II. 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). (Ref. Table I)

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.

## III. RESULT AND DISCUSSIONS

All the taxa under present investigation in the family Apocynaceae along with *Cryptostegia grandiflora* R. Br. belonging to Asclapiadaceae exhibited corolline corona whereas it was staminal corona in *Calotropis gigantea* R. Br. and *Marsdenia volubilis* T. All the taxa under observation in Apocynaceae possess epipetalous stamens with sagittate anthers while the stamens were found to be adherent to stigma for the taxa under Asclepiadaceae. Insertion points of stamen in the corolla tube vary among the members in Apocynaceae and Asclepiadaceae. Stamens were inserted at the wide part of corolla tube in *Catharanthus roseus* L. and *Tabernaemontana divaricata* L. It was inserted at narrow part of the corolla tube in *Allamanda cathartica* L. and at the apex of corolla tube in *Nerium oleander* L.

Based on the shape, the pollen grains can be grouped into peroblate, oblate, sub oblate, oblate-spheroidal, spheroidal, prolate, sub prolate, euprolate and perprolate (Table I). During the present study the shape of the pollen grains was found to be oblate spheroidal in *Allamanda cathartica* L., prolate spheroidal in *Nerium oleander* L., prolate in *Tabernaemontana divaricata* L. and prolate in *Catharanthus roseus* L. (Table II). In *Cryptostegia grandiflora* R.Br., the shape of pollen was found to be prolate (Table III).

Presence of pollinia is a distinguishing and diagnostic feature of the family Asclepiadaceae. Robert Brown (1810) separated the family Asclepiadaceae from Apocynaceae mainly on the basis of the presence of translator in the Asclepiadaceae and its absence in Apocynaceae. Although Brown's classification has been universally accepted and implemented; controversy over the delimitation of the two families has been never put to rest.

The present investigation provided the study of shape, size, colour, position and attachment translator and corpusculum of pollinia. The pollinia of *Calotropis*

*gigantea* R.Br. was found to be obovate in shape and found pendulous with stalk, whereas the pollinia of *Marsdenia* was ovate- elliptical in shape and erect with stalk. The attachment of pollinia was terminal in position for both the taxa. The pendulous pollinia (*Calotropis gigantea* R.Br.) and erect pollinia (*Marsdenia volubilis* T.) are the two conditions observed in Asclepiadaceae. The latter is considered to be primitive condition (Kunze,1993). No marked differences were found in the case of translator and corpusculum in the investigated taxa except the difference in their sizes

### CONCLUSION

On the basis of the present investigation of selected members of Apocynaceae and Asclepiadaceae it was evident that the family Asclepiadaceae has clear distinguishing features like presence of pollinium and gynostegium from the former. Even though *Cryptostegia grandiflora* R.Br. posses pollen in grain form it was in tetrad condition similar to the pollen grains of some members of Apocynaceae such as *Thevetia*. Eventhough both families show some morphological similarities,they vary in many features like epipetalous free stamen in Apocynaceae while they were found to be adherent to stigma in Asclepiadaceae;presence of gynostegium and pollenia only in Asclepiadaceae and absent in Apocynaceae.

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

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

P:Polar diameter, E: Equatorial diameter

Name of taxon	Aperture morphotype	Shape	Exine ornamentation
<i>Catheranthus roseus</i>	3 zonocolporate	Perprolate	Foveolate - perforate
<i>Tabernaemontana divaricata</i>	4 zonocolporate	Prolate	Smooth perforate
<i>Nerium oleander</i>	3-4 zonoporate	Prolate spheroidal	Psilate
<i>Allamandacathartica</i>	3 zonocolporate	Oblate spheroidal	Psilate

TableIII: Table showing pollen grain features of *Cryptostegia grandiflora*

Name of taxon	Shape	Exine ornamentation
<i>Cryptostegia grandiflora</i>	Prolate	Psilate

Table II: Pollen Characters of Apocynaceae Members