Pollen Morphology and Phylogeny of Apocynaceae from Murshidabad District, West Bengal

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Abstract: The family Apocynaceae comprise about 4530 species and 412 genera, are widely distributed throughout the world. Most of the grow species commonly found to grow in tropical parts and a few are in the temperate regious of the world. The family is represented in India by 29 genera and 60 species, found to grow chiefly in Eastern Himalayas and also in southern and Peninsular India. Apocynaceae is very much related to Asclepia daceae and differ in the presence of pollen grains not in pollinia. Palynological observations were carried out 8 genus with 8 species collected from various localities of Murshidabad District, West Bengal, India. Palynological features have been evaluated in understanding the taxonomic phylogeny of the family.

Key words: Apocynaceae, pollen morphology, phylogeny.

INTRODUCTION

Pollen morphology is now recognised as an important tool in taxonomic studies. Diversity of pollen size, shape, polarity, symmetry, apertural types and ornamentations can be used to understand the taxonomic relationships (Bhattacharya et al. 209, Ganga Kailas et al. 2016). Pollen of Apocynaceae is diverse and because it is often rather homogenous within a genus. Palynological characters will continue to be used both in characterization of genera and in assessing their phylogenetic relationships (Scotland 1993 and Tantawy et al. 2003).

Apocynaceae has been the subject of several taxonomic, evolutionary and phylogenetic analyses (Endress at al. 2007; Rapini 2012), many of which have described pollen morphological characteristics.
In the present investigation, pollen grains of 8 genera and 8 species belonging to Apocynaceae were collected from different part of Murshidabad District. In the present findings, the pollen morphological data are compared with available other pollen studies to evaluated the taxonomic value of pollen traits in Apocynaceae taxa by using multiple microscopic techniques. Moreover, molecular and phylogenetic studies were recommended to strengthen the systematic of Apocynaceae taxa.

The district Murshidabad is located in 23°43' and 24°52', North latitude and 87°49' and 88°44' East longitude. The shape of the district resembles an isosceles triangle with its apex pointing towards North-west. It is bounded on the East by the river Padma; on South by the districts of Burdwan and Nadia and to its West lie the districts of Birbhum and Sauthalparganas. The town Berhampur is the headquarter of the district the river Bhagirathi, flowing through the district from North to South divides it into two more or less equal portion of contrasting physiography.

The tract to the West of Bhagirathi is locally referred to as Rarh and the tract of the East as Bagri. Bagri the Eastern tract is low lying alluvial plain occasionally getting flooded by the spill of Bhagirathi and other rivers, having a relatively humid climate and fertile soil. In the Western tract on the other hand the surface is high and undulating, the soil is haw clay and the climate is drier in the eastern tract. Being situated in the lower Gangetic valley, The overall inclination of the district is from North-West to South-East.

MATERIALS AND METHOD

The work is primarily based on fresh collection of materials from different regions of Murshidabad District of West Bengal. Polliniferous material were preserved in FAA along with preparation of corresponding herbarium sheets of plant specimen.

Acetolysed preparation of polleniferous material was done Erdtman's (1960) acetolysed technique. Pollen morphological characters were studied under Leitz, Laborluxs (Germany) microscope. Photomicrographs of suitable magnifications were made under a Leica DMLB(Germany) microscope. Pollen grain have been described as per standard terminologies of Erdtman (1953), Faegri and Iversen (1975) and Walker and Doyle(1975).

Description of pollen grains:

Alstonia scholaris R. Br.

Pl. 1, Figs. 1-2

Pollen grains spheroidal, 34-37 µm in diameter, colpi long, tapering, endoaperture lalongate, (3x4.5µm); exine ± 1.5µm thick, sexine and nexine not discernible; surface psilate.

Carissa carandas L. Mant.

Pl. 1, Figs 3-4

Pollen grains subprolate, PXE= 25-31x19-23 µm; amb subcircular, trizonocolporate, colpi narrow elliptic, 21-24 µm long and 2-3 µm wide at the equator, tips acuminate, endoaperture lolongate, 4-5 x 8-10 µm; exine 2-2.5 µm thick, sexine thicker than nexine, tegillate; sculpturing reticulate, lumina polygonal, about 1 µm wide.

Ervatamia divericata L.

Pl. 1 Figs 7-8

Pollen grains spheroidal, PXE=38-46 µm in diameter, amb square; tetrazonocolporate, sinoaperturate, colpi narrow elliptic, about 4 µm wide near the equator, endoaperture lalongate, 3.5-4 x 6.5-7.5 µm ; each colpus on either side with streak like thickening; exine 3-4 µm thick, sexine thicker than nexine; sculpturing reticulate, lumina irregularly polygonal, 1-1.75 µm in width.

Holarrhena antidysenterica (L.) Wall.

Pl. 1 Figs 5-6

Pollen grains prolate, PXE=38-50 x 25-34 µm, amb circular; tetrazonocolporate, colpi narrow elliptic, 32-43 µm long and 2-3 µm wide at the middle, ends acute, endoaperture lalongate, 2.5 x 4 µm; exine 2.5-3 µm thick, sexine thicker than nexine; sculpturing faintly reticulate, lumina polygonal.

Nerium indicum Mill.

Pl. 1 Figs 10-11

Pollen grains suboblate to oblate spheroidal, PXE=65-72x75-83 µm; amb subcircular; trizonoporate, spore circular to oval, 7-10 µm in diameter; exine 3-5.5 µm thick sexine much thicker than nexine, tegillate; surface ruguloreticulate.

Rouvolfia serpentina (L.) Benth. Ex Kurtz.

Pl. 1 Fig 9

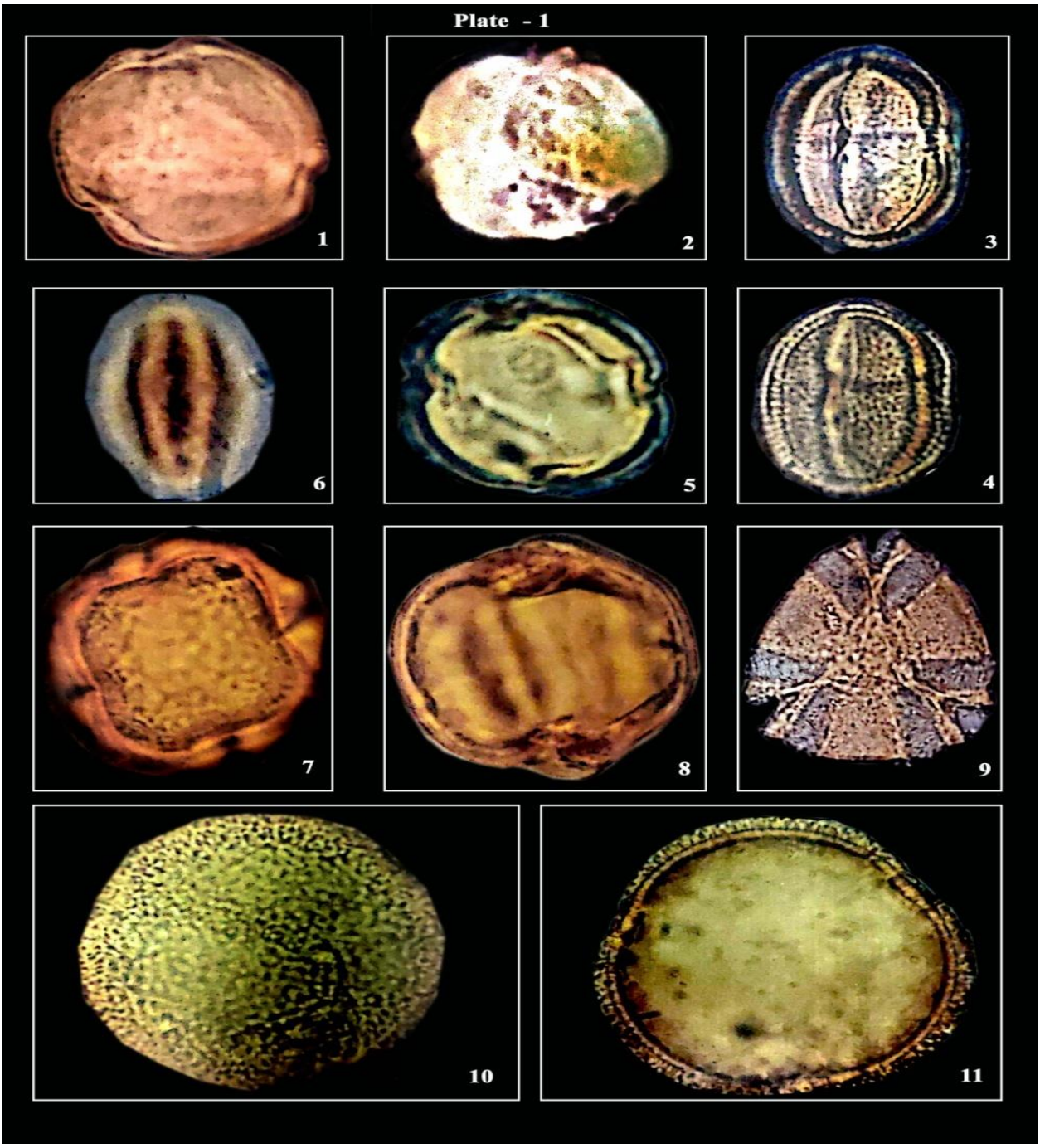
Pollen grain spheroidal, 34-40 µm in diameter, trizonocolporate, colpi elliptic, 22-25 µm long and 3-4 µm wide, endoaperture circular, 3-3.5 µm in diameter, exine ± 1.5 µm thick, sexine thicker than nexine; sculpturing reticulate.

Vinca rosea L.

Pollen grains prolate spheroidal to spheroidal, equatorial outline circular, PXE=62-70X 56-62 µm; trizonocolporate, colpi narrow elliptic, 48-55 µm long, 1.5-2.5 µm wide at the middle, ends acute, endoaperture lalongate (8 x 12 µm); exine 3-4 µm thick, sexine almost equal to nexine, sculpturing reticulate, lumina 1-1.5 µm across.

Wrightia tinctoria (Roxburgh.) R. Brown.

Pollen grains ± spheroidal, equatorial outline ± circular, PXE=32-39X33-37 µm; tetrazonoporate, pore circular, 3-6 µm in diameter; exine 3-3.75 µm thick, sexine much thicker than nexine, surface psilate.



EXPLANATION OF PLATE – 1

Fig 1-2. Pollen grains of *Alstonia Scholaris*, x 1180

1. Pollen view showing colporate aperture
2. Same grain in surface in focus

Fig 3-4. Pollen grains of *Carissa carandas*, x 1180

3. Equitorial view in optical section
4. Same grain with surface in focus showing reticulate sculpturing

Fig 5-6. Pollen grains of *Holarrhena antidysenterica*

5. Polar view in optical section, x 1180
6. Equitorial view showing two colporate apertures in focus, x 460

Fig 7-8. Pollen grain of *Ervatamia divericata*, x 1180

7. Polar view showing square amb with tetrazonoporate aperture and reticulate surface with irregularly polygonal lumina
8. Equitorial view in optical section showing sporoderm structure and faintly visible colporate apertures accompanied by exinal thickening on either side, the lalongate endoaperture is faintly visible in the colpi on left

Fig 9. Pollen grain of *Rouvolfia serpentine*, in polar view showing surface in focus, x 1180

Fig 10-11. Pollen grain of *Nerium indicum*, x 1180

10. Pollen grain showing ruguloreticulate surface ornamentations
11. Polar view in optical section showing exine stratification and trizonoporate aperture.

Palynological features of the material studied:

SPECIES	SHAPE	SIZE P X E MEAN µM	EXINE		APERTURE			REMARKS AMB
			Thickness µm	Ornamentation	Type	Ecto-aperture	Endo-aperture	
Alstonia scholaris	Spheroidal	34x37	± 1.5	Psilate	Colporate	Slit like	Lalongate	
Carissa carandas	Subprolate	28x21	2-2.5	Reticulate	Colporate	Slit like	Lolongate	Circular
Ervatamia divericata	Spheroidal	38x46	3-4	Reticulate	Colporate	Slit like	Lalongate	Square
Holarrhena antidysenterica	Prolate	44x29.5	2.5-3	Faintly reticulate	Colporate	Slit like	Lalongate	Circular
Nerium indicum	Sub-oblate to Oblate Spheroidal	68.5x79	3.5-5	Rugulo-reticulate	Porate	Slit like	Circular	Sub-circular
Rouvolfia serpentine	Spheroidal	34x40	±1.5	Reticulate	Colporate	Slit like	Circular	
Vinca rosea	Prolate spheroidal to spheroidal	66x59	3-4	Reticulate	Colporate	Slit like	Lalongate	
Wrightia tinctoria	Spheroidal	35.5x35	3-3.75	Psilate	Porate	Slit like	Circular	

DISCUSSION

Pollen grains are microscopic and develop to maturity in a protected environment that is only indirectly affected by external factors such as climate, habitat and soil type. Pollen morphological types of 8 species belonging to 8 genera in Murshidabad District have been worked out. Among the collected materials 4 taxa are spheroidal, with tetrazonocolporate, trizonocolporate and tetrazonoporate aperture. One taxa exhibit subprolate with trizonocolporate aperture. Prolate tetrazonocolporate pollen grain found in *Itolarrhena antidysenterica*. Sub oblate pollen grain with tetrazonoporate type of pollen grain found in *Nerium indicum*. Prolate spheroidal grain found in *Vinca rosea*. Endoaperture varies from Lalongate – circular to lolongate type.

In general, there was a great degree of morphological variation among the pollen grains, which were apolar or isopolar with ornamentation ranging psilate, reticulate to regulo-reticulate.

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