Pollen Diversity Studies in Some Taxa of Bicarpellatae from Nagpur

Sapna V. Awachat
Department of Botany, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Abstract:

Dicots are the diverse group of plants on the basis of morphology, anatomy, cytogenetics, embryology and pollen morphology. Pollen diversity is the study of the variations in the morphology of pollen grains. Pollen has also proved to be an excellent tool in taxonomic studies. The application of pollen characters in solving controversial taxonomical and phylogenetic problems has now been widely recognized all over the world (Mandal, 2010). In the present paper, pollen diversity of several taxa belonging to Bicarpellatae (Apocynaceae, Asclepiadaceae, Boraginaceae, Convolvulaceae, Solanaceae, Scrophulariaceae, Acanthaceae, Thunbergiaceae, Verbenaceae, Lamiaceae, etc.) from Nagpur is selected. The pollen grains show variations with respect to exine ornamentation, aperture type, shape, size and NPC (number, position, character) classification etc. The pollen slides were prepared by using acetolysis method (Erdtman 1952) and documentation was done by using light microscope and digital camera. The pollen grain studies show variation in exine ornamentation (psilate to verrucate), aperture (porate to spiraperturate), shape (oblate to prolate) and size (small to large). The pollens described on the basis of NPC classification are presented. Pollen calendar and distribution was also noted in all taxa. It is found that the pollen grains with relative variations in pollen morphology help us to differentiate families.

Keywords: Bicarpellatae, Pollen grains, Acetolysis.

Introduction:

Palynology involves the study of pollen and encompasses the structural and functional aspect of pollen. Pollen grains come in an infinite variety of shapes with complex surface ornamentation and occur on almost every surface in nature. On account of its unique characters, pollen and spores are often referred as nature's fingerprints of plants (Agashe 2006). The study of morphology of pollen grains is basic necessity because of its fundamental value in the recognisation and identification of grains found in various conditions (Arora and Modi, 2008). Dicot families are highly diversified and pollen morphology of these plants shows great variation. The study of the variations in the morphology of pollen grains is known pollen diversity. The application of pollen characters in solving controversial taxonomical and phylogenetic problems has now been widely recognized all over the world. Pollen has also proved to be an excellent tool for taxonomic studies.

In the present investigation, the pollen diversity in several taxa of Bicarpellatae from Nagpur is studied. The series Bicarpellatae includes four orders (cohorts) as Gentiales, Polemoniales, Personales, Lamiales and fourteen families (orders) according to Bentham and Hooker system of classification. The pollen grain morphology of several taxa belonging to series Bicarpellatae (Apocynaceae, Gentianaceae, Ploemoniaceae, Convolvulaceae, Solanaceae, Scrophulariaceae, Acanthaceae, Thunbergiaceae, Lamiaceae ,Verbenaceae etc.) from Nagpur were selected. The study was undertaken to reveals the pollen morphological variations using Light Microscope so as to understand palynological characteristics within different taxa. The pollen grains were acetolyzed to remove the protoplasmic

contents so that its exine diagnostic features such as ornamentation, apertures and exine stratification can be observed. The pollen grains show variations with respect to aperture type, shape, size [polar axis (PA), equatorial axis (EA)], exine ornamentation and NPC (number, position, character) classification etc.

Material and Methods:

Polliniferous material (mature anthers) was mostly collected from identified plants fresh flowers in small vials and fixed in 70% alcohol during field trip. At least five floral buds per specimen were dissected for anthers. The anthers were then acetolyzed according to Erdtman (1960) for eight to nine minutes at 80–90°C; depending on the condition of the anthers the duration and temperature were modified as necessary. Samples for light microscopy were mounted on slides using glycerol jelly, and then sealed with nail polish. Microphotography of slides of pollen grains was done by Zeiss Axio Star Plus Trinocular microscope using Canon Power shot A 620 7.1 Megapixel digital camera.

Observations:

The pollen diversity of total 24 taxa belonging to Bicarpellatae from Nagpur is selected. The investigated families and taxa for pollen diversity are as follows, in Apocynaceae 4 taxa (*Rauvolfia serpentina Allamanda cathartica Plumeria rubra Plumeria alba Nerium oleander),* Convolvulaceae 4 taxa (*Ipomoea aquatic, Ipomoea obscura, Ipomoea carnea sub sp. fistulosa and Convolvulus arvensis),* Solanaceae 2 taxa (*Physalis minima* , *Solanum virginianum),* Polemoniaceae 1 taxa (*Phlox dovnondii*)**,** Scrophulariaceae 1 taxa (*Verbascum chinense),* Gentianaceae 1 taxa (*Canscora decurrens*), Thunbergiaceae 1 taxa (*Thunbergia fragrans*) , Acanthaceae 6 taxa (*Ecbolium ligustrinum, Justicia adhatoda, Gantelbua urens, Ruellia tuberose, Blepharisrepens* and *Rungia rapens)*, Lamiaceae 2 taxa (*Hyptis suaveolens, Leucas biflora*) and Verbenaceae 1 taxa (*Petrea volubilis).* The pollen grains variations with respect to above taxa are categorized into different groups as size (polar axis) PA(µ) and (equatorial axis) EA(µ) **,** shape classes , nature of apertures, NPC (number, position, character) classification , exine ornamentation, sexine nexine ratio and pollen calendar is shown in Table 1.

Table. 1 – Palynological description of taxa.

S. No	Plant Name	Family	Size PA (µ)	Size EA (µ)	Shape classes	Nature of aperture	NPC	Exine ornam-entation	Sexine Nexine ratio	Pollen calendar
1	*Rauvolfia serpentina*	Apocynaceae	46	30	Prolate	Colporate	345	Reticulate	Equal	March – May
2	*Allamanda cathartica*	Apocynaceae	20	20	Spheroidal	Colporate	345	Reticulate	Equal	Almost throughout year
3	*Plumeria rubra*	Apocynaceae	22	22	Spheroidal	Syncolpate	343	Psilate	Equal	March-Sept.
4	*Plumeria alba*	Apocynaceae	22	22	Spheroidal	Syncolpate	343	Psilate	Equal	May – Sept.
5	*Nerium oleonder*	Apocynaceae	28	28	Spheroidal	Colporate	345	Finely reticulate	Equal	Almost throughout year
6	*Canscora decurrens*	Gentianaceae	22	16	Prolate	Colporate	345	Reticulate	Equal	Sept - Feb.
7	*Ipomoea aquatica*	Convolvulaceae	46	46	Spheroidal	Pantoporate	764	Echinate	Equal	Throughout year
8	*Ipomoea obscura*	Convolvulaceae	58	58	Spheroidal	Pantoporate	764	Echinate	Equal	Aug.- Feb.
9	*Ipomoea carnea sub sp. fistulosa*	Convolvulaceae	134	134	Spheroidal	Pantoporate	764	Echinate	Equal	Throughout year
10	*Convolvulus arvensis*	Convolvulaceae	40	40	Spheroidal	Colpate	343	Reticulate	Sexine thick	Dec.- June
11	*Solanum virginianum*	Solanaceae	20	14	Prolate	Colpate	345	Psilate	Equal	Dec. - May
12	*Physalis minima*	Solanaceae	22	18	subprolate	colporate	345	Psilate	Nexine thick	July – April
13	*Phlox dovnondii*	Polemoniaceae	20	20	Spheroidal	Porate	746	Crotonoid pattern	Sexine thick	Sept. – Dec.
14	*Verbascum chinense*	Scrophulariaceae	18	14	Sub-prolate	Colporate	345	Psilate	Equal	Sept. – June
15	*Thunbergia fragrans*	Thunbergiaceae	40	40	Spheroidal	Spiraperturate	800	Reticulate	Sexine thick	Sept. - Dec.
16	*Ecbolium ligustrinum*	Acanthaceae	20	20	Spheroidal	Heterocolpate	645	Reticulate	Sexine thick	Oct. - May
17	*Justicia adhatoda*	Acanthaceae	32	20	Prolate	Porate	244	Reticulate	Sexine thick	Aug. – March
18	*Gantelbua urens*	Acanthaceae	36	20	Prolate	Porate	444	Striate	Equal	Dec. – March
19	*Ruellia tuberosa*	Acanthaceae	46	46	Spheroidal	Porate	344	Crotonoid pattern	Sexine thick	Sept. - May
20	*Blepharis repens*	Acanthaceae	20	14	Prolate	Colpate	143	Reticulate	Equal	Oct. – March
21	*Rungia rapens*	Acanthaceae	20	14	Prolate	Colpate	244	Psilate	Nexine thick	Nov.- March
22	*Hyptis suaveolens*	Lamiaceae	10	12	Sub-oblate	Colpate	643	Reticulate	Sexine thick	Oct. - Feb.
23	*Leucas biflora*	Lamiaceae	16	12	Prolate	Colpate	343	Finely reticulate	Equal	Aug. - April
24	*Petrea volubilis*	Verbenaceae	20	30	Oblate	Porate	344	Obscure	Sexine thick	Feb.- April

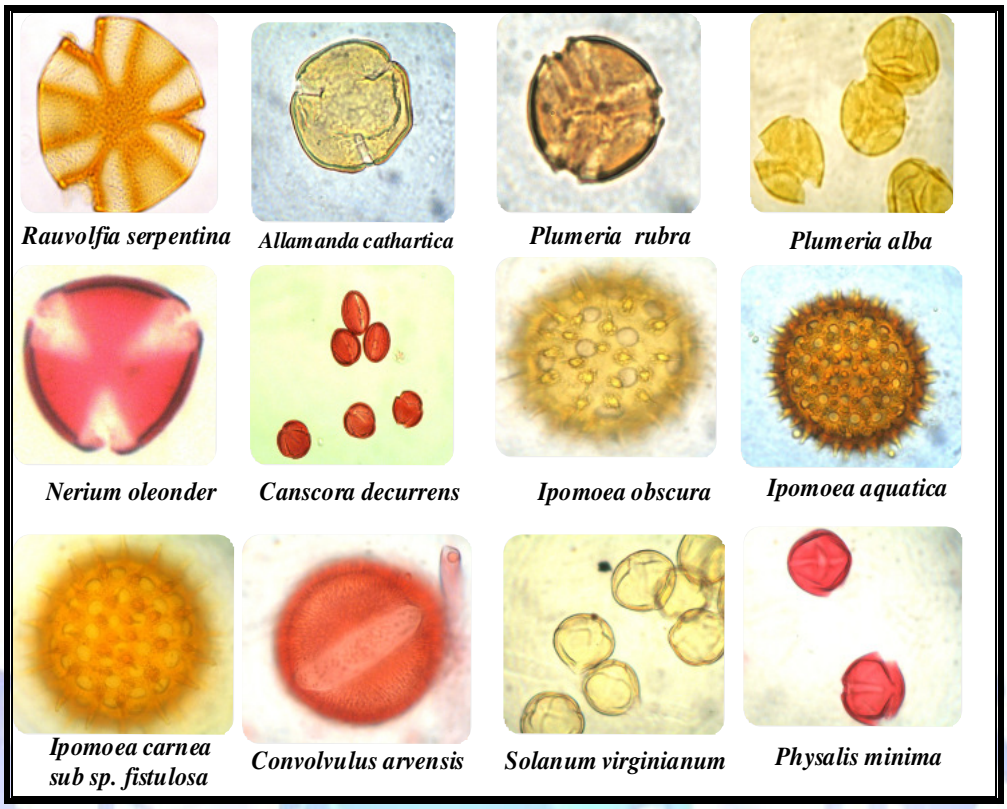

Figure. 1- Microphot ographs of taxa

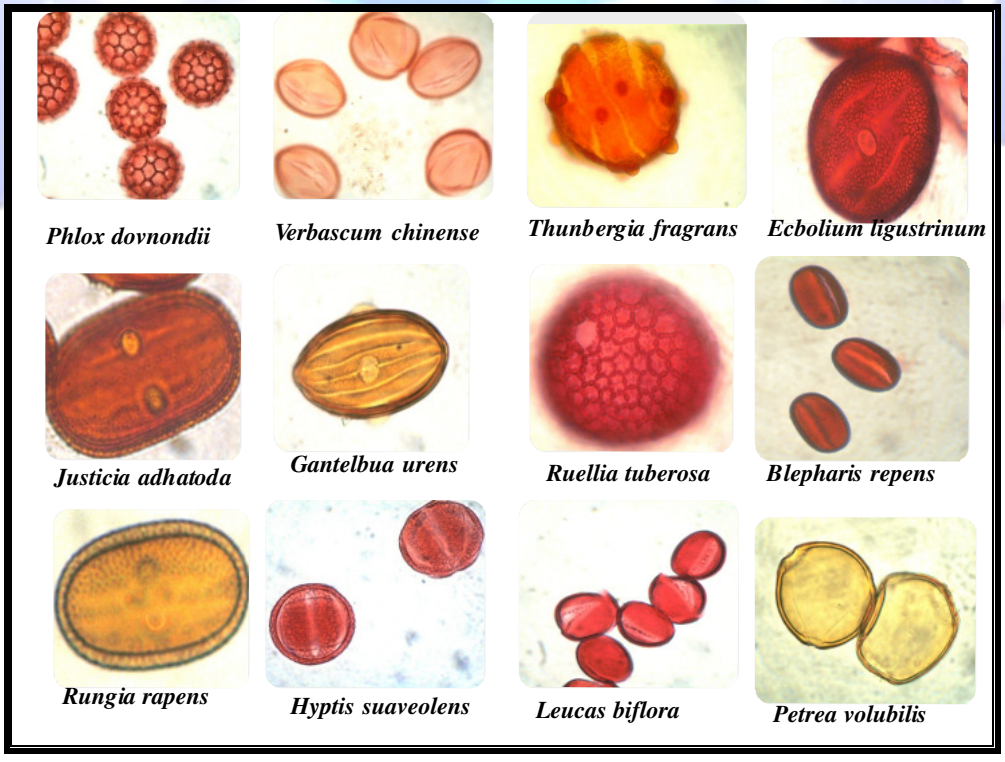

Figure. 2– Microphotographs of taxa

Conclusions:

The pollen grain studies of several families of series Bicarpellatae (Apocynaceae, Gentianaceae, Polemoniaceae, Convolvulaceae, Solanaceae, Scrophulariaceae, Thunbergiaceae, Acanthaceae, Lamiaceae, Verbenaceae etc.) show variations in aperture (porate to spiraperturate), shape (oblate, spheroidal to prolate) size (small to large) and exine ornamentation (psilate to reticulate).

The pollens were described on the basis of NPC classification. Pollen calendar was also recorded for all taxa. As pollen calendar provide knowledge of the occurrence and concentration of the allergenic pollen, which is of great help to the aerobiologists and clinicians. It is found that the pollen grains with relative variations in pollen morphology help us to differentiate families.

In the study we also found trend of evolution in pollen grains apertures, the tricolpate condition have given rise to polycolpate, heterocolpate, tricolporate, triporate, pantoporate, the similar condition reported by Takhtajan (1980) . The present investigation can be an additional tool for taxanomic identification.

Acknowledgement:

The author wishes to record his deep sence of gartitude to Dr. Saoji mam for their help during investigation and Dr. Nitin Dongarwar who were chiefly instrumental in introducing me to this intresting discipline of Botany. They were constantly a source of inspiration during the period of this investigation.

References:

Agashe S. (2006). Palynology and Its Application. *Oxford and IBH Pub. Co. Pvt Ltd.* New Delhi, India

Arora A. and Modi A. (2008). An acetolysis technique for pollen slide preparation. *Indian J. Aerobiol.* 21 (2): 90-91.

Erdtman G. (1952). The acetolysis method. A revised description. *Sv. Bot. Tidskr.,* 54, 561–564.

Takhtajan, AL. (1980). *Bot. Rev.***46**:225-359.