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RESEARCH ARTICLE

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Pollen morphological study of some plant taxa from Arambagh region of Hooghly District, West Bengal, India

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Abstract

The pollen morphology and exine structure of some plant taxa growing in the area of Arambagh of Hooghly District, West Bengal, India were studied using light microscopy during the period of September 2012 to February 2013. The pollen grains of *Alstonia scholaris, Thevetia purpurea, Plumeria alba, Catharanthus roseus,Tabernaemontana divericata, Moringa oleifera, Carica papaya, Mangifera indica* are 3-colporate type. The pollen grains of *Nerium odoratum* are 5-porate type and in *Brassica campestris* it is 3-porate type. The endangered plant *Rauwolfia serpentina* reveals 3-colpate type of pollen grain. The polyad type of pollen grains consisting of 12 cells is observed in *Acacia auriculiformis*. The flowering period of the investigated taxa are recorded. The opening of the flower of *Catharanthus roseus* is observed. The pollination of this plant is nocturnal as the flowers of these plants blossoms at evening 6.30 pm-7.00 pm. The aim of the present investigation is to study different pollen parameters such as shape, size, colpa and exine ornamentation for the taxonomic assessment of the groups of plants.

Keywords: pollen, taxonomic assessment, opening of flower

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Introduction

Now a days study of pollen is an important area of research. Various pollen morphological features such as symmetry, shape, apertural pattern and exine configuration are very conservative features for the taxonomic assessment of the plants (Perveen, 2006; Bera et al., 2007; Keshavarzi et al., 2012). Moreover, some plants growing in the surroundings causes respiratory troubles or allergy in human beings (Singh and Kumar, 2004; Chauhan and Goyal, 2006). There are many plants in the Arambagh regions of Hooghly district, West Bengal such as rice, mustard, coconut, grasses, *Alstonia scholaris, Moringa oleifera, Carica papaya* etc., the pollen grains of which are responsible for allergy. Keeping in view the sufferings of the people due to allergic disorders in this district primarily detailed pollen morphological study of some plants growing in Arambagh region of Hooghly district during the period of September 2012 to February 2013 was undertaken.

Materials and Methods

The mature flowers of some plant taxa growing around Arambagh region of Hooghly District during the period of September 2012 to February 2013, such as *Alstonia scholaris, Thevetia purpurea, Plumeria alba, Catharanthus roseus, Tabernaemontana divericata, Moringa oleifera, Carica papaya, Mangifera indica, Nerium odoratum, Brassica campestris, Rauwolfia serpentina* and *Acacia auriculiformis* were collected and

pollen morpho types studied following acetolysis method (Erdtman, 1952). The anthers of the collected flowers were crushed in 70% alcohol in a centrifuge tube and it was centrifuged for 5 mins at 2500 rpm.Water was decant off and acetolysis mixture (9 parts acetic anhydride and 1 part conc. H_2SO_4) added slowly to the residue sample. It was kept in hot water bath at 80°c for 2-3 mins. It was then centrifuged again for 20 mins. After centrifugation the residue sample was mounted in glycerine jelly. Relative humidity and temperature of the month was recorded with the help of hygrometer and thermometer. To study the opening of flower of *Catharanthus roseus* a good number (100) of healthy flower buds was observed throughout day and night for confirming the period of blooming of the flower. The microphotographs of the pollen grains were taken in a microscope (Make-Olympus and Model-CX21i and number 12M268). The measurement of the pollen grains were taken with the help of an Ocular Stage Division (Erma) and the measuring unit converted into µm (micrometer).The terminology of pollen is in accordance with Bhattaqcharya et al. (2009), Erdtman (1952), Faegri and Iversen (1964), Kremp (1965), and Moore and Webb (1978).

Results

Flowers of different plant taxa growing in the Arambagh region was collected during the period of September 2012 to February 2013 (Fig. 1). The flowering period of the investigated taxa was recorded (Table 1). The temperature (°C) and humidity (%) of the said period was also recorded (Table 2). The pollen morphology of the investigated taxa was studied critically. Out of twelve genera studied, 3-colporate type of pollen grains were observed in *Alstonia scholaris,Thevetia purpurea,Plumeria alba, Catharanthus roseus, Tabernaemontana divericata, Moringa oleifera, Carica papaya* and *Mangifera indica* (Table 3; Fig. 2). The pollen grains of *Nerium odoratum* are 5-porate type,where as the grain is 3-porate type in *Brassica campestris*. The endangered plant *Rauwolfia serpentina* reveals 3-colpate type of pollen grain. The polyad type of pollen grains consisting of 12 cells is observed in *Acacia auriculiformis*. The shape of the grains, exine ornamentation, length of colpa, diameter of pore, exine thickness and the value (PA/EDX100) for determining the shape of the grains are given below in Table 3.

Table 1. Flowering period of the investigated taxa (A-Apocynaceae, M-Mimosaceae, Mo-Moringaceae, C-Caricaceae, B-Brassicaceae, An-Anacardiaceae, T-thorough out the year)

Name of the Plants	Common name	Family	Flowering period
Alstonia scholaris	Chatim	A	Sep-Jan
Thevetia purpurea	Kolkae	A	T
Plumeria alba	Katgolap	A	Nov-Mar
Nerium odoratum	Karobi	A	Nov-Mar
Catharanthus roseus	Nayantara	A	T
Tabernaemontana divericata	Tagar	A	T
Rauwolfia serpentina	Sarpagandha	A	Sep-Dec
Acacia auriculiformis	Sonajhuri	M	Sept-Dec
Moringa oleifera	Sajnae	Mo	Jan- Mar
Carica papaya	Papaya	C	July-Oct
Brassica campestris	Mustard	B	Dec-Jan
Mangifera indica	Mango	An	Feb-Mar

The pollen sample i.e. anthers of collected flowers was acetolysed for clear observations of exine layers. Different parameters of the pollen grains like colpa, exine ornamentation etc. were determined comparing acetolysed grains. Microphotographs were taken of the acetolysed grains (Fig. 2) by light microscopy. To observe the opening of flower of *Catharanthus roseus,* 100 plants having flower buds were tagged with proper label and opening or

blossoming of flowers noticed throughout the day and night. Full blossoming was noticed at evening 6.30 pm-7.00 pm.

Table 2. Records of temperature and humidity

Month	Temperature (°c)	Humidity (%)
September,2012	28	87
October,2012	27	80
November,2012	25	70
December,2012	20	34
January,2013	19	35
February,2013	23	36

Discussion

The present investigation deals with botanical survey of flowering plants growing in the area of Arambagh, West Bengal during the period of September 2012 to February 2013. The purpose of this survey work is to collect the pollen materials from plants growing in the field and study of different pollen parameters such as shape, size, colpa and exine ornamentation. The present study is useful in the preparation of a complete pollen calendar in different seasons of the area under investigation. A pollen calendar is useful for allergy clinics (Tilak, 2012). Pollen calendar is compiled based on data and knowledge obtained from field botanical survey of the area under investigation combined with data from aeropalynological survey (Agashe, 2012). In the present study, 12 genera were studied. Most of the genera such as *Alstonia scholaris, Thevetia purpurea, Plumeria alba, Catharanthus roseus, Tabernaemontana divericata, Moringa oleifera, Carica papaya* and *Mangifera indica* shows 3-colporate type of pollen grains (Fig. 2). The polyad type of pollen grains is found in *Acacia auriculiformis*. In the previous study (Pal, 1992, Pal et al., 1993a, 1993b) it has been shown that the taxa having tricolporate pollen grains reveals their advanced status whereas taxa with polyad or colpate type of pollen grains shows its primitive status in the evolutionary scale. Thus the taxonomic assessment of the species investigated is possible considering the pollen parameters. However, the data from other field of study like cytological, serological, biochemical and immunological might strengthen this taxonomic assessment of the species.

Pollen characters such as the polar axis, average diameter of lumen, average diameter of muri, length of mesocolpium, width of colpus, form of lumen, shape of colpi and P/E of the *Clypeola* species of the family Brassicaceae are valuable diagnostic features in species delimination (Keshavarzi et al., 2012). On the basis of pollen parameters the present investigated taxa like *Alstonia scholaris, Thevetia purpurea, Plumeria alba, Catharanthus roseus, Tabernaemontana divericata, Moringa oleifera, Carica papaya* and *Mangifera indica* having tricolporate pollen grains may be considered as in advanced status whereas *Acacia auriculiformis* has primitive status in scale of evolution. The prepared pollen slides of the taxa investigated may be used as reference slides for identifying the pollen grains captured from air. Aerobiologists reported that the pollen grains of *Alstonia scholaris, Catharanthus roseus, Acacia auriculiformis, Moringa oleifera, Carica papaya, Mangifera indica* and *Brassica campestris* are allergenic in nature (Chakroborty et al., 2005, Ghosh et al., 2007; Talukdar et al., 2012). Plant pollen is one of the most common causes of seasonal allergic disease worldwide. Mango flower pollen has allergic effects on animal (Talukdar et al., 2012).

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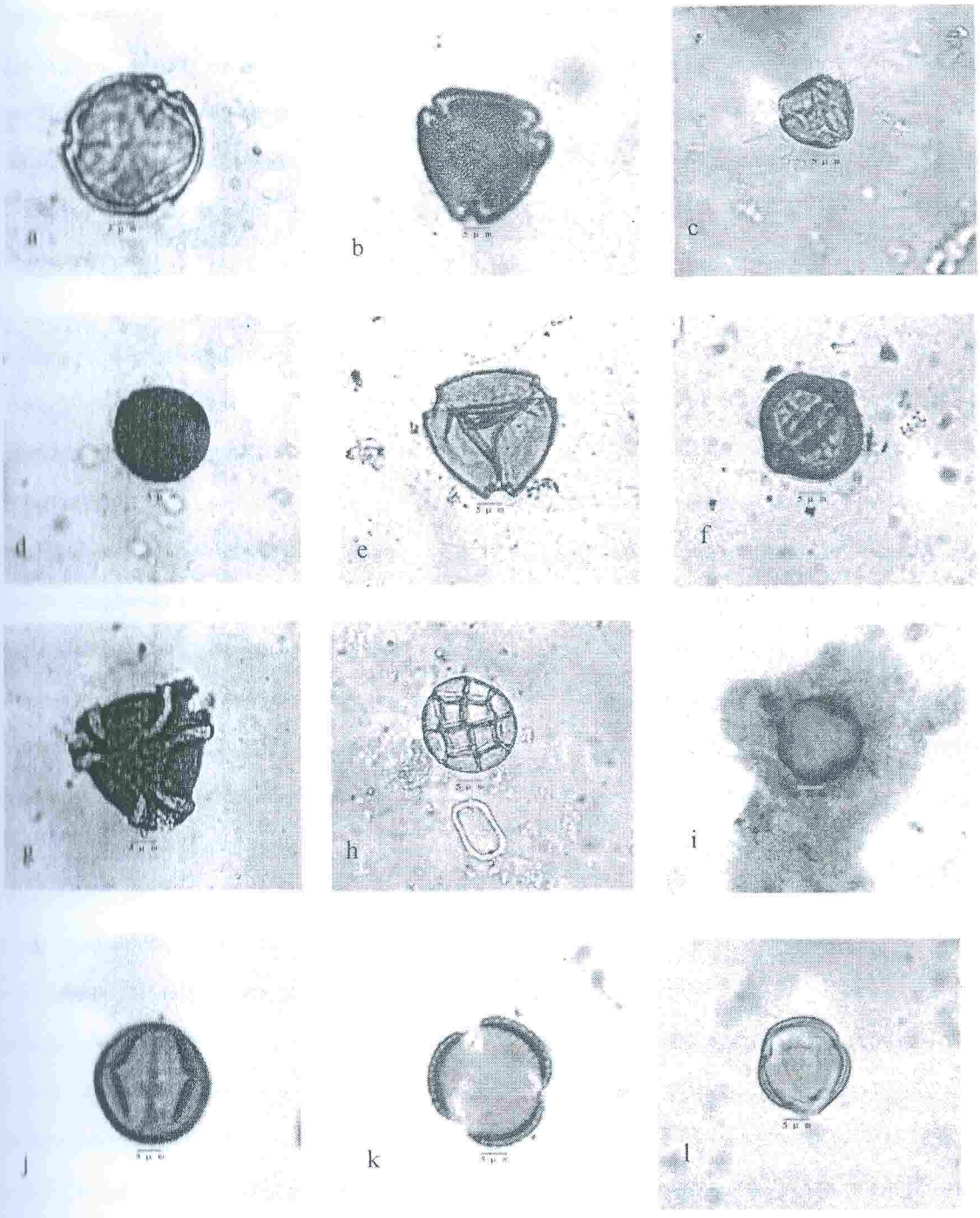
Fig. 1 Some plant taxa for collection of pollineferous materials a. *Acacia auriculiformis* b. *Catharanthus roseus* c. *Brassica campestris* d. *Moringa oleifera* e. *Mangifera indica*. f. *Alstonia scholaris*

Table 1. Pollen parameters of the investigated taxa by light microscopic study (*E-Exine thickness, O-Exine ornamentation)

Name of plants	Pollen type	Polar axis (P) (µm)	Equatorial axis (E) (µm)	Length of colpa (µm)	Diameter of pore (µm)	E * (µm)	O*	P/E X 100	Shape of pollen
Alstonia scholaris	3-colporate	24.70	18.62	17.33	2.41	±1.29	Finely areolate	132.60	Prolate
Ixora coccinea	3-colporate	60.00 - 65.00	40.00 - 45.00	35.00	9.00	±1.50	Psilate	144.40	Prolate
Plumeria alba	3-colporate	29.00	28.00	20.00	2.50	±1.40	Scabrate	103.50	Prolate spheroidal
Nerium odoratum	5-porate	39.00	40.00	----	6.50	±1.29	Finely reticulate	97.50	Oblate spheroidal
Catharanthus roseus	3-colporate	55.00 - 60.00	45.00 - 50.00	29.00	3.50	±1.30	Psilate	120.00	Sub prolate
Tabernaemontana divericata	3-colporate	60.00 - 65.00	45.00 - 50.00	34.50	6.50	±1.50	Finely reticulate	130.00	Sub prolate
Rauwolfia serpentina	3-colpate	55.00 - 60.00	50.00 - 55.00	34.00		±1.29	Psilate	109.00	Prolate spheroidal
Acacia auriculiformis	Polyad-12 celled	---	----	---	---	---	----	---	---
Moringa oleifera	3-colporate	23.73	22.05	21.50	2.00	±2.70	Sub-psilate	107.60	Prolate spheroidal
Carica papaya	3-colporate	35.00 - 45.00	45.00 - 60.00	30.00-40.00	5.00-10.00	±1.30	Psilate	77.77	Sub oblate
Brassica campestris	3-porate	20.00 - 30.00	25.00 - 35.00	----	2.50	±1.20	Reticulate	116.60	Sub prolate (trilobed)
Mangifera indica	3-colporate	25.00 - 30.00	30.00 - 35.00	29.00	2.50-5.00	±1.25	Striato-reticulate	140.00	Prolate (trilobed)

Fig. 1. Acetolysed pollen grains a. *Alstonia scholaris* b. *Thevetia purpurea*, c. *Plumeria alba* d. *Nerium odoratum* e. *Catharanthus roseus* f. *Tabernaemontana divericata* g. *Rauwolfia serpentina*, h. *Acacia auriculiformis* i. *Moringa oleifera* j. *Carica papaya* k. *Brassica campestris* l. *Mangifera indica*.



The pollen extract of *Catharanthus roseus* contains an important IgE-reactive protein component of 100 kDa molecular weight with esterase activity (Chakraborty et al., 2003). To study the opening of flower of *Catharanthus roseus*, the blossoming of the flower bud was observed at different intervals throughout day and night. It was noticed that the flower buds open fully at evening at 6.30 pm-7.30 pm. Though *Catharanthus roseus* is primarily an entomophilus, its pollen grains are reported to be present in air around the year with a relatively high concentration from October to January. *Catharanthus roseus* pollen grain had been reported to air borne and allergenic (Ghosh et al.,

Conclusion: Along with the structure of pollen grains the study of anthesis, dehiscence of anthers and dispersal of pollen grains are important parameters in pollen study.

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