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Scope of research on pollen grains in Arambagh region of Hooghly District (India) with reference to allergic disorders

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Abstract

The study of pollen is an important area of research. Various pollen morphological features such as shape, size, symmetry, apertural pattern and exine configuration are very conservative features for the taxonomic assessment of plants. Pollen can be captured from the air. The analysis of atmospheric sample provide the presence of pollutants as well as microbes, fungal spores and pollen grains as bio-particles; some of which may cause asthma, allergic diseases or respiratory troubles in human beings. In this connection, the study of pollen incidence in the atmosphere through aerobiological survey helped in the preparation of a pollen calendar of a particular area. A pollen calendar can be prepared by capturing the pollen grains from air throughout different seasons of the year with the help of Rotorod Sampler, Burkard Sampler or any other sampler devices. The pollen grains captured from the air are identified comparing the pollen grains of reference slides. The Reference slides of the pollen grains of a particular area are prepared following acetolysis methods of Erdtman. Thus, it is possible to prepare a complete pollen calendar of the taxa growing in the surroundings. There are large number of plants growing in wild such as *Alstonia scholaris*, *Catharanthus roseus, Acacia auriculiformis, Moringa oleifera, Carica papaya, Mangifera indica, Brassica campestris, Amaranthus* sp, *Cassia* sp, *Argemone mexicana* and grasses which are responsible for allergic diseases as reported by many workers. The humid climatic set up favours the growth of different fungal spores, a part of airspora. Besides different types of fungal spores, husk of *Oryza sativa, Brassica campestris* and *Sesamum indicum* coming from harvesting are causative factors for the expression of the allergic diseases or respiratory troubles to the farmers. The diversity of flowering plants is also high. So, there is ample scope of work in the Arambagh region for finding out the reasons of allergy caused by pollen grains in human beings. From the clinical view point allergy is described as hypersensitivity reaction mediated through immunological mechanisms. Among different classes of immunoglobulin like IgA, IgD, IgE, IgG and IgM; the IgE is involved in accelerating allergic reactions in human body. Different workers isolated allergen protein from pollen grains of some plants like *Catharanthus roseus, Mangifera indica* etc. and they have found the IgE reactivity in animals along with the expression of some hypersensitive symptoms.

Keywords: pollen, taxonomic assessment, pollen incidence, allergy, allergen

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Introduction

Hooghly district is located in latitude 22°45′N and longitude 88°45′E. Rivers Darakeswar and Mundeswari constitute main drainage of the district. Due to humid and tropical climatic set up with prolonged monsoon, the diversity of flowering plants in this district is high. Pollen grains, the first cell of gametophyte of angiosperms are disseminated in the atmosphere for the purpose of sexual

reproduction. There are many plants in the Hooghly district such as rice, mustard, coconut, grasses, *Alstonia scholaris*, *Eucalyptus* sp., *Carica papaya*, *Moringa oleifera* etc. the pollen grains of which are responsible for allergy. Due to humid climatic set up of this geographical location, the occurrence of slime moulds in this area is high which may also cause the respiratory troubles. In general, there is no cure for allergies, but certain treatments using antihistamines, decongestants, combination drugs are applied for the same. The medicines as brand name in the market for the treatment of allergy are Allegra, Fexidine, Telfast, Claritin, Tavist etc. Some medicines having chemical formula like Fexofenadine, Levocetrizin, Cetrizin, Salbutamol, Ambroxol etc. are generally used for the treatment of allergic patients.

The prevalence of allergic disease has increased considerably during the last decades. Pollen allergy is the most typical form of allergic disease. The increase in its frequency during recent years is most evident. Aeroallergens and the environment play an important role in the pathogenesis of respiratory allergies (Ridolo et al., 1987). The environmental factors play an important role in the problem of pollen allergy in large cities. It has been found that the polluted pollen is more effective than non-polluted one, and mature pollen has more allergy potency than immature one. During teaching and research experiences, we have seen that a large number of patients of different parts of Hooghly district, West Bengal, India are suffering from bronchial asthma and other respiratory troubles. There may be several causes such as pollutants, dusts, industrial dusts, fungal spores, pollen grains etc. for bronchial asthma and related respiratory troubles. One of the most important reasons of these diseases is pollen allergy. Moreover, there are a good number of Rice Mills in this area, the dust or husk coming from processing of rice may cause the respiratory troubles to the workers of the Rice Mills. Although the study of pollen grains has role in the different fields like Melisso palynology, Forensic palynology, Paleo-palynology, thorough investigation on pollen allergy is still now a challenging issue in the society.

Current status of knowledge: International status

Now a day's 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). A number of authors Wodehouse (1935), Erdtman (1952), Rowley (1960), Tsukada (1964), Kremp (1965), Faegri and Iversen (1975), Walker and Doyle (1975), Moore and Webb (1978) and other workers studied the pollen morphology of angiospermic plants. Kholer and Lange (1979) distinguished cereal from grass pollen by LM and SEM. Pollen morphology of 49 species of family Gramineae from Venezuelan mountain have examined by Salgado-Labouriau and Rinaldi (1990) and Salgado-Labouriau et al. (1993). Pollen allergies and air borne pollen were monitored at the University of Rome in 1999 in order to determine the concentration and the quality of air borne pollen belonging to allergenic plants by Caiola et al. (2002). Sanchez-Mesa et al. (2005) reported that the occurrence of symptoms in pollen allergy patients in urban areas might be affected by local environmental factors such as sources of pollution, natural and ornamental vegetation etc. Birch (*Betula* sp.) pollen grains are the main cause of seasonal allergies in northern and central Europe. The allergen particles released from the grains are often well distributed in the air. Due to their size, airborne protein particles can easily penetrate into the lower parts of

the respiratory airways and may lead to symptoms of asthma (Madeja et al., 2005). In the subtropical climate of South Africa grasses of the subfamily Panicoideae are predominant.

The IgE epitopes of Bermuda grass extracts are important local allergen (Potter and Prescott, 2007). D'Amato (2007) of Italy reported that atmospheric pollen grains cause Thunderstorm asthma. In China the airborne pollen are the major inhalant allergen, and they can elicit type I hypersensitivity such as asthma, rhinitis, and hay fever which result from a serial of complicated immune disorder in atopic individuals who contact with pollen allergens frequently and there are about 10 000 000 patients with pollinosis in China (Chi-Gang Liu et al., 2010). According to Caimmi et al. (2012) Cupressaceae pollen allergy is a worldwide winter pollinosis. Exposure to cypress pollen has increased enormously during recent decades, and cypress pollen allergy has become a major health problem, especially in Mediterranean countries.

National status

The diversified characters of sporomorphs provide an important basis for generic and specific deliminations. On the basis of aperture and exine ornamentation different distinct pollen types have been recognized in angiospermic taxa by Sharma (1968). In India many workers Nayeeduddin et al. (1942), Nair (1962), Choudhuri and Malik (1965), Choudhuri (1965) worked out on pollen morphology in some species of Bombaceae. In West Bengal Chanda (1962, 1966) and Datta and Chanda (1980) conducted study on pollen morphology of some angiospermic plants for its taxonomic assessment. Pal et al. (1993) also conducted cytopalynological investigation in *Cassia fistula* to assess any correlation between palynological and cytological data. The centre for Biochemical Technology, Delhi has published a book on pollen calendars of 12 different states in India (Singh et al., 1992) which is useful for clinicians as well as allergic patients to establish chronological correlation between the concentration of pollen in air and seasonal allergic symptoms. 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). Recent surveys carried out in India revealed 20 to 30% of the population suffers from allergic rhinitis and 15% develop asthma (Singh and Kumar, 2004).

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). In the agricultural area of Eastern India, *Phoenix sylvestris* Roxb or date sugar palm is grown or cultivated and seasonal allergic rhinitis is common during the pollen season (Chakraborty et al., 2006). The pollen calendar of Agra was recorded with special reference to allergenic significance. Pollen grains of 35 species belonging to 23 angiosperm families have been identified out of a total catch of 24,220/m^3 of air annually. High occurrence of pollen grains in air belonged to Asteraceae (5222/m^3) and *Parthenium hysterophorus* contributed the maximum (17.91%) of the total airspora. Higher counts of pollen were found in ecozones surrounded by agricultural fields, parks and gardens. Patients of bronchial asthma with rhinitis (62.30%) were maximum followed by bronchial asthma (25.61%) and allergic rhinitis (12.07%). Maximum number of patients

between the age group of 31-40 years and more sensitive than females. Maximum caused by *Amaranthus spinosus*, followed *P. hysterophorus*, *Chenopodium album*, and *Cassia occidentalis* (Chauhan 2006). *Catharanthus roseus* G. Don. (CR) or plants are widely grown/cultivated as garden in the tropics and subtropics. In spite of its entomophilous nature, CR pollen had been to be airborne and allergenic (Ghosh et al., 2007). qualitative and quantitative analysis of spore and present in the spider webs was studied in by Reddy et al. (2009). A continuous survey at Central Calcutta for two years (1985-1987) was done by using a Day Recording Volumetric Spore Trap. A pollen taxa was identified of which pollen showed a maximum frequency (about followed by Poaceae and Cyperaceae. A pollen was prepared and seasonal periodicities were Some entomophilous pollen types e.g. *Delonix* *Bougainvillaea spectabilis* were also observed (Barik and Chanda, 2009). A quantitative survey of pollen in the atmosphere of Korba-Chhattisgarh, India was by Shukla and Shukla (2010). Plant pollen is one of most common causes of seasonal allergic disease worldwide. Mango flower pollen has allergic effects in (Talukdar et al., 2012). The study of atmospheric pollen incidence will be helpful for proper diagnosis and treatment of allergic patients.

Regional status

An aerobiological survey of Hooghly district was conducted from February, 1999 to January, 2000. The aim of this study was to identify various air borne allergens in the atmosphere. 52 types of pollen grains and 14 types of airborne fungi were recorded from the atmosphere (Tripathi and Chakravorty, 2001). 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 (LM) during the period of September 2012 to February 2013 for the taxonomic assessment of the groups of plants (Bhattacharya-Sasmal et al., 2013). Pollen morphology of the honey samples collected from Arambagh region of Hooghly district, India were studied (Pal, 2005).

Objectives of the study

1. Description of the pollen grains of flowering plants in different seasons of the year.
2. Enumeration of the diagnostic features of the pollen grains of a species.
3. Preparation of the pollen identification key of the flora.
4. Monitoring of pollen incidence in the air.

Significance and social relevance of the study

To offer an useful pollen calendar of the Hooghly district which may provide pollen season for grasses, weeds and trees in this area. The pollen flora of this district will be an important aid to identify the honey pollen. The pollen calendar can be utilized for enhancement of crop yield. Pollen morphological data will be helpful for the taxonomic assessment of the plants. Monitoring of atmospheric pollen incidence will be helpful for the treatment of allergic patients.

Conclusion

Pollen morphological features such as shape, size, symmetry, apertural pattern and exine configuration are very conservative features for the taxonomic assessment of plants. Atmospheric air provides the presence of pollutants, microbes, fungal spores and pollen grains. Different pollen

are responsible for allergic diseases in human beings. The study of pollen incidence in the atmosphere through aerobiological survey helped in the preparation of region's pollen calendar of a particular area, which may be useful for proper diagnosis and treatment of allergic patients. The pollen allergens (proteins) isolated from the wall of pollen grains shows the immunoglobulin IgE cross-reactivity in animals. The diversity of angiospermic plants in the district Hooghly, West Bengal, India is high. There is ample scope for investigation of allergic pollen grains in this region. The exact reason for allergic diseases in human body is yet to be explored.

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References

Agashe Shripad N (2012). Is Aerobiology Really Useful to Mankind. Proc. 17th National Conference of Indian Aerobiological Society on Impact of Airborne Microbes, pp.3.

Basak S, Chanda S (2009). Airborne pollen survey of Central Calcutta, India, in relation to allergy. Grana 31: 71-75.

Bera SK, Basumatary SK, Dixit Swati (2007). Studies on pollen morphology and phonological characteristics of some economically important arborescent taxa of tropical forest,lower Brahmaputra valley, Assam, North East India. Journal of Palynology 43:1-19.

Bhattacharya (Sasmal) P, Pal JK, Biswas P, Pal PK, (2013). Pollen morphological study of some plant taxa from Arambagh region of Hooghly District, West Bengal, India. Int J Curr Sci 7: E 97-103.

Caimmi D, Raschetti R, Pons P, Dhivert-Donnadieu H, Bousquet PJ, Bousquet J, Demoly P (2012). Epidemiology of Cypress Pollen Allergy in Montpellier. J Investig Allergol Clin Immunol 22(4): 280-285.

Caiola MG, Mazzitelli A, Capucci E, Travaglini A (2002). Monitoring pollinosis and airborne pollen in a Rome University. Aerobiologia 18: 267-275.

Chakraborty P, Roy I, Chatterjee S, Chanda S, Gupta-Bhattacharya S (2006). *Phoenix sylvestris* Roxb Pollen Allergy: A 2-Year Randomized controlled Trial and Follow-up study of Immunotherapy in Patients with Seasonal Allergy in an Agricultural Area of West Bengal, india. Esmon Publicidad J Investig Allergol Immunol 16 (6): 377-384.

Chakraborty P, Ghosh D, Chowdhury I, Roy I, Chatterjee S, Chanda S, Gupta-Bhattacharya S (2005). Aerobiological and Immunochemical studies on Carica papaya L. pollen: an aeroallergen from India. Allergy 60 (7): 920-926.

Chanda S (1962). On the pollen morphology of some Scandinavian Caryophyllaceae. Grana Palynol 3: 67-89.

Chanda S (1966). On the pollen morphology of the Centrolepidaceae, Restionaceae and Flagellariaceae with special reference to taxonomy. Grana Palynologica 6:355-415.

Chauhan SVS, Goyal Rekha (2006). Pollen calendar of Agra city with special reference to allergenic significance. Jour Environ Biol. 27(2): 275-281.

Choudhuri SK (1965). Pollen morphological studies of the

...ales II. Bull Bot Soc Beng 19:147-158.

...Malik N (1965). Pollen morphological studies of the order Malvales I. Bull Bot Soc Beng 19:13-36.

...Liccardi G, Frenguelli G (2007). Thunderstorm-asthma and pollen allergy. Allergy 62:11-16.

...Chanda S (1980). Pollen morphology of the order Leguminosae with reference to Taxonomy and Palynology. Transactions of the Bose Research Institute, Calcutta, India 43:73-9.

...G (1952). Pollen morphology and plant taxonomy Angiosperm. (In Introduction to Palynology. Almquist and Wiksell, Stockholm, Sweden.

...K, Iversen J (1975). Text Book of Pollen Analysis. 4th Ed. Munksgaard, Copenhagen, Denmark.

...H, Ray Endrani, Chanda S,Gupta-Bhattacharya S (1987). Allergy to Periwinkle pollen (*Catharanthus roseus* G DON.) Ann Agric Environ Med 14: 39-43.

...M, Ahassian S, Sheidai M (2012). Pollen morphology of the genus, *Clypeola* (Brassicaceae) in Iran. Phytologia Balcanica 18(1):17-24.

...F, Lange F (1979). A contribution to distinguishing cereal from wild grass pollen by LM and SEM. Grana 18: 133-14.

...GGW (1965). Encyclopedia of Pollen Morphology. Univ Arizona Press Tuscon, USA.

...J, Wypasek E, Plytycz B, Sarapata K, Harmata K (2005). Quantification of air borne birch (*Betula* sp) pollen grains and allergens in Krakow. Arch Immunol Ther Exp (Warsz) 53 (2): 169-174.

...FH, Webb JA (1978). An illustrated guide to pollen analysis. Hodder and Stoughton, London, UK.

Nair PKK (1962). Pollen grains of Indian plants III. Malvaceae and Bombaceae. Bull Natn Bot Gdns Lucknow, India 63: 25-32.

Pal JK (2005). Melissopalynological Investigation in Arambagh Subdivision of Hooghly district, West Bengal. Proc National Conference on Current Researches in plants and Microbial Sciences Burdwan University, India pp.80.

Pal JK, Datta BK, Mandal S,Bhattacharya GN(1993). Cyto-palynological Investigation in *Cassia fistula* L. Environment and Eco 11(2): 435-438.

Perveen A (2006). A contribution to the pollen morphology of the family Gramineae. Wld App Sci J 1:60-65.

Potter PC, Prescott RA (2007). Immunochemical characterisation of grass pollen allergens in South Africa. Curr Aller and Clini Immunol 20 (4): 189-193.

Reddy A, Vijay Bhaskar, Chaya P, Ramakrishna H (2009). Spider webs-a natural trap of spores and pollen. J Palynol 45:65-73.

Ridolo E, Albertini R, Giordano D, Soliani L, Usberti I, Dall'Aglio PP (2007). Airborne pollen concentrations and the incidence of allergic asthma and rhinoconjunctivitis in northern Italy from 1992 to 2003. Int Arch Allergy Immunol 142(2): 151-157.

Rowley J (1960). Exine structure of cereal and wild type grass pollen. Grana Palynol 2:9-15.

Salgado-Labouriau ML, Nilsson S, Rinaldi M (1993). Exine sculpture in *Pariana* pollen (Gramineae). Grana 32: 243-249.

Salgado-Labouriau ML, Rinaldi M (1990). Palynology of Gramineae of Venezuelan mountain. Grana 29: 128.

Sanchez-Mesa JA, Serrano P, Carinanos P,Prieto-Baena JC, Moreno C, Guerra F, Galan C (2005). Pollen

Walker JW, Doyle JA (1975). The bases of angiosperm phylogeny: Palynology. Ann Missouri Bot Gard 62: 664-723.

Wodehouse RP (1935). Pollen grains. Mc Graw Hill book Co Inc, New York Bot Rev 2: 67-84.

Zhi-Gang Liu, Song JJ, Xiao-Likong (2010). A study on Pollen Allergens in China. Biomedical and Environmental Sciences pp. 319-322.