Indian J. Applied & Pure Bio. Special Vol. 2(1): 344-349 (2021). **ISSN: 0970-2091**
A web of Science Journal
National e-Conference on Biodiversity Building and Natural Resource Management (NC BBNRM) Date: 22nd-23rd, December, 2021

A study on prevalent aero-allergens during the post-monsoon season of West Bengal

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Abstract

Respiratory allergy, triggered by large number of bioparticles, is increasing at an alarming rate worldwide with India being not an exception. Around 15–30% of world population is estimated to suffer from respiratory allergy caused by pollen grains of ambient outdoor environment.So an aerobiological investigation has been carried out on prevalence of aeroallergens during the post monsoon season in Midnapore. The prevalence of seasonal allergic rhinitis was established through population based surveys. This study identifies pollen producing plant species during post monsoon season, aeroallergens, and events of allergic outbreaks in local population.

The complexity and severity of allergic diseases continue to increase particularly in children and young adults[16]. Allergy is an immediate type hypersensitivity reaction caused due to malfunction of immune system that produces antibodies in response to otherwise harmless substance. Allergens bind to IgE on the surface of mast cells or basophils and trigger degranulation of chemical mediators. Allergens may be inhalative or ingestive. Among inhalative or respiratory allergens, pollen grains and various fungal spores are major risk factor for both seasonal allergic rhinitis and asthma, whereas indoor allergens (*e.g.* dust mites, pets dander, fungal spores) become a risk factor for perennial rhinitis although sensitization profiles varied considerably depending on the geographic location of the study population[7-10].

Allergic rhinitis or hay fever is the most common symptom of seasonal allergy; other symptoms include shortness of breath, wheezing, coughing, chest tightness, allergic

eyes (conjunctivitis), eczema (atopic dermatitis) *etc*. Indian subcontinent comprises of varied climatic zones and geographical regions, that's why the types and distribution of natural vegetation leads to a variable range of pollen grains present in air [1,4,13]. However only few researchers have extended their studies on identification and characterization of pollen allergen. Chakraborty *et al*.[5] have reported a study on *Carica papaya* L. which contributes a significant aeropollen and aeroallergen load of Kolkata. A population study performed by Jindal *et al*.[11] in different parts of India revealed that 20–30% of the Indian population was clinically diagnosed as allergic. In another report Mamidipudi et al. have discussed about the barriers and burden of allergic diseases in Indian subcontinent[12]. In our surroundings, several allergy causing pollen grains are present, which are not well characterized. So there is a growing need to identify these pollen grains and the allergy causing proteins, for efficient diagnosis and treatment of allergy sufferers.

The present study is conducted with a preliminary attempt to identify the pollen grains causing allergy particularly during post monsoon season. It was found that events of cough and cold increases during this time[2,15,17]. To investigate the role of pollen allergens in it an aerobiological, questionnaire based and hospital based study were carried out during the post monsoon season. Previous reports said that *Moringa* pollen grains are one of the causes of allergies in many people[14]. In this study special emphasis was given on the prevalence of *Moringa* pollen grains in the air during this time.

Aerobiological sampling :

Air sampling was carried out in Midnapore, West Bengal, India at 7 days interval using Burkard personal air sampler during the month of November, 2020 to April 2021. According to guidebook of the British Aerobioogy Federation 1995 pollen grains were identified following several parameters and examined under light microscope.

Collection of pollen grains and alkali maceration:

During the flowering season we collected inflorescence of various herbs, shrubs and trees, and then anther lobes were isolated with the help of forceps and kept stored at -20°. Afterthat those samples were treated with alkali maceration process with slight modification described elsewhere[6]. Anthers were crushed in acetic acid and centrifuged at 2000 rpm for 15minutes. After washing pellets were collected and dissolved in 10%KOH solution. Then the whole solution was kept in waterbath maintaining temperature of 80°C until the solution turns brownish in colour. Next, centrifugation was again done and pellets were collected, washed and bleached in HCl. Finally the pollen grains were viewed under microscope by mounting it in safranin and glycerine jelly.

Study of pollen grains through light microscopy (LM) and Scanning electron microscopy (SEM):

To image the inner cavity, ornamentations and pore structure of pollen grains LM and SEM analysis were done and viewed at different magnifications.

Questionnaire based study :

A cross sectional study was conducted for 6 months (November- April) using standard questionnaire to assess the prevalence of respiratory allergic symptoms among local people during the study period.

Hospital data collection:

The patients' clinical histories and total IgE data were collected from hospital with the permission taken from competent authority to understand prevalence of allergic sensitization among the population. Patients were divided into 3 groups: 18-30, 31-50, 51-75. Total numbers of patient were 165 (Males 91, Females 74).

Aeropollen load :

The amount of pollen load was studied by airsampling during post-monsoon season that is during the month from November to April. The main reason behind inhalative allergies is airborne pollen grains. Aeroallergens were present in higher amount during autumn and spring season in comparison to other season.That's why we selected particularly this time period from November to April, which is the flowering season of most plants. The pollen grains which were mostly present in this season are *Cocos nucifera, Borassus flabellifer, Carica papaya, Eucalyptus* sp., grasses *etc.* Along with all of these *Moringa oliefera* was found to be present predominantly in air during February to March. Total pollen load and *Moringa* pollen load during the study period was depicted in Fig. 1(A).

Prevalence of allergy in the population:

Questionnaire based study showed that events of allergic diseases increase during autumn and winter seasons irrespective of age group. It was found in the study of patient's clinical history that the total IgE of the patients visiting to hospitals during these times was higher than normal range which depicted increase of allergic sensitization mostly during this time of the year. Among the total number of studied samples it was found that number of male individuals are comparatively more affected than female as shown in Fig. 1(B) Interestingly highest sensitization was found in the age group of 18-30 as depicted in Fig. 1(C).

Allergic diseases have become a major health problem, alleric rhinitis, hayfever, asthma; skin irritation affects the quality of millions of people worldwide. A continuous aerobiological monitoring was carried out to know aero-pollen load of the study area. Pollen induced allergies were found to be increasing within us due to climate change, urbanization westernized lifestyle[3]. Clinical studies showed that the number of male individuals was comparatively more affected than the female. During our study period *Moringa oliefera* pollens were found to be present in considerable amount in the air. Although it was only a preliminary study but it gives valuable information regarding increasing pattern of sensitization among local population during this time. It can be said that *Moringa* pollen grains may have some impact on causing allergies in this population. In future further characterization would be needed.

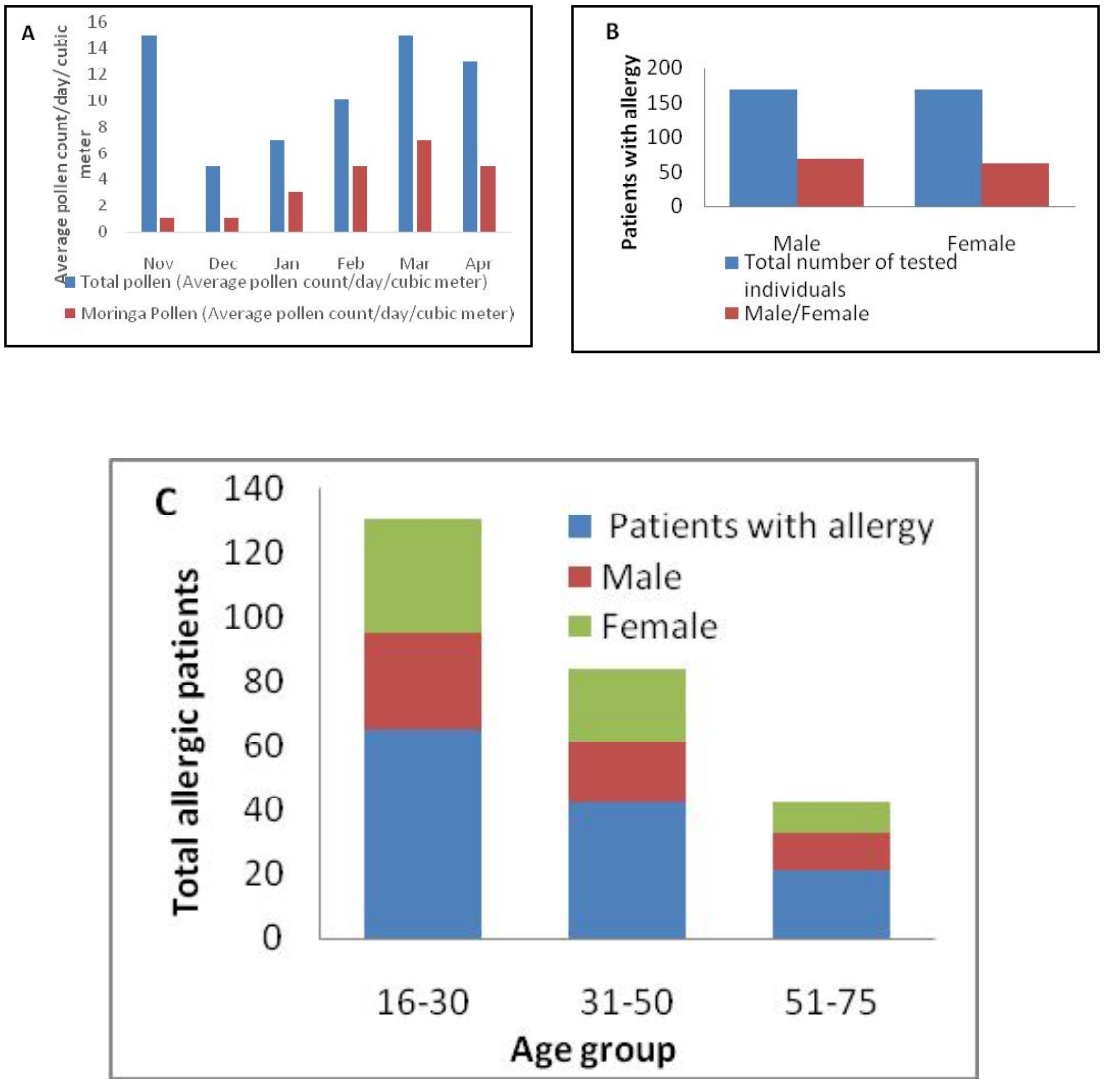

Fig.1(A): Seasonal periodicities of total pollen vs.*Moringa* pollen in the study area. (B). Sex ratio of allergy patients, (C). Age group wise distribution of allergic population.

Characterization of pollen grains through LM and SEM:

We have undergone the local vegetation analysis which provides a variety of plant species. Among which we identified out few of the samples and analyzed through LM and SEM study depicted in Fig 2.

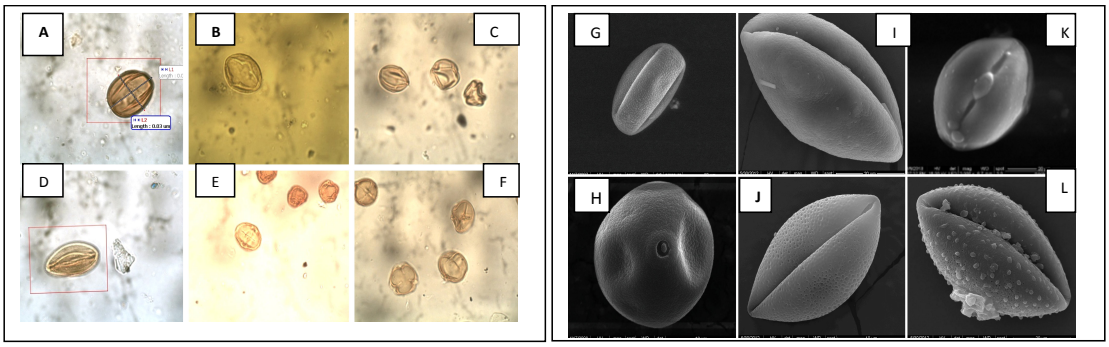

Figure 2. **LM** Study of **(A)** *Casia ssophera*, **(B)** *Mangifera* sp., **(C)** *Solanum lycopersicum,* **(D)***Tecoma* sp., **(E)***Tabernaemontana divaricata,* **(F)** *Solanum syssimbrifolium* and **SEM** study of **(G**) *Shorea robusta*, **(H)**Grass, (**I**) *Cocos nucifera,* **(J)** *Phoenix sylvestris*, **(K)** *Moringa oliefera* and (**L**) *Borassus flabellifer.*

IgE mediated allergic disorders associated with airborne pollen sensitization is increasing day by day. This sensitization potential found to be increasing mostly during the post monsoon season. There are many types of pollen grains along with *Moringa* which are planted for its immense economic and medicinal value. Even *Moringa* has become popular as a natural leaf powder supplement; the pods, roots, bark, flowers, seeds, and fruits are also edible. However, this study helps to find out Moringa *oliefera* pollen grains remains in considerable amount in the air during this period and atopic individuals can elicit allergic symptoms in response to those allergens. This information can be linked with future studies which can help allergists and clinicians for understanding pollen present in atmosphere during this season. Moreover through this survey will also help to make people aware of the consequent health hazards as well as for the diagnosis and treatment.

We are thankful to the Department of Microbiology, VU for providing us the infrastructural facilities that we needed during our study period. Thanks are also due to all our labmates for their constant support throughout the work period.

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