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PREVALENCE OF ALLERGENIC POLLEN GRAINS IN THE CITY OF ISLAMABAD, PAKISTAN AND ITS IMPACT ON HUMAN HEALTH

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Abstract

In this study we explored aerobiological aspects for a period of two years (2009-1010) in Islamabad city using RotoRod Sampler Model 40. Presence of large amount of pollens in the air poses serious implications on pollinosis. In the month of March highest daily pollen count was observed. This revealed a correlation of pollen count with optimum range of temperature for flourishing and dispersing of pollen grains. General trend between pollen count release and the number of allergy patients was found in accordance suggesting a high pollen risk for the residents and the visitors during peak time of the year.

Introduction

Pollens released from trees, weeds and grasses are the inhalant source of allergens. Its dispersal totally depends on pollen type, water content available, type of carbohydrate and other mechanisms to avoid desiccation during pollen release (Pacini & Hesse, 2004). Pollen production is mainly affected by meteorological factors amongst which temperature, rainfall, wind speed and direction are the major concentration moderators (Lattore & Caccvari, 2009). The impact of environmental conditions on airborne pollen counts has been widely studied in woody species, revealing a marked influence of temperature on reproductive phenology, especially in trees flowering in early spring (Menzel *et al*., 2006). Airborne pollen number has much significance for the social issues like pollinosis (Mandal *et al*., 2008) which is also one of the most emerging health problems in Islamabad city. Many plant species are responsible in aggravating pollens allergy by producing pollen that includes *Broussonetia papyrifera, Alternanthera pungens, Cannabis sativa*, *Eucalyptus globules, Grasses* and *Pinus* sp. It is revealed that percentage of woody taxa in the atmosphere results in pollen allergy related diseases (Parveen *et al*., 2012; Ozturk *et al*., 2013). *Broussonetia papyrifera* is considered as the world's worst alien invasive species and it has played a major role in deteriorating natural landscapes in the study area (Ali & Malik, 2010). It grows aggressive, has high seed production and a shallow root system (Anon., 2004) due to which it is widely dispersed throughout the urban area inspite of the practices adopted by CDA for its eradication. Grass and tree pollens are considered amongst the most effective inhalents for causing asthma, rhitinis and hay fever (Liu *et al*., 2010).

This study revealed the relationship between temperature with the daily pollen count of *Broussonetia papyrifera* and its distribution in the atmosphere during the study period 2009-2010. Furthermore researchers assessed the potential risk of pollen allergy to related respiratory problems in the residents of the area to hep in terms of sensitization.

Materials and Methods

Study area: Islamabad Capital Territory (ICT) lies between 33°-- 42´ N, and 73°-- 10´ E at the edge of the Potohar Plateau with a sub-tropical climate. The weather ranges between 3.9°C (In January) to 46.1°C (In June) with an annual rainfall of about 1141 mm. The predominant flora includes *Pinus roxburghii*, *Acacia modesta*, *Acacia arabica*, *Olea ferrugenia*, *Dodonaea viscosa*, *Justicia adhatoda*, *Carisa opaca* (garanda), *Woodfordia fruticosa*, *Morus alba*, *Ficus carica*, while *Broussonetia papyrifera* trees are found in the foothills or plain areas of Islamabad (Anon., 1998). Most of these species are widely spreaded in the residential areas of Islamabad and their air borne pollens have been proved in this study as the potential cause of pollen allergy to the residents.

Open areas in the Islamabad city are occupied by a very dense vegetation of different species of plants and grasses producing various types of pollen grains. Fig. 1 show the *Broussonetia papyrifera* pollen grains locations targeted by Pakistan Meteorology Department (PMD). The main reason to determine the *Broussonetia papyrifera* patches other than the sampling sites is because its pollen grains are dispersed via wind and animals which then participate in enhancing the daily pollen count.

Data sampling and analysis: We collected two years data of Environmental parameters (2009-2010) from PMD on daily basis. Also the data concerning to the pollen allergy patients was taken from Pakistan Institute of Medical Sciences (PIMS). Data was compiled from the investigation reports of patients comprising of different age groups who reported PIMS during allergy season for the treatment.

Rotorod sampler technique was used in order to take the sample of pollen grains from the atmosphere. The rotorod sampler is essentially independent of wind speed and direction and can efficiently collect approximately 64 percent of particles in the size range of pollen. It samples approximately 60 L. per minute, but for long-period samples it may be operated intermittently to prevent overloading. Sampler was placed on the roof of PMD for the pollen trap. The pollen count is the number of certain type of pollen grains per cubic meter of air sampled averaged over 24 hours. Glass slide was firstly lubricated with jelly like glycerin so that pollen grains present in the atmosphere get stuck onto the glass slide. This process was repeated every morning for ten minutes. Trapped Pollens were placed on the surface of glass slit and glass slide was then taken into the laboratory for its examination under the electron microscope. The *Broussonetia papyrifera* pollens were observed in higher concentration than other plant species. Minimum and maximum range of atmospheric temperatures was measured by using thermometer.

Data was analyzed and processed using Microsoft Excel 2007 for showing spatio-temporal trend of *Broussonetia papyrifera* with temperature and its impacts on human health.

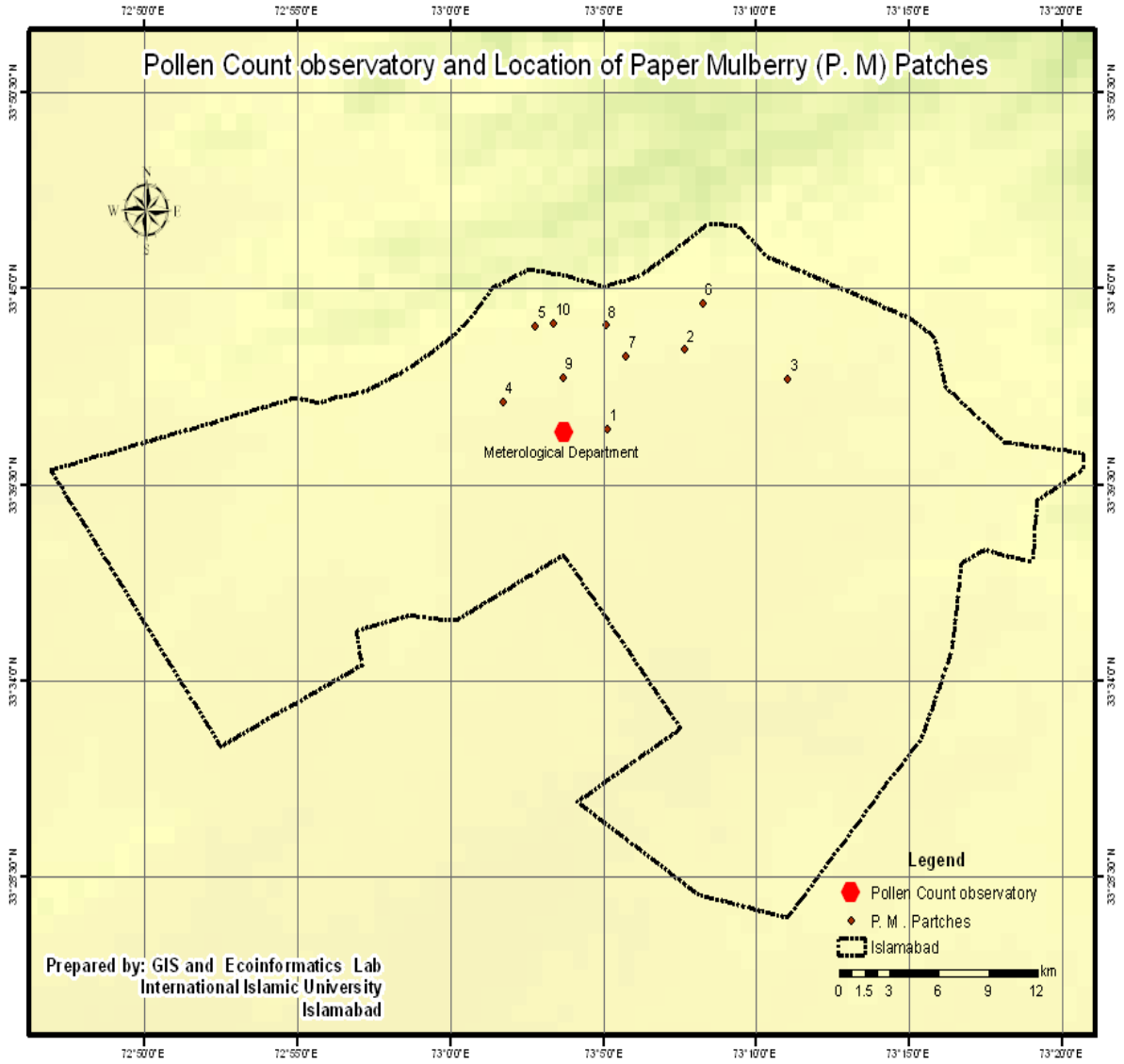

Fig. 1. Pollen count observatory and location of *Broussonetia papyrifera* in Islamabad city.

Results and Discussion

***Broussonetia papyrifera* pollen trend and its correlation with temperature fluctuations for Islamabad city:** In the year 2009 the peak pollen count for *Broussonetia papyrifera* was recorded in the month of March with a value of 4143.0 pollens/m^2 and the lowest was observed in month of September with a value of 1718.07 pollens/m^2. Same trend was observed in the year 2010 when peak pollen count was high in the month of March with a value of 4431.6 pollens/m^2 and the lowest was observed in the month of September (Fig. 2).

The annual pattern of pollen production in co-relation with temperature was observed during the study years 2009-2010. It revealed that meteorological factors particularly optimum range of average temperature directly influences the release of pollen from anthers and its dispersal in the air. Generally, sunny and warm weather conditions enhance higher pollen production (Davies & Smith, 1973). Therefore, with the rise in temperature in early time of the year 2009, there was an increase in the number of pollen grains and peak pollen count was observed in the month of March with an optimum average temperature of 17.5°C. Then gradually it decreased although there was a gradual rise in average temperature. While in relatively colder months i.e., October, November and December, lowest pollen count was observed (Fig. 3a).

Similar trend was observed in the year 2010, except for optimum temperature range and highest pollen count. Pollen numbers were low in numbers till the mid of February and then gradually increased and reached to its peak (4, 09,162/m^3) in the middle of March at an optimum average temperature 20.5°C and then gradually decreased and reached to lowest value till the end of the year (Fig. 3b). We observed that the optimum temperature supported the highest pollen numbers in the air of Islamabad city and same is observed when spring pollen count is found highest (Recio *et al*., 2009).

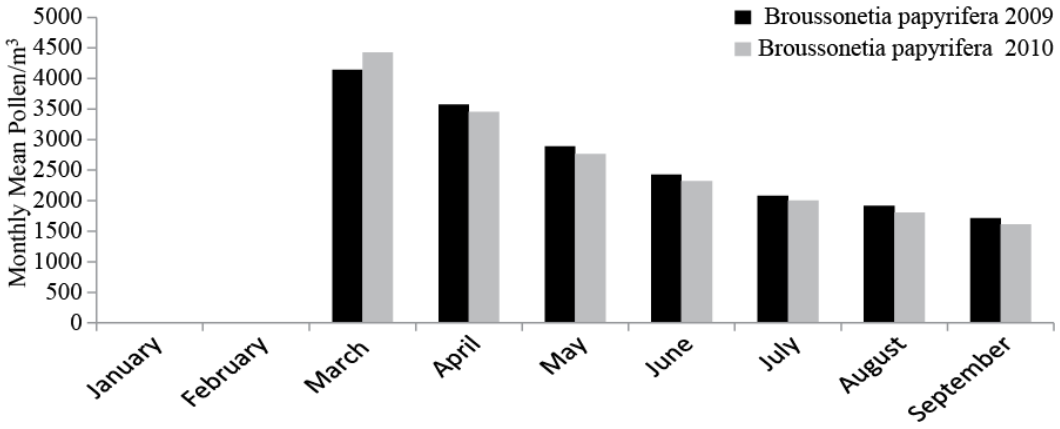

Fig. 2. *Broussonetia papyrifera* pollen trend for Islamabad city during study years 2009-2010.

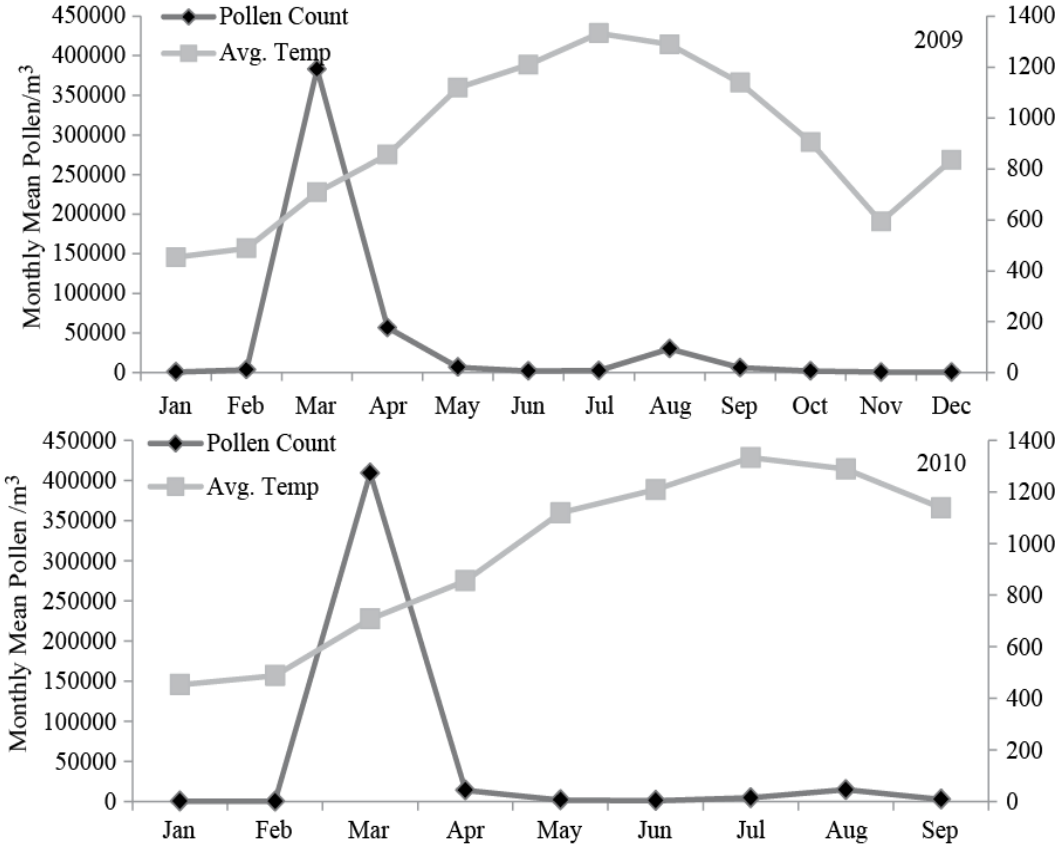

Fig. 3(a, b). Relationship between Monthly Pollen Count with Temperature during the study years 2009-2010.

Residents response towards *Broussonetia papyrifera*: According to Pakistan Institute of Medical Sciences (PIMS) sources, 80-110 pollen allergy patients visit the hospital for nebulization and oxygen on daily basis during the season. The time of release of pollen grains and identification of their type is useful information for patients suffering from allergic diseases (Scevkova *et al*., 2010). *Broussonetia papyrifera* was found to be vulnerable in causing sensitization amongst residents of Islamabad city. Vegetation covered area correlates significantly with the prevalence of allergies (Khan *et al*., 2010). Allergic patients were compared with monthly pollen count during the study years 2009-2010. In 2009 the highest numbers of patients recorded were 1624 in the month of March when the pollen was at its peak with the value of 4143.21 pollens/m^2 and the lowest number was 0 in the month of January and February at the start of the season (Fig. 4a) In 2010, the highest numbers of patients recorded were 1724 in the month of March with a pollen count 4431.5 pollens/m^2 and the lowest number was 492 in the month of June (Fig. 4b). The general trend shows an increase in number of patients registered during pollen season in both years (2009-2010).

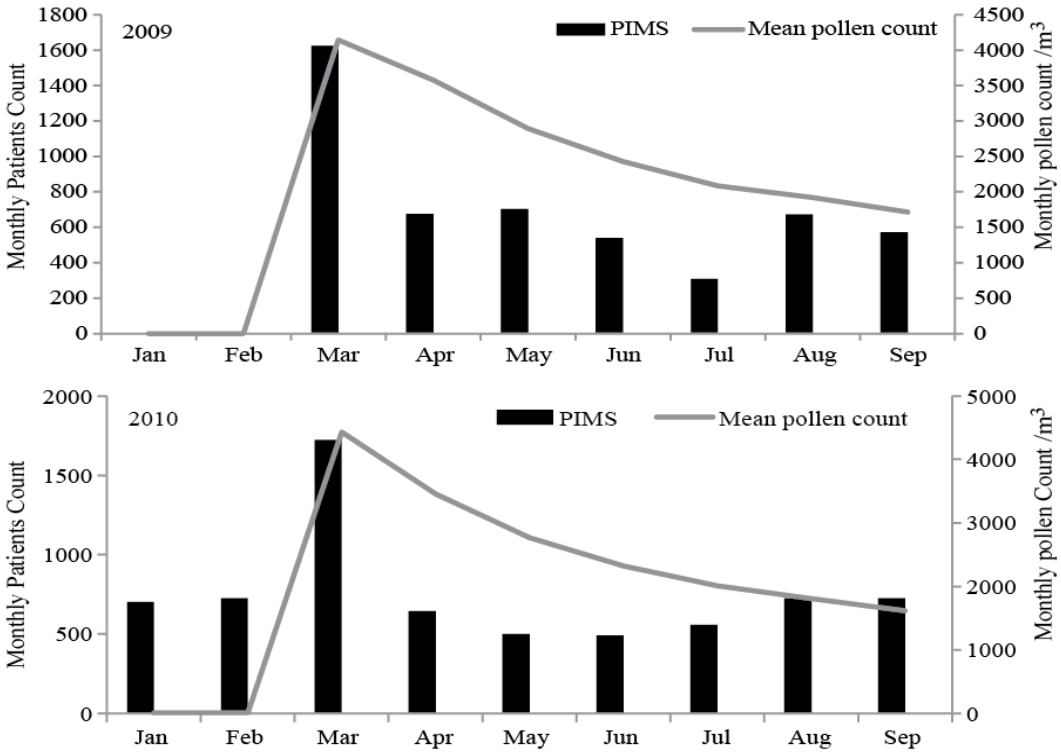

Fig. 4(a,b). Monthly recorded allergic patients and mean pollen count for the study years 2009-2010.

In particular, modifications in pollen and allergen production related to climate change has increased the incidence of illnesses related to asthma and allergies (Shea *et al*., 2008). It is suggested that capital authorities and forest departments should be conscious regarding the selection of invasive species for plantation. Mass awareness about preventing measures should be conducted through print, electronic and social media.

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