

Growing urbanization fostering invasive species Parthenium hysterophorus and resultant economic burden in urban Bangalore

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ABSTRACT

Parthenium hysterophorus is a species of flowering plant in Asteraceae, which is native to the American tropics. It is a common noxious invasive species in India. It invades farms, pastures, and roadsides. It is an important weed in agriculture and a source of highly allergenic pollen. This weed causes allergic respiratory problems, contact dermatitis and mutagenicity in humans. Also aggressive dominance of this weed threatens biodiversity. The main objective of the study is to record Parthenium pollen incidence and check sensitivity for the same using Skin Prick Test (SPT) method in allergic rhinitis (AR) patients visiting the ENT OPD at St. Johns Hospital. The study also aims to implement effective control measures for AR in Bangalore. AR is the most common cause of rhinitis, and is often referred to the allergist for SPT. Two significant complications of AR are asthma and impaired quality of life. This is a condition which carries enormous cost implications, direct, indirect and intangible. Bangalore has been deemed as allergy capital of India. We undertook this study to determine the reactivity to aeroallergens in the local population. The results of SPT to 32 aeroallergens and 2 controls were analysed in 120 patients out of which Parthenium pollen sensitivity was highest among weed pollens. Parthenium was the top allergen. Hence a dedicated approach to eradicate parthenium and awareness of public about ill effects of its growth is the need of the hour. It should be jointly addressed by environmentalists, medical professionals and the law makers.

Keywords: AR, Parthenium hysterophorus, invasive plant, pollen, SPT, Aeroallergens, quality of life, economic burden.

1. INTRODUCTION

Parthenium hysterophorus is a species of flowering plant in Asteraceae, which is native to the American tropics. It is a common noxious invasive species in India. This prolific weed is often spotted on abandoned lands, developing residential colonies around towns, railway tracks, roads, irrigation canals, etc. This weed grows luxuriantly in established gardens, plantations and vegetable crops.^[1] It is commonly known as carrot grass, white top, the "Scourge of India" and congress grass.

This alien weed is believed to have been introduced into India as contaminants in PL 480 wheat imported from the USA in the 1950s. Presently, *Parthenium* is widely prevalent in India (Singh et al. 2008). Approximately two million hectares of land in India have been infested with this herbaceous menace (Dwivedi et al. 2009).^[2]

It is an important weed in agriculture and a source of highly allergenic pollen. This weed causes allergic respiratory problems, contact dermatitis and mutagenicity in humans.^[3] Allergic rhinitis (AR) is an allergic reaction that happens when your immune system overreacts to substances that you have inhaled, such as pollen. AR is the most common type of chronic rhinitis and evidence suggests that the prevalence of the disorder is increasing. Severe AR has been associated with significant impairments in quality of life, sleep and work performance.^[4] In order to diagnose and predict the allergic diseases by the airborne spores and pollen, it is very essential to know the incidence of the aerospora in the atmosphere of a locality.^[5]

2. AIMS AND OBJECTIVES

The main objective of the study is to record *Parthenium* pollen incidence and check sensitivity for the same using Skin Prick Test (SPT) method in allergic rhinitis (AR) patients visiting the ENT OPD at St. Johns Hospital. The study also aims to implement effective control measures for AR in Bangalore.

3. METHODOLOGY

Duration: Period from October 2012 to May 2014 (1 year 8 months).

Study design: Prospective study has been carried out over a period of 1 year 8 months by recruiting patients who come to the Allergy clinic in St. John's Hospital. A detailed history taking and clinical examination was carried out for each patient, which includes a diagnostic nasal smear and skin prick testing. Before undergoing the skin prick tests, the patients were asked to abstain from oral antihistaminic and steroid medications for 1 week. All the patients underwent skin prick testing (with the same spectrum of antigens), nasal smear, serum specific and total IgE, and blood investigations such as haemoglobin, total and differential count, absolute eosinophil count. The allergens selected for SPT was based on the pollen calendar of Bangalore and clues from patients history.

Inclusion Criteria:

1. Patients diagnosed to have AR based on clinical history and positive SPT (b/n 5-65 yrs.)
2. Patients with coexistent AR and bronchial asthma with positive SPT (b/n 5-65 yrs.).

Exclusion criteria:

1. Patients in the age group less than 5 years and above 65 years.
2. Patients with past history of anaphylaxis or adverse reactions to skin prick tests.
3. Patients who are unable to discontinue antiallergic medications 1 week prior to testing.
4. Patients with co morbidities (IHD).

4. MATERIALS AND METHODS

We studied a total of 120 patients out of which 115 had AR and 5 patients had Non-Allergic Rhinitis. The majority of AR patients were between the age group 26-35 years, of which 55% were female and 45% were male.

i) Skin Prick Test: Based on case history, patients were referred for the SPT by doctors of ENT Dept., St John's Medical College Hospital. Patients were advised to avoid any anti-histamines (or medications that block the effect of histamine) for at least 5 days prior to the test. SPT was then performed on the inner forearm against 34 allergens. The following is a brief overview of how the test was performed.

- Patient's forearm was cleaned with alcohol.
- The forearm was coded with a skin marker pen corresponding to the number of allergens being tested. Marks were at least 2cm apart.
- A drop of allergen solution was placed beside each mark.
- A small prick through the drop was made to the skin using a sterile prick lancet.
- After 20 minutes skin reactions were observed for 'wheal' and a 'flare'.

In addition to the allergens tested, a positive and negative control were used. The positive control is histamine solution (generally shows itchy, red, swollen with a wheal in the centre) and the negative control is saline solution (should show no response). The mean wheal size was recorded and SPT was regarded as positive with a wheal size of minimum 3-mm larger than the negative control.

ii) Method of obtaining pollen:

It involved the monitoring and sampling of the atmospheric pollens. The sampling of air borne pollens was done by using a Vertical Cylinder Air Sampler. It is a Non-Powered Impaction Sampler.

Sampling Procedure:

Vertical Cylinder Air Sampler consists of a metal angle, 2ft in height to which a glass rod 18.5cm in length is clamped. A 2 × 2 cm Vaseline coated tape is wound around it. This acts as an adhesive sampling surface.

A 30 × 30 cm square metal shield acts as a protection to the glass rod from direct sunlight and precipitation. The sampler is fixed to the parapet wall on the terrace of the building. This ensures there is free flow of wind from all directions. The tape is changed once in 24hrs. The sample Vaseline coated tape is then mounted on a glycerine jelly coated slide using a 2 × 2 cover slip and analysed under the Microscope.

Observation and Evaluation:

The slides were scanned under 10X magnification using a light microscope. Pollen were visualized and captured under 40X magnification. The pollen was then identified by comparison with reference slides.

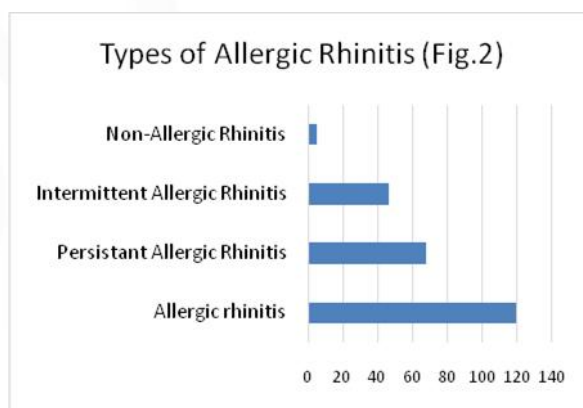
5. RESULTS

In this study, 115 patients with AR were evaluated for their SPT response to 34 aeroallergens out of which 45% were male and 55% were female (Fig.1a). The majority of AR patients were between the age group 26-35 years (Fig.1b). Five patients were found to have negative reaction to both negative (normal saline) and positive control (histamine).

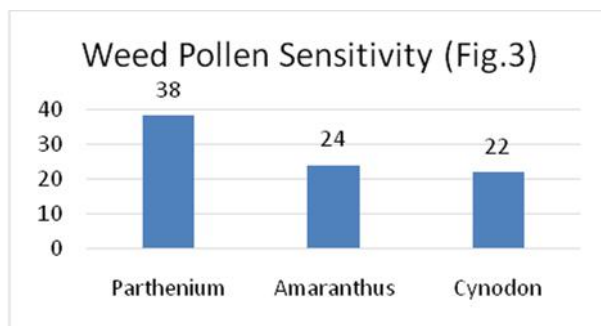
Male	52
Female	63

11-25	33
26-35	51
36-45	19
46-55	8
56-65	4

57% of subjects had persistent type of AR, while 47% of subjects had intermittent allergic rhinitis and 4% of subjects were found to have non-allergic rhinitis. (Fig.2).

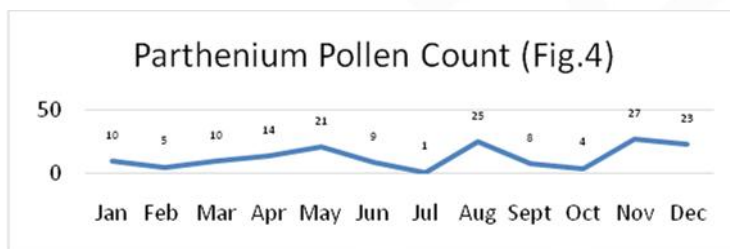


The overall rate of sensitisation to any allergen was 96 % and 4 % of patients did not show positive skin response to any of tested allergens. Parthenium pollen sensitivity was seen 33% of patients i.e., in 38 out of 115 allergic rhinitis patients. (Fig. 3)



The sampling of air borne pollens was done by using a Vertical Cylinder Air Sampler. The most prevalent aeroallergen (weed pollen) was found to be Parthenium.

An increase in the Parthenium pollen incidence was seen in May followed by a steep decline in the frequency of the pollen in July. A more or less same pattern was seen in August and October. The highest monthly incidence of Parthenium pollen was during November. Thus, there were peaks in Parthenium pollen incidence in the months of May, August and highest in November. While the incidence was low in the months of February, October and the least in July. (Fig.4)



6. DISCUSSION

The prevalence of allergic rhinitis varies widely from one population to another. However, it is well known that the prevalence is increasing worldwide.^[6] The difference in prevalence depends on many factors, including potency and composition of the allergen preparations, methods used to diagnose allergic diseases, selection criteria of subjects for diagnostic tests, age of subjects and environmental factors.^[7] Increased urbanization may be considered to be related to a higher prevalence of allergic rhinitis in some studies.^[8]

Skin prick testing, which is considered the gold standard for diagnosis of allergic rhinitis, is known to be safe and effective as a routine diagnostic test and is used frequently to assess specific sensitization and to verify the diagnosis of allergic (IgE mediated) disease in symptomatic subjects.^[9] Allergen skin reactivity has long been recognized to be associated with allergic respiratory diseases. Although positive SPT is interpreted as a sign of allergy.^[10]

In our study, 96% of the subjects with symptoms of chronic rhinitis were documented to have sensitization to at least one allergen via skin prick testing. In a similar study performed by Yuen et al.,^[11] 67% of the patients with symptoms of chronic rhinitis were found to have positive SPT reactions.

The allergens used in SPT vary from one region to another. It depends on the plant life and other environmental conditions of that particular region. Humans are exposed to a variety of pollens in the atmosphere. The type and role of pollens change according to environmental factors such as climate and pollution.^[12]

Knowledge of the specific pollen types in different seasons is very important for physicians interested in allergic respiratory diseases. Pollen calendars are used for this purpose.^[13]

In another study performed by JyothiNayar et al., the pollen of Parthenium was recorded throughout the year from May 1988 to April 1989.^[5] Parthenium pollen incidence was recorded from June'88 to September'88, with the highest monthly incidence in August and the least catch being recorded in February.^[5] In our study, Parthenium pollens were recorded from April'13 to March'14. But, the highest monthly incidence of Parthenium pollen was in November and the incidence was the least in July.

7. CONCLUSION

The government and the environmentalists are under the misconception that we have all but eradicated the deadly menace Parthenium. But our study has shown that Parthenium is still the top allergen and a major cause of allergic diseases such as allergic rhinitis and asthma. Thus we conclude that a dedicated approach to eradicate parthenium and awareness of public about ill effects of its growth is the need of the hour. It should be jointly addressed by environmentalists, medical professionals and the law makers.

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