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Aerobiological Investigation of Hingoli City with Special Reference to Allergy

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ABSTRACT

Among all the populations all over the world, respiratory allergy is prevalent and progressively increasing health issue. An increase in allergic diseases is occurs mostly due to indoor civilizations, pollution and other environmental issues. Apart from this bio-pollutants are also always considered as major factor in allergenic disorders. The persons mostly seen with allergic rhinitis and asthma. An aeropalynological survey was conducted at two different sites of Hingoli City in Maharashtra State of India. In present investigation, the qualitative and quantitative analysis of pollen types from Hingoli City is briefly studied. No such work was undertaken in Hingoli City previously. The major pollen types were found viz, *Acacia* Sp., *Azadirachta indica, Cassia siamia, Datura* Sp., *Eucalyptus globulus, Moringa oleifera* and *Parthenium hysterophorus* from about total 20 pollen types recorded. The dominant fungal species which have documented in the Hingoli City viz, *Alternaria, Penicillium, Aspergillus* and *Curvularia*. The Tilak Air Sampler was found to be effective in present investigation. It was found that frequency, variation and aerial transport of pollen grains depend on many factors. The type of pollen species was further correlated with allergenic cases found in clinical studies of Local Dermatologist. The study will provide useful data to local hospitals for effective diagnosis and treatment of respiratory and allergic diseases. Recently a group of Black Fungi and White Fungi have been reported huge health damages to peoples suffering from Covid 19, during hospitalization.

Keywords: Aerobiology, Hingoli City, Allergy.

INTRODUCTION

Among all the populations all over the world, Respiratory allergy is prevalent and progressively increasing health issue. More than 20-30% of the world population is known to suffer from one or other allergic ailments such as bronchial asthma, allergic rhinitis and atopic

dermatitis etc (Singh and Dahiya, 2008). An increase in allergic diseases is occurs mostly due to indoor civilizations, pollution, environmental issues. Apart from this bio-pollutants are also always considered as major factor in allergenic disorders. An increasing rate of bio-pollutants stimulates the appearance of new health problems. Youngsters who mostly out of house in whole day, seen affected by allergenic symptoms frequently. This age of group, frequently seen visiting to hospitals, due to fungal, bacterial and pollen allergy symptoms. It is acceptable to say, the number of people suffering from allergy reaches to 20-30% of population in general. The persons mostly seen with allergic rhinitis and asthma. Irrespective of the type of allergic symptoms, allergies are chronic disease seriously affecting the quality of life. It may even sometime be fatal. Therefore, fighting with them may demand a change of lifestyle or even profession maintaining allergen avoidance, long term pharmaco-therapy and even immuno-therapy. Major causative agents are pollen grains fungal spores, dust mites, insect debris and other plant fragments and foods etc (Singh and Dahiya, 2008).

Allergenic pollen and fungal species are always changing according to region, time and environment. So, its need of time to investigate the pollen types present in the air. Therefore, it is essential to have the knowledge of locally prevalent aeroallergens for diagnosis and therapy of allergic patients. The knowledge about allergens must be needed to monitor, especially with recent molecular and immunological techniques. Structure and function of allergens have been identified. These researches have provided explanations about the relationship between allergic sensitization, allergen exposure and clinical observations. In this article, the qualitative and quantitative analysis of pollen allergens from Hingoli City is briefly studied. Previous similar work has been conducted at Wardha City in Maharashtra by Dalal et al (2011), at Rohtak City by Ahlawat et al (2013) and at Pune by Thakur (2018).

MATERIAL AND METHODS

In present investigation, aerobiological studies conducted at two different sites of Hingoli City; Adarsh College Area (civilian crowded area) and Narayan Nagar Area (hospital crowded area). The study area Hingoli City belongs to Maharashtra state in India (19.7115° N, 77.1453° E). The aerobiological study was conducted during July 2018 to December 2022 by operating Volumetric Tilak Air Sampler. The changes in the meteorological conditions and their results are also analysed in this work. Clinical Data was collected from Local Dermatologist and pollen types present in air is correlated during occurrence of allergic patients. Relationship among incidence of allergenic patients and fungal - pollen types were represented in the article.

RESULTS

(A) Pollen allergens

The pollen grains are transported of by wind or by the insects, from flower anther to recipient stigma. It is the critical reproductive event among higher plants. The dispersion of massive amount of pollen grains in typical stipulated time interval leads to human health problems including asthma, rhinitis, atopic dermatitis, etc. Pollen occurrence at any time period reflects the plant source. The climatic factors and pollution in same time also increase the degree of exposure of pollen grains into nasal passage of peoples. The presence of pollen, origin of species, its concentration, etc., is depends upon various climatic factors such as temperature, humidity, wind direction, sun light, precipitation and other seasonal factors. Because of change in the climatic conditions, the study of variations in the diurnal and seasonal prevalence becomes very important.

Airborne pollen and their concentration vary in the different seasons depending upon the flowering seasons and climatic factors which are quite variable from one part of the country to other. Exposure to air pollution increases airway responsiveness to aeroallergens. People who live in urban areas tend to be more affected by pollen-induced respiratory allergy than those from of rural areas. The air pollutants could modify the antigenic properties by adhering to the surface of airborne allergenic agents. Factors such as type of air pollutant, plant species, nutrient balance, climatic factors, degree of airway sensitization and responsiveness of exposed subjects influence this interaction. The airway mucosal damage and the impaired mucociliary clearance induced by air pollution may facilitate the penetration and the access of inhaled allergens to the cells of the immune system thereby promoting airway sensitization.

Table 1: Pollen Counts and Month of Occurrence

Sr. No.	Pollen Type	Total Pollen Count	Month of Occurrence
1.	*Acacia* Sp.	340	July – Nov.
2.	*Ageratum conyzoides*	75	July – Sept.
3.	*Argemone mexicana*	22	Mar. – June
4.	*Azadirachta indica*	307	Feb. – April
5.	*Cassia siamia*	316	Feb. – April
6.	*Bauhinia racemosa*	118	Sept. – Dec.
7.	*Brassica Sp.*	48	Sept. – March
8.	*Datura* Sp.	315	June – Sept.
9.	*Eucalyptus globulus*	278	Oct. – Jan.
10.	*Gliricidia maculata*	146	Feb. – April
11.	*Mangifera indica*	156	Feb. – April
12.	*Moringa oleifera*	208	Oct. – Dec.
13.	*Parthenium hysterophorus*	365	July – Nov.
14.	*Peltophorum pterocarpum*	292	July – Nov.
15.	*Pongamia pinnata*	221	April - June
16.	*Ricinus communis*	76	Aug. – Nov.
17.	*Tamarindus indica*	221	July – Sept.
18.	*Thevetia neriifolia*	537	Aug. – Nov.
19.	*Tridax procumbens*	160	Aug. – Nov.
20.	*Vernonia cineria*	104	Aug. – Nov.
21.	Unidentified types	1028	Jan. – Dec.

Therefore, an enhanced immunoglobulin mediated response to aeroallergens and enhanced airway inflammation favoured by air pollution could account for the increasing prevalence of allergic respiratory diseases in urban areas (Singh and Shahi, 2008). Air carries large number of bioparticles (biopollutants) and chemical pollutants and these poses burden for the respiratory tract of humans (Singh, 2017).

To be clinically relevant, outdoor allergens, carried most often on plant pollens and mold spores, must reach a high airborne concentration. The level of exposure to these particles is determined by the vicinity of the flora to the patient, the density of production of the pollen or spores by its source, the seasonal and diurnal timing of pollen or spore release, weather conditions, and the aerodynamic characteristics of the vector carrying the allergenic proteins. Flora that are present in great numbers and produce large pollen and mold spores occur in seasonal patterns (Lieberman and Anderson, 2007).

In Hingoli city, typically the allergenic pollen originated from 20 plant species viz, *Acacia* Sp., *Ageratum conyzoides, Argemone Mexicana, Azadirachta indica, Cassia siamia, Bauhinia racemosa, Brassica* Sp., *Datura* Sp., *Eucalyptus globulus, Gliricidia maculata, Mangifera indica, Moringa oleifera, Parthenium hysterophorus, Peltophorum pterocarpum, Pongamia pinnata, Ricinus communis, Tamarindus indica, Thevetia neriifolia, Tridax procumbens* and *Vernonia cineria* (Table 1).

(B) Fungal allergens

Fungi possess highly evolved mechanism of spore liberation due to which the spores remain suspended in the air for a long duration, i.e. few hours to several days. Fungi and fungal particles can clearly induce an allergic response in susceptible individuals. Typical symptoms include wheezing, cough, rhinorrhoea, itchy

nose, sore throat, sinus congestion, etc. The development of allergies to fungi follows the same biological phenomenon as allergies to other environmental allergens. Fungi are ubiquitous in nature and are reported to be prevalent from different parts of the world, both in outdoor and indoor environments. Airborne surveys of fungal allergens have been reported from different parts of India (Singh and Shahi, 2008).

Fungal spores are always a component of the atmosphere, constituting the largest proportion of aerobiological particles in our environment, which even exceeds the concentration of pollen grains but are much less studied than them. Fungi cause toxic and allergic reactions, toxic reactions are non-immunological and occur with first encounter, allergic reaction on the other hand requires previous sensitizing exposure. Sensitization to Alternaria alternate has been linked to a major risk factor for fatal asthma attacks (Ezikanyi et al, 2018). Numerous species of fungi have been discovered as triggers of allergy although their contributions are species-specific.

The dominant fungal species which have documented in the Hingoli City viz, *Alternaria, Penicillium, Aspergillus* and *Curvularia* (Table 2).

Table 2: Fungal Spore Count and Month of Occurrence

S.N.	Spore Type	Class	Total No. of Spores/m3 of Air	Month of Occurrence
1.	*Albugo*	Oomycetes	2378	Jan-Dec
2.	*Alternaria*	Ascomycetes	3723	June-Nov
3.	*Aspergillus*	Ascomycetes	3817	Mar-Oct
4.	*Cladosporium*	Ascomycetes	2815	Feb-Nov
5.	*Curvularia*	Ascomycetes	4409	Jan-Dec
6.	*Fusarium*	Ascomycetes	1177	Aug-Sept
7.	*Helminthosporium*	Ascomycetes	2998	Jan-Dec
8.	*Mucor*	Zygomycetes	1736	July-Sept
9.	*Penicillium*	Ascomycetes	3341	June-Nov
10.	*Phytophthora*	Oomycetes	1331	Aug-Nov
11.	*Rhizopus*	Zygomycetes	1335	July-Sept
12.	Unidentified 1	-	1111	Nov-Dec
13.	Unidentified 2	-	985	Jan-Feb
14.	Unidentified 3	-	975	March-May
15.	Unidentified 4	-	963	Feb-June
16.	Unidentified 5	-	793	June-Aug
17.	Unidentified 6	-	594	July-Sept
18.	Unidentified 7	-	472	June-Aug
19.	Unidentified 8	-	138	June-Sept
Identified Total			29060/m3	
Unidentified Total			6031/m3	
Total			35091/m3	

Table 3: Clinical Data from July 2018 to December 2022

Sr. No.	Month	No. of Pollen Allergenic Patients		Pollen Types Represented in Air Sampling	Pollen Types Represented in Air Sampling
		Hospital 1	Hospital 2		
1.	January	15	12	*Acacia* Sp., *Eucalyptus globulus*	*Albugo*
2.	February	231	345	*Azadirachta indica, Cassia siamia*	*Albugo*
3.	March	217	413	*Azadirachta indica, Cassia siamia*	*Aspergillus*
4.	April	124	167	*Azadirachta indica, Cassia siamia*	*Aspergillus*
5.	May	45	16	*Mangifera indica*	*Aspergillus*
6.	June	14	11	*Datura Sp.*	*Alternaria, Aspergillus, Penicillium*
7.	July	23	34	*Acacia Sp., Parthenium hysterophorus, Peltophorum pterocarpum, Datura* Sp.	*Alternaria, Aspergillus, Penicillium*
8.	August	345	452	*Acacia Sp., Parthenium hysterophorus, Peltophorum pterocarpum, Datura Sp., Vernonia cineria*	*Alternaria, Aspergillus, Penicillium*
9.	September	567	674	*Acacia Sp., Thevetia neriifolia, Parthenium hysterophorus, Peltophorum pterocarpum, Datura Sp., Vernonia cineria*	*Alternaria, Aspergillus, Penicillium*
10.	October	568	765	*Acacia Sp., Thevetia neriifolia, Parthenium hysterophorus, Peltophorum pterocarpum, Vernonia cineria, Eucalyptus globulus*	*Alternaria, Aspergillus, Penicillium*
11.	November	432	563	*Acacia Sp., Thevetia neriifolia, Peltophorum pterocarpum, Parthenium hysterophorus, Vernonia cineria, Eucalyptus globulus*	*Alternaria, Penicillium*
12.	December	45	74	*Eucalyptus globulus*	*Albugo*

The pollen and fungal allergenic patients clinical data is represented (Table 3). It shows, relation of increasing the number of allergenic patients and occurrence of specific pollen and fungal type. Specifically, in the month of February and March, the number of allergenic cases increases due to flowering to the plants *Azadirachta indica* and *Mangifera indica* due to pollen dispersal. In the month of December, January and February, the patients with Candidiasis increase due to occurrence of *Albugo*. In the months of August to October, number of Cough and Cold patients are also found to be increasing, may be said to increase in echinate pollens like *Parthenium hysterophorus* and moisture growing fungi like *Aspergillus* and *Penicillium*.

DISCUSSION

Aeroallergens are airborne substances that can cause allergic reactions in sensitive individuals. They may be any substance, light enough to be carried away by the air currents and capable of evoking an immune response. Aeroallergens can be of plant or microbial origin. The most common indoor allergens are derived from dust mites. Some aeroallergens are found only in a particular region while others seen to be ubiquitous. The frequency, variation and aerial transport depend on many factors. Many people who have inhaled allergies have seen symptoms during certain seasons. Pollen, grass, molds are most triggers of seasonal allergies. Changes in climate factors can affect aeroallergen production, which in turn effects the severity of allergic illness through sensitivity and response pathways. Aeroallergens include a variety of plant and microbial material, usually protein. The common type of aeroallergens of biological origin are pollen grains, fungal spores, dust mites etc. The most common allergic conditions include allergic rhinitis (hay fever), asthma, allergic conjunctivitis, allergic bronchitis, allergic eczema (Weber, 2002). Although

pollen is present throughout the year but peak pollen season are March-May and August-October (Singh and Dahiya, 2008). Preparation of National and Regional pollen calendars is of immense help to the clinicians for effective diagnosis and efficient treatment of patients (Singh, 2017).

Weather conditions greatly influence the airborne concentrations of these particles, sometimes in unexpected ways. Pollination and mold sporulation require warmth and are highest at midday and on warm days. However, some types of fungi release spores with active rainfall, whereas others suppress sporulation during precipitation. Pollen release is generally suppressed by humidity, but for some pollens water exposure may enhance availability of sub-microscopic, allergen-rich particles that can become airborne and induce reactions (Lieberman and Anderson, 2007). Aeroallergens such as pollen grains, molds, dust mite and insects play a major role in respiratory allergy, particularly asthma and rhinitis. Pollen grains are well studied from across the world and are important aeroallergens (Singh and Shahi, 2008).

Aeroallergens are airborne organic substances which are responsible for allergenic diseases in hypersensitive individuals. People are exposed to their allergens either directly or after their entrance into the interiors. Aeroallergens are continuous component of the air, and their type and abundance vary according to biological and environmental factors (Ezikanyi et al, 2018). In Outdoors, the allergic patient faces pollution (irritant) and pollens (allergens). Trees, grasses, and weeds can wreak havoc on an allergic sufferer. Likewise, different pollens may predominate in a particular region. Growing seasons may vary according to residential area. Pollens are common triggers of allergic responses, and several proteins from each source are recognized as allergens (Lieberman and Anderson, 2007).

The airborne fungal spores show great variation in composition, concentration and may vary from place to place. The types and concentration of fungal spores is determined by time, day, weather parameters and seasons (Thakur and Jite, 2015). In most of these fungi, dispersal of conidia is by wind as well as rain accounting for disease in rainless and rainy days (Tilak, 1987). Aerobiological investigation has significant role in study of disease prediction. Various literature is available on the aspect that clearly indicate a close relationship between concentration of pathogenic spore load in air, meterological parameters, growth stages of the crop and the appearance and spread of diseases (Tilak and Vaidya, 1998). Maximum pollen concentration was observed in the month of March to April and August to September and minimum in July. The major pollen types were found viz, *Acacia* Sp.*, Azadirachta indica, Cassia siamia, Datura* Sp.*, Eucalyptus globulus, Moringa oleifera* and *Parthenium hysterophorus* from about total 20 pollen types recorded (Table 1). The dominant fungal species which have documented in the Hingoli City viz, *Alternaria, Penicillium, Aspergillus* and *Curvularia* (Table 2). Recently a group of Black Fungi and White Fungi have been reported huge health damages to peoples suffering from Covid 19, during hospitalization.

CONCLUSION

The type of pollen species was found to be correlated with number of allergenic cases found in clinical studies provided by local dermatology hospitals. The increasing number of allergenic patients and occurrence of specific pollen and fungal type in the month of February and March, is due to flowering to the plants *Azadirachta indica* and *Mangifera indica.* In the month of December to February, the patients with Candidiasis increase due to occurrence of *Albugo*. In the months of August to October, number of Cough and Cold patients are also found to be increasing, said to be increase due to echinate pollens like *Parthenium hysterophorus* and moisture growing fungi like *Aspergillus* and *Penicillium*. These important findings give importance to the study. The study has provided useful information for effective diagnosis and treatment of respiratory and allergic diseases. The persons mostly seen with allergic rhinitis and asthma.

Conflict of Interest: The authors declare no conflict of interest in relation to this research.

Data Availability Statement: Not applicable.

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