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Review article

POLLEN ALLERGY IN INDIA

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ABSTRACT
Several aerobiological studies have been conducted in different parts of the country to ascertain aerial concentration and seasonality of pollen grains. Recently, an "All India Coordinated Project on Aeroallergens and Human Health" was undertaken to discover the quantitative and qualitative prevalence of aerosols at 18 different centers in the country. Predominant airborne pollen are *Holoptelea*, *Eucalyptus*, *Casuarina*, *Putanjiva*, *Cassia*, *Quercus*, Cocos, *Pinus*, *Cedrus*, *Ailanthus*, Cheno/Amaranth, *Cyperus*, *Argemone*, *Xanthium*, *Parthenium* and others. Allergenically important pollen are *Prosopis juliflora*, *Ricinus communis*, *Morus*, *Mallotus*, *Alnus*, *Querecus*, *Cedrus*, *Argemone*, *Amaranthus*, *Chenopodium*, *Holoptelea*, *Brassica*, Cocos, *Cannabis*, *Parthenium*, *Cassia* and grasses.. *Ricinus communis* pollen from commonly growing weeds in India, cross-reacts with latex (*Hevea brasiliensis*), *Mercurialis annua* and also with seeds of *Ricinus communis* – all belonging to family Euphorbiaceae. *Areca catechu* cross-reacts with other members of Arecaceae such as *Phoenix sylvestris*, *Cocos nucifera* and *Borassus flabelifer*.

KEY WORDS: Aeroallergens, Pollen, Human Health.

INTRODUCTION

Aeroallergens play a major role in the pathogenesis of respiratory allergic diseases, particularly asthma and rhinitis. Pollen, fungi, animal danders, house dust mites, domestic pets, and insects are of particular importance as triggering factors. Pollen grains are well studied as important aeroallergens and a cause of pollinosis. Knowledge about allergens has progressed, especially with recent molecular and immunological understanding of the disease. Structure and function of allergens have been identified. These studies have provided explanations about the relationship between allergic sensitization, allergen exposure, and about clinical observations such as allergic cross-reactions. Pollen allergens may cross-react with allergens of other pollen species as well as foods. Pollen associated food allergy has also been reported. We have tried to briefly review these aspects with particular reference to pollen allergy in India (Singh and Kumar, 2004). The role of the different pollen allergens varies with environment conditions, such as climatic factors, pollution and degree of exposure. Because of change in the climatic conditions, the study of variations in the diurnal and seasonal prevalence becomes very important (D'Amato *et al*., 2002). Knowledge about diurnal, seasonal and annual fluctuation in airborne pollen in any geographical area is essential for effective diagnosis and treatment of pollen allergy.

AIRBORN POLLEN ALLERGY IN DIFFERENT PARTS OF INDIA

In Eastern /North eastern region the state of Bihar, Orissa, West Bengal, Manipur, Meghalaya, Sikkim, Assam, Nagaland, Tripura, Arunachal Pradesh and Mizoram are included in this region. The other dominant pollen types being *Azadirachta, Caesalpaenia, Carica papaya, Mangifera indica, Amaranthus, Chenopodium, Xanthium and Argemone* (Mandal and Chanda, 1982). From the Eastern Himalayas dominant tree pollen types recorded are *Acer, Alnus nepalensis, Betula, Bucklandia populnea, Eucalyptus* and *Pinus* (Singh and Devi, 1992). From Eastern India, allergenically significant pollen types were found as *Lantana, Cucurbita maxima, Cassia fistula, Cocos nucifera* and *Calophyllum inophyllum*. Recent studies based on clinical and immunologic parameters reported *Phoenix, Ricinus communis and Aegle marmelos* as causative agents of allergy in this region (AICP, 2000). In Northern region it includes the state of Jammu and Kashmir, Himachal Pradesh, Haryana, Punjab, Rajsthan, Delhi and Union Territory of Chandigarh. In Delhi, surveys have been conducted from by Malik *et al*. (1981). The dominant pollen types recorded are grasses, *Cheno/amaranth, Ailanthus, Ricinus, Morus, Xanthium, Cannabis, Artemisia* and *Holoptelea*. Lakhanpal and Nair reported 30 pollen types from the atmosphere of Lucknow (Lakhanpal *et al*., 1958), Later, important pollen causing allergy were identified for Delhi some of them are *Ageratum, Ailanthus, Amaranthus, Anogeissus pendula, Artemisia, Cassia siamea, Cenchrus, Chenopodium, Cynodon. Ipomoea fistulosa, Paspalum distichum and Poa annua*, recorded positive skin reactions in 16.9% patients to *Pinus roxburghii* from the foot hills of Himalayas (Singh *et al*., 1987). *Prosopis Julifera* pollens in 180 patients suffering from nasobronchial allergy in Bikaner. Out of them, 54 had allergic rhinitis, 32 bronchial asthma and 94 had both. Chaudhry *et al*. (1990) from Bikaner worked on the purification and partial characterization of a major allergenic part of the pollen of *Amaranthus spinosus.* The dominant types were *Holoptelea*, Poaceae,

Eucalyptus, Casuarina, Putranjiva etc. *Holoptelea* contributed 22.2% pollen to the air from March to May. Poaceae pollen was recorded (11.8%) with maximum concentration in April to June, followed by *Asteraceae* (Mittre and Khandelwal, 1973). Under the same project at Solan (Himachal Pradesh), out of 22 types of pollen recorded, pollen of family Poaceae and Asteraceae were recorded in high concentration. Peak pollen season of Asteraceae was from March to October with maximum concentration in April. Poaceae pollens were recorded in high concentration in September. *Cassia, Quercus, Pinus, Cedrus* were also important contributors to pollen load (AICP, 2000). From Northern India, important allergens identified are *Prosopis juliflora, Ricinus communis, Morus, Mallotus, Alnus, Quercus, Cedrus, Argemone*. *Amaranthus, Chenopodium, Holoptelea* and grasses (AICP, 2000). In western region**,** it includes the states of Gujrat, Maharashtra, Goa and Union territories of Daman and Diu and Dadra and Nagar Haveli. Sarpotdar and Rajmane (1978) worked on asthmogenicity of *Parthenium hysterophorus* pollen grains in Kolhapur. Aerobiological surveys carried out at Mumbai, Pune and Kolhapur revealed *Cicer, Ricinus communis, Holoptelea, Cheno/Amaranth, Argemone, Cocos nucifera and Hibiscus* the dominant pollen types (Tilak, 1974 and Deshpandey and Chitaley, 1976). Recent survey at Pune revealed *Parthenium* to be the highest contributor to the pollen load with two peak seasons *i.e*. from September to November and January to April. *Cocos* and *Cassia* were observed throughout the year. *Cocos* pollen was recorded in high concentration in April - May and November- December (AICP, 2000). At Aurangabad, *Datura alba* was prevalent in air from August to October with 8.2% annual concentration. *Cleome* contributed 6.8% pollen in June to August. Other important contributors were *Alternanthera, Typha, Bougainvellia etc*. (AICP, 2000).

In southern region it comprises the state of Andhra Pradesh, Karnataka, Kerala, Tamilnadu and the union territory of Pondicherry. Saha and Kalyansundaram (1962) prepared a pollination calendar for the potentially allergic plants in Pondicherry. Reddi (1970) reported the atmospheric incidence of 10 pollen types from Anakapalli and Visakhapatnam. Jankibai and Reddi (1979) made forecasting of Gramineae and Cyperaceae pollen season of Visakhapatnam. From South India *Cassia, Ageratum, Salvadora, Ricinus, Albizia lebbeck and Artemisia scoparia have been reported* as important aeroallergens. Subbarao *et al*. (1985) recorded allergenicity to *Parthenium hysterophorus* pollen extracts in 34% of allergic rhinitis and 12% bronchial asthma patients from Bangalore and also recorded high skin reactivity to *Casuarina equisetifolia* in patients (Agashe and Soucenadin, 1992). From Southern India, studies carried out earlier at various places such as Visakhapatnam, Bangalore, Trivandrum, Kodaikanal and Chennai, revealed that *Casuarina, Parthenium, Spathodia,* Cheno/Amaranth, *Cocos* and *Eucalyptus* were dominant pollen types. However, at Visakhapatnam, 24 pollen types were recorded and Poaceae, *Peltophorum, Cocos, Casuarina,* Cyperaceae, *Eucalyptus* were the dominant types (Satheesh *et al*., 1992) Recent aerobiological survey at Trivandrum revealed 15 pollen types and dominant were Poaceae, Cheno/Amaranth, A*porosa etc*. At Chennai, 38 pollen belonging to 24 genera were identified. Pollen from Poaceae was the most abundant type and contributed 19.4% to the total pollen load from June to August. Pollen of *Acalypha* was recorded in highest concentration in the month of August which is followed by the pollen of *Casuarina* in the month of January and March (AICP, 2000). From South India *Cassia, Ageratum, Salvadora, Ricinus, Albizia lebbeck and Artemisia scoparia have been reported* as important aeroallergens. Subbarao *et al*. (1985) recorded allergenicity to *Parthenium hysterophorus* pollen extracts in 34% of allergic rhinitis and 12% bronchial asthma patients from Bangalore recorded high skin reactivity to *Casuarina equisetifolia* in patients from Bangalore (Agashe & Soucenadin, 1992). In Central region it comprises the state of Uttar Pradesh and Madhya Pradesh. The floristic surveys, aeropalynological surveys and clinical investigations have been performed by several of the region. Khanduri *et al.* (1999) studied on anthesis, pollen production and dispersal in *Grevillea robusta* and he found that the pollen production of a tree ranged from 1.04×10^8 to 1.16×10^8 grains at Garhwal. Kothari and Kothari (1999) reviewed the incidence of airborne pollen and fungal allergens in some cities and pointed out their clinical significance for the treatment of allergic disorders in human beings from Meerut .From Central India, surveys carried out at Gwalior, Nagpur, Bhopal, and Kolhapur, revealed that the dominant pollen types were from Poaceae, Asteraceae, Apocynaceae families, *Rosa, Cicer, Ricinus, Ailanthus, Holoptelea,* Cheno/Amaranth and *Cyperus* (Jain and Mishra, 1988). Grass pollen in India has been reviewed which observed that highest percentage was reported from Aurangabad (80.64%), followed by Bhavnagar (70.26%) and Raipur (66.73%), all in Central India (Chaturvedi *et al*., 1992). Aerial pollen flora of Kanpur was studied by (Shukla and Mishra, 1978). The clinical aspect was studied by (Mittal *et al*., 1978), who reported the results of intradermal test by using pollen antigen of some patient of nasobranchial allergy. Gupta *et al*. (1984) also investigated pollen allergy in Kanpur, where out of 100 patients, 77 showed positive skin reactions to one or more pollen antigens with highest potency of grass pollen. Jha *et al*. (1975) performed clinical test with some airborne pollens and dust recorded from Varanasi area.

Sahney *et al.* (1995) surveyed the atmosphere of Allahabad with special reference to pollen grains and Singh and Chauhan (1999) made aeroplynological studies of Agra city. From Central India important pollen allergens are *Argemone, Brassica, Cannabis, Asphoedelus, Parthenium, Cassia, Azadirachta,* grasses, *Alnus, Betula, Malotus, Trewia nudiflora* (AICP 2000).

DISCCUSSION

The general analysis of flowering period of the local vegetation revealed following two main flowering seasons (Singh, 2000).

February-April: Flowering in this period was mainly dominated by tree species like *Ailanthus excelsa, Bauhinia sp., Bombax ceiba, Cassia siamea, Eucalyptus sp., Holoptelea integrifolia, Mangifera indica, Ricinus communis, Terminalia arjuna.*

August- October: The months include monsoon and post-monsoon seasons. these were characterized by the

flowering of herbaceous species like *Amaranthus spinosus, Amaranthus viridis, Argemone maxicana,Cassia tora Chenopodium album, Hyptis suaveolens, parthenium hysterophorus, Scoparia dulcis, Tephrosia purpurea, Tridax procumbens, Xanthium strumarium, Apluda Varia, Cenchrus ciliaris, Cynodon dactylon, Dicanthium annulatum, Eragrostis sp. Cyperus triceps, Fimbristylis dichotoma, Cyperus dactylon, Dicanthium annulatum, Eragrostis sp. Cyperus triceps, Fimbristylis dichotoma , Cyperus killinga and and Cyperus irria.* A number of tree species viz. *Cassia siamea, Eucalyptus sp.Parkinsonia aculeate; shrub species like Bouganvillea glabra, Carica papaya, Hamelia patens, Hibiscus rosa sinensis, Lantana camara, Thevelia peruviana*, etc. flower irregularly with variable frequency (Singh, 2000).

CONCLUSION

Allergic diseases are amongst the most common chronic disorders worldwide. Today, more than 300 million of the population is known to suffer from one or other allergic ailments affecting the socio-economic quality of life. Pollen grains are one of the major causative agents. Several aerobiological studies have been conducted in different parts of the world to as certain aerial concentration and seasonality of pollen grains. Especially from clinical point of view, it is important to know the details about the pollen season and pollen load in the atmosphere. The flowering time of higher plants are events that come periodically in each season, but the time of blooming may differ from year to year, in different geographic locations. Based on differences recorded in several years of observations in airborne pollen, pollen calendars are drawn as an aid to allergy diagnosis and management. This research paper emphasises on various aerobiological parameters of environmental pollen from different parts of the India. Still all the possible allergens have not been characterized .As allergen avoidance is the measure of choice for the treatment of allergies and asthma in particular, all the possible allergens are required to be characterized bio-chemically as well as at molecular level. And relationship of the allergens with pathogenesis of the respiratory allergies and the increase in the prevalence are important questions which are required to be studied in detail. Molecular studies with reference with the cross reactive allergens are important for the proper diagnosis and treatment of the allergy. Allergens are required to be studied up to epitope level details. Genetic factors associated with susceptibility to pollen allergy need to be studied. Pollen calendars are very useful for clinicians as well as allergic patients to establish chronologic correlation between the concentration of pollen in air and seasonal allergic symptoms. Pollen calendar has to be published that chalks out the time when different plant pollens peak, causing allergies. Centre for Biochemical Technology Institute of Genomics and Integrative Biology (Council for Scientific and Industrial Research) had published a book on pollen calendars of 12 different states of India Important pollen season for grasses, weeds and trees prevalent in India are provided in the book. Researchers have to visit to every corner of the city to research on pollen allergens and came out with a weekly report on which locality was the worst hit by the pollen count. Researchers should make a project to draw up pollen calendars to identify dispersed airborne pollen grains in various bio-zones in India. Thus, the study may be useful for allergologists in establishing a right diagnosis and ultimately enable an improved quality of life for the inhabitants of the area of investigation. The results of the study may be used in public awareness programmes about the health hazards caused by pollen grains.

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