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, Ailanthus 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, Rajasthan, 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, Chen/amaranth, Ailanthus, Ricinus, Morus, Xanthium, Cannabis, Artemisia and Holoptelea. Lakhpanal and Nair reported 30 pollen types from the atmosphere of Lucknow (Lakhpanal 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 (Mitter 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 pollen 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 Prosois jutilflora, 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 Deshpande and Chitaley, 1976). Recent survey at Pune revealed Parthenium to be the highest contributor to the pollen load 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, Bougainvella 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 species 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, Salvadoria, Ricinus, Albizia lebeck 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). In Central region it comprises the state of Uttar Pradesh and Madhya Pradesh. The floristic surveys, aeroplynological 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 X 10^8 to 1.16 X 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 Meenur .From Central India, surveys carried out at Gwalior, Nagpur, Bhopal, and Kolhapur, revealed that the dominant pollen types were from Poaceae, Asteraceae, Apocyaneae families, Rosa, Cic, Ricinus, Ailanthus, Holoptelea, Chenol/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.


DISCUSSION
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 mexicana, Cassia tora Chenopodium album, Hypitis suaveolens, parthenium hysterophorus, Scoparia dulcis, Tephrosia purpurea, Tridax procumbens, Xanthium strumarium, Aphula Varia, Cenchrus ciliaris, Cyanodon dactylon, Dicanthium annulatum, Eragrostis sp. Cyperus triceps, Fimbrystylis dichotoma, Cyperus dactylon, Dicanthium annulatum, Eragrostis sp. Cyperus triceps, Fimbrystylis dichotoma, Cyperus killinga 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 pollen species 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. 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.

ACKNOWLEDGEMENT

The authors are thankful to Dean and Head, Department of Biological Science R. D. University, Jabalpur (M.P.) for their co-operation and motivation.

REFERENCES


Pollen allergy in India


