REVIEW OF LITERATURE

Ecofloristic Survey

Systematic studies on the flora of West Bengal was done by several workers (Voigt, 1842; Prain, 1903, 1905; Cowan, 1929, etc.). Botanical Survey of India (BSI) published the first volume of the '*Flora of West Bengal*' in 1997 (Anonymous, 1997). For the Northern part of the state, Biswas (1966) started publishing the flora of Darjeeling. Hara (1966, 1971), Matthew (1981), Ohashi (1975), Das (1986), Bhujel (1996) contributed much to the floristics of the region. Very recently some workers have started surveying the district floras of West Bengal and have enumerated the plant species of the respective regions (Dutta & Majumdar 1966, Bhattacharya *et al.*, 1984; Bishayee and Bhattacharya, 1992). The flora of Jalpaiguri district has been studied earlier by Sikdar and Samanta (1984), Sikdar (1984) and Bhattacharya *et al.* (1988). But a detailed flora of the district is yet to be published.

Aeropalynological Survey

Aeropalynology deals with airborne pollen grains. Pollen grains are the carriers of male genetic materials of higher plants. In the matter of plant reproduction pollen grains have to be transmitted from flower to flower, for which they utilize a range of different vectors, of which air is an important agent for dispersal. For this reason, pollen grains are important airborne bioparticulates and now a days, these are also recognized as important aeroallergens. Bostock (1819) was the first to suspect that pollen grains caused hay fever but it was Blackley (1873) who established the fact. Scheppegrell (1916) from U.S.A. felt the need of field exploration and aerial survey to record aero-allergens. F.C. Meirs (1935) coined the terms 'aerobiology' as the scientific discipline focused on the aerial biomass consisting of pollen grains, spores, insect debris and other biological material, also referred to as the bioaerosol. Therefore, aerobiology is a multidisciplinary subject deals with the origin, release, transport and surface impact of wind borne particles.

For study an aerobiological pollen survey in a particular area, it is first necessary to make an eco-floristic survey of that area and to study the detailed pollen morphology of the species found to enable proper identification of airborne pollen grains. Such studies on pollen morphology were started by Wodehouse (1935)

followed by the immense contribution by Prof. G. Erdtman, summarized in 'Pollen Morphology and Plant Taxonomy' (Erdtman, 1952) and in '*Handbook of Palynology*' (Erdtman, 1969).

Initiation of aerobiological survey was made by Durham (1946) by devising a sampler which was based on principle of simple gravity deposition on the gelatin coated slides and this was followed by other workers (Hyde and Williams, 1944). Subsequently, volumetric samplers based on aerodynamic principles were designed, among them the Hirst trap. Andersen sampler, Rotorod sampler, and Burkard volumetric sampler are the most versatile collectors of pollen grains and spores.

In Abroad :

Pollen grains constitute a significant fraction of airborne biopollutants. Systematic aeropalynological surveys were carried out in various parts of the World at different times. Durham initiated aerobiological survey in the U.S.A. in 1925. In 1944 a survey was done at Cardiff by Hyde and Williams which was later extended to several other stations in Great Britain. Based on the data, Hyde published an atlas of airborne pollen grains of the U.K. (Hyde and Adams, 1958; Hyde, 1969). Emberlin *et al.* (1994) analysed the annual variation in grass pollen in London during 1961-1990. Annual variation of grass pollen in London was carried out by Emberlin *et.al.* (1993).

In France, studies carried out at Montpellier, Marseilles, Paris, Lyon have shown Chenopodiaceae, Compositae, Cupressaceae, *Pinus,* Plantain, Poaceae, *Alnus, Betula, Quercus* as the pollen species encountered in large numbers (Charpin *et.al.* 1966; Michel *et.al.* 1976). Airborne pollen of *Ambrosia* was reported from Burgundy of France by Laaidi and Laaidi (1999). Another important center was in Basel, Switzerland, where Leuschner (1974) carried out survey using individual pollen collectors and found *Aesculus, Artemisia* and *Salix* as important pollen contributors to the atmosphere. Airborne brich pollen was recorded from Neuchatel (Switzerland) by Clot (2001).

In Germany survey carried out at Darmstadt revealed 70% of the total pollen catch consisted of birch, grasses, nettle, oak and pine (Stix, 1977). The dominant airborne pollen grains in Italy were originated from Cupressaceae, *Fraxinus,* Urticaceae, *Parietaria*, Poaceae, Betulaceae, Corylaceae, Oleaceae (Caramiello *et. al.* 1990; Famularo *et.al.*, 1992; Fornaciari *et.al.*, 1996, Filon *et.al.*, 2000). Whereas several workers have observed *Parietaria, Artemisia* and *Olea* as the most important airborne pollen (Eriksson *et.al.*, 1984; D' Amato and Spieksma, 1991, Spieksma *et. al.* 2000). The most abundantly encountered pollen types in Sweden were *Pinus,*

Betula, Urtica, Ulmus, Quercus, members of Poaceae, *Alnus* and some others (Kutzamanidou and Nilsson, 1977; El-Ghazaly *et.al.*, 1993). Extensive studies on airborne pollen and the mode of sampling has been carried out by Kapyla (1984) in Finland. In the air of Denmark the important pollen contributing species are *Alnus, Artemisia, Betula, Corylus,* Poaceae and *Ulmus* (Goldberg *et.al.*, 1988). In Norway the survey was carried out by Johansen (1991).

In other European countries like Portugal, Yugoslavia, Spain and Poland the important airborne pollen grains were *Alnus*, Cheno-Amaranth group, *Corylus, Cupressus, Morus, Olea, Pinus,* Poaceae, *Populus, Quercus* and *Taxus* (Kantoor *et.al.*, 1996; Galan *et.al.*, 1989; Belmonte and Roure, 1991, Zawisza *et.al.* 1993, Weryszko-Chmielewska *et.al.*, 2001).

In the U.S.A. most of the investigators have recorded Gramineae, *Ambrosia, Quercus,* Chenopodiaceae, Amaranthaceae, Pinaceae, *Artemisia, Xanthium* as important constituents of the atmosphere (Anderson *et.al.*, 1978) In Canada the pollen survey was carried out by Bassett (1964). In South Africa aerobiological studies were initiated by Ordman (1970). Later other workers (Hawke & Meadows, 1989; Cadman & Dames, 1993) revealed the members of aeropalynoflora consisting of *Morus, Cannabis,* Poaceae, Asteraceae, Fabaceae, *Pinus, Cynodon* etc. Smart and Knox (1979) had shown that *Lolium* and *Phalaris* were major sources of atmospheric pollen in Australia. In Japan palynological survey was started in the 1960s. The most important pollen being Japanese Cedar followed by pine (Higuchi *et.al.*, 1977, Ishizaka *et.al.*, 1987). Artemisia, Casuarinaceae, Euphorbiaceae, Graminae, Moraceae and Pinaceae are the major contributors to the atmosphere of China (Chen and Zhang, 1985; Chen *et.al.*, 1988). Chen and Huang (1980) recorded 56% contribution of tree species to the total pollen load of Taiwan.

In India :

The first report of a comprehensive aerobiological work in India was published in 1873 by Cunningham dealing with the atmosphere of Calcutta, the then capital of India. There was no co-ordinated national programme in India till 1979. In 1980 aeribiologists from different parts of India assembled to attend the Workshop on "Modern Trends in Aerobiology with particular refrence to Plant Pathology and Medicine" held at the Bose Institute, Calcutta, where the Indian Aerobiological Society (IAS) was formed and started functioning from 31st January 1980.

Following is a brief account of aerobiological researches done in India and the results so far obtained. In view of the climatic, topographical and ecological

diversities and for the sake of convenience, the country has been divided into four biozones, namely, Eastern, Western, Northern and Southern regions.

Eastern Region :

After a long gap after the first report by Cunningham (1873) Baruah and Chettia (1966) reported the occurrence of 17 pollen types from the atmosphere of Gauhati. Bora and Baruah (1980) recorded a high number of pollen in winter season. Singh (1981, 1983) investigated the aeropalynomorphs of Shillong and reported 53 types of pollen grains. Singh (1985) further investigated the indoor aerospora of a hospital where grass pollen was found to be present throughout the year. Chanda and Nandi (1971) reported the incidence of large number of pollen grains from the air of Calcutta. Chanda and Sarkar (1972) reported the presence of grass pollen grains from the same place throughout the year. Chanda (1973) later reported a still high frequency of grass pollen, i.e. 32.5% from the atmosphere of Falta, followed by Arecaceae (10.2%) and Amaranthaceae/Chenopodiaceae jointly 15.7%. Similar results were obtained from Kalyani, semi-urbanised township about 35 km. north of Calcutta (Chanda, and Mandal, 1980, 1981), where 32 pollen types were identified, out of which the maximum contribution was made by grass pollen (38.9%) followed by weeds (33.6%) and trees (19.0%).

In other parts of West Bengal, e.g. Digha, Durgapur and Jhalda, grass pollen grains were recorded in highest frequency (Bhattacharya *et.al.* 1981). Identical results were obtained from earlier investigation in other places of West Bengal (Mandal and Chanda, 1979, 1981). Nandi *et al.* (1985) presented a preliminary report on the incidence of atmospheric pollen of Krishnapur, Calcutta, where pollen grains of *Cassia fistula, Azadirachta indica, Chenopodium ambrosioides*, etc. were found to occur. Banik and Chanda (1987) did a survey work in Tripura. Aerobiological investigation in Darjeeling, the Eastern Himalayas was done by Kundu *et.al.* (1982). A total of 51 pollen types were recorded of which *Cryptomeria japonica* was recorded with a highest frequency followed by Poaceae, Cupressaceae, *Betula, Pinus, Alnus*, etc. In Eastern Himalaya pollen survey was also done by Gupta and Chanda (1989) and Singh and Devi (1992).

A more detailed atmospheric pollen survey of Kurseong, was done by Gupta *et.al.* (1985), Gupta and Chanda (1994). Tree pollen grains dominated over grasses and weeds. The common tree pollen originated from *Alnus, Betula, Engelhardtia, Quercus, Bucklandia, Acer, Salix, Ilex, Cryptomeria, Pinus, Cupressus*, etc. A survey

compilation of Indian aerobiological works was published by Nair *et.al.* (1986) and Gupta and Chanda (1994). Aeropalynological investigation of Coochbehar town, West Bengal was done in detail by Mazumder, *et.al.* (1988). Later, Banik and Chanda (1992) recorded 65 pollen types in the air of Central Calcutta with *Trema orientalis* as the most numerous followed by grasses. A total of 46 pollen types were identified by Chakraborty *et.al.* (1998, 2001) of a farm in West Bengal. Airborne pollen concentration in Berhampur was carried out (Boral and Bhattacharya 1999, 2000, Boral *et al.* 2004).

Western Region :

Karla and Dumbrey (1957) reported 30 airborne pollen type from a survey at the Army Medical Campus at Poona. A three year survey work of the air of the same place was done by Chaubal and Deodikar (1964). They reported the occurrence of pollen grains of 20 monocotyledons and 21 dicotyledons. Karnik (1962) reported some airborne pollen grains from the air of Jalgaon. Aeropalynological survey of Kolhapur was done by Chaubal and Gadve (1978). Doshi and Kulkarni (1981) worked on aeropalynology of Bombay and reported the presence of 13 pollen types. Tripathi *et.al.* (1977) recorded a comprehensive atmospheric pollen assemblage from Bhopal with a pollination calendar. Tripathi (1978) reported that the frequency of tree pollen was higher (51.1%) followed by herbs (46.0%) and shrubs (3.0%).

A pollen flora of Nagpur along with a pollen calendar as an aid to aerobiology was prepared by Deshpande and Chitaley (1976) and later by Chitaley (1977). They reported grass pollen as the most dominating type followed by trees and weeds. Patil (1981) also did aeropalynological studies in Nagpur. Aeropalynological survey at Jabalpur was done by Agarwal *et.al.* (1987) which reflected general vegetational association of the area.

Tilak and Vishwe (1979 & 1980) reported 33 pollen types from the air of Aurangabad. Tilak *et.al.* (1981) reported 12 aeroallergenic pollen types from the atmosphere of Aurangabad where *Parthenium* contributed 12.47% followed by grass pollen (8.79%). Vishwe (1979) presented an annual average of pollen grains of the atmosphere of Aurangabad. Grass pollen in India was revived by Chaturvedi *et.al.* (1992) and have observed that the highest percentage was reported from Aurangabad (80.64%) followed by Bhavnagar (70.26%) and Raipur (66.73%).

Northern Region :

Aeropalynological survey of Jaipur was done for the first time by Sanghvi *et.al.* (1957). Thirty pollen types were recorded from the air of Lucknow by

Lakhanpal and Nair (1958). In 1960 they studied the pollen incidence of Almora atmosphere recording maximum pollen incidence during March to April and minimum in July and December. Vishnu-Mittre and Khandelwal (1993) recorded 48 pollen types from the air of Lucknow. A fresh survey of airborne pollen of Lucknow was done by Chaturvedi *et.al.* (1987-88), where a total of 128 pollen types were identified.

Nautiyal and Midha (1978) estimated the frequency of airborne pollen in Allahabad and concluded that majority of the trapped grains were from anemophilous plants, Shukla and Mishra (1980) made a tree pollen survey at Kanpur and that of Bareilly was done by Kumar (1986) where grass pollen dominated followed by *Azadirachta, Pisum, Mimusops, Brassica, Eucalyptus, Holoptelea,* etc. The airflora of Bhabnagar was reported by Dutta (1989). Out of 49 types recorded there, the maximum contribution came from trees. Gaur (1978) also studied the airborne pollen grains of Meerut mostly dominated by grasses, *Holoptelea, Azadirachta, Ailanthus* etc.

Dua and Shivpuri (1962), Shivpuri *et. al.* (1960) and Singh and Shivpuri (1971) investigated the air of Delhi. Singh *et.al.* (1978) studied the diurnal and seasonal periodicities of the atmospheric pollen of Delhi. Singh *et al.* (1979) reported that the grass pollen constitute the highest amount of pollen in the air of Delhi followed by *Morus* and Chenopod-Amaranthaceae group. Singh and Babu (1980a) again recorded a high amount of grass pollen in the atmosphere of Delhi area. Later Singh (1984), Singh and Babu (1980b, 1982) studied aeroallergens of Delhi with their seasonal periodicities. Singh and Gangal (1986) recorded an account of the sampling and distribution pattern of allergens in the atmosphere. Jain and Mishra (1988) surveyed atmospheric pollen grains and other biocomponents of Gwalior. Singh *et.al.* (1987) recorded the pollen types from the foot hills of the Himalayas (Dehra Dun). Malik *et.al.* (1991) reported the dominant pollen types of Delhi as Poaceae, Cheno-Amaranthaceae, *Ailanthus, Ricinus, Holoptelea* etc. Munshi (1997) reported the pollen of *Platanus orientalis, Narcissus, Salix,* etc. to be the major airborne types in Srinagar.

Southern Region :

Saha and Kalyansundaram (1962) prepared a pollination calender of the potentially allergenic plants in Pondicherry. Nair (1963) revealed the presence of 17 types of airborne pollen from Vellore. Ramalingam (1966) and Sreeramulu and Ramalingam (1966) recorded some atmospheric pollen grains over a paddy field at

Visakhapatnam. Reddi (1970, 1973) performed aerobiological survey in Anakapalle and Visakhapatnam and recorded the occurrence of ten types of pollen. Ramalingam (1971) reported the presence of some pollen grains, from the air of Mysore. Shenoi and Ramalingam (1976) published the air spora of a sorghum field from Mysore. Reddy and Janakibai (1978) and Janakibai and Reddi (1982) studied the airborne pollen types of Visakhapatnam. A preliminary aerobiological study of Vijaywada was carried out by Apanna and Reddi (1978). Reddi and Ramanujam (1989) studied the aerobiology of Hyderabad.

Agashe and Vinay (1980), Agashe *et.al.* (1983) studied aero-palynoflora of Bangalore and reported the dominance of the pollen grains of *Parthenium hysterophorus,* Agashe and Chatterjee (1987) did sampling using an aircraft of the upper airspora of Bangalore. Airborne pollen having allergenic significance in Bangalore was recorded by Agashe and Anand (1982). A pollen calendar of Bangalore city was prepared by Agashe and Abraham (1988). Occurrence of grass pollen under the influences of meteorological factors in Hyderabad was recorded by Kanta and Chapla (1987). Bhat and Rajasab (1985, 1988) did survey works on the airborne pollen for a period of two years in a commercial location at Gulbarga. Seetharam *et.al.* (1989) recorded the atmospheric pollen grains of Gulbarga. Alturi *et.al.* (1992) reported site to site variations in airborne pollen grains at Visakhapatnam. Anupama (1992) studied the airborne pollen of Pondicherry.

Airborne Pollen in relation to meteorological parameters

Variation in the airborne pollen distribution depended upon climatic factors as revealed by various workers. Different regions like deserts, forests, temperate and tropical regions etc. constitute different plant species resulting in considerable variation in the airborne pollen types. Meteorological parameters like temperature, rainfall, relative humidity, wind velocity and direction are also responsible for fluctuations in pollen concentration (Andersen, 1980; Bricche *et.al.*, 1992; Hjelmroos, 1992, Subiza *et.al.* 1992; Puc and Wolski, 2002, Vega-Maray, 2003). Wind direction and velocity play an important role in the long-distance transport of pollen grains (Keynan *et al.*, 1986; Wallin *et al.*, 1991). It was found by Norris-Hill and Emberlin (1993) that increased pollen concentration in London was associated with increased rainfall.

From India, Agashe and Alfadi (1989), Boral *et.al.* (2004) have correlated atmosphere biopollutants with meteorological parameters such as temperature, relative humidity, wind speed and cloud cover. They have observed that high temperature and low relative humidity enhances the liberation and distribution of pollen in the atmosphere. The pollen counts were drastically reduced during the rains. It was found that pollen concentration was positively correlated with temperature and negatively correlated with rainfall and humidity.

Pollen allergy – a clinical approach :

Pollen of plants provide a source of aeroallergens. The term allergy was introduced in 1906 by von Pirquet. Allergy, also termed immediate hypersensitivity, is defined as an altered and accelerated reaction of a person to a second or subsequent exposure of a substance to which he has been sensitized during the first exposure, so it is an altered immune response. The immune system has developed to protect the human body against the harmful effect of environmental bioparticulates. Gell and Cooms (1963) described four types of allergic reactions, as follows :

Type I (Anaphylactic reaction) :

This reaction is initiated by the antigen reacting with tissue mast cells passively sensitized by antibodies elsewhere, leading to pharmacologically active mediator release. The reaction is manifested within seconds or minutes after exposure and referred as immediate hypersensitivity. It includes general anaphylaxis and local manifestation of symptoms in various organs or systems. The examples include bronchial asthma, rhinitis, urticaria, vomiting, diarrhoea etc.

Type II (Antibody dependent cytotoxic/cytolytic reaction) :

In this case the antibody is directed against the antigen on an individuals' own cells (target cells) or foreign antigen e.g., transfused red blood cells. This may lead to cytotoxic action by killer cells or by complement mediated lysis. The examples are mismatched blood transfusion, transplant rejection etc.

Type III (Arthus/Immune Complex reaction) :

In a type III reaction, the immune complexes are deposited in the tissue. The complement cascade is activated and polymorphos are attracted to the site of deposition causing local damage. The examples include the Arthus reaction, serum sickness etc.

Type IV (Delayed/Tuberculin Type reaction) :

This type of reaction is initiated by the action of antigen sensitized T-lymphocytes, releasing lymphokines following a secondary contact with the same

antigen. Lymphokines induce inflammatory reaction and activate macrophages which release mediators. The reaction takes more than 12 hours to develop. The examples are tuberculin hypersensitivity, graft rejection, contact dermatitis etc.

The type I reaction, characterized by an allergic reaction occurs due to contact with allergic substance is called antigen/allergen. Pepys (1973) referred allergy as type I and type III reaction. Such restricted meaning was not originally introduced by von Pirquet. It is only in recent years that 'allergy' has become synonymous with type I hypersensitivity (Roitt *et.al.*, 1993). Allergic reactions are dependent on the specific triggering of the unique antibody, i.e., immunoglobulin E (IgE) sensitized mast cell, which release mediators to produce inflammatory reactions. The common allergens have been classified according to the route of exposure into the following types :

1) Inhalants (e.g., bioaerosols including pollen and spores)
2) Ingestants (e.g., food substances)
3) Injectants (e.g. insect venom, injected medicines)
4) Contactants (e.g. cosmetics)

Among these inhalants are most important as the causative agents of respiratory allergic disorders due to systematic nasodilation and smooth muscle contraction in the lungs. In general it is considered that particles larger than 5μm. initiate type-I allergy, particles smaller than 5μm. cause type-III allergy.

Type I are mediated by Immunoglobulin E (IgE). IgE-mediated hypersensitivity is disorders of the respiratory system and that is why it is very relevant to the present study. So, it is necessary to describe it in details. It includes allergic branchial ashma and allergic rhinitis, affecting people of all age groups.

Diagnosis of Allergey

The idea of skin test for the diagnosis of allergic disorders came after the introduction of a cutaneous test for tuberculosis by von Pirquet (Feinberg, 1946). An intradermal skin test is more sensitive and reliable, while the skin prick test is more convenient and has least chance of systemic reactions (Hejjaoui *et.al.*, 1992; Lin *et al.*, 1993). Several *in vitro* techniques are also used for allergy diagnosis which include Radio Allergo Sorbent Test (RAST), Enzyme Linked Immuno-Sorbent Assay (ELISA). At present, diagnosis should be based on careful clinical history supported by documentation of IgE-mediated sensitivity by the skin prick test.

Clinical Study :

In Abroad :

Based on clinico-immunological studies with pollen antigens, important allergenic pollen have been identified for different countries. In the U.S.A., Lewis (1975) reported that vernal and orchard grass were skin test positive in 43.7% patients tested, followed by red top (36.6%) and june (35.4%). Some of the species whose pollen plays an important role in respiratory allergic diseases in the U.S.A. and Canada are *Acer, Agrostis, Ambrosia, Artemisia, Alnus, Betula, Cannabis, Cynodon, Dactylis glomerata, Juniperus, Morus* and others (Lewis *et al.*, 1984; Daniel, 1984). In European countries grasses are considered to be the most important cause of pollinosis (Bagni *et al.*, 1976; D' Amato and Spieksma, 1991; Clayton *et al.*, 1989). In England, 6% of hay fever patients were reported to be sensitive to *Pinus* pollen (Kalliel & Settipane, 1988). In Sweden birch pollen is the major cause of allergy (Eriksson *et al.*, 1984). Bousquet *et al.* (1984) found that in France, almost 85% of pollinosis was caused by grasses. In Italy, occupational allergy to the pollen of *Acacia floribunda* among floriculturists has been recorded (Ariano *et.al.*, 1991). Only 2% of patients from the general population gave a positive skin test, while it was 31% in the case of floriculturists. In a study of skin reactivity among unselected Danish population it was found that almost 17.6% were positive to pollen antigens (Nielsen *et al.*, 1994).

In South Africa, the principle cause of pollinosis are *Cupressus, Prosopis, Cyperus* and grasses (Ordman, 1970). In Saudi Arabia, *Phoenix dactylifera* effects 25% of respiratory allergic patients (Harfi *et al.*, 1992, Kwaasi *et al.*, 1993). The important aeroallergens in Japan are the pollens of *Artemisia, Cryptomeria, Erigeron, Pennisetum* (Ishizaka *et al.*, 1987).

In India :

In India work on pollen allergy was initiated by Shivpuri (1962) in Delhi and continued by his co-workers (Shivpuri and Prakash, 1967; Shivpuri *et al.*, 1979; Singh and Dahiya, 2002; Singh and Kumar, 2003). The important allergenic pollen identified are *Ageratum, Ailanthus, Amaranthus, Cassia, Ipomea fistulosa, Putranjiva roxburghii, Ricinus communis.*

In Southern India, Acharya (1980) and Agashe and Anand (1982) have reported *Cassia, Ageratum, Salvadora, Ricinus, Albizzia lebeck, Artemisia* and *Scoparia* as important aeroallergens. The allergenic potential of the pollen grains of *Parthenium hysterophorus* (Subbarao *et.al.*, 1984) and *Casuarina equisetifolia*

(Agashe and Soucenadin, 1992) have been emphasized especially in patients in Bangalore.

The major allergenic pollen grains of Central India are *Parthenium, Argemone, Cassia, Brassica, Azadirachta* and grasses (Tiwari, 1970; Chaubal and Gadve, 1979).

The important allergenic pollen grains from West Bengal include *Acacia auriculiformis, Madhuca indica, Eucalyptus citriodora, Cassia siamea, Lantana, Cucurbita maxima, Cassia fistula, Cocos nucifera, Calophyllum inophyllum, Azadirachta* and *Phoenix* (Chanda *et.al.*, 1978; Banik and Chanda, 1992; Karmakar *et.al.*, 1994; Gupta-Bhattacharya *et.al.*, 1994; Chowdhury *et.al.* 1998; Boral and Bhattacharya 1999, 2000; Boral *et.al.*, 1999, 2004).

Thus, pollen species causing allergy are quite variable in different ecozones which makes it very important to identify pollinosis causing species from every region for proper diagnosis, immunotherapy and should be considered in environmental planning.