Chapter 2
2. REVIEW OF LITERATURE

The history of medicine shows that the prevalent political, social and hygienic conditions characterising various epochs, countries and occupational groups are accompanied by certain distinctive types of diseases.

Vön pirquet (1906) who coined the term "allergy" has indeed described it as an altered reactivity to a substance usually harmless in itself but induces synthesis of antibodies in susceptible persons on first and subsequent exposure. Lucretius (first century B.C.) opined that inhalation of contaminated air played a major role in disease development while some other workers mention that hypersensitivity is the main cause for allergy. Galen (200 AD), Botallus (1565), Benningerus (1673) and Herlinus (1693) have revealed the fact that some people became affected with attacks of sneezing and asthma in the presence of certain flowers, shrubs and trees.

The studies on pollen allergy started in 1766 when dissemination of pollen by wind was reported by Köelreuter (Singh and Malik, 1992). However, John Bostock (1819) was the first to suspect pollen as a cause of "summer catarrh" also called "Hay fever". Later new synonyms came to be used such as rose cold, pollen catarrh, or June cold, spasmodic rhinitis, descriptive of the symptomatology or hay fever and hay asthma. The term "pollen allergy" or pollinosis is persistent.
Maculloch (1828) reported that the disease was caused particularly by hay fields. Gordon (1829) who studied further on the impact of allergy and reported a kind of allergic disease called hay asthma. Later Elliotson (1831) reported that the disease was preceded by dermatitis of the hands following the handling of the flowers of grass. But in the subsequent years many scientists have reported contact of allergen through various routes viz. membranes of the air tubes, dust with seasonal variation etc. (King, 1843; Ramadge, 1847; Gream, 1850; Watson, 1857; Salter, 1860).

Phoebus (1862) noted a marked predisposition in patients and refers to Kirkman's experiment on himself with the pollens of the grass (*Anthroxanthum odoratum*) which produced typical symptoms when sniffed up the nose.

Pirrie (1867) and Moore (1870) both considered solar heat and intensity of light as additional factors to emanations from plants causes allergy. Wyman (1872) found out ragweed pollen (*Ambrosia*) as the cause of allergic disorders in America.

Charles Blackley (1873) of United Kingdom rubbed grass pollen on the scratched surface of his arm and elicited allergic reactions such as conjunctivitis, rhinitis and asthma. Thus proving that pollen was responsible for hay fever.

Marsh (1877) supported Wyman's observations, and Dunbar (1903) firmly established the pollen theory and amplified the work of the previous...
observers. Curtis (1900) demonstrated the possibility of achieving hyposensitization by means of subcutaneous injections of certain plant blossoms or pollens.

Noon (1911) in England and Cooke (1911) in America, obtained positive results by applying the pollen of grasses to the conjunctiva in hay fever subjects, and used them for therapeutic purposes. However, Clowes (1913) was the first in America to apply these reactions, both cutaneous and ophthalmic, to the ragweeds and initiate vaccination. Köessler (1914) the first in America to place desensitization on a scientific basis. Goodale's (1915) research demonstrated the results of the pollen skin reactions. Scheppegrell (1916) from USA was the first to realise the importance of field exploration and aerial surveys to record "aeroallergens" from the atmosphere.

Later, studies carried out by Ordman (1945), Feinberg (1946), Durham (1946), Saad (1958a, 1959b) and some others also established that pollen is responsible for symptoms of allergic diseases such as asthma, hay fever, allergic rhinitis and atopic dermatitis.

However, during the recent years there has been significant global progress in aerobiological researches with reference to respiratory allergy (Solomon and Buell, 1969; Newmark, 1968, 1970; Solomon, et al. 1983; Solomon, 1984; 1988; Lewis, 1984).
2.1 INCIDENCE OF ALLERGIC DISORDERS

Allergy is a common human ailment. About 15-20% of the world population is known to suffer from major allergic disorders such as allergic rhinitis, bronchial asthma, atopic dermatitis and urticaria. Allergic rhinitis in Belgium is reported to be 0.5% whereas in Sweden it afflicts about 15% of the population. Allergic rhinitis, also called hay fever, varies between 6% and 12% in USA, Canada, Finland, New Zealand and Australia (Smith and Slavin 1988). It has been empirically established that the prevalence of asthma is on the increase in USA and other countries during the past two decades. Allergic rhinitis is more common than bronchial asthma. It is estimated that 40 million Americans are suffering from asthma and other allergic diseases. Of these 8.9 million suffer from asthma with or without hay fever; 25 to 30 million have hay fever alone and 11.8 million have other allergic manifestations such as eczema, urticaria, angioedema, or food, drug or insect hypersensitivity (Kaliner, 1987). The reports indicate that 1.5% to more than 6% of population in the countries like Britain, USA, Canada, France, Australia and New Zealand are afflicted with this syndrome (Smith, 1983). However, of asthmatic cases are rare in races like American Indians, Eskimos and the natives of New Papua Guinea Highlands. Whereas in Papua New Guinea, asthma prevalence has increased to the tune of 39 times than that reported in 1972.

The prevalence of allergic disorders in India is high and alarming. Statistics reveal that nearly 10% of the population suffer from major allergic disorders (Vishwanathan, 1964). Bronchial asthma patients constitute nearly
1% of the total population (Anonymous, 1961). Based on skin test results conducted with various inhalant allergens from different parts of India 2% to 42% of the population are reported to be atopic (Agnihotri and Singh, 1971; Mittal, et al. 1978; Shivpuri, 1980).

2.2 AEROBIOLOGY

Aerobiology, is the science studying the transportation of biological particles through the air. This process includes the release, the staying airborne, and deposition of particles of biological origin (Spieksma, 1992).

Empirical work on aerobiology in India

The first systematic aerobiological work in India was pioneered in Calcutta by Cunningham (1873). It was followed by Mehta (1933), Kasliwal and his colleagues (1955,1958), Kalra and Dumbrey (1957), Lakhanpal and Nair (1958, 1960).

Aerobiological work done earlier in India was reviewed by Nair (1960), Sreeramulu (1967) are reported the existence of a rich and everchanging air spora. Recently Singh and Malik (1992) reviewed the aerobiological and allergological aspect of environmental pollen from different parts of the world.

An extensive investigation on airborne microflora and their relation to allergy was made by Shivpuri and his school in Delhi (1960, 1962, 1964, 1971). Later the studies were carried out in North India by various scientists.

In central India, significant work on aerobiological studies were contributed by Tilak, 1974; Deshpande and Chitaley, 1976; Tripathi, et al. 1978; Chaubal and Kotmire, 1982; Tripathi, et al. 1982b; Jain and Mishra, 1988.

In eastern part of India, after Cunningham's pioneering work, aerobiological studies were initiated by Chanda and his students. Later several aeropalynological investigations had been carried out by many workers (Chanda and Sarkar, 1972; Chanda, 1973; Mandal and Chanda, 1979; Chanda and Mandal, 1980; Mandal and Chanda, 1980).

The aeropalynological work was carried out in the Southern part of India by Agashe, et al. 1983; Agashe and Alfadil, 1989; Bhat and Rajasab, 1989; Reddi and Ramanjuam, 1989.

In addition, extensive aeropalynological work has been carried out systematically in different parts of the country under the All India co-ordinated project on Aerobiology (Nair, et al. 1986).
The following are the significant contributions made by scientists on aerobiological work.

1. In most of these surveys the sampling was based essentially on gravitation principle and Durham's gravity settling device had been used. However, in some of the recent surveys volumetric sample are employed.

2. Pollen grains reported from various centres vary according to the vegetation of the area besides topography and climatic factors.

3. The maximum pollen were recorded in the air from anemophilous taxa followed by amphiphilos and entomophilous species. Similarly pollen from tree taxa constituted major part of the pollen air spora at various places compared to pollen from grasses and weeds.

4. The airborne pollen show diurnal, seasonal and annual variation. Two broad pollen seasons are 1. February - April and 2. August - October. The former being dominated by trees species, while later is predominantly the season for grasses and weeds.

5. The dominant pollen types recorded at various regions of India are as follows.


**Amaranthus, Asteraceae, Acacia, Albizia, Alnus, Ailanthus, Azadirachta, Argemone, Borassus, Cassia, Casuarina, Cocos, Cupressus, Cedrus, Cyperaceae, Caesalpinia, Carica papaya, Dodonaea, Delonix, Eucalyptus, Euphorbiaceae, Holoptelea, Moringa, Morus, Moraceae, Magnifera indica, Parthenium, Phoenix, Pinus, Poaceae, Prosopis, Peltophorum, Quercus, Ricinus, Typha, Tamarinder, Xanthium.**

**Empirical work on aerobiology from foreign countries**

Systematic aeropalynological survey to identify the local pollen allergens has gained ground at different parts of the world.

Scheppegrel (1916) initiated the atmospheric surveys with field study in U.S.A. Later, it was carried by various workers (Durham, 1946, 1954; Walkington, 1960). In United Kingdom, Hyde and Williams initiated aerial surveys at Cardiff in 1944 which was later extended to other stations. Later they also published an atlas of airbone pollen grains and reviewed the work done in U.K. (Hyde and Adams, 1958; Hyde, 1969). The work on airbone pollen in South Africa was initiated by Ordman 1945 followed by many researchers. The literature on aerobiological investigation on pollen from the West Asian Countries is scant. Pollen of Gramineae and Chenopodiaceae were present in large quantity in the atmosphere of Alexandria (Saad, 1958 a&b, 1959).

Airbone pollen survey in Japan was carried out by Ishizaka, et al. 1987 and in China by Chen and Zhang (1985).
**Allergological survey in India**


The allergenically significant pollen of various centres and regions of the country is listed as follows: *Ageratum, Amaranthus, Ailanthus, Azadirachta, Artemisia, Anogeissus, Argemone, Albizia, Brassica, Asphodelus, Canabis, Cassia, Cenchrus, Chenopodium, Cocos, Cynodon, Curcurbita, Calophyllum, Dodonaea, Gynandropsis, Holoptelea, Imperata, Ipomea, Lantana, Morus, Parthenium, Pennisetum, Pinus, Prosopis, Paspalum, Poa, Potamogeton, Poaceae, Ricinus, Ranunculus, Sorghum, Suaeda, Salvador, Veronia.*

**Allergological surveys in foreign countries**

Based on clinico - immunological studies carried out with pollen antigens, important allergenic plants were compiled by different workers in

The important plant species of pollen allergens which play a role in the etiology of respiratory allergic diseases in the above countries is as follows. (Artemisia, Ailanthus, Acer, Agrastis, Ambrosia, Artemisia, Alnus, Acacia, Betula, Brassica, Canabis, Casuarina, Carya ovata, Citrus, Chenopodium, Chrysanthemum, Cillineonsis, Cryptomeria, Cupressus, Cynodon, Dactylis, Erigeron, Juniperus, Juglans, Poaceae, Pinus, Plantago, Prosopis, Parthenium, Pennisetum, Pistacia, Morus, Olea, Schinu, Taxodium, Ulmus, Xanthium.)
Lunden (1956) reviewed the pollen chemistry from 1918 till 1955 and described the various pollen constituents viz., protein and aminoacids, carbohydrates, lipids, vitamins and hormones, enzymes and coenzymes, pigments, inorganic constituents and miscellaneous. Baer could not find any relationship between the total nitrogen or protein content and the biological potency of the allergens (Nair, et al. 1986). *Melia azadirachta* and *Ipomoea fistulosa* pollen protein content were analysed by Chanda and Ganquly (1976).

The chemical analyses of the pollen grains of *Cucurbita maxima*, *Azadirachta indica* and *Datura metal* were performed to know the proteinaceous nature and amino acid compositions (Chanda, et al. 1975). Agarwal and Nair, 1989 investigated the protein and amino acid content of *Acacia auriculaeformis*. They also discussed the importance of protein and amino acids in bee nutrition and human allergy.

Datta, et al. 1992 and Mandal, et al. 1993 analysed the carbohydrates, proteins nucleic acids, minerals, ash and moisture content of *Carica papaya*, *Holoptelea integrifolia*, *Madhuca indica* and *Spathodea campanulata* pollens. They revealed that these chemical constituents may be responsible for controlling the rate and type of allergic reaction caused.

Leiferman, et al. 1979 described Radioimmuno Precipitation (RIP) method for measuring the potencies of ragweed and grass pollen extracts. Haavik, et al. 1985 extracted carbohydrate content of timothy pollen and
purified this allergen by chromatography. The cross reactivity of Callistemon citrinis and Melaleuca quinquenervia pollen was demonstrated by Stanaland, et al. 1986. Matthiesen (1989) raised polyspecific rabbit antisera against the Cynodon pollen extract. And they recognised 13 major antigens by cross-immunoelectrophoresis.

Thaka (1989) purified the pollen of Prosopis julifera and antigenicity of the allergens were checked by gel diffusion test, rocket immunoelectrophoresis etc.

Antigenic extracts prepared from Holoptelea integrifolia pollen samples collected at weekly intervals during the same season did not exhibit significant variation in protein concentration. Stored samples from different years, however, showed significant variations in protein concentration (Malik, et al. 1991).

**Acacia pollen allergy**

The survey of literature indicates that allergenicity due to some insect pollinated types like Acacia are reported to be very less (Lewis and Vinay, 1979; Lewis, 1983; Wender, et al. 1987; Ariano, et al. 1991; Kundu, et al. 1983; Tilak, 1989).

**Cupressus pollen allergy**

The airborne pollen of Cupressus family has been recognised as a cause for respiratory allergy disorders by many scientists (Ordman, 1945, 1963, 1964,

**Pinus pollen allergy**

*Pinus* pollen allergy was observed by various scientists in different parts of the world (Rowe, 1939; Santos and Unger, 1958; Wodehouse, 1965; Newmark and Itkin, 1967; Collins - Williams, et al. 1971; Kimura, 1977; Lewis, 1984; Harvis and German, 1985; Fine, 1987; Singh et al. 1987; Galan, 1989; Armentia, et al. 1990; Fountain and Cornford, 1991; Pessi and Pulkkinen, 1994).