CHAPTER II

REVIEW OF LITERATURE
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Microbial pollution of atmosphere have been a problem since micro-organism caused biological pollution, this is the matter of post history. But a systematic study of micro-organisms of air started only a century ago, even though people were quit aware of the fact that air is a medium for the transport of microbes and spread of diseases. It was Antony Van Leeuwenhoek (1632-1723) who brought into notice the presence of invisible micro-organisms in the air. His finding were confirmed by experiments of Lazzaro Spallanzani (1729-1799) and John Tyndall (1820-1893).

Almost every country of the world had surveyed it’s airspora. The vital continental dispersal and vertical distribution of airborne fungi upto stratosphere has been experimentally proved. Probably, Micheli (1729) for the first time reported fungal spores in air. The case of first fungal sensitivity was reported by Floyer (1726). Pasteur (1861) while advocating his germ theory of disease, found molds, yeasts and bacteria in airborne dust and theirby demonstrated that air is the carrier of many common germs.

J.B. Porta, observed the rusty coloured spores of fungi for the first time in 16th century. P.A. Micheli (1679-1737) for the first time concluded that spores of moulds are distributed through the air. J.G. Koelrueter in 1766 was perhaps the first recognized the wind and insect pollination in some plants and pointed the airborne nature of pollens. Knight (1799) further confirmed the long distance transport of pollens.

The present knowledge of airborne bioparticles is based on the studies made by Ehrenberg (1872) who first published the information on micro-organisms collected form the atmospheric dust. Some other contribution made in this field during the 19th century were: Thompson
(1854) and Blackley (1873) in England, Salisbury (1866) and Miquel (1883) in France and Cunningham (1873) in India.

In 1912, Molisch coined the term “aeroplankton” in which he included suspended particles like dust of all kinds and particles of living matter like pollen grains, fungal spores, algae, bacteria and the fine hairs. Finally in 1930’s. Fred Campbell Meier introduced the word “aerobiology” as an independent branch of science.

However, the experimental aerobiology was made possible through the invention of “aeroconoscope” (air sampler) by Maddox (1870, 1871). Later, Hesse (1884, 1888) conducted air sampling in Germany with the help of his own (Hesse’s) apparatus. Frankland (1886, 1887) was first to study aerodynamic effects and tried to increased the trapping efficiency of the apparatus. The basic knowledge on techniques of air sampling was provided by Committee on Apparatus in Aerobiology (1941).

May (1945) devised the cascade air sampler and gave principles for efficient air sampling. Later, Hirst automatic volumetric spore trap (Hirst, 1952) and the Andersen sampler (Andersen, 1958) based on the same pattern were developed. Perkins (1957) developed a battery operated rotorod air sampler having constant rotational speed. Durham’s air sampler (Durham, 1946) was later modified by Lakhan Pal and Nair (1958). Tilak and Kulkarni (1970) and Pauber (1974) developed different models of air samplers. Heise and Heise (1948, 1949) employed aircraft sampling techniques. Errington and Powell (1969) developed electostatics high volumes samplers and errigated cyclone separators.

In India, the first aerobiological study was carried out by Cunningham (1873) in Kolkatta Later in Agra, Prof. K.C. Mehta (1933, 1940, 1952) contributed immensely towards the study on transport of cereal rusts from hill to plains and their annual recurrence.

In foreign countries aerobiological informations have been drawn by different workers, viz Chikago (Bernstein and Feinverg, 1942) United States (Durham, 1946), Sweden (Nilsby, 1949; Nilsson, 1972), Newzeland (Di Menna, 1955; Dye and Vernon, 1952), London (Hamilton, 1957, 1959), New York (Ogden and Lawis, 1960), Australia (Frey and Durie, 1962), Jamaica (Meredith, 1962), Cardiff (Adams and Hyde, 1965, Nottingham (Pawsey and Heath, 1964), Samaru (Dransfield, 1966), Hong Kong (Terner, 1966), Melbourne (Derrick, 1966), Fineland (Koivikko, 1973; Kapyla and Koivikko, 1975), Switzerland (Leuchner and Boehm, 1982), California (Dungy et.al. 1986), Egypt (Youssef and El-Din, 1987; Abdel-Hafiz and El-Said, 1989), Kuwait (Halwagy, 1989), North Italy (Montanari, 1989), Riyadh
(Hasamain et al. 1989), South Africa (Cadman, 1990), Denmark (Larsen and Gravesen, 1991), Spain (Belmonte and Roure, 1991; Rosses-Codinachs, 1992), South Italy (Caiaffa et al. 1993).


Aerobiological studies with reference to some specific fungal spores were also carried out. Harey et al. (1969) worked on airspora of Cardiff with special reference to Chaetomium spores. Lawrence and Meredith (1970) studied the wind dispersal of conidia of cercospora beticole. Tilak and Patil (1985) studied the atmospheric concentration of Albigo sp.

The outdoor studies (extramural) have opened new vistas in various disciplines of science as air biocomponents have significant impact on plants and animals as well as cause allergic disorders in human beings. The extramural aerobiological studied have been carried out by a number of workers all around the world. Some of the important contributions in this field are those of Proctor (1932), Meier (1935a and b; 1936), Durham (1937), Hyde (1950), Gregory (1954-1978), Pady and Kelly (1954), Cole and Harrington (1967), Sreeramulu (1967, 1970), Ali et al., (1977), Nagarajan and Singh (1975), Aldoory et al. (1980), Gaur and Bhat (1980), Bungy et al. (1986), Alderman et al. (1987), Oommachan et al. (1988), Verma and Khare (1991) and Mishra (1992).

Aerobiological studies have been proved to be helpful in plant pathology and agriculture. Various disease forecasting models have been prepared which are highly important in preventing the occurrence of diseases in plants and crops. The aerobiological studies in this regard have been done by several workers in various parts of the world viz., Durham (1937) in United States, Mehta (1933, 1940, 1952) in India; Gregory (1952) in Britain; Dransfield (1966) in Samaru; Papavassiliou and Bartzokas (1975) in Athens; Ali et. al. (1977) in Riyadh; Bandyopadyay et. al. (1991) in India (A.P.); Famularo et. al. (1992) in Italy. Studies of Commack (1958); Suzuki (1959) and Zadoks (1973) Krause et. al. (1975) also supported to disease forecasting system from Pennsylvania state university for late blight of potatoes. Forecasting based on weather patterns were devised by Hyre (1954) and Wellin (1962) in U.S.A., Large (1955) in Britain, Bourke (1970) in Ireland and Nagarajan and Singh (1975) in India.

Aeromycological studies have been conducted by different workers in India i.e. Konger and Baruah, 1958 (Shilong), Gupta et. al. 1960 (Jaipur), Baruah and Chettia, 1966 (Gauhati), Tilak et. al. 1981; Tilak and Bhalke, 1978 (Aurangabad), Rajiv Kumar, 1984 (Dehra Dun), Singh and Singh, 1988 (Imphal), Santra and Chanda 1981, 1989 (Kolkatta), Singh and Singh, 1992 (Manipur), Verma and Khare, 1988;

Aerobiological study is of great importance on veterinary science as it gives concentration of spores in air. Brook and Mutch (1964) Pathak and Mittal (1966), Austwick (1969) and Sellers (1971) investigated fungal diseases in animals. The air is one of the source through which contamination in feed, equipments and spread of diseases take place. A number of diversified habitats have been investigated for their air mycoflora. These include cattle sheds (Baruah, 1961), chick hatcheries (Chute and Barden, 1963), sheep shed (Tilak, 1974) and poultry sheds (Hamiltons, 1975, Rati *et.al.* 1980; Bhandari, 1991).

Aerobiological investigation have been proved to be an essential tool for the prevention of biodeterioration. The biodeterioration includes mildewing or rotting, mechanical damage, staining or spoilage of materials. The investigation of Huek (1968), Katapalia (1960). Tilak and Co-workers (1972, 1975, 1986), Verma and Khare (1987) and Raman and Regina (1991) have contributed immensely to this enterprising aspect.

The study of environmental factors is important as they affect the presence of biocomponents in the air. Berry *et al* (1945), Shapiro *et.al.* (1965), Bartzokas (1975), Hawke and Meadows (1989) Cadman (1991) and Hasnian (1993) correlated the occurrence of air-biocomponents with meteorological factors. Sreeramulu and Ramalingam (1964) studied spore period changes in the atmospheric spore content which are associated with changes in weather and other conditions. Price and Meyer (1976) suggested that relative humidity and temperature are the most important in meteorological factors affecting the release and deposition of air born spores.
A number of biocomponents are responsible for naso-branchial allergy in beings. Pollen grains and fungal spore are the major components of aero-allergens. Wyman (1876) identified pollen grains of *Ambrosia (Asteraceae)* as the principal causative agents for seasonal hayfever in the United States. However, Dunbar (1903) concluded that pollen grains are actually the cause of hayfever. Noon (1911) published the first successful result of the treatment of hayfever by subcutaneous injections of the pollen extract. Dale (1913) stated that the allergenic response involves an immunological complex reaction between an antigen and antibody.


Epidemiology of allergic disease was discussed by Wuthrich (1989). Nilson (1990) recorded regional and global distribution of pollen allergens. Pollinosis in Europe was explained by Spieksma (1990) and Ramfjord (1991) studied aero-allergens in Norway. Fungi display “rhythmicity in the production and release of spores” have been known since 1886 when Miquel in France performed his classic experiments using culture technique. He reported that airborne bacteria and fungi show diurnal periodicity. Later, with the availability of automatic air samplers, the interest in this field was developed through the work of Hirst (1953), Meredith (1962), Ingold (1965) and Gergory (1973).

The micro fungi and their components are also source of some important potent allergens (Voorhorst *et al.* 1964; Maunsell, 1971; Gravesen, 1978). It is well known that micro fungi can provoke allergy (Gravesen, 1979; Salvaggio and Aukrust, 1981) and they also play an important role in interaction with house-dust mites (Sinha *et al.* 1970; Bronswijk, 1973; Bronswijk and Sinha, 1973).

A persual of above literature shows that no aerobiological study has so far been conducted in Chitrakoot Dham district Chitrakoot (Uttar Pradesh). It is, therefore, imperative to formulate atmospheric fungal calendar along with a picture of airspora of Chitrakoot Dham, that may be useful for the diagnosis and treatment of allergic patients of this area.