INTRODUCTION
1. INTRODUCTION

Aerobiology has a long history, dating back to the late nineteenth century when the importance of microorganisms in the cause of disease was recognized. Fred C. Meier of the U.S. Department of Agriculture coined the term 'aerobiology' for the first time in 1935 (Edmonds, 1979). Aerobiology relates to the study of character and behavior of suspended bioparticles (pollen grains, animal dander, mites and fungal spores) in the atmosphere, living or not, whose transfer from one site to another is controlled by atmospheric agents.

Fungi are an important component of the ecosystem. They are essential for the recycling of minerals and carbon by the decomposition of organic debris and waste. It has been estimated that fungi recycle millions of tons of organic waste annually. Life for other types of organism would come to a virtual halt without the activity of fungi. In addition, mushrooms and other fleshy fungi are a source of nutrition for many animals, including humans (Moore-Landecker, 1996). In general fungi are free-living in nature and are in no way dependent on humans (or animals) for their survival.

The fungal spores form an important constituent of air-spora all over the world. The atmosphere contains an incredible diversity of fungal spores. Fungi have a highly evolved liberation mechanism, next only to angiosperms and the number of spores liberated is very high. These spores occur chiefly in the air, both indoor and outdoors. They are ubiquitous due to the method of their discharge, their circadian rhythms, their morphology and the influence of meteorological agents.
Fungal spores are discharged either passively or through active mechanisms. Active mechanisms that propel spores into the atmosphere are common in fungi. Wind dispersal is the best understood passive method. However, many spores are also discharged by rain. Many ascospores and basidiospores are discharged by mechanisms that require moisture or high humidity.

Fungal spores may travel short distances or occasionally may get blown to upper strata of the atmosphere to be transported for long distances before they get deposited. The modes of transportation of aerosols vary depending on various meteorological agents.

The spores being light and small in size remain suspended in the air over an extended period of time. The wet weather air-spora is typically dominated by ascospores and basidiospores. Basidiospores and some ascospores are common during the late night and early morning hours, when the humidity is high. The variations could be attributed to the prevailing weather and the availability of suitable substratum for growth and sporulation of individual fungi, which vary from place to place and year to year as reported by earlier studies (Lacey, 1981; Singh et al., 1987; Singh and Babu, 1993).

The worldwide acrobiological surveys have implicated fungal spores as ubiquitous aeroallergens. Aeroallergens are airborne particles that can cause respiratory, cutaneous or conjunctive allergies in human beings. Out of the biological particulate matter suspended in the atmosphere, fungal spores constitute the largest percentage, both in indoor and outdoor environment (Spieksma, 1995). They are highly allergenic for sensitive individuals and their amount may exceed that of pollen in the air even during the height of the pollen season.
The aerospora of an area reflects its ground flora composition. Changes in the composition of the ground flora may take place over a period of time due to urbanization, felling of trees, introduction of exotics etc. This expresses an impact on the aerospora. In Bangalore, the problem of environmental pollution is due to the ever-increasing industrialization, urbanization, increasing population and unplanned introduction of exotics, which can often prove to be hazardous for human health.

Fungi are the major cause of plant diseases in the world. Some are widely distributed throughout crop growing regions, but many are restricted in their occurrence (Hawksworth and Kirsop, 1988). Among the 50,000 to 250,000 species of fungi that have been described, fewer than 200 have been associated with human diseases. With few exceptions, fungal infections of humans originate from an exogenous source in the environment and are acquired through inhalation, ingestion, or traumatic implantation (Malcolm and David, 1994).

Fungal infections can be classified into a number of broad groups according to the initial site of infection. Grouping the diseases in this manner brings out clearly the degree of parasitic adaptation of the different groups of fungi. The way in which the site got affected can also be related to the route by which the fungus entered the host.

Allergic Fungal Rhino-Sinusitis (AFRS) is initiated when an atopic individual inhales fungal spores. AFRS is a term used by Robson (Robson, 1989) to describe a constellation of unusual findings in a unique group of patients suffering from chronic sinusitis. These are not life threatening, but they are the source of much discomfort and affect the normal life (Prasad, 1997). Although, AFRS represents the most common type of fungal sinus infection,
understanding of this disease is still limited. The cases of AFRS are increasing each year with the increase of pollution. A thorough understanding of the relationship between the concentrations and the total count of spores can lead to the major causative factors in diseases like AFRS. This can in-turn help us to identify, understand and treat the afflictions more positively.

In order to explore the application of information on inhalant fungal spores in Bangalore's atmosphere, it was decided to carry out the work jointly with Dr. Raman, Dept. of E.N.T. at Manipal Hospital, Bangalore.

Air monitoring is a standard way of assessing air quality. The diversity of fungal spores in the air gives us a useful indication to the inhaled particles (Verma and George, 1997). This gave impetus to the study of environmental conditions affecting the prevalence of fungal spores, outdoor. The data thus generated has been put to use mainly to study allergy problems and there is almost a total lack of any established system of fungal forecasting as far as India is concerned.

Research work carried out in our laboratory in the past three decades has brought out the significance of bio-pollution to public health (Agashe and Chatterjee, 1987; Agashe et al., 1995; Avasthi and Agashe, 1997; Agashe and Sudha, 1997; Agashe and Vidya, 2000; Agashe et al., 2002).

Continuous fungal spore monitoring was undertaken for collecting data on the frequency and distribution of airborne fungal spores present in the air. This would help the allergologist to identify the allergy causing fungal spore types. Although more than 150 different types of fungal spores were recorded
INTRODUCTION

from the Bangalore's atmosphere, emphasis was given to the most prevalent fungal spore types from the allergy point of view.

In addition, the above work is also supplemented by atmospheric pollen and fungal spore surveys, compilation of pollen and fungal spore calendars, publishing of weekly monitoring of pollen and fungal spores in mass media by Agashe and his research students. On account of this, it can be said that Bangalore has been an important center for Aerobiological studies.

There is a critical threshold of exposure to allergens beyond which one is bound to get symptoms and this threshold varies with each individual. Similarly, the allergenicity of individual antigens varies. When allergenicity is of a severe degree, these allergens can cross this critical threshold by themselves e.g. *Penicillium* sp.

However, in case of many of the allergens allergenicity is not of a severe degree. Therefore, these allergens may not be able to cross the critical thresholds on their own. But, collectively they would do so and would cause symptoms. Thus seasonal, geographical and diurnal variations of symptoms depend upon the increase in the total allergenic fungal spore load. The constant changing of aerospora necessitates its continual monitoring for recognizing the incidence of allergic spore types.

The present research work was carried out with the following objectives:

- To find out the most predominant types of airborne fungal spores in Bangalore city.
- To study weekly qualitative and quantitative variations of fungal spores in the atmosphere.
INTRODUCTION

- To publish a weekly fungal spore calendar in the mass media.
- To study impaction of meteorological factors on the qualitative and quantitative variation of fungal spores in the air.
- Facilitate further studies trying to forecast aeroallergens and help to find out the threshold value of fungal spores for allergic manifestations.