CHAPTER-1

INTRODUCTION
Aerobiology is a branch of Microbiology, which deals with airborne bio-
particles and their impact on human and living system in relation to environmental
condition. Aerobiological study concerns their sources, liberation, dispersal,
deposition and impact of bio particles on living organisms. The term aerobiology
was introduced by Meier (1935) as collective term for the studies of Aerospora like
airborne fungal spores, pollen grains and other microorganisms. Nilson (1992)
defined aerobiology as an interdisciplinary and limitless science. Various
definitions are given to define Aerobiology like it is the study of the sources,
dispersion and effects of air borne biological materials, such as pollen, spores and
microorganisms. In few other definitions, Aerobiology is defined as a branch of
biology that studies organic particles, such as bacteria, fungal spores, very small
insects, pollen grains and viruses, which are passively transported by the air
(Spieksma, 1991). Aerobiology is the scientific discipline focusing on the study of
the passive transport of microorganisms and particles of biological origin in the
atmosphere. Aerobiology is mainly an experimental science and it is
interdisciplinary with applied aspects. It involves the interests of allergists, plant
pathologists, microbiologists, entomologists, palynologists, mycologists, air
pollution specialists and biometeorologists. Aerobiology is basically concerned
with the study of airborne organisms, with their sources; take off, dispersal,
deposition and their effects on other organisms, a sequence termed the
aerobiological pathway (Edmonds, 1979) and the effect of environmental factors
on each of these stages. Bio particles may occur as solitary, free organisms or as
aggregates of organisms, even adhering to non-biological particulate matter.

In India, Cunningham (1873) observed for the first time microbiological
materials in the air at Calcutta. An important medical application of aerobiology is
the study of the transmission of air borne diseases. It is known that many
microorganisms like bacteria, viruses and fungi can be transmitted through the air,
possibly within droplets. In addition, air contains a variety of bio pollutants, which
can cause many allergic diseases and therefore transmission of diseases through air
creates interest to many aero biologist. Aerobiology has gained much importance
in recent years due to its wide application in the field of diagnosis and treatment of
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allergic disorder (Lacey, 1991). It is a rapidly developing science, which also involves interactions with engineering and meteorology. Aerobiology is a vast branch of science, which draws information from various disciplines like mycology, microbiology, plant pathology, meteorology, environmental science, and medical sciences (Edmonds, 1979).

India has the unique distinction of being one of the earliest countries where aerobiological studies in general and aero-mycological studies in particular were initiated (Cunningham, 1873). Environmental mycology or aero-mycology constitutes one of the major aspects of aerobiology, mainly because of the dominance of fungal spores in the ambient air. In general, aero-mycological investigations take in to account the identification of source, mode of release, dispersal, deposition, impaction and effects of impaction of fungal spores on various living system. The fungal spores and hyphae fragments are commonly recorded in the air and are important for the survival and subsequent continuation of generations. Many of the fungal spores are endowed with unique structures and capacity to survive under unfavorable environmental conditions and these probably account for their predominance in the air. Nearly all the spores are essentially dispersive units and their significance as gene dispersal units should not be lost.

In the course of evolution, the fungi have probably exploited the wind for their dispersal more thoroughly than any other group of organisms and consequently dominate the air spora. The spores or fungal propagules are quite variable in size and shape, often liberated in the air massively and remain there for a long time. The mycoflora concentrations in the atmosphere are influenced by the processes involved in their production, release and deposition (Lyon et al., 1984). Fungal spores represent a major fraction of bioaerosol with more than 80000 species of which the majority are cosmopolitan in origin (Hawksworth, 1983).

The fungal spores are often liberated in the air in massive concentration and can remain airborne for a long time. The atmosphere contains airborne viruses, bacteria, protozoa, pollen grains, different propagules and vegetative cells of algae, fungi, Lichens, bryophytes and Pteridophytes. Numerous airborne organisms, their
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fragments as well as particles of biological origin passively float in the atmosphere. Among the wide variety of biological particles present in the atmosphere, there are very significant numbers of fungal spores (Sabariego et al., 2007).

These fungal spores play a significant role in childhood asthma, allergies, mycotoxicity, bio-deterioration and infections of man and animals (Amanianda et al., 2010). Fungal spores infect, play a very important role in triggering allergies, asthmatic symptoms, skin and systemic mycoses and may be fatal at times as in case of invasive aspergillosis, which easily develops in an immune depressed host. Despite allergenicity, there exists requirement of information regarding spore dispersal due to the role in the field of plant diseases and also due to microbial deterioration of the materials like paper, textiles, printed surfaces etc. The understanding of factors governing spore release and dispersal may clarify aspects of fungal spore exposure.

In view of increasing environmental pollution, the survey of aeromycoflora of cities has assumed great significance. Recent scientific reports indicated that the environment is full of variety of dangerous fungal propagules comprising allergens, phytopathogens and saprophytes (Mishra and Bhandari, 2006). Airborne fungi are considered to act as indicator of the level of atmospheric biopollution. The presence of fungal spora, volatile and mycotoxins in the air can cause health hazards in all segments of population (Kakade, et al., 2001).

Aeromycology is a scientific discipline focused on the transport of airborne spores in outdoor and indoor environments. Fungal spores comprise the greatest portion of suspended biological materials (Salvaggio and Aukrust, 1981). The source of fungal spores and hyphal fragments is often unknown, unlike that of pollen grains, which are easily traced back to their plant species. Aerobiological investigations can be broadly classified as outdoor or extramural aerobiology and indoor or intramural aerobiology. The presence and concentration of airborne fungal spores in both indoor and outdoor environment has been the subject of numerous studies in various geographical regions (Kasprzyk, 2004 and Steplaska et al., 2005). A large number of airborne micro-fungal propagules were found in
indoor and outdoor environments and generally widely distributed in nature (Ghosh et al., 2011). The indoor air is very dynamic system in which particles of biological and non-biological origin are distributed and displaced. Air borne fungi are able to grow and propagate under favorable conditions on variety of indoor surfaces, causing indoor air pollution. A large number of fungi have been found to be responsible for the deterioration of organic material in indoor environments.

Fungi are present in both indoor and outdoor air, although their concentrations in the outdoors vary depending on the climate and other factors. The concentration and the presence of indoor allergens vary substantially and are dependent on moisture content, ventilation, and the presence or absence of carpets, pets, and house plants (Gravesen, 1999). Clinically, the presenting symptoms of fungal allergy are not different from other allergies caused by other agents and include sneezing, coughing, wheezing and shortness of breath. Reversible pulmonary airway obstruction, and angioedema, urticaria, and even anaphylaxis may be present in these patients. Inflammation is an important feature of these conditions that include complex histological reactions in different tissues. The inflammatory condition results from antigen- induced immune response involving both cellular as well as humoral components of the immune system.

Several micro-fungal species have the potential adverse effects to cause allergies, spoilage of foods and many other adverse health effects (Khan and Karuppayil, 2012). Monitoring airborne fungal spores in the atmosphere of metropolitan cities, towns including monitoring of airborne fungal spores in an open area like fields, forests, vegetable markets, Railway stations, Bus stand, premises of Hospitals can be studied under outdoor aerobiology, while, monitoring airborne fungal spores in indoor environments like inside houses, inside commercial complexes, inside hospitals, libraries, storage godowns etc. can be studied under indoor aerobiology. Fungal spores are abundant in outdoor air. Sources for indoor air borne fungi can be a outdoor air (Burge, 1995). Throughout the history of aerobiology, the emphasis of studies has successively shifted from one aspect to another. With each move, aerobiology has gained new strengths and insights. After early speculation as to the origin of disease by Hippocrates and
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Lucretius and much later, the discovery of fungal spores by Michele, aerobiology was historically, first concerned with airborne bacteria and dispute over spontaneous generation extending from the time of Antoine Van Leeuwenhoek (about 1680) to Pasteur (1861-62). Pasteur (1861) proved in his classical experiments of combating theory of spontaneous generation of life and developing germ of disease that air is a carrier of many common germs. Many workers have conducted their experiments in outdoor as well as indoor environments and in particular the microbial components of air in general and over useful in understanding the plant pathogen and in establishing the forecasting system for disease control of plant.

Continuous sampling of the magnitude and quality of airborne particles in all weather of different geographical sites and ecological niches of the same site (outdoors and indoors) is necessary in several fields of research especially they are known to be responsible for the diverse human allergic disorders. In addition to this understanding of the incidence of particulate matter in the atmosphere would be of immense help in predicting and control of various types of plant and animal diseases in the area. Long term aerobiological survey can also lead to construction of statistical models for prediction of aero biota loads which may be used to schedule timing of correct protective sprays (Tilak, 1989; Hirst, 1991; Mishra et al., 1992; Singh, 1994).

Aero biologists have traditionally been involved in the measurement and reporting of airborne pollen and fungal spores as a service to allergy sufferers (Larson, 1993). High interest is given to the source of microorganism or materials released in to the atmosphere, its dispersion, deposition and impact on animals, plants or human systems. It focuses on the transport of airborne microorganisms in outdoor and indoor environments. The air of the outdoor and other environment contains a variety of biotic air pollutants. Biotic pollutants include bacteria, fungi, pollen grains, trichomes, mites, algae and spores of bryophytes, pteridophytes and other particles of biological origin. This airborne bio-particles/pollutant transported through air current and is the main cause of human allergic disorders. The bio particulate material in the environment known as allergens causes allergic
disorders. Some spores of fungi are responsible for allergy in sensitive individuals, since spores are inhaled and deposited on mucosa of lungs in human beings (Tilak and Jogdand, 1989). Many allergic manifestations in human beings such as asthma, rhinitis, skin allergy etc. and a range of cardio respiratory diseases are attributed to inhalation of airborne fungal spores and pollen grains (Reddy, 1970).

The atmosphere of the earth contains many particles of solid matter. A large proportion of which is being of biological origin. Most viable air borne particles are spores of different organisms, which are to some extent suited for survival in such an environment. Not only spores of fungi, Myxomycetes, bryophytes, pteridophytes, but also pollen grains, moss gemmae, propagules of lichens, cells of algae, vegetable cells, and spores of bacteria, cysts of protozoa, may occur in the air and constitute the aerospora, which pollute the air. Spore remain suspended in air for long as fall speeds are less than speed of frequently recurring upward air currents.

Air is an essential medium for dispersal and inoculums for microorganism inhabiting aerial plant surface. Fungal spores pre dominate the other bio particles in the air spore. Due to their adaptability, the fungal spores are encountered more or less throughout the year. Wind is the most uncontrollable agent in transport of inoculums. Many fungi are adopted for aerial transport. Therefore air is the source and sinks of fungal spore that constitutes the major bio component of air. Aerobiological studies, in relation to allergy, have a great relevance as the problem of allergy is assuming alarming proportions all over the world. Air carries large number of bioparticles (biopollutants) and chemicals, which poses burden for the respiratory tract of humans. The bioparticles include pollen grains, fungal spores, insect debris, plant parts, animal danders and mites, etc. These materials of biological origin are known to be causative agents of respiratory disorders like asthma, allergic rhinitis and atopic dermatitis.

Allergies are hypersensitive immune responses to substances that either enter or come in contact with the body, such as pet dander, pollen or bee venom. A substance that causes an allergic reaction is called an "allergen". Allergens can be
found in food, drinks or the environment. Allergy is one form of human disease, which affects about 20% of the population. A number of allergens associated with various forms of allergy have been reported from all over the world. The concentration of allergens in the environment varies, depending on various factors including climate, vegetation, and air quality. Plant pollens and fungal spores predominantly constitute the outdoor allergens. The indoor allergens, on the other hand, are represented by allergens from dust mites, cockroaches and pets. Fungal spores also have been reported from the indoor environment. The concentration and prevalence of the indoor allergens vary substantially and are dependent on moisture content, ventilation, and the presence or absence of pets, caretakers, and house plants. Although an allergic reaction to fungal allergens is suggested as an important contributing factor in development of respiratory symptoms, other mechanisms, such as increased exposure to fungal metabolites, mycotoxins and other compounds of immunosuppressant or irritant properties may also be important.

During the last decades, allergic diseases have been constantly increasing in incidence and prevalence and consequently an increasing attention was paid to aeromycological monitoring of fungal spores in various parts of the world. Due to increasing awareness of the relationship of airborne fungi to allergies in patients with asthma, many biologists and allergists have begun to examine the distribution and type of fungal spores and conidia in both indoor and outdoor environments (Miller, 1998). Allergy is defined as the exaggerated response of the immune system to foreign proteins (Blumenthal and Rosenberg, 1999). Sensitivity may also develop in normal individuals who are chronically exposed to the conidia of certain fungi at work. Since only selected individuals develop allergy despite the extensive exposures to allergens, evidence for genetic predisposition for development of atopic disease in these patients is likely (Kurup et al., 2000).

Bioaerosols are airborne particles that are living or originated from living organisms. They include microorganism’s fragments, toxins and particulate waste products from variety of sources (e.g. viruses, bacteria, fungi, plants, protozoa, animals) (Fung and Hughson, 2003). Modern lifestyle and environmental
conditions may be contributing to the production and concentration of indoor allergens and consequently have been associated with increase in the prevalence of several allergic diseases (Platts-Mills, 2003). There is a lack of investigations on ambient inhalable bio-aerosols and little attention has been paid on the interrelationship between allergenic inhalable bio-aerosols, ambient air pollutants relevant to respiratory health, and meteorological factors. A significant portion of atmospheric aerosol is of biological origin. Bio-aerosol is always observed in natural air and their concentration changes depending on environmental conditions. Fungi produce varied forms of spores, which are differently, actively, or passively released, however, their further fate usually depends on the wind. The wind is a blind vector; hence an abundant production of spores is necessary for the fulfillment of their biological function. Because of the size, fungal spores can cover large distances with the air currents. The distant transport is unimportant for the development of the fungus unless its spores are viable, however, even a dead spore can contain an allergen dangerous for humans.

People are exposed to aeroallergens at home and at work. Allergy is one form of human disease, which affects about 20% of the population. A number of allergens associated with various forms of allergy have been reported from all over the world (Blumenthal and Rosenberg, 1999). The concentration of allergens in the environment varies, depending on various factors including climate, vegetation and air quality. The concentration and prevalence of the indoor allergens vary substantially and are dependent on moisture content, ventilation and the presence or absence of pets, carpets and houseplants.

About 12-20% of world population is known to suffer from allergic disorders such as bronchial asthma, allergic rhinitis, atopic dermatitis and urticaria etc. The magnitude of allergic problems in India is alarming as more than 30% of the population was estimated to suffer from major allergic diseases of which asthmatics constitute 1%, while allergic rhinitis is about 3-4%. The recent survey conducted through medical questionnaires from work places in Delhi has shown that workers suffered up to 60% from respiratory disorders. The preliminary reports from AICP (All India Coordinated Project) on aero allergens and human
health suggests 10-30% bio particles are of allergic nature. Each year the numbers are increasing by 5% with as many as half of all those affected being children. The most common allergens are pollen from trees and grasses, house dust mite, fungal spores, pets such as cat and dogs, insects little wasps and bees, industrial and household chemicals, medicines and foods such as milk and eggs and the common symptoms are sneezing, runny nose, itchy eyes and ears, severe wheezing, coughing, shortness of breath, sinus problems, a sore palate and nettle like rash.

Amongst all the biotic pollutant, the fungal spores contribute significantly, hence the term Aeromycoflora was used for the study of fungal spores and parts of fungal components in the air. The allergenicity of airborne fungal spores and knowledge of their significance in the management of nasobronchial allergy has been convincingly demonstrated. The magnitude and quality of fungal spores in the atmosphere varies from season to season and year to year and also from region to region depending on local flora, topography, landscape and human interferences. With urbanization, man spends most of his time at indoor either at office or house; hence he is more exposed to indoor allergens than the outdoor. The knowledge on composition and incidence of fungal spores at each patient's environment helps all allergist to identify the cause for their allergy. The common in-vivo tests generally employed for diagnosis of allergy are intradermal/skin prick test, bronchial provocation tests, ophthalmic and Praushitzkustener tests. The above tests are further confirmed by in-vitro investigations such as determination of specific IgE in the sera of patients against the allergens in question. Enzyme Linked Immuno Sorbent Assay (ELISA) is also used in identification of important allergic fractions.

More than 80 genera of fungi have been associated with respiratory tract allergy (Horner et al., 1995). Most of the allergenic fungi are classified under Ascomycetes and Deuteromycetes and few in Basidiomycetes (Kurup et al., 2000). Some genera of airborne fungal spores such as Alternaria, Apergillus and Cladosporium are found throughout the world. Number and types of fungi vary with time of the day, weather, and seasonal fluctuations, condition of the surrounding areas, climatic conditions and the presence of a local source of spores.
About 20% of human population is easily sensitized by normal fungal spores concentrations and all fungal spores are potentially allergenic. Numerous plant diseases such as rusts, smuts, mildew’s, leaf spots etc. are caused by air borne fungi (Kendrick, 2000).

On the basis of above inferences, it is apparent that fungal spores contribute the significant part of bio-pollutants/bio-particles in air and they have long known associations with human diseases. Exposure can be inhalation, contact, ingestion and by injection. Its structure and nature, host factors such as genetically, predisposition and environmental factors, including pollution and high levels of allergen concentrations, determine the response to an allergen.

Fungi are eukaryotic, filamentous, and mostly spore bearing organisms. Fungi exist as saprophytes or as parasites of animals and plants. Allergy to fungi follows the same biological phenomena as allergy to any other environmental allergens. Fungi grow on most substrates even in adverse conditions. Large number of airborne spores is usually present in outdoor air throughout the year and the number may exceed that of pollen at times (Burge, 1989). The major indoor allergens constitute house dust containing mites, epithelial cells, dandruff, cats, dogs, cockroaches, and fungi (Gravesen, 1999). Fungi are associated with a number of allergic diseases in man. The prevalence of fungal allergy is estimated to be about 30% among atopic individuals and about 6% in general population. The major allergic manifestations induced by fungi are allergic asthma, rhinitis, allergic broncho-pulmonary aspergillosis, and hypersensitivity pneumonitis (Burge, 1989; Kurup and Fink, 1993). These diseases can result from exposure to a variety of antigens present in the fungal spores and hyphae. A number of fungal spores can reach the alveolar surface through breathing because of their small size. Soluble antigens liberated from fungi also will be inhaled. The spores and antigens mediate diverse allergic reactions depending on the genetically and other predisposition of subjects. Some genera of airborne fungal spores such as *Alternaria, Aspergillus, Penicillium* and *Cladosporium* are distributed throughout the world. The airborne spores of these fungi are generally considered as an important cause of both allergic rhinitis and allergic asthma (Vijay et al., 1998). It was not until 1906 that
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The mechanisms of allergy as a type of hypersensitivity were understood following the work of Clemens von Pirquet. Allergies are common heredity and environmental exposures may contribute to a predisposition to allergies. It is roughly estimated that one in three people has an active allergy at any given time and at least three in four people develop an allergic reaction at least once in their lives. In Western countries, between 10–25% of people annually are affected by allergic rhinitis.

Allergens are antigens that stimulate the allergic reaction (Blumenthal and Rosenberg, 1999). Commonly inhaled allergens that result in the manifestation of allergic disease can be divided into indoor and outdoor allergens (Sporik et al., 1996, Boulet et al., 1997; Burge and Rogers, 2000; Kerkhof et al., 2003). Mites, fungi and endothelial tissues/dander from pets are common indoor allergens. For outdoor allergens, pollen and fungal spores dominate (Sporik et al., 1996, Boulet et al., 1997; Burge and Rogers, 2000). Allergens are organic compounds containing hydrogen, oxygen and nitrogen which form an important part of living organisms. The term allergy is used to describe a response, within the body to a substance, which is not necessarily harmful in itself, but results in an immune response and a reaction that causes symptoms and diseases in a predisposed person, which in turn can cause inconvenience, or a great deal of misery. Allergies cannot only develop at any age, but many individuals also outgrow allergies over time. While environment plays a role in allergy development, there is a greater risk of developing allergic conditions, if a person has a family history of allergy, especially in parents or siblings.

Exposure to airborne fungal spores is a special health concern in tropical region, as the warm and humid climate in the study area complements the microbial and plant growth. Fungal spores have long been known as one of the important environmental bio-particles causing dermatitis, respiratory infections (Garrett et al., 1997). Adverse health effects associated with fungal exposure are widely documented and extremely diverse, ranging from headaches to allergy and invasive infections (Chapman, 2006), causing respiratory allergy in 20 to 30% of atopic individuals (Kurup et al., 2000). Particles of 10 μm are deposited easily into
the bronchial tree and are associated with immediate hypersensitivity responses, while particles of 2.5 μm or less can easily penetrate the lower airway and are associated with delayed hypersensitivity with major allergic manifestations including asthma, rhinitis, and allergic bronchopulmonary mycoses (Horner et al., 1995, Kurup et al., 2000; Burge, 2002).

Increased urbanization and industrialization in recent time has made a significant impact on air quality. Varieties of biopollutants/bioparticles are suspended in the air and they are the main concern of study in recent times. The Central Pollution Control Board (CPCB) has declared Raipur as the country's most polluted city. Raipur ranked highest as per suspended particulate matter (spm). Raipur's air is 250 micrograms per cubic meter (g/m$^3$) (standard is fixed at 200 g/m$^3$) while the concentration of dust particles is 350 parts per million (ppm) (fixed limit is 200 ppm). The respirable particles are 230 ppm, much more than the standard of 100 ppm. It is believed that the presence of respirable suspended particulate matter (rspm) is also 3-4% higher than the acceptable limit. Several factors are responsible for the acute air pollution in Raipur is toxic industrial waste, domestic waste, too many vehicles (rough estimates say the number of vehicles has doubled in the last two years), rapidly increasing constructions and fast growing population. According to World Health Organization (WHO) report, Raipur has gained the dubious distinction of being the third worst city in India and has found its way on the list of top twenty polluted cities in world. Environmentalists fear that it's only a matter of time that this city would top the list, if urgent steps wouldn’t be taken to improve the air quality. In terms of PM10, particulate matter smaller than about 10 micrometers that can settle in the bronchi and lungs and cause health problems, Raipur with 305 micrograms per cubic meter is second only to Gwalior's 329 micro grams per cubic meter. Particulate matter is the collective term used to describe very small solid, liquid or gaseous particles in the air. PM10 is the one of the biggest sources of asthmatic problem. A 2008, WHO report clearly states that every fifth child in Chhattisgarh is affected with asthma. As per a report of the health ministry, 1.39 lakh people in Chhattisgarh suffered from respiratory disorders. This number arose to 2.32 lakhs in 2007 and 3.39 lakhs in 2008, indicating a 100% increase in such patients every year.
In view of increasing environmental pollution the survey of aeromycoflora of Raipur city assumed to be of great significance. Recent scientific reports indicated that the environment of Raipur city is full of variety of dangerous fungal propagules, comprising allergens, phytopathogens and saprophytes. (Bajaj, 1978; Chaubel and Kotmire 1985; and Mishra and Bhandari; 2006). The importance of biopollutants as a major cause of outdoor and indoor air has widely been recognized. Much work is being done on the study of airborne fungal spores and pollen grains and their impact on causing allergic diseases. The airborne fungal spores show great variations and vary from place to place. Hence aeromycological study is of great importance.

The present study was set out to explore the aeromycoflora of selected indoor and outdoor areas of the Raipur city to determine the distribution pattern of fungal flora and to identify the fungal spores responsible for various allergic diseases in Raipur city. In the survey of airborne fungal spores in different environmental conditions both in indoors and outdoors region were carried out by many workers with conventional techniques and a diverse number of fungal genera were identified and isolated. With this background, it was aimed to do the systematic quantification of fungal flora of indoor areas like inside houses of different localities, inside commercial complexes, inside hospitals and outdoor area like premises of hospitals, vegetable markets and railway station were done, where daily many people visit as per their needs and come in contact with aero allergens which are supposed to be the major cause of allergic diseases in humans. There is increasing concern about the exposure to fungal aerosol in occupational environments and associated allergic diseases like asthma, rhinitis, sinusitis, eczema, atopic dermatitis, mycosis and aspergillosis. The information about the fungal aerosols causing allergy was largely lacking. The aim of the study was to assess the concentration of the major airborne pathogenic fungal spores in air and to assess their allergenic potential causing respiratory and other allergies in humans.

In the present study aeromycoflora of both indoor and outdoor sites was undertaken to study the concentration, distribution and composition of
biopollutants and bio particles in the air which will provide valuable information to allergologist and clinician in treatment of fungal associated allergic diseases. The study also aimed to update current scientific knowledge concerning the health effects of indoor and outdoor exposure to fungi and their role in causing various allergic diseases, their treatment process, and control measures, diagnosis of allergic diseases and identification of aeromycoflora born allergic diseases. The prevalence of respiratory allergy to fungi is estimated to 20-30% among atopic individuals and up to 6% in general population (Wucrich; 1984). Hence it is most important that allergens, viable microbes and other noxious agents that prevail in any particular environments need to be identified and studied. These measures will not only help to monitor the levels of these agents in the environments but also aid clinicians in advising and treating patients as well as those at risk before they are exposed and sensitized. (Zwick et al., 1991).

Allergens of airborne pollen or fungal spores are the main cause of many allergic diseases like allergic rhinitis, allergic asthma, allergic fungal sinusitis, aspergillosis, eczema and atopic dermatitis in the Raipur city. Fungal spores and dust are the main cause of allergic rhinitis and asthma, as more than 36% of the population in the city is known to suffer from allergic rhinitis and asthma. Air contains many fungal spores that cause hazardous allergic diseases so tracking of these fungal spores, which are the main cause of allergy, is important.

It is necessary to recognize allergic diseases as a global public health concern. Steady increase in the prevalence of allergic diseases in Raipur city has occurred with about 30-40% of the population now being affected by one or more allergic conditions. Fungal spores are known as one of the important bio pollutants causing allergic manifestation in human beings. Hence, knowledge of airborne fungal spores causing allergic diseases in Raipur city is a prerequisite for proper diagnosis and treatment of allergic disorders. Of the various agents, dust and fungal spores are the major sources of morbidity among sensitive individuals. Detail information on their daily, seasonal and annual variations in the atmosphere is a prerequisite for proper diagnosis and treatment of allergic ailments.
A high proportion of allergic diseases are occurring in adults and young subjects; thus, as this young population reaches adulthood, and adults grow into older once the burden of allergic diseases was expected to increase even more. Complex allergies involving polysensitization and multiple organ involvement are increasing, with a high morbidity placing a higher demand on health care delivery services. It is forecasted that allergic problems will increase further as air pollution and the ambient temperature increase. These environmental changes will affect pollen counts, the presence or absence of stinging insects, and the presence or absence of molds associated with allergic diseases. In many countries and attempts to tackle these problems on a national basis are widely variable and fragmented resulting in decreased quality of life, increased mobility and mortality and considerable cost to patients with allergic diseases.

Hence, the study of Aeromycoflora of Raipur city is very important to trace the fungal allergen present in both indoor and outdoor environments, although many studies have been done to describe environmental conditions that lead to fungal growth. Airborne and dust containing fungi have also been described for a variety of environments, including residences, workplaces and schools; however, their clinical relevance hasn’t been much studied. Therefore, the present investigation was undertaken to survey the indoor and outdoor aeromycoflora and to identify aeroallergens and associated diseases in industrial city like Raipur. Clinical study revealed the means of treatment used against the variety of aeromycoallergens in which people of Raipur are exposed. Study was conducted with following objectives:-

**OBJECTIVES:**

Following are the objectives of the present study:-

1. To survey aeromycoflora of the selected indoor and outdoor area of the Raipur city.
2. To investigate the seasonal variation in aeromycoflora of the selected indoor and outdoor area of the Raipur city.
3. Ecological studies will be done in order to record the distribution pattern of aeromycoflora.

4. Identification of aeromycoflora will be done.

5. To survey the allergic diseases prevalent in Raipur city.

6. To identify an aeromycoflora born allergic diseases in Raipur city.

7. To study the sources, transmission and control measures for aeromycoflora and born allergic diseases.

8. To survey the clinical profile for the allergic diseases.

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