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Bio - Aerosol - Impact Studies In Indoor and Outdoor Environments in Hyderabad

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Abstract: **Bioaerosols1 are particles which may be biological origin like microbes, plants, animals etc., or may be artificial like house dust,organic waste etc.,Most of the bioaerosols host on humans and moist places. Size of bioaerosol particles varies from below 1 µm to 100 µm in aerodynamic diameter. Indoor bio-aerosols may originate from outdoor air and indoor reservoirs.Major sources of bacteria and viruses are humans and pets-sneezing, coughing, dander and saliva.Fungi,many bacteria, protozoa, algae and green plants (pollen) are present outdoors that are induced indoors by natural or mechanical ventilation.**

Bioaerosols induce into human body by inhalation or by deposition on wounds.A possible reason of sick building syndrome (SBS) is the presence of Bioaerosols in the buildingDespite the defense mechanism of the body these Bioaerosols could cause damage to the body.Other common health effects of Bioaerosols are Viral: infectionssuch as Common cold, Influenza, Measles, Bronchitis,Fungal – Histoplasmosis, Cocciodomycosis and Blastomycosisand Antigens:Allergic diseases of Hypersensitivity pneumonitis (HP)Allergic asthma, Rhynitis and Pergillosis Control Strategies include -After identifying the airborne microorganisms the source can either be eliminated or its strength can be reduced.Preventive maintenance is one the most effective ways to control the microorganisms indoorsMaintenance of air handling systems andHumidifiers2 using the re-circulated water should not be used. Steam should be used instead of cold water in humidifiers, heating and HVAC systems.Disinfectants3 and biocides4 should be used in the humidifier water reservoirs, which kill the microorganisms.

Keywords:-- Bio-aerosols 1 Humidifiers 2 Disinfectants 3Biocides

I. INTRODUCTION

Aerobiology is study of biological particles present in the air, both outdoors (extramural) and indoor (intramural). Many aspects of our life are affected by biological particles that are carrot in the air and are deposited from it.

The term aerobiology was first coined by F.C. Meir's of U.S.A in 1930's it is a scientific discipline focused on the transport of organisms and biologically significant materials by the atmosphere. Because of the practical application in the diagnosis and treatment of the respiratory allergic disorders, aerobiological investigations have acquired new dimensions. This is very much evident by the spurt of research publications, review articles monographs, atlases, pollen/spore bulletins etc. in the recent times.

It is science and multidisciplinary approach focused on the transport of organisms and biologically significant materials. It is concerned with the source of an organism or material their release in the atmosphere, dispersion, deposition and impaction on animals and human systems. With the inception of International Biological Programmer (IBP) in 1964, the term has been further extended to include investigations of airborne materials of biological significance.

1.1Fungal Spores: Airborne microbes (Fungi) are implicated in the causation of allergic diseases and infections in immune compromised patients. The fungi constitute an independent group equal in rank to that of plants and animals. They differ from bacteria by having genetic material arranged on chromosomes, and membranes surrounding the nucleus. The fungi that produce spores and get airborne are called 'Airborne'. They cause a number of infections in tropical countries including ringworm, athlete's foot in human, and rust, smuts, and leaf, root, and stem rots in plants. Aspergillus sp. can invade the lungs and cause serious pneumonia in people with an impaired immune system. They are also established to cause Type I hypersensitive diseases with IgE mediated response. The common symptoms of hypersensitivity are bronchial asthma, allergic rhinitis and atopic dermatitis. Spores are the reproductive particles or seeds of fungi.

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1.2 Allergy: Type I hypersensitivity is also known as immediate or anaphylactic hypersensitivity. Anaphylaxis typically produces many different symptoms over minutes or hours. Symptoms typically include raised bumps on the skin, itchiness, red face or skin (flushing), or swollen lips. Anaphylaxis can be caused by the body's response to almost any foreign substance. Common triggers include venom from insect bites or stings, foods, and medication. People with atopic diseases such as asthma, eczema, or allergic rhinitis have a high risk of anaphylaxis from food, latex, and radio contrast agents. Anaphylaxis is a severe allergic reaction that starts suddenly and affects many body systems. It results from the release of inflammatory mediators and cytokines from mast cells and basophiles. Common allergies include eczema, hives, hay fever, asthma attacks, food allergies, and reactions to the venom of stinging insects such as wasps and bees.

1.3 Pollen: One of the most obvious features of pollen allergy is its seasonal nature. Each plant has a pollinating period. Exactly when a plant starts to pollinate depends on the relative length of night and day and on geographical location. Thus, the farther north you go, the latter is the plant's pollinating period and the latter is the allergy season. Pollen count (represents the concentration of the pollen in the air in a certain area at a specific period of time) tends to be highest on warm, dry, breezy days and lowest during chilly, wet periods.

II. MATERIALS AND METHODS:

To trap the bio-aerosols, the following methods are usually employed -

- ♣ Rotorod air sampler
- ♣ Culture plate exposure
- ♣ Tape lift sampling
- ♣ Rotorod air sampler:

Perkins (1957) developed a battery operated Rotorod sampler sampling at constant rotational speed since the efficiency of stationary impactor sampler is low and highly variable, the rotating impactor has been advantageously used. The collecting arms of this model are made up of brass having 0.159cm cross sectional area. It is in square shape and slightly bent inwards. The vertical arms are 6cm long and 4cm wide from the axis. According to Gregory (1951), this width should give more than 60-70% efficiency of deposition for 20um diameter spores at wind speed about 4m.p.h. The model employs miniature D.C motor with controlled speed of the type used for recorders. With the rods n proper position, the motor gives about 23,000rpm.

III. COLLECTION EFFECIENCY:

The model has been tested for efficiency and it shows 85% efficiency. The sampling efficiency for particles greater than 15µm is 100%. Wind speed has little effect in the efficiency drag and load on the motor. The Rotorod tested by carter (1965) showed 60-90% efficiency. The Rotorod sampler is used for short period sampling up to 2 hours. The sampler is volumetric and highly efficient. The efficiency is not affected at even high wind speed.

Mount ant Medium Used and Its Preparation:

Glycerine jelly was used as the mountant, which has the best optical properties in visual examination. The composition and preparation of this are as follows

Table1: Composition of Glycerine jelly

INGREDIENTS	QUANTITY
Gelatin	**40gm**
Glycerin	**120gm**
Distilled water	**140ml**
Phenol crystals	**0.5gm**
Phenol crystals	**0.5gm**

Scanning:

The scanning of slides was done regularly after the preparation of slides. The conversion factor of the sampler is 5. For example, if the total number of fungal spores types are 20 for the total catch, the n the total number of fungal spores/m^3 of air= 5*20=100/m^3 of air. Assuming the taping efficiency to be 75% with the help of conversion factor, we can easily estimate the fungal spore concentration per meter cube of air. The constant factor is irrespective of locality, season and weather. All the time described in the work is given in Indian Standard Time (IST).

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Figure1: Rotorod Sampler

IV. RESULTS

In the present investigation we have selected indoor and outdoor habitat for analyzing the various bio aerosol concentration. An attempt has been made in the present investigation to find out the role of airspora in causing various allergies.

Ten sites (named S1 to S10)have been selected for conducting outdoor aerobiological survey to ascertain the role of outdoor fungi and pollen in and around Hyderabad(LakkarajuAparna,K.Mythili,Mr.VenkataRatnam,Mrs.SujathaUram-Air Quality Analysis in the city of Hyderabad 2015 International Journal of Research and Innovation(IJRI)).25 Persons were selected as they have been suffering from various allergies and the cause was yet to be known even after they have consulted the doctor. Depending on their problem they have been divided into 5 types which includes a control group also.5 Types have been selected for conducting indoor aero biological survey to ascertain the role of indoor pollutants in causing allergic disorders in and around Hyderabad.

Type1: Patients living in Independent house, surrounded with gardening and non cultivated flowering plants.

Type 2: Patients living in Independent house, surrounded with gardening and non cultivated flowering plants near agricultural fields.

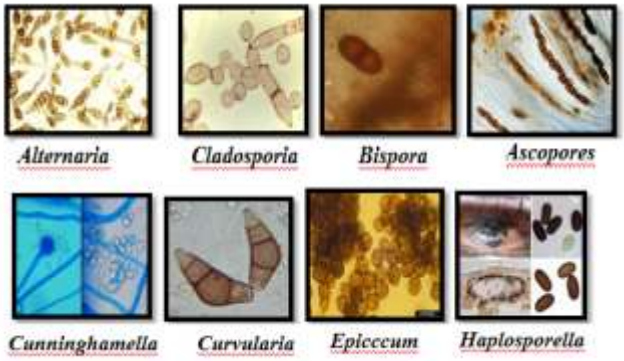
Type 3: Patients living in Apartments, with good ventilation near main road.

Type 4: Patients living in Apartments, near by to sewage treatment plant domestic waste water pond.

Control: Random samples from normal people.

The fungal spores identified in the indoor are tabulated below –

Zygomycota	Ascomycota	Basidiomycota	Deuteromycota	Others
Cunninghamella	Ascospores Didymosphaeria Melanospora Parodiella Pleospora Sordaria	Rust spore Smut Spore	Alternaria Bispora Cladosporium Circenella Curvularia Diplodia Epicoccum Haplosporella Helminthosporium Heterosporium Humicola Nigrospora Papularia Periconia Pithomyces Tetracoccosporium Torula	Hyphal Fragments Plant Trichomes Insect scales Grass pollen Parthenium pollen



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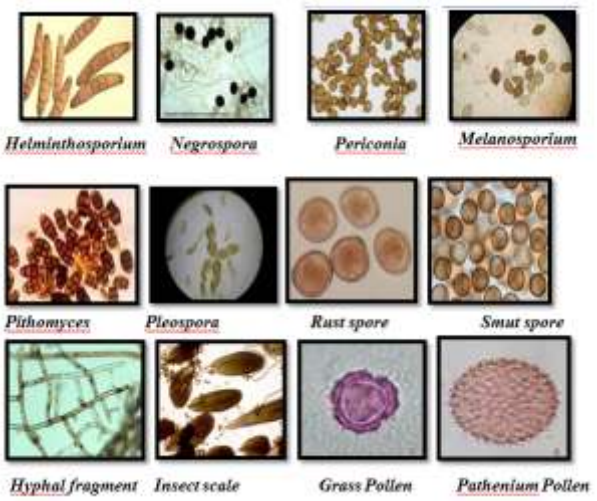
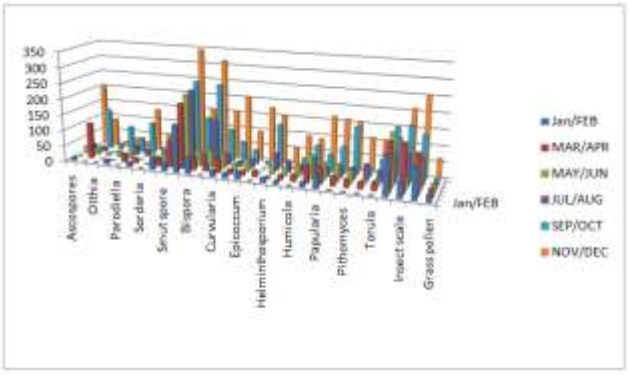


Bimonth wise variation in the concentration of fungal spores/m^3 of air at T1fromJan to Dec 2015

S.No	Fungal Spore Name	JAN/ FEB	MAR/APR	MAY/JUN	JUL/AUG	SEP/OCT	NOV/DEC	Total	%
	Ascomycotina								
1	Ascospores	10	0	25	20	0	200	255	2.3
2	Didymosphaeria	0	115	20	15	130	90	370	3.3
3	Otthia	0	0	10	0	15	15	40	0.3
4	Melanospora	15	0	20	0	80	30	145	1.3
5	Parodiella	0	25	20	30	45	20	140	1.2
6	Pleospora	15	15	0	20	100	135	285	2.6
7	Sordaria	0	0	20	0	15	55	90	0.8
Basidiomycotina									
8	Rust spore	35	25	25	45	95	85	310	2.8
9	Smut spore	25	85	75	30	20	0	235	2.1
Deuteromycotina									
10	Alternaria	150	205	225	230	250	345	1405	12.9
11	Bispora	50	40	50	25	135	155	455	4.01
12	Cladosporium	0	25	50	140	245	315	775	7.1
13	Curvularia	20	45	45	35	105	155	405	3.7
14	Diplodia	15	15	20	15	65	205	335	3
15	Epicoccum	25	15	40	25	45	95	245	2.2
16	Haplosporella	0	20	0	0	10	175	205	1.8
17	Helminthosporium	15	5	25	55	135	155	390	3.5
18	Heterosporium	10	15	25	35	0	55	140	1.2
19	Humicola	0	20	35	25	35	95	210	1.9
20	Nigrospora	15	55	75	55	80	90	370	3.3
21	Papularia	45	55	55	25	55	165	400	3.6
22	Periconia	0	30	55	35	85	160	365	3.3
23	Pithomyces	0	25	40	35	150	155	405	3.7
24	Tetracoccosporium	0	20	15	50	25	110	220	2
25	Torula	0	25	20	35	55	105	240	2.1
Others									
26	Hyphal fragment	125	150	165	95	160	120	815	7.4
27	Insect scale	50	150	35	95	170	210	710	6.5
28	Planttrichome	95	125	85	85	145	250	785	7.1
29	Grass pollen	20	25	25	15	15	65	155	1.5
	Total	735	1330	1300	1270	2465	3810	10910	
	%	6.7	12.1	11.1	11	22.5	34.9		100%



Graphical representation of fungal spore and other groups concentration from January to December 2015

V. CONCLUSION:

In the present investigations hyphal fragments stood next to Alternaria and Cladosporium, in terms of concentration, at all the sites where the airsampling was performed. Therefore, our results throw light on the importance of further studies with novel techniques to find out the role of hyphal fragments in causing allergic disorders in Hyderabad city, which has nearly 40% population being patients of some or the other kind of allergy.

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