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AIR QUALITY ANALYSIS IN THE CITY OF HYDERABAD

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Abstract

Access to good quality air for healthy living is a fundamental right of citizens of every country. India with a population of 1.27 billion people (2013) must ensure good quality air for healthy living of citizens. In a published editorial article of THE NEWYORK TIMES (02/13/2014).The editorial board has used a catchy title "India's air Pollution Emergency" which itself speaks volumes on the State of degenerating ambient air quality in India.

In the month of February 2014 YALE Performance index has ranked India 174th out of 178 countries on air pollution. According to India's pollution watchdog CPCB (Central Pollution Control Board), in 2010, Particulate Matter (PM) in the air of 180 Indian cities was 6 times higher than the WHO (World Health Organization) Standards. According to New York Times more people die of asthma in India than anywhere else in world. Outdoor air pollution is the 5th leading cause of death in India. Environmental Pollution Control Authority of India believes that the air pollution has reached such severe levels that it is cause of 3000 child deaths a year in Delhi alone.

Hyderabad, the capital city of recently announced Telangana State is no far better in terms of ambient air quality. Roughly a year ago THE TIMES OF INDIA carried a news article (22/03/2013), making it Official that the air in Hyderabad is not fit to breathe, citing AP-PCB (Andhra Pradesh Pollution Control Board) report. Hyderabad Air is fully studded with the SPM (Suspended Particulate Matter) of PM10 and PM 2.5 particles.

Hyderabad the capital of newly formed Telangana State is all set to cross 10 million (1 crore) population. With the continuous increase in the population and migration of people from rural from urban settlement's, puts tremendous pressure on the quality of living of the people living in urban environment (cities) pressure will be in terms of space, availability of water both for drinking and other uses, housing ,employment and various other related necessities. So far Central and State Pollution Control Boards have come up with technologies required for measuring the pollution levels in the cities. However, no agency in Hyderabad has expertise to measure the bio aerosols which are also indicators of pollutions (bio-pollution). Of late, the numbers of allergy disorders have gone up to 40% in the population of Hyderabad. Majority of such disorders are due to either gaseous pollutants or bio-pollutants. Therefore, present topic is selected to estimate the bio aerosol concentration at various major junctions (like Abids, RTC cross road, Panjagutta cross road, Charminar, Dilsukhnagar, Kukatpally, Uppal cross road, MGBS, Paradise, JNTU etc.) in the greater Hyderabad area.

The results of experiments would be of immense value in making Hyderabad a clean and green city for healthy living. Various air sampling methods employed in the proposed investigations.

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INTRODUCTION

Air is a mixture of various components which includes myriad gases and several microbes. An average human being can live for two weeks without food, two days without water, but hardly for a minute without air. Air is very much essential for a human being to survive and this valuable air is being polluted day by day. Air pollution has become an area of concern as consists of various minute particle called microbes which may cause several problems in humans. The air without the pollutants released by the human, itself is very much polluted. Imagine the air we inhale after all the pollutants in the form of various emissions getting mixed up with it. Air we inhale may contain various pollutants, gases, and pollen, bacterial and fungal spores etc., which may be released by plants, fungal molds, bacteria and various other pollution emitters. This air we breathe may cause allergies in various people who are susceptible to the pollutants.
Aerobiology is 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. In other terms it is explained as "microbiology of atmosphere". According to IUBS commission of aerobiology it has been regarded as transport of organisms and biological significant materials by the atmosphere. Aero biologists have traditionally been involved in the measurement and reporting of airborne pollen and fungal spores as a service to allergy sufferers.

ALLERGY

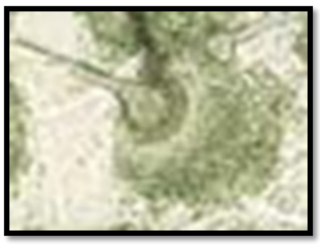
Allergy is hypersensitive reaction caused by many kinds of agents. These agents are called 'allergens' and the condition to which they take a human into is called as allergic condition or we simply say that the person has allergy or

we may even say that the person is allergic to a particular allergen. Allergy is a hypersensitivity disorder of the immune system. Allergic reactions occur to normally harmless environmental substances known as allergens; these reactions are acquired, predictable, and rapid. Strictly, allergy is one of four forms of hypersensitivity and is called type I (or immediate) hypersensitivity. It is characterized by excessive activation of certain white blood cells called mast cells and basophils by a type of antibody known as IgE, resulting in an extreme inflammatory response.

ALLERGIC REACTIONS OF FUNGI

ASTHAMA **FARMERS LUNG**

Chain spores of Alternaria



conidiophore of asperigillus

POLLEN

Pollens are released from the male flowers of flowering plants and their size varies from 10-100 microns. They are tiny, granular male reproductive cells found in the flowering plants. Some species are self-pollinating wherein pollination takes place in the same flower. In others, pollen has to be transferred from one plant to another for fertilization to take place. This is known as cross – pollination and one of the medium of transportation of the pollen is the wind.

The airborne pollens are small, light and dry in texture, as a result are easily carried by the wind across small or large distance. For example, ragweed (Ambrosia artemisiifolia) pollen may travel as far as 400 miles and as high as 2 miles in the air. Airborne pollens are produced in large numbers by the plant as most of the pollens are lost in transit (owing to contact with some insect, animal or human body) and do not reach their target. Pollens which directly or indirectly come in contact with human bodies are the major source of allergic reactions.

List of plants whose pollens are the source of pollen allergy:

Trees: Ash, birch, acacia, cottonwood, walnut, oak, maple, elm, cypress, box elder and hickory in the US. In India, common sources of pollen allergy in this category are Ailanthus excelsa (tree of heaven or Mahanimb), Azadirachtaindica (neem), Madhucaindica (mahua), Mimusopselengi (bakula), Morus alba (white mulberry), Eucalyptus spp, Cassia spp. and Murrayapaniculata (orange jasmine, kamini).

Grass: Bermuda grass, rye, wild oat, orchard, Sorghum (Johnson grass, fodder grass), Pennisetum

Weeds: Parthenium, Amaranthus, Argemonemexicana (prickly poppy), Prosopis juliflora (kikar), ragweed, pigweed, cocklebur, sagebrush, marsh elder and tumbleweed.

MATERIALS AND METHODS

To trap the air borne fungal spores, the following method is employed

Rotorod air sampler

Apparatus used for trapping the air borne particles or air, is known as “air sampler”.
Different kinds of samplers have been employed in various countries. Even in India aero-biologists are using different kinds of samplers for trapping the components of air spora in various parts of the country.
According to Gregory (1961), in any aerobiological work, the apparatus employed to catch the air borne particle is important as each has its own virtues and limitations. The choice of sampler depends upon its efficiency in catching the aero-spora components and also on the components that we want to investigate thoroughly.
In the present investigation the “Rotorod Sampler” method was used.

ROTOROD SAMPLER

Rotorod Sampler

DESCRIPTION:

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 device relies upon the high efficiency with which the small air borne particles are deposited on narrow oriented arms at right angles to high velocity winds. A battery operated small motor with constant speed is used to whirl sticky coated brass rotates about its axis at a constant speed. It is been developed into a cheap, portable, high efficient sampler with great sensitivity. It is well fitted for use in the field and is relatively independent of the external wind speed. In the Rotorod sampler, instead of moving spores impacting surface in current of air, the surface is rotated so that is strikes the spores. The volume of air swept can be calculated from the frontal area of the rod, the diameter through which it is turned and the number of revolution for which it is run. The sampler does not require vacuum system. It is very suitable for field sampling field and number of rods can be carried.

SAMPLING RATE:

Since the sampler was originally intended for the direct observation of under spores on rods. No mounting was necessary. The use of glycerine, gelatine or petroleum jelly has been recommended now. The Rotorod sampler has also been widely used for a wide variety of air borne particles. After setting the jelly or Vaseline, the edges of cello tape were trimmed back to the width of rods with sharp razor blade (the alternative would be to apply the transparent cello tape, trim and then coat with adhesive). The cello tape was cut into four equal parts (each of 105cm length) before the application of the adhesive. After exposure to the air, these were mounted beneath a cover glass with a suitable mounting medium like glycerine jelly.

METHOD OF SAMPLING:

The air sampler experiments were conducted by operating the Rotorod sampler in the patient's house. The Rotorod sampler was kept at variable height of 2-4 feet from the ground level. The transparent cello tape fixed on the two arms coated with white petroleum jelly acts as adhesive, which permits the particles from the air to stick on the surface of the tape. The tape was changed after each sampling. The slides were prepared as described earlier and mounting was done with the help of mounting medium.

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/m3 of air= 5*20=100/m3 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).

PROCEDURE:

The samples were collected from the patient's homes by using the Rotorod sampler.

Sample collection method	Duration of operation/ exposure
Rotorod sampler	30-45min

The sample were collected and then mounted and analysed under the microscope. Appendix contains the patient's case sheets ROTOROD AIR SAMPLER

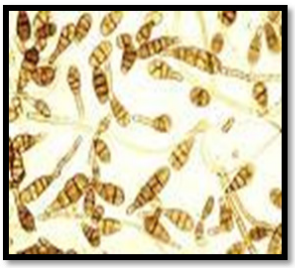
RESULTS

In the present investigation we have selected outdoor habitat for analysing the various bio aerosol concentration. Outdoor habitats have been considered as the potential harbours of allergic material. Therefore, an attempt has been made in the present investigation to find out the role of outdoor 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.
Samples were collected from ten major junctions at regular intervals from 1stApril to 30thseptember; altogether 180 samples were collected from the ten sites.
The fungal spores identified in the outdoor air at S1 to S10 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 Tetracocosporium Torula	Hyphal Fragments Plant Trichomes Insect scales Grass pollen Parthenium pollen

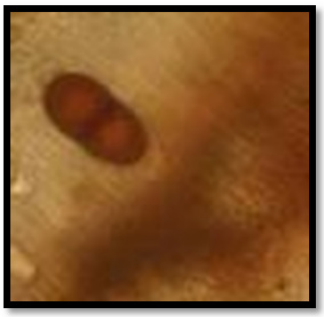
CHARACTERISTICS OF IDENTIFIED SPORE TYPES

Images of fungal spores



Alternaria

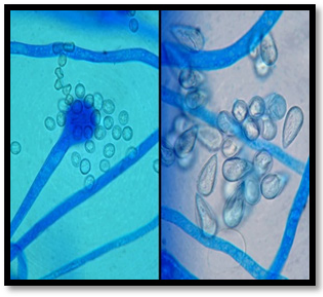
Ascospores



Bispora

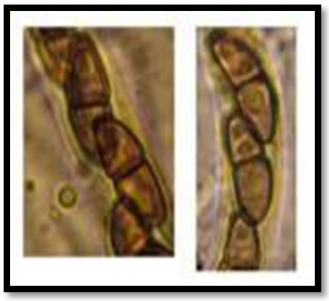
Cladosporium

Images of fungal spores

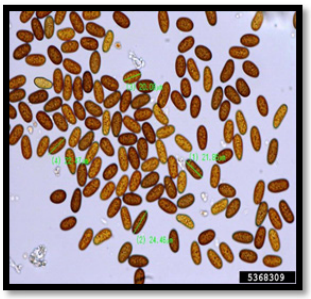


Cunninghamella

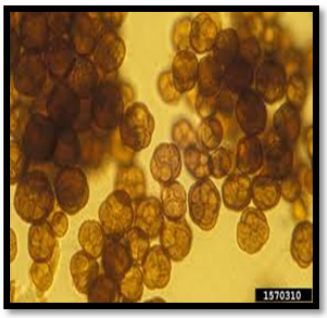
Curvularia



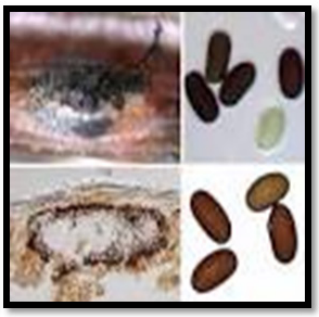
Didymosphaeria



Diplodia



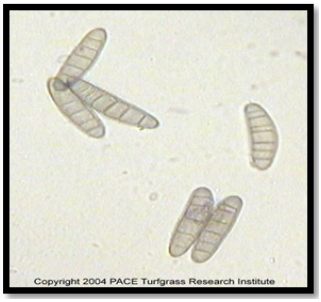
Epicccum



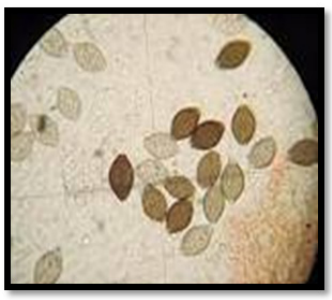
Haplosporella

Images of fungal spores

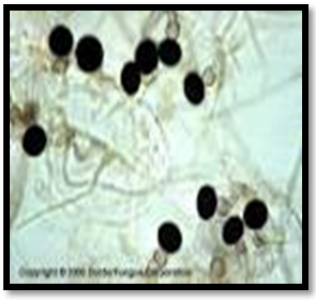
Helminthosporium



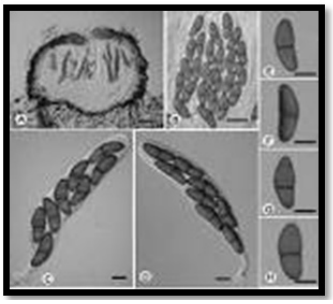
Heterosporium



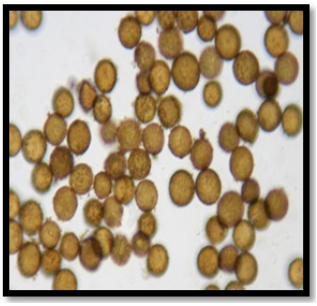
Melanospora



Nigrospora

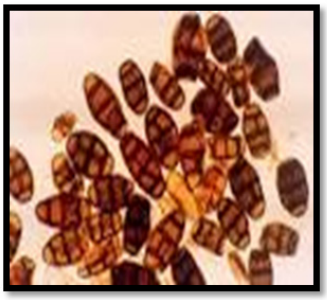


Parodiella

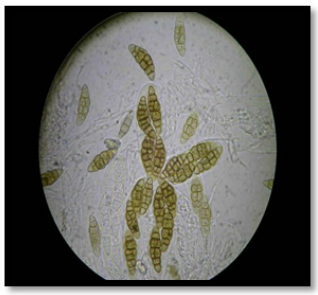


Periconia

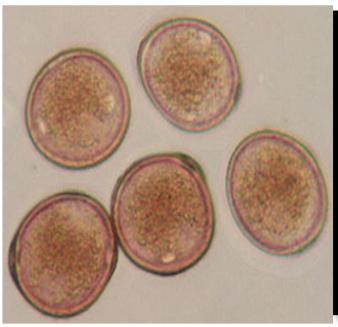
Images of fungal spores



Pithomyces



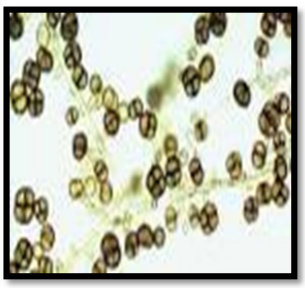
Pleospora



Rust spore

Smut spore

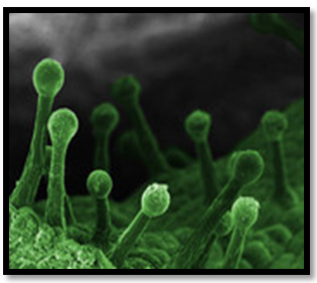
Sordaria



Tetracoccosporium

Images of fungal spores

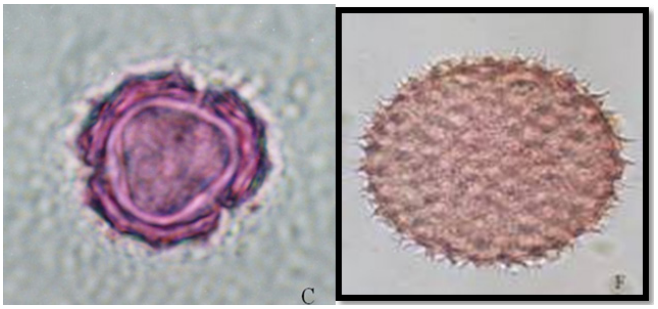
Torula



Plant trichome

Hyphal fragments

Insect scale

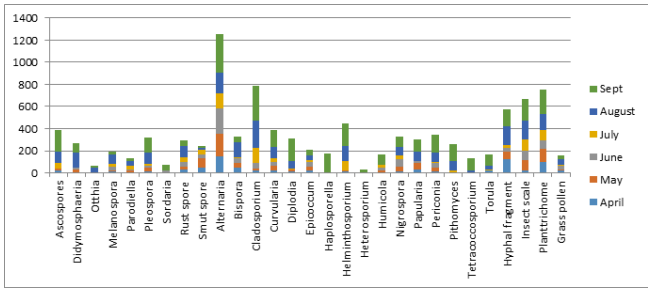


Grass pollen Parthenium pollen

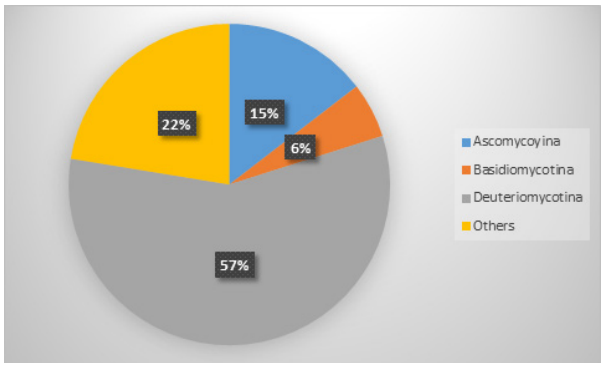
Date and time of sample collection along with weather conditions at S1

S.NO	Date of Sample col-lected	time of Sample col-lected	Tempera-ture C)	Humid-ity (%)	Rainfall	Sky condi-tion	Air con-dition
1	13-04-2014	10:40 AM	33	29%	No	Clear	Windy
2	22-04-2014	02:30 PM	32	36	No	Clear	Windy
3	10-05-2014	12:10 PM	36	20	No	Clear	Windy
4	15-05-2014	01:12 PM	38	28	No	Clear	Windy
5	20-05-2014	10:30 AM	32	32	No	Clear	Windy
6	23-05-2014	09:50 AM	29	32	No	Clear	Windy
7	10-06-2014	11:10 AM	35	26	No	Clear	Calm
8	20-06-2014	10:15 AM	31	29	No	Clear	Windy
9	24-06-2014	09:30 AM	30	36	No	Clear	Calm
10	28-06-2014	10:20 AM	33	29	No	Clear	Windy
11	03-07-2014	11:10 AM	35	35	No	Clear	Windy
12	06-07-2014	09:30 AM	30	32	No	Clear	Windy
13	13-08-2014	10:20 AM	31	43	Yes	Cloudy	Windy
14	21-08-2014	09:05 AM	28	49	Yes	Cloudy	Windy
15	26-08-2014	10:30 AM	30	61	No	Clear	Windy
16	30-08-2014	09:30 AM	31	78	Yes	Cloudy	Windy
17	12-09-2014	11:05 AM	34	65	No	Clear	Windy
18	15-09-2014	10.20 AM	32	62	No	Clear	Windy

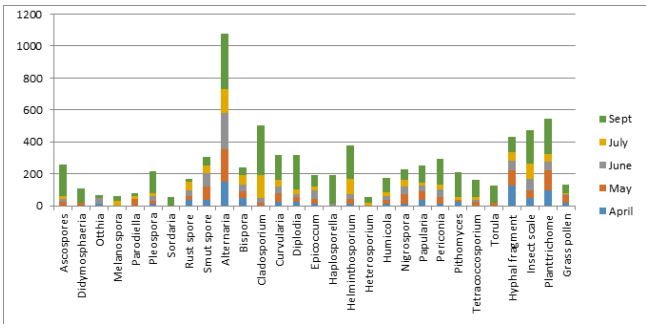
Graphical representation of fungal spore concentration in S1from April to September 2014.



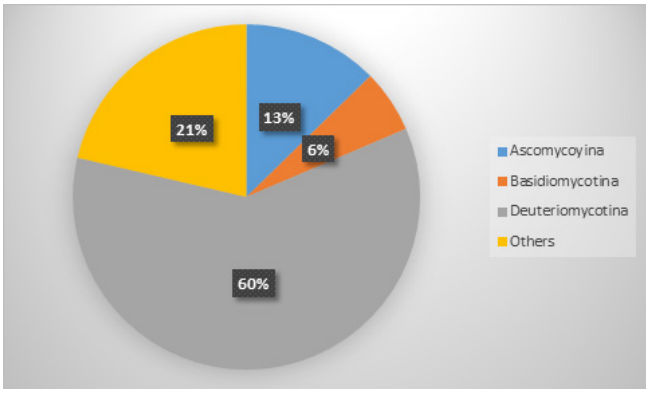
Percentage contribution of fungal and other groups at S1 from April to September 2014



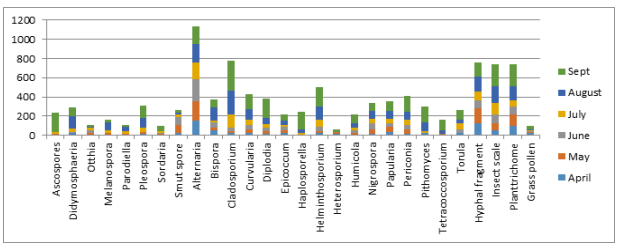
Graphical representation of fungal spore concentration in S2 from April to September 2014



Percentage contribution of fungal and other groups at S2 from April to September 2014



Graphical representation of fungal spore concentration in S3 from April to September 2014.



DISCUSSION

This study revealed that a great variety of fungal spores constitute the airborne fungal spores in the major junctions of Hyderabad. The results revealed that there is huge concentration of Alternaria, Cladosporium and Helminthosporium etc. In the present investigation there is a possibility that the increase in the concentration of bio aerosols might be causing the problem to the people dur-

ing day time. Water is usually results in continuous wetness of the soil, which might be acting like a support for the growth of fungi in outdoor environment. The fungal spores released by excessively grown fungi may get circulated in environment which might be making the people to get expose to such fungal spores. This might have resulted in skin allergy.

Maximum number of fungal genera was isolated from dilsukhnagar area which could be attributed to the accumulation of huge organic matter present. It is an established fact that the organic matter is a favourable source of nutrition for various groups of saprophytic fungi. Results of the present investigation also indicate the high concentration of Alternaria, Cladosporium and Helminthosporium etc. in the air of dilsukhnagar area.

"During a rainstorm, the pollen in your environment gets saturated and fractures, releasing small particles into the air at a much higher concentration," When patients inhale them it causes a syndrome called thunderclap asthma." The present extensive investigation conducted by selecting all major junctions in Hyderabad to find out the airborne pollen and fungal spores and other bioaerosol concentration has yielded interesting results. Results of all the sites S1 to S10 have revealed that Alternaria and Cladosporium are the dominant members in the air, which have been known as the established airborne allergens world over. Their high concentration in all the sites is a major area of concern for the citizens of Hyderabad as the sensitive individuals may suffer from allergic attacks. After these two major contributors, plant trichomes and hyphal fragments were dominant. Recently scientists started focussing on the allergy caused by hyphal fragments which have been hitherto conveniently ignored as non-entities in causing allergy, for many years. The contribution of other airborne spores, hyphae and fungal fragments to exposure and allergic sensitization are poorly characterized. However, there is an increased interest in the role of aerosolized fungal fragments following reports that the combination of hyphal fragments and spore counts improve the association with asthma severity (Green et al., 2006). In a very recent study Samir et al., (2014) have demonstrated conclusively that fungal hyphae and hyphal fragments cause allergic rhinitis as aeroallergens, by using a novel immunostaining technique. They concluded that fungal hyphae and fragments are underestimated sources of aeroallergens. 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.

CONCLUSION

There is a huge variation in predominance of allergens from region to region in allergic disorders with the fact that there are topographical variations in nature. In our present study air samples were obtained by using Rotorod sampler. Alternaria and Cladosporiumwas the most dominant spore types trapped in the air of the major junction of Hyderabad, Outdoor fungal concentrations were highest in Mahatma Gandhi bus stand, Charminar, Uppal, Dilsukhnagarwhile the lowest value was detected in kukatpally. From April to June, Cladosporium spp. was predominant, in July,Cladosporium and Alternaria were equally predominant, and in August and September Alternaria spp. was predominant. Which are known and established allergens among fungal group which are also associated with skin allergy, Sinusitis and allergic Rhinitis.

REFERENCES

1. Adhikari. A; Bhattacharya, S; and Chanda, S. 1996. Aerobiology and allergenicity of indoor fungal spores in Calcutta during summer months. Indian journal of Allergy and applied Immunology, 10: 11-19.
2. Ahmed; Razzak. 2013. Study on the Airborne Allergens in Hyderabad city and their role in inciting allergy. B.Tech Project thesis,JNTU Hyderabad.
3. Agashe S.N. 2006. Palynology and its applications – oxford & IBH Pub. Co. NewDelhi.
4. Aliya Asif Ali. 2007 Aeromycoflora of Vegetable Market. B.Tech Project thesis. JNTU Hyderabad..,pp 38.
5. Bandyopadhyay. N.N. and Kathuria, S. 1989. Studied in pollen allergy in Patna 1. Floristic and pollination survey. Jour. Of palynology, 25:81-87.
6. Baruah. A.K. and Chettia, M. 1966. Aerospora and allergic human deseases : A study of certain fungal spores and pollen grains of Gauhati. Ind. J. Exp. Biol. 4: 236- 238.
7. Baruah, H.K. 1961. Airspora of a cowshed. J.Gen.Microbil. 25:483-491
8. Bhattachary. K., Mandal, S. and Chanda, S. 1981. Incidence of allergic pollen in the atmosphere of West Bengal. Proc. Nat. Conf. Env. Bio. 93-96.
9. Boehm. G, Leuschner. R M. 1986.International Conference on Aerobiology (3rd: 1986: Basel, Switzerland).
10. Boehm. G, Leuschner. R.M. 1987, English, Conference Proceedings edition: Advances in aerobiology: proceedings of the 3rd International Conference on Aerobiology, August 6-9, 1986, Basel, Switzerland.
11. Bora. K. N. and Baruah, H.K. 1980. A study of atmospheric pollen grains of Gauhati. Advances in pollen spore research; 2: 92- 96.
12. Bradbury. J.P. and Waddington, J.C.B. 1973. The impact of European settlement on Shagawa Lake, northeastern Minnesota, U.S.A. pp 289- 308 IN: H.J.B. Birks and R.G. West, eds. Quaternary plant ecology Juhn Wiley and Sons, New York.
13. Burhansen and AhmetAsan. 2001. Airborne fungi in vegetable growing areas of Edime. Turkey. Aerobiologia, 17; 69-75.
14. Cadman. A. 1991.Airspora of Johannesburg and Pretoria, South Africa, 1987/88.I1Meteorological relationships. - Grana 30:181-183
15. Chakrabarthi, H.S., Das, S. and Gupta-Bhattacharya, S. 2012. Outdoor airborne fungal spora load in a suburb of Kolkata, India: Its variation, meteorological determinant and health impact. Int. J Environ Health Res. 22:37-50
16. Christine. A. Rogers.2003. Indoor fungal exposure. Immunology and Allergy Clinics of North America, 23: 501 – 508.
17. Cunningham. D.D. 1873. Microscopic examination of air. Govt. printer, Calcutta, pp.58.
18. Davis. O.K., Kolva, D.A., and Mehringer, P.J., Jr. 1977. Pollen analysis of Wildcat Lake, Whitman County, Washington: The last 1000 years. Northwest Science 51(1): 13-30.
19. Deepthy 2013. Isolation and Identification of Microalgae and Cyanobacteria from various habitats.. M.Tech Project thesisJNTU Hyderabad.
20. Deadoss. H. K. P., V. Anand Gideon and T. Pankajavalli 1997. Pollen survey from suburbs of Madras, In Aerobiology (Ed.S.N.Agashe) 39-48.
21. Deshpande. S. U, and Chitaley, S. D. 1976. Pollen calendar of Nagpur. India. Rev. Paleeobit. Palyno. 21: 253-262.
22. Deshpande. S. U, and Chitaley, S. D. 1977. Airspora of Nagpur in relation to allergy; Proc. 4th Int. Palyno. Conf. Lucknow. P. 33-34.

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