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A study of bioallergens in selected areas of Visakhapatam

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ABSTRACT - The air consists of several bioallergens like spores of bacteria, fungi, organic dust and pollen grains which can cause severe allergic reactions in humans. To estimate the bioallergens, a study of air micro flora was conducted in different locations in Visakhapatnam. The fungal density in the air varied from $0.9x10^1$ to $4.3 x10^3$. In the present study twenty two fungal species were reported. The most common fungi identified were *Aspergillus, Cladosporium, Alternaria, Penicillum, Curvularia, Mucor* and *Rhizopus*. *Aspergillus* strains were present in alarming levels followed by *Cladosporium*, *Alternaria* and *Curvularia*. Fungal spores are known to be potential aeroallergen and could well be a health hazard to all people traveling regularly in these areas.

Key words - Bioallergens, Air, Fungi, Health hazard

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The air consists of many bioparticles of different origin like solid impurities from human activities, terrestrial, pollen from flowers and spores of fungi from soil, water and air. Various plants and animal diseases are important source for fungal spores. These spores are liberated into air, cause a potential risk of allergy. Hence the concentrations of the spores are to be known. Hyde and Williams discussed the population of fungal spore in the atmosphere of United Kingdom. Meteorological variations affecting the circulation of fungal spores and the correlation of the observations with particle size was assessed by Ludlam. The significance of fungal spores in the air, in relation to allergy was studied by Sandhu *et al.* Saadabi studied the presence of toxigenic fungi in the air, risk for human health and urgent recommendation for management decisions. The study of airborne fungal spores is essential to overcome life threatening problems. The identification of fungal types and their relative health effects need to be known. There are no such standards that specify acceptable and allowable fungal spores in air either by government or by industry. In Visakhapatnam, there is no such documented information regarding fungal population and their abundance in different areas. The study was undertaken to assess bioallergens in selected areas of Visakhapatnam.

EXPERIMENTAL METHODOLOGY

The study was conducted at the department of Biotechnology, GITAM Institute of Technology, GITAM University, Visakhapatnam.

Study area:

Visakhapatnam consists of two sewage treatment plants where the wastes from different localities are collected and undergo treatment before releasing into the sea. These two places are directly exposed to climatic hazards. Very close to these places many residential areas with high population making a possible drift of fungal spores causing health allergy.

Sampling of fungal spores:

A study was undertaken from August-December 2011 to determine fungal spores in two different sewage treatment plants of Visakhapatnam. From each treatment plant location five areas were selected which are 4 meters away from each other. At each location 10 petri plates containing Sabouraud

agar media were exposed to air for 5 minutes at a height of 0.2 meters from ground. Samples were collected once in a week for a month at early morning (6 a.m to 7 a.m) as the process of treatment starts at that time. After samples are collected these plates are placed in sterile air tight containers and brought to the laboratory. These plates are placed in an incubator and incubated at 25^{0}C for five days. After incubation the plates were taken out and a small mycelium was taken out and made into pure cultures on Potato Dextrose Agar (PDA). Then, these cultures are examined under the compound microscope and identified using fungal keys provided by Domsch *et al.,* Singh *et al.* and Quimio.

EXPERIMENTAL FINDINGS AND ANALYSIS

The results obtained from the survey conducted in each location are given in Table 1 and 2. A total of twenty two species of seventeen genera were isolated. From first location the abundance of fungi found were *Aspergillus flavus, Aspergillus niger, Aspergillus parasiticus, Cladosporium cladosporioides* and in second location along with these species *Penicillium* sp was also shown high occurrence. The other species which shown moderate occurrence *Alternaria alternate, Alternaria solani, Aspergillus candidus, Curvularia affinis, Fusarium moniliforme, Fusarium oxysporum, Trichoderma* sp., Yeast cells. Where as *Botrytis* sp., *Cephalosporium* sp., *Cercospora* sp., *Helminthosporium* sp., *Mortierella zonata, Rhizopus oryzae, Stachybotrys* sp. and *Verticillium* sp. are fewer occurrences. It is clearly indicated from two tables that the abundance of fungi decreased with the increase of distance. During the treatment of waste water high release of fungi was observed and some of the air borne fungi which shows high colony forming units are shown in Table 3. Wind velocity which flow into the city through treatment plant can cause allergic reactions to the people who travel in those area. Some of the fungi like *Cladosporium* cause allergic disease reported by Sen and Asan. In our study these fungal species were observed in both locations and in different distances. Menezes *et al.* reported that *Alternaria* showed positive skin tests in human. This species were found in moderate occurrence in L_1 and L_2. Agrios assessed aflatoxin produced by *Aspergillus flavus* cause aminotoxicity in human. High occurrence of the species was found in L_1 and L_2. Spores of *Alternaria, Penicillium* and *Cladosporium* play a significant role in causing allergic asthma (Suerdem *et al.*). In our survey these species are showing moderate to high occurrence. According to Lacey *et al. Rhizopus* can cause organic dust syndrome (ODTS). In the present study spores of *Rhizopus* are abundantly found in

Table 1 : Shows relative abundance of bioallergens in location: 1 of Visakhapatnam

Sr. No.	Species	Location-1 (L1)				
		4M	8M	12M	16M	20M
1.	*Alternaria alternate*	++	+	+	+	-
2.	*Alternaria solani*	++	++	++	+	+
3.	*Aspergillus candidus*	++	+	-	-	-
4.	*Aspergillus flavus*	+++	+++	+++	++	++
5.	*Aspergillus niger*	+++	+++	++	+	+
6.	*Aspergillus parasiticus*	+++	+++	+++	++	+
7.	*Botrytis* sp.	+	+	+	-	-
8.	*Cephalosporium* sp.	+	+	-	-	-
9.	*Cercospora* sp.	+	+	-	-	-
10.	*Cladosporium cladosporioides*	+++	++	++	+	-
11.	*Curvularia affinis*	++	+	+	-	-
12.	*Fusarium moniliforme*	++	++	+	+	-
13.	*Fusarium oxysporum*	++	+	+	+	-
14.	*Helminthosporium* sp.	+	+	-	-	-
15.	*Mortierella zonata*	+	+	-	-	-
16.	*Mucor microsporus*	++	++	+	+	-
17.	*Penicillium* sp.	++	++	+	+	-
18.	*Rhizopus oryzae*	+	+	+	-	-
19.	*Stachybotrys* sp.	+	+	-	-	-
20.	*Trichoderma* sp.	++	+	+	-	-
21.	*Verticillium* sp.	+	+	-	-	-
22.	*Yeast Cells*	++	++	+	+	-

Table 2 : Shows relative abundance of bioallergens in location: 2 of Visakhapatnam

Sr. No.	Species	Location-2 (L_2)				
		4M	8M	12M	16M	20M
1.	*Alternaria alternate*	++	+	+	+	+
2.	*Alternaria solani*	++	++	++	+	+
3.	*Aspergillus candidus*	++	++	+	-	-
4.	*Aspergillus flavus*	+++	+++	+++	++	++
5.	*Aspergillus niger*	+++	+++	++	+	+
6.	*Aspergillus parasiticus*	+++	+++	+++	++	+
7.	*Botrytis* sp	++	+	+	-	-
8.	*Cephalosporium* sp	++	+	-	-	-
9.	*Cercospora* sp	++	+	-	-	-
10.	*Cladosporium cladosporioides*	+++	++	++	+	+
11.	*Curvularia affinis*	++	+	+	-	-
12.	*Fusarium moniliforme*	++	++	+	+	+
13.	*Fusarium oxysporum*	++	+	+	+	-
14.	*Helminthosporium* sp	+	+	+	-	-
15.	*Mortierella zonata*	+	+	+	-	-
16.	*Mucor microsporus*	++	++	+	+	-
17.	*Penicillium* sp	+++	++	+	+	+
18.	*Rhizopus oryzae*	++	++	+	+	-
19.	*Stachybotrys* sp	-	-	-	-	-
20.	*Trichoderma* sp	++	+	+	-	-
21.	*Verticillium* sp	+	+	+	-	-
22.	*Yeast Cells*	++	++	+	+	+

+++= High occurrence (more than 65% of total samples), ++=Moderate occurrence (35-65%), +=Low occurrence(less than 35%), - =NIL
4M=4 meter, 8M=8 meter, 12M=12 meter, 16M=16 meter, 20M=20meter

Table 3 : Colony forming units

Sr. No.	Species	Location 1	Location 2
1.	*Alternaria*	$1.6x10^1$	$1.2x10^2$
2.	*Aspergillus*	$3.3x10^3$	$4.2x10^3$
3.	*Cladosporium cladosporioides*	$1.7x10^1$	$2.6x10^1$
4.	*Curvularia affinis*	$0.9x10^1$	$1.3x10^1$
5.	*Fusarium*	$1.3x10^1$	$1.9x10^1$
6.	*Mucor microsporus*	$1.2x10^1$	$1.9x10^1$
7.	*Penicillium* sp	$1.1x10^1$	$1.8x10^1$
8.	*Rhizopus oryzae*	$1.4x10^1$	$1.6x10^1$

two locations.

The present study was undertaken to assess the bioallergens in air near sewage treatment plant area. Further studies are required to correlate with seasonal variation of bioallergens with increase in population and its risk health hazards. Climatic parameters like temperature, humidity and its effect on airborne fungi also are concerned.

Conclusion:

– Predominate fungi in the air of selected area of Visakhapatnam were: *Alternaria, Aspergillus, Cladosporium, Penicillium* and *Rhizopus.*

– To protect from dust allergen recognition of bioallergens hazard is necessary.

– A study throughout year and variation among seasons indicates the level of bioload people are exposed to.

– Threshold limit value (TLV) in each area could be a guideline to control health hazards due to bioallergens.

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