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PRELIMINARY STUDY OF AIRBORN MICROBIOTA IN SOME AREAS OF AMARAVATI CITY

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ABSTRACT: The microorganisms are ubiquitous in our environment and have special impact on the whole biosphere. The impact of diversity of airborne micro biota varies from causing diseases in human, other animals and plants. Air act as a good dispersal medium for microbiota and are sensitive indicators of environmental quality. Therefore, a preliminary investigation of air borne microbiota was undertaken in some areas of Amravati city, a fifth most populous city of Maharashtra, India. The study was done twice a month, in triplicate for three months (August –October, 2016), in six selected areas- Bajarang Tekadi, Bhuteshwar, Amba Devi Temple, Rajkamal Square, Bus Station and Rajapeth. The result revealed 11 fungal and 8 bacterial isolates from the study area. Three fungal species *Aspergillus flavus* and *Aspergillus niger* and *Fusarium spp*. were found to be common species in all the areas. *Bacillus spp*. and *Escherichia coli* were noted as dominant bacterial isolates. The results showed maximum fungal population in Rajapeth(9) followed by Amba Devi(8) temple area. The highest bacterial isolates were recorded from Bajarang Tekadi(7) and Bhuteshwar areas(6). The diversity of aeromicrobiota recorded in this preliminary investigation indicate lower degree of cleanliness and potential threat to health and wellbeing of the people in these areas. Data generated underlines the usefulness of continuous monitoring of aerobilogical status of the city for clean and healthy environment.

KEYWORDS: Aerobiology, Bacteria, fungi, city localities, air sample

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1. INTRODUCTION

Aerobiology studies organic particles, such as bacteria, fungal spores, very small insects, pollen grains and viruses, which are passively transported by the air (Spieksma, 1991). The microorganisms are ubiquitous in our environment and have special impact on the whole biosphere. They influence the man in different ways. The diversity of microbial activities varies from causing diseases in human, other animals and plants. Microorganisms are sensitive indicators of environmental quality. Air acts as a very good dispersal medium for microbiota. Physical and chemical factors like sunlight, temperature, humidity, various gases, suspension of organic and inorganic material, affect the distribution and occurrence of the microbiota in the air. In addition, human activities also determine the diversity of microbes in an area (Kumari et al., 2011). In view of increasing environmental pollution of the cities, the surveys of the air borne microbiota in the cities have assumed great significance. The alarming increase in allergic disorders and bacterial infections, such as allergic rhinitis, bronchial asthma, sinusitis, atopic dermatitis, and gastro intestinal disorders covering as high as 30 % of the population world over, created an increasing interest in the presence and movement of bioparticulate matter in the earth's atmosphere and their impact on human health. The bioparticulates implicated to cause allergic symptoms are pollen grains, fungal spores, bacteria, insect debris, house dust mites, animal dander, chemicals and foods, etc. Among all these agents, pollen grains, fungal spores and bacteria are the most predominant allergens in the air. Bacterial pathogens leads to diseases like skin diseases, respiratory sinusitis, dysentery, typhoid and food poisoning (Khan, et al.,2015). Airborne surveys for fungi have been reported from different parts of the world and India. Makut, et al., 2014 and Ekhaise, et al., 2011 reported indoor and outdoor microbiological air quality in some Nigerian cities. They reported that *Staphylococcus aureus, S. epidermidis, Micrococus sp* and *Bacillus sp*. were the most frequently occurring airborne bacterial isolates, while they reported *Aspergillus niger, A. flavus, Mucor sp.* and *Botryodiplodia acerina* as frequently occurring airborne fungal isolates. Dominant genera reported from Vishakhapatnam and Tirupati are *Cladosporium, Aspergillus, Nigrospora, Alternaria, Curvularia, basidiospores, ascospores, Helminthosporium* and *Periconia* (Reddy and Shrinivas, 2012; Bavaji, et al, 2012). Studies from Bikaner (Arora and Jain,2005); Kolkata (Bhaskar, 2007); Gorakhpur (Kumari, et al.,2011) reported *Cladosporium spp, Epicoccum Cladosporium, Alternaria, Aspergillus, Penicillium, Curvularia, Helminthosporium, Aureobasidium, Neurospora, Mucor* and *Nigrospora* as the major aeroflora. In Maharashtra state as well, many workers reported common genera at Nagpur, Mumbai and Osmanabad (Kakade et al., 2001; Potti, 2007 and Jadhav et al., 2010). Aeromycology constitutes the major bulk of aerobiological investigations, however it is noteworthy that among the microorganisms present in the atmosphere, bacteria are often the highest in number (Mouli, et al, 2005). Thus, for the effective

diagnosis and therapeutic management of the ailments caused by air born microbiota, a detailed information on the diversity of various bioparticles is essential. No survey of airborne microbiota of the localities has been attempted in Amravati till now. Therefore, an attempt has been made to make a preliminary study of aerobiology in different localities of Amravati city – Bajarang Tekadi, Bhuteshwar, Amba Devi Temple, Rajkamal Square, Bus Station and Rajapeth Square (vegetable market area).

2. MATERIALS AND METHODS

STUDY AREA: Amravati is the 5th most populous metropolitan city in Maharashtra, India. Amravati is located at 20°56′N 77°45′E20.93°N 77.75°E. It has an average elevation of 343 meters. It lies 156 km west of Nagpur. Samples were collected from slum areas (Bajarang Tekadi, Bhuteshwar), temple area (Amba Devi), traffic area (Rajkamal Square and Bus Station) and vegetable market area (Rajapeth) in the city of Amravati due to heavy population residing and representing different environmental conditions. This study would help to evaluate and compare the actual status of air quality in different areas of the city.

AIR SAMPLING: Aerobiological investigations were carried out for three months i.e., August to October, 2016. Comparative account of diversity of air borne microbiota is considered over here. For present study, the air samples were collected with the help of the Air Petri Sampling system (Make-Himedia,Model-LA030) on different media plates. The culture plate exposure method was adopted for trapping the microbiota. Potato Dextrose Agar (PDA), Nutrient Agar (NA), Mac-Conkey Agar (MA) (HI-MEDIA) were used as cultural medium. 10-15 ml of sterilized PDA, NA and MA medium were aseptically poured in petri plates and allowed to solidify. These petri plates were then exposed in triplicates for 10-15 minutes at 1 meter above the ground level at the selected sites. The study was conducted in the intervals of 15 days in every month. The time was fixed for sampling i.e., 4.00P.M. - 6.00 P.M. The exposed petri plates were brought to the laboratory and incubated for two days at 37ºC. After incubation fungal and bacterial colonies were counted, isolated and identified. Fungal and bacterial colonies were initially characterized by cultural, morphological and microscopic examinations. For species identification bacterial culture was stained by Gram's staining method. Fungal samples were stained with lacto phenol and cotton blue stains. Photographs of the slides were taken, identified and then classified. The results were recorded for different study areas.

3. RESULTS AND DISCUSSION

In the present study total 11 fungal and 8 bacterial isolates were recorded from the selected areas. The fungal genera observed were *Aspergillus, Cryptococcus, Candida, Fusarium, Penicillium, Rhodoturula, Sacchromyces, Scopulariopsis* and *Trichoderma.* It was revealed that *Aspergillus niger, Aspergillus flavus* and *Fusarium spp.* were common in all the studied localities, followed by *Candida* and *Scopulariopsis*. While the bacterial isolates include *Bacillus spp., Escherichia coli, Enterobacter aerogenes, Klebsiella pneumonniae, Pseudomonas aeruginosa, Salmonella typhi*, *Shigella spp.* and *Staphylococcus aureus. Bacillus spp., Escherichia coli* and *Shigella spp.* bacterial isolates were common in most areas studied. *Trichoderma spp*. and *Pseudomonas aeruginosa* were found only in, Bhuteshwar and Bajarang Tekadi areas respectively. The diversity of aero microbiota in different localities is shown in table 1.

DISCUSSION: Microbial damage in indoor/outdoor areas, is caused most frequently by molds and bacteria. In the environment they may become airborne and are therefore ubiquitous (Yassin and Almouqatea, 2010). Thus**,** in recent years, the study done in India and other countries on analysis of the number of airborne microorganisms has gained interest. The data helps to assess the quality of air at each area and can also be used to compare with each other. During the present investigation a diverse pattern of airborne microbiota was noted in different localities. The airborne micro-flora obtained matches with that obtained by Kumari, *et al.* (2011), Reddy and Shrinivas (2012) and Khan *et al.* (2015) who reported the *Aspergillus*, *Alternaria, Fusarium*as dominant fungal strains in Gorakhpur, Vishakhapattnam and Raipur. The present study revealed that *Aspergillus niger* and *Aspergillus flavus*, these two species were present in all the sampling sites posing a potential risk of Aspergillosis (Gangneux, 2004; Bhatia and Vishwakarma, 2010). *E.coli* and *Staphylococcus aureus* are used as indicator organisms, indicating the possibility of occurrence of different disease agents especially in immunocompramised persons (Yagoub and Agbash, 2010). The aerobacterial isolates reported by Makut, *et al.,* (2014) matches to that obtained in the present investigation. These microorganisms are known primary agents of food poisoning and dysentery, infections of the skin, deeper tissue and organs, pneumonia. In present investigation the trend of air quality observed for different locations in Amravati was:

Amba Devi > Rajapeth > Bus Station > Bajarang Tekadi >Bhuteshwar >Rajkamal Square.

The impact of airbornmicroflora (fungi and bacteria) includes their release, dissemination, deposition and their data is of great significance to identify, the health hazards and physical disorders in living being (Kumari, et al, 2011). The recorded microbiota has already established their allergic nature and pathogenic effects. Although, information about the aerobiological diversity variation is important for any exposure assessment (Rintala *et al.,* 2008), it is rarely available. Moreover, studies

on microbial flora in indoor and outdoor environments have mostly concentrated on viable counts of fungi (Koch *et al*., 2000; Pitkäranta *et al*. 2008), though air born bacterial load is usually quite high and data of their diversity is seldom available (Mouli *et al,* 2005).

4. CONCLUSION

The result generated in this preliminary aerobiological survey shows that all the studied localities of Amravati city have remarkably high load of microbial flora (fungi and bacteria). The predominant fungal and bacterial isolates clearly indicate the lower degree of cleanliness in the studied localities and possess a potential threat to the health and wellbeing of the population. Clean air and healthy environment is right of every citizen and more such studies are needed to attend the same.

CONFLICT OF INTEREST

The authors have no conflict of interest.

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Supplementary File

Table 1: List of fungal and bacterial isolates in different localities of Amravati city

Sr. No.	FUNGAL ISOLATES	*1	2	3	4	5	6
1	*Aspergillus fumigatus*	-.	-	√	√	-	√
2	*Apergillus flavus*	√	√	√	√	√	√
3	*Aspergillus niger*	√	√	√	√	√	√
4	*Cryptococcus spp.*	-	-	-	-	√	√
5	*Candida albicans*	√	-	√	√	-	√
6	*Fusarium spp.*	√	√	√	√	√	√
7	*Penicillium spp.*	-	-	√	-	√	√
8	*Rhodoturula spp.*	-	-	-	√	√	-
9	*Sacchromyces spp.*	-	-	√	-	-	√
10	*Scopulariopsis spp.*	-	-	√	√	√	√
11	*Trichoderma spp.*	-	√	-	-	-	-
	BACTERIAL ISOLATES						
1	*Bacillus spp.*	√	√	√	√	√	√
2	*Escherichia coli*	√	√	√	-	√	√
3	*Enterobacte raerogenes*	-	-	-	√	√	-
4	*Klebsiella pneumonniae*	√	√	-	-	-	-
5	*Pseudomonas aeruginosa*	√	-	-	-	-	-
6	*Salmonella typhi*	√	√	-	-	√	-
7	*Shigella spp.*	√	√	√	√	-	√
8	*Staphylococcus aureus*	√	√	√	-	-	√

*1.Bajrang Tekadi, 2. Bhuteshwar, 3.Amba Devi Temple,

4. Rajkamal Square, 5.Bus Station, 6. Rajapeth Square