



Aero-mycoflora of National Highways in Andhra Pradesh, India

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ABSTRACT: National highways or roads were most frequently polluted areas in the world. Burning of petroleum products in vehicles releases green house gases like CO₂, CO, NO₂, SO₂, CFC, particulate matter; in which Fungal spores constitute a significant fraction of bio-aerosol. Among the different microorganisms in bio-aerosol, fungal spores are larger in concentration. A survey was undertaken during 2012-2015 to evaluate the airborne fungi in the indoor environment of the Andhra Loyola College, Library and Intermediate block and outdoor environment of National Highways-5 (NH-5) across Vijayawada, Andhra Pradesh, India. The trapping of fungal spores was done using plate exposure method. More number of microbial and fungal colonies was observed in Ramavarappadu Ring Road, NH-5 when compared to NTR University, Benz Circle. Most frequently observed fungal spores on national highways are *Aspergillus niger*, *A. flavus*, *A. fumigatus*, *A. awamorii*, *Alternaria alternata*, *Chaetomium globosum*, *Pencillium* sp and *Rhizopus stolanifer*. For the first time Aero-mycoflora of National Highways was studied in India.

Key words: Aeromycoflora, National Highways, *Aspergillus*, *Pencillium*, India

INTRODUCTION

Seasonal variations affect aeromycoflora of the different areas. Fungal spores are not equally distributed in the environment. The concentration of fungal spores in the air is linked to geographical regions, seasonal variations and atmospheric conditions (Keressies 1993). Airborne microfungal propagules are found in large numbers in indoor and outdoor environments which are widely distributed in nature. Some of the fungal spores have potentiality to cause allergies, spoilage of foods and many other adverse health effects, namely, bronchial asthma, allergic rhinitis and atopic dermatitis (Burge and Rogers 2000, Terui *et al.*, 2000, Akiyama *et al.*, 2001). About 10% of the Indian population suffers from one or other type of allergic disorders (Channy and Verma 1994).

Hospital in Nigeria, Fruit Market – Kano, Nigeria, although date fruits (*Phoenix dactylifera*, Linn.) form a vital component of diet in Arabian Peninsula especially Saudi Arabia, they are as well being consumed in many countries of the world, Nigeria inclusive (Redmond, 2009).

A systematic quantification of the indoor fungal flora of the Shyambazar Metro-Railway Station, Kolkata was carried out for a period of four months beginning from March to June, 2007. The aim of this study was to determine the fungal flora, their identification, concentration and diversity in the metro-railway station. The environment may possess both beneficial and harmful fungal flora. In the case of beneficial fungi, they could be cultured in laboratories and could be used for producing valuable substances. On the other hand, in the case of harmful fungi, their effects could be studied more critically.

Thus, precautions could be taken, their bio-control may be done and ultimately there will be more awareness of these particular contaminants. To the best of our knowledge, this is the first report regarding the identification of fungal population in a metro-railway station (Ghosh *et al.*, 2011).

National highways in New capital of Andhra Pradesh i.e. Vijayawada, is NH 5, 7, 9 and 221. National highway 5 is a major national highway in India that runs along India's east coast through the state of Odisha, Andhra Pradesh and Tamilnadu. National highway 9 is 181 km long and a major national highway in central India, stretching 841km from Pune in Maharashtra through the states of Karnataka and Telangana to machilipatnam in Andhra Pradesh. National highway 221 is a national highway connects Vijayawada in Andhra and Jagdalpur in Chhattisgarh. The total length of this highway is 329km. It starts at the junction of NH9 at Vijayawada and ends at the junction of NH16 at Jagdalpur. In the present study a survey was conducted from 2013 to 2015 in two important areas of Vijayawada i.e. Ramavarappadu and Benz circle. Ramavarappadu is one of the busiest ring roads in Vijayawada situated on national highway 5 in the out skirts of the city. Benz circle is one of the busiest chowks and a prominent land mark located on Bandar Road in the Indian city of Vijayawada, two highways NH5 and NH9 intersect at this junction. On an average of 57000 vehicles crossing daily.

MATERIALS AND METHODS

A. Selection of study sites

The sites selected for the present study was the ALC Library, Intermediate wing, National highway of Ramavarappadu ring road, Benz circle, NTR University in Vijayawada, Andhra Pradesh, India. The micro flora studies of this particular place have never been reported. So, information about the airborne sample in the specific places is largely lacking. Although the environment of the ALC Library and Intermediate block is more or less equivalent to a natural outdoor environment.

B. Isolation of fungi

Sampling of fungal spores was done with the help of gravity Petriplate method containing Potato Dextrose Agar (PDA) medium. The Petri dishes were taken to the selected site like ALC Library, Intermediate block, and National highways of selected sites like Ramavarappadu ring road, Benz circle, NTR University. The samples were collected at three months intervals between January 2012 to March 2015. Samples were taken

in the busy hours like 8.30 to 10:30 am. 12:30 to 1:30 pm and 4:30 to 7:30 pm. Five Petri dishes were exposed to the air for 10 min and brought to the laboratory. The Petri plates containing the samples were incubated for 3 to 7 days in BOD incubator. The percentage frequency and percentage contribution of the total fungal flora were assessed (Jadhav and Tiwari 1994).

% frequency = (No of observations in which a species appeared/ total no of observations) X 100

% Contribution = Total No of colonies of species in all observations taken together/Total no of colonies in all the species X 100

C. Identification of fungal strains

The colonial features of the fungal colonies were studied as well as the morphological features of the fungi were studied using compound microscope. The determination of the morphological structures of fungi was carried out after being mounted in lactophenol and cotton blue covered with cover slip. The fungal types were analyzed for each day. The species were identified on the basis of micro and macro morphology; and reverse and surface coloration of colonies grown on the PDA media. The fungi were identified up to genus level and in some cases up to species level (Cooke 1963).

RESULT AND DISCUSSION

The present study was aimed at determining the fungal flora, their identification, concentration and diversity on the National highways. National highway like Ramavarappadu ring road, Benz circle, NTR University in Vijayawada, Andhra Pradesh, India has good number of aeromycoflora fungi. The dominance of *A. niger*, *A. flavus*, *Penicillium*, *Alternaria* had been found through this investigation (Plate I Figure C – F). Generally, fungal count is high in outer polluted environments but in our study, the high number of colony forming fungi in the study area was due to lack of efficient maintenance probably. The high percentage frequency and %contribution in Ramavarapadu ring road was shown by *Epicocum*, *Pencillum* sp *Rhizopus stolanifer* *A. niger*. The high % frequency and % contribution near Ntr Universty road was shown by *Pencillum* sp *Rhizopus* sp, *R. stolanifer*, *A. fumigates*, and *Aspergillus* sp. The high percentage frequency and %contribution in Benz Circle was shown by *P. notatum* and *Pencillum* sp (Table 1).

Table 1: Occurrence of mycoflora in National highways of Andhra Pradesh.

S.No	Name of Fungi	Ramavarappadu Ring Road		NTR University		Benz Circle		Total	
		A	B	A	B	A	B	A	B
1	<i>Alternaria alternata</i>	5	4.8	8	5.4	10	6.8	23	5.7
2	<i>Alternaria sp.</i>	6	5.7	10	6.8	8	5.4	24	6.0
3	<i>Aspergillus awamori</i>	6	5.7	8	5.4	12	8.1	26	6.5
4	<i>A. flavus</i>	5	4.8	10	6.8	6	4.8	21	5.2
5	<i>A. fumigatus</i>	8	7.6	12	8.2	10	6.8	30	7.5
6	<i>A. nigar</i>	10	9.6	10	6.8	8	5.4	26	6.5
7	<i>Aspergillus sp</i>	8	7.6	14	9.5	12	8.1	34	8.5
8	<i>Chaetomium globosum</i>	6	5.7	8	5.4	8	5.4	22	5.5
9	<i>Chaetomium sp</i>	6	5.7	10	6.8	10	6.8	26	6.5
10	<i>Epicocum</i>	10	9.6	8	5.4	12	8.1	30	7.5
11	<i>Pencillium notatum</i>	8	7.6	10	6.8	14	9.5	32	8.0
12	<i>Pencillum sp</i>	10	9.6	12	8.2	15	10.2	37	9.3
13	<i>Rhizopus stolanifer</i>	10	9.6	14	9.5	12	8.1	36	9.0
14	<i>Rhizopus sp</i>	8	7.6	12	8.2	10	6.8	30	7.5

A= % of frequency, B= % of contribution

The percentage of some airborne fungal viability is higher concentration. it was found that *Aspergillus flavus*, *Aspergillus fumigatus*, *Alternaria alternata*, *Cladosporium*, *Curvularia pallescens* demonstrated greater than 60% positive reactions in skin prick tests in many experimental cases so in the present study also the *Aspergillus flavus*, *Aspergillus fumigatus*, *Alternaria alternata* was observed in study area. The aeromycoflora study of ALC was shown some positive results of

occurrence of fungal spores. The high percentage frequency and % contribution in Degree Library was shown by *A. niger* and *Aspergillus sp*. The high percentage frequency and % contribution in inter block was shown by *A. flavus* and *Aspergillus sp*. The high percentage frequency and % contribution in P.G. block was shown by *Epicocum*, and *Pencillum sp* (Table 2). In present study area different bacterial colonies was observed (Table 3 Plate I Fig. A, B).

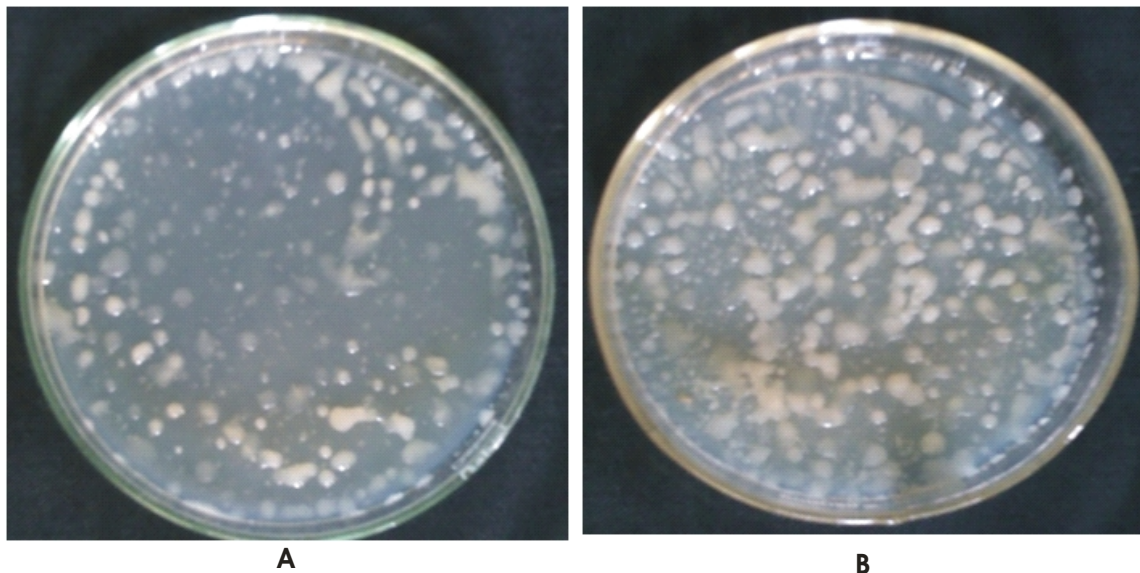


Plate I. A. Bacterial colonies of Benz Circle, B: Bacterial colonies of Inter block.

There were many reports for the aflatoxin production in the *Aspergillus spp.* (Bennett and Goldblatt 1973, Hesseltine *et al.*, 1970; Schroeder

1966). In the present paper different aflatoxin producing fungi like *Aspergillus sps* was observed. So the negligence of proper cleaning and

maintenance of this site became a good source of the deteriorative and detrimental effect of the mould which may cause a potential health hazard. Certain corrective measures, strict maintenance or precautions which can reduce their frequency of occurrence include installation of exhaust fan to

remove spores from the indoor environment before they get a chance to settle; air filtration; good ventilation; use of vacuum cleaner to remove dust; air conditioning machines and more frequent cleaning and preventive processes.

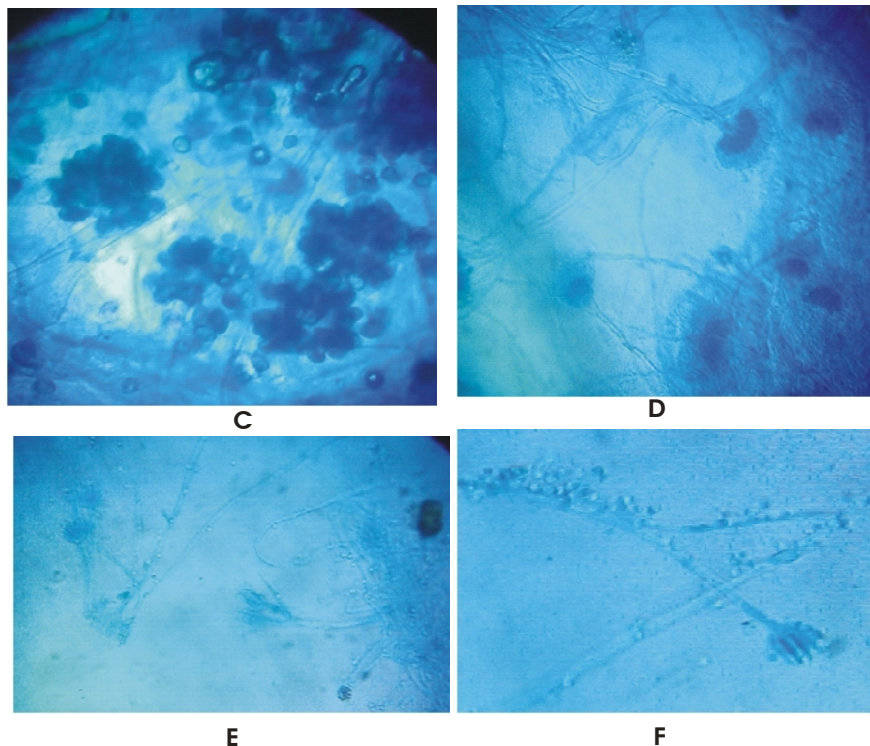


Plate I. C. Microscopic view of *Aspergillus niger*, D. Microscopic view of *Aspergillus flavus*, E Microscopic view of *Penicillium notatum*, F. Microscopic view of *Penicillium* sp.

Table 2: Occurrence of mycoflora in Andhra Loyola college of Andhra Pradesh.

S.No	Name of the fungi	Degree Library		Inter block		P.G. Block		Total	
		A	B	A	B	A	B	A	B
1.	<i>Alternaria alternata</i>	5	5.2	8	8.2	6	5.8	19	6.2
2.	<i>Alternaria</i> sp	8	8.4	10	10.3	8	7.8	26	8.5
3.	<i>Aspergillus awamori</i>	10	10.5	8	8.2	12	11.7	30	9.8
4.	<i>A. flavus</i>	12	12.6	12	12.3	10	9.8	34	11.1
5.	<i>A. nigar</i>	14	14.7	10	10.3	8	7.8	32	10.5
6.	<i>Aspergillus</i> sp	15	15.7	14	14.4	10	9.8	39	12.8
7.	<i>Epicocum</i> sp	8	8.4	9	9.2	14	13.7	31	10.1
8.	<i>Penicillium notatum</i>	10	10.5	6	6.1	12	11.7	38	12.5
9.	<i>Penicillium</i> sp	5	5.2	10	10.3	14	13.7	29	9.5
10.	<i>Rhizopus stolonifer</i>	8	8.4	10	10.3	8	7.8	26	8.5

A= % of frequency, B= % of contribution

Table 3: Occurrence of bacteria in National highways and Andhra Loyola college of Andhra Pradesh.

S. No	Location	Bacterial Colonies Observed
1.	LIBRARY	155
2.	INTERMEDIATE BLOCK	144
3.	RAMAVARAPPADU RING ROAD	250
4.	NTR UNIVERSITY	125
5.	BENZ CIRCLE	127

Fungal spores constitute a significant fraction of bio-aerosol and they are often much more numerous than other airborne bio-particulate matters. Among the different microorganisms in bio-aerosol, fungal spores are larger ranging from 3 to 30 μm in diameter with various sources (Kerssies 1993). In the present study different fungal spores was observed. The trapping of fungal spores was done using plate exposure method. Weekly exposures were made. The most frequently found airborne spores were *Aspergillus* (23.08%), *Cladosporium* (19.73%), *Curvularia* (7.71%) and *Helminthosporium* (7.13%) (Verma and Chile 1992). In the present study also different fungal spores was isolated by plate method and the frequently observed fungi was *A. niger*, *A. flavus*, *Penicillium*, *Alternaria*. Allergy is a major cause of bronchial asthma, allergic rhinitis, migraine, urticaria, eczema etc. About 10% of the Indian population suffers from one or other type of allergic disorders (Channy and Verma 1994). In the present study also different fungi can cause health problems. A comparative survey of airborne fungal spores in five indoor and five outdoor environments in Burdwan, West Bengal, India was carried out for a period of two years using Rotorod samplers and sedimentation plates (Chakraborty *et al.*, 2000). An air survey of jute fields for two seasons in West Bengal, India, revealed that the total colony forming units (CFUs) varied with time, showing peaks (231 and 483 CFUs respectively) during the harvesting of the crop. The effect of temperature as well as relative humidity was probably not so significant (Uddin, 2005). In present paper the fungal spores was observed in different seasons.

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