*International Research Journal of Environmental Sciences*_____ ISSN 2319–1414
Vol. **7(6),** 52-55, June **(2018)** *Int. Res. J. Environmental Sci.*

Short Communication

A preliminary study on fungal air spora at railway station with special reference to summer season

Kavita Naruka* **and Sanjana Heda**
Department of Zoology, J.N. Vyas University, Jodhpur, Rajasthan, India
narukak@gmail.com

Available online at: www.isca.in, www.isca.me
Received 8th February 2018, revised 17th April 2018, accepted 20th May 2018

Abstract

Railway stations are associated with daily exposure of the human population. Fungal air spora concentrated in the outdoor atmosphere of railway stations affect public health by inducing allergic diseases and infections. Human population needs a safe and healthy environment to avoid the adverse health effects. The present study was conducted to evaluate the prevalent species of airborne fungi in the environment of the railway station, Jodhpur during the summer season. Airborne fungal concentration averaged between 8.33-35 CFU/m³. The predominant fungal genera isolated were Aspergillus, Alternaria, Fusarium, Mucor, Penicillium and Rhizopus.

Keywords: Fungal air spora, allergic diseases, infections, health effects, mycology, air pollution.

Introduction

Air pollution is one of the major environmental risks to human health and earth's ecosystem. Responses of every individual subjected to air pollutants vary depending upon their type and extent of exposure as well as one's health condition. The transport and dispersal of microbes is facilitated with the air current[1]. Fungi comprise the significant component of microbial diversity. Spores of fungi are often liberated in the air in an extensive agglomeration and remain suspended in air for a longer duration. These can be transmitted from outdoor sources to an indoor environment which is a matter of public concern. Fungi basically act as an indicator of the measure of aerial bio-pollution. Airborne pathogenic fungal spores could cause infections or allergies[2]. The considerable fungal susceptible diseases involve allergic rhinitis, bronchial asthma, hypersensitivity pneumonia and allergic bronchopulmonary mycoses[3].

The fungal spores, mycotoxins and volatiles suspended in the atmosphere can create health hazards in all fragments of the population[4,5]. Microbial volatile organic compounds (MVOCs) have been detected to be emitted by fungal species of the genera *Penicillium*, *Aspergillus*, *Fusarium* and *Cladosporium*. Most of the mycotoxins produced by fungi are neurotoxic and carcinogenic for humans.

The health and well being of the public are influenced by the quality of outdoor air because of the presence of a variety of allergenic aero mycospora. Estimation values of their quantity and type serve as an index of cleanliness of the environment and adverse effects on human health. Therefore, the aim of present study is to detect the fungal diversity in the air of railway station, Jodhpur, Rajasthan (India). The results of the above study would be useful in the identification of fungal forms prevailing in outdoor air responsible for affecting public health.

Materials and methods

Study area: The present study was carried out in the outdoor environment of Railway Station, Jodhpur to estimate mycological air pollution during the summer season. The city has well-established rail network connecting it to other major cities of the country. The public gathering is quite common due to tourist attractions in Jodhpur. During the study, meteorological variables like temperature and relative humidity were also recorded. The temperature and relative humidity of outdoor air in the summer varied from 32.2-41ºC and 41-63% respectively.

Air sampling and analysis: Air sampling was performed in the months of March to June covering the summer season by a passive method using the settle plates. Duplicate Petri plates of media containing Potato Dextrose Agar (PDA) (HiMedia Laboratories Limited, Mumbai, India) were exposed in outdoor air of platforms at about 1.5 m above the surface for a time span of 30 minutes to reproduce the human breathing zone[6]. These plates were incubated at 25°C for 5-7 days. Incubation was followed by the counting of fungal colonies and the total number of CFU/m³ of air (Colony Forming Units) was calculated.

Identification: Fungal isolates were identified on the basis of colonial characteristic features. A Lactophenol-cotton-blue solution was used for the preparation of slides representing different colonies. Hyphal and spore attributes of these prepared

slides were microscopically analyzed[7,8]. During the assessment, percentage contribution and percentage frequency of fungal flora were computed[9] using the following formula:

Percentage contribution =
Total number of colonies of a species × 100
Total number of colonies of all species
Percentage frequency =
Number of observation in which a species appeared × 100
Total number of observations

Results and discussion

In the present study, the concentration of fungal air spora averaged between 8.33-35 CFU/m³ during summer season (March to June) as shown in the Fig. A low level of fungal colonies was recorded during the summer season on account of unfavorable relative humidity as well as temperature for aeromycospora. These findings were in accordance with Prasad *et al.*[10] The lower extent of the overall airborne fungal count investigated in the outdoor atmosphere of the railway station is an indication of good hygienic environmental status. Although fungal concentration was less in the observed area yet pathogenic forms were prevalent. Exposure to these pathogenic airborne spores and their metabolic by-products may cause serious health issues in humans.

A total of 6 fungal genera representing 10 fungal species which comprises *Aspergillus sp., Alternaria sp., Fusarium sp., Mucor sp., Penicillium sp.* and *Rhizopus sp.* were isolated from the sampling location. Previously Sunita *et al.*[11] reported fungal species such as *Aspergillus niger, Aspergillus flavus, Aspergillus fumigatus, Aspergillus terreus, Alternaria alternata*, *Fusarium oxysporum, Mucor sp. Penicillium sp. and Rhizopus stolonifer* in their study. Similarly, Pandian and Sivasakthivel[12] isolated fungal species such as *Rhizopus stolonifer*, *Alternaria alternata*, *Aspergillus flavus*, *Aspergillus fumigatus*, *Aspergillus niger*, *Aspergillus terreus and Fusarium oxysporum* from the atmospheric air of Chennai central railway station. Such species of fungi like *Aspergillus niger*, *Alternaria alternata*, *Fusarium sp., Mucor sp., Penicillium sp.* and *Rhizopus sp.* were also isolated by Ravikala and Nagalakshamma[13] from the air of railway station. Climatic conditions and human activities affect quantity of fungal spores in the air[14].

In the present investigation, highest count of *Aspergillus sp.* during summer is in agreement with the fact that spores of this species are generally well adapted to survival in the lack of nutrient and water available in the aerosphere[15]. Similarly Naruka and Gaur[16] also reported the highest count of *Aspergillus sp.* in their outdoor study. In the present study *Aspergillus niger* was the most prevalent fungal species in the summer season. Similar results were also observed previously by Patle and Jadhav[17] and Prasad *et al.*[10] Most of the fungal genera recorded in our studies such as *Fusarium*, *Penicillium* and *Aspergillus* are relevant as mycotoxin producers besides their established role in respiratory allergies[18,19]. The highest contribution among the aeromycoflora was recorded by the fungal genera *Aspergillus* which is mostly responsible for the occurrence of aspergillosis, ear and skin infections[20].

The maximal percentage contribution were reported by *Aspergillus niger* (19.89%) along with *Aspergillus fumigatus* (19.35%) followed by *Aspergillus flavus* (12.36%), *Alternaria alternata* (10.21%), *Fusarium oxysporum* (8.60%), *Fusarium solani* (8.06%), *Rhizopus stolonifer* (7.53%), *Aspergillus terreus* (5.38%), *Penicillium sp.* (5.38%) while the minimal percentage contribution shown by *Mucor sp.* (3.22%) (Table-1).

Table-1: Distribution of various fungal species at Railway Station, Jodhpur in the summer season.

Name of the fungal species	% Contribution	% Frequency
Aspergillus niger	19.89	100
Aspergillus flavus	12.36	100
Aspergillus fumigatus	19.35	100
Aspergillus terreus	5.38	50
Fusarium solani	8.06	100
Fusarium oxysporum	8.60	100
Alternaria alternata	10.21	75
Penicillium sp.	5.38	25
Mucor sp.	3.22	100
Rhizopus stolonifer	7.53	75

The results of the present work reveals that the frequently occurring airborne fungal species were *Aspergillus flavus*, *Aspergillus fumigatus*, *Aspergillus niger*, *Fusarium solani*, *Fusarium oxysporum, Mucor sp*. (100%), *Alternaria alternata*, *Rhizopus stolonifer* (75%) while the minimum frequency was shown by *Aspergillus terreus* (50%) and *Penicillium sp.* (25%) (Table-1).

Conclusion

It is an essential requirement to understand and assess the threat of outdoor pathogens in the air. There is a necessity to give attention to the monitoring of the quality and quantity of air spora. Therefore, this study will be helpful to find out the status of various types of pathogenic and allergenic fungal species prevailing in outdoor air and improving the hygienic environment at railway facilities.

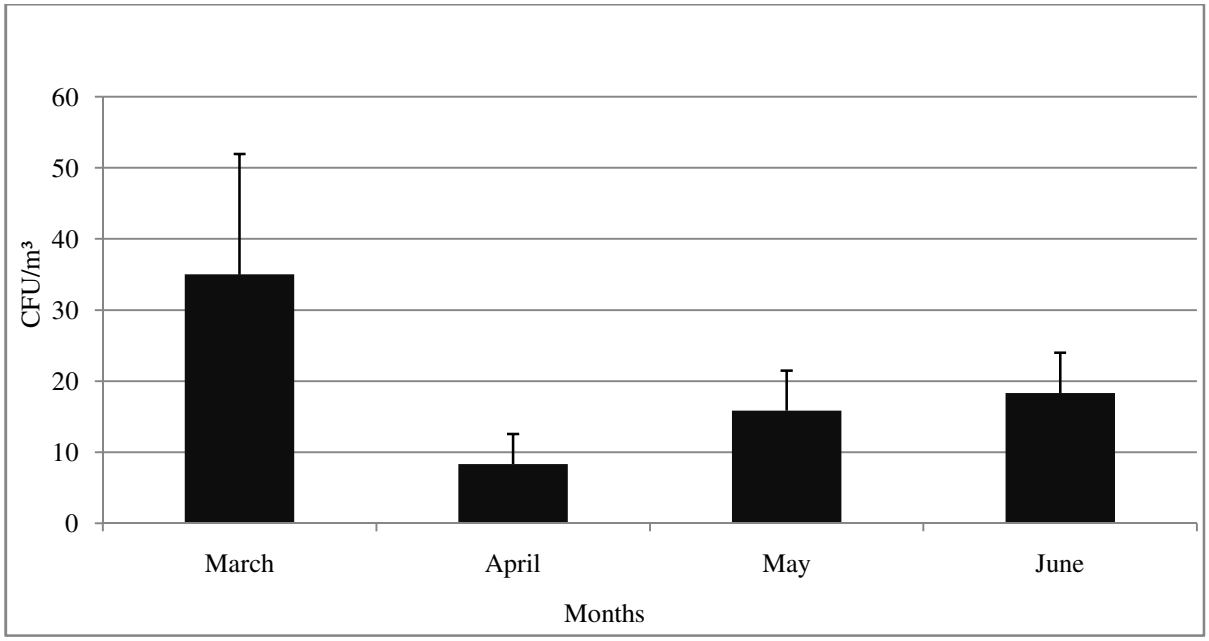

Figure-1: Total CFU/m³ count of airborne fungi in the summer season (Mean ± S.D.).

Acknowledgement

We would like to sincerely thank the Head, Department of Zoology for providing the significant resources in the completion of the research study at J.N. Vyas University, Jodhpur.

References

1. Ekhaise F.O., Ighosewe O.U. and Ajakpovi O.D. (2008). Hospital Indoor Airborne Microflora in Private and Government Owned Hospitals in Benin City, Nigeria. *World Journal of Medical Sciences,* 3(1), 19-23.

2. Monso E.M. (2004). Occupational Asthma in Greenhouse Workers. *Curr. Opin. Pulm. Med*, 10, 147-150.

3. Kurup V.P., Shen H.D. and Vijay H. (2002). Immunobiology of Fungal Allergens. *Int. Arch. Allergy. Immunol.,* 129, 181-188.

4. Tilak S.T. (1982). Aerobiology. Vaijayanti Prakashan, 'Ushakal' Saraswati Colony (West) Aurangabad, 211.

5. Salvaggio J.E. (1986). Human Symptoms and Epidemiology of Fungi in the Working Paper Provided to the Health and Welfare. Canada working group on fungi and indoor air. Environmental Health Directorate. Health and Welfare Canada, Ontario, K1A, OL2.

6. Obbard J.P. and Fang L.S. (2003). Airborne Concentrations of Bacteria in a Hospital Environment in Singapore. *Water, Air & Soil Poll*., 144(1-4), 333-341.

7. Frey D., Oldfield R.J. and Bridger R.C. (1979). A Color Atlas of Pathogenic Fungi. Wolfe Medical Publications Ltd. Holland. ISBN: 9780723407447.

8. Watnabe T. (2002). Pictorial Atlas of Soil and Seed Fungi. Morphologies of cultured Fungi and Key to species. 2nd edition CRC Press London. ISBN: 9780849311185.

9. Dalal L., Bhowal M. and Kalbende S. (2011). Incidence of Deteriorating Fungi in the Air inside the College Libraries of Wardha City. *Arch. Appl. Sci. Res.,* 3(5), 479-485.

10. Prasad H., Tiwari P. and Ekka M.K. (2016). Study of Seasonal Variation of Aeromycoflora of Railway Station Janjgira Naila, Janjgira, CG, India. *Int. Res. J. Biological Sci*., 5(5), 67-76.

11. Sunita K., Gond D.K., Samuel C.O. and Abbasi P. (2011). A Comparative Study of Aeromycospora in Different Localities of Gorakhpur, U.P. *Indian J. Sci. Res.,* 2(4), 51-55.

12. Pandian R. and Sivesakthvel T. (2013). A Preliminary Study on the Airborne Mycoflora of Central Railway Station- Chennai. *J. Modern Biotech.,* 2(2), 23-26.

13. Ravikala K.L. and Nagalakshamma K.V. (2016). Survey on Outdoor Airborne Fungal Spores of Tumkur city, Karnataka State, India. *Int. J. Pharm. Bio. Sci.,* 7(1), (B) 575-577.

14. Fernstrom A. and Goldblatt M. (2013). Aerobiology and its Role in the Transmission of Infectious Diseases. *J. Pathogens,* 6, 1-13.

15. Ingold C.T. (1971). Fungal Spores: their Liberation and Dispersal. Clarendon Press. Oxford, UK. ISBN: 9780198541158.

16. Naruka K. and Gaur J. (2014). Distribution Pattern of Airborne Bacteria and Fungi at Market Area. *American Eurasian J. Sci. Res.,* 9(6), 186-192.

17. Patle K.D. and Jadhav S.K. (2014). Incidence of Airborne Fungal Spores at Raipur with Special Reference to Railway Station. *Int. J. Sci. Res.,* 3(6), 1770-1776.

18. Nieminen S.M., Karki R., Auriola S., Toivola M., Laatsch H., Laatikainen R., Hyvarinen A. and Von Wright A. (2002). Isolation and Identification of *Aspergillus fumigatus* Mycotoxins Growth Medium and Some Building Materials. *App Environ Microbiol.,* 68(10), 4871-4875.

19. Nielsen K.F. (2003). Mycotoxin Production by Indoor Molds. *Fungal Genet. Biol.,* 39, 103-117.

20. Jaffal A.A., Banat I.M., El Mogheth A.A., Nsanze H., Benar A. and Ameen A.S. (1997). Residential Indoor Airborne Microbial Populations in the United Arab Emirates. *Environ. Int.,* 23(4), 529-533.