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A Preliminary Study of Fungal Flora in Air and its Impact on the Environment

Kawnsar -Ul - Yaqoob and Azra N. Kamili
Department of Environmental Science, University of Kashmir, Srinagar, J&K, India, 190006

ABSTRACT

The investigation was carried out by using Rose Bengal agar medium laden pertriplates and exposing them at different study sites in different seasons for a definite time period. The results of the study revealed that although fungal colonies were prevalent throughout the year but there were noted significant difference among the number and type of fungal species on the basis of season and study sties. The fungal colonies were more prevalent during spring season at all the sites due to favourable climatic conditions. Study also revealed that the fungal flora present in air can be useful for forecasting the onset of diseases in plant and animals.

Keywords: Fungal flora, bio-indicators, impact.

INTRODUCTION

Environmental mycology or aeromycology constitutes one of the major aspects of aerobiology mainly because of the dominance of fungal spores in the airspora. Of the various types of aeromicrobiota the fungal propagules represent about 80 -90 % forms in the airspora mainly because of wind dissemination and a variety of mechanisms developed by the group in efficiently liberating and dispersing the reproductive propagules. Such liberated spores get into air and are subsequently transported. Some fungal spores are dominant during rains and some during dry conditions. Aeromycological investigations take into consideration the identification of the source, mode of release, take-off and deposition, the impact and effect on the various living systems. Fungi is commonly encountered in air due to its ability to survive under unfavorable conditions. Fungal spores are responsible for various kinds of diseases in plants and animals.

In Kashmir there is prevalence of many air borne diseases both in plants and animals including mammals and not much work has been done in aeromycology of this region. Hence an attempt was made to undertake studies in this direction.

AREA OF STUDY

For carrying out the present study three sites chosen were :

Site I : University campus (Naseem Bagh) - 11 Km away from city, Lal Chowk.

Site II : Lal Chowk (Partap Park)- Heart of the city.

Site III : Residential Area (Khanabal, Anantnag) - 55 Km away from Lal Chowk.

MATERIAL AND METHODS

Methods of Sterilization and Disinfection

Sterilization of inoculation chamber was carried out by using U.V radiations, 95% Ethylalcohol and Phenyl. Washing of glassware was undertaken by using lab wash, cleaning by suitable brushes and then washing with running tap water. The glassware was finally rinsed with distilled water. The contaminated culture vials were first autoclaved at 15Psi at 121° C before washing. Sterilization of glassware and instruments was accomplished by pressure and flame sterilization respectively. Rose Bengal Agar medium (Martin,1950 c.f. Singh *et al.*, 1998) was prepared systematically in 1000 ml flasks (Borosil), followed by its pH adjustment at 7.3. Later on small aliquotes of the medium were dispensed into smaller flasks and test tubes for use and subsequently its sterilization was achieved by autoclaving at 15 Psi at 121°C for 20 - 30 minutes . Medium was allowed to cool upto 40 – 50 °C and was dispensed from flasks in to previously sterilized petriplates. Medium in test tubes was used for isolating and growing pure cultures.

Sampling

For sampling, autoclaved petriplates (five replicates) laden with already sterilized Rose Bengal agar medium were taken and then exposed for half an hour at the three study sites under reference by employing gravity petridish procedure (c.f. Tilak, 1989). Control was maintained at each site. During sampling time, season and temperature were noted down. The exposed petriplates were incubated in an inverted position at 25 ± 3°C. The data was scored after seven days of incubation. The colonies were counted and isolated for pure cultures and identified. The counting was done according to key given by Johnson and Case (1995). For identifying fungi, the mycelium and spores were stained with cotton blue lactophenol stain on a slide and were subsequently observed under microscope.

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RESULTS

The data was scored after seven days in each case although the colonies started appearing after 48 hours only. Visual counting of colony number was followed by recording their other parameters like colour, shape, size, appearance, margin, elevations etc. as per key (Johnson and Case, 1995) for identification purposes. The data was recoded for four different seasons and was evaluated on comparative basis for seasonal variation in number of fungal colonies at different sites (Figs. 1-3).During

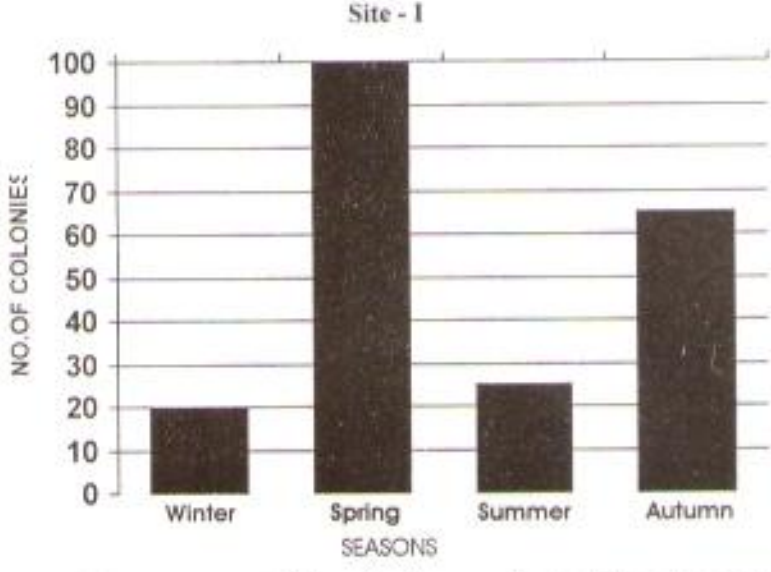

Fig. 1 : Comparative assessment of fungal colony number in different seasons at site - I

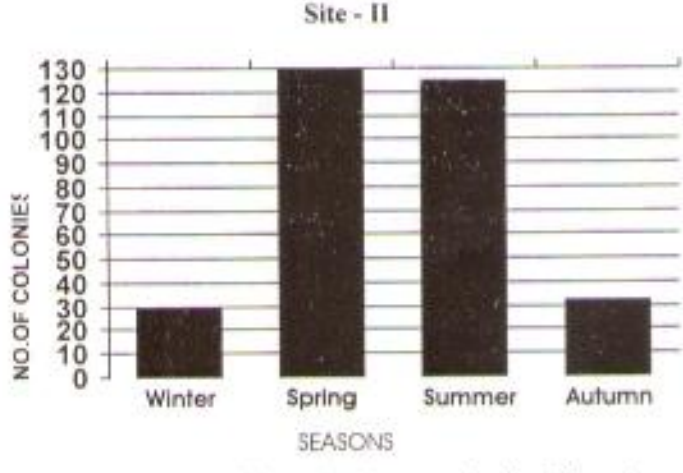

Fig. 2 : Comparative assessment of fungal colony number in different seasons at site - II

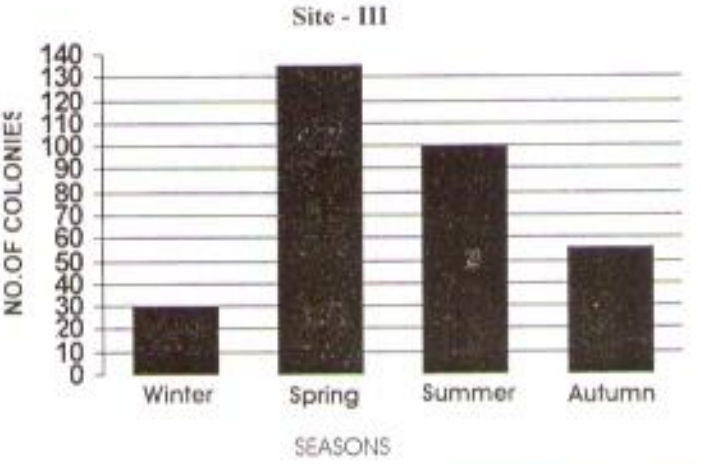

Fig. 3 : Comparative assessment of fungal colony number in different seasons at site - III

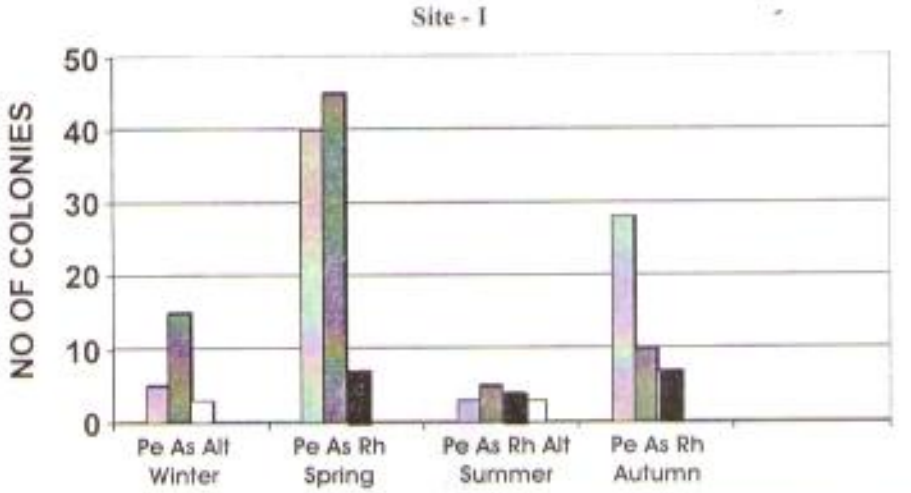

Fig. 4 : Comparative assessment of different generic colonies in different seasons at site - I.

Abbreviations:

Pe	=	*Penicillium* spp.
As	=	*Aspergillus* spp.
Alt	=	*Alternaria* spp.
Rh	=	*Rhizopus* spp.
Pi	=	*Pyricularia* spp.

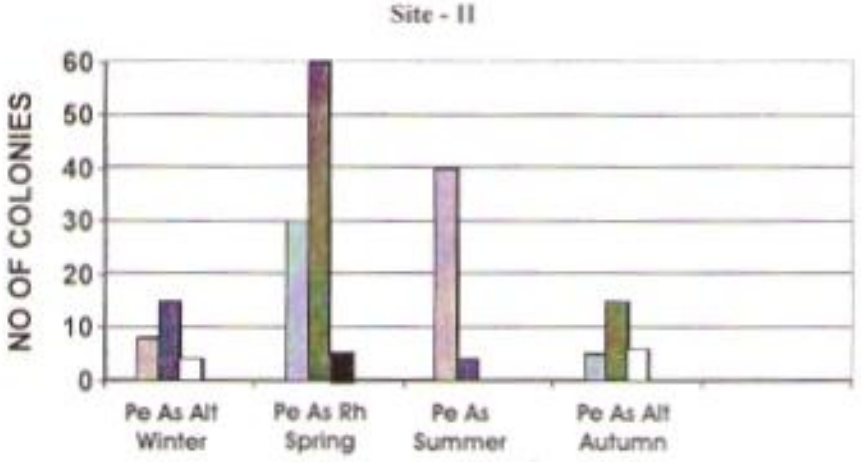

Fig. 5 : Comparative assessment of different generic colonies in different seasons at site - II.

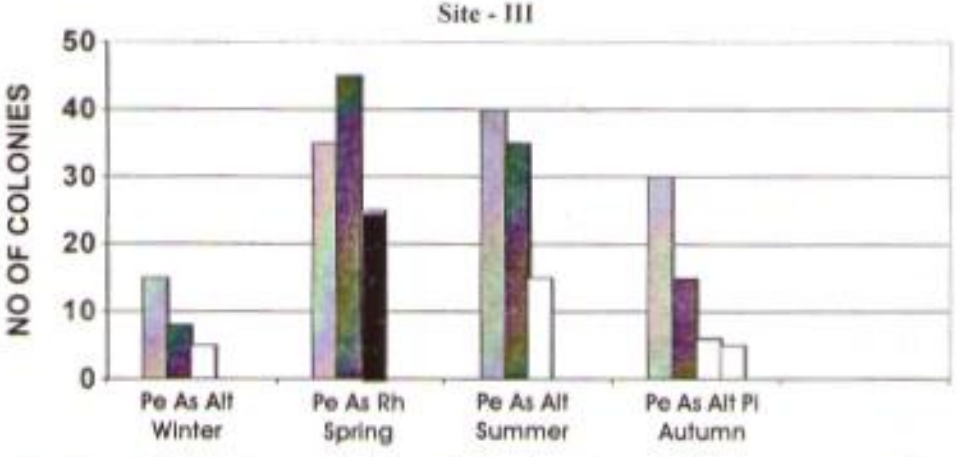

Fig. 6 : Comparative assessment of different generic colonies in different seasons at site - III.

Abbreviations:

Pe	=	*Penicillium* spp.
As	=	*Aspergillus* spp.
Alt	=	*Alternaria* spp.
Rh	=	*Rhizopus* spp.
Pl	=	*Pyricularia* spp.

winter total number of colonies never exceeded 30 at all the sites indicating less favourable temperature which was recorded as 12 °C. Where as in spring the number exceeded 130 indicating favourable temperature which was recorded as 25°C.A comparative account of the number of fungal colonies site wise indicate that maximum number of total colonies appeared in site III (320) followed by site II (315) and site I (210).In summer colony number was above 100 at site II followed by site III and least number of colonies were found at site I. In autumn season colony number was less than summer except at site I.

Different fungal colonies and spores identified under microscope from pure cultures of different sites were *Aspergillus* spp., *Penicillium* spp., *Rhizopus* spp., *Alternaria* spp. and *Pyricularia* spp. A comparative assessment of different generic colonies recovered in different seasons at each site was drawn and is depicted in (Figs. 4-6).

Penicillium and *Aspergillus* colonies were present throughout the four seasons. *Rhizopus* colony was absent during winter at all the sites but was present during spring season at all the sites with highest number recorded at site III during spring season. *Alternaria* spores were altogether missing in spring months at all sites, with highest number recorded at site III during summer season and were found more prevalent during the winter season at all sites. *Pyricularia* spp. was recorded only from site III during autumn.

DISCUSSION

Fungal spores are usually present thoughout the year but are dominant during spring (rainy) season and some during dry conditions The reason being that frutification of majority of fungi takes place during rainy season and also environmental conditions like optimum temperature and wind currents are favourable for their dissemination. As such temperature and other environmental conditions are not so much favourable during winter, thus there is obviously fall of spore concentration and these go into perennation stage (Tilak, 1989). In the present study all the sites exhibited maximum colony number during spring season while as low colony number was observed during winter season, the reason being favourable climatic conditions that prevailed during spring season at all the sites. Amongst the selected sites, site III showed maximum number of fungal colonies during spring season as compared to other sites because a lot of organic matter was present around the site and climatic conditions were congenial for growth and dissemination of fungal spores present on the decomposing organic matter. Further, during summer season the colony count was higher at site II followed by site III which was due to windy

and dusty climate, accompanied by fall of temperature that prevailed at crowded area of Lal Chowk (site II) during sampling time. This has already been pointed out by several aerobiologists that when environmental conditions like windy climate, overnight rainfall, low temperature prevail there is abundance of fungal spores in air (Tilak, 1991; Gregory, 1980). At site III no windy climate was recorded during summer but fungal density was due to presence of abundant organic matter around the site. Site I favoured least fungal growth and development during summer because of comparatively low temperature due to abundance of chinar trees.

Fungal density in Autumn was lowest at site II as compared to other two sites which can be attributed to stie being an open and crowded one, due to business establishements and heavy vehicular traffic, thus having a warmer climate and less of humidity than other two sites under consideration which have a large number of tree plantation around.

At site III the spores of *Pyricularia* spp. were isolated in autumn season which is obvious because the rice fields surrounding the site were infeçted with the blast disease. During spring season *Aspergillus* spp. was found in dominance at every site, this might be because of favourable climatic conditions which is supported by a study made by Tilak (1989a) that maximum concentration of *Aspergillus* spp. is during rainy months (67%) and less during hot, dry months (40%). During late autumn *Alternaria* spp. was found at every site perhaps because of dry climate which the spore can sustain and favour its dispersal. This assumption is supported by Tilak (1987) who has reported that when the rain is followed by a dry day there is abundance of spores of *Alternaria*, *Cladosporium* etc. The spores of deuteromycotina constitute about 70% of total airspores during November and December of which *Cladosporium* (30%), *Alternaria* (5%), *Pyricularia* (4%) and *Helminthosporium* (3%) are some major contributors (Tilak,1989). *Rhizopus* spp. were present during spring at all the sites because of favourable climate conditions. In summer and autumn these were recovered from site I only which can be attributed to comparatively low temperature and humidity prevailing due to chinar trees. Winter season was found unfavourable for *Rhizopus* spp. at all the sites like *Aspergillus* spp. *Penicillium* spp. were present at all the sites and in all the four seasons, the reason being that both the species can grow on a wide variety of dead decaying matter and can sustain a wide fluctuation of environmental conditions.

ENVIRONMENTAL IMPACTS

Presence of *Aspergillus* spores can cause Aspergilloses in Mammals and also biodeterioration of food items, crop plants, vegetables, leather goods and clothes

(Alexopolus and Mims, 1985). *Penicillium* spores cause allergic diseases in man i.e Rhinitis (Hay Fever) and Asthama, so a major cause of seasonal allergy. *Penicillium* also causes biodeterioration of crop plants, food items fruits,leather goods and clothes (Alexopolus and Mims, 1985). Rhizopus in air causes biodeterioration of food items on a large scale.It is also responsiable for a number of diseases in human beings (Alexopolus and Mims, 1985). Due to the presence of *Pyricularia* spp. blast disease of rice can be caused and can be spread over to other areas. *Alternaria* causes a number of diseases of crop plants e.g. early blight of potato and tomato. It is also one of the chief causes of fungal allergy.

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REFERENCES

Alexopolus,C.J. and Mims,C.W. 1985. *Introductory Mycology*. 3rd edition John Wiley and Sons, Inc. New Delhi, India.

Gregory, P.H. 1980. *The microbiology of atmosphere*.4th edition Hafner publishing Company, New York.

Johnson, T.R. & Case, C. L. 1995. *Laboratory Experiments in Microbiology*. The Benjamin/ Cummings Publishing Company, Inc. California, 4th edition.

Singh, V., Pande, P.C. and Jain, D.K. 1998. *A text book of Botany*. 2nd edition Rastogi Publications, Meerut, India.

Tilak,S.T. 1987. Splash dispersal and air spora. *Proc. III. Nat Conf. on Aerobiology*. Kalyan. Atm. Biopo II Env. Publications, Karad, India.

Tilak, S.T. 1989. *Aerobiology and airborne organisms*. 7th edition Satyajeet Prakashan, New Dehli.

Tilak, S.T. 1989a. *Airborne Pollen & Fungal spores*. Vaijayanti Prakashan, Aurangabad.

Tilak, S.T. 1991. Aeromycology. In : *Aspects and Prospects in Fungi and Biotechnology- Recent advances*. (H.C. Dube, ed.) Today and Tomorrow Publisher, New Delhi IV pp. 127-156.