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AIRBORNE *Penicillium* IN THE ATMOSPHERE OF PANABARAS, RAJNANDGAON DISTRICT

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ABSTRACT

Aerobiological studies are widely used to determine the fungal spectrum in the air. One year survey of airborne *Penicillium* was carried out in the atmosphere of Panabaras, Rajnandgaon district with help of gravity petriplates method containing PDA (Potato Dextrose Agar) medium. The survey revealed a total 12 species of *Penicillium* with marked seasonal and annual variations. *Penicillium chrysogenum* (20.15%) was found to be the most dominant atmospheric fungal species throughout the season followed by *Penicillium spinulosum* (14.72%), *P. jenseni and P. multicolor* (13.17%), *P. notatum* (12.41%), *P. verruculosum* (7.75%) and *P. turbatum* (6.21%) etc. Aim of the present work was to analyze the behavior of *Penicillium* species and to study the relationship between the fungal spore levels and the environmental factors.

KEYWORDS: Airborne *Penicillium*, Panabaras, Environmental factors.

The air is abundant of fungal spores although it is not a good medium for growth unlike the soil, water, surfaces of living organisms and non-living materials (Deacon 1980). The knowledge of air-spora not only contributes to the understanding of their abundance and seasonal variations, but is also helpful in forecasting the epidemics of crop plants (Waggoner, 1960). Geographical location, climate, and short-term meteorological conditions are responsible for outdoor types and levels of fungal spores. Many aerobiological studies have confirmed that *Aspergillus* and *Penicillium* spores are the most abundant species found in indoor ambient (Garret et al. 1998; Ren et al. 1999; Aira et al. 2002; Gorny and Dutkiewiczi 2002; Archana and Aarti 2004; Cho et al. 2008; Sen and Asan 2009). The small size and the ease dispersion of their propagules favour the presence of high concentrations of fungal spores in both indoor and outdoor environments (Aira et al. 2002). Evaluation of airborne fungal contaminants has gained importance because of the health hazards caused by the spores or microbial metabolites (Sen and Asan 2009). Therefore; the purposes of our study were to determine variations in the composition and concentration of the aeromycoflora in tribal area.

MATERIALS AND METHODS

Study Site

Samples were collected from February 2005 to March 2006 in the Panabaras of Rajnandgaon district, Chhattisgarh State, India. A suitable substrate or culture medium supporting nutritional needs of fungi was required for our study. For this purpose, Potato Dextrose Agar (PDA) media was used.

Sampling Procedure and Identification of Fungi

The samples were collected at fifteen days intervals using gravity petriplate method for the isolation of fungi. Petriplates were exposed to the air for 10 minutes, so that spores of fungi in the air can fall and settle on the potato dextrose agar in the petriplates. After the exposed petriplates were brought into the laboratory and incubated for 3-5 days at 25±1ºC temperature to allow proper growth of the fungal colonies for identification. All the fungi growing on the plates were numbered and later sub cultured onto new potato dextrose agar plates.

After the incubation period, fungal colonies were counted and identified on the basis of morphological characters and available literatures (Barent and Hunter, 1972, Ellis 1971 and Gilmans 1959) and finally identify the authentic authority. The meteorological parameters like temperature (°C), relative humidity (%) and rainfall had intense effect on air-borne fungal species both qualitatively and quantitatively and these were also recorded.

RESULTS AND DISCUSSION

Aerobiological studies are widely used to determine the fungal spectrum in the air. One year atmospheric survey of airborne *Penicillium* was carried out in the atmosphere of Panabaras. The survey revealed a total of 12 species of *Penicillium* with marked and annual variations. The average *Penicillium* percentage contributions as well as number of *Penicillium* species isolated at air are also shown in Table 1. Out of total mycoflora *Penicillium chrysogenum* (20.15%) showing the maximum percentage contribution followed by *P. spinulosum* (14.72%), *P. jenseni* and *P. multicolor* (13.17%), *P.*

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notatum (12.41%) and *P. verruculosum* (7.75%), *P. turbatum* (6.21%) and *Penicillium* species (3.87%) was the minimum percentage contribution in the total aeromycolfora.

Table 1: Showing the distribution of *Penicillium* species in the atmosphere of Panabaras at Rajnandgaon district.

S. N.	Name of fungi	Summer season				Total	Rainy season				Total	Winter season				Total	Total no. of fungal colonies	Percentage Contributions
		Mar	Apr	May	Jun		Jul	Aug	Sep	Oct		Nov	Dec	Jan	Feb			
1	*Penicillium chrysogenum*	2	4	-	-	6	2	3	-	-	5	4	-	5	6	15	26	20.15
2	*P. funiculosum*	-	-	-	-	-	-	-	-	-	-	-	3	-	-	3	3	2.32
3	*P. godlewskii*	-	-	2	-	2	-	-	-	-	-	2	-	-	-	2	4	3.11
4	*P. jenseni*	3	-	-	1	4	-	-	5	-	5	-	-	-	8	8	17	13.17
5	*P. multicolor*	-	1	-	3	4	2	-	-	4	6	-	4	-	3	7	17	13.17
6	*P. lilacinum*	-	-	-	-	-	-	1	-	-	1	-	-	-	-		1	0.77
7	*P. notatum*	2	-	3	-	5	3	-	2	-	5	-	-	-	6	6	16	12.41
8	*P. piceum*	-	-	-	-	-	-	-	-	2	2	-	-	1	-	1	3	2.32
9	*P. spinulosum*	2	4	-	-	6	-	10	-	-	10	1	2	-	-	3	19	14.72
10	*P. turbatum*	-	-	-	-	-	-	6	-	-	6	2	-	-	-	2	8	6.21
11	*P. verruculosum*	-	-	-	-	-	-	-	-	-	-	-	3	7	-	10	10	7.75
12	*Penicillium* sp.	-	-	-	-	-	-	-	-	-	-	1	-	-	4	5	5	3.87

During the summer season, *Penicillium chrysogenum* (22.23%) were the most dominant species followed by *P. spinulosum* (22.22%), *P. notatum* (18.51%), *P. jenseni* & *P. multicolor* (14.81%) and *P. godlewskii* (07.4%) was the least dominant fungal species in the total airspora (Figure-01).

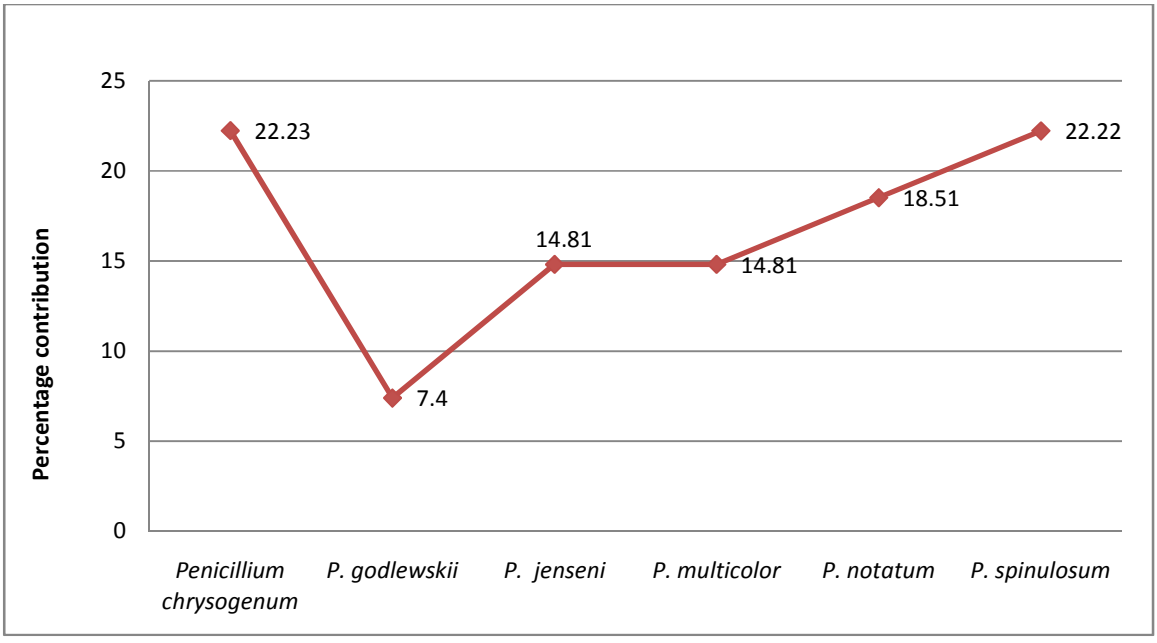

Figure 1: Showing percentage contribution of *Penicillium* species in the summer season.

In the rainy season, *Penicillium spinulosum* (25%) showing the maximum percentage contribution followed by *P. multicolor* & *P. turbatum* (15%) and *P. chrysogenum, P. jenseni* & *P. notatum* (12.5%) while *P. piceum* (05%) and *P. lilacinum* (2.5%) revealed the minimum percentage contribution in the mycoflora (Figure-02).

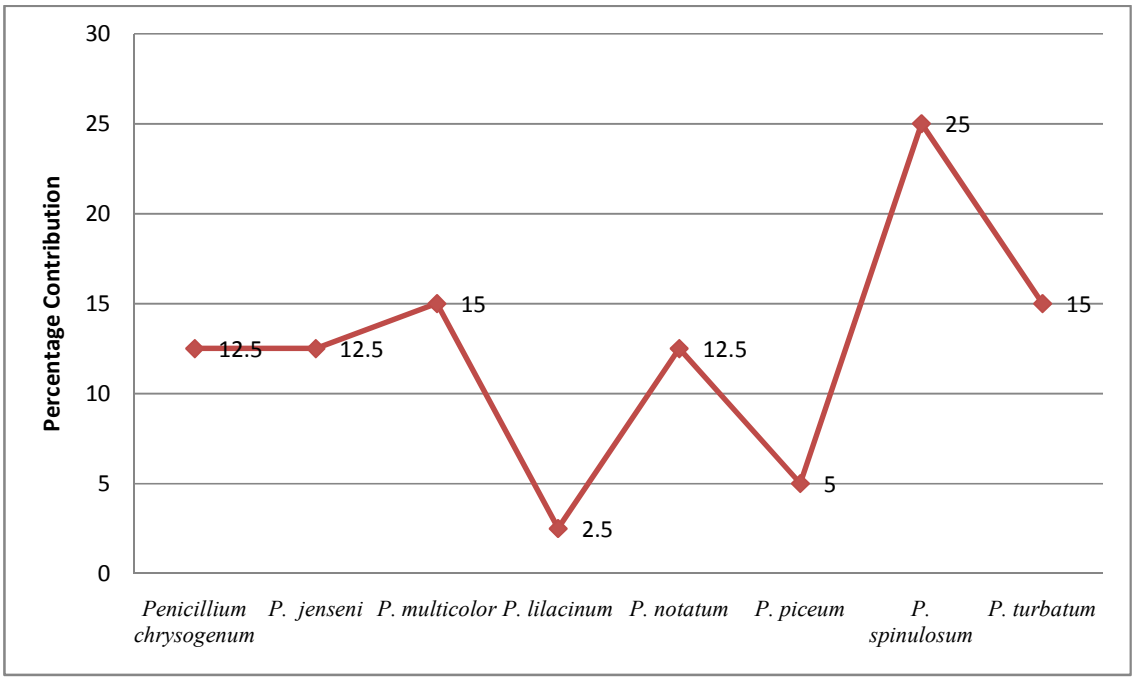

Figure 2: Showing percentage contribution of *Penicillium* species in the rainy season

Penicillium chrysogenum (24.14%) were the most abundant fungal species during the winter season followed by *P. verruculosum* (16.12%), *P. jenseni* (12.9%), *P. multicolor* (11.29%), *and P. notatum* (9.67%) was the moderate and *P. spinulosum*, *P. spinulosum* (4.83%) and *P. godlewskii* showing the least abundant to the total aeromycoflora (Figure-03).

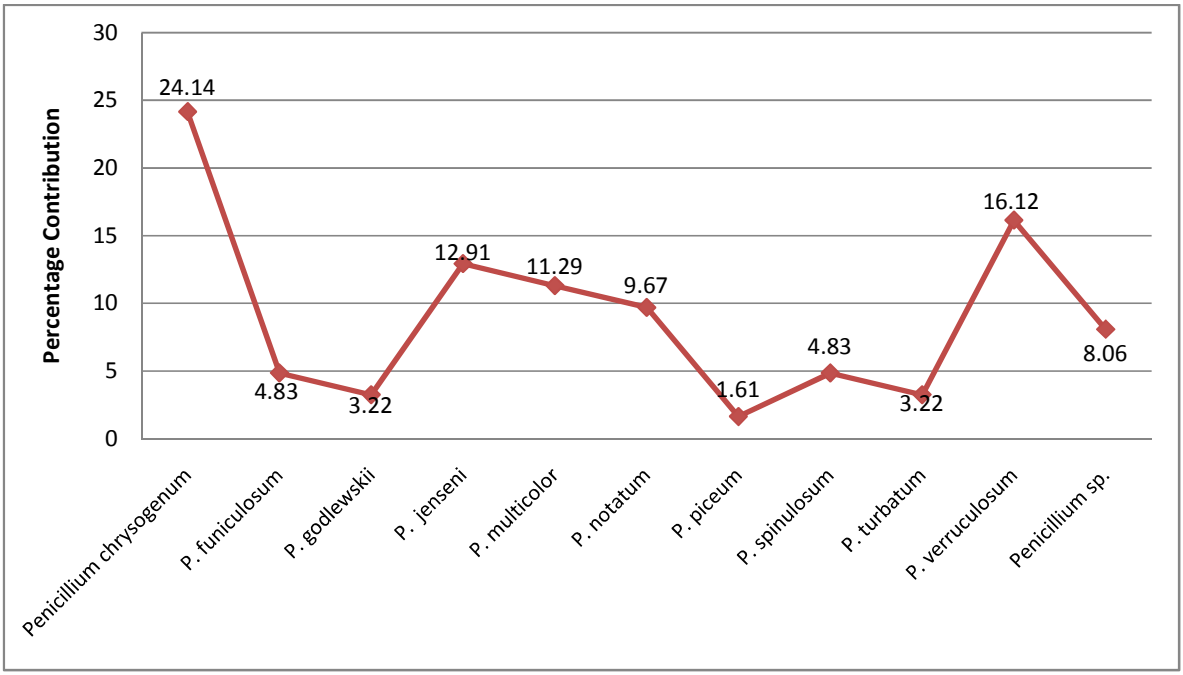

Figure 3: Showing percentage contribution of *Penicillium* species in the winter season

Fungal spores are varying from season to season, month to month and hours. The maximum Penicillium species reported in the season of winter (62 species) followed by rainy (40 species) and summer season (27 species) (Figure-04).

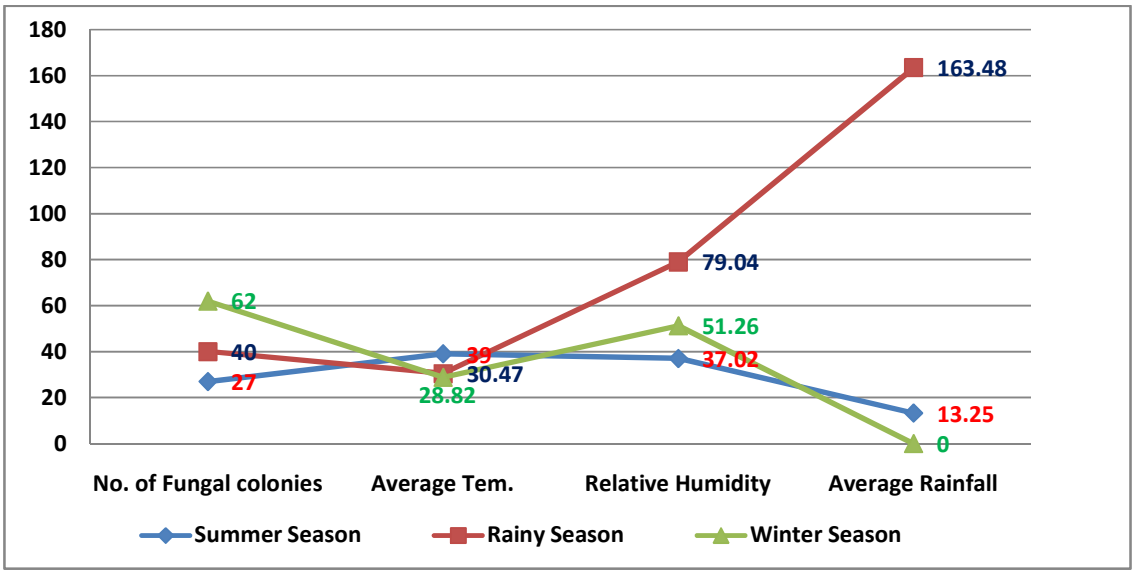

Figure 4: Showing distribution of colonies of *Penicillium* species in relation to meteorological parameters

The air temperature and relative humidity as one of the most important meteorological factors affecting the level of concentration of many types of fungal spores in the air. These results agree with the effects reported by the other authors (Ho et al 2005, Li and Kendrick 1995, O'Gorman and Fuller, 2008). *Penicilliums* are the common soil fungi decaying dead plant materials and are produced in response to the temperature and moisture conditions (Burge and Rogers, 2000). Rosas et al (1993) reported *Penicillium* spores concentration in México City as constant between dry and rainy season. Kakde et al (2001) reported *Penicillium* fungal spores are the most dominated in a fruit market environment at Nagpur. Agnieszka Grinn-Gofron (2011) studied the *Penicillium* spores are the most abundant in the atmosphere of Szczecin, Poland. The higher contribution of the *Penicillium* in the old part of the city has also been revealed by Al-Suwaine et al. (1999) in Saudi Arabia.

Many studies have reported *Penicillium* to be a dominant genus. Levetin and Hurewitz (1978) have reported *Penicillium* percentage varying from 5.0 to 41.7 in different homes with a mean of 21.1% in the air inside homes. *P. chrysogenum*, *P. citrinum*, and *P. oxalicum* were the dominant species in the study of Abdel Hafez et al. (1993). The maximum isolation of *Penicillium* has been earlier reported in the months with low mean temperatures (Larsen and Gravesen, 1991; Abdel Hafez et al., 1993). This can be explained by the fact that *Penicillium* requires cooler climate and high humidity (Mehrotra, 1983), which is usually available in the winter season in Nagpur. The greater concentration of *Penicillium* in indoor air than outdoor air has been reported by many researchers (Beaumont et al., 1984; Lehtonen et al., 1993; Li and Kendrick, 1995). *Penicillium* spores are important aeroallergens. The high concentrations of *Penicillium* spores are hazardous and they are known to cause respiratory tract disorders. Some of the species of this genus are mycotoxic while some species are considered to be true or opportunistic pathogens (Rati et al., 1980).

CONCLUSION

In the present study, *Penicillium chrysogenum* and *P. spinulosum* was the most dominant fungal species. The maximum fungal spore concentration was occurred in the winter season. Minimum temperature and relative humidity are the most important factors for the occurrence of the fungal flora in the environment.

REFERENCES

Barnett H.L. and Hunter B.B., 1992. Illustrated genera of imperfect fungi. Minneapolis, Burgess Publication Cop.

Ellis M.B., 1971. Diatomaceous Hyphomycetees. Kew, England Common Wealth Mycological Institute.

Glimans J.C., 1959. A manual of soil fungi. Oxford and IBH Pub, New Delhi India.

Deacon, J.W., 1980. Introduction to modern mycology. Oxford: Blackwell Publications.

Garret M., Rayment P., Hooper M., Abramson M. and Hooper B., 1998. Indoor airborne fungal spores, house dampness and associations with environmental factors and respiratory health in

children. Clinical and Experimantal Allergy, **28**:459–467.

Ren P., Jankun T. M. and Leaderer B. P., 1999. Comparisons of seasonal fungal prevalence in indoor and outdoor air and in house dusts of dwellings in one Northeast American county. Journal of Exposure Analysis and Environmental Epidemiology, **9**:560–568.

Aira M. J., Rojas T. I. and Jato V., 2002. Fungi associated with three houses in Havana, CUBA. Grana, **41**:114–118.

Gorny R. L. and Dutkiewiczi J., 2002. Bacterial and fungal aerosols in indoor environment in Central and Eastern European Countries. Annals of Agricultural Environmental Medicine, **9**:17–23.

Archana M. S. and Aarti A. S., 2004. A report on *Penicillium* in the intramural and extramural air of residential areas of Nagpur city (India). Aerobiologia, **20**:229–236.

Cho S. J., Ramachandran G., Banerjee S., Ryan A. D. and Adgate J. L., 2008. Seasonal variability of culturable fungal genera in the house dust of inner-city residences. Journal Annals Occupational Hygiene, **5**:780–790.

Sen B. and Asan A., 2009. Fungal flora in indoor and outdoor air of different residential houses in Tekirdag City (Turkey): Seasonal distribution and relationship with climatic factors. Environmental Monitoring and Assessment, **151**:209–219.

Ho H.M., Rao C. Y., Hsu H.H., Chiu Y.H., Liu Ch.M. and Chao J. H., 2005. Characteristic and determinants of ambient fungal spores in Hualien, Taiwan. Atmospheric Environment, **39**:5839–5850.

Li D.W. and Kendrick B., 1995. A year-round study on functional relationships of airborne fungi with meteorological factors. International Journal of Biometeorology, **39**:74–80.

O'Gorman C. M. and Fuller H. T., 2008. Prevalence of culturable airborne spores of selected allergenic and pathogenic fungi in outdoor air. Atmospheric Environment, **42**:4355–4368.

Burge H. A. and Rogers C. A., 2000. Outdoors allergens. Environmental Health Perspectives, **108**:653–659.

Rosas I., Calderon C., Ulloa M. and Lacey J., 1993. Abundance of airborne penicillium CFU in relation to urbanization in Mexico city. Applied and Environmental Microbiology, **58**:2648–2652.

Kakde U.B., Kakde H.U. and Saoji A., 2001. Seasonal variation of fungal propagules in a fruit market environment, Nagpur (India). Aerobiologia, **17**:177–182.

Al-Suwaine A.S., Bahkali A.H. and Hasnain S.M., 1999. Seasonal incidence of airborne fungal allergens in Riyadh, Saudi Arabia. Mycopathologia, **145**(1):15–22.

Levetin E. and Hurewitz D., 1978. A one year survey of the airborne moulds of Tulsa, Oklahoma. II. Indoor survey. Ann. Allergy., **41**:25–27.

Rati E., Jayprakash K.B. and Ramalingam A., 1980. Air-spora of a poultry shed at Mysore. Indian J. Microbiol., **20**(1):6–12.

Abdel-Hafez S.I.I., Moubasher A.H. and Barakat A., 1993. Seasonal variations of fungi of outdoor air and sedimented dust at Assiut region, Upper Egypt. Grana, **32**:115–121.

Mehrotra B.S., 1983. The impact of fungal infestation of cereal grains in field and storage. In A. Hussain K. Singh B.P. Singh and V.P. Agnihotri (eds), Recent Advances in Plant Pathology. Print House: Lucknow, India, pp. 185–200.

Beaumont F., Kauffman H.F., Sluiter H.J. and de Vries K., 1984. Volumetric aerobiological study of seasonal fungus prevalence inside and outside dwellings of asthmatic patients living in the North-East Netherlands. Ann. Allergy, **53**:486– 492.

Lehtonen M., Reponen T. and Nevalainen A., 1993. Everyday activities and variations of fungal spore concentrations in indoor air. Int. Biodeterior. Biodegrad., **31**:25–39.

Li D.W. and Kendrick B., 1995. A year-round comparison of fungal spores in indoor and outdoor air. Mycologia, **87**(2):190–195.

Agnieszka G.G., 2011. Airborne *Aspergillus* and *Penicillium* in the atmosphere of Szczecin, (Poland) (2004–2009). Aerobiologia, **27**:67–76.