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 Dutkiewicz 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±1°C 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.
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.

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Name of fungi</th>
<th>Summer season</th>
<th>Rainy season</th>
<th>Winter season</th>
<th>Total no. of fungal colonies</th>
<th>Percentage Contributions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mar</td>
<td>Apr</td>
<td>May</td>
<td>Jun</td>
<td>Jul</td>
</tr>
<tr>
<td>1</td>
<td><em>Penicillium</em> chrysogenum</td>
<td>2</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td><em>P. funiculosum</em></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td><em>P. godlewskii</em></td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td><em>P. jenseni</em></td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td><em>P. multicolor</em></td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td><em>P. lilacinum</em></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td><em>P. notatum</em></td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td><em>P. piceum</em></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td><em>P. spinulosum</em></td>
<td>2</td>
<td>4</td>
<td>-</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td><em>P. turbatum</em></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>11</td>
<td><em>P. verruculosum</em></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>12</td>
<td><em>Penicillium</em> sp.</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td>-</td>
</tr>
</tbody>
</table>

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).

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).
Penicillium chrysogenum 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).

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).
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). *Penicillium* 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**


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