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Original Article

A Study of Seasonal Diversity in the Indoor Mycoflora of Rural Begusarai District of Bihar

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Abstract

Fungi are among the most common microbiota found in the houses having unplastered floor in the rural areas of Begusarai district. Fungi of these regions, mostly belongs to the class Ascomycota and Zygomycota. The dust samples were collected in sterilized polythene bag during January 2010 to December 2010 from 4 different spots like Bachhwara, Cheria Bariarpur, Matihani and Sahibpur kamal region of Begusarai district. The mycoflora were isolated using soil dilution plate technique on different culture media, supplemented by suitable antibiotics. Among them nearly 32 mycoflora were identified. Identification and characterization of the mycoflora were made with the help of authentic manuals of fungi. The most common among them viz; *Alternaria alternata*, *Aspergillus fumigatus*, *Fusarium oxysporum*, *Mucor hiemalis*, *Penicillium chrysogenum*, *Penicillium funiculosum*, *Penicillium citrinum*, *Curvularia lunata*, *Aspergillus niger* and *Trichoderma viride* were isolated, identified and characterized. The seasonal variation and percentage frequency of the mycoflora were statistically analyzed.

Keywords: Microbiota, Ascomycota, Zygomycota, Phylloplane, Colony Forming Units, Moisture, Organic and Inorganic particles

Introduction

Fungi inhabit in nearly all terrestrial environments including household dust. In recent years, the quality of indoor air has been the subject of several studies. Because of increase in air humidity, decreased ventilation and increase moisture level subsequently increase the proliferation of fungi and bacteria (Ruest, 2004). These fungal elements may cause sever illness as a result of indoor mold exposure. In the present investigation dust samples were collected in rural Begusarai district where the floors were unplastered. It was observed that dust formation occurs as a result of air borne organic and inorganic particles continues incoming from outdoor sources. House dust is composed of fibrous material primarily of textile fibers, hairs and shed epithelial debris (Bronswijk, 1981).

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The fungal spores in indoor air are typically correlated with prevailing weather conditions, including wind speed and moisture that are responsible for mediating spore release in the outdoor environment (Ingold, 1965; Li and Kendrick, 1994; 1995). Plant pollen arising from the phylloplane likely provides additional nutritional input to the house dust ecosystem (Bronswijk, 1981). As such, surveys of fungi from indoor air and dust usually demonstrate the presence of phylloplane taxa that are qualitatively similar to outdoor air albeit at lower levels (Abdel-Hafez *et al*., 1993; Bunnag *et al*., 1982; Calvo *et al*., 1980; Dillon *et al*., 1996; Ebner *et al*., 1992).

Inside the house, fungal spore settle in a number of areas favorable to mould growth. Areas which provide warmth, moisture, a high level of humidity and a continual supply of organic matter and dirt, such as the bathroom and kitchen are prime location. Damp housing is a common problem across the globe, especially in areas of high humidity and is heavily associated with the presence of mould in house, as well as an increase in the incidence of health problems

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(Stevens, 2004). In the present study show that seasonal variation, monitored and frequency percentage of indoor mycoflora observed during the periods of January 2010 to December 2010.

Material and Methods

The dust samples were collected from four regions in rural areas of Begusarai district, Bihar (Map -1) during January 2010 - December 2010, in sterilized polyethene bag and brought to laboratory for further studies. The dust suspensions in sterile distilled water were vortexed for 15 minutes and then allowed the debris to settle. A serial dilution agar plating method was employed for the isolation of indoor mycoflora. Dust suspensions were further diluted to obtain 15-20 Colony Forming Units per plate. Although a number of culture media *viz*; Potato Dextrose Agar (PDA) medium, Czapek's Dox Agar medium and Martin's rose Bengal Agar medium were used. Streptomycin (50mg/l) was added in the medium to avoid bacterial contamination. Three replicates of the pure culture were maintained. The culture plates were kept for seven days of incubation at 25 ± 1^0C in incubator. Where possible, fungi were identified to the genus level directly from colonies on the Potato Dextrose Agar isolation media using well-established techniques of macroscopic and microscopic examination and standard reference works for the identification of moulds (Arx, 1970; Barnett and Hunter, 1986; Barron, 1968; Carmichael *et al*., 1980; Domsch *et al*., 1980; Ellis, 1971, 1976; Hanlin, 1990; Malloch, 1981). The photograph of colony and the microscopic Photographs of reproductive parts were taken.

The percentage of frequency of fungal species occurrence, were calculated as follows:

$$\%\ of\ frequency\ of\ species = \frac{\text{Average no. of total colonies of a species in one plate}}{\text{Average no. of total colonies of all the species in one plate.}}$$

Results and Discussion

The Indoor fungal diversity in rural Begusarai region of Bihar depending upon varied range of temperature, pH and chemical composition of house dust and hence, a diverse type of mycoflora were obtained (fig.1) in one year of survey. In the present investigation the most prominent genera obtained ascomycetes and zygomycetes *viz*; *Aspergillus*, *Penicillium* and *Mucor* with their different species (Fig. 2).

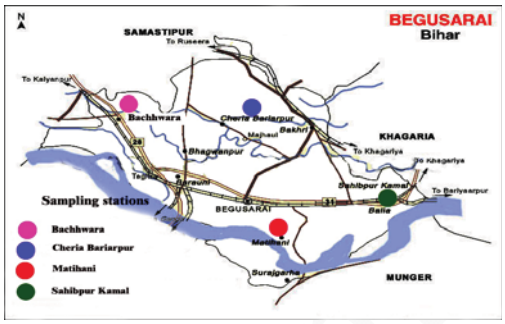


Fig.1: Map showing location of the sampling area

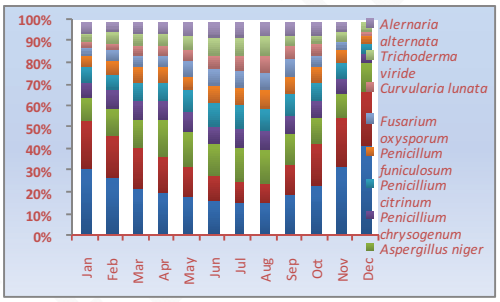
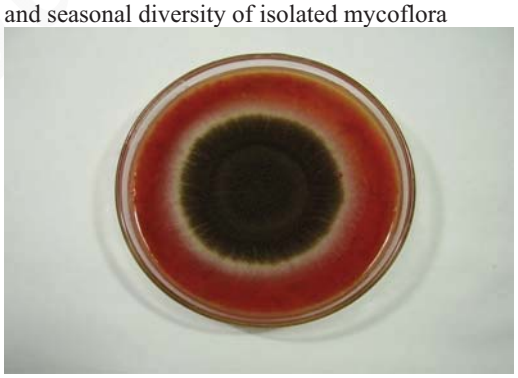
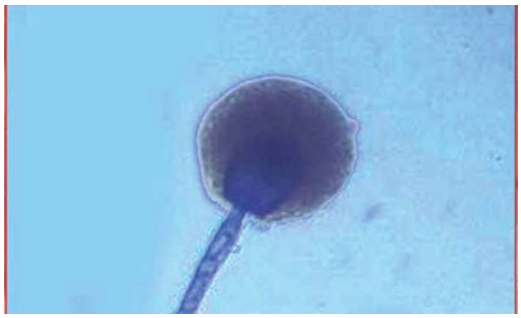


Fig.2: Graph Showing the percentage frequency and seasonal diversity of isolated mycoflora



Culture plate of *Mucor hiemalis*



Microscopic photograph of *M. hiemalis*

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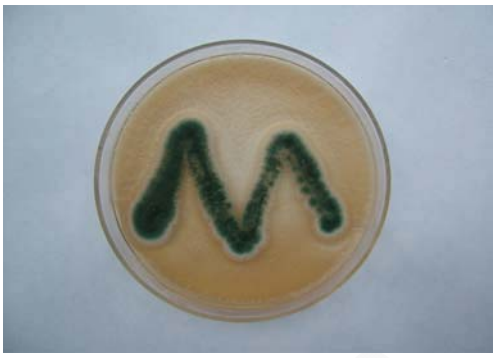
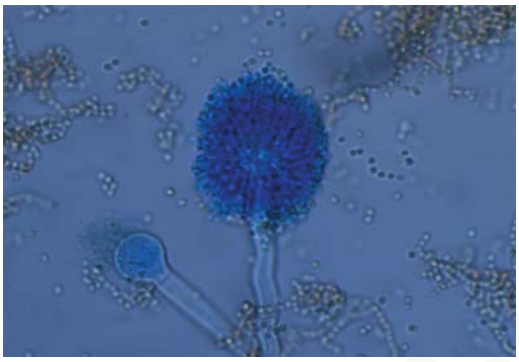
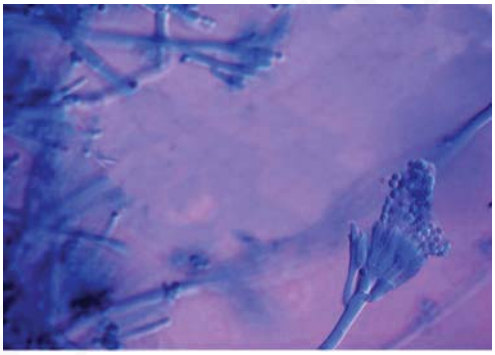
Culture plate of *Aspergillus fumigates*



Culture plate of *Penicillium chrysogenum.*

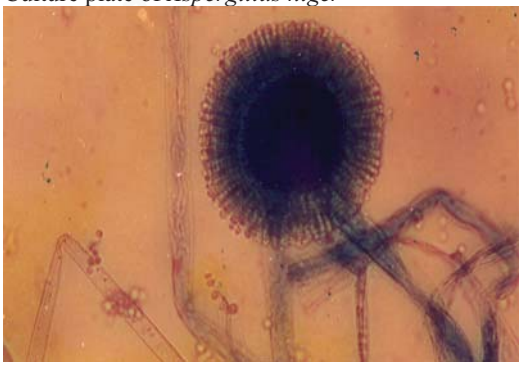


Microscopic photograph of *A. fumigatus*



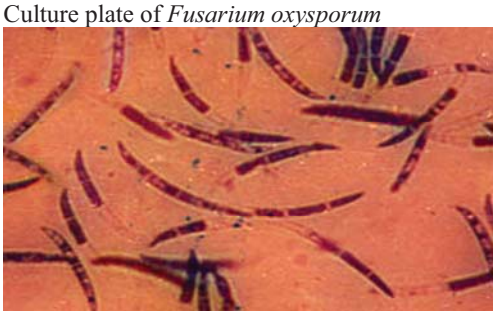
Microscopic photograph of *P. chrysogenum.*

Culture plate of *Aspergillus niger*



Microscopic photograph of *A. niger*

Culture plate of *Fusarium oxysporum*



Microscopic photograph of *F. oxysporum*

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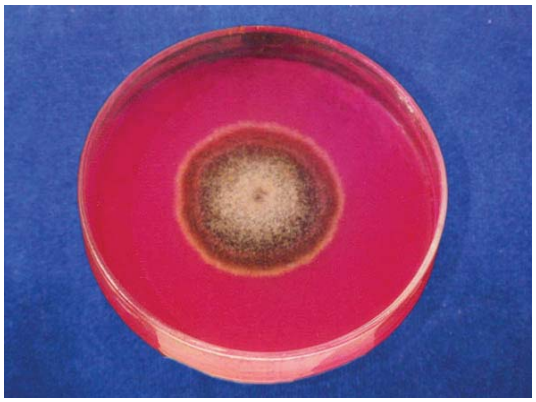
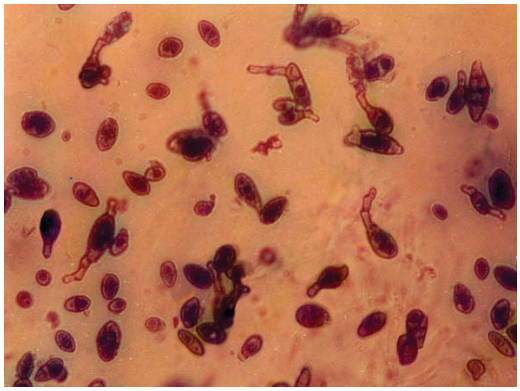


Culture plate of *Alternaria alternata.*



Microscopic photograph of *A. alternata.*

These fungi were mostly observed in month of March to September due to suitable temperature and humidity. Fungi imperfect were the largest group to be reported from the house dust. Some common of them were *Alternaria* and *Curvularia.* Qualitatively the flora isolated from the different habitat is widely separated in indoor and outdoor dust. Some species like *Alternaria alternata , Fusarium oxysporum,* and *Curvularia lunata* were obtained in low counts in samples from house hold dust. Contrary to it some other mycoflora like *Mucor, Penicillium, Aspergillus and Trichoderma* showed a progressive increase in counts from dust during summer season. Besides above mentioned fungal members some sterile hyphae without fruiting body were also observed. Similar opinion was given by (Dix and Webster, 1995; Aguislar, 1996; Stetter, 1999) while working on soil mycoflora. The observation of *Aspergillus fumigatus* and *Aspergillus niger,* during the month of March and April were also in consonance with the work of Salar and Aneja, (2006). The results also showed that *Fusarium sp.* survived in moist soil condition and that species of *Aspergillus* and *Penicillium* could tolerate the same condition for atleast 50 to 55 days. *Fusarium oxysporum, Aspergillus niger, Penicillium funiculosum* were found to be able to grow in low oxygen content and so they were reported in abundance of indoor dust. This observation was in agreement with Domesh, (1960). Soilborne fungi occur only at very low levels in indoor air, and their presence in indoor environments is mostly limited to the soil of indoor, potted ornamental plants (Summerbell *et al.,* 1992).

Conclusion

The results obtained by clearly indicate that *Mucor hiemalis, Aspergillus fumigates, Aspergillus niger* and *Penicillium chrysogenum* were of high occurrence in house dust and some other fungi like *Fusarium oxysporum* and *Curvularia lunata* were negligible in the house dust. The seasonal variation in the frequency of the house dust fungi were found to be regulated by many factors like temperature, humidity, dust chemistry etc.

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