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RESEARCH ARTICLE

DISPERSAL AND DIVERSITY OF AIR BORNE FUNGI IN SOUTHERN DISTRICTS OF TAMILNADU

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ABSTRACT

The dispersal of fungal spore districts like Thanjavure, Pudukottai and Madurai, Tamil Nadu, India was enumerated during the period 2010-2011 in the present investigation. In all twenty sample sites of Thanjavur district this fluctuations showed some uniformity. In Thanjavure, the lowest concentrations of fungal spores were observed both in June and July. The fluctuation trends in all months for all sampling sites in Pudukkottai district was as similar as observed in Thanjavur district. In Madurai, the highest range of fungal spores observed in the month of April suddenly decreased to 50- 60% in January and these trends continued up to June. Hence, the fungal spore concentration fluctuation trends were more or or less similar in all sampling places of Thanjavur, Pudukkottai and Madurai districts.

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INTRODUCTION

Fungi are widespread all over the world. It can grow almost anywhere, as long as moisture and oxygen are present. When excessive moisture accumulates in buildings or on building materials, fungal growth will often occur, particularly if the moisture problem remains undiscovered or unresolved. Airborne fungal spores have been widely recognized as major allergens capable of causing asthma and allergic rhinitis as well as other allergic diseases. They are very important sensitizing agents in allergic respiratory diseases such as asthma and rhino-conjunctivitis (Chapman,1999; Green *et al*, 2006; Al-Doory and Domoson,1984) associated with both asthma severity and death (Pongracic et al, 2010 and Gioulekas *et al*, 2004) act as etiological agents of otomycosis, keratomycosis, onychomycosis, acute respiratory mycoses and chronic bronchitis (Rippon,1988 and Larone, 1987) allergenic diseases such as bronchial asthma, allergic rhinitis and atopic dermatitis (Burge and Rogers, 2000; Terui, 2000). Fungal spores larger than 10 µm are deposited in the nasopharynx and can unchain nasal and ocular disorders. The respirable size fraction of 1-10 µm is of primary concern. Spores and fragments smaller than 10µm especially those smaller than 6 µm can be transported to the lower airways and lungs, and trigger allergic reactions or infect tissues (Martinez *et al*., 2004; Stetzenbach *et al*., 2004). Climate and human activities are the main factors that influence the composition of outdoor atmosphere. The concentration and type of fungal spores in the atmosphere change in a 24h period and from one season to another (Wang, 2001). Distribution of fungal spores in atmospheric air has a varying nature and is determined by a combination of many environmental and biological factors (De-Wei and Kendrick, 1996; Burch and Levetin, 2002). The concentration of airborne fungal spores has been linked to wind, humidity, temperature, rainfall, altitude, vegetation and various specific reservoirs of contamination. Nowadays, worldwide the atmospheric air of all major cities are full of fungal spores due to human anthropogenic activities and gives health hazard effect to the inhabitants. Hence, the present study has been programmed to assess the level of fungal spores in the atmospheric air and their impact on lungs health of inhabitants.

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MATERIALS AND METHODS

Fungal collection and culture method

Sampling was made using a gravitational method. The sterilized petriplate containing PDA medium was kept on a temporary platform set at the height of 6 feet and directly exposed to atmospheric air for 15 minutes from 10.00am to 10.15 am for each sampling day to collect the fungal spores. In this way, a total of 2160 exposure was made for the entire study during the year 2010-2011.The fungal spore collection was also made in the same days and same places of pollen collection. After sampling, the plates were incubated at 25 ± 2_C for 6–8 days. The fungal colonies grown for each species were counted and the total colony count was also recorded for each culture plate by using the digital colony counter model

RAC-887. For identification purposes, fungal colonies were isolated and purified on potato dextrose agar and/or 1% glucose-Czapek's agar, 0.05% yeast extract and then incubated for 5 days. Identification at specific level, if possible was based on the macro- and microscopic features following the keys and description given by Booth (1971), Domsch *et al*. (1980), Kozakiewicz (1989), Moubasher (1993), Pitt and Hocking (1997), Barnett and Hunter (1999) and Samson *et al*. (2002).

RESULTS

Fungal concentrations in Thanjavur district

Fungal concentrations in the atmospheric air of all twenty sampling locations in Thanjavur were counted for the year 2010-2011 from Januray to December and their values are shown in Figure 1. The average levels of fungi in the atmospheric air of Thanjavur district was 1471/hr exposue. The upper and lower ranges of fungal spores were recorded as 4000 and 101/hr exposure for all twenty sampling points. The highest level of fungal spores was obtained at sampling point TR2 Thalavai Palayam and the lowest at sampling point TU3 Saraswathi Mahal.The values for other sites fall in-between these two maximum and minimum level. Generally, the highest fungal concentrations for all sites were observed only at the month of December. The next highest levels were observed in November. The fungal concentrations throughout the year in the atmospheric air of all sample sites showed some fluctuation. In all twenty sample sites of Thanjavur district this fluctuations showed some uniformity. The highest range of fungi observed in April suddenly decreased to 30-35% in January and this trend continues up to June. The lowest concentrations of fungal spores were observed both in June and July. Thereafter, they gradually increased and attained the maximum rate in December for all sample sites.

Fungal concentrations in Pudukkottai district

Fungal concentrations in the atmospheric air of all twenty sampling locations in Pudukkottai were counted for the year 2010-2011 from Januray to December and their values are shown in Figure 2. The mean concentrations of fungal in the atmospheric air of Pudukkottai district was 1521/hr exposure. In all twenty sampling sites of Pudukkottai district, the maximum concentrations of fungal spores 4000/hr were noted at PR4 Talampatty and the minimum concentrations 100/hr were observed at three sampling points such as PSU3, PSU5 and PR4 Ponnappan oorani, Sudharsan street, Talampatty. The values for other sites fall in-between these two maximum and minimum level. The fluctuation trends in all months for all sampling sites in Pudukkottai district was as similar as observed in Thanjavur district.

Fungal concentrations in Madurai district

Fungal concentrations in the atmospheric air of all sixty sampling locations in Madurai were counted for the year 2010-2011 from Januray to December and their values are shown in Figure 3. The average levels of fungi in the atmospheric air of Madurai district was 1678/hr exposure. The upper and lower ranges of fungal spores in Madurai district were recorded as 4000 hr and 122/hr exposure for all twenty sampling points. The highest level was obtained at sampling point MU4 Aarya Bavan Hotel and the lowest at sampling point MSU5 KK nagar. The values for other sites fall in-between these two maximum and minimum levels. Generally, the highest fungal concentrations and the next highest concentrations of fungal were observed at December and November. The fluctuation trends for all sampling sites were more or less similar. The highest range of fungal spores observed in the month of April suddenly decreased to 50- 60% in January and these trends continued up to June. Both in June

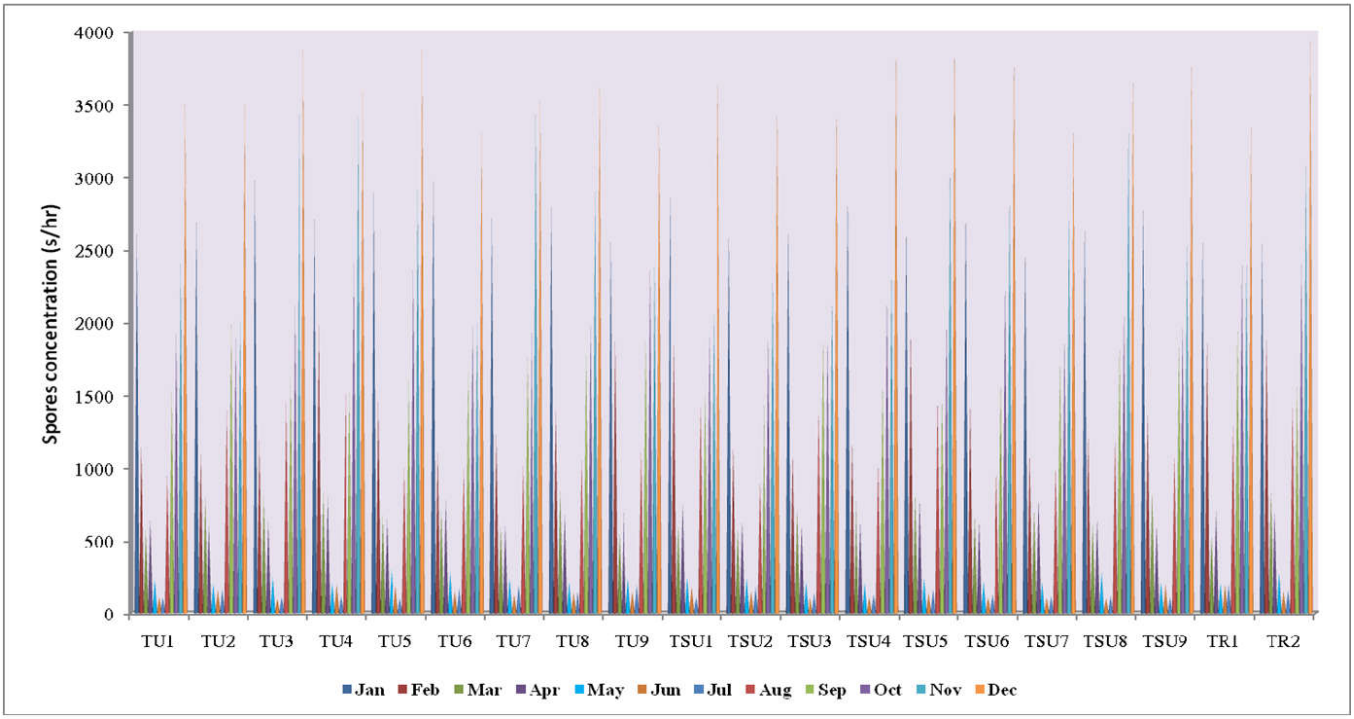

Fig. 1. The spores concentration (s/hr) in urban, semiurban, rural sample sites of Thanjavur District from January to December 2010-2011

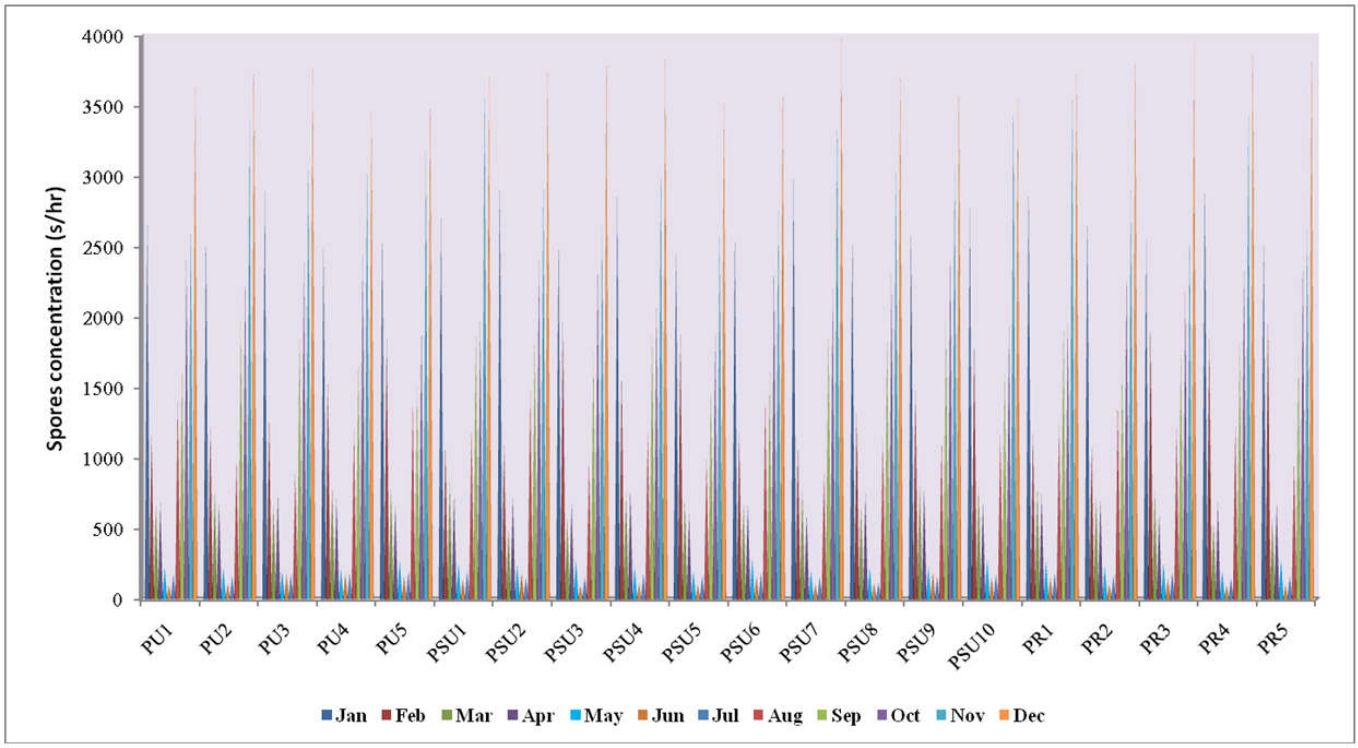

Fig. 2. The spores concentration (s/hr) in urban, semiurban, rural sample sites of Pudukkottai District from January to December 2010-2011

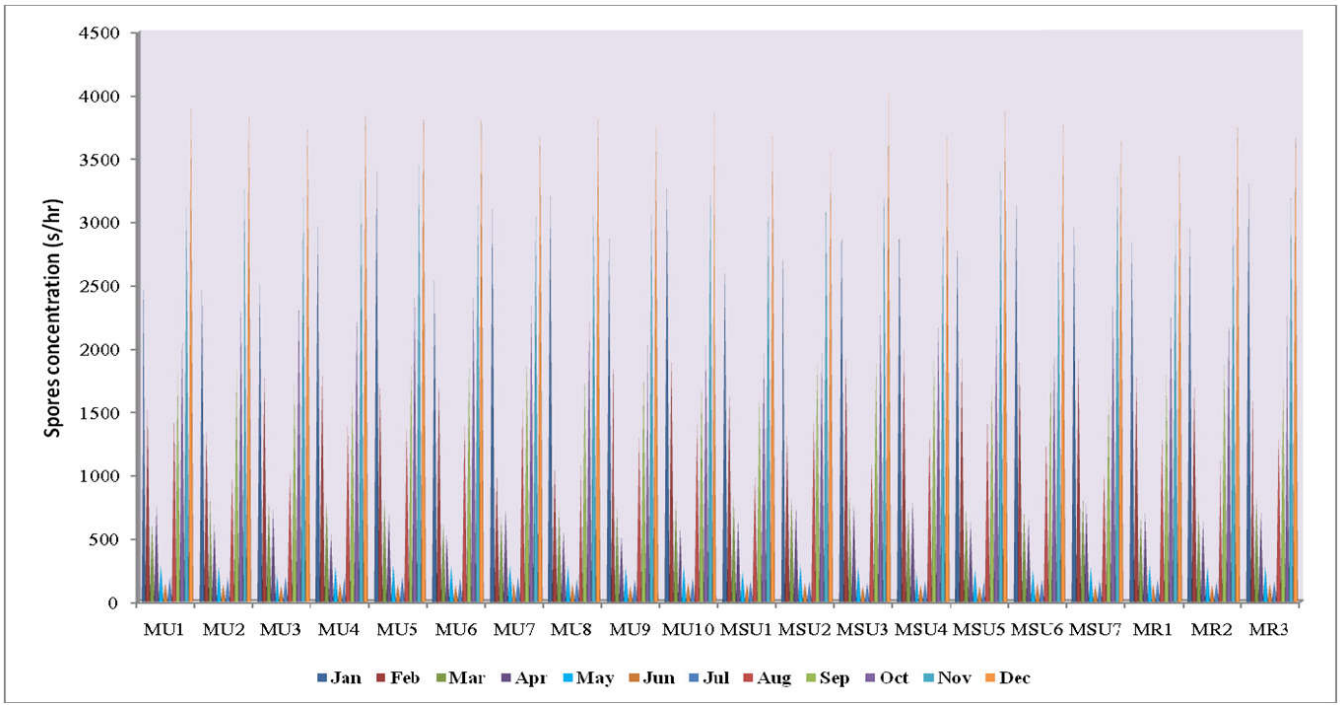

Fig. 3. The spores concentration (s/hr) in urban, semiurban, rural sample sites of Madurai District from January to December 2010-2011

and July the fungal concentrations showed very low concentrations in all the sample sites when compared with other months of the study year 2010-2011. Thereafter, they were gradually increased and attained the maximum rate in the month of December.

DISCUSSION

The fungal population is not homogenous throughout the year and show seasonal variations. Seasonal variations in the concentration of fungal species take place due to change in the meteorological conditions. In the present study, the average fungal spores for all sampling sites were in maximum number in the month of November, December and January. They were recorded as 3012 3804.3 and2813 respectively. The fungal spores concentrations for other months such as February, March, April, May, June, July, August, Sept and October were very low, when compared to November, December and January. They were recorded as 1546, 970.4, 788.5, 252.1, 139.3, 163.7, 1221.6, 1766.3 and 2208 respectively. In all

Tamil Nadu, all these three months such as November, December and January are winter; So according to the present study, the fugal spores were high in the winter season.This findings show an agreement with the results observed by Jadhav (1996) who reported maximum fungal types during winter over rice field. Tiwari (1999) observed maximum fungal types during winter from Raipur. Singh (2006) over Spinach, Tiwari and Sharma (2008) for leaf surface of *Ocimum anctum*, Tiwari and Saluja (2009) in *Catharanthus roseus* have also reported highest fungal incidence during winter season.

Some results of the previous studies are controversial to the present results. For the months where relative humidity was high, higher number of species and colonies were found. The highest relative humidity during 1998 day was of august 73. 6% and during 1999 day was of July respectively. During the days of August 104 colonies and during 1999 July 90 colonies were found. On the other hand the lowest R.H was observed during November 1998 49.5% and February1999 46.5%. The qualitative and quantitave picture of fungi was also limited. During November only thirteen species with 48 colonies were recorded. Similarly during February 1999, 19 species 91 colonies were isolated from the atmosphere. On the whole, May June, July, August and September Monsoon period yielded greater number of species of fungi. Contrary to this, spring and winter months October-February yielded low number of fungi due to low level of relative humidity. In the present study results, there was not any area-wise difference in the fungal spores'densities among all sample sites at each month. In Tamil nadu, the substratum of the fungal growth is plenty in amount in all places, particularly, in down areas, in the household waste dumped outside in each street for a period of a month without treatment. The fungus grown in all these household wastes were enhanced by the moisture content in the winter seasons. Similarly in the rural areas, the plant wastes such as leaves, twigs and dead wood act as a substratum to grow the various fungal species in the winter season. Hence, the fungal spore concentration fluctuation trends were more or or less similar in all sampling places of Thanjavur, Pudukkottai and Madurai districts.

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