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Effect of Relative Humidity and Temperature on Airborne Fungal Allergens of Karachi City

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Abstract: A survey on atmospheric fungi of Karachi city was performed during the years 1998 and 1999.A total number of 53 species belonging to 21 genera of fungi was recorded. During the entire study, seasonal variation was found to be related with atmospheric temperature and relative humidity, especially. An increase in temperature and relative humidity of the atmosphere resulted in increased number of mycoflora, qualitatively and quantitatively.

Key words: Seasonal variation, temperature, relative humidity, mycoflora, atmosphere, fungal allergy

INTRODUCTION

Our atmosphere is full of pollutants including organic and inorganic particulates. These particulates remain present in the atmosphere for 24 h a day but their number decrease or increase according to seasonal variation of the atmosphere. Among these particulates, fungal allergens are also important which cause pathogenic and allergenic problems to human being. The seasonal variation of the atmosphere also affects the population of fungi in the atmosphere. So this causes a direct relationship between the number of allergic incidences and population of fungi as well as the intensity of allergenicity also, (Afzal and Mehdi, 2002).

The fungal air spora and its variation in relation to environmental condition in the tropics remain largely unknown despite the considerable amount of literature on fungal aerobiology (Ebner *et al*., 1989; Palmas and Cosentino 1990).The few available reports from the tropics are mostly based on studies conducted in India, (Kumar and Gupta, 1976). Boehm and Leuschner (1994) reported that spores are sexual or asexual propagating cells of fungi, an ambient air is charged with organic as well as inorganic particles. Later includes the pollen grains, fungal spores and hyphal fragments. Tripathi (1994) reported that a pre-requisite for successful treatment of allergy is complete identification of allergens responsible for the symptoms. Delfino *et al*. (1997) worked on the effect of outdoor fungal spores concentration on daily asthma severity. They observed and noted that exposure to fungal spores can adversely affect the respiratory status of the patients. Tan *et al*. (1992) reported that spore load is related with relative humidity. Hodgkiss and Harvey (1970) stated that effect of relative humidity is difficult to separate from temperature and rainfall. Ahmed *et al*. (1960) discussed that due to temperature and relative humidity, spores production is affected.

The aim of this study was to conduct a survey as to know the relation between temperature, relative humidity and population of allergenic fungi in the atmosphere. Because, the incidences of allergic cases in the city hospitals are on increase day by day.

MATERIALS AND METHODS

For the record of airborne mycoflora of Karachi city, exposed plate method was used, as it is simple to use the best to have live spores and reveals variation in abundance. Although this method has some deficiencies as a spore trap, (Upsher and Griffith, 1973). It is regarding as suitable for sampling the air spores to determine the occurrence of various species and to considerable extent, their relative abundance. The exposed plate method has been widely used in spore investigations, (Horne 1935; Rajan *et al*., 1952; Frey and Durie,1962; Rees, 1964; Dransfield, 1966; Upsher and Griffith, 1973).The nine centimeters glass petriplates containing either potato dextrose agar (PDA) or sabourad dextrose agar (SDA) media were used. As to know the variation in climatic situation, different timings (morning, noon and evening) were selected for exposure. Poured plates were exposed were exposed for only five minutes thrice a day, (9am, 1 pm and 5 pm.) at the heights of 1.5, 5 and 10 m above ground level. The sampling was done twice a month. The exposed plates were returned to the laboratory and incubated at 30°C for seven days and 15-20 days for fungi of slow growth rate. Developing colonies were counted, subcultured into pure isolates and identified by their microscopic morphology, consulting the following authentic literature. Thom and Raper (1945), Raper *et al*.

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(1949), Gilman (1959), Barnett (1962), Ellis (1971), Hawksworth *et al.* (1983) Nelson *et al.* (1988) and Bilgrami *et al.* (1991). Climatic data was obtained from the Department of Meteorology, Karachi.

RESULTS AND DISCUSSION

For the purpose of study of relationship between temperature relative humidity and occurrence of fungal allergens in the atmosphere of Karachi, results were clear to great extent as according to two years (1998, 1999) data, listed in Table 1.

During the present work, species and population of fungi were found to be closely related with temperature with the fluctuation of temperature, marked increase or decrease in fungal population was noted. During the entire work, the lowest temperature was during January 1998, (19.4°C) and 1999, (11.9°C), the fungal colonies and species were also decreased. Colonies of fungi were 82 and 66 and species were 18 and 16, respectively. The highest temperature was during June 1998 (32.4°C) and 1999 (31.6°C), the number and species of fungi were also recorded as high, the colony counts were 115 and 125 and species were 24 and 23, respectively. The increased degree of temperature caused significant increase in species and colonies of fungi during the summer season from April-September (Table 1).

As far as relative humidity is concerned, a marked variation in quality and quantity of fungi were observed due to fluctuation in relative humidity factor during the day time. The months where relative humidity was high, higher number of species and colonies of fungi 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 July 1999, 90 colonies were recorded while the number of species during both the years was 21.On the other hand, the lowest R.H. was observed during November 1998 (49.5%) and February 1999 (46.5%), the qualitative and quantitative picture of fungi was also limited. During November only thirteen species with 48 colonies were recorded. Similarly, during February 1999, 19 species with 91 colonies of fungi were isolated from the atmosphere. As a whole May, June, July, August and September (mon-soon period), yielded greater number of species and population of fungi. Contrary to this, spring and winter months (October-February) yielded lower number of fungi due to low level of relative humidity.

The incidence of air borne mycoflora was the highest in the mon-soon period (June-September) which includes the hottest month (June) and low incidence in winter

Table 1: Effect of temperature and relative humidity on airborne fungal allergens recorded during 1998-1999

Months of the years	Mean monthly temperature (day)	Mean monthly R.H.% (day)	Total No. of colonies	Total No. of fungal species
January				
1998	19.4±0.25	53.5±1.22	82±0.02	18±0.04
1999	11.9±0.02	50.5±0.33	66±0.23	15±0.08
February				
1998	20.8±0.21	50.0±0.22	72±0.08	16±0.03
1999	22.3±1.22	46.5±0.33	67±0.04	19±0.02
March				
1998	25.8±0.08	60.0±0.08	78±0.02	18±0.01
1999	26.6±0.06	51.0±0.06	67±0.04	17±0.23
April				
1998	29.9±0.08	60.0±0.33	87±0.04	21±0.04
1999	30.0±0.77	56.0±0.11	70±0.03	19±0.02
May				
1998	32.0±1.08	60.5±0.25	91±0.05	20±0.06
1999	31.2±0.05	65.0±0.23	114±0.04	22±0.08
June				
1998	32.4±0.11	66.5±0.22	115±0.08	24±0.08
1999	31.4±0.08	68.0±0.15	125±0.33	23±0.05
July				
1998	30.7±0.02	71.5±0.33	104±0.08	20±0.03
1999	30.1±0.08	70.5±0.25	90±0.06	21±0.02
August				
1998	29.4±0.02	73.6±0.06	104±0.08	21±0.03
1999	29.6±0.88	68.5±0.25	107±0.08	22±0.04
September				
1998	31.0±0.03	65.5±0.05	119±0.03	23±0.03
1999	29.0±0.02	66.0±0.22	108±0.04	23±0.01
October				
1998	29.3±0.11	62.0±0.11	66±0.08	13±0.05
1999	30.7±1.22	59.0±0.14	56±0.44	15±0.02
November				
1998	25.5±0.11	49.5±0.02	48±0.01	13±0.03
1999	26.2±0.33	57.5±0.25	68±0.22	14±0.04
December				
1998	21.9±0.25	53.5±0.33	94±0.03	20±1.03
1999	21.4±0.08	47.0±0.25	78±0.47	18±0.025

(Nov-Feb.). Similar pattern have been recorded in other tropical areas (Dransfield, 1966; Turner, 1966; Upsher and Griffith 1973). Tan *et al.* (1992) also reported that spore load started to build up in the morning and then decreased. It was noted that spore load is related with relative humidity which was greater in morning than noon. Hodgkiss and Harvey (1970) stated that effect of relative humidity is difficult to separate from temperature and rainfall. Evidently, tempeature and relative humidity are the important factors in this regard. Ahmed *et al.* (1960) observed that summer season favors greater production of spores while autumn lows production due to comparatively low temperature and relative humidity. Harvey (1970) stated that during the months of July, August and September, maximum number of fungi were recorded, June was second to these months with respect to fungal species. Halwagy (1978) found that higher fungal trough occurred in summer. The situation is some what similar in the present work from May to September, an increased picture of fungal population is obtained associated with relative humidity and temperature, while

during autumn and winter comparatively low number of fungi have been recorded probably due to decreased R.H., temperature and substrates. However, the variability in colony counts could also depend upon the method of trapping the spores involving exposure of plates to wind. In the months where the wind velocity is high (May-June) greater number of dust particles to which the spores adhere and also the spores themselves strike and consequently greater number of spores are deposited on the surface of the media giving rise to greater colony counts.

In addition to this, another important factor on which the colony counts depend, is the type of media used. Marchisio *et al.* (1992) reported that inspite of the fact that air borne fungal particles have been extensively studied in all the climates, the results are not easily compared mainly because of the different sampling techniques that different authors have used. Each technique has some limitations. Various media have their own advantages and disadvantages.

In short, it seem to be a close relationship between the occurrence of fungal allergens and seasonal fluctuation of the atmosphere. Hence, the patients of respiratory and skin allergy may be advised as to avoid and take necessary precautions during the mon-soon period or in the months, where fungal population is supposed to be more. So this study will be helpful to the people who are suffering from the problem of the allergy and immunodeficiency, especially in the metropolitan city of Karachi.

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