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Allergenic Fungal Spore Concentrations in the Atmosphere of Bursa, Turkey

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ABSTRACT

The daily distribution of allergic fungal spores for Bursa during 1999 was established using a 7-day volumetric Lanzoni trap. Ten of the important allergic fungal spores (Cladosporium sp., Alternaria sp., Aspergillus sp. / Penicillum sp., Fusarium sp., Epicoccum sp., Drechslera sp., Pithomyces sp., Stemphylium sp., Chaetomium sp. and Curvularia sp.) were identified. The dominant spore types detected were Cladosporium 88.11%, Alternaria 4.99%, Aspergillus / Penicillum 4.65%., Fusarium 0.84%, Epicoccum 0.62%, Drechslera 0.24%, Pithomyces 0.15%, Stemphylium 0.14%, Chaetomium 0.13% and Curvularia 0.13%. Spore levels of Cladosporium, Alternaria and Aspergillus / Penicillum peaked throughout the year. Fusarium April-June, Epicoccum June-August, Dreschlera July, September, Pithomycetes March, June and August, Stemphylium June-July, Chatemium May, July, Curvularia peaked July. In conclusion, a range of allergenic fungal spores were present in the air of Bursa throughout the year.

Key Words: Aerobiology, Lanzoni trap, fungi, allergenic spores, spore concentration

INTRODUCTION

Fungi spores are among the most commonly encountered airborne particles. Some fungi and their spores have a negative effect on human health and are a frequent cause of allergies and immunotoxic diseases Qualitative and quantitative knowledge of allergenic fungal spores is of great importance and concern because they can cause several respiratory diseases in man such as asthma and rhinitis when inhaled (Bush and Portnoy 2001; Dutkiewicz 1997). The allergenic action of aerospores is limited in relation to their amount. According to some reports, allergy to moulds amounts to 10% of all allergic patients and is especially widespread among children as asthma and in adolescence as rhinitis (Andri et al 1986). Therefore, the daily distribution of fungal spores in the atmosphere has important for health. Given that 10 of fungal genera are allergenic (Cladosporium, Alternaria, Aspergillus / Penicillum, Fusarium, Epicoccum, Drechslera, Pithomyces, Stemphylium, Chaetomium and Curvularia), the characterization of fungal spore seasons can allow physicians and allergy sufferers to more accurately establish preventative strategies.

In Turkey, a few studies have been done only for Alternaria and Cladosporium spores (Bicakci et al 2001; Tatlidil et al 2001; Sakiyan and Inceoglu 2003). In these studies monthly variations of Alternaria and Cladosporium spores were investigated. There has not yet been a quantitative investigation of the range of airborne spores in Bursa atmosphere.

The aim of study is to assess daily appearance of some important allergenic fungal spores and give specialized insight to the major fungal allergens to Bursa's population.

MATERIALS AND METHODS

Spore sampling was carried out using a volumetric trap (VPPS 2000 Lanzoni, Bologna, Italy) placed about 25m above ground level, on the roof of the Almira Hotel which is located in the center of the city in a densely populated zone. The sampling airflow rate was 10 l/min. Spore was caught on a 14 mm wide transparent tape coated by a thin film of silicon oil. The tape was mounted on a cylinder rotating at a speed of 2 mm per hour. A complete rotation of the cylinder took seven days. Weekly tape strips were cut into 7 pieces, each 48 mm in length. Each piece corresponded to one day sampling. They were then mounted and stained in glycerin jelly mixed with basic fuchsine for pollen identification and examined microscopically. A sampling method, slide preparation and data interpretation were performed according to the standard method of the Italian Network for the Aerobiological Monitoring (D'Amato and Spieksma 1990), and pollen and spore concentrations were expressed as number of pollen grains and spores per cubic meter (spore/m3/24h). The analysis of the spore concentration trend in 1999 was performed using the annual sum of the daily mean values. The spore was counted at a magnification of × 100, in 24 transverse bands corresponding to every full hour, and total daily counts were converted into the number of spore per m3 of air. Allergenic 10 taxa spore concentrations for Bursa is given in the figures on the basis of daily means.

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RESULTS

In this study, some allergic spores of fungal taxa such as Alternaria, Aspergillus / Penicillum, Chatemium, Cladosporium, Curvularia, Drechslera, Epicoccum, Fusarium, Pithomyces, Stemphylium have been identified first time in the atmosphere of Bursa. This study is the first one presenting airborne ten fungal spores counts also for Turkey. During the observation year, 130344 spores / m³ were counted (Table 1). The dominant spore types detected were Cladosporium, Alternaria and Aspergillus / Penicillum They form 97.75% of the total spores (Table 1). Daily variations of investigated spores were shown in Figure 1-2.

Table 1. List and percentage contribution of airborne fungal spores in the atmosphere of Bursa

Spore Type	Annual count	Percentage total
Cladosporium	114848	88,11
Alternaria	6498	4,99
Aspergillus/Penicillum	6059	4,65
Fusarium	1095	0,84
Epicoccum	814	0,62
Drechslera	314	0,24
Pithomyces	194	0,15
Stemphylium	186	0,14
Chaetomium	171	0,13
Curvularia	165	0,13
TOTAL	**130344**	**100,00**

Table 2. Monthly amounts of spores/m³ in the atmosphere of Bursa

	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
Alternaria	12	38	52	168	398	1844	2167	750	632	319	91	27
Asp./Pen.	107	201	201	650	1367	1346	793	247	392	406	270	79
Chaetomium	9	15	20	9	22	18	27	8	17	19	7	-
Cladosporium	802	1075	1273	4789	14645	43633	32740	8251	3886	2869	724	161
Curvularia	5	7	20	19	19	13	26	6	21	21	9	-
Drechslera	6	6	12	13	25	55	60	21	59	42	14	1
Epicoccum	19	9	12	54	48	147	241	150	77	37	14	6
Fusarium	31	32	63	553	195	126	38	15	22	15	5	-
Pithomyces	17	19	22	9	17	22	19	21	19	19	10	-
Stemphylium	4	4	15	7	15	51	35	13	19	13	7	3
TOTAL	1012	1406	1690	6271	16751	47255	36146	9482	5144	3760	1151	277
%	0,78	1,08	1,30	4,81	12,85	36,25	27,73	7,27	3,95	2,88	0,88	0,21

Cladosporium sp.: Spores of this genus constituted 88.11% of total spores in the atmosphere of Bursa (Table 1). Cladosporium was found as dominant spores in the atmosphere of Bursa Spores were identified in the air all of the year and were peaked between mid-May and mid-July (Table 2, Figure 1).

Alternaria sp.: Spores of this genus constituted 4.99% of total spores in the atmosphere of Bursa Spores were identified in the air all of the year and were peaked June and July. Maximum value of Alternaria spores was recorded last of June, first days of July and on July 29 (Table 2, Figure 1).

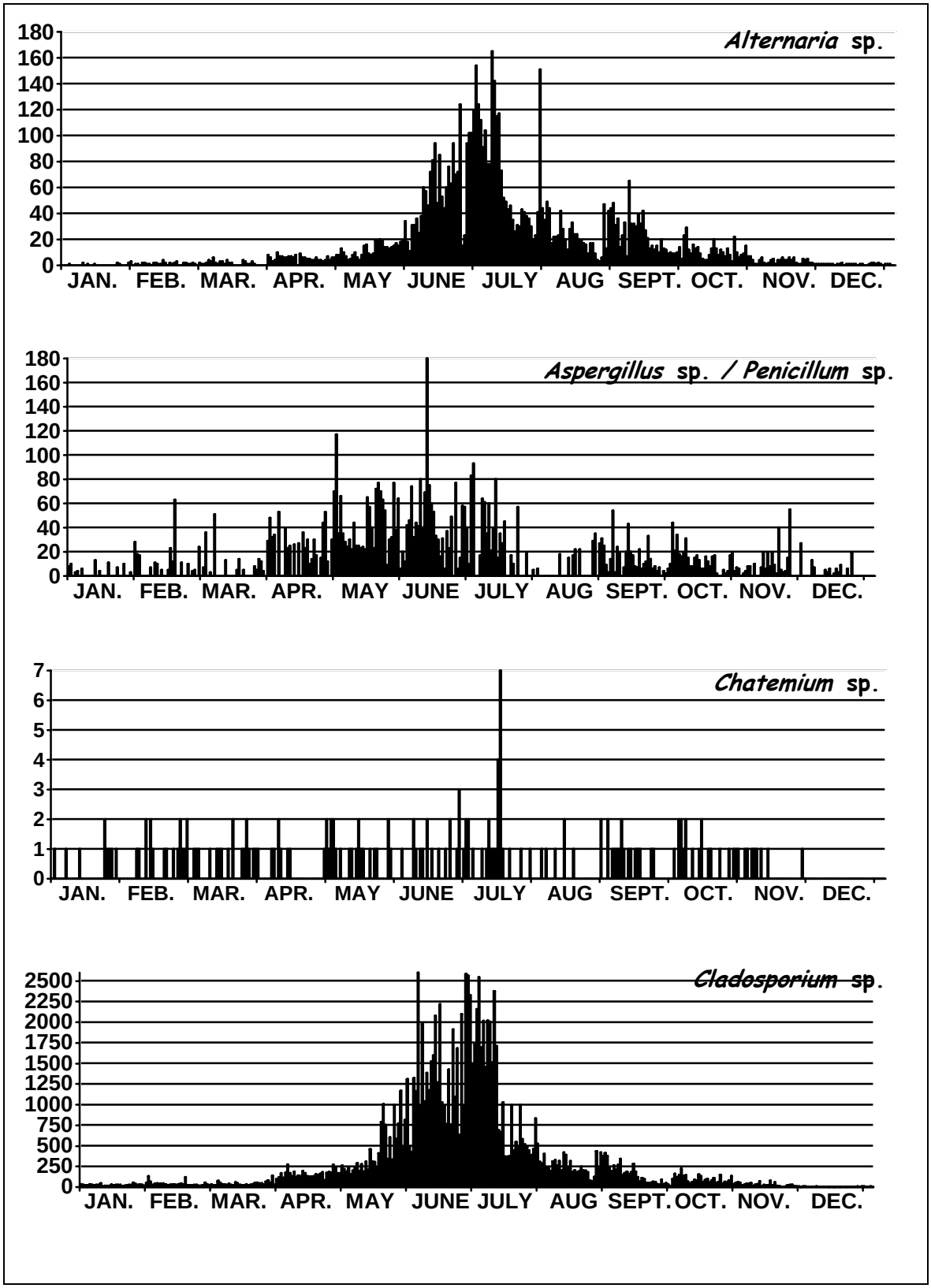

Figure 1. Annual daily variations of Alternaria, Aspergillus / Penicillum, Cladosporium, Chaetomium and Curvularia spores/m³ in the atmosphere of Bursa (1999).

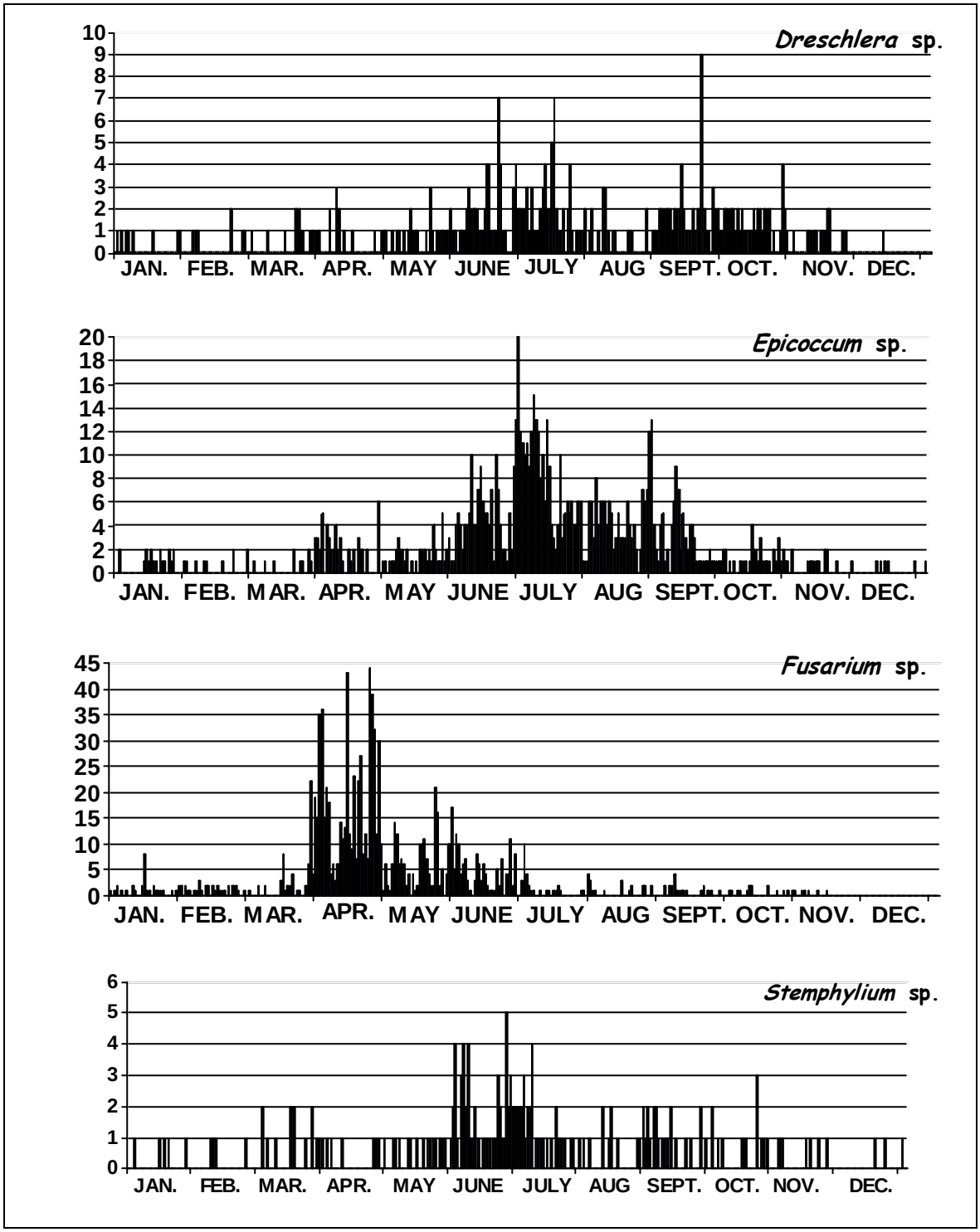

Figure 2. Annual daily variations of Dreschlera, Epicoccum, Fusarium, Pithomyces and Stemphylium spores/m³ in the atmosphere of Bursa (1999)

Aspergillus sp. / Penicillium sp.: Spores of this genus constituted 4.65% of total spores in the atmosphere of Bursa Spores were identified in the air all of the year and were peaked June and July. Maximum value of these spores was recorded on May 2 and on June 12 (Table 2, Figure 1).

Fusarium sp.: Spores of this genus constituted 0.84% of total spores in the atmosphere of Bursa Spores were identified in the air all of the year and were peaked between June and August. Maximum value of

Epicoccum spores was recorded in the last day of June, first days of July and in the last two days on August (Table 2, Figure 2).

Epicoccum sp.: Spores of this genus constituted 0.62% of total spores in the atmosphere of Bursa Spores were identified in the air all of the year and were peaked between June and August. Maximum value of Epicoccum spores was recorded in the last day of June, first days of July and in the last two days on August (Table 2, Figure 2).

Drechslera sp.: Spores of this genus constituted 0.24% of total spores in the atmosphere of Bursa These spores were identified in the atmosphere all of the year and was recorded as dominant on June 21, July 16 and September 20 (Table 2, Figure 2).

Pithomycetes sp.: Spores of this genus constituted 0.15% of total spores in the atmosphere of Bursa These spores were identified in the atmosphere all of the year except from mid-November to last of December and was recorded as dominant (5 spores/m^3) on August 27 and November 12 (Table 2, Figure 2).

Stemphylium sp.: Spores of this genus constituted 0,14% of total spores. These spores were identified in the atmosphere all of the year and was recorded as dominant (5 spores/m^3) on June 27 (Table 2, Figure 2).

Chaetomium sp.: Spores of this genus constituted 0.13% of total spores in the atmosphere of Bursa Spores were identified in the atmosphere all of the year except from mid-November to last of December and was recorded as dominant on July 16 (Table 2, Figure 1).

Curvularia sp.: Spores of this genus constituted 0.13% of total spores in the atmosphere of Bursa. These spores were identified in the atmosphere all of the year except from mid-November to last of December (Table 2, Figure 1).

DISCUSSION

Total amount of spores was recorded as minimum in the atmosphere of Bursa between on January and March (Table 2, Figure 3). In these months, the temperature of air was very low (Figure 3), and low temperature effected concentration of spores in the atmosphere. In the other studies, it is stated that cooler temperature causes decreasing in spore numbers in the air (Ebner et al 1992; Gioulekas et al 2004).

The number of spores increased on April and May. In June, total amount of spores reached maximum level because of optimum conditions of wind speed, relative humidity, temperature and rainfall. Rainfall remained fleeting though June and after fleeting rainfall, increasing of relative humidity and air temperature was increased number of spores in the atmosphere (Gioulekas et al 2004; Kendrick and Li 2000). The number of spores recorded as high on July and August. Increasing number of spores on between April and September related to high temperature and sunshine. The role of high temperature of the air increasing airborne spore concentration has been documented by a few authors (Corden and Millington 2001; Mitakakis et al 1997). Also, the amount of spores in the atmosphere of Bursa related to low temperature decreased on between October and December (Figure 3).

Maximum values a total of spores were recorded on between on May and July. Airborne conidia of Cladosporium spp. were the most frequent and most abundant in these months (Figure 3, Table 2). Most aeromycological papers report this taxon in both temperate and hot climates (Adams 1964; Mitakakis and Guest 2001). Conidia belonging to Cladosporium spp. are the commonest in the air, also. Second dominant spore in the atmosphere of Bursa was identified as Alternaria spp.. In everyday practice, only the data on the occurrence of 2 taxa are usually taken into account: Cladosporium and Alternaria spp. It is these taxa which most commonly cause allergies, and according to Haines et al (1999) and Bush and Portnoy (2001) the conidia and spores of all the taxa studied in this work cause allergies. In Bursa, the concentrations of the spores often exceeded threshold values, provoking allergy symptoms (Gravensen 1979). Such co-occurrence of aeroallergens increases the risk of disease (Nikkels et al 1996).

Several studies have been done in other countries, maximum values a total of spores were recorded on between April to October in Italy (D'Amato 1984); on June in India (Khandelwal 2001), on summer in Australia (Mitakakis and Guest 2001).

Studied fungal spores cause allergic diseases (Agarwal et al 1969; Benyon et al 1999; Black et al 2000; D'Amato et al 1984; 9 Gioulekas et al 2004; Gupta et al 2004; Mitakakis et al 2000). The dominant spore types detected were Cladosporium, Alternaria and Aspergillus / Penicillum. They form 97.75% of the total spores (Table 1). Similar studies have been done in other countries, the dominant spores being Cladosporium, Alternaria and Aspergillus in India (Agarwal et al 1969); Cladosporium, Alternaria, Penicillum and Aspergillus in Canada (Kendrick and Li 1994) and Japan (Takahashi 1997); Cladosporium and Alternaria in Seoul (Oh et al 1998), Santiago (Henriquez et al 2001).

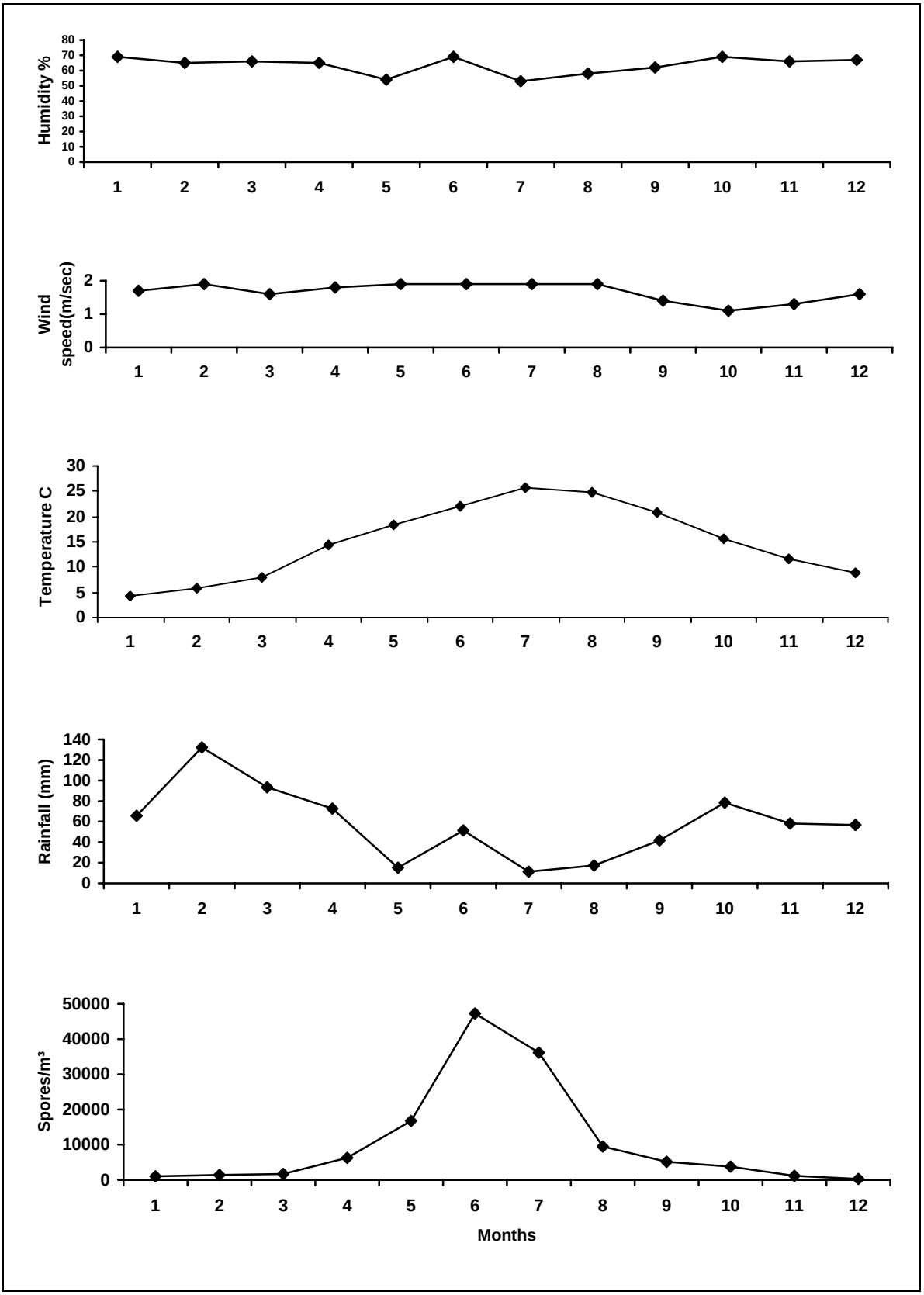

Figure 3. Monthly variations of Temperature, Humidity, Wind speed, Rainfall and concentrations of spores/m³ (1999).

Spores of the studied fungal taxa occur in the air throughout nearly the whole year; however their daily concentration varies considerably. A diversity of allergic ten fungal spores was present in the atmosphere of Bursa Spore levels of Cladosporium, Alternaria and Aspergillus / Penicillum peaked throughout the year. Fusarium April-June, Epicoccum June-August, Dreschlera June, July and September, Pithomycetes March, June and August, Stemphylium June-July, Chatemium May, July, Curvularia peaked July. The maximum spore concentration of most taxa occurred in July, and their concentrations exceeded threshold values provoking allergy symptoms from March to August.

Finally, this kind of data is being presented for the first time in our area and could constitute the infrastructure of many medical, biological and other scientific field applications.

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