J. BIOL. ENVIRON. SCI.,
2007, 1(3), 127-130

Cladosporium Link ex Fr. and *Alternaria* Nees ex Fr. Spores in the Atmosphere of Edirne

Sevcan Celenk[1*], Adem Bicakci[1], Perihan Erkan[1], and Mehmet Aybeke[2]
[1] Biology Department, Science Faculty, Uludag University, 16059 Bursa - Turkey
[2] Biology Department, Science Faculty, Trakya University, 22030 Edirne - Turkey

ABSTRACT

In this study which was carried out during the years 2000-2001, was aimed to identify the amount of spores of *Cladosporium* Link ex Fr. and *Alternaria* Nees ex Fr. in the atmosphere of Edirne city. This study was carried out according to the gravimetric method. Before exposure of the atmospheric particles, the slides smeared with glycerine jelly stained with basic fuchsine and were changed weekly. The number of spores was expressed as spores per square centimeter of microscope cover glass. Spores of *Cladosporium* spp. and *Alternaria* spp. were recorded throughout the year in the atmosphere of Edirne. During the two years observations, a total 6318 spores/cm^2 belonging to *Cladosporium* spp. and *Alternaria* spp. were identified. In total 1223 spores/cm^2 belonged to *Alternaria* spp. and 5095 spores/cm^2 belonged to *Cladosporium* spp.. Maximum spores were encountered in July.

Key Words: *Alternaria* spp.; *Cladosporium* spp.; allergy; Edirne; meteorology.

INTRODUCTION

Fungi spores are among the most commonly encountered airborne particles. Over the last few years significant progress has been observed in the study of the airborne fungi, because of the biomedical and phytopathological consequences cause by fungal propagules. 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 aero spores 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). Mould spores are found in large numbers in indoor and outdoor environments and they have been recognized as important inhalant allergens. *Cladosporium* Link ex Fr. and *Alternaria* Nees ex Fr. are found everywhere, it is an extremely common saprophyte found in the soil, on plants and in the air. Especially *Alternaria* spp. present in large numbers throughout the late summer (Hyde and Williams 1946).

Certain fungal spores are known to allergic response and spores of the *Alternaria* spp. and *Cladosporium* spp., a member of the Deuteromycetes, have been known to tigger asthma for over 50 years (Agaryal et al 1981). The risk of asthma related deaths is more than doubled when there is a high incidence of mould spores (Targonski et al 1995). In Turkey, the first study was done by Ozkaragoz et al (1967). Then Ince and Pehlivan (1991), Bicakci et al (1999) and Tatlidil et al (2001), Sakıyan and Inceoglu (2003), Ataygul et al(2007) did similar studies. An understanding of seasonal patterns of fungal spore number and type may assist in determining the total allergen load of the atmosphere, and thus the risk to sufferers of asthma and hay fever.

MATERIAL AND METHOD

Edirne, situated at 40º 30' - 42º 00' N and 26º 00' - 27º 00'E in the northwest of Turkey at an altitude of 41 m above the sea level. Edirne has an anthropogenic steppe vegetation, both Mediterranean and Middle European climate generally. Twenty-five percent of the Edirne area is covered by forest and shrubbery, 57% by planted fields, and 10% by meadow and pasture. The study area consists of agricultural areas. The main agricultural plants in the region are; wheat, sunflower, sugar beet, squash, onion, potato, clover, melon, watermelon, tomato, pepper, cabbage, cucumber and eggplant. General vegetation consists of maquis and pseudomaquis (Kirec and Yarci 1999).

This study was carried out according to gravimetric method, using a Durham sampler (Durham 1946). The Durham sampler was placed on the office roof at height of 15m above grand level. Slides placed the Durham sampler were changed weekly. Before exposure, the slides were covered with glycerine jelly mixed

* Corresponding author: sevcant@uludag.edu.tr

with basic fuchsin (Charpin and Surinyach 1974). The slides were examined in the light microscope weekly. Finally *Alternaria* spp. and *Cladosporium* spp. spores found in cover glass area were identified and counted. The amount and monthly variation of *Alternaria* sp. and *Cladosporium* sp. spores, and meteorological data belong the same time shown in Figure1. SPSS was used for the statistical analysis, and Spearman's correlation was applied on meteorological parameters and spore concentration.

RESULTS

During the observation years, a total 6318 spores/cm^2 belonging to *Alternaria* spp. and *Cladosporium* spp. were identified. Out of, 5095 spores/cm^2 belong to *Cladosporium* spp. and remaining 1223 spores/cm^2 to *Alternaria* spp. In the atmosphere of Edirne, *Alternaria* spp. and *Cladosporium* spp. were found every mount of the year.

Minimum spore level was found in January, February and March. In April, it seemed that an important increasing spore concentration. While temperature continued to increase, the rainfall seemed to occur during this month. In May, due to temperature increases, the spore concentration of both *Cladosporium* spp. and *Alternaria* spp. increased. In June, both *Cladosporium* spp. and *Alternaria* spp. spore concentrations continued the increase.

In July, spore concentrations were very different from in June. Both *Cladosporium* spp. and *Alternaria* spp. concentrations increased and reached their maximum level. Although the highest temperature was recorded in July, low rainfall and relative humidity caused an increase in spore concentrations.

In August, a significant decreasing was observed on concentrations of the two spores. Although humidity and rainfall were high enough, a decreasing in temperatures caused a decrease in spore concentrations during this month (Figure 1).

During September, spore concentrations were highest from in August. All climatic parameters, except temperature, were highest than in the previous months. In October, November and December, mean temperature was lower than in the previous months. Although humidity and wind were high enough, low temperatures caused a decrease in spore concentrations during these months.

DISCUSSION

In each geographic area, there is a succession of different vegetation. Weather conditions probably have an important influence on the numbers of spores in the atmosphere. Such conditions influence both the ontogeny of spores and their dispersion. *Cladosporium* spp. and *Alternaria* spp. spores found in the atmosphere of the city all around the year and reached their maximum level on June. Second peak for *Alternaria* spp. and *Cladosporium* spp. were observed in September (Figure 1). In the region, agricultural activities are intensively carried out. Harvesting time for investigated region, start on June and last on October. According to Landecker (1996), massive quantities of spores are found only in specialized situations, often associated with a particular occupation. Agriculture is foremost among these occupations because many fungi that are normally present in the air are pathogens on plants. Spore numbers in the air are increased dramatically as a result of agricultural practises such as harvesting of cereal crops or making hay. After the harvest, stored grains, fruits, and vegetables support the growth of storage fungi (Landecker 1996). As a result of harvesting of crops in the investigated area, huge amounts of spores are found in the harvesting time.

In the atmosphere of Edirne, spores of *Cladosporium* spp. were found most abundant than spores of *Alternaria* spp.. Similarly Davies (1965), Hamilton (1959), Vittal and Krishnamoorthi (1981) also reported in their aeropalynologic studies that the most common spores were *Cladosporium* spp.. Spore level was found as minimum in first tree months of the year. In earlier studies, it was shown the lower temperature to be penetrating the amounts of spores (Halwagy 1989; Hjelmros 1993). In April, it seemed that an important increasing spore concentration while temperature continued to increase, the rainfall seemed to occur during this month. Sufficient amount of precipitation when combined with a high temperature seemed to optimize the sporulation conditions for *Alternaria* spp. and *Cladosporium* spp. A significant increase in spore concentration after precipitation was observed by Kramer et al (1959). In June, both *Cladosporium* sp. and *Alternaria* sp. spore concentrations continued the increase. Temperature was higher than in May. According to Hjelmros (1993), when the relative humidity rises above 45% and wind is rather strong, concentrations of *Alternaria* sp. spores increase (Hjelmros 1993). Also, the changes in wind speed had a large influence on the spore concentration, especially when the other climatic factors were optimal.

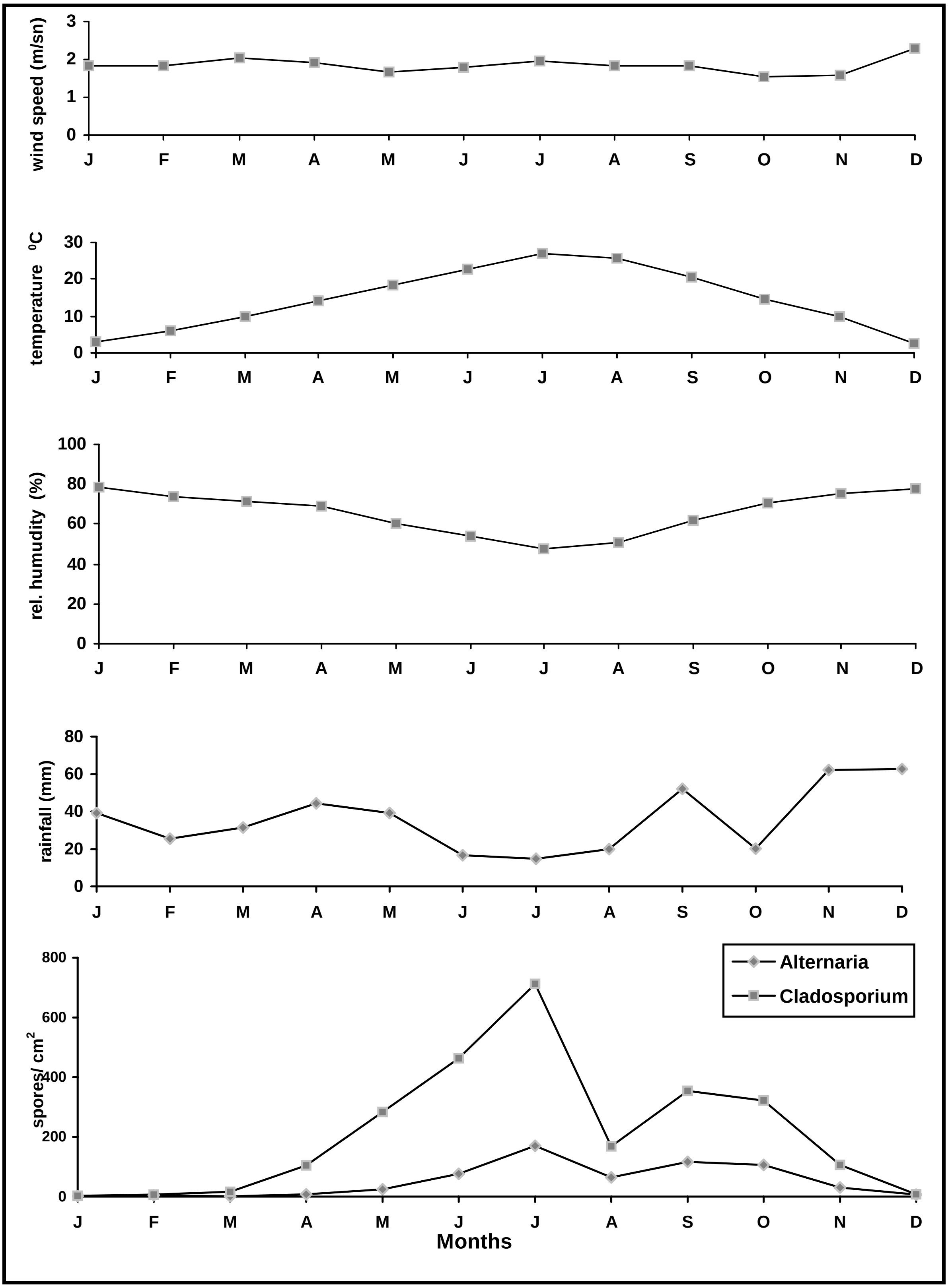

Figure 1. Monthly variations of wind speed, temperature, relative humidity, rainfall and *Alternaria* spp., *Cladosporium* spp. spores/cm^2 in the atmosphere of Edirne.

Table 1. Coefficients of correlation between the spore concentration and the main meteorological parameters by using the Spearman correlation test (**. Correlation significant at the 0.01 level).

	Temperature $_{mean}$	*Humidity* $_{mean}$	*Wind speed* $_{mean}$	*Rainfall* $_{total}$
Alternaria spp.	0.737**	-0.618**	-0.171	-0.167
Cladosoporium spp.	0.698**	-0,543**	-0.102	-0.163

In conclusion, the highest level of *Alternaria* spp. and *Cladosporium* spp. spores in the atmosphere of Edirne was recorded in July. *Cladosporium* spp. and *Alternaria* spp. spore concentrations in Kemalpasa (Bursa) (Bicakci et al 2001) was highest during July. In Burdur (Tatlidil et al 2001) and Ankara (Sakiyan and Inceoglu 2003) was highest during August. Ataygul et al (2007) found high concentrations of *Alternaria* spp. and *Cladosporium* spp. spores in the atmosphere of Bursa. *Alternaria* spp. spores was peaked in July and *Cladosporium* spp. spores was reached maximum level in June in the atmosphere of Bursa (Ataygul et al 2007). We found positive correlation with mean temperatures (Figure 1, Table 1) as found in Derby (UK) (Corden and Willington 2001) whilst showing a slight negative correlation with daily precipitation, agreeing with work by Mitakakis et al in Australia (Mitakakis et al 1997). Gregory and Hirst (1957) found high *Alternaria* type spore concentrations most often in August, in warm dry spells after a period of wet weather. The investigated airborne fungal spores are allergenic to fewer people. Therefore, monitoring of airborne fungal spore may be useful for patients and allergologist.

REFERENCES

Agaryal M.I.C, Yunginger J.V., and Swanson B.A. (1981). An immunomedical method to measure atmospheric allergen. J Allergy Clin Immunology 68:194.
Ataygul E., Celenk S., Bıçakçı A., Canıtez Y., Malyer H., Sapan N. (2007). Allergenic fungal spore concentrations in the atmosphere of Bursa, Turkey. J Biol Environ Sci 1(2): 73-79.
Andri L., Senna G.E, Andri G., Pezzini A., Menegazzi M., and Cavalleri M.P. (1986). Rilievi clinico-diagnostici nell'allergia al-l'Alternaria tenuis. Folia. Allergol Immmunol Clin 33: 215-222.
Bicakci A., Canıtez Y., Sapan N., and Malyer H. (1999). Allergenic spores of Inegöl (Bursa). Allergy Supp 51:54; 46.
Bicakci A., Tatlidil S., Canıtez Y., Malyer H., and Sapan N. (2001). Mustafa Kemalpaşa (Bursa) ilçesi atmosferindeki allerjen *Cladosporium* sp. ve *Alternaria* sp. Sporları. Akciğer Arşivi Dergisi 2: 69-72
Bush R.K., and Portnoy J.M. (2001). The role and abatement of fungal allergens in allergic diseases. J Allergy Clin Immunol 107(3 Suppl): 430- 440.
Charpin J., and Surinyach R. (1974). Atlas of European Allergenic Pollen. Paris:Sandoz Editions.
Corden J.M., and Millington W.M. (2001). The long term trends and seasonal variation of the aeroallergen *Alternaria* in Derby, UK. Aerobiologia 17: 127-136.
Davies R.R. (1957). A study airborne *Cladosporium*. Trans Br Mycol Soc 40: 1695
Durham O.C. (1946). Volumetric incidence of atmospheric allergens IV. J Allergy 79-86.
Dutkiewicz J. (1997). Bacteria and fungi in organic dust as potential health hazard. Ann Agric Environ Med 4: 11-16.
Gregory P.H., and Hirst J.M. (1957). The Summer Airspore at Rothamsted in 1952. J Gen Microbiol 17: 135-152.
Halwagy M. (1989). Seasonal airspora at three sites in Kuwait 1977-1982. Mycol Res 93: 208-213.
Hamilton E.D. (1959). Studies on the airspore. Acta Allergol 13:143-175.
Hjelmros M. (1993). Relation between airborne fungal spore precence and weather variables *Cladosporium* sp. and *Alternaria* sp. Grana 32: 40-47.
Hyde H.A., and Williams D.A. (1946). A daily census of *Alternaria* spores caught from the atmosphere at Cardiff in 1942 and 1943. Trans Brit Mycol Soc 29: 78-85.
İnce A., Pehlivan S. (1991). Serik (Antalya) havasında *Alternaria* spp.sporları ile ilgili araştırma, J Biol Fac Sci Arts Gazi Üniv 2: 109-120.
Kramer C.l., Paday S.M., Rosergen C.T. (1959). Kansas aeromycology VIII.Phycomycetes. Trans Kns Acad Sci 63: 19-23.
Kirec M., Yarci C. (1999). The flora of the agricultural areas in Enez (Edirne) and environs. Tr J of Botany 23: 53-62.
Landecker E.M. (1996). Fundamentals of Fungi. Publ. Benjamin Cumings .
Mitakakis T., Ong E.K., Stevens A., Guest D., and Knox R.B. (1997). Incidence of Cladosporium, *Alternaria* and total fungal spores in the atmosphere of Melbourne (Australia) over three years. Aerobiologia 13: 83-90.
Ozkaragoz K. (1967). Pollens, Mould spores and other inhalants as etiolojik agents of respiratory allergy in the central part of Turkey. J Allergy 40: 21-25.
Sakiyan N., and Inceoğlu O. (2003). Atmospheric Concentrations of *Cladosporium* Link and *Alternaria* Nees Spores in Ankara and the Effects of Meteorological Factors. Turk J Bot 27: 77-81.
Targonski P.V., Persky V.W., and Ramekrishnan V. (1995). Effects of environmental molds on risk of death from asthma during the pollen season. J Allerg Clin Immunol 95: 955-961.
Tatlidil S., Bicakci A., Akkaya A., and Malyer H. (2001). Burdur atmosferindeki allerjen *Cladosporium* sp ve *Alternaria* sp sporları, SDÜ Tıp Fak Dergisi 8(4): 1-3
Vittal B.P.R., and Krishnamorthi K. (1981). Airspore of an agricultural farm in Madras, India. Grana 20: 61-64.