Allergen Alternaria and Cladosporium Spores Concentration in the Atmosphere of Çamkoru (Ankara - Turkey), 2003 - 2004

Research Article
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ABSTRACT

Alternaria and Cladosporium spores have been shown to be important aeroallergens in many regions throughout the world and the densities of these spores show considerable differences according to the years. Therefore, Alternaria and Cladosporium spores were collected with a Durham sampler in the atmosphere of Çamkoru (Ankara), between September 2003 to August 2004. Spores/cm² of Alternaria and Cladosporium were recorded daily. Monthly total spores/cm² of Alternaria and Cladosporium were correlated with the monthly meteorological factors (temperature, rainfall, wind speed) of the same period by using Spearman correlation analysis. During this period, a total of 684 spores/cm² belong to Alternaria and Cladosporium genera were determined. 406 (59.36%) spores/cm² of this total belong to Cladosporium and remaining 278 (40.64%) spores/cm² to Alternaria. The concentration of Alternaria and Cladosporium spores reached to highest ratios in May, 2004. According to Spearman correlation analysis the quantity of Alternaria ve Cladosporium spores shows significant positive relationship with the temperature and the wind speed, but showed insignificant negative relationship with the rainfall. These findings will help to the allergist for the diagnosis, tracing and treatment of the respiratory system diseases.

Key Words
Aeroallergen, Alternaria; Cladosporium; Durham sampler; meteorological factors; Spearman correlation analysis; Çamkoru (Ankara).

ÖZET

Alternaria ve Cladosporium cinslerine ait sporlar, dünyanın birçok bölgesinde önemli aeroallerjenler olarak görülmektedir, ancak bu sporların yoğunlukları yılara göre önemli farklılıklar gösterir. Bu yüzden Alternaria ve Cladosporium sporların, durham aleti ile Çamkoru (Ankara) atmosferinden 2003 yılının eylül ayından 2004 yılının ağustos ayına kadar toplandı. Alternaria ve Cladosporium'a ait spor miktarı/cm² günlük olarak kaydedildi. Alternaria ve Cladosporium sporlarının aylık miktarları/cm² ile aynı döneme ait meteorolojik faktörler ( sıcaklık, yağış, rüzgar hızı) arasındaki ilişki Spearman korelasyon analizi kullanılarak belirlenmiştir. Bu süre içerisinde Alternaria ve Cladosporium cinslerine ait 684 spor tanesi toplandı. 406 (59.36%) spor tanesi/cm² of this total belong to Cladosporium and remaining 278 (40.64%) spor tanesi/cm² to Alternaria. The concentration of Alternaria ve Cladosporium spores reached to highest ratios in May, 2004. According to Spearman correlation analysis the quantity of Alternaria ve Cladosporium spores shows significant positive relationship with the temperature and the wind speed, but showed insignificant negative relationship with the rainfall. These findings will help to the allergist for the diagnosis, tracing and treatment of the respiratory system diseases.

Anahtar Kelimeler
Aeroallerjen, Alternaria; Cladosporium; Durham sampler; meteorolojik faktörler; Spearman korelasyon analizi; Çamkoru (Ankara).

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INTRODUCTION

The spores reproduced by nonflowering plants, as well, are at least as intense as the pollen in the atmosphere and they induce allergy [1,2]. Fungus spores are more allergic in comparison to other Cryptogam plant spores [3]. According to intradermal tests results, the prevalence of fungal allergy at a world level could vary between 3% and 10% [4-5]. Therefore, air fungal spores studies were made [6-18].

Çamkoru is one of the most important recreation area of Ankara, the capital city of Turkey. According to the 2007 population census the city has approximately a population of 4.5 million which includes eight districts under the city’s administration [19]. So many people go to picnic areas of Çamkoru at weekends. For this reason in our study, Alternaria Nées and Cladosporium Link known as the most allergenic spores, were collected by means of a Durham sampler from the Çamkoru (Ankara) atmosphere from September 2003 to August 2004. The monthly variations in spores/cm² of Alternaria and Cladosporium were determined. The effects of some climatological factors such as temperature, rainfall, and wind speed on variations of spore concentrations have been investigated.

MATERIAL AND METHODS

Study area
Çamkoru takes place between 40° 34’ 30’’, 40°36’ 30’’ north latitude and 32° 29’ 30’’, 32° 31’ 30’’ east longitude (Figure 1). Altitude of Çamkoru region becomes different from 1350 m to 1699 m [20].

Çamkoru region is a place of Pinus sylvestris L. and Pinus nigra Arnold, forest which continue from Aladağ and Köroğlu mountains to direction of northwest although the steppe vegetation of Ankara [21].

Sampling procedure
Allergen Alternaria and Cladosporium spores were collected by Durham sampler. The Durham sampler was placed 15 m above the ground at the roof of Hacettepe’s social facility in Çamkoru.

Slides placed on the Durham sampler were changed daily. The collected slides were covered with glycerin jelly containing basic fuchsin before identification. The slides were examined under the light microscope daily. The counts were made under the microscope were converted into atmospheric concentrations and expressed as spores/cm².

Meteorological data
The meteorological data were derived from the records of the Meteorological Station in Kızılcahamam (Ankara) between September 2003 to August 2004.

Statistical methods
Statistical analyses were done with SPSS 15 for Windows (Chicago, IL, USA). The relation between the monthly total amount of Alternaria and Cladosporium spores in the atmosphere of Çamkoru (Ankara) between September 2003 to August 2004 have been investigated in relation to the monthly average temperature, wind speed and rainfall values using the Spearman correlation analysis. The significance threshold has been accepted to be p < 0.005.

RESULTS AND DISCUSSION

A total of 684 fungal spores from 2 taxa, comprising 140 grains in 2003 and 544 grains in 2004, was identified in the atmosphere of Çamkoru (Table 1). 406 (59.36%) of these spores belong to Cladosporium and remaining 278 (40.64%) spores to Alternaria (Table 1, Figure 2).

In our study, Cladosporium spores concentrations were higher than those of Alternaria (Figure 2). This is a because of the character of the vegetation and geographical location of the study area. In addition, many surveys in the different region of the world have shown Cladosporium spores of dominance in comparison with other spores [22-26].

Dixit et al. [27] show that spores were usually more abundant between late spring and late summer in each calendar year, when several major deuteromycetes, such as Cladosporium, Alternaria, Aspergillus, Penicillium, and Nigrospora spores, approached peak levels.
Figure 1. Map of Turkey showing the localization of Çamkoru (Hacisalioğlu 1999).
Sabariego et al. [22] explained that correlation between climatic factors and the daily content of certain fungal spores (Alternaria, Ustilago and Cladosporium) in the atmosphere of the city of Granada (southern Spain) in 1994. They analyzed the Spearman correlation coefficients between the spore concentrations and the meteorological parameters showing that Alternaria and Cladosporium are significantly correlated with temperature and hours of sunlight, while Ustilago shows positive correlation indices with relative humidity and negative indices with wind speed.

Troutt and Levetin [28] examined to correlate fungal spore concentrations with meteorological data from Tulsa, Oklahoma during May 1998 and May 1999. They were identified the most abundant spore types Cladosporium, ascospores, and basidiospores during the study period.

Hollins et al. [29] analyzed two different time series of Cladosporium conidia observed in England and Wales over 27 years; the results demonstrated that the number of days in summer when the Cladosporium spores are above the allergenic concentration was positively correlated with regional temperature and negatively correlated with precipitation for both sites over the study period.

Peternel et al. [30] analyse the relationship between meteorological conditions and Alternaria and Cladosporium spore concentrations in the air of Zagreb in August 2002 and August 2003. They showed that a strong association between average daily temperature and average daily Alternaria and Cladosporium concentrations in Zagreb.

Grinn-Gofron and Rapiejko [31] investigated the concentration of airborne spores of Cladosporium and Alternaria at three monitoring stations situated along the west-north and central-east transect in Poland. Cladosporium spores were dominant at all the stations. The highest Cladosporium and Alternaria numbers of spores were observed at all the cities (Szczecin, Olsztyn, Warszawa) in July and August. Statistically significant correlations have been found between the Cladosporium and Alternaria concentration in the air and the mean air temperature, amount of precipitation, air pressure and relative air humidity.

Oliveira et al. [32] studied the seasonal distribution of fungal spores continuously (2005-2007) using volumetric spore traps in Porto and Amares. To determine the effect of meteorological factors (temperature, relative humidity and rainfall) on spore concentration, the Spearman rank correlation test was used. Alternaria and Cladosporium, had positive correlations with temperature and negative correlations with relative humidity and rainfall.

In this study, the statistical analysis demonstrated significant relationship between the spore concentrations of Alternaria and Cladosporium and 2 of the 3 meteorological parameters are important, as temperature (positive) and wind speed (positive). No statistically significant correlation was observed between the

<table>
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<tr>
<th>Table 1. Seasonal and monthly distribution and number of colonies of airborne fungi isolated in Çamkoru.</th>
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<tbody>
<tr>
<td>FUNGI</td>
</tr>
<tr>
<td>Alternaria</td>
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<tr>
<td>Cladosporium</td>
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<tr>
<td>TOTAL</td>
</tr>
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Figure 2. Percentages of Alternaria and Cladosporium spores the region of Çamkoru for the period 2003-2004.
Figure 3. Monthly variations in atmospheric Alternaria and Cladosporium spores and weather conditions over the period Sep. 2003- Aug. 2004.
spore concentrations and rainfall in any of the analysed season (Table 2). In addition to, spores of Alternaria and Cladosporium showed a correlation with some meteorological parameters, such as temperature, wind speed and rainfall (Figure 3).

During December 2003, January, February and March 2004, Alternaria and Cladosporium spores has not been found in the slides of Çamkoru atmosphere.

This is due to the increased amount of rain, decrease in temperature and speed of wind in November 2003 and January, February, March 2004.

In rainy days the bioparticulles of atmosphere are getting heavy so they drop to the ground. This circumstance is called “rain washing” [33-35]. In May 2004, the amount of spores of Alternaria and Cladosporium reached the maximum since temperature, rain and wind speed were optimum.

In September, October 2003 and June, July, August 2004, Alternaria and Cladosporium spores were observed in intensively high amounts in Çamkoru region (Table 1). Because temperature, rainfall and wind speed were suitable in these months.

The high concentration of Cladosporium spores affects the human health by increasing the incidence of asthma and bronchial ailments [36].

Epidemiological studies from a variety of locations worldwide indicate that Alternaria sensitivity is closely linked with the development of asthma. In addition, up to 70% of mold-allergic patients have skin test reactivity to Alternaria, so its sensitivity has been shown to be a risk factor for asthma [37]. More people are allergic to Alternaria than Cladosporium. Alternaria also produces more strongly positive reactions, while the Cladosporium generally only produces a mild allergic reaction [38].

We believe that in our opinion the results obtained from the study can help the allergy doctors for the diagnosis, tracing and treatment of the respiratory system diseases that caused from Alternaria and Cladosporium spores.

ACKNOWLEDGEMENT

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Table 2. Relationship between total spores of Alternaria and Cladosporium and meteorological parameters.

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<thead>
<tr>
<th></th>
<th>Alternaria</th>
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<th>Cladosporium</th>
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<tbody>
<tr>
<td></td>
<td>Correlation</td>
<td>p</td>
<td>Correlation</td>
<td>p</td>
</tr>
<tr>
<td>Temperature</td>
<td>0.847**</td>
<td>0.001</td>
<td>0.854**</td>
<td>0.000</td>
</tr>
<tr>
<td>Wind speed</td>
<td>0.646 *</td>
<td>0.023</td>
<td>0.757**</td>
<td>0.004</td>
</tr>
<tr>
<td>Rainfall</td>
<td>-0.466</td>
<td>0.127</td>
<td>-0.502</td>
<td>0.096</td>
</tr>
</tbody>
</table>

REFERENCES


