

MYCOTAXON

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June, 2007

Determination of outdoor fungal flora in Afyonkarahisar, Turkey

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Abstract–The outdoor air microfungal flora of Afyonkarahisar district was determined by using Air Ideal sampler. 2400 fungal colonies were isolated from 216 samples taken monthly from six different areas of Afyonkarahisar in 2005. 32 different microfungal taxa were identified. Frequencies of the main genera were; *Penicillium* (35.8%), *Cladosporium* (24.5%), *Alternaria* (13.1%), sterile coloni (12.0%), *Aspergillus* (8.9%), *Ulaclodium* (6.6%), *Drechslera* (0.6%), *Rhizopus* (0.5%), *Polyscytalum* (0.1%), respectively. The full text can be seen at <http://www2.aku.edu.tr/~mkonuk/mycotaxon/07-117.pdf>

Key words–airborne fungi, bioaerosols, inner Aegean region

Introduction

Airborne fungi are among the most common organisms in nature. They were considered to be correlated with air pollution and proposed as a cause of adverse health effects on humans, animals and plants, e.g. acting as aeroallergens and causing infections. More than 80 genera of the fungal groups have been associated with respiratory tract disorders (Shelton et al. 2002, Beaumont et al. 1985, Flückiger et al. 2000, Su et al. 2001). Several studies have reported that exposure to large concentrations of airborne microbes is often associated with asthma and rhinitis (Beaumont 1988), and hypersensitivity pneumonitis (Siersted & Gravesen 1993).

Examination of typical fungal distributions at one particular region can be helpful in identifying associations between domestic fungal sensitivity and clinical prevention of seasonal allergic diseases (Wu et al. 2000, Li 1995, Verhoeff 1997).

The last decade has seen a significant increase in scientific data on non-occupational exposure as well as occupational exposure to bioaerosols in many developed countries for the purpose of evaluating the relationship between exposure and health effects (Gorny & Dutkiewicz 2002)

Determination of outdoor fungi flora is of importance. Only limited information on indoor fungi is available in Afyonkarahisar (Orman et al. 2005, 2006). Similarly, there is no published information on outdoor fungal flora in different parts of Afyonkarahisar. The purpose of the present work was to determine the types and their relative frequencies of outdoor fungi in Afyonkarahisar.

Material and Methods

The altitude of the province is 1034 m. Its landscape is covered by moderately high mountains with lowlands among them. Its vegetation is mainly steppe with a low incidence of woodlands (15%). It is situated in lakes district.

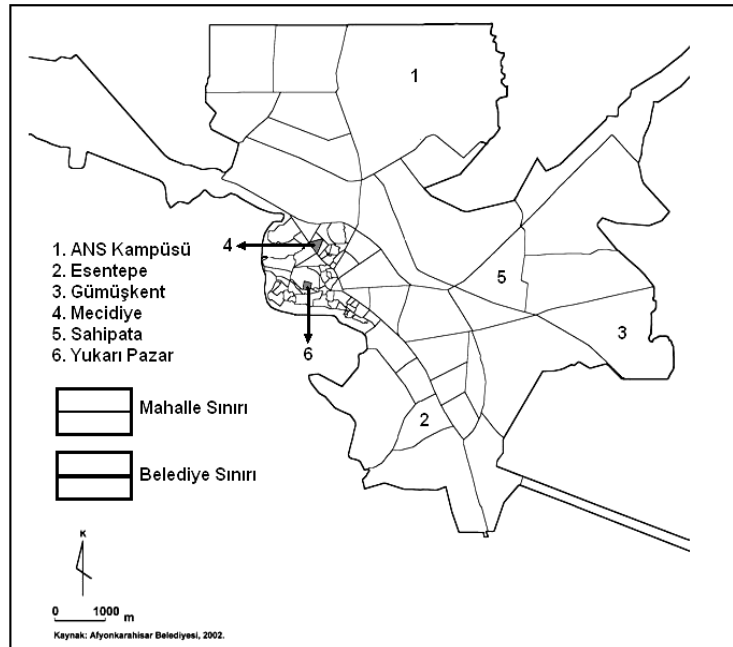


Figure 1. Map of Study area

The concentration of airborne fungal spores from 6 areas (ANS Campus, Esentepe, Gümüşkent, Mecidiye, Sahipata, Yukarıpazar) in Afyonkarahisar downtown have been measured. Taking the samples and preparation of Petri dishes were carried out

by using Air Ideal™ aerobiocollector with air intake of 100 L/min and impact speed of <20 m/sec, capturing particles from 3 to 10 microns was used. Simply, it traps the spores, where the sampling carried out, on Agar Petri dish plates.

Cultures were identified to species level according to various mycological taxonomic keys: Pitt (1979), Hasenekoğlu (1991), and Raper et al. (1949) were used for *Penicillium* linked species, Raper & Fennell (1965) for *Aspergillus* species, and Barnett & Hunter (1998), Hasenekoğlu (1991), and Ellis (1971) were used for other fungal species.

In this paper, citation of author names was presented according to Brummitt & Powell's (1992) list of accepted author abbreviations.

Afyonkarahisar has a typical continental climate regime and it is situated on transition zones of Euro-Siberian and Iran-Turanian vegetation regions. Statistical analyses were carried out by using the both SPSS 11.0 and 13.0. In these analyses Pearson and Spearman correlations, and one-way analysis of variance ANOVA were performed.

Results and discussion

A total of 2400 fungal colonies were isolated from 216 Petri dishes. 32 fungal species were identified (Table 1). When the specimens were counted, maximum yearly average was observed in Sahipata as 799 CFU/m³. It was followed by Esentepe 775 CFU/m³ and Gümüşkent 575 CFU/m³. Minimal colony number was observed in ANS Campus as 279 CFU/m³. In all sampling sites, the most prevalent genus was *Penicillium*. It generally occurred in the highest percentage (35.9%), followed by *Cladosporium* (24.5 %), *Alternaria* (13.1 %), sterile hypha (12.0%), *Aspergillus* (8.9%), *Ulaclodium* (6.6%), *Drechslera* (0.6%), *Rhizopus* (0.5%) and *Polyscytalum* (0.1%). *Cladosporium cladosporioides* was the species found most frequently followed by *Alternaria alternata* and *Cladosporium herbarum*. When their presentation and climatic data compared statistically, no significant variations in fungal concentrations were found (p>0.05).

Table 1. Total fungal colony numbers found in research station and their distributions to the months.

Taxa	Sites	N	%
<i>Alternaria</i> Nees	A, E, G, S, T, Y	314	13.0
<i>A. alternata</i> (Fr.) Keissl.	A, E, G, S, T, Y	292	12.1

<i>A. tenuissima</i> (Kunze)	A, S	22	0.9
Wiltshire			
Aspergillus Link	A, E, G, S, Y	213	8.9
<i>A. candidus</i> Link	G, S	25	1.0
<i>A. carneus</i> (Tiegh.)	S	4	0.2
Blochwitz			
<i>A. flavus</i> Link	S, Y	35	1.5
<i>A. foetidus</i> Thom & Raper	S	18	0.8
<i>A. fumigatus</i> Fresen.	A, G, S	78	3.2
<i>A. petrakii</i> Vörös-Felkai	Y	20	0.8
<i>A. versicolor</i> (Vuill.) Tirab.	E, S	33	1.4
Cladosporium Link	A, E, G, S, T, Y	541	22.5
<i>C. cladosporioides</i> (Fresen.)	A, E, G, S, T, Y	324	13.5
G.A. de Vries			
<i>C. herbarum</i> (Pers.) Link	E, T, S, Y	132	5.5
<i>C. oxysporum</i> Berk. & M.A. Curtis	A, E, G, S, Y	85	3.5
Drechslera S. Ito	S	14	0.6
<i>D. poae</i> (Baudyš)	S	14	0.6
Shoemaker			
Penicillium Link	A, E, G, S, T, Y	859	35.6
<i>P. brevicompactum</i> Dierckx	A, G, S, Y	92	3.8
<i>P. botryosum</i> Bat. & H. Maia	A, G, S, Y	85	3.5
<i>P. canescens</i> Sopp	E, T	77	3.2
<i>P. castellanense</i> C. Ramírez & A.T. Martínez	G, T, Y	46	1.9
<i>P. charlesii</i> G. Sm.	S	26	1.1
<i>P. chermesinum</i> Biourge	A, E	20	0.8
<i>P. fagi</i> A.T. Martínez & C. Ramírez	E, S, Y	99	
4.1			
<i>P. simplicissimum</i>	E, S, Y	87	3.6
(Oudem.) Thom			
<i>P. steckii</i> K.M. Zalesky	G, T, Y	118	4.9
<i>P. stoloniferum</i> Thom	E	7	0.3
<i>P. verrucosum</i> var. <i>cyclopium</i>	A, G, Y	65	2.7
(Westling) Samson et al.			
<i>P. verrucosum</i> var. <i>melanochlorum</i>	E	36	1.4
Samson et al.			
<i>P. verrucosum</i> Dierckx var. <i>verrucosum</i>	E	24	1.0
(Die.) Sam., St. & Had.			
<i>P. yarmokense</i> Baghd.	Y	32	1.3
<i>P. waksmanii</i> K.M. Zalesky	E, S	45	1.9
Polyscytalum Riess	Y	2	0.1
<i>P. berkeleyi</i> M.B. Ellis	Y	2	0.1
Rhizopus Ehrenb.	E, G, S	33	1.4
<i>R. oryzae</i> Went & Prins. Geerl.	E, G, S	33	1.4
Ulocladium Preuss	A, E, S	159	6.6
<i>U. atrum</i> Preuss	A, E, S	111	4.6
<i>U. oudemansii</i> E.G. Simmons	S	48	2.0
Sterile hyphae	A, E, G, S, T, Y	275	11.4
Total		2410	

(A) Ahmet Necdet Sezer Campus; (E) Esentepe; (G) Gümüşkent; (S) Sakipata; (M) meci diye; (Y) Yukarı Pazar; and (N) Number of colony

216 Petri dishes exposed were found to be containing an overall 2400 colonies belonging to 32 genera and 287 non-sporulating cultures were obtained during the study.

Penicillium generally presented in maximum percentage (35.9%) and it was followed by *Cladosporium* (24.5 %), *Alternaria* (13.1 %), sterile hypha (12.0%), *Aspergillus* (8.9%), *Ulaclodium* (6.6%), *Drechslera* (0.6%), *Rhizopus* (0.5%) and *Polyscytalum* (0.1%), respectively. *Cladosporium cladosporioides* species were found up to a maximum percentage, followed by *Alternaria alternata* and *Cladosporium herbarum*. Similar results were reported by Efe (1995), Asan et al (2003), Fang et al (2005), and Wu et al. (2000).

Cladosporium spores probably occur more abundantly worldwide than any other spore type and are the dominant outdoor spores in many areas, especially in hot climates as we found similar to Takahashi (1997); Şen (2001), and El-Morsy (2006). *Cladosporium herbarum*, is often the major contributor to inhalant allergy and allergic asthma in humans (Cosentino et al. 1995).

Alternaria alternata allergens have long been considered to cause significant respiratory allergies and serious cases of respiratory arrest (O'Hollaren et al. 1991, Vijay et al. 1990).

In brief, Afyonkarahisar has clinically important fungi, such as *Cladosporium* and *Penicillium*, and these are dominant in the flora. One of the other important results is that the numbers of taxa were less when compared with other results. It could be because of the geographic position and vegetation of the study area. It is a bowl-like city surrounded by the mountains.

Acknowledgements

Authors wish to thank to Afyon Kocatepe University Research Fund for supporting this study financially (Project no: 051.FENED.03) Also special thanks to Profs A Asan, Prof İ Hasenekoğlu, and Drs SR Pennycook, S Helfer for reviewing this article and their helpful comments.

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