

## BRIEF COMMUNICATION

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# Airborne Fungi in Indoor and Outdoor of Asthmatic Patients' Home, Living in the City of Sari

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## ABSTRACT

The aim of this study was identification of fungi in indoor and outdoor of asthmatic patients' home environment.

Opened plates (containing of Malt extract agar media) were used for isolation of fungi in the air of indoor (n=360) and outdoor (n=180) of 90 asthmatic patients' home living in the city of Sari at the level of breathing height. Plates were incubated in room temperature for 7-14 days. Then grown fungi were identified by standard mycological techniques.

A total of 1876 colonies with 31 and 1692 colonies with 27 genera of fungi were identified from indoor and outdoor of asthmatic patients' home respectively. The most common fungi isolated were *Cladosporium*, *Aspergillus* and *Penicillium*. *Stachibotryis*, *Oedocephalum*, and *Stemphillium* showed the least frequencies among the isolated fungi.

*Cladosporium*, *Aspergillus*, *Penicillium*, and *Alternaria* as the most common allergenic moulds had the most frequencies in indoor air of the houses of asthmatic patients.

**Key words:** *Alternaria*; *Aspergillus*; Asthma; *Cladosporium*; Fungi; *Penicillium*

## INTRODUCTION

Airborne fungal spores have been widely recognized as major allergens capable of causing asthma and allergic rhinitis as well as other allergic diseases.<sup>1</sup> Moreover in the past years an increasing incidence of sensitization to fungi has been reported.<sup>2</sup> Indoor air quality has become an important health concern and susceptible persons have a high chance of response to these allergens.<sup>3</sup> Considering the fact that an allergic reaction may occur with exposure to minute concentration of an allergen,<sup>4</sup> mold indoor could create health risk for atopic individuals occupying such a building. Although there are several reports on the presence of fungi in the air of some cities,<sup>5,6</sup> there is not

any special focus on home environment for airborne fungi. Regarding the reactive role of fungi in asthmatic patients, this project identified the fungi simultaneously found in the indoor and outdoor asthmatic patients' home.

## MATERIALS AND METHODS

Ninety patients were randomly selected from the asthmatic patients who had been referred to respiratory disease center of Emam Hospital of Sari, north of Iran. Patients had resided in their houses for at least 1 year.

The airborne fungal spores were collected by sedimentation method from January 1 to March 30 in the year 2004. Samples were collected in rooms in which the patient spent the most of their time, including a living room, kitchen, bedroom and bathroom. Opened petri dish plates containing malt extract agar with Chloramphenicol were used at the level of breathing height for each room and outdoor environment from 1

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to 1.5 m for 15 min. The plates were incubated at 27-30°C for 7-14 days before colonies present were counted and identified up to the genus level. The fungi were identified by mycological techniques based upon gross cultural and microscopic morphology.

### RESULTS

During the air sampling phase of the investigation, 360 indoor samples and 180 outdoor samples were collected using opened plate method. All of these plates showed fungal growth. Table 1 shows the frequency of different fungal genera isolated from indoor and outdoor of asthmatic patients' home. A total of 1876 colonies with 31 and 1692 colonies with 27 genera of

fungi were identified from indoor and outdoor of asthmatic patients' home, respectively. The most common fungi isolated were *Cladosporium*, *Aspergillus*, and *Penicillium*. *Stachibotryis*, *Oedocephalum* and *Stemphillium* showed the least frequencies among the isolated fungi. *Cladosporium*, *Aspergillus*, *Penicillium*, *Sterile mycelium* (*S. mycelium*), *Rhodotorula*, *Yeast*, *Fusarium*, *Oedodendrone*, *Botrytis*, *Menispora*, *Trichosporun*, and *Geotrichum* were isolated from all of the rooms of asthmatic patients' home. *Cladosporium* was the most abundant genus in bathroom, bedroom and living room; whereas, *Aspergillus* had the highest frequency in kitchen.

**Table 1. The frequency of fungal genera isolated from indoor and outdoor of asthmatic patients' homes**

Fungal genera	Bathroom	Kitchen	Living room	Bedroom	Outdoor	Total
<i>Cladosporium</i>	177(13.7)	103(7.9)	124(9.6)	141(10.9)	749(57.9)	1294(100.0)
<i>Aspergillus spp</i>	83(14.4)	108(18.8)	99(17.2)	75(13.1)	209(36.4)	574(100.0)
<i>Penicillium</i>	53(11.5)	86(18.7)	95(20.7)	107(23.3)	118(25.7)	459(100.0)
<i>S. mycelium</i>	64(16.4)	63(16.2)	51(13.1)	32(8.2)	179(46.0)	389(100.0)
<i>Alternaria</i>	32(10.3)	36(11.6)	27(8.7)	29(9.3)	187(60.1)	311(100.0)
<i>Rhodotorula</i>	9(9.0)	3(3.0)	6(6.0)	60(60.0)	22(22.0)	100(100.0)
<i>Yeast</i>	3(3.2)	7(7.5)	15(16.1)	17(18.3)	51(54.8)	93(100.0)
<i>Fusarium</i>	14(16.3)	12(13.9)	1(1.2)	7(8.1)	52(60.5)	86(100.0)
<i>Oidiodendron</i>	4(12.5)	5(15.6)	9(28.1)	8(25.0)	6(18.7)	32(100.0)
<i>Botrytis</i>	8(33.3)	3(12.5)	3(12.5)	2(8.3)	8(33.3)	24(100.0)
<i>Unknown</i>	8(25.0)	3(9.4)	1(3.1)	3(9.4)	17(53.1)	32(100.0)
<i>Menispora</i>	2(8.0)	5(20.0)	4(16.0)	2(8.0)	12(48.0)	25(100.0)
<i>P. boydii</i>	-	1(4.0)	4(16.0)	4(16.0)	16(64.0)	25(100.0)
<i>Trichosporun</i>	1(4.8)	3(14.3)	3(14.3)	1(4.8)	13(61.9)	21(100.0)
<i>Aureobasidium</i>	2(8.0)	-	4(16.0)	1(4.0)	18(72.0)	25(100.0)
<i>Geotrichum</i>	2(18.2)	1(9.1)	3(27.3)	1(9.1)	4(36.4)	11(100.0)
<i>Nigrospora</i>	1(20.0)	3(40.0)	-	-	1(20.0)	5(100.0)
<i>Trichthecium</i>	2(33.3)	2(33.3)	-	-	2(33.3)	6(100.0)
<i>Scopulariopsis</i>	2(50.0)	1(25.0)	-	-	1(25.0)	4(100.0)
<i>Acremonium</i>	1(11.1)	-	-	2(22.2)	6(66.6)	9(100.0)
<i>Rhizopus</i>	2(22.2)	-	1(11.1)	-	6(66.6)	9(100.0)
<i>Bipolaris</i>	-	-	1(20.0)	2(20.0)	2(40.0)	5(100.0)
<i>Chrysosporium</i>	-	-	3(75.5)	-	1(25.5)	4(100.0)
<i>Sepedonium</i>	2(100.0)	-	-	-	-	2(100.0)
<i>C. neoformans</i>	-	-	2(100.0)	-	-	2(100.0)
<i>Chloridium</i>	-	1(50.0)	1(50.0)	-	-	2(100.0)
<i>Candida</i>	-	-	2(100.0)	-	-	2(100.0)
<i>S. chartarum</i>	-	-	-	1(100.0)	-	1(100.0)
<i>Oedocephalum</i>	-	-	-	1(100.0)	-	1(100.0)
<i>Beauveria</i>	-	1(20.0)	-	-	4(80.0)	5(100.0)
<i>Chrysonilia</i>	-	-	-	1(33.3)	2(66.7)	3(100.0)
<i>Mucor</i>	1(25.0)	-	-	-	3(75.5)	4(100.0)
<i>Trichoderma</i>	-	-	-	-	2(100.0)	2(100.0)
<i>Stemphillium</i>	-	-	-	-	1(100.0)	1(100.0)
<b>Total</b>	<b>473(13.2)</b>	<b>447(12.5)</b>	<b>459(12.9)</b>	<b>497(13.9)</b>	<b>1692(47.4)</b>	<b>3568(100.0)</b>

## DISCUSSION

Our study showed that *Cladosporium*, *Aspergillus* and *Penicillium* were the most common fungi recovered inside the homes, these findings are in agreement with the findings of several other researchers.<sup>7-9</sup>

It is well known that spores of species of *Aspergillus*, *Cladosporium*, and *Penicillium* generated in damp buildings can cause bouts of asthma and/or rhinitis among atopic occupants; as well as having a role in such individual cases of allergic disease. Fungi are now seen as having a wider role in respiratory ill-health.<sup>8,10</sup>

The incidence of fungal genera varied, both quantitatively and qualitatively, among different houses and often among the rooms of the houses: e.g. *Aspergillus* was the most common fungus in kitchen, probably due to their thermo-tolerant ability, whereas *Cladosporium* had the most prevalence in other rooms (bedroom, living room and bathroom). The most common airborne fungi encountered indoors nearly paralleled those found outdoors. The numbers of fungal genera in indoor air were more than outdoor air, probably due to indoor source; but the number of colonies (per plates) in outdoor air was more than indoor air. The outdoor colonies number of *Cladosporium* was higher than indoors; because *Cladosporium* is generally considered the most common outdoor genus. Such a pattern may therefore suggest that environmental and housing characteristics in homes allows a more frequent air exchange during day. In the present study we surprisingly isolated *C. neoformans* and *Stachybotrys chartarum* (*S. chartarum*). *C. neoformans* is yeast-like form fungus that it is found in pigeons. This fungus has a risk factor for immunosuppressed patients, especially AIDS patients. *S. chartarum* especially grows on wet materials containing cellulose (e.g. gypsum board, wallpaper insulation materials and straw).<sup>11</sup> Detection of *S. chartarum* in buildings can be difficult for several reasons. Firstly, because they are normally found in natural cracks and cavities.<sup>11</sup> Secondly, up to 90% of the spores that do become air-borne may not be viable.<sup>12</sup> Thirdly, the media recommended for general detection of fungi indoors are not selective towards *S. chartarum*. Thus in our study we isolated only one colony of *S. chartarum* from one of the bedrooms of sampled houses. Recently, attention has been focused on the *S.*

*chartarum* in human disease, especially, in sick building syndrome.<sup>10</sup>

However, the presence of fungi in buildings does not necessarily imply a cause and effect relationship with illness, but should alert physicians and healthcare professionals to do more vigorous environmental testing.

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