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ISOLATION OF FILAMENTOUS FUNGI FROM PUBLIC TELEPHONES OF THE METROPOLITAN REGION OF THE CITY OF RECIFE, PE, BRAZIL

Flavia Paiva Coutinho[1]*; Marilene da Silva Cavalcanti[2]; Francisco Cordeiro Neto[2]

[1]Instituto de Ciências Biológicas, Universidade de Pernambuco, Recife, PE, Brasil; [2]Departamento de Micologia, Centro de Ciências Biológicas, Universidade Federal de Pernambuco, Recife, PE, Brasil

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ABSTRACT

Fungi can inhabit our organism without causing any harm, but they show themselves when the immunological system is compromised. In this study, a survey of the occurrence of filamentous fungi was carried out in public telephones of the Metropolitan Region of the City of Recife, PE, Brazil. This showed the public phones as a possible mean of transmission of fungal diseases among humans. Samples from the environment, audios, speakers and keyboards were taken at the airport, mall, subway and bus station in the months of October/2003 (dry season) and June/2004 (rainy season), totaling 120 samples. The procedure of identification of species was carried out through conventional taxonomy. Thirty-four genera were isolated, totaling 73 species, the majority belonging to the anamorphic fungi (91.78%), followed by the Ascomycota (6.85%) and the Zygomycota (1.37%). There was no significant difference in the proportion of species between the dry and rainy seasons, with 46 and 53 species identified, respectively. Due to the lack of maintenance, or inadequate cleaning of public telephones, the fungi present in these appliances may cause mycosis in the users as these telephones are used by people from different social classes and variable habits, both healthy and immunocompromised.

Key words: filamentous fungi, mycosis, public telephones

INTRODUCTION

The fungi comprise a heterogeneous group of the heterotrophic achrolophyllous microorganisms, acting as saprobes or parasites or, less frequently, as symbionts that live in association with other organisms (11). They mostly feed on decomposed organic substrates and are essential in the recycling of minerals and carbon, both in the soil and water (23).

They are found in all types of ecosystems carrying out various functions such as breaking down organic substances into simpler molecules easier to assimilate, producing substances toxic to other organisms, contaminating objects, and acting in fermentation processes in the manufacture of alcohol, beer, wine and bread (11,23). They can also be in contact with our organism without causing any harm; however, depending on the degree of infestation and the exposure of the immunological system, they may cause serious illness (29).

The use of public telephones (audio, speaker and keyboard) installed inside airports, bus stations, malls and commercial centers, among other places of great circulation, may initiate the disease process as the apparatus may be contaminated with pathogenic fungi (2).

Considering the importance of fungi as mycosis agents, the presence of fungi in public telephones in the metropolitan area of the city of Recife, PE, Brazil, and their role in the transmission of fungal diseases was surveyed.

MATERIALS AND METHODS

Sampling Sites

Samples were collected from four public telephones and the surrounding environment of four sampling sites: international airport of Recife, Shopping Center Recife, subway terminal in the Recife city centre, and integrated passengers terminal (bus

*Corresponding Author. Mailing address: Rua Senador Soares Meireles, 213 - Casa Amarela 52070-360 Recife, PE - Brasil. E-mail: flaviapaco@zipmail.com.br

station), located in Recife. The samplings were carried out in the months of October/2003 and June/2004, corresponding to the dry and rainy seasons, respectively.

Samplings

Samples from the audios, speakers and keyboards of 16 public telephones were collected using sterile swabs. The swabs were labeled and sealed, and transported to the laboratory. Ninety six samples were collected, being 48 in the dry season and 48 in the rainy season. For the sampling of the anemophilous fungi, triplicate Petri dishes containing Sabouraud Agar added of chloranphenicol (50 mg L^{-1}) were exposed to the air for 10 minutes, at approximately 2m above the ground, in each sampling site. These counted up to 12 samples in the dry season and 12 in the rainy season, totaling 120 samples.

Isolation of filamentous fungi from public telephones

In the laboratory, the swabs were transferred to test tubes containing 5.0mL of sterilized distilled water. The test tubes were vigorously shaken (Vortex – mod. 251, FANEM, São Paulo, Brazil), for approximately 60 seconds, to release the fungal spores. Next, 1.0mL of each suspension was cultured into a Petri dish containing the same culture medium used for the air fungi. The plates were kept at room temperature (± 28ºC) until the development of colonies (3-4 days). The colonies were transferred to test tubes containing Potato Dextrose Agar and kept at room temperature until the identification of the species. When necessary to induce the fungal sporulation, the colonies were transferred to specific media such as Czapek Agar, Corn Meal Agar, and Lactrimel Agar, all added of chloranphenicol (50 mg L^{-1}), according to nutritional deficiency. The culture media were autoclaved at 121ºC (1 atm), for 15 minutes, and the pH was adjusted to 6.5.

Identification of the filamentous fungi isolated from public telephones

The identification of the filamentous species was carried out through macroscopic observation of the colonies and examination of the microstructural characteristics, and a comparative analysis with parameters established in the conventional taxonomy, in accordance with the revised literature (5-7,9,12,14,16,17,20,24,25,32-34). Specific original descriptions were used with the objective of confirming the identification and the taxonomical validity. After the identification, the colonies were transferred to test tubes containing specific culture medium.

RESULTS

Thirty four fungal genera were isolated from the 120 samples, totaling 73 species. Most of the species belong to the anamorphic fungi (91.78%), followed by Ascomycota (6.85%) and Zygomycota (1.37%). *Penicillium* was the dominant genus, with 12 species, followed by *Aspergillus* (11 species); *Phoma* (five species); *Acremonium* and *Cladosporium* (four species); *Scopulariopsis* (three species); *Chaetomium, Chrysosporium, Fusarium, Phialophora* and *Sporothrix* (two species); *Aureobasidium, Beauveria, Curvularia, Eupenicillium, Eurotium, Exophiala, Geotrichum, Humicola, Monilia, Myrothecium, Nigrospora, Paecilomyces, Phomopsis, Pyrenochaeta, Rhizopus, Scolecobasidiella, Scolecobasidium, Septonema, Talaromyces, Trichophyton, Tritirachium* and *Zetiasplozna* (one species). Fungi that did not produce spores were also detected (Tables 1 and 2).

During the dry season, 46 species were isolated, and 36.06% of them were from the subway sampling site, followed by 25.41% from the bus station, 23.77% from the airport and 14.76% from the mall. In the rainy season, 53 species were identified, being most of them from the subway (40.18%), followed by 31.25% from the bus station, 16.96% from the mall and 11.61% from the airport.

In the dry season, the incidence of fungi on the telephones and their surroundings was: keyboards (36.06%), audios (26.23%), speakers (19.67%) and 18.04% in the environment. In the rainy season, keyboards yielded 30.35%, followed by the environment (25.90%), audios (22.32%) and speakers (21.43%).

DISCUSSION

Thirty-four genera were isolated during this study, however, in similar works carried out in Feira de Santana, BA, and São Luís, MA, Brazil, only 4 genera (*Aspergillus, Cladosporium, Paecilomyces* and *Penicillium*) and 5 genera (*Aspergillus, Curvularia, Drechslera, Nigrospora* and *Penicillium*) were isolated, respectively (3,8).

Fungal colonies occurred in all the audios and speakers samples (100%). Very similar results were obtained by Costa *et al.* (8) that found 97.2% occurrence in speakers and 91.6% in audios.

Among the anamorphic fungi isolated from audios, speakers and keyboards, the genera *Acremonium, Aspergillus, Aureobasidium, Beauveria, Chrysosporium, Cladosporium, Curvularia, Exophiala, Fusarium, Nigrospora, Paecilomyces, Penicillium, Phialophora, Phoma, Scopulariopsis, Sporothrix, Trichophyton,*and *Tritirachium* are mentioned as opportunistic, according to Lacaz *et al.* (22), Sidrim & Moreira (29) and Sidrim & Rocha (30). The taxa mentioned in specialized literature as pathogenic to humans and animals were also isolated. Among them, *Aspergillus flavus* causes allergic bronchial infection, otitis, sinusitis, and skin lesions (16,19); *Fusarium solani,* causes cutaneous infections and nail lesion (16,22,28); *Aspergillus niger, Aureobasidium pullulans, Chrysosporium keratinophilum, Cladosporium cladosporioides, C. sphaerospermum* and *Phoma eupyrena,* are also cutaneous infection agents (1,4,12,13,15,16,18,21); *Aspergillus restrictus* is a pulmonary infection agent (20); *Penicillium chrysogenum* is mentioned as

Table 1. Fungi isolated from public telephones of the Metropolitan Region of the City of Recife, PE, Brazil, in October/2003 (dry season).

Taxa	OCTOBER/2003																Total
	Airport				Subway				Mall				Bus Station				
	A	S	K	E	A	S	K	E	A	S	K	E	A	S	K	E	
Acremonium chrysogenum Thirum. & Sukap.			+														01
A. fusidioides (Nicot) W. Gams				+													01
A. strictum W. Gams						+									+		02
Aspergillus candidus Link ex Link								+									01
A. flavus Link ex Gray	+	+	+	+	+		+	+	+	+	+						10
A. fumigatus Fres.			+														01
A. niger van Tieghem	+	+	+	+	+	+	+	+	+	+	+	+		+	+		14
A. oryzae (Ahlburg) Cohn				+													01
A. restrictus G. Sm.			+				+				+		+				04
A. sydowii (Bain. & Sart.) Thom & Church				+	+		+							+	+		05
A. versicolor (Vuill.) Tiraboschi											+						01
Aureobasidium pullulans (de Bary) Arnaud					+	+		+					+				04
Beauveria bassiana (Bals.) Vuill.			+										+				02
Chaetomium globosum Kunze ex Steud.							+								+		02
Chrysosporium ketatinophilum Frey																+	01
C. pruinosum Gilman & Abbott																+	01
Cladosporium cladosporioides (Fres.) de Vries			+		+		+	+	+	+					+		07
C. sphaerospermum Penz.					+		+										02
C. staurophorum Kendrick							+		+	+					+		04
Curvularia pallescens Boedijn		+	+														02
Eupenicillium javanicum (van Beyma) Stolk & Scott															+		01
Eurotium glabrum (Wiggers) Link ex Gray					+												01
Exophiala salmonis Carmichael		+				+	+			+			+				05
Fusarium lateritium Nees							+										01
F. solani (Mart.) Sacc.							+									+	02
Geotrichum candidum Link: Fr.				+	+											+	03
Nigrospora sphaerica (Sacc.) Mason					+								+		+	+	04
Paecilomyces variotti Bain.									+								01
Penicillium chrysogenum Thom	+									+							02
P. commune Thom							+										01
P. frequentans Westling					+	+			+					+			04
P. funiculosum Thom	+		+		+												03
P. purpurogenum Bainier	+	+	+		+	+	+	+	+						+		09
P. variabile Sopp														+			01
Phialophora bubakii (Laxa) Schol-Schwarz	+																01
Phoma eupyrena Sacc.							+										01
Phomopsis archeri (Cke & Harkn.) Grove								+									01
Pyrenochaeta unguis-hominis Punithalingam & English					+												01
Scolecobasidiella avellanea Sappa & Mosca				+													01
Scopulariopsis chartarum (G. Sm.) Morton & G. Sm.															+		01
Septonema fasciculare (Corda) Hughes															+		01
Sporothrix luteoalba Hoog							+								+		02
S. schenckii Hektoen & Perkins						+								+			02
Trichophyton tonsurans Malmsten						+											01
White Mycelia Sterilia							+								+	+	03
Black Mycelia Sterilia	+														+	+	03
TOTAL	**7**	**5**	**10**	**7**	**13**	**8**	**16**	**7**	**7**	**6**	**4**	**1**	**5**	**5**	**14**	**7**	122

A= audio; S= speaker; K= keyboard; E= environment.

Table 2. Fungi isolated from public telephones of the Metropolitan Region of the City of Recife, PE, Brazil, in June/2004 (rainy season).

Taxa	JUNE/2004																Total
	Airport				Subway				Mall				Bus Station				
	A	S	K	E	A	S	K	E	A	S	K	E	A	S	K	E	
Acremonium kiliense Grütz						+											01
A. strictum W. Gams								+							+		02
Aspergillus flavus Link ex Link															+		01
A. niger van Tieghem													+				01
A. niveus Blochwitz												+					01
A. restrictus G. Sm.				+		+				+			+				04
A. sclerotiorum Huber				+			+										02
A. sparsus Raper & Thom												+		+	+		03
A. versicolor (Vuill.) Tiraboschi										+							01
Aureobasidium pullulans (de Bary) Arnaud	+	+					+	+					+		+		06
Chaetomium funicola Cooke					+												01
C. globosum Kunze ex Steud.					+		+						+				03
Chrysosporium pruinosum Gilman & Abbott							+		+	+					+		04
Cladosporium cladosporioides (Fres.) de Vries								+		+			+	+	+		05
C. oxysporum Berk. Curt.							+								+		02
C. sphaerospermum Penz.			+				+			+					+		04
C. staurophorum Kendrick								+									01
Exophiala salmonis Carmichael	+	+				+	+	+					+		+		07
Fusarium solani (Mart.) Sacc.															+		01
Geotrichum candidum Link: Fr.							+				+						02
Humicola grisea Traaen						+											01
Monilia sitophila (Mont.) Sacc.					+				+								02
Myrothecium roridum Tode ex Steudel		+															01
Paecilomyces variotti Bain.																+	01
Penicillium chrysogenum Thom																+	01
P. commune Thom							+	+							+		03
P. expansum Link																+	01
P. frequentans Westling								+									01
P. minioluteum Dierckx																+	01
P. oxalicum Currie & Thom																+	01
P. puberulum Bainier										+							01
P. sclerotiorum van Beyma													+				01
P. simplicissimum (Oudem.) Thom				+													01
Phialophora bubakii (Laxa) Schol-Schwarz					+												01
P. richardsiae (Nannf.) Conant.			+					+									02
Phoma eupyrena Sacc.							+							+			02
P. glomerata (Corda) Wollenw. & Hochapfel								+									01
P. leveillei Boerema & Bollen								+									01
P. sorghina (Sacc.) Boerema et al										+							01
P. tropica Schneider & Boerema								+									01
Pyrenochaeta unguis-hominis Punithalingam & English					+												01
Rhizopus oryzae Went & Prinsen Geerl.		+				+	+										03
Scolecobasidiella avellanea Sappa & Mosca						+			+								02
Scolecobasidium constrictum (Abbott) de Hoog & von Arx										+							01
Scopulariopsis baarnensis nom. nov.								+									01
S. parvula sp. nov.							+										01
Sporothrix luteoalba Hoog			+				+										02
S. schenckii Hektoen & Perkins					+	+		+								+	04
Talaromyces flavus (Klöcker) Stolk & Samson											+						01
Tritirachium album Limber						+									+		02

Zetiasplozna unicolor Nag Raj																+	01
White Mycelia Sterilia					+		+	+	+			+	+		+	+	08
Black Mycelia Sterilia	+				+		+		+	+			+		+	+	08
TOTAL	**3**	**4**	**3**	**3**	**8**	**8**	**15**	**14**	**5**	**9**	**2**	**3**	**9**	**3**	**14**	**9**	112

A= audio; S= speaker; K= keyboard; E= environment.

a keratitis and endophthalmitis agent (26,28); *Sporothrix schenckii* is the sporotrichosis ethyological agent (16,22,27,31); *Trichophyton tonsurans* is considered to cause dermatophytosis, such as *tinea capitis, corporis, pedis* and onychomycosis (10,16,21).

Due to the lack of maintenance or inadequate cleaning of public telephones, the existing fungi in these telephones may cause mycosis in the users as these facilities are used by people from different social classes and variable habits, both healthy and immunocompromised people. The latter have greater possibility of becoming infected by the fungal spores and other microorganisms (29,30) present in the public telephones.

RESUMO

Isolamento de fungos filamentosos em telefones públicos da Região Metropolitana da Cidade do Recife, PE, Brasil

Os fungos podem circular pelo nosso organismo sem causar qualquer mal, mas manifestam-se quando o sistema imunológico está comprometido. Neste estudo foi realizada uma análise da ocorrência de fungos filamentosos em telefones públicos da Região Metropolitana da Cidade do Recife, PE, Brasil. Apresentando-os como possível meio de transmissão de doenças de natureza fúngica entre os indivíduos. Amostras dos ambientes, áudios, bocais e teclas foram obtidas no aeroporto, shopping, metrô e rodoviária nos meses de outubro/2003 (período seco) e junho/2004 (período chuvoso), totalizando 120 amostras. O procedimento de identificação das espécies ocorreu através da taxonomia convencional. Trinta e quatro gêneros foram isolados, totalizando 73 espécies, a maioria pertencente aos fungos anamórficos (91,78%), seguido de Ascomycota (6,85%) e Zygomycota (1,37%). Não houve diferença significativa quanto a proporção de espécies entre os períodos seco e chuvoso, com 46 e 53 espécies identificadas, respectivamente. Por falta de manutenção ou limpeza inadequada dos telefones públicos, os fungos presentes podem vir a provocar micoses nos usuários, pois esses aparelhos são utilizados por pessoas de diferentes classes sociais e hábitos variados, tanto sadias quanto imunocomprometidas.

Palavras-chave: fungos filamentosos, micoses, telefones públicos.

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