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Dedicated to Professor Barbara Gumińska on the occasion of her eighty-fifth birthday

Potentially pathogenic fungi in the material collected by the Specialist Regional Hospital, Łódź

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The mycobiota responsible for the development of pathological changes of the skin and its adnexa in patients presenting at the Specialist Regional Hospital, Łódź, with suspected superficial mycosis between 01 May 2003 and 30 April 2005 is analyzed. In total of 2144 isolations 39.96% were dermatophytes, 39.39% were yeast-like fungi and 20.65% were moulds. *Candida albicans* was the most frequently diagnosed species in fallowed by *Trichophyton rubrum*.

Key words: infections, dermatophytes, yeast-like fungi, moulds

INTRODUCTION

As potentially pathogenic fungi commonly occur in the biosphere, people are exposed to them throughout their development while susceptibility to fungal infection is universal and concerns people of all ages (Kurnatowska 1998).

Fewer than 200 of ca 100 000 fungal species described so far are causative agents of diseases in people (Richardson, Warnock 1995; Ławrynowicz 2002; Chodorowska 2008). The intensity of infections and toxic or allergic reactions varies while quantitative and qualitative changes are observed in the range of fungi pathogenic to humans depending mostly on the environment (Richardson, Warnock 1995). The following factors are considered to condition the changes: the level of urbanisation and industrialisation of an area, geographic location and climatic conditions. The fungal biota also changes over time (Boliński et al. 2003; Baran, Szepietowski 1994; Dynowska et al. 2004). That is why for many years around the world epidemiologic investigations are conducted (Baran et al. 1993; Venugopal, Venugopal 1993; Khosravi et al. 1994; Korstanje, Staats 1995; Merlin et al. 1999; O´Grady, Sahn 1999; Foster et al. 2004; Dynowska et al. 2008).

The prevalence of mycoses, both superficial and systemic, has been growing rapidly in the last few years. About 40% of the world population are estimated to suffer from fungal infections (Kaszuba et al. 1997; Chodorowska 2008).

Superfical mycoses are an especially serious epidemiological, medical and social problem (Jabłońska, Chorzelski 1988; Gliński et al. 2002) and are commonly considered to be diseases associated with civilisation (Bojarski et al. 2001; Macura 2004). While they do not pose an immediate risk to human life and are often trivialized, fungal infections can be exceptionally bothersome by negatively influencing everyday life. Not only do they cause health problems but also the physical appearance adversely affected by the pathogen makes those suffering from mycoses self-conscious. Patients often feel they are limited both in professional and private lives. The discomfort and embarrassment related to the altered body image frequently undermines confidence, leads to diminished social contacts and everyday activities, and, in extreme cases, even to depression (Nowicki 1999).

Dermatophytes, yeast-like fungi and moulds are the etiologic factors of superfical mycoses (Macura 1998; Dobrowolska et al. 2002).

Traditional methods of identification of this pathogens are based on phenotypic features, which, on the one hand, can be influenced by environmental factors, and, on the other hand, are very time – consuming and inefficient. Thus, molecular methods of identification, based on genotype are more and more frequently applied. They are fast and reliable and may supplement traditional methods in the future (Bojarski et al. 2001; Dobrowolska et al. 2008; Dobrowolska, Jaworski 2008; Nawrot 2008).

MATERIAL AND METHODS

Fungi identified in the clinical material (01 May 2003 – 30 April 2005) obtained from patients referred to the Laboratory of Mycology and Sexually Transmitted Diseases, Specialist Regional Hospital (*Wojewódzki Szpital Specjalistyczny im. dr. Władysława Biegańskiego*), Łódź, with suspected mycosis of the skin and/or its adnexa were analysed.

The taxonomic range of the mycobiota was analysed using descriptions of the clinical cases diagnosed. Each description contained the following data:

- the patient's sex,
- the patient's age,
- the site or sites on the body from which the material was collected for mycological analysis,
- the result of the initial direct examination,
- culture results (species or genus of the fungus).

Only those infections in which a positive result was obtained in culture were analysed.

The material identification was based on the works by De Hoog and Guarro (1995) as well as Baran (1998).

The article presents species or genus of the fungus depending on the patient's sex. Other factors will be presented and analyzed in the next articles.

RESULTS

A total of 5 514 (100%) patients, including 3 370 (61.12%) women and 2 144 (38.88%) men, were examined. Positive results of mycological tests (direct preparations confirmed in culture) were obtained for 2 103 patients (38.14%) and negative results for 3 411 (61.86%) patients (Tab. 1). Monofocal isolations were performed for 1 587 (75.46%) patients while the material was collected from more than one site changed pathologically in 516 patients (24.54%).

In the group of 3 370 (100%) women, positive results of mycological tests were obtained in 1 298 (38.52%) cases and negative results in 2 072 (61.48%) cases. Monofocal isolations were performed for 990 (76.27%) female patients and multifocal isolations for 308 (23.73%) women. The total number of pathological foci with positive mycological results was 1 493.

In the group of 2 144 (100%) men, positive mycological results were obtained in 805 (37.55%) cases and negative results in 1 339 (62.45%) cases. In the group with positive results, monofocal isolations were conducted for 597 (74.16%) male patients while the material was collected from more than one pathological site in 208 (25.84%) men. The total number of pathological foci with positive results was 938.

Of a total of 2 475 (100%) isolations in men and women, 989 (39.96%) isolates were dermatophytes, 975 (39.39%) were yeast-like fungi and 511 (20.65%) were moulds.

Table 1
Patients presenting with suspected mycosis between 01 May 2003 and 30 April 2005

Month	No of patients examined for mycosis	No of patients with mycosis diagnosed		No of patients with no mycosis diagnosed	
		n	%	n	%
V 2003	201	96	47.76	105	52.24
VI 2003	238	85	35.71	153	64.29
VII 2003	235	78	33.19	157	66.81
VIII 2003	213	78	36.62	135	63.38
IX 2003	206	86	41.75	120	58.25
X 2003	195	69	35.38	126	64.62
XI 2003	187	54	28.88	133	71.12
XII 2003	151	43	28.48	108	71.52
I 2004	229	79	34.50	150	65.50
II 2004	276	77	27.90	199	72.10
III 2004	325	152	46.77	173	53.23
IV 2004	260	81	31.15	179	68.85
V 2004	212	93	43.87	119	56.13
VI 2004	274	123	44.89	151	55.11
VII 2004	107	44	41.12	63	58.88
VIII 2004	248	106	42.74	142	57.26
IX 2004	231	98	42.42	133	57.58
X 2004	257	109	42.41	148	57.59
XI 2004	259	96	37.07	163	62.93
XII 2004	212	80	37.74	132	62.26
I 2005	240	95	39.58	145	60.42
II 2005	232	75	32.33	157	67.67
III 2005	259	101	39.00	158	61.00
IV 2005	267	105	39.33	162	60.67
Total	5514	2103	38.14	3411	61.86

Candida albicans (Robin) Berkhout (847 isolations, 34.22%) was the most frequently diagnosed species, followed by *Trichophyton rubrum* (Castellani) Sabouraud (586 isolations, 23.68%) (Tab. 2).

In the group of women (1 524 isolations - 100%), 540 (35.43%) isolations were dermatophytes, 664 (43.57%) were yeast-like fungi and 320 (21.00%) were moulds (Table 2). *C. albicans* (588 isolations, 38.58%) and *T. rubrum* (301 isolations, 19.75%) were the most frequently diagnosed species (Tab. 2).

Table 2
Aetiological factor depending on the patient's sex

Species	Women		Men		Total	
	n	%	n	%	N	%
T. rubrum	301	19.75	285	29.97	586	23.68
T. mentagrophytes var. *granulosum*	93	6.10	64	6.73	157	6.34
T. mentagrophytes var. *interdigitale*	-	-	2	0.21	2	0.08
T. tonsurans	11	0.72	10	1.05	21	0.85
M. canis	127	8.33	76	7.99	203	8.20
M. gypseum	-	-	1	0.11	1	0.04
E. floccosum	8	0.52	11	1.16	19	0.77
Dermatophytes total	**540**	**35.43**	**449**	**47.21**	**989**	**39.96**
C. albicans	588	38.58	259	27.23	847	34.22
C. glabrata	7	0.46	3	0.32	10	0.40
C. krusei	3	0.20	1	0.11	4	0.16
G. candidum	39	2.56	27	2.84	66	2.67
Rhodotorula sp.	8	0.52	6	0.63	14	0.57
Trichosporon sp.	3	0.20	2	0.21	5	0.20
Pityrosporum sp.	13	0.85	11	1.16	24	0.97
P. ovale	3	0.20	2	0.21	5	0.20
Yeast-like fungi	**664**	**43.57**	**311**	**32.70**	**975**	**39.39**
S. brevicaulis	43	2.82	25	2.63	68	2.75
A. niger	30	1.97	16	1.68	46	1.86
A. fumigatus	23	1.51	15	1.58	38	1.54
Aspergillus sp.	5	0.33	1	0.11	6	0.24
Penicillium sp.	2	0.13	-	-	2	0.08
Other moulds	217	14.24	134	14.09	351	14.18
Moulds total	**320**	**21.00**	**191**	**20.08**	**511**	**20.65**
Total	1524	100	951	100	2475	100

Table 3
Dermatophytes: species

Species	Women		Men		Total	
	n	%	n	%	N	%
T. rubrum	301	55.74	285	63.47	586	59.25
T. mentagrophytes var. *granulosum*	93	17.22	64	14.25	157	15.87
T. mentagrophytes var. *interdigitale*	-	-	2	0.45	2	0.20
T. tonsurans	11	2.04	10	2.23	21	2.12
M. canis	127	23.52	76	16.93	203	20.53
M. gypseum	-	-	1	0.22	1	0.10
E. floccosum	8	1.48	11	2.45	19	1.92
Dermatophytes total	540	100	449	100	989	100

In the group of men (951 isolations - 100%), 449 (47.21%) isolations were dermatophytes, 311 (32.70%) were yeast-like fungi and 191 (20.08%) were moulds (Tab. 2). *T. rubrum* (285 isolations, 29.97%) and *C. albicans* (259 isolations, 27.23%) were the most frequently diagnosed species (Tab. 2). *T. rubrum* (586 isolations, 59.25%), followed by *Microsporum canis* Bodin (203 isolations, 20.53%) and *T. mentagrophytes* var. *granulosum* (Robin) Blanchard (157 isolations, 15.87%) was the most frequently diagnosed species of the 989 (100%) strains of dermatophytes isolated (Tab. 3). Of the 975 (100%) strains of yeast-like fungi, *C. albicans* (847 isolations, 86.87%), followed by *Geotrichum candidum* Link (66 isolations, 6.77%) and the genus *Pityrosporum* (24 isolations, 2.46%), was the most frequently diagnosed fungus while *Pityrosporum ovale* (0.51%) was isolated in five cases (Tab. 4). In the group of the 511 (100%) strains of moulds, *Scopulariopsis brevicaulis* ((Sacc.) Bainier 68 isolations, 13.31%), followed by *Aspergillus niger* v. Tieghem (46 isolations, 9.00%) and *Aspergillus fumigatus* Fresenius (38 isolations, 7.44%), was the most frequently identified species. Pathogens were identified as a mould and further identification was not conducted in 351 (68.69%) cases (Tab. 5).

In the group of women, *T. rubrum* (301 isolations, 55.74%), followed by *M. canis* (127 isolations, 23.52%) and *T. mentagrophytes* var. *granulosum* (93 isolations, 17.22%), was the most frequently identified taxon of the 540 (100%) strains of dermatophytes isolated (Tab. 3). Of the 664 (100%) strains of yeast-like fungi, *C. albicans* (588 isolations, 88.55%) dominated, followed by *G. candidum* (39 isolations, 5.87%) (Tab. 4). In the group of 320 (100%) strains of moulds isolated, *S. brevicaulis* (43 isolations, 13.44%), *A. niger* (30 isolations, 9.38%) and *A. fumigatus* (23 isolations, 7.19%) were the most frequently isolated species. Pathogens were identified as a mould and further identification was not conducted in 217 (67.81%) cases (Tab. 5).

In the group of men, *T. rubrum* (285 isolations, 63.47%), followed by *M. canis* (76 isolations, 16.93%) and *T. mentagrophytes* var. *granulosum* (64 isolations, 14.25%), was the most frequently diagnosed species of the 449 (100%) strains of dermatophytes isolated (Tab. 3). Of the 311 (100%) strains of yeast-like fungi isolated, *C. albicans* (259 isolations, 83.28%) was definitely the most frequently isolated species, followed by *G. candidum* (27 isolations, 8.68%) (Tab. 4). In the group of 191 (100%) strains of moulds, *S. brevicaulis* (25 isolations, 13.09%), *A. niger* (16 isolations, 8.38%) and *A. fumigatus* (15 isolations, 7.85%) were the most frequently

Table 4
Yeast-like fungi: species

Species	Women		Men		Total	
	n	%	n	%	N	%
C. albicans	588	88.55	259	83.28	847	86.87
C. glabrata	7	1.05	3	0.96	10	1.03
C. krusei	3	0.45	1	0.32	4	0.41
G. candidum	39	5.87	27	8.68	66	6.77
Rhodotorula sp.	8	1.20	6	1.93	14	1.44
Trichosporon sp.	3	0.45	2	0.64	5	0.51
Pityrosporum sp.	13	1.96	11	3.54	24	2.46
P. ovale	3	0.45	2	0.64	5	0.51
Yeast-like fungi total	664	100	311	100	975	100

Table 5
Moulds: species

Species	Women		Men		Total	
	n	%	n	%	N	%
S. brevicaulis	43	13.44	25	13.09	68	13.31
A. niger	30	9.38	16	8.38	46	9.00
A. fumigatus	23	7.19	15	7.85	38	7.44
Aspergillus sp.	5	1.56	1	0.52	6	1.17
Penicillium sp.	2	0.63	-	-	2	0.39
Other moulds	217	67.81	134	70.16	351	68.69
Moulds total	320	100	191	100	511	100

diagnosed species. Pathogens were identified as a mould and further identification was not conducted in 134 (70.16%) cases (Tab. 5).

DISCUSSION

Fungal isolations confirmed in culture were recorded in 38.14% of the total group in the study period. Although considerably more women (61.12%) than men (38.88%) were examined, positive results in both groups were recorded in fewer than 50% patients. This corresponds to both world and Polish trends for superficial mycoses. A higher percentage of positive results (55.54%) was recorded in studies by Kaszuba et al. (1997) comprising all mycological diagnostic data from the Łódź region between 1982 and 1986. However, women always constituted a more numerous group (53.33%). Positive results were recorded in only 32% of the total study group in studies by Erkiert-Polguj et al. (2008) and women were diagnosed more often than men.

Dermatophytes which constituted 39.96% of all mycological isolations were observed in only a small majority of infections, almost immediately followed by yeast-like fungi (39.39%). Moulds constituted 20.65% isolations. Similar results were observed by Kaszuba et al. (1997), Sikora et al. (2000) and Boliński et al. (2003).

Nowicki et al. (2006) report that non-dermatophytic fungi were major pathogens causing superficial mycoses in studies conducted in the Gdańsk region between 2003 and 2005. Erkiert-Polguj et al. (2008) demonstrate the dominance of infections caused by yeast-like fungi which constituted 54% of infections diagnosed while dermatophytic infections accounted for 40.5%.

C. albicans (34.2%) was the most frequently isolated species in the present study, while the keratinophilous and keratinolytic *T. rubrum* constituted 23.7% of isolations. Similar results: *Candida* sp. (39.08% of all isolations) and *T. mentagrophytes* (27.90%), were obtained in studies conducted in the Wrocław region between 1995 and 1999 (Sikora et al. 2000).

T. mentagrophytes var. *granulosum* (32.35% of total isolations) and *T. rubrum* (24.99%) were the most frequently isolated species in studies conducted on patients with mycoses of the skin and its adnexa treated at the Outpatient Clinic, City Hospital, Health Care Centre, Białystok, between 1996 and 2001 (Boliński et al. 2003).

T. rubrum (59.25% of isolations) was the most frequently identified species of dermatophytes in the study period (01 May 2003 – 30 April 2005), followed by *M. canis* (20.53%) and *T. mentagrophytes* var. *granulosum* (15.87%). *T. rubrum* (34.15%) was also the most frequently isolated species in studies conducted in the Łódź region between 1987 and 1996 while *T. mentagrophytes* var. *granulosum* constituted 23.03% and *M. canis* 11.82% of total isolations (Kaszuba et al.1997).

In their analysis of the geographic distribution of dermatophytes in Poland between 1988 and 1992, Baran and Szepietowski (1994) also demonstrated that *T. rubrum*, a definite dominant throughout almost entire Poland, was the most frequently recorded species, followed by *T. mentagrophytes*.

Sikora et al. 2000 report that *T. mentagrophytes* (62.7%) was the most frequently isolated dermatophytic fungus in the Wrocław region between 1995 and 1999. *T. rubrum* (27.8%) was the second and *Epidermophyton floccosum* (Harz) Langer. et Milochevitch (6.2%) was the third most frequently identified species. These results closely correspond with the results obtained by Erkiert-Polguj et al. (2008) in the material collected by the Clinical Hospital of Dermatology, Medical University, Łódź, between 2004 and 2006. The sequence of the three aetiological factors was the same: *T. mentagrophytes*, *T. rubrum*, *E. floccosum*.

C. albicans (86.87%) was the most frequently diagnosed species of strains of yeast-like fungi in the study period (01 May 2003 – 30 April 2005). Sikora et al. (2000) also report *Candida* sp. as the genus dominant in this group of pathogens.

S. brevicaulis (13.31%) was the most frequently diagnosed mould in the study period, followed by *A. niger* (9.00%) and *A. fumigatus* (7.44%). In 68.69% cases, pathogens were identified as moulds and further identification was not conducted. Sikora et al. (2000) also show that *S. brevicaulis* was the most frequently identified species in this group of fungi.

CONCLUSIONS

Fungal isolations confirmed in culture were recorded in 38.14% of the total group in the study period and women were diagnosed more often than men. Dermatophytes were observed in only a small majority of infections, almost immediately followed by yeast-like fungi.

C. albicans was the most frequently diagnosed species in the present study, followed by *T. rubrum*. *C. albicans* was also the most frequently isolated species of strains of yeast-like fungi. *T. rubrum* was the most frequently isolated dermatophytic fungus and *S. brevicaulis* was the most frequently diagnosed mould.

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Grzyby potencjalnie chorobotwórcze w materiale z Wojewódzkiego Specjalistycznego Szpitala w Łodzi

Streszczenie

Zakażenia grzybicze, a szczególnie powierzchowne grzybice skóry, paznokci i włosów, stanowią obecnie poważny problem epidemiologiczny i terapeutyczny na całym świecie, a ich liczba nieustannie wzrasta. Obserwowane zmiany dotyczą zarówno częstości jak i rodzaju grzybic i związane są z warunkami geograficznymi, klimatycznymi a także stopniem uprzemysłowienia i urbanizacji danego terenu.

Celem pracy była analiza wyników badań osób kierowanych w okresie 01.05.2003–30.04.2005 do Pracowni Mikologiczno-Wenerologicznej Wojewódzkiego Specjalistycznego Szpitala im. dr Wł. Biegańskiego w Łodzi z podejrzeniem zakażeń grzybiczych skóry i\lub jej przydatków. Dokonano przeglądu mikobioty na podstawie opisu przypadków klinicznych.

Przebadano 5514 (100%) osób: 3370 (61,12%) kobiet i 2144 (38,88%) mężczyzn. Dodatnie wyniki mikologiczne uzyskano u 2103 (38,14%) osób. Spośród 2475 (100%) wszystkich izolacji u kobiet i mężczyzn łącznie, na dermatofity przypadało 989 (39,96%), grzyby drożdżoidalne 975 (39,39%), a na grzyby pleśniowe 511 (20,65%) izolacji. Najliczniej izolowanymi gatunkami u wszystkich badanych były: *Candida albicans* (34,22%) i *Trichophyton rubrum* (23,68%). Wśród dermatofitów najczęściej notowano *T. rubrum* (59,25%), znacznie rzadziej *Microsporum canis* (20,53%) oraz *T. mentagrophytes* var. *granulosum* (15,87%). Wśród grzybów drożdżoidalnych zdecydowanym dominantem był *C. albicans* (86,87%), a wśród grzybów pleśniowych *Scopulariopsis brevicaulis* (13,31%). W przypadku 68,67% zakażeń identyfikację zakończono na zaliczeniu czynnika infekcyjnego do grupy grzybów pleśniowych.