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Presence of *Saccharomycopsis capsularis* in the human respiratory system

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The following paper represents a fragment of studies on the dynamics of microflora in the human respiratory system with a particular focus on new species developing in that ontocoenosis.

Saccharomycopsis capsularis amounts to 6.7% of all the isolated fungi. The isolates were obtained from sputum (41.9%), bronchoscopic material (18.6%) and the pharyngeal, nasal and oral swabs representing jointly 39.5% of the positive results. Almost twice as many isolates were obtained from women (66.3%) as from men (33.7%). The fungi were most frequently found in the spring and autumn, more rarely in the winter, the rarest in the summer.

Appearance of *S. capsularis* in the human body is, most probably, a consequence of its increased expansiveness in the external environment. So far it has been isolated from the soil, pollens of some tropical plants and from water reservoirs contaminated with municipal sewage.

Key words: *Saccharomycopsis capsularis*, human respiratory system.

INTRODUCTION

The studies which have been carried out for several years at the Independent Public Center for Pulmonology and Oncology in Olsztyn on the species composition and dynamics of microflora of the respiratory system indicate its differentiated character. An increasing number of saprotrophic organisms establish their position in human body becoming a potential pathogenic factor (R i c h a r d s o n and W a r n o c k 1995). *Saccharomycopsis capsularis* Schiönning belonging to the yeast fungi of *Cryptococcaceae* family is one of them (B a r n e t t, P a y n e and Y a r r o w 1990). Within the area of the province of Warmia and Masuria the species was isolated for the first time in 1991 from a number of water reservoirs contaminated with municipal sewage and from clinical material (D y n o w s k a 1995). B a r n e t t et al. (1990) report that the soil and pollens

of some tropical plants may be the reservoirs of *Saccharomycopsis capsularis*. In Poland this fungus is very little known and so far it has not been included in the list of fungi posing hazard to humans. However, on the basis of own observations (D y n o w s k a 1995; B i e d u n k i e w i c z 1999) it could be believed that *Saccharomycopsis capsularis* found favorable conditions for growth and development in the human respiratory system. That is why gaining the knowledge on its morphology and biology seems very important.

The study aimed at the analysis of the presence of *Saccharomycopsis capsularis* in the human respiratory system as compared to other fungi and bacterial flora accompanying the studied species.

MATERIAL AND METHODS

The studies were carried out during the years 1996 (IV)–1997 (III). The material for the study (sputum, bronchitis lavatio and pharyngeal and nasal swabs) originated from 3041 patients (women and men) of the Independent Public Center for Pulmonology and Oncology in Olsztyn.

The material collected was treated according to the generally accepted guidelines for diagnostic mycology laboratories (D y n o w s k a 1995; K u r n a t o w s k a 1995). The initial cultures were made on the solid and liquid Sabouraud medium (plates, slants).

The macroscopic analysis was conducted on Sabouraud medium while microscopic features were studied on the Nickerson selective medium (K u r n a t o w s k a 1995).

The API tests by bioMérieux (API 20C, API 20C AUX) were used for biochemical analysis. A direct preparation was made of each collected sample and stained using the Gram method.

In identification of fungi the works by B a r n e t t et al. (1990), L o d d e r and K r e g e r-v a n R i j (1967), R i e t h (1983) and K u r n a t o w s k a (1995) were used.

RESULTS AND DISCUSSION

The respiratory system is the system most susceptible to contamination with fungi. No wonder then that in the case of 1285 people (42.26%) the results were positive. In the case of 86 persons (6.7%) the presence of *Saccharomycopsis capsularis* was confirmed (Table 1).

The result may seem to be of low significance, however, it should be remembered that the fungus only recently has appeared in the respiratory system and nothing is known about its pathological potential. That is the reason why more attention should be devoted to it as contamination with yeasts continuously increases and the boundaries between individual ecological

Table 1

The number of patients from whom *Saccharomycopsis capsularis* was isolated in particular seasons of the year (IV 1996–III 1997)

Season of the year	F (%)	M (%)	Total positive results (%)	Total number of tests
Spring	22 (≈25.6)	8 (≈9.3)	360 (≈11.87)	851
Summer	7 (≈8.1)	6 (≈7.0)	326 (≈10.72)	772
Autumn	16 (≈18.6)	9 (≈10.5)	302 (≈9.93)	715
Winter	12 (≈14)	6 (≈7.0)	297 (≈9.77)	703
Total	57 (≈66.3)	29 (≈33.7)	1285 (≈42.26)	3041
	Σ (86 (≈6.7)			

F – females, M – males

groups of pathogenic forms start to disappear (Cisowski 1971; Dynowska 1993). Most probably, it is related to a decrease in the immunity of human body to contamination with fungi and continuously increasing (at a very fast rate) number of factors determining their development in different ontocoenoses. These factors include excessive use of antibiotics in therapy against bacteria, and their inappropriate application without prior determination of the susceptibility of the microorganisms. Opportunistic contamination with fungi is a very frequent effect (Baran 1998; Richardson and Warnock 1995; Kurnatowska 1995). Preventive measures, which practically do not exist in Poland, are of major importance. It happens very rarely that a doctor, applying antibiotics, also applies an antimycotic shield. It is extremely important that the studied population consisted of patients with chronic diseases of the respiratory system treated for many years with antibiotics, and sometimes also with cytostatic and immunosuppresive drugs which disturb biological balance of the body significantly.

In the case of women, the fungi were isolated most frequently in the spring and autumn, slightly less frequently in the winter and the least frequently during the summer (Table 1). As men are concerned, *S. capsularis* was isolated most frequently during the spring and autumn, less frequently in the summer and the least frequently in the winter (Table 1).

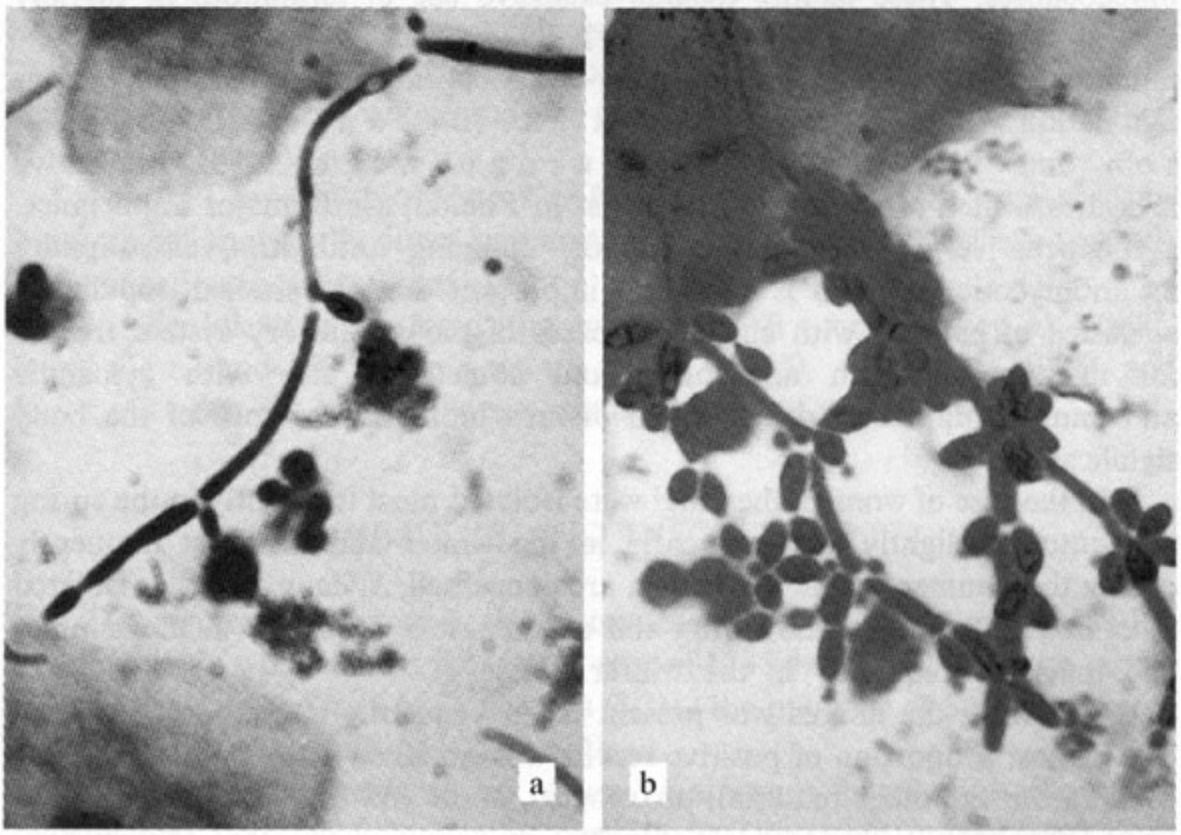
Generally, the fungus was present more frequently in women than men. The highest proportion of positive results was obtained form sputum (41.9%), 39.5% from the other material: pharyngeal, nasal and oral swabs and 18.6% from bronchoscopic material (Table 2).

On the Sabouraud agar *S. capsularis* develops a creamy-white spawn with slightly rowing surface, smooth edge, rarely growing into the medium.

Table 2
Percentage of women and men in the examined material

Season of the year	Sex	Type of the material		
		S	bm	oth
Spring	F	9.3	4.7	11.6
	M	2.3	2.3	4.7
Summer	F	4.7	–	3.5
	M	4.7	–	2.3
Autumn	F	9.3	2.3	7.0
	M	2.3	4.7	3.5
Winter	F	8.1	–	5.8
	M	1.2	4.7	1.2

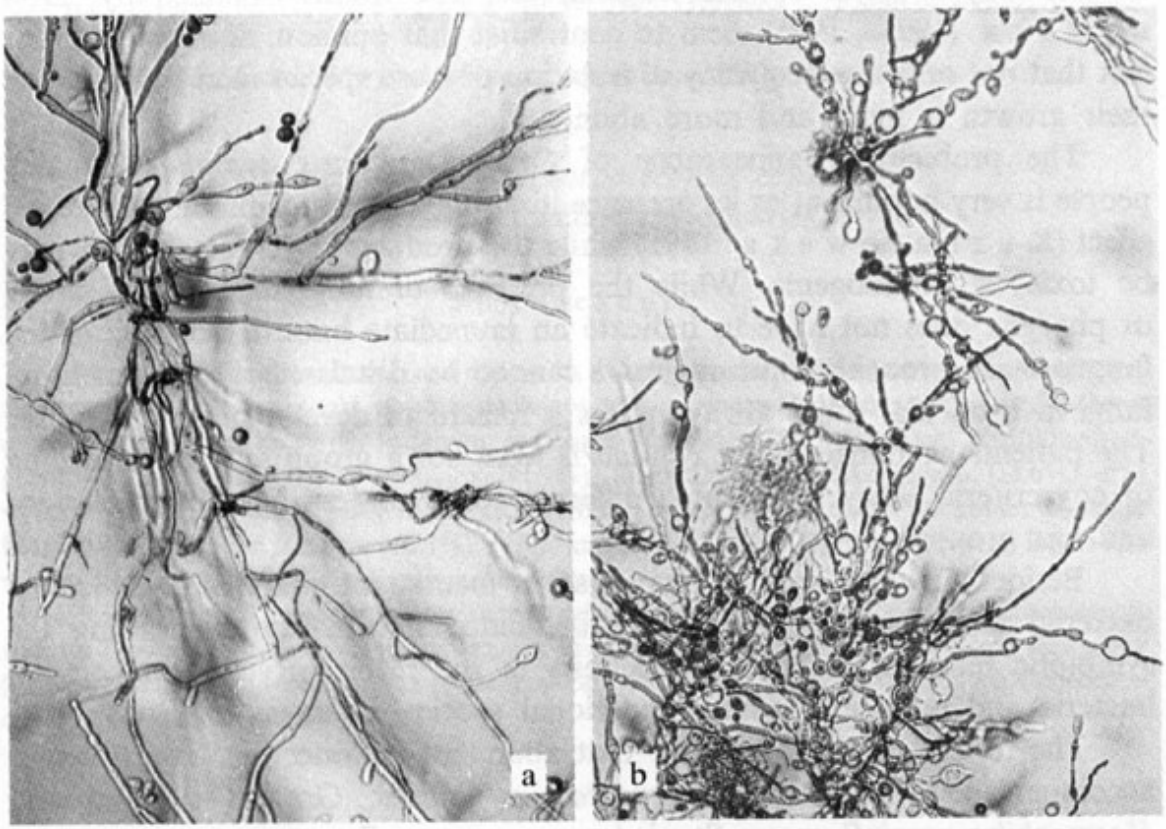
F – females, M – males; S – sputum, bm – bronchoscopic material, oth – pharyngeal, nasal and oral swab



Figs 1a, 1b. *S. capsularis* – direct preparation from bronchoscopy stained by the Gram method

The vegetative cells and blastospores are of different shapes, most frequently oval. In direct preparations a well developed real spawn was observed with clearly visible septs and blastospores concentrating around the septs (Figs 1a and 1b).

In microcultures on the Nickerson agar the spawn clearly develops and geminate. The geminating cells are most frequently oval or lemon shaped (Fig. 2a). In some strains the hyphae are subject to extensive placation while blastospores change a shape depending on their position in the hyphae. Cells similar to chlamydospores develop in a lot of places. However, as for chlamydospores, they have excessively thin wall and too few grains inside (Fig. 2b).



Figs 2a, 2b. *S. capsularis* – microculture on the Nickerson agar

Saccharomycopsis capsularis has 4 synonyms:

Endomyces capsularis (Schiönning) Guilliermond, *Endomycopsis capsularis* (Schiönning) Dekker, *Prosaccharomyces capsularis* (Schiönning) Novak et Zsolt, and *Williopsis capsularis* (Schiönning) Zender. The most frequent synonym is *Endomycopsis capsularis* (Lodder and Kreger-van Rij 1967).

The *Saccharomycopsis* genus includes 8 species. It was described in 1932 by Schiönning and Dekker as a unit separated from genus *Endomyces* (L o d d e r and K r e g e r-v a n R i j 1967). *Endomyces* can multiply only by division while *Endomycopsis* also by germination. Additionally, the fimbrias of *Endomycopsis* may divide into oidia on some media. In the case of *Endomycopsis* it was also established that in extended culturing on malt agar sacs may appear as a result of earlier conjugation or through parthenogenesis. The later attempts at obtaining sacks in artificial culturing were unsuccessful. At that time morphological similarity between *Endomycopsis vernalis* and *Trichosporon pullulans* were noticed (L o d d e r and Kreger-v a n R i j 1967).

According to R i e t h (1983) the species of the genus *Saccharomycopsis* do not play a major epidemiological role. The results obtained by D y n o w s k a (1993a, 1995) seem to contradict that opinion. She points at the fact that not only the frequency of isolation of these species increases but also their growth is more and more abundant.

The problem of appearance of *Saccharomycopsis capsularis* in sick people is very important as its presence itself may have the immunosuppresive effect (K u r n a t o w s k a 1995) while the products of its metabolism may be toxic or carcinogenic. While the presence of fungi in the oral cavity or pharynx does not have to indicate an immediate hazard, isolation of the fungus from bronchoscopic material cannot be dismissed. Development of fungi in bronchial tubes always poses a hazard of development of mycosis. The patients examined for *S. capsularis* were not a group selected according to any criteria. They represented different communities, different professions and age groups.

Besides *S. capsularis* the examination focused on search for associated bacterial and mycotic flora. There is limited information concerning the symbiotic relations in the ontocoenosis of the respiratory system between bacteria and fungi and among individual species of fungi.

The results obtained indicate that abundant presence of *S. capsularis* is accompanied by numerous *Streptococcus viridans*, Gram (−) cocci and *Haemophilus parainfluenzae*, *Staphylococcus aureus*, *Streptococcus pneumoniae* and less frequently, *Enterobacter* species, *Klebsiella oxytoca* and *Moraxella catarhalis*. Among the fungi most frequently associated with *S. capsularis*, *Candida albicans* and *Trichosporon* species should also be mentioned. It is difficult to determine whether the above relations are of mutual or antagonistic symbiosis type or maybe of parabiosis type.

Further study on the presented phenomena is necessary because of the superior objective, i.e. maintaining the biological balance of the body. The appearance of new species of fungi in the human body is a consequence of the increase of their rank in the external environment and high expansion of opportunistic forms.

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Występowanie *Saccharomycopsis capsularis* w układzie oddechowym człowieka

Streszczenie

Praca jest fragmentem badań nad dynamiką mikoflory układu oddechowego ze szczególnym zwróceniem uwagi na gatunki nowe zasiedlające tę ontocenozę. Jednym z nich jest *Saccharomycopsis capsularis*, który w badanym materiale stanowi 6.7% wszystkich wyizolowanych grzybów. Izolaty uzyskano z plwociny (41.9%), materiału bronchoskopowego (18.6%) oraz wymazów z gardła, nosa i z jamy ustnej (łącznie 39.5% wyników dodatnich). Od kobiet uzyskano blisko dwa razy więcej izolatów (66.3%), niż od mężczyzn (33.7%). Grzyby najczęściej izolowano wiosną i jesienią, rzadziej zimą, najrzadziej latem.

Pojawienie się *S. capsularis* w organizmie człowieka jest najprawdopodobniej konsekwencją wzrostu ekspansywności jego występowania w środowisku zewnętrznym. Dotychczas izolowany był z gleby, ziaren pyłku niektórych roślin tropikalnych oraz ze zbiorników wodnych zanieczyszczonych ściekami komunalnymi.