

Search of yeast-like fungi in some lakes of the Tucholski Landscape Park (NW Poland)

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The occurrence of pathogenic yeast-like fungi was determined in the catchment of the Suska and Racińska Struga. Fourteen strains of fungi from 3 genera were isolated: *Candida inconspicua*, *C. lambica*, *C. glabrata*, *Rhodotorula rubra*, *Rh. glutinis* and *Trichosporon capitatum*.

Key words: yeast-like fungi, aquatic fungi, Tucholski Landscape Park.

INTRODUCTION

With the increasing pollution and degradation of the environment, numerous fungal species are isolated from waters of various trophic nature, which can be used as indicators of purity or contamination of water. Another problem is the detection of fungi strains, among others yeast-like fungi, which are potentially pathogenic for humans and animals (Niewolak (1976) 1977, Czeczuga and Woronowicz 1991–1992, Czeczuga 1994, 1995, 1996, Kornilłowicz 1994, Dynowska 1993, 1995). Due to significant anthropopressure, the process of water eutrophisation is often modified and its rate increases (Babski, Ró z g a, Biały and Gondko 1992; Babski, Ró z g a nad Biały 1998). The number and type of species isolated depends on the amount of organic substances in the water basin. They reveal the intensity of the biodegradation and self-purification processes. The importance of this phenomenon from the strictly epidemiological point of view is unquestionable.

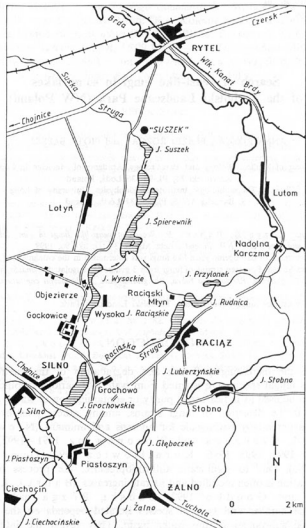


Fig. 1 The investigated area — the lakes of the north-west part of the Tucholski Landscape Park (the drainage area of the Brda river)

The aim of this study was to evaluate the presence of potentially pathogenic yeast-like fungi in seven lakes from the catchment of the Suska Struga and Racińska Struga, which differ as to morphometric and hydrographic features and the area of catchment. These lakes are situated in the north-west part of the Tucholski Landscape Park – Bory Tucholskie (Fig. 1). The studies on the physical and chemical parameters of water purity were initiated at the Chair of Biophysics, University of Łódź in 1984 (B a b s k i et al. 1992).

MATERIALS AND METHODS

Material for the study was collected in July 1998 from various sampling sites on the surface (p) and on the bottom (d) of lakes and streams. Samples of 750 cm³ were taken from each site and centrifuged for 30 minutes at 3000 rpm. Subsequently, the sediment was diluted to 25 cm³ with 0.9% NaCl and centrifuged again. The sediment was again diluted to 1 cm³ with 0.9% NaCl and transferred onto a solid Sabouraud medium with: 4% glucose, 1% peptone, 2% agar, 0.025% streptomycin, 0.025% chloromycetin, 0.1% chloramphenicol. The cultures were incubated for 48 hours at 25°C, and evaluated macroscopically and microscopically. The number of fungal colonies was calculated. The cultures were then transferred onto Sabouraud solid medium without antibiotics. Mycological diagnostics was based on morphological and biochemical features. The morphological features were evaluated on the basis of macroscopic assessment of mature colonies (their colour, shape, surface structure and borders) and microscopic assessment by characterising microcultures on slides covered with a layer of Sabouraud agar incubated for 24–48 hours. The type, size and way of spores distribution was evaluated. The biochemical features, fermentation and ability to assimilate carbohydrates and nitrogen, were determined with API 20C test and API 20C AUX according to the rule of numerical identification (Analytical Profile Index, bio Mérieux Lyon 1990), and nitrogen auksanogram, respectively (L o d d e r 1971, K r e g e r-V a n R i j 1984, K u r n a t o w s k a 1995).

Sampling sites are presented in Figure 2. The description of the lakes is presented below (B a b s k i et al. 1998):

Lake Suszek (11.0 ha, max depth 4.8 m) small, shallow, non-stratified, situated in the north part of the area studied, collecting run-off waters from the fields and forests which flow into the Suska Struga stream. It does not collect contaminated waters from sources of impurities. It is susceptible to degradation and belongs to purity class III.

Lake Śpiewnik (138.9 ha, max depth 14.8m) the largest stratified water basin of all the lakes studied. It is situated in the forest and does not collect sewage or contaminated waters. It belongs to purity class II.

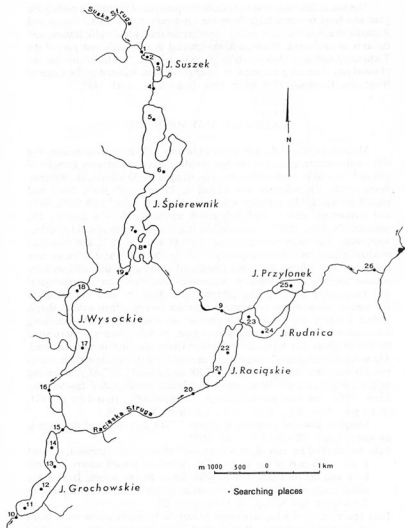


Fig 2. Location of the water sampling sites in the lakes studied

- Lake Wysockie (42.0 ha, max depth 19.0 m) small and the deepest of the lakes studied. It belongs to purity class III. It is surrounded by crop lands (90.0%) and collects contaminated water from a distillery and farms.
- Lake Grochowskie (71.7 ha, max depth 5.0 m) shallow and non-stratified water basin collecting municipal sewage from 2 villages and rural contamination from fields. It belongs to purity class III.
- Lake Raciąskie (39.2 ha, max depth 13.2 m) a small water basin, mixing waters from Lake Grochowskie and also rural contamination from fields and Raciąskie village. Out-of-class waters.
- Lake Rudnica (25.0 ha, max depth 9.3 m) small shallow basin surrounded by forests. It does not receive sewage from contamination sources. Out-of-class waters.
- Lake Przyłonek (10.4 ha, max depth 5.5 m) receives water from all the lakes studied and by Raciąska Struga stream inflows to Brda river. It is surrounded by forests (92.3%) and does not collect contaminated water. Out-of-class waters.

RESULTS AND DISCUSSION

Two water samples were collected from each site — on the surface (p) and bottom (d) from 18 sampling sites on 7 lakes and on the surface from 8 sampling sites in 3 streams and canals. Yeast-like fungi were cultured from 14 water samples collected from 11 sampling sites: Suska Struga, Lake Śpiewnik, Ciechocińska Struga, Lake Grochowskie, Lake Wysockie, Raciąska Struga, Lake Raciąskie and Lake Przyłonek (Table 1).

Table 1

Occurrence of yeast-like fungi in the water of lakes in the catchment of the Suska and Raciąska Struga

Species	Abundance of colony/dm ³	No of site	Locality
<i>Candida inconspicua</i>	13	1	Suska Struga
<i>Trichosporon capitatum</i>	11	5 (p)	Lake Śpiewnik
<i>Rhodotorula glutinis</i>	3	5 (d)	Lake Śpiewnik
<i>Candida glabrata</i>	37	7 (d)	Lake Śpiewnik
<i>Rhodotorula glutinis</i>	20	8 (p)	Lake Śpiewnik
<i>Candida lambica</i>	poor growth	10	Ciechocińska Struga
<i>Candida inconspicua</i>	5	12 (p)	Lake Grochowskie
<i>Candida inconspicua</i>	1021	16	Wysocka
<i>Candida inconspicua</i>	poor growth	18 (p)	Lake Wysockie
<i>Rhodotorula rubra</i>	poor growth	18 (d)	Lake Wysockie
<i>Candida glabrata</i>	97	20	Raciąska Struga
<i>Rhodotorula rubra</i>	5	21 (d)	Lake Raciąskie
<i>Rhodotorula glutinis</i>	poor growth	25 (p)	Lake Przyłonek
<i>Rhodotorula glutinis</i>	187	25 (d)	Lake Przyłonek

Fourteen strains of fungi from 3 genera, of which presently *Candida* is associated with *Ascomycetes* and *Rhodotorula* and *Trichosporon* with *Basidiomycetes* (Van Hoog and Guarro 1995) were isolated. Three species belong to the genus *Candida*: *C. inconspicua* (Lodder et Kreger-van Rij), Meyer et Yarrow, *C. lambica* (Lindner et Genoud), van Uden et Buckley, and *C. glabrata* (Anderson), Meyer et Yarrow. Two species belong to the genus *Rhodotorula*: *Rh. rubra* (Demme), Lodder and *Rh. glutinis* (Frasenius), Harrison and one species to the genus *Trichosporon* — *T. capitatum* Diddens et Lodder.

Three species of yeast-like fungi were isolated from the water samples collected from 3 sampling sites on Lake Śpiewnik: *Candida glabrata*, *Trichosporon capitatum* and *Rhodotorula glutinis*. *C. glabrata* was very abundant (37/dm³), whereas the remaining species were not as numerous. It is notable that *C. glabrata* has small fermentation and carbohydrate assimilation abilities, and small ability to assimilate carbon from other organic compounds. In comparison to other species from the genus *Candida* it is less susceptible, to antifungal drugs.

Candida glabrata has been isolated quite frequently from the oral cavity onocenosis and sexual organs, and also from multifocal infections from patients treated at the Centre for Treatment of Parasitic and Fungal Diseases, Chair of Biology and Medical Parasitology, Academy of Medicine in Łódź (Kurnatowska 1995). *Th. capitatum* (*Geotrichum capitatum*, (Diddens et Lodder), von Arx has been isolated from the sputum and from the skin of healthy persons but it can also be the etiologic factor of disseminated mycosis (Baran 1998). This species does not ferment simple sugars, but can utilise carbon from other sources, for example succinic and citric acids. It was demonstrated that *Rh. glutinis* played an important role in the process of auto-purification of waters, and it could also be used as an indicator of the type of contamination (Dynowska 1995). This has been confirmed by the findings of authors Dąbrowski, Bogusławska-Wąs and Daczowska-Kozon (1998), who studied the microflora of Szczecin Lagoon waters and by Wójcik and Tarczyńska (1999) who surveyed the Sulejowski Bay.

In Lake Wysockie a high number of *C. inconspicua* specimens was recorded (1021/dm³). This species was also isolated from Lake Grochowskie. The strains obtained were cultured from the surface samples taken from the lakes and streams. This species is rarely isolated from patients (Kurnatowska 1995). It can utilise carbon from glucose, ethanol, glycerol, lactic and succinic acids, which explains its presence in waters contaminated with municipal sewage (from the farm) and industrial sewage (from the distillery). This species has not been described from Polish lakes before.

Samples collected from the sites on the Lake Raciąskie and Lake Przyłonek contained strains of *Rh. rubra* and *Rh. glutinis*. These lakes contain

out-of-class waters, susceptible to degradation. The presence of fungi from the genus *Rhodotorula* points to the processes of auto-purification, which takes place in these lakes. These strains can utilise carbon and nitrogen from numerous inorganic and organic compounds, and can produce urease, which decomposes urea. In *Rh. glutinis* the sexual form, *Rhodospiridium diobovatum* (Newell et Hunter) has been described. It should be noted that some strains from the cultures species may cause mycosis of various organs, especially in patients with impaired immunity (Warnock and Richardson 1991).

It is notable that there were no species from the *Candida* genus which are common pathogens for the humans, e.g. *C. albicans* (Robin), Berkhout was isolated from some of the studied lakes and streams around Olsztyn (Dyńska 1995), Sulejowski Bay (Wójcik and Tarczyńska 1999), Masurian Lake District (Czczuga 1996), from the lakes around Elk (Czczuga 1995) and in the Augustowskie area (Czczuga 1994).

The number of yeast-like fungi cells in the lakes studied is lower than that obtained from the lakes around Olsztyn: (Dyńska 1995) Lake Kortowskie (180 (p) – 250 (d)/cm³), Lake Skanda (230 (p) – 200 (d)/cm³) and Lake Trackie (950 (p) – 870 (d)/cm³) in the summer.

The most important nutrients for fungi, which are accessible in eutrophic lakes, include nitrogen and phosphorous compounds. The lakes studied belong either to purity class II (Śpiewnik) or III (Grochowskie, Wysockie) and two of them (Raciąskie, Przyłonek) are out-of-class lakes. These lakes are highly susceptible to degradation and are significantly polluted (hypertrophic) (Babski et al. 1998).

The composition of yeast-like fungi varies slightly. They are present in small quantities and there are no species pathogenic for humans or animals. However, cultured strains are bioindicators of human impact on native aquatic environment. Their presence indicates the possibility of spreading fungi pathogenic for humans in the aquatic ecosystems which are undergoing biodegradation.

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Poszukiwanie grzybów drożdżopodobnych w wybranych jeziorach Tucholskiego Parku Krajobrazowego

Streszczenie

Poszukując w siedmiu jeziorach zlewni Suskiej i Raciąskiej Strugi grzybów drożdżopodobnych potencjalnie chorobotwórczych dla człowieka i zwierząt, wyizolowano czternaście szczepów z trzech rodzajów. Były to następujące gatunki: *Candida inconspicua*, *Candida lambica*, *Candida glabrata*, *Rhodotorula glutinis*, *Rhodotorula rubra* i *Trichosporon capitatum*.