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ORIGINAL RESEARCH PAPER

TOLERANCE OF NAKED AMOEBAS (PROTISTA) TO THE ABIOTIC FACTORS

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SYNOPSIS

The tolerance ranges of most distributed naked amoeba species are estimated for the first time on the territory of Ukrainian Polessje. On this base the ecological groups of naked amoebas were determined: eurythermal, stenothermal thermophilic, euryoxidic, stenooxidic, those marked in the wide range of permanganate oxidability values and in the narrow one.

INTRODUCTION

As the analysis of naked amoebas biotopic distribution has shown that their spreading and species diversity (Patcyuk, 2010, 2011a, b, 2012a, b; Patsyuk & Dovgal, 2012) are mainly caused by the abiotic factors of water environment, such as the temperature, concentration of oxygen and organic matter dissolved in the water.

However the information on the tolerance ranges of naked amoebas to mentioned factors is practically absent, so we have analyzed the relation of 15 naked amoeba species mostly common in the waters of Zhytomir and Volyn' Polessje to the variety of abiotic factors.

MATERIAL AND METHODS

The material was gathered during 2009-2012. The 745 samples were collected in 124 points of Zhytomir and Volyn' Polessje located on 44 rivers, 32 floodplain waterbodies, 20 soil-reclamation canals, 28 bogs and 22 lakes (Lakes of Shatsk). Samples for the research of seasonal changes in naked amoeba populations were collected 3 times per month during the year in the Kamyanka River (Zhytomir neighborhood).

It should be noted that modern methods don't allow to receive data about abundance of amoebas, so we have estimated only value ranges of those

environmental factors, at which the certain naked amoeba species have been marked.

For receiving materials the amoebas were reproduced on the non-nutrient agar by the Page's method (Page, 1988, 1991).

Observation for the protists and photomicrographs were made with the light microscope Axio Imager M1 (in Centre of scientific devices collective usage «Animalia» of the Shmalhausen Institute of Zoology, Kiev) with the differential interference contrast applying.

Identification of amoebas was made in two stages – at first the definition of their morphotype with the help of special studies (Smirnov & Goodkov, 1999; Brown & Smirnov, 2004; Smirnov, 2008) was provided; after that (if the data allowed) the keys to taxa of Page (1988, 1991) together with the later publications on naked amoebas (Smirnov et al., 2007; Smirnov, 2008; Smirnov et al., 2011) were used.

Such parameters of water were defined: temperature, content of oxygen and dissolved organic matter (the latter by permanganate oxidability - the amount of oxygen which spent for the oxidation of dissolved organic matter).

RESULTS AND DISCUSSION

As was indicated above the most distributed naked amoeba species were investigated. Frequencies of these species findings in the waters of explored region were: *Saccamoeba stagnicola* – 70.88 %; *Saccamoeba* sp. (1) – 66.85 %; *Korotnevella stella* – 74.68 %; *Vexillifera* sp. – 76.20 %; *Cochliopodium* sp.(1) – 81.00 %; *Vannella* (cf) *lata* – 75.95 %; *Ripella* sp. – 48.10 %; *Mayorella* sp.(1) – 51.64 %; *Thecamoeba striata* – 73.92 %; *Stenamoeba stenopodia* – 51.90 %; *Flamella* sp. – 54.17 %; *Vahlkampfia* sp.(1) – 70.88 %; *Vahlkampfia* sp.(2) – 70,38 %.

The tolerance ranges obtained for the investigated naked amoeba species are shown in Table 1.

Relations of the naked amoebas to the temperature

Tolerance ranges to such factor as temperature may be estimated only in condition of the year-round observations. Such observations were made in the Kamyanka River during 2009-2010. Temperature range in the river was from + 3 °C до + 26 °C during the observation period.

Six amoeba species (*Korotnevella stella*, *Mayorella cantabrigiensis*, *Vannella lata*, *Thecamoeba striata*, *Cochliopodium* sp.(1) and *Vahlkampfia* sp.(1)) were eurythermal because they were registered at the whole range of temperature changes (Table 1). The other species were observed at the next temperature ranges: *Deuteramoeba mycophaga* from 16 to 26 °C; *S. stagnicola* from 3 to 14 °C;

Saccamoeba sp. (1) from 6 to 24 °C; *Saccamoeba* sp. (3) was observed at 3 °C; *Mayorella vespertilioides*, *Flamella* sp. and *Vahlkampfia* sp.(2) from 16 to 24 °C; *Mayorella* sp. (1) at 14 °C; *Vexillifera* sp. from 14 to 26 °C and *Paradermamoeba valamo* and *Paradermamoeba levis* from 4 to 6 °C.

So *D. mycophaga*, *S. stagnicola*, *Saccamoeba* sp. (1), *M. vespertilioides*, *Flamella* sp., *Vahlkampfia* sp. (2), *Mayorella* sp. (1) and *Vexillifera* sp. might be characterizing as the thermophilic stenothermal species whereas *Saccamoeba* sp. (3), *P. valamo* and *P. levis* are the psychrophilic stenothermal species.

Table 1. The tolerance ranges of naked amoeba species to the abiotic factors.

№	Species	Temperature, °C	Content of oxygen dissolved in the water, mg/L	Permanganate oxidability, mg O_2/L
1.	*S. stagnicola*	-	4.52-17.21	2.43-30.52
2.	*Saccamoeba* sp.(1)	-	1.37-18.32	5.57-38.03
3.	*K. stella*	3-26	4.50-31.94	9.03-50.01
4.	*Korotnevella* sp.(2)	-	1.37-11.05	6.00-48.50
5.	*Vexillifera* sp.	-	3.05-18.04	1.32-50.01
6.	*Cochliopodium* sp.(1)	3-26	3.05-17.84	2.17-50.21
7.	*Vannella lata*	3-26	2.35-30.05	2.84-50.01
8.	*Ripella* sp.	-	5.28-31.94	4.21-56.50
9.	*M. cantabrigiensis*	4-26	3.05-17.84	5.60-50.01
10.	*Mayorella* sp.(1)	-	4.35-31.94	3.25-28.53
11.	*T. striata*	3-26	3.05-28.02	2.17-50.01
12.	*S. stenopodia*	-	4.85-15.32	2.54-37.12
13.	*Flamella* sp.	-	3.04-18.04	7.81-50.38
14.	*Vahlkampfia* sp.(1)	3-26	2.35-24.02	2.17-50.01
15.	*Vahlkampfia* sp.(2)	-	2.35-24.02	3.15-38.03

RELATIONS OF THE NAKED AMOEBAS TO THE DISSOLVED OXYGEN

The such species as *K. stella*, *Mayorella* sp. (1), *V. lata*, *Ripella* sp., *T. striata*, *Vahlkampfia* sp. (1) and *Vahlkampfia* sp. (2) are existing under significant changes of oxygen dissolved in the water (from 1.37 mg/L to 31.94 mg/L) (Table 1). These species were classified as euryoxidic.

Such naked amoeba species as *S. stagnicola*, *Saccamoeba* sp. (1), *Korotnevella* sp. (2), *Vexillifera* sp., *M. cantabrigiensis*, *S. stenopodia*, *Flamella* sp. and *Cochliopodium* sp. (1) have been found at the oxygen content in water not higher than 18.32 mg/L (Table 1). These species were classified as stenooxidic.

RELATIONS OF THE NAKED AMOEBAS TO THE DISSOLVED ORGANIC MATTER

The values of permanganate oxidability have fluctuated from 1.32 mg O_2/L to 56.5 mg O_2/L in the observed waterbodies.

The such species as *K. stella* were observed at the permanganate oxidability from 9.03 mg O_2/L to 50.01 mg O_2/L; *Korotnevella* sp.(2) – from 6.00 mg O_2/L to 48.50 mg O_2/L; *Vexillifera* sp. – from 1.32 mg O_2/L to 50.01 mg O_2/L; *M. cantabrigiensis* – from 5.60 mg O_2/L to 50.01 mg O_2/L; *V. lata* – from 2.84 mg O_2/L to 50.01 mg O_2/L; *Ripella* sp. – from 4.21 mg O_2/L to 56.50 mg O_2/L; *T. striata* – from 2.17 mg O_2/L to 50.01 mg O_2/L; *Flamella* sp. – from 7.81 mg O_2/L to 50.38 mg O_2/L; *Cochliopodium* sp.(1) – from 2.17 mg O_2/L to 50.21 mg O_2/L; *Vahlkampfia* sp.(1) – from 2.17 mg O_2/L to 50.01 mg O_2/L (table 1). The above-listed species have been found at the wide ranges of concentration the organic matter dissolved in water. As this takes place, the high concentrations of organic matter are possible the most favorable for their development.

The *Mayorella* sp. (1) in turn is sensitive to the concentration of the organic matter since was registered at the permanganate oxidability from 3.25 mg O_2/L to 28.53 mg O_2/L. The same is true to the such species as *S. stagnicola* which observed under permanganate oxidability from 2.43 mg O_2/L to 30.52 mg O_2/L, *Saccamoeba* sp. (1) observed under 5.7 to 38.03 mg O_2/L, *S. stenopodia* registeated under 2.54 to 37.12 mg O_2/L and *Vahlkampfia* sp. (2) that found under oxidability from 3.15 mg O_2/L to 38.03 mg O_2/L.

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