Morphology of some species of heterotrophic flagellates from tundra soils (Protista: Kinetoplastea: Cercomonadida)

Морфология некоторых видов гетеротрофных жгутиконосцев из тундровых почв (Protista: Kinetoplastea: Cercomonadida)

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INTRODUCTION

Heterotrophic flagellates are an abundant group of Protozoa, which has a worldwide distribution in marine, freshwater and soil biotopes (Fenchel, 1987). Biodiversity and morphology of soil heterotrophic flagellates are poorly known (Ekelund & Patterson, 1997), and data on heterotrophic flagellates in tundra soils is absent from the literature. Many species of these organisms (especially, cercomonads and kinetoplastids) were described in 19th and the beginning of 20th centuries (Lemmermann, 1914), and theirs taxonomy needs urgent clarification and revision (Lee et al., 2003).

MATERIAL AND METHODS

Samples were collected on August 6, 2007, from the upper horizon of podzolised sandy podbur (moss-dwarf-shrubs-Cetraria community) near the Akhmelo Lake (13 km to the west of Chersky), south-eastern part of Khallerchinskaya Tundra (interfluve of Kon’kovaya and Kolyma Rivers, north-eastern Yakutia, Russia). Five grams of the soil from each sample were analysed in two replicates in Petri dishes with the sterile Pratt medium. Light microscopical observations were made using a Biolam-I microscope (Russia) equipped with phase contrast and water immersion objectives (the
total magnification 770x). The microscope was equipped with an analogous video camera AVT HORN MC-1009/S, which was connected to a video recorder Panasonic NV-HS 850.

RESULTS

Five species of heterotrophic flagellates were found in the investigated samples. Species descriptions are presented below.

RHIZARIA Cavalier-Smith, 2002
CERCOZOA Cavalier-Smith, 1998, emend. Adl et al., 2005
Family CERCOMONADIDAE Kent, 1880, emend. Myl’nikov & Karpov, 2004
Genus Cercomonas Dujardin, 1841
Cercomonas angustus (Skuja, 1948) (Figs 1–3)

Cercobodo angustus (Skuja, 1948)
Cercomonas angustus: Myl’nikov & Karpov, 2004

Description. Cell cylindrical, usually straight or slightly curved, 10–14 μm long and 3–4 μm wide. Anterior end obtuse, posterior end thinning and roundish. Two flagella arising from the ventral depression on the anterior part of the cell. Anterior flagellum about the cell length or shorter, posterior flagellum 1.5–2 times the cell length. Pseudopodia not numerous, simple and short, originate from the any part of the cell. Median nucleus in the anterior end of the cell. One or two contractile vacuoles usually situated in the anterior half of the cell body, rarely – in the posterior half. Food vacuoles in the posterior part of the cell. Moves rather quickly, at that cell strongly twists. Front flagellum is a little deflected sideways during the swimming.

The species was originally described from fresh waters of Sweden (Skuja, 1948).

Comparative Remarks. Zhukov (1971) reported a larger cell, 19–26 μm long, but relatively narrower, 2.5–4 μm wide.

Cercomonas ovatus Klebs, 1892, new combination (Figs 4–6)

Dimorpha ovata Klebs, 1892
Cercobodo ovatus: Lemmermann, 1910

Description. Cell almost round or ovate, 7–11 μm long and 6–10 μm wide. Equal flagella two times the cell length. Amoeboid stage with a broad obtuse pseudopodia. Contractile vacuole and median nucleus in the anterior end of the cell. Food vacuoles situated in the posterior part of the cell body. Nutrition animal and saprophytic.

The species was observed in stagnant waters of Europe within epibioses and detritus (Lemmermann, 1910, 1914)

Comparative Remarks. Other authors reported a noticeably larger cell of this species: 19–26 μm long and 18–21 μm wide (Lemmermann, 1910; Zhukov, 1993).

At present, the name Cercomonas is considered as the senior synonym of the following generic name: Reptomonas Kent, 1880, Cercobodo Krassiltschik, 1886, Dimorpha Klebs, 1892, Dimastigamoeba Blochmann, 1894, Cercomastix Lemmermann, 1913, and Prismatomonas Massart, 1920 (Mignot & Brugerolle, 1975; Schuster & Pollack, 1978; Patterson & Zöllfel, 1991; Myl’nikov & Karpov, 2004).

Cercomonas radiatus (Klebs, 1892) (Figs 7–9)

Dimorpha radiata Klebs, 1892
Cercomonas radiatus: Myl’nikov & Karpov, 2004

Description. Cell oval or egg-shaped, sometimes with a pointed posterior end, 8–12 μm long and 3.5–7 μm wide. Anterior flagellum about the cell length, trailing posterior flagellum two times the cell length. Amoeboid stage with a long, thin, radial pseudopodia.
Figs 1–13. Morphology of the species. 1–3, *Cercomonas angustus* (1, type view, 2, cell variability, 3, amoeboid stage); 4–6, *C. ovatus* (4, type view, 5, cell variability, 6, amoeboid stage); 7–9, *C. radiatus* (7, type view, 8, cell variability, 9, amoeboid stage); 10–11, *Bodo globosus* (10, type view, 11, cell variability); 12–13, *B. spora* (12, type view, 13, cell variability). Scale bar: 10 μm (1–11), 5 μm (12, 13).

Median nucleus in the anterior end of the cell. Contractile vacuole in the posterior half of the cell body. Food vacuoles in the posterior part of the cell. Nutrition animal and saprophytic.

It is a polysaprobic species, which occurs in miry water bodies within over rotten plant residues (Lemmermann, 1910, 1914). The species is also known from sod-podzol soil of Azerbaijan (Nikolyuk, 1956; Lepinis et al., 1973).

Comparative Remarks. Other authors reported the inflation of the posterior end of the cell with a large, apparently food vacuole (Lepinis et al., 1973).

Bodo globosus Stein, 1878
(Figs 10, 11)

Description. Cell broadly oviform or spherical, without distinct rostrum, 5–10 μm long and 3–8 μm wide. Anterior flagellum about the cell length, posterior flagellum two times the cell length. Median nucleus and contractile vacuole situated in the central part of the cell. Kinetoplast not seen. The most typical movement is quaky, without rotation concerning a longitudinal axis of a cell, with a frequent change of a direction.

Known to occur in mesosaprobic waters (Zhukov, 1993) on the planktonic algae (Skuja, 1956). It is widely distributed in sod-podzol soils (Lepinis et al., 1973) and, at the same time, a representative of coprozoan protistofauna (Sandon, 1927; Skuja, 1948; Nikolyuk, 1956).

Comparative Remarks. Calkins (1926) reported cells with a very long posterior flagellum (about 5 times the cell length).

Bodo spora Skuja, 1956
(Figs 12, 13)

Description. Cell oval or spherical, slightly metabolic, 2–4 μm long and 1.5–3 μm wide. The dorsal side of the cell is more prominent than ventral one. Visible only half face small pointed rostrum situated on the anterior end of the cell. Two flagella arising from the ventral depression under the rostrum. Anterior flagellum 2–3 times longer than cell, posterior flagellum 3–4 times the cell length. Kinetoplast not seen. Contractile vacuole situated in the anterior or posterior part of the cell.

It was originally described from freshwaters of Sweden (Skuja, 1956), and is commonly observed in mesosaprobic waters (Zhukov, 1993).

Comparative Remarks. The species is the smallest one among other representatives of the genus.

DISCUSSION

The examined species of heterotrophic flagellates are extremely rarely identified in protistological studies, although they are typical inhabitants of soils and small-size stagnant water bodies of high trophic status (Zhukov, 1971, 1993; Lepinis et al., 1973). These species are bacterivorous and play an important role in the control of abundance, production and structure of the bacteriocenoses (Berninger et al. 1991).

The cell morphology of examined heterotrophic flagellates corresponds to that described earlier (Lemmermann 1910, 1914; Skuja, 1956; Zhukov, 1971, 1993). However, they are generally distinguished by a smaller size of the cell, but the ratios of the flagellum length and the cell length are similar.

Bodo globosus and Bodo spora are characterised by some features which are not
typical for bodonids. In particular, there was found the cell body metaboly, and the kinetoplast was not seen. Besides, the contractile vacuole is not always situated in the anterior end of the cell and can migrate. The latter feature is different from what is known for bodonids, which are characterised by the contractile vacuole always located in the anterior end of cell because its content belongs to the cavity of the flagellum pocket (Myl’nikov, 1992). On the contrary, the contractile vacuole of cercomonads does not usually occupy a strictly determined place in the cell and can migrate due to cyclosis (Myl’nikov, 1992).

Owing to the rare occurrence and low abundance, B. globosus and B. spora were not isolated as clonal cultures, this is why their ultrastructure was not studied. However, that could indicate an authentic taxonomic position of the species. Formally, I left the two species in the genus Bodo but their relations with bodonids seems only superficial while affinities to Cercomonadida is evident.

ACKNOWLEDGEMENTS

This study was supported by the Russian Foundation for Basic Research (grants Nos. 08-04-00244 and 10-04-00496).

REFERENCES


Received 6 December 2008 / Accepted 5 May 2010