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Acanthocorbis mongolica nov. spec. – Description of the first freshwater loricate choanoflagellate (Acanthoecida) from a Mongolian lake

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This paper is dedicated to Prof. Dr. Dietrich Uhlmann on the occasion of his 80th birthday.

Abstract

A new acanthoecid choanoflagellate species, *Acanthocorbis mongolica* sp. nov. was found in preserved phytoplankton samples from the freshwater lake Bayan Nuur (Uvs Nuur Basin, NW Mongolia) in concentrations of up to 1.8×10^5 cells L^{-1}. It is the first well-documented species of the mainly marine order Acanthoecida to be found in a freshwater lake. The lorica structures were studied with scanning electron microscopy. Key morphological features of the vase-shaped lorica are spine bases that are composed of multiple (2–4) parallel costal strips, and the existence of two transverse costae. The ecological implications of this find are discussed.

Keywords: Choanoflagellate; Acanthoecida; *Acanthocorbis*; Freshwater; Mongolia

Introduction

Loricate choanoflagellates (order Acanthoecida Cavalier-Smith) are characterized by a basket-like structure of siliceous costae housing the protoplast. The often voluminous loricae support life as planktonic filter feeders by providing increased drag to counteract the flagellum's driving force (Leadbeater 2008). The morphology, physiology and life cycle of acanthoecids have been studied intensely (e.g. Leadbeater 1979a,b, 1987, 2010; Thomsen and Larsen 1992; Pettitt et al. 2002; Leadbeater et al., 2008; Leadbeater and Cheng 2010; Gong et al. 2010). The highly conservative morphology of the protoplast with a single flagellum, surrounded by a collar of microvilli, shows little variation. In contrast, there is a wealth of lorica forms and sizes among the over 120 known species. This extracellular structure is assembled from a defined set of costal strips produced, exocytosed and stored by the cell. Assembly proceeds in a single complex sequence of movements taking some minutes. The mode of reproduction is nudiform in a few species, whereby the costal strips for the new lorica are produced by the temporarily sedentary daughter cell after cell division and departure from the mother cell. In the majority of acanthoecids, the mode of reproduction is tectiform: a complete set of costal strips is produced and stored near the collar in advance of cell division. After division, the juvenile cell departs from the mother cell, taking these strips with it, and assembles its own lorica. Acanthoecid taxa showing either of the two modes of reproduction were found to belong to genetically strongly supported monophyletic clades (Carr et al. 2008).

Acanthoecids are an ecologically important element of the microzooplankton in marine and brackish water habitats where they have been found worldwide. In highly productive Antarctic coastal waters they can reach maximum abundances of about 10^7 cells L^{-1} (Marchant and Perrin 1990) and contribute substantially to the grazing on bacteria and picoplankton with maximum daily consumption rates of

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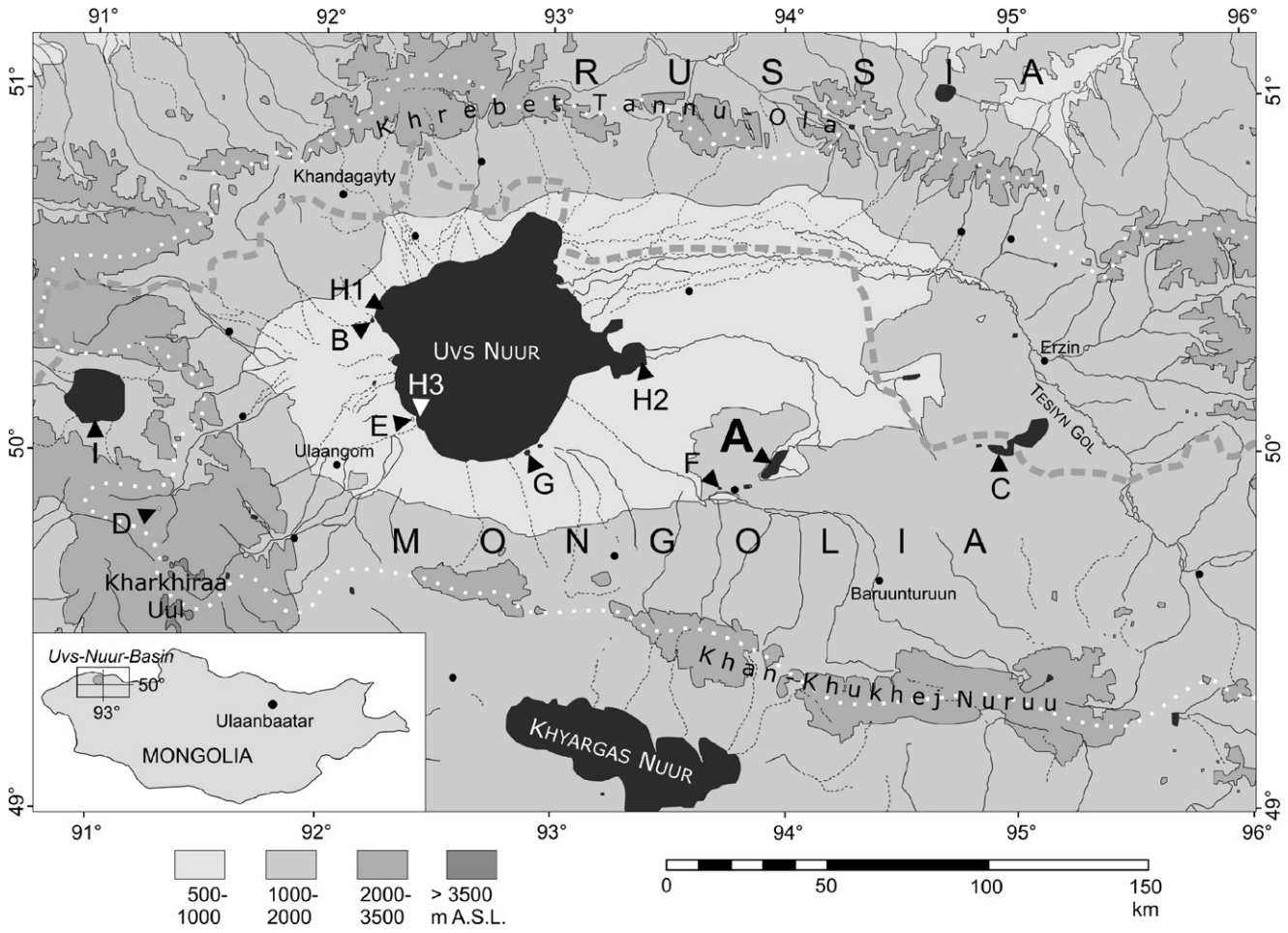

Fig. 1. Map of the Uvs Nuur Basin. Sampled lakes (arrowheads): A – Bayan Nuur (type locality), B – Baga Nuur, C – Döröö Nuur, D – Nogoon Nuur, E – Seepage Lake, F – Shavart Nuur, G – Southern Baga Nuur, H1-3 – Uvs Nuur, I – Üüreg Nuur. Dotted white line: catchment border of the Uvs Nuur Basin, black dots: settlements over 1000 inhabitants. Lakes are in black.

about 14% of the bacterial production (Buck and Garrison 1988). The average abundances in the polar seas, however, are in the range of 10^3–10^4 cells L^{-1} (Chen 1994; McKenzie et al. 1997).

The loricate choanoflagellate under consideration here was found in the plankton of a Mongolian freshwater lake in 1997 and 1998, which is of significance because until now species of this group have not been found outside marine and brackish waters (Carr et al. 2008; Leadbeater 2008). The aim of this study was to give a description of the lorica and the habitat of this species, and discuss the ecological implications of this find.

Material and Methods

Over four successive years (1996–99) during August, a Mongolian-German limnological research group investigated several representative water bodies in the Uvs Nuur Basin, among them nine lakes with salinities between 0.05 and 20 g L^{-1} (see sampling locations in Fig. 1). Results have been published among others in Horn and Paul (2000), Paul and Horn (2000) and Flößner et al. (2005). The described choanoflagellate was only found in the freshwater lake Bayan Nuur, which is located at 49°59′N, 93°58′E amidst a large dune field. The lake has a surface area of 32.0 km^2, a maximum and mean depth of 29.2 m and 10.2 m, respectively. It is situated at an altitude of 932 m above sea level and fed by groundwater originating from the dunes. Its permanent outflow at the northern shore discharges into the eastern bay of the salt lake Uvs Nuur. The lake was thermally stratified and reached epilimnion temperatures of 18–22 °C. Hypolimnetic ionic composition and salinity did not differ substantially from that of the epilimnion. The hydrochemical characteristics of Lake Bayan are summarized in Table 1.

The lake was oligo- to mesotrophic with summer chlorophyll concentrations of 2–3 μg L^{-1}. The phytoplankton was dominated by Dinophyceae, Bacillariophyceae and Cyanobacteria. In the zooplankton, Calanoida, Cyclopoida and Cladocera were dominant. One fish species of the genus *Oreoleuciscus* was found and some waterfowl were present, but in low abundance.