A choanoflagellate (craspedomonad) epiphytic on Microcystis aeruginosa

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A large population of the choanoflagellate, Salpingoeca sp., developed on Microcystis aeruginosa Kütz. emend. Elenkin which had been collected from a hypertrophic lake and maintained for several days in the laboratory. The choanoflagellate appears to be related to, but not identical to, S. ampulloides Bicudo and Bicudo which occurs in Brazil on Salvinia. Staining of the flagellates with fluorescent dye demonstrated the ingestion of bacteria.

'n Groot bevolking van die koanoflagellaat het op kolonies van Microcystis aeruginosa Kütz. emend. Elenkin ontwikkel nadat die cyanobakterium in 'n hipertrofe dam versamel is en 'n paar dae in die laboratorium gehou is. Die koanoflagellaat is verwant aan, maar is nie identies met S. ampulloides Bicudo en Bicudo wat in Brasilië op Salvinia voorkom nie. Kleuring van die flagellate met 'n fluoressensiekleurstof het die inname van bakterieë aangetoon.

Keywords: Cyanobacteria, Hartbeespoort Dam, hypertrophic, Salpingoeca

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Introduction

The choanoflagellates comprise a group of uniflagellated organisms of uncertain taxonomic position characterized by the presence of a collar at the flagellar base. In the zoological classification system the organisms are placed in the zooflagellate class Zoomastigophorea (Norris 1982; Leadbeater 1985) while some phycologists have placed them in the order Protomonadidae (Fott 1971) or in the order Craspedomonadidae of the Chrysophyceae (Bourrelly 1968). However, it is now generally accepted that the organisms should not be regarded as algae but as protozoans and thus be excluded from the plant kingdom (Lewin & Gibbs 1982).

Choanoflagellates are often recorded as epiphytes on planktonic and benthic algae, on macrophytes, detritus and on aquatic animals (Lemmermann 1910). Free-living choanoflagellates are often neutonic, attaching themselves upside down (the flagellum pointing downwards) to surface films (Norris 1965). They collect food by generating water movements with their flagellum, carrying particulate matter into the extensible collar for ingestion and digestion (Ellis 1929). Ultrastructurally the collar consists of anastomosing radiating microvillae (Laval 1971).

During the course of the National Institute for Water Research’s studies on Hartbeespoort Dam we noticed the development of a choanoflagellate population epiphytic on colonies of the cyanobacterium Microcystis aeruginosa. We believe this to be the first record of the choanoflagellate Salpingoeca sp. in South Africa and since there are only limited references and no illustrations of Salpingoeca epiphytic on Microcystis we supply photographic illustrations of the association between the two organisms.

Methods

Water samples, with and without preservative [a mixture of water, ethyl alcohol and formalin in a ratio of 6:3:1 (Standard Methods 1985)], were examined by phase contrast microscopy with a Zeiss Research Microscope and photographed with an Olympus automatic photomicrograph camera model PM-10AD. Samples were also stained with the fluorochrome 4',6-diamidino-2-phenylindole (DAPI), which is DNA-specific, and examined by epifluorescence microscopy as described by Robarts & Sephton (1981).

Results

In July 1986 a 5-l surface water sample from Hartbeespoort Dam was kept in the laboratory with gentle stirring over the weekend. On Monday numerous specimens of the flagellates were observed on the Microcystis colonies (Figures 1 – 3). The flagellates were not noticeable in the sample at the time of collection.

We compared our species with illustrations and/or descriptions in the literature of more than 50 other species of Salpingoeca but could not identify our specimens as belonging to species already described. It resembles S. ampulloides Bicudo & Bicudo (1983; 1984a, b) but the neck of the vase-like lorica (or theca) in our specimens are shorter. The neck is approximately half the total length of the lorica in our specimens compared with the two-thirds length for S. ampulloides by Bicudo & Bicudo (1983). Like S. ampulloides, our specimens possess a round base with no pedicle with the cell completely filling the lorica up to the neck (Figure 3). The flagella in our specimens also appear shorter than those illustrated for S. ampulloides (Bicudo & Bicudo 1983). The diameter of the lorica is 6 to 6.5 µm at the base and it is 10 µm long. The length of the cell including the collar is 16 µm excluding the flagellum.

The collar and flagellum disappeared after fixation with either the alcohol:formalin fixative used for preservation or the formalin-only fixative used to preserve samples for DAPI staining. DAPI staining clearly demonstrated the presence of the organism as well as the DNA of ingested bacteria (Figure 4).

Discussion

Although several authors reported the presence of various Salpingoeca species on phytoplankton and water plants in general, we could find only two authors specifically mentioning the presence of Salpingoeca on Microcystis colonies (Skuja 1956; Tauscher 1980). The report from Sweden by Skuja (1956) mentioned S. vaginicola Stein, S. gracilis Clark fa. and S. uruma Skuja on various species of Microcystis while Tauscher (1980) found S. frequentissima (Zach.) Lemm. on the sheaths of M. aeruginosa and M. viridis (A. Br.) Lemm. in East Germany. Three of these four species are stalked and only S. vaginicola is sessile like the Salpingoeca sp. from...
Hartbeespoort Dam. *Salpingoeca marssonii* Lemm. (not stalked), *S. frequentissima* and *S. elegans* (Bachmann) Lemm. have been observed on the related cyanobacterial genus *Coelosphaerium* by earlier authors (see Huber-Pestalozzi 1941). All of the above species are quite different from the *Salpingoeca* found in Hartbeespoort Dam. A similar species of choanoflagellate to that found in Hartbeespoort Dam is *S. ampulloides* from Brazil which was found on the leaves of *Salvinia herzogii* De la Sota (Bicudo & Bicudo 1983).


