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SHORT PAPER

First Record of the Order Choanoflagellida in Turkey

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Abstract

We report the first record of the order Choanoflagellida in the waters of Turkey. The choanoflagellate *Salpingoeca amphoridium* James-Clark was found in plankton net samples in November and December 2008, and January 2009 from the Batman Dam Lake, the Batman Stream and Hasankeyf sampling site of the Tigris River. *Salpingoeca amphoridium* was found attached to planktonic diatom *Aulacoseria granulata* (Ehrenberg) Simonsen.

Keywords: Choanoflagellida, *Salpingoeca amphoridium*, new records, Turkey

Türkiye'deki Choanoflagellida Ordosunun İlk Kaydı

Özet

Biz, Türkiye sularında Choanoflagellida ordosunun ilk kaydını rapor ediyoruz. Koanoflagellat Salpingoeca amphoridium Clark, Kasım ve Aralık 2008 ile Ocak 2009 tarihlerinde Batman Baraj Gölü ile Dicle Nehri'nin Batman Çayı ve Hasankeyf örnekleme sitelerinden alınan plankton örneklerinde bulundu. Salpingoeca amphoridium planktonik diatom Aulacoseria granulata (Ehrenberg) üzerine bağlı olarak bulunmuştur.

Anahtar Kelimeler: Choanoflagellida, Salpingoeca amphoridium, yeni kayıtlar, Türkiye.

Introduction

Choanoflagellates are one of the most important and ubiquitous groups of heterotrophic nanoflagellates in aquatic ecosystems (Leadbeater, 2008). Choanoflagellates have a distinctive cell morphology characterized by an ovoid or spherical cell body 3–10 µm in diameter with a single apical flagellum surrounded by a collar of 30–40 microvilli (Figure 1) (Fairclough and King, 2006). The function of the flagellum is to create a current of water from which potential food particles, mostly bacteria, become entrapped on the outer surface of the collar (Pettitt *et al*., 2002; Fairclough and King, 2006).

Choanoflagellates are either free-swimming in the water column or sessile, adhering to the substrate directly or through either the periplast or a thin pedicel (Leadbeater, 1983). They are found globally in marine, brackish and freshwater environments from the Arctic to the tropics, occupying both pelagic and benthic zones (Fairclough and King, 2006). Although most sampling of choanoflagellates has occurred between 0 m and 25 m, they have been recovered from as deep as 300 m in open water (Thomsen, 1982) and 100 m under Antarctic ice sheets (Buck and Garrison, 1988).

Although many species of choanoflagellates are hypothesized to be cosmopolitan on a global scale (Fairclough and King, 2006), choanoflagellate species have not yet been recorded in Turkish waters. In this paper, we report the first record of the order Choanoflagellida in Turkey. The choanoflagellate *Salpingoeca amphoridium* was found in plankton net samples taken in the Batman Dam Lake, the Batman Stream and the Tigris River in Southeastern Anatolia Region of Turkey.

Materials and Methods

The Tigris River originates in the Toros mountains of the Eastern Anatolia of Turkey, and follows a southeastern route in Turkey to Cizre, where it forms the border between Turkey and Syria for 32 km before entering Iraq (Guo, 2006). The river is

approximately 1900 km long and most of it (77%) is in Iraq followed by Turkey (22%) and Syria (1%) (Kibaroğlu, 2002). Currently, there are two major dams under operation on the Tigris River in Turkey: Kralkızı and Dicle (Figure 2). The Batman Stream is one of the important tributaries of the Tigris River. The stream is fed by water released from Batman Dam Lake. The Batman Dam Lake is fed by Kulp, Sorkan and Sason streams. It has a surface area of 49 km^2 and a volume of 1 175 hm^3. The elevation of the lake is 652 m a.s.l. It is used for hydro-electric energy production and irrigation.

Material for this study came from one research project. It was a survey of the plankton and water quality of dam lakes and rivers in the Tigris River Basin of Turkey. Plankton samples were collected using a plankton net at monthly intervals from 17 sampling sites between February 2008 and January 2009. All samples were fixed in 4% formalin. The samples were examined by using an Olympus BX51 microscope equipped with an Olympus DP71 digital camera. Identification was carried out according to Pascher and Lemmermann (1913).

Results and Discussion

Members of the order Choanoflagellida are divided into three families based upon the composition and structure of their periplast: Codonosigidae, Salpingoecidae and Acanthoecidae. The family Salpingoecidae consists of species whose cells are encased in a firm theca that is visible under both light and electron microscope. The theca is a secreted covering predominately comprised of cellulose or other polysaccharides (Adl *et al*., 2005; Carr *et al*., 2008; Leadbeater, 2008).

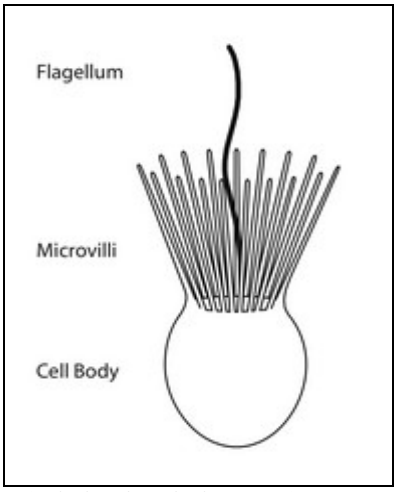

Figure 1. Choanoflagellate cell morphology (Fairclough and King, 2006).

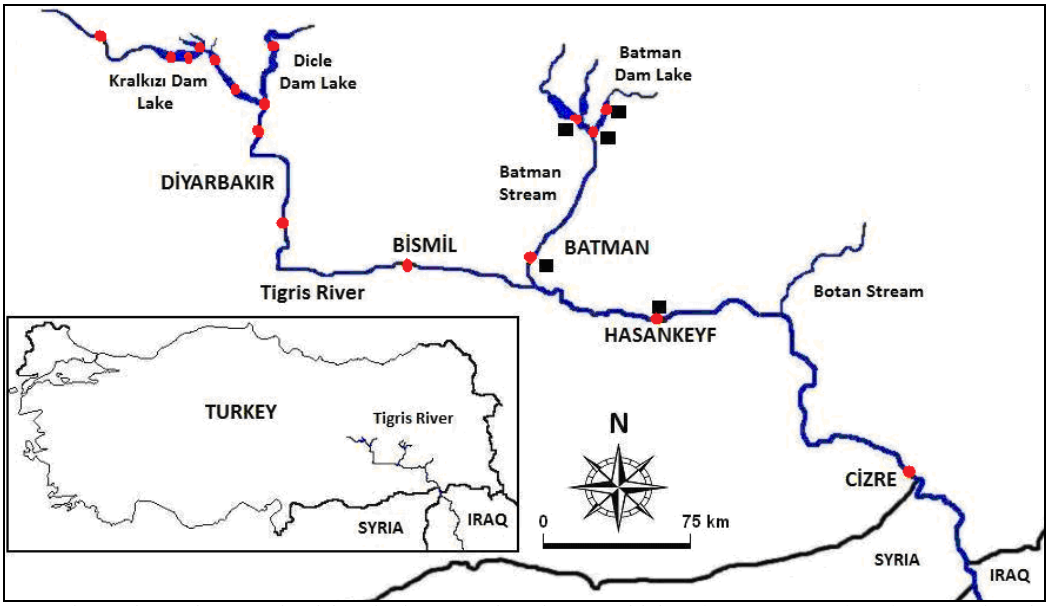

Figure 2. Locations of samples examined for plankton (●); locations at which *Salpingoeca amphoridium* was found (■)

The taxonomy of this species is as follow:
Phylum: Sarcomastigophora
Class: Zoomastigophorea
Order: Choanoflagellida
Family: Salpingoecidae Kent 1880
Genus: *Salpingoeca* James-Clark, 1867
Species: *Salpingoeca amphoridium* James-Clark, 1867
Syn: *Salpingoeca ampullacea* Stein, 1878 (Synonym)
Salpingoeca ampulloides Bicudo & Bicudo, 1983

S. amphoridium was recorded only in the Batman Dam Lake, the Batman Stream and Hasankeyf sampling site of the Tigris River (Table 1). It was found attached to the planktonic diatom *Aulacoseria granulata*. *S. amphoridium* was recorded only in November and December 2008, and January 2009, all of when there was a high abundance of *Aulacoseria granulata*. Simek *et al*. (2004) reported *S. amphoridium* found attached to the colonial diatoms *Asterionella formosa* Hassall and *Fragilaria crotonensis* Kitton in the Rimov reservoir (South Bohemia).

S. amphoridium cells on *Aulacoseria granulata* are flask-shaped, sessile with no visible peduncle. The theca has a neck, which is everted at the anterior end. The protoplast bears a well-developed collar of tentacles and a long single flagellum (Figure 3).

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Table 1. Occurrences of *Salpingoeca amphoridium* in samples from Tigris River Basin, Turkey

Location and Date	Coordinates	Altitude (m)
Batman Dam Lake, B-1 9 Nov 2008, 14 Dec 2008, 11 Jan 2009	38º 11' N - 41º 09' E	652
Batman Dam Lake, B-2 9 Nov 2008, 14 Dec 2008, 11 Jan 2009	38º 11' N - 41º 13' E	652
Batman Dam Lake, B-3 9 Nov 2008, 14 Dec 2008, 11 Jan 2009	38º 09' N - 41º 12' E	652
Batman Stream, Batman 9 Nov 2008, 14 Dec 2008, 11 Jan 2009	37º 54 N - 41º 05' E	540
Tigris River, Hasankeyf 9 Nov 2008, 14 Dec 2008, 11 Jan 2009	37º 42' N - 41º 24' E	471

Figure 3. *Salpingoeca amphoridium* attached to planktonic diatom *Aulacoseria granulata* collected from the Tigris River Basin (Scale 10 µm).

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