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SHORT COMMUNICATION KISA MAKALE

New record for the algal flora of Türkiye: *Antithamnionella spirographidis* (Schiffner) E.M.Wollaston, 1968 (Ceramiales, Ceramiaceae)

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Abstract: In this study, the new record of the non-indigenous Rhodophyta *Antithamnionella spirographidis* (Schiffner) Wollaston (1968) has been reported from the Marmara Sea that the connection area between the Mediterranean Sea and the Black Sea. The species, originally described from Trieste (Northern Adriatic Sea), is currently known throughout the Central and Western Mediterranean Sea. Our finding is the easternmost record of this tiny filamentous alga in the Mediterranean Sea.

Keywords: *Antithamnionella spirographidis,* Rhodophyta, Ceramiales, Marmara Sea, Algae

INTRODUCTION

Antithamnionella spirographidis (Schiffner) E.M. Wollaston has reported firstly by Schiffer as *Antithamnion spriographidis* in 1916 based on a specimen that he collected in 1914 the harbour at Trieste (Italy). Wollaston has located the species under the genus *Antithamnionella* (Wollaston, 1968). The species is known for with rapid reproduction and high colonization capacity. Species spreads by fragmentation and the rapid production of new thalli, whereas it is ephemeral. *Anthithamnionella spirographidis* is a fouling organism; however, considering its small size and life circle, the effect is dispensable.

The Sea of Marmara is a semi-enclosed sea connected through the Strait of Istanbul (also known as Bosporus Strait) to the Black Sea and through the Strait of Çanakkale (also known as Dardanelles Strait) to the Aegean Sea. It has a limited size of approximately 250 × 70 km, and the deepest point reaches 1,370m. The Sea of Marmara is characterized by high current movements that originate from hydrostatic pressure differences created by the different water masses of the adjacent seas and explained the existence of a counter-current of Mediterranean water below the surface flow of Black Sea water (Beşiktepe et al., 1994; Guiry, 1996; Sannino et al., 2017). The persistence of these two-layer structures occurs due to salinity differences. Low salinity Black Sea waters (~18‰) flow into the Marmara Sea through the Bosporus Strait and denser, salty Aegean waters (~38.5‰) water flows into the Sea of Marmara through the Dardanelle Strait. A sharp pycnocline separates the two different water bodies at a depth of approximately 25 m (Beşiktepe et al., 1994). Thus, even though the maritime traffic is high, reported alien species are lower respect to Aegean and Levantine, and they are mainly composed of Algal species (Çınar et al., 2005). The aim of this study is to examine algal samples collected during "Diversity and Community Structure of Benthic Invertebrate in the Sea of Marmara and Bosporus Survey" and contribute algal biodiversity information of Turkish waters.

MATERIALS AND METHODS

The identified specimens have found in the Sea of Marmara during "The Diversity and Community Structure of Benthic Invertebrate in the Sea of Marmara and Bosporus Survey" in 2013. The sampling point where the species is found is shown in Figure 1.

Figure 1. Working area; sampling point referred to as red dot represents between 10-20 meter depth range

Materials were collected once between June 6th, 2013 and June 26th, 2014, with three replicates per station at depths of 10, 25, and 50 meters, as part of the Benthic Invertebrate Diversity and Community Structure in the Sea of Marmara and Straits Project 2013-2015. The sampling has done with a box corer. Taken specimens were fixed in 4% formaldehyde water-solution and afterward they examined under Olympus BX53 optical microscope of the Department of Biology, Dokuz Eylül

University. For identification of the species, the studies of Athanasiadis (1996) and Schiffner (1916) works were used.

RESULTS

Growth of indeterminate axis sinusoidal, by slightly oblique division of apical cells successively to one side and then the other, shifting orientation at sites of future indeterminate branches; branching of determinate branches variable; gland cells cut off laterally, covering length of the bearing cell, or proximal to a lateral filament; nuclei and plastids as in Antithamnion (Nägeli, 1847).

Antithamnionella spirograpgidis is a small, delicate, dark red species of alga that can form carpets or fringes of up to 4 cm in height. The thallus is composed of a single row of cells without cortex and has creeping, prostrate axes bearing flexuous, unattached branches which can reach up to 1 cm in length. On the upper part of the algal body, there are side branches opposite to the branchlets, and 3-5 branches on the side branches produce branchlets that are biased to one side.

The opposite branchlets of the lower part of the main axis and side branches are often bent towards the axial plane. On erect branches these may be either opposite or unilateral on the axis. Rhizoids near the base of the algae often grow on the lowest cells of the branchlets. 2-3 whorl branches are found per whorl, and whorl-branchlets are initiated laterally from axial cells several below the apex of branches. In the upper parts of the thallus, 2nd and/or 3rd cells of whorl-branchlets have pitted gland cells, 10-1211 µm in diameter, which partially curve around the parent cell, cut off from their upper side. Details is shown in Figure 2, 3, 4. Basionym type locality, homotypic and heterotypic localities of species have been given as Guiry (2018).

The species has observed in northeast part of the Sea of Marmara with the coordinates 40°57'13"N 28°51'25"E, in 10-meter depth. 22 °C degree water temperature was recorded for the sampling point. 16‰ salinity, total organic carbon 0.06%, 0.10-12.53 µM ammonium nitrogen values were registered up to 10-meter depth.

Figure 2. General view of *Antithamnionella spirographidis*

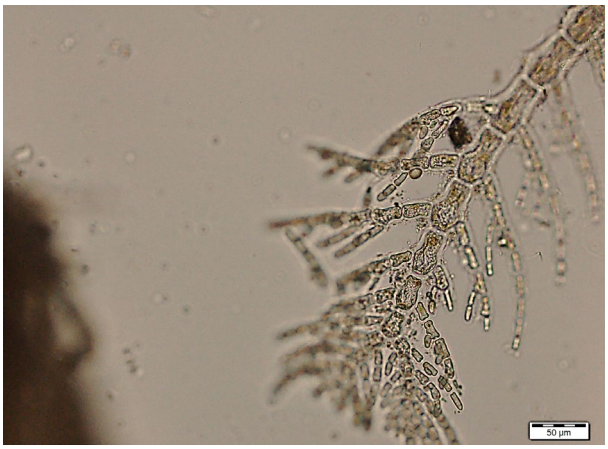

Figure 3. Apical branches of *Antithamnionella spirographidis*

Figure 4. Gland cells of *Antithamnionella spirographidis*

DISCUSSION

The distribution of the *A. spirographidis* is worldwide and it has predicted that naval ropes and worldwide oyster tread caused to the spread of the species (Haydar and Wolff, 2011; Maggs and Stegenga, 1998). This species even though widely seen in Mediterranean waters, reports indicate that it mostly seen in the western and central Mediterranean region (Furnari, 1999; Gallardo et al., 2016; Gómez Garreta et al., 2001), the easternmost place has been reported in Greece (Wollaston, 1968). Bathymetrically it is found in the low intertidal region. *A. spirographidis* is naturally attached on rocks or are epiphytic on various organic bases such as algae, molluscs and polychaetes tubes and also found on artificial substrata such as ropes and marina pontoon bridges. In our research the benthic habitat characterized by sandy and Rhodolith based bottom. Other filamentous algae such as *Polysiphonia* spp, *Ceramium* spp. were observed attached on Rhodoliths. The species was observed on the *Ceramium* spp. and *Laurencia* spp. without showing mass coverage.

As the closest point to the Sea of Marmara, the reference station was found in the Greece, where dominant species *are Cystoseira corniculata* (Turner) Zanardini, 1841, *Cystoseira schiffneri f. latiramosa* (Ercegovic) Giaccone, 1992 and

Hydrolithon farinosum (Lamouroux) Penrose and Chamberlain (1993) sampling depth reported as 0.2- 0.5 m from Malian Gulf where the gulf contact with Aegean Sea (salinity between 34.7 and 38.7‰, during year 50.000 t/year for nitrate and 30.000 t/year for phosphate) (Bacoyannis Chryssovergis, 1995). Temperature tolerance of this species are unknown but the records from the North Sea show it could resist also low temperature as well as Mediterranean temperate waters (Guiry, 1996; Stegenga et al., 1997).

Our samples were taken in June and there were no tetrasporongial individual. Spermatangia, procarps and cytocarps reported in July and December, tetrasporangia in June-July, September December and March in the works of Maggs and Hommersand (1993) while the culture plant gave rise to 1:1 ratio of female and male gametophytes, the carpospores grew into tetrasporephytes; females later also spermatagania or tetrasporocytes (Drew, 1955; L'Hardy-Halos, 1986). In another work of Maggs and Stegenga (1998) plants occur year-round but are most abundant during the second half of the year. Tetrasporangia is formed throughout the year, and gametangia in May to November.

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AUTHORSHIP CONTRIBUTIONS

The author confirm contribution to the paper as follows: study conception and design: Senem Onen Tarantini; investigation, validation, writing- reviewing & editing. All author(s) reviewed the results and approved the final version of the manuscript.

CONFLICT OF INTEREST STATEMENT

The author declare that there are no conflicts of interest or competing interests.

ETHICS APPROVAL

No specific ethical approval was necessary for this study.

DATA AVAILABILITY

All relevant data is in the article.

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