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TASKIN E.

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First report of the North Atlantic myrionematoid brown alga
Ulonema rhizophorum Foslie (Phaeophyceae, Chordariaceae) in the Mediterranean Sea

E. TAŞKIN

Department of Biology, Faculty of Arts and Sciences, Celal Bayar University, Muradiye-Manisa 45140, Turkey
Corresponding author: ergun.taskin@cbu.edu.tr

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Abstract

The myrionematoid brown alga Ulonema rhizophorum Foslie (Phaeophyceae, Chordariaceae) is reported for the first time from the Mediterranean Sea. This species was collected growing as an epiphyte on Ulva sp. from the Dardanelles (Sea of Marmara, Turkey) in the midlittoral zone. Ulonema rhizophorum is characterized by downwardly produced rhizoids from the basal system. A key to the Mediterranean related genera of Ulonema is provided.

Keywords: Brown algae, Mediterranean Sea, seaweeds, Turkey, Ulonema rhizophorum.

Introduction

The monospecific genus Ulonema was established by Foslie (1894: 131), with the species Ulonema rhizophorum Foslie from Norway. Foslie (1894) reported that this species was growing on the red algal host Dumontia filiformis (Hornemann) Greville [=Dumontia contorta (S.G. Gmelin) Ruprecht]. Ulonema closely resembles another myrionematoid genus, namely Myrionema Greville, but it differs from that in having rhizoids arising from the basal system (Fletcher, 1987; Taşkın et al., 2006). U. rhizophorum has been recorded from the north-eastern Atlantic Ocean [Ireland and Great Britain (Fletcher, 1987), the Faroes (Nielsen & Gunnarsson, 2001), France (Dizerbo & Herpe, 2007), The Netherlands (Stegenga & Mol, 1983), Norway (Jaasund, 1951, 1965), Sweden (Kylin, 1947)], Germany [Schories et al., 1997; as Ulonema rhizophorum (Foslie) Sauvageau] and the north-western Atlantic Ocean (Mathieson & Hehre, 1986).

Six species encompassing four genera of the myrionematoids have previously been recorded to occur in Turkey (Taşkın et al., 2008): Microspongium globosum Reinke, Myrionema furcatum Jaasund, M. orbiculare J. Agardh, M. strangulans Greville, Protectocarpus speciosus (Bergesen) Kornmann and Compsonema saxicola (Kuckuck) Kuckuck. This paper reports the first record of a seventh species, namely, Ulonema rhizophorum, in Turkey. U. rhizophorum was probably introduced into the Sea of Marmara (Turkey) by aquaculture or ballast water. The Dardanelles is a very important strait in the Mediterranean Sea; a transition zone for ships travelling to the Black Sea. Recently, 33 taxa - at specific and infra-specific level - of alien marine macrophytes were reported to occur on the coasts of Turkey (Taşkın et al., 2011a; Taşkın, 2012). However, the species could be native and have been overlooked in previous studies because of its close resemblance with Myrionema strangulans.

Materials and Methods

Ulonema rhizophorum was collected in the midlittoral zone, as an epiphyte on the green alga Ulva sp. from the Dardanelles (40°01'03″N; 26°19'17″E), Sea of Marmara, Turkey, and was preserved in 4% formalin in seawater. The identification was made on the basis of Foslie’s (1894) and Fletcher’s (1987) accounts. The material was studied using light microscopy (Nikon SE), and photographs were taken using a Nikon P5100. Magellan SporTrak Color. A GPS device was used to measure the co-ordinates of the collection site. Voucher material was deposited at the Department of Biology of Celal Bayar University, Manisa, Turkey.

Results

Ulonema rhizophorum Foslie 1894: 132, pl. III, figs 11-17.
Type locality: Lyngöy, Tromsö, Norway (Foslie, 1894).

Thalli were epiphytic on the green alga Ulva sp., forming light brown circular spots up to 1mm in diameter (Fig. 1). In a squash preparation, the thallus consists of a monostromatic basal layer of cells, with basal...
cells measuring 10-20μm long and 7-8μm wide; erect filaments simple or rarely branched, uniseriate, 60-80μm long (Figs 2 & 3); cells of the erect filaments 15-20μm long, 5-6μm wide, each one contains one or two plate-like chloroplasts; downwardly produced rhizoids from the basal system present, single or multicellular (Fig. 2); phaeophycean hairs present, arising from the basal layer; unicellular sporangia common, spherical to pyriform, measuring 20-25 x 35-45μm, borne directly from the basal cells, sessile or on one-celled stalks at the base of the paraphyses (Figs 2 & 3); plurilocular sporangia were not observed in our plants.

This species was collected from the Dardanelles (40º01′03″N; 26º19′17″E), Sea of Marmara, Turkey in March 2012; water temperature was 13°C and salinity of 25‰. The collection site is characterized partially by both sandy and stony bottoms. Other algal species that were present at the collection site were: Ceramium ciliatum (J. Ellis) Ducluzeau, Cladophora spp., Codium fragile (Suringar) Hariot subsp. fragile, Colpomenia sinuosa (Mertens ex Roth) Derbès & Solier, Corallina elongata J. Ellis & Solander, Dictyota dichotoma (Hudson) J.V. Lamouroux, Ectocarpus siliculosus (Dillwyn) Lyngbye, Feldmannia irregularis (Kützing) G. Hamel, Giraudia sphaelarioides Derbès & Solier, Gracilaria gracilis (Stackhouse) Steentoft, Irvine & Farnham, Halopteris scoparia (L.) Sauvageau, Halothrix lumbricalis (Kützing) Reinke, Laurencia obtusa (Hudson) J.V. Lamouroux, Myrionema strangulans Greville, Padina pavonica (L.) Thivy, Punctaria latifolia Greville, Scytosiphon lomentaria (Lyngbye) Link, Striaria attenuata (Greville) Greville, and Ulva spp., as well as the seagrasses Posidonia oceanica (L.) Delile and Zostera sp.

Discussion

Turkish plants identified here as Ulonema rhizophorum strongly resemble the figures of the species provided by Foslie (1894, Figs 11-17). Plurilocular sporangia were not observed by Foslie (1894), but later Sauvageau (1897), Hamel (1935) and Fletcher (1987) showed that plurilocular sporangia are present in this species. However, they were absent in our specimens.

Ulonema rhizophorum has been assigned to the Myriophyllumataceae (Sauvageau, 1897; Hamel, 1935; Fletcher, 1987). Recently, this species was assigned to the Chordariaeaceae with other myriophyllumoids (Myriophyllum Greville, Microspongium Reinke) (Guiry & Guiry, 2012).

The genus Ulonema shows similarities to the other myriophyllumoid genera Myriophyllum and Microspongium, but differs from those in having irregularly spreading basal filaments and downwardly produced branched rhizoidal filaments from the basal system (Foslie, 1894; Sauvageau, 1897; Fletcher, 1987; Taşkın et al., 2006). More
specifically, *U. rhizophorum* is similar to *Myrionema strangulans* (Fig. 4) as regards the monostromatic basal layer and shape of unilocular sporangia, but it differs from that species by its downwardly produced rhizoidal filaments from the basal cells, the rarely branched erect filaments (erect filaments are simple in *M. strangulans*) and by the uniseriate plurilocular sporangia (occasionally biseriate in *M. strangulans*).

Some authors have further discussed the possible conspecificity between *Ulonema rhizophorum* and *Myrionema strangulans* (Fletcher, 1987). There is a need for further experimental and culture studies to test this possibility. Loiseaux (1972) showed that both microscopic discoid thalli and macroscopic filamentous thalli occur in the life history of *M. strangulans*. Pedersen (1984) included *Myronema*-like microthalli in the life history of Giriadaceae and Chordariaceae. Recently, *Myrionema*-like microthalli of *Cladosiphon* were observed in nature from Turkey by Taşkin et al. (2011b).

Jaasund (1951) recognized *Ulonema rhizophorum* from Norway, and he claimed that “it appears desirable to keep it as separate species until it has been cultured”. Jaasund (1951) described two new species, *Myrionema irregulare* Jaasund, which grew on the surface of *Scytosiphon lomentaria* (Lyngbye) Link, and *Myrionema furcatum* Jaasund, which grew on the surface of *Dumontia incrassata* (O.F. Müller) J.V. Lamouroux [= *Dumontia contorta* (S.G. Gmelin) Ruprecht]. *M. irregulare* was considered as a stage of *Myriotrichia filiformis* Harvey (= *Myriotrichia clavaeformis* Harvey) by Athanasiadis (1996). *Myrionema furcatum* differs from *Ulonema rhizophorum* in plurilocular sporangia (on the upper part of the erect filaments, biseriate or uniseriate and furcate in *M. furcatum* (Jaasund, 1951), sessile or shortly stalked on basal layer, uniseriate and simple in *U. rhizophorum* (Fletcher, 1987)), by habit (*M. furcatum* exhibits a papillous under-side of *Dumontia*, while *U. rhizophorum* develops real rhizoids), and by the cell size of the erect filaments [8-12 µm wide in *M. furcatum* (Jaasund, 1951), 6-9 µm wide in *U. rhizophorum* (Foslie, 1894)]. Jaasund (1951) reported that the shape of the plurilocular sporangia of *M. furcatum* is similar to that of *Streblonema fasiculatum* Thuret. The plurilocular sporangia were abundant and the unilocular sporangia were very rare in *M. furcatum*, while unilocular sporangia were abundant in *U. rhizophorum* (Jaasund, 1965). Taşkin et al. (2008) reported that *M. furcatum* should be confirmed in Turkey and the Mediterranean Sea.

Molecular analysis and culture studies comparing the Mediterranean material of *Ulonema* and the Atlantic species should be carried out for progress. *Ulonema rhizophorum* and *Myrionema strangulans* also need experimental and culture studies to investigate the microthalli of *Cladosiphon*.

**Fig. 4: Myrionema strangulans**, monostromatic basal layer, simple filaments and unilocular sporangia.

**Key to the Mediterranean Myrionematoids related with *Ulonema*:**

1. Basal layer monostromatic or distromatic ……………
   ................................................................................. *ChilIonema*
   1. Basal layer monostromatic ...................................... 2
   2. Presence of irregularly spreading basal filaments and
      downwardly produced branched rhizoidal filaments
      from the basal system ........................................ *Ulonema*
   2. Lack of irregularly spreading basal filaments and
      downwardly produced branched rhizoidal filaments
      from the basal system ........................................... 3
   3. The erect filaments simple or pseudodichotomously
      branched ............................................................ *Microspongium*
   3. The erect filaments simple or secundly branched ...... *Myrionema*

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