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New records for the benthic algal flora of the Northern Adriatic Sea

Abstract

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The habitat and morphology of four species of Florideophyceae collected in the Island of Cres (Kvarner Gulf, Northern Adriatic Sea) are described. *Gelidiella antipae* Celan, *Polysiphonia banyulensis* Coppejans and *Womersleyella setacea* (Hollenberg) R. E. Norris are new reports for the Adriatic Sea; *Chondria pygmaea* is recorded for the first time in the Northern Adriatic Sea. Biogeographical considerations are discussed for each species.

Introduction

The marine benthic algal flora of the Northern Adriatic Sea has received much attention in the last few years. Several sites, both on the western and eastern coasts, have been investigated in relation to the changes in the structure of the phytobenthic communities as a result of increasing coastal eutrophication (for references see Sfriso & Marcomini 1996, Munda 1996). Changes in the general vegetation pattern were usually accompanied by a floristic impoverishment; however, subsequent to the comprehensive species list published by Giaccone (1978), many previously unrecorded taxa have been found in the Northern Adriatic Sea and large, shallow areas have been colonized by newly introduced species (Gargiulo & al. 1992, Rismondo & al. 1993, Curiel & al. 1996a, 1996b).

During a floristic survey of the deep water algal flora along the eastern coast of the island of Cres, in the Kvarner Gulf, four Rhodophyceae not previously reported from the Northern Adriatic Sea were identified among epibionts growing on dead portions of gorgonians: *Chondria pygmaea* Garbary & Vandermeulen, *Gelidiella antipae* Celan, *Polysiphonia banyulensis* Coppejans and *Womersleyella setacea* (Hollenberg) R. E. Norris. Although the benthic marine algae of the Kvarner Gulf had been studied only sporadically (Munda 1960, Rizzi-Longo 1972), the presence of these taxa in this region, with the exception of *G. antipae*, is most likely the result of recent introduction. These new records confirm the hypothesis that the Kvarner Gulf has become, in the last decade, a preferred site in the Northern Adriatic Sea for the introduction of species of Indo-Pacific origin, some of which are invasive such as *Caulerpa taxifolia* (Vahl) C. Agardh (Meinesz & al. 1997).

Material and methods

Collections of specimens were made by SCUBA diving at two locations on the eastern coast of Cres: Merag, 30 Jul 1997 and Malibok cove, 2 Aug 1997 (Fig. 1).

The plants were collected at 20-25 meters depth as epiphytes on crustose or erect macroalgae growing on dead portions of *Eunicella cavolinii* (Koch). Fragments of the hosts bearing attached plants were detached and preserved in 5% buffered formalin/seawater.

Microscopic slides for observation were mounted and stained in a solution of 1% aniline blue/1N HCl/Liquid glucose (Karo syrup)/water (4:1:30:65). Photographs were taken through a Zeiss Axiophot microscope. Herbarium specimens and slide preparations have been deposited in the Herbarium Universitatis Florentinae (FI).

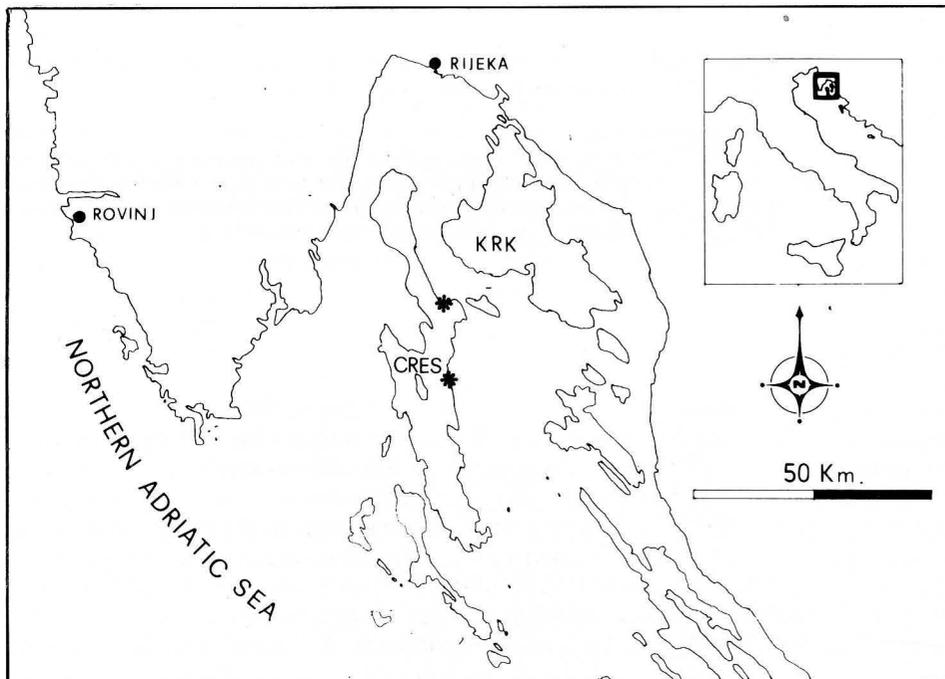


Fig. 1. Map of the Kvarner Gulf (Northern Adriatic Sea) showing the sampling stations.

Results and Discussion

Chondria pygmaea Garbary & Vandermeulen

Plants up to 13 mm in height, with one to three erect axes 290-450 μm in diameter, arising from a small discoid holdfast; terete axes unbranched or with a few lateral branches markedly tapered at the base; outer cortical cells brick-like, arranged in longitudinal rows, 20-30 μm in length and 8-13 μm wide near the apex, becoming elongate below and reaching 115 μm in length; spermatangial plates discoid, 390-610 μm in diameter, with a row of sterile marginal cells, angular in surface view, occasionally

cutting off small cells from their corners (Fig. 2); sessile, ovoid cystocarps about 500 µm wide; released pyriform carpospores 40-45 µm in diameter.

Male and cystocarpic thalli were of common occurrence on *Dictyota linearis* (C. Agardh) Greville and *Peyssonnelia* spp. covering branches of gorgonians devoid of ectodermal tissue at 24 m depth.

Chondria pygmaea was described as an epiphyte on the seagrass *Halophila* in the Red Sea (Garbary & Vandermeulen 1990), and later it was also found at the Seychelles (Wynne 1995). Its presence in Mediterranean waters represents a further illustration of the Lessepsian migration process. After the discovery of *C. pygmaea* on eastern coasts of Sicily (Cormaci & al. 1992), this species was reported from Albania (Kashta & Pizzuto 1996) and the Maltese Islands (Cormaci & al. 1997). Its occurrence in the Kvarner Gulf, the westernmost record in the Adriatic Sea, shows that this species is a successful migrant in terms of area extension. This record confirms that this minute *Chondria* is not strictly linked to seagrasses but grows within a wide ecological range.

Gelidiella antipae Celan

Terete, creeping axes 35-50 µm in diameter, attached by a discontinuous fringe of simple rhizoids; unbranched, erect branches 30-45 µm in diameter, up to 3 mm high, tapering to a conspicuous apical cell; in surface view outermost cortical cells 6-10 µm wide and transversely slightly elongate in the creeping axes, isodiametric or twice as long as wide and longitudinally arranged in the younger parts of the erect axes.

Terminal tetrasporangial stichidia cylindrical, about 70 µm in diameter, up to 250 µm long; tetrasporangia in tetrastichous arrangement, 25-35 µm in diameter and irregularly decussately divided.

Only a few isolated plants were collected growing on crustose fleshy species, mainly *Peyssonnelia* spp.; the epibiotic community includes erect or procumbent associated algae such as: *Pseudochlorodesmis furcellata* (Zanardini) Børgensen, *Dipterosiphonia rigens* (Schousboe ex C. Agardh) Falkenberg, *Drachiella minuta* (Kylin) Maggs & Hommersand, *Eupogodon planus* (C. Agardh) Kützing and *Polysiphonia scopulorum* Harvey.

Gelidiella antipae was described by Celan (1938) from specimens collected in the Black Sea. Since then, it has been frequently recorded in the Western Mediterranean Sea (Boudouresque 1972, Giaccone & al. 1985, Ballesteros & al. 1986, Boisset 1986, Verlaque 1990) and in the Eastern Basin (Cirik 1978, Athanasiadis 1985). *G. antipae* has never been reported for the Adriatic Sea where it may well be widely distributed but overlooked, even if the peculiar tetrasporangial stichidia enable this species to be easily recognized (G. Furnari and M. Cormaci communicated verbally that *G. antipae* was found also in the Tremiti Islands, Adriatic Sea). Outside the Mediterranean *G. antipae* is known from Pacific Mexico (Dawson 1953 sub *G. stichidiospora*), South Africa (Norris 1992) and Southern Australia (Womersley 1994).

A small, related species, *Gelidiella adnata* Dawson, is regarded by Norris (l.c.) as a synonym of *G. antipae* thus extending its distribution in tropical and subtropical Indo-Pacific areas to Mexico (Silva & al. 1996). Critical ecological studies on the morphological variability of these minute species are scanty, however in our material

tetrasporangia sometimes are born in short, swollen stichidia (Fig. 3), similar to those illustrated by Dawson (1954).

Polysiphonia banyulensis Coppejans

Isolated plants mostly 1-3 cm high, with a limited basal attachment by a number of unicellular and digitate rhizoids cut off from the distal end of the lower pericentral cells; ecorticate, erect axes pseudodichotomously branched and distinctly tapering towards the apices; main axis 250-400 μm in diameter with articles wider than high, decreasing gradually to about 25 μm in diameter near the apices with articles 4-5 times long than wide; lateral branches arising in the axils of trichoblasts characterized by a very large suprabasal cell up to 400 μm long and 25-40 μm wide; cystocarps short-stalked, ovoid or globular, 220-250 μm in diameter; spermatangial branches developing from a primary fork of a trichoblast, subcylindrical, sometimes slightly bent and lacking sterile tip cells, 160-200 μm long and 40-45 μm in diameter (Fig. 4); tetrasporangia about 80 μm in diameter, forming short, linear series in upper, slightly swollen branchlets.

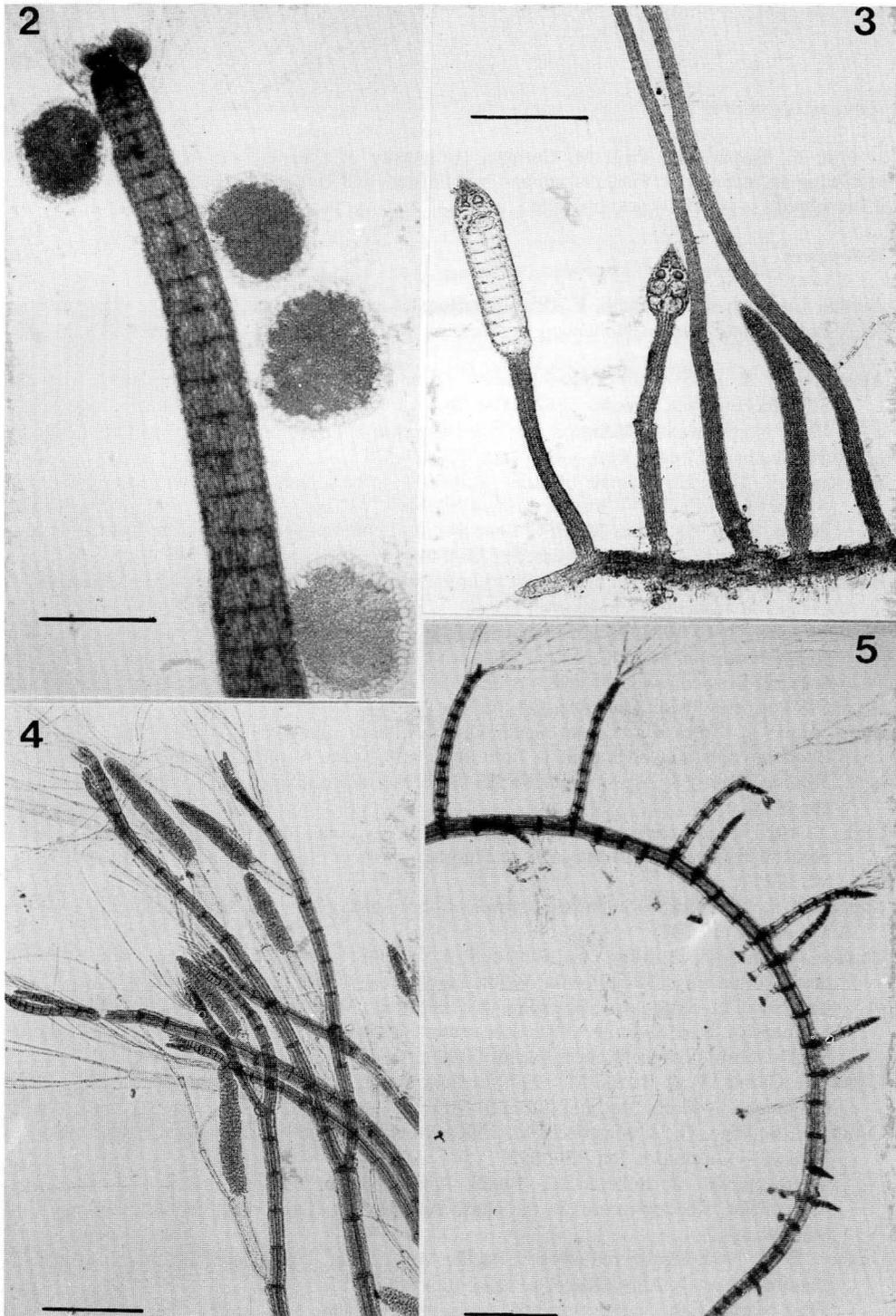
Scattered, fertile thalli were collected as epiphytes on brown and red algae such as: *Halopteris filicina* (Grateloup) Kützinger, *Dictyota linearis* (C. Agardh) Greville and *Crouania attenuata* (C. Agardh) J. Agardh.

Since its description from the French coast (Coppejans 1975), this distinctive species has been frequently recorded in the North-Western Mediterranean (Gallardo & al. 1985, Boudouresque & Perret-Boudouresque 1987, Ballesteros 1992, Cossu & al. 1993, Pardi & al. 1993) and, more recently, from the Maltese Islands (Cormaci & al. 1996). This first record from the Adriatic Sea extends the distribution area of *P. banyulensis*, which is now known from widely separated geographical areas.

Womersleyella setacea (Hollenberg) R. E. Norris

Plants forming entangled mats with extensive creeping system giving rise to erect filaments; ecorticate, prostrate filaments 80-105 μm in diameter, attached by short rhizoids, 20-35 μm wide, cut off from the distal end or, occasionally, from the middle of pericentral cells and developing multicellular tips; erect filaments mostly unbranched, composed of articles 70-80 μm in diameter and 0.7-2 diameters long, with slightly oblique pericentral cells; sporadic trichoblasts relatively coarse, with 3-4(5) dichotomies, mostly reduced and quickly deciduous (Fig. 5).

Athanasiadis (1997) summarized the recent distributional reports of this new member of the Mediterranean algal flora which was first noted in 1987 (Verlaque 1989). Considering the rapid spread of *W. setacea* in both the western and eastern Mediterranean, its occurrence in the Kvarner Gulf is not surprising. This species has been recently found at the Tremiti Islands, Adriatic Sea, by G. Furnari and M. Cormaci (pers. com.). As it is the case for all collections of this species in the Mediterranean localities, our specimens are vegetative. Only a few scattered plants have been found during the floristic survey, however, the massive propagation of this fast growing species may also affect, in the next years, the sublittoral communities of the Northern Adriatic Sea as it happened in the Western Mediterranean Sea (Airoldi & al. 1994, Di Martino & Giaccone 1996).



Figs. 2-5. 2, *Chondria pygmaea*: spermatangial plates (bar = 500 μ m); 3, *Gelidiella antipae*: terminal tetrasporangial stichidia (bar = 200 μ m); 4, *Polysiphonia banyulensis*: spermatangial branches (bar = 200 μ m); 5, *Womersleyella setacea*: apical portion of the thallus (bar = 400 μ m).

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