

First report of a species of *Prasiola* (Chlorophyta: Prasiolaceae) from the Mediterranean Sea (Lagoon of Venice)*

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SUMMARY: A green alga belonging to the genus *Prasiola*, known from terrestrial, marine and freshwater habitats of polar and cold-temperate regions, is recorded for the first time in the Mediterranean Sea. In 2002, during a survey on soft substrata in the Lagoon of Venice (Italy), specimens referable to this genus were found in several areas. The morphological features of thalli are described and their occurrence in the Lagoon of Venice is discussed. Data on associated algal vegetation are also presented.

Keywords: green algae, Lagoon of Venice, Mediterranean Sea, *Prasiola*, phytobenthos

RESUMEN: PRIMERA CITA DE UNA ESPECIE DE *PRASIOLOA* (CHLOROPHYTA: PRASIOLOACEAE) PARA EL MAR MEDITERRÁNEO (LAGUNA DE VENECIA).— Un alga verde, perteneciente al género *Prasiola* conocida de hábitats terrestres, marinos y de agua dulce, se cita por vez primera en el mar Mediterráneo. En 2002, durante un monitoreo en sustratos blandos en la laguna de Venecia (Italia), fueron hallados en diversas áreas especímenes atribuibles a este género. Las características morfológicas de los talos son descritas y se discute su presencia en la laguna de Venecia. Se presentan datos sobre la vegetación algal asociada.

Palabras clave: algas verdes, laguna de Venecia, Mar Mediterráneo, *Prasiola*, fitobentos.

INTRODUCTION

The green alga *Prasiola* (C. Agardh) Meneghini is known from terrestrial, marine and freshwater habitats of Ireland and Britain, the Baltic sea, the Atlantic coasts, Australia, New Zealand, Antarctica and Japan (Womersley, 1984; Burrows, 1991; Rindi *et al.*, 1999; Kovácik, 2001). Species of *Prasiola* have also been reported for the Black and Azov Seas (Zinova, 1967). According to Athanasiadis (1987), the occurrence of the genus in the Aegean Sea is

doubtful (Gallardo *et al.*, 1993). In spring 2002, during studies of the benthic flora of the Lagoon of Venice (North Adriatic Sea, Italy), some small thalli attributable with certainty to the *Prasiola* genus were found.

STUDY AREA, MATERIAL AND METHODS

The macroalgae communities survey was carried out on 90 sites in a 31,000 ha study area, excluding canals, salt marshes and fish farms but comprising various environmental lagoon typologies like shal-

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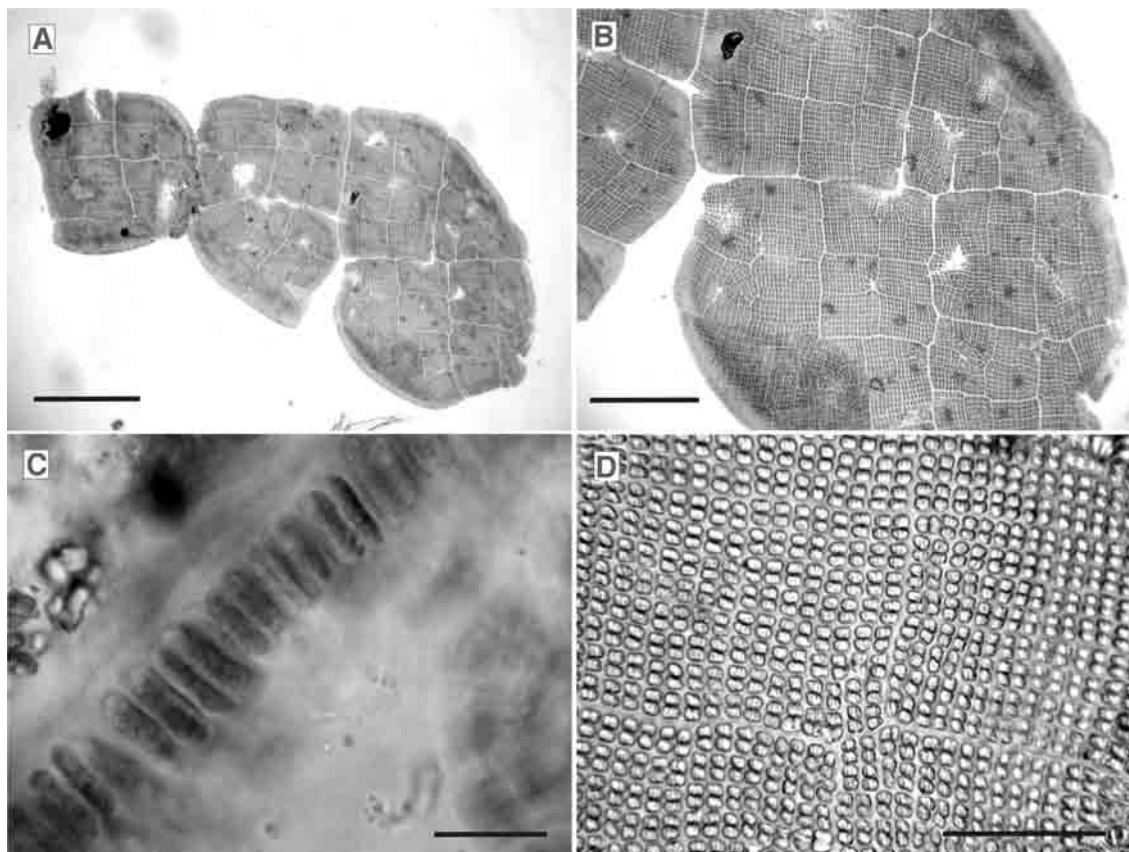


FIG. 1. – A, habit of thallus (scale bar = 500 μm); B, detail of a blade (scale bar = 200 μm); C, transverse section of a blade (scale bar = 20 μm); D, surface view of a blade (scale bar = 50 μm).

low waters, tidal flats and seabeds that were both colonised and not colonised by seagrass communities. Data collection was carried out in spring and autumn to detect seasonal variability, and 5 replicas of 1.5 m² each were collected for a total of 7.5 m² for each station.

Sampling was performed in the midlittoral zone using a bladed net (0.5 mm mesh) to penetrate the first few centimetres of sediment. Sampling sites inside seagrass beds were investigated by collecting 5 shoots for epiphyte analysis.

The collected material was preserved in seawater-formalin (4%) for later study in the laboratory. Permanent slides for microscopic observation were made by mounting the material in a 50% glycerol-seawater mixture. Voucher specimens were preserved in 4% formalin seawater and deposited in SELC laboratories.

DESCRIPTION

The thalli of *Prasiola* are up to 0.5 cm long and consist of bright to dark-green leafy monostromatic

blades with a irregularly rounded-ovate shape, sometimes divided and crisped. The blades, devoid of stipe (Fig. 1A, B), are attached to the substratum by means of a rim of the frond or free and are 17-20 μm thick (Fig. 1C). Thalli have a marginal and diffuse growth, with a smooth to irregular margin. In surface view the cells are square or rectangular, 4-5 (7) x 5-8 (9) μm , clustered in groups of 4 or multiple, arranged in regular longitudinal and transverse rows giving the thalli the characteristic grid-like appearance (Fig. 1D); the groups of cells are separated by thick walls of 3.5-5 μm .

The chloroplast is often in a central position, occupying a large area of the cell; it is somewhat lobate with a central pyrenoid.

ECOLOGY AND DISTRIBUTION

The thalli of *Prasiola* were collected in April and May 2002 on soft substrata in the southern basin of the Lagoon and in November 2002 on leaves of the seagrass *Nanozostera noltii* (Hornemann) Tomlinson *et* Posluzny in the northern basin of the

Lagoon. In the southern basin all the sites consist of muddy substrata and are located in supralittoral and midlittoral zones, where tide excursion is up to 1 metre, resulting in a continuous wash and dry environment. In the northern basin thalli of *Prasiola* occurred in midlittoral meadows of *N. noltii*, on muddy-sandy substrata that are continuously exposed, as reported for the southern basin sites.

In the southern basin the specimens of *Prasiola* were associated with the green algae *Ulva laetevirens* Areschoug, *Chaetomorpha linum* (O.F. Müller) Kützing and several species of the genus *Cladophora*, such as *Cladophora albida* (Nees) Kützing, *Cladophora dalmatica* Kützing, *Cladophora sericea* (Hudson) Kützing, *Cladophora vagabunda* (Linnaeus) C. Hoek and the red algae *Antithamnion cruciatum* (C. Agardh) Nägeli, *Chondria capillaris* (Hudson) M.J. Wynne, *Gracilariopsis longissima* (S.G. Gmelin) Steentoft *et al.* and *Polysiphonia elongata* (Hudson) Sprengel. In this area the substrata are mostly covered by filaments of *Vaucheria submarina* (Lyngbye) Berkeley (= *Vaucheria dichotoma* (Linnaeus) Martius f. *marina* Hauck). In the northern basin, *Prasiola* have been recorded on leaves of *N. noltii* with the red algae *Ceramium diaphanum* (Lightfoot) Roth, *Hydrolithon farinosum* (J.V. Lamouroux) Penrose *et Chamberlain v. farinosum*, *Hydrolithon boreale* (Foslie) Y.M. Chamberlain and *Pneophyllum fragile* Kützing, the brown alga *Myrionema orbiculare* J. Agardh, and filamentous benthic diatoms of the genus *Navicula*.

DISCUSSION

The morphology of the specimens collected is in agreement with the genus *Prasiola*, in particular with *Prasiola crispa* (Lightfoot) Kützing, for the following features: a) monostromatic thalli, more or less rounded and crisped, b) lack of a stipe, and c) cells arranged in regular longitudinal and transversal rows (Womersley, 1984; Burrows, 1991; Rindi *et al.*, 1999). *P. crispa* differs from other species reported for Europe in the habit of the thallus and attachment to the substratum. *Prasiola calophylla* (Charmichael *ex* Greville) Kützing is characterised by a slender frond, gradually becoming uniseriate towards the base, attached by a disc-shaped holdfast. *Prasiola furfuracea* (Mertens *ex* Hornemann) Kützing has a fan-shaped frond with a short stipe, attached by basal cells or a few rhizoids. *Prasiola*

stipitata Suhr *ex* Jessen is characterised by a wedge-shaped, fan or hearth-shaped thallus with a long stipe. We never found blades of *Prasiola* with filaments of *Rosenvingiella*, as reported by several authors (Kornmann and Sahling, 1974; Edwards, 1975; Rindi *et al.*, 1999), or mixed with uniseriate filamentous specimens (“*Hormidium* stage”) and pluriseriate ribbon-like plants (“*Schizogonium* stage”). *P. crispa* is primarily a terrestrial alga (Knebel, 1936; Burrows, 1991; Rindi *et al.*, 1999) and we cannot exclude its presence in terrestrial habitats, because we sampled only in the midlittoral zone of the Lagoon. Conversely, the association with bird colonies (Scarton and Valle, 2000) is in accordance with many studies (Kristiansen, 1972; Womersley, 1984).

The identification of our specimens as *P. crispa* is supported by agreement between the characteristics of our samples and the morphology of this species as described in the literature. Nevertheless, due to the low abundance and very small size of the specimens, we prefer to postpone identification at species-level until further collection is available.

Desmarestia viridis (O.F. Müller) J.V. Lamouroux, *Sargassum muticum* (Yendo) Fensholt, *Undaria pinnatifida* (Harvey) Suringar, *Antithamnion pectinatum* Brauner *ex* Athanasiadis *et* Tittley, *Polysiphonia morrowii* Harvey and *Lomentaria hakodatensis* Yendo, recently recorded in the Lagoon of Venice (Gargiulo, *et al.*, 1992; Rismondo *et al.*, 1993; Curiel *et al.*, 1996a, 1996b, 2002; Bellemo *et al.*, 2001), were found for the first time at Chioggia Island (southern basin), where several aquaculture farms importing molluscs and fish from other countries are present. Conversely, specimens belonging to the genus of *Prasiola* and *Sorocarpus* (Curiel *et al.*, 1999) were found in other areas of the Lagoon. We think that these two genera, already present in Atlantic Europe, have probably reached the Venice Lagoon via a vector other than aquaculture farms. This hypothesis is in agreement with our discovery of the hybrid and sterile form of Gramineae *Spartina x townsendii*, which is common in northern Europe, in natural and artificial salt marshes close to the areas where thalli of *Prasiola* were collected (Scarton and Valle, 2000; Scarton *et al.* 2003).

In the years following the first occurrence, the genus *Prasiola* has not been found again either by our study group or by other researchers (Sfriso, pers. comm.), mainly because no more surveys have been carried out in these areas and also because its prop-

agation is currently limited only to soft substrata of a specific area of the lagoon.

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