

## First record of the alien alga *Antithamnion amphigeneum* (Rhodophyta) in the Adriatic Sea

Vesna MAČIĆ<sup>1\*</sup> and Enric BALLESTEROS<sup>2</sup>

<sup>1\*</sup> *Institute of Marine Biology, Dobrota b.b.; 85330 Kotor; Montenegro*

<sup>2</sup> *Centre d'Estudis Avançats de Blanes (CSIC), Accés Cala Sant Francesc 14, 17300, Blanes, Girona, Spain*

\*Corresponding author, e-mail: vmacic@ibmk.org

---

*We report on the alien red alga Antithamnion amphigeneum from the coast of the Adriatic Sea, which represents the easternmost distribution record in the Mediterranean. Being A. amphigeneum a small filamentous alga, it can be easily overlooked therefore it is probably more widespread. Further surveys on Montenegro and other Mediterranean areas – mainly in harbors and other polluted places - will provide more accurate information on its current distribution.*

---

**Key words:** *Antithamnion amphigeneum*, non-native alga, Adriatic Sea, Montenegro

### INTRODUCTION

An introduction of species into new environments has taken place for a long time, but the number of non-native species in the Mediterranean Sea has been growing exponentially in the last few decades (ZENETOS *et al.*, 2010). Introduction and spread of non-native species are considered one of the main threats to biodiversity at different scales and extent (GALIL, 2007; STREFTARIS & ZENETOS, 2006). Due to the above said and to possible negative effects of alien species on human health and economy, the considerable international effort is being dedicated to collect information on the distribution and ecology of non-native species (OCCHIPINTI-AMBROGI *et al.*, 2011; ZENETOS *et al.*, 2010).

A red alga species *Antithamnion amphigeneum* A. Millar 1990 (Rhodophyta: Ceramiaceae) was initially described by MILLAR (1990) from New South Wales (Eastern Australia) and

almost at the same time it was also described by VERLAQUE & SERIDI (1991) as a different species, *Antithamnion algeriense* M. Verlaque & Seridi 1991 from Bjord-El-Kiffan (Algeria). Later on, this taxon was reported from the Island of Alboran, Spain (RIBERA & SOTO 1992), the Medes islands, Spain (E. BALLESTEROS, personal observation), several localities from Morocco (GONZÁLEZ & CONDE 1994), the western coast of Italy (La Spezia) (RINDI *et al.*, 1996), Monaco (VERLAQUE & BERNARD, 1998) and the French Mediterranean coast (KLEIN & VERLAQUE, 2011). This species was first reported in the Atlantic Ocean from the area of the harbor of Bilbao, Spain (SECILLA *et al.*, 1997) where reproductive structures (tetrasporangia) were found.

In the area of Biscay, *A. amphigeneum* invaded about 90 km of coast in less than 10 years (SECILLA, 2012). Subsequently, it has been also reported from different areas of the Atlantic Spanish coasts (DÍAZ *et al.* 2008; BÁRBARA *et al.*, 2012).

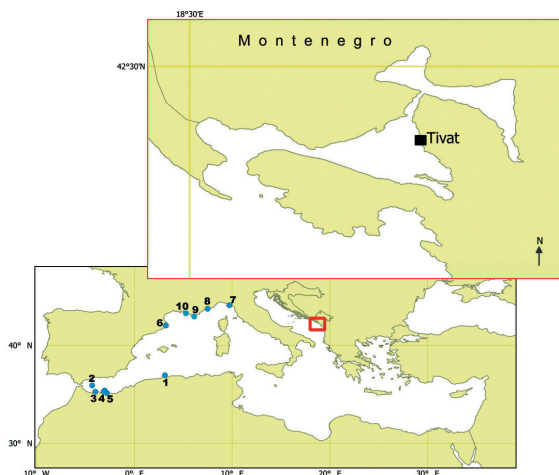


Fig.1. New location of *Antithamnion amphigeneum* in Montenegro and its known distribution in the Mediterranean Sea: 1. Bjord-El-Kiffan, Algeria (VERLAQUE & SERIDI, 1991), 2. Island of Alboran, Spain (RIBERA & SOTO, 1992), 3. Playa de la Cebadilla, Morocco (GONZALES & CONDE, 1994), 4. Cala Charranes and Punta Negra, Morocco (GONZALES & CONDE, 1994), 5. Karia Arkemanne and Punta de Rostrogorde, Morocco (GONZALES & CONDE, 1994), 6. Medes islands, Spain (E. Ballesteros, unpublished), 7. La Spezia, Italy (RINDI *et al.*, 1996), 8. Monaco (VERLAQUE & BERNARD, 1998), 9. Port Cros Island, France (KLEIN & VERLAQUE, 2011) and 10. Marseille, France (KLEIN & VERLAQUE, 2011)

Here we present the first record of *A. amphigeneum* from the Adriatic Sea, which represents the easternmost record of its known distribution in the Mediterranean Sea.

## MATERIAL AND METHODS

Samples of red filamentous algae were collected during SCUBA dives in the Porto Montenegro (Tivat, Montenegro) in May and July 2015 (Fig. 1) as part of a seasonal environmental monitoring started in 2015. Specimens were immediately fixed in 4% formalin/seawater. Microscopic analysis and photography of collected material was done with Zeiss Axio Imager.A1. Voucher specimens of the examined species (*Antithamnion amphigeneum*) were preserved in formalin at the seaweed collection of the Institute of Marine Biology in Kotor (University of Montenegro).

## RESULTS AND DISCUSSION

*Antithamnion amphigeneum* was growing mostly on mussel shells (*Mytilus galloprovincialis*) but also on other organisms on the vertical walls of pier 1 from Porto Montenegro (Boka Kotorska, Montenegro). In most cases, *A. amphigeneum* grew abundantly in relatively shaded and shallow (less than 2 meters depth) places, without being either dominant or invasive. The collected specimens match with the descriptions by MILLAR (1990), VERLAQUE & SERIDI (1991), SECILLA (2012) and RODRÍGUEZ-PRIETO *et al.*, (2013). The ceramiacean red alga *Acrothamnion amphigeneum* is similar to the also alien species *Acrothamnion preissii*, as well as to the natives *Pterothamnion crispum* and *Balliella cladoderma*. Microscopic examination is necessary for identification. The thallus is pink-reddish in color, made by 5-10 mm long filaments with opposite and distichous whorl branchlets. Axial cells are up to 130  $\mu\text{m}$  long and up to 30  $\mu\text{m}$  broad. Whorl-branches are composed of 9-13 cells and are up to 210  $\mu\text{m}$  long. Their basal cells are subquadrate while other cells are elongated, up to 2 times as long as broad, bearing a pair of first-order branchlets. Elliptical gland cells (up to 12  $\mu\text{m}$  long and 11  $\mu\text{m}$  broad) were more abundant on samples collected in May than in July and were almost always in contact with 2 cells, rarely 3 cells, situated on the two basal cells of short terminal branchlets (Fig. 2). Tetrasporocysts were observed in July and were pedicellate, cruciately divided, averaging 12 x 8  $\mu\text{m}$  (Fig. 3). Fertile specimens have been observed in the area of Bilbao (Atlantic Spain) throughout the year (SECILLA *et al.*, 1997), while reproductive structures in the Mediterranean have not been usually observed (KLEIN & VERLAQUE, 2011).

The vector of introduction of this species is still unknown although its presence within or close to large harbours (VERLAQUE & SERIDI, 1991; SECILLA, 2012) outside its natural area of distribution (Western Australia; MILLAR, 1990) suggests a way of dispersal related to shipping (probably fouling; CORMACI *et al.*, 2004; OCCHIPINTI-AMBROGI, 2011). Thus, the presence of *A. amphigeneum* in Porto Montenegro, in a pier where most big yachts berth in Boka Kotor-



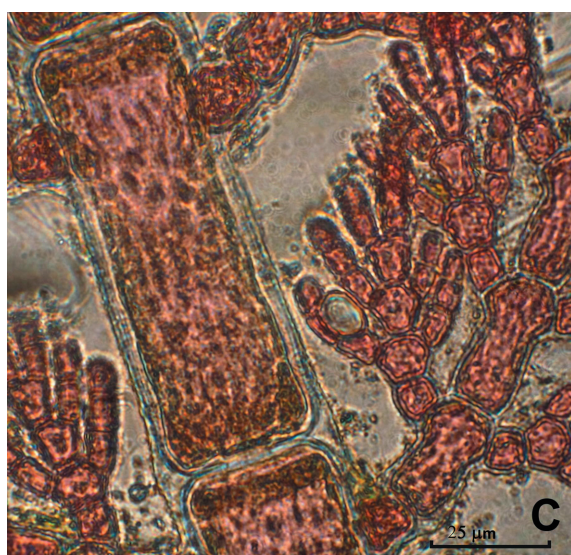
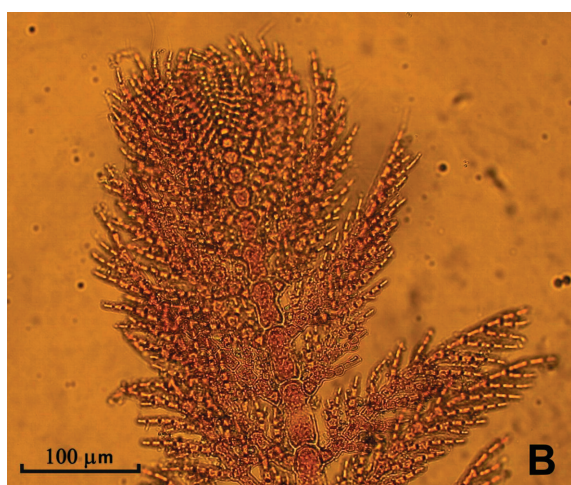


Fig.2. *Antithamnion amphigeneum*: A) branch; B) apex of the branch; C) gland cell

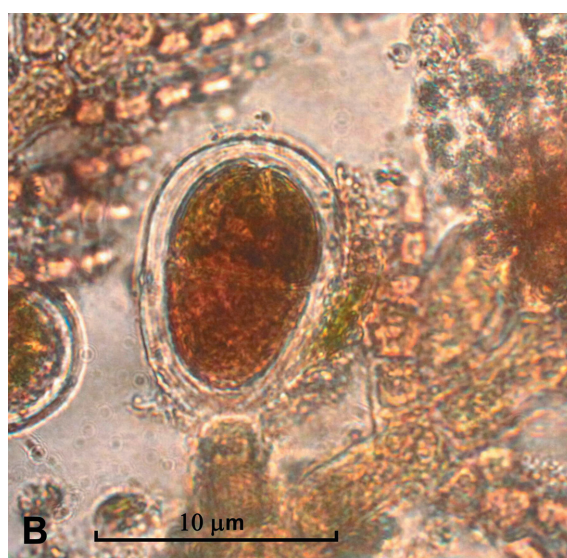
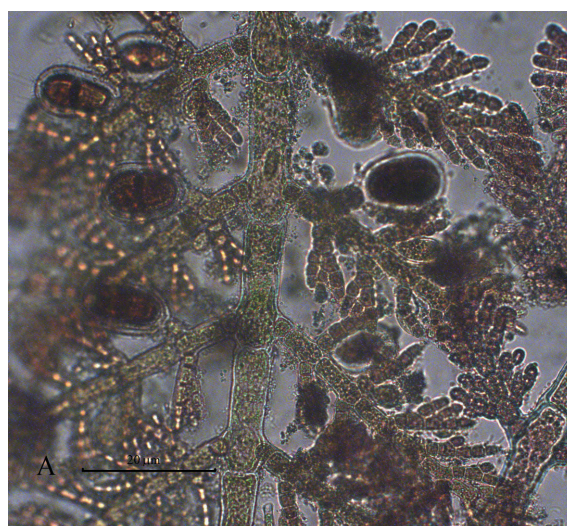


Fig. 3. *Antithamnion amphigeneum*: A) branch with tetrasporocysts; B) tetrasporocyst

ska, corroborates the possibility that this alga spreads by shipping. As far as we know, inside the Mediterranean *A. amphigeneum* was only recorded in localities from the western Mediterranean (ZENETOS *et al.*, 2010) but not in the Ionian, the Adriatic or the Aegean seas. Given that *A. amphigeneum* is a small filamentous alga, it can be easily overlooked and it is probably more widespread. The common presence of *A. amphigeneum* in harbors suggests that this species is highly tolerant to pollution (SECILLA *et al.*, 1997). Further surveys in Montenegro and other Mediterranean regions, mainly in harbors and other polluted places, will provide more accurate information on its current distribution.



## ACKNOWLEDGEMENTS

Specimens were collected within the framework of the Biological Monitoring of Porto

Montenegro Marina in 2015-2016, this study was funded by Porto Montenegro, Tivat.

## REFERENCES

- BÁRBARA, I., P. DÍAZ TAPIA, C. PETEIRO, E. BERCIBAR, V. PEÑA, N. SÁNCHEZ, A. M. TAVARES, R. SANTOS, A. SECILLA, P. RIERA FERNÁNDEZ, R. BERMEJO & V. GARCÍA. 2012. Nuevas citas y aportaciones corológicas para la flora bentónica marina del Atlántico de la Península Ibérica (New records and observations for the benthic flora of the Atlantic Iberian Peninsula). *Acta Botanica Malacitana*, 37: 5-32.
- CORMACI M., G., FURNARI, G. GIACCONE & D. SERIO. 2004. Alien macrophytes in the Mediterranean Sea: A review. *Recent Res. Devel. Environ. Biol.*, 1: 153-202.
- DÍAZ, P., I., BÁRBARA, S., SECILLA, C. PETEIRO, S. CALVO, N. SÁNCHEZ, A. SANTOLARIA, I. DÍEZ, T. GALLARDO, J. CREMADES & J. M. GOROTIAGA. 2008. Adiciones corológicas a la flora bentónica marina de Cantábrico (Additions to the benthic flora of the Cantabrian Sea). *Nova Acta Científica Compostelana (Biología)*, 17: 177-189.
- GALIL, B. 2007. Loss or gain? Invasive aliens and biodiversity in the Mediterranean Sea. *Marine Pollution Bulletin*, 55: 314-322.
- GONZÁLEZ, J. A. & F. CONDE. 1994. Catálogo del macrofitobentos del Mediterráneo de Marruecos (Check-list of the macrophytobenthos from the Mediterranean coasts of Morocco). *Acta Botanica Malacitana*, 19: 5-27.
- KLEIN, J. & M. VERLAQUE. 2011. Macroalgae newly recorded, rare or introduced to the French Mediterranean coast. *Cryptogamie Algologie*, 32: 111-130.
- OCCHIPINTI-AMBROGI, A., A. MARCHINI, G. CANTONE, A. CASTELLI, C. CHIMENZ M. CORMACI, C. FROGLIA, G. FURNARI, M. C. GAMBÌ, G. GIACCONE, A. GIANGRANDE, C. GRAVILLI, F. MASTROTOTARO, C. MAZZIOTTI, L. ORSIRELINI & S. PIRAINO. 2011. Alien species along the Italian coasts: an overview. *Biological Invasions*, 13: 215-237.
- MILLAR, A.J.K. 1990. Marine algae of the Coffs Harbour region, northern New South Wales. *Australian Systematic Botany*, 3: 293-593.
- RIBERA, M.A. & J. SOTO. 1992. Presencia de *Anthithamnion algeriense* (Rhodophyta, Ceramiales) en las costas españolas. *Cryptogamie Algologie*, 13: 25-30.
- RINDI, F., I. PAPI & F. CINELLI. 1996. New records of Ceramiales (Rhodophyta) for the northwestern Mediterranean. *Cryptogamie Algologie*, 17: 223-238.
- RODRÍGUEZ-PRIETO, C., E. BALLESTEROS, F. BOISSET & J. AFONSO-CARRILLO. 2013. Guía de las macroalgas y fanerógamas marinas del Mediterráneo Occidental (Guide of macroalgae and marine flowering plants from the Western Mediterranean). Omega, Barcelona, 656 pp.
- SECILLA, A. 2012. La familia Ceramiaceae *sensu lato* en la costa de Bizkaia (The family Ceramiaceae *sensu lato* in the coast of Bizkaia). Universidad del País Vasco, Euskal Herriko Unibertsitatea, Leioa, pp. 371.
- SECILLA, A., J.M. GOROSTIAGA, I. DIEZ & A. SANTOLARIA. 1997. *Anthithamnion amphigeneum* (Ceramiales, Rhodophyta) from the European Atlantic coast. *Botanica Marina*, 40: 329-332.
- STREFTARIS, N. & A. ZENETOS. 2006. Alien marine species in the Mediterranean - the 100 'worst invasives' and their impact. *Mediterranean Marine Science*, 7: 87-118.
- VERLAQUE, M. & G. BERNARD. 1998. Inventaire de la flore marine de la Principauté de Monaco (Inventory of the marine flora in the Principality of Monaco). GIS Posidonie Publ., Marseille, 39 pp + Annexes.
- VERLAQUE, M. & H. SERIDI. 1991. *Anthithamnion algeriense* nov. sp. (Ceramiales, Rhodo-

phyta) from Algeria (Mediterranean Sea).  
*Botanica Marina*, 34: 153-160.

ZENETOS, A., S. GOFAS, M. VERLAQUE, M.E. INAR,  
J.E. GARCI, A RASO, C.N. BIANCHI, C. MORRI,  
E. AZZURRO, M. BILECENOGLU, C. FROGLIA, I.  
SIKOU, D. VIOLANTI, A. SFRISO, G. SAN MAR-  
TIN, A. GIANGRANDE, T. KATA AN, E. BALLE-  
TEROS, A. RAMOS-ESPLA, F. MASTROTOTARO,

O. OCAÑA, A. ZINGONE, M.C. GAMBI & N.  
STREFTARIS. 2010. Alien species in the Medi-  
terranean Sea by 2010. A contribution to  
the application of European Union's Marine  
Strategy Framework Directive (MSFD).  
Part I. Spatial distribution. *Mediterranean  
Marine. Mediterranean Marine Science*, 11:  
381-493.

Received: 3 August 2015

Accepted: 12 July 2016

## Prvi podaci o unesenoj algi *Antithamnion amphigeneum* (Rhodophyta) u Jadranskom moru

Vesna MAČIĆ\* i Enric BALLESTEROS

\*Kontakt e-adresa: vmacic@ibmk.org

### SAŽETAK

U ovom radu prikazani su podaci o unesenoj algi *Antithamnion amphigeneum* u Jadransko more, što predstavlja najistočniji nalaz njenog rasprostranjenja u Sredozemlju. Filamentozna alga *A. amphigeneum* je malih dimenzija i na terenu se lako može previdjeti pa je za očekivati veću rasprostranjenost. Daljnja istraživanja na crnogorskoj obali i drugim dijelovima Sredozemlja – prije svega u lukama i drugim zagađenim područjima, pružiti će detaljnije informacije o njenom rasprostranjenju.

**Ključne riječi:** *Antithamnion amphigeneum*, unesena, Jadransko more, Crna Gora