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FIRST RECORD OF THE BRYOZOAN *TRICELLARIA INOPINATA* (D'HONDT & OCCHIPINTI AMBROGI, 1985) FROM THE SLOVENIAN SEA

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ABSTRACT

In this paper we present the first record of Tricellaria inopinata d'Hondt & Occhipinti Ambrogi, 1985 for the Slovenian coastal sea. The colonies of this bryozoan were found attached to the mussel shells in the sight of Sečovlje, Strunjan and Debeli rtič mussel cultures from April to October 2018 and in Valdoltra harbour in November 2018. After the introduction into the Lagoon of Venice in the 1980s and its rapid spread throughout the lagoon in the following years, the species was regarded as an invasive taxon for that area and it is highly expected to colonize the whole Northern Adriatic region. The status of T. inopinata and its ecological impact has yet to be determined for the Slovenian coastal sea.

Key words: *Tricellaria inopinata*, alien species, Gulf of Trieste, Adriatic Sea, mussel aquaculture

PRIMA SEGNALAZIONE DEL BRIOZOO *TRICELLARIA INOPINATA* (D'HONDT & OCCHIPINTI AMBROGI, 1985) PER IL MARE SLOVENO

SINTESI

L'articolo tratta il primo ritrovamento di Tricellaria inopinata d'Hondt & Occhipinti Ambrogi, 1985 per le acque costiere slovene. Le colonie di questo briozoo sono state trovate attaccate ai gusci delle cozze nelle mitilocolture di Sicciole, Strugnano e Punta grossa da aprile a ottobre 2018, e nel mandracchio di Valdoltra nel novembre 2018. Dopo l'introduzione della specie nella Laguna di Venezia negli anni '80 e la rapida diffusione in tutta la laguna negli anni seguenti, la specie è stata considerata invasiva per quell'area e si prevede che colonizzi l'intero Adriatico settentrionale. Lo stato di T. inopinata e il suo impatto ecologico devono ancora venir determinati per le acque costiere slovene.

Parole chiave: *Tricellaria inopinata*, specie aliena, Golfo di Trieste, mare Adriatico, mitilicoltura

INTRODUCTION

The arborescent Cheliostomatid Bryozoan *Tricellaria inopinata* d'Hondt & Occhipinti Ambrogi, 1985 (Bryozoa: Candidae) is creamy-light brown in colour and it forms bushy colonies on hard substrata. The species is tolerant to a broad range of temperatures and salinity and it is capable of year-round reproducing, which makes it very competitive (Cook *et al.*, 2013).

T. inopinata was first described from the Venice lagoon (Mediterranean Sea) in 1982 (d'Hondt & Occhipinti Ambrogi, 1985). Although the precise native origin of the Bryozoan remains unclear, it is assumed that the species originates from the Pacific (Dyrnda *et al.*, 2000), where the *T. inopinata* –*occidentalis* –*porteri* complex of several closely related morphospecies occurs (Occhipinti Ambrogi & d'Hondt, 1994).

The complex of species is widespread in the whole Pacific, classified either as an introduced species in the case of New Zealand (Gordon & Mawatari, 1992) or as a cryptogenic species on the coast of the USA, Canada, Japan and Australia (Dyrnda *et al.*, 2000). It has been reported from several locations in the Eastern Atlantic: Portugal, Spain, Scotland, Ireland, Southern coast of England, France, Germany, Belgium and Netherlands (De Blauwe & Faasse, 2001; Breton & d'Hondt, 2005; Arenas *et al.*, 2006; Marchini *et al.*, 2007; Buschbaum *et al.*, 2012; Cook *et al.*, 2013); in the Western Atlantic:

Massachusetts (Johnson *et al.*, 2012); as well as in the Arctic Ocean: Norwegian Sea (Porter *et al.*, 2015).

In the Mediterranean Sea, *T. inopinata* has most frequently been recorded in the Italian part of the Northern Adriatic (Occhipinti-Ambrogi, 2000). It has also been reported in some other parts of Italy (harbours La Spezia and Olbia in Ligurian and Tyrrhenian Sea, respectively) (Lodola *et al.*, 2012), in Tunisia (Ben Souissi *et al.*, 2006) and in marinas of Agde and Le Grau-du-Roi, France and Heraklion in Greece (Ulman *et al.*, 2017).

Besides the records from the Italian part of the northern Adriatic there were no other records so far in the Adriatic. The finding presented in this work is thus the first record of *T. inopinata* outside Italian waters of the Adriatic Sea and the first record for the Slovenian Sea.

MATERIAL AND METHODS

The colony of *T. inopinata* was collected from the mussel aquaculture in Sečovlje (GPS coordinates: 45°29'21.18", 13°34'57.96") on 6th of April 2018 (Fig. 1). It was found attached to a shell of *Mytilus galloprovincialis* from the depth of 0.5 m. Mussels were scraped

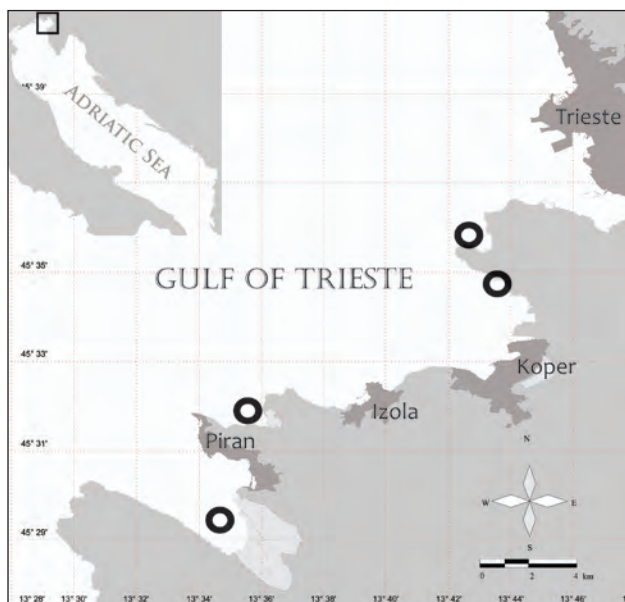


Fig. 1: Map of the Gulf of Trieste with four locations where colonies of *Tricellaria inopinata* were found (circle).

Sl. 1: Zemljevid Tržaškega zaliva z označenimi štirimi območji (krogec), kjer so bile najdene kolonije vrste *Tricellaria inopinata*.

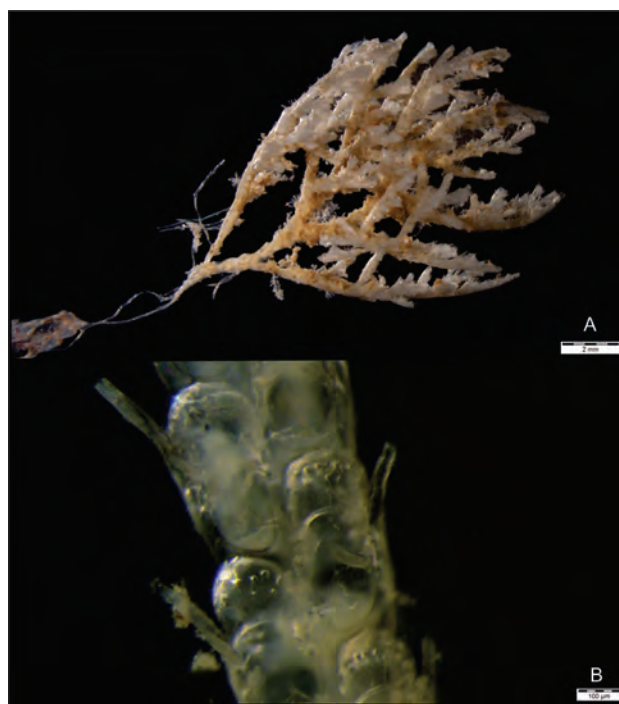


Fig. 2: Photographs of the colony of *Tricellaria inopinata*: A – a broad view of the colony, B – a close-up view of one branch of the colony with autozooids (photos: A. Fortič).

Sl. 2: Fotografije kolonije mahovnjaka *Tricellaria inopinata*: A – široki posnetek razvejane kolonije, B – približani posnetek dela kolonije z vidnimi avtozoidi (fotografiji: A. Fortič).

off a buoy and a rope with a scraping net and brought back to the laboratory. Detailed inspection of the fouling community with the dissection microscope revealed a cream-coloured arborescent bryozoan colony (Fig. 2A). It was preserved with an ethanol-based fixation reagent (FineFIX) and is stored as a part of species record collection of Marine Biology Station (National Institute of Biology) in Piran.

Consequent samplings were performed on three sites of mussel aquaculture in Strunjan, Debeli rtič and Sečovlje. On six occasions we found several colonies of *T. inopinata*, using the same sampling procedure. We employed the similar protocol, when sampling in some Slovenian harbours. Fouling community was scraped off the hulls of boats and later inspected in the laboratory. *T. inopinata* was found in Valdoltra harbour, attached both to mussel shells and directly to the boat hull (Tab. 1).

RESULTS AND DISCUSSION

The colonies of *T. inopinata* were found attached to the mussel shells and in one case on the boat hull with smooth rhizoids. The bryozoan was determined due to certain diagnostical features. The stem is dichotomously branched, bearing autozooids arranged in two rows, with large lateral avicularia. The colony is composed of autozooids with or without distally positioned globular shaped brooding chambers (ovicells), which are multi-pored. The scuta, partially covering opesia are highly diverse throughout the colony, but are mainly antler-shaped (Fig. 2B). Some of the proximal external spines have double tips, but not all. The specimen was assigned to the species *T. inopinata*, following the description from Dyrinda *et al.* (2000), Johnson *et al.* (2012) and Lodola *et al.* (2012).

Tab. 1: Dates and sites of sampling in three Slovenian mussel aquacultures and one harbour when colonies of *T. inopinata* were found.

Tab. 1: Datumi in lokacije vzorčenja v treh slovenskih školjčičih in enemu mandraču, kjer smo našli mahovnjaka *T. inopinata*.

Date	Site	GPS coordinates
6.4.2018	Sečovlje	45°29'21.18", 13°34'57.96"
7.5.2018	Sečovlje	45°29'21.18", 13°34'57.96"
5.6.2018	Debeli rtič	45°35'54.31", 13°42'29.32"
3.7.2018	Strunjan	45°31'50.22", 13°35'45.78"
27.9.2018	Sečovlje	45°29'38.00", 13°34'36.00"
5.10.2018	Debeli rtič	45°36'01.68", 013°42'19.92" and 45°35'58.56", 13°42'33.00"
5.10.2018	Sečovlje	45°29'24.54", 13°34'56.76"
16.11.2018	Valdoltra	45°34'47.68", 13°43'32.42"

The ability to colonize brackish and fully saline environments, combined with high tolerance to temperature variations and eutrophication levels, along with high reproductive potential, caused the rapid spread of *T. inopinata* (Occhipinti Ambrogi & d' Hondt, 1994; Dyrinda *et al.*, 2000; Occhipinti Ambrogi, 2000). Ecological consequences of introduction of *T. inopinata* to the Lagoon of Venice were quickly evident. A rapid spread of *T. inopinata* through the canals of Venice, caused a disappearance of some native bryozoan species, consequently reducing biodiversity in the fouling community (Occhipinti Ambrogi, 2000). Competition with other bryozoan species was also observed in other parts of the world (Johnson *et al.*, 2012). Another mention-worthy aspect of the colonisation of *T. inopinata* into new environments, is harbouring of the mobile alien fauna, such as *Caprella scaura*, *Monocorophium sextonae* (both Amphipoda) and *Paracerceis sculpta* (Isopoda) in Cádiz, Spain (Gavira-O'Neill *et al.*, 2016).

Most likely the bryozoan is being transferred by means of shipping or aquaculture and secondary diffused by small boat traffic (Watts *et al.*, 1998; de Blauwe & Faasse, 2001; Occhipinti Ambrogi, 2002; Lodola *et al.*, 2012; Porter *et al.*, 2015), as concluded from the occurrence of the species in harbours and marinas (Dyrinda *et al.*, 2000). It was also found in Japanese tsunami debris that landed on the coast of North America in 2011 (Calder *et al.*, 2014).

Recently, Johnson and Woollacott (2015) have successfully assessed the introduction and spread of *T. inopinata* in Western Atlantic through multiple introduction events by the means of characterizing polymorphic microsatellite loci. It might be sensible to perform a similar study analysing both Pacific and Mediterranean specimens.

Although this species is highly expected for the whole area of the northern Adriatic, this is the first record of *T. inopinata* in Slovenian coastal sea. Currently we do not have enough data to assess the population status of this species in Slovenia. Up to date we have found the colonies of *T. inopinata* in Sečovlje, Strunjan and Debeli rtič mussel aquacultures, however in neither of those sites was the bryozoan abundant. We have yet to discover, whether the species is mostly present in mussel aquacultures, or it is already established and distributed over larger area. As earlier data show, *T. inopinata* often appears in marinas, harbours, ports and canals (d'Hondt & Occhipinti Ambrogi, 1985; Breton & d'Hondt, 2005; Porter *et al.*, 2015). Our sampling effort in Slovenian harbours has in fact recently revealed few colonies of this bryozoan in the Valdoltra harbour. In the future, we are keen on continuing to study the spatial and temporal patterns of *T. inopinata* in Slovenian waters and to assess its possible impact on the ecosystem.

The unclear taxonomic status of *T. inopinata* –*occidentalis* - *porteri* complex, caused by the missing type species for *T. occidentalis* and lack of conclusive

morphological and molecular information on both *T. occidentalis* and *T. porteri* (Dyrynda *et al.*, 2000), causes confusion around the origin and introduction pathways of *T. inopinata*. The status of *Tricellaria inopinata* in the Northern Adriatic remains unclear and further studies, namely ecological and molecular, are necessary in order to elucidate it.

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PRVI ZAPIS O POJAVLJANJU MAHOVNJAKA *TRICELLARIA INOPINATA* (D'HONDT & OCCHIPINTI AMBROGI, 1985) IZ SLOVENSKEGA MORJA

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POVZETEK

V članku predstavljamo prvi primer pojava mahovnjaka *Tricellaria inopinata* d'Hondt & Occhipinti Ambrogi, 1985 v slovenskem morju. Kolonije mahovnjaka smo našli na lupinah klapavic v školjčičih Sečovlje, Strunjan in Debeli rtič med aprilom in oktobrom 2018 in v mandraču v Valdoltri novembra 2018. Po vnosu v Beneško laguno v osemdesetih letih prejšnjega stoletja in naglem širjenju v naslednjih letih, so vrsto označili za invazivno za to območje in jo zato lahko pričakujemo v celotni regiji severnega Jadrana. Status vrste *T. inopinata* v slovenskem priobalnem morju še ni jasan, prav tako je potrebno v prihodnje razjasniti možne vplive mahovnjaka na tukajšnji ekosistem.

Ključne besede: *Tricellaria inopinata*, tujerodna vrsta, Tržaški zaliv, Jadransko morje, školjčiče

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