



Short communication

New record of alien species in Albania: *Isognomon legumen* (Gmelin, 1791) (Mollusca Bivalvia Isognomonidae)

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ABSTRACT

In the last five years, there have been reports of the non-endemic Indo-Pacific tree oyster *Isognomon legumen* (Mollusca, Bivalvia, Isognomonidae) species in various areas of the Mediterranean Sea. Three specimens of the species were sampled in three areas of the Albanian coasts between 0.8 m and 1.5 m depth, among the calcareous algae attached to the rocks. An attempt to determine the age of the species and its expansion in the Albanian coast has been conducted based on the number of filaments of the byssus. The results of this study confirmed the identification of the mentioned species in the Adriatic and Ionian seas. Moreover, it concluded that *I. legumen* is well established on the south-eastern coasts of Albania and its arrival may be mediated by the naval routes that pass through the Otranto channel.

Introduction

The introduction of non-indigenous species into the Mediterranean Sea has long been known as one of the main phenomena of climate change, with consequences on biodiversity, and on the structure and function of marine ecosystems (Wallentinus & Nyberg, 2007; Molnar et al., 2008; Katsanevakis et al., 2014; Ojaveer et al., 2015; Zenetos et al., 2019; Haim, et al. 2019; Crocetta et al., 2021; Gaber & Elghazaly, 2021; Kolokotronis et al., 2023). This phenomenon seems to be caused many factors, such as the variable routes in the Mediterranean Sea (i.e. through ballast water) and the diffusion through the Suez Canal (Gonçalves, 2013; Fernandes et al., 2016; Zenetos et al., 2017; Tsiamis et al., 2018, 2020; Crocetta et al., 2021). The Indo-Pacific tree oyster *Isognomon legumen* (Gmelin, 1791) (Mollusca: Bivalvia: Pteriidae) was initially reported in the Mediterranean Sea by Mienis et al. (2016). However, a reevaluation of historical data revealed that its presence can be traced back to 1996 (Crocetta, 2018). This earlier occurrence in the Mediterranean Sea was overlooked due to its initial misidentification as *Malleus regula* (Forsskål in Niebuhr, 1775), as documented by Crocetta (2018) and Dragičević et al. (2019). The presence of this alien bivalve has recently been confirmed in Israel, Greece, Turkey, and Sicily (Mienis et al., 2016; Stamouli et al., 2017; Scuderi & Viola, 2019; Marchini et al., 2020). However, data regarding its presence in the Adriatic Sea are lacking. The coasts of the Adriatic are equally affected by alien invasions, mainly by the introduction of oysters, mussels and clams of Manila on the Italian coasts due to intensified aquaculture (Katsanevakis et al., 2011). Moreover, this bioinvasion seems to be driven by the displacement of alien species already established in the Ionian Sea

(Katsanevakis et al., 2011). This study aims to update the count of alien species in the Albanian Adriatic waters by documenting the discovery of three living specimens and a shell of the bivalve *I. legumen* in three distinct areas along the southern coast of Albania.

Materials and methods

Three specimens of *Isognomon* sp. were found accidentally in three locations as shown in Fig. 1 and Table 1. The first specimen of *Isognomon* sp. was accidentally sampled in the Gulf of Dafina, in the Marine Protected Area (MPA) of Sazan Karaburun in June 2021, with a 20 x 20 sample of *Ellisolandia elongata* algae during an evaluation of the associated fauna of this algal species. The following two specimens of *Isognomon* sp. were sampled incidentally during a research on the fauna of the rocky coasts of Porto Palermo and Llanan (Fig. 1). Both samples were alive, and were preserved in alcohol (ethanol 95–100 %) for further study. In addition, all the samples were found on the seabed with *Ellisolandia elongata* and other calcareous algae at depths ranging between –0.8 and –1.5 m. The observation of the specimens was conducted with a stereoscope (Model Optica SZN-6, trinocular with camera, OPTIKA Italy) and compared to the data collected on the description of *Isognomon legumen* from various publications, including the original description of the species (Gould, 1850; Deshayes, 1863; Katsanevakis et al., 2011; Mienis et al., 2016; Stamouli et al. al., 2017; Angelidis & Polyzoulis, 2018; Scuderi & Viola, 2019). To ascertain the correct identification of the species, the specimens were also compared with *Isognomon australica* and *Malleus regula*.

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Results & discussion

Specimen description

Fig. 2 shows the three sampled specimens off the Albanian coast. The specimens examined were identified as *Isognomon legumen* on the basis of the characteristic of the “denticulate” hinge (Figure 2.6). The identification involved cross-referencing the specimens with descriptions in the literature and prior reports in the Mediterranean Sea (Mienis et al., 2016; Stamouli et al., 2017; Scuderi & Viola, 2019). To prevent potential identification errors, the specimens were also meticulously compared to *Malleus regula* (Forsskål, 1775), with which *I. legumen* has been previously misidentified (Crocetta, (2018), and to *Isognomon australica* (Reeve, 1858), a species recently documented in Greece (Micali et al., 2017; Angelidis & Polyzoulis, 2018). As *I. legumen* is a species with semi-convex valves, relatively hard and with a pointed umbo (Scuderi & Viola, 2019), it was easy to distinguish the species from *I. australica*, which is characterized by quite fragile valves. Furthermore, the depth of the species found excludes the possibility of a wrong identification, given that the two species are distributed in different depths.

All three sampled specimens were characterized by fragile laminar shells coated with a mother-of-pearl layer inside them (Figures 2.2 & 2.6). The inner part is characterized by a yellow-orange color with orange edges of the mantle. Only one oval-shaped white bead was found (Figures 2.4 & 2.10). The byssus filaments were short, greenish in color and very dense.

Taking into consideration the measurements of the specimens found and also the thickness of the byssus filaments in each one, a conclusion was reached that two of the specimens were fully grown with about 65 byssus filaments, while the third specimen (Figures 2.1, 2.2, & 2.3) has only three byssus filaments (Harper & Morton, 1994; Scuderi & Viola, 2019). The specimen discovered in the Karaburun Sazan Marine Protected Area is younger than those previously sampled in the Gulf of Dafina. Additionally, with a lower count of byssus filaments, it is suggested that the species has recently begun moving northwards (Harper & Morton, 1994).

However, this assumption must be confirmed by further sampling.

Considering the reports of the presence of *I. legumen* in Israel, Turkey, Greece and Sicily (Mienis et al., 2016; Micali et al., 2017; Stamouli et al., 2017; Angelidis and Polyzoulis, 2018; Scuderi & Viola, 2019) and the description of the species according to Harper & Morton (1994), it is thought that this species is already well established on the south-eastern coasts of Albania, probably arriving two or three years earlier mediated

Table 1

Location, coordinates, depth and number of sampled specimens of *Isognomon legumen* in Albania.

Location	Latitude	Longitude	Depth	Number of specimens
Dafina Bay, Vlore	40.3379116° N	19.3689665° E	0.8 m	1 (one)
Llamani Gulf	40.0794661° N	19.7673546° E	1.2 m	1 (one)
Porto Palermo Bay	40.0617612° N	19.7931662° E	1.5 m	1 (one)

by the naval routes that pass through the Otranto channel.

Species Systematics

Class BIVALVIA Linnaeus, 1758.

Order OSTREIDA Férussac, 1822.

Superfamily PTERIOIDEA Gray, 1847.

Family ISOGNOMONIDAE Woodring, 1925.

Genus *Isognomon* Lightfoot, 1786.

Type species: *Isognomon perna* (Linnaeus, 1767) *Isognomon legumen* (Gmelin, 1791).

Original name: *Ostrea legumen* Gmelin, 1791.

Distribution and habitat

Isognomon legumen is an Indo-Pacific species with a wide range of distribution from the Philippines to Japan, Hawaii, and the Red Sea (Lam et al., 2008). It is found in the intertidal and subtidal regions attached to boulders, ceilings and walls of submarine caves, mussel aggregations, coral heads, and on pilings (Valentich-Scott, 2003; Lam et al., 2008). In the present study, *I. legumen* was found on the calcareous substrate, characterized by red calcareous algae, mainly *Ellisolandia elongata* and *Ericaria crinita*. The associated invertebrates and rapeseed fauna mainly were represented by *Columbella rustica* (Linnaeus, 1758), *Acanthonyx lunulatus* (Risso, 1816) *Heterotanais gurneyi* (Norman, 1906), *Ptilohyale eburnea* (Krapp-Schickel, 1974), *Pleonexes helleri* (Karaman, 1975), *Dynamene edwardsi* (Lucas, 1849), *Paguristes eremita* (Linnaeus, 1767), *Musculus costulatus* (Risso, 1826), *Phorcus turbinatus* (Born, 1778), and *Mytilus galloprovincialis* (Lamarck, 1819). No other non-indigenous species was found in the samples examined.

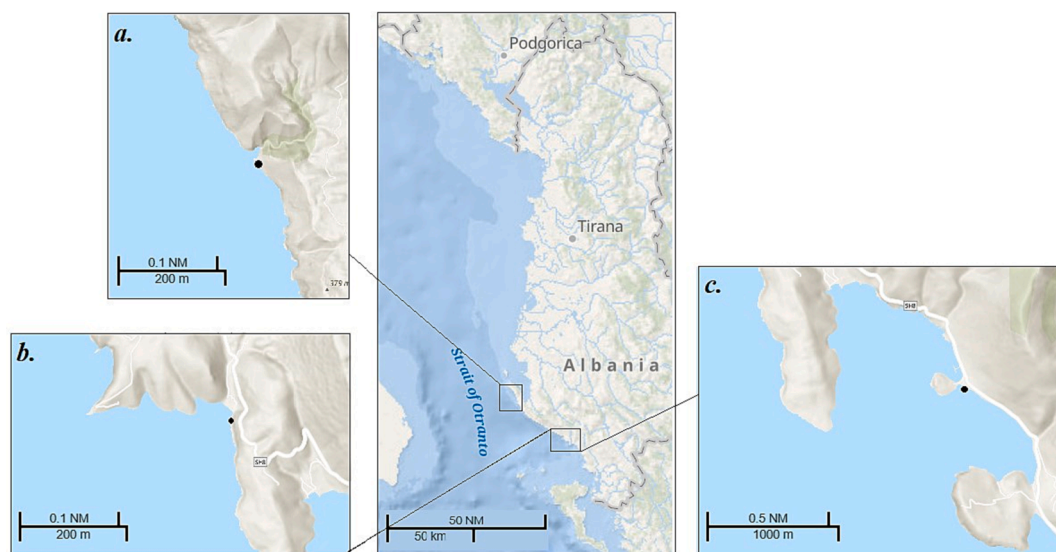


Fig. 1. Map of the areas where *Isognomon legumen* (Gmelin, 1791) has been found in Albania. (a) Dafina Bay, Vlore, (b) Llamani Gulf, and (c) Porto Palermo Bay.

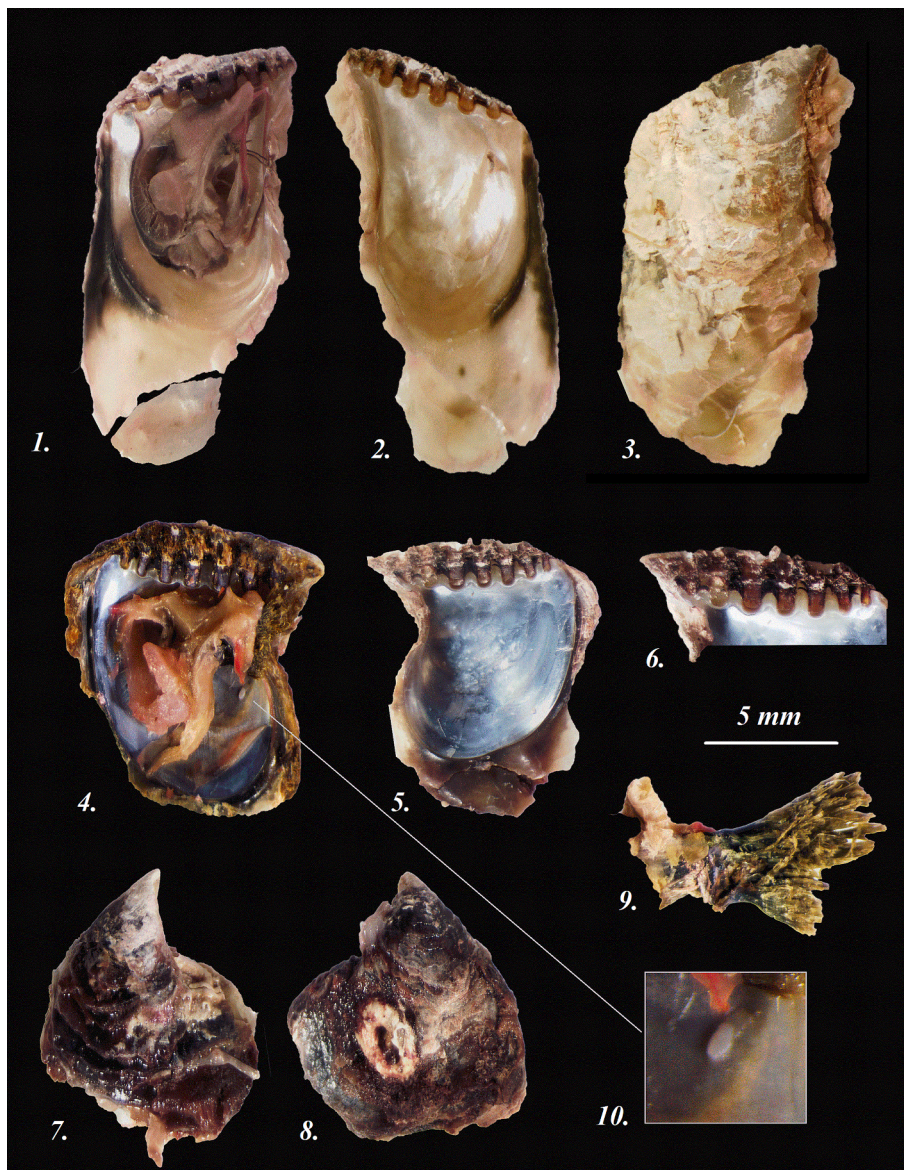


Fig. 2. *Isognomon legumen* (Gmelin, 1791). 2.1; 2.2; and 2.3: Specimen sampled in Dafina Gulf, Sazan Karaburun MPA are showing left and right valve from inside and outside. 2.4. 2.5; 2.7 and 2.8: Specimen sampled in the Gulf of Porto Palermo, Albania, seen from inside and outside. 2.6: View of the hinge structure of the same specimen. 2.9: View of the structure of the byssus filaments from the same specimen. 2.10: Pearl found in the same specimen.

Conclusions

This study confirms the first record of the non-endemic Indo-Pacific *Isognomon legumen* species on the Albanian south-eastern coasts. From age calculation, the species seems to be well established in the area of study. It is recommended to track the magnitude of the expansion of this fouling species to the north-eastern coast of Albania. Furthermore, to study its biology after changing its range of distribution and its impact on the ecosystem and native species.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Declaration

We hereby declare that the manuscript is an original work produced by genuine research, never previously published. No data was fabricated or manipulated (including images).

Ethical clearance.

We further declare that the present study followed international, national, and institutional guidelines for animal treatment and complied with relevant legislation from “for sampling and research on marine protected areas in Albania”. No experiment against Ethical clearance for the use of animals in scientific research has been carried out.

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