

# XENOPHORA

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D. BERSCHAUER

THE TRUE IDENTITY OF *GRADICONUS ANABATHRUM* (CROSS, 1865)

# New records and distributional status of marine Mollusca for the Hellenic Seas (by September 2021)

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Greece, Lessepsian migrant, Mediterranean Sea, Mollusca, New Records

## Abstract

The work is part of the ongoing study of the marine malacofauna of the entire Hellenic territory during the period from May 2021 to September 2021. It incorporates 11 species out of which 6 are known Lessepsian migrants, 2 are new for the Hellenic malacofauna, 7 exhibit a broader distribution, and 7 are second documented records for the area. Main taxonomic characteristics and ecological data, such as habitat, distribution and origin, are presented and discussed.

## Introduction

The molluscan biodiversity of the Hellenic Seas has been influenced by environmental and anthropogenic changes described and discussed by a number of investigators (e.g. Galil, 2000; Galil and Zenetos, 2002; Zenetos *et al.*, 2005; Abdulla and Linden, 2008; Galil *et al.*, 2008; Zenetos *et al.*, 2009; Skliris *et al.*, 2011, Tsiaras *et al.*, 2012). Recent faunistic works revealed some 300 new species (Streftaris and Zenetos, 2007, Manousis *et al.*, 2010, Manousis *et al.*, 2012, Tzomos *et al.*, 2012, Manousis and Galinou-Mitsoudi, 2014, Crocetta *et al.*, 2013, Manousis *et al.*, 2017, Micali *et al.*, 2017, Romani *et al.*, 2017, Manousis *et al.*, 2018a,b; 2019, Mbazios *et al.*, 2020, Manousis *et al.*, 2020a-c, Kontadakis *et al.*, 2021, Manousis *et al.*, 2021a, b, Zaminos *et al.*, 2021). Detailed collecting efforts based on attentive human resources management continue to give us new records.

## Methods

Sampling, handling and species recognition were conducted according to Manousis and Galinou-Mitsoudi (2014) and Mbazios *et al.* (2020) from May 2021 to September 2021 in certain locations throughout the Hellenic Seas. All 1st and 2nd documented records from the Hellenic Seas are listed in Table 1 with collection data. A brief description of certain findings is given below whenever additional information is supportive to their identification. They are all presented in Figures 1-2. The specimens are deposited in the premises of S. Karypidis, G. Mbazios, G. Minos, K. Papavasileiou, T. Rozakis, and T. Manousis. Scientists are welcome to have access to the biological material for inspection by appointment.

## Results

### The records

This work includes 11 completely identified species out of which 2 are known Lessepsian migrants, 2 are new for the Hellenic malacofauna, 2 exhibit a broader distribution to North Aegean Sea and 7 are second documented records for the area.

**Abbreviations:** **AS** – Aegean Sea, **Be** – Beached, **Co** – Common, **E** – Expanded, **EMS** – East Mediterranean Sea, **EMS1** – First record for the East Mediterranean Sea, **FFN** – Fish Farming Nets, **G1** – First record for Greece, **G2** – Second record for Greece, **KLM** – Known Lessepsian Migrant, **Ma** – Maerl, **MB** – Mixed Bottom, **MS** – Mediterranean Sea, **MoS** – Moored Ship, **Pos** – Posidonia, **Ra** – Rare, **SB** – Stony Bottom, **Un** – Uncommon,

**WCMS** – West and Central Mediterranean Sea.

***Isognomon australicus*** (Reeve, 1858) (Fig. 1a). A known for the Mediterranean Sea Lessepsian migrant reported for Greece from Astypalaia, in the Eastern Aegean Sea (Lipej *et al.* 2017; Angelidis and Polyzoulis 2018), Plakias, Crete (Albano *et al.* 2021) and Saronic Gulf (Manousis *et al.*, 2021a).

***Isognomon legumen*** (Gmelin, 1791) (Fig. 1b). Also a known for the Mediterranean Sea Lessepsian migrant reported for Greece initially from Karpathos Island (Micali *et al.*, 2017) and subsequently from Astypalaia, Eastern Aegean Sea (Angelidis and Polyzoulis 2018).

***Dendostrea folium*** (Linnaeus, 1758) (Fig. 1c). This known Lessepsian migrant for Greece (Crocetta *et al.*, 2017) has been last reported from Anavissos Saronic Gulf (Manousis *et al.*, 2021a) and now this 2 years old specimen (Fig. 1c) from NW Aegean (Nea Potidaia, Chalkidiki).

***Dendostrea frons*** (Linnaeus, 1758) (Fig. 1d). A known for the Mediterranean Sea Lessepsian migrant reported for Greece by Zenetos *et al.* (2011) without image documentation. The specimens were detached from the ropes of aquaculture cage nets and their age was estimated to 3 years plus based on the number of the posterior scars of the valves.

***Mendicula ferruginosa*** (Forbes, 1844) (Fig. 1e). Previously reported once for Greece (Manousis *et al.*, 2021a)

***Gibbula vimontiae*** Monterosato, 1884 (Fig. 2a). Previously reported once for Greece (Manousis *et al.*, 2018a).

***Rissoa electrae*** Manousis, 2019 (Fig. 2b). Described recently as sp. n from Thermaikos Gulf (Manousis *et al.*, 2019).

***Vexillum hypatiae*** (Pallary, 1912) (Fig. 2c) has been reported for Greece twice from Karpathos Island (Micali *et al.*, 2014, Mbazios *et al.*, 2020).

***Aplus gaillardoti*** (Puton, 1856) (Fig. 2d) Described rather recently as sp. n from Astypalea, Kotsoumiti and Paxos Islands, Greece as well as from Lebanon by Aissaoui *et al.* (2016). This is the second image documented presence of the species in the Hellenic waters.

***Cingulina isseli* (Tryon, 1886)** (Fig. 2e). Our shells fit the given description for the species (<http://www.ciesm.org/atlas/Cingulinaisseli.html>) and the figure of NHMR. The depicted one is translucent-white, is elongated cirriconoid with 7 teleconch whorls, each bearing three robust spiral cords and evident incremental lines between the cords, and has base with 1 cord, sub circular aperture, umbilical rim, weak columellar fold and type A2 heterostrophic protoconch. It is 4 mm high and 1.35 mm wide. It remotely resembles *Seila trilineata* (Philippi, 1836) due to its turriculate outlook and the spirally decorated shell, but the latter is much bigger, conical, of light to dark brown colour and does not possess the heterostrophic protoconch. It also resembles the alien to the Mediterranean *Oscilla jocosa* Melvill, 1904, which is smaller, with proportionally larger body whorl, and sharper and somehow beaded spiral keels. The lack of tooth emphasized by van Aartsen (1994) is not significant as a distinguishing character, as there are specimens with a conspicuous tooth also (Zenetos *et al.*, 2004a).

***Tibersyrnola unifasciata*** (Forbes, 1844) (Fig. 2f) has been previously reported for Greece (Manousis *et al.*, 2020a), though this time it was collected live and wet stored (96% ethanol).

***Bulla arabica*** Malaquias & D. Reid, 2008 (Fig. 3a), a known Lessepsian migrant, has been initially reported for Greece from Saronikos Gulf by Vardala-Theodorou (1999) misidentified as *B. ampulla* Linnaeus, 1758 (Zenetos *et al.*, 2011; Crocetta *et al.*, 2017). Since then, it has been collected from the Gulf of Corinth, Monastiraki Gulf of Patras, Kimolos Island, and Fragkokastello Crete Island (present publication).

***Amphorina linensis*** (Garcia-Gomez, Cervera & Garcia, 1990) (Fig. 3b). Elongated hyaline animal of some 15 mm, with an overall blue-white coloration and some irregular red-brown spots dorsally. The edge of the foot exhibits a fine iridescent white pigmentation which becomes more evident on the apices of the cerata, the rhinophores and the oral tentacles. The rhinophores are smooth and much longer than the oral tentacles. The cerata are arranged in rows and in some 9-10 groups, are elongated and narrower at the base, with the digestive gland inside light brown and visible by transparency. The species inhabits rocky infralittoral areas of the W and C Mediterranean Sea (Gofas *et al.*, 2011).

## Discussion

This work includes results of the period from May 2021 to September 2021 and is part of the ongoing study of the marine malacofauna of the entire Hellenic territory. It incorporates 11 species out of which 1 is new for the Eastern Mediterranean Sea, 6 are known Lessepsian migrants and 2 are new for the Hellenic malacofauna, and 7 exhibit a broader distribution. An additional species (*Rissoa electrae*) is reported from a new locality.

Bioinvasions have been recognized as a serious threat in the Mediterranean (Galil *et al.*, 2015) with main vector of introduction the progressive entrance via the Suez Canal (Lessepsian migration or Erythrean invasion). Thus, the area most affected by this migration is the Levantine Sea (Por, 1990; Galil and Zenetos, 2002). Since Pancucci-Papadopoulou *et al.* (2005) have shown an increasing tendency in the introduction of alien species in the Hellenic Seas, 19 more Lessepsian migrants have been reported (e.g. Manousis *et al.*, 2010; 2020a-c; 2021a,b, Manousis and Galinou-Mitsoudi, 2014, Zenetos *et al.*, 2020, Kontadakis *et al.*, 2021). This number is added to the, by then, already known 28 Lessepsian migrants (Pancucci-Papadopoulou *et al.* 2005).

*Isognomon australicus* (Reeve, 1858) and *Isognomon legumen* (Gmelin, 1791) have both expanded to the Ionian Sea.

*Dendostrea folium* (Linnaeus, 1758) and *D. frons* (Linnaeus, 1758) have also expanded north: *D. folium* from the South Aegean Sea to North Aegean Sea, and *D. frons* to Argolic Gulf where established. *D. folium* has been originally reported for Greece by Zenetos *et al.* (2011) without image documentation.

*Mendicula ferruginosa* (Forbes, 1844) and *Gibbula vimontiae* Monterosato, 1884 are second image documented records for Greece (Manousis *et al.*, 2021a and Manousis *et al.*, 2018a, respectively).

*Rissoa electrae* Manousis, 2019 new findings - some tens of kilometers away from the type localities of Palioura, Epanomi and Cape, Epanomi (Manousis *et al.*, 2019) and three years after the original records, comprise further evidence that the species is a permanent inhabitant of Eastern Thermaikos Gulf. Since the first finding, its presence in other locations is carefully monitored.

*Vexillum hypatiae* (Pallary, 1912) is considered a rare species (Repetto *et al.*, 2005, Öztürk *et al.*, 2015). Its double record from Karpathos Island and now from North Crete with 6 specimens is indicative of a broader presence in the Sea of Crete and a status that should change from rare to uncommon.

*Aplus gaillardoti* (Puton, 1856) seems to have a broader presence in the Hellenic waters, as after its 1st report from Astypalea, Kotsoumiti and Paxos Islands (Aissaoui *et al.*, 2016), is now reported from the Saronic Gulf.

Our findings of *Cingulina isseli* in the Aegean Sea are indicative of a recent NW expansion of the species and establishment of an active population as our specimens are fresh and the area where found has been thoroughly and repeatedly searched in the past. The species presence is rather expected after taking into account the geographic position of the area which has been characterized as hotspot for alien species in the Mediterranean Sea (Zenetos *et al.*, 2020), the environmental conditions (e.g. higher temperature and salinity that are more favorable for the alien species arriving via the Suez Canal, as designated by Zenetos *et al.* in 2004b), the Eastern Mediterranean hydrography which is characterized by waterside currents moving anticlockwise from the coasts of Egypt to south of Turkey and then up to the Aegean Sea through the Dodecanese (Manousis and Galinou-Mitsoudi, 2014), and finally the recent finding of the long known Lessepsian minute Pyramidellid *Odostomia* sp. which exhibits a similar record history as that of *Cingulina isseli* (Zaminos *et al.*, 2021).

*Tibersyrnola unifasciata* (Forbes, 1844). This is the 2nd image documented report of the species from Greece as it has been previously reported once more (Manousis *et al.*, 2020a)

The finding of *Bulla arabica* in Kimolos Island of the Cyclades Archipelago is further evidence that the species has expanded throughout the South Seas of Greece.

*Amphorina linensis* (Garcia-Gomez, Cervera & Garcia, 1990) (Gofas *et al.*, 2011) was known until now from the West and Central Mediterranean. It's finding in the Eastern Mediterranean Basin is no surprise as the Hellenic Seas are only relatively recently intensively and extensively searched.

As mentioned above, the majority of the recorded alien species has expanded and/or established. The Hellenic marine ambient conditions nowadays seem to be suitable for those species as the Hellenic seas are being converted from temperate to sub tropic or tropic. During the summer of 2021 the sea temperature of N Aegean was measured to be over 30°C, even at depths of up to 20 m; identical to that of the tropic seas (<https://oceanexplorer.noaa.gov/facts/temp-vary.html>). If the climatic change continues, the biodiversity is expected to change even further with numerous organisms expected to be introduced and established all over the Mediterranean Sea

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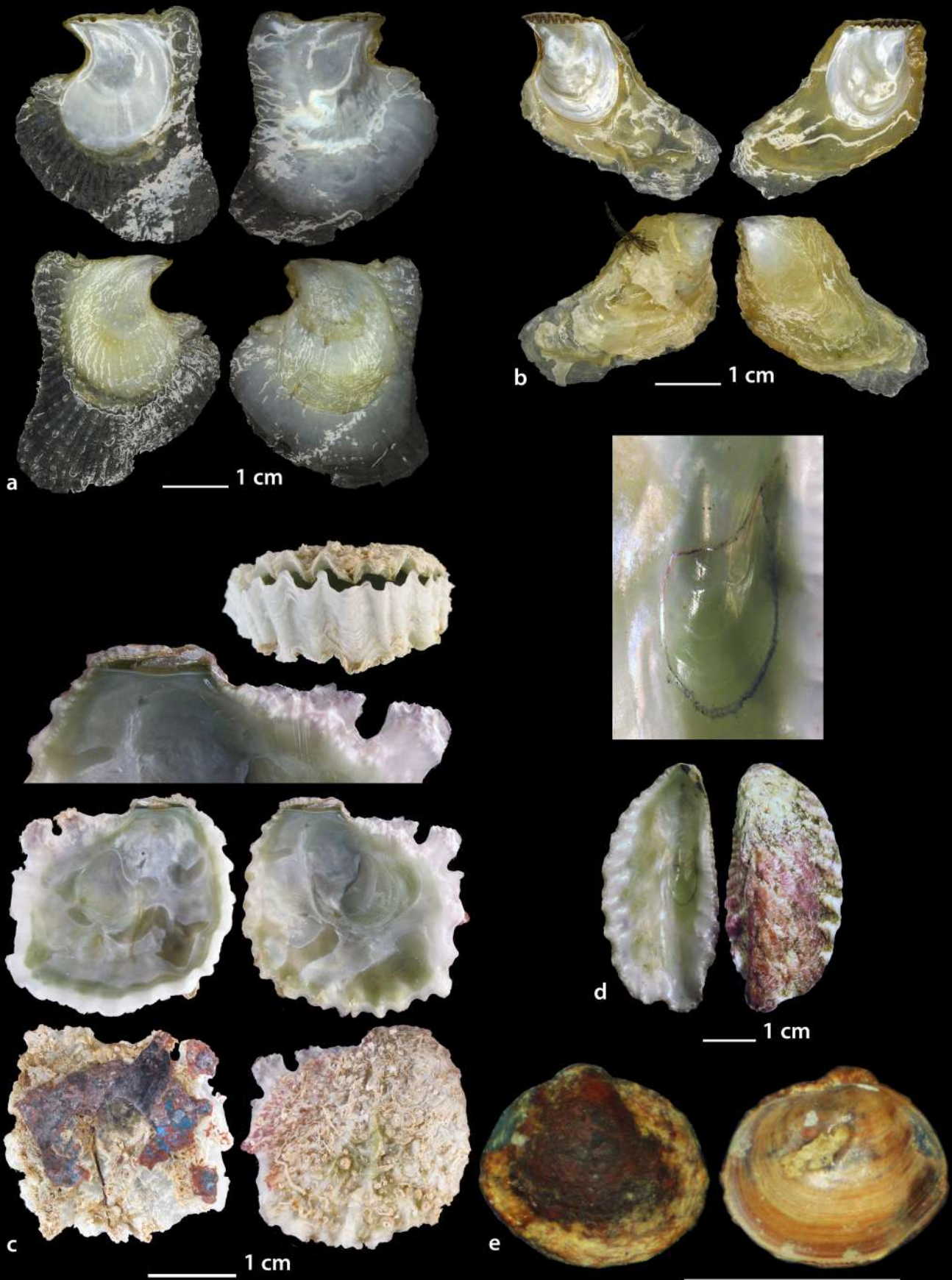
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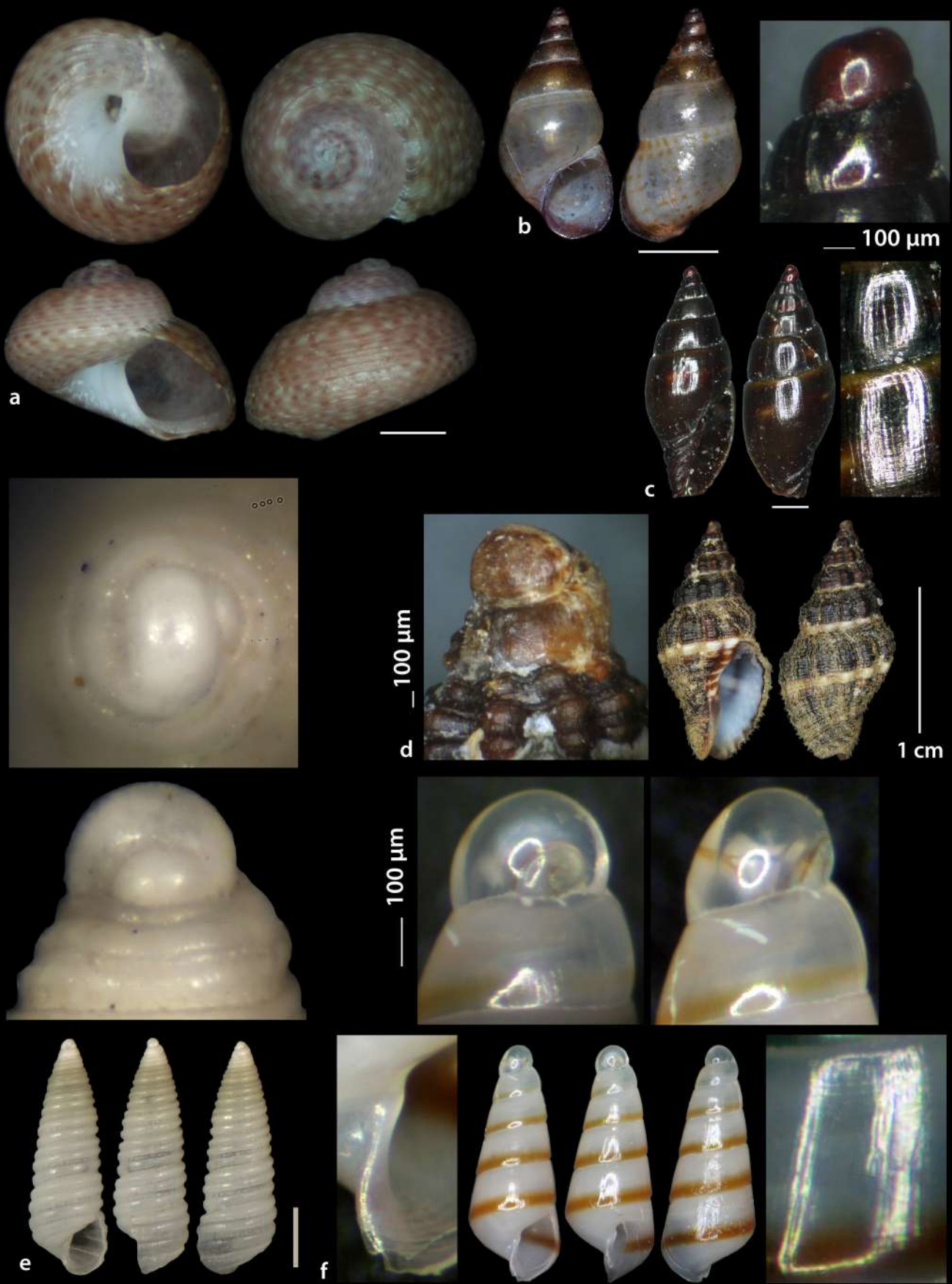
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PLATE 1



a. *Isognomon australicus* (Reeve, 1858), b. *Isognomon legumen* (Gmelin, 1791), c. *Dendostrea folium* (Linnaeus, 1758), d. *Dendostrea frons* (Linnaeus, 1758), e. *Mendicula ferruginosa* (Forbes, 1844). Barr = 1 mm, unless otherwise indicated.

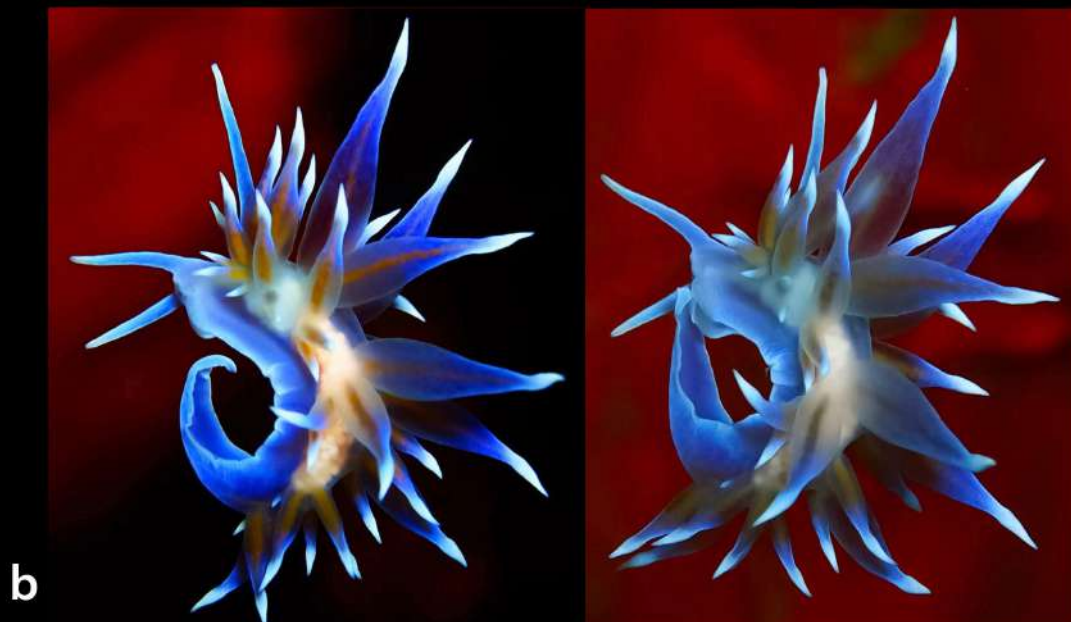
PLATE 2



a. *Gibbula vimontiae* Monterosato, 1884, b. *Rissoa electrae* Manousis, 2019, c. *Vexillum hypatiae* (Pallary, 1912), d. *Aplus gaillardoti* (Puton, 1856), e. *Cingulina isseli* (Tryon, 1886), f. *Tibersyrnola unifasciata* (Forbes, 1844). Barr = 1 mm, unless otherwise indicated.



PLATE 3



a. *Bulla arabica* Malaquias & D. Reid, 2008,  
b. *Amphorina linensis* (Garcia-Gomez, Cervera & Garcia, 1990). Barr = 1 cm..

Table 1: List of recorded species with collection data and corresponding references.

Class	Family	Species	Figure	Shells	Live	Depth m	Bottom	Area	Global coordinates	Rarity	Origin	Record	Relevant Literature
Bivalvia	Isognomomidae	<i>Isognomon australicus</i> (Reeve, 1858)	1a	1	2	SB	Mitikas, Preveza	38°59'N – 20°41'E	Un	KLM	E	Angelidis & Polyzoulis, 2018 Manousis <i>et al.</i> , 2021a	
		<i>Isognomon legumen</i> (Gmelin, 1791)	1b	1	2	SB	Mitikas, Preveza	39°00'N – 20°42'E	Un	KLM	E	Micali <i>et al.</i> , 2017 Angelidis & Polyzoulis, 2018	
Gastropoda	Ostreidae	<i>Dendostrea folium</i> (Linnaeus, 1758)	1c	1	2	MoS	Nea Potideaia, Chalkidiki	40°11'N – 23°19'E	Co	KLM	E	Crocetta <i>et al.</i> , 2017 Loderos <i>et al.</i> , 2020 Manousis <i>et al.</i> , 2021a	
		<i>Dendostrea fons</i> (Linnaeus, 1758)	1d	5	5	FFN	Akra Thyri, Argolic Gulf	37°23'N – 23°03'E	Co	KLM	G2, E	Zenetos <i>et al.</i> , 2011, no image documentation <a href="http://www.marinespecies.org/aphia.php?p=image&amp;tid=420779&amp;pic=66524">http://www.marinespecies.org/aphia.php?p=image&amp;tid=420779&amp;pic=66524</a>	
	Thyasiridae	<i>Mendicula ferruginosa</i> (Forbes, 1844)	1e	1	40-80	MB	Gulf of Souda	35°28'N – 24°10'E	Ra	MS	G2	Manousis <i>et al.</i> , 2021a	
		<i>Gibbula vimontiae</i> Monterosato, 1884	2a	4	0	Be	Stavros, Chania, Crete Island	35°35'N – 24°05'E	Un	MS	G2	Scaperrotta <i>et al.</i> , 2010	
	Rissoiidae	<i>Rissoa electrae</i> Manousis, 2019	2b	5	0	Be	Kalamaria, Thessaloniki	35°16'N – 23°33'E	Un	AS	G2	Manousis <i>et al.</i> , 2019	
		<i>Vexillum hypatae</i> (Pallary, 1912)	2c	6	20	MB	Chania, Crete Island	35°30'N – 23°59'E	Ra	EMSI	E	Repetto <i>et al.</i> , 2005 Micali <i>et al.</i> , 2014 Mbazos <i>et al.</i> , 2020	
	Pisaniidae	<i>Aplus guillardoti</i> (Paton, 1856)	2d	2	2	MB	Anavyssos, Saronic Gulf	37°44'N – 23°54'E	Un	EMS	G2	Aissouli <i>et al.</i> , 2016	
		<i>Cingulina isseli</i> (Tryon, 1886)	2e	4	0	Be	Toroni, Toroneos Gulf	40°23'N – 22°53'E	Un	KLM	G1, E	<a href="http://www.ciesm.org/alias/C/mgulinaiisseli.html">http://www.ciesm.org/alias/C/mgulinaiisseli.html</a>	
	Pyramidelidae	<i>Tibersynola unifasciata</i> (Forbes, 1844)	2f	1	50	Ma	Toroni, Toroneos Gulf	39°58'N – 23°53'E	Ra	MS	G2	Giannuzzi-Savelli <i>et al.</i> , 2014	
		<i>Bulla arabica</i> Malaquias & D. Reid, 2008	3a	1	5	Pos	Gulf of Corinth	37°58'N – 22°49'E	Un	KLM	G2, E	Manousis <i>et al.</i> , 2020a Vardala-Theodorou, 1999, as <i>B. ampullia</i> Linnaeus, 1758 Malaquias & Reid, 2008	
Bullidae	<i>Amphorina linensis</i> (Garcia-Gomez, Cervera & Garcia, 1990)	3b	1	10	MB	Monastiraki, Gulf of Patras	38°24'N – 21°56'E	Un	KLM	G1, E	Zenetos <i>et al.</i> , 2011		
	<i>Amphorina linensis</i> (Garcia-Gomez, Cervera & Garcia, 1990)	3b	1	5	MB	Kimolos Island	36°47'N – 24°34'E	Un	KLM	G1, E	Zenetos <i>et al.</i> , 2011		
Eubranchidae	<i>Amphorina linensis</i> (Garcia-Gomez, Cervera & Garcia, 1990)	3b	1	5	MB	Fragkokastello, Crete Island	35°10'N – 24°13'E	Un	KLM	G1, E	Crocetta <i>et al.</i> , 2017 Manousis, 2021a, b		
	<i>Amphorina linensis</i> (Garcia-Gomez, Cervera & Garcia, 1990)	3b	1	20	MB	Porto Ennia, Keratea, Attica	37°47'N – 24°05'E	Un	WCMS	G1	Gofas <i>et al.</i> , 2011 Korshunova <i>et al.</i> , (2020)		