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Inventory of Crustacea Decapoda and Stomatopoda from Rhodes island (Eastern Mediterranean Sea), with emphasis on rare and newly recorded species

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The list of decapod and stomatopod crustacean fauna of Rhodes island (SE Aegean Sea, Eastern Mediterranean Sea) is updated, with the addition of 14 decapods and one stomatopod collected during the last six years. The occurrence of the pelagic crab *Planes minutus* is recorded for the first time in the Hellenic waters, while the finding of the species *Parasquilla ferussaci*, *Paractaea monodi*, *Paragalene longicrura* and *Spinolambrus macrochelos*, rarely captured in the Mediterranean Sea, is documented in detail, with notes on their geographical distribution. The crustaceans recorded around the island number today 109 decapod and 4 stomatopod species. About 16% of them is composed of alien species, mostly entered the South Aegean during the last two decades. A comparison between the decapod fauna of Rhodes and neighboring areas is also presented.

Key words: Decapoda, Stomatopoda, distribution, alien species, Eastern Mediterranean Sea.

INTRODUCTION

The island of Rhodes, located in the SE Aegean Sea and very close to the NW Levantine Sea, is influenced by intense hydrological phenomena. The Rhodes gyre, south-east of the island, and the Asia Minor Current (AMC) are the major hydrological features affecting the area, which is characterized by a sub-tropical open-sea environment. Surface salinity ranges from 39.0‰ to 39.6‰ and temperature from 16.4ºC to 28.5ºC in winter and summer, respectively (Corsini-Foka, 2010; Pancucci-Papadopoulou *et al*., 2011, 2012). Due to these characteristics, similar to the Levantine Basin (Mavruk & Avsar, 2008), the island and the nearby region were classified as part of the biogeographic "Lessepsian Province" of the Mediterranean Sea (Por, 1990), since it offers suitable environmental conditions for the establishment of thermophilous organisms, including tropical or sub-tropical species from the Red Sea and the Indo-Pacific ocean introduced via the Suez Canal (the so-called Lessepsian immigrants).

Moreover, the evolution of the Eastern Mediterranean Transient (EMT) (Theocharis & Lascaratos, 2000; Galil & Kevrekidis, 2002), the global warming and the tropicalization of the Mediterranean Sea (Bianchi, 2007; Occhipinti-Ambrogi, 2007), together with the probable existence of vacant niches, contribute to enhance the rate of introduction in the area and the opportunities for introduced warm-water alien species to establish viable populations (Raitsos *et al*., 2010; Pancucci-Papadopoulou *et al*., 2011). The term "alien species" is used here following the definition of the Convention on Biological Diversity (http://www.cbd.int/invasive/terms.shtml).

There is no doubt that the marine region around Rhodes presents a great zoogeographical significance for the whole Mediterranean, as it is the first Aegean area which Lessepsian immigrants meet in their way from the Levantine following the Asia Minor coasts and the main pathway of their further spreading (Corsini-Foka, 2010; Pancucci-Papado-

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poulou *et al.,* 2012). Thus, improvement of the knowledge on the biodiversity of this region contributes to assess possible rearrangements of its composition which could lead to loss of native biota and alteration of ecosystem functioning and productivity.

Decapods are an important benthic group, represented in the Mediterranean Sea by 384 species (Coll *et al*., 2010). Although prevalently Atlanto-Mediterranean, with a minority of endemic species, the Mediterranean decapod fauna includes today a large number of alien species (20% of the total decapod fauna, see Zenetos *et al.*, 2010), showing a fast establishment and spreading into the basin; the majority of them are of Red Sea/Indo-Pacific origin and occur in the Eastern Mediterranean Sea introduced via the Suez Canal (Galil, 2006, 2011; Koukouras *et al*., 2010; Zenetos *et al*., 2010).

It is also worth mentioning that, in contradiction to the total of alien invertebrates in Greece, where molluscs are the leading group (Zenetos *et al*., 2009), in the study area crustaceans are dominant, followed by molluscs, polychaetes and echinoderms (Pancucci-Papadopoulou *et al*., 2012).

Twelve stomatopod species are known in the Mediterranean Sea, including three aliens of Indo-Pacific origin (Colmenero *et al*., 2009; Froglia, 2010; Zenetos *et al.*, 2010).

Knowledge on the decapod and stomatopod crustacean diversity along the coasts of Rhodes Island has increased in the last years, mostly due to the finding of alien species introduced via the Suez Canal and the Gibraltar Strait.

In the review conducted by Kevrekidis & Galil (2003), 83 Decapoda (8 Dendrobranchiata, 11 Caridea, 8 Thalassinidea, 4 Palinura, 16 Anomura, 36 Brachyura) and 3 Stomatopoda Crustacea were recorded from Rhodes Island, including alien species of Red Sea/Indo-Pacific (4 Dendrobranchiata, 2 Brachyura and 1 Stomatopoda) and Atlantic origin (1 Brachyura). Two native species were later added to the local fauna, *Bathynectes longipes* (Risso, 1816) (Corsini-Foka *et al*., 2004) and *Herbstia condyliata* (Fabricius, 1787) (Corsini & Kondilatos, 2006), while a noticeable number of alien brachyurans were recorded (1 species introduced from the Atlantic, 9 from the Indo-Pacific ocean) (Corsini-Foka *et al*., 2010 and references therein), increasing the decapod species known from the island to 95.

The aim of this work is to update the list of the decapod and stomatopod crustacean species occurring in the shallow and deep waters around the island and to provide new information on their distribution in the Eastern Mediterranean Sea. Furthermore, decapod species diversity of the Aegean waters, Cyprus and Levantine coasts of Turkey is briefly discussed.

MATERIALS AND METHODS

The present work is based on the information available to date from the scientific literature, after careful verification and reference cross-checking. Additional records of species collected from various localities along the northwestern and eastern coasts of the island (Fig. 1) in the period 2006-2011 are also included. Various sampling methods were used, namely fishing nets, boat seining, crayfish traps, snorkeling and hand-nets, while a specimen was found in a prefilter of the public Aquarium installations, supplied by seawater pumped at depth of 32 m.

The main sources for specimens' identification were Holthuis (1987), Noël (1992) and Falciai & Minervini (1992). In particular cases, Manning (1977), Tan & Ng (2007) and Mavidis *et al*. (2009) were used. The sites "European Register of Marine Species" (http://www.marbef.org/data/erms.php) and "World Register of Marine Species" (http://www.marinespecies.org) were consulted for scientific nomenclature and the site "Greek biodiversity" (http://greek-biodiversity.web.auth.gr) for biogeographic information.

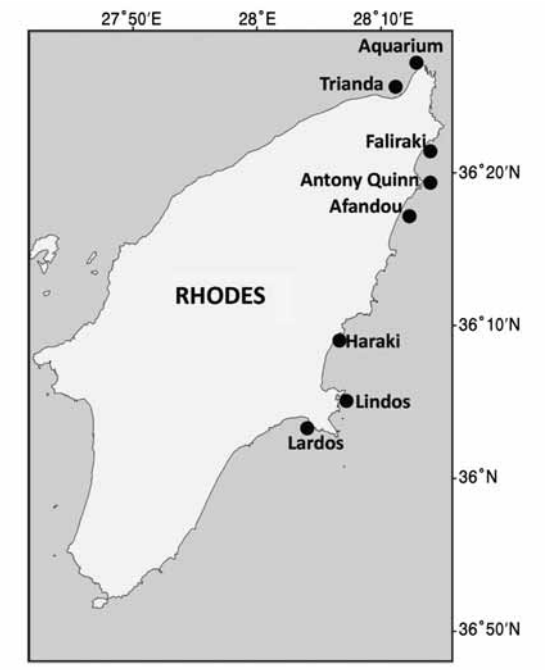

FIG. 1. Map of Rhodes island showing the sampling localities.

Specimens were preserved in 70% alcohol, while the large-sized were dried; they have been deposited in the collection of the Hydrobiological Station of Rhodes (HSR) of the Hellenic Centre for Marine Research (HCMR) or in the HCMR collection.

The following abbreviations were used throughout the text: CL, carapace length; CW, carapace width; TL, total body length.

RESULTS

A total of 109 decapods and 4 stomatopods are listed in the present study (Table 1), including one stomatopod and 14 decapod species (1 Dendrobranchiata, 2 Caridea, 3 Anomura and 8 Brachyura) new to the marine fauna of Rhodes Island. Six of them were collected on coarse substrate (biogenic detritus mixed with mud), at depths between 100 m and 200 m (Haraki and Lindos, Fig. 1). Specimens of the remaining nine species were collected mainly in shallow waters down to 30 m depth, on sandy, rocky or sandy muddy substrate covered with vegetation.

Data on the collected material, sampling sites, methods, habitat, along with body measurements and detailed information on the distribution of the six most interesting species are given below, while data on the remaining species newly reported from Rhodes are given in Table 2.

TABLE 1. Updated list of Stomatopoda and Decapoda Crustacea from Rhodes island

Stomatopoda	
Parasquillidae	*Parasquilla ferussaci* (Roux, 1830)*
Squillidae	*Erugosquilla massavensis* (Kossmann, 1880)
	Rissoides pallidus (Giesbrecht, 1910)
	Squilla mantis (Linnaeus, 1758)
Decapoda	
Dendrobranchiata	
Penaeidae	*Marsupenaeus japonicus* (Bate,1888)
	Melicertus kerathurus (Forskål, 1775)
	Metapenaeopsis aegyptia Galil & Golani, 1990
	Metapenaeopsis mogiensis consobrina (Nobili, 1904)
	Parapenaeus longirostris (Lucas,1846)
	Trachysalambria palaestinensis Steinitz, 1932
	Sicyonia carinata (Brünnich, 1768)
Solenoceridae	*Solenocera membranacea* (Risso,1816)
Stenopodidae	*Stenopus spinosus* Risso, 1827*
Caridea	
Alpheidae	*Alpheus dentipes* Guérin-Méneville, 1832
	Synalpheus gambarelloides (Nardo,1847)
Crangonidae	*Aegaeon cataphractus* (Olivi,1792)
Gnathophyllidae	*Gnathophyllum elegans* (Risso,1816)*
Hippolytidae	*Lysmata seticaudata* (Risso,1816)*
Palaemonidae	*Palaemon elegans* Rathke,1837
	Palaemon xiphias Risso,1816
	Palaemonetes antennarius (H. Milne-Edwards, 1837)
	Pontonia pinnophylax (Otto,1821)
Pandalidae	*Plesionika edwardsii* (Brandt, 1851)
	Plesionika narval (Fabricius, 1787)
Processidae	*Processa acutirostris* Nouvel & Holthuis, 1957
	Processa macrophthalma Nouvel & Holthuis, 1957
Thalassinidea	
Callianassidae	*Callianassa candida* (Olivi, 1792)
	Callianassa subterranea (Montagu, 1808)
	Callianassa tyrrhena (Petagna, 1792)
	Gourretia denticulata (Lütze, 1837)
Upogebiidae	*Upogebia pusilla* (Petagna, 1792)
	Upogebia stellata (Montagu, 1808)
	Upogebia talismani (Bouvier, 1915)
	Upogebia tipica (Nardo, 1869)
Palinura	
Palinuridae	*Palinurus elephas* (Fabricius, 1787)
Scyllaridae	*Scyllarides lat*us (Latreille, 1803)
	Scyllarus arctus (Linnaeus, 1758)
	Scyllarus pygmaeus (Bate, 1888)
Anomura	
Diogenidae	*Calcinus tubularis* (Linnaeus, 1767)
	Clibanarius erythropus (Latreille,1818)
	Dardanus arrosor (Herbst,1796)
	Dardanus calidus (Risso,1827)
	Diogenes pugilator (Roux,1829)
	Paguristes eremita (Linnaeus,1767)
Paguridae	*Anapagurus bicorniger* A. Milne-Edwards & Bouvier, 1892*
	Anapagurus laevis (Bell, 1846)
	Anapagurus petiti Dechancé & Forest, 1962*
	Cestopagurus timidus (Roux, 1830)
	Pagurus anachoretus Risso, 1827
	Pagurus prideaux Leach, 1815
Galatheidae	*Galathea intermedia* Lilljeborg, 1851
	Galathea machadoi Barrois, 1888
	Galathea squamifera Leach, 1814
	Galathea strigosa (Linnaeus, 1767)
	Munida curvimana A. Milne-Edwards & Bouvier, 1894*
Porcellanidae	*Pisidia bluteli* (Risso,1816)
	Porcellana platycheles (Pennant, 1777)

Brachyura	
Calappidae	*Calappa granulata* (Linnaeus, 1758)
Dromiidae	*Dromia personata* (Linnaeus, 1758)
Epialtidae	*Acanthonyx lunulatus* (Risso,1816)
	Herbstia condyliata (Fabricius, 1787)
	Lissa chiragra (Fabricius, 1775)*
	Pisa armata (Latreille, 1803)
	Pisa corallina (Risso, 1816)
	Pisa muscosa (Linnaeus, 1758)
	Pisa tetraodon (Pennant, 1777)
Eriphiidae	*Eriphia verrucosa* (Forskål, 1775)
Ethusidae	*Ethusa mascarone* (Herbst, 1785)
Goneplacidae	*Goneplax rhomboides* (Linnaeus, 1758)
Grapsidae	*Pachygrapsus marmoratus* (Fabricius, 1787)
	Planes minutus (Linnaeus, 1758)*
Homolidae	*Homola barbata* (Fabricius, 1793)
Inachidae	*Inachus communissimus* (Rizza, 1839)
	Inachus dorsettensis (Pennant, 1777)
	Inachus leptochirus (Leach, 1817)
	Inachus thoracicus (Roux, 1830)
	Macropodia rostrata (Linnaeus, 1761)
Latreilliidae	*Latreillia elegans elegans* (Roux, 1830)
Leucosiidae	*Coleusia signata* Paulson, 1875
	Ilia nucleus (Linnaeus, 1758)
	Ixa monodi Holthuis & Göttlieb, 1956
	Myra subgralunata Kossmann, 1877
Macrophthalmidae	*Macrophthalmus graeffei* A. Milne-Edwards, 1873
Majidae	*Eurynome aspera* (Pennant, 1777)
	Maja crispata (Risso, 1827)
	Maja goltziana d'Oliveira, 1888*
	Maja squinado (Herbst, 1788)
Ocypodidae	*Ocypode cursor* (Linnaeus, 1758)
Palicidae	*Palicus caronii* (Roux, 1830)
Parthenopidae	*Derilambrus angulifrons* (Latreille, 1825)*
	Spinolambrus macrochelos (Herbst, 1790)*
Pilumnidae	*Pilumnus hirtellus* (Linnaeus, 1761)
	Pilumnus villosissimus (Rafinesque, 1814)*
Plagusiidae	*Percnon gibbesi* (H. Milne Edwards, 1853)
Polybiidae	*Liocarcinus navigator* (Herbst, 1794)
	Liocarcinus corrugatus (Pennant, 1777)
	Liocarcinus depurator (Linnaeus, 1758)
	Liocarcinus zariquieyi (Gordon, 1968)
Portunidae	*Bathynectes longipes* (Risso, 1816)
	Callinectes sapidus Rathbun, 1896
	Carupa tenuipes Dana, 1851
	Charybdis hellerii (A. Milne-Edwards, 1867)
	Charybdis longicollis Leene, 1938
	Gonioinfradens paucidentatus (A. Milne Edwards, 1861)
	Portunus hastatus (Linnaeus, 1767)
	Portunus segnis (Linnaeus, 1758)
	Thalamita poissonii (Audouin, 1826)
Progeryonidae	*Paragalene longicrura* (Nardo, 1869)*
Xanthidae	*Atergatis roseus* (Rüppell, 1830)
	Monodaeus guinotae Forest, 1976
	Paractaea monodi Guinot, 1969*
	Xantho granulicarpus Forest, 1953
	Xantho poressa (Olivi, 1792)

* Species recorded in the present work

TABLE 2. Additional decapod crustacean species new to the Rhodes island fauna, along with collection data

	Date	Method	Location	Substrate	Depth (m)	Specimens number/sex	Catalogue Number
Dendrobranchiata							
Stenopus spinosus Risso, 1827	November 2006	Boat seining	Trianda	Sandy mud, vegetation	5-30	1 ♀	HSR61
Caridea							
Gnathophyllum elegans (Risso, 1816)	7/2/2007	Boat seining	Trianda	Sandy mud, vegetation	5-30	1 ♀	HSR62
Lysmata seticaudata (Risso, 1816)	5/5/2008	Aquarium prefilter	Aquarium	Sand, gravel	32	1 ♂	HSR63
Anomura							
Anapagurus bicorniger A. Milne-Edwards & Bouvier, 1892	22/7/2009	Grab Ponar	Antony Quinn	Sand	6	1 ♀	C103
Anapagurus petiti Dechancé & Forest, 1962	22/7/2009	Grab Ponar	Faliraki	Sand	6	1 ♀	C104
Munida curvimana A. Milne-Edwards & Bouvier, 1894	May 2010	Crayfish trap	Haraki	Biogenic detritus, rocks	200	2 ♂	HSR64 HSR65
Brachyura							
Lissa chiragra (Fabricius, 1775)	28/6/2010	Crayfish trap	Haraki	Biogenic detritus, rocks	200	1 ♂	HSR66
Derilambrus angulifrons (Latreille, 1825)	2009			*Lagocephalus sceleratus* stomach		1 ♂	HSR72
Pilumnus villosissimus (Rafinesque,	22/2/2010	Hand-net	Lindos	Rocky	2	1 ♂	HSR75
1814)	20/6/2010	Hand-net	Faliraki	Rocky	5	1 ♂	HSR76

PARASQUILLIDAE

***Parasquilla ferussaci* (Roux, 1830)**

Material

1 ♂; CL (excluding rostrum): 23.1 mm, TL: 92.7 mm; station Haraki; crayfish trap; depth 150 m; biogenic detritus mixed to mud, rocks present; 18 May 2010; Catalogue number HSR60.

Remarks

Parasquilla ferussaci (Fig. 2) is considered a rare species (Özcan *et al*., 2008a). Its usual habitat appears to be the muddy and lightly sandy substrates (Abelló *et al*., 1993), at depths between 175 and 700 m, but also on the continental shelf (Colmenero *et al*., 2009). The known distribution of *P. ferussaci* comprises the Eastern Central Atlantic and the Mediterranean Sea, mainly its western part (Colmenero *et al*., 2009 and references therein). The occurrence of the species in the Eastern Mediterranean was firstly reported from Rethymnon Bay, northern coast of Crete, at 50 m of depth on soft bottom (Dounas & Steudel, 1994) and more recently in the Turkish waters of the NE Aegean Sea, near Babakale, at depth between 150 and 200 m, on sandy-silt bottom (Özcan *et al*., 2008a).

FIG. 2. Male specimen of *Parasquilla ferussaci*, TL 92.7 mm (Photo: G. Kondylatos).

MAJIDAE

***Maja goltziana* d'Oliveira, 1888**

Material

1 ♂; CL: 71.6 mm, CW: 50.0 mm; station Trianda; boat seining; depth 5-30 m; sandy mud with vegetation; 20 June 2007; Catalogue number HSR67. 1 ♂; CL: 83.2 mm, CW: 57.3 mm; station Trianda; boat seining; depth 5-30 m; sandy mud with vegetation; 17 August 2008; Catalogue number HSR68.

Remarks

According to Udekem d'Acoz (1999), *M. goltziana* is distributed in the Eastern Atlantic Ocean and the Mediterranean Sea. The species was first recorded from the Mediterranean Sea off the coast of Israel in the late 1950's (Holthuis & Gottlieb, 1958). Later, it was recorded in the Levantine basin and the Aegean Sea (Ramadan & Dowidar, 1972; Koukouras, 1979; Kocataş, 1981; Koukouras *et al*., 1992), the Ionian Sea (Pastore, 1983), the strait of Sicily (Pipitone & Tumbiolo, 1993), the Adriatic (Pallaoro & Dulčić, 2004) and the Tyrrhenian Sea (Vignoli *et al*., 2004; Soppelsa *et al*., 2005). Recently, it was found in the North Aegean Sea (Artüz, 2006).

Although considered by far the rarest species of the Majidae family (Zariquiey Alvarez, 1968), recent studies conducted in Lebanese and Syrian coasts confirmed its frequent occurrence in the Levantine basin (Hasan *et al*., 2008; Lelli *et al*., 2008).

XANTHIDAE

***Paractaea monodi* Guinot, 1969**

Material

1 ♂; CL: 20.5 mm, CW: 28.9 mm; station Faliraki; fishing nets, depth 8 m; sand and rocks with vegetation; 24 June 2011; Catalogue number HSR69.

Remarks

Paractaea monodi (Fig. 3) lives in shallow waters up to 150 m depth on sand or gravel and in areas with *Posidonia oceanica* meadows (Falciai & Minervini, 1992). It inhabits the Eastern Atlantic Ocean, the Azores, Madeira, Ilhas Desertas, the Canary Islands, the Cape Verde Islands and the Mediterranean Sea (Manning & Holthuis, 1981). It has been reported from the western Mediterranean (Zariquiey Alvarez, 1968; Castelló *et al*., 1987; Noël, 1993), the Adriatic Sea (Ševčić, 1990; Kljajo & Ševčić, 2000), and the central basin (Udekem d'Acoz, 1999). In the Eastern Mediterranean Sea, *P. monodi* is known from the Egyptian and Turkish Levantine waters (Balss, 1936; Holthuis & Gottlieb, 1956; Udekem d'Acoz, 1994; Ateş *et al*., 2010) and the Aegean Sea, where it was firstly recorded in 1955, in the Gulf of Kalamata (Peloponnese), 38-40 m deep, on biogenic detritus and later at Milos Island (Koukouras *et al*., 1992, 1993; Mavidis *et al.*, 2008). *Paractaea monodi* is generally considered a rare species in the Mediterranean Sea (Vignoli *et al*., 2004).

FIG. 3. *Paractaea monodi*, male, CL: 20.5 mm, dorsal and ventral view.

PROGERYONIDAE

***Paragalene longicrura* (Nardo, 1869)**

Material

1 ♂; CL: 36.7 mm, CW: 48.9 mm; station Trianda; fishing net; depth 5-30 m; sand and rocks with vegetation; June 2007; Catalogue number HSR70. 1 ♀; CL: 32.9 mm, CW: 43.2 mm; station Haraki; crayfish trap; depth 150 m; biogenic detritus and rocks; 17 June 2010; Catalogue number HSR71.

Remarks

Today, the genus *Paragalene* comprehends two species, the recently described *P. danieleae* (Tavares & De Melo, 2010) from the Western Atlantic and *P. longicrura* (Nardo, 1869). *Paragalene longicrura* (Fig. 4) is a rare species known from the Mediterranean Sea and the Eastern Atlantic Ocean (Madeira and Canary Islands) (Udekem d'Acoz, 1999; Castro & Ng, 2008). Concerning the Mediterranean Sea, *P. longicrura* has been recorded from Malta and mainly the western basin, namely Balearic Islands area, Naples Bay, Algerian waters, Tuscany islands, and Adriatic (Pallaoro, 2005). In the eastern part of the basin, it has been reported from the island of Skyros in the Aegean Sea (Türkay, 1976), while in the Levantine basin the species has been recorded for the first time at Kastelorizo Island, only in 2004 (Mavidis *et al*., 2008). The collection of two more specimens of *P. longicrura* from Rhodes increases significantly the knowledge on its distribution in the Eastern Mediterranean Sea.

According to Udekem d'Acoz (1999), *P. longicrura* occurs in dark caves and on hard bottoms with algal growth and shells, at depths between 30 and 160 m, as confirmed by the species finding in Rhodes.

FIG. 4. A live female of *Paragalene longicrura*, CL: 32.9, dorsal and ventral view.

PARTHENOPIDAE

***Spinolambrus macrochelos* (Herbst, 1790)**

Material

1 ♂; CL: 28.5, CW: 32.0; station Faliraki; fishing nets; depth 20-25 m; sandy; 5 September 2011; Catalogue number HSR73. 1 ♂; CL: 42.5 mm, CW: 50.4 mm; station Haraki; crayfish trap; depth 180 m; biogenic detritus and rocks; 10 October 2011; Catalogue number HSR74.

Remarks

Spinolambrus macrochelos is considered a rare species (Falciai & Minervini, 1992) distributed over the Mediterranean Sea on sandy-muddy bottoms at depths between 18 and 370 m (Guerao & Abelló, 1999; Politou *et al*., 2003; Fanelli *et al*., 2007), but also down to 750 m (Mura & Cau, 1994), sometimes shallower than 5 m, and exceptionally at great depths (Hasan *et al*., 2008). In the Eastern Mediterranean Sea *S. macrochelos* is known from the Aegean Sea up to the Turkish Straits (Koukouras *et al*., 1992; Kocataş *et al*., 2004; Ateş *et al*., 2010), the coasts of Israel (18-97 m) (Holthuis & Gottlieb, 1958; Fishelson, 2000), Cyprus (37-70 m) (Kocataş *et al*., 2001), along the Syrian coasts (30 m) (Hasan *et al*., 2008) and the Mediterranean coasts of Turkey (Ateş *et al*., 2010). It was recently collected in the eastern Aegean Sea (200-300 m) (Özcan & Katağan, 2009).

GRAPSIDAE

***Planes minutus* (Linnaeus, 1758)**

Material

1 ♀; CL: 18.9 mm, CW: 19.4mm; station Lindos; crayfish trap; depth 150 m; biogenic detritus and rocks; 12 June 2010; Catalogue number HSR77.

Remarks

The species, considered rare, occurs in the Atlantic waters up to the North Sea and in the Mediterranean Sea (Falciai & Minervini, 1992). In the Eastern Mediterranean Sea, it has been recorded in Israel (Lewinsohn & Holthuis, 1964) and Cyprus (Kocataş *et al*., 2001). The present record of *Planes minutus* (Fig. 5) is the first for the Aegean Sea.

The species is characteristically associated with non-living and living floating objects like branches, algae and pelagic marine animals such as sea turtles (Raso, 1984; Falciai & Minervini, 1992; Cuesta *et al*., 1997; Casale *et al*., 2004; Frick *et al*., 2011). The present finding of this pelagic crab in a trap lift from deep waters contrasts with the usual observations. However, the possibility that the specimen entered the trap near the surface, attached to a floating object during the lifting up, is not to be excluded.

DISCUSSION

After a review of the available literature (Türkay *et al*., 1987; Koukouras *et al*., 1992, 1998; Udekem d'Acoz, 1994, 1995, 1999; Koukouras, 2000; Koukouras & Dounas, 2000; Kirmitzoglou *et al*., 2006; Zenetos *et al*., 2009, 2011; Corsini-Foka *et al*., 2010; Ateş *et al*., 2010; Çinar *et al*., 2011) and taking into account the occurrence of *P. minutus* recorded in the present work, the overall decapod fauna of the Aegean Sea numbers 281 species (73% of the total Mediterranean decapod fauna) and it is the richest in species compared to other region of the Eastern Mediterranean Sea, as assessed in the comprehensive study of Koukouras *et al*. (1992) (Table 3).

The results of the present study increase the

FIG. 5. *Planes minutus*, female, CL: 18.9 mm, dorsal and ventral view.

TABLE 3. Comparison of decapod fauna between Rhodes island and neighboring areas (IP: Red Sea/Indo-Pacific Ocean origin, AT: Atlantic Ocean origin)

	Origin	Dendro-branchiata	Caridea	Astacidea	Thalassinidea	Palinura	Anomura	Brachyura	Total
Rhodes island	Native	5	13		8	4	19	43	**92**
	IP aliens	4						11	**15**
	AT aliens							2	**2**
	Total	9	13		8	4	19	56	**109**
Levantine Sea (Turkey)	Native	7	41		7	4	28	61	**148**
	IP aliens	9	8					18	**35**
	AT aliens	1	1					2	**4**
	Total	17	50		7	4	28	81	**187**
Cyprus	Native	7	36		7	5	22	66	**143**
	IP aliens	3						5	**8**
	AT aliens							2	**2**
	Total	10	36		7	5	22	73	**153**
Aegean Sea	Native	23	67	2	16	6	39	101	**254**
	IP aliens	6	2					13	**21**
	AT aliens		2					4	**6**
	Total	29	71	2	16	6	39	118	**281**

number of decapod species known for Rhodes island from 95 to 109, accounting for 38.8% of the whole Aegean Sea decapod fauna.

According to Dounas & Steudel (1994), Kocataş & Katağan (1995) and to the recent review of Bakir & Cevirgen (2012), the stomatopod fauna of the Aegean Sea lists eight species. Along the Mediterranean coasts of Turkey, the Indo-Pacific alien *Clorida albolitura* Ahyong & Naiyanetr, 2000 was recently added (Galil *et al*., 2009) to the previously recorded *Erugosquilla massavensis* (Kossmann, 1880) and *Squilla mantis* (Linnaeus, 1758) (Kocataş & Katağan, 1995; Bakir & Cevirgen, 2012), while *Rissoides desmaresti* (Risso, 1816), *Rissoides pallidus* (Giesbrecht, 1910) and *E. massavensis* occur in Cyprus (Kocataş *et al*., 2001; Katsavenakis *et al*., 2009).

The record of the stomatopod *Parasquilla ferussaci* reported here is the second one for the Hellenic waters and the third one for the Eastern Mediterranean Sea (Aegean Sea) (Dounas & Steudel, 1994; Özcan *et al*., 2008a). It adds a new stomatopod to the three species previously known from the island, the native *R. pallidus*, *S. mantis*, and the Lessepsian *E. massavensis* (Kevrekidis & Galil, 2003). *Erugosquilla massavensis,* a successful colonizer with a wide distribution range in the Aegean waters (Özcan *et al*., 2008b), seems to increase its population around Rhodes (10 to 180 m depth, pers. observation).

The total number of Aegean decapods includes 27 alien species, which constitute approximately 10% of the total recorded species (Table 3) (Zenetos *et al*., 2009, 2010, 2011; Ateş *et al*., 2010; Koukouras *et al*., 2010; Çinar *et al*., 2011; Galil, 2011). In the waters around Rhodes island, 17 (63%) of the above Aegean alien decapods species occur, 15 of Indo-Pacific and two of Atlantic origin, representing 15.7% of the 109 decapod species currently known. Apart from the portunid *Callinectes sapidus* Rathbun, 1896, the remaining alien decapods are warm-water species. All species of Indo-Pacific origin are Lessepsian immigrants, including *Gonioinfradens paucidentatus* (A. Milne Edwards, 1861), firstly recorded for the Mediterranean in the waters of Rhodes island (Corsini-Foka *et al*., 2010), and also occurring eastward along the Mediterranean coasts of Turkey (Karhan & Yokes, 2012).

It is worth mentioning that, apart from few cases of northward spreading, mainly along the Aegean coast of Asia Minor, up to date most Indo-Pacific decapod species introduced into the Aegean waters, are concentrated along the coasts of the south-eastern corner of the basin, from Rhodes island up to Gökova Bay (see Koukouras *et al*., 2010), a marine environment particularly suitable to the establishment of warm-water alien species.

Comparing native and alien decapods of Rhodes island and its neighbouring areas (Cyprus, Aegean Sea, Turkish Levantine waters), on the base of the present knowledge the majority of species recorded in Cyprus (97%) are in common with the Aegean Sea, while a lower percentage (80%) is in common with the Levantine coasts of Turkey. As for Rhodes

island, 75% of the known decapod fauna results in common with Cyprus and 80% with the Turkish Levantine waters. Only ten alien decapods have been reported from Cyprus, out of a total 153 species (Table 3) (Lewinsohn & Holthuis, 1986; Kocataş *et al*., 2001; Kirmitzoglou *et al.*, 2006; Tzomos *et al*., 2007; Dogan *et al*., 2008; Christodoulou et *al*., 2009; Katsavenakis *et al*., 2009, 2011). This strong difference between the two islands could be attributed to the isolation of Cyprus and the lack of a strong connecting current with the Levant coast (Ben Eliahu & Payatas, 1999), but also to the limited research effort devoted to this area (see Christodoulou *et al*., 2009).

The Levantine coasts of Turkey, although inhabited by a lower number of decapod species compared to the whole Aegean, have been significantly enriched by a high number of alien decapods (39 species), which constitute 21% of the total species listed (Table 3) (Ateş *et al*., 2010; Özcan *et al*., 2010; Çinar *et al*., 2011; Galil, 2011; Karhan & Yokes, 2012). In this area, 88% of decapod species is in common with the Aegean fauna, while the remaining species, the majority Red Sea/Indo-Pacific aliens, have not been recorded up to date in the Aegean Sea.

As already remarked above, five of the newly reported species from Rhodes, namely *Parasquilla ferussaci*, *Paractaea monodi*, *Paragalene longicrura*, *Spinolambrus macrochelos* and *Planes minutus*, are generally considered rare species in the Mediterranean Sea. The occurrence of the brachyuran *Planes minutus* represents the first record for the Aegean Sea, while the remaining 13 decapods signaled in the present study have already been listed (Koukouras *et al*., 1992; Ateş *et al*., 2010). Limited sampling effort performed in the deep waters around the island allowed to report the presence of *Parasquilla ferussaci* and *Planes minutus* and to collect a second specimen of *Paragalene longicrura*, showing that these species are rarely captured probably because they inhabit areas difficult to be reached by sampling devices. The first findings of *Paractea monodi* in the shallow waters of Faliraki, an area of Rhodes where fishing activities and underwater observations are intense all over the year, could indicate that its population is represented by a scarce number of individuals. *Spinolambrus macrochelos*, although considered a rare species, was collected in a short period of time both from shallow and deep waters. Consequently, it is more probable that the occurrence of the species was undetected or disregarded until now along the coasts of the island. A well establishment of *Maja goltziana* in the Levantine Basin has been recently ascertained (Hasan *et al*., 2008; Lelli *et al*., 2008). Along the last few years, the species is often captured in the shallow waters of Rhodes and live specimens are regularly displayed in the Aquarium of the Hydrobiological Station. This fact may suggest that the species is today rather common also in the southeastern Aegean Sea.

Up to date, a total of one hundred alien species occur in Rhodes area, of which 98 are warm-water, the majority entered during the last two decades via the Suez Canal, some showing abundant populations along the coasts (cf. Pancucci-Papadopoulou *et al*., 2011, 2012; Corsini-Foka *et al*., 2012).

The introduction rate of Lessepsian biota is increasing (Tzomos, 2007; Belmaker *et al*., 2010; Koukouras *et al.*, 2010; Tzomos *et al*., 2012) and evidence is accumulating that the entry of tropical species into the Mediterranean Sea is linked to global climate changes and warming of the basin (Ben Rais Lasram & Mouillot, 2009; Raitsos *et al*., 2010; Pancucci-Papadopoulou *et al.*, 2011, 2012). The phenomenon of warm-water aliens introductions, in particular of Indo-Pacific origin in the Eastern Mediterranean Sea, amplified by climatic changes (Raitsos *et al*., 2010), and accomplished to the rapid integration and often population explosion of this new biota, conduces to an accelerated alteration of the native marine communities into mixed Red Sea-Mediterranean Sea ones (Fishelson, 2000). Although consequences of this process are largely unknown (Philippart *et al*., 2011), the magnitude of its impact at environmental and socio-economic level begins to appear manifest (EASTMED, 2010; Zenetos *et al*., 2010; Galil, 2011; Pancucci-Papadopoulou *et al*., 2011, 2012).

Monitoring of the benthic biota in Rhodes area, a geographically crucial region subjected to invasions and already considered biopolluted (Pancucci-Papadopoulou *et al*., 2011), is therefore imperative.

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