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Research article

The establishment of the invasive crab *Percnon gibbesi* (H. Milne Edwards, 1853) (Crustacea: Decapoda: Grapsidae) in Greek waters

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Abstract

The tropical Atlantic grapsid crab *Percnon gibbesi* (H. Milne Edwards, 1853) may be regarded as the most invasive decapod currently expanding its distribution in the Mediterranean Sea. The present paper records its presence in Greek waters since 2004. The species seems well established along the coasts of Messiniakos Gulf, Crete and Rhodes Islands as several individuals of various sizes were observed on shallow, rocky bottoms. The proximity of these localities to ports may hint at shipping as potential vector, but larval transport from already established populations across the Ionian Sea cannot be excluded. The wide adaptability, the potential for colonising new habitats and the population dynamics of *P. gibbesi* merit further investigation.

Key words: *Percnon gibbesi*, Eastern Mediterranean Sea, Greece, invasive species, Messiniakos Gulf, Crete, Rhodes

Introduction

The rapidly accelerating human activities over the past century (trade, transport, tourism) have dramatically enhanced the spread of alien species. The Mediterranean is by far the major recipient of alien species with an average of one introduction every four weeks over the past five years (Streftaris et al. 2005). According to data compiled in Galil et al. (2006), 63 alien decapod crustaceans are present in the Mediterranean. The great majority (73%) are of Indo-Pacific origin, with only 15% of tropical Atlantic origin. In Greece, 14 alien decapods have been reported, four of which were added in the past two years (Pancucci-Papadopoulou et al 2005, 2006, Corsini-Foka et al. 2006, Corsini and Kondylatos 2006, Cannicci et al. 2006). As a result of its geographical position, the great majority of alien decapods recorded so far from Greece are of Indo-Pacific origin (invasion via the Suez Canal). Thus, as for other animal groups, most alien decapods have been encountered only in SE Greek waters, their occurrence decreasing significantly northwards and westwards (Pancucci-Papadopoulou et al. 2005).

Percnon gibbesi (H. Milne Edwards, 1853) is one of the newcomers in the Mediterranean, first observed in Linosa Isl., Sicily Straits, in 1999 (Relini et al. 2000). Subsequently, it was recorded from the Balearic Archipelago (Garcia and Reviriego 2000, Müller 2001, Deudero et al. 2005), Sardinia, Tyrrhenian Sea, Sicily and Malta (Pipitone et al. 2001, Mori and Vacchi 2002, Russo and Villani 2005). Recently Cannicci et al. (2006) reported the species from Crete and Antikythira Islands (Greece). The crab's native distribution extends from Chile to California, from Florida to Brazil and from the Gulf of Guinea to the Azores (in Galil et al. 2006). The present study records the earliest finding in Greek waters and supports its establishment towards the eastern Mediterranean region.

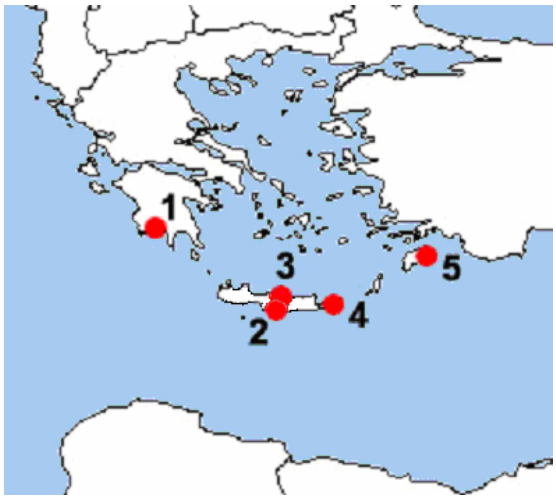

Figure 1. Distribution of *Percnon gibbesi* in Greek waters according to the present paper (see also Annex)

Results and Discussion

Living specimens of *P. gibbesi* were hand collected by snorkelling in 2004 and 2005. Several specimens were identified in the field and then returned to the sea. Seven specimens were retained, measured, preserved in 70% ethanol, and deposited at the authors' institutions. The specimens collected fit the descriptions of *P. gibbesi* from the western Atlantic coast (Williams 1984) and the central Mediterranean (Relini et al. 2000). Their carapace length ranged between 15 and 35 mm. The first Greek specimens were found on the NE coast of Messiniakos Gulf at distances ranging from 2 to 8 km from the port of Kalamata in March 2004.

In July 2005, the species was found on the eastern coast of Rhodes, where an ovigerous female was collected, as well as on three locations in Crete (Figure 1, Annex). Most individuals were found at 1.5-2 m depth in a variety of rocky microhabitats, from crevices on vertical rocks to boulders and photophilous algae (Annex).

Observations in Messiniakos Gulf through to 2006 confirmed the persistent occurrence of *P. gibbesi*. Preliminary assessment of crab density showed an increase in the summer of 2005 (~ 1 indiv. m^{-2}), and a decline in numbers during the winter of 2005-2006.

The Mediterranean habitat of preference for the species seems to be the shallow infra-littoral rocky shore, more frequently around 1-2 m depth (Müller 2001, Deudero et al. 2005, present study), characterized by the occurrence of boulders. Although boulders - with or without macroalgal cover - are considered as an important habitat feature for the newly established western Mediterranean populations, the crab was found on a variety of rocky surfaces in the Greek localities. This may reflect a still unbalanced condition of the new arrival in Greek waters. Earlier studies (Pipitone et al. 2001, Müller 2001), found the crab present only in certain sites on the same island, a fact occurring also in its native range (e.g. Edgar et al. 2004, Mille-Pagaza et al. 2003). More recently, however, Deudero et al. (2005) reported its occurrence all around Dragonera Island (Balearic Archipelago), where it attains abundances of up to 3 indiv. m^{-2}, although showing a very patchy distribution.

The first alien decapod of tropical E. Atlantic origin found in Greek waters was the swimming crab *Callinectes sapidus* Rathbun, 1896 (Serbetis 1959), arriving in ballast waters. *Percnon gibbesi* may have entered the western Mediterranean through larval drift/adult movements (Pipitone et al. 2001, Abelló et al. 2003), or accidental transport through shipping (Mori and Vacchi 2002, Cannicci et al. 2006). At present, it is difficult to determine the means of arrival of *P. gibbesi* in Greek waters. The earlier record in Messiniakos Gulf, near the port of Kalamata, hints at a possibility of shipping as a vector. However, considering the geographical position of the Greek localities on the Hellenic Arch, colonization via larval transport by currents crossing the Ionian Sea seems to be reasonable. It is suggested that the relatively long larval phase (Paula and Hartnoll 1989) possibly made this transport successful, while the large size of the first crab

stage (Hartnoll 1992) facilitated subsequent colonization.

Whatever the means, the observation of several individuals in a wide size range, of an ovigerous female in Rhodes as well as the timing of the consecutive findings in Greek sites confirm that the species is currently invading the eastern Mediterranean. Its algivorous feeding habit (Puccio et al. 2006) may prove advantageous in this oligotrophic environment. Because of its rapid spread, *P. gibbesi* has been proposed to be included in the 100 worst invasive marine species at the European level (SEBI2010, 2006).

Further surveys in southern Greek waters to assess the extent of *P. gibbesi* occurrence, including monitoring of population density and reproduction in selected sites, and studies for the determination of potential competitors and predators are needed. These surveys should be conducted as part of a collaborative trans-Mediterranean study in order to obtain comparable results on habitat preference and population density and to follow the evolution of this invasion.

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Annex

Records of *Percnon gibbesi* in coastal waters of Greece in 2004-2005*

Map Ref.	Location	Record coordinates		Record date	Habitat (depth)	Collector
		Latitude, °N	Longitude, °E			
	Messiniakos Gulf					
1	Mikra Mantinia-Akrogiali-Almyros	36º58.4'	22º08.8'	March 2004	Crevices on vertical rocks (1-2 m)	P. Kouraklis
	Crete					
2	Kaloi Limenes (south coast)	34º55.9'	24º48.2'	December 2005	Boulders (1.5 m)	C. Dounas
3	Tobrouk (north coast)	35º20.0'	25º12.8'	July 2005	Photophilous algae (1.5-2 m)	C. Dounas
4	Kato Zakros-Xerokambos (east coast)	35º03.4'	26º14.7'	August 2005	Rock crevices (1 m)	C. Dounas
	Rhodes					
5	Pefki (east coast)	36º04.0'	28º03.2'	July 2005	Rocks (2 m)	P. Margies

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