

New localities in the Aegean Sea for alien shrimps *Penaeus aztecus* (Ives, 1891) and *Metapenaeus affinis* (H. Milne Edwards, 1837)

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New findings about the distribution area of *Penaeus aztecus* and *Metapenaeus affinis* were reported with this study. Diagnostic features of the both species and some morphometric measures of the specimens were given. In addition, the recent occurrence map of these species in the Mediterranean Sea is provided.

Key words: *Penaeus aztecus*, *Penaeus kerathurus*, *Metapenaeus affinis*, Aegean Sea

INTRODUCTION

Penaeus aztecus (Ives, 1891) is a commercially important Atlantic shrimp (TAVARES, 2002). It has been recorded for the first time from Levantine coast of Turkey in the Mediterranean Sea (DEVAL *et al.*, 2010). From that date until today it has expanded the distribution area from the Gulf of Iskenderun (Turkish Levantine coast) to the Aegean Sea (NIKOLOPOULOU *et al.* 2013, KEVREKIDIS 2014, MINOS *et al.* 2014, KONDYLATOS & CORSINI-FOKA 2015), the Ionian Sea (KAPIRIS & APOSTOLIDIS, 2014), the Adriatic Sea (MARKOVIĆ *et al.*, 2014) and the Tyrrhenian Sea (GÖKOĞLU & ÖVZAROL, 2013; CRUSCANTI *et al.*, 2015). Besides this, *Metapenaeus affinis* (H. Milne Edwards, 1837) is also a commercially important species but its homeland is western Indo-Pacific (CHAN, 1998). Unlike the former species, *M. affinis* was

only known from Izmir Bay so far in the Mediterranean Sea (AYDIN *et al.*, 2009). In this study, new regions and some morphological properties are given for both species.

MATERIAL AND METHODS

P. aztecus specimens were captured by commercial bottom trawl operations (44 mm stretched mesh size) from December 2015 to February 2016 in Çandarlı Bay (38°53'N-26°53'E) and Ildır Bay (38°25'N-26°24'E, Fig. 1). The obtained specimen of *M. affinis* was caught with trammel net (40 mm stretched mesh size) by a local fisherman (38°55'N-26°58'E) in Çandarlı Bay. The sampling depths were given in Table 1. Diagnostic features of the specimens of both species were examined under a stereomicro-

Table 1. The morphological parameters of the shrimp specimens

Species	Date	Region	Depth (m)	TL (cm)	CL (cm)	ECL (cm)	Width (cm)	Weight (g)	Gender
<i>P. aztecus</i>	Feb 2016	Çandarlı Bay	40-80	25.4	9.3	6.3	3.2	136.95	F
<i>P. aztecus</i>	Feb 2016	Çandarlı Bay	40-80	24.6	9.1	6.4	3.3	131.97	F
<i>P. aztecus</i>	Feb 2016	Çandarlı Bay	40-80	21.4	7.6	5.4	2.8	94.86	F
<i>P. aztecus</i>	Feb 2016	Çandarlı Bay	40-80	18.6	6.8	4.5	2.3	58.11	F
<i>P. aztecus</i>	Dec 2015	Çandarlı Bay	40-80	18.3	6.4	4.3	2.3	45.70	F
<i>P. aztecus</i>	Dec 2015	Çandarlı Bay	40-80	17.9	6.8	4.3	2.3	43.04	F
<i>P. aztecus</i>	Dec 2015	Çandarlı Bay	40-80	17.0	6.4	4.2	2.1	37.51	F
<i>P. aztecus</i>	Feb 2016	Çandarlı Bay	40-80	15.7	5.7	3.5	1.8	31.81	M
<i>P. aztecus</i>	Feb 2016	Ildır Bay	65-80	18.5	6.5	4.6	2.5	54.26	F
<i>M. affinis</i>	Jan 2016	Çandarlı Bay	16-25	11.3	4.1	2.7	1.2	9.3	M

(TL: total length, CL: carapace length, ECL: eye cavity length)

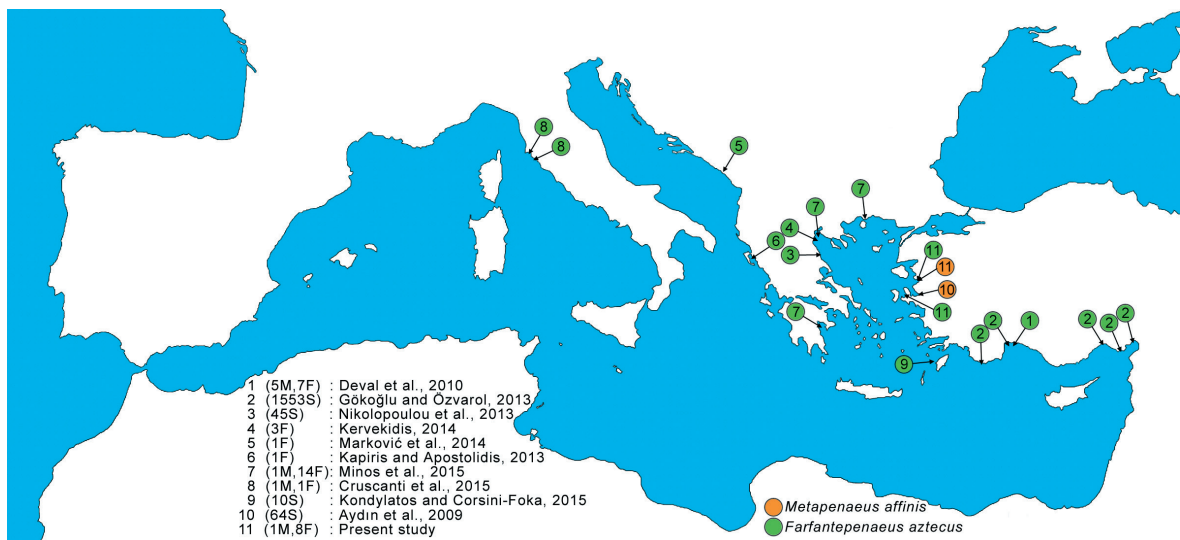


Fig. 1. The distribution map of *Penaeus aztecus* and *Metapenaeus affinis* in the Mediterranean Sea (M: male, F: female, S: specimen)

scope and all measurements (total length, carapace length, eye cavity length) were done with a digital caliper. The wet weight of the specimens was measured to the nearest 0.01 g (Table 1). The specimens were fixed in 96% ethanol for further possible DNA analysis and deposited in the crustacean collection of the Ege University Faculty of Fisheries Museum (ESFM). The identifications of *P. aztecus* and *M. affinis* were made according to descriptions and keys in IVES (1891), PÉREZ FARFANTE (1969; 1988) and TAVARES (2002).

RESULTS

Penaeus aztecus (Ives, 1891)

Material: A total of eight specimens of *F. aztecus* as one or two individual in each trawl operation were caught in the sampling area (Fig. 2). All of them, except one were females and maximum total length was 25.4 cm. This is the second largest specimen after the one mentioned by GÖKOĞLU & ÖVZAROL (2013) in the Eastern Mediterranean Sea.

Description: The rostrum bears 9 teeth on dorsal (epigastric tooth included) and 2 teeth

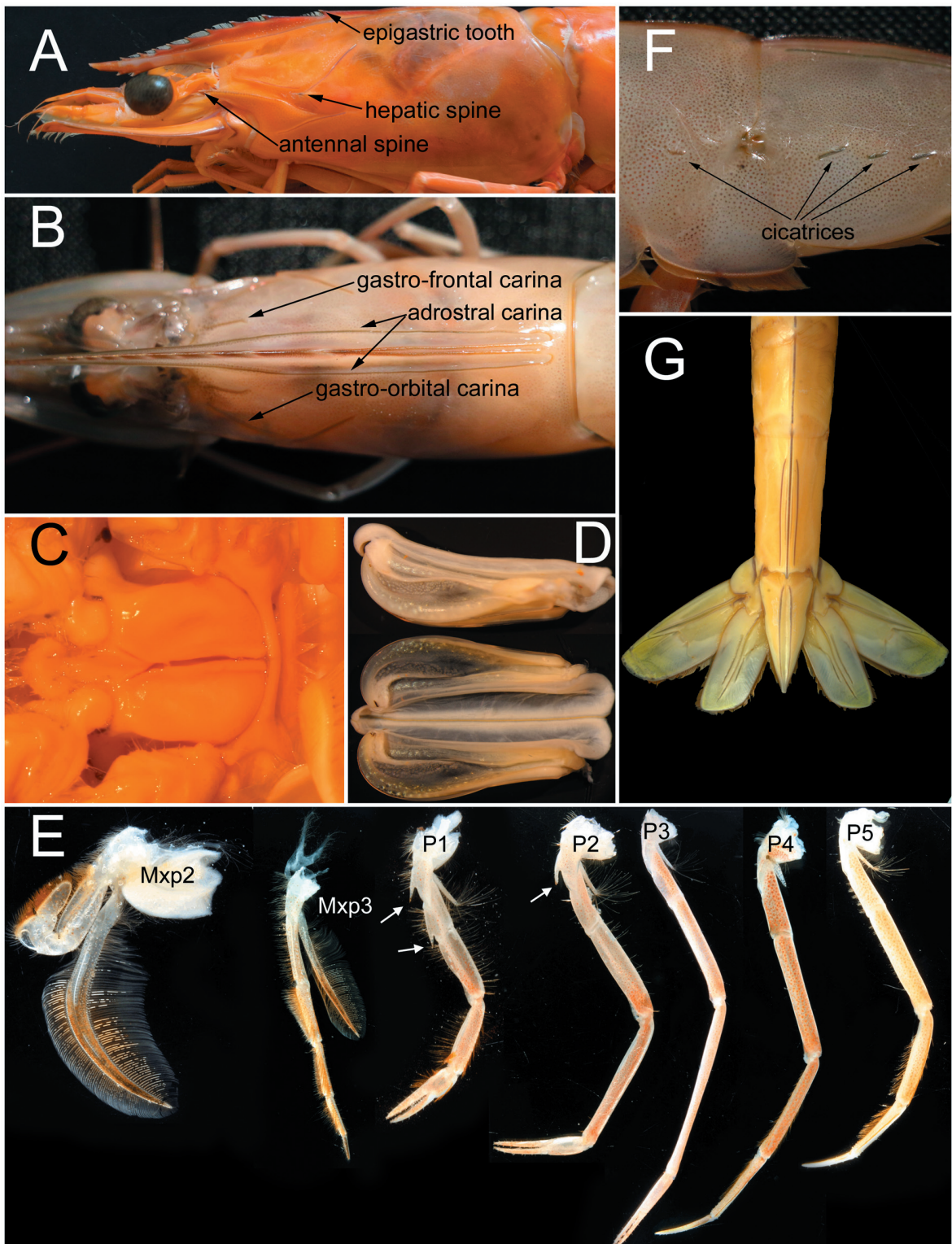


Fig. 2. The body parts of the *Penaeus aztecus* A) lateral view of carapace; B) dorsal view of carapace; C) thelycum; D) pereiopods and maxillipeds; E) petasma; F) fifth and sixth abdominal segments; G) telson and uropods

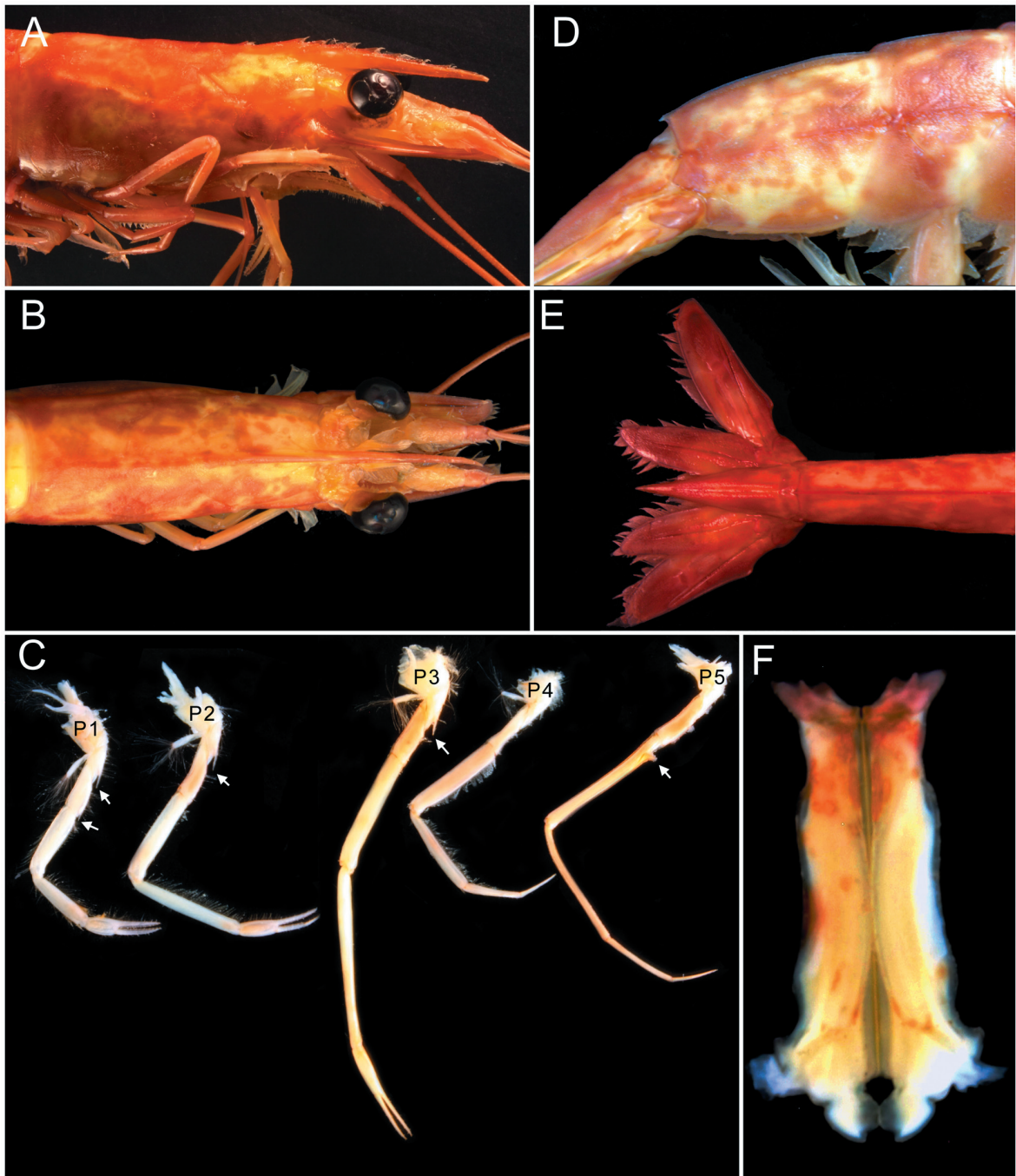


Fig. 3. The body parts of the *Metapenaeus affinis* A) lateral view of carapace; B) dorsal view of carapace; C) pereopods; D) fifth and sixth abdominal segments; E) telson and uropods; F) petasma

on ventral margin (Fig. 2A). Adrostral carina begins slightly ahead of the first dorsal tooth on the rostrum and ends at 2 mm before of the hind edge of the carapace. Adrostral sulci are present along the adrostral carina and reach their widest part at the level of the 8. rostral and epigastric teeth. Median sulcus is long and continuous.

Antennal spine, hepatic spine, gastro-frontal carina and gastro-orbital carina are present (Fig. 2B). Petasma and telycum were a perfect match with the original description (IVES, 1891) (Figs. 2C, 2D). Both basal and ischial spine are present on the first pereopod. Only basal spine is present on the second pereopod. All

five pereopods bears exopods (Fig. 2E). One short cicatrix on the fifth abdominal segment and three more prominent cicatrices on the sixth abdominal segment present (Fig. 2F). Postero-dorsal spine and well defined dorsolateral sulcus present on six abdominal segments. Telson has a broad dorsal groove throughout its length and without fixed or movable spine (Fig. 2G).

Metapenaeus affinis

(H. Milne Edwards, 1837)

Material: Only one male specimen of *M. affinis* was obtained from a local fisherman (Fig. 3). According to him, this species is caught in recent years especially from May to August in the area.

Description: The rostrum bears 9 teeth on dorsal (epigastric tooth included) margin. There is no tooth on its ventral margin (Fig. 3A). Adrostral carina and sulci are absent (Fig. 3B). Both basal and ischial spine are present on the first pereopod. Only basal spine is present on second and the third pereopods. The merus of the fifth pereopod bears a protrusion on posterior margin (Fig. 3C). There is no cicatrix on the fifth or sixth abdominal segment. Posterodorsal spine is present and no dorsolateral sulcus on six abdominal segments (Fig. 3D). Telson has a dorsal groove throughout its length and without fixed or movable spine (Fig. 3E). The petasma was a perfect match with the western Indian Ocean specimens (MIQUEL, 1984) (Fig. 3F).

DISCUSSION

Penaeus aztecus was observed in Antalya Bay on Turkish Levantine coast as the first record for the Mediterranean Sea (DEVAL *et al.*, 2010). According to DEVAL *et al.* (2010) and KEVREKIDIS (2014), this species was introduced with ballast waters to its new location. Contrary to it, CRUSCANTI *et al.* (2015) noted that the possibility of the escape or release of the species from the aquaculture facilities by human impact. The introduction with ballast water idea is more likely because there are very few shrimp farms on the Turkish coasts and none of them is culturing this species. The morphological description

of the species in mentioned article corresponds exactly to the specimens in this study. After this interesting record, GÖKOĞLU & ÖVZAROL (2013) caught individuals of *P. aztecus* in large quantities (1553 ind.) on different localities along the Levantine coast of Turkey. This information has shown that *P. aztecus* established a constant population along the Turkish Levantine coast and expanded its distribution area to the east. NIKOLOPOULOU *et al.* (2013) and KEVREKIDIS (2014) have informed the existence of *P. aztecus* in the northern Aegean Coast of Greece. The next record has come from Adriatic Sea as a single female specimen (MARKOVIĆ *et al.*, 2014). Subsequently, another female specimen was caught in the Ionian coast of Greece (KAPIRIS & APOSTOLIDIS, 2014). At the same date, 14 female specimens were caught again in the northern Aegean Sea coast of Greece (MINOS *et al.*, 2014). However, there was no evidence regarding the availability in Turkish Aegean coast during the spread from east to west. This deficiency was corrected by the findings of this study.

Metapenaeus affinis is also a possibly ship transferred species from west-into Pacific to the Mediterranean Sea. Although the presence of large quantity of aquaculture farms in Izmir Bay were mentioned by AYDIN *et al.* (2009), none of them are cultivating shrimp species. Besides this, no records from elsewhere in the Mediterranean Sea supports that the species introduced with ballast water. *M. affinis* was caught in large quantities in the summer of 2008 in Izmir Bay where it was first observed in the Mediterranean Sea (AYDIN *et al.*, 2009) and the situation has not changed in the ensuing years. Now it expands its distribution area towards the north. According to the authors' personal interviews with the local fishermen, *M. affinis* was carried to Aliğa and Çandarlı Bays by some fishermen who realize the economic value of this species. According to another aspect, this species spread on its own. In either case, the fact is that it spread beyond the Izmir Bay. Hereafter, the Çandarlı Bay is under a potential danger by these new alien shrimp visitors. The maximum depth in the bay is 80 m and it supplied by Bakırçay river with a large delta at the seashore. These ecological properties are

very suitable for breeding and establishing huge populations for them as in Izmir Bay and Levantine coast of Turkey. Also, *Penaeus kerathurus* and *Parapenaeus longirostris* are the native and abundant commercial decapod species in the sampling region. At the end of the trawling operation, *P. aztecus* individuals are put in the same boxes with *P. kerathurus* at a price of approx. 15 Euros/kg today. However, the increase in the number of individuals of *P. aztecus* in Çandarlı Bay as was *M. affinis* in İzmir Bay could change

both catch composition and possible commercial income in the future.

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Novi lokaliteti nalaza stranih vrsta kozica *Penaeus aztecus* (Ives, 1891) i *Metapenaeus affinis* (H. Milne Edwards, 1837) u Egejskom moru

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SAŽETAK

Novi nalazi kozica *Penaeus aztecus* i *Metapenaeus affinis* predstavljeni su u ovom radu, te su iznesene dijagnostičke značajke obje vrste i neka morfometrijska mjerenja uzoraka. Osim toga, prikazana je i nova mapa nalaza ovih vrsta u Mediteranu.

Ključne riječi: *Penaeus aztecus*, *Penaeus kerathurus*, *Metapenaeus affinis*, Egejsko more