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First record of the Indo-Pacific species *Iphione muricata* Savigny in Lamarck, 1818 (Polychaeta: Iphionidae) from the Mediterranean Sea, Israel

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Abstract

The Indo-Pacific scaleworm *Iphione muricata* was observed and caught in the Mediterranean Sea along the coast of Israel. Morphological and molecular diagnostic characters of the species are discussed. This is the first record of this alien species in the Mediterranean Sea, and its previous reports from the Suez Canal suggest its introduction via Lessepsian migration.

Keywords: *Iphione muricata*, marine bioinvasions, Levant, Mediterranean Sea, Lessepsian migration, biological invasions, alien species

Introduction

The genus *Iphione* from the recently resurrected family Iphionidae (Norlinder *et al.*, 2012), comprises eight species of scale worms that superficially resemble chitons in their appearance and behavior. All eight species have an Indo-Pacific distribution and none of them were previously recorded from the Mediterranean Sea (Pettibone, 1986; Piotrowski, 2014; Read & Fauchald, 2015). *Iphione muricata* (Savigny in Lamarck, 1818) was originally described from Mauritius and was subsequently reported from the Red Sea, the Indian Ocean, Korea, the Philippines, Australia, various Pacific islands (Samoa, Micronesia, Marshall Islands), and the Pacific coast of Mexico (Savigny, 1818; Day, 1967; Pettibone, 1986; Salazar-Silva, 2006). It is one of the most widely-distributed species in the genus. It dwells mainly in the intertidal and shallow waters of the Indo-Pacific and is associated with coral reefs (Pettibone, 1986; Day, 1967). This study reports the occurrence of *I. muricata* at two sites along the coast of Israel, providing first records for the distribution of the species and family in the Mediterranean Sea.

Materials and Methods

Two specimens of *I. muricata* were photographed at Mikhmoret beach (32.404295°N, 34.866274°E) in May 2015 and May 2016, at a depth of about 1 m; and another two specimens were found north of Akhziv National Park (33.056459°N, 35.101746°E) in June 2015 and June 2016, at the same depth (Fig. 1). The temperature along the northern Mediterranean coast of Israel in late May and early mid-June in 2015 ranged between

20.5° - 27.23° C and 21.5°-25.5° C, respectively. The salinity during the same period in 2015 and 2016 ranged between 38.87-39.44 and between 39.07-39.57 ppt in (Israel Oceanographic & Limnological Research, http://isramar.ocean.org.il/isramar_data/TimeSeries.aspx). All specimens were found attached to rocks in a vermetid reef habitat. The specimens from Akhziv beach were collected and deposited in the Steinhardt Museum of Natural History, Tel Aviv University (VR.25177, VR.25178). The specimens were collected by hand and preserved in 100% ethanol. In the lab they were identified under a stereomicroscope according to Piotrowski (2014) and Pettibone (1986), and compared with museum specimens *I. muricata* (E62-2658, E62-2237, SE65-1195, NS-1760, NS-4270) and *I. ovata* (VR.25060, VR.25061, VR.2062) from the Red Sea. DNA from VR.25178 was extracted with Qiagen DNeasy (#69504), and the 18S rDNA gene was amplified using the primer set 18S1/18S2 (Borchiellini *et al.*, 2001). The sequence was submitted to GenBank under accession number KX645966. A blastn search was performed against the nucleotide collection in GenBank.

Results and Discussion

Iphione muricata Savigny in Lamarck 1818

Diagnosis: Body short, broad and oval (Fig. 2a). Flattened ventrally and arched dorsally. Strongly tapered at anterior and posterior ends. Length 18 mm, width (including parapodia) 12 mm with 29 segments. Styles of lateral antennae papillate, slightly longer than ceratophores (Fig. 2b). Palps stout with several rows of small papillae, longer than antenna and approximately the same size as tentacular cirri (Fig. 2b). Tentacular cirri shaped like an-

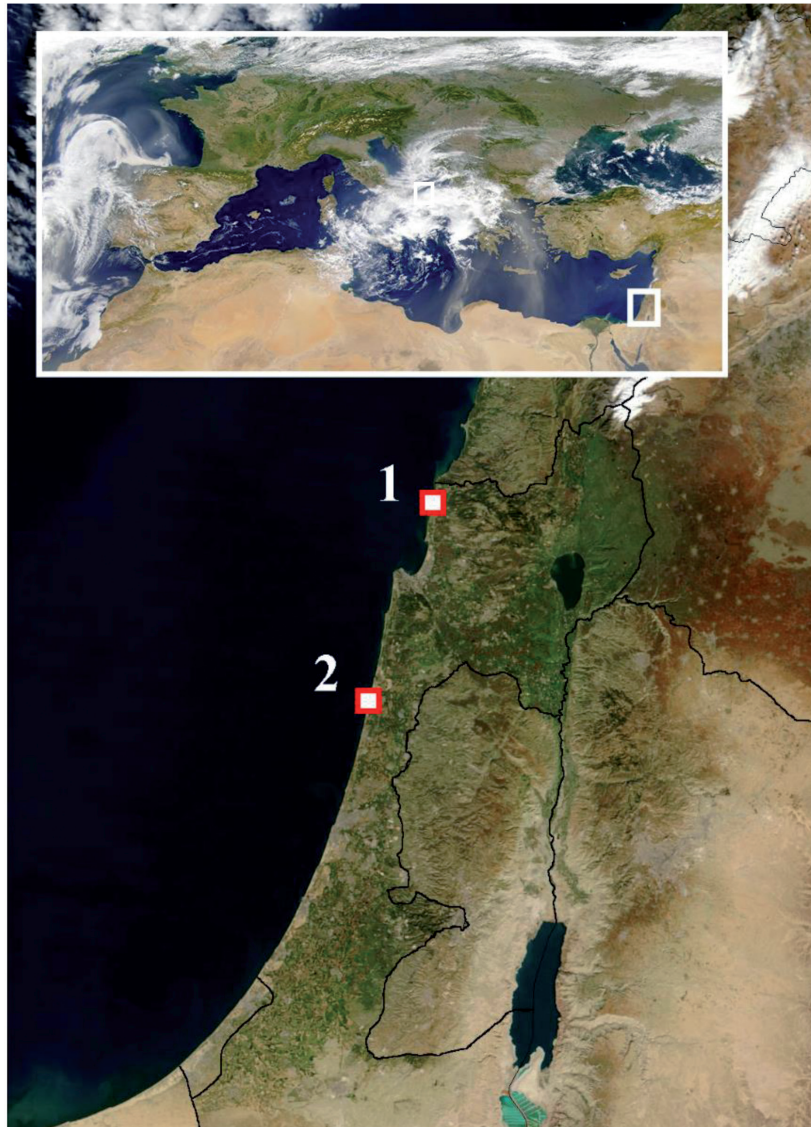


Fig. 1: Satellite image showing sites where *Iphione muricata* specimens were collected along the Mediterranean coast of Israel. (1) Akhziv beach (2) Mikhmoret beach. Image by NASA.

tenna. Two pairs of eyes on the posterior half of the prosomium. Thirteen pairs of imbricating elytra completely covering the dorsum (Fig. 2a). Color of elytra yellowish with brown streaks. Lateral streaking sometimes masked by foreign particles. Lateral margins of elytra darker than center. Elytra vary in shape along the body; anterior (Fig. 2b) and posterior elytra smaller; first elytron oval, second and third pairs of elytra boomerang-shaped with broad anterior notch (Fig. 2c), median elytra larger and reniform. Elytra reticulated with hexagonal and polygonal areas, containing numerous secondary areoles. Several rows of larger conical spinous macrotubercles toward the lateral and posterior margins of the elytra, usually erected diagonally in a posterior direction (Fig. 2c, 2d). Fringing papillae occur on the lateral margins (cylindrical column with flexible base and radiating spines, Fig. 2e). Parapodia biramous. Notopodia small and neuropodia larger (Fig. 2g). Dorsal cirri with large, cylindrical cirrophore

and long, papillate style with terminal filum. Notochaeta consist of white bushy bundles of fine capillaries. Neurochaeta golden and stout with close-set spinous rows and slightly hooked tips (Fig. 2h).

The collected specimens were identified as *I. muricata* Savigny in Lamarck 1818, according to the presence of several rows of large conical spinous tubercles and fringe papillae on the elytra, and length of the palps, which is about the same length as the tentacular cirri. The blastn search revealed the 18S rDNA sequence of the Mediterranean *Iphione muricata* to be 99% identical (1717/1721 nucleotides 0/1721 gaps, E value 0.0) to the sequence of *Iphione* sp. #JN852819 and 97% identical to *Thermiphione* sp. #JN852820 (1878/1944 nucleotides 17/1994 gaps, E value 0.0).

This report extends the distribution of *I. muricata* into the Mediterranean Sea. Its presence in the Suez Canal (Ben-Eliahu, 1972, Wehe, 2006) suggests its introduc-

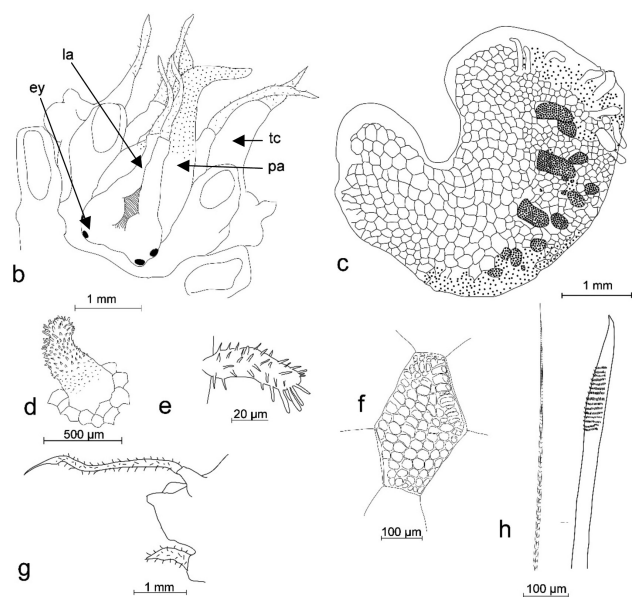


Fig. 2: (A) General view of *Iphione muricata* VR25177. (B) Illustrated dorsal view of anterior end; two pairs of eyes (ey), lateral antenna (la), palps (pa) and tentacular cirri (tc). (C) Third right anterior elytron. (D) Spinous tubercle on elytra surface. (E) Fringing papillae. (F) Compartment with secondary areolae on elytra. (G) Left middle cirriferous parapodium. (H) Notochaeta and neurochaeta.

tion into the Mediterranean via Lessepsian migration (Galil, 2009). No other iphionid species are known to have migrated into the Mediterranean Sea. However, two polynoid species (*Lepidonotus tenuisetosus* and *L. carinulatus*) were reported to have been introduced into the Levant Sea and the Sea of Marmara, respectively, presumably via Lessepsian migration (Çinar, 2009; Çinar *et al.*, 2014). *I. muricata* along the coast of Israel inhabit the shallow subtidal rocky shore, concurring with previous observations (Storch, 1967; Piotrowski, 2014). Along with the *I. muricata* specimens, the following polychaete species were collected: *Neogyptis mediterranea* (Hesionidae), *Lepidonotus clava* (Polynoidae), *Lumbrineris perkinsi* (Lumbrineridae), *Hermodice carunculata* (Amphinomidae), *Branchiomma* sp. (Sabellidae) and *Lanice* sp.

(Terbellidae). The shallow rocky habitat of Mikhmoret and Akhziv were meticulously surveyed in the 1970s (Ben-Eliahu, 1972; 1975; 1976a, b; 1977a, b; Ben-Eliahu & Safriel, 1982) and again more recently (in the 2000s) as part of the faunistics courses at Tel-Aviv University and the Ruppin Academic Center. No specimens of *I. muricata* were observed during those surveys. We therefore assume that *I. muricata* was recently introduced into the area. Its presence in two different locations and in two consecutive years may indicate a stable self-sustaining population along the Israeli coast. The marine coastal biota of the Levant Sea is susceptible to Lessepsian invasion through the Suez Canal (Çinar *et al.*, 2005b; Çinar *et al.*, 2006). Previous studies from the Levant Sea have reported a total of 77 alien polychaete species (Çinar *et al.*, 2014; Zenetos *et al.*, 2010), 61% of which are known to be Lessepsian immigrants, and up to 86% of which could have originated in the Red Sea and Indo-Pacific. With the ongoing expansion of the “New Suez Canal” (Galil *et al.*, 2015), this number is expected to become even higher.

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