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A new alien polychaete species for the Mediterranean Sea: *Glycera cinnamomea* (Annelida: Glyceridae)

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Abstract

The present study reports the first occurrence of an alien glycerid polychaete worm, *Glycera cinnamomea* (Polychaeta: Glyceridae) in the Mediterranean Sea. Only one specimen of this species was collected on April 2021 on the shallow–water sandy mud substratum (9 m depth) in the western part of Mersin Bay, near Taşucu Turkey(in the Eastern Mediterranean Sea). This species is mainly characterized by having non–retractile branchiae with maximally five rami, emerging on the posterior side of the parapodia, and three types of proboscidial papillae. It is previously known from the Indo–Pacific areas and the Red Sea (Suez Bay). The species had been most probably introduced to the Mediterranean Sea via the Suez Canal (Lessepsian species) and have been unnoticed in the Levantine Sea so far. However, as the sampling area has one large international harbor (MersinHarbor), its introduction to the Mediterranean Sea via shipping cannot be ruled out. The morphological, ecological, and distributional features of this species are presented and discussed.

Keywords: *Glycera cinnamomea;* Glyceridae; alien; Levantine Sea; eastern Mediterranean Sea; Turkey.

Introduction

The family Glyceridae Grube, 1850 is represented by 80 valid species worldwide (74 *Glycera* species, one *Glycerella* species, and five *Hemipodus* species) (WORMS, 2022) and nine species (all *Glycera* species) in the Mediterranean Sea (Böggemann *et al*., 2012). Along the coast of Turkey, seven *Glycera* species, namely *G. alba* (Müller, 1776), *G. fallax* Quatrefages, 1850, *G. lapidium* Quatrefages, 1866, *G. oxycephala* Ehlers, 1887, *G. tesselata* Grube, 1863, *G. tridactyla* Schmarda, 1861 and *G. unicornis* Savigny, 1818 have been recorded to date (Ergen, 1992; Çinar *et al*., 2014). The representatives of this family inhabit mainly soft bottom sediments from intertidal to abyssal depths (Böggemann, 2002), and are generally considered to be carnivorous burrowers, capturing and killing prey with their strong, well–developed jaws connected to venom glands (Jumars *et al*., 2015).

The Mediterranean Sea is one of the hot spot areas for the introduction of the polychaete species (Çinar, 2013; Zenetos *et al*., 2017). Almost 75 species belonging to different polychaete families have been reported from the region (author's database), with the Serpulidae and Spionidae being the most speciose. No established alien species belonging to the family Glyceridae heve been reported from the Mediterranean or other parts of the world so far (see Çinar, 2013).

The present study reports a new alien glycerid species (*Glycera cinnamomea* Grube, 1874) for the Mediterranean Sea and provides additional information about its distributional and morphological features.

Material and Methods

One specimen of *Glycera cinnamomea* (ESFM–POL/2021–1) was collected at 9 m depth in silty sandy mud substratum (36.285278°N-34.026667°W) in the western part of Mersin Bay Turkey (near Taşucu, the Levantine coast of Turkey) on 26 April 2021 by a standard Van Veen Grab (Fig. 1).

Material taken at the station was washed through a 0.5mm mesh and fixed with a 4% formaldehyde solution in the field. In the laboratory, material was washed with tap water and then sorted under a stereomicroscope. The specimen of *Glycera cinnamomea* was identified using stereo– and compound microscopes, and preserved in 70% alcohol. The biometrical features of the specimen were measured using an ocular micrometer.

The specimen of *G. cinnamomea* was deposited at the Museum of the Faculty of Fisheries, Ege University (ESFM), in Izmir, Turkey.

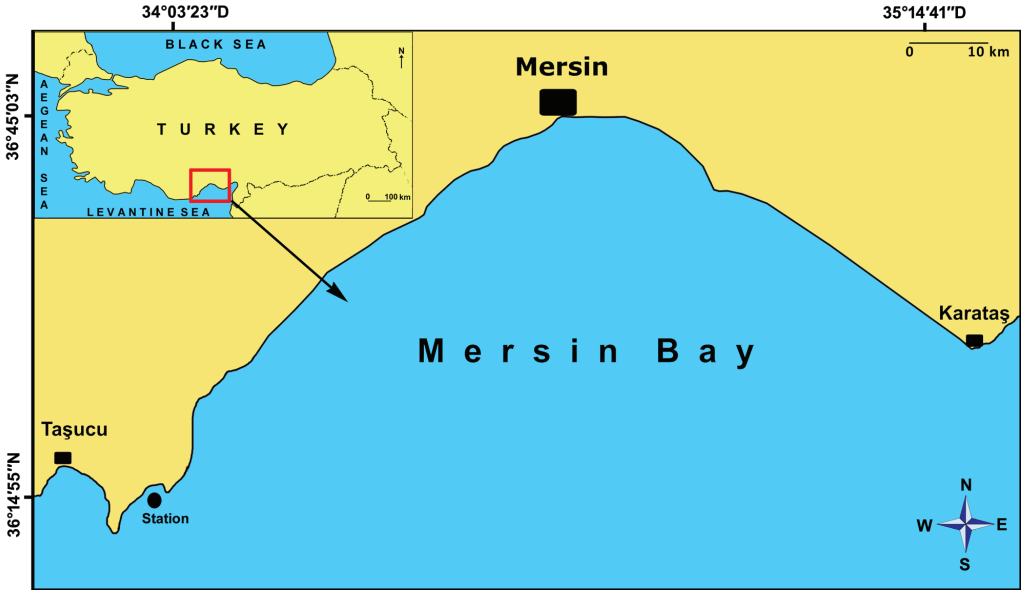

Fig. 1: Map of the investigated area, with the location of sampling station.

Result and Discussion

Glycera cinnamomea Grube, 1874

Figures 2–4

Glycera cinnamomea Grube, 1874: 327–328; Böggemann, 2002: 69–70, Figs. 97–99.

Description: Specimen incomplete, with anterior fragment, 118 mm long, 9.3 mm wide, with 189 chaetigers. Body slender, enlarged anteriorly, gradually tapering to the posterior end; preserved specimen in alcohol is dark yellow–brownish, with irregular dark brownish color patches on the dorsal side of the body (Fig. 4A).

The prostomium is conical and pointed, with 10 distinct rings; the terminal ring has four antennae; basal one with a pair of distinct, slit–like nuchal organs; without eyes (Fig. 2A). The proboscis is partly everted, with three types of papillae: type 1: numerous long, thin, more or less slender papillae with a long stalk and a terminal fingernail (with longitudinal ridges) structure on the tip and a subapical tuft of cilia (Fig. 2C and E, 4C) ; type 2: less numerous and slightly shorter digitiform papillae without longitudinal ridges, with a subapical tuft of cilia (Fig. 2D, 4C); type 3: isolated, shorter and broader, oval to globular papillae, without longitudinal ridges, bearing a subapical

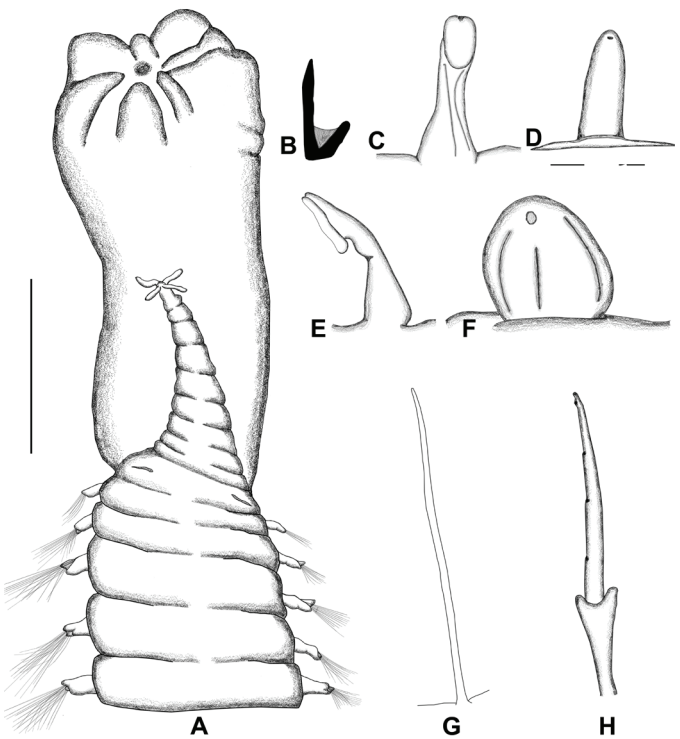

Fig. 2: *Glycera cinnamomea*. A. Anterior part of body, dorsal side B. Aileron, C–F, proboscidial papillae (type 1: C and E, type 2: D, type 3: F) , G, Notopodial capillary chaeta on anterior parapodium; H, compound spinigerous chaeta on anterior parapodium (Scale bars: A= 2 mm, B=238 µm, C= 197 µm, D=74 µm, E= 187 µm, F= 97 µm, G=35 µm, H= 31 µm).

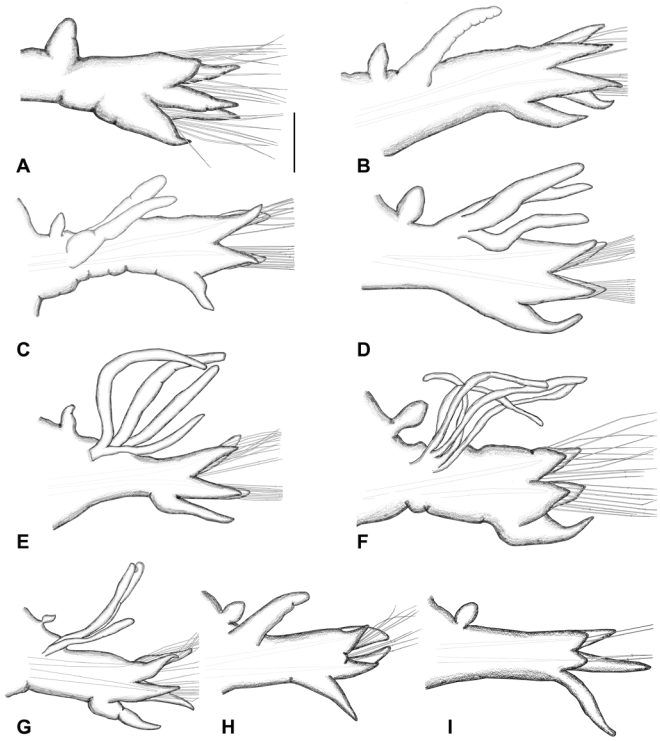

Fig. 3: *Glycera cinnamomea*. A–I, Morphology of anterior, middle and posterior parapodia, posterior view (A, Chaetiger 1; B, Chaetiger 20; C, Chaetiger 30; D, Chaetiger 52; E, Chaetiger 80; F, Chaetiger 90; G, Chaetiger 100; H, Chaetiger 120; I, Chaetiger 160) (Scale bars: A= 300 µm, B=241 µm, C= 323 µm, D=180 µm, E= 287 µm, F= 209 µm, G=152 µm, H= 280 µm, I= 201 µm).

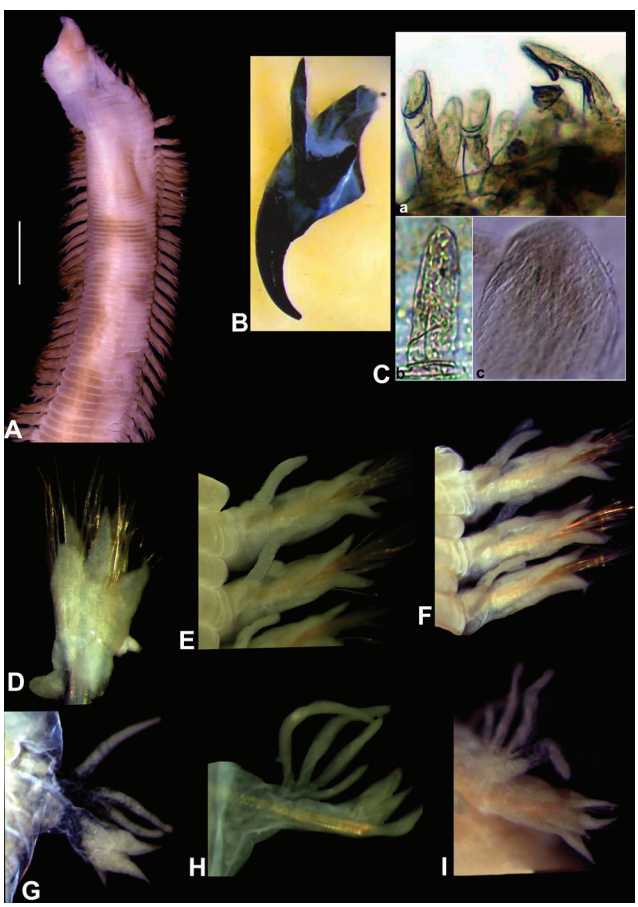

Fig. 4: *Glycera cinnamomea*. A, Anterior end, dorsal view, B, hook shaped jaw with aileron, C, proboscidial papillae (a, type1; b, type 2; c, type 3), D–I, Anterior to posterior parapodia, posterior view (D, chaetiger 1; E, parapodium of single branchia, chaetigers 20–22; F, parapodium of branchia with two rami, chaetigers 30–32; G, parapodium of branchia with three rami, chaetiger 55; H, parapodium of branchia with four rami, chaetiger 80; I, parapodium of branchia with five rami) (Scale bars: A= 2 mm, B= 423 µm, C= 45 µm, D= 302 µm, E= 391 µm, F= 444 µm, G= 261 µm, H= 285 µm, I= 214 µm).

tuft of cilia (Fig. 2F, 4C). The proboscis black with four hook–shaped jaws arranged in a cross and accessory ailerons with a pointed triangular base (Fig. 2B, 4B).

The parapodia of the first chaetiger is uniramous, with a prechaetal and a postchaetal lobe (Fig. 3A, 4D); following parapodia biramous. Two slender triangular to digitiform prechaetal lobes of the about same length; both lobes becoming slimmer in the posterior parapodia (Fig. 3B–H, 4 E–I); in the last parapodia notopodial prechaetal lobe are shorter than the neuropodial one (Fig. 3I). Two short postchaetal lobes; the notopodial lobe is rounded, the neuropodial lobe is somewhat triangular in the most anterior chaetiger (Figures 3A, 4D); both lobes are more or less similar in size, becoming more elongated and triangular in the following parapodia; the lobes are becoming shorter in the more posterior parapodia (Figures 3B–H, 4 E–I).

A knob-like or ovoidal dorsal cirri, starts from chaetiger 4, is inserted on the body wall slightly above the parapodial base (Fig. 2A). The ventral cirri, situated in the midventrally on parapodia, is large, triangular to digitiform in shaped; about as long as or slightly shorter than the postchaetal lobes in the anterior parapodia (Fig. 3A, 4D); triangular shaped and as long as the neuropodial lobes in the middle parapodia; well developed in the posterior parapodia (Fig. 3B–I, 4D–I).

The non–retractile branchiae are situated on the posterior–dorsal sides of the parapodia, and are best developed in the middle body region, about twice as much as the prechaetal lobes, with 1–5 rami; single digitiform branchiae first appearing on chaetiger 16; branchiae with 2 rami first appearing on chaetiger 26; branchiae with 3 rami first appearing on chaetiger 51; branchiae with 4 rami first appearing on chaetiger 79; branchiae with 5 rami first appearing on chaetiger 84 (Fig. 3B–H, 4E–I).

The noto and neuropodia each are needle like with a single needle and have an amber colored aciculum.

The notopodia are slender with capillaries with one margin covered with spines. The neuropodia have compound spinigers with serrated blades of different lengths; blades are 19µm in the anterior parapodia, 26 µm in the middle parapodia, and 33 µm in the posterior parapodia (Fig. 2 H).

The pygidium are missing.

Distribution. This species was previously reported from the Indo–Pacific area between intertidal and 1427 m depths (Böggemann, 2002). The original description of the species was based on the specimens collected from the coast of Sri Lanka (Grube, 1874), and it was subsequently reported in the Indian and Pacific Oceans (28 m) under the same or different names like *G. parashadi* Fauvel, 1932, *G. cirrata* Grube, 1857 and *G. manorae* Fauvel, 1932. Böggemann (2002) also reported it in the SE Atlantic (South Africa) (25.6 m) and the Red Sea (Suez Bay). This species is being reported from the Mediterranean Sea for the first time in the present study.

Remarks. *Glycera cinnamomea* mainly differs from other species of the genus in having non–retractile branchiae with maximally 5 rami, emerging on the posterior sides of the parapodia, and three types of proboscidal papillae including a long slender papilla with a fingernail on the tip (type 1 papilla). It morphologically resembles the Mediterranean *Glycera* species, *G. unicornis* Lamarck, 1818, but the latter species has branchiae with maximally two rami and lacks the proboscidal papilla with a fingernail like structure.

The morphological features of the Mediterranean specimen of *G. cinnamomea* are similar to those of the original and subsequent descriptions, but some minor differences were observed. For example, the first chaetiger is uniramous in our specimen, whereas Böggemann (2002) reported that the first two chaetigers were uniramus. The knob–like dorsal cirri first appears on chaetiger 4 in our specimen, whereas they appeared on the chaetiger 3 on the Böggemann's specimens. These characters might be size-related or such minor morphological differences might be expected to occur in distant populations of the same species. To find out to determine the ontogenetic morphological variations on the species, more specimens are needed.

Possible Pathways for its introduction to the Mediterranean Sea

As *Glycera cinnamomea* occurs in the north Red Sea (Suez Bay), the species might have been introduced to the Mediterranean via the Suez Canal by natural dispersal mechanisms. This species might have been overlooked or unnoticed from other coasts of the Levantine Sea. The other possible pathway for its introduction to the region is shipping. The area where this species was found includes a large international harbor, the Mersin harbor, which was claimed to be responsible for the introductions of several species including the Persian conch *Conomurex persicus* (Swainson, 1821) (Çinar *et al*., 2021). To shed more light on where this species originated and via which pathway it was introduced to the region, more data on its distribution in and outside the Mediterranean are needed.

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