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Research Article

First record of *Paraprionospio coora* Wilson, 1990 (Polychaeta: Spionidae) from the Mediterranean Sea

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Abstract

The spionid polychaete *Paraprionospio pinnata* (Ehlers, 1901) has been widely reported from the Mediterranean Sea. We examined some specimens belonging to the genus *Paraprionospio* that had been collected from the Aegean Sea, the Sea of Marmara and the Spanish Mediterranean coast, and identified them as *Paraprionospio coora* Wilson, 1990, which is new to the Mediterranean fauna. This finding indicates that *P. coora* has a widespread geographical distribution in Australia, the Far East and the Mediterranean, and suggests that the previous records of *P. pinnata* from the Mediterranean are questionable.

Keywords: *Paraprionospio coora;* Taxonomy; Aegean Sea; Sea of Marmara; Turkey; Spain.

Introduction

The spionid polychaete *Paraprionospio pinnata* (Ehlers, 1901) has been reported not only from the Mediterranean (BELLAN, 1964; DIAPOULIS & BOGDANOS, 1983; ERGEN, 1992; REDONDO & SAN MARTÌN, 1997; SIMBOURA & NICOLAIDOU, 2001; ERGEN *et al.,* 2002, 2006; ÇINAR, 2005; DOĞAN *et al.,* 2005) but also from various temperate and tropical waters in the world (e.g., FAUVEL, 1932; WESENBERG-LUND, 1949; HARTMAN, 1960; DAY, 1961; IMAJIMA & HARTMAN, 1964; HARTMANN-SCHRÖDER, 1965), resulting in it gaining recognition as a cosmopolitan species (LIGHT, 1978; MACIOLEK, 1985). FOSTER (1971) demonstrated that *P. pinnata* is a monotypic species which belongs to the genus *Paraprionospio* Caullery, 1914. YOKOYAMA & TAMAI (1981), however, found that the Japanese specimens of *Paraprionospio pinnata* comprised four distinct forms of morphological variations based on a series of 11 characters including papillae on posterior margins of the peristomial wings, pigment patches on the peris-

tomium, accessory processes on the first pair of branchiae, shapes of branchial lamellae, filaments on the third chaetiger, a ventral ridge on the eighth chaetiger, transverse dorsal crests, a semi-transparent dorsal cuticle, interneuropodial pouches, lateral anal cirri and the first appearance of nonlimbate capillaries in neuropodia. They suggested that the observed variations might be sufficient to allow the forms to be distinguished at the specific level, but they did not determine species names. Later, YOKOYAMA (2007) published a revision of the genus *Paraprionospio*, in which 9 valid species including 4 Japanese species that are *P. coora* Wilson, 1990, and 3 undescribed species (*P. cordifolia* Yokoyama, 2007, *P. oceanensis* Yokoyama, 2007 and *P. patiens* Yokoyama, 2007) were validated. ZHOU *et al.* (2008) also examined the Chinese specimens, which were previously identified as *P. pinnata,* and found that they belonged to the three species, *P. coora, P. inaequibranchia* (Caullery, 1914) and an undescribed species (*P. cristata* Zhou, Yokoyama & Li, 2008). The above-mentioned studies suggested a possibility of misidentification of the specimens, which were previously reported as *P. pinnata*. Hence, we examined some specimens of *Paraprionospio* collected from the Aegean Sea, the Sea of Marmara and the Spanish Mediterranean coast to identify species.

Material and Methods

Specimens of *Paraprionospio* were collected at 21 stations in the Aegean Sea and the Sea of Marmara between the years 1999 and 2008 (Fig. 1). Samples were taken by an anchor dredge and a Van Veen Grab at depths ranging from 17 to 135 m. All benthic samples were sieved through a 0.5 mm mesh and then the retained material was fixed with a 4% formaldehyde-sea water solution. In the laboratory, the samples were sorted according to taxonomic groups under a stereomicroscope and preserved in 70% ethanol. Afterwards, specimens were identified and counted under stereo- and compound microscopes. The body length and width of the 5th chaetiger (excluding parapodia) of the worms were measured using an ocular micrometer. The specimens examined were deposited at ESFM [Ege Universitesi Su Urünleri Müzesi (Museum of Faculty of Fisheries, Ege University)].

A specimen which was collected from the Spanish Mediterranean coast and described as *Paraprionospio pinnata* in REDONDO & SAN MARTÌN (1997) was also examined. The specimen was deposited at MNCN (Museo Nacional de Ciencias Naturales).

Taxonomic Account

Paraprionospio coora Wilson, 1990

Paraprionospio sp. Form CI Yokoyama & Tamai, 1981: 311, Fig. 5.

Paraprionospio coora Wilson, 1990: 266-268, Figs 75-83; Yokoyama, 2007: 264, Fig. 8; Zhou *et al.,* 2008: 309-311, Fig. 1.

Material examined: The Aegean Sea: ESFM-POL/08-22, 1 specimen, 21 May 2008, Gerence Bay, Station 1, 38°26'32''N, 26°29'07"E, 45 m, mud with shell fragments, coll. E. Dağli; ESFM-POL/07-37, 9 specimens, 17 October 2007, Izmir Bay, Station 3, 38°28'50"N, 26°46'27"E, 40 m, mud, coll. E. Dağli; ESFM-POL/08-23, 8 specimens, 4 May 2008, Gerence Bay, Station 4, 38°27'17"N, 26°27'14"E, 52 m, sandy mud, coll. E. Dağli; ESFM-POL/00-192, 1 specimen, 29 July 2000, Izmir Bay, Station 5, 39°44'22"N, 26°01'59"E, 60 m, sandy mud, coll. E. Dağli; ESFM-POL/99-19, 1 specimen, 27 May 1999, Izmir Bay, Station 6, 36°35'25''N, 26°47'03''E, 22 m, mud, coll.

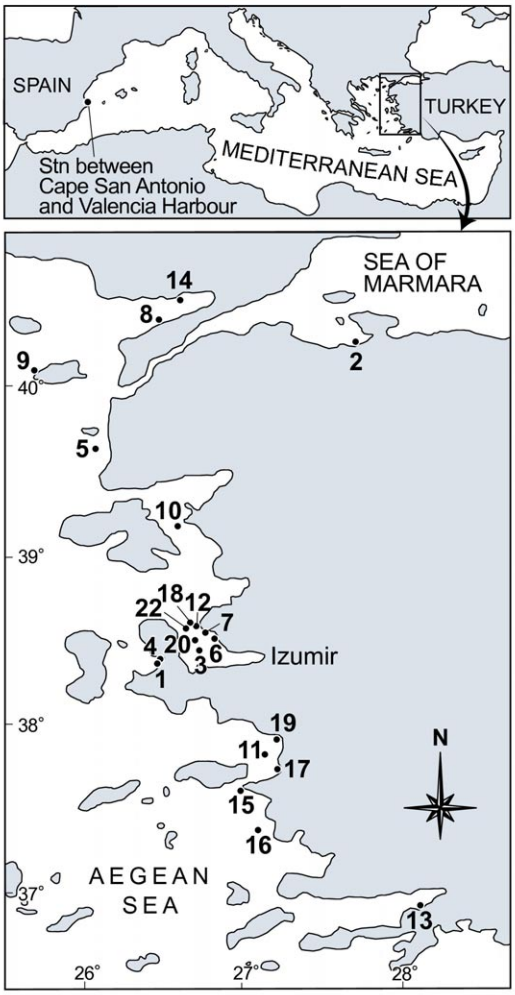

Fig. 1: Map showing sampling stations of *Paraprionospio coora.*

M. E. Çinar; ESFM-POL/00-201, 2 specimens, 14 July 2000, Izmir Bay, Station 7, 38°35'10''N, 26°45'35''E, 33 m, mud, coll. E. Dağli; ESFM-POL/00-189, 1 specimen, 3 August 2000, Saroz Bay, Station 8, 40°27'40''N, 26°29'57''E, 135 m, mud, coll. E. Dağli; ESFM-POL/00-191, 2 specimens, 13 August 2000, Gokceada Island, Station 9, 40°10'40''N, 25°40'50''E, 104 m, mud, coll. E. Dağli; ESFM-POL/00-193, 1 specimen, 28 July 2000, Aegean Sea, Station 10, 39°15'00''N, 26°32'05''E, 53 m, sandy mud, coll. E. Dağli; ESFM-POL/00-208, 4 specimens, 14 September 2000, Kusadasi Bay, Station 11, 37°55'18''N, 27°07'41''E, 78 m, mud, coll. E. Dağli; ESFM-POL/00-196, 4 specimens, 14 July 2000, Izmir Bay, Station 12, 38°40'36''N, 26°41'50''E, 62 m, mud, coll. E. Dağli; ESFM-POL/00-213, 1 specimen, 19 September 2000, Gökova Bay, Station 13, 36°54'40''N, 28°09'57''E, 19 m, sandy mud, coll. E. Dağli; ESFM-POL/00-

187, 1 specimen, 4 August 2000, Saroz Bay, Station 14, 40°36'08''N, 26°33'53''E, 66 m, mud, coll. E. Dağli; ESFM-POL/00-210, 3 specimens, 29 September 2000, south western of Dilek Peninsula, Station 15, 37°38'50''N, 27°01'17''E, 35 m, mud, coll. E. Dağli; ESFM-POL/00-211, 4 specimens, 15 September 2000, east of Agathonisi Island, Station 16, 37°23'55''N, 27°06'52''E, 71 m, mud, coll. E. Dağli; ESFM-POL/00-209, 1 specimen, 29 September 2000, Kusadasi Bay, Station 17, 37°48'00''N, 27°16'00''E, 31 m, mud, coll. E. Dağli; ESFM-POL/00-194, 2 specimens, 14 July 2000, Izmir Bay, Station 18, 38°40'36''N, 26°37'05''E, 73 m, mud, coll. E. Dağli; ESFM-POL/00-207, 3 specimens, 30 September 2000, Kusadasi Bay, Station 19, 37°59'00''N, 27°11'15''E, 32 m, mud, coll. E. Dağli; ESFM-POL/00-200, 1 specimen, 14 July 2000, Izmir Bay, Station 20, 38°35'10''N, 26°43'05''E, 61 m, mud, coll. E. Dağli; ESFM-POL/00-622, 1 specimen, 19 January 2000, Izmir Bay, Station 22, 38°39'19''N, 26°37'04''E, 69 m, mud, coll. E. Dağli; **Sea of Marmara:** ESFM-POL/08-24, 1 specimen, 9 August 2008, Erdak Bay, Station 2, 40°18'42''N, 27°46'18''E, 17 m, sandy mud, coll. E. Dağli; **Spanish Mediterranean coast:** MNCN 16.01/2646, 1 specimen, Station between Cape San Antonio and Valencia Harbour, coll. CIS (Centro de Investigaciones Submarinas).

Description: Largest complete specimen, 42 mm long, 1.3 mm wide with 95 chaetigers. Prostomium fusiform with round or bluntly pointed anterior end (Fig. 2a), extending posteriorly as a faintly raised ridge to first chaetiger. Two pairs of black, small eyes in trapezoidal arrangement. Brown pigment patch usually present on lateral side of peristomium (Fig. 2a). Faint groove just posterior to pigmented area on peristomium. Small papilla on posterior margin of peristomium (Fig. 2a). Notopodial postchaetal lamellae on chaetigers 1–3 long, foliaceous, distally pointed (Fig. 2b-d); posterior to chaetiger 4, becoming rounded and reducing in size (Fig. 1e-h); posterior to chaetiger 10, elevated increasingly, showing triangular to lanceolate (Fig. 2i,j). Neuropodial postchaetal lamellae of chaetiger 1–3 lanceolate (Fig. 2b-d); posterior to chaetiger 4, lamellae becoming rounded and reducing to low postchaetal ridges by about chaetiger 9 (Fig. 2e-h). Three pairs of branchiae on chaetigers 1–3. First branchiae longest extending posteriorly to about chaetiger 10 (Fig. 2a), second branchiae extending posteriorly to about chaetiger 9, third pair shortest extending to about chaetiger 6. In basal region of first branchial shaft, 2–5 conic processes placed along anterior face. All branchiae bearing lamellar plates; in proximal region of branchial shaft, lamella consisting of single triangular plate; succeeding lamellae consisting of two plates; in middle and distal regions, two plates united completely, showing flabellate-shape. A small protuberance usually present on dorsum near base of third branchiae (Fig. 2d), instead of the slender filament in some of the other *Paraprionospio* species. Anterior chaetae all limbate capillaries bearing granules (Fig. 3a). Posterior to about chaetiger 16, notopodial limbate capillaries replaced by slender, nonlimbate capillaries. Neuropodial hooded hooks with 2–3 pairs of apical teeth above main fang and striate secondary internal hood from chaetiger 9 (Fig. 3b,c), accompanied by alternating nonlimbate slender capillaries (Fig. 3d) and one to two granulated sabre chaetae (Fig. 3e). Notopodial hooded hooks with 3 pairs of apical teeth above main fang and striate secondary internal hood appearing from about chaetiger 33 (Fig. 3f). No ventral bilobed flap on chaetiger 8. No interneuropodial pouches

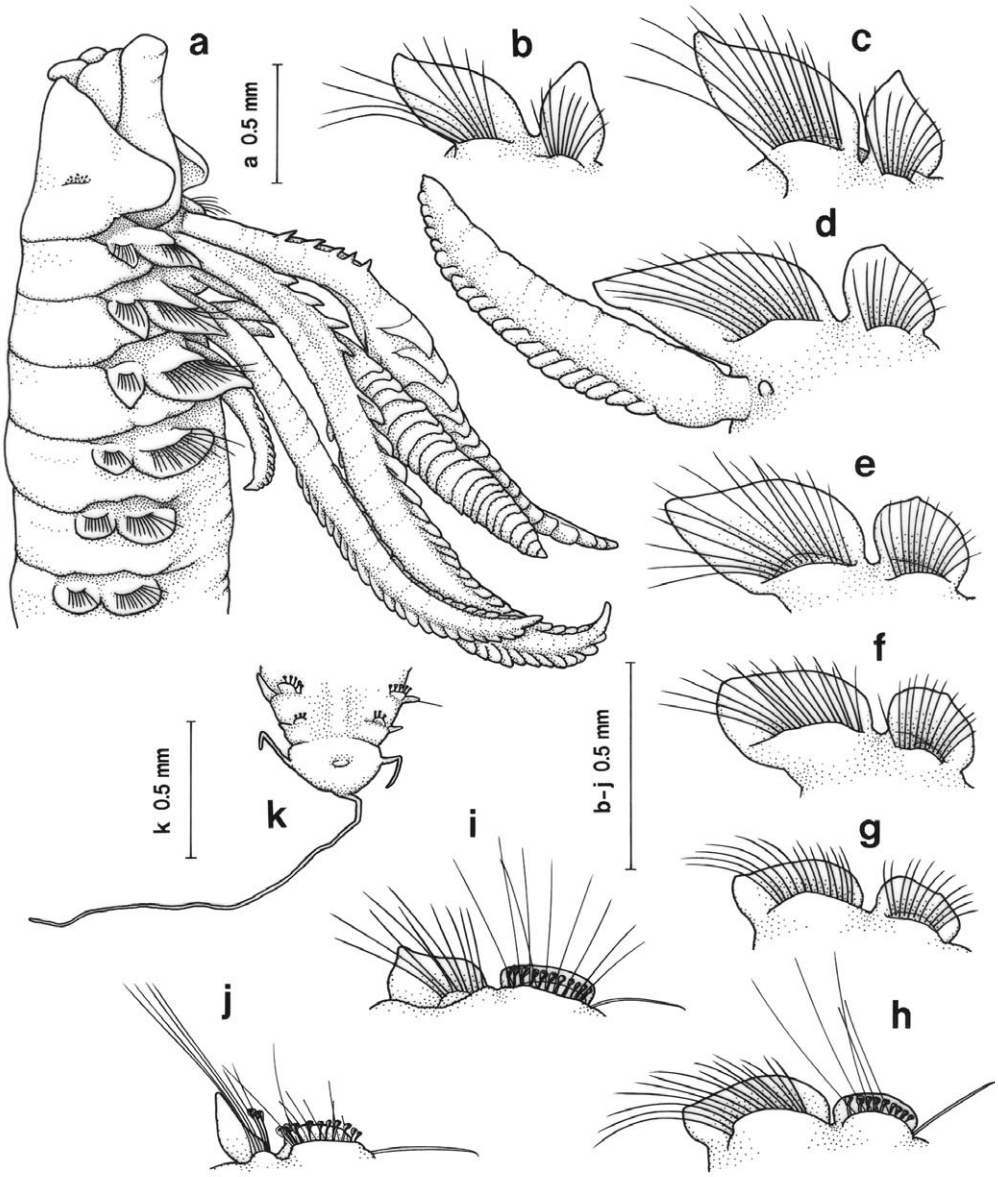

Fig. 2: *Paraprionospio coora* collected from the Aegean Sea (a, ESFM-POL/99-19; b-k, ESFM-POL/08-23). a, Anterior end in dorso-lateral view; b, 1st parapodium, in anterior view; c, 2nd parapodium, in anterior view; d, 3rd parapodium, 3rd branchia and a protuberance near the base of the 3rd branchia, in anterior view; e, 4th parapodium, in anterior view; f, 5th parapodium, in anterior view; g, 8th parapodium, in anterior view; h, 9th parapodium, in anterior view; i, 15th parapodium, in anterior view; j, 48th parapodium, in anterior view; k, posterior end, in ventral view.

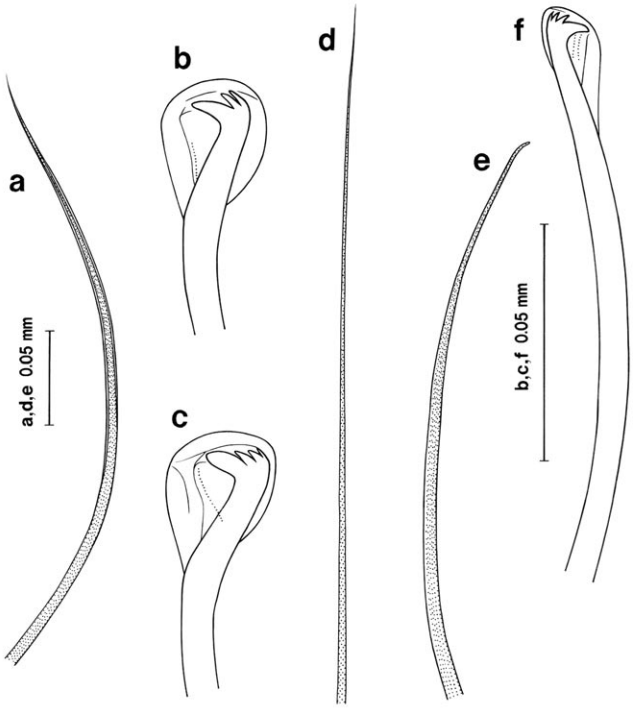

Fig. 3: *Paraprionospio coora* collected from the Aegean Sea (ESFM-POL/08-23). a, Notopodial limbate capillary from chaetiger 4; b, neuropodial hooded hood from chaetiger 9, bearing 2 pairs of apical teeth; c, neuropodial hooded hood from chaetiger 9, bearing 3 pairs of apical teeth; d, neuropodial non-limbate capillary from chaetiger 9; e, sabre chaeta from chaetiger 39; f, notopodial hooded hook from chaetiger 48.

from all specimens. Dorsum of chaetigers 4–11 faintly biannulated. Dorsum of chaetigers 12–17 transverse series of lighter colored slightly raised ridges, 3 ridges per chaetiger. Membranous dorsal crests and semi-transparent dorsal cuticle absent. Pygidium with a long median anal cirrus and two short, lateral cirri (Fig. 2k). Muscular gizzard present between chaetigers 6–8.

Distribution: Western Japan, more southern than 37°N; Yellow Sea, East China Sea, New South Wales to Tasmania in Australia, Mediterranean.

Remarks: The Mediterranean specimens of *Paraprionospio coora* closely agree with the original description of the species from Australia by WILSON (1990), but have 2–3 pairs of apical teeth in neuropodial hooded hooks rather than only 2 pairs of apical teeth. A variable number of apical teeth was noted within the Mediterranean specimens, suggesting that this is not a stable characteristic to be used in distinguishing species. Interneuropodial pouches were found in most specimens collected from Australia (WILSON, 1990) and in some specimens from Japan (YOKOYAMA, 2007) and China (ZHOU *et al.,* 2008), whereas all Mediterranean specimens examined in this study lack this characteristic. However, it seems this is not a stable characteristic which can be dependably used in distinguishing species,

because the number of interneuropodial pouches varies from zero to about 30 even in a local population in Australia, China and Japan. The Mediterranean specimens have a small protuberance on the dorsum near the base of third branchiae (Fig. 2d) instead of the slender filament in some of the other *Paraprionospio* species (see Figs 1,10,11,13,14 in YOKOYAMA, 2007). WILSON (1990), YOKOYAMA (2007) and ZHOU *et al.* (2008) did not mention this characteristic however, we found the same structure in the Japanese specimens of *P. coora.* Hence, we identified the Mediterranean specimens as *P. coora.* It is the first time this species has been recorded from the Mediterranean Sea; the present study has revealed the widespread geographical occurrence of *P. coora* from Australia, the Far East and the Mediterranean.

The closely similar species *Paraprionospio pinnata* was first recorded from the western Mediterranean by BELLAN (1964) and from the eastern Mediterranean by ERGEN (1992). Later, this species was reported especially from the eastern Mediterranean (DIAPOULIS & BOGDANOS, 1983; SIMBOURA & NICOLAIDOU, 2001; ERGEN *et al.,* 2002, 2006; DOĞAN *et al.,* 2005; ÇINAR, 2005) and the Red Sea (FAUVEL, 1933). The examination of the older benthic material, which was collected in the Aegean Sea and identified as *P. pinnata,* in fact belongs to *P. coora.* This finding suggests that the occurrence of *P. pinnata* in the Mediterranean should be reexamined.

Paraprionospio coora is closely related to *P. pinnata* in morphological and chaetal appearances. However, *P. coora* easily distinguishes from *P. pinnata* in the following characteristics 1) *P. coora* has a small papilla on posterior margin of the peristomium (no papilla in *P. pinnata*); 2) The first branchiae of *P. coora* are usually the longest or the first and second branchiae are approximately equal in length, the third pair is the shortest (branchiae are almost equal in size in *P. pinnata*); 3) *P. coora* has conic processes in the basal region of the first branchial shaft (no processes in *P. pinnata*); 4) *P. coora* has a small protuberance on the dorsum near the base of the third branchiae (no protuberance in *P. pinnata*); 5) *P. coora* lacks a semi-transparent dorsal cuticle (*P. pinnata* has a semi-transparent dorsal cuticle); and 6) Interparapodial pouches are present in some specimens of *P. coora* (absent in *P. pinnata*).

Paraprionospio coora has been reported from distant regions (i.e. Australia, Japan and China) before (WILSON, 1990; YOKOYAMA, 2007; ZHOU *et al.,* 2008). The occurrence of *P. coora* in the Mediterranean Sea indicates that this species has a wider distributional pattern than we know now. Spionid polychaetes are known to invade different zoogeographic regions as a result of their introduction via the ballast waters of ships (BASTROP *et al.,* 1997; ÇINAR *et al.,* 2005, 2006, 2008; DAĞLI & ÇINAR, 2009) or the introduction of molluscs into coastal waters for further commercial cultivation (MORENO *et al.,* 2006; RADASHEVSKY *et al.,* 2006). *P. coora* may be included in alien species however, at present their alien status cannot be demonstrated based on scientific data except for their extensive geographical distribution. The discovery of this species in other parts of the world and genetic studies on its distant populations would shed more light on its alien status.

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