

Presence of the Australian spionid species, *Prionospio paucipinnulata* (Polychaeta: Spionidae), in the Mediterranean Sea

Ertan DAĞLI and Melih Ertan ÇINAR

Ege University, Faculty of Fisheries, Department of Hydrobiology, 35100, Bornova, Izmir, Turkey
Fax: +902323883685. E-mail: ertan.dagli@ege.edu.tr

Abstract: The present study deals with the first occurrence of *Prionospio* (*Prionospio*) *paucipinnulata* in the Mediterranean Sea. It was collected on muddy bottom at depths ranging from 4.5 to 35 m on the Aegean (Gökova Bay) and Levantine coasts of Turkey (Iskenderun Bay) in 2000 and 2009. This species is mainly characterized by a long caruncle and the arrangement of apinnate (second and fourth) and pinnate (first and third) branchiae through the body, which have a few number of pinnules. This species could have been introduced to the Mediterranean from the Pacific Ocean (southern Australia) via ballast water of ships. The morphology, ecology and distribution of the species are explained.

Résumé : *Présence du spionidé australien Prionospio paucipinnulata (Polychaeta : Spionidae) en Mer Méditerranée.* Le présent travail décrit la première découverte de *Prionospio* (*Prionospio*) *paucipinnulata* en Mer Méditerranée. Elle a été récoltée au cours des années 2000 et 2009 sur un fond envasé de la Mer Egée (Gökova Bay) et des côtes levantines de Turquie (Iskenderun Bay) entre 4,5 et 35 m de profondeur. Cette espèce est caractérisée principalement par une longue caroncule et la disposition des branchies apennées (deuxième et quatrième) et pennées (première et troisième) le long de corps, ces dernières ne portant qu'un petit nombre de pinnules. Cette espèce pourrait avoir été introduite en Mer Méditerranée dans des eaux de ballast de navires en provenance de l'Océan Pacifique (Australie méridionale). La morphologie, l'écologie et la distribution de l'espèce sont expliquées.

Keywords: *Prionospio paucipinnulata* • Spionidae • Mediterranean • Levantine Sea • Aegean Sea • Alien species • Turkey

Introduction

Spionid polychaetes can be easily transported world-wide via ships or aquaculture trade and become invasive species especially in polluted areas (Bailey-Brock, 2000; Çinar et al., 2005a; Dagli & Çinar, 2008). They can alter structures of soft-bottom benthic communities or become a nuisance for shell farms (i.e. boring spionids). The record of alien spionid species is continuously increasing in the Mediterranean, partly through the increase in the number of studies performed in the area and partly by an increase in international shipping. A total of 9 alien spionid species have been reported from the Mediterranean Sea up to date (Zenetos et al., 2008; Dagli & Çinar, 2008 & 2009; Çinar et al., 2005a & b), eight of which occurred on the coast of Turkey. The only spionid species that has not been found from the coast of Turkey is *Apoprionospio pygmaea* (Hartman, 1961), which was solely reported from the Sardinia (Italian coast) [as *Prionospio (Apoprionospio) pygmaea*] at 70 m depth (Martinelli et al., 1992).

The genus *Prionospio* is represented by 13 species belonging to three subgenera (*Prionospio* Malmgren, 1867, *Minuspio* Foster, 1971, *Aquilaspio* Foster, 1971) in the Mediterranean Sea (see Table 1). Till now, 11 *Prionospio* species have been reported from the coasts of Turkey, of which four are considered to be alien; *P. (Prionospio) saccifera*, *P. (Aquilaspio) sexoculata*, *Prionospio (A.) krusadensis* and *Prionospio (P.) depauperata*. The former two species could have been introduced to the Mediterranean from the Red Sea through the Suez Canal (Lessepsian migrants) and the others from the Pacific or

Indian Oceans via ballast water of ships (Dagli & Çinar, 2009).

Prionospio (Prionospio) paucipinnulata Blake & Kudenov, 1978 was originally described from Victoria (Port Phillip Bay, south Australia), and can be easily distinguished from other species of *Prionospio* by having a long caruncle, and the distribution of apinnate (on chaetigers 2 and 4) and pinnate (on chaetigers 1 and 3) branchiae through the body (Blake & Kudenov, 1978). Unlike other *Prionospio* species, this species has a few numbers of pinnules (4-5) on the pinnate branchiae. It has been only reported from the type locality. The present study extends its distributional range to the Mediterranean and provides additional information about its distribution and ecology.

Material and Methods

Specimens of *Prionospio (Prionospio)* were collected from Gökova Bay (Aegean Sea) in September 2000 and Iskenderun Bay (Levantine Sea) in May-July 2009 by a Van Veen Grab (stations 3-7) and an anchor dredge (stations 1-2) (Fig. 1). The dates, coordinates, depths, and biotopes structures of the stations are indicated in the material examined section of the species.

All materials collected were washed through a 0.5-mm-mesh sieve and fixed with a 4% formaldehyde solution. In the laboratory, material washed with tap water and then sorted under a stereomicroscope. The specimens of *Prionospio (Prionospio) paucipinnulata* were identified and counted, using stereo- and compound microscopes. A

Table 1. *Prionospio (Prionospio) paucipinnulata*. Records of *Prionospio* species in the Mediterranean Sea and on the coasts of Turkey (* alien species).

Tableau 1. *Prionospio (Prionospio) paucipinnulata*. Signalement des espèces du genre *Prionospio* en Mer Méditerranée et sur les côtes de la Turquie (* espèce exotique).

SPECIES	Western Mediterranean	Eastern Mediterranean	Turkish coasts
* <i>Prionospio (Aquilaspio) krusadensis</i> Fauvel, 1929	-	+	+
* <i>Prionospio (Aquilaspio) sexoculata</i> Augener, 1918	-	+	+
<i>Prionospio (Minuspio) cirrifera</i> Wirén, 1883	+	+	+
<i>Prionospio (Minuspio) multibranchiata</i> Berkeley, 1927	+	+	+
* <i>Prionospio (Minuspio) pulchra</i> Imajima, 1990	-	+	-
* <i>Prionospio (Prionospio) depauperata</i> Imajima, 1990	-	+	+
<i>Prionospio (Prionospio) dubia</i> Day, 1961	+	+	+
<i>Prionospio (Prionospio) ehlersi</i> Fauvel, 1928	+	+	+
<i>Prionospio (Prionospio) ergeni</i> Dagli & Çinar, 2009	-	+	+
<i>Prionospio (Prionospio) fallax</i> Söderström, 1920	+	+	+
* <i>Prionospio (Prionospio) paucipinnulata</i> Blake & Kudenov, 1978	-	this study	this study
* <i>Prionospio (Prionospio) saccifera</i> Mackie & Hartley, 1990	-	+	+
<i>Prionospio (Prionospio) steenstrupi</i> Malmgren, 1867	+	+	+
<i>Prionospio (Prionospio) tripinnata</i> Maciolek, 1985	-	+	-

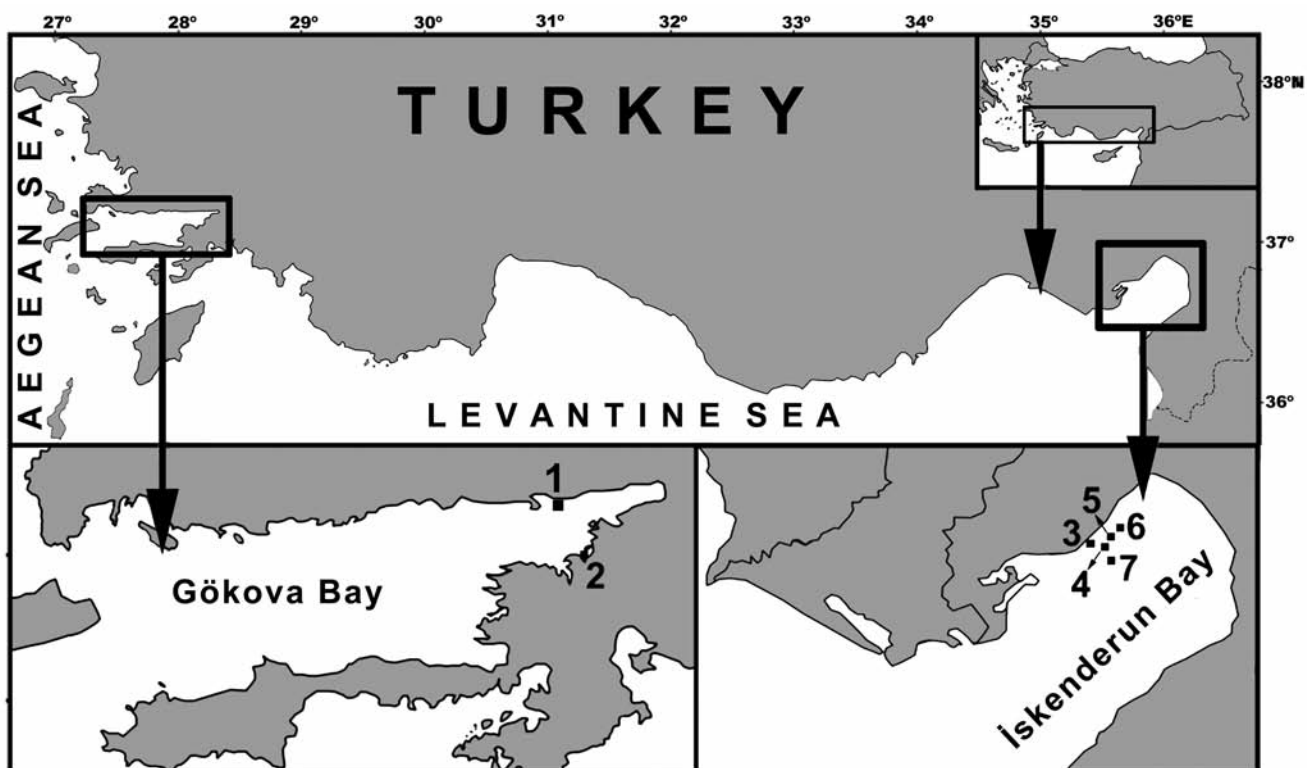


Figure 1. Map of the investigated area with location of sampling sites.

Figure 1. Carte de la région étudiée et localisation des stations d'échantillonnage.

number of biometrical features (i.e. the length and width of the body, the length of hooks and saber chaeta. etc.) of the largest individual of the species were measured using an ocular micrometer. Drawings were made with the aid of a camera lucida.

All specimens are deposited at the Museum of the Faculty of Fisheries, Ege University (ESFM), Izmir, Turkey.

Results and Discussion

Family Spionidae Sars, 1862

Genus *Prionospio* Malmgren, 1867

Subgenus *Prionospio* Malmgren, 1867

Prionospio (Prionospio) paucipinnulata Blake &

Kudenov, 1978

(Figs 2 & 3)

Prionospio (Prionospio) paucipinnulata Blake & Kudenov, 1978: 217-219, Fig. 22.

Material examined

ESFM-POL/2000-623, 5 specimens, 18 September 2000, Gökova Bay, St. 1, 37°01'50"N-28°09'27"E, 31 m, sandy

mud; ESFM-POL/2000-624, 6 specimens, 18 September 2000, Gökova Bay, St. 2, 36°57'52"N-28°11'40"E, 35 m, sandy mud; ESFM-POL/2009-263, 51 specimens, 9 May 2009, Iskenderun Bay, St. 3, 36°49'34"N-35°53'46"E, 11.5 m, muddy sand; ESFM-POL/2009-264, 17 specimens, 9 May 2009, Iskenderun Bay, St. 4, 36°54'22"N-35°53'32"E, 10.2 m, muddy sand; ESFM-POL/2009-265, 3 specimens, 9 May 2009, Iskenderun Bay, St. 5, 36°49'52"N-35°53'58"E, 11.7 m, muddy sand; ESFM-POL/2009-266, 3 specimens, 9 May 2009, Iskenderun Bay, St. 6, 36°49'13"N-35°53'35"E, 18 m, mud; ESFM-POL/2009-267, 2 specimens, 9 May 2009, Iskenderun Bay, St. 7, 36°49'49"N-35°52'57"E, 4.5 m, sandy mud; ESFM-POL/2009-268, 2 specimens, 11 July 2009, Iskenderun Bay, St. 3, 36°49'34"N-35°53'46"E, 11.5 m, muddy sand.

Description

Largest specimen complete, 5.9 mm long, 0.29 mm wide, with 45 chaetigers. Body slender, enlarged anteriorly, gradually tapering to posterior end. Color in alcohol opaque white. Prostomium rounded on anterior margin, slightly inflated at level of eyes, tapering posteriorly to form a narrow caruncle extending to chaetiger 4 (Fig. 2A). Four eyes present, anterior pair small, rounded; posterior pair

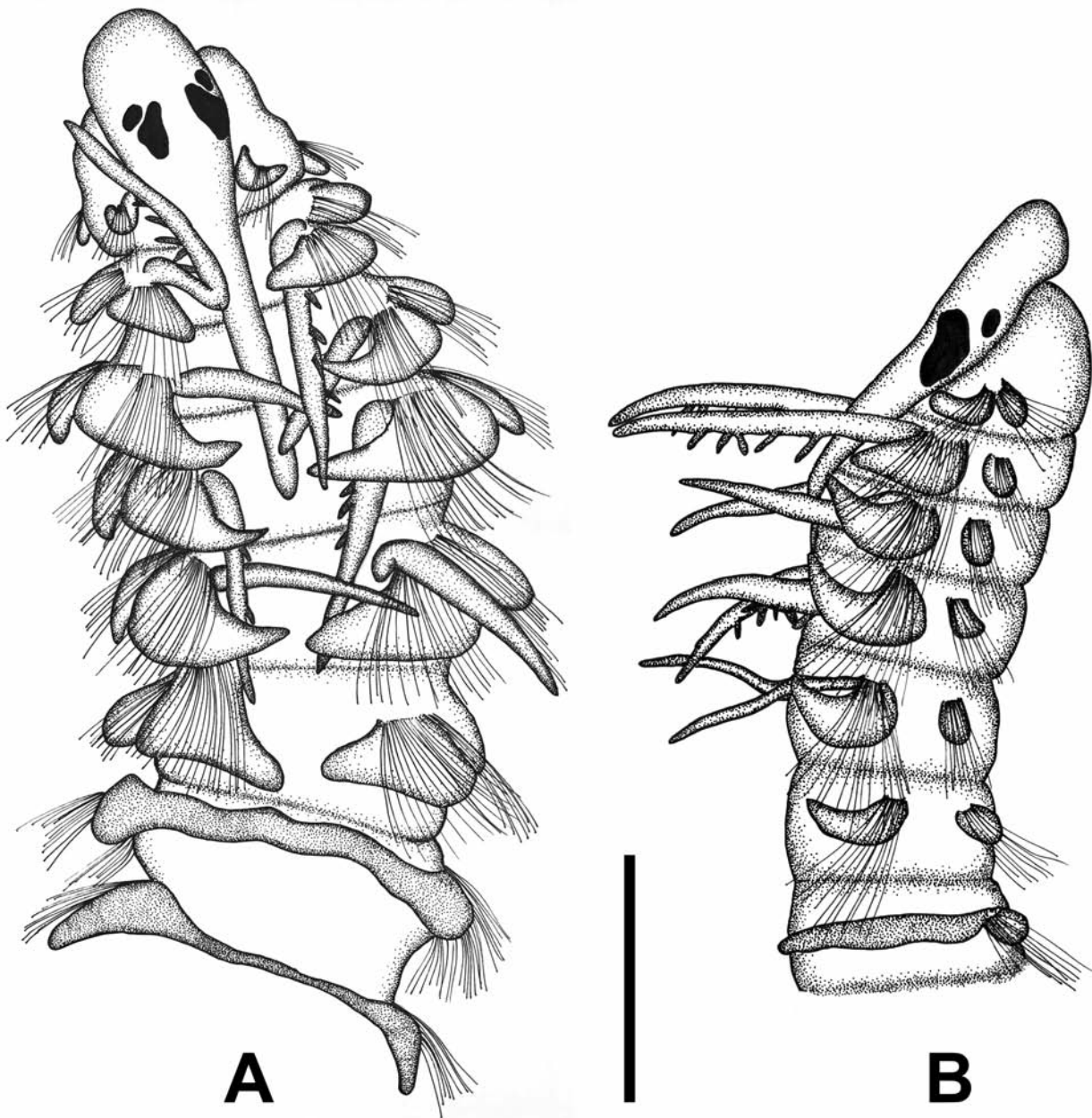


Figure 2. *Prionospio* (*Prionospio*) *paucipinnulata*. **A.** Anterior end, dorsal view (ESFM-POL/09-263). **B.** Anterior end, lateral view (ESFM-POL/09-263). Scale bar: A = 0.1 mm, B = 0.12 mm.

Figure 2. *Prionospio* (*Prionospio*) *paucipinnulata*. **A.** Partie antérieure, vue dorsale (ESFM-POL/09-263). **B.** Partie antérieure, vue latérale (ESFM-POL/09-263). Échelle : A = 0,1 mm, B = 0,12 mm.

large, irregular shaped (Fig. 2A & B). Peristomium reduced, fused to chaetiger 1, with small lateral wings.

Branchiae 4 pairs, present on chaetiger 2-5; first and third pairs pinnate, second and fourth pairs apinnate; each pinnate branchia with sparse digitiform pinnules (Figs 2A-B & 3A & C). First pair longest, extending to chaetiger 4 (Fig. 3A), with 4-5 pinnules on each branchia; third pair, shorter than first pair, with 3-4 pinnules on each branchia

(Fig. 3C); second and third pairs apinnate, equal in length, shorter than pinnate pairs, slightly longer than notopodial lamellae; with densely ciliated sides (Figs 2A-B & 3B).

Parapodia of chaetiger 1 distinct; notopodial and neuropodial postsetal lamellae smaller than those of succeeding chaetigers, with capillary chaetae only (Fig. 3A & B). Parapodia of chaetiger 2 with rectangular-shaped notopodial lamellae and small rounded neuropodial

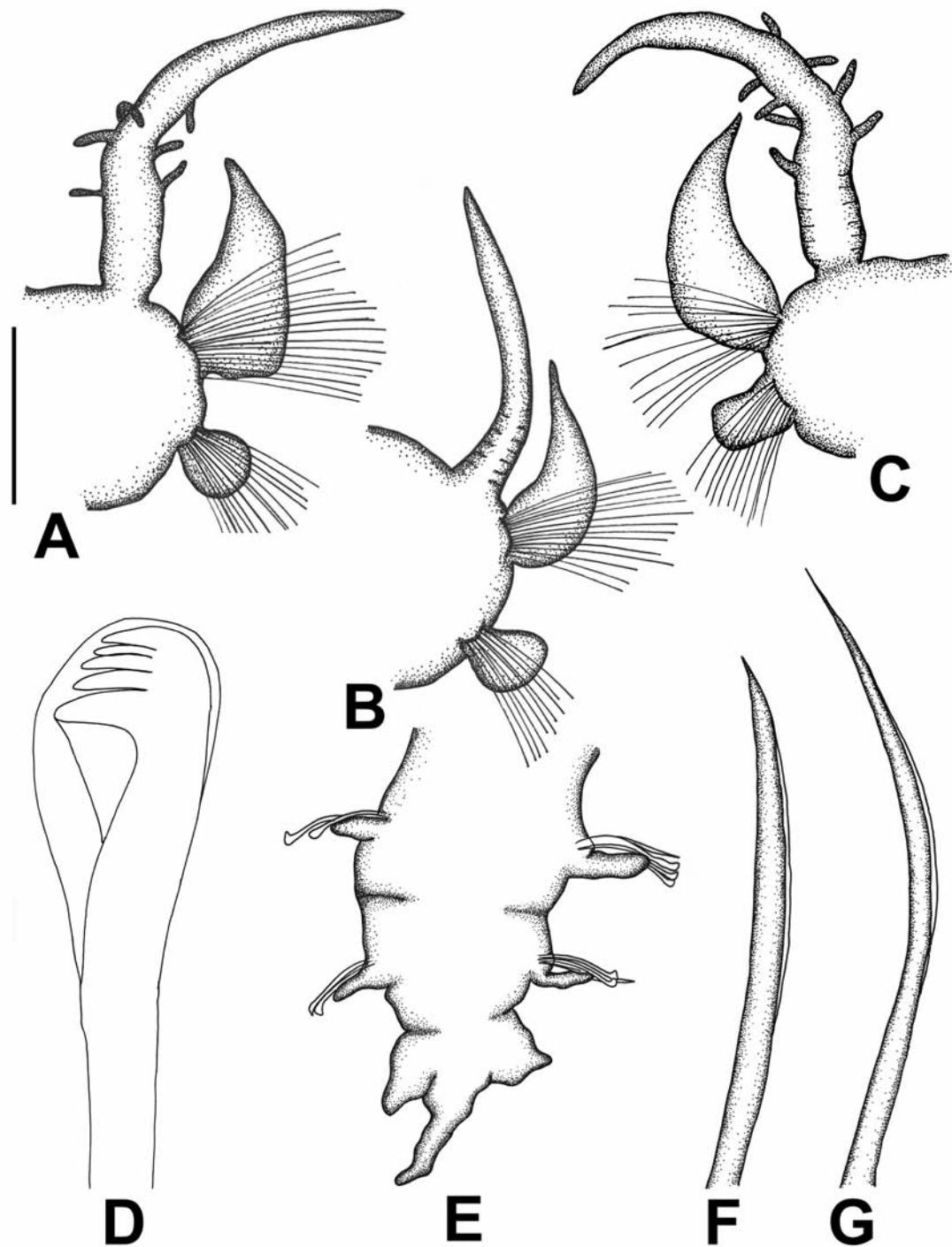


Figure 3. *Prionospio (Prionospio) paucipinnulata*. **A.** Parapodium 2 with branchia (first branchial segment), anterior view, (ESFM-POL/09-264). **B.** Parapodium 3 with branchia (second branchial segment), anterior view. **C.** Parapodium 4 with branchia (third branchial segment), anterior view. **D.** Neuropodial hook on chaetiger 20. **E.** Posterior end, dorsal view. **F.** Ventral sabre chaeta on chaetiger 15. **G.** Notopodial capillary chaeta on chaetiger 10. Scale bar: A-C = 0.1 mm, D = 10.7 mm, E = 0.09 mm, F-G = 18.9 mm.

Figure 3. *Prionospio (Prionospio) paucipinnulata*. **A.** Parapode 2 avec la branchie (premier sétigère branchial), vue antérieure (ESFM-POL/09-264). **B.** Parapode 3 avec la branchie (deuxième sétigère branchial), vue antérieure. **C.** Parapode 4 avec la branchie (troisième sétigère branchial), vue antérieure. **D.** Crochet neuropodial sur le sétigère 20. **E.** Partie postérieure, vue dorsale. **F.** Soie en épée ventrale sur le sétigère 15. **G.** Soie capillaire notopodiale sur le sétigère 10. Échelle: A-C = 0,1 mm, D = 10,7 mm, E = 0,09 mm, F-G = 18,9 mm.

lamellae (Figs 2B & 3A). Notopodial postchaetal lamellae of chaetigers 3, 4 and 5 becoming crescent shaped, with pointed distal end. Notopodial lamellae united across dorsum, forming low crests from chaetiger 7 to 16. Dorsal crests initially conspicuous, slightly higher on chaetiger 7, less-developed on chaetiger 8, gradually decreasing thereafter (Fig. 2A & B). Notopodial lamellae on median chaetigers low, broadly rounded, becoming elongate leaf-like lobes on posterior chaetigers. Neuropodial lamellae of chaetiger 3 rounded, those of chaetiger 4 rectangular. Following notopodial lamellae gradually decreasing in size and becoming rounded. Neuropodial lamellae small, triangular on middle parapodia, digitiform on posterior parapodia. Interparapodial pouches absent.

Anterior noto- and neuropodial capillaries moderately granulated, with thin sheath (Fig. 3G); chaetae arranged in two rows; chaetae of anterior row shorter than those of posterior row. Neuropodial hooded hooks present from chaetiger 13, numbering up to 5-6 per fascicle; notopodial hooded hooks from chaetiger 32-33, numbering up to 4-5 per fascicle; hooks with 4 pairs of small teeth above main fang (Fig. 3D), hooks accompanied by capillaries throughout. Ventral sabre chaeta first present on neuropodia of chaetiger 10; slightly granulated; numbering one or two per fascicle (Fig. 3F).

Pygidium with one long medial cirri and two lateral lappet (Fig. 3E).

Remarks

Prionospio (Prionospio) paucipinnulata is easily distinguished from other species of the genus in the following characters: 1) the combination of pinnate and apinnate branchiae (1 and 3 pairs pinnate; 2 and 4 pairs apinnate), 2) having sparse digitiform pinnules on branchiae (3-5), and 3) having a long caruncle extending to chaetiger 4. The Mediterranean specimens agree well with the original description of the species from the Port Phillip Bay (Victoria, South Australia). However, some slight differences were observed. Notopodial hooded hooks first appeared on chaetigers 32 or 33 in the Mediterranean specimens, whereas they first occurred on chaetigers 34 or 35 in the Australian specimens. The other difference between the distant populations of this species is the number of sabre chaetae (1 or 2 in the Mediterranean specimens vs. single in the Australian specimens).

Ecology

Prionospio (Prionospio) paucipinnulata was previously reported from sand bottoms between 2 and 9 m in Port Phillip Bay (Blake & Kudenov, 1978; for habitat structure see Poore et al., 1975). This species was found on sandy muddy sediment between 4.5 and 35 m depths in the

eastern Mediterranean Sea. The highest population density (510 individuals.m⁻²) of this species was found on muddy sand bottom at 11.5 m depth at station 3.

Distribution and the way of its introduction to the eastern Mediterranean

Prionospio (Prionospio) paucipinnulata was originally described from the south-eastern Australia (Victoria, Port Phillip Bay) by Blake & Kudenov (1978). This species has not been reported anywhere else after its original description. The present study extends its distributional range to the Mediterranean Sea. The pathway through which this species become established in the eastern Mediterranean is probably by ballast water of ships. Its settlement in sediment accumulated at bottom of ballast tanks and producing larvae just before the tanks are being emptied might lead to its introduction to the area. The Iskenderun and Mersin Bays, where large international harbors and jetties for petroleum pipelines and coals are present, are known to be invaded by some Australian species. Cevik et al. (2007) reported that the killer alga *Caulerpa taxifolia* (Vahl) C. Agardh was introduced to Iskenderun Bay from the north-east Australia. Dense populations of *Laonome triangularis* Hutchings & Murray, 1984, which was only known from the Australian coast, were reported from Iskenderun and Mersin Bays (Çinar, 2009).

Prionospio species in the Mediterranean Sea

The number of *Prionospio* species, including the present record of *Prionospio (Prionospio) paucipinnulata*, is fourteen in the Mediterranean Sea (Table 1). Six species were reported from the western part, fourteen species from the eastern part (Maciolek, 1985; Çinar & Ergen, 1999; Simboura & Nicolaidou, 2001; Zenetos et al., 2005; Çinar et al., 2006; Dagli & Çinar, 2009). Seven species occur only in the eastern Mediterranean. The number of *Prionospio* species known from the coast of Turkey was raised from eleven to twelve. The species previously given under the genus *Prionospio* in the Mediterranean Sea such as *Prionospio banyulensis*, *P. pinnata*, *P. pygmaea*, and *P. salzi* were later transferred to the genus *Aurospio* Maciolek, 1981, *Parapriospio* Caullery, 1914, *Apopriospio* Foster, 1969 and *Laubieriellus* Maciolek, 1981, respectively (Foster, 1971; Blake & Kudenov, 1978; Maciolek, 1981; Sigvaldadóttir, 1998). In addition to these species, *P. (P.) caspersi*, which has three pairs of apinnate branchiae on chaetigers 2-4 and a pair of pinnate branchiae on chaetiger 5, has been transferred to the genus *Apopriospio* by Foster (1971).

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References

- Bailey-Brock J.H. 2000.** A new record of the polychaete *Boccardia proboscidea* (family Spionidae), imported to Hawai'i with oysters. *Pacific Science*, **54**: 27-30.
- Blake J.A. & Kudenov J.D. 1978.** The Spionidae (Polychaeta) from southeastern Australia and adjacent areas, with a revision of the genera. *Memoirs of the National Museum of Victoria*, **39**: 171-280.
- Cevik C., Yokes M.B., Cavas L., Erkol L.I., Dereci O.B. & Verlaque M. 2007.** First report of *Caulerpa taxifolia* (Bryopsidales, Chlorophyta) on the Levantine coast (Turkey, eastern Mediterranean). *Estuarine, Coastal and Shelf Science*, **74**: 549-556.
- Çinar M.E. 2009.** Alien polychaete species (Annelida: Polychaeta) on the southern coast of Turkey (Levantine Sea, eastern Mediterranean), with 13 new records for the Mediterranean Sea. *Journal of Natural History*, **43**: 2283-2328.
- Çinar M.E. & Ergen Z. 1999.** Occurrence of *Prionospio saccifera* (Spionidae: Polychaeta) in the Mediterranean Sea. *Cahiers de Biologie Marine*, **40**: 105-112.
- Çinar M.E., Ergen Z., Dagli E. & Petersen M.E. 2005a.** Alien species of spionid polychaetes (*Streblospio gynobranchiata* and *Polydora cornuta*) in Izmir Bay, eastern Mediterranean. *Journal of the Marine Biological Association of the United Kingdom*, **85**: 821-827
- Çinar M.E., Bilecenoglu M., Öztürk B., Katagan T. & Aysel V. 2005b.** Alien species on the coasts of Turkey. *Mediterranean Marine Sciences*, **6/2**: 119-146.
- Çinar M.E., Katagan T., Öztürk B., Egemen Ö., Ergen Z., Kocatas A., Önen M., Kirkim F., Bakir K., Kurt G., Dagli E., Kaymakçi A., Açıık S., Dogan A. & Özcan T. 2006.** Temporal changes of soft bottom zoobenthic communities in and around Alsancak Harbor (Izmir Bay, Aegean Sea), with special attention to the autoecology of exotic species. *Marine Ecology*, **27**:229-246.
- Dagli E. & Çinar M.E. 2008.** Invasion of polluted soft substrate of Izmir Bay (Aegean Sea, eastern Mediterranean) by the spionid polychaete worm, *Pseudopolydora paucibranchiata* (Polychaeta: Spionidae). *Cahiers de Biologie Marine*, **49**: 87-96.
- Dagli E. & Çinar M.E. 2009.** Species of the subgenera *Aquilaspio* and *Prionospio* (Polychaeta: Spionidae: *Prionospio*) from the southern coast of Turkey (Levantine Sea, eastern Mediterranean), with description of a new species and two new reports for the - Mediterranean fauna. *Zootaxa*, **2275**: 1-20.
- Foster N.M. 1971.** Spionidae (Polychaeta) of the Gulf of Mexico and the Caribbean Sea. *Studies on the Fauna of Curaçao and other Caribbean Islands*, **36**: 1-183.
- Maciolek N.J. 1981.** Spionidae (Annelida, Polychaeta) from the Galapagos Rift geothermal vents. *Proceedings of the Biological Society of Washington*, **94**: 826-837.
- Maciolek N.J. 1985.** A revision of the genus *Prionospio* Malmgren, with special emphasis on species from the Atlantic Ocean, and new records of species belonging to the genera *Apoprionospio* Foster, and *Paraprionospio* Caullery (Polychaeta: Spionidae). *Zoological Journal of the Linnean Society*, **84**: 325-383.
- Martinelli M.R., Milella I. & Lardicci C. 1992.** *Prionospio (Aprionospio) pygmaea* Hartman, 1961 (Polychaeta, Spionidae): première signalisation en Méditerranée. *Marine Life*, **1**: 17-20.
- Poore G.C.B., Rainer S., Spies R.B. & Ward E. 1975.** The zoobenthos program in Port Phillip Bay, 1969-73. *Fisheries and Wildlife Paper Victoria*, **7**: 1-78.
- Sigvaldadóttir E. 1998.** Cladistic analysis and classification of *Prionospio* and related genera (Polychaeta, Spionidae). *Zoology Scripta*, **27**: 175-187.
- Simboura N. & Nicolaidou A. 2001.** The Polychaetes (Annelida, Polychaeta) of Greece: Checklist, distribution and ecological characteristics. *Monographs on Marine Sciences*, **4**: 114 pp.
- Zenetos A., Çinar M.E., Pancucci-Papadopoulou A.M., Harmelin J.G., Furnari G., Andaloro F., Bellou N., Streftaris N. & Zibrowius H. 2005.** Annotated list of marine alien species in the Mediterranean with records of the worst invasive species. *Mediterranean Marine Science*, **6/2**: 63-118.
- Zenetos A., Meriç E., Verlaque M., Galli P., Boudouresque C.-F., Giangrande A., Çinar M.E. & Bilecenoglu M. 2008.** Additions to the annotated list of marine alien biota in the Mediterranean with special emphasis on Foraminifera and Parasites. *Mediterranean Marine Science*, **9/1**: 119-165.