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MARCO LEZZI[1], EMANUELE MANCINI[2,6], ANDREA BONIFAZI[3], FABIO BERTASI[4], JOACHIM LANGENECK[5]

[1] Arpae Emilia-Romagna - Daphne Oceanographic Structure, Cesenatico (FC) Italy;
[2] Dipartimento di Scienze e Tecnologie Biologiche ed Ambientali, DiSTeBA, University of Salento, 73100 Lecce, Italy
[3] ARPA Lazio. Dipartimento Stato dell'Ambiente, Roma, Italy
[4] Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA), Via Vitaliano Brancati, Roma (RM), Italy
[5] Consorzio Nazionale Interuniversitario per le Scienze del Mare (CoNISMa), U.L.R. di Lecce, c/o Palazzina A, Campus Ecotekne, strada provinciale Lecce-Monteroni, Lecce (LE), Italy
[6] NBFC, National Biodiversity Future Center - Palermo, Piazza Marina 61, 90133 Palermo, Italy
e-mail: mlezzi@arpae.it

TAXONOMIC INSIGHTS: AN IDENTIFICATION KEY TO MEDITERRANEAN SPIONIDAE GRUBE, 1850

RIASSUNTO

Gli Spionidae rappresentano una famiglia di policheti diversificata e cruciale negli ecosistemi bentonici mediterranei come bioindicatori e nel ciclo dei nutrienti. L'identificazione accurata a livello specifico è complessa, ed ostacola gli studi ecologici. Questo lavoro fornisce una chiave per i generi e le specie di Spionidae del Mediterraneo. Questa chiave mira ad essere una risorsa vitale per ricercatori e studenti, migliorando l'identificazione degli Spionidae nel Mediterraneo, in particolare considerato il loro significato ecologico e il potenziale impatto delle specie non indigene sui popolamenti nativi e sulle attività umane.

SUMMARY

Spionidae is a diverse polychaete family crucial in Mediterranean benthic ecosystems as bioindicators and in nutrient cycling. Accurate identification is challenging, hindering ecological studies. This work provides a key for Mediterranean Spionidae genera. This key aims to be a vital resource for researchers and students, improving Spionidae identification in the Mediterranean, considering their ecological significance and invasive potential.

INTRODUCTION

Spionidae Grube, 1850, is one of the major polychaete families, with over 700 valid species (WoRMS, 2025). They are found from the intertidal to the deep sea and can be a dominant component of shallow-water sandy sediments. They have been found in the vicinity of hydrothermal vents, and several species have been recorded in freshwater (Sigvaldadóttir and Desbruyeres, 2003; Dix *et al.*, 2004; Blake, 2006; Rouse *et al.*, 2022). Most species live in soft mud, sandy, and mixed sediments, including shells and gravel, and some build permanent tubes in soft substrata (e.g., *Paraprionospio* Caullery, 1914). Many species of the *Polydora* complex build tubes and establish dense populations in clastic sediments. However, others are able to bore into calcareous substrates like mollusc shells, living corals, coral rubble and coralline algae; some species of polydorids have also been found in silty clay (Sato-Okoshi and Okoshi, 1997; Lezzi and Mazziotti, 2024). Numerous species are free-living and burrowing in mud and sand, such as those belonging to *Aonides* Claparède, 1864, and *Scolelepis* De Blainville, 1828. Spionids have been considered selective feeders of surface deposits, suspension feeders, or both deposit and suspension feeders at the sediment–water interface (Dauer *et al.*, 1981).

One of the problems in the taxonomy of this family is that many species are considered cosmopolitan. However, some questionable records have been clarified in previous studies (e.g. Delgado-Blas, 2004, 2006, 2008; Sikoroski *et al*. 2021b; Surugiu *et al.*, 2022). We hope that this catalogue provides taxonomists, ecologists and students with updated and revised information about this group within the region.

Spionidae is a family of marine worms, which are marine worms known for their vital role in environmental monitoring. Their ecological characteristics and sensitivity to habitat changes make them valuable bioindicators for both marine and estuarine ecosystems (Dauer, 1993, Rosenberg *et al.*, 2004). Their presence, absence, or abundance can provide insights into the health of benthic communities. Changes in spionid populations may reflect alterations in environmental conditions such as pollution or habitat degradation. Moreover, spionids are sensitive to variations in the sediment quality and water chemistry. Monitoring populations can help detect shifts in ecosystem dynamics, particularly in areas influenced by anthropogenic activities such as shipping and aquaculture (Dean, 2008). As deposit feeders, spionids contribute to nutrient cycling by breaking down organic matter and enhancing the sediment turnover. This activity helps maintain the health of benthic ecosystems, which is crucial for marine biodiversity (Heip *et al.*, 1995). Spionid worms play a crucial role in marine ecosystems as both primary producers and food sources at higher trophic levels (Fauchald and Jumars, 1979). Their feeding strategies, which can vary from suspension feed-

ing to deposit feeding, make them key players in detrital food webs (Heip *et al.*, 1995)

Some spionid species are invasive, posing risks to local ecosystems by outcompeting native species and altering their habitat structures (Dagli and Çinar, 2008; Maximov, 2011). These invasive species can act as ecosystem engineers and can significantly modify ecosystems (Golubkov *et al.*, 2021; Radashevsky *et al.*, 2022). Monitoring spionid populations can aid in the early detection of invasive species and help to manage their impact on local biodiversity. Increasing global trade in shellfish has facilitated the spread of invasive spionids. Understanding their distribution patterns through monitoring can inform management strategies aimed at mitigating biological invasions and preserving the native marine life.

The species list, which includes all polychaete species recorded in the Mediterranean Sea to date, was initially compiled based on published Mediterranean checklists of polychaetes (Castelli *et al.*, 2008; Coll *et al.*, 2010; Mikac, 2015; Faulwetter *et al.*, 2017; Bakalem *et al.*, 2020; Ayari-Kliti *et al.*, 2022; Rousou *et al.*, 2023; Çinar *et al.*, 2024; Toso *et al.*, 2024). Moreover, we decided to add species occurring in the Black Sea or the eastern Atlantic Ocean, as it is possible that they might also occur in the Mediterranean Sea. The nomenclature of each species was reviewed based on WoRMS (2025).

Key for genus identification

Identification of genera constitutes a fundamental initial step in taxonomic studies of spionids. The dichotomous key utilized herein has been adapted and modified from the works of Fauchald (1977) and Radashevsky (2012). Morphological characteristics, particularly the arrangement of chaetae and the presence of distinct anatomical structures, such as gills (often identifiable even when detached based on the presence of scars), are critical for accurate genus identification.

The key initially categorizes the extensive group of polydorids, which are characterized by modified chaetae on the fifth chaetiger. These chaetae are readily observable under a stereomicroscope, as the fifth chaetiger often exhibits a band of more pronounced setae, barely protruding through the epidermis, and different proportions compared to the adjacent chaetigers. In the identification of polydorids, the key frequently requires an analysis of the chaetae on the fifth chaetiger, specifically focusing on the presence or absence of capillary or falcate setae positioned in particular body parts. Accurate identification of species belonging to this group requires both stereomicroscopic and optical microscopic techniques.

When the key requests information regarding chaetal characteristics, it is recommended to utilize a light microscope for detailed examination of the

specified chaetigers. For instance, in the case of *Spiophanes*, the presence of crook-like chaetae on the first chaetiger must be confirmed.

Additional significant features for identification include prostomial horns, occipital antennae, and gill arrangement. These characteristics can be accentuated through staining techniques using stains such as Shirlastain A. This dye is commonly employed in polychaete systematics to facilitate the examination of external structures, which are often crucial for accurate taxonomic classification. Shirlastain A, when used in a water solution, significantly improves the contrast of various external anatomical features of spionids such as notopodial lamellae, branchiae patterns and morphology, and other important morphological traits that are essential for species identification (Fig. 4 a). This method involves briefly immersing the specimen in dye (usually 2-5 seconds are enough), thereby enhancing visualization of whitish anatomical structures under microscopic observation. In particular, while generally the dye fades after immersion in water or ethanol, its fading is different between structures with different thickness, leading to differential colouration and to an easier examination of these features. Methyl green is often used to highlight glandular structures, which are particularly widespread in sedentary polychaetes that build tubes. As several Spionidae build tubes, this technique is useful for this family as well, and since in some groups methyl green patterns differ between different species, methyl green staining can be used to support the identification to species level.

Family Spionidae Grube, 1850

1a. Chaetiger 5 with only capillaries 2
1b. **Chaetiger 5 with heavy spines** in addition to capillaries **(Fig. 1a**) 16

2a. Branchiae absent. Neuropodia of chaetiger 1 with one or two large **crook-like (Fig. 1 b)** spines in addition to capillaries .....*Spiophanes* Grube, 1860
*2*b. Branchiae present. Neuropodia of chaetiger 1 with only capillaries 3

3a. Branchiae from chaetigers 1–3 for a variable number of chaetigers 4
3b. Branchiae beginning after chaetiger 10, limited to middle and posterior chaetigers. A pair of dorsal appendages (horns) present on chaetiger 2 in males.....
.....*Pygospio elegans* Claparède,1863
Type locality: Atlantic Ocean, western France.
Notes: tube-building opportunist in soft sediment (Morgan, 1997).

4a. Branchiae throughout most of body length 5
4b. Branchiae limited to anterior half of body 10

5a. **Head anteriorly conical (Fig. 1c)** and distally pointed 6

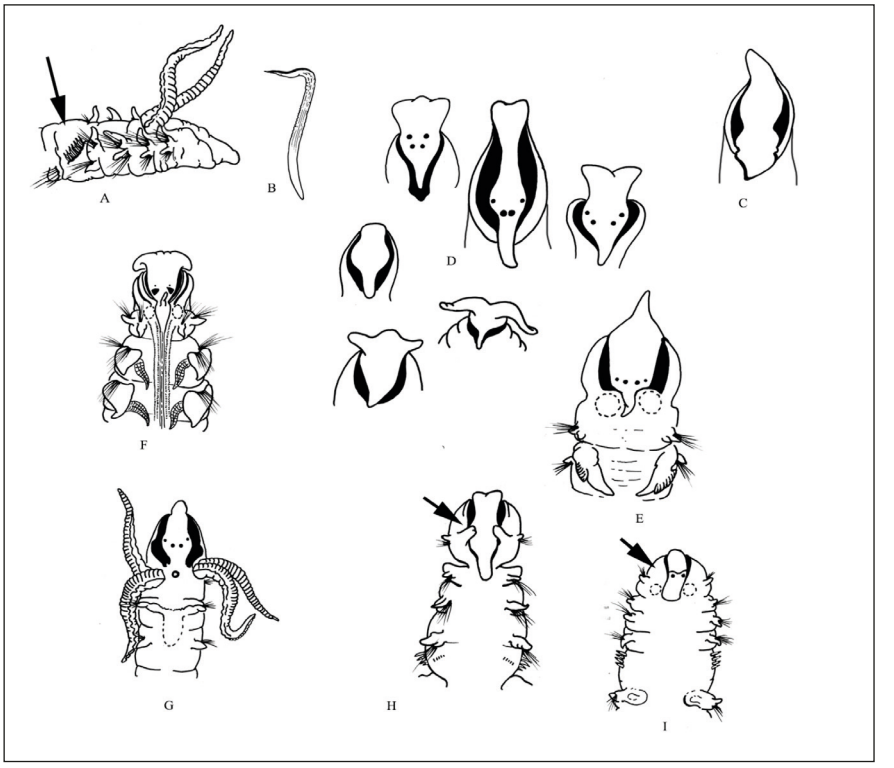

Fig. 1 - Key morphological characters used for genus identification in Spionidae. **a)** Chaetiger 5 with heavy spines, typical of polydorid genera (e.g., *Polydora, Dipolydora, Boccardia*). **b)** Crook-like spine in the neuropodia of chaetiger 1, characteristic of *Spiophanes*. **c)** Anteriorly conical and distally pointed head, found in genera such as *Scolelepis* and *Dispio*. **d)** Anteriorly wide, truncate to conical head. **e)** Branchiae starting from chaetiger 2, a key feature for *Scolelepis*. **f)** Presence of an occipital antenna, as seen in *Laonice*. **g)** Single pair of branchiae on chaetiger 1, characteristic of *Streblospio*. **h)** Chaetiger 1 with notochaetae, a feature used to identify *Dipolydora*. **i)** Chaetiger 1 without notochaetae, a feature used to identify *Polydora*.

5b. Head anteriorly **wide, truncate to conical (Fig. 1d)** but not distally pointed 7

6a. Branchiae from chaetiger 1. Posterior notopodia with only capillaries .....
..... *Dispio* Hartman, 1951
6b. **Branchiae from chaetiger 2 (Fig. 1e).** Posterior notopodia with hooks in addition to capillaries .....*Scolelepis* Blainville, 1828

7a. Branchiae from chaetiger 1 8
7b. Branchiae from chaetiger 2 .....
..... *Microspio mecznikowiana* (Claparède, 1869)
Type locality: Gulf of Naples, Italy, Mediterranean Sea
Ecology: Coarse sand and muddy sediments, 8-60 m (Lardicci, 1989).

8a. Posterior notopodia with only capillaries 9
8b. Posterior notopodia **with hooded hooks in addition to capillaries** .....
.....*Marenzelleria* Mesnil, 1896
Notes: The recent southward range expansion of *Marenzelleria* species, a genus not yet recorded in the Mediterranean but known for the North Sea, the Baltic Sea, and the Black Sea, raises concerns about their potential as future NIS (Radashevsky *et al.*, 2022).

9a. Prostomium **with fronto-lateral horns** ..... *Malacoceros* Quatrefages, 1843
9b. Prostomium **without fronto-lateral horns**..... *Spio* Fabricius, 1785

10a. Occipital antenna present or absent. Branchiae limited to first 20 chaetigers 11
10b. **Occipital antenna present (Fig. 1 f).** Branchiae present over most of anterior body
.....*Laonice* Malmgren, 1867

11a. Posterior notopodia with only capillaries 12
11b. Posterior notopodia **with hooks** in addition to capillaries 13

12a. Single pair of branchiae on chaetiger 1 **(Fig. 1 g)** ..... *Streblospio* Webster, 1879
12b. Four pairs of branchiae on chaetigers 2–5 .....
..... *Laubieriellus salzi* (Laubier, 1970)
Type locality: Ashdod, Israel, Mediterranean Sea
Ecology: on hard bottoms, sometimes artificial ones (Dağli, 2013).

13a. Prostomium conical with narrow and rounded tip anteriorly .....
.....*Aonides* Claparède, 1864
13b. Prostomium broadly rounded to truncate anteriorly 14

14a. Branchiae from chaetiger 1 ..... *Paraprionospio* Caullery, 1914
14b. Branchiae from chaetiger 2 ..... *15*
14c. Branchiae from chaetiger 3 (2–3 pairs).....
..... *Aurospio banyulensis* (Laubier, 1966)
Type locality: Banyuls, France, Mediterranean Sea
Ecology: on hard bottoms with sciaphilous algae.

15a. Parapodial lamellae do not change in size or shape along the entire body length, and are triangular in both rami; prostomium flattened ..... *Aonidella* López-Jamar, 1989
15b. Parapodial lamellae can change in size and shape along the length of the body, being normally broadly oval or foliaceous; prostomium conical, continuing posteriorly as a caruncle .....*Prionospio* Malmgren, 1867

16a. Chaetiger 4-5 with heavy falcate or aristate spines in **neuropodia** and only capillaries in notopodia 17
16b. Chaetiger 5 with heavy falcate spines in **notopodia** and only capillaries in neuropodia 18

17a. Flattened branchiae fused to the dorsal lamellae from setiger 10 .....
..... *Aciculaspio anaximanderi* Blake and Ramey-Balci, 2020
Type locality: Eastern Mediterranean Sea off Turkey
Cold seeps, 2216 m depth (Blake and Ramey-Balci, 2020).
17b. Flattened branchiae fused to the dorsal lamellae from setiger 7 .....
..... *Atherospio guillei* (Laubier and Ramos, 1974)
Type locality: Gulf of Roses, Spain, Western Mediterranean Sea.
On soft sediment, 40-100 m depth.

18a. Hooks in neuropodia from chaetiger 7; Branchiae from chaetigers 2-10 19
18b. Hooks in neuropodia from chaetiger 8; Branchiae from chaetiger 7 .....
.....*Pseudopolydora* Czerniavsky, 1881

19a. Branchiae from chaetigers 7–10 in individuals of all sizes 20
19b. Branchiae from chaetiger 2 (from chaetiger 7 in early juveniles) 21

20a. Chaetiger 1 with notochaetae **(Fig. 1 h)**. Hooded hooks without constriction on shaft. Branchiae from chaetigers 7–10.....*Dipolydora* Verrill, 1881
20b. Chaetiger 1 without notochaetae **(Fig. 1 i)**. Hooded hooks with constriction on shaft. Branchiae from chaetiger 7.....*Polydora* Bosc, 1802

21a. Heavy spine of chaetiger 1 of two types: **simple falcate and highly modified**.....
.....*Boccardia* Carazzi, 1893
21b. Heavy spine of chaetiger 1 of one type, simple falcate .....
..... *Boccardiella ligerica* (Ferronnière, 1898)
Type locality: Loire Estuary, France.
Notes: Reported from Greece by Papazacharias (1991) and in the Adriatic (Casellato and Stefanon, 2008). Infaunal polychaete, characteristic of brackish water. Occurring on soft mud and hard clay.

Aonidella López-Jamar, 1989

1a. Prostomium rounded, eyes absent .....
..... *Aonidella cirrobranchiata* (Day, 1961)
Type locality: South Africa.
Notes: The occurrence of this species in the Mediterranean

is questionable (Faulwetter *et al.*, 2017). In the Mediterranean only reported from Greece (Bogdanos and Satsmadjis, 1983). A re-evaluation of the specimen is necessary to explore the potential classification of the Greek record within the subgenus *Prionospio* (*Minuspio*) (Faulwetter *et al.*, 2017).

1b. Slight small indentation in the prostomium, four eyes .....
..... *Aonidella dayi* López-Jamar, 1989
Type locality: Gulf of Cadiz.
Cosmopolitan species (Maciolek, 2000).

Dispio Hartman, 1951

Relevant references: Delgado-Blas *et al.* (2016, 2019)

1a. Branchiae from anterior chaetigers completely fused to notopodial lamellae 2
1b. Branchiae from anterior chaetigers partially fused to notopodial lamellae .....
..... *Dispio uncinata* Hartman, 1951
Type locality: Florida, USA, Gulf of Mexico.
Notes: Records of *D. uncinata* from other localities, including the Mediterranean (Streftaris *et al.*, 2005), are dubious and should be reviewed (Delgado-Blas, 2016).

2a. Elliptic or rounded prostomium; the first branchiae are shorter than the following ones. .....
..... *Dispio glandulosa* Delgado-Blas, Díaz-Díaz and Viéitez, 2019
Type locality: Mediterranean Sea, Puerto de Sagunto to Puerto de Castellón (Valencia).
2b. Fusiform prostomium; the first branchiae are similar in length to the following ones
..... *Dispio magna* (Day, 1955)
Type locality: Originally described from South Africa.
Notes: In the Mediterranean also known from the central basin (Zenetos *et al.*, 2012).

Spiophanes *Grube, 1860*

Relevant references: Meissner (2005) and D'Alessandro *et al.* (2020)

1a. Occipital antenna absent, dorsal ciliated organs short (at most to chaetiger 4) or long (extending to about chaetigers 10-15) 2
1b. Occipital antenna present, ciliated organs long 4

2a. Dorsal ciliated organs short, reaching at most chaetiger 4 3
2b. Dorsal ciliated organs extending to about chaetigers 13–14 .....
..... *Spiophanes duplex* (Chamberlin, 1919)
Type locality Balboa, California, USA, Pacific Ocean.
North Pacific Ocean: from California to Gulf of Nicoya (Costa Rica); South Pacific Ocean: off Chile; North Atlantic

Ocean: Gulf of Mexico and Caribbean Sea; South Atlantic Ocean: South Brazil to Northern Argentina.
Questionable status. Meissner (2005) restricts the distribution of the species to the Atlantic and Pacific coast of America and the Greek record is probably a misidentification (Faulwetter *et al.*, 2017).

3a. Prostomium with long anterolateral horns .....
..... *Spiophanes bombyx* (Claparède, 1870)
Type locality: Gulf of Naples (Italy).
3b. Prostomium without horns .....
..... *Spiophanes wigleyi* Pettibone, 1962
Type locality: Georges Bank, off Massachusetts, USA, Northwest Atlantic
Notes: *Spiophanes wigleyi* occurs from subtidal to bathyal bottoms (Meissner and Hutchings, 2003) although in the Mediterranean it has been found only on subtidal sandy bottoms (Faulwetter *et al.*, 2017). Cosmopolitan species.

4a. Chaetal spreader of the **'0 + 1 type'(Fig. 2 a, 4 c)** 5
4b. Chaetal spreader of the '**2 + 3 type' (Fig. 2 a , 4 b)** 8

5a. Absence of glandular organ opening (vertical slit) on chaetiger 8..... 6
5b. Presence of glandular organ opening (vertical slit) in chaetiger 8.....
..... *Spiophanes reyssi* Laubier, 1964
Type locality: Mediterranean Sea, off France, NE Lacaze-Duthiers, at 360 m.

6a. Ventrolateral intersegmental pouches present from between chaetigers 15–16 7
6b. Ventrolateral intersegmental pouches present from between chaetigers 14–15. Dorsal ciliated crests from about chaetiger 18. Dark brown pigment around glandular opening on parapodia of chaetigers 9–14 .....
..... *Spiophanes mediterraneus* Meißner, 2005
Type locality: Mediterranean Sea, off Israel.

7a. Dorsal ciliated organs thin near middorsal bands extending to chaetigers 14–16
..... *Spiophanes kroyeri* Grube, 1860
Type locality: North Atlantic Ocean, Greenland Sea
Questionable Status
Notes: While *Spiophanes kroyeri* has been widely reported from Greece and other Mediterranean regions (Castelli *et al.*, 2008, Çınar *et al.*, 2014), Meissner (2005) determined that only North Atlantic specimens should be definitively identified as this species. Mikac (2015) confirmed the occurrence of *Spiophanes afer* in the Adriatic Sea, but found no evidence of *S. kroyeri*. Furthermore, *Spiophanes afer* is documented in the Turkish Aegean Sea and the Sea of Marmara (Dağli *et al.*, 2011; Faulwetter *et al.*, 2017).
7b. Dorsal ciliated organs as two mediolateral, broad bands extending to about chaetigers 14–15 .....

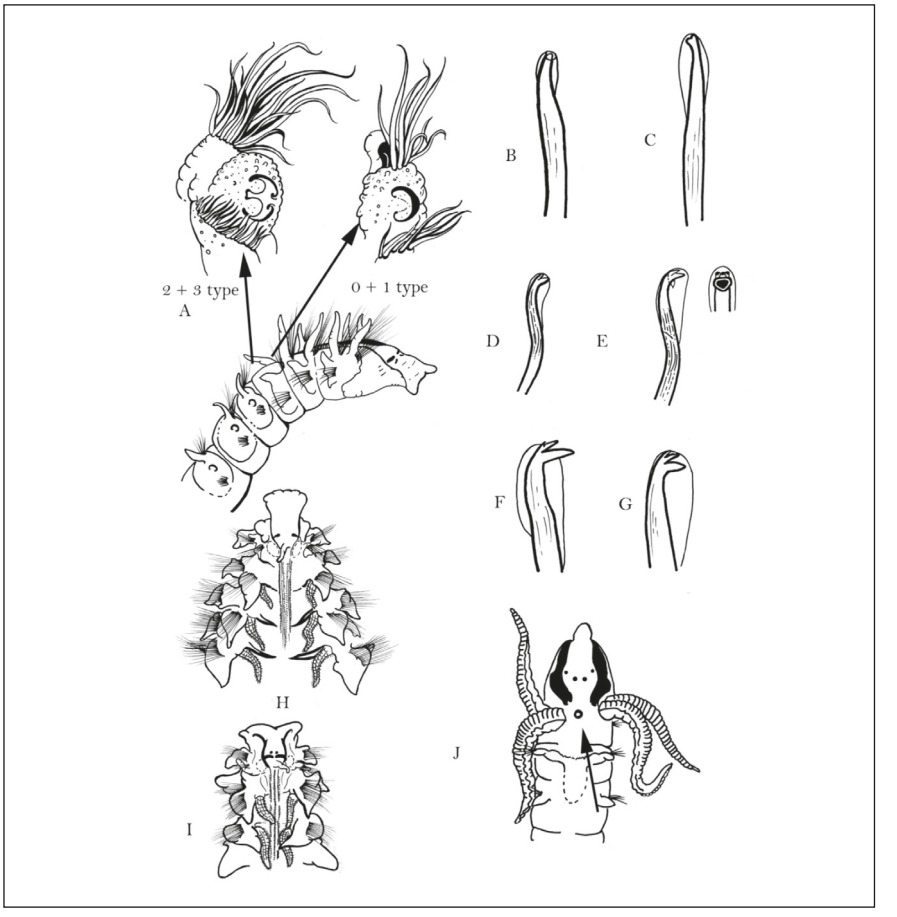

Fig. 2 - Key morphological characters for species identification in various genera. **a)** Chaetal spreader types (0+1 and 2+3) used in the identification of *Spiophanes* species. **b, c)** Hooded hooks with a short, falcate main fang, characteristic of some *Scolelepis* species. **d, e)** Hooded hooks with a long, tapering main fang, characteristic of some *Scolelepis* species. **f)** Tridentate hooded hook with a hardly visible uppermost tooth, found in *Spio symphyta*. **g)** Tridentate hooded hook with a distinct uppermost tooth, found in *Spio decorata*. **h)** Prostomium not fused with the peristomium at the anterior margin, as in *Laonice (Appelloefia)*. **i)** Prostomium fused with the peristomium at the anterior margin, as in *Laonice (Laonice)*. **j)** Presence of a dorsal papilla on chaetiger 1, a character used to separate species of *Streblospio*.

..... *Spiophanes algidus* Meißner, 2005
Type locality: South Africa French Crozet Islands.
NIS (questionable)
Notes: Mediterranean *Spiophanes algidus* resemble the Crozet Island specimens described by Meissner (2005), but show slight variations. The prostomium is nearly rounded, unlike the Atlantic specimens' projected margin, and Chaetiger 1 has one or two crook-like chaetae, instead of one (Dağli *et al.*, 2011). Molecular data are necessary to investigate whether these differences might point to a different, undescribed species.

8a. Dorsal ciliated organs to chaetigers 13–15. Fully developed ventrolateral intersegmental pouches present from between chaetigers 15–16. Dorsal ciliated crests distinct from chaetigers 18–19. Up to four eyespots, may be absent
..... *Spiophanes afer* Meißner, 2005
Type locality: off Spain, Mediterranean Sea (between Cape San Antonio and Valencia harbour).
8b. Ventrolateral intersegmental pouches present from between chaetigers 14–15, rarely 13–14 or 15–16. Dorsal ciliated crests from chaetiger 14–17. Two pairs of black eyes present .....
..... *Spiophanes adriaticus* D'Alessandro *et al.*, 2018
Type locality: offshore of Po Delta, Italy.
Note: Based on the close morphological similarity, Jourde *et al.* (2020) suggested that *S. adriaticus* might be synonymous with *S. afer*.

Scolelepis Blainville, 1828

Relevant references: Surugiu (2016; 2023), key adapted after Surugiu *et al.* (2022).

1a. Hooded hooks characterized by a short, falcate main fang, bearing 0–3 blunt conical apical teeth, and a straight or slightly curved shaft (Fig. 2 b, c)..... 2
1b. Hooded hooks with a long, flattened, and tapering main fang, topped by 2–4 sharply pointed apical teeth, and having a strongly curved shaft. (Fig. 2 d, e)..... 7

2a. Anterior notopodial postchaetal lamellae completely fused with branchiae 3
2b. Anterior notopodial postchaetal lamellae with free tips..... 4

3a. Notochaetae on chaetiger 1 present.....
..... *Scolelepis foliosa* (Audouin and Milne Edwards,1833)
Type locality: Brittany, France, English Channel.
Mostly shallow sandy substrates, 0-30 m (Lardicci, 1989)
3b. Notochaetae on chaetiger 1 absent
..... *Scolelepis cantabra* (Rioja, 1918)
Type locality: Cantabrian Sea, Atlantic Ocean.
Sandy bottom 0-62 m (Lardicci, 1989)
4a. Prostomium anteriorly trilobed; peristomium short .....

.....*Scolelepis neglecta* Surugiu, 2016
Type locality: Spain. Cantábria, Asturias, sedimentary area and Cabo de Peñas. The species inhabits fine sublittoral sands with an admixture of shells at depths ranging from 0.5 to 32 m (Surugiu, 2016).

4b. Prostomium anteriorly conical and pointed; peristomium long..... 5

5a. Eyes usually absent; posterior margin of prostomium raised from dorsum as a tentacle
.....*Scolelepis bonnieri* (Mesnil, 1896)
Type locality: Ponte aux Oies, Wimereux (Pas-de-Calais), Northern France, English Channel. Lower shore or shallow sublittoral.

5b. Eyes usually present; posterior margin of prostomium attached to dorsum;..... 6

6a. Tips of notopodial lamellae pointed; neuropodial hooded hooks starting from chaetigers 14–35; hooks with 1–2 apical teeth and with more or less right angle between main fang and shaft ..... *Scolelepis mesnili* (Bellan and Lagardère, 1971)
Type locality: Ile d'Oleron, Charente, France

6b. Tips of notopodial lamellae rounded; neuropodial hooded hooks starting from chaetigers 23–48; hooks with 0–1 apical teeth and wide angle between main fang and shaft
.....*Scolelepis squamata* (Müller, 1806)
Type locality: Düne, Helgoland, Germany, North Sea
Habitat. Fine (125–300 µm median grain size), clean sands, sometimes with an admixture of shells, from the upper intertidal to the shallow subtidal zone of exposed beaches (Bellan and Lagardère, 1971; Surugiu, 2016).
Notes: Mediterranean records could comprise specimens of *Spiophanes neglecta* Surugiu, 2016.

7a. Notochaetae on chaetiger 1 absent..... 8
7b. Notochaetae on chaetiger 1 present .....
..... *Scolelepis gilchristi* Day, 1961
Type locality: South Africa
Questionable status.
Notes: The species has been reported in the Mediterranean, with specific records from Egypt (Ben-Eliahu, 1972), Italy (Cantone and Fassari, 1982) and Greece (Nicolaidou and Pitta, 1986). However, its absence from subsequent Italian reviews and checklists (Lardicci, 1989; Castelli *et al.*, 2008) suggests that these earlier identifications were likely deemed erroneous by later authorities (Faulwetter *et al.*, 2017).

8a. Eyes usually absent. Neuropodial hooks have median tooth situated below lateral ones.
..... *Scolelepis korsuni* Sikorski, 1994
Type locality: Atlantic Ocean, North Sea, Lille Frigg II Gas Field. Distribution: Northeast Atlantic Ocean: North Sea. Arctic Ocean: Barents Sea.
Depth range 95-450 m (Sikorski, 1994).
Notes: Not yet recorded in the Mediterranean, but potentially occurring in bathyal zones.

8b. Eyes present. Neuropodial hooks otherwise 9

9a. Branchiae are separated from notopodial lamellae from chaetigers 15–30 .....
..... *Scolelepis bellani* Surugiu, 2023
Type locality: Black Sea, Ukraine.
This species inhabits coarse sand among algae, gravelly sand, sand with shell debris, fine sand, and muddy sand at depths of 0–30 meters. Present in Black Sea, Sea of Marmara and Tyrrhenian Sea (Surugiu, 2023).
9b Branchiae are completely fused or only weakly separated to end of body.....
..... *Scolelepis tridentata* (Southern, 1914)
Type locality: NE Atlantic, Ireland.
The species inhabits the upper sublittoral and is found in *Laminaria* roots or in dead *Posidonia*.
Atlantic coasts of Ireland, France, and Spain and the Western Mediterranean Sea (Surugiu, 2023).

Malacoceros Quatrefages, 1843

Relevant references: Delgado-Blas and Díaz-Díaz (2013).

1a. Bidentate hooks 2
1b. Tridentate hooks .....
..... *Malacoceros vulgaris* Johnston, 1827
= *Malacoceros girardi* Quatrefages, 1843
Type locality: contained in French part of the English Channel Sand and sandy mud, 10-20 m (Lardicci, 1989).
Notes: Pettibone (1963) established the synonymy of *Malacoceros girardi* with *Malacoceros vulgaris*, a taxonomic decision subsequently adopted by numerous authors. However, despite this established synonymy, recent Mediterranean records have employed the name *M. girardi* (e.g., Castelli *et al.*, 2008; Dağli, 2008; Çinar *et al.*, 2014), indicating a persistent divergence in taxonomic application (Faulwetter *et al.*, 2017).

2a. 4 hooks per fascicle .....
..... *Malacoceros fuliginosus* (Claparède, 1868)
Type locality: Naples harbour (Italy).
Notes: this species is recognized as a species complex, exhibiting significant intra-specific variation. Guérin and Kerambrun (1984) delineated three distinct morpho-ecological and genetic forms within this complex. Of these, two forms are sympatric within the Mediterranean Sea, whereas the third one is restricted to the North East Atlantic (Guérin and Kerambrun, 1984). This species inhabits muddy substrates.
2b. 7-12 hooks per fascicle .....
..... *Malacoceros tetracerus* (Schmarda, 1861)
Type locality: Coast of Bretagne (Northern France), in sand. Fine sand, 10 m (Lardicci, 1989).

Spio Fabricius, 1785

Relevant references: Bick *et al.* (2010), Meissner *et al.* (2011).

1a. 2- 3 pairs of eyes, hooks from chaetigers 10-14 2
1b. 3 to 7 pairs of eyesarranged irregularly eyes, hooks from chaetigers 28-32 .....
..... *Spio multioculata* (Rioja, 1918)
Type locality: Atlantic Ocean, Spain
Sand.

2a. Tridentate hooks 3
2b. Bidentate hooks ..... *Spio filicornis* (Müller, 1776)
Type locality: West Greenland, Iluilârssuk, near Paamiut (Frederikshaab).
Notes: The status of this species in the Mediterranean Sea remains questionable. Meissner *et al.* (2011) provided a redescriptive analysis from the type locality in Iluilârssuk, Greenland, concluding that the traditional diagnostic features used to identify the species are inadequate. These authors restricted the distribution of the species to Greenland and advocated for a reassessment of specimens from other regions, as noted by Faulwetter *et al.* (2017).

3a. Neuropodial hooded hooks from chaetiger 10-11 4
3b. Neuropodial hooded hooks from chaetiger 14.....
..... *Spio martinensis* Mesnil, 1896
Type locality: Atlantic Ocean, France.
This species is present in different coastal sublittoral habitats, such as fine to medium sands or muddy sands (Dauvin, 1989; Bick *et al.*, 2010).

4a. Neuropodial hooded hooks tridentate (uppermost tooth distinct) **(Fig. 2 g)**, from chaetiger 10-11 .....
..... *Spio decorata* Bobretzky, 1870
Type locality: Black Sea.
Sublittoral; coarse and fine sand (Lardicci, 1989).
4b. **Neuropodial hooded hooks tridentate (uppermost tooth hardly visible) (Fig. 2 f)**, from chaetiger 10-11 ..... *Spio symphyta* Meißner, Bick and Bastrop, 2011
Type locality: North Sea.
Fine and coarse sand areas without silt. Subtidal species.
Found in Tyrrhenian Sea at 5-15 m depth, pers. obs. (FB)

Laonice Malmgren, 1867

Relevant references: Sikorski *et al.* (2003; 2021a; 2021b).

1a. Prostomium **not fused with peristomium at anterior margin (Fig. 2 h)**, clearly visible in dorsal view 2
1b. Prostomium **fused with peristomium at anterior margin (Fig. 2 i)** or it is not visible in

dorsal view 3

2a. Inter-parapodial pouches appear from chaetiger 8–17 .....
..... *Laonice (Appelloefia) norgensis* Sikorski, 2003
Type locality: Norway.
150 m, sandy mud, recorded in Mediterranean Sea by Dağli *et al.* (2011) and Ayari-Kliti *et al.* (2022).
2b. Inter-parapodial pouches appear from chaetiger 5–8 .....
.....*Laonice (Appelloefia) barcinensis* Sikorski, 2021
Type locality: NW Mediterranean Sea, 990 m depth, submarine canyon (Sikorski *et al.*, 2021a).

3a. No complete dorsal transverse crests connecting bases of notopodial post-setal lamellae in very last branchiate and several following segments 4
3b. Complete dorsal transverse membranes connecting bases of notopodial post-setal lamellae in last branchiate and several following segments. Hooded hooks with two apical teeth in lateral view .....*Laonice (Laonice) bahusiensis* complex *5*

4a. Hooded hooks with one apical tooth in lateral view. .....
.....*Laonice (Laonice) cirrata* (M. Sars, 1851)
Hammerfest, Norway (new designation) from Sikorski (2003) Circumpolar.
Notes: This species is considered a species complex, with at least two putative cryptic species identified in the Canadian Pacific (Carr *et al.* 2011). Records of *Laonice cirrata* in the Mediterranean may actually refer to *Laonice bahusiensis* (Söderström 1920) (Mikac, 2015; see Sikorski, 2003 for species differences) or to the two seemingly endemic species recently described by Sikorski *et al.* (2021b). A thorough investigation of all previous records of *L. cirrata* is needed to confirm their correct identification.
4b. Hooded hook with two apical teeth in lateral view .....
..... *Laonice (Sarsiana) alberti* Sikorski, Langeneck and Pavlova, 2021
Type locality: central Mediterranean Sea, 1200 m.
Clay, bathyal environments, Mediterranean Sea and possibly Gulf of Cadiz (Sikorski *et al.*, 2021a).

5a. Dorsal crests present on several posterior chaetigers with nuchal organs. Branchiae usually absent on chaetigers posterior to nuchal organs ($-5 \leq$ Br-NO ≤ 1). Distinct staining with methyl green usually absent on anterior part of prostomium .....
..... *Laonice (Laonice) mediterranea* Sikorski, Nygren and Rousou, 2021
Type locality: Cyprus, off Cape Greco (Cavo Grekko)
On shell fragments, 4-70 m, fine sand, muddy sand or *Posidonia oceanica* root mat.
5b. Dorsal crests absent on chaetigers with nuchal organs. Branchiae usually present on up to 12 chaetigers posterior to nuchal organs ($-2 \leq$ Br-NO ≤ 12). Narrow transverse band intensely stained with methyl green along anterior edge of prostomium and peristomium
..... 6

6a. Branchiae up to twice as long as notopodial postchaetal lamellae, dorsal crests on posterior branchiate chaetigers single. Upper tips of notopodial postchaetal lamellae with an acute peak on at least anterior half of branchiate chaetigers
..... *Laonice (Laonice) bahusiensis* Söderström, 1920
Type locality. Sweden, Skagerrak, At 14-373 m depth.
Notes: Reported for the Mediterranean Sea by Dağli *et al.* (2011), Mikac (2015) and Ayari-Kliti *et al.* (2022). While records preceding Sikorski *et al.*'s (2021b) might refer to the two Mediterranean endemic species (*L. mediterranea* and *L. grimaldii*), Ayari-Kliti *et al.* (2022) stress the morphological identity of Tunisian specimens with *L. bahusiensis*, rather than with the two remaining species.
6b. Branchiae slightly longer than notopodial postchaetal lamellae, dorsal crests on posterior branchiate chaetigers double. Upper tips of notopodial postchaetal lamellae rounded after chaetigers 4–6. .....*Laonice (Laonice) grimaldii* Sikorski, Nygren and Mikac, 2021
Type locality: Italy, Ligurian Sea.
At 10–80 m, muddy sand.

Streblospio Webster, 1879

Relevant references: Delgado-Blas *et al.* (2018), Munari *et al.* (2020; 2025)

1a. Dorsal papilla on chaetiger 1 absent..... 2
1b. Dorsal papilla on chaetiger **1 present (Fig. 2 j)** 3

2a. Dorsal membranous collar on chaetiger 2 bilobed; hooks with two pairs of teeth above main tooth .....*Streblospio shrubsolii* (Buchanan, 1890)
Type locality: Atlantic Ocean, mouth of River Thames, England Brackish and marine waters.
Notes: Munari *et al.* (2025) establish a neotype for *S. shrubsolii* based on an individual from Sacca di Goro, Adriatic Sea. However, according to the ICZN code (art. 75.3), the qualifying conditions for a neotype are not met by this publication. In particular, Munari *et al.* (2025) did not explicitly explain the circumstances calling for neotype designation (art. 75.3.1), nor their reasons to believe that the original type material is lost (art. 75.3.4); the evidence for the correspondence of the neotype described for Sacca di Goro with the original type material is not clear (art. 75.3.5) and the locality where the neotype is samples is very far away from the original type locality (art. 75.3.6).
2b Dorsal membranous collar on chaetiger 2 entire; hooks with five pairs of teeth above main tooth.....
..... *Streblospio padventralis* Delgado-Blas, Díaz-Díaz and Viéitez, 2018
Type locality: Combarro beach, Ría de Pontevedra, Galicia, Spain, Atlantic Ocean
Distribution. Northeastern Atlantic Ocean: Iberian Pen-

insula, Atlantic littoral of north and south Spain (Galicia; Andalusia). Notes: Intertidal, observed in brackish-water environments in the Ionian Sea (J.L., *pers. obs*.). Potentially, its distribution might largely overlap with that reported for *S. shrubsolii*, with which it might have been confused.

3a. Hooks with 3-4 pairs of teeth above main tooth; pygidium with lappets .... *Streblospio eridani* Munari, Wolf, Infantini, Moro, Sfriso and Mistri, 2020.

Cryptogenic

Notes: the examined topotypic specimens genetically match with Indian specimens of *Streblospio* sp. (Munari *et al.*, 2020), even though it is not possible at the moment to assess whether the species originates from the Mediterranean Sea, or from the Indian Ocean.

Type locality: Sacca di Goro. North Adriatic Sea, Mediterranean sea

Marine and brackish shallow waters.

3b. Hooks with five pairs of teeth above the main tooth, pygidium simple .... *Streblospio gynobranchiata* Rice and Levin, 1998

NIS

Type locality: Florida (marine), Tampa Bay, Courtney Campbell Causeway.

Marine and brackish shallow waters.

***Aonides* Claparède, 1864**

Relevant references: Brito *et al.* (2006)

1a. Four eyes present 2

1b. Eyes absent; 6-8 pair of branchiae, neuropodial hooks tridentate from chaetiger 11 ..... *Aonides* cf. *selvagensis* Brito, Núñez and Riera, 2006

Type locality: Savage Islands, Macaronesia.

Notes: Originally described from the central Macaronesian region, on muddy sand at 15 m depth. Individuals overall matching with *A. selvagensis* from the morphological point of view, and clearly distinct from both *A. oxycephala* and *A. paucibranchiata*, were sampled in the Tyrrhenian Sea at 30-50 m depth (J.L. *pers. obs*.).

2a. 10-30 pairs of branchiae, neuropodial hooks bidentate from chaetiger 28-46 .... *Aonides oxycephala* (Sars, 1862)

Type locality: Florøen, Norway.

Notes: Faulwetter *et al.* (2017) document the frequent occurrence of this species throughout the Mediterranean, including Greece and Cyprus (Rousou *et al*., 2023). However, Radashevsky (2015) challenges the assumption of its cosmopolitan distribution, positing the potential existence of a complex of cryptic species. Ecological preferences indicate a prevalence in sedimentary environments characterized by mud, sand, gravel, and mixed substrates.

2b. 6-11 pairs of branchiae, neuropodial hooks tridentate from chaetiger 17-30 .....
..... *Aonides paucibranchiata* Southern, 1914

Notes: The taxonomic identification of specimens reported from Greece, relying heavily on Fauvel's (1927) description, has been subject to potential misinterpretation (Faulwetter *et al*. 2017), particularly with *Aonides oxycephala* (Sars, 1862) or other morphologically similar species. Ecologically, this species is reported to inhabit muddy substrates within a depth range of 60 to 100 meters.

Prionospio Malmgren, 1867

The following bibliographic entries provide valuable resources for the study of *Prionospio* and related Spionidae polychaetes, particularly within the Mediterranean: Maciolek (1985), Dağli and Çinar (2009, 2010, 2011); Delgado-Blas *et al*. (2018, 2019). Although the subgenera proposed by Foster (1971) based on branchial arrangement are now considered artificial groupings (Sigvaldadóttir, 1998; Hektoen *et al*., 2024), they are retained here for their practical utility in species identification.

1a. Only **apinnate (Fig. 3 a)** branchiae, either smooth or wrinkled *Minuspio* Foster, 1971
1b. Only **pinnate (Fig. 3 b)** branchiae .....*Aquilaspio* Foster, 1971
1c. Apinnate and pinnate branchiae .....*Prionospio* Malmgren, 1867

***Prionospio (Minuspio)* Foster, 1971**

1a. Some branchiae distinctly longer than notopodial lamellae (minimally 4–5 times) 2
1b. All branchiae short, nearly as long as notopodial lamellae 3

2a. Eyes absent, 7 pairs of long branchiae .....
..... *Prionospio (Minuspio) anatolica* Dağli .....and Cinar, 2011

Type Locality: Iskenderun Bay, Levantine Sea.
10- 25 m, sandy mud.
Distribution. Eastern Mediterranean (Levantine Sea, southern coast of Turkey) (Dağli and Çinar, 2011). Observed off Cyprus and in the southern Tyrrhenian Sea (J.L., *pers. obs.*).

2b. Two pairs of eyes, 9-10 pairs of branchiae, last three shorter than the first seven
..... *Prionospio (Minuspio) pulchra* Imajima, 1990

NIS
Type Locality: Japanese coast
At 10-20 m, muddy sand (Dağli and Çinar, 2011

3a. Notopodial lamellae lacking on chaetiger 1 .....
..... *Prionospio (Minuspio) maciolekae* Dagli .....
.....and Cinar, 2011

Type Locality: Finike Bay Muddy substratum, 50 m.
Distribution. This species was found in the eastern Mediterranean Sea (Dağli and Çinar, 2011; Rousou *et al*., 2023), in the Ionian Sea (Langeneck *et al*., 2024a; J.L., *pers. obs.*) and in the Tyrrhenian Sea (J.L., *pers. obs.*).

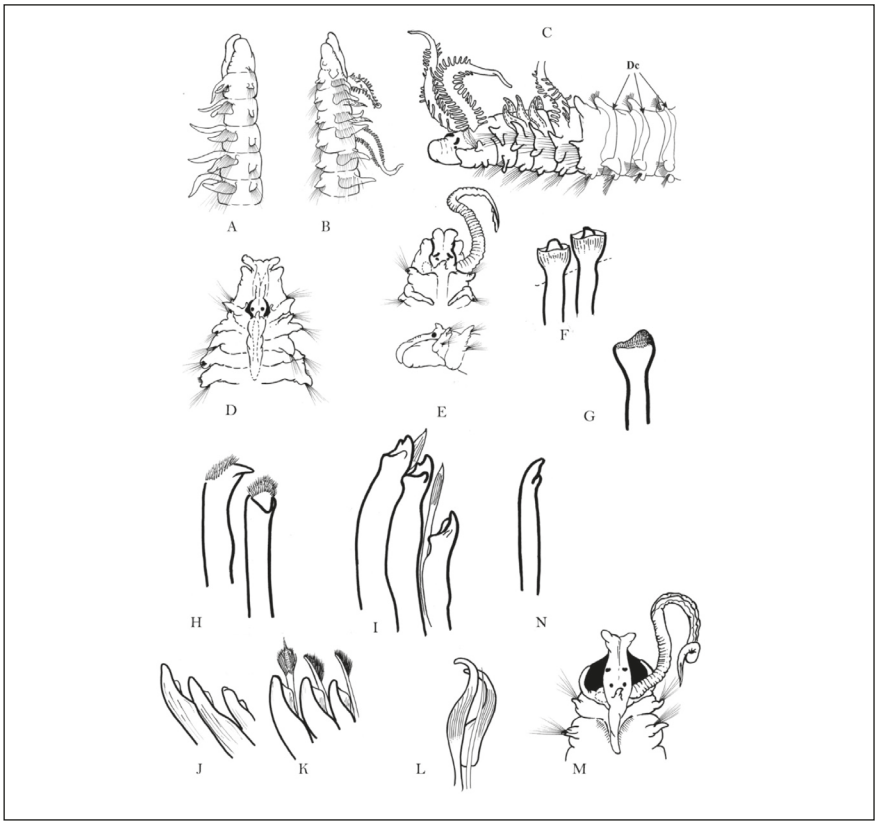

Fig. 3 - Key morphological characters, particularly for *Prionospio* and polydorid species. **a)** Apinnate branchiae, characteristic of the subgenus *Prionospio (Minuspio)*. **b)** Pinnate branchiae, characteristic of the subgenus *Prionospio (Aquilaspio)*. **c)** Dorsal crests or folds. **d)** Prostomium bilobed anteriorly, a feature used in the *Pseudopolydora* key. **e)** Presence of an occipital antenna, as seen in *Boccardia semibranchiata*. **f)** Modified chaetae of chaetiger 5 without a hairy edge, characteristic of *Boccardia semibranchiata*. **g)** Modified chaetae of chaetiger 5 with a hairy edge, found in species like *Boccardia proboscidea*. **h)** Falcate spines with bristles on chaetiger 5, a feature of several *Dipolydora* species. **i)** Falcate spine without bristles or a lateral flange on chaetiger 5, found in some species of *Dipolydora* and *Polydora*. **j)** Modified spine of chaetiger 5 with a delicate, long, narrow subterminal flange, characteristic of *Polydora caeca*. **k)** Modified spine of chaetiger 5 with a broad, short lateral flange, characteristic of *Polydora websteri*. **l)** Specialized curved spines in posterior chaetigers, a key feature of *Polydora colonia*. **m)** Presence of an occipital antenna, characteristic of *Polydora cornuta*. **n)** Falcate spine of chaetiger 5 with a curved accessory tooth or lateral flange, a general feature for many *Polydora* species.

Notes: see *P. (M.) multibranchiata*.

3b. Notopodial lamellae more or less well-developed on chaetiger 1. 4

4a. 6-8 branchiae pairs. Notopodial lamellae on chaetiger 1 triangular, well developed .....*Prionospio (Minuspio) cirrifera* Wirén, 1883 *sensu* Maciolek (1985)

Distribution: North Atlantic Sea (Maciolek, 1985).

4b. 8-10 branchiae pairs. Notopodial lamellae on chaetiger 1 rounded 5

5a. **Dorsal crests or folds on chaetigers 10-17 (Fig. 3 c)**..... ..... *Prionospio (Minuspio) sanmartini* Delgado-Blas, Díaz-Díaz and Viéitez, 2019

Type locality: Cantabrian Sea.
Cantabrian Sea (Galician coast) and East Atlantic (Andalusian coast).
From the intertidal zone to 10 m depth.

5a. Dorsal crests or folds absent ....*Prionospio (Minuspio) multibranchiata* Berkeley, 1927

NIS (questionable)
Type location: Bazan Bay (Canada).
Notes: This species was found in mud inside a tire attached to a dock (Delgado-Blas *et al.* 2019). Reported mostly for brackish-water environments across the Mediterranean Sea (Capaccioni-Azzati, 1988; Gravina *et al.*, 1988). However, specimens collected along the Turkish coasts and identified as *P. (M.) multibranchiata* have been determined to actually belong to *P. (M.) maciolekae*. Consequently, the presence of *P. (M.) multibranchiata* in the Mediterranean Sea appears questionable, and records from various basins should be re-evaluated (Dağli and Çinar, 2011).

Prionospio (Prionospio) Malmgren, 1867

1a. First and fourth pairs of branchiae pinnate, second and third pairs apinnate 2
1b. Branchiae arranged otherwise 7

2a. **With dorsal crests**..... 3
2b. Without dorsal crests ..... *Prionospio (Prionospio) dubia* Day, 1961

Type locality: South Africa.
Questionable.
Notes: Despite having type locality very distant from the Mediterranean Sea, Mediterranean records exhibit considerable depth, suggesting that it might represent a species complex rather than a NIS.
The maximum population density (30 individuals m^{-2}) of this species was encountered on muddy substratum at 100 m depth (Finike Bay) (Dağli and Çinar, 2009).

3a. Ventral crests present on chaetigers XI/XII–XV/XIX; high dorsal crests on chaetigers X–XI, and low dorsal crests on chaetigers III–IV, XII–XXII/XXX-IV; notopodial prechaetal lamellae very large on anterior chaetigers, basally fused with notopodial postchaetal lamellae. .....

Prionospio (Prionospio) cristaventralis Delgado-Blas, Díaz-Díaz and Viéitez, 2018

Type locality: Between Cabo Vidio and Cabo de Peñas, Asturias, Spain.

Remarks: The species occurs in shallow waters at a depth between 24 and 34.5 meters. It is not currently reported from the Mediterranean Sea.

3b. Ventral crests absent; high dorsal crests present or absent; notopodial prechaetal lamellae moderate or low on anterior chaetigers, not basally fused with notopodial postchaetal lamellae. 4

4a. Dorsal crests present, with a high dorsal crest on chaetiger VII. 5

4b. Dorsal crests absent; prostomium bottle-shaped; caruncle short; peristomium short; second and third branchial pairs subtriangular; neuropodial postchaetal lamellae subtriangular, ventrally pointed on chaetiger II, and subtriangular, dorsally pointed on chaetiger III..... *Prionospio (Prionospio) fallax* Söderström, 1920

Habitat: This species inhabits silty sediments (mud rich in detritus) at depths ranging from 25 to 140 meters.

Notes: *P. (P.) fallax* has been widely documented in Mediterranean regions (Castelli *et al.*, 2008, Çinar *et al.*, 2014, Mikac, 2015). Many European specimens previously labeled *Prionospio malmgreni* Claparède, 1870, are actually *Prionospio fallax*. The original description of *Prionospio malmgreni* noted up to nine pairs of branchiae, a characteristic not observed in later specimens. Fauvel's (1927) description of *Prionospio malmgreni* aligns with *Prionospio fallax*, resulting in numerous misidentifications (Sigvaldadóttir and Mackie, 1993). *Prionospio malmgreni* is now considered an indeterminable species (Maciolek, 1985, Sigvaldadóttir and Mackie, 1993), and it is recommended that previous Mediterranean records be reclassified as *Prionospio fallax* (Çinar *et al.*, 2014, Mikac, 2015).

Distribution: This species is found in the Northeast Atlantic, ranging from northern Scotland (Shetland Islands) to the Mediterranean.

5a. Short caruncle, extending posteriorly only to the middle of chaetiger 1. Neuropodial postchaetal lamellae of chaetigers 2 and 3 oval in shape .... *Prionospio (Prionospio) parapari*

Delgado-Blas, Díaz-Díaz and Viéitez, 2018

Type Locality: Ría de Ferrol and the mouth of the Piedras River, Huelva, Spain.

To date, the species has only been reported from the Atlantic coast of Spain (Ría de Ferrol and the mouth of the Piedras River, Huelva). Not recorded from the Mediterranean Sea.

5b. Long caruncle, extending posteriorly to the posterior margin of chaetiger 2 or beyond.

Neuropodial postchaetal lamellae of chaetigers 2 and 3 broadly triangular or squarish/ rounded in shape..... 6

6a. Two pairs of **distinct** eyes; high dorsal crest on chaetiger VII, followed by low crests up to chaetiger XIII–XVI; neuropodial lamellae broadly **triangular**. Pinnules on the fourth pair of branchiae restricted to the basal third; neuropodial lamellae broadly triangular; sabre chaetae with a distal filament.. .....
.....*Prionospio (Prionospio) depauperata* Imajima, 1990
NIS (questionable)
Type locality: Tsukumo Bay, Noto Peninsula, Honshu, Japan, Sea of Japan, Pacific Ocean.
Muddy sand substratum.
Notes: Langeneck *et al.* (2024b) highlighted the occurrence of small morphological differences between Mediterranean individuals of *P. depauperata* and the original description, as well as a 19% genetic distance between Mediterranean and Korean individuals, suggesting that they might in fact represent an undescribed species.

6b. Two pairs of **indistinct** eyes; high dorsal crest on chaetiger VII, followed by low crests on subsequent chaetigers; neuropodial lamellae broadly **squarish to rounded**. Pinnules on the fourth pair of branchiae distributed over most of its length; neuropodial lamellae squarish to rounded; sabre chaetae lacking a distal filament. .....
.....*Prionospio (Prionospio) steenstrupi* Malmgren, 1867
Type locality: contained in Icelandic part of the North Atlantic Ocean.
Notes: the taxonomic validity of *Prionospio steenstrupi* remains uncertain. Frequent misidentifications, particularly with *Prionospio dubia* Day 1961 (Maciolek, 1985; Faulwetter *et al.*, 2017), contribute to this ambiguity. Furthermore, the wide distribution of this species is debatable. While literature documents its presence in the Atlantic, Pacific, Arctic, and Indian Oceans, Sigvaldadóttir and Mackie (1993) restricted its confirmed range to the Icelandic coast, challenging these broader claims. However, Dağli and Çinar (2009) subsequently confirmed its occurrence in Turkey, further complicating the established distribution pattern.

7a. First three pairs of branchiae pinnate, last pair apinnate.....
..... *Prionospio (Prionospio) ergeni* Dağli and Çinar, 2009
Type locality: Iskenderun bay, Eastern Mediterranean Sea, Sand, Infralittoral.

7b. Branchiae arranged otherwise 8

8a. First three pairs of branchiae apinnate, last pair pinnate .....
.....*Prionospio (Prionospio) caspersi* Laubier, 1962
Mediterranean Sea: Italy, Venetian Lagoon (type locality); Southern coast of Turkey; Black Sea; Iberian coasts: Aveiro (Portugal), Catalonia, Valencia, Denia (Alicante); Pacific Ocean: Japan. Sand, muddy sand, depth 3–68 m.
Notes: *Prionospio caspersi* might be an alien species. In

fact, its presence was not recorded in biocenoses or studies prior to its description, even though it is currently the most abundant species in SFBC biocoenoses. Originally found in Venice lagoon (Laubier, 1962) it is now widespread across all neighbouring regions. Moreover, it has also been detected in Japan, exhibiting the same morphotype. Molecular analyses are needed to confirm this hypothesis.

8b. Branchiae arranged otherwise 9

9a. First pair of branchiae pinnate, remaining ones apinnate 10
9b. First and third pairs of branchiae pinnate; second and fourth pairs apinnate .....
..... *Prionospio paucipinnulata* Blake and Kudenov, 1978

NIS

Type locality: South-eastern Australia (Victoria, Port Phillip Bay) 2-9 m (Blake and Kudenov, 1978).
Notes: Dağli and Çinar (2010) found this species on sandy muddy sediment between 4.5 and 35 m depth in the eastern Mediterranean Sea.

10a. Interparapodial pouches first present between chaetigers 2-3 .....
..... *Prionospio (Prionospio) saccifera* Mackie and Hartley, 1990

NIS

Notes: *Prionospio (P.) saccifera* was initially described from specimens collected in Hong Kong and the Gulf of Suez (Red Sea) by Mackie and Hartley (1990). Subsequent records include the Turkish Mediterranean coast (Çinar and Ergen, 1999), with maximum population densities (350 individuals m^{-2}) observed in sandy mud substrates at 25 m depth within Fethiye Bay. The species exhibits a broad distribution, encompassing the Eastern Pacific, Red Sea, and Mediterranean Sea, with reported depth ranges of 11-85 m (Çinar and Ergen, 1999).

10b. Interparapodial pouches first present between chactigers 4-5 .....
..... *Prionospio (Prionospio) ehlersi* Fauvel, 1928

Type locality: Morocco.
Distribution: Eastern Atlantic, Indo-West Pacific and the Mediterranean Sea (Delgado-Blas *et al.*, 2018)

***Prionospio (Aquilaspio)* Foster, 1971**

1a. Three pairs of branchiae ... *Prionospio (Aquilaspio) krusadensis* Fauvel 1929

NIS

Type locality: Krusadai Island, India, Gulf of Mannar, Indian Ocean
Western Pacific Ocean and Indian Ocean (Imajima, 1990); intertidal to 30 m.
Notes: first identified in the Gulf of Mannar (Indian Ocean) by Fauvel (1929) and later documented from the coast of Japan by Imajima (1990), *Prionospio (Aquilaspio) kru-*

sadensis has been observed in the Mediterranean. While the primary morphological traits of Mediterranean specimens align with previous descriptions, subtle differences are present. The introduction of this species to the region is suspected to have occurred through ship ballast water. Notably, the highest population density (5575 individuals m^{-2}), was found on sandy bottoms at a depth of 4 meters (Dağlıand Çınar, 2009).

1b. Two pairs of branchiae ..... *Prionospio (Aquilaspio) sexoculata* Augener 1918

NIS

Type locality: Atlantic Ocean, Walvis Bay, Namibia

Ecology: The highest population density of this species was found on sandy mud substratum at 5 m depth (Mersin Bay) (Dağlıand Çınar, 2009).

Distribution: Southeast Atlantic, Northwest Pacific (Imajima 1990); Mediterranean Sea, Red Sea, Indian Ocean (Amoureux *et al.*, 1978, Ben-Eliahu, 1995); intertidal to 20 m.

Notes: it was previously considered as a Lessepsian migrant (Ben-Eliahu, 1995), it is now recognised as an introduced species by vector dispersal.

***Paraprionospio* Caullery, 1914**

Relevant references: Yokoyama *et al.* (2010)

1a.Branchiae with similar length .... *Paraprionospio pinnata* (Ehlers, 1901)

Type locality: Pacific Ocean, Chile.

Notes: The documented presence of *Paraprionospio pinnata* in the Mediterranean Sea, initially reported by Bellan (1964) in the western basin and Ergen (1992) in the eastern basin, showed an increasing trend in the eastern Mediterranean and the Red Sea. However, individuals previously attributed to *P. pinnata* from the Aegean Sea turned out to actually represent misidentifications of *P. coora*, suggesting the need for a critical re-evaluation of the distribution of *P. pinnata* within the Mediterranean (Yokoyama *et al.*, 2010). Ecologically, this species is typically found in muddy, infralittoral environments.

1b. Third pair of branchiae shorter, small papilla on posterior margin of the peristomium ..... *Paraprionospio coora* Wilson, 1990

NIS

Distribution: This species is found in Western Japan, the Yellow Sea, the East China Sea, from New South Wales to Tasmania in Australia, and in the Mediterranean.

Notes: Analysis of the distribution of *P. coora* reveals a potentially wider geographic range than previously documented. While historically reported from geographically disparate locations including Australia, Japan, and China, the recent identification of *P. coora* (Kleitou *et al.*, 2025)

within the Mediterranean Sea necessitates a re-evaluation of its global distribution. The classification of *P. coora* as an alien species within the Mediterranean remains inconclusive. Although its wide, disjunct distribution suggests the possibility of introductions, definitive evidence is currently lacking. Future investigations, encompassing targeted surveys in under-sampled regions and comprehensive genetic analyses of geographically distinct populations, are crucial for elucidating the origin of this species and establishing its potential alien status (Yokoyama *et al.*, 2010).
Habitat: Typically found in muddy, infralittoral environments.

***Pseudopolydora* Czerniavsky, 1881**
Relevant references: Dağli and Çinar (2008), Radashevsky (2021), Latry *et al.* (2024).

1a. Prostomium **bilobed** anteriorly **(Fig. 3 d)**. Occipital antenna present..... 2
1b. Prostomium narrow and rounded anteriorly .....
..... *Pseudopolydora paucibranchiata* (Okuda, 1937)
Type locality: Japan, Inland Sea, Onomichi, Honshu Island.
NIS
Intertidal mudflats and soft sand or mud substrates

2a. Pigmentation absent on body and palps. Caruncle to end of chaetiger 4 .....
..... *Pseudopolydora antennata* (Claparède, 1869)
Type locality: Italy, Tyrrhenian Sea, Gulf of Naples, Naples, Castel dell'Ovo.
In tubes in soft sediments and on rocks at 1-2 m.
2b. Dark pigmentation on anterior part of the body. Caruncle not reaching chaetiger 4 3

3a. Dark pigmentation intense on prostomium, peristomium, palps and 5-8 anterior chaetigers. Notochaetae of the 5th chaetiger arrange in a U- or flared J-shaped double row. Caruncle to end of chaetiger 1. Pygidium without dorsal appendage.
..... *Pseudopolydora pulchra* (Carazzi, 1893)
Type locality: Italy, Tyrrhenian Sea, Gulf of Naples, Naples, Castel dell'Ovo.
Shallow intertidal mudflats, but is also known from harbour pilings and oyster beds. Tube-building spionid polychaete.
3b. Dark pigmentation only on lateral edges of anterior chaetigers. Notochaetae of the 5th chaetiger arranged in a sharp J-shaped double row. Caruncle to end of chaetiger 3. Pygidium with 2 dorso-lateral digitiform lappets.
..... *Pseudopolydora kempi japonica* Imajima and Hartman, 1964
NIS
Type locality: Japan, Pacific Ocean.
Mud and muddy sand, typically in intertidal mudflats.
Notes: recently reported from the Atlantic coast of France as a NIS (Latry *et al.*, 2024), it might have been introduced in European waters either with oysters or with ballast waters. Although the species is not currently reported in the

Mediterranean Sea, its potential spread into European waters requires close monitoring. The relationship between the ssp. *japonica* and the nominal subspecies of *Pseudopolydora kempi* (Southern, 1921) is rather unclear, as the two subspecies have completely different ecology and disjoint distribution, and might actually represent two different species.

Boccardia Carazzi, 1893
Relevant references: Martínez *et al.* (2006), Radashevsky (2019).

1a. Occipital antenna absent, **hairy edge on the modified chaetae of chaetiger 5 (Fig. 3 g)**..... 2
1b. **Occipital antenna presen**t **(Fig. 3 e)**, chaetae of the chaetiger 5 without hairy edge (Fig. 3 f)
..... *Boccardia semibranchiata* Guérin, 1990
Type locality: Mediterranean Sea. Étang de Prévost and Étang de Berre, (France) (Guérin, 1990).
Muddy bottom with shell remains at 8 depth.

2a. Notochaetae present on chaetiger1, undivided prostomium .....
..... *Boccardia proboscidea* Hartman, 1940
Type locality Pacific Ocean, central California.
NIS
Notes: The species is widely distributed in the northeastern Atlantic. The only record for the Mediterranean Sea consists of a specimen found inside an oyster served at a restaurant (Radashevsky *et al.*, 2019). Although the restaurant owners attributed the oyster to a Mediterranean aquaculture facility, the absence of *in situ* observations of the species, and the known import of Atlantic oysters into the Mediterranean region, raise significant doubts about the occurrence of established populations in the Mediterranean.
2b. Notochaeta absent on chaetiger 1, bifid prostomium .....
..... *Boccardia polybranchia* (Haswell, 1885)
Type locality: Hunter River, New South Wales, Australia
Notes:
B. polybranchia is recognized as a species complex, distinguished by specific morphological traits: a bifid prostomium, a characteristic caruncle length, and the absence of notochaetae on the 1st chaetiger. Simon *et al.* (2010) highlighted the morphological variations that differentiate species within this group. The initial description of *B. polybranchia*, from oyster farms in the Hunter River, was insufficient, lacking detailed illustrations and preserved type specimens. Later, Carazzi (1893) and Fauvel (1927) provided more thorough descriptions based on specimens from Naples and France, respectively. The taxonomic uncertainty surrounding *B. polybranchia*, its seemingly

worldwide distribution, and its importance as a potential pest of commercial bivalves and as an indicator of environmental pollution (Borja *et al.*, 2000) underscore the need for a thorough taxonomic revision. Such a revision, ideally incorporating molecular analyses from diverse geographic locations, is necessary to resolve this species complex.

***Dipolydora* Verrill, 1881**
Relevant references: Radashevsky and Simboura (2013), Gil, (2011)

1a. **Falcate spines with bristles** on chaetiger 5 **(Fig. 3 h)** 2
1b. **Falcate spines without bristles** on chaetiger 5 **(Fig. 3 i)** 5

2a. Falcate spines of chaetiger 5 without apical transverse flange; lateral teeth present or absent 3
2b. Falcate spines of chaetiger 5 each with a large lateral tooth and an apical transverse flange on the convex side of the main fang. .....
..... *Dipolydora armata* Langerhans, 1880
Type locality: Atlantic Ocean, Madeira.
Boring into shells, corals and coralline algae.

3a. Falcate spines of chaetiger 5 each with a long pointed main fang bearing dense bristles on the convex side 4
3b. Falcate spines of chaetiger 5 distally bifurcated, each with two short massive unequal teeth and fine bristles between them.....
..... *Dipolydora quadrilobata* (Jacobi, 1883)
Type locality: Atlantic Ocean, Kieler Canal.
Inhabiting tubes on soft sediments.

4a. Falcate spines of chaetiger 5 without lateral tooth .....
..... *Dipolydora caulleryi* (Mesnil, 1897)
Type locality: Cap de la Hague France.
Inhabiting tubes on soft sediments.
4b. Falcate spines of chaetiger 5 each with large lateral tooth .....
..... *Dipolydora blakei* (Maciolek, 1984)
Cryptogenic
Type locality: United States, off New England, in the northwest Atlantic Ocean.
Distribution West Atlantic Ocean, off North America (USA) and South America (Brazil); European waters, Mediterranean (Radashevsky and Simboura, 2013).
Inhabiting tubes on soft sediments.

5a. Falcate spines of chaetiger 5 each with a large lateral tooth and an apical transverse flange on the convex side of the main fang .....
..... *Dipolydora giardi* (Mesnil, 1896)
Type locality: Northern France,
Borer of coralline algae, from shells of the whelks (Mesnil, 1896).

5b. Falcate spines of chaetiger 5 each without a large lateral tooth 6

6a. Major spines of chaetiger 5 with collar on convex side of falcate tip
..... *Dipolydora langerhansi* (Mesnil, 1896)
Type locality Atlantic Ocean, Madeira
Borer of shells.
6b Major spines of chaetiger 5 without collar on convex side of falcate tip..... 7

7a. Specialized fine capillary from the chaetiger 8 or after; modified spines of chaetiger 5 blunt, with a subterminal shallow depression .....
..... *Dipolydora flava* (Claparède, 1870)
Type locality: contained in Gulf of Naples (Italy)
Bores into shells and other calcareous substrates.
7b. Four specialized large spines on the last chaetigers; modified spines of chaetiger 5 with a stout curved distal end, with a pointed tip .....
.....*Dipolydora coeca* (Örsted, 1843)
Type locality: Atlantic Ocean, Denmark.
Originally described from soft sediments, reported as a borer of calcareous substrates by Dağli and Çinar (2021).

Polydora Bosc, 1802
Relevant references: Aguirre *et al.* (1986), Dağli *et al.* (2011), Çinar *et al.* (2015), Gil, (2011), Lezzi and Mazziotti (2024); Mikac *et al.* (2025).

1a. Falcate spines of the chaetiger 5 **without a curved accessory tooth** or lateral flange **(Fig. 3 i)** 2
1b. Falcate spines of the chaetiger 5 **with a curved accessory tooth** or lateral flange **(Fig. 3 j, k, n)** ...3

2a. **Curved spines in last chaetigers (Fig. 3 l)** .....
.....*Polydora colonia* Moore, 1907
Cryptogenic
Type locality: Northwest Atlantic Ocean, USA, Massachusetts, harbor of Vineyard Haven
David and Williams (2012) proposed that *P. colonia* be considered cryptogenic across its global distribution, emphasizing the necessity of molecular analyses to resolve its taxonomic ambiguities. This recommendation stems from the recognition that the true origin and dispersal pathways of the species remain unclear. Furthermore, observed ecological discrepancies may indicate the presence of a species complex. Specifically, while *P. colonia* exhibits a consistent association with sponges in Northwestern Atlantic habitats, while Mediterranean specimens have been reported to associate with algae (Aguirre *et al.*, 1986). This divergence in habitat preference raises the possibility that Mediterranean populations may represent a distinct, yet morphologically similar, species. Consequently, molecular investigations are crucial to clarify the taxonomic status of

P. colonia and to determine if the observed ecological differences reflect genuine species-level divergence.

2b. Specialized posterior notochaetae absent, borer into sponges .....
..... *Polydora spongicola* Berkeley and Berkeley, 1950
NIS (questionable) (Faulwetter *et al*., 2017)
Type locality: Pacific Ocean, Nanaimo, British Columbia.
Notes: Questionable status. Existing records are limited to a single report from Greece (Arvanitidis, 2000), raising questions regarding its established status in the region. The primary distribution of the species is documented in the East and West Pacific, with type locality in Western Canada. Notably, *P. spongicola* is associated with sponge habitats, a niche that has received limited investigation in the Mediterranean Sea concerning polychaete fauna (Faulwetter *et al.*, 2017). This paucity of research may contribute to the potential underreporting or misidentification of this species within the Mediterranean.

3a. No modified posterior notochaetae 4
3b. Last chaetiger with recurved notopodial spines. Shell-associated.....
..... *Polydora hoplura* Claparède, 1868
Type locality: Gulf of Naples, Italy, Mediterranean Sea
Often found boring in oysters.

4a. No occipital antenna 5
4b. **Occipital antenna present (Fig. 3 m)**, on mud .....
.....*Polydora cornuta* Bosc, 1802
NIS
Type locality: Atlantic Ocean, South Carolina
Tube-building, estuarine and marine (Bertasi, 2016).

5a. Modified spines of chaetiger 5 with **lateral flange.** (Fig 3 j,k) 6
5b. Modified spines of chaetiger **5 with** lateral triangular tooth or/and a protuberance, or a distinct single lateral tooth 7

6a. Modified spines of chaetiger 5 with **broad, short, almost-terminal lateral flange (Fig 3 k)**, caruncle extends to mid-chaetiger 2/3. Very narrow black line along the palp groove edge. Burrowing species. ..... *Polydora websteri* Hartman, 1943
NIS
Type locality: Long Island Sound, Connecticut, USA
Shell boring species
Present in the northern Adriatic Sea (Lezzi and Mazziotti, 2024, Mikac *et al.*, 2025).

6b. Modified spines of chaetiger 5 with **delicate long narrow subterminal flange (Fig 3 j)**, caruncle extends to mid-chaetiger 4. Fine bands of black on palps. Narrow black stripes on anterior lateral
sides of prostomium. Burrowing species. .....
.....*Polydora caeca* Webster, 1879
NIS

Type locality: Australia, Sydney Harbour, New South Wales
Shell boring species from North and South America, Asia, Australia, and New Zealand.
Present in north Adriatic Sea (Mikac *et al*., 2025).

7a. Modified spines of chaetiger **5 with** distinct lateral triangular tooth 8
7b. Modified spines of chaetiger **5 with** located anteriorly with small laterally bulge or protuberance; three or four spines located posteriorly with both a bulge and lateral tooth; developing spines simple falcate without accessory tooth or protuberance. .....
..... *Polydora brunneopunctata* Çinar, Dagli, Çağlar and Albayrak, 2015
Type locality: Sea of Marmara
It was found in sandy mud bottoms in brackish waters of the Sea of Marmara and Levantine Sea (Çinar *et al*., 2015).

8a. Chaetiger 5 with lancet-shaped chaetae next to the major spines 9
8b. Chaetiger 5 with simple, thin capillary chaetae next to the major spines .....
..... *Polydora limicola* Annenkova, 1934
Type locality; Arctic Ocean, Bering Strait
Surfaces of rocks on tidal flats, chiefly in sandy and muddy bottoms.
Notes: Mediterranean specimens should be re-examined, as in the case of *P. ciliata*.

9a. Palps ringed with black bands .....
..... *Polydora agassizi* Claparède, 1869
Type locality: Mediterranean sea, Gulf of Naples
Inhabitant of mud tubes in soft bottoms.
9b. Palps without black bands .....
..... *Polydora ciliata* (Johnston, 1838)
Type locality: Berwick Bay (Berwick upon Tweed), Northumberland, England.
Inhabitant of mud tubes.
Notes: Mustaquim (1986, 1988) presented evidence, derived from behavioral (boring vs. tube-dwelling) and genetic analyses, indicating the existence of two distinct forms within this nominal species. Furthermore, morphological differences between these forms were documented. Radashevsky and Pankova (2006), focusing on European specimens, subsequently assigned the tube-dwelling form to *Polydora ciliata* (*sensu stricto*) and the boring form to *Polydora calcarea* (Templeton, 1836). The validity of *Polydora ciliata* presence in the Mediterranean Sea has been subject to debate. Çinar *et al*. (2005) and Dağli *et al*. (2011) questioned its occurrence, although Mikac (2015) provided a contrasting perspective. These authors posited that historical identifications of *Polydora ciliata* in the Mediterranean may have resulted from misidentification of *Polydora cornuta* Bosc, 1802, *Polydora agassizii* Claparède , 1869 or *Polydora websteri* Hartman, 1943. Notably, *Polydora*

agassizii, previously synonymized with *Polydora ciliata* by Carazzi (1893), was revalidated as a distinct species by Radashevsky and Hsieh (2000).

The following table (Tab. 1) provides a concise summary of the status of specific Spionidae taxa reported for within the Mediterranean Sea, categorized as Non-Indigenous (NIS), Cryptogenic, or having a questionable/suspected NIS status. This categorization is derived *exclusively* from the annotations and explicit designations presented within the accompanying taxonomic identification key focused on Mediterranean Spionidae genera. It serves as a snapshot of the assessed status based on the information compiled within that specific resource. It is important to recognize that taxonomic understanding and the documented status of species are dynamic fields; ongoing research, particularly employing molecular methodologies, continues to refine species boundaries, distributions, and origins, potentially leading to future revisions of these classifications. Therefore, this table reflects the current assessment within the framework of the provided key, highlighting the significant contribution of potentially non-native Spionidae to the Mediterranean fauna.

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Tab. 1 List of species and their assigned status. (NIS = Non-Indigenous Species).

Specie	Status
Boccardia proboscidea	NIS
Dipolydora blakei	Cryptogenic
Paraprionospio coora	NIS
Polydora caeca Webster, 1879	NIS
Polydora colonia	Cryptogenic
Polydora cornuta	NIS
Polydora spongicola	NIS - (questionable)
Polydora websteri	NIS
Prionospio (Aquilaspio) krusadensis	NIS
Prionospio (Aquilaspio) sexoculata	NIS
Prionospio (Minuspio) pulchra	NIS
Prionospio (Prionospio) caspersi	NIS ? - (see notes)
Prionospio (Prionospio) depauperata	NIS - (questionable)
Prionospio (Prionospio) paucipinnulata	NIS
Prionospio (Prionospio) saccifera	NIS
Pseudopolydora paucibranchiata	NIS
Spiophanes algidus	NIS - (questionabile)
Streblospio eridani	Cryptogenic
Streblospio gymnobranchiata	NIS

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