

On the presence of *Prionospio pulchra* (Polychaeta: Spionidae) in the Atlantic Ocean

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Abstract: The presence of the Japanese spionid polychaete *Prionospio pulchra* in the Atlantic Ocean is confirmed by specimens found in the north-west coast of Spain (Iberian Peninsula). This species is characterized by its eight to ten pairs of long and apinnate branchiae, the longest extending over six to eight segments, and by the presence of five prostomial marginal peaks. Notes on variability of some anatomical aspects and ecological preferences of this species in the Atlantic coast of Spain are also given to complement the original description.

Résumé : *Prionospio pulchra* (Polychaeta: Spionidae) dans l'Océan Atlantique. La présence du Polychète Spionidae japonais *Prionospio pulchra* dans l'Océan Atlantique est confirmée par la récolte de spécimens au nord-ouest de l'Espagne (Péninsule Ibérique). L'espèce est caractérisée par la présence de huit à dix paires de branchies longues et simples, les plus longues s'étendant sur six à huit segments, et par la présence de cinq pointes marginales au prostomium. Des notes sur la variabilité de quelques particularités anatomiques et sur les préférences écologiques de cette espèce sur les côtes atlantiques espagnoles complètent la description originale.

Keywords : *Prionospio pulchra*, Spionidae, Atlantic Ocean, Galicia, Spain.

Introduction

To date, seven species of the genus *Prionospio* Malmgren, 1867 (Polychaeta: Spionidae) have been reported from the coasts of the Iberian Peninsula (NE Atlantic): *Prionospio aluta* Maciolek, 1985; *P. caspersi* Laubier, 1962; *P. dubia* Day, 1961; *P. ehlersi* Fauvel, 1928; *P. fallax* Söderström, 1920; *P. fauchaldi* Maciolek, 1985 and *P. multibranchiata*

Berkeley, 1927 *sensu* Mackie (1984) (Junoy & Viéitez, 1992; López-Jamar & Parra, 1997). As a result of a study on soft-bottom macrobenthic communities in Ensenada de Baiona (Galicia, NW Spain), the presence of the spionid *Prionospio pulchra* Imajima, 1990, a species previously recorded in the Ría de Ferrol (Galicia) by Parapar (1991) and Parapar et al. (1996) as *P. cf. pulchra*, has been confirmed. Apart from the record of Dean (1996, as *P. cf. pulchra*) in the Pacific waters of Costa Rica, this is the only confirmed record of this species out of the Japanese waters, where it was originally described by Imajima (1990).

Material and methods

Specimens of *Prionospio pulchra* were collected in six soft-bottom subtidal stations in Ensenada de Baiona (Fig. 1), sampled with a 0.05 m² Van Veen grab. Sediment was sieved through a 0.5 mm mesh and then fixed in a 10% formaldehyde-seawater solution. Specimens were transferred for definitive conservation to 70% ethanol. Line drawings were made by means of a camera lucida. For SEM studies, specimens were dehydrated via a graded series of ethanol, critical-point dried using liquid-CO₂, sputter coated with Au and examined in a Philips SEM XL30 and JEOL JSM-6400. For comparison purposes, specimens of this species from the Ría de Ferrol (NW Spain) and the Japan coasts (loaned by Dr. M. Imajima, National Science Museum, Tokyo) were also examined.

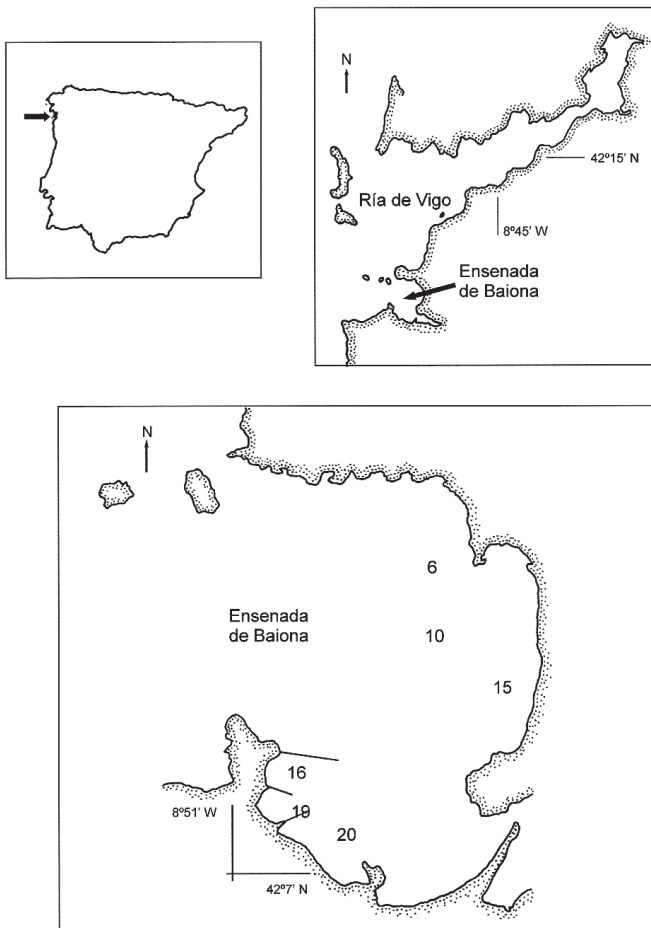


Figure 1. Geographic location of Ensenada de Baiona with sampling stations.

Figure 1. Emplacement géographique de l'Ensenada de Baiona et des stations de récolte.

Results

Family Spionidae Sars, 1862
Genus *Prionospio* Malmgren, 1867
Prionospio pulchra Imajima, 1990
Figures 2-4, Table 2

Prionospio (Minuspio) pulchra Imajima (1990): 68-71, figs. 6-7.

Prionospio cf. pulchra Parapar (1991): 181-184, pl. 46.

Material examined.

Ensenada de Baiona (Galicia, NW Spain): Station (St.) 6, 42°8'30"N, 8°49'44"W, Dec. 95, muddy sand, 7 m depth,

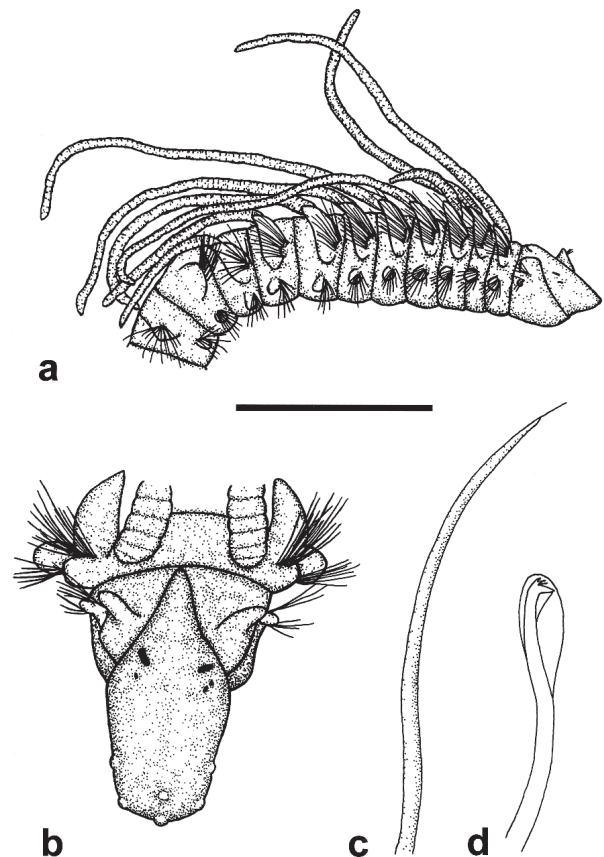


Figure 2. *Prionospio pulchra*. **a** Anterior end, lateral view; **b** Prostomium and chaetigers 1-2, dorsal view; **c** Sabre chaeta; **d** Hooded hook.

Scale bar a: 0.6 mm, b: 0.2 mm, c and d: 0.03 mm.

Figure 2. *Prionospio pulchra*. **a** Région antérieure, vue latérale; **b** Prostomium et sétigères 1-2, vue dorsale; **c** Soie en sabre; **d** Soie en crochet encapuchonnée.

Echelle: a: 0,6 mm, b: 0,2 mm, c et d: 0,03 mm.

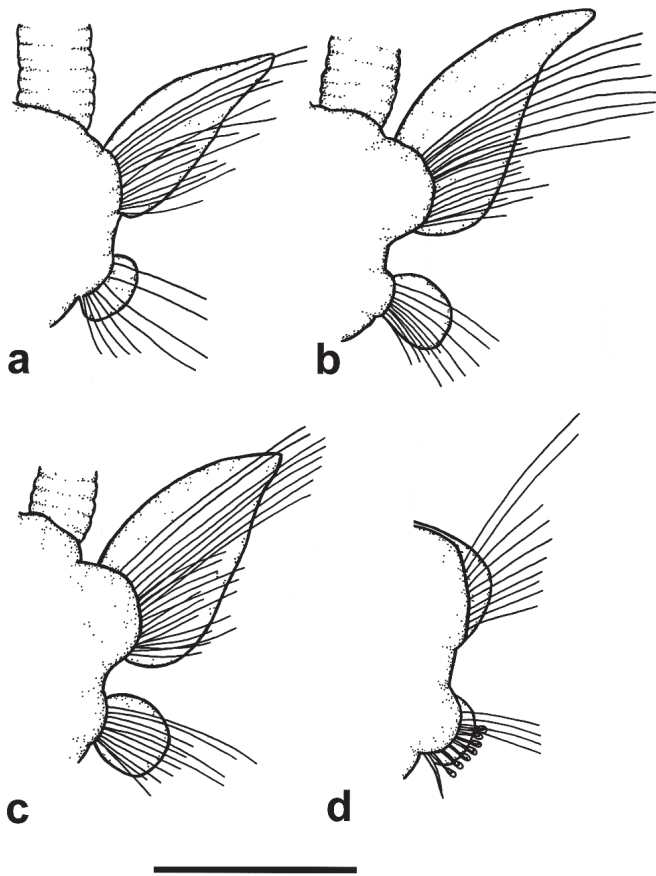


Figure 3. *Prionospio pulchra*. **a** Chaetiger 2, anterior view; **b** Chaetiger 4, anterior view; **c** Chaetiger 9, anterior view; **d** Chaetiger 23, anterior view.

Scale bar: 0.1 mm.

Figure 3. *Prionospio pulchra*. **a** Sétigère 2, vue antérieure; **b** Sétigère 4, vue antérieure; **c** Sétigère 9, vue antérieure; **d** Sétigère 23, vue antérieure.

Echelle : 0,1 mm.

2 specimens; St. 10, 42°8'10"N, 8°49'44"W, Dec. 95, muddy sand, 8 m, 2 spec.; St. 15, 42°7'50"N, 8°49'13"W, Dec. 95, fine sand, 4 m, 2 spec.; St. 16, 42°7'30"N, 8°50'45"W, Dec. 95, mud, 4 m, 2 spec.; St. 19, 42°7'19"N, 8°50'45"W, Dec. 95, mud, 2 m, 34 spec.; St. 20, 42°7'10"N, 8°50'15"W, Dec. 95, mud, 3 m, 129 spec.

Additional material.

Ría de Ferrol (Galicia, NW Spain): Station 54, 43°28'10"N, 8°12'43"W, Aug. 89, muddy sand, 15 m, 13 spec. Tokyo Bay (Japan): 35°37.1'N, 140°1.5'E, Dec. 71, 96 spec. Ise Bay (Japan): 34°56.8'N, 136°40'E, Oct. 72, 8 spec.

Description

Colourless fixed material. Longest complete specimen measuring 11.0 mm in length for 62 chaetigers. Body

slender. Prostomium subtriangular, rounded anteriorly, extending posteriorly as a narrow caruncle to the base of chaetiger 1 (Figs 2b, 4b); with five anterior small marginal peaks (Fig. 2b) and an anterodorsal peak (Fig. 4d). Two pairs of dark eyes, the anterior pair always as single eyespots, the posterior pair larger, sometimes as single eyespots (Fig. 2b). Peristomium fused to chaetiger 1, forming moderate wings.

Branchiae long, apinnate, cylindrical, numbering eight to ten pairs, from chaetiger 2 to 9-11 (Figs 2a, 4a); pairs one to four the longest, extending to chaetigers 8-11, two-three last pairs shortest, extending over three chaetigers.

Parapodia of chaetiger 1 reduced, lacking notopodial postchaetal lamellae, neuropodial postchaetal lamellae small, noto- and neurochaetae present. Chaetiger 2 with erect, triangular notopodial postchaetal lamellae, and smaller, rounded neuropodial postchaetal lamellae (Fig. 3a). Following notopodial lamellae larger and V-shaped in branchial region (Figs 2a, 3b-c, 4c); rounded in posterior chaetigers, forming low dorsal crests on several post-branchial chaetigers (Fig. 4d). Neuropodial lamellae rounded in branchial region (Figs 2a, 3b-c), low and rectangular in posterior chaetigers.

Anterior notopodial and neuropodial chaetae all capillaries, with thin sheath. Ventral sabre chaetae usually from chaetiger 11, sometimes from chaetiger 12, numbering one-two per fascicle (Fig. 2c). Neuropodial hooded hooks from chaetigers 16-18 (in some small specimens from 14-15), usually numbering up to seven per fascicle (six-nine); notopodial hooded hooks usually from chaetigers 28-31 (22-33), numbering up to four per fascicle; hooks with three pairs of small teeth above the main fang (Fig. 2d).

Pygidium with long mid-dorsal cirrus and two shorter ventrolateral ones.

Ecology

Intertidal to 67 m; in soft-bottoms, attached on buoys and among organisms attached on rope (Imajima, 1990); in *Capitella* and *Paraprionospio* sp. (form A) communities in estuarine waters with a high content in organic matter (Yokoyama, 1994); subtidal (8-17 m), mainly in sandy mud bottoms (5.5 to 6.1 % organic matter), reaching 10 cm depth in sediment (Parapar, 1991; Parapar et al., 1996). In Ensenada de Baiona this species was found in the subtidal area (2-8 m), mainly in muddy bottoms around the harbour of Baiona, but also on fine sand and muddy sand. In Station 20, *Prionospio pulchra* was the most abundant polychaete with a density of 516 indiv. m⁻². Table 1 shows the most abundant species found in the same stations as *P. pulchra*.

Distribution : Japan (Imajima, 1990; Yokoyama, 1994); Gulf of Nicoya (pacific coast of Costa Rica) (Dean, 1996, as *Prionospio* cf. *pulchra*); Galicia (NW Spain): Ría de Ferrol (Parapar, 1991; Parapar et al., 1996, both as *P. cf. pulchra*) and Ensenada de Baiona (this work).

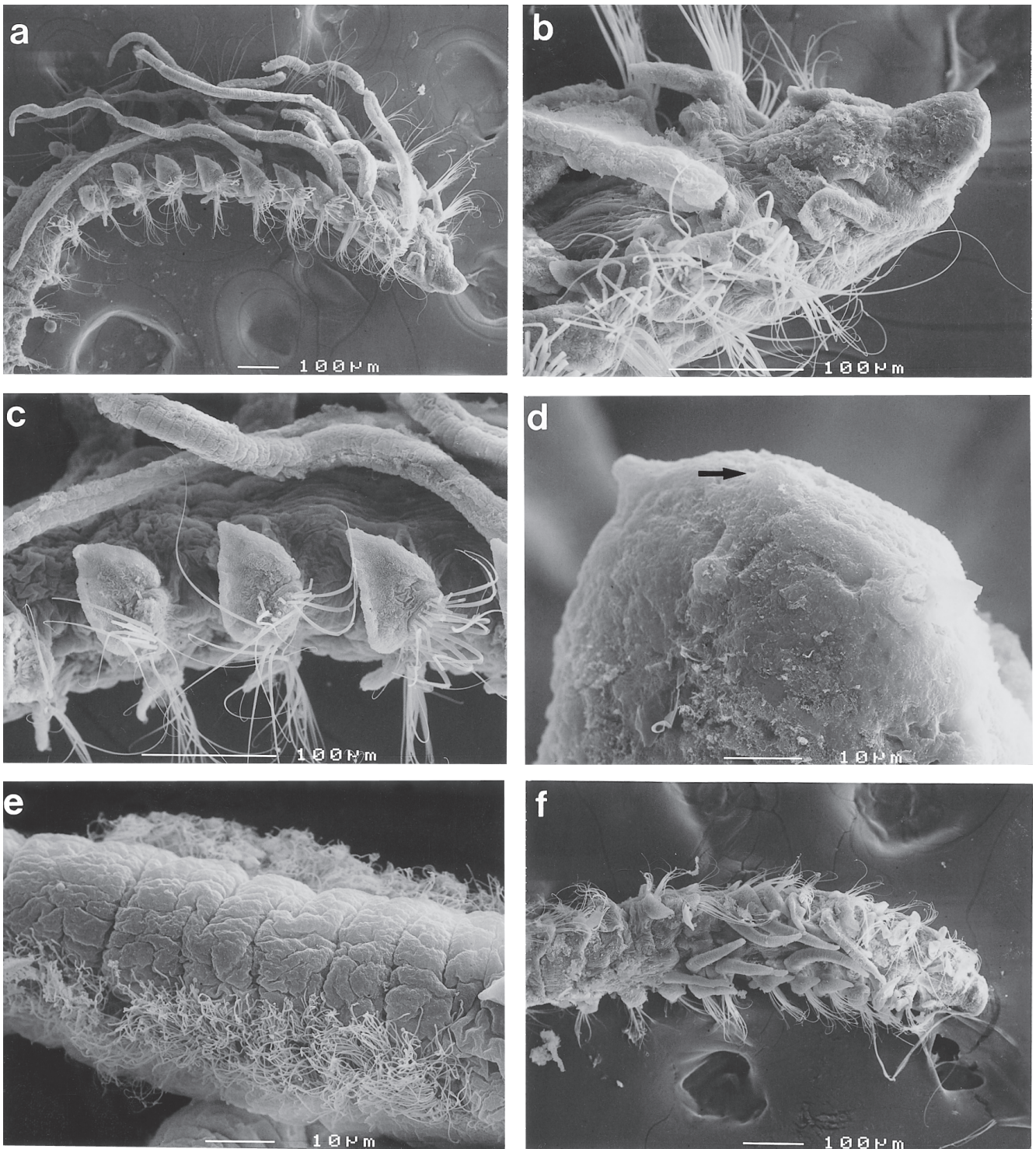


Figure 4. *Prionospio pulchra*. SEM micrographs. **a-e** Atlantic specimen. **a** Anterior end, dorso-lateral view; **b** Detail of prostomium, dorso-lateral view; **c** Notopodial lamellae of branchial region, lateral view; **d** Prostomium peaks (arrow indicates the most anterior peak); **e** Detail of branchiae ciliature. **f** Japanese specimen: short-branched specimen, dorsal view.

Figure 4. *Prionospio pulchra*. Micrographies MEB. **a-e** spécimen atlantique. **a** Région antérieure, vue dorso-latérale ; **b** Détail du prostomium, vue dorso-latérale ; **c** Lamelles notopodiales de la région branchiale, vue latérale ; **d** Pointes du prostomium (la flèche montre la pointe la plus antérieure) ; **e** Détail de la ciliature des branchies. **f** Spécimen japonais avec branchies courtes, vue dorsale.

Table 1. Abundance (indiv. m⁻²) of dominant species in stations where *Prionospio pulchra* was found.**Tableau 1.** Abondance (indiv. m⁻²) des espèces dominantes dans les stations où *Prionospio pulchra* est présente.

Species	St. 6	St. 10	St. 15	St. 16	St. 19	St. 20
Polychaeta						
<i>Paradoneis armata</i> Glémarec, 1966	128	120	192	-	4	8
<i>Cossura pygodactylata</i> Jones, 1956	-	-	-	660	232	36
<i>Spio decoratus</i> Bobretzky, 1871	48	120	48	20	84	76
<i>Spiophanes bombyx</i> (Claparède, 1870)	508	504	1332	-	12	16
<i>Prionospio fallax</i> Söderström, 1920	28	116	32	12	240	72
<i>Magelona filiformis</i> Wilson, 1959	148	212	252	-	-	-
<i>Capitella capitata</i> (Fabricius, 1780)	48	160	164	140	76	92
<i>Euclymene oerstedii</i> (Claparède, 1863)	4	56	-	-	124	72
<i>Exogone hebes</i>						
(Webster & Benedict, 1884)	128	168	-	4	300	60
<i>Nephtys hombergii</i> Savigny, 1818	56	24	48	16	148	188
Bivalvia						
<i>Loripes lacteus</i> (Linnaeus, 1758)	-	-	-	40	232	8
<i>Thyasira flexuosa</i> (Montagu, 1803)	-	-	-	8	792	240
<i>Mysella bidentata</i> (Montagu, 1803)	84	240	312	40	188	140
<i>Fabulina fabula</i> (Gronovius, 1781)	1188	108	984	-	20	212
<i>Abra alba</i> (Wood, 1802)	-	-	12	-	56	104
Amphipoda						
<i>Perioculodes longimanus</i>						
(Bate & Westwood, 1868)	112	88	20	-	-	36

Table 2. Comparison of selected characters between pacific and atlantic specimens of *Prionospio pulchra*.**Table 2.** Comparaison de caractères sélectionnés entre spécimens du Pacifique et de l'Atlantique de *Prionospio pulchra*.

	Japan (Imajima, 1990)	Ría de Ferrol (Parapar, 1991;) this work	Ensenada de Baiona (this work)
Number of branchiae	9-10	8-9	8-10
Sabre chaetae start at chaetiger	11 (12)	11	11 (12)
Neuropodial hooks start at chaetiger	15-16	16-19	16-18 (14-15)
Notopodial hooks start at chaetiger	25-33	24-32	28-31 (22-33)
Number of neuropodial hooks	7	5-6	7 (6-9)
Number of notopodial hooks	3	2	1-4

Remarks

Morphological characteristics of specimens from Japan and NW Spain are summarized in Table 2. Some differences have been observed on the range of appearance of neuropodial hooks: while in the Japanese specimens they

appear from chaetigers 15-16, in the Atlantic specimens they show a wider range (14-19). Whereas the original description mentions three notopodial hooded hooks in *Prionospio pulchra*, we found up to four hooks in the Japanese specimens we revised, as in the Atlantic ones. Likewise, the Atlantic specimens usually show longer branchiae than most of the Japanese ones (Fig. 4a-f), but always within the range reported by Imajima (1990). An anterodorsal prostomial peak, not mentioned in the original description, was detected by SEM studies in the Atlantic specimens (Fig. 4d), and not observed in the specimen from Japan. However, Dauer (pers. com.) suggests that these prostomial structures are eversible as it happens in *Streblospio benedicti* Webster, 1879, *Paraprionospio pinnata* (Ehlers, 1897) and *Marenzelleria viridis* (Verrill, 1873), and not always obvious in preserved specimens, therefore their presence may be easily overlooked.

Discussion

Foster (1971) erected the genus *Minuspio* for species of *Prionospio sensu lato* having only apinnate branchiae, with *Prionospio cirrifera* Wirén, 1883 as type species. Later, after the work of Blake & Kudenov (1978), *Minuspio* was considered a subgenus of *Prionospio* (Mackie, 1984; Maciolek, 1985). Recently, Sigvaldadóttir (1998) in a cladistic analysis of *Prionospio sensu lato*, recognizes the character "apinnate branchiae" as a plesiomorphic condition

which represents a “heterogeneous and non-homologous assemblage of characters” and therefore considers *Minuspio* as a junior synonym of *Prionospio*.

As pointed out by Imajima (1990), the presence of long and thin apinnate branchiae is a character shared with *Prionospio pulchra* by other species such as *P. lighti* Maciolek, 1985 from California, *P. patagonica* Augener, 1923, from West Patagonia, and *P. perkinsi* Maciolek, 1985, from Gulf of Mexico to New England. However, *P. lighti* lacks notopodial chaetae on chaetiger 1, *P. patagonica* lacks postchaetal lamellae in both rami on chaetiger 1 and *P. perkinsi* lacks ventral sabre chaetae.

Parapar (1991) also noted several similarities between *Prionospio pulchra* and *P. delta* Hartman, 1965, from off northeastern South America, based on the redescription given by Maciolek (1985). This last species possesses like *P. pulchra* long and thin branchiae (up to six pairs), as well as low dorsal crests in several post-branchial chaetigers, and lacks notopodial postchaetal lamellae on chaetiger 1. Moreover, sabre chaetae appear on chaetiger 12, neuropodial hooks from chaetigers 18-21 and notopodial hooks from chaetigers 28-35, similar to *P. pulchra* (11-12, 16-18 and 22-33, respectively). But despite those similarities, *P. delta* basically differs from *P. pulchra* in the form and shape of the prostomium, broader on anterior margin with a blunt medial peak and with none to two pairs of small eyes, as illustrated in Maciolek (1985), instead of the five marginal prostomial peaks and two pairs of bigger eyes present in *P. pulchra*. Besides, *P. delta* shows broad differences in the ecological preferences in comparison to *P. pulchra*, the former was recorded at great depths (520-2200 m), while the latter seems to be a shallow waters species (0-67 m).

Giangrande & Gambi (1982) described an atypical form of *Prionospio cirrifera* from the Lago di Sabaudia (Italia), with 10-11 pairs of long branchiae, neuropodial hooded hooks from chaetigers 13-16, notopodial hooded hooks from chaetigers 21-25 and inhabiting mainly muddy bottoms. These characteristics are rather similar to those of our specimens, and also their appearance, as it is showed in the drawings. However, these authors did not describe other important characteristics, as the chaetigers of first occurrence of sabre chaetae or the presence-absence of prostomial peaks, therefore we can't assure that these animals belong to the same species as ours.

Among the species of *Prionospio* recorded in the Iberian Peninsula, only *P. multibranchiata* Berkeley, 1927 *sensu* Mackie (1984), also found in the Ría de Ferrol (Parapar et al., 1995), have similarities with *P. pulchra*. Nevertheless they clearly differ in the length of branchiae, extending only over two-three segments in *P. multibranchiata* in opposition to *P. pulchra*, in which the longest ones extend over six-eight segments.

The reason for the presence of this species in the Galician coast of Spain, so far away from its up to now known area of distribution, remains unknown, but it could be explained by unintentional introduction by human activity, a very common phenomenon, especially in estuarine conditions, recently proved by an increasing number of works and reviews as those of Carlton (1985, 1989) and Carlton & Geller (1993). This artificial immigration process in polychaetes, generally linked to ballast water or ship hulls (Hutchings et al., 1987) was recently observed for the spionids *Marenzelleria* spp., with an original distribution in the North American East coast and now successfully established in the North Sea and Baltic Sea (Bastrop et al., 1998). However, in our opinion, the vector of invasion of *Prionospio pulchra* in the Galician coast is more probably related to the bivalve culturing on rafts, a practice very extended in the Galician rías, as for example that of the bivalve *Crassostrea virginica* (Gmelin, 1791) and the associated gastropod *Crepidula fornicata* (Linnaeus, 1758); the latter species had an original distribution along the North American East Coast and was recently introduced in the Ría de Vigo (Galicia), mixed with juvenile specimens of the bivalve *Ostrea edulis* (Linnaeus, 1758) (Rolán et al., 1985). Another species introduced in European waters with specimens of the Japanese oyster, *Crassostrea gigas* (Thunberg, 1793), is the ascidian *Styela clava* Herdman, 1882, recorded also in Galicia by Ortea & Vizcaíno (1981).

However, despite these facts, the disjunct distribution of *Prionospio pulchra* could only be the consequence of an incomplete knowledge of spionid taxonomy and biogeography in many parts of the world.

Acknowledgements

This work is a contribution to the project “Cartografía y distribución vertical de las poblaciones de la macroinfauna de sustratos blandos de la Ensenada de Baiona (Galicia)” supported by Vicerrectorado de Investigación, Universidad de Vigo (Spain) and the research projects XUGA30114A96, XUGA30101A98 and XUGA10305B98 financed by Xunta de Galicia. The authors wish to express their gratitude to F.J. Cristobo, C. Olabarría and P. Reboreda for their help in the sampling campaign, to J. Méndez (C.A.C.T.I., Universidad de Vigo) and B. Souto (S.X.A.IN., Universidad de A Coruña), for technical assistance with SEM, to E. Sigvaldadóttir (Icelandic Institute of Natural History) for her helpful suggestions, to M. Imajima (National Museum Science, Tokyo) for the loan of *Prionospio pulchra* from Japan, and to two anonymous referees for their valuable comments.

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