Notes on the species of *Perkinsiana* (Polychaeta: Sabellidae) from Antarctica with the description of *P. brigittae* sp. nov.

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Abstract

Nine nominal species are known from Antarctica and adjacent waters that have been assigned to the genus *Perkinsiana* (Polychaeta: Sabellidae). Taxonomic notes for these species are provided. Currently, only six species are considered valid: *Perkinsiana antarctica* (Kinberg), *P. decorata* (Rullier), *P. borsibrunoi* Giangrande and Gambi, *P. magalhaensis* (Kinberg), *P. milae* Giangrande and Gambi and *P. pusilla* (Johansson); *P. antarctica* (Gravier) is incertae sedis; *P. littoralis* (Hartman) is a suggested synonym of *P. magalhaensis* (Kinberg) and *P. antarctica* (Gravier), while *Potamilla antarctica christenseni* Augener probably belongs to the genus *Notaulax*. *Perkinsiana* is amended based on the presence of a palmate membrane and radiolar flanges, and three types of abdominal chaetae. The new species *Perkinsiana brigittae* sp. nov. is here described from collections taken by the U. S. Antarctic Research Program (USARP) at Wilkes Station. A taxonomic key for species of *Perkinsiana* from Antarctica is provided.

Key words: Antarctica, Sabellidae, *Perkinsiana*, symbiosis.

Introduction

The sabellid genus *Perkinsiana* was established by Knight-Jones (1983) in order to accommodate species previously assigned to the genera *Demonax* Kinberg, 1867 (= *Parasabella* fide Tovar-Hernández & Harris, 2010), *Potamilla* Malmgren, 1866 and *Potamethus* Chamberlin, 1919. Fitzhugh (1989) provided a diagnosis slightly modified from that of Knight-Jones (1983) and pointed out that *Perkinsiana* is not definable by any synapomorphy. Rouse (1996) emended the genus to incorporate features found in other species belonging to the taxon. Capa (2007) amended the genus again in order to update the modifications of genus diagnosis after the exclusion of *P. riwo* Rouse, 1996 (placed in *Kirkia* Nogueira et al. 2004 and then in *Aracia* Nogueira et al. 2010 when the former was recognized as a homonym) and the inclusion of two species (*Pekinsiana* (sic) *longa* Capa, 2007, and *P. anodina* Capa, 2007). Based on a cladistic analysis, Capa (2007) concluded that *Perkinsiana* is paraphyletic.

Knight-Jones’ (1983) original diagnosis stated that *Perkinsiana* have radioloes without flanges or webbing (though the radioloes are fused for a short distance basally); and superior and inferior abdominal chaetae similar in shape, either slender or with a bulbous knee, arranged in two close short transverse rows. The subsequent three generic diagnoses stated that radiolar flanges and palmate membrane are lacking, and the anterior and posterior rows of abdominal chaetae have elongate, broadly-hooded chaetae in all chaetigers (Fitzhugh 1989; Fig. 24C–D; Rouse 1996; Capa 2007). However, a great variability of abdominal chaetae and in the length of handles in thoracic uncini is present within species ascribed to the genus. Additionally, *Perkinsiana* exhibits a high variability of

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reproductive features, sperm morphology and oocyte sizes as shown in species distributed in Antarctica (Gambi & Patti 1999; Gambi et al. 2000).

Thus, the genus Perkinsiana while distinguishable on character combinations was based on absences rather than synapomorphy, requires a full examination of the 18 species currently known in the genus in order to study the variation of abdominal chaetae either broadly-hooded, elongate, narrowly-hooded or, elongate broadly-hooded; the length of handles in thoracic uncini; and the presence or absence of radiolar flanges and palmate membrane. These characters have potential application in the phylogeny and such variation could result in splitting the genus.

During the course of a revision of the sabellid polychaetes from Antarctica, several specimens from an undescribed species belonging to Perkinsiana were found infested with a gastrodelphyd copepod attached to the radioles. In this contribution, that species of sabellid polychaete is described and notes for the species of Perkinsiana from Antarctica are provided as a first step towards a better understanding of the morphological characters with some potential applications to the phylogeny of the genus.

Methods

The width of the medium thorax, the body length (from peristomium to pygidium), the number of radiolar pairs and the number of thoracic and abdominal segments of holotype and paratypes of the new species of sabellid were measured. Samples of chaetae and uncini were processed and examined after final dehydration in two changes of 100% ethanol at the Laboratorio de Microscopía Electrónica de Barrido (Centro de Ciencias Básicas, Universidad Autónoma de Aguascalientes, México). To critical point dry the specimens, CO₂ was used and then they were mounted on stubs with platinum tape and coated with gold (200 Å thickness) before being viewed with a scanning electron microscope. Digital photographs were taken by a camera attached to stereo and compound microscopes and line drawings were made to scale with a drawing tube attached to both stereo and compound microscopes to illustrate general morphology. Symbiotic copepods were extracted from the radioles and were described as Sabellacheres antarcticus Suárez and Boxshall, 2012. Specimens were deposited in the collection of the National Museum of Natural History, Smithsonian Institution (USNM).

Additionally, holotypes of Potamilla antarctica decorata Rullier, 1973 (MNHN, Muséum National d’Histoire Naturelle, Paris, POLY TYPE 1352) and Potamilla antarctica christenseni Augener, 1932 (ZMO, Naturiska Rikumusset Stockholm, Sweden, C547) were examined.

Results

Family Sabellidae Latreille, 1825

Genus Perkinsiana Knight-Jones, 1983 amended

Diagnosis

Radioles arranged in two semicircles sometimes slightly involuted ventrally. Radiolar flanges absent or present. Radiolar skeleton with two, four or more cells in transverse section. Palmate membrane absent or present. Dorsal and ventral basal flanges absent. Dorsal lips with tapering radiolar appendages. Dorsal pinnular appendages similar to length of dorsal radiolar appendages or absent. Ventral lips and parallel lamellae present; ventral sacs absent. Anterior margin of anterior peristomial ring low, of even height all around. Posterior peristomial ring collar present, with midventral incision and two ventral lappets; dorsal margins of collar well separated. First segment enlarged (about twice length of next ones). Collar chaetae arranged in oblique rows. Collar and superior thoracic notochaetae elongate, narrowly-hooded. Inferior thoracic notochaetae paleate, arranged in transverse rows. Thoracic neuropodia with uncini of similar-sized teeth above main fang, variable handle length (2-5 times the length of crest), hood absent and breast well developed. Companion chaetae present, with teardrop-shaped membrane. Abdominal neurochaetae fascicles with transverse rows of broadly-hooded and progressively tapering to distal tip (type A), or elongate broadly-hooded chaetae (type B), or elongate, narrowly-hooded chaetae (type C) (Fig. 1). Abdominal uncini with equal-sized teeth above main fang, breast well developed with short to medium length handle.
Remarks

The present definition primarily follows Capa (2007) except for the following:

Radioles in Branchiomma Kölliker are united at the base by short web called a palmate membrane in several contributions (Fitzhugh 1989; Knight-Jones 1994; Tovar-Hernández & Knight-Jones 2006). This web is similar to that present in some species of Perkinsiana, as a consequence it should be called a palmate membrane. Although Capa (2007) defined the genus Perkinsiana as lacking palmate membrane, for P. anodina she described the presence of a low membrane. In the same manner, the presence or absence of radiolar flanges requires special attention since P. borsibrunoi Giangrande and Gambi, 1997, was described as lacking radiolar flanges but these structures were illustrated accompanying the original description (Giangrande & Gambi 1997: Fig. 8E) and corroborated in specimens of P. borsibrunoi examined during this study from Antarctica (Smithsonian Oceanographic Sorting Center, HERO 721, Sta. 1074, 64° 47’ S, 64° 07’ W, 106–110 m).

Based on revision of original descriptions of Perkinsiana species and taking into account the generic revision provided by Knight-Jones (1983), three kinds of abdominal chaetae (types A, B, and C as below) are recognized and these are catalogued and explained as follows, except for Perkinsiana assimilis (McIntosh, 1885). For P. assimilis this structure was not described or illustrated. Hartman (1959) referred P. assimilis as a member of Sabellastarte Krøyer, but Knight-Jones (1983) examined the holotype and transferred it to Perkinsiana, as corroborated later in Knight-Jones & Mackie (2003).

Type A: Includes those abdominal chaetae with a broad hood and progressively tapering to distal tip in all chaetigers (Fig. 1A). This kind of chaeta is referred as broadly-hooded in Fitzhugh (1989) and Giangrande & Gambi (1997). Type A is present in P. antarctica (Kinberg, 1867), P. decorata (Rullier, 1973), P. milae Giangrande and Gambi, 1997, P. borsibrunoi Giangrande and Gambi, 1997, P. corcovadensis (Hartmann-Schröder, 1965) and P. pusilla (Johansson, 1922). The original description of P. antarctica did not detail or illustrate the abdominal chaetae but Knight-Jones (1983) described the abdominal chaetae as “scarcely geniculate with very little swelling at the knee”. The latter author illustrates a superior abdominal chaetae narrowly-hooded from one specimen from Ushuaia (Argentina). Giangrande & Gambi (1997) described the neotype of P. antarctica from Punta Arenas (Chile) in which abdominal chaetae are broadly-hooded (type A).

Type B: Includes those abdominal chaetae with a basal broad knee and distal end narrowing abruptly in all chaetigers (Fig. 1B). This kind of chaeta is referred as with a bulbous knee in Knight-Jones (1983) or elongate, broadly-hooded in Fitzhugh (1989) and Capa (2007). Abdominal chaetae type B is present in the type species P. rubra (Langerhans, 1880), P. socialis (Langerhans, 1884), P. fonticula (Hoagland, 1919), P. ceylonica (Augener, 1926), P. linguicollaris (Day, 1961), P. anodina and P. longa.

Type C: Includes elongate abdominal chaetae with a narrow hood in all chaetigers (Fig. 1C). This kind of chaetae is referred as elongate, narrowly-hooded chaetae in Fitzhugh (1989) and it is present in P. littoralis (Hartman, 1967), P. acuminata (Moore and Bush, 1904), P. minuta (Treadwell, 1941), P. magalhaensis (Kinberg, 1867) and a new species described in this study (see below).

As Capa (2007) pointed out, great variability is also found in the length of handles in thoracic uncini. For example, in P. longa and P. rubra the handles are very long (4–5 times the length of crest). In P. fonticula, P. ceylonica, P. linguicollaris, P. anodina and P. briggtae sp. nov., handles are medium length (three times the length of crest). In P. antarctica, P. littoralis, P. milae, P. borsibrunoi, P. socialis, P. assimilis, P. acuminata and P. minuta, handles are short-sized (2–2.5 times the length of crest). The length of handles of thoracic uncini in P. corcovadensis, P. decorata and P. pusilla is unknown (not described in both species, the original drawing of P. corcovadensis shows an incomplete handle, and they are not illustrated in P. decorata and P. pusilla).

Antarctic species of Perkinsiana

The genus Perkinsiana currently include 18 species world-wide, and nine nominal species have been described from Antarctic and adjacent waters and considered as belonging to Perkinsiana. Six species are considered valid here; two are incertae sedis while one species belong to the genus Notaulax. Comments on these species are detailed below.

1) Perkinsiana antarctica (Kinberg), described as Laonome antarctica Kinberg, 1867: 354 (valid).
Perkinsiana antarctica was once considered the most common sabellid in Antarctic waters (Giangrande & Gambi 1997). It was poorly described from Bahía Laredo, Punta Arenas, Strait of Magellan (Chile) and no illustrations were provided but numerous subsequent records from Antarctic and subantarctic areas revealed a high degree of
morphological variability (Giangrande & Gambi 1997). The revision by Giangrande & Gambi (1997) included the designation of a neotype from Punta Arenas (Chile) and their study revealed that the species has been often confused with other taxa and that *P. antarctica* probably has a distribution restricted to subantarctic areas.

2) *Potamilla antarctica* Gravier, 1907: 59–62, figs. 38–43 (*incertae sedis*).

Gravier (1907) described *Potamilla antarctica* from the Antarctica Peninsula. Ehlers (1913) recorded some specimens from Kerguelen as *P. antarctica* Kinberg and synonymized this species with *Potamilla antarctica* Gravier emphasizing that Gravier (1907) named his species ignoring the species previously described by Kinberg (*Laonome antarctica* Kinberg, 1867). Subsequently, Fauvel (1916: 474), Monro (1939: 148–149) and Hartman (1952: 236) accepted the synonymy proposed by Ehlers (1913). According to Knight-Jones (1983), the whereabouts of the type material is unknown but to judge from Gravier’s description it is indeed a different species from Kinberg’s (1867), Ehlers’s and Fauvel’s species. Knight-Jones (1983) also pointed out that *P. antarctica* Gravier, 1907 and *P. littoralis* Hartman, 1967 share several characters, but as Gravier figures only chaetae; it would be difficult to prove synonymy without Gravier’s type material. However, Giangrande & Gambi (1997) reported and replaced either by an available and potentially valid synonym (possibly *P. littoralis*).

Although the Article 60 of the ICZN (1999) stated that a junior homonym must be rejected and replaced either by an available and potentially valid synonym (possibly *P. littoralis*), it is not possible to prove the synonymy of *P. antarctica* Gravier and *P. littoralis* Hartman. Furthermore, as discussed below, *P. magalhaensis* and *P. littoralis* may also be found to be the same species. If this potential synonymy is validated, the name *P. magalhaensis* would have priority over *P. littoralis*.

3) *Perkinsiana decorata* (Rullier), described as *Potamilla antarctica decorata* Rullier, 1973: 22 (valid).

Rullier (1973) described a subspecies from Ile du Chat (Kerguelen Islands) collected from 15 m depth as *Potamilla antarctica decorata*. According to Rullier, this species differs from *P. antarctica* (Kinberg) in having brown spots along the abdominal chaetigers. Rullier did not include diagnostic features or illustrations for *Potamilla antarctica decorata* and there have been no additional records since its original description. However, the diagnostic features of the holotype were examined (MNHN POLY TYPE 1352) in order to proof the validity of *P. decorata*, which is supported by the following features: the presence of the interramal spots located between notochaetae and neurochaetae in all abdominal segments (referred as brown spots in original description); palmate membrane and flanges absent; radiolar tips short, broad; ventral sacs present; ventral lappets triangular, not overlapping; dorsal pockets present; peristomium exposed dorsally; thoracic tori contacting ventral shields; abdominal chaetae broadly-hooded and pygidal eyes present. *Perkinsiana decorata* differs from *P. antarctica* (Kinberg) especially in the presence of interramal spots along the abdominal segments, dorsal pockets and ventral sacs (all these features absent in *P. antarctica*).

4) *Perkinsiana magalhaensis* (Kinberg), described as *Sabella magalhaensis* Kinberg, 1867: 353 (valid).

Kinberg (1867: 353) described *Sabella magalhaensis* from Bucket Island (Isla Sánchez), Bahía San Nicolás, Strait of Magellan (Chile), as “Corpus mediocre nec branchii 4:pl. longius; cirri tentaculares minuti, attenuati; bases branchiariun in circulo contortae; radii utrinque c. 24, equales, dorso nudo; sete limbatae et hastatae; uncini”. Ehlers (1901: 215) only listed *S. magalhaensis* indicating its type locality, without any new records or remarks accompanying the species name. Illustrations for chaetae, radiole, ventrum and chaetigers were provided in Kinberg (1910: 72, Pl. 27, Fig. 7). Fauvel (1916: 471, Pl. 9, Figs. 34–43) transferred *Sabella magalhaensis* to *Bispira* Krøyer and recorded it from Roy Cove (Falkland Islands). Johansson (1925: 22, Fig. 7) in his revision of sabellariid and sabellid species described by Kinberg, mentioned that the type of *Sabella magalhaensis* was broken into four pieces (branchial crown, two pieces of thorax, and two pieces of the abdomen, near to 100 segments) and provided a new illustration for a thoracic paleate chaeta (not broadly-hooded as Kinberg illustrated). Monro (1930: 201) recorded *Bispira magalhaensis* from East Falkland Island and Hartman (1966: 123, Pl. 39, Figs 2–6) recorded it from Antarctica but provides illustration re-drawn from Fauvel (1916). Knight-Jones & Perkins (1998) examined the type (Naturiska Riksmusset Stockholm, 1086) of *Sabella magalhaensis* and transferred it to *Perkinsiana* Knight-Jones, 1983, but they did not provide a diagnosis or illustrations to accompany this new combination.

*Perkinsiana magalhaensis* and *P. littoralis* (Hartman, 1967) share the presence of ventral lappets overlapped, anterior peristomial ring exposed only dorsally, abdominal chaetae narrowly-hooded (type C) and they were described from Magellan Strait and South Shetland Islands respectively. The similarities between both species could be enough to consider them synonyms. Thus, the name *P. magalhaensis* would have priority over *P. littoralis*, although re-examination of type material and topotypes is certain needed to confirm this hypothesis and a designation of a neotype would be desirable.

5) *Potamilla antarctica christenseni* Augener, 1932: 69–70 (probably *Notaulax*).
FIGURE 3. Scanning electron micrographs, *Perkinsiana brigittae* sp. nov. A) Thoracic chaetiger, B) paleate chaetae, C) thoracic uncini and companion chaetae, D) thoracic uncini, E) companion chaetae; F) abdominal uncini; G) chaetiger from anterior abdomen, H) chaetae from anterior abdomen; I) posterior abdominal chaetigers, J) chaetae from posterior abdomen. A–J) Paratype of *P. brigittae* sp. nov. Scale bars: A, H–J) 100 µm, B) 20 µm, C) 50 µm, D–F) 10 µm, G) 500 µm.
Augener (1932) described Potamilla antarctica christenseni from Adelaide Island at 620 m depth. Giangrande & Gambi (1997) examined the holotype (ZMO, C547) and revealed that it belongs to a different genus, probably Notaulax.

6) Perkinsiana pusilla (Johansson), described as Sabella pusilla Johansson, 1922: 5–6, pl. 1, fig. 6 (valid).

Johanssion (1922) described Sabella pusilla from Falkland Islands, Puerto Williams, 12 m depth and Tierra del Fuego, eastern Ushuaia, 10 m depth. Hartman (1966) included this species in her monograph and her description is identical to the original by Johansson. Also Hartman (1966) included a figure of a collar in dorsal view and refers it to P. pusilla (Pl. 42, Fig. 9). However, this figure belongs to those of P. elegans originally illustrate by Johansson (1922: pl. 1, fig 5). There are no new records since then. Knight-Jones and Perkins (1998: 404) transferred Sabella pusilla to the genus Perkinsiana. The type material is housed at the Naturiska Riksmuseum Stockholm (NRM 1084) but it was not possible to examine for this paper. Perkinsiana pusilla has very long triangular lappets (the length of three thoracic segments) and broad abdominal chaetae (type A).


Hartman (1967) described Potamethus littoralis from the South Shetlands Island at a depth of 79 m and provide illustrations for uncin and chaetae. Later, Knight-Jones (1983) re-examined the holotype of P. littoralis, transferred it to Perkinsiana and provided new illustrations for branchial crown, thorax, chaetae and uncini. Giangrande and Gambi (1997) also re-examined the holotype, providing a description that agreed to that provided by Knight-Jones (1983). Perkinsiana magalhaensis, P. antarctica Gravier and P. littoralis may be the same species (see notes on Sabella magalhaensis and P. antarctica).


This is a valid species of Perkinsiana described from Terra Nova Bay (Ross Sea) collected from 146 m depth.


This is a valid species of Perkinsiana described from Terra Nova Bay (Ross Sea) collected from 150 m depth.

**Perkinsiana brigittae** sp. nov.

Figures 1D–R, 2A–L, 3A–J, 4C

**Type material:** Holotype (USNM 1180547) and four paratypes (USNM 1180548): Antarctica, Wilkes Land, Budd Coast, Wilkes Station, Station DX, 66° 21’ 14” S, 110° 28’ 09” E, U. S. Antarctic Research Program (USARP), Antarctica, December 03, 1961, 237 m.

**Additional materials:** Smithsonian Oceanographic Sorting Center, U.S. Antarctic Research Program (USARP), Antarctica, Wilkes Station, Sta. DX, 66° 21’ S, 110° 28’ E, December 03, 1961, 238 m (38 spec.); 66° 22’ S, 110° 29’ E, December 13, 1961, 237–256 m (2 spec.); 66° 17’ S, 110° 13’ E, January 05, 1962, 155–326 m (12 spec.).


**Description** (measurements based on holotype, data in brackets correspond to paratypes)

Holotype and paratypes entire. Branchial crown longer than thorax, 18 mm length (23.5 mm, 17–27, n=4) with 16 pairs of radioles (19 pairs, 14–21, n=4). Radioles with 3–5 brown bands, each color band occupying five pinnules and color extending onto pinnules. Radioles united at the base by short web palmate membrane (Fig. 2L). Flanges present (Figs 2K, 4C). Two or three ventralmost radiolar pairs poorly developed. Longest pinnules at mid-radioles. Radioles with filiform tips, as long as equivalent space of 10–12 pinnules (Fig. 2K, 4C). Dorsal lips triangular erect with distinct longitudinal mid-rib forming two wide lateral labeillae (Figs 1H–I, 2D) and dorsal pinnular appendages. Ventral lips broadly rounded (Figs 1H–I, 2D). Labeillae parallel present. Triangular dorsal keel situated dorsal to mouth. A pair of ventral sacs located below mouth. Dorsal collar margins diagonal, not fused to faecal groove (Figs 1D, 2A, E). Anterior peristomial ring level dorsally, exposed (Figs 1D, F, 2A, E). Ventral lappets of collar rounded, not overlapped (Fig. 1E, 2B, F). Lateral collar margins oblique, higher ventrally, not covering the basal union of radioles (Figs 1F, 2C, G). Ventral shield of collar divided transversely in two parts, the anterior one rectangular and the posterior one trapezoidal (Figs 1E, 2B, F). Collar with narrowly-hooded chaetae. Thin body, 101 mm length (88.25 mm, 65–102, n=4). Thorax with 10 segments (10, 8–13, n=4). Thorax width 3
mm (2.7 mm, 2.5–3, n=4). Thoracic ventral shields rectangular (Figs 1E, 2B). Thoracic torus of equal length in all segments, contacting ventral shields (Figs 1E, 2B–C). Superior thoracic chaetae narrowly-hooded (Figs 1P, 3A). Inferior thoracic chaetae paleate (Figs 1Q, 3A–B). Thoracic uncini with several rows of teeth of equal size above main fang (Fig. 3D), occupying a half of main fang length, hood absent, breast well developed, handles as long as three times the length of crest (Fig. 1J). Companion chaetae with tear-drop shaped membranes (Figs 1M–O, 3C, E). Abdomen with 151 segments (139, 100–158, n=4). Anterior abdominal segments with bundles of short, narrowly-hooded chaetae (type C) (Fig. 3G–I). Posterior abdominal segments with very long, narrowly-hooded chaetae (Fig. 3I–J). Abdominal uncini with dentition similar to those from thorax (Fig. 3F) but with handles short, a half of handles in thoracic uncini (Fig. 1K–L). Pygidium lobed (Fig. 1G) or bilobed. Two groups of small pygidial eyes located dorsally in one paratype (Fig. 2I). Anus ventral (Figs 1G, 2J). Tubes chitinized, translucent, vertical distally, irregularly spiralled posteriorly, with incrusting ascidians at mid-length.

Gametes: Holotype and paratypes mature, simultaneous hermaphrodites with male and female gametes distributed in abdomen. Spermatozoa with a spherical nucleus and rounded cap-like acrosome, four mitochondria and a long flagellum. Oocytes diameter 0.1041 mm ±0.042 (min 0.025, max 0.175, n=30). Brooding unknown.

Symbiosis: Paratype with a female gastrodelphyid copepod attached to the fifth ventralmost radiole (Sabellacheres antarcticus Suárez-Morales and Boxshall, 2012) (Fig. 2H).

Remarks: Perkinsiana brigittae sp. nov., is characterized by a long and thin body, distinguished from other species in the genus by a unique combination of features: the presence of a low palmate membrane, an anterior peristomial ring level dorsally and exposed beyond margins of collar (dorsal and laterally), abdominal chaetae narrowly-hooded (type C) and handles of thoracic uncini as long as three times the length of crest.

Among the 18 nominal species of Perkinsiana, P. brigittae sp. nov., P. acuminata and P. minuta are unique in having the abdominal chaetae narrowly-hooded in all chaetigers (type C). Perkinsiana brigittae sp. nov., and P. minuta have the ventral lappets of collar that do not overlap (overlapping in P. acuminata). Perkinsiana brigittae sp. nov., differs from P. minuta in having the anterior peristomial ring exposed dorsally and laterally (exposed only dorsally in P. minuta) and handles of thoracic uncini as long as three times the length of crest (two times in P. minuta).

FIGURE 4. Radiolar tips. A) Perkinsiana antarctica from Bahía Laredo, B) P. milae from BF2/03, C) paratype of P. brigittae sp. nov. Scale bars: 0.15mm. Radiolar flanges as indicated with arrows in C.
**Perkinsiana brigittae** sp. nov., *P. fonicula*, *P. ceylonica*, *P. linguicollaris* and *P. anodina* have thoracic uncini with handles as long as three times the length of crest, but in *P. brigittae* sp. nov., the thoracic tori are contacting the ventral shields (not contacting the ventral shields in *P. fonicula*, *P. ceylonica*, *P. linguicollaris* and *P. anodina*) and abdominal chaetae are type C (type B in *P. fonicula*, *P. ceylonica*, *P. linguicollaris* and *P. anodina*).

*Perkinsiana brigittae* sp. nov., *P. milae*, *P. borsibrunoi*, *P. socialis*, *P. fonicula*, *P. linguicollaris*, *P. anodina* and *P. longa* have the anterior peristomial ring exposed dorsally and laterally; however, among these species only *Perkinsiana brigittae* sp. nov., *P. milae* and *P. borsibrunoi* have thoracic tori contacting the ventral shields (not contacting shields in the remaining five species). *Perkinsiana borsibrunoi* has long radiolar tips compared to medium-sized tips in *P. milae* (Fig. 4B) and *P. brigittae* sp. nov. (Figs 2K, 4C). *Perkinsiana brigittae* sp. nov., and *P. milae* have similar lateral collar margins, but in the first species the anterior peristomial ring is level dorsally (triangular in *P. milae*); it has abdominal chaetae type C (type A in *P. milae*); the length of handle of thoracic uncini is three times the length of crest (2–2.5 times in *P. milae*) and large body size about 65–102 mm excluding the branchial crown (small size about 24 mm excluding branchial crown in *P. milae*).

Among the currently valid species distributed in Antarctica, *P. antarctica* (Kinberg) (Fig. 4A), *P. decorata*, *P. magalhaensis* (Kinberg 1910, Pl. 27, Fig. 7V) and *P. milae* (Fig. 4B) have radioles without flanges while radiolar flanges are present in *P. borsibrunoi* and *P. brigittae* sp. nov. (Fig. 4C). Radiolar flanges in *P. littoralis sensu* Giangrande and Gambi (1997) or Knight-Jones (1983) are unknown. The presence or absence of radiolar flanges is unknown in *P. pusilla*, but this species has triangular lappets as long as the height of three thoracic segments and abdominal chaetae type A (ventral lappets as long as two thoracic segments and abdominal chaetae type C in *P. brigittae* sp. nov.). *Perkinsiana brigittae* sp. nov., *P. littoralis sensu* Giangrande & Gambi (1997) and *P. magalhaensis* have abdominal chaetae type C, but in the first species the ventral lappets of collar are not overlapped (overlapped in *P. magalhaensis* and *P. littoralis sensu* Giangrande & Gambi (1997)) and the anterior peristomial ring is exposed dorsal and laterally (exposed only dorsally in *P. magalhaensis* and *P. littoralis sensu* Giangrande & Gambi (1997)).

As pointed out in the introduction, *Perkinsiana* is not only a genus with a high morphological variability, but it exhibits variability of reproductive features, sperm morphology and oocyte sizes. Among sub-antarctic and Antarctic species, *P. antarctica* (Kinberg) is a brooder simultaneous hermaphrodite (Gambi & Patti 1999), *P. littoralis* (sensu Gambi et al. 2000) and *P. borsibrunoi* are gonochoric and free spawners, whilst *P. milae* showed asexual reproduction via scissiparity (Gambi et al. 2000), although a few large specimens were found mature and gonochoric (Cigliano et al. 2007). *Perkinsiana brigittae* sp. nov., is a simultaneous hermaphrodite as seen in *P. antarctica*, but probably is a free spawner, in having spermatozoa with spherical nucleus and rounded cap-like acrosome or ect-aquasperm type (barrel shaped nucleus and pointed acrosome or ent-aquasperm type in *P. antarctica*), oocytes diameter ranging from 25 to 175 µ (30–250 µ in *P. antarctica*) and gametes female and male distributed together in abdomen (oocytes in anterior abdomen and sperm in posterior abdomen in *P. antarctica*). A

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**FIGURE 5.** Latitudinal distribution of *Perkinsiana* species.
similar ect-aquasperm spermatozoa type to \textit{P. brigittae} sp. nov., is present in both \textit{P. littoralis} \textit{(sensu Gambi et al. 2000)} and \textit{P. borsibrunoii}, but these latter species are gonochoric with oocytes diameter ranging from 30 to 225 µ (Gambi \textit{et al.} 2000). Among the remaining species of \textit{Perkinsiana}, information on spermatozoa morphology are available only for the type species \textit{P. rubra}, which shows spermatozoa with a barrel-shaped nucleus and pointed acrosome (Chughtai 1986), similar to \textit{P. antarctica}.

The knowledge of reproductive features plus consideration of types abdominal chaetae, could be of valuable help in clarifying the taxonomy of species currently assigned to \textit{Perkinsiana}. \textit{Perkinsiana littoralis} \textit{(sensu Gambi et al. 2000)}, \textit{P. borsibrunoii} and \textit{P. brigittae} sp. nov., have abdominal chaetae type C and spermatozoa with rounded cap-like acrosome while \textit{P. rubra} and \textit{P. antarctica} have pointed acrosomes and types A and B abdominal chaetae, respectively.

\textbf{Etymology}: This species is named in honor of Brigitte Ebbe (Senckenberg Institut) in recognition of her expertise and enthusiastic interest to promote the taxonomy of polychaetes from the Southern Ocean.

\textbf{Key for species of Perkinsiana from the Antarctica}

1. Anterior peristomial ring exposed dorsally and laterally; ventral lobes of collar not overlapped ......................... 2
2. Anterior peristomial ring exposed dorsally; ventral lobes of collar overlapped ........................................... 5
2. Radiolar tips long (as long as equivalent space of 20–24 pinnules) with flanges. \textit{P. borsibrunoii} Giangrande and Gambi, 1997
3. Radiolar tips medium length (as long as equivalent space of 10–12 pinnules) without flanges. ........................ 3
4. Abdominal chaetae broadly-hooded; adult form short size (24 mm) ......................................................... \textit{P. milae} Giangrande and Gambi, 1997
5. Abdominal chaetae narrowly-hooded; adult form long size (65–102 mm) .................................................. \textit{P. brigittae} sp. nov.
6. Ventral shields of thorax contacting tori ......................................................... \textit{P. antarctica} (Kinberg, 1867)
7. Ventral shields of thorax not contacting tori ....................................................................................... \textit{P. magalhaensis} (Kinberg, 1867) & \textit{P. antarctica} (Gravier, 1906) & \textit{P. littoralis} (Hartman, 1967) (see previous discussion).

\textbf{BIOGEOGRAPHIC CONSIDERATIONS}

Differently from other sabellid genera which are particularly speciose in the warm area of the world, with the maximum of diversity in the tropical region (Giangrande & Licciano 2004), \textit{Perkinsiana} shows higher diversity at higher latitude especially in the southern hemisphere notwithstanding the northern hemisphere generally has been more investigated. In particular, as regards the Polar regions \textit{Perkinsiana} seems to be restricted to Austral cold waters, where it represents the most speciose genus within Sabellidae (Fig. 5). Up to now 18 species of \textit{Perkinsiana} were described worldwide, almost 50% are distributed in sub-Antarctic and Antarctic areas. As regards their distribution within these areas, some taxa \textit{(P. antarctica, P. decorata and P. pusilla)} are restricted to sub-Antarctic shallow zones, while all the other species, including the new species described here, are distributed both in the sub-Antarctic and continental Antarctic areas and are recorded in deep waters of the continental shelf. Integrating previous records (Giangrande & Gambi 1997) with the analysis of additional material derived from a PhD thesis (Micaletto 2007) and from the Southern Annelid Project (SOAP) Workshop, \textit{P. borsibrunoii} and \textit{P. milae} previously considered as Antarctic species, and \textit{P. milae} as endemic to the Ross Sea, have now been recorded also in sub-Antarctic areas.

The present results highlight an evident intense speciation within \textit{Perkinsiana} in the Southern ocean. Although the records for most of the species is still scanty, and many of the distributions are discontinuous, the co-occurrence of most of the species leads us to hypothesize the existence of different ecological conditions and requirement in an environment often perceived as homogeneous, which may have led to sympatric speciation.

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