



An updated checklist of the scaleworm *Harmothoe* (Annelida, Polynoidae) from South America, with two new records from Brazil

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Abstract. The family Polynoidae includes a group of scale worms which is abundant in several marine environments, and many members are associated with other invertebrates. The genus *Harmothoe* is one of the largest in number of species within the polynoids, with more than 150 described species. We summarize in a checklist information relative to 23 nominal species of *Harmothoe* from South America, with valid names, synonyms and original citations, discuss possible taxonomic problems, and provide illustrations of specimens from the northeastern coast of Brazil. Redescriptions of two species based on new specimens collected along the littoral of the State of Pernambuco, northeastern Brazil, are included. *Harmothoe fuscipinae* and *Harmothoe lanceocirrata* are reported for the first time for Brazilian waters.

Key words: Scale worms, polynoids; South Atlantic, new records.

Resumo: Uma lista atualizada de vermes escamosos *Harmothoe* (Annelida, Polynoidae) da América do Sul, com dois novos registros do Brasil. A família Polynoidae inclui um grupo de vermes escamosos que são abundante em muitos ambientes marinhos, e muitos membros estão associados com outros invertebrados. O gênero *Harmothoe* é um dos maiores em número de espécies entre os polinoídeos, com mais de 150 espécies descritas. Nós resumizamos em uma lista anotada informações relativas a 23 espécies nominais de *Harmothoe* da América do Sul, com nomes válidos, sinônimos, e citações originais, discutimos possíveis problemas taxonômicos, e fornecemos ilustrações de espécimens da costa nordeste do Brasil. Redescrições de duas espécies baseadas em espécimens coletadas ao longo do litoral do Estado de Pernambuco, nordeste do Brasil, são incluídas. *Harmothoe fuscipinae* e *Harmothoe lanceocirrata* são registradas pela primeira vez para águas brasileiras.

Palavras chave: Vermes escamosos, polinoídeos; América do Sul, novos registros.

Introduction

Polynoidae Kinberg, 1986 represents a common family of scale worms, abundant in marine regions from intertidal regions to the deep-sea (Naeni & Rahimian 2009, De Assis *et al.* 2015, Eckelbarger, 2005), totaling about 700 described species (Read & Fauchald 2020). Members of polynoids are found in close obligatory or facultative association with other invertebrates, especially corals, echinoderms, mollusks, and other polychaetes (Pettibone 1991, Martin & Britayev 1998, Eckelbarger *et al.* 2005, De Assis *et al.* 2019).

The genus *Harmothoe* Kinberg, 1856 belongs to the family Polynoidae, and contain more than 150 described species distributed worldwide (Read & Fauchald 2020).

Members of *Harmothoe* have a dorsoventrally flattened body, subrectangular in cross-section, short, and with more than 50 chaetigers. Fifteen pairs of elytra on chaetigers 2, 4, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 26, 29, 32, covering the dorsum almost completely, with only a short tail region being uncovered. The prostomium has cephalic peaks, and there are three antennae. The lateral antennae occur on ceratophores and are inserted ventrally to the median antennae. The long palps are smooth or covered with papillae; being distally tapered. Two pairs of eyes are present, anterior pair inserted dorsolaterally, posterior pair inserted dorsally. The surface of the elytra has microtubercles, macrotubercles, or both, and filiform papillae. Parapodia have elongate acicular lobes, with both aciculae penetrating the epidermis; neuropodia have a supra-acicular process. Notochaetae are stout, with distinct rows of spines with blunt tips. Neurochaetae are more numerous and usually more slender; they have distinct rows of spines distally and falcate or straight tips, either all bidentate, with a subdistal secondary tooth, or some bidentate and some unidentate (Wehe 2006, Barnich & Fiege 2009).

There are several contributions for the taxonomy of this genus in South America. Papers on polynoids from the southeast Pacific Ocean were published for Colombia (Laverde-Castillo 1986), Ecuador, Peru (Chamberlin 1919, Monro 1928, Hartman 1956, Pettibone 1988, 1989, Salazar-Silva 2006, 2010), and Chile (Rozbaczylo & Cañete 1993, Cañete *et al.* 1993, Rozbaczylo *et al.* 2005). For the Atlantic there are papers for Brazil (Morgado & Amaral 1981, Amaral & Nonato 1982) and Argentina (Pettibone 1993a).

Morgado & Amaral (1981) and Amaral & Nonato (1982) reported the majority of species of polynoids from South America, most material examined therein being from south and southeastern Brazil, from the States of Santa Catarina, São Paulo, and Rio de Janeiro. Studies from the north and northeast of Brazil are still scarce. For species reported for northeastern Brazil, we highlight contributions of De Assis *et al.* (2012, 2019) and Brito *et al.* (2013). De Assis *et al.* (2015) provided a catalogue of the genus *Lepidonotus* Leach, 1816 from South America and reported two exotic species from Brazilian waters.

In this paper, an updated checklist of the species of *Harmothoe* from South America is provided, and *H. fuscaspinae* Salazar-Silva, 2003 and *H. lanceocirrata* Treadwell, 1928 are redescribed and illustrated, collected in the intertidal region of the State of Pernambuco, northeastern Brazil. These two species are reported for the first time along the Brazilian littoral.

Material and Methods

Specimens were collected by hand during low tides in intertidal regions (0.0–0.2 m), at Suape beach, on the coast of the State of Pernambuco. Material was preserved in 10% formaldehyde. Samples were observed with an Olympus Nikon SMZ800 stereomicroscope. Chaetae and elytrae were observed with an Olympus BX41 compound microscope. All illustrations were drawn using a camera lucida, and photographs were edited in Photoshop cs5, PhotoScape and CorelDraw X6. Specimens are deposited in the Coleção de Invertebrados Paulo Young, Departamento de Sistemática e Ecologia da Universidade Federal da Paraíba (POLY–UFPB), and in the Laboratório de Comunidades Marinhas (LACMAR).

Subsequently, we have compiled the information of all species of *Harmothoe* recorded from South America, and the specimens are reported herein (Fig. 1). Species names are arranged alphabetically under subfamilies. Each name, when available, contains author, publication year, page number, plates, and number of figures. When available, we provide holotype and other type numbers, together with the abbreviation of the museum or institution in which the type material is deposited, type locality, and geographical distribution. Known associations and other biological interactions are summarized. For some species, we include remarks on possible taxonomical

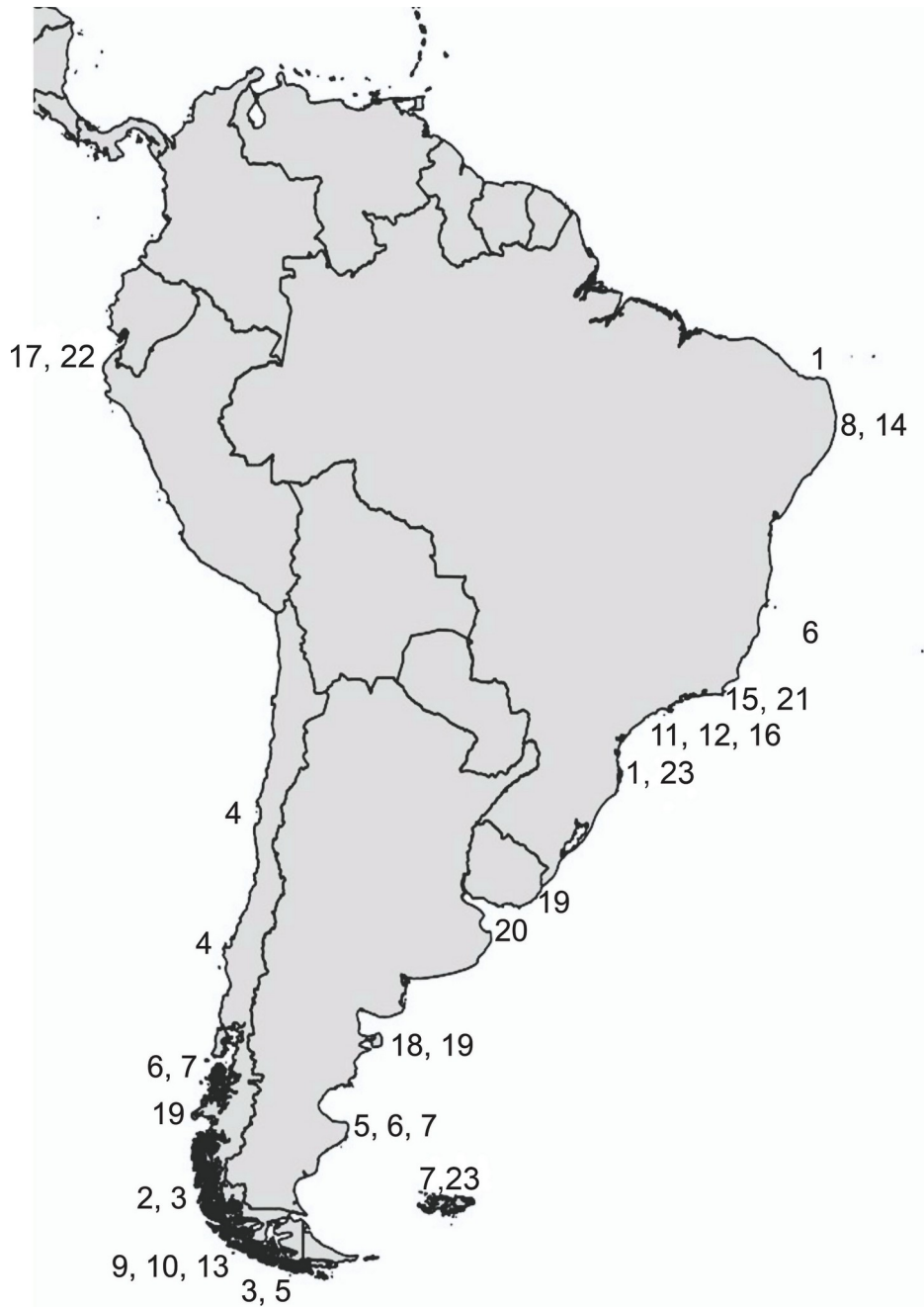


Figure 1. Map showing the distribution of genus *Harmothoe* in South America: 1) *H. aculeata*; 2) *H. campoglacialis*; 3) *H. ciliata*; 4) *H. commensalis*; 5) *H. crosetensis*; 6) *H. ernesti*; 7) *H. exanthema*; 8) *H. fuscaspinae*; 9) *H. fullo*; 10) *H. hirsuta*; 11) *H. imbricata*; 12) *H. impar*; 13) *H. juvenalis*; 14) *H. lanceocirrata*; 15) *H. longidentis*; 16) *H. macginitiei*; 17) *H. macnabi*; 18) *H. madrynsis*; 19) *H. magellanica*; 20) *H. pulchella*; 21) *H. reticulata*; 22) *H. sylliformia*; 23) *H. spinosa*.

problems encountered, or the necessary bibliography for further research.

The validity of species reported here was checked in WoRMS (World Register of Marine Species), and ITIS (Integrated Taxonomic Information System), but we accept conclusions in the recent literature on the basis of last reviewer when taxonomic decisions were based on the

revision of museum specimens or when decisive circumstantial evidence was provided. Furthermore, many new references not contained in WoRMS are provided herein. Page numbers have not been provided for some of the papers protected with copyright in the Web and when not available at this time to the authors. We attempt to provide references

as complete as possible for each species occurring in South America.

The following abbreviations are used in the text:

AMNH, American Museum of Natural History, New York.

BMNH, British Museum of Natural History.

ECOSUR, El Colegio de la Frontera Sur-Chetumal.

LACM-AHF, Los Angeles Co. Museum of Natural History, Allan Hancock Foundation Polychaete collection—USA.

MCZ, Museum of Comparative Zoology, Harvard University, Massachusetts.

NRS, Naturhistoriska Riksmuseet, Stockholm.

SMNH, Swedish Museum of Natural History, Department of Invertebrate Zoology.

SSM, Swedish State Museum, Stockholm.

SSUC, Colección de Flora y Fauna Profesor Patricio Sánchez Reyes, Pontificia Universidad Católica, Chile

USNM, National Museum of Natural History, Smithsonian Institution, Washington D.C.

ZISP, Zoological Institute of the Russian Academy of Science, St Petersburg.

ZMB, Zoologisches Museum, Museum für Naturkunde der Humboldt Universität, Berlin, Germany.

ZMH-P, Polychaete Collection, Zoologisches Institut und Museum der Universität Hamburg, Germany.

ZMUC-POL, Polychaete Collection, Zoological Museum, University of Copenhagen.

Results

Updated checklist of Harmothoe species from South America:

Family **Polynoidae** Kinberg, 1856

Subfamily **Polynoinae** Kinberg, 1856

Genus **Harmothoe** Kinberg, 1856

Type species: *Harmothoe spinosa* Kinberg 1856 (designated by Bergström, 1916)

1. ***Harmothoe aculeata*** Andrews, 1891

Polynoe (Lepidonotus) iphionoides McIntosh, 1885 (subjective synonym).

Lepidonotus iphionides [auct. lapsus] (misspelling in Rouse and Pleijel 2001).

Source of synonymys: Salazar-Silva (2003: p 56).

Type material: Holotype: USNM 4876.

Type locality: Western Atlantic, from North Carolina, USA.

Distribution: Western Atlantic from USA (North Carolina) to Brazil (Rio Grande do Norte to Paraná), intertidal to 69 m. The collections of the USNM contain 7 samples from Belize (USNM 11342–46–52) (Amaral *et al.* 2013, Salazar-Silva 2003, 2010, De Assis *et al.* 2012).

Remarks: In the catalogue of Hartman (1951) *Polynoe (Lepidonotus) iphionoides* McIntosh, 1885 from the Philippine Islands is listed as a synonym of *Harmothoe aculeata* Andrews, 1891. However, in this case, *Harmothoe iphionoides* (McIntosh, 1885) would become the correct name for this species. Because otherwise *Harmothoe aculeata* Andrews, 1891 is only known from the Western Atlantic, we have refrained from accepting this proposed synonym and the consequent required name change for the time being. The two specimens found in Paraíba show the ceratophores of antennae with black pigmentation. These represent differences between this and the specimen reported in Amaral and Nonato (1982).

2. ***Harmothoe campoglacialis*** Hilbig & Montiel, 2000

Harmothoe campoglacialis Hilbig & Montiel 2000: 6–11, figs 1–6.

Type material: Holotype: SSUC–6866.

Type locality: Magellan Region of Chile.

Distribution: Known only type locality (Hilbig & Montiel 2000).

3. ***Harmothoe ciliata*** Monroe, 1936

Harmothoe brevipalpa var. *ciliata* Monroe, 1936: 87, fig. 6.

Harmothoe impar ciliata Monroe, 1936: 87–88, fi.

Harmothoe impar Monroe (1939): 98 [not *Harmothoe impar* (Johnston, 1839)].

Harmothoe fimbriata Hartmann-Schröder, 1965: 64–67, figs 8–12.

Source of synonymys: Hartman (1964: p. 17); Barnich *et al.* (2012: p. 8).

Type material: Holotype of *Harmothoe brevipalpa ciliata*: BMNH 1936.2.8.120; holotype of *Harmothoe fimbriata*: ZMH-P–13984.

Type locality: Magellan Strait, Chile.

Distribution: Antarctica and Magellan region in the southern tip of South America (Barnich *et al.* 2012).

4. ***Harmothoe commensalis*** Rozbaczylo & Cañete, 1993
Harmothoe commensalis Rozbaczylo & Cañete, 1993: 667–669, figs. 1–4.
 Type material: Holotype USNM 157690.
 Type locality: Bahía La Herradura, Coquimbo and Bahia Concepcion, Central Chile.
 Distribution: Known only from Chile, 10–20 m (Rozbaczylo & Cañete 1993).
 Biology: Associated with clam *Semele solida* (Gray 1828).
5. ***Harmothoe crosetensis*** (McIntosh, 1885)
Lagisca crosetensis McIntosh, 1885: 88, pl. 8: fig. 6; pl. 13: fig. 2, pl. 18: fig. 7; pl. 11a: figs 4–6.
Evarne kerguelensis McIntosh, 1885: 97, pl. 6: fig. 4; pl. 19: fig. 6; pl. 6a: figs 12–14.
Harmothoe spinosa var. *lagiscoides* Willey, 1902: 265.
Harmothoe spinosa fullo lagiscoides Willey, 1902: 265, pl. 43: fig. 6.
Harmothoe crosetensis var. *laciniata* Willey, 1902: 267.
Harmothoe lagiscoides Willey, 1902: 267.
 Source of synonymys: Bergström (1916: p. 284); Barnich *et al.* (2006: p. 9).
 Type material: Lectotype (BMNH 1885.12.1.68) and paralectotype (BMNH 2005.2454) of *Lagisca crosetensis*; syntypes (numerous juveniles) of *Evarne kerguelensis*: BMNH 1885.12.1.77, BMNH 1885.12.1.80, BMNH1921.5.1.490. Holotype of *Harmothoe spinosa fullo lagiscoides*: BMNH 1902.1.8.97. Paratype of *Harmothoe gruzovi*: ZISP 5.
 Type locality: Crozet Islands.
 Distribution: Antarctica. Southeastern Pacific from Chile, Southwestern Atlantic from Argentina. Southeastern Indian Ocean from the Mozambique Basin off South Africa. 0–29 m. Doubtful from Malai Archipelago (Barnich *et al.* 2006).
6. ***Harmothoe ernesti*** Augener, 1931
Harmothoe ernesti Augener, 1931: 281–282, fig. 1a–d.
 Type material: Holotype, ZMH 10268.
 Type locality: Coral reefs of Abrolhos Bank, off southern Bahia, Brazil.
 Distribution: Eastern Pacific from Chile. Western Atlantic from Guadeloupe, off Bahia, and southern Argentina (Augener 1931, Amaral *et al.* 2013, Salazar-Silva 2010).
7. ***Harmothoe exanthema*** (Grube, 1856)
Polynoe exanthema Grube, 1857: 46.
Antinoe exanthema Grube, 1857: 46.
Lagisca vesiculosa Grube, 1857: 46.
Harmothoe exanthema bergstroemi (Monro, 1936: 85–86.
Lagisca globulosa Hartmann-Schröder, 1962.
 Source of synonymys: Baird (1865: p. 193); Barnich *et al.* (2006: p. 40).
 Type material: Holotype of *Polynoe exanthema*: ZMUC POL 1671. Holotype of *Polynoe vesiculosa*: ZMB 877. Holotype of *Lagisca globulosa*: ZMH–P: 13995. Nine paratypes: ZMH–P: 15461. Syntypes of *Harmothoe exanthema bergstroemi*: BMNH 1936.2.8.104–109.
 Type locality: Valparaíso, Chile.
 Distribution: Antarctica and Subantarctic Islands (Bouvet Island, Falkland Islands), Argentina, and Chile. 0–260 m (Barnich *et al.* 2012).
 Biology: On kelp *Macrocystis pyrifera* (Linnaeus) C.A. Agardh 1820.
 Remarks: *Harmothoe exanthema bergstroemi* Monro, 1936 and *Lagisca globulosa* Hartmann-Schröder, 1962 are included in the synonymy of *Harmothoe exanthema* based on the examination of type material (Hartmann-Schröder 1965).
8. ***Harmothoe fuscaspinae*** Salazar-Silva, 2003
Harmothoe aculeata Long & Zottoli 1997: 29–30 (not Andrews 1981).
 Type Material: Holotype, USNM 174074, San Salvador Island, Bahamas, north coast (24°06'N 74°27'W); Paratypes: USMN 1006970, San Salvador Island, Bahamas, north coast.
 Type Locality: San Salvador Island, Bahamas.
 Examined material: Specimen collected under rocks in Suape beach, Cabo de Santo Agostinho, Pernambuco, northeastern Brazil (8°21'23.23" S, 34°57'07.63" W) (POC-UFPE000324).
 Description: Incomplete specimen, with 34 chaetigerous segments, length 15 mm, width 3.5mm. Fifteen pairs of elytra on chaetigers 2, 4, 5, 7, then on every second segment to 23, and then on segments 26, 29, and 32.
 Prostomium bilobed, wider than long, lobes tapering anteriorly, with a conspicuous cephalic peak; facial tubercle absent; two pairs of small, black, circular eyes, anterior dorsolateral pair at the widest part of the prostomium, posterior pair near the posterior margin of the prostomium (Fig. 2a).
 Palps long and slender, with short papillae in longitudinal rows on the surface, distally with fine tip. Median antenna with cylindrical ceratophore,

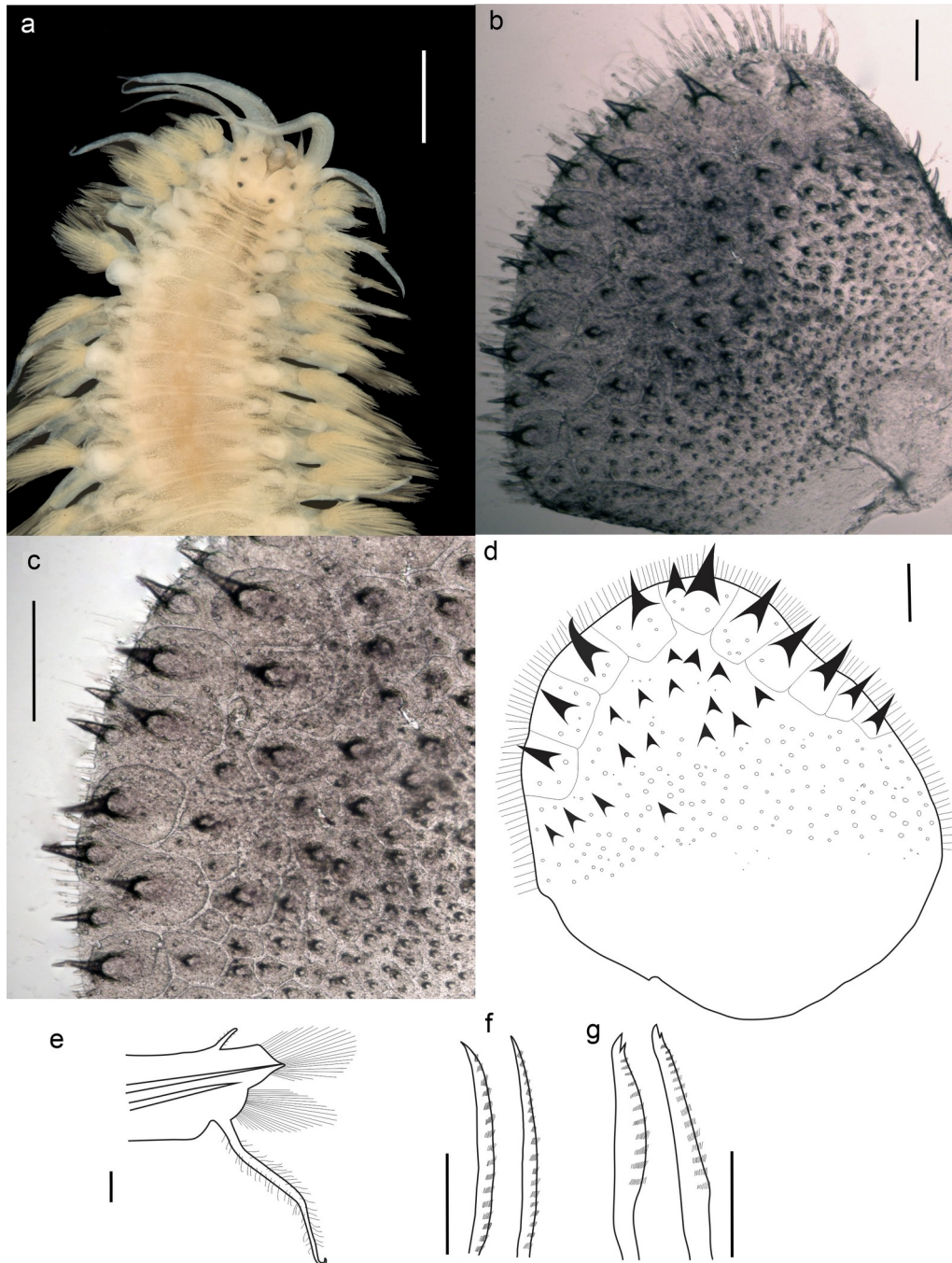


Figure 2. *Harmothoe fuscaspinae*: a) dorsal view of anterior end; b) general view from middle right elytron; c) conical macrotubercles with different length; d) macrotubercles spine-like from later border of same; e) left cirriferous parapodium from chaetigers 23; f) long notochaetae from chaetiger 17; g) low and middle neurochaetae from chaetiger 15. Scale bars: a, b, c, d, 1.0 mm; e, 0.1 mm; f, g: 0.05 mm.

long, inserted frontally between the separated lobes; style slender, with abundant long, filiform papillae over surface. Lateral antennae with cylindrical ceratophores, inserted ventrally, and not fused in midline; style long, slender, with long filiform papillae on surface, and with fine tips. Pharynx not observed.

Tentaculophores inserted laterally to prostomium, slender, with chaetae and two pairs of tentacular cirri; cirri about half length of the palps, with long filiform papillae on surface. Segment two with a short, triangular nuchal lobe, first pair of elytriphores prominent and lateral to the

prostomium; parapodia of this segment slightly projecting anteriorly.

Fifteen pairs of elytra covering the dorsum overlapping in midline; with surface of the elytra with hard microtubercles on the anterior part; macrotubercles on the posterior part uncovered; both with approximately pentagonal basal areoles, each with numerous short and erect filiform papillae. First pair of elytra circular, others reniform and larger, the posterior pair enlarged (Fig. 2b, c).

Macrotubercles arranged in rows on the posterolateral surface of each elytron, conical, slender, bulbous basally, dark, and more or less of same length, with sharp simple tips, some with bifid tips; with spine-like, very slender macrotubercles on posterior border (Fig. 2a, 2b). Posterior and outer lateral border of elytra with fringe of short filiform tubercles (Fig. 2c, d).

Parapodia biramous; elyptophores and dorsal tubercles elevated; elyptophores circular and larger than the dorsal tubercle. Notopodia shorter than neuropodia, projected postchaetal lobe in a short ventrolateral acicular lobe; neuropodia cleft dorsally, prechaetal lobe tapering in a short projected acicular lobe with a digitiform supra-acicular process, postchaetal lobe shorter and rounded. With tapering dorsal cirri, long and filiform papillae; cylindrical and long cirrophore. Ventral cirri short and papillate (Fig. 2e). Nephridial papillae small, located between the parapodia.

Notochaetae stouter, much thicker than the neurochaetae, with transverse rows of spines distally, slender and short tips. Dorsal notochaetae more strongly curved and thicker than ventral ones (Fig. 2f). Neurochaetae abundant, bidentate; main teeth medially thick, distally curved, sharply pointed, three times longer than secondary teeth, with transverse rows of long spines beyond the length (Fig. 2g).

New Record: Suape beach, Pernambuco, Brazil.

Distribution: San Salvador Island, Bahamas (Salazar-Silva 2006); northeastern Brazil (in this paper).

Remarks: *Harmothoe fuscaspinae* was first described as a member of *Harmothoe aculeata* Long & Zottoli (1997) from San Salvador Island, Bahamas. After taxonomic revision of *Harmothoe aculeata* deposited in National Museum of Natural History (USNM), Washington, and non-type material from this museum and other material in the collections of the Natural History Museum of Los Angeles County, Salazar-Silva (2006), described the new

species as *H. fuscaspinae*. This is the first time that this species is reported outside its original collection site.

9. *Harmothoe fullo* (Grube, 1878)

Polynoe fullo Grube, 1877: 5515.

Harmothoe fullo Grube, 1877: 515.

Harmothoe gourdoni Gravier, 1911b: 312–313.

Harmothoe spinosa Augener, 1932a, p. 98. (Not *Harmothoe spinosa* Kinberg, 1856)

Harmothoe monroi Uschakov, 1962: 160–163, pl. 5: figs. a–b; pl. 6: figs. a–b.

Source of synonymys: Barnich *et al.* (2006: p. 46).

Type material: Lectotypes of *Polynoe fullo* ZMB 685 and 1139. Paratypes (15) of *Harmothoe monroi*: ZISP 10203.

Type locality: Tuesday Harbor, Magellan Strait, Chile.

Distribution: Antarctica to Chile. 15.5–540 m (Barnich *et al.* 2006).

10. *Harmothoe hirsuta* Johnson, 1897

Harmothoe hirsuta H.P. Johnson, 1897: 182–183, pl. 6: figs 27–29, pl. 7: fig. 38, pl. 8: figs. 53, 53a–c.

Type material: Holotype (LACM-1 AHF Poly 0017); Syntypes: MCZ 1935.

Type locality: California, San Pedro, at the low water mark.

Distribution: Antarctica. Eastern Pacific from Alaska to Chile and Hawaii. Western Atlantic from Caribbean Panama. From the Arabian Sea; 2–156 m (Ruff 1995).

Remarks: Hartman (1939: 51) remarks that *H. hirsuta* Ehlers (1901) from Tumbes, Chile, was later made the type of *H. anderssoni* Bergström (1916). Posteriorly, the species *H. anderssoni* was transferred to the genus *Eunoe* Malmgren, 1865 while the species reported by Ehlers 1901 from Chile is unlikely to be the same species described by H.P. Johnson, 1897. In our opinion, these can be new species. The second syntype (LACMAHF 0017), used by Ruff (1995) to characterize the species, does not correspond to the original description of H.P. Johnson (Ruff 1995).

11. *Harmothoe imbricata* (Linnaeus, 1767)

Aphrodita lepidota Pallas, 1767: 94, pl. 7, fig. 15a–b, pl. 8, figs 1–2. *Aphrodita imbricata* Linnaeus, 1767: 1084.

Aphrodita violacea Ström, 1768: 366.

Aphrodita cirrata O.F. Müller, 1776: 218.

Aphrodita lepidota minuta Pennant, 1777.

Aphrodita plana Gmelin in Linnaeus, 1788.
Lepidonote cirrata.—Örsted, 1843a: 13–14, fig. 45; 1843b: 166, pl. 1: figs 1, 5–6, 11, 14–15. *Aphrodita varians* Dalyell, 1853: 168, pl. 24, figs 11–12.
Harmothoe unicolor Baird, 1865: 196.
Polynoe complanata Quatrefages, 1866: 253.
Polynoe incerta Bobretsky, 1881: 187, pl. 6: fig. 1a–g.
Harmothoe maxispinosa De Saint-Joseph, 1888: 161–162, pl. 7: fig. 24.
Harmothoe levis Treadwell, 1937: 26–27, figs. 1–5.
Harmothoe hartmanae Pettibone, 1948: 412, fig. 1a–f.
 Source of synonymy: Malmgren (1866: p. 59), Pettibone (1963: p. 36–38), Dauvin (2003: p. 77).
 Type material: Neotype of *Harmothoe imbricata*: SMNH–Type–7728. Syntypes (2) of *Harmothoe unicolor*: BMNH 1860.2.29.13.
 Type locality: Iceland.
 Distribution: Core distribution: Widely distributed in Arctic and northern temperate coastlines. The distribution reaches the tropic of Capricorn along the Western Atlantic (São Paulo) and Oceania in the Pacific (New Caledonia). In the eastern Pacific it reaches Costa Rica, in the eastern Atlantic the Gulf of Guinea, and in the Indian Ocean, Pakistan and India. 0–3711 m. The species seems to be absent only from the Southern Ocean. Also recorded as a fossil from the Oligocene of Japan (Katto 1984).
 Biology: Facultative host of the ciliate *Cothurnia acuta* Levander, 1915, the trematode *Derogenes varicus* (Müller, 1784), the nemertean *Carcinonemertes carcinophila* (Kölliker 1845), the larva and adult of the nematode *Hysterothylacium aduncum* (Rudolphi, 1802) the echiurid *Lissomyema exilii* (Lambert, 1883), the parasitic copepods *Eurysilenium truncatum* M. Sars, 1870, *Herpyllobius arcticus* Steenstrup and Lütken, 1861, *H. elongata* Lütken, 1967, *H. polynoes* (Krøyer, 1863), and *Selioides bolbroei* Levinsen, 1878. Associated with Mediterranean seagrass *Posidonia oceanica* (Linnaeus) Delile, 1813, sponges *Petrosia* and *Ircinia*, the hydroid *Nemertesia antennina* (Linnaeus, 1758), the chaetopterid polychaetes *Chaetopterus* sp. and *Chaetopterus cautus* Marenzeller, 1879, the onuphid polychaete *Diopatra ornata* Moore, 1911, the terebellid polychaetes *Eupolymnia nebulosa* (Montagu, 1818), *Neoamphitrite robusta* (H.P. Johnson, 1901), *Thelepus cincinnatus* (Fabricius, 1780), *T. crispus* H.P. Johnson, 1901, and *Polycirrus* sp., the

sabellariid polychaete *Neosabellaria cementarium* (Moore, 1906), associated with the bivalves *Macoma calcarea* (Gmelin, 1791) and *Mesodesma deauratum* (Turton 1822), and inside a shell of the gastropod *Neverita lewisii* (Gould, 1847). Associated with the northern stone crab *Lithodes maja* (Linnaeus 1758), the hermit-crab *Pagurus ochotensis* F. Brandt, 1851, and the asteroid *Asterias amurensis* Lütken, 1871. It is part of the diet of the nemertean *Rhizophogordius sanguineus* (J. Rathke, 1799). Is is food for fishes, the fourbeard rockling *Enchelyopus cimbicus* (Linnaeus 1766), the fish doctor *Gymnelus viridis* (Fabricius, 1780), the variegated snailfish *Liparis gibbus* Bean, 1881, the bastard halibut *Paralichthys olivaceus* (Temminck & Schlegel 1846), the flounder *Pseudopleuronectes americanus* (Walbaum, 1792), and the Arctic shanny *Stichaeus punctatus punctatus* (Fabricius, 1780). It is also food of birds, the black grullernut *Cephus grylle* (Linnaeus, 1758), chicks of the Atlantic puffin, *Fratercula arctica* (Linnaeus 1758), the northern fulmar *Fulmarus glacialis* (Linnaeus 1761), and the kittiwake *Rissa tridactyla tridactyla* (Linnaeus 1758).

Remarks: The most common North Atlantic polynoid, if not one of the most common polychaetes, showing great adaptability as regards salinity and bathymetric range (Wesenberg-Lund 1950). *Harmothoe imbricata* is one of the most frequently identified and most problematic scaleworm species from northern European coasts (Barnich & Fiege 2009). It represents a species complex (Davis & McGrath 1984). They present 10 color morphs along the Scandinavian coast, but with no genetic evidence to suggest they represent different species (Nygren *et al.* 2011). Bhaud (1972) has classified the species as of temperate affinities regarding reproductive mode. There does not seem to be any temperature barriers against the cosmopolitan distribution of *H. imbricata*.

12. *Harmothoe impar* (Johnston, 1839)

Polynoe impar Johnston, 1839: 436, pl. 22: figs. 3–9.

Antinoe impar Johnston, 1839: 1839: 436, pl. 22: figs. 3–9.

Evarnella impar Johnston, 1839: 1839: 436, pl. 22: figs. 3–9. *Harmothoe (Evarne) impar* Johnston, 1839: 1839: 436, pl. 22: figs. 3–9.

Harmothoe (Evarnella) impar Johnston, 1839: 1839: 436, pl. 22: figs. 3–9.

Evarne atlantica McIntosh, 1897: 168, pl. III, fig. 12.

Evarne atlantica McIntosh, 1897: 168, pl. III, fig. 12. *Harmothoe elisabethae* McIntosh, 1900: 662–663, pl. 33, figs. 1–4.

Lagisca elisabethae McIntosh, 1900: 662–663, pl. 33, figs. 1–4.

Source of synonymy: Fauvel (1923: p. 59), Baird (1865: p. 192), Barnich & Fiege (2009: p. 48).

Type material: No type material available of *Polynoe impar*, *Polynoe reticulata* and *Tricosmochaeta trilobocephala*.

Type locality: Berwick-upon-Tweed, Bucket Rocks, United Kingdom.

Distribution: Eastern Atlantic from the British Isles and Senegal, the Mediterranean Sea to the Suez Channel and the Black Sea. This species has been cited for São Paulo (Amaral *et al.* 2013) on the basis of an unpublished dissertation.

Biology: Found in Mediterranean seagrass *Posidonia oceanica* (Linnaeus) Delile, 1813.

Remarks: Hartman (1959) lists *Polynoe granulosa* Rathke, 1837 from Sebastopol in the Black Sea (Rathke, 1837), and also listed as *Antinoë granulosa* by Baird (1865), as a synonym of *Harmothoe reticulata* (Claparède 1870). However, acceptance of this proposal would require the present species to be renamed *Harmothoe granulosa* (Rathke 1837) on the basis of priority.

13. *Harmothoe juvenalis* Hartmann-Schröder, 1962 *Harmothoe juvenalis*.—Hartmann-Schröder, 1965: 63–64, figs 5–7.

Type material: ZMH–P 13989; Paratypes ZMH–P 13988.

Type locality: Strait of Magellan, Chile.

Distribution: Known only from Chile. 20–240 m (Hartmann-Schröder 1965).

14. *Harmothoe lanceocirrata* Treadwell, 1928

Harmothoe lanceocirrata Treadwell, 1928: 454–455, fig. 177 (1–5).

Harmothoe lanceolata Treadwell, 1928, explanation of figs [erroneous spelling].

Harmothoe aculeata: Ebbs (1966): 496–500, Figure 3a–g (not Andrews 1891).

Harmothoe crucis: Hartman (1956): 272–273 (not Grube 1856).

Type locality: Caribbean Sea, SW of Sabo Island.

Type Material: Holotype—AMNH 3529.

Examined material: Specimen collected under rocks in Suape beach, Cabo de Santo Agostinho, Pernanbuco, northeastern Brazil (8°21'23.23" S, 34°57'07.63" W) (PO-UFPE000325).

Description: Complete specimen, with 13 chaetigerous segments; 5.95 mm of length, and 3.56 mm wide. Specimen with 15 pairs of elytra on chaetigers 2, 4, 5, 7, 9, 11, 13.

Prostomium bilobed, wider than long, lobes tapering anteriorly, with pointed cephalic peak; facial tubercle absent; three small eyes, two on right side, and one on left side; black, circular eyes, anterior pair dorsolateral at the widest part of the prostomium, and the other eye near the posterior margin of the prostomium (Fig. 3a).

Palps long and slender, with short, digitiform papillae in longitudinal rows on the surface, distally with fine tip. Median antenna with cylindrical ceratophore, no ring, long, inserted frontally between the separated lobes; style slender, with abundant short filiform papillae over the surface. Lateral antennae with cylindrical ceratophores, inserted ventrally, and not fused in midline; style long, slender, with long filiform papillae on the surface, and fine tips. Pharynx not observed.

Tentaculophores inserted laterally to prostomium, slender, with chaetae and two pairs of tentacular cirri; cirri of about half length of palps, with long filiform papillae on surface. Segment two with a short, triangular nuchal lobe, first pair of elytraphores prominent and lateral to the prostomium; parapodia of this segment slightly projecting anteriorly.

Fifteen pairs of elytra completely covering the dorsum; elytra with digitiform papillae; surface of the elytra granular, with hard microtubercles on the anterior part; macrotubercles on the posterior part uncovered; both with approximately pentagonal basal areoles, each with numerous short and erect filiform papillae (Fig. 3b, c). First pair of elytra circular, others reniform and larger, the posterior pair enlarged; posteriorly elytra more or less oval (Fig. 3d).

Parapodia biramous; neuropodia longer than notopodia, obliquely truncate on tip; elytraphores and dorsal tubercles elevated; elytraphores circular and larger than the dorsal tubercle. Notopodia shorter than neuropodia, projected postchaetal lobe in a short ventrolateral acicular lobe; neuropodia cleft dorsally, prechaetal lobe tapering in a short projected acicular lobe with a digitiform supra-

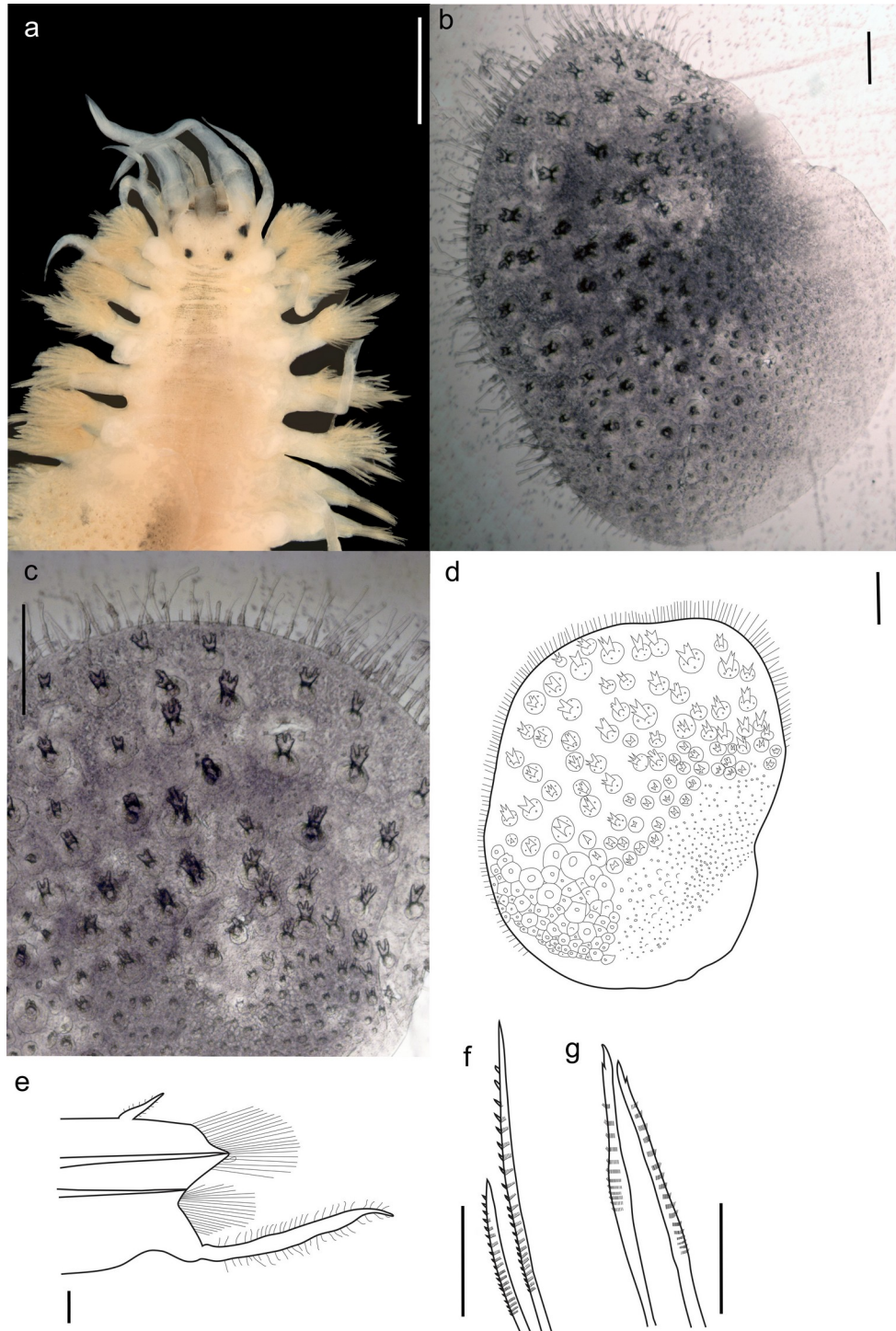


Figure 3. *Harmothoe lanceocirrata*: a) dorsal view of anterior end; b) general view of middle right elytron; c) bifid and trifid macrotubercles with different lengths; d) bifid and trifid macrotubercles, and posterior papillated surface; e) left cirriferous parapodium from chaetigers 22; f) long notochoetae from chaetiger 18; g) low and middle neurochaetae from chaetiger 14. Scale bars: a, b, c, d, 1.0 mm; e, 0.1 mm; f, g: 0.05 mm.

acicular process, postchaetal lobe shorter and rounded. With tapering dorsal cirri, long and filiform

papillae; cylindrical and long cirrophore. Ventral cirri short and papillate (Fig. 3e). Nephridial papillae small, located between the parapodia. Notochaetae stouter, much thicker than the neurochaetae, with

transverse rows of spines distally, slender and short tips. Dorsal notochaetae more strongly curved and thicker than the ventral ones (Figure 3f). Neurochaetae abundant, bidentate; main teeth medially thick, distally curved, sharply pointed, three times longer than the secondary teeth, with transverse rows of long spines beyond the length (Fig. 3g).

New record: This species is here report for northeastern littoral from Brazil, Suape beach, Pernambuco State.

Distribution: Mexican and Colombian Caribbean, shore (Salazar-Silva 2003, 2010).

Remarks: *Harmothoe lanceocirrata* Treadwell, 1928 was originally described from the Caribbean Sea, SW of Sabo Island. After taxonomic revision of *Harmothoe aculeata* deposited in National Museum of Natural History (USNM), Washington, and non-type material from this museum and other material in the collections of the Natural History Museum of Los Angeles County, Salazar-Silva (2006) included the species *Harmothoe aculeata* reported by Ebbs (1966: 496–500), not Andrews (1891), and the species *Harmothoe crucis* reported by Hartman (1956: 272–273), not Grube (1856), as synonyms of *H. lanceocirrata*. This is the first time that this species is reported outside of its original collection site.

15. *Harmothoe longidentis* Salazar-Silva, 2003

Harmothoe aculeata.—Nonato & Luna 1970: 67, pl. 3: fig. 26.

Harmothoe sp.—Nonato & Amaral 1979: 19, fig. 12.

Harmothoe longidentis Salazar-Silva, 2003: 60–61, fig. 3a–j.

Source of synonymy: Salazar-Silva (2003: p. 60–61).

Type material: Holotype–ECOSUR 0041; Paratype: LACM AHF POLY 2109.

Type locality: Contoy Island, Quintana Roo, Mexico.

Distribution: Caribbean Mexico, and Brazil (Rio de Janeiro). 54–69 m (Salazar-Silva 2003).

16. *Harmothoe macginitiei* Pettibone, 1955

Harmothoe macginitiei Pettibone, 1955: 122–124, fig. 4a–h.

Harmothoe macginitiae Morgado and Amaral 1981: 92–93.

Type material: Holotype–USNM 26458.

Type locality: Hadley Harbor, Naushon Island, Massachusetts, USA.

Distribution: From Massachusetts to São Paulo (Amaral *et al.* 2013).

Biology: Associated with the bryozoan *Schizoporella errata* (Waters, 1878) and the sponge *Mycale* (*Zygomycala*) *parishii* (Bowerbank 1875).

17. *Harmothoe macnabi* Pettibone, 1985

Harmothoe macnabi Pettibone, 1985: 749–753, figs 6–7; 1994: 613, fig. 2.

Type material: Holotype–USNM 97451.

Type locality: Galapagos Rift, 2482 m.

Distribution: East Central Pacific, from Galapagos Rift (0°), in 2482 m, and North Pacific (41°N), in 2059 m (Pettibone 1985, Salazar-Silva 2010).

18. *Harmothoe madrynensis* Barnich, Orensanz & Fiege, 2012

Harmothoe madrynensis Barnich *et al.* 2012: 400, fig. 4a–i.

Type material: Syntypes–2 specimens, SMF 19913.

Type locality: Playa Mimosa, Puerto Madryn, Nuevo Gulf, Argentina, intertidal.

Distribution: Known only from the type locality in Argentina (Barnich *et al.* 2012).

19. *Harmothoe magellanica* (McIntosh, 1885)

Lagisca magellanica McIntosh, 1885: 82–83, pl. 13: fig. 5, plate 18: figs 3–4, pl. 7a: figs. 1–2.

Harmothoe (*Harmothoe*) *magellanica* McIntosh, 1885: 82–83, pl. 13: fig. 5, plate 18: figs 3–4, pl. 7a: figs. 1–2.

Hermadion molluscum Ehlers, 1897: 16, pl. 1: figs. 1–8.

Hermadium ambiguum Ehlers, 1900a: 209.

Harmothoe brevialpa Bergström, 1916: 277–279, pl. 2: fig. 1; pl. 4: figs 4–7.

Harmothoe (*Evarnella*) *impar* var. *notialis* Monro, 1930: 58–59, figs.13 a–d.

Harmothoe impar notialis Monro, 1930: 58–59, figs.13 a–d.

Source of synonymy: Bergström (1916: p. 280–282); Barnich *et al.* (2006: p. 52).

Type material: Lectotype of *Lagisca magellanica*, BMNH 1885.12.1.69.

Type locality: Strait of Magellan, Chile,

Distribution: Antarctic and Subantarctic regions. Eastern Pacific from southern Chile. Southwestern Atlantic from Argentina and Uruguay. Southwestern Pacific from Australia, from 0 to 900 m. There is a specimen from Macquire Ridge, off New Zealand, collected in 333–371 m (USNM 65949) (Barnich *et al.* 2012).

Biology: Associated with polychaetes *Phyllochaetopterus* sp. and *Pectinaria chilensis* Nilsson, 1928. Also commensal with unidentified gorgonians and a sponge (Cañete *et al.* 1993).

20. ***Harmothoe pulchella*** (Kinberg, 1856)

Antinoe pulchellus Kinberg, 1856: 385.

Antinoe pulchella Kinberg, 1858: 20, pl. 6, fig. 29, pl. 10, fig. 56.

Harmothoe pulchella.—Pettibone, 1993b: 29–30, fig. 17a–e.

Type material: Holotype–SSM; Syntype: NRS 399.

Source of synonymy: Pettibone (1993: p. 29).

Type locality: Rio de la Plata, Northern Argentina, 90 m.

Distribution: Known only from type locality (Pettibone 1993b).

21. ***Harmothoe reticulata*** Claparède, 1870

Polynoe granulosa Rathke, 1837: 408–409.

Antinoe granulosa (Rathke, 1837): 408–409.

Polynoe reticulata Claparède, 1870: 374–376, pl. I, fig. 1.

Tricosmochaeta trilobocephala Morgera, 1918: 1–14, pl. I, fig. 1–9.

Source of synonymy: Baird (1865: p. 194); Fauvel (1927: p. 406).

Type material: Holotype–AMNH 3527.

Type locality: Gulf of Naples, Italy.

Distribution: Spain, North Atlantica and Mediterranean; Ubatuba, São Paulo, Brazil (Dauvin *et al.* 2003, Amaral *et al.* 2013).

Biology: Accompanied by a calanoid copepod and may thus be pelagic.

22. ***Harmothoe sylliformia*** Treadwell, 1928

Harmothoe sylliformia Treadwell, 1928: 452–454, figs 1–4.

Type material: Holotype–AMNH 3527.

Type locality: Tagus Cove, Albemarle, Galapagos Island; 548–1280 m.

Distribution: Known only from the type locality (Treadwell 1928).

Biology: Accompanied by a calanoid copepod and may thus be pelagic.

23. ***Harmothoe spinosa*** Kinberg, 1856

Harmothoe spinosa Kinberg, 1856: 386; 1858: 21–22, pl. 6, fig. 31.

Harmothoe (*Harmothoe*) *spinosa* Kinberg, 1856: 386; 1858: 21–22, pl. 6, fig. 31.

Hermadion fulgineum Baird, 1865: 198.

Polynoe fullo Grube, 1877: 515–516.

Lagisca antarctica McIntosh 1885: 80–82, pl. 13: fig.1; pl. 16: fig. 3; pl. 18 fig.1; pl. 6a: figs. 10–11.

Lagisca magellanica grubei McIntosh 1885: 84–85, pl. 3: fig. 5, pl. 18, fig. 2; pl. 7a: figs 14–16.

Lagisca magellanica murrayi McIntosh, 1885: 83–84, pl. 19: fig. 1, pl. 19a, figs 13, 14.

Source of synonymy: Ehler (1897: p. 12–14), Bergström (1916: p. 284–286).

Type material: Lectotype–SMNH–type–409.

Type locality: Straits of Magellan, Chile.

Distribution: Antarctica and Subantarctic islands to Chile in the southeastern Pacific, Falkland Islands and Santa Catarina in the southwestern Atlantic, South Africa in the southeastern Atlantic, and Australia and New Zealand in the Southwestern Pacific. Low tide to 3397 m (Barnich *et al.* 2006).

Biology: Parasited by copepods *Herpyllobius arcticus* Steenstrup and Lütken, 1861, *H. australis* Lützen, 1964, *H. gravieri* Lützen, 1964 and *H. luetzeni* López-González and Bresciani, 2001. With entoproct *Loxosomella compressa antarctica* Franzén, 1973. Diet of sharp-spined notothenia, *Trematodus pennellii* Regan, 1914 and emerald notothenia, *T. bernacchii* Boulenger, 1902.

Remarks: Rozbaczylo *et al.* (2005) reports *H. spinosa* as a synonym of *Hermadion molluscum* (Ehlers, 1897) for specimens from Calbuco and Magellan Strait, Chile. In their revision for *H. spinosa*, Barnich *et al.* (2006) indicate differences between *Harmothoe spinosa* and other species previously considered synonyms (Barnich & Fiege 2009). Wilson (1920) reports an Arctic parasitic copepod, *Herpyllobius arcticus* Steenstrup and Lütken, 1861, for both the Arctic *H. imbricata* and the Antarctic *H. spinosa*.

Discussion

A major revision of the scale-worm *Harmothoe* is clearly needed (Fauchald & Rouse 1997), although some papers have been presented, including subfamily and genus revisions (Pettibone 1993a, b, Barnich & Fiege 2000, 2009).

Herein, information on members of the genus *Harmothoe* found around South American coasts in the literature has been gathered, and additional data on two species collected along the northeastern coast of Brazil is provided. Twenty three species are catalogued from South America,

and five of them represent endemic taxa: *H. campoglacialis*, *H. commensalis* and *H. juvenalis* from the coast of Chile and *H. madryensis* and *H. pulchella* from the coast of Argentina.

In the last decades it was verified that polychaetes with wide distributions are geographically restrict to specific regions, and may be considered cryptic species (Hutchings & Kurpiyanova 2018). Therefore, the two species of *Harmothoe* found in South America may be considered exotic: *H. imbricata*, with original description from Iceland, and worldwide distribution for Arctic and northern temperate coastlines (Murina 1997, Barnich & Fiege 2009, David & Krick 2019), and *H. impar*, with original description from the Gulf of Naples, Italy, and worldwide distribution for north Atlantic and southeastern Brazil (San Martin *et al.* 1981, Barnich & Fiege 2009). A study with a COI marker provided evidence that *H. imbricata* is a cryptic species with a complex pattern of dispersal that reflects past climatic events, leading to marked genetic structure of the species (David & Cahill 2020).

In relation to the association with other species of organisms, the species *Harmothoe commensalis* was found associated with the clam *Semele solida* (Gray 1828) (Rozbaczylo & Cañete 1993). *Harmothoe imbricata* was reported associated to the several marine organisms, such as trematodes, nemerteans, nematodes, echiurids, parasitic copepods, seagrass, sponges, and other polychaetes, bivalve mollusks, and echinoderms (Moore 1909, Pettibone 1948, Hartmann-Schröder 1971). Members of *Harmothoe macginitiei* were found in association with the bryozoan *Schizoporella errata* (Waters 1879) and the sponge *Mycale (Zygomycale) parishii* (Bowerbank 1875). The species *Harmothoe magellanica* was found in association with the polychaetes *Phyllochaetopterus* sp. and *Pectinaria chilensis* Nilsson, 1928, and also as a commensal of unidentified gorgonians and a sponge (Cañete *et al.* 1993). The species *H. sylliformia* was found accompanied by a calanoid copepod, indicating that it could be pelagic, while the species *H. spinosa* was found to be parasited by copepods, and with the entoproct *Loxosomella compressa antarctica* Franzén, 1973 (Salazar-Vallejo & Londoño-Mesa 2004, Salazar-Silva 2006). The two last species, *Harmothoe exanthema* and *H. impar*, were found on marine plants, the kelp *Macrocystis pyrifera* (Linnaeus) (Agardh 1820), and the seagrass *Posidonia oceanica* (Linnaeus) (Delile 1813), respectively.

Acknowledgments

To all members of the Laboratory of Invertebrates Paulo Young (LIPY), for their work in assembling the collection of marine invertebrates, and in particular to Carmen Alonso, for her dedication to the preservation of this collection. The authors thank the anonymous referees for valuable contributions to the manuscript. We thank CNPq for a productivity grant to M.L. Christoffersen, FACEPE (Fundação de Amparo a Ciência e Tecnologia de Pernambuco) for a post-doctoral scholarship to J.E. De Assis (DCR-0086–2.04/13), and CAPES (Conselho Nacional de Pesquisas) for a Master in Science scholarship to T. K. S. Souza

Authors' contributions: José Eriberto De Assis, Thais Kananda S. Souza and José Roberto B. de Souza collected the species de *Harmothoe* and wrote the manuscript. Martin Lindsey Christoffersen translated and edited the English grammar of the manuscript, and provided general corrections in taxonomic content along the manuscript. The author(s) read and approved the final manuscript.

Funding: CNPq FACEPE and CAPES provided funding in the form of a Productivity Grant to Dr Martin Lindsey Christoffersen a post-doctoral scholarship to Dr José Eriberto De Assis, and. A Master in Science scholarship to T.K.S. Souza, respectively.

Availability of data and materials: The collected specimens are deposited at the Collection of Invertebrates Paulo Young, at Universidade Federal da Paraíba.

Ethics approval: The worms were collected under a standing permit for collecting appended to research agency projects. The worms were frozen or preserved in 95% ethanol directly after collection.

Competing interests: Authors declare no competing interests.

Pictures were taken by Thais Kananda S. Souza in Universidade Federal da Paraíba, Brazil

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Received: September 2020

Accepted: December 2020

Published: December 2020