



## *Inermonephtys brasiliensis* sp. nov. (Polychaeta: Nephtyidae) from SE Brazil, with a redescription of *I. palpata* Paxton, 1974

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### Abstract

A new species of Nephtyidae, *Inermonephtys brasiliensis*, is described from material previously referred to *I. palpata* Paxton 1974 from off São Paulo and Paraná States, SE Brazilian coast. The new species is characterized by interramal branchiae starting from setiger 3, basal papillae starting on setiger 5, and two kinds of lyrate setae. Several lyrate setae occur as a postacicular spiral bundle in both noto- and neuropodia all along the body, showing two different morphologies (i.e., very short or very long tines). Lyrate setae with long tines are the most common, while those with short tines are more difficult to distinguish and may be absent in some parapodia. A redescription of *I. palpata* is also provided.

**Key words:** nephtyids, new species, São Paulo and Paraná States, SW Atlantic Ocean, redescription, Australia, Coral Sea

### Introduction

The uncommon features of *Nephtys* (*Aglaophamus*) *inermis* were already recognized in the original description, which suggested that the species could be the basis for erecting a new genus (Ehlers 1887). *Inermonephtys* was later proposed by Fauchald (1968) to include nephtyids lacking “the first pair of prostomial antennae” (op. cit., p. 14), and having involute interramal branchiae, lyrate setae and nuchal organs with long eversible digitiform processes. The new genus was based on *Inermonephtys inermis* (Ehlers, 1887), as the type species, and *I. gallardi* Fauchald, 1968. Based on innervation studies, however, several authors considered the second ventral pair of antennae to be homologous with the ventral palps of other polychaetes (Binard & Jeener 1929; Rouse & Fauchald 1997), a criterion we have followed herein.

Six species of *Inermonephtys* are currently considered valid: *I. inermis* (Ehlers, 1887) from the SE coast of USA, *I. gallardi* Fauchald, 1968 from Vietnam, *I. palpata* Paxton, 1974 from Australia, *I. japonica* Imajima & Takeda, 1985 from Japan, *I. patongi* Nateewathana & Hylleberg, 1986 from Thailand, and *I. tetrophthalmos* Rainer & Kaly, 1988 from Australia.

The genus was first reported from the SW Atlantic by Lana (1986), who referred a number of specimens collected in continental shelf bottoms off SE Brazil to *Inermonephtys palpata*, based on the presence of “bifid lateral antennae” (“antenas laterais bifidas”, p. 142) and barred preacicular

setae with rows of denticles. This identification proved erroneous when access to the type material of *I. palpata* enabled the reexamination of both taxa. As a consequence, the Brazilian material is described herein as a new species, *I. brasiliensis*, and the original description of *I. palpata* is emended on the basis of new observations.

## Materials and methods

The original samples were collected using a modified Van Veen grab and a box corer during the cruises “Sueste I” and “Sueste II” with the research vessel *Almirante Saldanha*, within the frame of a research project partly financed by the Comissão Interministerial para os Recursos do Mar and the Conselho Nacional de Desenvolvimento Científico e Tecnológico, Convênio DHN–CBM/UFPR (Lana 1986).

For SEM observations, one paratype of the new species and several parapodia of the holotypes of both the new species and *Inermonephtys palpata* were washed three times (30 min each) in distilled water, run through a series of increasing ethanol concentrations, and stored in 70% ethanol until observation. Immediately prior to viewing in a Hitachi S.570 scanning electron microscope (SEM) at the *Laboratori de Microscopia Electrònica (Institut de Ciències del Mar of Barcelona, CMIMA, CSIC)*, they were run through a series of increasing ethanol concentrations ending with 100% alcohol, critical point dried, attached to a stub, and coated with gold. All images were captured and stored in digital format using Printerface System hardware and software (GW Electronics, & K.E. Development Ltd.).

Light microscope observations and line drawings were made with a Leitz Diaplan stereomicroscope equipped with Nomarski interference contrast optics and linked to a *camera lucida*. Light microscope micrographs were made with a Zeiss Axioplan and a Zeiss Stemi 2000-c stereomicroscopes equipped with the SPOT hardware and software (SP100 KAF1400 digital camera and software version 2.1.) from Diagnostic Instruments Inc.

The examined specimens are deposited in the collections of the Museu do Centro de Biologia Marinha, Universidade Federal do Paraná (MCBM, *Inermonephtys brasiliensis* sp. nov) and the Australian Museum, Sydney (AMS, *Inermonephtys palpata*).

## Results

### Family Nephtyidae

#### Genus *Inermonephtys* Fauchald, 1968

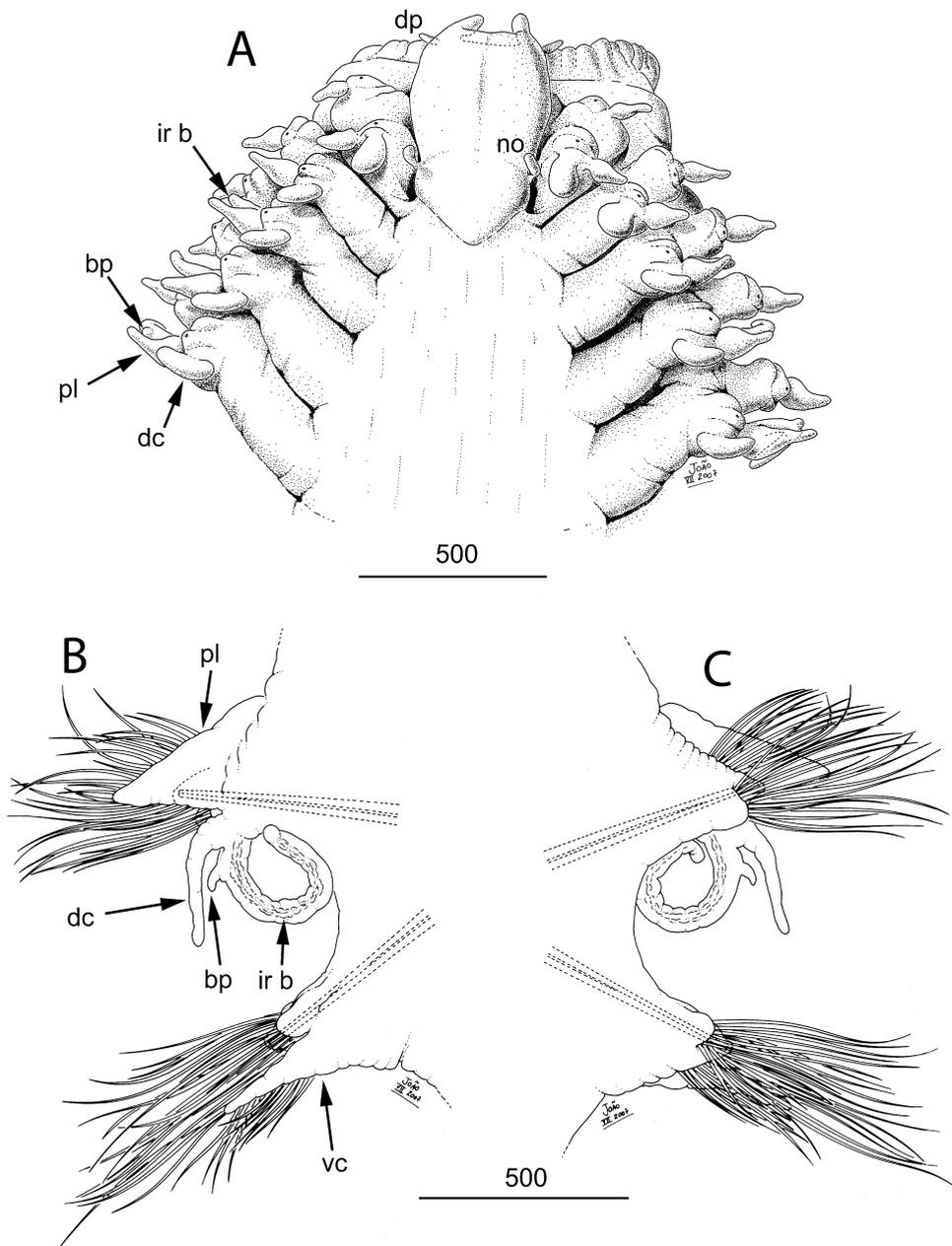
#### *Inermonephtys brasiliensis* sp. nov.

Figures 1–4

*Inermonephtys palpata*: Lana 1986: p. 141–143, Figs 11–15. Not Paxton 1974.

**Material examined.** Holotype: Continental shelf bottoms off São Paulo and Paraná States, SE Brazilian coast, Sta. 6256 (MCBM-BPO-23), 25°26'00"S, 47°55'00"W, 25 m, fine sand, P. C. Lana coll. 25May1983; Paratypes: two specimens (MCBM-BPO-24), Sta. 6138, 24°24'05"S, 43°34'00"W, 60 m, silty sand, P. C. Lana coll. 1Aug1982; one specimen used for SEM observations (MCBM-BPO-25), Sta. 6287, 24°36'04"S, 45°12'00"W, 88 m, silty sand, P. C. Lana coll. 01June1983.

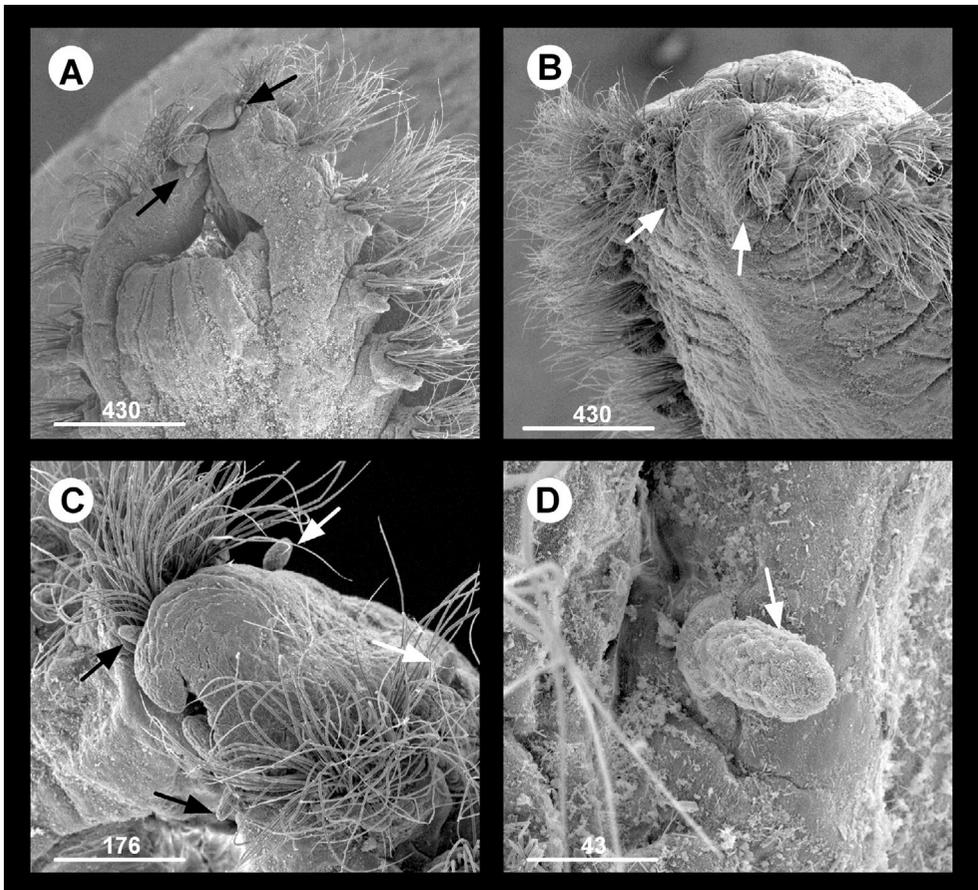
**Diagnosis.** *Inermonephtys* with branchiae starting from setiger 3, basal papillae starting on setiger 5, and two kinds of lyrate setae.



**FIGURE 1.** *Inermonephtys brasiliensis* sp. nov. Holotype MCBM-BPO-23. A, anterior end showing the first five parapodia (setae omitted); B, mid-body parapodium in posterior view; C, mid-body parapodium in anterior view; ir b: interramal branchia; bp: basal papilla; no: nuchal organ; dp: digitiform papilla; pl: postsetal lobe; dc: dorsal cirrus; vc: ventral cirrus. Scale bars are μm.

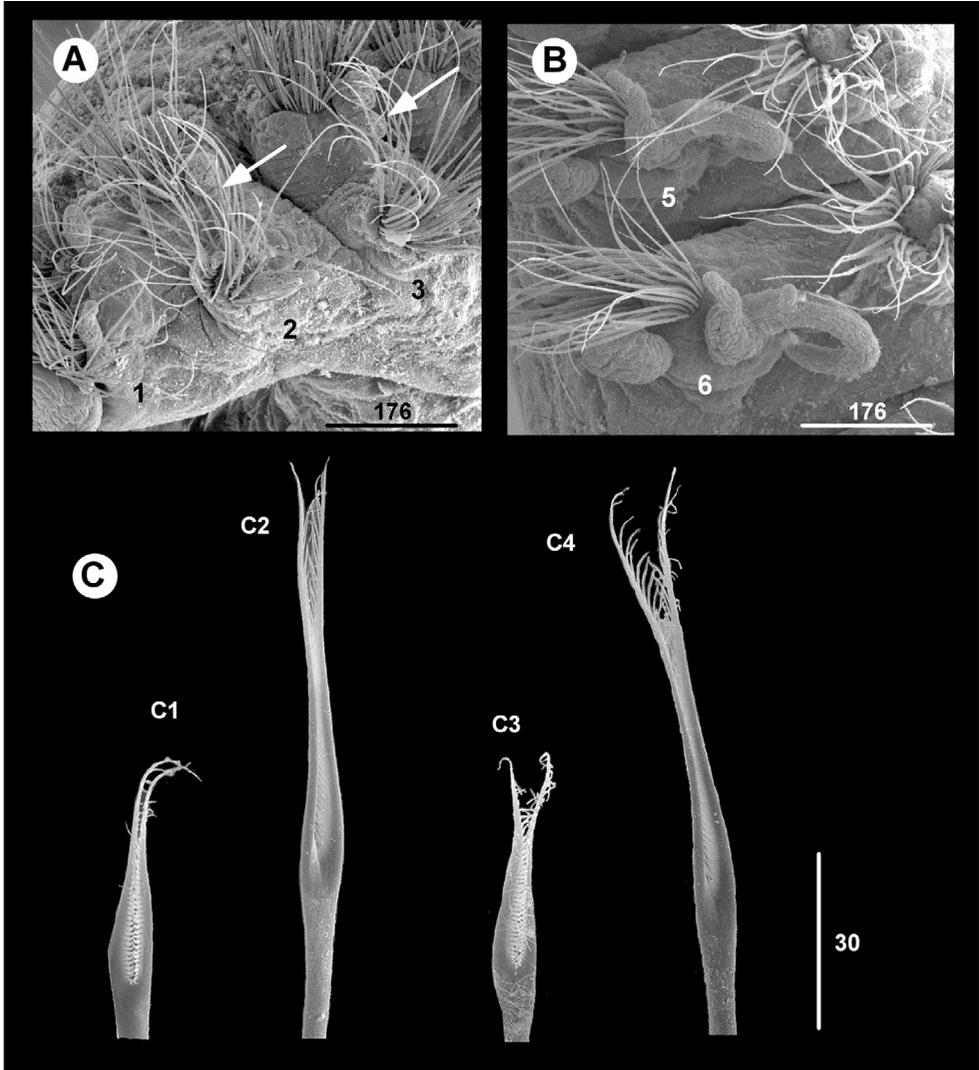
**Description.** Holotype an incomplete anterior fragment, 22 mm long for 53 setigers, 1.5 mm wide without parapodia, 2.5 mm wide with parapodia at level of setiger 20; color in alcohol amber–yellowish. All paratypes incomplete anterior fragments, 11–17 mm long for 0.44–1.1 mm wide without parapodia, 0.64–1.5 mm wide with parapodia at level of setiger 10.

Prostomium nearly pentagonal, long, narrow, about one-fifth of total body width (at setiger 15), with straight frontal margin and rounded corners; posterior margin rounded, extending posteriorly to middle of setiger 2 (Figs. 1A, 2B–C). Nuchal organs including pair of short eversible digitiform papillae on posterolateral margins of prostomium (Figs. 1A, 2D). Eyespots not seen. Prostomial palps diverted ventrally below frontal margin of prostomium, each palp with digitiform papilla (similar to nuchal organs) projecting distally (Figs. 1A, 2C). Proboscis completely smooth. Jaws translucent, amber colored, flattened, near pharyngeal base.

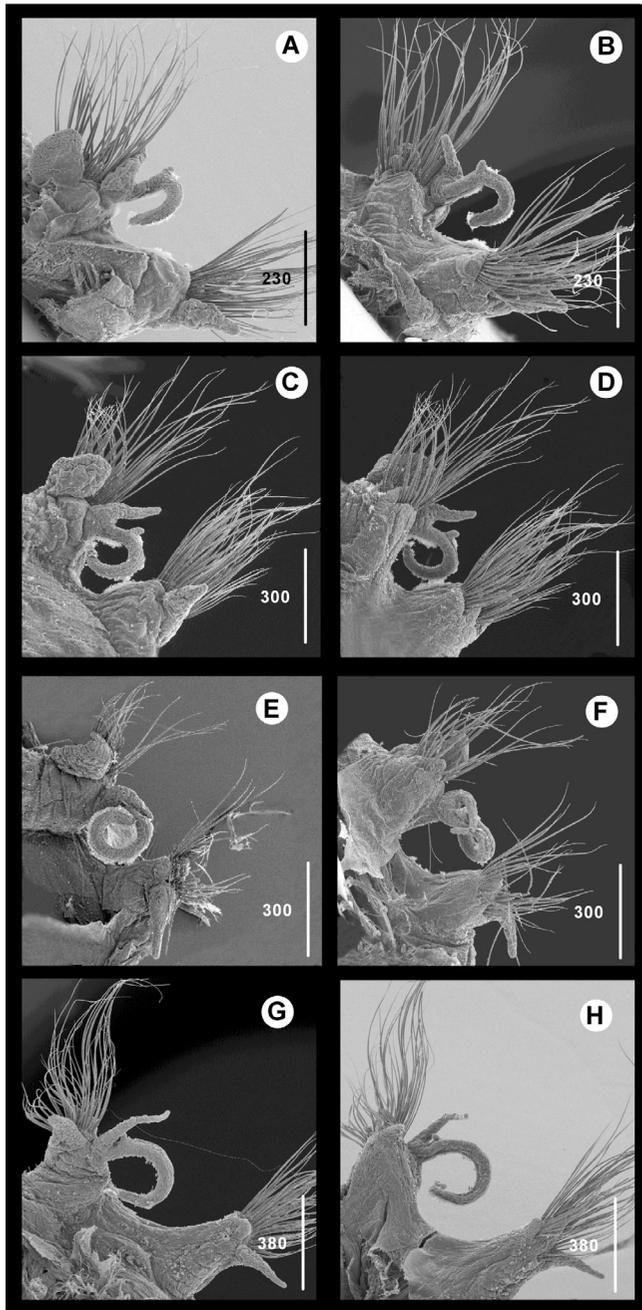


**FIGURE 2.** *Inermonephtys brasiliensis* sp. nov. Paratype MCBM-BPO-25. A–C, detail of the anterior region in ventral (A), dorsal (B) and frontal (C) views; D, detail of the nuchal organ. Scale bars are μm.

Parapodium 1 biramous, well developed (Figs. 1A, 3A); notopodium with conical acicular lobe and low preacicular lamella, postacicular lamella well developed, quadrangular, dorsal cirrus long and cirriform. Neuropodial acicular lobe and preacicular lamella similar to notopodia; postacicular lamella rounded, less prominent than notopodial lamella. Ventral cirrus digitiform, longer than dorsal one (Figs. 1B–C).



**FIGURE 3.** *Inermonephtys brasiliensis* sp. nov. Paratype MCBM-BPO-25. A, first three parapodia; B, parapodia 5 and 6 in posterolateral view; C, lyrate setae from a mid-body setiger: notopodial setae with short (C1) and long (C2) tines; neuropodial setae with short (C3) and long (C4) tines. Scale bars are µm.



**FIGURE 4.** *Inermoneptyx brasiliensis* sp. nov. Paratype MCBM-BPO-25. A–B, parapodium 6 in posterior (A) and anterior (B) views; C–D, parapodium 10 in posterior (C) and anterior (D) views; E–F, parapodium 20 in posterior (E) and anterior (F) views; G–H, parapodium 40 in posterior (G) and anterior (H) views. Scale bars are  $\mu\text{m}$ .

Fully developed parapodia (Figs. 1B–C, 4A–H) with conical dorsal cirri in anterior setigers (Fig. 4A–D), becoming long, cirriform from middle to posterior setigers (Figs. 1B–C, 4E–H). Noto- and neuroacicular lobes conical, with neuropodial lobes broader than notopodial lobes. Notopodial preacicular lamellae short, rounded, half shorter than acicular lobes. Notopodial postacicular lamellae three times longer than preacicular lamellae, broad, rounded in anterior setigers, becoming triangular to lanceolate in middle and posterior segments. Neuropodial lamellae very short, round in anterior setigers, with postacicular lamellae becoming longer, but always shorter than acicular lobe. Ventral cirri digitiform with broad bases, always longer than lamellae (four times) and acicular lobe (three times), slightly shorter in far posterior segments. Two aciculae in each ramus, tips ending at same point.

Interramal branchiae first present from setiger 3 as small digitiform process (Fig. 1A), but vestigial papilla sometimes present on setiger 2 at ventral base of dorsal cirrus, visible only under SEM (Fig. 3A); branchiae becoming progressively longer on parapodia 4–5, then well developed, involute, occupying up to two-thirds of interramal space (Figs. 1B–C). Basal papilla small, digitiform, present on upper part of each branchia, from setiger 5 (Figs. 1A, 3B); barely visible, slight swelling indicates position of branchial papillae on setiger 4.

Setae emerging in an open spiral around acicular lobe, opening at preacicular lobe. Noto- and neuropodial preacicular fascicles with 10–15 short, stout, barred setae (Figs. 3A–B, 4A–H, and Lana, 1986: fig. 15A) with faint annulations. Noto- and neuropodial postacicular fascicles with many long spinulose setae (Fig. 4A–H, and Lana 1986: fig. 15C). Lyrate setae (Fig. 3C) present along body except in 4–6 anteriormost setigers. Lyrate setae of two types: some with short tines (Fig. 3C1, 3C3), others with very long tines (Fig. 3C2, 3C4), but tines of each type always similar in length. Lyrate setae 2–3 per bundle, long-tined setae more common than short-tined setae, latter more difficult to distinguish, or even absent in some parapodia.

**Etymology.** The species name *brasiliensis* means “from Brazil.”

**Remarks.** The erection of the new species is justified by the presence of two types of lyrate setae, among a number of other features (Table 1). *I. brasiliensis* sp. nov. differs from *I. palpata* in size (*I. palpata* is larger), interramal branchiae starting from setiger 3 (setiger 2 in *I. palpata*), basal papillae starting from setiger 5 (setiger 10 in *I. palpata*), and postacicular noto- and neuropodial lyrate setae of two kinds (only one kind in *I. palpata*, absent from setigers 1–10), always in very low numbers and present all along the body. In addition, *I. palpata* has a distinctive development of lamellae along the body, in the bifid dorsal cirri up to setiger 10 and bifid ventral cirri up to setiger 11, and in having single dark red protuberances near the tips of the aciculae. These protuberances are perfectly visible under SEM as round smooth structures (often split in a similar way as if they were filled with lipids).

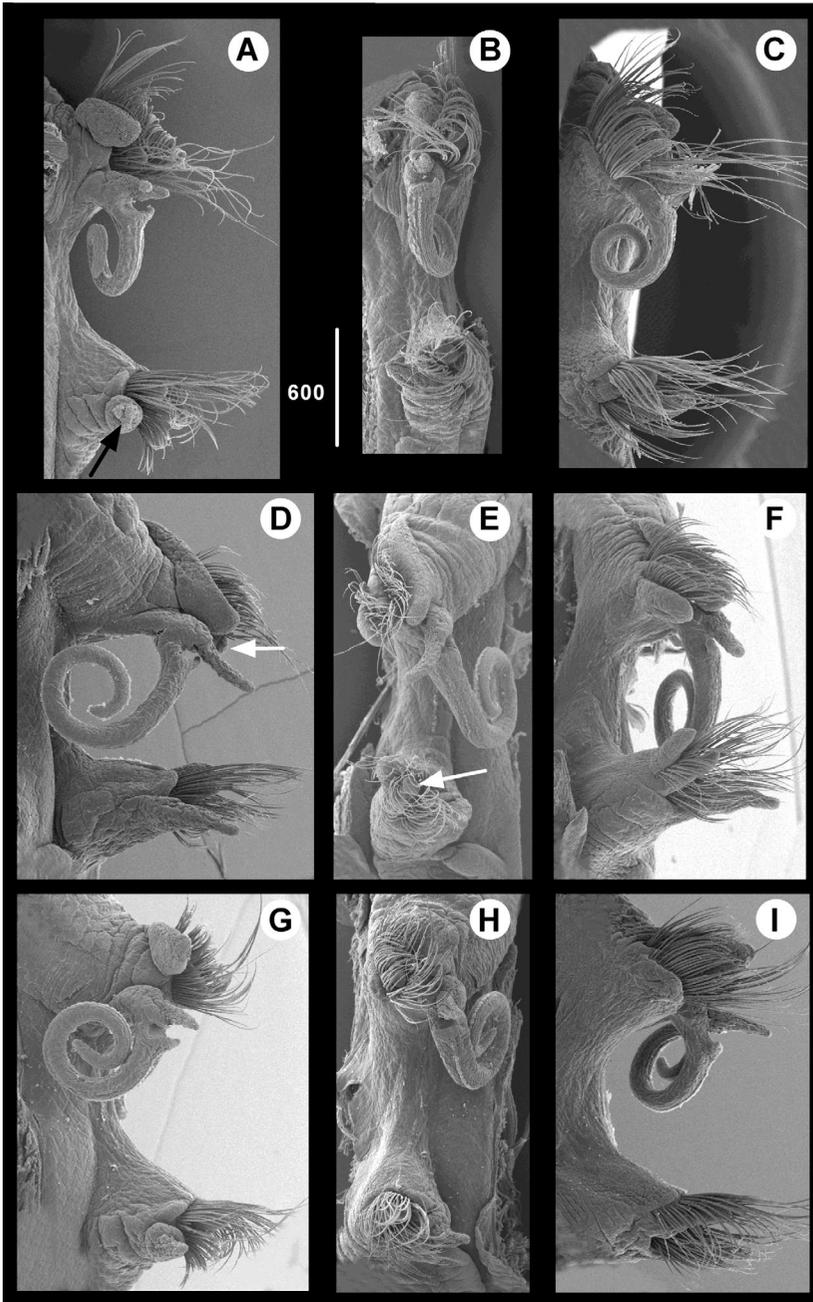
The presence of interramal branchiae starting from parapodium 3 also distinguishes *I. brasiliensis* sp. nov. from the remaining known species of the genus, except *I. inermis* (Table 1). These two species, however, differ in the first parapodium to bear branchiae with basal papillae (third in *I. inermis*) and in the types of lyrate setae (only one in *I. inermis*).

**Distribution.** Known only from the type locality, off São Paulo and Paraná States, southeastern Brazilian coasts of the Atlantic Ocean, in fine and silty sands from 25–88 m deep.

### ***Inermonephtys palpata* Paxton, 1974**

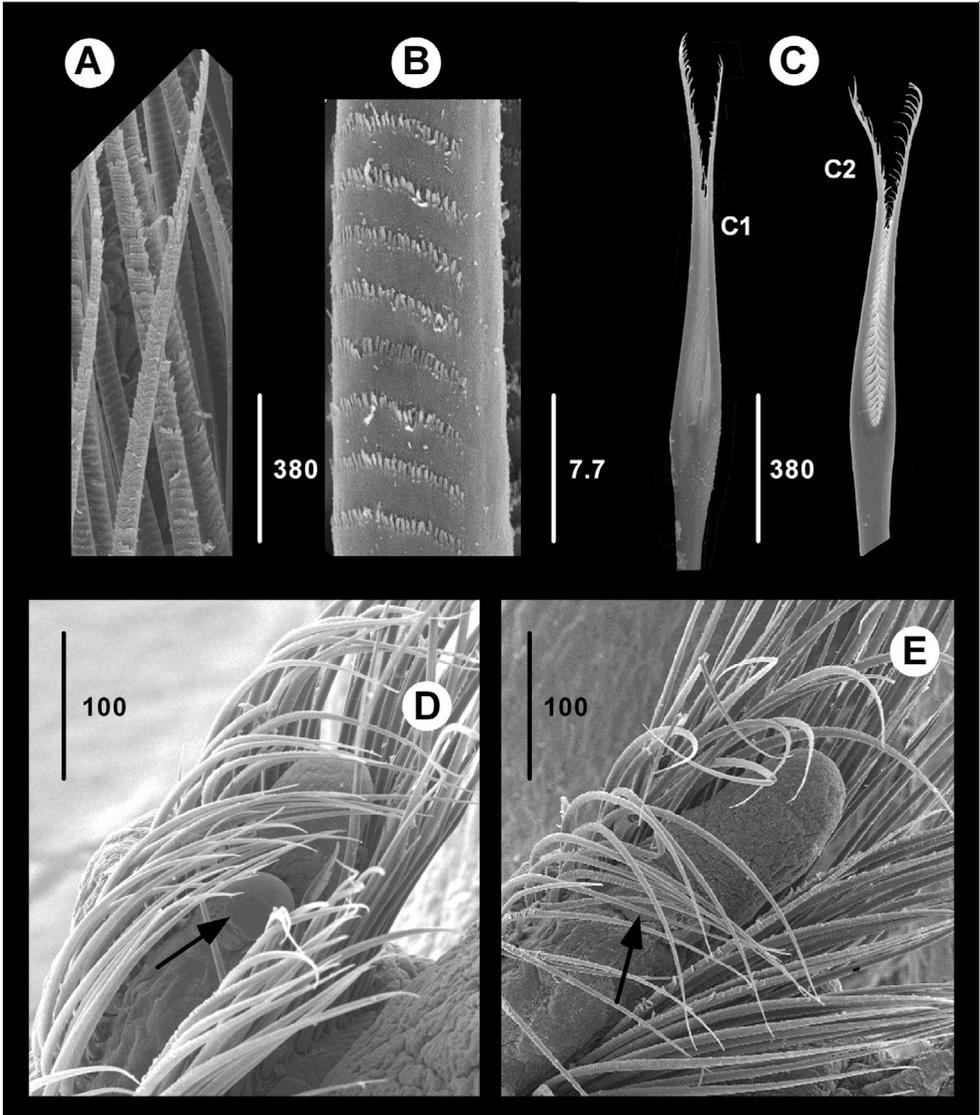
Figures 5–6

*Inermonephtys palpata* Paxton 1974: 200–202, figs. 2–6; Rainer & Hutchings 1977: 320; Rainer & Kaly 1988: 696.



**FIGURE 5.** *Inermonephtys palpata*. Holotype AMS W1710. A–C, parapodium 10 in posterior (A), lateral (B) and anterior (C) views; D–F, parapodium 20 in posterior (D), lateral (E), and anterior (F) views. G–I, parapodium 40 in posterior (G), lateral (H), and anterior (I) views. Dark red protuberances indicated by white arrows when visible. Black arrow in A: bifid ventral cirri. Scale bar is  $\mu\text{m}$ .

**Material examined.** Holotype (AMS W1710). Queens Beach, Port Denison, Bowen, Queensland, Australia, Coral Sea, approx. 20°03'S, 148°15'E, sandflat, E. H. Rainford, coll. 27July1925.



**FIGURE 6.** *Inermonephtys palpata*. Holotype AMS W1710. A, mid-body capillary setae; B, detail of serration on the capillary setae; C, lyrate setae from notopodia (C1) and neuropodia (C2). Dark red protuberances (indicated by black arrows) at the base of the notopodial (D) and neuropodial (E) acicular lobes. Scale bars are  $\mu\text{m}$ .

**Description.** Holotype large, complete specimen, 150 mm long with 215 setigers, 4.5 mm wide without parapodia, 6 mm wide with parapodia at level of setiger 20, with downward-bent palps with small projecting digitiform process located distally on external side of each palp; nuchal organs with 2–3 everted digitiform processes. Notopodial and neuropodial acicular lobes with bulbous bases ending in digitiform lobes along body (Fig. 5A–I). Two aciculae in each ramus, converging at subdistal zone of each acicular lobe, before tips of noto- and neuropodia, respectively; with one noto- and one neuropodial dark red bulbs with very smooth surfaces (Figs. 5A, 6D–E), bulbs present in first 50 setigers, then disappearing, with aciculae protruding from acicular lobe. Notopodial preacicular lobes rudimentary in anterior setigers, slender, conical, with rounded tips in mid-body setigers (Fig. 5C, F, I). Notopodial postacicular lobes cordiform (Fig. 5A, D, G). Dorsal cirri bifid on setigers 1–10, digitiform, slender, longer than notopodial lobes in median setigers (Fig. 5A–I). Neuropodial preacicular lobes rudimentary in first setigers, conical, shorter than acicular lobe in anterior setigers, longer, slightly surpassing acicular lobe towards median setigers (Fig. 5C, F, I). Neuropodial postacicular lobes rudimentary in anterior setigers, then becoming short, rounded (Fig. 5A, D, G). Neuropodial cirri with irregularly formed conical bases and slender tips, bifid on setigers 1–11 (Fig. 5A–I). Interramal branchiae from setiger 2, involuted by setiger 5, then becoming slender, long, filling interrampal space; branchiae absent from last six setigers (Fig. 5A–I). One conical basal papilla present from segment 11 (Fig. 5A–I).

Setae of anteriormost setigers strongly geniculate, long, then decreasing in length. Preacicular fascicles arranged in spiral (Fig. 5A–I); short, stout, slightly geniculate setae present, each with rows of small denticles towards distal half (Fig. 6A–B). Geniculate setae grading from smooth to barred. Postacicular fascicles with longer, straighter setae, with closely set denticles as in preacicular fascicles. A few long-tined lyrate setae present in noto and neuropodial postacicular fascicles (Fig. 6C).

**Remarks.** As a result of the present observations, several new morphological features are reported for *Inermonephtys palpata*. (1) Dark red bulbs are present at the bases of both noto- and neuropodia. (2) The shape of the pre- and postacicular notopodial lobes changes along the body. The preacicular lobes are rudimentary in the first setigers, slender, conical, with rounded tips in mid-body segments and similar but with a more rounded tip on the posteriormost segments. The cordiform postacicular lobes are shorter than the acicular lobes in the first setigers and longer than the acicular lobes in mid-body setigers, where they become triangular with their basal regions extending dorsally towards the bases of the parapodia; in posteriormost setigers, they are conical with rounded tips. (3) Dorsal and ventral cirri with slender bifid tips are present on setigers 2–10 and on setigers 2–11, respectively. (4) Finally, *I. palpata* has a single type of lyrate seta with long tines of similar length, present from setiger 10.

**Distribution.** Known only from the type locality, Queensland, Queens Beach, Port Denison, Bowen, Australia.

## Discussion

Although we have not examined type material other than *I. brasiliensis* sp. nov. and *I. palpata*, the analysis of the existing literature reveals some degree of misunderstanding in the taxonomy of the genus. A number of characters have been apparently confused or misreported in the literature (as revealed by the number of question marks in Table 1), due to the fact that many of the podial and setal structures were inadequately described.

TABLE 1. Key morphological items for the known species of *Inermonephtys* based on the original descriptions.

<i>Inermonephtys</i> Authority	<i>inermis</i> (Ehlers, 1887)*	<i>patongi</i> (Naeewathana & Hylleberg, 1968)	<i>gallardi</i> (Fauchald, 1968)	<i>japonica</i> (Imajima & Takeda, 1985)	<i>terrophilatus</i> (Räner & Käly, 1988)	<i>palpata</i> (Paxton, 1974)**	<i>brasiliensis</i> sp. nov. Present paper
<b>Location</b>	USA, Florida	Thailand	Vietnam	Japan	Australia	Australia	Brazil
<b>Prostomium</b>	Pentagonal, with quadrangular frontal margin and pointed posterior end	Straight margin with rounded frontal corners and rounded posterior end	Small, nearly quadrangular with rounded frontal corners and rounded posterior end	Subrectangular with rounded frontal corners and rounded posterior end	Subrectangular with rounded frontal corners and conical posterior end	Subrectangular with rounded frontal corners and rounded posterior end	Nearly pentagonal with rounded posterior end
<b>Palps</b>	1 lateral pair, ventrally bent, with a cushion-like base and a digitiform process	1 pair, long	1 pair of ventral minute digitiform process	1 pair, ventrally bent, with a small distal digitiform papilla	1 pair, small, digitiform, ventrally attached	1 pair, ventrally bent, with a small distal digitiform process	1 pair, ventrally diverged, with distal digitiform papilla
<b>Nuchal organs</b>	1 pair, long digitiform	1 pair, digitiform	1 pair, long eversible process	1 pair, digitiform	1 pair, digitiform	2-3 pairs, digitiform	1 pair, short digitiform papilla
<b>Eyespots</b>	two pairs	Absent	Absent	Absent	Two pairs	Absent	Absent
<b>Jaws shape</b>	?	?	?	Spindle-shaped	Spindle-shaped	Spindle-shaped	Yellow, flattened
<b>Interramal branchiae from setiger</b>	3	6-7	15	2	2	2	3
<b>Notopodial acicular lobe</b>	Rounded or conical	Digitiform	Pointed, conical, with a ventral digitiform lobe	Digitiform lobe with thick base	Conical	Bulbous with digitiform lobe	Short rounded to lanceolated
<b>Neuropodial acicular lobe</b>	Obliquely truncated	Two digitiform, superior longer than inferior	Conical, with a central, erect digitiform lobe	Digitiform lobe with thick base	Conical	Bulbous with digitiform lobe	Short rounded to acuminate
<b>Notopodial preacicular lamellae</b>	Short rounded	Rounded, somewhat longer than acicular lobe	Divided in two, superior small fold and inferior foliate, as long as the acicular lobe	Long, stout, digitiform	Low, rounded	Slender with rounded tip	Short rounded
<b>Neuropodial preacicular lamellae</b>	Small, rounded	Longer than acicular lobe	Divided in two, superior a reduced faint line and inferior forming a low fold	Conical, short	Conical	Short conical	Short round to acuminate
<b>Notopodial postacicular lamellae</b>	Large, foliaceous	Swollen, triangular, much longer than acicular lobe	Rounded, somewhat longer than acicular lobe	Ellipsoid with rounded tip	Greatly expanded, petal-like	Swollen with rounded tips to flatter and more slender	Long, swollen, round
<b>Neuropodial postacicular lamellae</b>	Rudimentary	Rudimentary	Short and thick	Short, rounded	Low fold	Swollen with rounded tips to flatter and more slender	Short, rounded to acuminate
<b>Neuropodial postsetal cirri</b>	Elongate, conical	—	—	—	Digitiform, stouter than dorsal cirrus	—	—
<b>Basal papillae from setiger</b>	3?	6-7?	15	1	?	10	5
<b>Preacicular barred setae</b>	Present	13-25	?	Present	Absent	Present	Present
<b>Lyrate setae from setiger</b>	?	6	?	?	Posterior setigers (>40)	10	5-7
<b>Types of lyrate setae</b>	1	1	1	1	1	1	2
<b>Length of lyrate lines</b>	Similar	Similar	1 line longer	Similar	?	Similar	Similar

\*Description complemented with data from Gardiner (1976) and Taylor *et al.* (1984). \*\*Description complemented with our own observations.

In particular, *I. inermis* has been reported from many locations worldwide, but differences in the published descriptions or drawings strongly suggest that more than one species is involved, and likely explains its “cosmopolitan” distribution. For the comparison with *I. brasiliensis* sp. nov., we have used only the original description of *I. inermis* by Ehlers (1887), complemented with some modern descriptions of the species from nearby biogeographical regions (Gardiner 1976; Taylor et al. 1984).

The analysis of the existing literature (summarized in Table 1) clearly supports the description of *I. brasiliensis* sp. nov. as a new species, diagnosed by the presence of two types of lyrate chaetae and interramal branchiae starting from setiger 3, besides a number of additional characters (Table 1).

One of the most distinctive traits of *I. brasiliensis* sp. nov. is the resemblance between the lateral digitiform expansion on the palps and those of the nuchal organs. The latter are clearly digitiform, looking more like a second posterior pair of digitiform papillae than a nuchal organ. We are not sure of the implications of this fact, but it may be relevant in future discussions of the nature and development of nuchal organs in nephtyids, as well as to assess the possible homologies between the anterior appendages (i.e., palps vs. antennae). The only way to solve this question, as well as that of the resemblance between the two types of digitiform expansions, seems to be a detailed analysis of their innervation (e.g., histologically or by confocal microscopy).

Nevertheless, the presence of these ventral digitiform processes seemed to be the reason leading to initially describe the genus *Inermonephtys* as having one pair of ventral antennae (Fauchald 1968, p. 14). In some later descriptions of new species within the genus, the reported ventral appendages refer to the digitiform papillae only (e.g., *I. patongi*, *I. gallardi*, *I. tetrophthalmos*), while the remaining descriptions also reported the presence of ventrally bent palps (Table 1). We assumed that all descriptions are in fact describing the same structures, but omitting in some cases the presence of the palps due to the most distinguishable presence of the digitiform processes or papillae.

Therefore, the most relevant topics for future research among Nephtyidae will be the assessment of the systematic importance of nuchal organs, setal arrangement, and development of lamellae. However, this will not be fully understood until a review of the remaining type material is carried out.

## Acknowledgements

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