

A new deep-sea species of *Chloeia* (Polychaeta: Amphinomidae) from southern Brazil

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A new species of Chloeia (Annelida: Amphinomidae) is described from deep water (750–1045 m) off southern Brazil. Chloeia kudenovi sp. nov. differ from previously described species by the extremely elongated neuropodial cirri of the second chaetiger, number and position of noto- and neuroaciculae and lack of body pigmentation. This study provides additional data on the morphological diversity of the genus.

Keywords: Polychaeta, Amphinomidae, *Chloeia*, deep sea, Brazil, Rio de Janeiro

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INTRODUCTION

Chloeia was established by Lamarck (1818) to accommodate *Chloeia flava* described from the Indian Ocean by Pallas in 1766. The genus was morphologically characterized by having an elliptical body with bipinnate branchiae. This kind of branchiae is shared with the monotypic genera *Bathychloeia* Horst, 1912 and *Chloenopsis* Fauchald, 1977. Adults of *Chloeia* are colourful and have shades of violet, green and yellow pigment impregnated mainly on the dorsum, notopodial cirri, cirrophores and caruncle. Dorsal pigmentation patterns appear to be important species-specific characters, although the maintenance of these patterns in preserved specimens has been questioned (Monro, 1933). Other important characters are chaetae, development of parapodial cirri, eyes, caruncle, shape of chaetiger 1, parapodia of mid-body chaetigers, types of noto- and neurochaetae, number and position of noto- and neuroaciculae, distribution and placement of branchiae and degree of development, and type of anal cirri (Kudenov, 1995).

Members of the genus *Chloeia* have a circumtropical distribution, with many more species in Indian and Pacific than Atlantic waters. Of the 20 valid species of *Chloeia* recognized by Hartman (1959), only *Chloeia viridis* Schmarda, 1961 from Jamaica was originally described from the Atlantic Ocean. Hartman (1959) recognized four junior synonyms of *C. viridis* including *C. pallida* Kinberg 1867 described from Brazil, *C. modesta* Ehlers, 1887 and *C. euglochis* Ehlers, 1887 from Florida, and *C. candida* Kinberg, 1910 from the West Indies. These synonymies should be reevaluated carefully, if possible with a molecular approach.

Moreover, besides *C. viridis* (Nonato & Luna, 1970; Gathof, 1984; Amaral & Nonato, 1994), *C. venusta* Quatrefages, 1866

(originally described from the Mediterranean Sea) is the only other species of the genus recorded to date in Atlantic waters (Fauvel, 1923; Kirkegaard, 2001). Despite the fact that most *Chloeia* species were described from shallow waters, few of those species have been referred to moderate deep-waters (e.g. *C. pinnata* Moore, 1911, California, 567 m (Kudenov, 1995); *C. venusta* Quatrefages, 1866, north-west Africa, 210 m (Kirkegaard, 2001) and *C. inermis* Quatrefages, 1866, New Zealand, 200 m (Probert & Grove, 1998)).

To date, the only phylogenetic hypothesis regarding relationships within Amphinomida was proposed by Wiklund *et al.* (2008), establishing *Chloeia* as a sister taxa of *Archinome* and suggesting the abandonment of the family Archinomidae. The morphology of the caruncle, body shape and the characteristic pigmentation patterns on the dorsum give some support to the hypothesis that *Chloeia* is closely related to *Notopygos*, the '*Chloeia-Notopygos*' complex (Kudenov, 1991), that could include *Bathychloeia* and *Archinome*.

In this paper we describe a new deep-water species (750–1045 m) of *Chloeia* from southern Brazil. The new taxon differs from other described congeners mainly by having extremely long neuropodial cirri on chaetiger 2 and lack of body pigmentation patterns.

MATERIALS AND METHODS

The specimens of *Chloeia* were collected in 3 stations (Figure 1) in the Campos Basin (southern Brazil—off Rio de Janeiro State, between 21°18'S and 23°00'S), during a deep-sea survey conducted by PETROBRAS (Brazilian Petroleum Company) under the scope of the project 'Campos Basin Deep-Sea Environmental Project' coordinated by CENPES/PETROBRAS. The sediment sampled with a box-corer was separated into three vertical strata (0–2 cm, 2–5 cm and 5–10 cm), sieved in a 0.5 mm mesh and fixed in 10%

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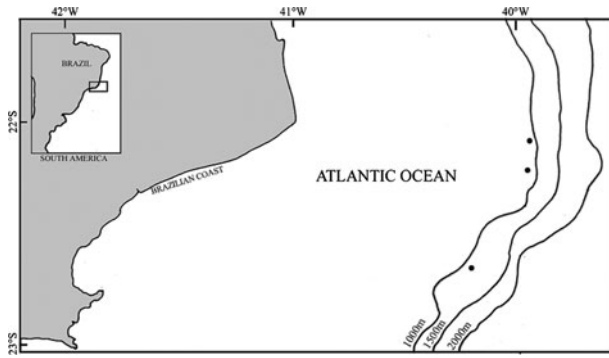


Fig. 1. Stations where specimens of *Chloeia kudenovi* sp. nov. were collected.

formalin. Type materials were deposited in the polychaete collection of the Zoology Department at the Universidade Federal do Rio de Janeiro, Brazil (IBUFRJ), and in the Museu de História Natural of the Universidade Estadual de Campinas (ZUEC: POL).

RESULTS AND DISCUSSION

SYSTEMATICS

Family AMPHINOMIDAE Lamarck, 1818

Genus *Chloeia* Lamarck, 1818

Chloeia kudenovi sp. nov.

(Figures 1 & 2)

MATERIAL EXAMINED

Holotype: (IBUFRJ: 634) ovigerous female, 20 mm long, 6 mm wide (without chaetae), 24 chaetigers; 20 November 2002; 22°19'50"S 40°00'35"W, 775 m; paratypes: (IBUFRJ: 636, 8 specimens) 14 mm long, 5 mm wide, 22 chaetigers; 8 mm long, 2.5 mm wide, 22 chaetigers; 7 mm long, 2.7 mm wide, 20 chaetigers; 6.7 mm long, 2.2 mm wide, 19 chaetigers; 11 mm long, 3 mm wide, 24 chaetigers; 10 mm long, 3 mm wide, 22 chaetigers; 7.5 mm long, 3.1 mm wide, 21 chaetigers; 6 mm long, 2.3 mm wide, 17 chaetigers; 20 November 2002, 22°40'57"S 40°16'30"W, 1045 m. (ZUEC: POL21, 1

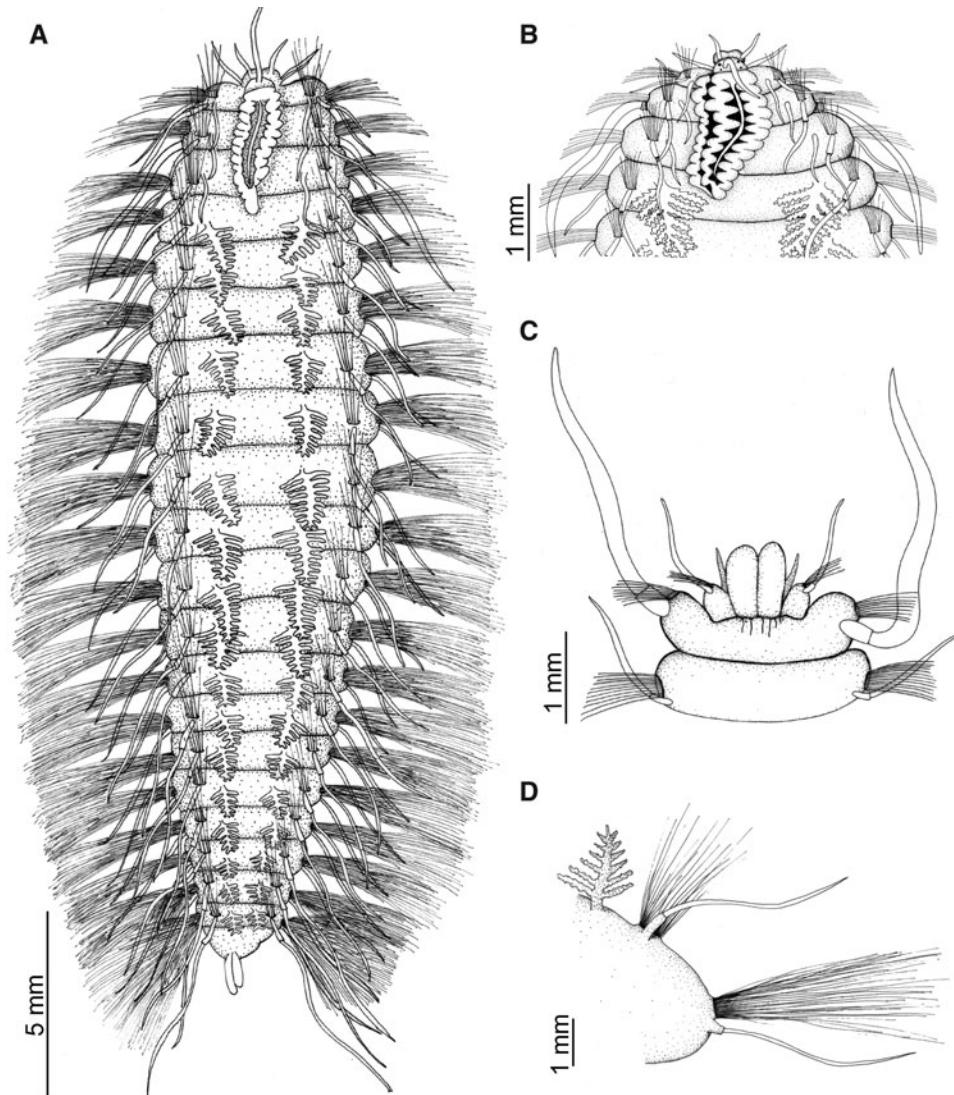


Fig. 2. *Chloeia kudenovi* sp. nov. (A) Dorsal view paratype (ZUEC: POL21); (B) anterior region in dorsal view; (C) anterior region in ventral view; (D) anterior parapodium in posterior view.

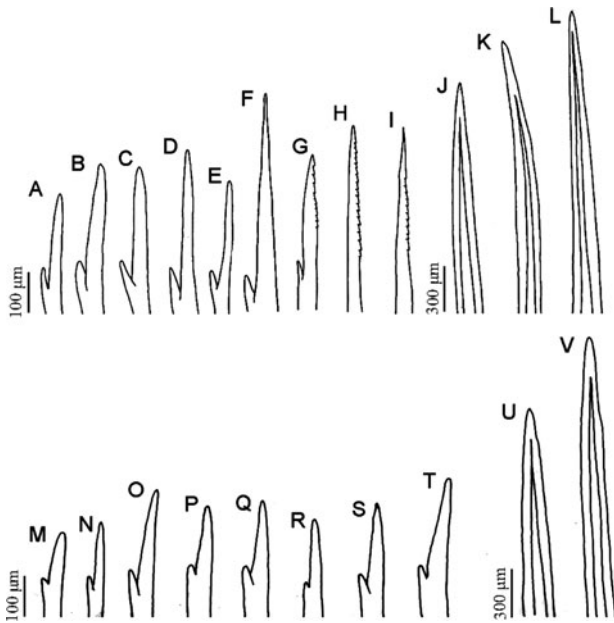


Fig. 3. (A–F) Bifurcate notochaetae; (G) bifurcate harpoon notochaetae; (H, I) harpoon notochaetae; (J) spinose notochaetae; (K, L) notoacaculae; (M–T) bifurcate neurochaetae; (U, V) neuroacaculae.

specimen) 9 mm long, 3 mm wide, 21 chaetigers; 20 November 2002, 22°10'27"S 39°54'46"W, 745 m.

DESCRIPTION OF THE HOLOTYPE

The holotype lacks dorsal pigmentation pattern. Anterior lobe of prostomium rounded. Posterior lobe of prostomium with two lateral cirriform antennae which are smaller than the palps. Two pairs of eyes the anterior pair being larger. Median antennae arising from anterior margin of caruncle are longer than lateral antennae and palps. Palps slender, cirriform. Palps fused, converging mid-ventrally into a longitudinal groove leading to mouth. Caruncle extends posteriorly to end of chaetiger 3 fused to dorsum on chaetigers 1–2 and free thereafter (Figure 2A, B). Mouth located between palps and posterior lip formed by chaetiger 2 (Figure 2C). Parapodia well developed with widely separated rami in all chaetigers (Figure 2D).

Notopodial chaetae of five types: (1) bifurcate chaetae (Figure 3A–F); (2) bifurcate harpoon chaetae with denticulations offset from small prong (Figure 3G) in all fascicles posterior to first third of body; (3) harpoon notochaetae (Figure 3H, I); (4) spinose notochaetae (Figure 3J), 8–12 per notopodial fascicle, arrayed in a row in superior region of fascicles; and (5) spinose notoacaculae (Figure 3K, L), 3–4 per fascicle, arrayed in front of notopodiol cirrus. Neurochaetae longer than notochaetae and arrayed in denser tufts, being of two types: (1) bifurcate chaetae (Figure 3M–T); and (2) spinose neuroacaculae, numbering 10–12 per fascicle, arrayed in a row along the most ventral region of fascicle (Figure 3U, V).

Parapodial cirri present in all chaetigers. Chaetigers 1–3 include branchial, notopodial and neuropodial cirri. Branchial cirri are lacking cirrophores. Notopodial cirri cirriform with cirrophores. The cirrostyle slender is about 3 × longer than the cirrophores. Neuropodial cirrophores are smaller than notopodial ones. Notopodial and neuropodial

cirri of similar size throughout the body, except for neuropodial cirri of the 2nd chaetiger, which are three times longer than dorsal (Figure 2A–C).

Branchiae are bipinnate from chaetiger 4 to the end of body, with 8–12 alternating branches arising from the primary axis each terminating in smaller alternating terminal filaments. Branchiae best developed in mid-chaetigers, decreasing in size in posterior chaetigers (Figure 2A, D).

Pygidium is terminal opening between a pair of thick, digitiform anal cirri (Figure 2A).

REMARKS

Regarding the recognition of valid species of *Chloeia*, three studies have presented a list based on literature surveys (Horst, 1910; Hartman, 1959; Baird, 1968), with, respectively, 13, 11 and 20 valid species.

The most referred and better described species are presented in Table 1, with the main morphological characters, current distribution and references. Some of these species are superficially described. Information regarding number and position of aciculae as well as shape and distribution of chaetae along the body is not given clearly in many descriptions.

However, *Chloeia kudenovi* and *C. violacea* differ from all other known species of the genus by the length of the neuropodial cirrus on the second chaetiger. *Chloeia kudenovi* differs from *C. violacea* in lacking a specific pattern of dorsal pigmentation, having shorter median and lateral antennae (not reaching the end of the caruncle), and having both noto- and neuropodial spines.

Furthermore, *C. violacea* was described from the Malay Archipelago (Indo-Pacific Ocean) in shallower depths. Regarding body pigmentation, *C. kudenovi* sp. nov. is similar to *C. inermis* Quatrefages, 1866, *C. pinnata* Moore, 1911, *C. entypa* Chamberlin, 1919 and *C. inermis* Quatrefages, 1866 in lacking pigmentation, but differs from these species in having a long neuropodial cirri on chaetiger 2.

This is the second species of *Chloeia* that has been reported from Brazilian waters and the third from the Atlantic Ocean. Until now, only *Chloeia viridis* (described from Jamaica) was previously reported for the Brazilian coast (Nonato & Luna, 1970; Amaral & Nonato, 1994) and *C. venusta* from the western South Atlantic (Kirkegaard, 2001). The low diversity of the genus in the Atlantic Ocean when compared to Indian-Pacific waters could be explained by the restricted distribution of coral reefs in this ocean, an environment which usually bears a great diversity and prevalence of *Chloeia* species.

Feeding

Large amounts of foraminifera were found in the digestive tract of two specimens.

Reproduction

One collected specimen (holotype) presented oocytes in its coelomic cavity, with diameter ranging between 0.60 and 0.95 µm ($X = 75.15$; $SD = 10.93$; $N = 30$).

Table 1. Most referred *Chloeia* species and *Chloeia Kudenovi* sp. nov. Character variation (number of chaetigers and size (length × width); 1st branchiate chaetiger; types of notopodial chaetoe; types of neuropodial chaetae; pigmentation pattern on dorsum); distribution and main references.

<i>Chloeia</i> species	Number of chaetigers	1st branchiate chaetiger	Notopodial chaetae	Neuropodial chaetae	Pigmentation pattern on dorsum	Distribution	References
<i>C. flava</i> (Pallas, 1766)	32	4	Bifurcate serrated	Bifurcate smooth	A rounded purple spot on each chaetiger	Tropical Indo-Pacific	McIntosh (1885); Horst (1912); Day (1967)
<i>C. viridis</i> Schmarda, 1861	34	4	Bifurcate smooth; serrated in long limbs at outer side	Bifurcate smooth	One narrow purple strip	Tropical Atlantic	Gathof (1984); Amaral & Nonato (1994)
<i>C. fusca</i> McIntosh, 1885	23 (18 mm long)	5	Bifurcate smooth; posterior: bifurcate serrated at outer side	Bifurcate smooth and spine smooth	A pair of longitudinal purple strips	Indian Ocean	Horst (1912); Fauvel (1953) Day (1967)
<i>C. inermis</i> Quatrefoes, 1866	30 (400 × 10 mm)	4	Spinous smooth; harpoon in posterior chaetigers	Bifurcate smooth	None	New Zealand	Day (1967)
<i>C. venusta</i> Quatrefoes, 1866	27 (20 × 5 mm)	4	Spinose smooth; harpoon; bifurcate serrated at outer side	Bifurcate smooth	?	Atlantic and Mediterranean	Fauvel (1923)
<i>C. tumida</i> Baird, 1868	36 (15 × 5 cm)	4	Harpoon, smooth spines, bifurcate	Bifurcate smooth	None	India	
<i>C. parva</i> Baird, 1868	26	4	Serrated, harpoon-shaped, with a very small pointed spur	Bifurcate smooth	A violet 'T' or 'Y' spot in each segment	Unknown	Horst (1912), Fauvel (1953)
<i>C. pulchella</i> Baird, 1868	32–35 (5 × 1.3 cm)	Not mentioned	Bifurcate serrated	Bifurcate 'simple'	A dark line	Reefs off the north-east coast of Australia	
<i>C. conspicua</i> Horst, 1910	37 (6.5 × 1.3cm)	4	Bifurcate with diminutive spur and serrated at outer side from chaetiger 6 onwards	Bifurcate smooth with diminutive spur	'Violet longitudinal stripe, interrupted in the intersegmental grooves'	Malay Archipelago	Horst (1912)
<i>C. amphora</i> Horst, 1910	24–26 (26 × 7mm)	4	Bifurcate, serrated along its exterior border from chaetiger 7 onwards	Bifurcate smooth (1/2)	Each segment shows a violet spot like a Roman amphora, surrounded by a white band	Malay Archipelago	Horst (1912), Fauvel (1953)
<i>C. pinnata</i> Moore, 1911	26 (17–28) (26 × 6.5mm)	4	Anterior: bifurcate with diminutive spur; median and posterior: bifurcate with serrations and capillaries without spur	Bifurcate with diminutive spur and long limbs, capillaries	'Purple spot in front of lateral tentacles'	Southern California	Kudenov (1995)
<i>C. violacea</i> Horst, 1912	26	4	Bifurcate; serrated in long limbs at outer side from chaetiger 9 onwards	Bifurcate smooth	Spots like an inverted 'T' in each chaetiger	Malay Archipelago	Horst (1910); Monro (1937)
<i>C. entypa</i> Chamberlin, 1919	23–24 (10 × 4.2mm)	Not mentioned	Anterior: bifurcate smooth; posterior: serrated in long limbs at outer side	Bifurcate smooth	None	Off West Mexico	Fauchald (1977), Hartman (1968)
<i>C. natalensis</i> Day, 1951	29 (47 × 17mm)	4	Stout serrated without spur	Bifurcate smooth	Median row of purple spots on dorsum 'amphora-like'	South Africa	
<i>C. australis</i> Kudenov, 1993	33 (50 × 1.2mm)	5	Smooth pointed spines with distal caps, notoacicula subdistally inflated	Distally bidentate spines, capillary-like with bidentate tips and subdistal spurs, neuroacicula distally bidentate.	Dorsal surface purple in ethanol; middorsal longitudinal stripe lacking pigment	Subantarctic region	
<i>C. kudenovi</i> sp. nov.	24 (20 × 6mm)	4	Spinose smooth; harpoon; bifurcate serrated at outer side	Bifurcate smooth and spinose neuroociculate	None	Southern Brazil	

ETYMOLOGY

The species is named after Jerry Kudenov for his essential contribution to the knowledge of taxonomy and biology of amphinomids.

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