Ceciamaralia, a new genus of Dorvilleidae (Annelida) from deep waters of the Southwest Atlantic Ocean and an insight into its relationship within the family

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Abstract

Dorvilleidae, Chamberlin, 1919 is a family of Annelida ~~grouping~~containing some of the smallest 'polychaete~~s~~' species, being poorly studied worldwide, and with little knowledge regarding its diversity and occurrence. Samples obtained in oceanographic campaigns performed in the Southwest Atlantic Ocean (Brazilian coast) revealed a high number of specimens of dorvilleids, a~~i~~dding to ~~increase~~ our knowledge of the family's biodiversity . A detailed morphological analysis of these organisms has revealed a new genus, *Ceciamaralia* **gen. nov.**, with two new species The new genus~~,~~ ~~which~~ differs from other Dorvilleidae genera in i) the robust and enlarged pharynx which are frequently everted[CG1], ii) unique composition of maxillae, with an elongated pair of serrated basal plates and one pair of anterior free maxillary plates with a long and thin anterior spine and iii) ventral

cirri~~us~~ present only in the few first chetigers. *Ceciamaralia lanai* **gen. et sp. nov.** is characterized by the presence of a broad and large dorsal cirrus on a few anterior parapodia and ~~of~~ by ~~a~~ furcate chaetae [CG2]in supra-acicular fascicles. While ~~,~~ *Ceciamaralia nonatoi* **gen. et sp. nov.** presents ~~a~~ one geniculate chaeta instead of ~~a~~ one furcate chaeta[CG3], the absence of dorsal cirri and, in some specimens, the absence of palps. A cladistic analysis supported the monophyly of *Ceciamaralia* **gen. nov**. by four synapomorphies related to the unique morphology of its maxillae, pharynx and appendages. This study is part of several recent taxonomic studies aiming to elucidate and increase the knowledge of Dorvilleidae since it is part of a Ph.D project focused on the family[CG4].

Key words: marine worms , Eunicida, 'Polychaeta', morphology, new species, new genus, taxonomy, cladistics

Introduction

The Order Eunicida (Annelida) comprises 'polychaetes' that have an internal jaw apparatus composed of ventral mandibles and dorsal maxillae (Zanol et al., 2021). Dorvilleidae Chamberlin, 1919 encompass ~~S~~some of the smallest~~-~~ ~~-~~bodied eunicid species ~~belong to Dorvilleidae Chamberlin, 1919, a~~ The family ~~with~~ exhibits varied life-styles, from free-living worms to ~~some~~ commensal and/or parasitic species, inhabiting unconsolidated and consolidated substrates, from the intertidal zones to great depths (Martin & Britayev, 1998; Martin & Britayev, 2018 ; Zanol et al., 2021).

Dorvilleidae is ~~characterized mainly by being~~ the only extant group of Eunicida that has a ctenognath-type jaw apparatus: two or four rows of symmetrical or subsymmetrical denticulate maxillary plates, upper comb-like jaws, and an unpaired posterior carrier-like structure (Zanol et al., 2021). Despite the small size of some dorvilleids, ~~a~~ great morphological heterogeneity among species is observed. Body appendages on the ~~(like~~ prostomium~~al~~, parapodia~~l~~ and pygidium~~,al),~~ important for the initial identification of species, present a diversity of sizes and shapes. ~~A detailed look reveals even more the morphological diversity, not only in smaller structures as t~~The number and shape of chaetae~~,~~ and ~~but also in~~ the internal jaw apparatus also shows great morphological diversity , which is important for delimiting genera and species within the family (Paxton, 2009).

Currently, Dorvilleidae comprises about 200 species distributed in 32 genera, of which 13 are monotypic, including the most recently described *Ikosipodoides* Westheide, 2000, while, almost ⅓ of the family species belong to the genus Ophryotrocha Claparède & Mecznikow, 1869. More than half of the Ophryotrocha diversity was described in the last 25 years (Read & Fauchald, 2024), as well as other studies encompassing biology, natural history, genetics and systematics (Zhang et al., 2023).

~~Meanwhile the r~~Relationships among genera and species of Dorvilleidae are also understudied. ~~The~~ In a broad morphological~~est~~ cladistic study (comprising all genera of the family known at the~~at~~ time), Eibye-Jacobsen & Kristensen (1994) analyze~~ding~~ ~~the~~ relationships within Dorvilleidae ~~was performed by Eibye-Jacobsen & Kristensen (1994),~~ using genera as terminal taxa , recovering several generic groupings[CG5] ~~based on the morphology of genera~~. Other studies ~~were~~ have focused on accessing the monophyly of some genera and ~~its~~ their relationship with closely related genera; for ~~, as~~ example ~~of~~ the work by de Oliveira Bonaldo (2022) on Eliberidens Wolf, 1986a, which recovered the monophyly of the genus and discussed its morphological similarities with ~~some~~ other genera. There are also studies including morphological and molecular data of genera~~us~~, like Parougia Wolf, 1986b (Yen & Rouse, 2020) and Ophryotrocha (Kvalø Heggøy, Schander & Åkesson, 2007) and one focused on the monotypic parasitic species Veneriserva pygoclava Rossi, 1984, exploring molecular data to analyze its relationship with ~~some~~ other Dorvilleidae genera, mainly Ophryotrocha (Tilic & Rouse, 2024). ~~Thus~~These latter studies reveal ~~,~~ the scarcity of molecular data and viable specimens from which to extract such data ~~from~~ are an obstacle to advancements in this field.

Among the reasons for the ~~-~~scarcity of knowledge on species of this family are : i) the difficulty to perform sampling in deep waters, ii) the rarity of some groups in the samples and iii) the lack of taxonomists specialized in this group. The~~is~~ knowledge gap i~~o~~n Dorvilleidae systematics is ~~a~~ worldwide ~~reality~~ ~~,~~ and exemplified ~~like~~ on the Brazilian coast, where, currently, there are only nineteen species ~~registered~~recorded: Dorvillea angolana (Augener, 1918), *Dorvillea moniloceras* (Moore, 1909), *D. sociabilis* (Webster, 1879), *Eliberidens forceps* Wolf, 1986, *E. hartmannschroederae* Hilbig, 1995, *Meiodorvillea hartmanae* Bonaldo, Steiner & Amaral, 2022, *M. jumarsi* Bonaldo, Steiner & Amaral, 2022, *M. minuta* (Hartman, 1965), *M. penhae* Bonaldo, Steiner & Amaral, 2022, *Ophryotrocha pueri lis* Claparède & Mecznikow, 1869, O. zitae Miranda, Raposo & Brasil, 2020, Pettiboneia sanmartini Aguirrezabalaga & Ceberio, 2003, *Pettiboneia sanmatiensis* Orensanz, 1973, *Protodorvillea*

biarticulata Day, 1963, *P. kefersteini* (McIntosh, 1869), *Schistomeringos annulata* (Moore, 1906), *S. anoculatus* (Hartman, 1965), *S. longicornis* (Ehlers, 1901), and *S. rudolphi* (delle Chiaje, 1828) (Amaral et al., 2006-2022); seven of them were recorded in three recent taxonomic studies (de Oliveira Bonaldo, Steiner & Amaral, 2022; de Oliveira Bonaldo et al., 2022; Miranda, Raposo & Brasil, 2020).

Recent o~~O~~ceanographic campaigns performed in the Southwest Atlantic Ocean (Brazilian coast) resulted in the collection of a ~~a~~ high number of Dorvilleidae specimens ~~in their samples~~, allowing for an increase in the ~~ing~~ knowledge on the biodiversity of the family in this region. By applying an integrative approach, with light and scanning electron microscopy and cladistic analysis, we identified and described a new genus of Dorvilleidae, *Ceciamaralia* **gen. nov.** with two new species, *Ceciamaralia lanai* **gen. et sp. nov**. and *Ceciamaralia nonatoi* **gen. et sp. nov.,** that present unique, external and internal (jaw apparatus)~~,~~ morphological characters.

Materials & Methods

Sampled area

The specimens analyzed were collected in two broad oceanographic campaigns carried out in Brazilian waters (Southwest Atlantic Ocean), coordinated by CENPES/PETROBRAS: (AMBES: Environmental Characterization of the Espírito Santo Basin (18°-21°S/37°-40°W) and HABITATS: Assessment of the Environmental Heterogeneity of the Campos Basin (21°-24°S/38°-45°W) (Lavrado & Brasil 2010) . The collections were done between 2008 and 2013 at depths ranging from 12 to 3301 meters; the organisms were ~~previously~~ fixed in 4% formalin and then preserved in 70% ethanol.

Morphological analysis

The external morphology of the specimens was analyzed ~~in~~ using a ZEISS Axioscop 2 Plus compound microscope and drawings were made with a camara lucida attached to the microscope. The images were captured with a ZEISS AxioCam MRc attached to a ZEISS

Axio Imager M2 and Axio Zoom V.16. All images and figures were edited[1] using Adobe® Photoshop and Inkscape®.

To perform the scanning electron microscopy (SEM), specimens were previously immersed in ethanol baths at the following concentrations: 70% ethanol (~~five~~ 5 min), 80%, 90%, 95% (15 min each) and in absolute ethanol, in three~~3~~ changes (15, 30 and 60 min). Critical point drying (Balzers CPD-30) was performed at 37 ◦C and at a 70 BAR of CO2 gas input, followed by gold coating using SPD-050 sputter coater (Steiner & Santos, 2004). Specimens on stubs were observed in a JEOL JSM-5800 LV scanning electron microscope and images were taken with the software Semafore (v.5.2). Critical point drying, gold-coating and SEM analysis were all performed at the Laboratório de Microscopia Eletrônica, Instituto de Biologia, Universidade Estadual de Campinas (LME-IB/UNICAMP).

The jaw apparatus was analyzed using two different method~~ologie~~s : i) placing the entire specimens on a drop of Hoyer solution (trichloroacetaldehyde) or Aquatex® on a slide and coverslip, or ii) placing the specimens between slide and coverslip, waiting for it to dry and analyzing the jaws by tissue transparency (~~not~~ without damaging the specimens, and recovering their~~its~~ integrity by putting them~~it~~ back in ~~the~~ ethanol). All observations were done ~~in~~ using the ZEISS Axio Imager M2 and Axioscop 2 Plus microscopes

Cladistic analysis

To analyze the relationships of *Ceciamaralia* **gen. nov.** with ~~the~~ morphologically similar genera of Dorvilleidae, we performed a cladistic analysis utilizing the character matrix and data developed in the study of de Oliveira Bonaldo et al., (2022), which analyzed the cladistic relationships of the following genera: *Dorvillea* Parfitt, 1866, *Eliberidens* Wolf, 1986, *Gymnodorvillea* Wainwright & Perkins, 1982 *Marycarmenia* Núñez, 1998, *Meiodorvillea* Jumars, 1974, *Pettiboneia* Orensanz, 1973, *Protodorvillea* Pettibone, 1961 and *Schistomeringos* Jumars, 1974. We added four new characters to the matrix (characters 43 to 46) and inserted a new character state for character 40 , to fit *Ceciamaralia* **gen. nov.** (Table 1). We also followed the methodologies of de Oliveira Bonaldo et al. (2022), keeping the characters coded as binary or multistate, coded as '-' when the character is non-applicable and '?' when the state of the character is unknown. All characters are unweighted. The final matrix comprised~~s~~ 21 species (Table 2), including the same outgroups from Oliveira

[1] The letter 'i' was skipped from all illustrations to avoid confusion with scale bars of the images.

de Bonaldo et al. (2022) (Pettiboneia urciensis Campoy & San Martín, 1980, Pettiboneia wui Carrasco & Palma 2000 (Dorvilleidae) and *Ninoe jessicae* Hernández-Alcántara, Pérez-Mendoza & Solís-Weiss, 2006 (Lumbrineridae)). The matrix has 46 morphological characters.

The character matrix was assembled using the Mesquite® software (Maddison & Maddison, 2019) and the parsimony analysis was performed through the software TNT® (Goloboff & Morales, 2023), with the heuristic search by the traditional search function starting with 10000 Wagner trees and utilizing the TBR (tree bisection reconnection) algorithm. We also used TNT® to analyze branch support by standard bootstrap with 1000 replicates and Bremer absolute support analysis, with 40 steps retaining suboptimal trees Finally, to view and edit the resulting tree we used Winclada® software (Nixon, 2002).

Deposition of specimens

The specimens , SEM stubs and slides, including the type series, were deposited in the Polychaeta Collection (ZUEC-POL) of the Museu de Diversidade Biológica of the Institute of Biology of the Universidade Estadual de Campinas (MDBio - IB/UNICAMP), Campinas, Brazil. Some paratypes were deposited elsewhere in Brazil: Museu de Zoologia of the Universidade de São Paulo, São Paulo (MZUSP) and Museu Nacional do Rio de Janeiro, Rio de Janeiro, Brazil (MNRJ).

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Results

Taxonomy

Phylum Annelida~~,~~ Lamarck 1802

Order Eunicida~~,~~ Fauchald 1977

Family Dorvilleidae Chamberlin, 1919

Genus *Ceciamaralia* gen. nov.

urn:lsid:zoobank.org:act:22B5ED41-CF25-4A97-8B75-DF336BE1CBE7

Type species: *Ceciamaralia lanai* **gen. et sp. nov.** described herein.

Etymology: Feminine. The genus name "*Ceciamaralia*" refers to the name Cecília and the surname Amaral of Dr. Antônia Cecília Zacagnini Amaral, a Brazilian researcher who immensely contributed, and still contributes to the enhancement of Annelida knowledge and to the education of zoologists, taxonomists and ecologists, including the three authors of this paper.

Diagnosis: Prostomium triangular-shaped with anterior margin rounded. One pair of simple antennae, distally clavate, with a long and slender basal portion. One pair of simple, short and clavate ventrolateral palps, or absent. Two peristomial rings. First two chaetigers usually enlarged to accommodate the large pharynx. Pharynx enlarged, normally protracted [CG6]out of the mouth in preserved specimens. First two parapodia shorter than those following~~s~~ and without appendages. Notopodia represented by a large and long dorsal cirrus (with a thin notoacicula) present in a few anterior parapodia or entirely absent. Ventral cirri short and papilliform, present only in a few anterior parapodia. Supra-acicular chaetae: capillary and furcate or geniculate. Sub-acicular chaetae: compound heterogomph falcigers with serrated unidentate blades. Two pairs of clavate pygidial cirri. Jaw apparatus with paired mandibles, medially connected, without fused or free teeth on the anterior margin. Maxillae composed of a posterior ligament fused to a pair of long and serrated basal plates, followed by one pair of short, anteriormost free maxillary plates with a long thin spine on the anterior margin. Carrier-like structure absent.

Remarks: *Ceciamaralia* **gen. nov.** is well distinguished from all Dorvilleidae genera by: i) its maxillae composed of a pair of elongated and serrated basal plates and one pair of free maxillary plates with an anterior long and thin spine, ii) its enlarged pharynx which

makes the anterior region of the specimens also enlarged when it is retracted; preserved specimens are found usually with the pharynx protracted[CG7], iii) antennae with a long and slender basal portion and clavate distal end, iv) first two parapodia slightly shorter and without appendages, and v) dorsal cirri present only in a few anterior parapodia.

The differences of *Ceciamaralia* **gen. nov.** with some morphologically similar genera of Dorvilleidae are analyzed in detail in the Discussion section.

Ceciamaralia lanai gen. et sp. nov. (Figs. 1-5)

urn:lsid:zoobank.org:act:3E16785F-8EDD-47E7-8CF4-34D5BD1F4062

Diagnosis: One pair of palps. Long and large dorsal dorsal cirri with a thin notoacicula present on parapodia 3 to 6-9. Supra acicular chaetae: capillary and furcate.

Type locality: Off Espírito Santo State, Brazil, 39º10'17.35"W, 19º36'26.24"S, 392 m, muddy.

Type specimens: Holotype: ZUEC-POL XXX (39º10'17.35"W, 19º36'26.24"S, 392 m, muddy, 14 Dec 2011); Paratypes: ZUEC-POL XXX (1 specimen, 39º10'17.35"W, 19º36'26.24"S, 392 m, muddy, 14 Dec 2011); ZUEC-POL XXX (1 specimen, 38º1'8.43"W, 19º34'20.42"S, 450 m, sandy mud, 9 Dec 2011); ZUEC-POL XXX (1 specimen 39º36'8.52"W, 19º49'7.27"S, 158 m, sandy muddy, 14 Jan 2012); ZUEC-POL XXX (3 specimens, 39º30'25.23"W, 19º45'54.56"S, 144 m, muddy, 15 Jan 2012); ZUEC-POL XXX (2 specimens, 39º53'47.1"W, 20º35'16.23"S, 410 m, muddy, 8 Jan 2012; ZUEC-POL (1 specimen on slide, 38º41'18.43"W, 19º34'20.42"S, 450 m, sandy mud, 09 Dec 2011); ZUEC-POL XXX (1 specimen on slide, 39º36'9.34"W, 19º49'6.26"S, 181 m, mud, 29 Jun 2013); ZUEC-POL XXX (1 specimen on slide, 39º30'25.97"W, 19º45'53.43"S, 143 m, muddy, 27 Jun 2013); MZUSP (2 specimens, 39º53'47.1"W, 20º35'16.23"S, 410 m, muddy, 8 Jan 2012); MNRJ (2 specimens, 39º53'47.1"W, 20º35'16.23"S, 410 m, muddy, 08 Jan 2012). SEM Material: (1 stub with 3 specimens - 39º53'47.1"W, 20º35'16.23"S, 410 m, muddy, 8 Jan 2012; 40º14'14.08"W, 21º4'4.56" S, 141 m, sandy, 11 Jul 2013).

Etymology: Masculine. The specific epithet *"lanai"* refers to the surname of Dr. Paulo da Cunha Lana (*in memorian*), a Brazilian polychaetologist who immensely contributed to the increase of knowledge of Annelida in Brazil and worldwide, and was the supervisor of the senior author of this paper.

Description of holotype: Cylindrical body (Fig. 1A). Complete specimen with 46 chaetigers, 4.18 mm long and maximum width of 0.25 mm in the anterior region (0.16 mm in the posterior region), excluding parapodia. First 3-4 chaetigers larger than the rest of the body to accommodate the enlarged pharynx (Fig. 1A). Prostomium triangular-shaped, anterior margin broadly rounded. Ocelli absent. One pair of simple dorsal antennae in the middle of prostomium, distally clavate, with a long and slender basal portion, almost as long as the prostomium (Figs. 1B, 4 A and 5 A). One pair of simple ventrolateral, short, and small clavate palps, on the base of prostomium, almost half as long as the prostomium (Figs. 1B, 4 A,B and 5 A). Two peristomial rings without appendages, posterior one longer and wider than anterior one. (Figs. 1B, 4 A,B and 5 A,B).

Parapodia cylindrical, small, and barrel- shaped. First two parapodia smaller than the following, without appendages (Figs. 1B and 5 A,B). Large and long dorsal cirrus with a thin notoacicula , almost 2.5 times the length of parapodium, present from the 3rd to the 7th chaetigers (Figs. 1D, 4 B,D and 5 D). Short and papilliform ventral cirri in the middle of parapodium, from the 3rd to the 7th chaetiger (Figs. 1D, 4 B,D and 5 B,D). Following parapodia slightly larger, longer, and without cirri (Fig 1E, 4 E and 5 E).

Supra-acicular chaetae: one long, thin and serrated capillary (Fig. 2A,C) and one furcate with asymmetrical prongs, one slightly shorter and more robust than the other; tip of both prongs blunt (Figs. 2C, 4 G and 5 G); furcate of first chaetigers with small prongs and prominent serration below the shorter prong (Figs. 2A, B and 4 F). Sub-acicular chaetae: three compound heterogomph facilgers, slightly different sizes, ventralmost shortest and dorsalmost longest; bifid shafts with a subtle serration on the distal end; short, robust, serrated, and unidentate blades (Figs. 2A-D, 4 J and 5 F,G). One serrated cultriform chaeta occasionally replacing the ventralmost compound chaeta on the last posterior chaetigers (Figs. 4 H and 5 F).

Median and posterior regions moniliform. Pygidium truncate and shorter than the previous chaetigers. Two pairs of clavate pygidial cirri, dorsal pair slightly longer than the length of pygidium and ventral pair half the length of the dorsal pair (Figs. 1A,C, 4 C and 5 C).

Paired mandibles medially connected in a region strongly sclerotized; anterior region slightly broader and less sclerotized than the slender posterior region (Figs. 3A-D and 4 K). Maxillae composed of one pair of elongated and serrated basal plates with small uniform

sharp teeth on one margin, posteriorly fused to a weakly sclerotized posterior elongated ligament. Basal plates anteriorly followed by one pair of anteriormost free maxillary plates a long, thin and prominent spine on its anterior margin (Figs. 3A-D and 4 L).

Variation: Complete specimens ranging from 2.9 mm to 7.6 mm in length and 33 to 61 chaetigers. All specimens ranging from 0.135 to 0.26 mm in maximum width . Dorsal cirri present from chaetiger 3 to 6-9 . The presence of ventral cirri usually follows the parapodia in which the dorsal cirrus is present, but in some specimens the ventral cirri can be present in the following one or two parapodia. The presence of the cultriform chaeta is occasional in posterior chaetigers, but it is also present in the median region of some specimens, and in some specimens it is absent . The enlarged pharynx is characteristic of the genus and it appears protracted CG8out of the mouth in most preserved specimens (Figs. 4 B and 5 B) but when it is retracted the specimen presents an enlarged anterior region to accommodate the pharynx (Fig. 1A and 4 A).

Location and bathymetrics: Off the s tates of Espírito Santo and Rio de Janeiro, Brazil, 141 - 450 m, substrates: mud, sandy mud, muddy or sandy.

Remarks: ~~r~~ . Ceciamaralia lanai gen. et. sp. nov. differs from C. nonatoi gen. et sp. nov. by the presence of a large and long dorsal cirri on a few anterior chaetigers and the presence of furcate chaeta in supra-acicular fascicle. The median and posterior regions of specimens are usually moniliform.

Ceciamaralia nonatoi gen. et sp. nov. (Figs. 6 -9)

urn:lsid:zoobank.org:act:EFF6CD0C-2071-48A2-915D-6F2F8530A343

Diagnosis: One pair of palps present or absent. Dorsal cirri absent. Supra-acicular chaetae: capillary and geniculate.

Type locality: Off Espírito Santo State, Brazil, 40º12'52.126"W, 21º11'12.073"S, 680 m.

Type specimens: Holotype: ZUEC-POL XXX (40º12'52.126"W, 21º11'12.073"S, 680 m 04 Feb 2009). Paratypes: ZUEC-POL XXX (1 specimen, 40º12'52.126"W, 21º11'12.073"S, 680 m 04 Feb 2009); ZUEC-POL XXX (2 specimens, 40º1'55.373"W, 21º47'26.771"S, 780 m, 06 Feb 2009), ZUEC-POL XXX (3 specimens, 41º18'33,045"W, 23º39'21.880"S, 692.7 m, 28

Jan 2009); ZUEC-POL XXX (2 specimens 40º26'37.449"W, 22º33'35.143"S, 401 m, 31 Jan 2009); ZUEC-POL XXX (1 specimen, 40º26'40.289"W, 22º33'33.805"S, 393.4 m, 11 Jul 2008); ZUEC-POL XXX (1 specimen, 40º17'33.343"W, 22º25'59.389"S, 387.1 m, 31 Jan 2009); ZUEC-POL XXX (1 specimen, 40º5'18.066"W, 21º44'21.493"S, 401.6 m, 07 Jul 2008); ZUEC-POL XXX (3 specimens - 39º30'4.65"W, 19º46'34.99"S, 428 m, muddy, 14 Jan 2012); ZUEC-POL (1 specimen on slide, 40º2'13.825"W, 21º47'26.324"S, 730.5 m, 28 Jun 2008); MZUSP XXX (1 specimen, 41º18'33.045"W, 23º39'21.880"S, 692.7 m, 28 Jan 2009); MZUSP XXX (1 specimen, 40º12'52.126"W, 21º11'12.073"S 680 m, 04 Feb 2009); MNRJ XXX (38º41'19.8"W, 19º34'20.47"S, 449 m, mud, 30 Jun 2013); MNRJ XXX (1 specimen, 40º1'45.543"W, 22º19'45.730"S, 701.7 m, 30 Jan 2009); MNRJ XXX (1 specimen, 40º26'37.585"W, 22º33'35.276"S, 400 m, 31 Jan 2009); ZUEC-POL XXX (3 specimens, 40º 2' 13,825" W, 21º 47' 26,324" S, 730.5 m, 28 Jun 2008). SEM Material: ZUEC-POL XXX (1 stub with 3 specimens, 40º2'13.825"W, 21º47'26.324"S, 730.5 m, 28 Jun 2008 / 40º12'52.126"W, 21º11'12.073"S 680 m, 04 Feb 2009 / 39º30'4.65"W, 19º46'34.99"S, 428 m, muddy, 14 Jan 2012).

Etymology: Masculine. The specific epithet *"nonatoi"* refers to the surname of Dr. Edmundo Ferraz Nonato (*in memorian*), one of the greatest Brazilian naturalists and oceanographers who was the pioneer of Brazilian polychaetology, responsible for the education and inspiration of generations of zoologists.

Description of holotype: Cylindrical body (Fig. 6 A). Complete specimen with 55 chaetigers, 6.27 mm long and maximum width of 0.41 mm in the anterior region (0.25 m m in the posterior region), excluding parapodia. First 3-4 chaetigers larger than the rest of the body to accommodate the enlarged pharynx (Fig. 6 A). Prostomium triangular-shaped, anterior margin broadly rounded. Ocelli absent. One pair of simple dorsal antennae in the middle of prostomium, distally clavate, with a long and slender basal portion, almost as long as the prostomium (Figs. 6 B,C, 8 A,B, 9 A,B). One pair of simple, ventrolateral, short, and small clavate palps on the base of prostomium, almost half as long as the prostomium (Fig. 6 B). Two peristomial rings without appendages, posterior wider and longer than anterior (Figs. 6 B,C, 8 A,B and 9 A,B).

Parapodia cylindrical, small and barrel- shaped. First two parapodia smaller than the followings, without appendages (Figs. 6 B, 8 A and 9 B). Dorsal cirri absent on all parapodia. Short and papilliform ventral cirri in the middle of the parapodium, from the

3rd to the 6th chaetiger (Figs. 6 E, 8 D and 9 B,C). Following parapodia slightly larger, longer and without cirri (Figs. 8 E and 9 D).

Supra-acicular chaetae: one long, thin and serrated capillary (Figs. 7A and 9 F,G) and one geniculate with distal region robust and slightly serrated (Figs. 7A,B , 8 F and 9 C,F). Sub-acicular chaetae: three compound heterogomph falcigers, almost equal length, ventralmost slightly shortest ; bifid shafts with a subtle serration on the distal end; short, robust, serrated and unidentate blades (Figs. 7A,B, 8 G,H and 9 E,G). One serrated cultriform chaeta occasionally replacing the ventralmost compound in the last posterior chaetigers (Figs. 7B , 8 J and 9C).

Median and p osterior regions moniliform. Pygidium truncate and shorter than the previous chaetigers. Two pairs of clavate pygidial cirri; dorsal pair slightly longer than the length of pygidium and ventral pair half the length of the dorsal pair (Figs. 6 D and 8 C) .

Paired mandibles medially connected in a region strongly sclerotized; anterior region slightly broader and less sclerotized than the slender posterior region (Figs. 7C-E and 8 K). Maxillae composed of one pair of elongated and serrated basal plates with small uniform sharp teeth on one inner margin, posteriorly fused to a weakly sclerotized posterior elongated ligament. Basal plates anteriorly followed by one pair of anteriormost free maxillary plates with a long, thin and prominent spine on its anterior margin (Figs. 7C-E and 8 L).

Variation: Complete specimens ranging from 3.23 to 6.27 mm in length and 46 to 62 chaetigers. A variation within this species, which was observed through the analysis of some specimens, is the presence or absence of palps. *Ceciamaralia nonatoi* **sp. nov.** has small and fragile palps, but many specimens do not present them (Figs. 5C and 7A,B). The small size of palps and the enlarged pharynx protracted [CG9]out of the mouth ~~are obstacles to clearly observe~~would obscure the scar of a possible broken palp. Therefore, it is debatable whether this is a variation or a methodological problem, so we decided to diagnose the species with presence/absence of palps. The ventral cirri are always present, from ~~the~~ parapodia 3 to 5-7. The presence of the cultriform chaeta is occasional in posterior chaetigers, but it is also present in the median region of some specimens, and in some specimens it is absent. The enlarged pharynx is characteristic of the genus and it appears protracted [CG10]out of the mouth in most preserved specimens, but when it is retracted the specimen presents an enlarged anterior region to accommodate the pharynx.

Location and bathymetrics: Off the states of Espírito Santo and Rio de Janeiro, Brazil, 387.1 - 780 meters deep, substrates: mud or muddy.

Remarks: *Ceciamaralia nonatoi* **sp. nov.** differs from its congener by the absence of dorsal cirri and by the presence of a geniculate chaeta instead of a furcate in the supra-acicular fascicle. The variation of the length of the blades of the compound chaetae is very subtle, while in *Ceciamaralia lanai* **gen. et sp. nov.** it is more ~~distinguished~~distinctive. The bathymetric distribution is also a difference between the two species; *Ceciamaralia nonatoi* **gen. et sp. nov.** is registered in deeper waters (387.1 - 780 m) than *Ceciamaralia lanai* **gen. et sp. nov.** (141 - 450 m).

Cladistic results

The cladistic analysis resulted in one most parsimonious cladogram from 467,210 rearrangements, with best score (length) of 79 steps, consistency index (ci) of 74 , retention index (ri) of 87 (Fig. 10). The cladogram shows the monophyly of *Ceciamaralia* **gen. nov.**, supported by the following synapomorphies: character 40 : only one pair of free maxillary plates; character 44 : enlarged pharynx/enlarged anterior region; character 45 : ventral cirri present only on a few anterior parapodia and character 46 : presence of a long and thin spine on the anteriormost maxillary plate. The genera Ceciamaralia gen. nov., Protodorvillea and Dorvillea were well supported by the Bremer absolute support index (9, 12 and 16 respectively) as well as the bootstraps values (87, 92 and 90 respectively) (Fig. 11).

The inclusion of *Ceciamaralia lanai* **gen. et sp. nov.** and *Ceciamaralia nonatoi* **gen. et sp. nov.,** as well as the addition of four new characters to the matrix of characters in the study of de Oliveira Bonaldo et al. (2022), did not substantially affect the results obtained in the previous study. *Ceciamaralia* **gen. nov.** was placed as a sister group of all other genera analyzed, except *Eliberidens* and *Gymnodorvillea*, in presenting the synapomorphy of the character 22: the chaeta which accompanies the capillary in the supra-acicular fascicle does not change along the body.

Discussion

At the first glance, *Ceciamaralia* **gen. nov.** specimens are hard to differentiate from other small- sized dorvilleids, but a closer look reveals their morphological differences and unique morphology. Below, these differences are discussed with some morphologically similar genera, specifically those present in the cladistic study of this work and also presented in de Oliveira Bonaldo et al. (2022). , —Prostomial *appendages*

Ceciamaralia **gen. nov.** presents a cylindrical and small- sized body, with small body appendages and triangular prostomium , as in *Protodorvillea*, *Meiodorvillea*, *Eliberidens*, and *Pettiboneia*. Those genera also appear closely related in cladistic studies (Eibye-Jacobsen & Kristensen, 1994; de Oliveira Bonaldo et al., 2022). *Protodorvillea* has long and biarticulated palps, while *Ceciamaralia* **gen. nov.** has simple, small, clavate and papilliform palps, when present. The palps of *Pettiboneia* are shorter than in *Protodorvillea* but are still biarticulated and also longer and larger than the palps of *Ceciamaralia* **gen. nov.** The small clavate palps in *Ceciamaralia* **gen. nov.** are similar to those observed in *Meiodorvillea* and *Eliberidens*. The antennae are described here as simple and clavate, as in some Dorvilleidae genera, but, in *Ceciamaralia* **gen. nov.** they are unique in having a longer and slender basal portion than the antennae from other genera.

Parapodial appendages

Ceciamaralia **gen. nov.** presents small papilliform ventral cirri only on a few anterior parapodia, while *Meiodorvillea Protodorvillea, Pettiboneia, Dorvillea, Schistomeringos* and *Eliberidens* present it on all parapodia, except the first; on the other hand, Eliberidens hartmannschroederae Hilbig, 1995 does not have ventral cirri.

Pettiboneia and *Ceciamaralia* **gen. nov.** also share the presence of dorsal cirri on anterior parapodia inserted at the base of parapodia, but they have two evident differences: i) *Ceciamaralia lanai* **gen. nov.** presents the dorsal cirri from parapodium 3 reaching the 9th, while in *Pettiboneia* they are present from parapodium 2 reaching at least the 7th, but in some species they can reach as far as the 25th, as in *Pettiboneia sanmartini* Aguirrezabalaga & Ceberio, 2003; ii) *Ceciamaralia lanai* **gen. et sp. nov.** has very long and large dorsal cirri, reaching more than three times the length of parapodia, while in *Pettiboneia* they are distinctively slender and shorter. Some species of Meiodorvillea, as Meiodorvillea minuta (Hartman, 1965), also present dorsal cirri in few anterior parapodia, but they small, papilliform/globular, from the 2nd parapodium and inserted in the middle of parapodium. Dorvillea and Schistomeringos also present a cylindrical dorsal cirri, but they are slender,

biarticulated and absent only on the first parapodium. In contrast, Ceciamaralia nonatoi gen. et sp. nov. does not have dorsal cirri.

Dorsal cirri x notopodium x notopodial lobe x branchiae

The presence of the dorsal cirri in *Ceciamaralia lanai* **gen. et sp. nov.** generated a debate regarding the origin of this appendage. It resembles the same structure observed in species of *Pettiboneia*, *Diaphorosoma* Wolf, 1986a and *Westheideia* Wolf, 1986a, but they are named differently. All species of these genera present this cylindrical appendage inserted at the base of parapodia. In *Diaphorosoma magnavena* Wolf, 1986a and *Westheideia minutimala* Wolf, 1986a, it is described as a notopodium bearing an internal acicula, and the former having an internal vascular loop, similar to a branchia. It is important to note that both species also present an appendage described as branchia inserted distally on the neuropodium and it also presents a vascular loop in that from *D. magnavena*. The notopodium in *Pettiboneia* species is described as a dorsal cirrus, also having internal acicula; some species, like *P. dibranchiata* (Armstrong & Jumars, 1978), also have a distal appendage in the neuropodium described as branchia, exactly as in *D. magnavena* and *W. minutimala*. Notopodium of *Ceciamaralia lanai* **gen. et. sp. nov.**, it shows a vascularized tissue and an acicula barely visible, so we decided to describe it as a dorsal cirrus because of its position and in agreement with ~~what~~how it is described in the literature.

Chaetae

The presence and format of furcate and geniculate chaeta shows a great diversity in Dorvilleidae. Of the two species of *Ceciamaralia* **gen. nov.**, *C. lanai* **gen. et sp. nov.** has furcate chaetae, while *C. nonatoi* **gen. et sp. nov.** has geniculate chaetae. This variation can also be observed in species of *Meiodorvillea;* *M. minuta* possesses furcate and *M. apalpata* possesses geniculate chaetae, while *M. penhae* and *M. jumarsi* present both types. Dorvillea and Schistomeringos are two similar genera, the former ~~does not have~~lacking furcate while the latter has them. All species of Protodorvillea and Eliberidens present furcate chaeta.

The blades of the compound chaeta of *Ceciamaralia* **gen. nov.** are smaller, straighter and more robust than in species of other genera in which the dorsalmost compound chaeta can be very long and spinigerous.

Jaw apparatus

The jaw apparatus of *Ceciamaralia* **gen. nov.** presents a distinct and specific morphology differing from that of all other species of the family. *Protodorvillea* and *Dorvillea* present a broad and robust jaw apparatus with a maxillae composed of strong basal plates, a carrier-like structure and four rows of many robust maxillary plates. The maxillae of *Pettiboneia* and *Meiodorvillea are* smaller, presenting only two rows of similar maxillary plates (species of *Pettiboneia have* some poorly sclerotized additional plates and they lack basal plates). On the other hand, the maxillae of *Eliberidens* do not have maxillary plates at all; they are composed only of superior and inferior long basal plates. The jaw apparatus of *Ceciamaralia* **gen. nov.** presents the posterior ligament fused to only one pair of long and serrated basal plates followed anteriorly by one pair of free maxillary plates presenting a long and thin distinct spine.

Cladistic analysis

The scarcity of taxonomic knowledge of Dorvilleidae is an obstacle to conduct phylogenetic analysis . But some studies ~~were~~ have been performed to elucidate relationships within the family; the most comprehensive was a cladistic one carried out by Eibye-Jacosbsen & Kristensen (1994) where they utilized all known genera of Dorvilleidae at that time as terminal taxa. Even with slow progress, molecular data is already aiding in the clarification of the phylogenetic relationships of dorvilleids, mainly *Ophryotrocha* (Heggøy, Schander & Åkesson, 2007), which is the genus with most sequence data. The ~~gap~~ lack of ~~in~~ molecular data ~~of~~ in other genera of the family opens space to specific cladistic studies with morphological data like Pleijel & Eide (2007), de Oliveira Bonaldo et al. (2022) and this present one. Those studies are important to ~~subsid~~provide data and results to future studies about the systematics of Dorvilleidae.

Ceciamaralia **gen. nov.** morphologically resembles other small- sized dorvilleids presented in the cladistics analysis by de Oliveira Bonaldo et al., 2022; hence we included both new species described here in the matrix of that study. The new genus appeared as monophyletic by the specific synapomorphies discussed here: ~~, which ranked it as a new genus,~~ the unique maxillae with only one pair of free maxillary plates, presenting a specific long and thin spine, the enlarged pharynx making the anterior region enlarged when it is retracted, which is not observed in others genera of the family, and the ventral cirrus present only in few anterior parapodia. The results of de Oliveira Bonaldo et al., 2022 placed *Meiodorvillea* as a sister group of all other genera presented in the analysis except *Eliberidens* and

Gymnodorvillea. The inclusion of the *Ceciamaralia* **gen. nov** species and the new characters in the analysis did not affect the previous relationship results among the genera or their monophyly .

Present and future

The study of small annelids has some obstacles like the difficulty to collect and identify them.~~,~~ In Brazil only nineteen species were registered before the present study, but this number does not reflect the true diversity of this family on the Brazilian coast. The continuous increase of scientific advancements and the development of new techniques and tools, researchers can perform new and more detailed analyses of unidentified species. These studies increase the systematic knowledge of the species and reveal the biodiversity of the group.

Museum collections play an important role since they preserve the organisms previously described and also contain unidentified organisms, which can hold much biological and ecological information aiding in several fields of study, mainly taxonomy and ecology. The specific identification of the organisms reveals records and occurrences of them aiding in biogeographical, ecological and distribution studies and ecological patterns subsidizing data of potential distribution (Budaeva et al., 2024). Morphological analysis can reveal new or different characters and structures supporting a refined description, reveal new species and aid the understanding of the phylogenetic relationship of the species of the group, as was demonstrated in the present study. That is why the education of taxonomists is important as well as encouraging them to identify, describe and study those neglected groups, enhancing the discovery of their biodiversity and knowledge.[CG11]

The incentive towards taxonomic studies and projects resulted in the first description of a new genus of Dorvilleidae in almost 25 years, presented here. Dorvilleids present a great morphological diversity, but our taxonomic knowledge of this group is still limited by the reasons mentioned before and the lack of incentive for taxonomist studies. This incentive is very important to aid researchers to better comprehend and classify those organisms, because their identification and description is not an easy task.

This study is a partial result obtained through the current Ph.D thesis of the first author, which is focused on the taxonomic study of Dorvilleidae; [CG12]~~P~~preliminary morphological analysis of museum materials of Dorvilleidae indicates

several new records of the family for the Brazilian coast and also potential new species to the family. In addition, we highlight the importance of the effort to collect new and fresh organisms in view of the fact that they can provide current biodiversity data and can also provide more accurate genetic information through molecular studies, since some groups like the Dorvilleidae present a huge gap in those data.

Key to species of *Ceciamaralia* gen. nov.

1a) A long, large dorsal cirri present on parapodia 3 to 7-9; furcate chaeta present in supra-acicular fascicle..…….…....…… Ceciamaralia lanai gen. et sp. nov.

1b) Dorsal cirri absent; geniculate chaeta present in supra-acicular fascicle……..…….…….…...… Ceciamaralia nonatoi gen. et sp. nov.

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