diversity

MDPI

Article

Synthesis of Brazilian Entomobryomorpha (Collembola: Hexapoda) with Special Emphasis on the Equatorial Oceanic Islands and Redescription of the First Species of Collembola Recorded in Brazil †

Estevam C. A. de Lima [1,2,*], Bruna C. H. Lopes [2,3], Misael A. Oliveira-Neto [2], Maria Cleide de Mendonça [1] and Douglas Zeppelini [2,3]

[1] Laboratório de Apterygotologia, Departamento de Entomologia, Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro 20940-040, Brazil; cleidecollembola@gmail.com
[2] Laboratório de Sistemática de Collembola e Conservação—Coleção de Referência de Fauna de Solo, CCBSA, Universidade Estadual da Paraíba Campus V, João Pessoa 58070-450, Brazil; brunacarolline@gmail.com (B.C.H.L.); misaeloliveira.nt@hotmail.com (M.A.O.-N.); zeppelini@daad-alumni.de (D.Z.)
[3] Programa de Pós-Graduação em Ciências Biológicas—Zoologia, Departamento de Biologia, Universidade Federal da Paraíba Campus I, Centro de Ciências Exatas e da Natureza, João Pessoa 58051-900, Brazil
* Correspondence: estevam.araujo@gmail.com
† urn:lsid:zoobank.org:pub:FE46ACFC-00B4-4CE8-B1C9-F6D8C97B66BD.

check for updates

Citation: de Lima, E.C.A.; Lopes, B.C.H.; Oliveira-Neto, M.A.; de Mendonça, M.C.; Zeppelini, D. Synthesis of Brazilian Entomobryomorpha (Collembola: Hexapoda) with Special Emphasis on the Equatorial Oceanic Islands and Redescription of the First Species of Collembola Recorded in Brazil. *Diversity* **2022**, *14*, 553. https://doi.org/10.3390/d14070553

Academic Editor: Roberto Pizzolotto

Received: 9 June 2022
Accepted: 7 July 2022
Published: 9 July 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Abstract: We presented a synthesis of Brazilian Entomobryomorpha species and new records of the Brazilian oceanic islands located in the Equatorial Atlantic. In this work, we observed the global distributions of the species that inhabit the Brazilian oceanic islands. We presented distribution maps for all species found on the islands and the closest records on the continent. Our study showed that species that occur in the islands also occur in the American continent, mainly in the neotropical region, or are widespread. We established a new neotype of the first species of Collembola described in Brazil together with a detailed morphological study.

Keywords: insular fauna; distribution; Collembola; neotropical fauna

1. Introduction

Entomobryomorpha is the most diverse order of Collembola, with more than 4000 described species in 200 genera, distributed among eight families and four superfamilies: Isotomoidea Schäffer, 1896 [1]; Entomobryoidea Womersley, 1934 [2]; Tomoceroidea Szeptycki, 1979 [3]; Coenaletoidea Soto-Adames et al. 2008 [4]. This order can be found in all biogeographic regions [5].

Among the most diverse families are Isotomidae (Isotomoidea), Entomobryidae and Paronellidae (Entomobryoidea). The Isotomidae family Schäffer, 1896, contain four subfamilies, 112 genera and about 1440 species. Entomobryidae is the largest family of Collembola, with about 1900 species in 64 genera. Paronellidae is also distributed worldwide, with about 550 species in 38 genera.

Abrantes et al. 2012 [6] summarized a list of Brazilian Collembola with 102 species of Entomobryomorpha. In this summary, the only species recorded on a Brazilian oceanic island was *Seira musarum* Ridley, 1890, which is the first species of Collembola recorded in Brazil. In the description of this species, Ridley [7] mentions: "Very abundant between the wet bases of the petioles of the bananas, at the base of the Peak (...) these small Collembola have been much neglected by collectors, and it is most probable that this species was introduced in the bananas."

After Ridley, in the Brazilian oceanic islands, the only Collembola fauna survey was made by Lima and Zeppelini, 2015 [8] at Fernando de Noronha Archipelago, which presented 13 morphospecies and 9 species; later, Cipola et al. 2019 [9] had access to this material and registered *Seira dowlingi* in Fernando de Noronha, and Rafael et al. 2020 [10] presented a checklist with taxonomic advances from the 2015 survey.

The growing human impact on biodiversity requires great efforts in the development of conservation strategies. These efforts must be a priority in oceanic islands. These environments have great barriers to dispersion and colonization, especially for terrestrial fauna, which generally present very particular diversities [8]. In this way, the survey of Collembola fauna is important for conservation, due to its known bioindicator potential.

In this study, we present the taxonomic advances from Lima and Zeppelini, 2015 [8], Cipola et al. 2019 [9] and Rafael et al. 2020 [10] (in Fernando de Noronha) and the results of the first surveys for the Rocas Atoll and São Pedro e São Paulo Archipelago [8–10]. We present new records of Isotomidae, Entomobryidae and Paronellidae, as well as an update on the distribution and habitat synthesis of the Brazilian Entomobryomorpha, including contributions after Abrantes et al. 2012 [6].

2. Materials and Methods

2.1. Study Area

This survey was conducted in 3 Brazilian oceanic islands (2 Archipelagos and 1 Atoll) located in the Equatorial Atlantic Ocean, all belonging to the Brazilian national territory, as follows: Fernando de Noronha Archipelago—FN (3°50′ S, 32°15′ O), São Pedro e São Paulo Archipelago—SPSP (0°55′ N, 29°20′ O) and Rocas Atoll—RA (3°51′ S, 33°48′ O), about 360, 1010 and 267 km from the American continent, respectively (Figure 1). All maps were generated using Geographic Information System QGIS 3.16. Base maps from Google Satellite were used. Datum: SIRGAS 2000.

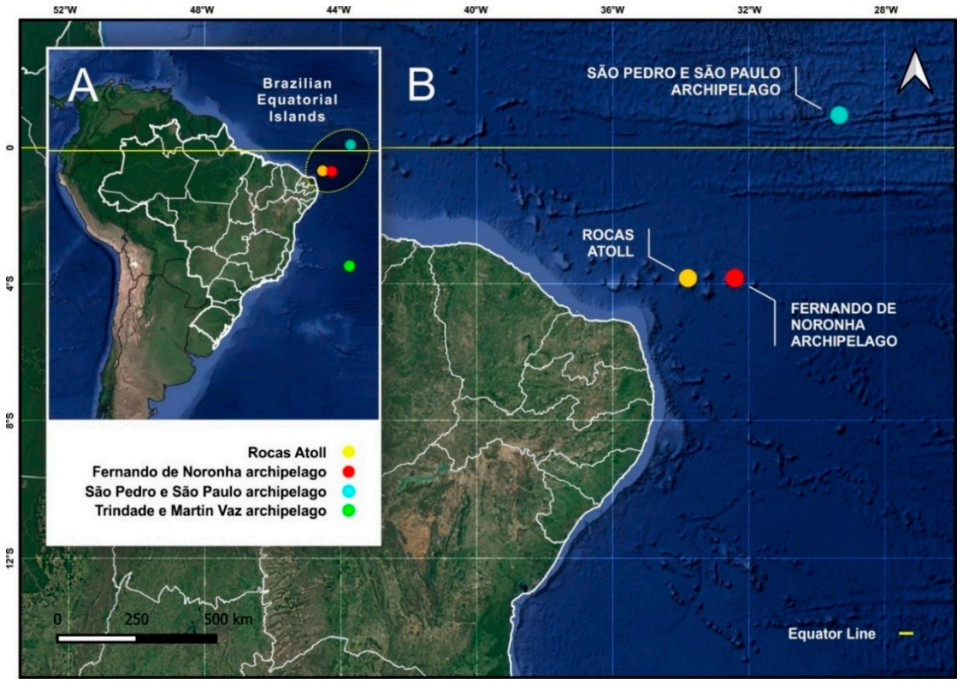

Figure 1. Brazilian oceanic islands. (**A**). Geographical position of all Brazilian oceanic islands showing the equatorial islands. (**B**). Details of the geographic position of the Brazilian equatorial oceanic islands.

2.2. Taxonomic Nomenclature of Seira Musarum

The terminology used in the descriptions mainly follows: [11] to labial chaetotaxy, with additions of [12,13] to labial palp papillae; [14] to labral chaetotaxy; [15] to dorsal

head chaetotaxy, with additions of [4,16] for abdomen V; to S-chaetotaxy with additions of [4,17] to dorsal chaetotaxy and [18] to the manubrial formula of ventral chaetae. For comparisons of the dorsal chaetotaxy, we also used the system of macrochaetae fields in [19], with adaptations provided by [18].

2.3. Sample Procedure

The Entomobryomorpha specimens were collected in three coastal environmental areas: the intertidal zone in sand or rock areas, without vegetation, referred to as sandy beach (SB); the sloping land closest to the intertidal zone, with vegetation, referred to as slope forest (SF) and the forest more distant from the beach, referred to as top forest (TF); the latter area only exists in Fernando de Noronha (Figure 2).

Collembola were captured with Berlese–Tullgren funnels (in SF and TF), and the washing technique and the extraction of floating specimens was carried out manually with aid of brushes (in SB) [8].

Specimens were preserved in ethanol, cleared in Nesbitt's solution and then mounted on glass slides in Hoyer's medium. Morphological analyses and measurements were obtained using a Zeiss Axio Scope A1 microscope with Axiocam 105 color and Zen 2 Blue software, and for analysis with a Scanning Electronic Microscope (SEM), specimens were dehydrated with ethanol, dried in a critical point dryer, and covered in gold. All species was deposited in the Coleção de Referência de Fauna de Solo (CRFS) at the Universidade Estadual da Paraíba, João Pessoa, PB, Brazil.

2.4. Species List of Brazilian Entomobryomorpha

Species records, collection location, habitat and biotope information for each species were modified from [6], which includes: newly described species, new records published between 2012 and 2022 and a survey of the Brazilian oceanic islands between 2012 and 2017. Publications that do not provide identifications of species with epithet have been omitted. Information on the world distribution of species was based on [20] and original new records. The biogeographical distribution regions according to [21], modified by [20,22], were as follows: Boreal (Bor) included regions 1–8, Paleotropical (Pal) regions 9–23, Neotropical (Neo) regions 24–30, South African (SAf) region 31, Australian (Aus) regions 32–34 and Antarctic (Ant) regions 35–37. Species restricted to Brazil were based on [20], defining the Brazilian biogeographic subregions: Amazon (Amz), North and Central Brazil (NCB) and Pampa (Pam), corresponding to biogeographic regions 26, 27 and 29, respectively [20]. Species distributed in at least four of the major regions (Neo, Pal, etc.) are considered widespread (WSP).

2.5. Abbreviations

Brazilian states, oceanic island and sites sampled: AC—Acre; AL—Alagoas; AM—Amazonas; AP—Amapá; BA—Bahia; CE—Ceará; ES—Espiro Santo; GO—Goiás; MA—Maranhão; MG—Minas Gerais; MS—Mato Grosso do Sul; MT—Mato Grosso; PA—Pará; PB—Paraíba; PE—Pernambuco; PI—Piauí; PR—Paraná; RJ—Rio de Janeiro; RN—Rio Grande do Norte; RO—Rondônia; RR—Roraima; RS—Rio Grande do Sul; SC—Santa Catarina; SE—Sergipe; SP—São Paulo; SPSP—São Pedro e São Paulo; TO—Tocantins; FN—Fernando de Noronha; RA—Rocas Atoll; TR—Trindade e Martim Vaz. SB—sandy beach sites; SF—slope forest site; TF—top forest site.

Taxonomic: a.a.—apical appendage; a—anterior; Abd.—abdominal segment; Ant.—antennal segment; b.c.—basal chaeta; Cd.—cephalic diagonal; l.p.—lateral process; mac—macrochaetae; meso—mesochaetae; mic—macrochaetae; m—medial; PC—papillary crests; Pl—prelabral, p—posterior; PSP—pseudopore; sens—sens, specialized ordinary chaetae (sensillum); Th.— thoracic segment, Tita—tibiotarsus.

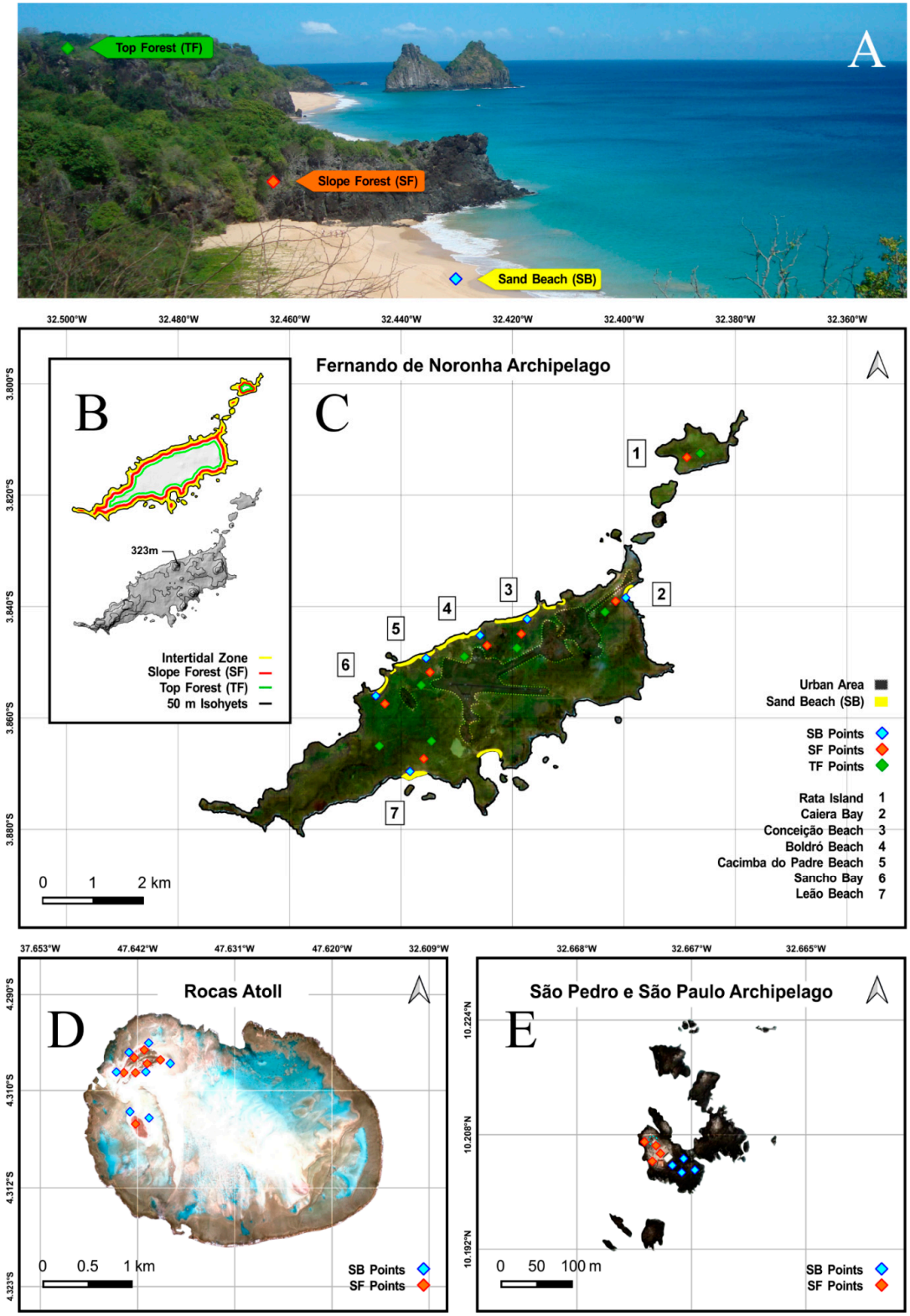

Figure 2. Maps of distribution sites sampled: (**A**), example of sampled environments; (**B**), map with delimitation of areas and elevation map; (**C**), Fernando de Noronha sites; (**D**), Rocas Atoll sites; (**E**), São Pedro e São Paulo sites.

3. Results

3.1. Entomobryomorpha Survey of the Brazilian Oceanic Islands

Twenty Entomobryomorpha species are recorded in Brazilian oceanic islands distributed in the families: Isotomidae, Entomobryidae and Paronellidae. Except *Archisotoma jariani* Lima, Zeppelini & Mendonça 2019 and *Psammisotoma* sp., all species found in the islands studied have distribution in the American continent (Table 1).

Table 1. Entomobryidae species recorded in Fernando de Noronha, São Pedro e São Paulo and Rocas Atoll. Abundance in environmental areas (SB, SF and TF), and biogeographic region of occurrence of the species. Neo, neotropical species, WSP, occurs in at least 3 biogeographic regions. *, new records; -, non-existent environment.

		Species	SB	SF	TF	Region
FN	Isotomidae	*Folsomides centralis* Denis, 1931 *	0	35	7	WSP
		Folsomides parvulus Stach, 1922 *	0	80	111	WSP
		Folsomina onychiurina Denis, 1931 *	0	59	34	WSP
		Hemisotoma thermophila Axelson, 1900	0	223	153	WSP
		Isotomiella nummulifer Deharveng & Oliveira, 1990 *	0	12	45	WSP
		Isotomodes cariocus Thibaud & Palacios-Vargas, 1999 *	0	82	108	Brazil
	Entomobryidae	*Entomobrya atrocincta* Schött, 1896	0	0	1	Nea
		Lepidocyrtus nigrosetosus Folsom, 1927	0	841	498	WSP
		Lepidocyrtus violaceus Fourcroy, 1785	0	0	1	WSP
		Pseudosinella biunguiculata Ellis, 1967	0	51	61	Neo
		Seira atrolutea Arlé, 1939 *	0	4	0	Brazil
		Seira musarum Ridley, 1890	0	3	0	WSP
	Paronellidae	*Cyphoderus agnotus* Börner, 1906	0	3	0	Neo
		Cyphoderus caetetus Zeppelini & Oliveira, 2016	0	3	15	Brazil
		Cyphoderus innominatus Mills, 1938	0	3	151	Neo
		Cyphoderus similis Folsom, 1927	0	43	20	WSP
		Trogolaphysa cotopaxiana Thibaud & Najt, 1988 *	0	11	6	Neo
SPSP	Isotomidae	*Hemisotoma thermophila* Axelson, 1900 *	0	2	-	WSP
		Proisotoma immersa Folsom, 1924 *	0	49	-	Nea
	Entomobryidae	*Seira musarum* Ridley, 1890 *	243	278	-	WSP
RA	Isotomidae	*Archisotoma jariani* Lima, Zeppelini & Mendonça 2019	462	0	-	RA
		Hemisotoma thermophila Axelson, 1900 *	0	2	-	WSP
		Psammisotoma sp. *	0	29	-	RA
	Entomobryidae	*Seira musarum* Ridley, 1890 *	0	6	-	WSP
	Paronellidae	*Cyphoderus innominatus* Mills, 1938 *	0	3	-	Neo

In Fernando de Noronha, six Isotomidae, six Entomobryidae and five Paronellidae were found. Of this total (15 spp.), eight are widespread, four are exclusive species from Brazil, five are neotropical and one occurs in the Nearctic region (Table 1).

In São Pedro e São Paulo, three species were found, two Isotomidae and one Entomobryidae; these species have known distribution in the neotropical region and are widespread and restricted to Brazil, respectively (Table 1).

On Rocas Atoll, five species were found, three Isotomidae and one Paronellidae. Rocas Atoll was the only oceanic island that presented one endemic species (*A. jariani*), a possible new endemic species (*Psammisotoma* sp.), one distributed in Brazil and another in the neotropical region (Table 1).

The species *Hemisotoma thermophila* and *Seira musarum* occur in the three studied islands, and *Cyphoderus innominatus* occurs in Fernando de Noronha and Rocas Atoll. The only species of Entomobryomorpha that are shared between the islands are as follows:

Entomobryomorpha Börner, 1913;

Isotomoidea Szeptycki, 1979;

Isotomidae Schäffer, 1896.
Archisotoma jariani Lima, Zeppelini & Mendonça, 2019
Brazilian Oceanic Island Records: RA (3°51′26.39″ S; 33°48′54.77″ W), SB, 14 Oct 2015, E. C. A. Lima leg., CRFS #15071—15073, 15076. RA (3°51′33.91″ S; 33°48′58.48″ W), SB, 13 Oct 2015, E. C. A. Lima leg., CRFS #15074-15075.
Brazil Occurrence: RA endemic species (Figure 3A).

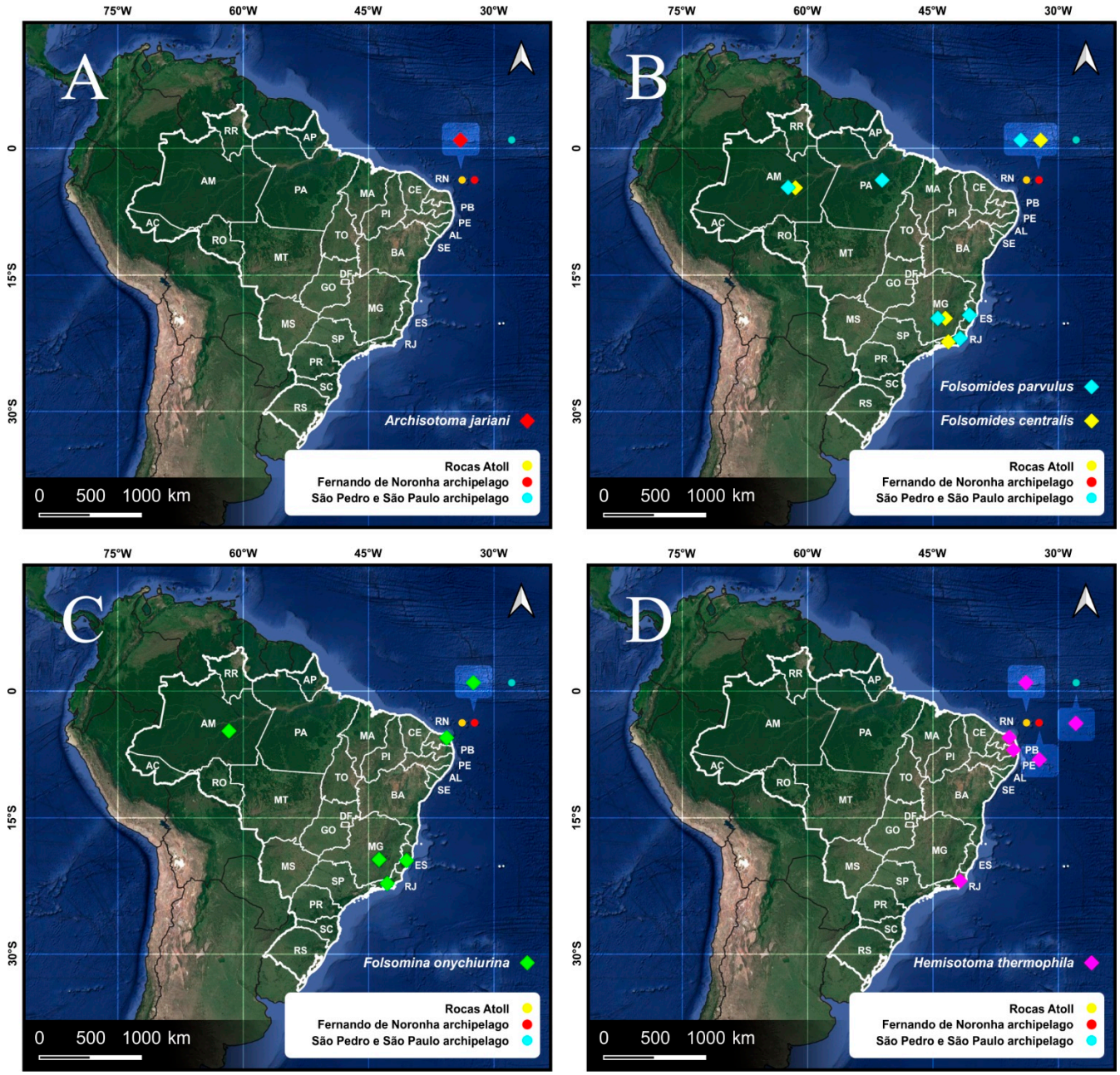

Figure 3. Distribution map for Isotomidae records in Brazil mainland and oceanic islands. (**A**). *Archisotoma jariani*; (**B**). *Folsomides parvulus* and *F. centralis*; (**C**). *Folsomina onychiurina*; (**D**). *Hemisotoma thermophila*.

Biogeographic distribution: *Achisotoma* distribution see Lima et al. 2019.
Folsomides centralis Denis, 1931
Brazilian Oceanic Island Records: FN (3°51′21.93″ S; 32°26′37.78″ W), SF, 31 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14785—14788.

Brazil Occurrence: RJ, MG, AM and FN (Figure 3B).
Biogeographic distribution: 6, 8, 15, 18, 20, 21, 22, 23, 24a, 24b, 26, 27, 28, 32. Widespread species.
Folsomides parvulus Stach, 1922
Brazilian Oceanic Island Records: FN (3°52′8.88″ S; 32°26′13.57″ W), SF, 01 Aug 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14771—14783. FN (3°51′50.41″ S; 32°26′5.44″ W), TF, 01 Aug 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14791, #14793. FN (3°52′8.88″ S; 32°26′13.57″ W), SF, 01 Aug 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14794. FN (3°50′31.85″ S; 32°24′14.74″ W), TF, 07 Aug 2012, E. C. A. Lima & D. D. Silva leg., CRFS #14775. FN (3°48′45.61″ S; 32°23′26.17″O), SF, 19 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #15066—15067. FN (3°48′45.06″ S; 32°23′14.07″ W), TF, 19 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #15068. FN (3°50′43.00″ S; 32°25′34.04″ W), SF, 20 Jul 2012, E. C. A Lima & D. Zeppelini leg., CRFS #14769—14770, #14776, #14780, #15165. FN (3°50′58.48″ S; 32°26′3.83″ W), SF, 25 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14772, #14778, #14789. FN (3°51′14.32″ S; 32°26′12.62″ W), TF, 25 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14773—14774. FN (3°51′14.32″ S; 32°26′12.62″ W), TF, 25 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14779, #14781—14782, #14784, #14790. FN (3°51′3.73″ S; 32°26′0.38″ W), SF, 27 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #15164. FN (3°51′52.31″ S; 32°26′38.80″ W), TF, 31 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14777. FN (3°51′21.93″ S; 32°26′37.78″ W), SF, 31 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14792.
Brazil Occurrence: RJ, MG, Espírito Santo, AM, Pará and FN (Figure 3B).
Biogeographic distribution: 1, 2a, 2b, 3a, 3b, 4, 5, 6, 7a, 7b, 8, 9, 13, 14, 15, 17, 19, 20, 21, 23, 24a, 24b, 26, 27, 28, 29, 32, 34, 35. Widespread species.
Folsomina onychiurina Denis, 1931
Brazilian Oceanic Island Records: FN (3°51′50.41″ S; 32°26′5.44″ W), TF, 01 Aug 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14805. FN (3°52′8.88″ S; 32°26′13.57″ W), SF, 01 Aug 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14806. FN (3°51′14.32″ S; 32°26′12.62″ W), TF, 25 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14807, #14810. FN (3°50′58.48″ S; 32°26′3.83″ W), SF, 25 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14808—14809, #14811—14817. FN (3°51′21.93″ S; 32°26′37.78″ W), SF, 25 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14815, #14816. FN (3°51′14.32″ S; 32°26′12.62″ W), TF, 25 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #15166.
Brazil Occurrence: AM, RN, Espírito Santo, MG, RJ and FN (Figure 3C).
Biogeographic distribution: 2a, 3a, 3b, 4, 5, 7a, 7b, 8, 9, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24a, 24b, 26, 27, 28, 29, 32, 33, 34, 35. Widespread species.
Hemisotoma thermophila Axelson, 1900
(as *Cryptopgus* sp1 and sp2 Lima & Zeppelini, 2015)
Brazilian Oceanic Island Records: FN (3°52′8.88″ S; 32°26′13.57″ W), SF, 01 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14853—14859, #15057. FN (3°51′21.93″ S; 32°26′37.78″ W), SF, 31 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14839. FN (3°51′52.31″ S; 32°26′38.80″ W), TF, 31 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14840, #14841, #14842, #14844, #14865, #14877. FN (3°48′45.61″ S; 32°23′26.17″ W), SF, 19 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14838, #15064. FN (3°48′45.06″ S; 32°23′14.07″ W), TF, 19 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14878—14879, #15053. FN (3°51′14.32″ S; 32°26′12.62″ W), TF, 25 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14860—14861. FN (3°50′48.92″ S; 32°25′13.61″ W), TF, 26 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #9616, #9552—9554, #15078. FN (3°50′36.76″ S; 32°25′12.64″ W), SF, 26 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #9534—9551, #9555—9561, #15049—15052. FN (3°51′3.73″ S; 32°26′0.38″ W), SF, 27 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14880—14883, #14885—14927, #14845—14852. FN (3°50′18.66″ S; 32°24′3.09″ W), SF, 07 Aug 2012, E. C. A. Lima & D. D. Silva leg., CRFS #14843, #14862—14864, #14870—14876, #14884. FN (3°50′31.85″ S; 32°24′14.74″ W), TF, 07 Aug 2012, E. C. A. Lima & D. D. Silva leg., CRFS #14866—14869.

Brazil Occurrence: Paraíba and RJ. FN, RA and SPSP (Figure 3D).
Biogeographic distribution: 1, 2a, 3a, 3b, 4, 5, 6, 7a, 7b, 7c, 8, 9, 12, 13, 15, 17, 18, 20, 22, 23, 24a, 24b, 26, 27, 28, 29, 30, 32, 33, 34, 35. Widespread species.
Isotomiella nummulifer Deharveng & Oliveira, 1990
Brazilian Oceanic Island Records: FN (3°51′52.31″ S; 32°26′38.80″ W), TF, 31 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14795, #14798—14799. FN (3°51′14.32″ S; 32°26′12.62″ W), TF, 25 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14796. FN (3°50′54.21″ S; 32°25′45.56″ W), TF, 20 Jul 2012, E. C. A Lima & D. Zeppelini leg., CRFS #14797. FN (3°52′8.88″ S; 32°26′13.57″ W), SF, 01 Aug 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14800—14802, #14804. FN (3°50′18.66″ S; 32°24′3.09″ W), SF, 07 Aug 2012, E. C. A. Lima & D. D. Silva leg., CRFS #14803.
Brazil Occurrence: AM, RJ and FN (Figure 4A).

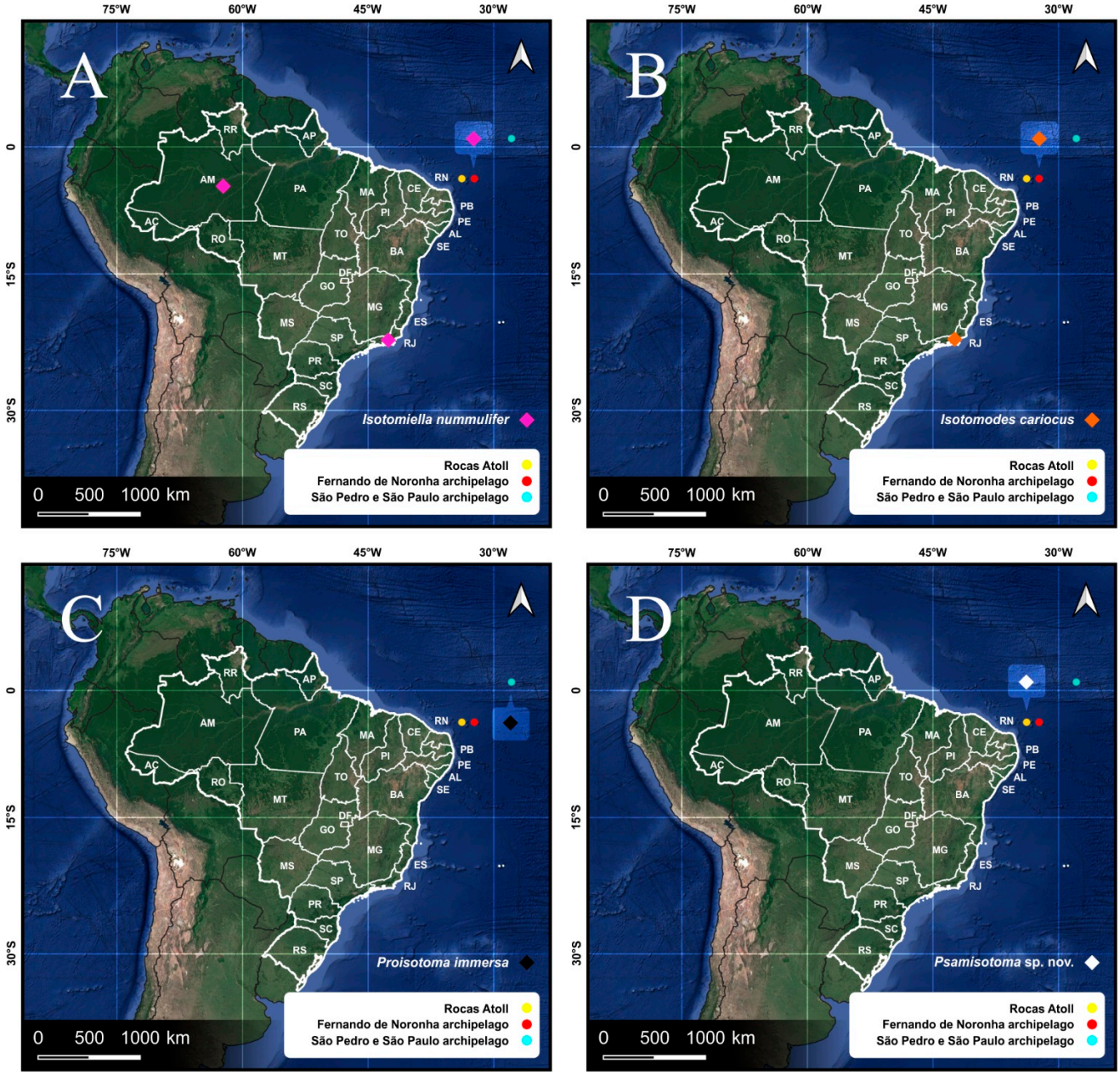

Figure 4. Distribution map for Isotomidae records in Brazil mainland and oceanic islands. (**A**). *Isotomiella nummulifer*; (**B**). *Isotomodes cariocus*; (**C**). *Proisotoma immersa*; (**D**). *Psammisotoma sp.*

Biogeographic distribution: 13, 18, 19, 24a, 26, 27. Widespread species.
Isotomodes cariocus Thibaud & Palacios-Vargas, 1999
Brazilian Oceanic Island Records: FN (3°50′43.00″ S; 32°25′34.04″ W), SF, 20 Jul 2012, E.C.A Lima & D. Zeppelini leg., CRFS #14820, #14831. FN (3°50′54.21″ S; 32°25′45.56″ W), TF, 20 Jul 2012, E. C. A Lima & D. Zeppelini leg., CRFS #14823, #14827, #14830, #14835. FN (3°50′58.48″ S; 32°26′3.83″ W), SF, 25 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14826, #14828, #14836. FN (3°51′14.32″ S; 32°26′12.62″ W), TF, 25 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14833. FN (3°50′48.92″ S; 32°25′13.61″ W), TF, 26 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #9600—9610, #9613. FN (3°50′36.76″ S; 32°25′12.64″ W), SF, 26 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #9611—9612. FN (3°51′21.93″ S; 32°26′37.78″ W), SF, 31 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14818—14819, #14824—14825, #14832. FN (3°51′52.31″ S; 32°26′38.80″ W), TF, 31 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14834, #14837, #14821, #14822. FN (3°50′31.85″ S; 32°24′14.74″ W), TF, 07 Aug 2012, E. C. A. Lima & D. D. Silva leg., CRFS #14829.
Brazil Occurrence: RJ and FN (Figure 4B).
Biogeographic distribution: Endemic species of Brazil.
Proisotoma immersa Folsom, 1924
Brazilian Oceanic Island records: SPSP (0°55′0.09″N, 29°20′45.36″O) SF, 01 May 2017, E. C. A. Lima & D. Zeppelini Leg., CRFS #15047.
Brazil Occurrence: SPSP (Figure 4C).
Biogeographic distribution: 7a, 7b, 8, 24a. *Proisotoma immersa* is distributed in neotropical and Nearctic regions. The closest registration to the SPSP was made by Cutz-Pool and Vázquez-González, 2012 in México, Quintana Roo, Felipe Carrillo Puerto.
Psammisotoma Greenslade & Deharveng, 1986
Psammisotoma sp.
Brazilian Oceanic Island Records: RA (3°51′27.44″ S; 33°48′53.66″ W), SF, 14 Oct 2015, E.C. A. Lima leg., CRFS #15089—15093, #15182, #15185. RA (3°51′33.33″ S; 33°48′54.05″ W), SF, 08 Oct 2015, E. C. A. Lima leg., CRFS #15181, #15183—15184, #15092.
Brazil Occurrence: RA (Figure 4D).
Biogeographic distribution: RA.
Remarks. *Psammisotoma* sp. is similar to *P. restingae* Abrantes & Mendonça, 2009 (Brasil, RJ) in many ways, such as the habitus, sensory organ of antennal segment III, number of eyes, furcal chaetotaxy and mucro. *Psammisotoma* sp. present manubrium anteriorly with 30–36 chaetae and a lateral line with 6 + 6 to 8 + 8, and 1 + 1 to 2 + 2 distal spine-like chaetae, while *P. restingae* present manubrium anteriorly normally with 44 chaetae and a lateral line with 8 + 8, and 2 + 2 distal spine-like chaetae. Abrantes and Mendonça, 2009 [23] mention possible variations such as reduced chaetotaxy on the manubrium, dens with small numbers of setae and only one pair of spine-like chaetae on the internal margin, which could be attributed to different ontogenetic stages.

These variations and the impossibility of analyzing the *P. restingue* type did not allow the establishment of a new taxon.

Entomobryoidea Womersley, 1934
Entomobryidae Schäffer, 1896
Entomobrya atrocincta Schött, 1896
Brazilian Oceanic Island Records: FN (3°51′52.31″ S; 32°26′38.80″ W), TF, 31 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #15100.
Brazil Occurrence: FN (Figure 5A).

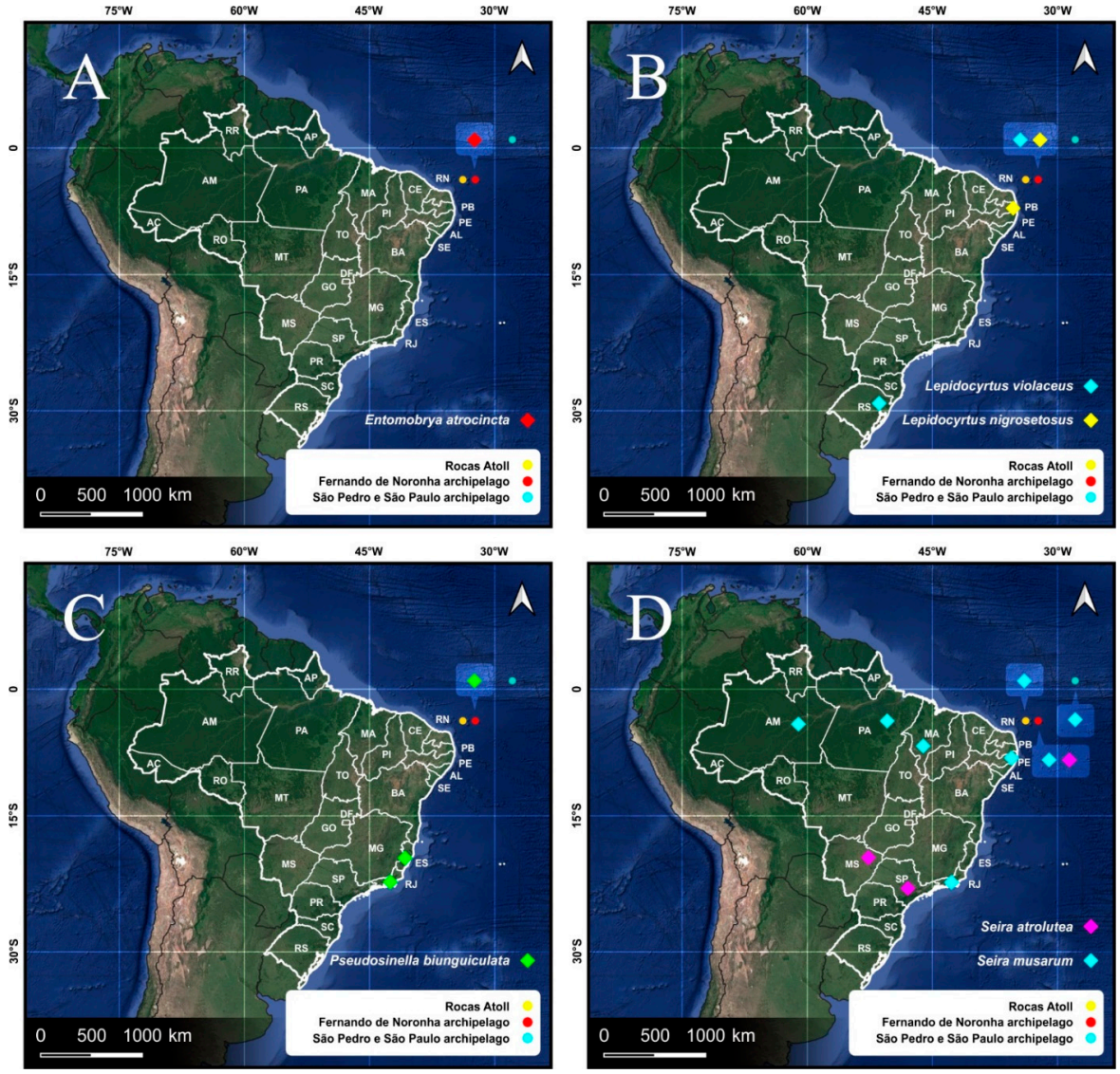

Figure 5. Distribution map for Entomobryidae records in Brazil mainland and oceanic islands. (**A**). *Entomobrya atrocincta*; (**B**). *Lepidocyrtus violaceus* and *L. nigrosetosus*; (**C**). *Pseudosinella biunguiculata*; (**D**). *Seira atrolutea* and *Seira musarum*.

Biogeographic distribution: 7a, 7b, 8. Nearctic species.

Lepidocyrtus nigrosetosus Folsom, 1927

(as *Pseudosinella flatua*, in Lima & Zeppelini (2015))

Brazilian Oceanic Island Records: FN (3°48′45.61″ S; 32°23′26.17″ W), SF, 19 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14942—14943, #14945—14954, #14956—14959. FN (3°50′18.66″ S; 32°24′3.09″ W), SF, 07 Aug 2012, E. C. A. Lima & D. D. Silva leg., CRFS #14156—14165, #14241—14307, #14320—14326, #14377—14379. FN (3°50′31.85″ S; 32°24′14.74″ W), TF, 07 Aug 2012, E. C. A. Lima & D. D. Silva leg., CRFS #14166—14169, #14372, #14380—14383, #14387—14398. FN (3°50′43.00″ S; 32°25′34.04″ W), SF, 20 Jul 2012, E. C. A Lima & D. Zeppelini leg., CRFS #14227, #14236—14237, #14374—14376, #14228—14235. FN (3°50′58.48″ S; 32°26′3.83″ W), SF, 25 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14337—14347. FN (3°51′14.32″ S; 32°26′12.62″ W), TF, 25 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14230, #14232, #14238—14240, #14327—14331, #14384—14386. FN (3°51′21.93″ S; 32°26′37.78″ W), SF, 31 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14138—14140, #14142—14155, #14369—14371, #14373. FN (3°51′3.73″ S; 32°26′0.38″ W), SF, 27 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14332—14336, #14348—14367. FN

(3°51′52.31″ S; 32°26′38.80″ W), TF, 31 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14121—14137. FN (3°51′52.31″ S; 32°26′38.80″ W), TF, 31 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14141, #14308—14319, #14365, #14368. FN (3°48′45.06″ S; 32°23′14.07″ W), TF, 19 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14944, #14955, #14960.
Brazil Occurrence: Paraíba and FN (Figure 5B).
Biogeographic distribution: 24a, 24b, 26, 27, 28. Neotropical species.
Lepidocyrtus violaceus Fourcroy, 1785
Brazilian Oceanic Island Records: FN (3°50′54.21″ S; 32°25′45.56″ W), TF, 20 Jul 2012, E. C. A Lima & D. Zeppelini leg., CRFS #14928. Brazil Occurrence: FN (Figure 5B).
Biogeographic distribution: 1, 2a, 2b, 4, 5, 7a, 8, 17, 20, 24a, 37. The closest registration to the FN was made by Cutz-Pool & Vázquez-González, 2012 in México, Quintana Roo, Felipe Carrillo Puerto. Widespread species.
Pseudosinella biunguiculata Ellis, 1967
(as *Pseudosinella aera* and *Pseudosinella* sp., in Lima & Zeppelini, 2015)
Brazilian Oceanic Island Records: FN (3°50′54.21″ S; 32°25′45.56″ W), TF, 20 Jul 2012, E.C.A Lima & D. Zeppelini leg., CRFS# 15155. FN (3°51′52.31″ S; 32°26′38.80″ W), TF, 31 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #15102—15106, #15123—15125. FN (3°51′14.32″ S; 32°26′12.62″ W), TF, 25 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #15150—15153, #15156, #15158, #15160. FN (3°51′3.73″ S; 32°26′0.38″ W), SF, 27 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #15154, #15159. FN (3°50′58.48″ S; 32°26′3.83″ W), SF, 25 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #15157.
Brazil Occurrence: RJ and FN (Figure 5C).
Biogeographic distribution: 24a, 24b, 27. Neotropical species.
Seiridae Yosii, 1961
Seira atrolutea (Arlé, 1939)
Brazilian Oceanic Island Records: FN (3°48′45.61″ S; 32°23′26.17″ W), SF, 19 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #15186.
Brazil Occurrence: SP, MS and FN (Figure 5D).
Biogeographic distribution: 27. Brazilian species.
Seira musarum Ridley, 1890
Syn.: *Seira dowlingi* (Wray, 1953)
Neotype designation. *Seira musarum* was first described by Ridley, 1890 based on specimens from the Fernando de Noronha Archipelago, Brazil. It is probable that Ridley's original collection was deposited at the British Museum, London; nevertheless, efforts to trace it failed, and the type material probably no longer exists. Thus, following Article 75.3.4 of the International Code of Zoological Nomenclature (ICZN) [24], here, we designate a female as a neotype on a slide; SF, Fernando de Noronha (3°50′44.85″ S; 32°25′44.80″ W), PE, Brazil. 17.VII.2008. D. Zeppelini leg., deposited at CRFS # 15119.

Redescription. Measurements according to Table 2. The habitus typical of genus (Figure 6A) and coloration are according to Ridley, 1890 [7] and the update by Cipola et al., 2019 [9]. Scales are presented from Ant I to the basal third of Ant III, all over the head, thorax, abdomen, legs (except empodia) and manubrium, anterior collophore and ventral dens. Chaetae and scale type are according to Figure 6(B1–15).

Table 2. *Seira musarum*—measurements (µm) of neotype body parts.

Whole body	1479.19
Cd.	284.42
Ant. I	82.35
Ant. II	148.13
Ant. III	211.96
Ant. IV	272.01
Mucro	11.31
Dens	407.57
Manubrium	298.90
Unguis III	45.36
Unguiculus III	26.96
Tita. III	363.50
Femur III	194.69

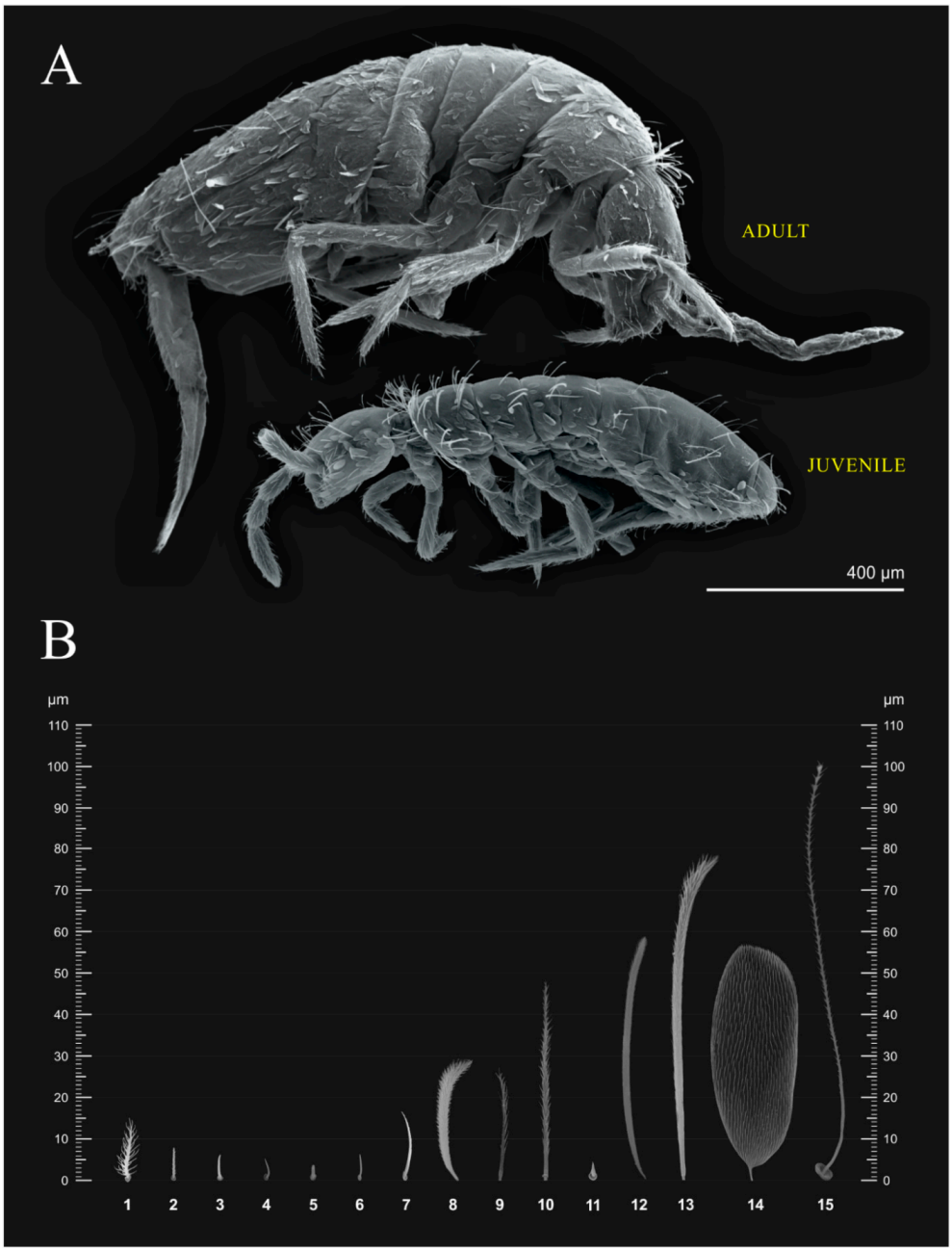

Figure 6. *Seira musarum* SEM (lateral view). (**A**). Habitus adult and juvenile; (**B**), general body chaetae; (**B1**), microchaeta with long ciliation; (**B2**), wrinkly sens; (**B3**), finger-shaped sens; (**B4**), microchaetae smooth; (**B5**), rod sens; (**B6**), smooth microchaeta; (**B7**), serrate chaetae; (**B8**), fan-shape chaeta; (**B9**), chaetae ciliated; (**B10**), strait macrochaeta with long ciliation; (**B11**), labial r macrochaetae; (**B12**), macrochaetae ciliated with rounded apex; (**B13**), macrochaetae ciliated with trucated apex; (**B14**), ordinary scale; (**B15**), bothriotrichum.

Antenna (Figure 7A). Ant IV (Figure 7B): not annulated, without an apical bulb, with four chaetae type according to Figure 6(B1–4). Ant III (Figure 7C): distal with two apical organs as rod sens (Figure 6(B5)), three guard sens (Figure 7C), numerous mic and mesochaetae with long ciliation (Figure 6(B1)) and two sens types: wrinkly and finger-shaped sens (Figure 6(B2,3)). Ant II (Figure 7D): numerous mic and mesochaetae with long ciliation (Figure 6(B1)), numerous wrinkly and bristle-like sens (Figure 6(B2,6)) and one rod sens (Figure 6(B5)) and three smooth microchaetae at the base of Ant II (Figure 6(B4)). Ant I (Figure 7E): numerous mic and meso with long ciliation (Figure 6(B1,7)), numerous

wrinkly and bristle-like sens (Figure 6(B2,6)) and four microchaetae (Figure 6(B4)) in the antennobasal plate with three pseudopores, two internal and one external (Figure 7E).

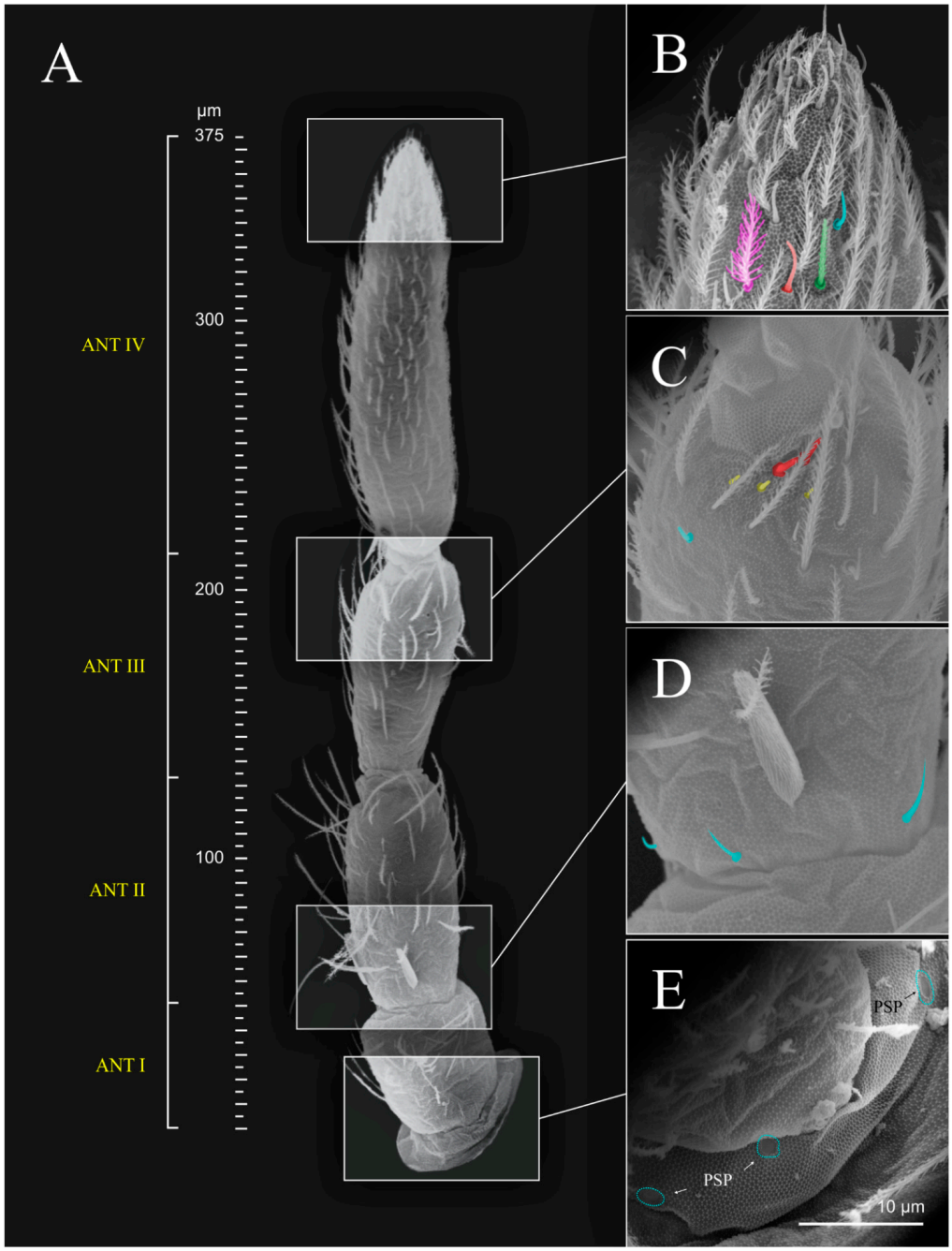

Figure 7. *Seira musarum* SEM. (**A**), antenna (right side) lateral view; (**B**), antennal segment IV apex, with the different types of chaetae shown in color; (**C**), antennal segment III apex, detail of the apical organ; (**D**), antennal segment II base with colored details for the microchaetae; (**E**), antennal segment I base, with dashed lines in the pseudopores.

Head (Figures 8 and 9). Prelabral and labral formula 4/5, 5, 4 a, m, a, p, smooth and pl ciliated (Figures 8A and 6(B7)), a1 longer than a2, others subequal in length, four labral papillary crests Pc1–2 (Figure 8B). Maxillary palp with apical appendage (a.a.) and basal chaeta (b.c.) subequal, sublobal plate with four chaetae; of these, one lateral minute (Figure 8C). Labial palps with E papilla with l.p. (lateral process does not extend beyond the base of papilla E) and e1–3; D with d1–4; C; B with b1–4 and A (Figure 8C). Head dorsal

chaetotaxy (Figure 9A), eyes G and H smaller than others, with six interocular chaetae (q, v, s, p, r, t) (Figure 9B); with eight An (An1a–3p), An1 as mic, six A (A0–5), A4 as mic, four M (M2–4), M2–4l as mic, six S (S0–S6), S5 as mic, three Ps (Ps2–3 and Ps5), six Pa (Pa1–6), Pa4 as mic and Pa6 as bothriotrichum, two Pm (Pm1 and Pm3), six Pp (Pp1–6), Pp4 and Pp6 as mic and two Pe (Pe3 and Pe5) chaetae. A0, A2–3, A5, M4, S0–S3, S6, Pa1—3, Pa5, Pm1—3, Pp1—3, Pp5 and Pe3 as mac. Clypeal formula with four (l1–2), four (ft) and three (pf0–1) chaetae (Figure 9C). Basomedial and basolateral labial fields (Figure 9D) with A1–5 smooth, M, Mi, E and L1–2 ciliate, r reduced (Figure 9E). Head ventral chaetotaxy with about 11 ciliate chaetae, without lateral reduced spines, postlabial formula four (G1–G4), four (H1–H4), four (X—4) and two (J1–J2); basal chaeta (b.c.) present (Figure 9F).

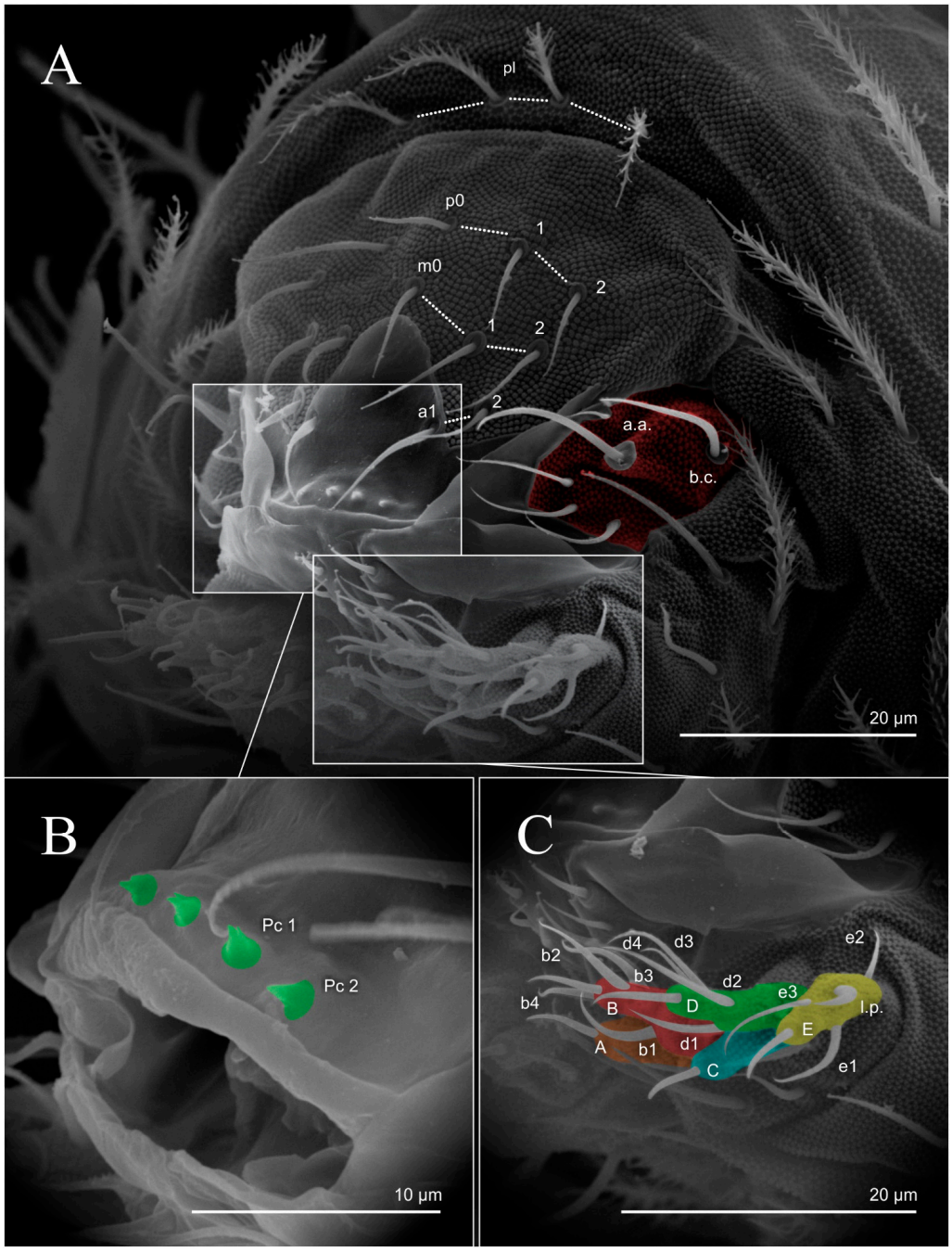

Figure 8. *Seira musarum* SEM: mouth parts. (**A**), prelabral, labral chaetotaxy; maxillary palp and sublobal plate; (**B**), papillary crests; (**C**), labial palps.

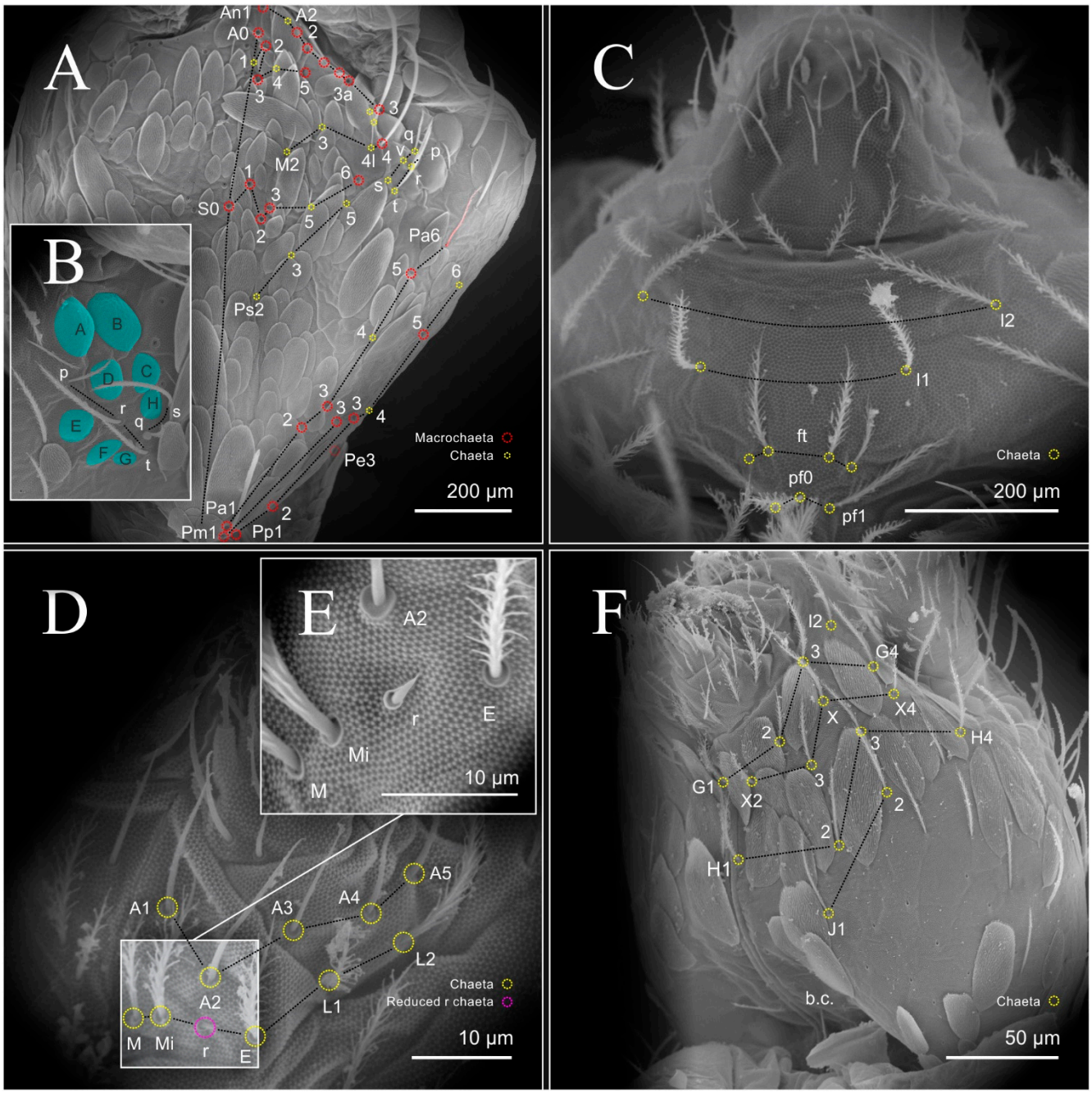

Figure 9. *Seira musarum* SEM: head chaetotaxy: (**A**), dorsal head; (**B**), eyes; (**C**), clypeus; (**D**), ventral head basomedial and basolateral labial fields; (**E**), r-chaeta position details; (**F**), postlabial.

Thorax chaetotaxy (Figure 10). Th II (Figure 10A): a, m and p series with two mic (a2p and a5ip), four mac (a5–i2 and a5p), four mic (m1i2, m4ip, m5 and m5p), seven mac (m1i, m2i, m4i, m1, m2, m4 and m4p), three mic (Pma 1i2p, p4 and p6) and fourteen mac (PmA p1, 1p, 1i, 1ip and 1i2; PmB 2a, p2 and 2p; PmC p3, 3p, 2ea, p2e and 2ep; p5), respectively; apex distal with numerous mac, meso and scales interspersed. Th III (Figure 10A): a, m and p series with three mic (a1a, a3 and a7), five mac (a1, a2, a4, a5 and a6), five mic (m1, m4, m5, m7, m6p), one mac (m6), three mic (p4—6) and four mac (p1, p2, p2a and p3), respectively.

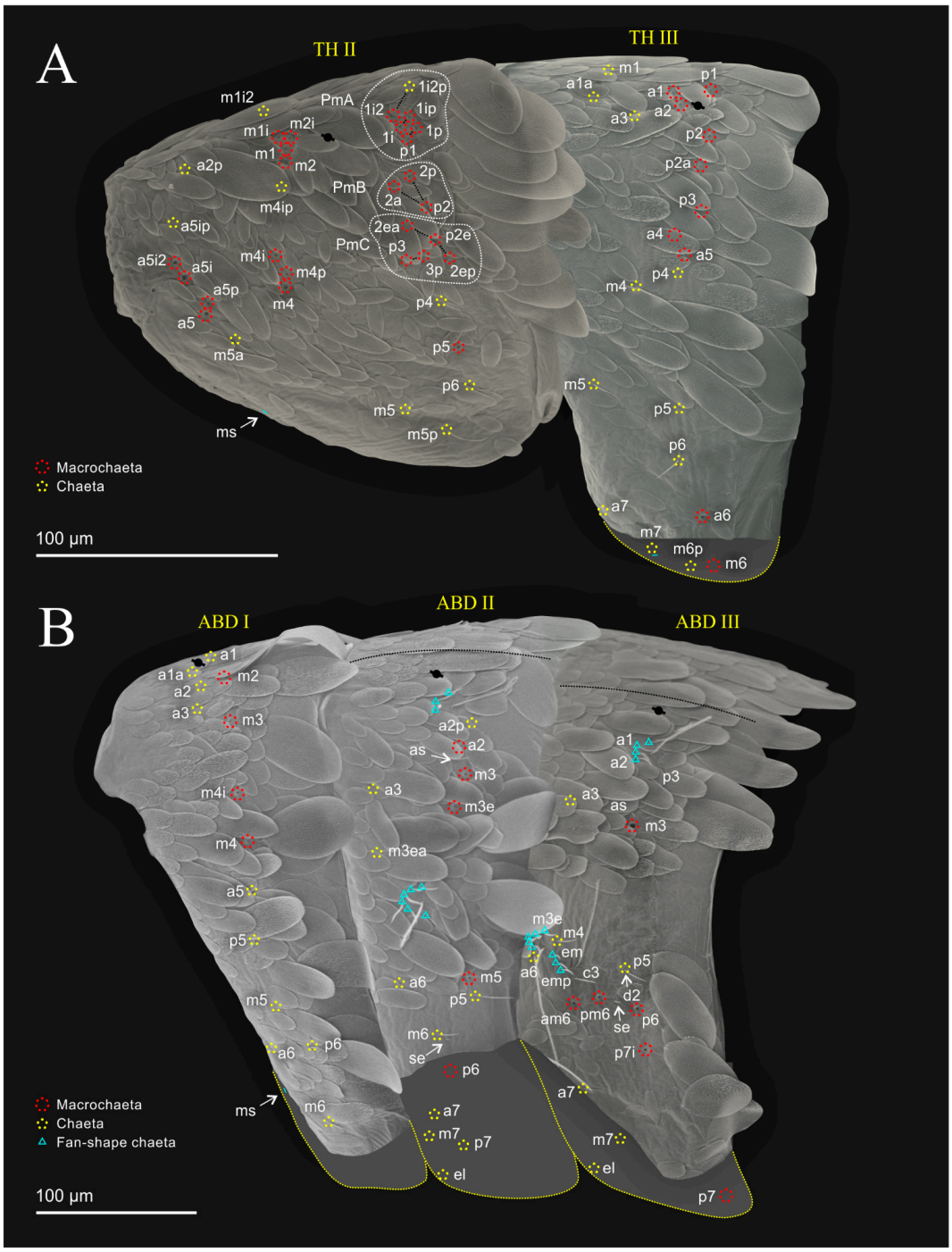

Figure 10. *Seira musarum* SEM: body chaetotaxy: (**A**), thorax II and III; (**B**), abdomen I to III.

Abdomen chaetotaxy (Figures 9 and 10). Abd I: a, m and p series with six mic (a1, a1a, a2, a3, a5 and a6), four mac (m2, m3, m4i and m4), two mic (m5—6) and two mic (p5–6), respectively. Abd II: a, m and p series with four mic (a2p, a3 and a6—7), one mac (a2), three mic (m3ea and m6–7), three mac (m3–3e and m5), two mic (p5 and p7) and one mac (p6), as, se present and el as mic. Abd III: a, m and p series with two fan-shaped (a1–2), one mic (a3), two meso (a7–8), mic (m7), three mac (m3, am6 and pm6), two mic (p3 and p5), three mac (p6, p7 and p7i) and p8 as meso, respectively, with as, ms, el, d2 and se present. Abd IV: A–Fe series with five mic (A1, A2a, A2, A3a, A6 and Ae7), three mac (A3, A4a and A5), two mic (B1–2), four mac (B3–6), four mic (C1p–4), one mac (C1), four mic (T1s, T3 and T5–6), one mac (T7), four mic (D1p, D2a, D2 and D3P), one mic (E1), seven mac (E2, E2P, E3,

E4, E4P, E4P2 and Ee10), eleven mac (F1—F3p and Fe2—Fe6) chaetae, respectively, and T2, T4 and D3 bothriotricha with four (T1p, s, m and D1) and three (T4a, pe and pi) fan-shaped chaetae, respectively, ps sens and x uncertain homology sens present, and posterior side of Abd IV with a transversal row of seven chaetae and one pseudopore (Figure 11A,B). Abd V: a, m and p series with four mac (a1, a3, a5 and a6), six mac (m2, m3, m5, m5a, m5e and m5ae), four mac (p3a, p4a, p5a and p6a), five mac (p1, p3, p4, p5 and p6), five mac (p1 and p3–6), two mic (p1p and p3pi) and four mac (p1p, p2p, p3pi and p5pi), respectively; as, acc.p4 and acc.p5 present.

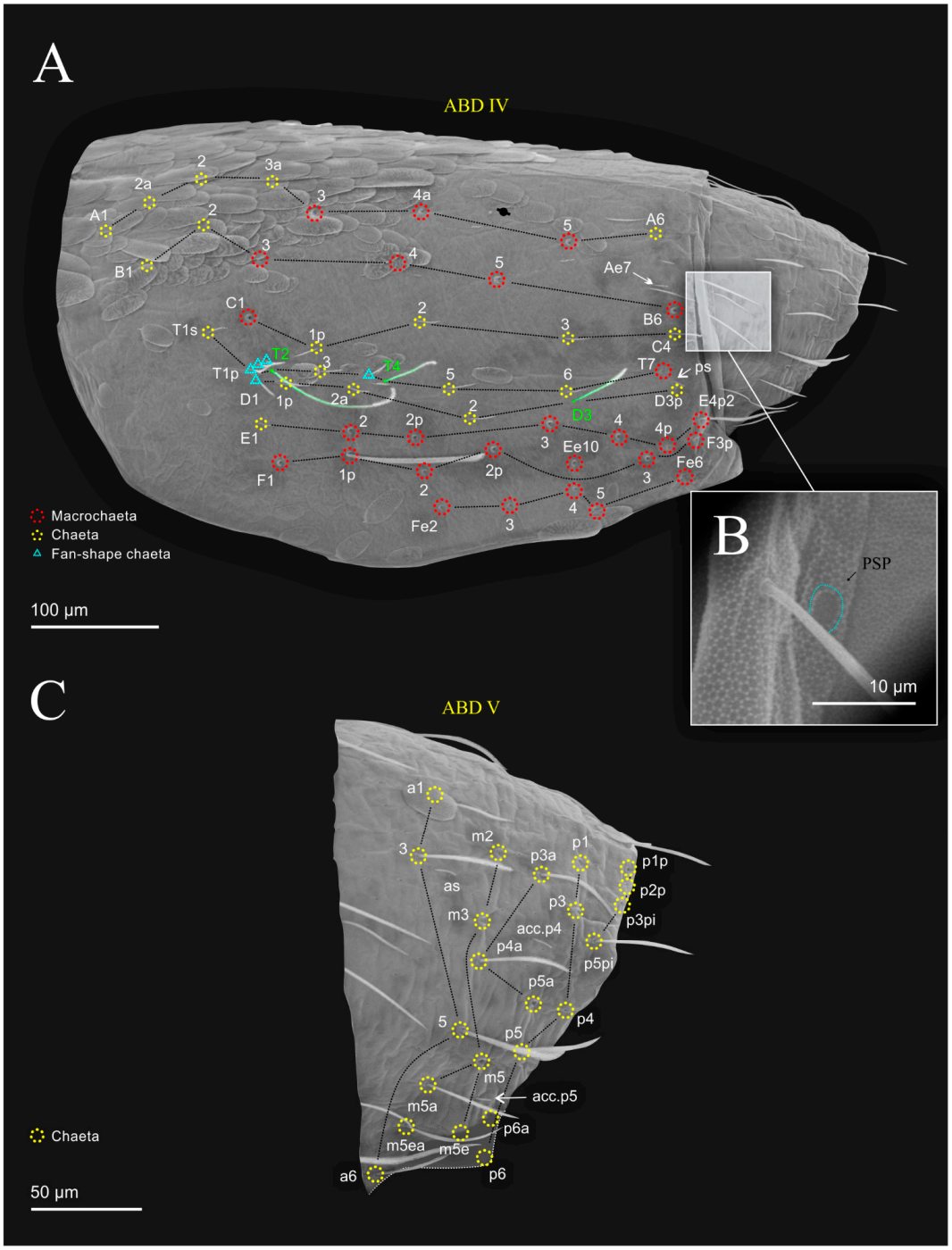

Figure 11. *Seira musarum* SEM: body chaetotaxy: (**A**), abdomen IV and V, (**B**), pseudopore details; (**C**), abdomen V.

Legs. Subcoxa I with four chaetae and two psp (Figure 12A); subcoxa II with a row with four chaetae and a p row with six chaetae and two psp (Figure 12B); subcoxa III with a row with six chaetae and a p row with three and two psp (Figure 12C). Trochanteral with 12 chaetae anterior, 2 spine internos and an organ with about 15 spine-like chaetae (Figure 12F). Unguis with four inner teeth, basal and medial teeth with the same length and a smaller apical tooth. Unguiculus with all lamellae acuminate and smooth (ai, ae, pi and pe), except for pe serrated; tenent hair capitate, finely ciliate (Figure 12G–I).

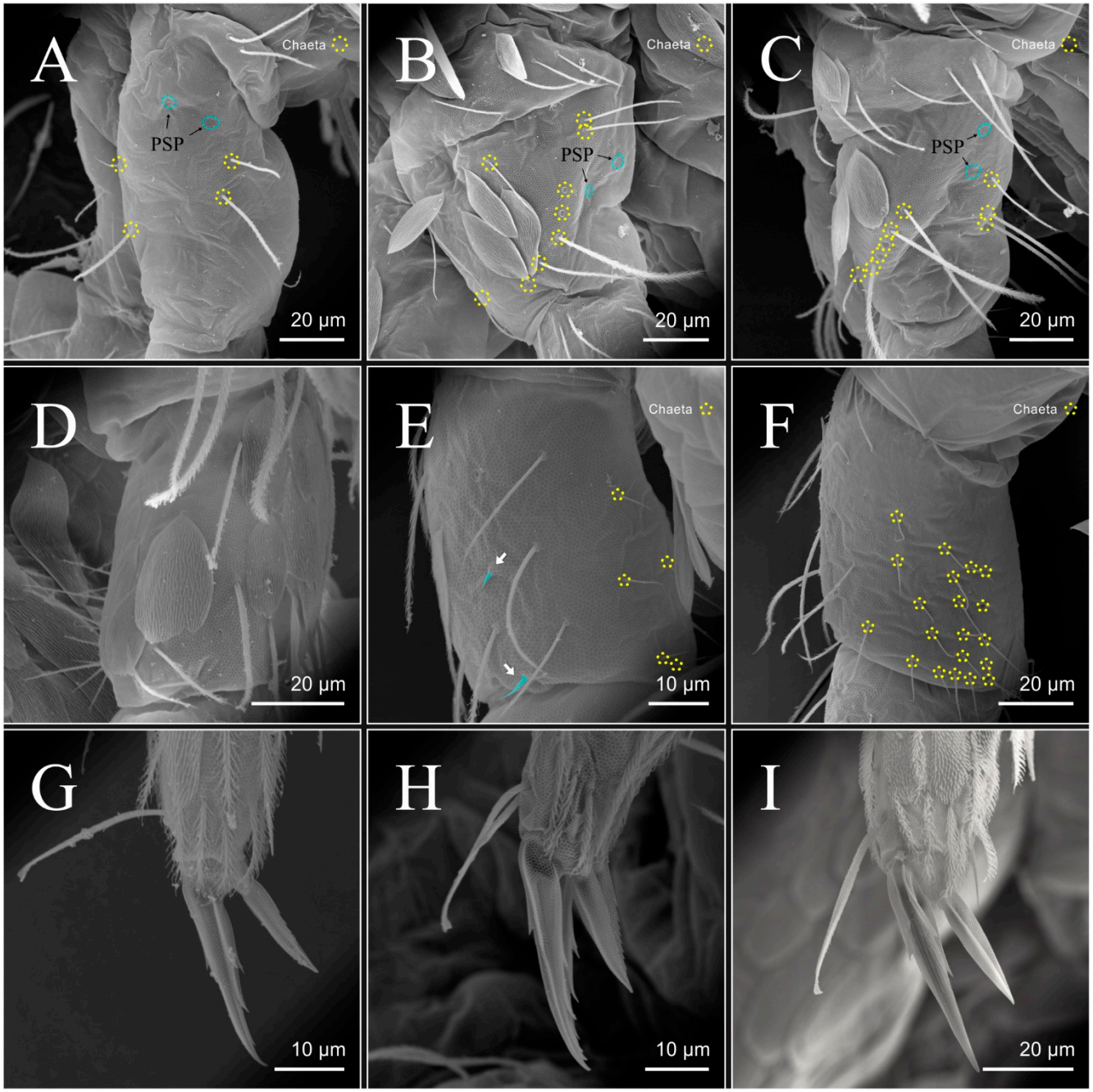

Figure 12. *Seira musarum* SEM: Legs: (**A**–**C**), subcoxa I, II and III; (**D**–**F**), metatrocater; (**G**–**I**), claws I, II and III.

Collophore (Figure 13). Anterior side (Figure 13A) with three proximal reduced spines (Figure 13B), five strait chaetae with long ciliation (Figure 6(B9)) and one smooth chaeta apically acuminate (Figure 6(B7)); lateral flap with about 13—16 smooth chaetae

(Figure 13C); distal posterior side with two distal smooth chaetae and three subdistal reduced spines per side (Figure 13D). Tenaculum with one chaeta on the corpus, ramus tenacular with four teeth (Figure 13E).

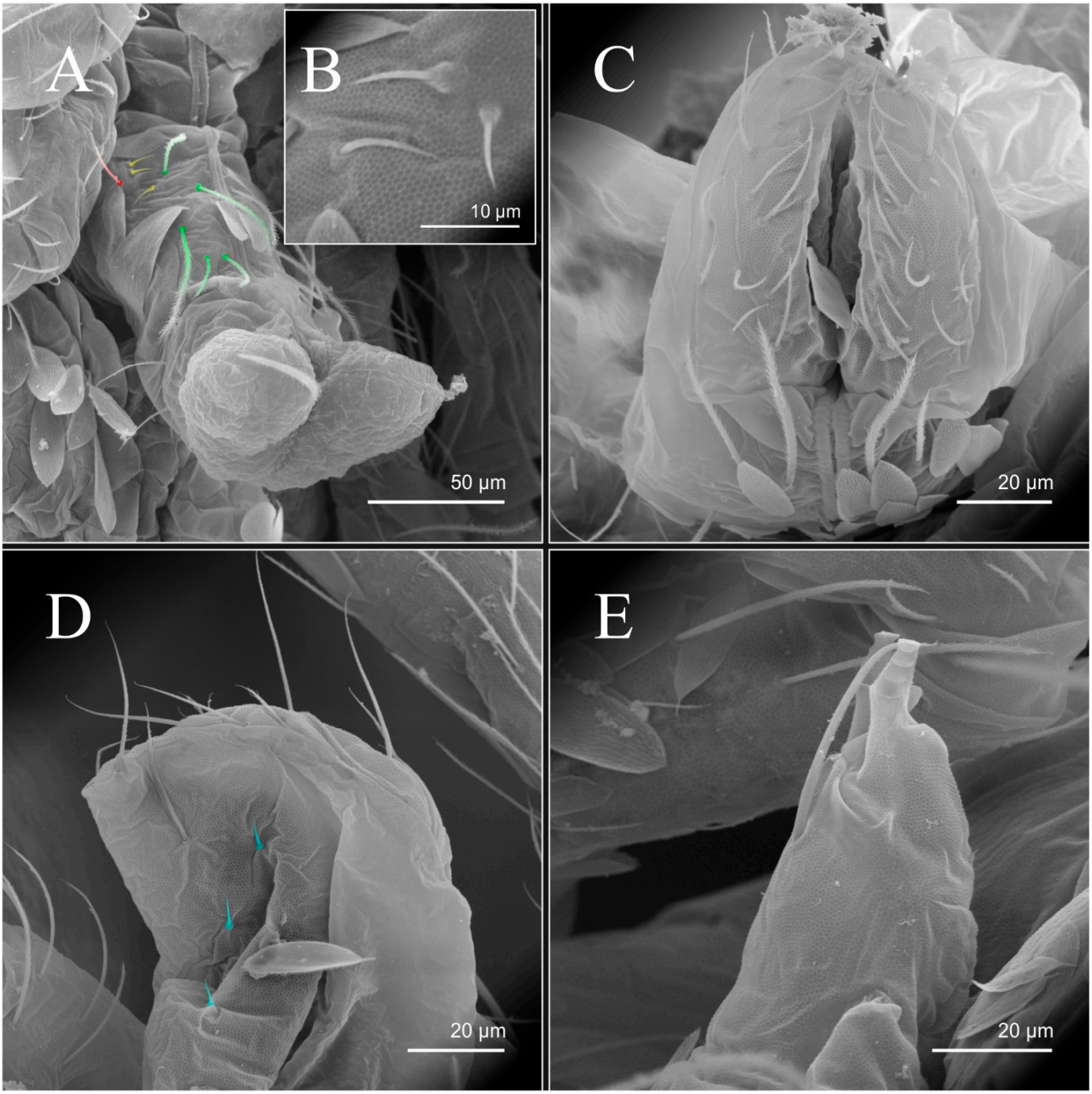

Figure 13. *Seira musarum* SEM: colophore and tenaculum. (**A**), anterior colophore; (**B**), spine of anterior colophore; (**C**), lateral flaps; (**D**), posterior colophore; (**E**), corpus tenaculum.

Furcula: manubrium ventral (Figure 14A) formula with 1, 0, 1, 1/2 (subapical) and 5 (apical) chaetae (Figure 14B); manubrial plate (dorsally) with five to six chaetae, two internal and three to four external, and three psp (Figure 14C). Mucro dorsally falcate, without basal spine (Figure 14D,E), crenulate dens with different crenulation distally (Figure 14E).

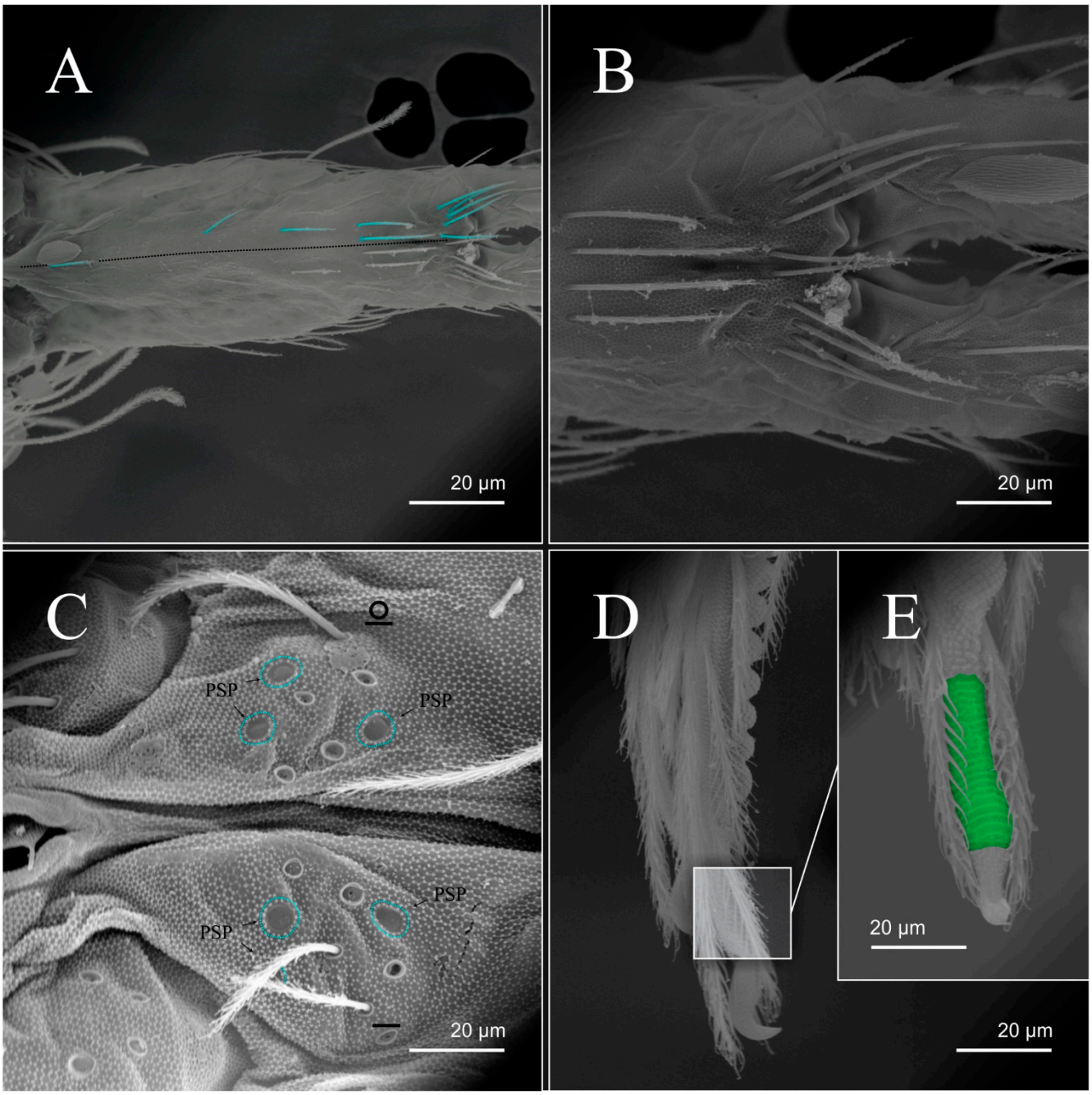

Figure 14. *Seira musarum* SEM: furca: (**A**), ventral manubrium, (**B**), manubrium ventral distally; (**C**), manubrial plate; (**D**), dens distally and mucro; (**E**), details of the dens distally and mucro.

Brazilian Oceanic Island Records: RA (3°51′32.38″ S; 33°48′56.96″ W), SF, 08 Oct 2015, E. C. A. Lima leg., CRFS #15079—15081. SPSP (0°54′59.98″N; 29°20′44.03″ W), SB, 25 Apr 2017, E. C. A Lima & D. Zeppelini leg., CRFS #15083, #15085, #15088. SPSP (0°54′59.74″N; 29°20′44.57″ W), SF, 24 Apr 2017, E. C. A Lima & D. Zeppelini leg., CRFS #15084, #15087. SPSP (0°55′1.00″N; 29°20′45.60″ W), SF, 26 Apr 2017, E. C. A Lima & D. Zeppelini leg., CRFS #15086. FN (3°51′3.73″ S; 32°26′0.38″ W), SF, 27 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #15117, #15118, #15121. FN (3°50′44.85″ S; 32°25′44.80″ W), SF, 17 Jul 2008, D. Zeppelini leg., CRFS #15119, #15120, #15122.
Brazil Occurrence: FN, RA, SPSP, AM, MA, RN, RJ, PE. (Figure 5D)
Biogeographic distribution: 3a 7b 24a 24b 26 27 28. Widespread species.

Remark. *Seira musarum* Ridley, 1890 was the first species of Collembola recorded and described in Brazil (type locality Fernando de Noronha). However, after its description, there was no other record of it until the specific survey to study the Collembola fauna on Brazilian oceanic islands was carried out by Lima and Zeppelini, 2015 [8] (more than one hundred years after the original description). In this survey, the authors recorded *Seira musarum*. Cipola et al. 2019 [9] had access to the same material and registered it as *S. dowlingi* (Wray, 1953); later, Rafael et al. 2020 [10] presented a study of the diversity of hexapods from Fernando de Noronha where existing and new records for the archipelago were compiled. Rafael et al. 2020 [10] recorded *S. musarum* and *S. dowlingi* (according to Lima and Zeppelini, 2015 [8] and Cipola et al. 2019 [9], respectively). The description of *S. musarum* is very old (Ridley 1890) and does not include characters used in the modern taxonomy of the genus. It is impossible to differentiate *S. musarum* from *S. dowlingi* (Wray, 1953) on the basis of the original description of the species. *S dowlingi* is known to be widespread and common on the islands [9,18]. Ernest Bernard analyzed Wray's types in [18], and in a recent study by Soto-Adames, 2008 [4], they presented further elucidation of the morphology of *Seira dowlingi* which is not different from the topotypes of *Seira musarum* analyzed in this study. Therefore, here, we use *S. dowlingi* (Wray, 1953), cited by [4,18,25–44] as a junior synonym of *Seira musarum* Ridley, 1890, as a new synonym according to "The Principle of Priority" (ICZN Article 23) that establishes "the valid name of a taxon is the oldest available name applied to it".

Paronellidae Börner, 1913

Cyphoderus agnotus Börner, 1906

Brazilian Oceanic Island Records: FN (3°50′58.48″ S; 32°26′3.83″ W), SF, 25 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14934.

Brazil Occurrence: Pará, Pernambuco, MG (Figure 15A)

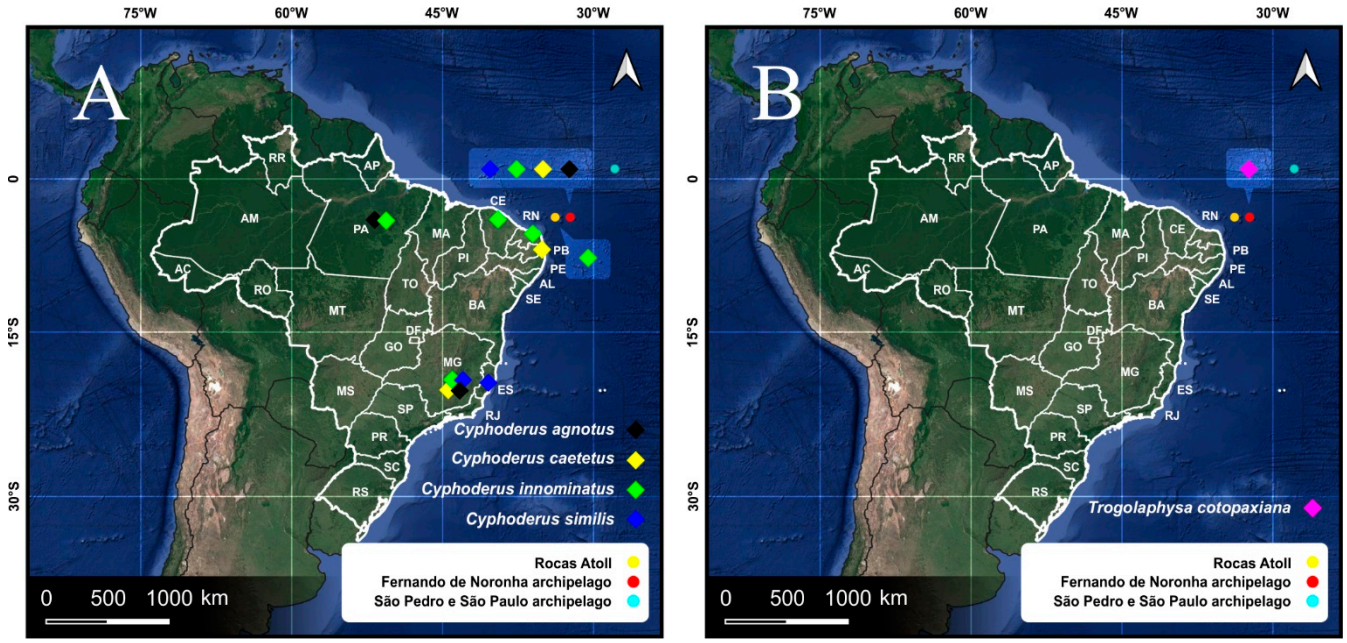

Figure 15. Distribution map for Paronellidae records in Brazil mainland and oceanic islands. (**A**). *Cyphoderus agnotus*, *C. caetetus*, *C. innominatus* and *C. similis*; (**B**), *Trogolaphysa cotopaxiana*.

Biogeographic distribution: 9?, 24b, 26, 27, 28, 29. Neotropical species.

Cyphoderus caetetus Zeppelini & Oliveira, 2016

Brazilian Oceanic Island Records: FN (3°50′36.76″ S; 32°25′12.64″ W), TF, 26 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #6146, #15161−16163.

Brazil Occurrence: MG, Paraíba and FN (Figure 15A)

Biogeographic distribution: 27. Brazilian species.

Cyphoderus innominatus Mills, 1938
Brazilian Oceanic Island Records: FN (3°48′45.61″ S; 32°23′26.17″ W), SF, 19 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14939−14941, #15077. FN (3°50′31.85″ S; 32°24′14.74″ W), TF, 07 Aug 2012, E. C. A. Lima & D. D. Silva leg., CRFS #14936. FN (3°50′36.76″ S; 32°25′12.64″ W), SF, 26 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #9614—9615. FN (3°51′21.93″ S; 32°26′37.78″ W), SF, 31 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #15107−15108, #15110−15111, #15113, #15116. FN (3°51′3.73″ S; 32°26′0.38″ W), SF, 27 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14935, #14937, #14938. FN (3°51′52.31″ S; 32°26′38.80″ W), TF, 31 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #15109, #15112, #15114−15115.
Brazil Occurrence: Pará, Ceara, Pernambuco, MG and RJ (Figure 15A).
Biogeographic distribution: 24a, 26, 27, 28, 29. Neotropical species.
Cyphoderus similis Folsom, 1927
(as *Cyphoderus javanus*, in Lima & Zeppelini, 2015)
Brazilian Oceanic Island Records: FN (3°48′45.61″ S; 32°23′26.17″ W), SF, 19 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14939—14941, #15077. FN (3°50′31.85″ S; 32°24′14.74″ W), TF, 07 Aug 2012, E. C. A. Lima & D. D. Silva leg., CRFS #14936. FN (3°51′21.93″ S; 32°26′37.78″ W), SF, 31 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #15107. FN (3°51′21.93″ S; 32°26′37.78″ W), SF, 31 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #15108-15111, #15113, #15116. FN (3°51′3.73″ S; 32°26′0.38″ W), SF, 27 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #14935, #14937—14938. FN (3°51′52.31″ S; 32°26′38.80″ W), TF, 31 Jul 2012, E. C. A. Lima & A. S. Ferreira Leg., CRFS #15109, #15112, #15114-15115.
Brazil Occurrence: MG and FN (Figure 15A)
Biogeographic distribution: 6, 7a, 7b, 8, 12, 20, 24a, 24b, 26, 27, 29. Widespread species.
Trogolaphysa cotopaxiana Thibaud & Najt, 1988
(as Lepidonella sp., in Lima & Zeppelini, 2015)
Brazilian Oceanic Island Records: FN (3°50′43.00″ S; 32°25′34.04″ W), SF, 20 Jul 2012, E. C. A Lima & D. Zeppelini leg., CRFS #15146, #15149. FN (3°50′54.21″ S; 32°25′45.56″ W), SF, 20 Jul 2012, E. C. A Lima & D. Zeppelini leg., CRFS #15147—15148.
Brazil Occurrence: FN (Figure 15B)
Biogeographic distribution: 28. South America species.

3.2. Species List of Brazilian Entomobryomorpha

In Brazil, Entomobryomorpha fauna is registered in all states and three oceanic islands. The only oceanic Archipelago of Trindade and Martim Vaz have no record of Entomobryomorpha. Including the new records presented in this study, 247 Brazilian species of Entomobryomorpha are distributed in the families Entomobryidae (124 spp.); Paronellidae (41 spp.); Oncopoduridae, 1901 (2 spp.); Isotomidae (80 spp.) and 44 genera; see Table 3. This number presents an increase of 125 new species records since the last synthesis by Abrantes et al. 2012 [6].

Table 3. Species of Entomobryomorpha recorded from Brazilian states and oceanic islands, modified and updated from [6]. *—recorded after [6]. In parentheses, information obtained from non-original reference. "?" following state abbreviation—questionable state record. "un"—unspecified or unknown Brazilian collection habitats. World distribution—see Methods/Species list of Brazilian Poduromorpha. "?" following the distribution abbreviation—questionable distribution record. Habitat—representative type of habitat for the species. "un"—unspecified or unknown habitat (Brazilian distribution; locality abbreviations refer to Brazilian states and insular locality, as listed in Table 1). Family names in bold.

Family/Species	Brazil Distribution	World Distribution	Habitat	Reference
Entomobryidae				
Amazhomidia ducke Cipola & Bellini, 2018	AM	Amz	Soil	[45] *
A. thaisae Cipola & Bellini, 2018	AM	Amz	Soil	[45] *
Capbrya brasiliensis Nunes, Santos-Costa & Bellini, 2020	PI, RN	Amz	Cave	[46] *
Coecobrya phoenix Brito, Lima & Zeppelini, 2019	MG, SP	NCB	Cave	[47] *
Dicranocentrus abestado Siqueira, Bellini & Cipola, 2020	BA	NCB	Cave	[48] *
D. albicephalus Xisto & Mendonça, 2017	ES, RJ	NCB	Atlantic forest litter	[49] *
D. amazonicus Bellini, Moraes & Oliveira, 2013	AM	Amz	Forest litter	[50] *
D. bicolor Handschin, 1924	SC	Pam	un	[51]
D. cuprum Xisto & Mendonça, 2016	MG	NCB	Rainforest and iron ore soil	[52] *
D. heloisae Arlé & Mendonça, 1982	RJ	NCB	Forest litter	[53]
D. magnus Xisto & Mendonça, 2017	SP	NCB	un	[49] *
D. marimutti Xisto & Mendonça, 2017	RJ	NCB	un	[49] *
D. melinus Xisto & Mendonça, 2016	MG	NCB	un	[49] *
D. pikachu Xisto & Mendonça, 2017	SP	NCB	un	[49] *
D. silvestrii Absolon, 1903	RJ	Neo	Forest; São Francisco River	[54,55]
D. termitophilus Handschin, 1924	MG	NCB	un	[51]
Entomobrya aipatse Arlé, 1959	MT	NCB	Scrubland, litter	[56]
E. ataquensis Arlé, 1959	MG, SP	NCB	On plants	[56]
E. atrocincta Schött, 1896	FN	NCB	Forest litter	[8] *
E. bahiana Bellini, Cipola & Godeiro, 2015	BA	NCB	Cave	[57] *
E. barbata Siqueira & Bellini, 2020	BA	NCB	Cave	[58] *
E. decora Nicolet, 1847	RJ	Neo	Duneland	[59]
E. egleri Arlé & Guimarães, 1978	AM, PA	Amz	Forest litter	[60,61]
E. griseoolivata Packard, 1873	PB	Bor, Neo	Forest litter, sand dune	[62]
E. inaequalis Arlé & Guimarães	PR	NCB	un	[63]
E. juneae Santos, Santos-Costa & Bellini, 2020	RN	NCB	Cave	[58]*
E. nivalis Linnaeus, 1758	PB	WSP	Forest litter, sand dune	[62]
E. paroara Arlé & Guimarães, 1978	PA	Amz	Littoral	[60]
E. spectabilis Reuter, 1890	AL, SE	NCB, Pal	On plants	[64–66]
E. tupiana Arlé, 1939	RJ	NCB	Forest	[67]
E. uambae Arlé, 1959	MT	Amz, NCB	Forest	[56]
E. wasmanni Handschin, 1924	RJ	Neo	Forest litter	[51]
Heteromurtrella anae Cipola, 2016	AM	Amz	Cave	[68] *
Lepidocyrtoides bicolorangelus Cipola & Bellini, 2017	RR	Amz	Cave	[69] *
L. caeruleomaculatus Cipola & Bellini, 2017	AM	Amz	Cave	[69] *
L. colormutatus Cipola & Bellini, 2017	AM	Amz	Cave	[69] *
L. tapuia Arlé & Guimarães, 1980	PB, RJ	NCB	Cave	[69] *
L. villasboasi Arlé & Guimarães, 1981	MT	NCB	Cave	[69] *
Lepidocyrtus amazonicus Cipola & Bellini, 2018	AM	Amz	Cultivation of organic guaraná	[69] *
L. americanus Cipola & Bellini, 2018	AM, PA	Amz	Cultivation of conventional guaraná and rainforest	[69] *
L. maldonadoi Mari-Mutt, 1986	PI, RN	NCB, Nea	Forest litter	[70] *
L. multisensillatus Cipola & Bellini, 2018	AM	Amz	Rainforest	[45] *
L. nigrosetosus Folsom, 1927	PB, FN	Neo	Forest litter, river sand	[8,71] *
L. pallidus Reuter, 1880	RS	Bor, Neo, Pal	On plants	[66,72]
L. sotoi Bellini, Cipola & Godeiro, 2015	PB	NCB	Atlantic forest and restinga woods	[57] *
L. violaceus Geoffroy, 1785	SC	WSP	Soil	[8,73] *
Lepidosira neotropicalis Nunes & Bellini, 2019	PI	Neo	Cave	[74]*
Mastigoceras camponoti Handschin, 1924	AM, CE, MG, RJ, SP	Amz, NCB	Ant nest, forest litter, soil	[51,54,75–77]
Nothobrya arlei Silveira & Mendonça, 2016	RJ	NCB	Urban area, litter and soil	[78] *

Table 3. *Cont.*

Family/Species	Brazil Distribution	World Distribution	Habitat	Reference
N. schubarti Arlé, 1961	PE, PI	NCB	Lagoon	[79]
N. sertaneja Nunes & Bellini, 2020	PI	Amz	Dryforest	[80] *
Pseudosinella acantholabrata Cipola, 2020	MG	NCB	Cave	[81] *
P. alba Packard, 1873	RJ	NCB	Forest litter	[82]
P. alfanjeunguiculata Bellini, Cipola & Souza, 2020	MG	NCB	Cave	[81] *
P. ambigua Zeppelini, Brito & Lima, 2018	MG	NCB	Cave	[83] *
P. aphelabiata Bellini, Cipola & Souza, 2020	MG	NCB	Cave	[81] *
P. biunguiculata Ellis, 1967	ES, FN	Neo	Papaya orchards, forest litter	[8,84] *
P. brevicornis Handschin, 1924	RJ	NCB	Forest litter, soil and roots	[51]
P. brumadinhoensis Cipola, 2020	MG	NCB	Cave	[81] *
P. cearensis Oliveira, Brito & Cipola, 2020	CE	NCB	Cave	[81] *
P. chimerambigua Oliveira, Lima & Cipola, 2020	MG	NCB	Cave	[81] *
P. diamantinensis Bellini, Cipola & Souza, 2020	MG	NCB	Cave	[81] *
P. dubia Christiansen, 1960	BA, CE, PB	NCB, Nea, Neo	Cave	[85]
P. guanhaensis Zeppelini, Brito & Lima, 2018	MG	NCB	Cave	[83] *
P. keni Cipola, 2020	MG	NCB	Cave	[81] *
P. labiociliata Cipola, 2020	MG	NCB	Cave	[81] *
P. labruspinata Cipola, 2020	MG	NCB	Cave	[81] *
P. macrolignicephala Oliveira, Lima & Cipola, 2020	MG	NCB	Cave	[81] *
P. marianensis Bellini, Cipola & Souza, 2020	MG	NCB	Cave	[81] *
P. mitodentunguilata Bellini, Cipola & Souza, 2020	MG	NCB	Cave	[81] *
P. neriae Bellini, Cipola & Souza, 2020	MG	NCB	Cave	[81] *
P. octopunctata Börner, 1901	RJ	WSP	Forest soil, beach sand	[82]
P. paraensis Cipola, 2020	PA	Amz	Soil and litter	[81] *
P. parambigua Oliveira, Lima & Cipola, 2020	MG	NCB	Cave	[81] *
P. phyllunguiculata Oliveira, Lima & Cipola, 2020	MG	NCB	Cave	[81] *
P. prelabruscervata Oliveira, Lima & Cipola, 2020	MG	NCB	Cave	[81] *
P. pusilla Oliveira, Brito & Cipola, 2020	PA	Amz	Cave	[81] *
P. serpentinensis Cipola, 2020	MG	NCB	Cave	[81] *
P. spurimarianensis Bellini, Cipola & Souza, 2020	MG	NCB	Cave	[81] *
P. taurina Cipola, 2020	PA	Amz	Cave	[81] *
P. triocellata Nunes & Bellini, 2018	PI	Amz	Dryforest	[86] *
P. unimacrochaetosa Cipola, 2020	MG	NCB	Cave	[81] *
Rhynchocyrtus klausi Mendonça & Fernandes, 2007	PB, RJ	NCB	Forest litter	[87]
Seira annulata Handschin, 1927	SP	Neo	Forest	[18]
S. arenicola Bellini & Zeppelini, 2008	PB	NCB	Forest litter, sand dune	[88]
S. atrolutea Arlé, 1939	MS, SP, FN	NCB	Over plants, rocks and dead wood	[10,89] *
S. brasiliana Arlé, 1939	MS, PB, RJ, SP	Bor, Neo	Beach sand, forest litter	[62,89]
S. caerucinerea Cipola, Morais & Bellini, 2014	TO	NCB	Dryforest	[14] *
S. coroatensis Godeiro & Bellini, 2015	RN	NCB	Dryforest	[90] *
S. dapeste Santos & Bellini, 2019	RN	NCB	Soil	[91] *
S. diamantinae Godeiro & Bellini, 2015	BA	NCB	Dryforest	[90] *
S. eidmanni Stach, 1935	RJ, SP	NCB	Ant nest, tree bark	[18,75,92]
S. glabra Godeiro & Bellini, 2013	PA	NCB	Dryforest	[93] *
S. harena Godeiro & Bellini, 2014	PB	NCB	Soil	[94] *
S. jiboiensis Godeiro & Bellini, 2014	BA	NCB	Soil	[94] *
S. mataraquensis Bellini & Zeppelini, 2008	PB	NCB	Forest litter, sand dune	[88]
S. melloi Arlé, 1939	ES, RJ	NCB	Lichen, moss	[92]
S. mendoncae Bellini & Zeppelini, 2008	PB	NCB	Litter, soil, rocks	[88]
S. mirianae Arlé & Guimarães, 1981	PB, RJ	NCB	Sand dune, forest litter, soil	[71,95]
S. musarum Ridley, 1890	AM, MA, PA, PE, RJ, RN, AM, MA, PA, FN, SPSP, RA	WSP	On plants, soil, forest litter	[7,8,10] *
S. nigrans Arlé, 1959	MT, PB	NCB	Scrubland, leaf litter, soil, rocks	[56,71]
S. nunezae Christiansen & Bellinger, 2000	MS, SP	NCB	Litter, soil	[18]
S. paraibensis Bellini & Zeppelini, 2010	PB	NCB	Forest litter, soil	[96]
S. paranensis Stach, 1935	PR	NCB	un	[75]
S. paulae Cipola, Morais & Bellini, 2014	PR	NCB	Atlantic forest	[14] *
S. picoensis Nunes, Bellini & Cipola, 2021	PI	Amz	Dryforest	[97] *
S. pietata Oliveira, Ferreira & Zeppelini, 2020	MG	NCB	Cave	[39] *
S. potiguara Bellini, Fernandes & Zeppelini, 2010	RN	NCB	Sand dune	[96] *
S. praiana Bellini, Fernandes & Zeppelini, 2010	RJ	NCB	Sand dune	[96] *
S. primaria Godeiro & Bellini, 2014	CE	NCB	Dryforest	[94] *

Table 3. *Cont.*

Family/Species	Brazil Distribution	World Distribution	Habitat	Reference
S. prodiga Arlé, 1959	MT, PB, PE, RJ	NCB	Forest litter, sand dune	[56,71]
S. pseudoannulata Bellini & Zeppelini, 2008	PB	NCB	Forest litter, sand dune	[88]
S. pulcher Handschin, 1924	SC	Bor, Pam	un	[18,51]
S. reichenspergeri Handschin, 1924	SC	Pam	un	[51]
S. ritae Bellini & Zeppelini, 2011	PB	Amz, NCB	Sand dune	[29] *
S. subannulata Denis, 1933	ES, RJ	Neo	Lichen, moss	[92]
S. tinguira Cipola, Morais & Bellini, 2014	PR	NCB	Rainforest	[12] *
S. trisetosa Nunes, Cipola & Bellini, 2021	PI	Amz	Dryforest	[97] *
S. xinguensis Arlé, 1959	MT; PB	NCB	Scrubland, reforestation in sand dune	[56,62]
Tyrannoseira bicolorcornuta Bellini, Pais & Zeppelini, 2009	PE	NCB	Over sand, rocks	[98] *
T. diabolica Bellini & Godeiro, 2012	RN	NCB	Litter, soil, rocks	[99] *
T. gladiata Zeppelini & Lima, 2012	PB	NCB	Litter, soil, rocks	[100] *
T. raptora Zeppelini & Bellini, 2006	PB	NCB	Litter, soil, rocks	[101] *
T. sex Bellini & Zeppelini, 2011	PB	NCB	Litter soil, rocks	[29] *
Paronellidae				
Campylothorax cassagnau Mitra & Dallai, 1980	RJ	Neo	Forest litter	[54]
C. mitrai Bellini & Meneses, 2012	AL, BA	NCB	Forest	[102] *
C. plagatus Cipola & Oliveira, 2016	AM	Amz	Rainforest	[103] *
C. schaefferi Börner, 1906	AM, MG, RJ	Amz, Pam	Forest	[55,61,82,104]
C. viruaensis Santos, Cipola & Bellini, 2016	RR	Amz	Rainforest	[105] *
Cyphoderodes xenopus Börner, 1913	RS	NCB	Ant net	[106]
Cyphoderus agnotus Börner, 1906	PE, FN	Bor?, Neo	Forest	[8,10,54] *
C. arlei Cassagnau, 1963	RJ	NCB	un	[54]
C. caetetus Zeppelini & Oliveira, 2016	MG, PE, FN	NCB	Rainforest	[8,10,107] *
C. equidenticulati Nunes & Bellini, 2018	PI	Amz	Dryforest	[86] *
C. innominatus Mills, 1938	PE, RJ, FN, RA	Neo	Sand dune, grassland	[8,10,54] *
C. javanus Börner, 1906	?	WSP	un	[86] *
C. mucrominimus Oliveira, Alves & Zeppelini, 2017	PA	Amz	Cave	[108] *
C. mucrostrimenus Oliveira, Alves & Zeppelini, 2017	PA	Amz	Cave	[108] *
C. similis Folsom, 1927	ES, FN	Bor, Pal, Neo	Papaya orchards	[8,10,84] *
Lepidonella zeppelinii Soto-Adames & Bellini, 2015	RN	NCB	Rainforest	[109] *
Paronellides alticolus Arlé, 1939	RJ	NCB	Forest, leaf litter	[67]
Salina bellinii Oliveira & Cipola, 2018	PA, PB, RN, RR	WSP	Rainforest	[110] *
S. brasiliana Oliveira & Cipola, 2018	AC, AL, AM, MG, PE, PR, RJ, RO, RR, SC	Nea, Neo, NCB	Rainforest	[110] *
S. celebensis Schäffer Schäffer, 1898	RJ	WSP	Forest	[54]
S. dedoris Mari-Mutt, 1987	RR	Neo, Amz	Rainforest	[110] *
S. hamadae Oliveira & Cipola, 2018	SC	NCB	Atlantic forest	[110] *
S. maculiflora Oliveira & Cipola, 2016	AM	Amz	Rainforest	[111] *
S. maculipenis Oliveira & Cipola, 2018	PR, RS	NCB	Atlantic forest	[110] *
S. serrana Oliveira & Cipola, 2018	SP	NCB	Atlantic forest	[110] *
S. tocantinensis Oliveira & Cipola, 2018	TO	NCB	Dryforest	[110] *
S. tristani Denis, 1931	AM, MS, MT, PA, PR, RJ, SC, SP	Neo, Amz, NCB	Rainforest	[110] *
S. unisetosa Oliveira & Cipola, 2018	AC	NCB	Rainforest	[110] *
S. zhangi Bellini & Cipola, 2017	BA	NCB	Soil, litter	[112] *
Troglobius albertinoi Cipola & Bellini, 2016	AP	Amz	Rainforest	[113] *
T. brasiliensis Palacios-Vargas & Zeppelini, 1995	PA, SP	Amz, NCB	Cave	[114]
T. ferroicus Zeppelini, Silva & Palacios-Vargas, 2014	MG	NCB	Cave	[115] *
Trogolaphysa aelleni Yoshii, 1988	SP	NCB	Cave	[116]
T. cotopaxiana Thibaud & Najt, 1988	FN	NCB	Forest litter	[8,10] *
T. ernesti Cipola & Bellini, 2017	CE	NCB	Dryforest	[112] *
T. formosensis Silva & Bellini, 2015	RN	Oriental, NCB	Atlantic forest	[117] *
T. hauseri Yoshii, 1988	SP	NCB	Cave	[116]
T. hirtipes Handschin, 1924	RJ, SC	Neo, Pam, NCB	Forest	[51,54]
T. millsi Arlé, 1939	RJ	NCB	Forest	[67]
T. piracurucaensis Nunes & Bellini, 2018	PI	Amz	Dryforest	[86] *
T. tijucana Arlé & Guimarães, 1979	RJ	NCB	Forest	[118]
Oncopoduridae				
Oncopodura hyleana Arlé, 1961	AP	Amz	Forest litter	[119]
O. itatiaiensis Arlé, 1961	RJ	NCB	Forest litter	[119]
Isotomidae				
Archisotoma arariboia Neves & Mendonça, 2014	RJ	NCB	Sand beach	[120] *
A. besselsii Packard Packard, 1877	RJ	Bor, Neo	Intertidal zone	[121]
A. catiae Abrantes & Mendonça, 2007	RJ	NCB	Sand dunes	[122]
A. gourbaultae Thibaud, 1993	RJ	Neo	Beach	[123]

Table 3. *Cont.*

Family/Species	Brazil Distribution	World Distribution	Habitat	Reference
A. jariani Lima, Zeppelini & Mendonça, 2019	RN, RA	NCB	Sand beach	[124] *
Arlea adetolai Mendonça, Abrantes & Fernandes, 2006	RJ	NCB	Soil, litter	[125]
A. arenicola Abrantes & Mendonça, 2005	RJ	NCB	Sand dune	[126]
A. lucifuga Arlé, 1939	MG, RJ	NCB	Litter, soil, humus, termites' nests	[67,127]
A. psammophila Mendonça, Abrantes & Fernandes, 2006	RJ	NCB	Beach	[125]
A. spinisetis Mendonça & Arlé, 1987	CE, RJ	NCB	Scrubland, beach, riparian vegetation, farming areas	[127]
Axelsonia littoralis Moniez, 1890	Brazilian Coast	Bor, Aus, Neo	un	[128]
A. tubifera Strenzke, 1958	SP	Neo	un	[121]
Ballistura fitchi Denis, 1933	ES, RJ	Bor, Pal, Neo	Lichen, moss, soil	[92,129]
Clavisotoma filifera Denis, 1931	RJ	Bor, Aus, Neo	Sand dune	[130]
Cryptopygus pentatomus Börner, 1906	?	NCB	un	[55]
C. separatus Denis, 1931	RJ	Neo, Pal	Soil, litter	[82]
C. tingus Queiroz & Mendonça, 2010	ES	NCB	Forest litter	[131]*
Desoria trispinata MacGillivray, 1896	RJ	Bor, Pal, Neo	Soil, litter, halophyte-psammophyte vegetation	[132]
Folsomia candida Willem, 1902	RJ	WSP	Litter	[133]
F. similis Bagnall, 1939	RJ	Bor, Aus, Neo	Litter, under rocks	[82]
F. wellingdae Potapov & Culik, 2002	ES	NCB	Soil	[134]
Folsomides centralis Denis, 1931	AM, ES, RJ, FN	WSP	Soil, tree trunk, halophyte-psammophyte vegetation, foredune environments, litter, grass over rocks between sand beach, mangrove	[61,92]
F. parvulus Stach, 1922	AM, ES, PA, RJ, FN	WSP	Soil, litter, humus, rotten trunk, grass over rocks between sand beach and mangrove, sand dunes, forest litter	[61,84,135]
F. semiparvulus Fjellberg, 1993	RJ	Bor, Neo	Sand dune	[122]
Folsomina onychiurina Denis, 1931	AM, ES, RS, FN	WSP	Beach, soil, litter, riparian vegetation, understory vegetation, sand dunes, beach, grass	[61,92,136]
Hemisotoma thermophila Axelson, 1900	PB, RJ, FN, SPSP, RA	WSP	Sand dune, halophyte-psammophyte vegetation, litter	[71] *
Isotomiella amazonica Oliveira & Deharveng, 1990	AM, RJ	Amz, NCB	Sand dune, litter	[137,138]
I. arlei Oliveira & Deharveng, 1990	AM	Amz	Flood plain, primary and secondary forest soil, litter	[138]
I. barrai Deharveng & Oliveira, 1990	AM, RJ	Amz, NCB	Primary forest soil and litter	[138,139]
I. barrana Mendonça & Abrantes, 2007	RJ	NCB	Herbaceous vegetation, sand dunes, litter and soil	[137]
I. bidentata Delamare Deboutteville, 1950	RJ	Neo, Pal	Litter	[137]
I. canina Mendonça & Fernandes, 2003	RJ	NCB	Soil, litter	[139]
I. denticulata Mendonça & Queiroz, 2017	RJ	NCB	Litter and soil in Atlantic Forest	[140] *
I. digitata Deharveng & Oliveira, 1990	RO	Amz	Forest soil and litter	[138]
I. distincta Mendonça & Fernandes, 2003	RJ	NCB	Soil, litter	[139]
I. dupliseta Deharveng & Oliveira, 1990	AM	Amz	Soil	[138]
I. falcata Mendonça & Fernandes, 2003	RJ	NCB	Soil	[139]
I. felina Mendonça & Fernandes, 2003	RJ	NCB	Soil, litter	[139]
I. granulata Oliveira & Deharveng, 1990	AM, RO	Amz, NCB	Scrub, forest litter	[138]
I. louisi Mendonça & Queiroz, 2016	PA	Amz	Rainforest	[141] *
I. macedoi Mendonça, Abrantes & Neves, 2012	RJ	NCB	Rainforest litter	[142] *
I. minor Schäffer, 1896	ES	WSP	un	[92]
I. nummulifer Deharveng & Oliveira, 1990	AM, RJ, FN	Pal, Neo	Soil	[138]
I. proxima Mendonça & Fernandes, 2003	RJ	NCB	Soil, litter	[139]
I. quadriseta Deharveng & Oliveira, 1990	AM; RJ	Amz, NCB	Litter, soil	[138,139]
I. sensillata Oliveira & Deharveng, 1990	AM, RO	Amz, NCB	Litter	[138]

Table 3. *Cont.*

Family/Species	Brazil Distribution	World Distribution	Habitat	Reference
I. similis Oliveira & Deharveng, 1990	AM	Amz	Soil	[138]
I. spinifer Deharveng & Oliveira, 1990	AM	Amz	Soil	[138]
I. symetrimucronata Najt & Thibaud, 1987	AM, ES, RJ	Pal, Neo	Soil, litter, sand dune	[86,138]
I. uai Mendonça, Abrantes & Nevez, 2012	MG	NCB	Rainforest litter	[142] *
Isotomodes cariocus Thibaud & Palacios-Vargas, 1999	RJ, FN	NCB	Beach	[136]
I. fernandesae Abrantes & Mendonça, 2007	RJ	NCB	Beach	[122]
I. trisetosus Denis, 1923	AM	Bor, Pal, Neo	Primary and secondary forest soil and litter	[61]
Isotomurus palustris Müller, 1776	BA, ES, PE	WSP	Seedbed	[92,143]
I. pseudosensillatus Mendonça, 1990	CE	NCB	Scrubland, litter	[144]
I. riparius Mendonça, 1990	RJ	NCB	Duneland	[144]
Micranurophorus musci Bernard, 1977	RJ	Bor, Neo	Sand dunes	[6]
Mucrosomia alticola Mendonça & Queiroz, 2013	MG, RJ	Europe	Litter and soil in Atlantic Forest in 1400 m	[145] *
Najtia vicaria Arlé, 1960	RJ	NCB	Soil, litter, rotten trunk, termite galleries	[56]
Paracerura airesi Mendonça, Abrantes & Fernandes, 2009	TO	NCB	Soil	[146] *
P. bella Mendonça & Queiroz, 2017	RJ	NCB	Soil and litter in Atlantic Forest	[140] *
P. cristinae Abrantes & Duarte, 2013	SP	NCB	Soil in Atlantic Forest	[147] *
P. gandarela Mendonça & Silveira, 2013	MG	NCB	Litter and soil on montane	[148] *
P. itatiaiensis Arlé, 1959	RJ	NCB	Moist soil	[56]
P. pallida Abrantes & Duarte, 2013	SP	NCB	Soil in Atlantic Forest	[147] *
P. paulista Abrantes & Duarte, 2013	SP	NCB	Soil in Atlantic Forest	[147] *
P. pindorama Queiroz & Mendonça, 2010	ES	NCB	Litter in Atlantic Forest	[131] *
P. serrana Mendonça, Abrantes & Fernandes, 2009	MG	NCB	Soil on 1600 m	[146] *
P. virgata Deharveng & Oliveira, 1994	AM	Amz	Forest soil	[149]
Proisotoma copiosa Mendonça, Queiroz & Silveira, 2015	ES	NCB	Soil and litter in 2447 m Atlantic Forest	[150] *
P. douglasi Mendonça, Queiroz & Silveira, 2015	RJ	NCB	Soil and litter in 2447 m Atlantic Forest	[150] *
Proisotoma immersa Folsom, 1924	SPSP	NCB	Soil and litter	*
P. minima Absolon, 1901	MG	WSP	Forest litter	[6]*
P. minuta Tullberg, 1871	RJ	WSP	Soil, litter, humus	[151]
P. oliveirae Deharveng, 1984	AM	Amz	Plant litter	[152]
P. ramosi Arlé, 1959	MG, RJ, SP	NCB	Litter	[56,119]
P. subminuta Denis, 1931	NCB	Bor, Neo	un	[127]
P. tenella Reuter, 1895	ES, PR, RJ	WSP	Halophyte-psammophyte vegetation, sand dune, soil	[84,130,153]
Psammisotoma restingae Abrantes & Mendonça, 2009	RJ	NCB	Halophyte-psammophyte vegetation	[23]
Yosiiella mira Hüther, 1967	AM	Amz	Rainforest	[154]

4. Discussion

We presented 14 new records for the Brazilian oceanic islands, 7 of which were in Fernando de Noronha (*Folsomides centralis*, Denis 1931; *Folsomides parvulus* Stach, 1922; *Folsomina onychiurina* Denis, 1931; *Isotomiella nummulifer* Deharveng & Oliveira, 1990; *Isotomodes cariocus* Thibaud & Palacios-Vargas, 1999; *Seira atrolutea* Arlé, 1939; *Trogolaphysa cotopaxiana* Thibaud & Najt, 1988), 3 in São Pedro e São Paulo (*Hemisotoma thermophila* Axelson, 1900; *Proisotoma immersa* Folsom, 1924; *Seira musarum* Ridley, 1890) and 4 on Rocas Atoll (*Hemisotoma thermophila* Axelson, 1900; *Psammisotoma* sp.; *Seira musarum* Ridley, 1890; *Cyphoderus innominatus* Mills, 1938).

Among the islands studied, we can highlight Fernando de Noronha as the island that most changed in its biodiversity. According to Teixeira et al. 2003 [155], Serafini et al. 2010 [156] and Rafael et al. 2020 [10], the archipelago has faced serious ecological disturbances due to various human interventions. In 1737, the archipelago was turned into a penal colony for nearly 200 years. During this period, much of the native vegetation was devastated and exotic plants and animals were introduced to serve as food. The human population in the archipelago increased significantly in 1942 through military occupation in World War II. During the 1980s, tourism intensified in the archipelago and is an important

economic activity today [155,156]. Our results show that Entomobryomorpha fauna of the Fernando de Noronha showed a high percentage of widespread species, which indicates the high rate of the introduction of species, likely by human activity.

The São Pedro archipelago and São Paulo presented the lowest richness in Entomobryomorpha species compared to the other islands, with its small size (0.17 Km^2), low variety of habitats and location (mid-Atlantic) being the main factors responsible for the low biodiversity. Our results corroborate the data presented by Teixeira et al. 2003 [155], Serafini et al. 2010 [156] and Campos et al. 2005 [157].

Taking into account the distribution of the species in the Brazilian oceanic islands, we can highlight that Rocas Atoll presented the highest percentage of potentially endemic Entomobryomorpha species, which increases the relevance of the conservation strategies already adopted in this environment. The survey carried out by Lima et al. 2021 [158] on Poduromorpha species reinforces the idea that, among the islands studied, Rocas Atoll has the most preserved environment in relation to the other study areas.

Although the increase in the number of Brazilian Entomobriomopha species over the past decade has been relevant (about 103% since [6]), when we consider the variety of Brazilian continental biomes and the complex physiognomy of these areas, current knowledge of the Enomobryomorpha fauna can still be considered scarce and far from providing a reliable overview of its biogeographical panorama.

Author Contributions: Conceptualization, all authors; methodology, E.C.A.d.L.; formal analysis, all authors; investigation, E.C.A.d.L. and D.Z.; resources, all authors; data curation, D.Z.; writing—original draft preparation, E.C.A.d.L. and M.A.O.-N.; writing—original draft preparation, E.C.A.d.L. and B.C.H.L.; writing—review and editing, E.C.A.d.L. and B.C.H.L.; supervision, M.C.d.M. and D.Z.; project administration, E.C.A.d.L. All authors have read and agreed to the published version of the manuscript.

Funding: E.C.A.d. Lima, M.C.d. Mendonça and D. Zeppelini are funded by CNPq (Process: Protax 440521/2015-7; 307644/2015-4 and 301803/2012-9, respectively), B.C.H. Lopes is granted by CAPES (Process 88882.440392/2019-01).

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board of Chico Mendes Institutefor Biodiversity Conservation (ICMBio) (SISBIO 32469).

Data Availability Statement: All the specimens collected and used in this research are deposited in the Coleção de Referência de Fauna de Solo at the State University of Paraiba (CRFS-UEPB) under tumble numbers as cited in this work.

Acknowledgments: The ICMBio provided the permits for collection and logistical support; Marinha do Brasil provided the transportation to São Pedro e São Paulo, the preparatory training and support during the scientific expeditions; Aíla Soares Ferreira and Diego Dias da Silva gave support during the fieldwork in Fernando de Noronha; Luís Carlos Stievano helped in the ordination of the samples and assisted in all laboratory work; João Victor Lemos Cavalcante de Oliveira provided taxonomic help; the British Natural History Museum and British Museum curators provided information and helped in the search for types; anonymous reviewers greatly improved the manuscript. A special thanks to the crew members of the boats Borandá and Alfa, for passages to the most incredible places I have yet had the opportunity to know: the Brazilian oceanic islands.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Schäffer, C. Die Collembolen der Umgebung von Hamburg und benachtbaren Gebiete. *Mitt. Dem Nat. Mus.* **1896**, *13*, 147–216.
2. Womersley, H. On some collembola-arthropleona from South Africa and Southern Rhodesia. *Ann. S. Afr. Mus.* **1934**, *30*, 441–475.
3. Szeptycki, A. *Chaetotaxy of the Entomobryidae and its Phylogenetical Significance. Morphosystematic Studies of Collembola IV. Polska Akademia Nauk, Zakład Zoologii Systematycznej i Doświadczalnej*; Państwowe Wydawnictwo Naukowe: Warszawa, Kraków, 1979; p. 219.
4. Soto-Adames, F.N.; Barra, J.A.; Christiansen, K.; Jordana, R. Suprageneric Classification of the entomobryomorpha Collembola. *Ann. Entomol. Soc. Am.* **2008**, *101*, 501–513. [CrossRef]

5. Bellinger, P.F.; Christiansen, K.A.; Janssens, F. Checklist of the Collembola of the World. Available online: http://www.collembola.org (accessed on 7 January 2022).
6. Abrantes, E.A.; Bellini, B.C.; Bernardo, A.N.; Fernandes, L.H.; Mendonça, M.C.; Oliveira, E.P.; Queiroz, G.C.; Sautter, K.D.; Silveira, T.C.; Zeppelini, D. Errata Corrigenda and update for the "Synthesis of Brazilian Collembola: An update to the species list". *Zootaxa* **2012**, *3168*, 1–21. [CrossRef]
7. Ridley, H.N. Notes on the zoology of Fernando Noronha; *Thysanura* and Collembola. *Zool. J. Linn. Soc.* **1890**, *20*, 556–559. [CrossRef]
8. Lima, E.C.A.; Zeppelini, D. First survey of Collembola (Hexapoda: Entognatha) fauna in soil of Archipelago Fernando de Noronha, Brazil. *Flor. Entomol.* **2015**, *98*, 368–369. [CrossRef]
9. Cipola, N.G.; Godeiro, N.N.; Bellini, B.C. New records of *Seira dowlingi* (Wray, 1953) (Collembola, Entomobryidae, Seirinae) for New World. *Entomol. Commun.* **2019**, *1*, ec01003-1. [CrossRef]
10. Rafael, J.A.; Limeira-de-Oliveira, F.; Hutchings, R.W.; Miranda, G.F.G.; Neto, A.M.S.; Somavilla, A.; Camargo, A.; Asenjo, A.; Pinto, A.P.; Bello, A.M.; et al. Insect (Hexapoda) diversity in the oceanic archipelago of Fernando de Noronha. Brazil: Updated taxonomic checklist and new records. *Rev. Bras. Entomol.* **2020**, *64*, e20200052. [CrossRef]
11. Gisin, H. Espèces nouvelles et lignées évolutives de Pseudosinella endogés. *Memórias Estud. Mus. Zoológico Univ. Coimbra* **1967**, *301*, 5–25.
12. Zhang, F.; Pan, Z.-X. Homology of labial chaetae in Entomobryoidea (Collembola). *Zootaxa* **2020**, *4766*, 498–500. [CrossRef]
13. Fjellberg, A. The labial palp in Collembola. *Zool. Anz.* **1999**, *237*, 309–330.
14. Cipola, N.G.; Morais, J.W.; Bellini, B.C. A new species of *Seira* (Collembola: Entomobryidae: Seirini) from Northern Brazil, with the addition of new chaetotaxic characters. *Zoologia* **2014**, *31*, 489–495. [CrossRef]
15. Mari-Mutt, J.A. A revision of the genus *Dicranocentrus* Schött (Insecta: Collembola: Entomobryidae). *Agric. Exp. Stn. Bull.* **1979**, *259*, 1–79.
16. Szeptycki, A. Morpho-systematic studies on Collembola. III. Body chaetotaxy in the first instars of several genera of the Entomobryomorpha. *Acta Zool. Cracov.* **1972**, *17*, 341–372.
17. Zhang, F.; Deharveng, L. Systematic revision of Entomobryidae (Collembola) by integrating molecular and new morphological evidence. *Zool. Scrip.* **2015**, *44*, 298–311. [CrossRef]
18. Christiansen, K.; Bellinger, P. A survey of the genus *Seira* (Hexapoda: Collembola: Entomobryidae) in the Americas. *Caribb. J. Sci.* **2000**, *36*, 39–75.
19. Jacquemart, S. Résultats de la mission Anthropologique Belge au Niger. Collemboles nouveaux du Sahara. *Bull. Inst. R. Sci. Nat. Belg.* **1974**, *50*, 1–46.
20. Culik, M.P.; Zeppelini, D. Diversity and distribution of Collembola (Arthropoda: Hexapoda) of Brazil. *Biodivers. Conserv.* **2003**, *12*, 1119–1143. [CrossRef]
21. Good, R. *The Geography of Flowering Plants*; Longman Group: London, UK, 1974; pp. 1–574.
22. Christiansen, K.; Bellinger, P. The biogeography of Collembola. *Bull. Entomol. Polog.* **1995**, *64*, 279–294.
23. Abrantes, E.A.; Mendonça, M.C. A new species of *Psammisotoma* Greenslade and Deharveng (Collembola: Isotomidae) from Brazil. *Zootaxa* **2009**, *2295*, 25–30. [CrossRef]
24. International Commission on Zoological Nomenclature. *International Code of Zoological Nomenclature*, 4th ed.; International Trust for Zoological Nomenclature: London, UK, 1999; p. 306.
25. Wray, D.L. New Collembola from Puerto Rico. *J. Agric. Univ. P. R.* **1953**, *37*, 140–150.
26. Callahan, P.S. *Evolution of Insects*, 1st ed.; Holiday House: New York, NY, USA, 1972; p. 192.
27. Palacios-Vargas, J.G. Guide of Springtails of Panama and Costa Rica (Collembola). In *Insects of Panama and Mesoamerica*; Quintero, D., Aiello, A., Eds.; Selected Studies; Oxford University Press: Cambridge, UK, 1992; pp. 25–36.
28. Barra, J. Springtails of the genus *Seira* Lubbock, 1969 (Collembola: Entomobryidae) from Socotra Island. *Fauna Arab.* **2004**, *20*, 399–408.
29. Bellini, B.C.; Zeppelini, D. A new species of *Seira* (Collembola: Entomobryidae: Seirini) from the Northeastern Brazilian coastal region. *Zoologia* **2011**, *28*, 403–406. [CrossRef]
30. Pan, Z.-X.; Shi, S.; Zhang, F. New species of *Homidia* (Collembola, Entomobryidae) from eastern China with description of the first instar larvae. *ZooKeys* **2011**, *152*, 21–42.
31. Zhang, F.; Yu, D.-Y.; Xu, G.-L. Transformational homology of the tergal setae during postembryonic development in the *Sinella-Coecobrya* group (Collembola: Entomobryidae). *Contrib. Zool.* **2011**, *80*, 213–230. [CrossRef]
32. Soto-Adames, F.N.; Taylor, S.J. New species and new records of Springtails (Hexapoda: Collembola) from caves in the Salem Plateau of Illinois, USA. *J. Caves Karst. Stud.* **2013**, *75*, 146–175. [CrossRef]
33. Katz, A.D.; Giordano, R.; Soto-Adames, F. Taxonomic review and phylogenetic analysis of fifteen North American Entomobrya (Collembola, Entomobryidae), including four new species. *ZooKeys* **2015**, *525*, 1–75. [CrossRef]
34. Soto-Adames, F.N. The dorsal chaetotaxy of first instar *Trogolaphysa jataca*, with description of twelve new species of Neotropical *Trogolaphysa* (Hexapoda: Collembola: Paronellidae). *Zootaxa* **2015**, *4032*, 1. [CrossRef]
35. Bernard, E.C.; Soto-Adames, F.N.; Wynne, J.J. Collembola of Rapa Nui (Easter Island) with description of five endemic cave-restricted species. *Zootaxa* **2015**, *3949*, 239–267. [CrossRef]

36. Katz, A.D.; Taylor, S.J.; Soto-Adames, F.N.; Addison, A.; Hoese, G.B.; Sutton, M.R.; Toulkeridis, T. New records and new species of springtails (Collembola: Entomobryidae, Paronellidae) from lava tubes of the Galapagos Islands (Ecuador). *Subterr. Biol.* **2016**, *17*, 77–120.
37. Soto-Adames, F.N. Chaetotaxy of first-instar *Campylothorax sabanus* (Wray), and description of three new *Campylothorax* species from Hispaniola (Collembola, Paronellidae). *J. Nat. Hist.* **2016**, *50*, 1–30. [CrossRef]
38. Soto-Adames, F.N.; Anderson, E.W. Two new species and new records of springtails (Collembola: Entomobryidae, Paronellidae) from Nevis, Lesser Antilles. *Fla. Entomol.* **2017**, *100*, 32–41. [CrossRef]
39. Oliveira, J.V.L.C.; Ferreira, A.S.; Zeppelini, D. Two new species of Collembola (Arthropoda: Hexapoda) from Minas Gerais, Brazil. *Neotrop. Entomol.* **2020**, *49*, 420–434. [CrossRef]
40. Cipola, N.G.; Morais, J.W.; Bellini, B.C. Review of *Lepidocyrtinus* Börner, 1903 (Collembola, Entomobryidae, Seirinae): The African species. *Zootaxa* **2020**, *4898*, 1–110. [CrossRef] [PubMed]
41. Godeiro, N.N.; Pacheco, G.; Liu, S.; Cipola, N.G.; Berbel-Filho, W.M.; Zhang, F.; Gilbert, M.T.P.; Bellini, B.C. Phylogeny of Neotropical Seirinae (Collembola, Entomobryidae) based on mitochondrial genomes. *Zool. Scr.* **2020**, *49*, 329–339. [CrossRef]
42. Godeiro, N.N.; Zhang, F.; Cipola, N.G. First partial mitogenome of a new *Seira* Lubbock species (Collembola, Entomobryidae, Seirinae) from Cambodia reveals a possible separate lineage from the Neotropical Seirinae. *Zootaxa* **2020**, *4890*, 451–472. [CrossRef]
43. Cucini, C.; Fanciulli, P.P.; Frati, F.; Convey, P.; Nardi, F.; Carapelli, A. Re-evaluating the internal phylogenetic relationships of collembola by means of mitogenome data. *Genes* **2021**, *12*, 44. [CrossRef]
44. Godeiro, N.N.; Zhang, F. First record of *Seira dowlingi* (Wray, 1953) (Collembola, Entomobryidae, Seirinae) from China and mitogenome comparison with the New World specimens. *Zootaxa* **2021**, *5020*, 191–196. [CrossRef]
45. Cipola, N.G.; Morais, J.W.; Bellini, B.C. New subgenus and four species of *Lepidocyrtus* Bourlet (Collembola, Entomobryidae, Lepidocyrtinae) from Amazon. *Insect Syst. Evol.* **2018**, *50*, 189–234. [CrossRef]
46. Nunes, R.C.; Santos-Costa, R.C.; Bellini, B.C. The first Neotropical *Capbrya* Barra, 1999 (Collembola: Orchesellidae: Nothobryinae) and the reinterpretation of Nothobryinae systematics. *Zool. Anz.* **2020**, *288*, 24–42. [CrossRef]
47. Brito, R.A.; Lima, E.C.A.; Zeppelini, D. Three new species of Collembola (Arthropoda: Hexapoda) from Brazil. *Zootaxa* **2019**, *4700*, 401–430. [CrossRef] [PubMed]
48. Bellini, B.C.; Cipola, N.G.; Siqueira, O.J.R. A Survey of the Brazilian *Dicranocentrus* Schött (Collembola, Orchesellidae, Heteromurini) with the description of a new species and notes on the genus. *Insect* **2020**, *11*, 709. [CrossRef] [PubMed]
49. Xisto, T.; Mendonça, M.C. New species and new records of *Dicranocentrus* Schött, 1893 (Collembola: Entomobryidae) from Southeastern Brazil. *Insect Syst. Evol.* **2017**, *49*, 23–58. [CrossRef]
50. Bellini, B.C.; Morais, J.W.; Oliveira, F.G.L. A new species of Dicranocentrus Schött (Collembola, Entomobryidae, Orchesellinae) from Brazilian Amazon. *Zootaxa* **2013**, *3709*, 296–300. [CrossRef]
51. Handschin, E. Neue myrmecophile und termitophile collembolenformen aus Süd Amerika. *Neue Beiträge Syst. Insektenkunde Berl.* **1924**, *3*, 13–28.
52. Xisto, T.; Mendonça, M.C. Two new species of *Dicranocentrus* Schött, 1893 (Collembola: Entomobryidae) from Serra do Gandarela, Minas Gerais State, Brazil. *Zootaxa* **2016**, *4079*, 223–227. [CrossRef]
53. Arlé, R.; Mendonça, C. Estudo preliminar das espécies de *Dicranocentrus* Schött, 1893, ocorrentes no Parque Nacional da Tijuca, Rio de Janeiro (Collembola). *Rev. Bras. Biol.* **1982**, *42*, 41–49.
54. Cassagnau, P. 1963 Collemboles d'Amérique du Sud, II. *Orchesellini, Paronellinae, Cyphoderinae. Biol. Amérique Australe* **1963**, *2*, 127–148.
55. Börner, C. Das System der Collembolen nebst Beschreibung neuer Collembolen des Hamburger Naturhistorischen museums. *Mitt. Nat. Mus. Hambg.* **1906**, *23*, 147–188.
56. Arlé, R. Collembola Arthropleona do Brasil oriental e central. *Arch. Mus. Nac.* **1959**, *49*, 155–211.
57. Bellini, B.C.; Cipola, N.G.; Godeiro, N.N. New species of *Lepidocyrtus* Bourlet and *Entomobrya* Rondani (Collembola: Entomobryoidea: Entomobryidae) from Brazil. *Zootaxa* **2015**, *4027*, 227–242. [CrossRef] [PubMed]
58. Santos, N.M.C.; Santos-Costa, R.C.; Siqueira, O.J.R.; Godeiro, N.N.; Bellini, B.C. Two new species of *Entomobrya* Rondani (Collembola, Entomobryidae) from northeastern Brazil and comments on the genus. *Zootaxa* **2020**, *4731*, 43–62. [CrossRef] [PubMed]
59. Christiansen, K. Preliminary notes on the genus Entomobrya in South America with special reference to Patagonia. *Biol. Amérique Australe* **1963**, *2*, 149–168.
60. Arlé, R.; Guimarães, A.E. Novas espécies de *Entomobrya* Rondani, 1861, do estado do Pará (Collembola, Entomobryomorpha). *Bol. Mus. Para. Emilio Goeldi Nova Ser. Zool.* **1978**, *89*, 1–18.
61. Oliveira, E.P.; Deharveng, L. Response of soil Collembola (Insecta) communities to forest disturbance in central Amazonia (Brazil). In *Functioning and Dynamics of Natural and Perturbed Ecosystems, Technique et Documentation*; Bellan, D., Bonin, G., Emig, C., Eds.; Lavoisier, Intercept Ltd.: Mauritius, NJ, USA, 1995; pp. 361–376.
62. Zeppelini, D.; Bellini, B.C.; Creão-Duarte, A.J.; Hernández, M.I.M. Collembola as bioindicators of restoration in mined sand dunes of Northeastern Brazil. *Biodivers. Conserv.* **2009**, *18*, 1161–1170. [CrossRef]
63. Denis, J.R. Sur les Collemboles du Muséum de Paris (1er Partie). *Ann. Soc. Entomol. Fr.* **1924**, *93*, 211–260.
64. Reuter, O.M. Notiser om finska Collembola. *Medd. Af Soc. Pro Fauna Flora Fenn. Helfingfors* **1892**, *18*, 231–232.
65. Reuter, O.M. Apterygogenea Fennica Finlands Collembola och Thysanura. *Acta Soc. Fauna Flora* **1895**, *11*, 1–35.

66. Kraepelin, K. Uber die durch den Schiffsverkehr in Hamburg eingeschleppten Tiere. *Mitt. Aus. Dem. Nat. Mus. Hambg.* **1901**, *18*, 183–209.
67. Arlé, R. Collemboles nouveaux de Rio de Janeiro. *An. Acad. Bras. Ciênc.* **1939**, *11*, 25–32.
68. Cipola, N.G.; Oliveira, F.G.L.; Morais, J.W.; Bellini, B.C. The *Heteromurini* Absolon & Ksenemann (Collembola, Entomobryidae): A review of the genera status and diagnoses, keys for species of *Alloscopus* Börnerand Heteromurtrella Mari Mutt and description of a new species. *Zootaxa* **2016**, *4084*, 151–186. [PubMed]
69. Cipola, N.G.; Morais, J.W.; Bellini, B.C. The discovery of *Lepidocyrtoides* Schött, 1917 (Collembola, Entomobryidae, Entomobryinae) from the New World, including three new species from Brazil and one from Australia. *Zootaxa* **2017**, *4324*, 201–248. [CrossRef]
70. Santos-Rocha, I.M.; Andreazze, R.; Bellini, B.C. Registros de Collembola (Arthropoda, Hexapoda) no Estado do Rio Grande do Norte, Brasil. *Biota Neotrop.* **2011**, *11*, 167–170. [CrossRef]
71. Bellini, B.C.; Zeppelini, D. First records of Collembola (Ellipura) from the state of Paraíba, Northeastern Brazil. *Rev. Bras. Entomol.* **2004**, *48*, 587–588. [CrossRef]
72. Börner, C. Collembolen aus Ostafrika, Madagascar und Südamerika. In *Reise in Ostafrika in den Jahren 1903–1905*; Voeltzkow, A., Ed.; E. Schweizerbartsche Verlagsbuchhandlung: Stuttgart, Germany, 1907; Volume 2, pp. 147–178.
73. Oliveira Filho, L.C.I.; Zeppelini, D.; Baretta, D.; Sousa, J.P.; Klauberg-Filho, O. Collembola community structure under different land management in subtropical Brazil. *Ann. Appl. Biol.* **2020**, *177*, 294–307. [CrossRef]
74. Nunes, R.C.; Godeiro, N.N.; Pacheco, G.; Liu, S.; Gilbert, M.T.P.; Alvarez-Valin, F.; Zhang, F.; Bellini, B.C. The discovery of Neotropical *Lepidosira* (Collembola, Entomobryidae) and its systematic position. *Zool. Scr.* **2019**, *48*, 783–800. [CrossRef]
75. Stach, J. Eine neue attophile collembole aus Brasilien. *Zool. Anz.* **1935**, *110*, 154–158.
76. Mari Mutt, J.A. A review of the genus *Mastigoceras* with remarks on its systematic position (Collembola: Entomobryidae). *Pan-Pac. Entomol.* **1978**, *54*, 43–47.
77. Cassagnau, P.; Oliveira, E. Sur Mastigoceras camponoti Handschin, collembole Orchesellinae d'Amazonie. *Bull. Soc. Hist. Nat.* **1992**, *128*, 27–31.
78. Silveira, T.C.; Mendonça, M.C. New species of *Nothobrya* (Collembola: Entomobryidae) from Southeast Brazil. *Zool.* **2016**, *33*, e20160126. [CrossRef]
79. Arlé, R. Novas espécies de colêmbolas aquáticas (Nota preliminar). *Atas Soc. Biol.* **1961**, *5*, 34–37.
80. Nunes, R.C.; Bellini, B.C. A new species of *Nothobrya* Arlé, 1961 (Collembola: Entomobryidae) from Brazil and notes on key characters for Nothobryinae taxonomy, with an identification key to the species of the subfamily. *Zootaxa* **2019**, *4615*, 375–391. [CrossRef] [PubMed]
81. Cipola, N.G.; Oliveira, J.V.L.C.; Bellini, B.C.; Ferreira, A.S.; Lima, E.C.A.; Brito, R.A.; Stievano, L.C.; Souza, P.G.C.; Zeppelini, D. Review of Eyeless *Pseudosinella* Schäffer (Collembola, Entomobryidae, and Lepidocyrtinae) from Brazilian Caves. *Insects* **2020**, *11*, 194. [CrossRef] [PubMed]
82. Fernandes, L.H.; Mendonça, M.C. A new species of *Xennyla* (Collembola, Poduromorpha, Hypogastruridae) with new records for the State of Espírito Santo, southeastern Brazil. *Rev. Bras. Zool.* **2010**, in press.
83. Zeppelini, D.; Brito, R.A.; Lima, E.C.A. Three new species of Collembola (Arthropoda: Hexapoda) from Central Brazilian shallow caves: Side effects of long term application of environmental law on conservation. *Zootaxa* **2018**, *4500*, 059–081. [CrossRef] [PubMed]
84. Culik, M.P.; Martins, D.S.; Ventura, J.A. Collembola (Arthropoda: Hexapoda) communities in the soil of papaya orchards managed with conventional and integrated production in Espírito Santo, Brazil. *Biota Neotrop.* **2006**, *6*, 1–8. [CrossRef]
85. Christiansen, K. The genus *Pseudosinella* (Collembola, Entomobryidae) in caves of the United States. *Psyche* **1960**, *67*, 1–25. [CrossRef]
86. Nunes, R.C.; Bellini, B.C. Three new species of Entomobryoidea (Collembola: Entomobryomorpha) from Brazilian Caatinga-Cerrado transition, with identification keys to Brazilian *Cyphoderus*, *Pseudosinella* and *Trogolaphysa* species. *Zootaxa* **2018**, *4420*, 071–096. [CrossRef] [PubMed]
87. Mendonça, M.C.; Fernandes, L.H. *Rhynchocyrtus* gen. nov. (Collembola, Entomobryidae) from the Southeast and Northeast Brazilian regions. *Zootaxa* **2007**, *1660*, 45–51. [CrossRef]
88. Bellini, B.C.; Zeppelini, D. Three new species of *Seira* Lubbock (Collembola, Entomobryidae) from Mataraca, Paraíba State, Brazil. *Zootaxa* **2008**, *1773*, 44–54. [CrossRef]
89. Arlé, R. Collembola, anexo nº. 2, ao relatório da excursão científica do Instituto Oswaldo Cruz realizada na zona da E. F. N. O. B., em outubro de 1938. *Bol. Biol.* **1939**, *4*, 295–300.
90. Godeiro, N.N.; Bellini, B.C. Two new species and two detailed chaetotaxy descriptions of *Seira* (Collembola: Entomobryidae) from Brazil. *Zootaxa* **2015**, *3972*, 209–215. [CrossRef] [PubMed]
91. Bellini, B.C.; Santos, N.M.C.; Souza, P.G.C.; Weiner, W.M. Two new species of Brazilian springtails (Hexapoda: Collembola) with comments on Neotropical *Brachystomella* Ågren and *Seira* (Lepidocyrtinus) Börner. *Insect Syst. Evol.* **2019**, *50*, 297–326. [CrossRef]
92. Arlé, R. Quelques collemboles de l´etat d´Espirito Santo (Brésil). *Physis* **1939**, *17*, 125–131.
93. Godeiro, N.N.; Bellini, B.C. A new species of *Seira* (Collembola: Entomobryidae) from the state of Paraíba, Brazil. *Zoologia* **2013**, *30*, 343–345. [CrossRef]
94. Godeiro, N.N.; Bellini, B.C. Three new species of *Seira* Lubbock (Collembola, Entomobryidae) from Caatinga Domain, northeastern Brazil. *Zootaxa* **2014**, *3764*, 131–151. [CrossRef]

95. Arlé, R.; Guimarães, A.E. Nova espécie saxícola do gênero *Seira* Lubbock, 1869, do Rio de Janeiro (Collembola). *Rev. Bras. Entomol.* **1981**, *25*, 1–3.
96. Bellini, B.C.; Fernandes, L.H.; Zeppelini, D. Two new species of *Seira* (Collembola, Entomobryidae) from Brazilian coast. *Zootaxa* **2010**, *2448*, 53–60. [CrossRef]
97. Nunes, R.C.; Cipola, N.G.; Bellini, B.C. Two new species of *Seira* Lubbock, 1870 (Collembola: Entomobryidae: Seirinae) from Brazilian Caatinga. *Zootaxa* **2021**, *5048*, 001–030. [CrossRef]
98. Bellini, B.C.; Pais, A.P.; Zeppelini, D. A new species of *Seira* Lubbock (Collembola: Entomobryidae) from Brazil with sexually dimorphic legs. *Zootaxa* **2009**, *2080*, 38–46. [CrossRef]
99. Bellini, B.C.; Godeiro, N.N. A new species of Tyrannoseira (Collembola: Entomobryidae: Seirini) from the Brazilian coastal region. *Zoologia* **2012**, *29*, 81–84. [CrossRef]
100. Zeppelini, D.; Lima, E.C.A. A new species of *Tyrannoseira* (Collembola, Entomobryidae, Seirini) from Paraiba, Northeastern Brazil. *Zootaxa* **2012**, *3423*, 37–42. [CrossRef]
101. Zeppelini, D.; Bellini, B.C. Two *Seira* Lubbock 1869 (Collembola, Arthropleona, Entomobryidae) new to science, with remarkable secondary sexual characters. *Zootaxa* **2006**, *1185*, 21–35. [CrossRef]
102. Bellini, B.C.; Meneses, L.F. A new species of *Campylothorax* (Collembola: Entomobryoidea: Paronellidae) from the state of Alagoas, Brazil. *Zoologia* **2012**, *29*, 451–454. [CrossRef]
103. Cipola, N.G.; Oliveira, F.G.L. A new species of *Campylothorax* Schött, 1893 (Collembola, Paronellidae) from Brazilian Amazon, with an identification key to the genus. *Zootaxa* **2016**, *4109*, 487–495. [CrossRef]
104. Mitra, S.K.; Dallai, R. Studies of the genus *Campylothorax* Schött, 1893 (Collembola Entomobryidae Paronellinae) with the description of a new species from Zaire. *Monit. Zool. Ital. NS Suppl.* **1980**, *13*, 273–321. [CrossRef]
105. Santos, I.P.S.; Cipola, N.G.; Morais, J.W.; Bellini, B.C. A new species of *Campylothorax* (Collembola: Paronellidae: Paronellinae) from Northern Brazil. *Zoologia* **2016**, *33*, 1–6. [CrossRef]
106. Börner, C. Neue Cyphoderinen. *Zool. Anz.* **1913**, *41*, 274–284.
107. Zeppelini, D.; Oliveira, J.V.L.C. Chaetotaxy of Neotropical *Cyphoderus caetetus* sp. nov. with comments on the taxonomic position of Cyphoderinae within Paronellidae (Collembola, Entomobryoidea). *Zootaxa* **2016**, *4098*, 560–570. [CrossRef]
108. Oliveira, J.V.L.C.; Alves, J.L.S.; Zeppelini, D. Two new *Cyphoderus* (Collembola: Paronellidae) of "tridenticulati" and "bidenticulati" groups from Brazilian Amazon. *Zootaxa* **2017**, *4350*, 047–060. [CrossRef]
109. Soto-Adames, F.N.; Bellini, B.C. Dorsal Chaetotaxy of Neotropical Species Supports a Basal Position for the Genus *Lepidonella* Among Scaled Paronellidae (Collembola, Entomobryoidea). *Fla. Entomol.* **2015**, *98*, 330–341. [CrossRef]
110. Oliveira, F.G.L.; Cipola, N.G.; Almeida, E.A.B. Systematics and biogeography of *Salina* MacGillivray (Collembola: Entomobryoidea), with emphasis on the species groups in the New World. *Insect Syst. Evol.* **2018**, *2018*, 1–58. [CrossRef]
111. Oliveira, F.G.L.; Cipola, N.G. Two new species of *Salina* MacGillivray (Collembola, Paronellidae) with rectangular mucro from South America. *Rev. Bras. Entomol.* **2016**, *60*, 128–136. [CrossRef]
112. Bellini, B.C.; Cipola, N.G. The Neotropical genera of Paronellinae (Collembola, Entomobryoidea, Paronellidae) with description of two new species and redescription of *Campylothorax mitrai*. *Zootaxa* **2017**, *4300*, 151–179. [CrossRef]
113. Cipola, N.G.; Morais, J.W.; Bellini, B.C. A New Epigeous Species of Troglobius (Collembola: Paronellidae: Cyphoderinae) from Brazil and Notes on the Chaetotaxy of the Genus. *Fla. Entomol.* **2016**, *99*, 658–666. [CrossRef]
114. Palacios-Vargas, J.G.; Zeppelini, D. A new species of *Troglobius* (Collembola, Paronellidae) from Brazil. *Int. J. Speleol.* **1995**, *23*, 173–177. [CrossRef]
115. Zeppelini, D.; Silva, D.D.; Palacios-Vargas, J.G. A new species of *Troglobius* (Collembola, Paronellidae, Cyphoderinae) from a Brazilian iron cave. *Subterr. Biol.* **2014**, *14*, 1–14. [CrossRef]
116. Yoshii, R. Paronellid Collembola from caves of Central and South America collected by P. Strinati. *Rev. Suisse Zool.* **1988**, *95*, 449–459.
117. Silva, D.D.; Bellini, B.C. *Trogolaphysa formosensis* sp. nov. (Collembola: Paronellidae) from Atlantic Forest, Northeast Region of Brazil. *Zoologia* **2015**, *32*, 53–58. [CrossRef]
118. Arlé, R.; Guimarães, A.E. Nova espécie do gênero *Paronella* Schott, 1893 do Rio de Janeiro (Collembola). *Rev. Bras. Entomol.* **1979**, *23*, 213–217.
119. Arlé, R. Notas sôbre a família Oncopoduridae, com descrição de duas espécies novas do Brasil (Collembola). *Arch. Mus. Nac.* **1960**, *50*, 9–23.
120. Neves, A.C.; Mendonça, M.C. New Brazilian species of *Archisotoma* Linnaniemi, 1912 (Collembola: Isotomidae). *J. Insect Biodivers.* **2014**, *2*, 1–7. [CrossRef]
121. Strenzke, K. *Axelsonia tubifera* n. sp., ein neuer arthropleoner Collembole mit Geschlechtsdimorphismus aus der brasilianischen Mangrove. *Acta Zool. Cracov.* **1958**, *2*, 607–619.
122. Abrantes, E.A.; Mendonça, M.C. New species and a new record of Isotomidae (Collembola) from the coast of Brazil. *Zootaxa* **2007**, *1500*, 55–60. [CrossRef]
123. Thibaud, J.M.; Palacios-Vargas, J.G. Révision du genre *Archisotoma* Linnaniemi, 1912 (Collembola: Isotomidae). *Ann. Soc. Entomol. Fr.* **2001**, *37*, 347–356.
124. Lima, E.C.A.; Zeppelini, D.; Mendonça, M.C. Brazilian *Archisotoma* Linnaniemi (Collembola, Isotomidae), with description of a new species from an oceanic atoll. *Zootaxa* **2019**, *4543*, 52–62. [CrossRef]

125. Mendonça, M.C.; Abrantes, E.A.; Fernandes, L.H. Novas espécies de *Arlea* do sudeste do Brasil (Collembola, Isotomidae). *Iheringia Série Zool.* **2006**, *96*, 57–60. [CrossRef]
126. Abrantes, E.A.; Mendonça, M.C. Uma nova espécie de *Arlea* Wormersley do sudeste do Brasil (Collembola, Isotomidae). *Rev. Bras. Entomol.* **2005**, *22*, 936939.
127. Mendonça, C.; Arlé, R. Nova espécie brasileira de *Arlea* Womersley, 1939 (Collembola, Isotomidae). *Bol. Mus. Nac.* **1987**, *315*, 1–7.
128. Arlé, R. Generalidades e importância ecológica da ordem Collembola (Apterygota). *Atas Soc. Biol.* **1959**, *3*, 4–7.
129. Mendonça, C.; Reis, S.F. Geographic and interspecific variation in two *Proisotoma* species (Collembola, Isotomidae). *Rev. Bras. Entomol.* **1990**, *34*, 643–649.
130. Mendonça, C.; Reis, S.F. Multivariate morphometric analysis of selected *Proisotoma* species (Collembola: Isotomidae). *Zool. Anz.* **1991**, *227*, 98–103.
131. Queiroz, G.C.; Mendonça, M.C. Two new Isotomidae species (Collembola) from Espírito Santo State, Brazil. *Zootaxa* **2010**, *2480*, 37–44. [CrossRef]
132. Mendonça, M.C. *Contribuição para o Conhecimento de Collembola Entomobrymorpha (Insecta) do Parque Nacional da Tijuca, Rio de Janeiro, Brasil*; UFRJ: Rio de Janeiro, Brasil, 1981; p. 150.
133. Massoud, Z.; Rapoport, E.H. Collemboles Isotomides d'Amerique du Sud et de l'Antarctique. *Biol. Amérique Australe* **1968**, *4*, 307–337.
134. Potapov, M.; Culik, M. A new species of *Folsomia* (Collembola: Isotomidae) from Brazil, with notes on foilsetae in the fimetaria group. *Pan. Pac. Entomol.* **2002**, *78*, 69–73.
135. Mendonça, C. Contribuição ao estudo do gênero *Folsomides* Stach, 1922 no Brasil (Collembola, Isotomidae). *Rev. Bras. Entomol.* **1984**, *28*, 121–128.
136. Thibaud, J.M.; Palacios-Vargas, J.G. Brazilian Collembola from littoral sand with description of *Austrogastrura* gen. n. and *Isotomodes carioca* sp. n. [Hypogastruridae; Isotomidae]. *Rev. Fr. Entomol.* **1999**, *21*, 25–31.
137. Mendonça, M.C.; Abrantes, E.A. A new Brazilian species of *Isotomiella* (Collembola: Isotomidae), with notes on I. bidentata Delamare Deboutteville, 1950 and *I. amazonica* Oliveira & Deharveng, 1990. *Zootaxa* **2007**, *1652*, 41–48.
138. Oliveira, E.; Deharveng, L. *Isotomiella* (Collembola, Isotomidae) d'Amazonie: Les espèces du groupe minor. *Bull. Mus. Natl. Hist. Nat.* **1990**, *12*, 75–93.
139. Mendonça, M.C.; Fernandes, L.H. Três novas espécies de *Isotomiella* Bagnall, 1939 do sudeste do Brasil (Collembola: Isotomidae). *Lundiana* **2003**, *4*, 111–116.
140. Mendonça, M.C.; Queiroz, G.C. Two new Isotomidae species (Collembola: Entomobryomorpha) from Rio de Janeiro State, Brazil. *Zootaxa* **2017**, *4350*, 385–395. [CrossRef]
141. Mendonça, M.C.; Queiroz, G.C. A new Brazilian species of *Isotomiella* (Collembola: Isotomidae) from the state of Pará, Brazil. *Zoologia* **2016**, *33*, e20160005. [CrossRef]
142. Mendonça, M.C.; Abrantes, E.; Neves, A.C.R. New species of *Isotomiella* Bagnall, 1939 from Southeast of Brazil (Collembola, Isotomidae). *ZooKeys* **2012**, *233*, 21–30. [CrossRef]
143. Costa, J.M. *Contribuição ao Estudo dos Colembolos Isotomus Palustrias Mueller Collembola—Isotomidae. Boletim Técnico*; Instituto Agronômico do Leste: Bahia, Brazil, 1961; Volume 6, pp. 43–59.
144. Mendonça, C. Duas novas espécies brasileiras de *Isotomurus* Börner, 1903 (Collembola: Isotomidae). *Rev. Bras. Biol.* **1990**, *50*, 453–462.
145. Mendonça, M.C.; Queiroz, G.C. A new species of *Mucrosomia* (Collembola: Isotomidae) from Brazil. *Zoologia* **2013**, *30*, 217–220. [CrossRef]
146. Mendonça, M.C.; Abrantes, E.A.; Fernandes, L.H. Two new Brazilian species of *Paracerura* Deharveng & Oliveira (Collembola: Isotomidae). *Zootaxa* **2009**, *2310*, 24–34.
147. Abrantes, E.A.; Duarte, M. New species of *Paracerura* (Collembola: Isotomidae) from the state of São Paulo, Brazil. *Fla. Entomol.* **2013**, *96*, 1392–1400. [CrossRef]
148. Mendonça, M.C.; Silveira, T.C. New species of Paracerura (Collembola: Isotomidae) from Minas Gerais State, Brazil. *Zootaxa* **2013**, *3681*, 73–78. [CrossRef]
149. Deharveng, L.; Oliveira, E.P. *Paracerura virgata* n. g., n. sp. (Collembola, Isotomidae), nouveau collembole d'Amazonie centrale. *Rev. Suisse Zool.* **1994**, *101*, 441–446. [CrossRef]
150. Mendonça, M.C.; Queiroz, G.C.; Silveira, T.C. Two new species of *Proisotoma* Börner, 1901 from Southeastern Brazil (Collembola: Isotomidae). *Soil Org.* **2015**, *87*, 51–60.
151. Moniez, R. *Isotoma pallida*, collembole nouveau de Brésil. *Rev. Biol. Nord. Fr.* **1894**, *6*, 354.
152. Deharveng, L. Un nouveau collembole Isotomidae du Brésil: *Proisotoma oliveirae* n. sp. *Bull. Soc. Hist. Nat.* **1984**, *120*, 123–125.
153. Arlé, R. Uma nova espécie de *Onychiurus* (Collembola-Onychiuridae) de ocorrência periódica em Belém (Pará). *Bol. Mus. Para. Emilio Goeldi Nova Ser. Zool.* **1970**, *72*, 1–11.
154. Hüther, W. Eine neue Anurophorinen-Gattung aus NordostBrasilien (Ins, Collembola). *Senckenb. Biol.* **1967**, *48*, 169–173.
155. Teixeira, W.; Cordani, U.G.; Menor, E.A.; Teixeira, M.G.; Linsker, R. *Arquipélago Fernando de Noronha–O Paraíso do Vulcão*; Terra Virgem: São Paulo, SP, Brasil, 2003; p. 168.

156. Serafine, T.Z.; França, G.B.; Andriguetto-Filho, J.M. Ilhas oceânicas brasileiras: Biodiversidade conhecida e sua relação com o histórico de uso e ocupação humana. Brazilian oceanic islands: Known biodiversity and its relation to the history of human use and occupation. *Rev. Gestão Costeira Integr. J. Integr. Coast. Zone Manag.* **2010**, *3*, 281–301. [CrossRef]
157. Campos, T.F.C.; Virgens Neto, J.; Srivastava, N.K.; Petta, R.A.; Hartmann, L.A.; Moraes, J.F.S.; Mendes, L.; Silveira, S.R.M. Arquipélago de São Pedro e São Paulo—Soerguimento tectônico de rochas infracrustais no Oceano Atlântico. In *Sítios Geológicos e Paleontológicos do Brasil*; Winge, M., Schobbenhaus, C., Berbert-Born, M., Queiroz, E.T., Campos, D.A., Souza, C.R.G., Fernandes, A.C.S., Eds.; SIGEP: Brasilia, Brazil, 2005; Volume 2, pp. 253–263.
158. Lima, E.C.A.; de Mendonça, M.C.; Queiroz, G.C.; da Silveira, T.C.; Zeppelini, D. Synthesis of the Brazilian Poduromorpha (Collembola: Hexapoda) with special emphasis on the Equatorial Oceanic Islands. *Insects* **2021**, *12*, 268. [CrossRef]