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First record of Pudeoniscidae Lemos de Castro, 1973 (Oniscidea) from Peru, with the description of a new genus and species

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Abstract. A new genus of Pudeoniscidae from Peru is described, *Loretoniscus* gen. nov., including a new species: *Loretoniscus mashiriaensis* gen. et sp. nov. The new genus is characterized by pereonite 1 epimera without dorsolateral furrows, pereonites 1 and 2 without ventral lobes, telson with distal portion covering uropod endopods, and pleopod 1–2 exopods with respiratory areas. This is the first record of the family Pudeoniscidae from Peru, considerably extending its distribution in the Neotropical region.

Keywords. Terrestrial isopods, endogean species, Loreto, Tropical Amazon Rainforest, Neotropical.

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Introduction

Terrestrial isopods (Oniscidea) comprise about 4000 species distributed in more than 500 genera in 38 or 39 families, occurring in almost all terrestrial habitats (Schmalfuss 2003; Javidkar *et al.* 2015, 2017; Sfenthourakis & Taiti 2015; Campos-Filho & Taiti 2021). Recently, the molecular evidence showed the genus *Ligia* Fabricius, 1798 to have uncertain relationships with all the other groups of Oniscidea, emerging a discussion of multiple invasions of the terrestrial environment (Dimitriou et al. 2019). However, these conclusions are still under debate.

About 480 species of Oniscidea have been recorded in South America, most of them placed in the families Philosciidae Kinahan, 1857 and Scleropactidae Verhoeff, 1938 (Schmalfuss 2003; Schmidt & Leistikow 2005; Schmidt 2007; Campos-Filho *et al.* 2018a, 2019, 2020, 2021b, 2022a, 2022b; Cardoso *et al.* 2020a, 2020b, 2021, 2022a, 2022b; Ocampo-Maceda *et al.* 2022; Carpio-Díaz *et al.* 2018, 2021; Grangeiro *et al.* 2021; López-Orozco *et al.* 2016, 2017, 2022). To date, in Peru, 24 species distributed in 12 genera are known so far, i.e., *Ligia* Fabricius, 1798 (1 sp.) (Ligiidae), *Andenoniscus* Verhoeff, 1941 (1 sp.), *Androdeloscia* Leistikow, 1999 (8 spp.), *Benthanoides* Lemos de Castro, 1958 (2 spp.), *Erophiloscia* Vandel, 1972 (2 spp.), *Ischioscia* Verhoeff, 1928 (4 spp.) (Philosciidae), *Circoniscus* Pearse, 1917 (1 sp.), *Scleropactes* Budde-Lund, 1885 (1 sp.) (Scleropactidae), *Rhyscotoides* Schmalfuss & Ferrara, 1978 (1 sp.) (Rhyscotidae), *Ethelum* Budde-Lund, 1899 (1 sp.) (Eubelidae), *Porcellio* Latreille, 1804 (1 sp.), and *Porcellionides* Miers, 1878 (1 sp.) (Porcellionidae) (Ocampo-Maceda *et al.* 2022).

The family Pudeoniscidae comprises 11 species in the genera *Brasiloniscus* Cardoso, Campos-Filho & Araujo, 2018 (3 spp.), *Iansaoniscus* Campos-Filho, Araujo & Taiti, 2017 (4 spp.), *Oxossioniscus* Campos-Filho, Lisboa & Cardoso, 2018 (2 spp.), and *Pudeoniscus* Vandel, 1963 (2 spp.). To date, *Iansaoniscus* comprises only cave-restricted species recorded in the Brazilian semi-arid biome (Caatinga), while the remaining genera are recorded in Atlantic Forest areas (Vandel 1963; Lemos de Castro 1973; Campos-Filho *et al.* 2017, 2018b; Cardoso *et al.* 2018, 2022b).

The present work aims to describe a new genus and species of Pudeoniscidae from the Peruvian Amazon Rainforest, representing the first record of the family outside the Brazilian territory.

Material and methods

Taxonomy

Specimens were collected by visual search and stored in 75% ethanol. The description was based on morphological characters with the aid of micro preparations in Hoyer's medium (Anderson 1954). The species was illustrated with the aid of a camera lucida mounted on Wild M3Z and M20 microscopes. The final illustrations were prepared using the software GIMP with the method proposed by Montesanto (2015, 2016).

The material is deposited in the Museum of Natural History Collection in San Agustín National University, Arequipa, Peru (MUSA).

Study area

The locality of Nuevo Sucre is placed in Peruvian Amazon Rainforest, Ucayali Province in Loreto Department. The sampling area presents a terra firme forest with low hills with altitudinal ranges between 131 to 194 m a.s.l., and vegetation species like *Apeiba* sp. (monkey comb), *Astrocarym* sp., *Phytelephas* sp. (yarina), and also crop patches of cocoa, banana, yucca, and corn. Three streams run through its land, which are: Mashiría, Yarinillo, and Yarina. The climatic description following Castro *et al.* 2021 reveals a warm and rainy zone with abundant humidity in all year's seasons.

RESULTS

Taxonomy

Order Isopoda Latreille, 1817
Suborder Oniscidea Latreille, 1802
Family Pudeoniscidae Lemos de Castro, 1973

Loretoniscus Ocampo-Maceda, López-Orozco & Campos-Filho gen. nov.
urn:lsid:zoobank.org:act:293A9B09-3480-4B20-807B-64C27672ACD0

Type species

Loretoniscus mashiriaensis gen. et sp. nov., by present designation and monotypy.

Diagnosis

Body convex. Animals with partial conglobation ability; exoantennal conglobation. Cephalon with well-developed antennary lobes, triangular frontal shield slightly developed, laterally interrupted by antennal grooves, frontal line delimiting frontal shield on upper portion. Pereonite 1 epimera without dorsolateral furrows and schisma. Pereonites 1–3 without ventral lobes. Pleon outline continuous with that of pereon. Telson triangular with distal portion covering uropod endopods. Antennula with three articles. Antenna with flagellum of three articles, second and third articles divided by thin suture. Mandible with molar penicil dichotomized. Maxillula outer endite with outer group bearing teeth cleft at apex. Uropod protopod subrectangular, exopod inserted distally. Pleopod exopods 1 and 2 with respiratory areas.

Etymology

The new genus is named after the department where the specimens were collected: Loreto.

Remarks

In the complex shape of the depressions in the frontal shield of the cephalon, and the absence of dorso-lateral furrow on pereonite 1 epimera, *Loretoniscus* gen. nov. resembles *Iansaoniscus*; however, it differs in the broad shape of the telson with lateral margins straight (vs concave), uropod protopod subrectangular (vs subquadrangular), and pleopod 1 and 2 exopods with respiratory areas (vs absent).

The Pudeoniscidae were recently revised by Campos-Filho *et al.* (2018b). The diagnostic characters of the family do not comprise the variation observed in *Iansaoniscus* and *Loretoniscus* gen. nov. Thus, the diagnosis of the family after Campos-Filho *et al.* (2018b) is emended as follows: animals with exoantennal conglobation; cephalon with triangular frontal shield and profons having complex depressions, and pereonite 1 epimera with dorsolateral furrow to fit antennae during conglobation (reduced or absent in cave-dwellers or endogean species); epimera of pereonites 1–3 with small ventral lobes or schisma on pereonite 1 (reduced or absent in cave-dwellers or endogean species); pleon outline continuous to that of pereonite 7, neopleurae 3–5 well developed and rectangular, telson triangular or trapezoidal with proximal portion wider than distal portion; antennal flagellum of three articles, second and third divided by suture; uropod protopod subquadrangular, exopod inserted distally, endopod not surpassing the distal margin of telson; and pleopod exopods with respiratory structures.

Loretoniscus gen. nov. is included in the family Pudeoniscidae by sharing most of these mentioned characters. The absence of dorso-lateral furrow and schisma on pereonite 1 epimera, and absence of ventral lobes on pereonites 1–3 epimera are closely related with the conglobation ability, an eco-morphological strategy of oniscideans used against predation and to reduce water loss (Edney 1951;

Schmalfuss 1984). The new genus includes one new species with endogean habits, and probably the absence of these structures is related with habitat selection.

Loretoniscus mashiriaensis Ocampo-Maceda, López-Orozco & Campos-Filho gen. et sp. nov.
urn:lsid:zoobank.org:act:64308EDB-88C0-4430-AF2E-F203B27B3268
Figs 1–4

Etymology

The epithet refers to a stream flowing near the collection site 'Quebrada Mashiría'. In the Shipibo-Conibo language, 'Mashi' means sand.

Material examined

Holotype

PERU • ♂ (parts in micropreparations); Loreto, Contamana, Nuevo Sucre, Quebrada Mashiría; 7°24′47.21′ S, 74°56′8.51′ W; Nov. 2019; A. Ocampo and C. Ruelas leg.; MUSA-ENT-ISO 025.

Description

Measurements. Body length: 3 mm.

Body. Colorless. Body outline in lateral view as in Fig. 1A; dorsal surface smooth and covered with fan-shaped scale-setae (Fig. 1B).

Cephalon. Vertex depressed; lateral lobes rounded, frontal shield triangular with frontal and paramedian depressions interrupting frontal shield; eyes absent (Fig. 1C–D).

Pereon. Pereonites 1 and 2 epimera rounded, epimera 3–7 subquadrangular (Fig. 1A, E).

Pleon. Pleonites 3–5 with epimera subquadrangular and directed backward (Fig. 1A, F–G). Telson as wide as long, lateral margins straight, and apex rounded (Fig. 1F–G).

Antennula. Third article longer than second article, apex with four subapical plus two apical aesthetascs (Fig. 1H).

Antenna. Robust; surpassing pereonite 2 when extended backward; flagellum with first and second articles subequal in length; apical organ half length of distal article (Fig. 1I).

Mouth. Mandibles (Fig. 2A–B) with molar penicil with 6–7 branches, left mandible with 2 + 1 penicils, right with 1 + 1 penicils. Maxillula (Fig. 2C) outer endite composed of 4 + 5 teeth, inner set apically cleft; inner endite with two penicils. Maxilla (Fig. 2D) with bilobate apex, outer slightly wider than inner lobe, rounded and covered with thin setae; inner lobe rounded bearing thick setae. Maxilliped (Fig. 2E) basis rectangular; palp basal article with two distinct setae; endite rectangular, medial seta surpassing distal margin, distal margin bearing one seta on outer portion.

Uropods. Uropod protopod longer than wide, exopod longer than endopod, endopod inserted slightly proximally (Fig. 2F).

Pereopods. Pereopods 1–7 (Fig. 3A–B) merus and carpus with sparse setae on sternal margin; carpus 1 with longitudinal antennal grooming brush; dactylar and ungual seta simple not surpassing outer claw.

Genital papilla. Ventral shield triangular, papilla bearing two subapical orifices (Fig.3C).

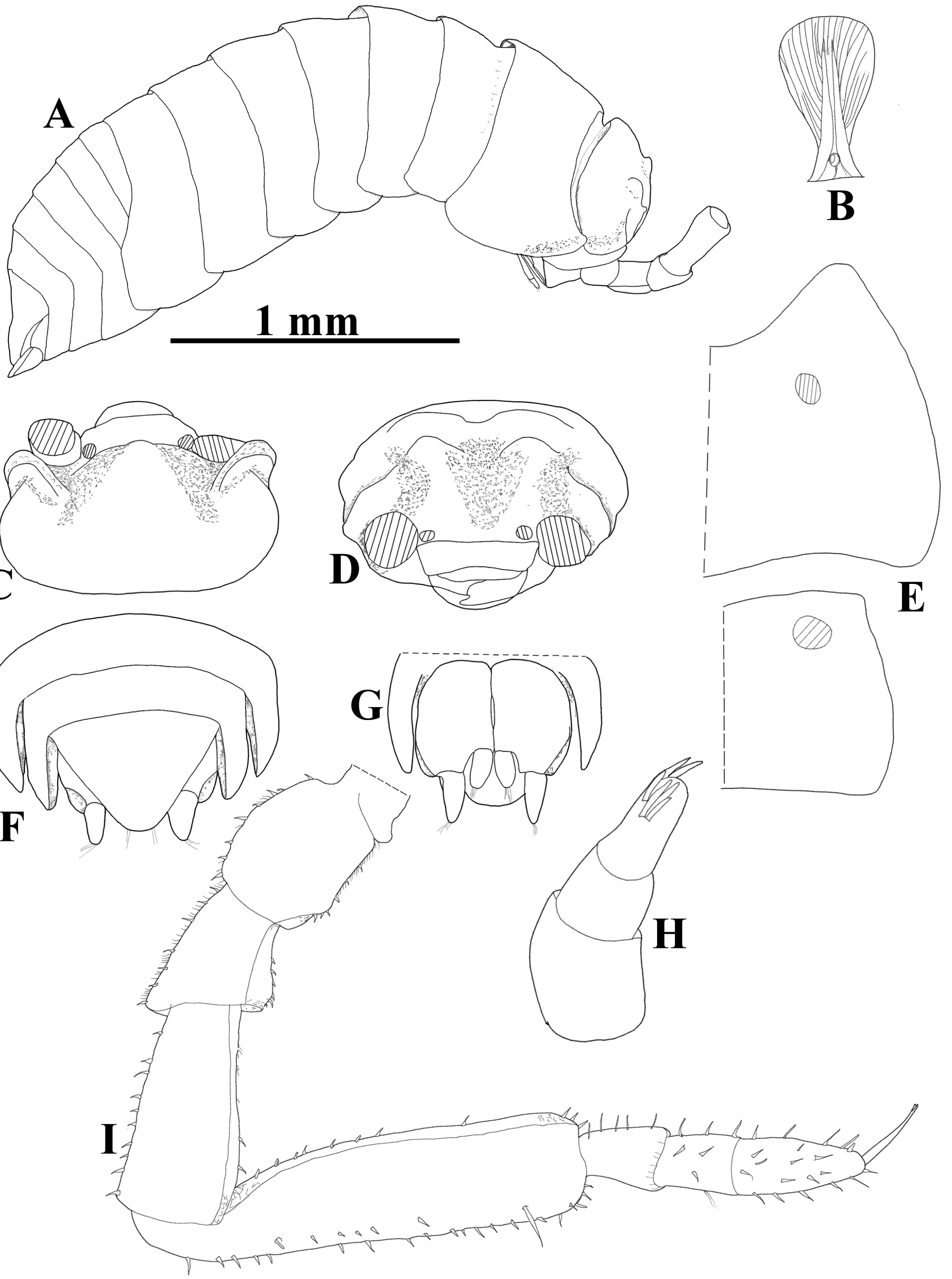

Fig. 1. *Loretoniscus mashiriaensis* gen. et sp. nov., ♂, holotype (MUSA-ENT-ISO 025). **A**. Habitus, lateral view. **B**. Dorsal scale-seta. **C**. Cephalon, dorsal view. **D**. Cephalon, frontal view. **E**. Pereonites 1 and 2 epimera, ventral view. **F**. Pleonites 4, 5, telson and uropods, dorsal view. **G**. Pleonite 5 and uropods, ventral view. **H**. Antennula. **I**. Antenna.

Pleopods. Pleopod 1 (Fig. 3C) exopod subrectangular, more than twice as wide as long, distal margin straight; endopod twice as long as exopod, distal portion tapering and slightly bent outwards, inner margin bearing small setae. Pleopod 2 (Fig. 3D) exopod triangular, outer margin almost straight bearing one seta. Pleopod 3–5 exopods as in Fig. 3E–G.

Discussion

Loretoniscus mashiriaensis sp. nov. was collected while the animal was climbing the base of a tree in the Peruvian Amazon Rainforest. The species shows a lack of body pigments and eyes, typical of endogean or troglobitic Oniscidea (Campos-Filho *et al.* 2014, 2017). Moreover, regarding the shape of the dorsal scale-setae, the species probably has endogean habits. The fan-shaped scale-setae are also present in other endogean genera of terrestrial isopods, e.g., *Caraiboscia* Vandel, 1968 (Philosciidae),

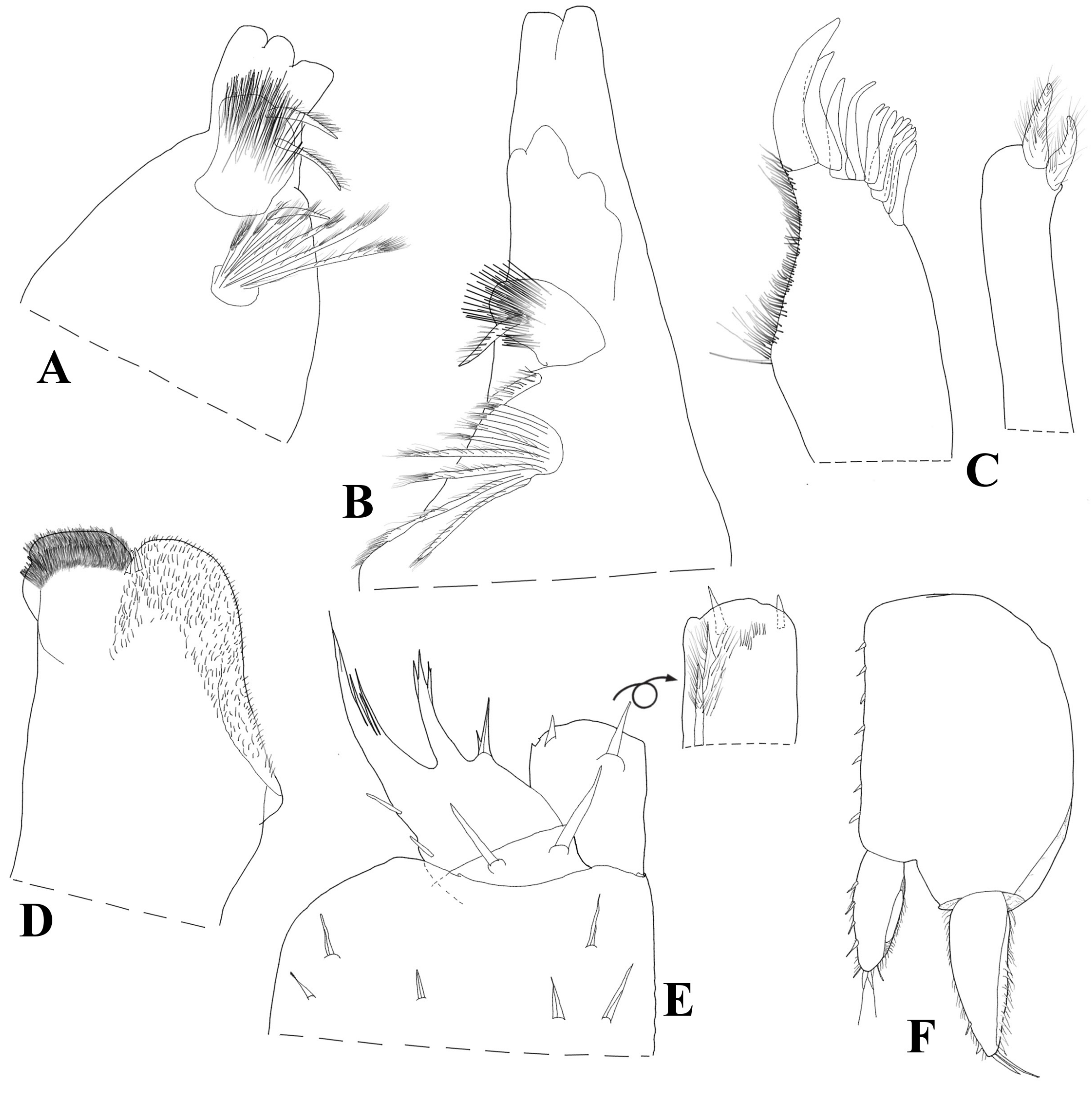

Fig. 2. *Loretoniscus mashiriaensis* gen. et sp. nov., ♂, holotype (MUSA-ENT-ISO 025). **A**. Left mandible. **B**. Right mandible. **C**. Maxillula. **D**. Maxilla. **E**. Maxilliped. **F**. Uropod.

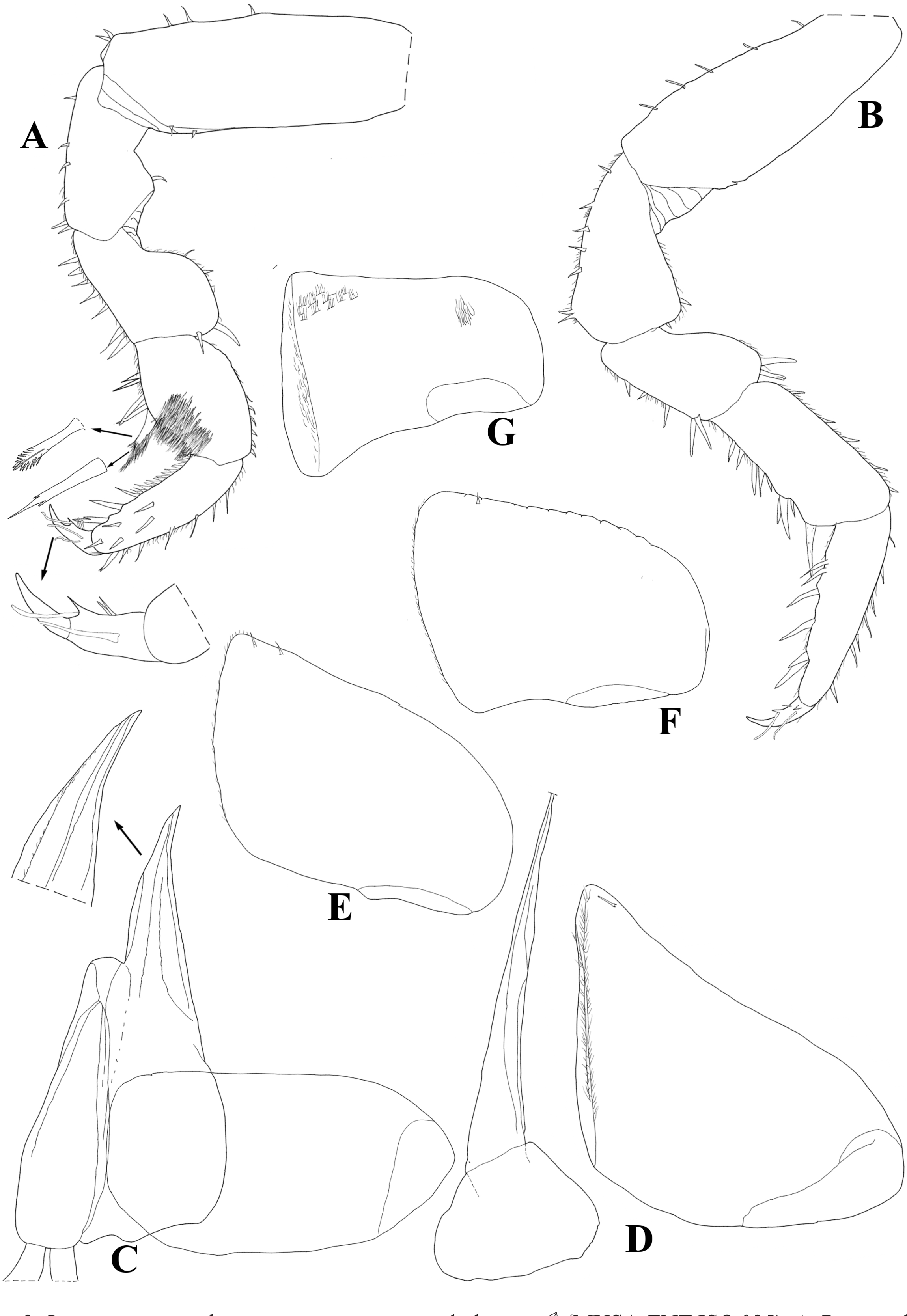

Fig. 3. *Loretoniscus mashiriaensis* gen. et sp. nov., holotype, ♂ (MUSA-ENT-ISO 025). **A**. Pereopod 1; **B**. Pereopod 7. **C**. Genital papilla and pleopod 1. **D**. Pleopod 2. **E**. Pleopod 3 exopod. **F**. Pleopod 4 exopod. **G**. Pleopod 5 exopod.

and *Trichorhina* Budde-Lund, 1908 (Platyarthridae) (Vandel 1968; Leistikow 2001; Campos-Filho *et al.* 2014). Moreover, these setae are useful for endogean animals to move in the substrate, reducing the adhesion of soil or water particles (Schmalfuss 1984; Wood *et al.* 2017).

In Pudeoniscidae, the respiratory structures vary among its genera, uncovered *Atracheodillo*-type in *Pudeoniscus*, polyspiracular covered *Eubelum*-type in *Oxossioniscus*, and absent in *Iansaoniscus* (see Campos-Filho *et al.* 2018b). The respiratory areas in the pleopods 1 and 2 exopods of *Loretoniscus mashiriaensis* sp. nov. is a reduction of thickness of the cuticle in the pleopod exopods, which is present in other groups of Oniscidea, e.g., *Atlantoscia* Ferrara & Taiti, 1981 and *Aphiloscia* Budde-Lund, 1908 (Philosciidae), *Circoniscus* and *Globopactes* Schmidt, 2007 (Scleropactidae) (see Ferrara *et al.* 1994, Leistikow & Araujo 2001; Schmidt 2007; Campos-Filho *et al.* 2013, 2021b). Zimmermann *et al.* (2018) in an integrative approach, observed that the respiratory areas of *Atlantoscia* and *Paratlantoscia* Zimmermann, Campos-Filho & Araujo, 2018 probably evolved due to historical events in the Brazilian Atlantic Forest, especially dry periods. The geological history of the Amazonian basin is quite complex, and the origin of its biodiversity have been extensively studied (e.g., Haffer 2008; Hoorn *et al.* 2010; Ribas *et al.* 2011; Dagosta & Pinna 2017; Ledo & Colli 2017).

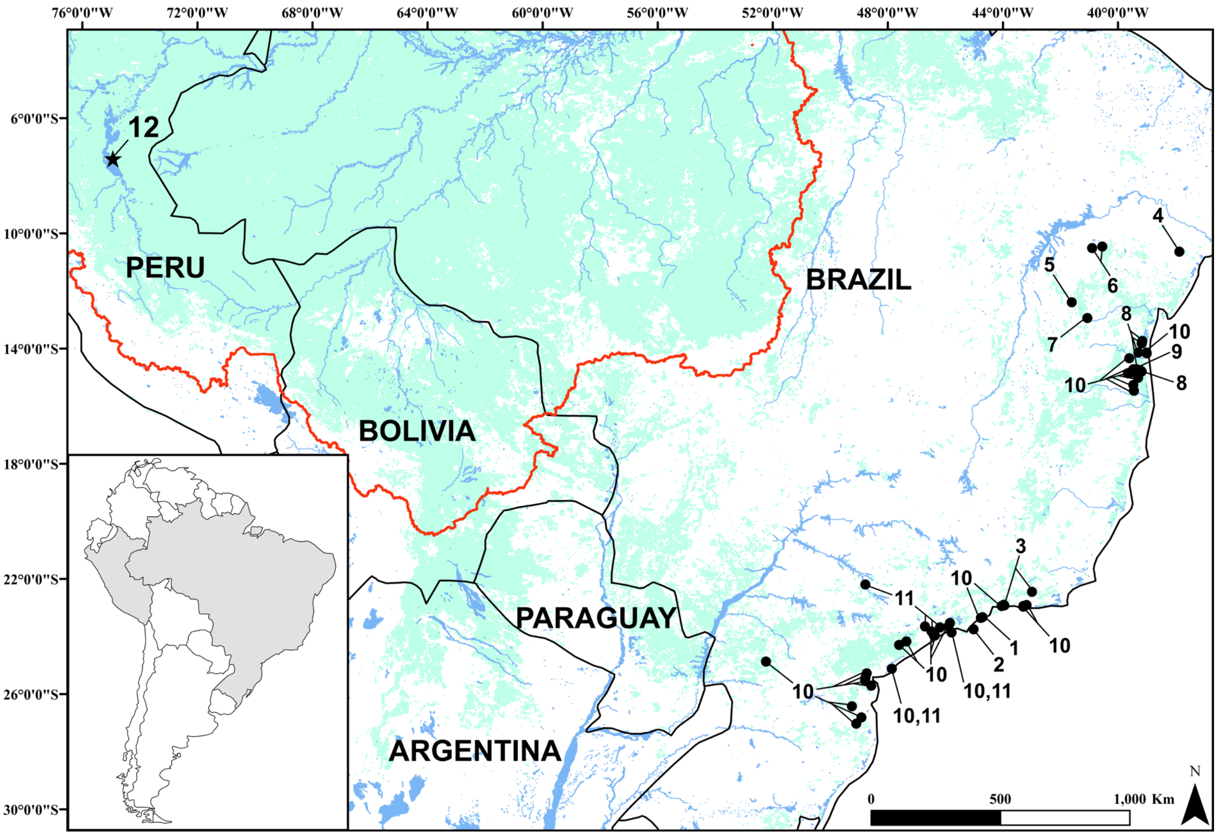

Fig. 4. Map of distribution of species of Pudeoniscidae: **1**. *Brasiloniscus littoralis* Cardoso, Campos-Filho & Araujo, 2018. **2**. *B. maculatus* Lemos de Castro, 1973. **3**. *B. verrucosus* Lemos de Castro, 1973. **4**. *Iansaoniscus georginae* Campos-Filho, Araujo & Taiti, 2017. **5**. *I. iraquara* Campos-Filho, Araujo & Taiti, 2017. **6**. *I. leilae* Cardoso, Bastos-Pereira & Ferreira, 2022. **7**. *I. paulae* Cardoso, Bastos-Pereira & Ferreira, 2022. **8**. *Oxossioniscus akoko* Campos-Filho, Lisboa & Cardoso, 2018. **9**. *O. pataxo* Campos-Filho, Lisboa & Cardoso, 2018. **10**. *Pudeoniscus birabeni* Vandel, 1963. **11**. *P. obscurus* Lemos de Castro, 1973. **12**. *Loretoniscus mashiriaensis* gen. et sp. nov. Green area = vegetative cover; blue areas = drainage; red line = Amazon delimitation.

Regarding the absence of ventral lobes on pereonites 1 and 2 epimera in the new species, this condition is also observed in *Iansaoniscus paulae* Cardoso, Bastos Pereira & Ferreira, 2022 (see also Campos-Filho *et al.* 2017). As mentioned previously, the lack of this structures, useful during conglobation, represents a secondary loss due to habitat pressure (see also Campos-Filho *et al.* 2018b). Moreover, *L. mashiriaensis* sp. nov. is considered an endogean species.

The present work considerably extends the distribution of the Pudeoniscidae in South America. The family apparently has a disjunct distribution in tropical rainforests (Fig. 4). Regarding the diversity of the ecosystems of Peru, the diversity of terrestrial isopods, as of other taxa, is considerably underestimated. More species will be described as soon as more areas across the country will have been sampled, as is common in tropical countries.

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