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ORIGINAL ARTICLE



## Two new species of *Neotroponiscus* Arcangeli, 1936 (Crustacea, Isopoda, Oniscidea) from Brazilian caves

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### ABSTRACT

Currently *Neotroponiscus* comprises eight species. In this study, two new species of this genus of terrestrial isopods are described. *Neotroponiscus iporangaensis* sp. nov. was collected in limestone caves located in Parque Estadual Turístico do Alto Ribeira (PETAR). *Neotroponiscus tuberculatus* sp. nov. occurs in iron ore caves of the Iron Quadrangle (local name Quadrilátero Ferrífero) and represents the first species of the genus recorded in iron caves. As tourism and mining are common activities in PETAR and in the caves of the Iron Quadrangle, respectively, both species' occurrence is threatened.

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### ARTICLE HISTORY

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### KEYWORDS

Terrestrial isopods; woodlice; neotropics

### Introduction

The genus *Neotroponiscus* was erected by Arcangeli (1936) to include *N. carolii* Arcangeli, 1936, from São Paulo state (Brazil). The description was based solely on a female specimen. Lemos de Castro (1970a) revised the genus and provided the male description. Currently, the genus includes eight species: *N. carolii*, *N. argentinus* (Giambiagi de Calabrese 1939), *N. plau-manni* (Andersson 1960), *N. daguerrii* (Giambiagi de Calabrese 1939), *N. littoralis* Lemos de Castro, 1970, *N. lobatus* Lemos de Castro, 1970, *N. lenkoi* Lemos de Castro, 1970, and *N. perlatus* Lemos de Castro, 1970 (Giambiagi de Calabrese 1939; Andersson 1960; Lemos de Castro 1970a; 1970b). Schultz (1972) revised the material used by Boone (1918) and synonymized *N. vedadoensis* (Boone 1918) with *Porcellio lamelatus* Budde-Lund (1885).

Most *Neotroponiscus* species occur in the Brazilian Atlantic Forest and can be found on banana and bromeliad leaves, decaying wood, and in ant and termite nests (Lemos de Castro 1970a, 1970b; Lenko 1971; Lisboa et al. 2013). Some species also occur in Argentina (*N. argentinus* and *N. daguerrii*) and Uruguay (*N. plau-manni*). Although there have been new records expanding the known distribution of some species (Araujo et al. 1996; Mugnai et al. 2013), new species have not been described since 1970. The present study describes two new species of *Neotroponiscus* from the Brazilian states of Minas

Gerais and São Paulo. Both species were collected in subterranean environments (caves), associated with organic matter such as guano piles and litter.

### Material and methods

Specimens were stored in 75% ethanol and identifications were based on morphological characters. The species were illustrated with the aid of a camera lucida on an Olympus CX31 microscope (Tokyo, Japan) and pictures were obtained with Nikon AZ100 (Tokyo, Japan). Illustrations were prepared according to Montesanto (2015, 2016).

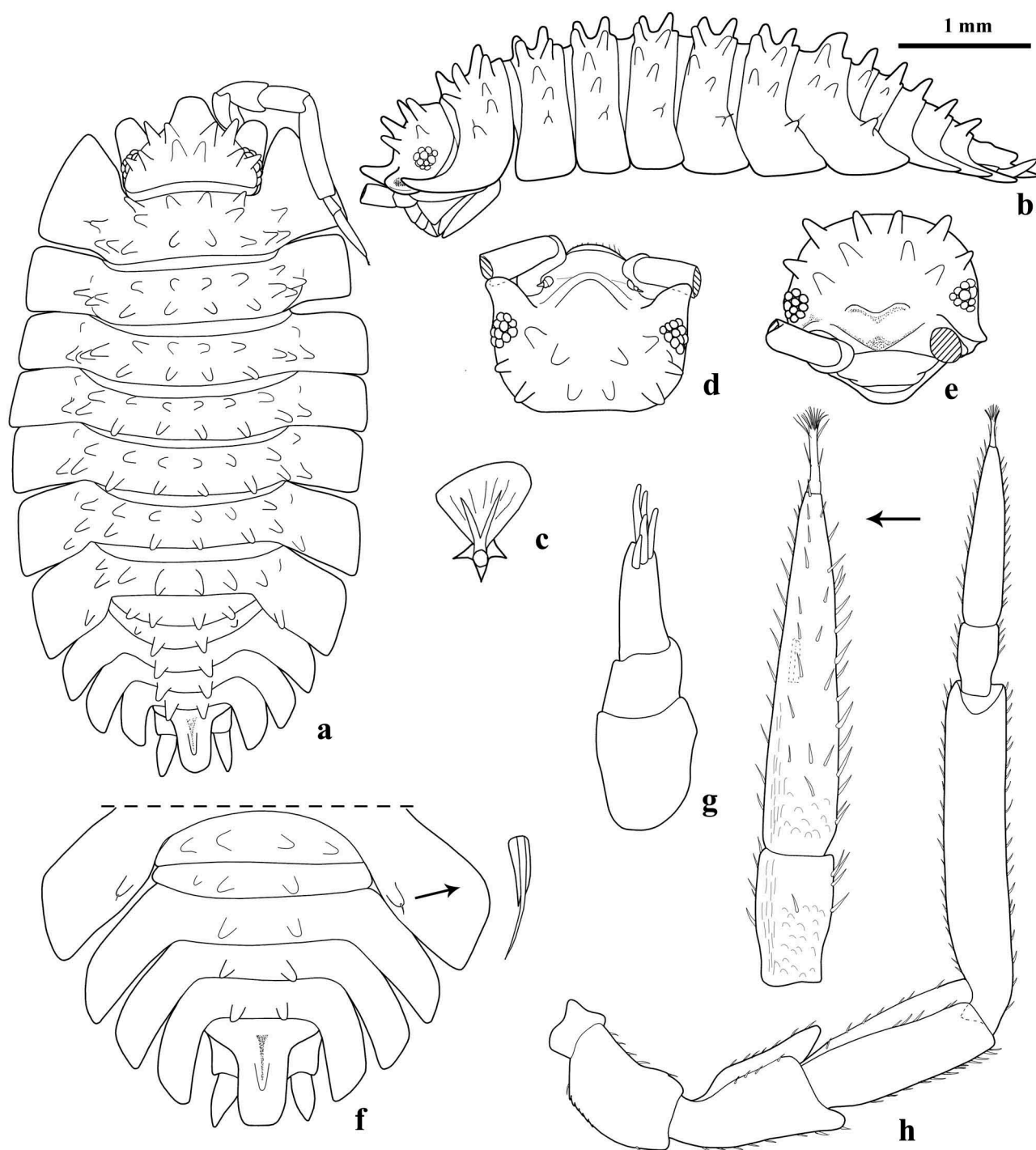
The material used for this study is deposited in the Museu de Zoologia (MZUSP), Universidade de São Paulo, São Paulo, Brazil; in the Laboratório de Estudos Subterrâneos, Universidade Federal de São Carlos (LES/UFSCar); and in the Coleção de Crustáceos do Departamento de Zoologia (UFRGS), Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil.

### Results

Genus *Neotroponiscus* Arcangeli, 1936

Type species *Neotroponiscus carolii* Arcangeli, 1936  
*Neotroponiscus iporangaensis* sp. nov. Cardoso & Araujo

(Figures 1–3, 6(A), 7(A–D))



**Figure 1.** *Neotroponiscus iporangaensis* sp. nov. ♂ holotype MZUSP 35061. (A) habitus, dorsal view; (B) habitus, lateral view; (C) scale-seta; (D) cephalon, dorsal view; (E) cephalon, frontal view; (F) pereonite 7, pleon, telson and uropods, dorsal view; (G) antennule; (H) antenna.

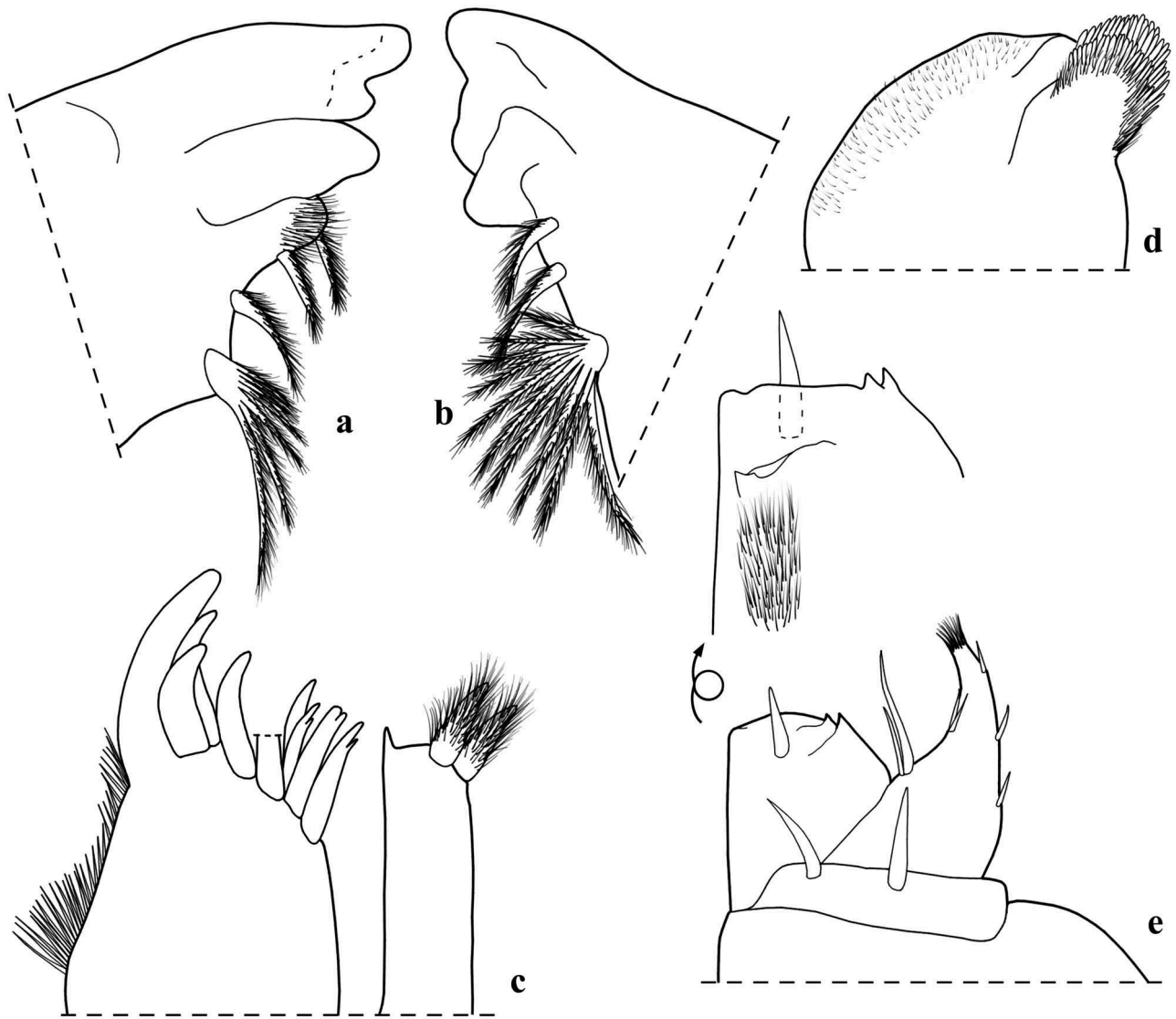
### Type material

São Paulo state, Iporanga: 1 ♂ Holotype (MZUSP 35061), Cafezal cave, Parque Estadual Turístico do Alto Ribeira (PETAR), 16–20 September 2009, leg. Pellegatti-Franco (col.); 2 ♀♀ 2 ♂♂ Paratypes (MZUSP 35062), Lage Branca, Parque Estadual

Turístico do Alto Ribeira (PETAR), 1 October 2012, leg. M. E. Bichuette (col.).

### Additional material

1 ♀ (LES/UFSCar 1774), Santana cave, Parque Estadual Turístico do Alto Ribeira (PETAR), 16–20 September



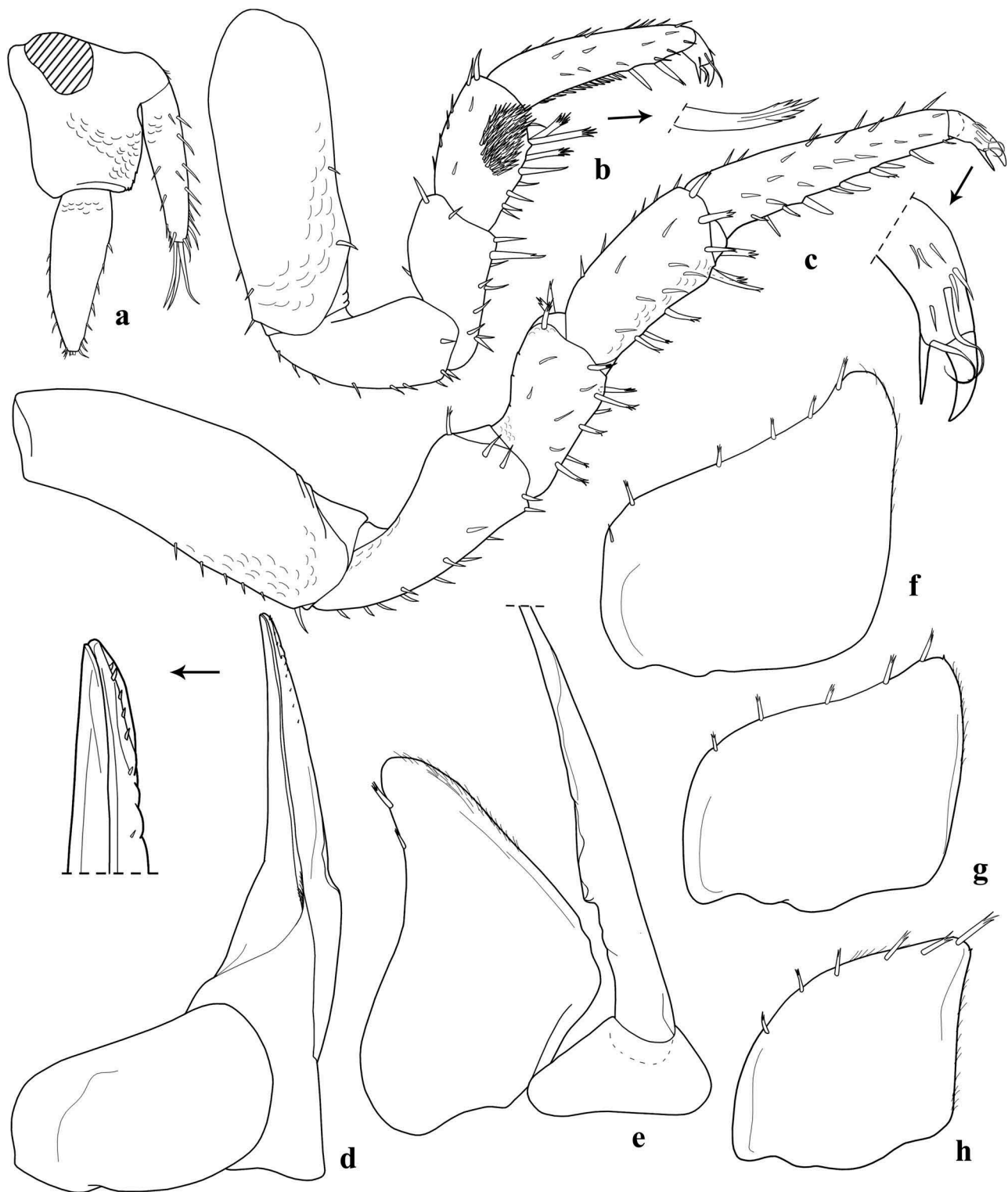
**Figure 2.** *Neotroponiscus iporangaensis* sp. nov. ♂ paratype MZUSP 35062. (A) left mandible; (B) right mandible; (C) maxillula; (D) maxilla; (E) maxilliped.

2009, leg. Pellegatti-Franco (col.); 1 ♂ (UFRGS 6070), Alambari de Baixo cave, Parque Estadual Turístico do Alto Ribeira (PETAR), 13–20 September 2009, leg. Pellegatti-Franco (col.); 1 ♀ (UFRGS 6093), Cafetal cave, Parque Estadual Turístico do Alto Ribeira (PETAR), 16–20 September 2009, leg. M. E. Bichuette (col.).

### Description

Maximum body length 8 mm. Specimens of brown color with yellow spots, antenna pigmented; cephalon lobes strongly pigmented, posterior part yellowish; epimera less pigmented than body, with median unpigmented area; pleon epimera, uropods, and telson strongly pigmented (Figure 6(A)). Dorsal tubercles conical with rounded apex located as follows: two lines on cephalon, three lines on pereonite 1, two lines on pereonites 2–6,

two or one line on pereonite 7, four tubercles on pleonite 1, sometimes two on pleonite 2, two tubercles on pleonites 3–5; telson with one carinated tubercle (Figure 1(A), 1(B)). Dorsum covered with fan-shaped scale-setae (Figure 1(C)); one line of *noduli laterales* per side, arranged on top of outmost tubercle (Figure 1(B), 1(F)). Pereon and pleon epimera enlarged; pereon 1 epimeron directed frontwards, other epimera progressively directed backwards (Figure 1(A), 1(B)); pleon epimera falciform directed backwards (Figure 1(F)). Cephalon (Figure 1(D), 1(E)) with rounded lateral lobes, directed outwards, and triangular median lobe directed upwards; eyes with 16 ommatidia. Telson (Figure 1(F)) as wide as long; convex lateral margins with rectangular distal part. Antennula (Figure 1(G)) with second article shortest; distal articles with two apical and three subapical



**Figure 3.** *Neotroponiscus iporangaensis* sp. nov. ♂ paratype MZUSP 35062. (A) uropod; (B) pereopod 1; (C) pereopod 7; (D) pleopod 1; (E) pleopod 2; (F) pleopod 3 exopod; (G) pleopod 4 exopod; (H) pleopod 5 exopod.

aesthetascs. Antenna (**Figure 1(H)**) reaching posterior margin of pereonite 2; flagellum shorter than fifth segment of peduncle, second flagellar article almost 3 times as long as first article, with two aesthetascs. Mandible with molar penicil with about 10 branches, left mandible

(**Figure 2(A)**) with 2 + 1 penicils, right mandible (**Figure 2(B)**) with 1 + 1 penicils. Maxillula (**Figure 2(C)**) inner endite bearing two hairy penicils, distal margin with lateral tip; outer endite with 4 + 5 teeth, inner set with cleft apex. Maxilla (**Figure 2(D)**) outer lobe



wider than inner lobe. Maxilliped (Figure 2(E)) palp with two long setae on proximal article; endite subrectangular, median seta surpassing distal margin, distal margin with two hooks. Pereopods with simple dactylar organ and unguis seta. Uropod (Figure 3(A)) protopod as wide as long; endopod inserted proximally; exopod as long as endopod, surpassing distal margin of telson.

**Male.** Pereopod 1 (Figure 3(B)) bearing sparse setae on sternal margin of merus and carpus; carpus with longitudinal antennal brush. Pereopod 7 (Figure 3(C)) bearing sparse setae on sternal margin of ischium, merus, and carpus. Pleopod 1 (Figure 3(D)) exopod small (one third of endopod length), rectangular, about twice as wide as long; endopod with setules on distal inner margin, straight distal part. Pleopod 2 (Figure 3(E)) exopod triangular, shorter than endopod. Pleopods 3–5 (Figure 3(F–H)) trapezoidal.

### Etymology

The name *iporangaensis* refers to the locality where the species was found.

### Remarks

The general body shape of *Neotroponiscus iporangaensis* sp. nov., with lateral epimera strongly developed, resembles *N. littoralis*. The type of tubercle, conical and rounded (as opposed to small boss in *N. perlatus* and *N. lobatus*, or ribs in *N. daguerrii* and *N. plaumanni*), resembles the tubercles of *N. carolii* and *N. littoralis*, but differs in number and position. On the pereon, the tubercles occur in five pairs, while in *N. carolii* they occur in four pairs. The rectangular shape of pleopod 1 exopod can also distinguish *N. iporangaensis* sp. nov. from *N. carolii* as the latter shows a quadrangular shape.

*Neotroponiscus iporangaensis* sp. nov. was recorded in touristic limestone caves located at Parque Estadual Turístico do Alto Ribeira (PETAR) in Southeastern Brazil (Figure 7(A–D)). The caves are under legal protection (State Conservation Unit), but their legal management allows a high number of visitors throughout the year. The specimens have been observed on and nearby guano piles, indicating a possible preference for this microhabitat, which implies that the species is vulnerable, since is dependent of a specific trophic resource. Despite having been collected only in a cave environment, the specimens did not show any troglomorphic character-states, but instead showed strong pigmentation and a regular number of ommatidia, similar to epigeic species. More samplings in epigeic habitats of PETAR and its surroundings are necessary to confirm if this species is troglomorphic.

***Neotroponiscus tuberculatus* sp. nov.** Cardoso & Araujo (Figures 4, 5, 6(B), 7(E), 7(F))

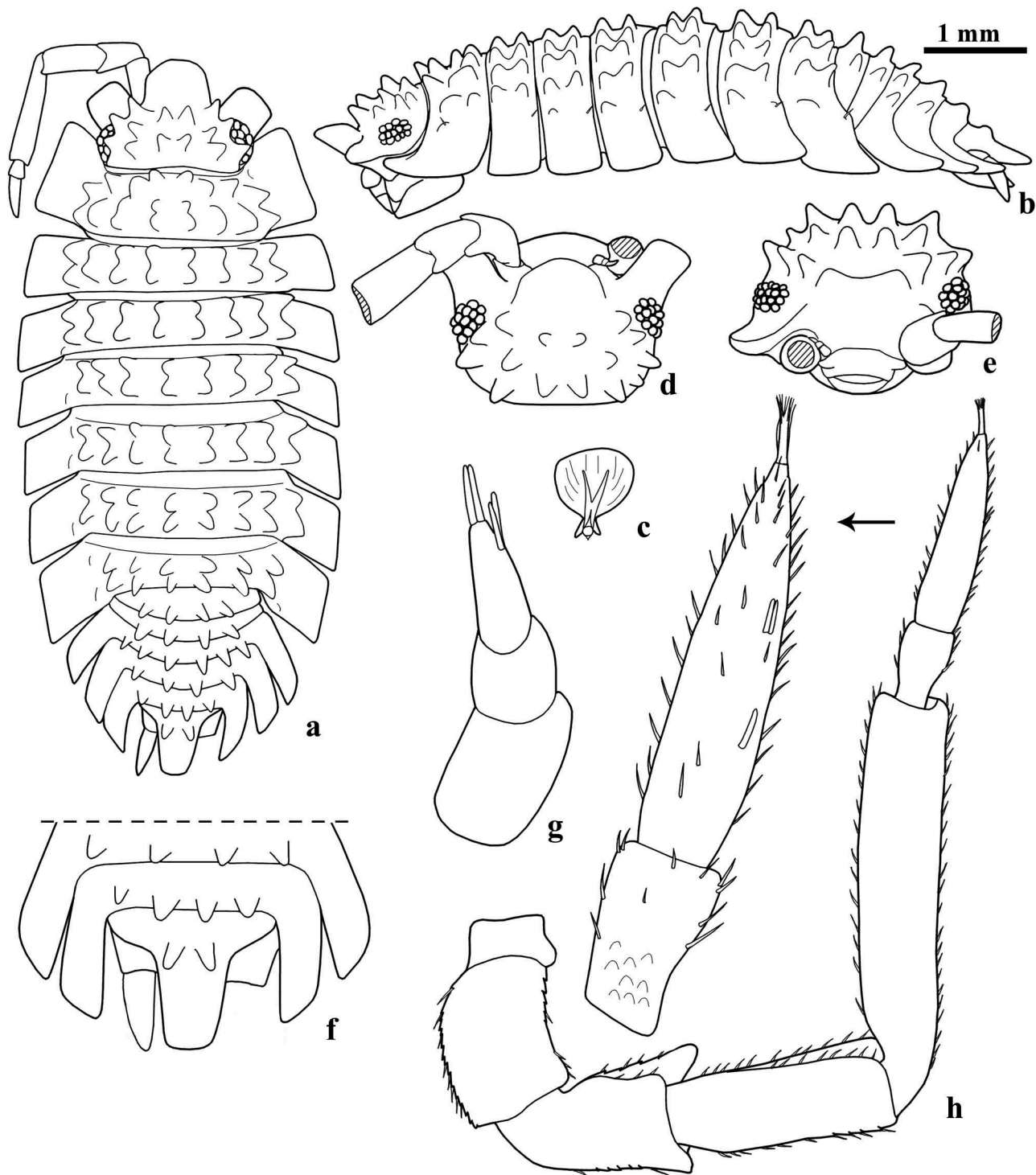
### Type material

Minas Gerais State, Brumadinho: 1 ♂ Holotype (MZUSP 35063) cave PBR23, 607479mE/7771357mN SAD'69 (20°09'07.2"S, 43°58'17.7"W), 28 September–3 October 2009, leg. Bessi (col.); 1 ♂ Paratype (MZUSP 35064) cave PBR03, 607729mE 7770560mN (20°09'33.1"S, 43°58'08.9"W) 15–20 March 2010, leg. Bessi (col.); 1 ♀ (UFRGS 5592) same data as holotype.

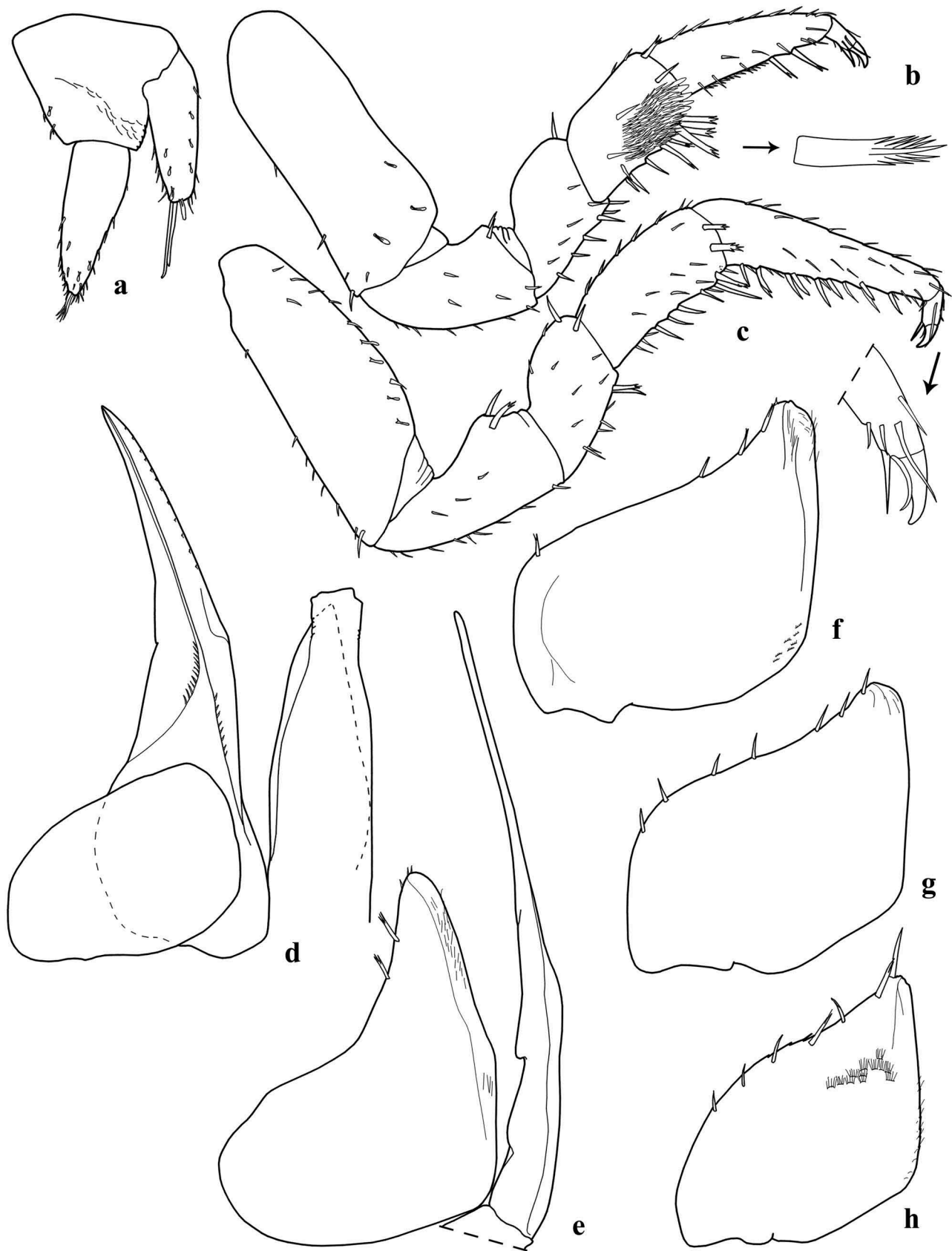
### Description

Maximum body length 5 mm. Brown color with unpigmented spots; antenna with first and second articles of peduncle yellowish, flagellum strongly pigmented; pereonite 1 epimeron weakly pigmented, pereonites 2–7 epimera with one unpigmented spot (Figure 6(B)). Dorsal conical tubercles (Figure 4(A), 4(B)) positioned as follows: three lines on cephalon and pereonite 1, two lines of fused tubercles on pereonites 2–7, four tubercles on pleonites 1–5, pleonite 3 with six tubercles, two tubercles on telson. Dorsum covered with fan-shaped scale-setae (Figure 4(C)); one line of *noduli laterales* per side, far from lateral margin and near outmost tubercle. Epimera of pereon and pleon enlarged; pereonite 1 epimeron directed frontwards, pereonite 2–7 epimera quadrangular with posterior margins progressively more acute and directed backwards (Figure 4(A), 4(B)). Cephalon (Figure 4(D), 4(E)) with quadrangular lateral lobes and directed outwards, median lobe rounded, directed upwards and larger than lateral lobes. Eyes small with 16 ommatidia. Telson (Figure 4(F)) wider than long, convex lateral margins with quadrangular distal part. Antennula (Figure 4(G)) with second article shortest; distal article with two apical and two lateral aesthetascs. Antenna (Figure 4(H)) reaching posterior margin of pereonite 2; flagellum with two articles, shorter than fifth article of peduncle, second flagellar article with two rows of aesthetascs. Pereopod with simple dactylar organ and unguis seta. Uropod (Figure 5(A)) protopod wider than long; exopod as long as endopod, surpassing distal margin of telson.

**Male.** Pereopod 1 (Figure 5(B)) bearing sparse setae on sternal margin of merus and carpus; carpus with antennal brush obliquely directed. Pereopod 7 (Figure 5(C)) bearing sparse setae on sternal margin of merus and carpus. Pleopod 1 (Figure 5(D)) exopod small (one third of endopod length), subrectangular, about twice as wide as long; endopod with straight distal part and triangular apical part. Pleopod 2 (Figure 5(E)) exopod triangular,

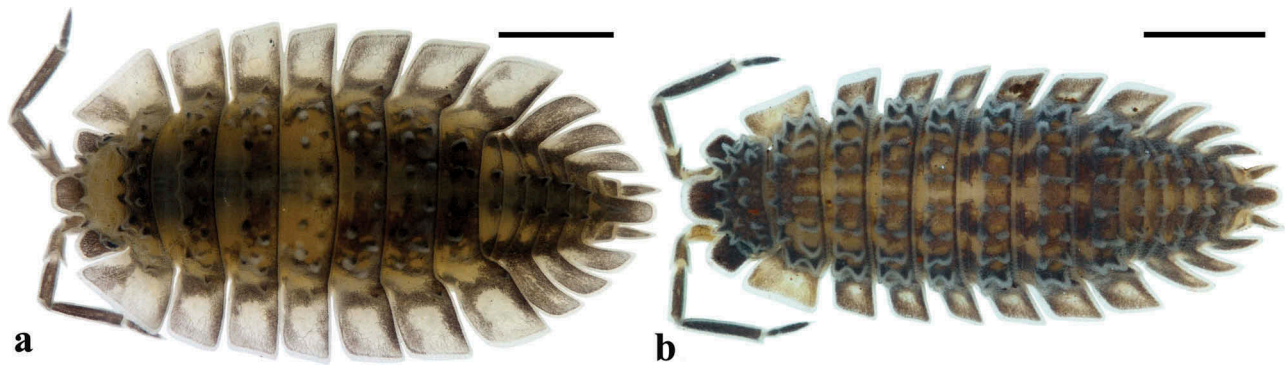


**Figure 4.** *Neotroponiscus tuberculatus* sp. nov. ♂ paratype MZUSP 35064. (A) habitus, dorsal view; (B) habitus, lateral view; (C) scale-seta; (D) cephalon, dorsal view; (E) cephalon, frontal view; (F) pleonites 4 and 5, telson and uropods, dorsal view; (G) antennule; (H) antenna.

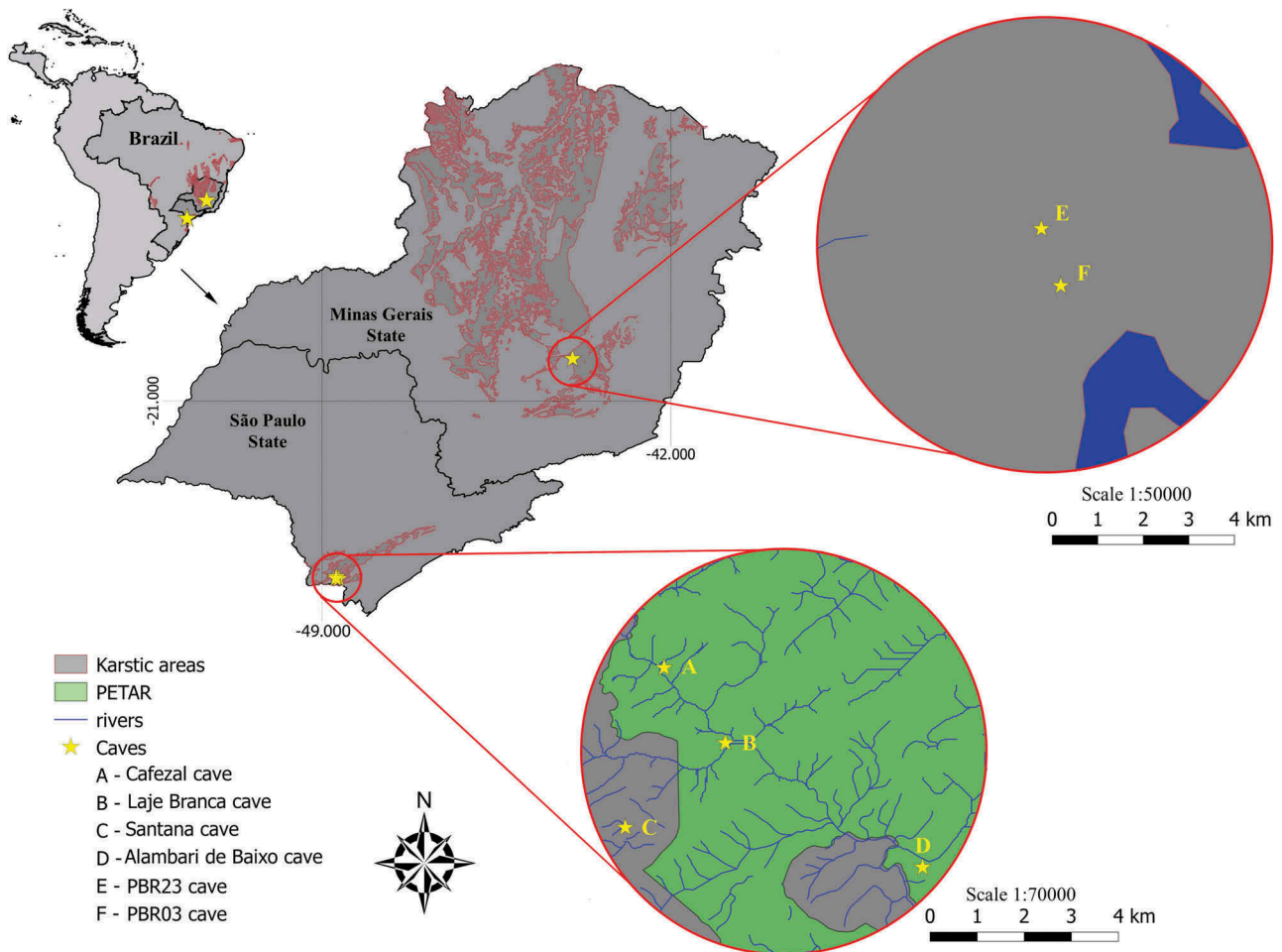


**Figure 5.** *Neotroponiscus tuberculatus* sp. nov. ♂ paratype MZUSP 35064. (A) uropod; (B) pereopod 1; (C) pereopod 7; (D) pleopod 1; (E) pleopod 2; (F) pleopod 3 exopod; (G) pleopod 4 exopod; (H) pleopod 5 exopod.





**Figure 6.** (A) *Neotroponiscus iporangaensis* sp. nov. ♀ paratype MZUSP 35062 in dorsal view; (B) *Neotroponiscus tuberculatus* sp. nov. ♂ paratype MZUSP 35064 in dorsal view. Scale: 1 mm.



**Figure 7.** Distribution of *Neotroponiscus iporangaensis* sp. nov. (A–D) and *Neotroponiscus tuberculatus* sp. nov. (E, F). By: Diego M. von Schimonsky.

shorter than endopod. Pleopods 3–5 (Figure 5(F–H)) trapezoidal.

### Etymology

The name *tuberculatus* refers to tubercles present on telson.

### Remarks

*Neotroponiscus tuberculatus* sp. nov. resembles *N. iporangaensis* sp. nov., *N. carolii*, and *N. littoralis* in the conical shape of the dorsal tubercles. In *N. tuberculatus* sp. nov., the tubercles occur in four pairs on pereon, as in *N. carolii*. However, the presence of six

tubercles on pleonite 3 and two tubercles on telson distinguish *N. tuberculatus* sp. nov. from the other species.

*Neotroponiscus tuberculatus* sp. nov. occurs in caves in Brumadinho municipality, in the central region of Minas Gerais state, Southeast Brazil (Figure 7(E), 7(F)). The caves are of iron ore lithology, located in the Iron Quadrangle (local name Quadrilátero Ferrífero) and are not included in conservation areas, i.e. are not under legal protection. These caves are severely threatened since they are located in and/or nearby mining operations; therefore, the new species is also threatened. Iron ore caves are commonly small cavities with many interposed channels and high humidity (Bichuette et al. 2015). The isopods were observed in the unconsolidated substrate, always exposed. The genus is usually distributed near the coastal region of the Atlantic Forest; therefore, this study represents the first record of the genus in the transition between Cerrado and Rainforest. Due to the occurrence site, this species must be considered in conservation initiatives as its occurrence in a mining region indicates its vulnerability.

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## Disclosure statement

No potential conflict of interest was reported by the authors.

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