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Terrestrial isopods (Crustacea: Isopoda: Oniscidea) from Brazilian caves

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Received 16 December 2013; revised 5 May 2014; accepted for publication 8 May 2014

To date, six species of terrestrial isopods were known from Brazilian caves, but only four could be classified as troglobites. This article deals with material of Oniscidea collected in many Brazilian karst caves in the states of Pará, Bahia, Minas Gerais, Mato Grosso do Sul, and São Paulo, and deposited in the collections of the Museu de Zoologia, Universidade de São Paulo, the Coleção de Carcinologia do Departamento de Zoologia, Universidade Federal do Rio Grande do Sul, and the collection of the Natural History Museum, Section of Zoology ‘La Specola’, Florence. Three new genera have been recognized: Spelunconiscus gen. nov. and Xangoniscus gen. nov. (Styloniscidae), and Leonardoscia gen. nov. (Philosciidae). Twenty-two species have been identified, 11 of which in the families Styloniscidae, Philosciidae, Scleropactidae, Plathyartridae, Dubioniscidae, and Armadillidae are new to science: Leonardoscia hassalli sp. nov., Metaprosekia quadriocellata sp. nov., Metaprosekia caupe sp. nov., Amazoniscus leistikowi sp. nov., Novamundoniscus altamiraensis sp. nov., Trichorhina yiara sp. nov., Trichorhina curupira sp. nov., and Ctenorillo ferrarai sp. nov. from Pará; Xangoniscus aganju sp. nov. from Bahia; and Spelunconiscus castroi sp. nov. and Trichorhina anhanguera sp. nov. from Minas Gerais. Four new species in the families Styloniscidae (Spelunconiscus castroi sp. nov. and Xangoniscus aganju sp. nov.), Philosciidae (Leonardoscia hassalli sp. nov.), and Scleropactidae (Amazoniscus leistikowi sp. nov.) with highly troglomorphic traits can be considered as troglobitic, whereas all the remaining species are either troglophilic or accidentals. Brazilian caves are now under potential threat because of recent legislation, and the knowledge of the subterranean biodiversity of the country is thus of primary importance.


INTRODUCTION

Terrestrial isopods (Oniscidea), widespread and abundant soil invertebrates, have great potential for successful colonization of subterranean habitats because of their detritivorous feeding habits and the availability of favourable substrates in caves throughout the world. Indeed, these animals have been recorded in all studied karst areas around the world as troglobites (species constituted by exclusively subterranean source populations), troglophiles (species with source populations in both hypogean and epigean habitats, with...
individuals regularly commuting between these habitats; Sket, 2008; Trajano, 2012), and accidentals (Culver & Pipan, 2009). Until 2004, c.300 troglobiotic species in 16 families of Oniscidea were recorded worldwide, most of which were from much more intensively investigated caves in the northern hemisphere (Taiti, 2004).

In the last decade, biospeleological surveys have progressed considerably in Australia, Asia, and South America. Taxonomic impediment has been a major problem in regions of mega-biodiversity, such as southeastern Asia and Brazil, because of the paucity of specialists able to describe such diversity, using characters that not only have a strong phylogenetic signal but that may also be used empirically in a straightforward manner, coping with the increasing demand for robust scientific bases for effective conservation policies.

Brazil has a great potential for subterranean habitats, either in karst or in non-karst areas. It has been estimated that c.2.8% of the country area (approximately 2,368,000 km²) is covered by exposed carbonatic rocks (Sallun Filho & Karmann, 2012), where the largest subterranean systems develop. In addition, karstic caves may also form in siliciclastic rocks, and non-karst cavities may occur in ferruginous and other types of rocks and sediments, which occupy large areas in the country. So far, more than 10,000 caves are known in Brazil, with potential for there being more than 100,000 (Sallun Filho & Karmann, 2012), with most of them lying outside of protected areas. Until recently, all Brazilian caves were legally protected (BRASIL, 1990). In 2008, a new decree (BRASIL, 2008) established a classification of caves into degrees of relevance according to criteria based on the presence of attributes of uniqueness. Because those attributes were largely insufficient, were ill defined, and because there was no scientifically valid method to test for presence versus absence, this new regulation may represent a major threat to Brazilian subterranean diversity. The decree is currently sub judice.

Not surprisingly, in view of the extensive collecting efforts carried out by speleobiologists throughout Brazil since the 1980s, dozens of oniscideans have been reported in faunistic publications (e.g. Pinto-da-Rocha, 1995; Souza-Kury, 1997a; Trajano, 2000; Trajano & Bichuette, 2010; Gallão, 2012), but because of the aforementioned taxonomic impediment, only six have been described so far: Benthana iporangensis Lima & Serejo, 1993 (Philosciidae), Amazoniscus eleonorae Souza, Bezerra & Araujo, 2006, Circioniscus buckupi Campos-Filho & Araujo, 2011, Circioniscus carajasensis Campos-Filho & Araujo, 2011 (Scleropactidae), Trichorhina guanophila Souza-Kury, 1993 (Platyarthridae), and Gabunillo aridica Souza, Senna & Kury, 2010 (Armadillidae) (Lima & Serejo, 1993; Souza-Kury, 1993; Souza, Bezerra & Araujo, 2006; Souza et al., 2010; Campos-Filho & Araujo, 2011). Four of these species (A. eleonorae, C. buckupi, C. carajasensis, and T. guanophila) present the classical troglomorphisms, such as regression of ocular structures and dark body pigmentation, which are indicative of their troglobitic status.

Strong economic pressures have been pushing for the liberalization of environmental policies in general, allowing for the destruction of huge areas of natural habitats in Brazil. Because conservation policies worldwide are mostly taxon-based, taxonomic studies are urgently needed in Brazil, especially for the relatively poorly known subterranean invertebrates. Recently, we have received a large collection of oniscideans from caves in the states of Pará, Bahia, Minas Gerais, Mato Grosso do Sul, and São Paulo. In addition to the listing of many already known species, the present study describes several new taxa present in this original collection.

MATERIAL AND METHODS

The material in the present article comes from collections of the Museu de Zoologia, Universidade de São Paulo, and the Coleção de Carcinologia do Departamento de Zoologia, Universidade Federal do Rio Grande do Sul.

Specimens have been collected by hand and stored in 75% ethanol, and identifications are based on morphological characters with the use of micropreparations. For each new species, the material examined, description, etymology, and remarks are presented. For the already described species only citations from Brazil are included. The terminology used in species descriptions is mainly based on Vandel (1960, 1962), Leistikow (2001a, 2001b), and Taiti & Argano (2009). Coordinates of the noduli laterales were obtained and illustrated as described in Vandel (1962). The classification of respiratory structures follows Hoese (1982) and Paoli, Ferrara & Taiti (2002). The taxa were illustrated with the aid of a camera lucida mounted on Wild M5 and M20 microscopes.

The material is deposited in the Museu de Zoologia (MZUSP), Universidade de São Paulo, São Paulo, in the Coleção de Carcinologia do Departamento de Zoologia, Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, and in the collection of the Natural History Museum, Section of Zoology ‘La Specola’, Florence (MZUF).

STUDY AREA

ALTAMIRA KARST AREA, CENTRAL STATE OF PARÁ, NORTHERN BRAZIL

This region is situated in the Equatorial Amazonian Domain, where the climate is tropical humid (Ab’Saber,
The caves are located in whitish sandstones of the Maecuru Group, Lontra Member, early to middle Carboniferous (Caputo, Rodrigues & Vasconcelos, 1971). Rocky outcrops form elongated hills, with an average altitude of 150 m a.s.l., and slopes facing south. The caves from Altamira contain very abundant and stable bat populations, which may reach thousands of individuals. Consequently, large quantities of guano are available as a food source for terrestrial and aquatic invertebrates (Trajano & Moreira, 1989).

Serra de Carajás, Canaã dos Carajás, and Parauapebas, state of Pará, northern Brazil

Serra dos Carajás, characterized by a series of discontinuous mountains and hills, is located in the basin between the Itacaiunas and Parauapebas rivers (5°54′–6°33′S, 49°53′–50°34′W), in the Equatorial Amazonian Domain, at elevations of 600–800 m a.s.l. The climate is wet tropical (Kottek et al., 2006). The ancient and extensive surface erosion prevented the development of dense tropical rainforest, contrasting with the surrounding dense forest (Campos & Castilho, 2012; Crescencio & Carmo, 2013). Ferruginous caves are very distinct in formation and structure from the karstic caves, and the structure and functioning of the ecosystems in this kind of habitat are still very poorly understood. To date, the Serra dos Carajás karst area has approximately 1350 caves (CECAV, 2013).

Lajeado de Soledade, Apodi karst system, states of Rio Grande do Norte and Ceará, north-eastern Brazil

Lajeado de Soledade is an area of approximately 3 km² located in the south-western portion of the Potiguar watershed, in the Caatinga biome (mesophytic and xeromorphic forests), with a semi-arid climate (Kottek et al., 2006). This karst area is formed by Upper Cretaceous carbonatic rocks (Bagnoli, 1994; Porrino, Júnior & Santos, 2009), consisting of calcarenites and dolomites originating during the Albian–Campanian period (113–72 Mya) in a subtidal zone. The caves in this karst area are also characterized by the presence of a large number of rupestrian paintings and well-preserved fossil records (Porrino et al., 2009).

Chapada Diamantina region, central state of Bahia (Itaetê and Iraquara), north-eastern Brazil

With an area of approximately 38 000 km², the Chapada Diamantina geographic region is a plateau reaching an altitude of 1700 m a.s.l., formed by exposed limestones of Neoproterozoic age (1000–541 Mya). It belongs to the Una Geological Group, in the Irecê, and the Una–Utinga sedimentary basins that are separated by much older mesoproterozoic exposed rocks of the Chapada Diamantina Group, including sandstone layers, where caves are also formed (Inda & Barbosa, 1978; Karmann & Sánchez, 1979). The climate is tropical dry (i.e. semi-arid; Kottek et al., 2006), with irregular rain, and with annual precipitation of c.640 mm (Instituto Nacional de Meteorologia – INMET), and with annual mean temperatures ranging between 20 °C and 22 °C (Nimer, 1989). Part of the area is protected by law, and the conservation status of the subterranean fauna is relatively good.

Morro do Chapéu karst area, state of Bahia, north-eastern Brazil

This region, situated at the north of Chapada Diamantina in a typical Caatinga area with a tropical dry (i.e. semi-arid) climate [Aw type (equatorial savannah with dry winter); Kottek et al., 2006], follows the course of the Jacaré River, right tributary of the Middle São Francisco River. Its main karst feature is Brejões Cave, with more than 7 km of mapped conduits. Brejões Cave is situated in a legally protected area, an APA (Environmental Protection Area), which contributes to its preservation.

Serra do Ramalho karst area, southern state of Bahia, north-eastern Brazil

The Serra do Ramalho karst, middle São Francisco River basin, has several important caves, a few with more than 30 km of passageways. Serra do Ramalho is dominated by a plateau formed by limestone rocks of the Bambuí Group (Auler, Rubbioli & Brandi, 2001). This plateau extends for kilometres and forms large cave systems in the region, distributed in two sections: the lower plateau, to the south, and the upper plateau, to the north (Mattox et al., 2008). According to the classification by Kottek et al. (2006), the climate is tropical dry (i.e. semi-arid), Aw type, characterized by a dry winter (from March to October), and with an annual precipitation of c.640 mm (Instituto Nacional de Meteorologia, INMET). The native vegetation consists of Caatinga, interspersed with Cerrado (savannah-like) vegetation. The Serra do Ramalho karst area is a spot of high subterranean biodiversity, both aquatic (Bichuette & Trajano, 2005; Mattox et al., 2008; Bichuette & Rizzato, 2012; Simone, 2012) and terrestrial (e.g. Baptista & Giupponi, 2002; Trajano & Bichuette, 2010). Nevertheless, it is not legally protected. Presently, the accelerated extraction of the original vegetation for cotton and soybean cultivation represents the main threat for subterranean ecosystems.
SÃO ROQUE DE MINAS (ZEFERINO I) AND PRESIDENTE OLEGÁRIO (VEREDA DA PALHA), STATE OF MINAS GERAIS, SOUTH-EASTERN BRAZIL

The caves from São Roque de Minas and Presidente Olegário are located, respectively, in the Serra da Canastra (south-western Minas Gerais) and in the Paracatu River basin (north-western Minas Gerais), Upper São Francisco river basin. These limestones belong to Bambuí Group, of Upper Proterozoic age, and the native vegetation is Cerrado (Brazilian savannah) (Ab’Saber, 1977). The climate is tropical and semi-humid, with four to five dry months (Nimer, 1989). Both karst areas are under threat from plantations and/or pasture, with many deforested areas. The area is completely unprotected. Only the limestone outcrops and cave entrances are better preserved because of the difficulties in establishing crops over rock landscapes.

SERRA DA BODOQUENA, MATO GROSSO DO SUL STATE, SOUTH-WESTERN BRAZIL

Serra da Bodoquena consists of a north-south carbonatic plateau of Neoproterozoic age, Corumbá Group, extending for approximately 200 km, of width varying between 10 and 70 km, that forms an important water divide in the Paraguay Belt, related to the development of the Cenozoic Pantanal Basin, which is still subsiding within the limits of the Paraguay Basin (Almeida, 1965; Boggiani, Fairchild & Coimbra, 1993; Cordeiro, Borghezan & Trajano, 2014). The climate is classified as Aw, tropical, with a wet summer and a dry winter (Justo, 2000). Rains are concentrated during November–February, with a mean average precipitation of about 1300 mm per year and a mean annual temperature of 24 °C. The natural vegetation consists of savanna in contact with semi-deciduous seasonal forest (Scremin-Dias et al., 1999; Galati et al., 2003; Boggiani et al., 2011). Part of the Serra da Bodoquena area is within the limits of the Parque Estadual da Serra da Bodoquena. Threats to subterranean communities include: poor control of activities in the park; habitat destruction from deforestation, causing cave siltation and a decrease of food input; pollution; and direct disturbance by uncontrolled visitor numbers and cave diving.

SYSTEMATIC ACCOUNT

FAMILY TRICHONISCIDAE SARS, 1899

GENUS MIKTONISCUS KESSELYÁK, 1930

Type species: Trichoniscus linearis Patience, 1908 by original designation and monotypy.

FAMILY STYLONISCIDAE VANDEL, 1952

GENUS SPELUNCONISCUS CAMPOS-FILHO, ARAUJO & TAITI GEN. NOV.

Type species: Spelunconiscus castroi Campos-Filho, Araujo & Taiti sp. nov.

Diagnosis

Body slightly convex, unable to roll up into a ball, with pleon slightly narrower than pereon. Cephalon with small antennary lobes and distinct suprantonial line. Pleonites 3–5 with epimera reduced, adpressed, without visible posterior points. Antennule of three articles, with a line of short and thickset aesthetascs on distal article. Antenna with flagellum of several articles, no visible aesthetascs. Right mandible with one penicil; left mandible with two penicils. Maxillule outer branch with 5 + 5 teeth, all entire, and two slender setose stalks; inner branch with three penicils at apex. Maxilla with outer lobe much broader than inner lobe. Maxilliped

Figure 1. *Miktoniscus medcofi* (Van Name, 1940), ♀: A, habitus, dorsal; B, cephalon, frontal; C, cephalon and pereonite 1, lateral; D, cephalon, dorsal; E, dorsal scale seta; F, pleonites 4 and 5, telson, and uropods; G, antennule; H, antenna.
with basis enlarged on distal portion; endite narrow bearing a large apical penicil. Pereopods with unbranched and glabrous dactylar setae. Uropod with endopod and exopod inserted at the same level. Pleopod exopods with a fringe of thin setae along margins. Genital papilla lanceolate. Male pleopod 1 exopod longer than endopod, endopod two-jointed with flagelliform distal article. Male pleopod 2 endopod robust, distal portion narrow, triangular.

**Etymology**
From the Latin *spelunca* = cave + *Oniscus*.

**Remarks**
Figure 3. *Miktoniscus medcofi* (Van Name, 1940), ♂: A, pereopod 1; B, pereopod 6; C, pereopod 7.
Barnard, 1932, Pectenoniscus Andersson, 1960, Styloniscus Dana, 1853, Thailandoniscus Dalens, 1989, and Trogloniscus Taiti & Xue, 2012; Madoniscus Paulian de Félice, 1950 might also belong to this family (Schmalfuß, 2003). Styloniscidae is divided into three subfamilies: Styloniscinae, Notoniscinae, and Kuscheloniscinae (Strouhal, 1961). The new genus belongs to Styloniscinae, which also includes Styloniscus.

Figure 4. Miktoniscus medcofi (Van Name, 1940), ♂: A, genital papilla and pleopod 1; B, pleopod 2; C, pleopod 3 exopod; D, pleopod 4 exopod; E, pleopod 5 exopod.
**Cordoniscus, Clavigeroniscus, Indonisicus, Thailandoniscus, Trogloniscus, and probably Pectenoniscus** (Taiti & Xue, 2012).

*Spelunconiscus* gen. nov. is readily distinguishable from all these genera in having the antennule with short and thickset aesthetasc, the dactylar seta unbranched and glabrous, instead of bifid and setose, and the male pleopod 1 exopod longer than endopod. It also differs from *Styloniscus* and *Cordoniscus* in the genital papilla not enlarged distally, from *Trogloniscus* in the antennal flagellum having several articles (only three in *Trogloniscus*), from *Clavigeroniscus* and *Thailandoniscus* by the male pleopod 2 endopod distally triangular, and not truncate.

**Spelunconiscus castroi** Campos-Filho, Araujo & Taiti sp. nov.

Figures 5–8, 40

**Type material**

*Holotype:* ♂, Brazil, Minas Gerais, Matozinhos, Gruta MOC-32, 19°31′S, 44°03′W, 8–18 February 2011, leg. F. Franco (MZUSP 27521).

*Paratypes:* Two ♂ (one in micropreparations), same data as holotype (MZUSP 27522).

**Etymology**

The species is named after Prof. Alceu Lemos de Castro, for his invaluable contribution to the knowledge of terrestrial isopods from Brazil.

**Description**

Maximum length: 6 mm. Body colourless, elongated, pereon with almost parallel sides (Fig. 5A). Dorsal surface smooth (Fig. 5B), with pointed scale setae (Fig. 5C). Eyes absent. Cephalon (Fig. 5D–F) with small quadrangular antennary lobes; profrons with a small carena and suprantennal line distinctly bent down in the middle. Posterior margin of pereonites 1–3 straight, and of pereonites 4–7 progressively more concave. Pleonites 3–5 epimera reduced, adpressed, with no posterior points visible in dorsal view. Telson (Fig. 5G) with concave sides and broadly rounded apex. Antennule (Fig. 5H) with distal article longer than second and first, conical, and bearing five short and stout aesthetasc. Antenna (Fig. 5I) with fifth article of peduncle shorter than flagellum; flagellum of between five and seven articles, according to animal size. Mandibles with two penicils on the left (Fig. 6A) and one penicil on the right (Fig. 6B). Outer branch of maxillule with 5 + 5 teeth, apically entire, and two slender stalks (Fig. 6C); inner branch with proximal penicil longer than the two apical ones. Maxilla with setose and bilobate apex, inner lobe smaller (Fig. 6D). Maxilliped basis enlarged on distal portion, outer, inner, and distal margins bearing a fringe of thin setae; endite rectangular and narrow, bearing a large apical penicil (Fig. 6E). Uropod (Fig. 7A) with endopod as long as exopod, and inserted at similar level. Pereopod 1 (Fig. 7B) carpus with transverse antennal grooming brush. Pereopod 7 (Fig. 7C) basis with lines of scales for the water conducting system, ischium with sternal margin straight and two setae on tergal margin, merus slightly concave, and carpus longer than merus. Genital papilla (Fig. 8A) with a conical shape and narrow and elongated apical part. Pleopod 1 (Fig. 8B) exopod triangular, elongated, outer margin concave, distal margin rounded, a fringe of thin setae along inner, distal, and outer margins; endopod narrow, with almost parallel sides, slightly shorter than exopod, basal part enlarged, distal part flagelliform. Pleopod 2 (Fig. 8C) exopod subretangular, with median portion narrower, distal margin slightly sinuous, and bearing four setae; endopod of two articles, about five times longer than exopod, second segment enlarged, more than twice as long as first, distal part narrow, triangular, bearing a subapical spine. Pleopod 3 exopod (Fig. 8D) trapezoidal, bearing six strong setae and with a fringe of thin setae along the margins. Pleopods 4 and 5 exopods (Fig. 8E,F) rhomboidal, bearing three and four strong setae, respectively, and covered with thin setae on the medial part.

**Remarks**

These specimens were collected in water, but other specimens have also been observed out of the water (M.E.B., pers. observ.), so the species should be considered as amphibian rather than aquatic. Other aquatic or amphibian species in the family Styloniscidae are known from Thailand (*Thailandoniscus annae* Dalens, 1989) and southern China (*Trogloniscus clarkei* Taiti & Xue, 2012 and *Trogloniscus trilobatus* Taiti & Xue, 2012).

**Genus Xangonisicus** Campos-Filho, Araujo & Taiti gen. nov.

*Type species:* Xangonisicus aganju Campos-Filho, Araujo & Taiti sp. nov.

**Diagnosis**

Body slightly convex, unable to roll up into a ball, with pleon narrower than pereon. Cephalon with long antennary lobes, distinct suprantennal line, and a transversal groove on the anterior part of vertex. Pleonites 3–5 with epimera well developed, with visible posterior points. Antennule of three articles with two long apical aesthetasc. Antenna with flagellum of three clearly distinct articles and a short apical organ. Right mandible with one penicil; left mandible with two penicils. Maxillule outer branch with 5 + 5 teeth entire and two long and thick setose stalks; inner branch with...
Figure 5. *Spelunconiscus castroi* Campos-Filho, Araujo & Taiti sp. nov., ♀: A, habitus, dorsal; B, adult specimen, lateral; C, dorsal scale seta; D, cephalon, frontal; E, cephalon, lateral; F, cephalon, dorsal; G, pleonite 5, telson and uropod; H, antennule; I, antenna.

Figure 6. *Spelunconiscus castroi* Campos-Filho, Araujo & Taiti sp. nov., ♂: A, left mandible; B, right mandible; C, maxillule; D, maxilla; E, maxilliped.
Figure 7. *Spelunconiscus castroi* Campos-Filho, Araujo & Taiti sp. nov. ♂: A, uropod; B, pereopod 1; C, pereopod 7.
Figure 8. *Spelunconiscus castroi* Campos-Filho, Araujo & Taiti sp. nov. C: A, genital papilla; B, pleopod 1; C, pleopod 2; D, pleopod 3 exopod; E, pleopod 4 exopod; F, pleopod 5 exopod.
three penicils at apex. Maxilla with outer lobe much broader than inner lobe. Maxilliped basis triangular, with enlarged distal portion; endite narrow, bearing a large apical penicil. Pereopods with unbranched and glabrous dactylar setae, and a fringe of large scales on distal margins of segments. Uropod with endopod and exopod inserted at the same level. Pleopod exopods with a fringe of thin setae along margins. Genital papilla lanceolate. Male pleopod 1 exopod shorter than endopod, endopod two-jointed, with flagelliform distal article. Male pleopod 2 endopod stout with distal article truncate, bearing a wrench-like apex.

**Etymology**
The new genus is named after Xangó Orisha, the Afro-Brazilian divinity of fire, thunderbolt, and justice, known as the only Orisha that has power over the dead, and with strong connections to trees and nature.

**Remarks**
In having the distal article of the second male pleopod 2 endopod with truncate and complex apex, *Xangoniscus* gen. nov. resembles *Clavigeroniscus* and *Thailandoniscus*. It is readily distinguished from both genera in having a transversal groove on vertex along the frontal margin, in lacking the penicil on the molar process of the right mandible, and in the more complex apex of the male pleopod 2 endopod; it is distinguished from *Clavigeroniscus* by the unbranched dactylar seta of the pereopods, and also from *Thailandoniscus* in the genital papilla distally not enlarged. In the stout endopod of the male pleopod 2, *Xangoniscus* gen. nov. is also similar to *Spelunconiscus* gen. nov., from which it differs by the well-developed epimera of pleonites 3–5, the antennule with long apical aesthetascs, the antennal flagellum with three distinct articles, the lines of scales on pereopods, male pleopod 1 exopod shorter than endopod, and the complex apical part of the male pleopod 2 endopod.

**XANGONISCUS AGANJU** CAMPOS-FILHO, ARAUJO & TAITI SP. NOV.
FIGURES 9–13, 40

**Type material**

*Paratypes:* Two ♂, one ♀, same data as holotype (MZUSP 27524).

**Etymology**
The new species is named after Aganju, an Afro-Brazilian divinity representative of the subterranean environment.

**Description**
Maximum length: ♂, 6 mm; ♀, 7 mm. Colourless body, pereon with almost parallel sides (Fig. 9A). Dorsal surface smooth with pointed scale setae, which are fringed on the posterior margins of the pereonites and pleonites (Fig. 9B,C). Eyes absent. Cephalon (Fig. 9D,E) with large quadrangular antennary lobes; profrons with a small carena and V-shaped supranotal line; vertex with rounded frontal groove and slightly depressed at sides. Posterior corners of pereonite 1 right-angled, of pereonites 2–7 progressively more acute. Pleonites 3–5 (Fig. 9F) with falciform epimera. Telson (Fig. 9G) with slightly concave sides and broadly rounded apex. Antennule (Fig. 9H) of three articles similar in length, and bearing two long apical aesthetascs. Antenna (Fig. 9I) with fifth article of peduncle longer than flagellum; flagellum of three distinct articles, first and second articles subequal in length, third article much shorter. Mandibles with two penicils in the left (Fig. 10A) and one penicil in the right (Fig. 10B); lacinia mobilis leaf-shaped. Outer branch of maxillule with 5 + 5 teeth, apically entire, and two thick plumose stalks (Fig. 10C); inner branch with proximal penicil longer than the two apical ones. Maxilla with setose and bilobate apex, inner lobe smaller (Fig. 10D). Maxilliped basis enlarged on distal portion, outer, inner, and distal margins bearing a fringe of thin and long setae; endite with a very large rounded apical penicil (Fig. 10E). Uropod (Fig. 11A) with exopod distinctly longer than endopod, and inserted at the same level.

**Male:** Pereopod 1 (Fig. 11B) with fringed scales on sternal and distal margin of merus, on almost whole surface of carpus, and on sternal margin of propodus. Pereopods 2–4 (Fig. 11C) with fringed scales on sternal and distal margin of merus, carpus, and on sternal margin of propodus. Pereopod 5 (Fig. 11D) with fringed scales on sternal and distal margin of merus and carpus; carpus with a depression on distal half of sternal margin and a distal rounded lobe. Pereopod 6 (Fig. 12A) basis, ischium, and merus with rows of scales on distal margin, ischium enlarged with a flattened sternal part, carpus with distal part narrower than basal one, propodus with rounded flat lobe on basal part. Pereopod 7 (Fig. 12B) with no distinct modifications; ischium with straight sternal margin. Genital papilla (Fig. 13A) lanceolate, enlarged on median portion, and apical part narrow and pointed. Pleopod 1 (Fig. 13B) exopod subtriangular, about two-thirds as long as endopod; endopod with narrow basal article and flagelliform distal article; basis with a triangular medial part fringed with fine and
Figure 9. *Xangoniscus aganju* Campos-Filho, Araujo & Taiti sp. nov., ♂: A, habitus, dorsal; B, pointed dorsal scale seta; C, fringed dorsal scale seta; D, cephalon, frontal; E, cephalon, dorsal; F, pereonite 7, pleonites 1–5, telson and uropods; G, telson; H, antennule; I, antenna.

Figure 10. *Xangoniscus aganju* Campos-Filho, Araújo & Taiti sp. nov. ♂: A, left mandible; B, right mandible; C, maxillule; D, maxilla; E, maxilliped.
Figure 11. *Xangoniscus aganju* Campos-Filho, Araujo & Taiti sp. nov. ♂: A, uropod; B, pereopod 1; C, pereopod 2; D, pereopod 5.
Figure 12. *Xangoniscus aganju* Campos-Filho, Araujo & Taiti sp. nov., ♂: A, pereopod 6; B, pereopod 7.
Figure 13. *Xangoniscus aganju* Campos-Filho, Araujo & Taiti sp. nov., ♂: A, genital papilla; B, pleopod 1; C, pleopod 2; D, pleopod 3 exopod; E, pleopod 4 exopod; F, pleopod 5 exopod.
long setae. Pleopod 2 (Fig. 13C) exopod trapezoidal, with longer outer part, distal margin bearing three setae; endopod of two articles, thickset, second segment about three times longer than first, distal part wrench-like, with a medial triangular lobe and transverse point. Pleopod 3 exopod (Fig. 13D) very large, trapezoidal, longer than wide, with distal margin bearing several short setae. Pleopods 4 and 5 exopods (Fig. 13E,F) rhomboidal, wider than long, with distal margin rounded and bearing several short setae.

Remarks
These specimens have been collected in water and on the ground, so this species must also be considered as amphibian.

FAMILY PHILOSCIDAE Kinahan, 1857

GENUS LEONARDOSCIA Campos-Filho, Araujo & Taiti GEN. NOV.

Type species: Leonardoscia hassalli Campos-Filho, Araujo & Taiti sp. nov.

Diagnosis
Body ovoidal, with pleon slightly narrower than pereon. Pereonites with fan-shaped scale setae; one series of noduli laterales per side inserted more or less on the same line, at a certain distance from the lateral margin of the pereonites; no visible gland pores. Cephalon with suprantennal line and without frontal line. Epimera of pleonites 3–5 reduced, but with small posterior points visible in dorsal view. Antennule with short and thickset third segment bearing two apical aesthetascs and a tuft of aesthetascs on medial margin. Antennal flagellum with apical seta as long as third segment. Molar penicil of mandible dichotomized. Maxillule outer ramus with 4 + 5 (four apically cleft) teeth, plus an accessory tooth; inner branch with a small posterior point. Maxilliped endite without penicil. Pereopods with flagellar dactylar and ungual seta. Pleopodal exopods without respiratory structures. Uropodal protopod with outer margin grooved in the distal part, insertion of endopod slightly proximal to that of exopod. Male pleopod 2 endopod long and thin, bearing some triangular teeth in the distal part. Male pleopod 5 exopod with a groove near medial margin.

Etymology
The new genus is named after Leonardo da Vinci, who also gives the name to the cave where the type species was collected.

Remarks
In the shape of the antennula with a medial tuft and two apical aesthetascs, the new genus shows affinities with Prosekia Leistikow, 2001 and related genera (tribe Prosekiini, according to Leistikow, 2001a,c), from which it is readily distinguishable in having fan-shaped instead of pointed dorsal scale setae. For this last character Leonardoscia gen. nov. also resembles Carabosca Vandel, 1968 and Colombophiloscia Leistikow, 2001 (see Leistikow, 2001e), which do not belong to the Prosekiini, however. It differs from both in lacking the penicil on the maxilliped endite, from Carabosca in having the outer teeth of the maxillule apically cleft, and from Colombophiloscia in having a dichotomized instead of simple molar penicil of the mandible. Within the Prosekiini the noduli laterales more or less at the same distance from the lateral margins of the pereonites are present only in the new genus and in Metaprosekia Leistikow, 2000 (see below), whereas in all the other genera (Prosekia, Xiphoniscus Vandel, 1968, Andenoniscus Verhoeff, 1941, Androdeloscia Leistikow, 1999, and Erophiloscia Vandel, 1972) the nudulus lateralis on pleomite 4 is inserted more medially.

LEONARDOSCIA HASSALLI Campos-Filho, Araujo & Taiti sp. nov.

FIGURES 14–16, 40

Type material

Paratypes: One ♂, eight ♀, same data as holotype (MZUSP 27526); two ♂, same locality as holotype, 14 April 2009, leg. M.E. Bichuette (MZUSP 27527).

Etymology
The new species is named after Prof. Mark Hassall, for his contribution to the knowledge on the biology of Oniscidea.

Description
Maximum length: ♂ and ♀, 2.5 mm. Body outline as in Figure 14A. Body colourless. Dorsum covered with semicircular scales and numerous fan-shaped scale setae (Fig. 14G); noduli laterales with b/c and d/c coordinates as in Figure 14B; gland pores not visible. Cephalon (Fig. 14C–E) with suprantennal line bent down in the middle; eyes reduced, consisting of four ommatidia. Telson with distal part triangular, with straight sides and obtuse apex (Fig. 14F). Antennule (Fig. 14H) with first and third articles subequal in length, second article shorter; third article with two long apical aesthetascs and a tuft of six aesthetascs on medial margin. Antenna (Fig. 14I) reaching back middle pereonite 2; fifth article of peduncle swollen; flagellum as long as fifth article.
Figure 14. **Leonardoscia hassalli** Campos-Filho, Araujo & Taiti sp. nov. ♀: A, habitus, dorsal; B, noduli laterales b/c and d/c coordinates (b = distance of the nodulus lateralis from the posterior margin of the pereonite; c = length of the pereonite; d = distance of the nodulus lateralis from the lateral margin of the pereonite); C, cephalon, frontal; D, cephalon and pereonite 1, dorsal; E, cephalon and pereonite 1, lateral; F, telson; G, pereonite 1, nodulus lateralis, and dorsal scale seta; H, antennule; I, antenna.
Figure 15. *Leonardoscia hassalli* Campos-Filho, Araujo & Taiti sp. nov., ♀: A, left mandible; B, right mandible; C, maxillule; D, maxilla; E, maxilliped; ♂: F, uropod; G, pereopod 1.
Figure 16. **Leonardoscia hassalli** Campos-Filho, Araujo & Taiti sp. nov. ♂: A, pereopod 7; B, genital papilla; C, pleopod 1; D, pleopod 2; E, pleopod 3 exopod; F, pleopod 4 exopod; G, pleopod 5 exopod.
of peduncle, distal flagellar article longer than first and second, and bearing two aesthetascas, apical organ as long as distal article of flagellum, showing sensory hairs enclosed by a common tube-like sheath, free sensilla short and inserted at one-quarter of the length of the apical organ. Mandibles (Fig. 15A,B) with molar penicil consisting of five branches, 2 + 1 free penicils on the left and 1 + 1 on the right mandible. Maxillule (Fig. 15C) outer branch with 4 + 5 teeth (four cleft); inner branch with two long narrow penicils at apex. Maxilla (Fig. 15D) with setose and bilobate apex; outer lobe about twice as wide as inner lobe, and with distal margin rounded. Maxilliped (Fig. 15E) basis rectangular, with sparse triangular scale setae; endite with short setae and two triangular teeth at apex. Pereopod 5 exopod (Fig. 16E,F) subquadrangular, bearing as long as exopod, with distal portion equipped with short basal article, narrow distal article about twice as long as exopod, with distal portion equipped with some triangular teeth and an arrow-like apex. Pereopods 3 and 4 exopods (Fig. 16E,F) subquadrangular, bearing three and four setae, respectively. Pereopod 5 exopod (Fig. 16G) triangular, outer margin convex, bearing three long setae, acute apex.

**Male:** Pereopod 7 (Fig. 16A) ischium with sternal margin slightly convex and bearing two long setae. Genital papilla (Fig. 16B) with a triangular ventral shield and two apical orifices. Pleopod 1 (Fig. 16C) exopod triangular, about as wide as long, with medial and outward margins rounded; endopod with distal portion bearing a subapical triangular lobe on medial margin, acute apex. Pleopod 2 (Fig. 16D) exopod triangular, outer margin slightly concave and bearing one seta; endopod with short basal article, narrow distal article about twice as long as exopod, with distal portion equipped with some triangular teeth and an arrow-like apex. Pleopods 3 and 4 exopods (Fig. 16E,F) subquadrangular, bearing three and four setae, respectively. Pereopod 5 exopod (Fig. 16G) triangular, outer margin convex, bearing three long setae, acute apex.

**Genus Metaprosekia**
Leistikow, 2000

*Type species:* *Metaprosekia nodilinearis* Leistikow, 2000 by original designation and monotypy.

**Diagnosis**

See Leistikow (2000).

**Metaprosekia quadriocellata** Campos-Filho, Araujo & Taiti sp. nov.

*Figures 17–19, 40*

*Type material*

*Holotype:* ♀, Brazil, Pará, Altamira, Caverna Leonardo da Vinci, 3°09’48”S, 52°05’09”W, 14 April 2009, leg. M.E. Bichuette (MZUSP 27528).

*Paratypes:* Brazil, Pará, Altamira, one ♂, same data as holotype (MZUSP 27529); one ♀, 3°15’11”S, 52°11’08”W, 8 July 2009, leg. M.E. Bichuette (MZUSP 27530), one ♂, two ♀ (part of one in micropreparations), 11 April 2009, leg. M.E. Bichuette (MZUSP 27531); one ♂ (part in micropreparations), one ♀, Abrigo do Sismográfano, 3°17’18”S, 52°13’28”W, 9 April 2009, leg. M.E. Bichuette (MZUSP 27532); one ♂, one ♀, Abrigos Assurini, 3°15’04”S, 52°10’45”W, 15 December 2010, leg. M.E. Bichuette and J.E. Gallão (MZUF 7698).

**Etymology**

Latin: *quadri* = four + *ocellatus* = having eyes. The name refers to the small eye of the species, consisting of only four ommatidia.

**Description**

Maximum length: ♂, 3.6 mm; ♀, 4 mm. Body elongated, outline as in Figure 17A. Colour yellowish brown, antenna and uropods completely pigmented, cephalon with irregular pale spots, pereonites 1–7 with the usual muscle pale spots, pereonites 4–7 with a longitudinal medial pale spot, pleon completely pigmented, telson displaying four small pale spots. Dorsum covered with sparse pointed scale setae (Fig. 17C); one line of noduli laterales per side, inserted more or less at the same distance from the lateral margin of pereonites, b/c and d/c coordinates as in Figure 17B; gland pores not visible. Cephalon (Fig. 17D,E) lacking frontal line, suprantennal line slightly sinusous; eyes reduced, with four ommatidia. Pleon narrower than pereon; pleonites 3–5 reduced, adpressed, with no visible posterior points (Fig. 17A). Telson (Fig. 17F) with distal part triangular, with slightly concave sides and obtuse apex. Antennule (Fig. 17G) of three articles, first article longer than second and third, third article with apical aesthetascas and a tuft of five aesthetascas on medial margin. Antenna (Fig. 17H) reaching rear margin of pereonite 3; flagellum as long as fifth article of peduncle, third flagellar article longer than first and second, and bearing one row of two aesthetascas, apical organ as long as distal article of flagellum, showing sensory hairs enclosed by a common tube-like sheath, free sensilla short and inserted at one-quarter of the length of the apical organ. Mandibles (Fig. 17I,J) with molar penicil consisting of five or six branches, 2 + 1 free penicils on the left and 1 + 1 on the right mandible. Maxillule (Fig. 18A) outer branch with 4 + 5 (four cleft) teeth and one slender seta; inner branch with two short penicils and a short triangular point. Maxilla (Fig. 18B) with setose and bilobate apex; outer lobe about twice as broad as inner lobe, with distal margin rounded. Maxilliped (Fig. 18C) basis rectangular; endite setose on the medial and distal margins, one seta overpassing distal margin, and one
Figure 17. *Metaprosekia quadriocellata* Campos-Filho, Araujo & Taiti sp. nov., ♂: A, habitus, dorsal; B, noduli laterales b/c and d/c coordinates; C, dorsal scale seta; D, cephalon, frontal; E, cephalon, dorsal; F, telson; G, antennule; H, antenna; I, left mandible; J, right mandible.
Figure 18. *Metaprosekia quadriocellata* Campos-Filho, Araujo & Taiti sp. nov., ♂: A, maxillule; B, maxilla; C, maxilliped; D, uropod; E, pereopod 1; F, pereopod 7.
triangular point on outer corner. Pereopod dactylus with ungual seta simple, apex reaching tip of outer claw, dactylar seta short, reaching base of inner claw. Uropod (Fig. 18D) protopod grooved on the distal half of the outer margin; exopod longer than endopod; insertion of endopod proximal to that of exopod.

Male: Pereopod 1 (Fig. 18E) and pereopod 7 (Fig. 18F) with no distinct sexual differentiation. Genital papilla (Fig. 19A) with a triangular ventral shield and two subapical orifices. Pleopod 1 (Fig. 19B) exopod cordiform, with distal margin broadly rounded, and outer margin concave; endopod with distal portion narrow, bearing

**Figure 19.** *Metaprosekia quadriocellata* Campos-Filho, Araujo & Taiti sp. nov., ♂: A, genital papilla; B, pleopod 1; C, pleopod 2; D, pleopod 3 exopod; E, pleopod 4 exopod; F, pleopod 5 exopod.
minute setae, and bent outwards. Pleopod 2 (Fig. 19C) exopod triangular, outer margin concave, bearing two setae; endopod distinctly longer than exopod. Pleopods 3 and 4 exopods (Fig. 19D,E) rhomboidal, with distal margins bearing two and four setae, respectively. Pleopod 5 exopod (Fig. 19F) triangular, outer margin sinuous, bearing three long setae.

Remarks
Leistikow (2000) established Metaprosekia for the new species M. nodilinearis from the Venezuelan Cordilleras, and included the genus in the Prosekii. Leistikow (2001a) considers the small eye with three ommatidia and the position of noduli laterales in a line at the same distance from the lateral margins of the pereonites as possible autoapomorphies of the genus. The new species here described shows all the characters of the genus except for the eye with four ommatidia. In general, eye size cannot be considered as a good generic character as it is linked to the ecology of the species. Metaprosekia quadriocellata sp. nov. is readily distinguished from M. nodilinearis by the eye with four instead of three ommatidia, seven instead of 12 aesthetascs on the antennule, shorter dactylar organ instead of three ommatidia, the smaller number of aesthetascs on the antennule (eight instead of 12), and the male pleopod 1 exopod with wider and more broadly rounded distal part, and different shape of the male pleopods 1–5 exopods.

Metaprosekia caupe
CAMPOS-FILHO, ARAUJO & TATTI SP. NOV.
Figures 20–22, 40

Type material
Holotype: ♀, Brazil, Pará, Caverna Sugiro, 3°17’54”S, 52°14’06”W, 13 December 2010, leg. M.E. Bichuette and J.E. Gallao (MZUSP 27550).

Paratypes: Two ♀, three ♂, same data as holotype (MZUSP 27551), one ♀, one ♂, same data as holotype (MZUF 7699).

Etymology
The new species is named after Caupé, the Tupi-Guarani divinity of beauty.

Description
Maximum length: ♀, 2.7 mm; ♂, 3 mm. Body outline as in Figure 20A. Colour yellowish brown. Dorsum covered with sparse lanceolate scale setae (Fig. 20B). Noduli laterales inserted more or less at the same distance from the lateral margin of pereonites; b/c and d/c coordinates as in Fig 20C; gland pores not visible. Cephalon (Fig. 20D, E) with suprannernal line straight; eye with four ommatidia. Pleonites 3–5 with epimera reduced, adpressed, with no posterior points (Fig. 20A).

Male: Pereopod 1 (Fig. 21E) and pereopod 7 (Fig. 22A) with no distinct sexual modifications. Genital papilla (Fig. 22B) with a triangular ventral shield and two subapical orifices. Pleopod 1 (Fig. 22C,D) exopod triangular, with outer margin concave and medial margin convex; endopod about twice longer than exopod, distally pointed and bent outwards, with a line of short setae near medial margin. Pleopod 2 (Fig. 22E) exopod triangular, outer margin slightly concave, bearing three setae; endopod distinctly longer than exopod. Pleopods 3–5 exopods (Fig. 22F–H) subquadrangular, with distal margins slightly concave and bearing two, four, and three setae, respectively.

Remarks
Metaprosekia caupe sp. nov. can be distinguished from M. nodilinearis by the eye with four instead of three ommatidia, the smaller number of aesthetascs on the antennule (eight instead of 12), and the male pleopod 1 exopod with shorter distal point and more concave outer margin. It is very similar to M. quadriocellata sp. nov., from which it differs mainly in the shape of the male pleopod 1 exopod, with a smaller distal point, and endopod, with the apical part less bent outwards.

Genus Benthana Budde-Lund, 1908
Type species: Philoscia picta Brandt, 1833 by subsequent designation (Van Name, 1936).

Diagnosis
Figure 20. *Metaprosekia caupe* Campos-Filho, Araujo & Taiti *sp. nov.*, ♀: A, habitus, dorsal; B, dorsal scale seta; C, noduli laterales b/c and d/c coordinates; D, cephalon, frontal; E, cephalon, dorsal; F, telson; G, antennule; H, antenna; I, left mandible; J, right mandible.
Figure 21. *Metaprosekia caupe* Campos-Filho, Araujo & Taiti sp. nov., ♂: A, maxillule; B, maxilla; C, maxilliped; D, uropod; E, pereopod 1.
Figure 22. *Metaprosekia caupe* Campos-Filho, Araujo & Taiti sp. nov. A: pereopod 7; B, genital papilla; C, pleopod 1 exopod; D, pleopod 1 endopod; E, pleopod 2; F, pleopod 3 exopod; G, pleopod 4 exopod; H, pleopod 5 exopod.
BENTHANA IPORANGENSIS
LIMA & SEREJO, 1993

Figure 40


Remarks
To date, Benthana includes two subgenera: Benthana s.s. with 21 species and Benthanoscia Lemos de Castro, 1958 with four species. The genus is distributed in south-eastern and southern Brazil; two species, Benthana angustata (Nicolet, 1849) and Benthana bilineata (Nicolet, 1849), are recorded from Chile, but their position in this genus is doubtful. Benthana iporangensis was described from material collected in three caves from São Paulo state: Águas Quentes, Areias de Cima, and Areias de Baixo caves (Fig. 40). Benthana iporangensis was the second cavernicolous oniscidean described from Brazil.

Distribution
Brazil: São Paulo.

BENTHANA TAENIATA
ARAUJO & BUCKUP, 1994

Figure 40


Material examined
Brazil, Minas Gerais: one ♀, Serra da Canastra, São Roque de Minas, Gruta Zeferino I, 20°06′08″S, 46°25′09″W, 7 April 2009, leg. M.E. Bichuette (UFGRS 5375).

Remarks
Despite Benthana species being recognized mainly by the shape of the male pleopod 1 exopod, female specimens can be identified by other characteristics found in the antennule, maxillule, maxilliped endite, uropods and telson. The female specimen examined here is identified as Benthana taeniata on the basis of these characters. Moreover, also the distinct colour pattern of the antenna is characteristic of this species (see Araujo & Buckup, 1994). Benthana taeniata was also collected out of caves in the state of Minas Gerais (I.S.C.-F., pers. observ.).

Benthana taeniata was previously known from the Brazilian states of Rio de Janeiro, Santa Catarina, and Rio Grande do Sul. The present record, the first north of south-eastern Brazil, indicates a wide distribution for this species.

GENUS ISCHIOSCIA
VERHOEFF, 1928

Type species: Ischioscia lobifera Verhoeff, 1928 [= Ischioscia variegata (Dollfus, 1893a)], by monotypy.

Diagnosis

ISCHIOSCIA AMAZONICA LEMOS DE CASTRO, 1955

Figure 40


Material examined
Brazil, Pará: One ♂, Canã dos Parauapebas, Gruta Cav 18 S11, 06°26′08″S, 50°17′43″W, 22–28 September 2010, leg. R. Andrade (UFRGS 4754); one ♂, Parauapebas, Gruta Cav 28 S11, 06°24′23″S, 50°14′56″W, 22–28 September 2010, leg. R. Andrade (UFRGS 4775).

Distribution
Brazil: Amazonia and Pará.

FAMILY SCLEROPACTIDAE VERHOEFF, 1938

GENUS AMAZONISCUS LEMOS DE CASTRO, 1967

Type species: Amazoniscus arlei Lemos de Castro, 1967, by original designation and monotypy.

Diagnosis

AMAZONISCUS LEISTIKOWI CAMPOS-FILHO, ARAUJO & TAITI SP. NOV.

Figures 23–25, 40

Material material
Figure 23. Amazoniscus leistikowi Campos-Filho, Araujo & Taiti sp. nov., ♂: A, habitus, lateral; B, cephalon, lateral; C, cephalon, frontal; D, cephalon, dorsal; E, cephalon, caudal; F, pleonites 3–5, telson, and uropods; G, pereonite 1, nodulus lateralis, and dorsal scale seta; H, antennule; I, antenna; J, left mandible; K, right mandible.

Figure 24. *Amazoniscus leistikowi* Campos-Filho, Araujo & Taiti sp. nov., ♂: A, maxillule; B, maxilla; C, maxilliped; D, uropod; E, pereopod 1.
Figure 25. *Amazoniscus leistikowi* Campos-Filho, Araujo & Taiti sp. nov., ♀: A, pereopod 7; B, genital papilla; C, pleopod 1; D, pleopod 2; E, pleopod 3 exopod; F, pleopod 4 exopod; G, pleopod 5 exopod.
Paratypes: One ♂ (in micropreparation), two ♀, same data as holotype (MZUSP 27535).

Etymology
The new species is named after Dr Andreas Leistikow, for his contribution to the knowledge of Neotropical Oniscidea.

Description
Maximum length: ♂, 4 mm; ♀, 4.4 mm. Colourless body. Body convex, endoantennal conglobation (Fig. 23A). Dorsum smooth, with some scattered triangular scale setae; one line of noduli laterales per side, more or less at the same distance from the lateral margins and close to the posterior margins of the pereonites; no visible gland pores (Fig. 23G). Cephalon (Fig. 23B–E) with frontal shield protruding upwards, frontal margin broadly rounded, no suprantennal line; eyes absent. Pereonites 1 and 2 with no schisma or ventral lobes; pereonites 1–5 with posterior margin straight; pereonites 6 and 7 with posterior margin slightly sinuous at sides. Pleon (Fig. 23F) continuous with pereon, epimera 1–5 well developed, directed backwards. Telson (Fig. 23F) short, more than twice as broad as long, with slight concave sides and rounded apex. Antenna (Fig. 23H) of three articles, third article about twice as long as second, bearing three rows of two aesthetascs each and an apical triangular point. Antenna (Fig. 23I) short and stout, reaching posterior margin of first pereonite when extended back, fifth article of peduncle slightly longer than flagellum, flagellum with two subequal articles, distal article with two rows of two aesthetascs each, apical organ as long as second article of flagellum, and with simple and short free sensilla. Mandibles (Fig. 23J,K) with molar penicil consisting of five setae, left mandible with two penicils, and right mandible with one penicil. Maxillule (Fig. 24A) with inner branch bearing two short penicils, inserted transversely, and a distal triangular point; outer branch with 4 + 6 (four cleft) teeth and a slender seta. Maxilla (Fig. 24B) with outer lobe about twice as broad as medial lobe, distal margin rounded, and covered with trichiform setae; medial lobe rounded, and covered with thick setae. Maxillipeds (Fig. 24C) with rectangular basis, sparse scale setae, distal margin with fringe of thin setae; endite rectangular with distal margin rounded with a short penicil and one hook; palp with three tufts of setae, proximal article with one long inner seta. Pereopods with short inner claw, ungual seta long and simple, long dactylar seta simple, and reaching tip of outer claw. Pereopods 1 and 2 with respiratory areas. Uropod (Fig. 24D) with insertion of endopod and exopod at different levels, protopod flattened and enlarged, endopod twice as long as exopod.

Male: Pereopod 1 (Fig. 24E) with merus and carpus with sternal margin covered with short scales. Pereopod 7 (Fig. 25A) ischium elongated with almost parallel sides, carpus twice as long as merus. Genital papilla (Fig. 25B) with narrow ventral shield and subapical orifices. Pleopod 1 (Fig. 25C) exopod rounded; endopod with narrow distal part bent outwards and bearing small triangular setae. Pleopod 2 (Fig. 25D) exopod triangular, with concave outer margin; endopod distinctly longer than exopod. Pleopod 3 (Fig. 25E) exopod subquadangular, with slightly concave outer margin, bearing one robust seta, inner and outer margins fringed with thin setae. Pleopod 4 (Fig. 25F) exopod triangular, straight outer margin with two robust setae, inner and outer margins fringed with thin setae. Pleopod 5 exopod (Fig. 25G) triangular, with distal part narrower and acute, inner and outer margins fringed with thin setae.

Remarks
To date, Amazoniscus includes two Brazilian species: Amazoniscus arlei Lemos de Castro, 1967, from the states of Amapá, Pará, and Tocantins (Lemos de Castro, 1967; Schmidt, 2007), and Amazoniscus eleonorae Souza, Bezerra & Araujo, 2006, from caves in the state of Pará (Souza et al., 2006). Amazoniscus leistikowi sp. nov. is readily distinguishable from A. arlei by the lack of eyes, the more broadly rounded telson, the male pereopod 7 ischium with sternal margin straight instead of concave, the male pleopod 1 exopod without a narrow posterior point, and endopod distinctly bent outwards. The new species is morphologically similar to A. eleonorae, the other cavernicolous species in the genus, from which it differs in having the antenna with stouter articles of the peduncle, the molar penicil of the mandible with five instead of 11 setae, and the male pleopod 1 endopod distinctly bent outwards in the distal part.

Amazoniscus eleonorae Souza, Bezerra & Araujo, 2006

Figure 40

Remarks
Amazoniscus eleonorae was the first Brazilian Scleropactidae species described from a hypogean environment, with material from three localities in the state of Pará – Pedra da Cahoeira, Planaltina, and Limoeiro caves – all located in the Altamira karst area (Fig 40).
**GENUS* Circoniscus* Pearse, 1917**  
*Type species: Circoniscus gaigei* Pearse, 1917, by monotypy.

**Diagnosis**  

**Remarks**  
Schmidt (2007) revised the Neotropical Scleropactidae and redefined *Circoniscus*, considering the schisma on pereonite 1 as the autapomorphic character of the genus, as assumed by Souza & Lemos de Castro (1991). The genus *Amazoniscus* was included in the same clade and considered as the sister group of *Circoniscus*. Recently, Campos-Filho & Araujo (2011) described two cavernicolous species of *Circoniscus* from Pará, Brazil, and recorded the presence of a schisma in young individuals of *C. buckupi*, but lacking in adults, interpreted as a secondary loss. At present, *Circoniscus* includes seven species from French Guiana, Guyana, Brazil, Peru, and Paraguay (Schmidt, 2007).

**CIRCONISCUS BEZZII** Arcangeli, 1931  
**Figure 40**


**Material examined**  
Brazil, Minas Gerais: one ♀, one ♂, Presidente Olegário, Caverna Vereda da Palha, near the entrance of the cave, 18°18′15″S, 46°07′33″W, 1 March 2011, leg. P.B. Araujo (UFRGS 4824).

**Distribution**  
Brazil (Pará, Minas Gerais and São Paulo) and Paraguay.

**CIRCONISCUS BUCKUPI** Campos-Filho & Araujo, 2011  
**Figure 40**


**Distribution**  
Brazil: Pará.

**CIRCONISCUS CARAJASENSIS** Campos-Filho & Araujo, 2011  
**Figure 40**


**Distribution**  
Brazil: Pará.

**CIRCONISCUS INTERMEDIUS** Souza & Lemos de Castro, 1991  
**Figure 40**


**Material examined**  

**Distribution**  
Brazil (Pará, Mato Grosso and Mato Grosso do Sul).

**Remarks**  
*Circoniscus intermedius* was described by Souza & Lemos de Castro (1991) from the Brazilian states of Mato Grosso and Pará. Schmidt (2007) redescribed the species, and stated that the paratypes from Pará might belong to a distinct species. The specimens examined by us correspond in all details to the description and figures provided by Souza & Lemos de Castro (1991) on the holotype from Mato Grosso, and are identified as *C. intermedius*.

**CIRCONISCUS INCISUS** Souza & Lemos de Castro, 1991  
**Figure 40**


Schultz (1995) established the species of Phalloniscus from the New World. The genus includes seven species from Venezuela and Brazil (Schmalfuss, 2003).

**Novamundoniscus altairensis** Campos-Filho, Araujo & Taiti sp. nov.

Figs 26–28, 40

**Type material**

**Holotype:** ♂, Brazil, Pará, Altamira, Abrigos Assurini, 3°15′02″S, 52°12′31″W, 15 December 2010, leg. M.E. Bichuette and J.E. Gallão (MZUSP 27536).

**Paratypes:** One ♂ (in micropreparations), one ♀, same data as holotype (MZUSP 27537); one ♂, Canaã dos Parauapebas, FLONA Carajás, 06°04′51″S, 50°09′31″W, 14 March–4 April 2010, leg. R. Andrade (UFRGS 5607P).

**Etymology**

The new species is named after the locality where the specimens were collected: Altamira, Pará.

**Description**

Maximum length: ♂, 2.4 mm; ♀, 2.6 mm. Body outline as in Figure 26A. Colour brown, antennae and uropods completely pigmented, cephalon with irregular pale muscle spots, pereonites with a median pale area, more evident on pereonites 1–4, pleon pigmented, pleonite 2 with pale spots on lateral portions. One line of noduli laterales inserted more or less at the same distance from the lateral margins of pereonites, b/c and d/c coordinates as in Figure 26B; dorsum covered with fan-shaped scale setae (Fig. 26F); gland pores not visible. Cephalon (Fig. 26C,D) with short frontal lobes and lacking frontal line, suprantennal line slightly sinuous; eye with 11 ommatidia. Pleonites 3–5 with well-developed epimera, directed backwards. Telson (Fig. 26E) more than twice as wide as long, with triangular distal part, concave sides and rounded apex. Antennule (Fig. 26G) of three articles, third article with two rows of two and three aesthetascs each, and an apical pair. Antenna (Fig. 26H) reaching rear margin of pereonite 3; flagellum about as long as fifth article of peduncle; flagellum of three articles with distal article longer than first and second articles, second article bearing one row of two aesthetascs and third article bearing two rows of two aesthetascs, apical organ short, free sensilla as long as apical organ. Mandibles (Fig. 27A,B) with molar penicil consisting of five or six setae, and 2 + 1 free penicils on the left mandible and 1 + 1 on right mandible. Maxillule (Fig. 27C) outer branch with 4 + 5 (four cleft) teeth; inner branch with two short penicils inserted transversely and distal margin rounded. Maxilla (Fig. 27D) with setose and bilobate apex; outer lobe about twice as wide as medial lobe, with distal margin rounded. Maxilliped (Fig. 27E) basis rectangular, with sparse scale setae; endite with distal margin curved, one stout seta, and no penicil. Pereopods with inner claw of dactylus as long as outer claw, ungual seta reaching tip of outer claw, and simple apex, and dactylar seta reaching median portion of outer claw and simple apex (Fig. 27G). Uropod (Fig. 27F) protopod grooved on outer margin; exopod distinctly longer than endopod; insertion of endopod proximal to that of exopod.

**Male:** Pereopod 7 (Fig. 28A) with fringe of hyaline scales on distal margins of ischium and merus, ischium with sternal margin straight. Genital papilla as in Figure 28B. Pleopod 1 (Fig. 28C) exopod subrectangular, with distal margin straight; endopod with tapering distal part slightly swollen subapically, and bearing minute setae. Pleopod 2 (Fig. 28D) exopod triangular, outer margin concave, bearing three strong setae; endopod slightly longer than exopod. Pleopods 3–5 as in Figure 28E–G.

**Remarks**

Novamundoniscus altairensis sp. nov. is readily distinguishable from the other Brazilian species Novamundoniscus dissimilis (Lemos de Castro, 1960), Novamundoniscus macrophthalmus (Lemos de Castro,
Figure 26. *Novamundoniscus altamiraensis* Campos-Filho, Araujo & Taiti sp. nov. O: A, habitus, dorsal; B, noduli laterales b/c and d/c coordinates; C, cephalon, frontal; D, cephalon, dorsal; E, telson; F, pereonite 1, nodulus lateralis, and dorsal scale seta; G, antennule; H, antenna.
Figure 27. *Novamundoniscus altamiraensis* Campos-Filho, Araujo & Taiti sp. nov., ♂; A, left mandible; B, right mandible; C, maxillule; D, maxilla; E, maxilliped; (F) uropod; G, pereopod 1.

Figure 28. *Novamundoniscus altamiraensis* Campos-Filho, Araujo & Taiti sp. nov., ♂: A, pereopod 7; B, genital papilla; C, pleopod 1; D, pleopod 2; E, pleopod 3 exopod; F, pleopod 4 exopod; G, pleopod 5 exopod.
1960), *Novamundoniscus singularis* (Lemos de Castro, 1967), *Novamundoniscus vandeli* (Lemos de Castro, 1960), and *Novamundoniscus gracilis* Lopes & Araújo, 2003, by the shape of male pleopod 1 and pleopod 2 endopod. It also differs from *N. dissimilis*, *N. singularis*, *N. vandeli*, and *N. gracilis* in the number of ommatidia (*N. dissimilis* = 7; *N. singularis* and *N. gracilis* = 15; *N. vandeli* = 8; *N. altamiraensis* Campos-Filho, Araújo & Taiti sp. nov. = 11). The new species differs from the Venezuelan species *Novamundoniscus marcuzzii* (Vandel, 1952b) and *Novamundoniscus persimilis* (Vandel, 1952b) in the telson with rounded instead of pointed apex.

**Genus Dubioniscus** Vandel, 1963

*Type species:* *Dubioniscus delamarei* Vandel, 1963, by monotypy.

**Diagnosis**


**Remarks**

Vandel (1963) established *Dubioniscus* mainly on the peculiar shape of the cephalon. At present it includes four species from Cuba, Brazil, Paraguay, and Argentina (Schmalfuss, 2003).

**Dubioniscus goeldii** (Lemos de Castro, 1967)

*Figure 40*


**Material examined**

Brazil, Pará, Altamira: one ♀, Abrigo do Paratizão, 3°17′03″S, 52°01′57″W, 12 November 2009, leg. M.E. Bichuette (UFRGS 5377); one ♀, Abrigos Assurini, 3°15′02″S, 52°12′31″W, 15 December 2010, leg. M.E. Bichuette and J.E. Gallão (UFRGS 5378); one ♀, Canaã dos Carajás, Gruta S11-07, 06°27′20″S, 50°14′29″W, 3–19 August 2010, leg. R. Andrade (UFRGS 4778); one ♂, one ♀, Parauepebas, Gruta Cav 24 S11, 06°25′21″S, 50°18′24″W, 22–28 September 2010, leg. R. Andrade (UFRGS 4753); one ♀, one ♀, Parauepebas, Gruta Cav 34 S11, 06°24′40″S, 50°20′35″W, 22–28 April 2010, leg. R. Andrade (UFRGS 4774); one ♂, one ♀, Altamira, Abrigo do Sismógrafo, 03°17′18″S, 52°13′30″W, 12 November 2009, leg. M.E. Bichuette (UFRGS 4752).

**Distribution**

Brazil: Pará.

**Dubioniscus marmoratus** Lemos de Castro, 1970

*Figure 40*


**Material examined**

Brazil, São Paulo: one ♂, Itu, Caverna do Riacho Subterrâneo, 23°16′10″S, 47°13′52″W, undated, leg. M.E. Bichuette (UFRGS 5379).

**Distribution**

Brazil: Rio de Janeiro and São Paulo.

**Family Platyaarthridae Verhoeff, 1949**

**Genus Trichorhina** Budde-Lund, 1908

*Type species:* *Bathytropa thermophila* Dollfus, 1896 [= *Trichorhina tomentosa* (Budde-Lund, 1893)] by original designation.

**Diagnosis**


**Trichorhina yiara** Campos-Filho, Araújo & Taiti sp. nov.

*Figures 29–31, 40*

*Type material*


*Paratypes:* One ♀, same data as holotype (MZUSP 27539), one ♂ (in micropreparations), one ♀, same data as holotype (MZUSP 27540); two ♀, Pará, Altamira, Abrigo do Abutre, 3°15′12″S, 52°11′01″W, 11 April 2009, leg. M.E. Bichuette (MZUSP 27552).

**Etymology**

The name of the new species refers to the Amazonian myth of Yiara, known in Tupi language as the Mother of Waters that lives in the River Amazon. In Amazonian legends she is a beautiful siren who, using her voice, is capable of making all fishermen fall in love with her.

**Description**

Maximum length: ♂, 2.6 mm; ♀, 3 mm. Body outline as in Figure 29A. Colour light brown; cephalon with irregular unpigmented spots; pereon with the usual pale muscle spots and a central unpigmented spot on pereonites 3–7, larger on pereonite 3; antennae, uropods,
Figure 29. *Trichorhina yiara* Campos-Filho, Araujo & Taiti sp. nov. ♂: A, habitus, dorsal; B, noduli laterales b/c and d/c coordinates; C, cephalon, frontal; D, cephalon, dorsal; E, telson; F, pereonite 1, nodulus lateralis, and dorsal scale seta; G, antennule; H, antenna.
Figure 30. *Trichorhina yiara* Campos-Filho, Araujo & Taiti sp. nov. ♀: A, left mandible; B, right mandible; C, maxillule; D, maxilla; E, maxilliped; F, uropod.
Figure 31. *Trichorhina yiara* Campos-Filho, Araujo & Taiti sp. nov., ♂: A, pereopod 1; B, pereopod 7; C, pleopod 1; D, pleopod 2; E, pleopod 3 exopod; F, pleopod 4 exopod; G, pleopod 5 exopod.
pleon, and telson completely pigmented. Dorsum covered with fan-shaped scale setae (Fig. 29F); one line of noduli laterales per side inserted close to the posterior margin, and far from the lateral margin of the pereonites, b/c and d/c coordinates as in Figure 29B. Cephalon (Fig. 29C,D) with short lateral lobes, no frontal line, supratennal line slightly sinuous; eye dark, with ten ommatidia. Pleon (Fig. 29A) slightly narrower than pereon, epimera of pleonites 3–5 well developed, falciform. Telson (Fig. 29E) triangular, concave sides and rounded apex. Antennule (Fig. 29G) of three articles, second article shorter than first and third, third article with four apical aesthetascs. Antenna (Fig. 29H) with fifth article of peduncle slightly swollen; flagellum as long as fifth article of peduncle, second flagellar article about three times as long as first, apical organ short, with free sensilla as long as apical organ. Mandibles (Fig. 30A,B) with molar penicil consisting of at least five setae, left mandible with 2 + 1 penicils and right mandible with 1 + 1 penicils. Maxillule (Fig. 30C) outer branch with 4 + 4 (two cleft) teeth. Maxilla (Fig. 30D) with setose and bilobate apex; outer lobe about twice as broad as inner lobe, with rounded distal margin. Maxilliped (Fig. 30E) basis rectangular, with sparse scale setae; endite with one seta overpassing distal margin, no penicil. Pereopod dactylus with short inner claw, ungual seta and dactylar seta almost reaching tip of outer claw, and simple apex (Fig. 31A). Uropod (Fig. 30F) exopod distinctly longer than endopod; insertion of endopod proximal to that of exopod.

Male: Pereopods 1–3 with brush of setae on sternal margin of carpus (Fig. 31A). Pereopod 7 (Fig. 31B) without distinct sexual dimorphism; ischium with sternal margin slightly convex. Pleopod 1 (Fig. 31C) exopod about twice as broad as long, with rounded distal part; endopod slightly bent outwards, with distal part triangular, acute, bearing few minute setae. Pleopod 2 (Fig. 31D) exopod triangular, with concave outer margin; endopod slightly longer than exopod. Pleopods 3–5 exopods as in Figure 31E–G.

Remarks
To date, Trichorhina includes 63 species, of which 19 are recorded from Brazil (Schmalfuss, 2003; Souza et al., 2011). The monophyly of the genus is questionable and in need of revision. In the number of ommatidia T. yiara sp. nov. resembles Trichorhina amazonica Souza-Kury, 1997b, from which it is readily distinguishable by the shape of the male pleopod 1 exopod, with shorter posterior lobe and endopod much thinner. In the presence of two cleft teeth on the outer branch of the maxillule, the new species is similar to Trichorhina argentina Vandel, 1963, Trichorhina brasiliensis Andersson, 1960, Trichorhina crassicostae Souza, Araujo & Campos-Filho, 2011, and Trichorhina paraensis Souza-Kury, 1997b, from which it differs in the fan-like dorsal scale setae, the number of aesthetascs on antennule, and the shape of the male pleopod 1.

Trichorhina curupira Campos-Filho, Araujo & Taiti sp. nov.
Figures 32, 33, 40

Type material

Paratypes: Five ♂ (one in micropreparations) and three ♀, same data as holotype (MZUSP 27542).

Etymology
The new species is named after Curupira, a mythological creature of Brazilian folklore. In Tupi language kuru’pir means covered with blisters, and the character is known as the protector of forests and animals.

Description
Maximum length: ♂ and ♀, 3 mm. Body outline as in Figure 32A. Colour pale yellow. Dorsum covered with fan-shaped scale setae (Fig. 32F); one line of noduli laterales inserted more or less at the same distance from the lateral margin of pereonites; b/c and d/c coordinates as in Figure 32B. Cephalon (Fig. 32C,D) with small lobes, no frontal line, supratennal line straight; eye reduced, with three ommatidia. Pleon (Fig. 32A) slightly narrower than pereon, epimera of pleonites 3–5 well developed, falciform. Telson (Fig. 32E) with triangular distal part, concave sides, and rounded apex. Antennule (Fig. 32G) of three articles, distal joint with nine apical aesthetascs. Antenna (Fig. 32H) short and stout, with flagellum as long as fifth article of peduncle, second flagellar article about three times as long as first, apical organ short. Mouth parts as in T. yiara sp. nov. Pereopod dactylus with short inner claw; ungual and dactylar seta, with simple distal part reaching tip and middle of outer claw, respectively (Fig. 33A). Uropod (Fig. 32I) protopod grooved on outer margin; exopod stout and longer than endopod; insertions of endopod and exopod almost at the same level.

Male: Pereopod 1 (Fig. 33A) carpus and, to a lesser extent, merus with a line of long setae on sternal margin. Pereopod 7 (Fig. 33B) with no peculiar modifications; ischium with sternal margin straight. Pleopod 1 (Fig. 33C) exopod ovoid; endopod with distal part bearing a few setae near medial margin. Pleopod 2 (Fig. 33D)
Figure 32. *Trichorhina curupira* Campos-Filho, Araujo & Taiti sp. nov., ♀: A, habitus, dorsal; B, noduli laterales b/c and d/c coordinates; C, cephalon, frontal; D, cephalon, dorsal; E, telson; F, pereonite 1, nodulus lateralis, and dorsal scale seta; G, antennule; H, antenna; I, uropod.

Figure 33. *Trichorhina curupira* Campos-Filho, Araujo & Taiti sp. nov., ♂: A, pereopod 1; B, pereopod 7; C, pleopod 1; D, pleopod 2; E, pleopod 3 exopod; F, pleopod 4 exopod; G, pleopod 5 exopod.
exopod triangular, outer margin slightly concave; endopod longer than exopod. Pleopods 3–5 exopods as in Figure 33E–G.

Remarks
In the eye with three ommatidia, T. curupira sp. nov. resembles Trichorhina mulaika Schmalfuss, 2003 from Mexico and Trichorhina triocellata Ferrara & Taiti, 1985 from Aldabra Island. It differs from T. mulaika in the pale colour, the presence of cephalic lobes, and the telson with rounded instead of pointed apex; it differs from T. triocellata in the less wide body shape, different shape of dorsal scale setae, and lack of tuft of setae on pereopod dactylus. In Brazil, other species of Trichorhina have a reduced number of eyes, e.g. Trichorhina acuta Araujo & Buckup, 1994, Trichorhina heterophtalma Lemos de Castro, 1964, and Trichorhina sexdens Souza, Araujo & Campos-Filho, 2011. The new species is readily distinguishable from those species by the different shape of the dorsal scale setae, by the different shape of the endite of the maxilliped, and by the different shape of the male pleopod 1.

TRICHORHINA ANHANGUERA CAMPOS-FILHO,
ARAUJO & TAITI SP. NOV.
FIGURES 34–36, 40

Type material

Paratypes: Two ♂, same data as holotype (MZUSP 27544); one ♀, one ♀, same locality and collector, 28 February 2012 (MZUSP 27545); one ♂, two ♀, same data (MZUSP 27546).

Etymology
The new species is named after the Tupi myth of Anhanguera, which means ‘old devil’, protector of animals against hunters.

Description
Maximum length: ♂, 4 mm; ♀, 4.5 mm. Body outline as in Figure 34A. Colourless body. Dorsum covered with fan-shaped scale setae (Fig. 34E). One line of noduli laterales inserted more or less at the same distance from the lateral margin of pereonites; b/c and d/c coordinates as in Figure 34B. Cephalon (Fig. 34C,D) with no lateral lobes; no frontal line, suprantennal line straight; eyes absent. Pleon (Fig. 34A) slightly narrower than pereon, epimera of pleonites 3–5 well developed, falciform. Telson (Fig. 34F) with distal part triangular, concave sides and rounded apex. Antennule (Fig. 34G) of three articles, distal article with about ten apical aesthetascs. Antenna (Fig. 34H) with flagellum as long as fifth article of peduncle, second flagellar article about three times as long as first, apical organ short. Mandibles (Fig. 35A,B) with molar penicil consisting of a single unbranched seta, left mandible with 2 + 1 penicils and right mandible with 1 + 1 penicils. Maxillule (Fig. 35C) outer branch with 4 + 5 teeth, all simple; inner branch with two short penicils and a short point on outer margin. Maxilla (Fig. 35D) with setose and bilobate apex; outer lobe about four times as wide as inner lobe, subquadratro with distal margin straight. Maxilliped (Fig. 35E) basis rectangular, with sparse triangular scale setae; endite with one seta overpassing distal margin, and distal margin straight, bearing two hooks. Uropod (Fig. 35F) exopod distinctly longer than endopod; insertion of endopod slightly proximal to that of exopod. Pereopod dactylus with long inner claw, ungual and dactylar seta with simple apex reaching tip and middle of outer claw, respectively (Fig. 35G).

Male: Pereopods 1–3 carpus and merus with a brush of piliform setae on sternal margin. Pereopod 7 (Fig. 36A) ischiium with sternal margin slightly concave. Genital papilla as in Figure 36B. Pleopod 1 (Fig. 36C) exopod ovoidal; endopod tapering, with no peculiar modification at apex. Pleopod 2 (Fig. 36D) exopod triangular, outer margin concave and bearing two setae; endopod longer than exopod, with almost parallel sides, and acute apex. Pleopods 3–5 exopods as in Figure 36E–G.

Remarks
Among the 19 species of Trichorhina presently known from Brazil (Souza et al., 2011), only two species are known to be blind and colourless: Trichorhina pittieri (Pearse, 1921) and T. brasilensis. Trichorhina anhanguera sp. nov. is readily distinguishable by the shape of the male pleopod 1 exopod, ovoidal without any posterior lobe. In having the molar penicil of the mandible consisting of a single unbranched seta, the new species resembles Trichorhina lenkoi Souza, Araujo & Campos-Filho, 2011, Trichorhina macrops Souza-Kury, 1993, Trichorhina myrmecophila Souza, Araujo & Campos-Filho, 2011, Trichorhina orensou Souza, Araujo & Campos-Filho, 2011, Trichorhina paraensis Souza-Kury, 1997b, and Trichorhina sexdens Souza, Araujo & Campos-Filho, 2011. It differs from these species in the lack of eyes, number of aesthetasces of the antennule, and shape of male pleopod 1.

TRICHORHINA GUANOPHILA SOUZA-KURY, 1993
FIGURE 40

Figure 34. *Trichorhina anhanguera* Campos-Filho, Araujo & Taiti sp. nov. ♂: A, habitus, dorsal; B, noduli laterales b/c and d/c coordinates; C, cephalon, frontal; D, cephalon, dorsal; E, pereonite 1, nodulus lateralis, and dorsal scale seta; F, telson; G, antennule; H, antenna.
Figure 35. *Trichorhina anhanguera* Campos-Filho, Araujo & Taiti sp. nov., ♀: A, left mandible; B, right mandible; C, maxillule; D, maxilla; E, maxilliped; F, uropod; ♂: G, pereopod 1.
Figure 36. *Trichorhina anhanguera* Campos-Filho, Araujo & Taiti sp. nov., ♂: A, pereopod 7; B, genital papilla; C, pleopod 1; D, pleopod 2; E, pleopod 3 exopod; F, pleopod 4 exopod; G, pleopod 5 exopod.

Distribution
Brazil: Bahia.

FAMILY PORCELLIONIDAE BRANDT, 1831
GENUS PORCELLIONIDES MIERS, 1877
Type species: Porcellio (Porcellionides) jelskii Miers, 1877 [= Porcellionides pruinosus (Brandt, 1833)], by subsequent designation (Schmalfuss & Ferrara, 1978).

Diagnosis

PORCELLIONIDES PRUINOSUS (BRANDT, 1833)


Material examined
Brazil, Bahia: one ♀, Iraquara, Gruta Alto da Cruz, 24 February 2007, leg. M.E. Bichuette (UFRGS 5382); one ♂, one ♀, one manca, Itaetê, Lapa de Bode, 6 July 2004, leg. M.E. Bichuette (UFRGS 5383).

Distribution
Cosmopolitan species of Mediterranean origin.

FAMILY ARMADILLIDIIDAE BRANDT, 1833
GENUS ARMADILLIDIUM BRANDT, 1831
Type species: Armadillidium commutatum Brandt, 1831 [= Armadillidium vulgare (Latreille, 1804)], by monotypy.

Diagnosis
Verhoeff (1942) established Ctenorillo to allocate the new species C. buddelundi from Uganda. Taiti, Paoli & Ferrara (1998) synonymized Tuberdillo Schmalfuss & Ferrara, 1983 and Vandelillo Arcangeli, 1957 with Ctenorillo. At present the genus has mainly an African distribution, with only one species, C. mineri (Van Name, 1936), recorded from Venezuela and Guyana (Schmalfuss, 2003).

CTENORILLO FERRARAI CAMPOS-FILHO, ARAUJO & TAITI SP. NOV.

Type material
Holotype: ♂, Brazil, Pará, Canaã dos Carajás, FLONA Carajás (FLONA – National forest), Gruta N5S 07, 6°06’20”S, 50°07’09”W, 3–13 May 2005, leg. R. Andrade and Arnoni (MZUSP 27547).

Paratypes: One ♂, five ♀, same data as holotype (MZUSP 24244, 24245, 24246, 24247, 24248, 24249); one ♀, Pará, Canaã dos Carajás, Gruta Cris 11, 6°26’29”S 49°40’51”W, 29 June–6 July 2008, leg. R. Andrade (MZUSP 24256).

Etymology
The new species is named after Dr Franco Ferrara, Florence, Italy, for his invaluable contribution to the knowledge of terrestrial isopods.

Description
Maximum length: ♂ and ♀, 5 mm. Colour brown. Dorsum covered with large tubercles, arranged as follows...
Figure 37. *Ctenorillo ferrarai* Campos-Filho, Araujo & Taiti sp. nov., O: A, habitus, lateral; B, disposition of dorsal tubercles; C, dorsal scale seta; D, cephalon and pereonites 1 and 2, frontal; E, cephalon, dorsal; F, cephalon, caudal; G, epimera of pereonites 1–4, ventral; H, pereonite 7, pleon, telson and uropods, frontal; I, pereonite 7, pleon, telson, and uropods, ventral; J, antennule; K, antenna. Scale bar: 1 mm.
Figure 38. *Ctenorillo ferrarai* Campos-Filho, Araujo & Taiti sp. nov. ♂: A, left mandible; B, right mandible; C, maxillule; D, maxilla; E, maxilliped; F, uropod.
Figure 39. *Ctenorillo ferrarii* Campos-Filho, Araujo & Taiti sp. nov., ♂: A, pereopod 1; B, pereopod 7; C, genital papilla; D, pleopod 1; E, pleopod 2; F, pleopod 3 exopod; G, pleopod 4 exopod; H, pleopod 5 exopod.
Figure 40. Distribution map of terrestrial isopods in Brazilian karst areas: 1, Miktoniscus medcofi; 2, Spelunconiscus castroi sp. nov.; 3, Xangoniscus aganju sp. nov.; 4, Leonardoscia hassalli sp. nov.; 5, Metaprosekia quadriocellata sp. nov.; 6, Metaprosekia caupe sp. nov.; 7, Benthana iporangensis; 8, Benthana laeniata; 9, Ischioscia amazonica; 10, Amazoniscus leistikowi sp. nov.; 11, Amazoniscus eleonorae; 12, Circoniscus bezi; 13, Circoniscus buckupi; 14, Circoniscus carajasensis; 15, Circoniscus intermedius; 16, Circoniscus incisus; 17, Novamundoniscus altamiraensis sp. nov.; 18, Dubioniscus goeldii; 19, Dubioniscus marmoratus; 20, Trichorhina yara sp. nov.; 21, Trichorhina curupira sp. nov.; 22, Trichorhina anhanuera sp. nov.; 23, Trichorhina guanophila; 24, Porcellionides pruinosis; 25, Armadillidium vulgare; 26, Ctenorillo ferrarai sp. nov.; 27, Cubaris murina; 28, Gabunillo aridicola.

Abbreviations: AC, Acre; AL, Alagoas; AP, Amapá; AM, Amazonas; BA, Bahia; CE, Ceará; DF, Distrito Federal; ES, Espírito Santo; GO, Goiás; MA, Maranhão; MT, Mato Grosso; MS, Mato Grosso do Sul; MG, Minas Gerais; PA, Pará; Pará; PR, Paraíba; PB, Paraná; PE, Pernambuco; PI, Piauí; RJ, Rio de Janeiro; RN, Rio Grande do Norte; RS, Rio Grande do Sul; RO, Rondônia; RR, Roraima; SC, Santa Catarina; SP, São Paulo; SE, Sergipe; TO, Tocantins.
(Fig. 37A,B): vertex of cephalon with three rows, an anterior row of six tubercles, a middle row of two tubercles, and a posterior row of six tubercles; pereonite 1 with an anterior row of four tubercles, a middle row of 12 tubercles, and a posterior row of eight tubercles; pereonites 2–7 with two rows of six tubercles; pleonites 3–5 with one row of four tubercles; telson with two paramedian tubercles. Dorsal surface with short triangular scale setae (Fig. 37C). Pereonites 1–7 with one nodulus lateralis on side inserted on the lateral surface of the second outer tubercle (Fig. 37A). Cephalon (Fig. 37D–F) with frontal shield slightly protruding above vertex and concave in the middle; eye consisting of 14 ommatidia. Pereonite 1 grooved on lateral margin for about two-thirds of its length, inner lobe of schisma rounded, distinctly extending beyond posterior margin of outer lobe (Fig. 37G). Pereonites 2–4 with triangular epimera, pereonites 5–7 with quadrangular epimera (Fig. 37A). Pereonite 2 with a subtriangular ventral lobe distinctly extending beyond posterior margin of the epimeron (Fig. 37G). Pereonites 6 and 7 (Fig. 37l) grooved on ventral portion of epimerae. Telson (Fig. 37H) hourglass-shaped, proximal part broader than distal part, and straight distal margin. Antenna (Fig. 37J) of three articles with six long apical and two subapical aesthetasces. Antenna (Fig. 37K) short and stout, slightly surpassing rear margin of cephalon; flagellum with second article about three times as long as the first. Mandibles (Fig. 38A,B) with molar penicil consisting of several plumose setae; left mandibles with 2 + 1 and right mandible with 1 + 1 free penicils. Maxillule (Fig. 38C) with outer branch bearing 4 + 6 simple teeth; inner branch with two long penicils and a small posterior point. Maxilla (Fig. 38D) bilobate, with inner lobe distinctly narrower than outer lobe. Maxillipeds (Fig. 38E) endite with a subapical large seta overpassing the distal margin, and two triangular setae distally; palp with two setae on the basal article. Pleopods 1–5 with monospiracular respiratory structures (Fig. 39D–H). Uropod (Fig. 38F) protopod flattened and enlarged on basal part, distal part trapezoidal, with medial margin slightly concave; exopod very short, inserted dorsally near the medial margin of the protopod.

Male: Pereopod 1 and 7 (Fig. 39A,B) with no particular modifications. Genital papilla as in Figure 39C. Pleopod 1 (Fig. 39D) exopod small, wider than long, with a triangular distal lobe and strongly concave distal margin; endopod with triangular distal part slightly bent outwards, bearing one row of small setae on the caudal surface near distal margin. Pleopod 2 (Fig. 39E) exopod triangular, L-shaped, with outer margin strongly concave; endopod longer than exopod. Pleopods 3–5 as in Figure 39F–H.

Remarks
At present Ctenorillo includes 12 species (Schmalfuss, 2003): Ctenorillo aussele Dollfus, 1893b), from the Canary Islands; Ctenorillo banananae (Van Name, 1920), from Cameroon, Congo, and Angola; Ctenorillo budeledondi Verhoeff, 1942, from Uganda and Kenya; Ctenorillo fagei (Paulian de Félíce, 1941), from Ivory Coast; Ctenorillo gabunensis (Schmalfuss & Ferrara, 1983), from Gabon; Ctenorillo guinensis (Schmalfuss & Ferrara, 1983), from Guinea; Ctenorillo kenyensis Schmölzer, 1974, from Uganda and Tanzania; Ctenorillo legai (Arcangeli, 1941), from Ethiopia; Ctenorillo partituberculatus (Taiti & Ferrara, 1987), from Malawi; Ctenorillo regulus (Van Name, 1920), from Zaire and Somalia; Ctenorillo strinatti (Schmalfuss & Ferrara, 1983), from Congo; and Ctenorillo mineri (Van Name, 1936), from Venezuela and Guyana. The best character to distinguish the species of Ctenorillo is the number and arrangement of dorsal tubercles. In having four tubercules on pleonites 3–5 and two on telson, C. ferrarai sp. nov. resembles C. fagei, C. gabunensis, C. guinensis, and C. mineri, from which it differs in the number and disposition of tubercles on the cephalon and pereon. In particular, it is recognized from the only other Neotropical species, C. mineri, by having 3 + 3 tubercles in the anterior and 3 + 3 tubercles in the posterior row on pereonites 2–7, instead of 5 + 5 tubercles in the anterior and 4 + 1 + 4 in the posterior row, and by the shape of the male pleopod 1 (compare Figure 39D with figure 97A in Vandel, 1952b, for C. mineri).

Genus Cubaris Brandt, 1833

Type species: Cubaris murina Brandt, 1833, by subsequent designation (Barnard, 1932).

Diagnosis
Vandel (1952b).

Cubaris murina Brandt, 1833

Figure 40


Material examined

Distribution
Species with a wide distribution along the tropics.
With the six species previously recorded, the number lies and 16 genera have been collected and identified from 35 caves in the states of Bahia, Minas Gerais, and Mato Grosso do Sul; and (3) Paraná subregion (Campos-Filho, Costa & Araujo, 2013; Morrone, 2013).

The genera of the family Armadillidae have a Gondwanan distribution; however, the affinities of the two new genera Spelunconiscus gen. nov. and Xangoniscus gen. nov., both collected from the Chacoan subregion, still need to be detected. It is interesting to notice that the two styloniscids, Spelunconiscus castroi sp. nov. and Xangoniscus aganju sp. nov., are amphibian species secondarily adapted to live in water, as demonstrated by the presence of a water-conducting system on pereopod 7 (for a discussion on the origin of aquatic Oniscidea, see Tabacaru, 1999; Taiti & Xue, 2012).

Among the new species described herein, four may be considered troglobitic because of the absence or low number of ommatidia and reduction of pigment (colourless or pale body) and absence in epigean habitats (Trajano, 2012): Spelunconiscus castroi sp. nov., Xangoniscus aganju sp. nov., Leonardoscia hassalli sp. nov., and Amazoniscus leistikowi sp. nov. The case with Trichorhina is more complicated because there is a great deal of variation concerning the condition of eyes and body colour, and there is evidence for highly convergent or parallel phenotypic evolution, with epigean species showing some troglomorphic traits, common among animals living in deep soil, and these can obscure taxonomic relationships among cave-adapted species and among closely related cave and surface species (see Wilkens & Strecker, 2003; Porter, 2007; Bendik et al., 2013). Therefore, the troglobitic status for the two troglomorphic species Trichorhina curupira sp. nov. and Trichorhina anhanguera is doubtful. Collections in contiguous epigean habitats, which are not usually performed properly in biospeleological surveys, may also show their occurrence outside caves, indicating a troglobilic rather than a troglobitic condition.

All the other species are not troglomorphic, and are either troglobilic or accidental in Brazilian caves, but their status is difficult to establish as we have no or only scattered data on species that occur outside of caves.

The genus Benthana is endemic to South America, and is distributed in the Atlantic forest areas of the Paraná subregion (Campos-Filho, Costa & Araujo, 2013; Morrone, 2013).

The family Scleropactidae with the genera Amazoniscus and Circorniscus occurs in the Amazonian and Paraná subregions (see Schmidt, 2007), indicating some historical connections between both these subregions (see also Nihei & Carvalho, 2007; Ferrari et al., 2010). The family Styloniscidae has mainly a Gondwanan distribution; however, the affinities of the two new genera Spelunconiscus gen. nov. and Xangoniscus gen. nov. have yet to be detected.

Nevertheless, these data show some biogeographic patterns. The species recognized herein occur in three different biogeographic units, sensu Morrone (2006, 2013): (1) the Amazonian subregion, specifically the province Tapajós-Xingu, with 17 species, 12 of which, mostly Philosciidae and Scleropactidae, are endemic to this subregion, in particular to Altamira and Carajás karst areas, state of Pará; (2) the Chacoan subregion, with nine species, three of which, belonging to the families Styloniscidae, Plathyrarthridae and Armadillidae, are endemic to Apodi, Una, Bambuí, and Corumbá karst areas, states of Ceará, Rio Grande do Norte, Bahia, Minas Gerais, and Mato Grosso do Sul; and (3) Paraná subregion, with four species, three of which, in the families Philosciidae, Dubioniscidae, and Plathyrarthridae, are endemic to Quadrilátero Ferrifero and Açungui karst areas, states of Minas Gerais and São Paulo (Fig. 40).

Two species occur in the Amazonian and Chacoan subregions: Circorniscus bezi from the states of Pará, Minas Gerais, and São Paulo, and Circorniscus intermedius from the states of Pará and Mato Grosso do Sul (Table 2).


GENUS GABUNILLO SCHMALFUSS & FERRARA, 1983
Type species: Gabunillo coecus Schmalfuss & Ferrara, 1983, by original designation and monotypy.

Diagnosis

GABUNILLO ARIDICOLA SOUZA, SENNA & KURY, 2010

Figure 40

Distribution
Brazil: Ceará.

GENERAL REMARKS
Twenty-two species of terrestrial isopods in nine families and 16 genera have been collected and identified from 35 caves in the states of Bahia, Minas Gerais, Mato Grosso do Sul, Pará, and São Paulo (Table 1). With the six species previously recorded, the number of oniscidean species confirmed for Brazilian caves is now 28. If we consider that the total number of terrestrial isopod species known from Brazil is 161, this number is not very high. We have to point out that only a limited number of caves in Brazil have been investigated as far as invertebrates are concerned, and the number of cave-dwelling terrestrial isopods will certainly increase as more caves are sampled.

Nevertheless, these data show some biogeographic patterns. The species recognized herein occur in three different biogeographic units, sensu Morrone (2006, 2013): (1) the Amazonian subregion, specifically the province Tapajós-Xingu, with 17 species, 12 of which, mostly Philosciidae and Scleropactidae, are endemic to this subregion, in particular to Altamira and Carajás karst areas, state of Pará; (2) the Chacoan subregion, with nine species, three of which, belonging to the families Styloniscidae, Plathyrarthridae and Armadillidae, are endemic to Apodi, Una, Bambuí, and Corumbá karst areas, states of Ceará, Rio Grande do Norte, Bahia, Minas Gerais, and Mato Grosso do Sul; and (3) Paraná subregion, with four species, three of which, in the families Philosciidae, Dubioniscidae, and Plathyrarthridae, are endemic to Quadrilátero Ferrifero and Açungui karst areas, states of Minas Gerais and São Paulo (Fig. 40).

Two species occur in the Amazonian and Chacoan subregions: Circorniscus bezi from the states of Pará, Minas Gerais, and São Paulo, and Circorniscus intermedius from the states of Pará and Mato Grosso do Sul (Table 2).
Table 1. List of terrestrial isopods from Brazilian caves

<table>
<thead>
<tr>
<th>Species</th>
<th>Locality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trichoniscidae</strong></td>
<td></td>
</tr>
<tr>
<td>1. Miktoniscus medcofi</td>
<td>PA, Canaã dos Carajás</td>
</tr>
<tr>
<td>2. <em>Speleoniscus castroi</em> sp. nov.</td>
<td>MG, Matozinhos, Gruta MOC-32</td>
</tr>
<tr>
<td>3. <em>Xan goniscus aganju</em> sp. nov.</td>
<td>BA, Caririnha, Gruna do Mandiaçu</td>
</tr>
<tr>
<td><strong>Styloniscidae</strong></td>
<td></td>
</tr>
<tr>
<td>4. <em>Leonardoscia hassalli</em> sp. nov.</td>
<td>PA, Altamira, Caverna Leonardo da Vinci</td>
</tr>
<tr>
<td>5. <em>Maetaproseka quadriocellata</em> sp. nov.</td>
<td>PA, Altamira, Caverna Leonardo da Vinci</td>
</tr>
<tr>
<td>6. <em>Metaproseka caupe</em> sp. nov.</td>
<td>PA, Altamira, Abrigo do Abutre</td>
</tr>
<tr>
<td>7. Benthana iporangensis</td>
<td>SP, Iporanga, Águas Quentes</td>
</tr>
<tr>
<td>8. Benthana taeniata</td>
<td>MG, São Roque de Minas, Gruta Zeferino I</td>
</tr>
<tr>
<td>9. <em>Ischioscia amazonica</em></td>
<td>PA, Parauapebas, Gruta Cav 18 S11</td>
</tr>
<tr>
<td><strong>Philoscidae</strong></td>
<td></td>
</tr>
<tr>
<td>10. <em>Amazoniscus leistikowi</em> sp. nov.</td>
<td>PA, Altamira, Abrigo do Sismógrafo</td>
</tr>
<tr>
<td>11. <em>Amazoniscus eleonorae</em></td>
<td>PA, Altamira, Pedra da Cachoeira</td>
</tr>
<tr>
<td>12. <em>Circoniscus bezzi</em></td>
<td>MG, Presidente Olegário, Caverna Vereda da Palha</td>
</tr>
<tr>
<td>13. <em>Circoniscus buckupi</em></td>
<td>PA, Parauapebas, FLONA Carajás, N4E karst system</td>
</tr>
<tr>
<td>14. <em>Circoniscus carajasensis</em></td>
<td>PA, Canaã dos Parauapebas, S11 karst system</td>
</tr>
<tr>
<td>15. <em>Circoniscus intermedius</em></td>
<td>PA, Canaã dos Carajás, Gruta S1D-12</td>
</tr>
<tr>
<td>16. <em>Circoniscus incisus</em></td>
<td>PA, Parauapebas, Gruta S1D-69</td>
</tr>
<tr>
<td><strong>Dubioniscidae</strong></td>
<td></td>
</tr>
<tr>
<td>17. <em>Novamundoniscus altamiraensis</em> sp. nov.</td>
<td>PA, Canaã dos Parauapebas, FLONA Carajás</td>
</tr>
<tr>
<td>18. <em>Dubioniscus goeldii</em></td>
<td>PA, Canaã dos Carajás, Gruta S11-07</td>
</tr>
<tr>
<td>19. <em>Dubioniscus marmoratus</em></td>
<td>PA, Altamira, Abrigo do Sismógrafo</td>
</tr>
<tr>
<td><strong>Platyarthridae</strong></td>
<td></td>
</tr>
<tr>
<td>20. <em>Trichorhina yiara</em> sp. nov.</td>
<td>PA, Altamira, Abrigo do Sismógrafo</td>
</tr>
<tr>
<td>21. <em>Trichorhina curupira</em> sp. nov.</td>
<td>PA, Altamira, Caverna Pedra da Cachoeira</td>
</tr>
<tr>
<td>22. <em>Trichorhina anhanguera</em> sp. nov.</td>
<td>MG, Morro do Pilar, Gruta MP-10</td>
</tr>
<tr>
<td>23. <em>Trichorhina guanophila</em></td>
<td>BA, Campo Formoso, Lapa do Convento</td>
</tr>
<tr>
<td><strong>Porcellionidae</strong></td>
<td></td>
</tr>
<tr>
<td>24. <em>Porcellionides pruinosus</em></td>
<td>BA, Iraquara, Gruta Alto da Cruz</td>
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<tr>
<td></td>
<td>BA, Itaaté, Lapa de Bode</td>
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<tr>
<td><strong>Armadillidiidae</strong></td>
<td></td>
</tr>
<tr>
<td>25. <em>Armadillidium vulgare</em></td>
<td>MG, São Roque de Minas, Gruta Zeferino I</td>
</tr>
<tr>
<td><strong>Armadillidae</strong></td>
<td></td>
</tr>
<tr>
<td>26. <em>Ctenorillo ferrarai</em> sp. nov.</td>
<td>PA, Canaã dos Carajás, FLONA Carajás, Gruta N5S 07</td>
</tr>
<tr>
<td>27. <em>Cubaris murina</em></td>
<td>PA, Canaã dos Carajás, Gruta Cris 1</td>
</tr>
<tr>
<td>28. <em>Gabunillo aridicolus</em></td>
<td>BA, Morro do Chapéu, Gruta dos Brejões</td>
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<td></td>
<td>CE, Aiuaba, Gruta do Sobradinho</td>
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<td></td>
<td>RN, Apodi, Lajeado da Soledade</td>
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</table>

Abbreviations: BA, Bahia; MG, Minas Gerais; MS, Mato Grosso do Sul; PA, Pará; SP, São Paulo.
Current Brazilian laws guarantee cave preservation when a cave reaches the maximum level of relevance, and this is only possible when there are rare or endemic troglobitic species (e.g. Mattox *et al*., 2008; Cardoso *et al*., 2014). Thus, although laws protect at least part of the obligate cave fauna, the conservation acts cannot come into effect if species remain undescribed. In fact, this is a major problem for biodiversity conservation, including the subterranean biota (Bichuette & Trajano, 2010), throughout the world. For this reason, taxonomic studies of subterranean species in Brazil have crucial importance for the preservation of both environment and species, particularly the endemic ones, and any delay in taxonomic research in caves may yield permanent loss to biodiversity, even before the species are discovered and described (e.g. Trajano, 2000; Bichuette & Trajano, 2005; Fíšer, Zagmajster & Ferreira, 2013). Taxonomic impediment is the major problem for the development of subterranean research and cave conservation in Brazil; therefore, investment in this field is a priority in the country (e.g. Cordeiro, Borghezan & Trajano, 2014).

Table 2. List of cave-dwelling terrestrial isopods according to Brazilian biogeographic subregions

<table>
<thead>
<tr>
<th>Biogeographic subregions</th>
<th>Amazonian</th>
<th>Chacoan</th>
<th>Paraná</th>
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<tbody>
<tr>
<td><strong>Trichoniscidae</strong></td>
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<tr>
<td>1. <em>Miktoniscus medcofi</em></td>
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<tr>
<td><strong>Styliniscidae</strong></td>
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<tr>
<td>2. <em>Spelunconiscus castroi</em> sp. nov.</td>
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<td>3. <em>Xangoniscus aganju</em> sp. nov.</td>
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<tr>
<td><strong>Philosciidae</strong></td>
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<tr>
<td>4. <em>Leonardoscia hassalli</em> sp. nov.</td>
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<td>5. <em>Metaprosekia quadriocellata</em> sp. nov.</td>
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<td>6. <em>Metaprosekia caupe</em> sp. nov.</td>
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<td>8. <em>Benthana taeniata</em></td>
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<tr>
<td><strong>Scleropactidae</strong></td>
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<tr>
<td>10. <em>Amazoniscus leistikowi</em> sp. nov.</td>
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<tr>
<td>12. <em>Circoniscus bezzi</em></td>
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<tr>
<td>13. <em>Circoniscus buckupi</em></td>
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<td>14. <em>Circoniscus carajasensis</em></td>
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<td>15. <em>Circoniscus intermedius</em></td>
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<tr>
<td>16. <em>Circoniscus incisis</em></td>
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<tr>
<td><strong>Dubioniscidae</strong></td>
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<tr>
<td>17. <em>Novamundoniscus altamirae</em> sp. nov.</td>
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<tr>
<td>18. <em>Dubioniscus goeldii</em></td>
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<td>x</td>
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<tr>
<td>19. <em>Dubioniscus marmoratus</em></td>
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<td><strong>Platyarthridae</strong></td>
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<td>20. <em>Trichorhina yiara</em> sp. nov.</td>
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<td>21. <em>Trichorhina curupira</em> sp. nov.</td>
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<td>22. <em>Trichorhina anhanguera</em> sp. nov.</td>
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<td>23. <em>Trichorhina guanophila</em></td>
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<tr>
<td><strong>Porcellionidae</strong></td>
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<tr>
<td>24. <em>Porcellionides pruinuosus</em></td>
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<td><strong>Armadillidiidae</strong></td>
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<tr>
<td>25. <em>Armadillidium vulgare</em></td>
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<tr>
<td><strong>Armadillidae</strong></td>
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<tr>
<td>26. <em>Ctenorillo ferrarai</em> sp. nov.</td>
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<tr>
<td>27. <em>Cubaris murina</em></td>
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<td>x</td>
</tr>
<tr>
<td>28. <em>Gabunillo aridicola</em></td>
<td></td>
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<td>x</td>
</tr>
</tbody>
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ACKNOWLEDGEMENTS

We are grateful to: Profs Marcos Tavares and Mauro Cardoso from MZUSP for loaning material and for assisting with depositing new material; Leme Engenharia for loaning the material from Altamira municipality; Giovanna M. Cardoso for helpful comments; CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico, MCT/CNPq/MEC/CAPES/PROTAX 562202/2010-2), for the productivity fellowship granted to P.B.A. and M.E.B.; CAPES/PDSE (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, Programa de Doutorado Sanduíche no Exterior 9156/11-9), for a scholarship to I.S.C.-F.; FAPESP (Fundação de Amparo à Pesquisa do Estado de São Paulo), for grants to M.E.B.; CAPES/PDSE (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, Programa de Doutorado Sanduíche no Exterior 9156/11-9), and to CNR (Consiglio Nazionale delle Ricerche, Istituto per lo Studio degli Ecosistemi, Florence, Italy), for hosting I.S.C.-F. during his PhD.

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