

## Article

### New records of rare *Ornithodoros* (Acari: Argasidae) species in caves of the Brazilian Amazon

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#### Abstract

The genus *Ornithodoros* is worldwide distributed and features 113 known species. However, some species are rare and collections are scarce. The present paper expands the known distribution of two species of soft ticks, *O. rondoniensis* and *O. marinkellei*, by about 1400 km to the east, in caves in two municipal districts in the state of Pará, northern Brazil. These species were previously known only from the western Brazilian Amazon. Furthermore, some morphological details and molecular analysis are shown.

**Key words:** Acari, Ixodida, Argasidae, cave, new records

#### Introduction

Cave environments present a series of rather peculiar characteristics, such as permanent absence of light far from the entrances, food scarcity, high humidity and nearly constant temperature (Culver 1982). Such characteristics may restrict colonization and the establishment of multiple species. However, mites and ticks are found colonizing many types of subterranean habitats. Many mite species are adapted to subterranean lifestyles, and some live exclusively in caves (Bernardi *et al.* 2009; Dusbábek 2001; Palácios-Vargas *et al.* 2001).

Although the subclass Acari is considered the most diverse group among Arachnida and are distributed worldwide, there are few specific studies about these organisms associated with cave environments (Bernardi *et al.* 2009; Dusbábek 2001; Palácios-Vargas *et al.* 2001). In Brazil, the subterranean acarofauna is poorly studied as

well (Bernardi *et al.* 2009; Bernardi *et al.* 2010; Hernandes *et al.* 2011; Labruna *et al.* 2011). Until now, 67 families belonging to six Acari orders have been recorded, with the soft tick family Argasidae showing the widest distribution in caves, in 12 out of 26 Brazilian states (Bernardi *et al.* 2009; Dantas-Torres *et al.* 2009; Labruna *et al.* 2008; Labruna *et al.* 2011; Labruna & Venzal 2009).

The Amazon Forest comprises a system of which little is known concerning the Brazilian cave fauna (Bernardi *et al.* 2009). However, the intensification of collections in the area during recent years has improved the knowledge on cave fauna. New species have been discovered and new occurrences of known species have been recorded. Thus, the present work presents new occurrences of two *Ornithodoros* species in Brazil, all associated with ferruginous caves.

## Material and methods

### Study area

Surveys of ticks were carried out in a total of 300 caves formed in iron ore, located in the municipal districts of Carajás, Parauapebas and Canaã dos Carajás, all located in the southeast portion of Pará state, in the eastern Brazilian Amazon. The ferriferous formation of Carajás, where such caves are located, is completely within the domain of the Amazon Forest, located in northern Brazil. All caves are located in an area with high concentrations of iron ore, within high incidence of exploration of this mineral by mining companies.

Most of the caves in this region (of ferruginous lithology) feature ascending floors from the entrance, which makes more difficult the input of organic material through water action. Although most of the caves are short in length, there are few larger and more confined caves, with completely aphotic chambers. In some there are colonies of insectivorous bats (*Pteronotus* spp.) that produce a great amount of guano. In these caves, a great number of ticks were found mainly on the soil, walking freely on the guano.

### Methods

The survey was conducted through manual capture by using tweezers and brushes inside the caves. All specimens were fixed in 70% ethanol and taken to the laboratory for examination.

The measurements are given in millimeters (mm) and photographs were made on a stereomicroscope with digital camera.

Taxonomic identification of the collected ticks were performed through morphological analyses according to Labruna *et al.* (2008) and Labruna *et al.* (2011), and we followed the list of valid species names of the Ixodida presented by Guglielmone *et al.* (2010).

For one argasid species, the taxonomic identification was confirmed by processing a specimen by molecular analysis through PCR and DNA sequencing of a portion of the tick mitochondrial 16S rRNA gene, as previously described (Mangold *et al.* 1998).

The specimens are deposited in the Collection of Subterranean Invertebrates (ISLA), Zoology Section/Biology Department at the Federal University of Lavras, Brazil and in the National Mite Collection (CNC), Faculty of Veterinary Medicine, University of São Paulo, Brazil.

## Results and discussion

The ticks were collected in the municipalities of Carajás and Parauapebas, Southern Pará, eastern Brazilian Amazon, revealed new records for the ticks *Ornithodoros rondoniensis* (Labruna, Terassini, Camargo, Brandão, Ribeiro and Estrada-Peña, 2008) and *Ornithodoros marinkellei* Kohls, Clifford and Jones, 1969 (Ixodida, Argasidae). Eight individuals of the species *O. marinkellei* were collected in caves SL-078 (two females and two males) and SL-088 (two females and one male). Thousands of *O. rondoniensis* were observed in caves SL 078, N5SM2-099 and N5SM2-019.

### New record of *Ornithodoros rondoniensis*

The genus *Ornithodoros* includes a group of species widely distributed in Brazilian caves (Bernardi *et al.* 2009; Labruna *et al.* 2011; Dantas Torres *et al.* 2012). Currently this genus features 113 known species (Guglielmone *et al.* 2010; Dantas-Torres *et al.* 2012), some of which were described based on individuals collected in caves. Among the species of this genus, *O. rondoniensis* is one of the rarest species, known only from one cave located in Porto Velho, Rondônia (08°40'S, 63°51'W), western Brazilian Amazon (Labruna *et al.* 2008).

*Ornithodoros rondoniensis* showed some others specific morphological variations of the species that are observed in the specimens collected in caves of Pará state, such as idiosoma devoid of mammillae, covered by smooth sclerotized plaque presenting 2 long and parallel deep grooves extending from anterior to posterior margin, devoid of mammillae, covered by various medium-sized sclerotized plaques separated by deep grooves. Small-sized punctations, some containing fine seta, evenly distributed through plaques and palpi with several tufts of long setae on articles 2 and 3 (Figs. 1 & 2). All of these features were described by Labruna *et al.* (2008), and the Pará specimens did not show morphological distinguished differences when compared with the specimens from Rondônia (Table 1).

One nymphal specimen of *O. rondoniensis* from the presented study was processed by molecular analysis. A portion of its 16S rRNA mitochondrial gene was successfully amplified by PCR and DNA sequenced. By BLAST analysis ([www.ncbi.nlm.nih.gov/blast](http://www.ncbi.nlm.nih.gov/blast)), this sequence showed to be 99.3% (425/428-bp) similar to the corresponding sequence of *O. rondoniensis* collected from its type locality in the state of Rondônia, Brazil (Genbank accession number EU090907). The 16S rRNA sequence of *O. rondoniensis* from the state of Pará, generated in the present study has been submitted to Genbank under the accession number JQ951962.

**Table 1.** Morphological measurements (mm) of *O. rondoniensis*, males and females

|        | Idiosoma (length) | Idiosoma (width) | Spiracular plate (length) | Spiracular plate (width) |
|--------|-------------------|------------------|---------------------------|--------------------------|
| Male   | 5.6–5.8           | 2.76–2.83        | 1–1.13                    | 0.46–0.5                 |
| Female | 5.2–5.91          | 2.57–3.08        | 0.94–1.13                 | 0.44–0.62                |

### New record of *Ornithodoros marinkellei*

*Ornithodoros marinkellei* is a rare species that is recorded for caves in Panama, Colombia, Venezuela, Guyana and Brazil. Their records in Brazilian caves were restricted to one cave located in Porto Velho, Rondônia (08°40'43''S, 63°51'05''W). *Ornithodoros marinkellei* showed some others specific morphological variations of the

species that are observed on specimens collected in caves of Pará state, such as, entire idiosoma devoid of mammillae, covered by smooth sclerotized plaques presenting two long and parallel deep grooves extending from anterior to posterior margin; small-sized punctations, some containing fine seta, evenly distributed through plaques (Fig. 3). All of these features were described by Labruna *et al.* (2011), but specimens from Pará, eastern Amazon, were smaller (body length and width) than the specimens reported in Rondônia, western Amazon (Table 2).



**Figure 1.** *Ornithodoros rondoniensis*. A. Ventral view of female; B. Ventral view of male; C. Color variation of tegument (– scale bar 2 mm) male, nymph, and female, respectively. Scale bar 1 mm (A & B); 2 mm (C).

In the present study, only 4 adult individuals – 2 males and 2 females – were observed, all walking freely on the soil and wall of cave SL 078. Some records of *O. marinkellei* related such species parasitizing bats of the genus *Pteronotus* (Labruna *et al.* 2011). The presence of *Pteronotus* in cave SL 078 suggests that they are hosts of *O. marinkellei* in that cave.

**Table 2.** Morphological measurements (mm) of *O. marinkellei*, males and females

|        | Idiosoma (length) | Idiosoma (width) | Spiracular plate (length) |
|--------|-------------------|------------------|---------------------------|
| Male   | 2.124–2.15        | 1.126–1.177      | 0.226–0.288               |
| Female | 2.04              | 1.228            | 0.226                     |

### Final remarks

The new records of *O. rondoniensis* and *O. marinkellei* presented by this work expand the known distribution of these two species for the state of Pará (Amazon region), extending 1,300 km east to the closest previous records of these ticks in South America (Table 3) (Fig. 4).

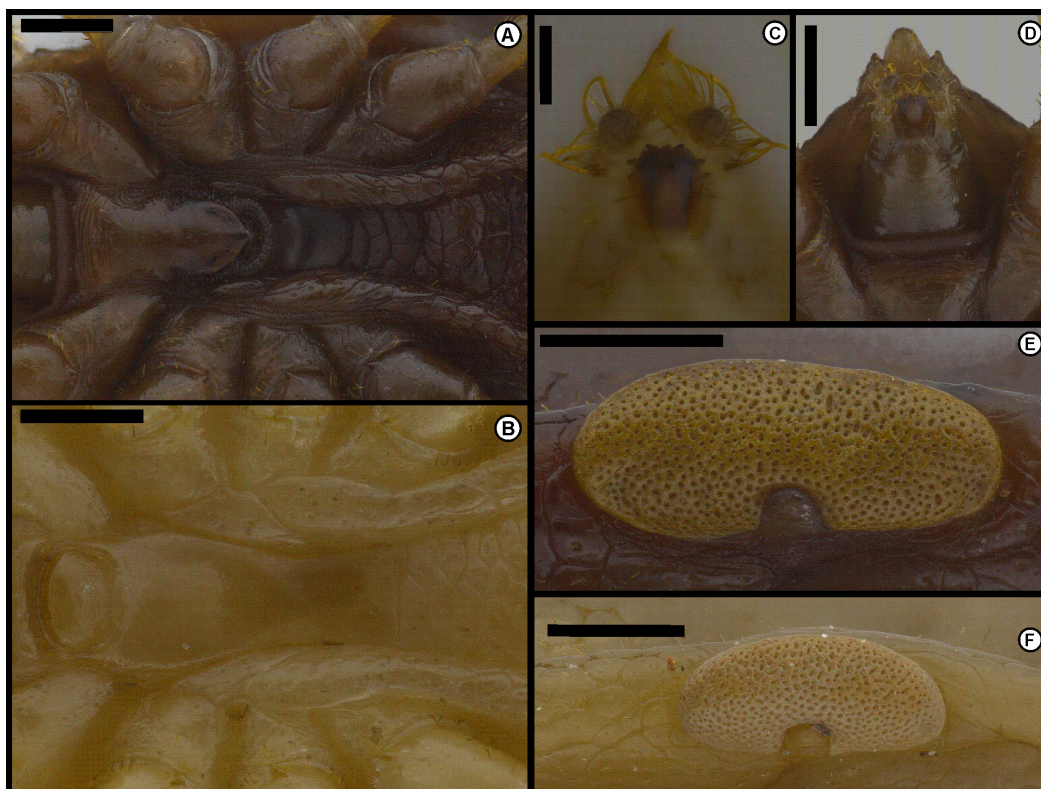
Bernardi *et al.* (2009) pointed a considerable lack of studies of Brazilian cave mites. Such facts is linked mainly to the lack of researchers dedicated to this study and also to inherent difficulties in collecting arthropods in cave environments, mainly in remote regions such as the Amazon Forest. The new records presented herein indicate that these species may be distributed in several additional caves located in that large biome.

**Table 3.** New occurrences of *Ornithodoros rondoniensis* and *Ornithodoros marinkellei*

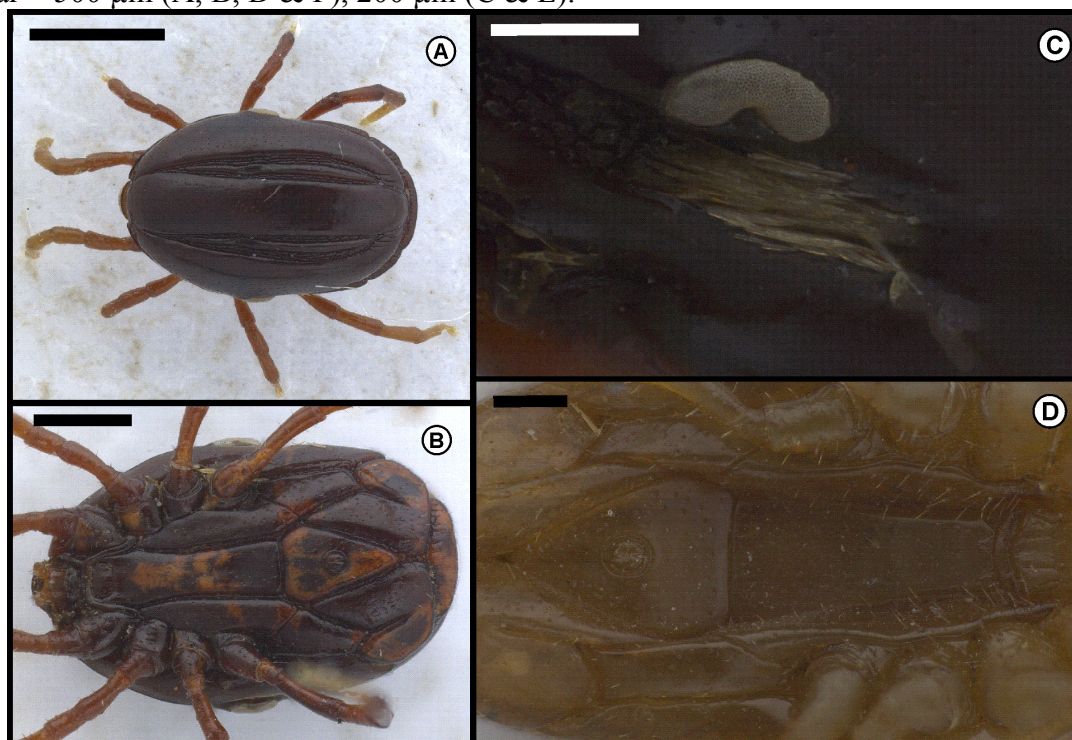
| Species                | Cave      | Geographical Coordinates (SAD69) |               | Date                 |
|------------------------|-----------|----------------------------------|---------------|----------------------|
| <i>O. marinkellei</i>  | SL-078    | S05°58' 00.9''                   | W49°38''31.9' | June 2010            |
| <i>O. rondoniensis</i> | SL-078    | S05°58'00.9''                    | W49°38''31.9' | June 2010            |
| <i>O. marinkellei</i>  | SL-088    | S05°57'30.7''                    | W49°38''07.8' | June 2010            |
| <i>O. rondoniensis</i> | N5SM2-099 | S06°08'07.1''                    | W50°07''46.5' | October and May 2010 |
| <i>O. rondoniensis</i> | N5SM2-019 | S06°07'30.6''                    | W50°07''54.2' | October and May 2010 |

### Acknowledgements

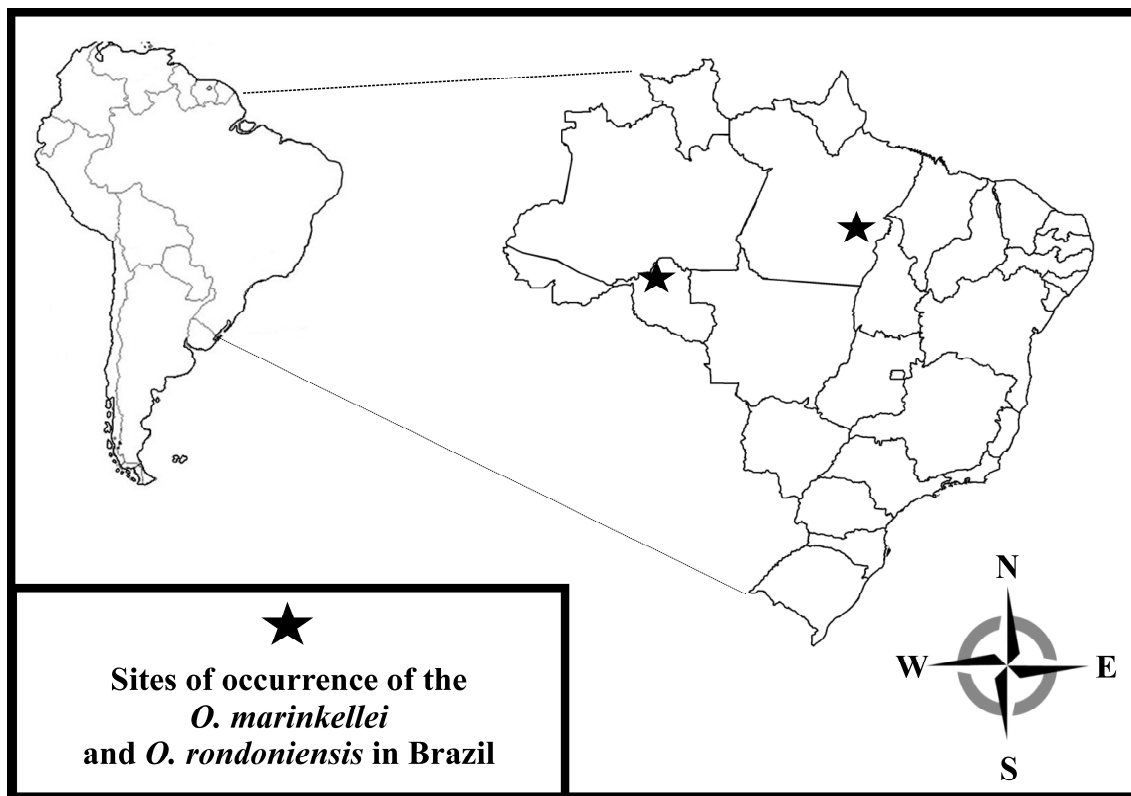
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**Figure 2.** *Ornithodoros rondoniensis*. A. Detailed view of genital aperture of female; B. male; C. Detailed view of ventral capitulum of male; D. Detailed view of ventral capitulum of female; E. Spiracular plate of female; F. Spiracular plate of immature. Scale bar = 500 µm (A, B, D & F), 200 µm (C & E).



**Figure 3.** *Ornithodoros marinkellei*. A. Dorsal view of male; B. Ventral view of male; C. Spiracular plate of female; D. Ventral view of female. Scale bar = 1mm (A), 500 µm (B), 200 µm (C & D).



**Figure 4.** Occurrences of *Ornithodoros rondoniensi* and *Ornithodoros marinkellei* in Brazilian caves.

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#### چکیده

جنس *Ornithodoros* گسترش جهانی دارد و ۱۱۳ گونه دارد. اما برخی از گونه‌ها کمیاب‌اند و کلکسیون‌ها [از امانت دادن آن‌ها] هراس دارند. مقاله حاضر، پراکندگی دو گونه کنه نرم به نام‌های *O. marinkellei* و *O. rondoniensis* را تا حدود ۱۴۰۰ کیلومتر به سمت شرق در غارهایی از دو

ناحیه شهرداری ایالت پرا در شمال برزیل گسترش می‌دهد. پیش‌تر این گونه‌ها تنها از غرب آمازون برزیل گزارش شده بودند. افزون بر این، برخی ویژگی‌های ریخت‌شناسی و تجزیه و تحلیل مولکولی ارایه شده است.