

# *Epiperipatus cratensis* sp. nov. (Onychophora: Peripatidae) from northeastern Brazil

## Uma nova espécie de *Epiperipatus* (Onychophora: Peripatidae) da região nordeste do Brasil

Samuel V. Brito<sup>1</sup>  
samuelvieirab@yahoo.com.br

Janaina C. Pereira<sup>1</sup>  
janainacross@yahoo.com.br

Felipe S. Ferreira<sup>1</sup>  
ferreira\_fs@yahoo.com.br

Alexandre Vasconcellos<sup>2</sup>  
avasconcellos@cb.ufrn.br

Waltécio O. Almeida<sup>1\*</sup>  
waltecio@gmail.com

### Abstract

This article aims to describe and illustrate *Epiperipatus cratensis* sp. nov. from Crato (coordinates 07°16'S, 39°26'W), Ceará State, Brazil. Specimens of onychophorans were collected under stones and decomposing tree barks during the rainy season. *E. cratensis* differs from all of the species of the genus by having: (i) many pairs of legs, even though it is the second smallest species in size to the genus in Brazil; (ii) fewer rings of antennae than the other Brazilian species. Furthermore, *E. cratensis* is similar to *E. tucupi*, especially because females have 34 pairs of legs, and differs morphologically only by being shorter in size. In addition, these two species are located in different biomes: *E. tucupi* is endemic to the Amazon region, while *E. cratensis* is derived from Chapada do Araripe mountains, within Atlantic Forest biome of the Brejos de Altitude complex of northeastern Brazil.

**Key words:** high land humid forest, *Epiperipatus*, peripatidae, onychophora.

### Resumo

O presente artigo visa descrever e ilustrar *Epiperipatus cratensis* sp. nov. proveniente de Crato (coordenadas 07°16'S, 39°26'W), Estado do Ceará, Brasil. Para tanto, os espécimes foram coletados sob pedras e cascas de árvores em decomposição durante a estação chuvosa. *E. cratensis* difere de todas as espécies do gênero por possuir: (i) um grande número de pares de pernas, mesmo sendo a segunda menor espécie em tamanho para o gênero no Brasil; (ii) menos anéis de antenas que as demais espécies brasileiras. *Epiperipatus cratensis* é semelhante a *E. tucupi*, principalmente porque as fêmeas apresentam 34 pares de pernas, diferindo morfológicamente apenas por serem de tamanho menor. Além disso, essas duas espécies estão inseridas em biomas distintos: a *E. tucupi* endêmica da região amazônica, enquanto a *E. cratensis* encontra-se na Chapada do Araripe, inserida no complexo dos brejos de altitude nordestinos na Mata Atlântica.

**Palavras-chave:** brejos de altitude, *E. cratensis*, Onychophora, Peripatidae.

<sup>1</sup> Universidade Regional do Cariri, Departamento de Química Biológica, Campus do Pimenta, Rua Cel Antônio Luiz, 1161, Bairro do Pimenta, 63105-100, Crato, CE, Brazil.

<sup>2</sup> Universidade Federal do Rio Grande do Norte, Departamento de Botânica, Ecologia e Zoologia – UFRN, Cidade Universitária, Lagoa Nova, 59072-970, Natal RN, Brazil.

\* Author for correspondence.

## Introduction

The Onychophora is a small group of terrestrial invertebrates that have received a great deal of attention lately due to their significant phylogenetic importance, as an intermediary group between Annelida and Arthropoda (Reid, 1996; Monge-Nájera and Hou, 1999). It is distributed in the tropical and temperate regions of the southern hemisphere, depending on the family. Onychophorans are obligatory inhabitants of humid environments with crepuscular habits, generally eating small invertebrates that are captured with the help of a sticky liquid ejected from their oral palps, which partially digests them (Read and Hughes, 1987; Hamer *et al.*, 1997).

There are approximately 173 species distributed among 49 genera and two families: while Peripatidae and Peripatopsidae are known (Reid, 1996; Monge-Nájera and Hou, 1999), Onychophora have not been extensively studied and little data is available concerning the ecology, natural history and taxonomy of this group in Neotropical region (Vasconcellos, *et al.*, 2004, 2006). Few studies have been undertaken in Brazil, where only eleven species are currently known, all of which belong to the family Peripatidae (Peck, 1975). This family is subdivided into ten genera (World Checklist of the Onychophora, 2009), of which four occur in Brazil: *Epiperipatus* (Clark, 1913), *Macroperipatus* (Clark, 1913), *Oroperipatus* (Cockerell, 1908) and *Peripatus* (Guilting, 1825) (Peck, 1975).

The genus *Epiperipatus* integrates the 'caraiba' group with the other genus *Peripatus* and *Macroperipatus*. *Epiperipatus* is characterized by the papillae on their dorsal region uniform in size at all ages, and the crural tubercles of the males found only on the two pairs of pregenital legs. It is very difficult to distinguish genus *Epiperipatus* from its cogenus

*Peripatus*. According to Peck (1975), the main separation characters are the size of the principal papillae in the dorsal region at different ages, and the spaces between the primary papillae and the crural tubercles of the males with pregenital legs. Read (1988) considered the characteristics used by Peck (1975) insufficient to separate the two genera, and this author concluded that the most reliable character for dividing these two taxa is the number of scales (rows of microscales located at the base of the papillae). Thus, for Read (1988) *Peripatus* can be characterized as having large numbers of scales at the base of the principal papillae (four or more), while *Epiperipatus* has at most three scales at the base of its papillae. Only four species have been described for *Epiperipatus* from Brazil: *E. brasiliensis* (Bouvier, 1905), collected in Santarém, Pará State; *E. edwardsii* (Blanchard, 1847), reported from Santarém, French Guyana, Suriname, Guyana, Trinidad, Tobago and Grenada; and *E. simoni* (Bouvier, 1908) and *E. tucupi* Froelich, 1968 collected on the Pará State (Peck, 1975).

There are currently no described species of onychophorans from northeastern Brazil, only records of some specimens described to the genus level (see Vasconcellos *et al.*, 2004, 2006; Santana *et al.*, 2008).

The present work describes a new species of *Epiperipatus* from the mountainous forests of the Chapada do Araripe mountain range in northeastern Brazil, with *E. cratensis* being the first species of the genus *Epiperipatus* to be reported out from the Amazon Forest (see revision by Peck, 1975).

## Material and methods

The specimens were collected in August 2007 along the banks of the *Batateiras* River in an environmental protection area (APA) (coordinates 07°16'S and 39°26'W) located in the municipality of Crato, in the southern

part of Ceará State, northeastern Brazil. The predominant climate in the area is tropical humid, with an average annual temperature near 27 °C, and an average rainfall of 700 to 1,000 mm/year. The typical vegetation along the banks of *Batateiras* river is tropical pluvial-nebular sub-perennial forest (Humid Forest) (Campello *et al.*, 2000).

As there are no standardized methodologies for actively collecting onychophorans, we applied a protocol typically used for collecting termites (Vasconcellos *et al.*, 2004) in which random sites were marked and 50 m transects established. These transects were subdivided into five 10 m<sup>2</sup> plots (each 2 m long x 5 m and perpendicular to transect), totalizing 600 m<sup>2</sup> for each locality studied. A time period of 1 hour/person was set to search all of the appropriate microhabitats in each subplot for onychophorans (in bromeliads, under the leaf-litter, stones, or fallen tree-trunks, and within small holes in the ground).

The specimens collected were fixed and conserved in 70% alcohol and deposited in the invertebrate collection of the Universidade Regional do Cariri - URCA. All morphological measurements were made using a stereomicroscope. Images of the surface of the animals were made using a Scanning Electron Microscope (SEM). The Onychophora specimens were not pre-treated in any manner before scanning in order not to alter their teguments, for this was the principal character utilized in their identification. The descriptions of the specimens collected were made in consulting the specialized literature (Clark, 1913; Peck, 1975; Read, 1988). Characters of dubious validity, such as coloration, were not utilized. The descriptions presented here are based principally on traditional characters, such as the shape and arrangement of the dorsal papillae on the tegument, the numbers of locomotive appendages and antenna rings, specimens' sizes, and the number of buccal lobes.

## Results

*Epipeperipatus cratensis* sp. nov.

Figures 1-6

**Type material.** Municipality of Crato (07°16'S and 39°26'W), State of Ceará, northeastern Brazil. Holotype (LZ-URCA 701♂), paratypes (LZ-URCA 591♀, 702♂, 703♂).

**Etymology.** The specific epithet was derived from the locality where the specimens were collected, municipality of Crato.

**Male.** Body dorsally cylindrical and ventrally semi-cylindrical, 27 mm long and 4.7 mm wide, flattened dorsal-ventrally at the posterior extremity, with a slight depression on each side of the body, and a very slight elevation along the margins of the body midline. Each segment has 12 transversal dorsal folds separated by furrows, these being deep and well-defined and relatively distant one from another (Figure 1). The principal dorsal papillae are large and clearly stand out from the secondary papillae. Both types are closely placed, but separated from each other by folds that are not well defined. Between the two principal papillae, it is always found two or three smaller secondary papillae and a larger more central papilla (Figure 2). There are significant differences between the principal median and lateral papillae in terms of their shape and size: the median papillae have rounded, almost conical bases forming a rounded apical section with a short central bristle; the lateral papillae are composed of a cylindrical base with a larger central median bristle (see Figures 3 and 4, respectively). The bases of the principal papillae have a small number of scales (generally three, or at most four).

**Cephalic region.** Eyes 210 to 160 µm in diameter, dark, and situated at the lateral base of the antenna, this having 31 to 36 complete rings of medium or large dimensions. The apex of the antenna is formed by six large rings and a terminal bulb, this having papillae

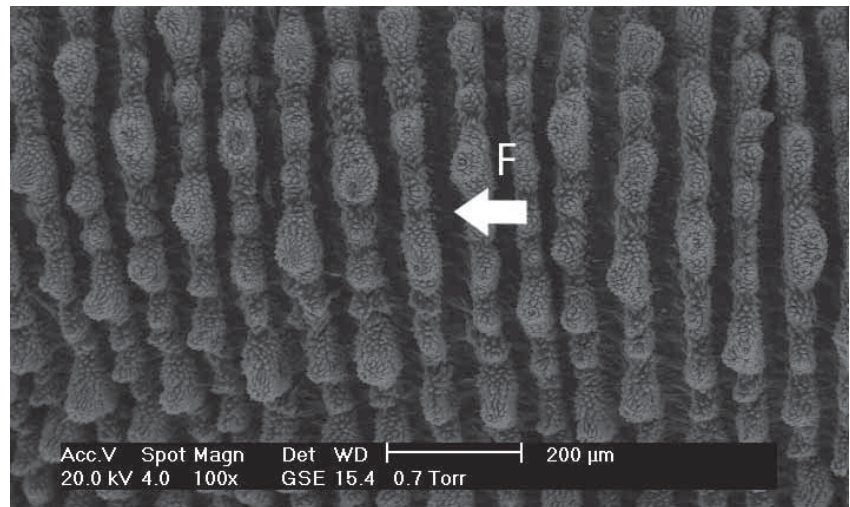


Figure 1. Transversal dorsal folds separated by furrows (F) (LZ-URCA 701).

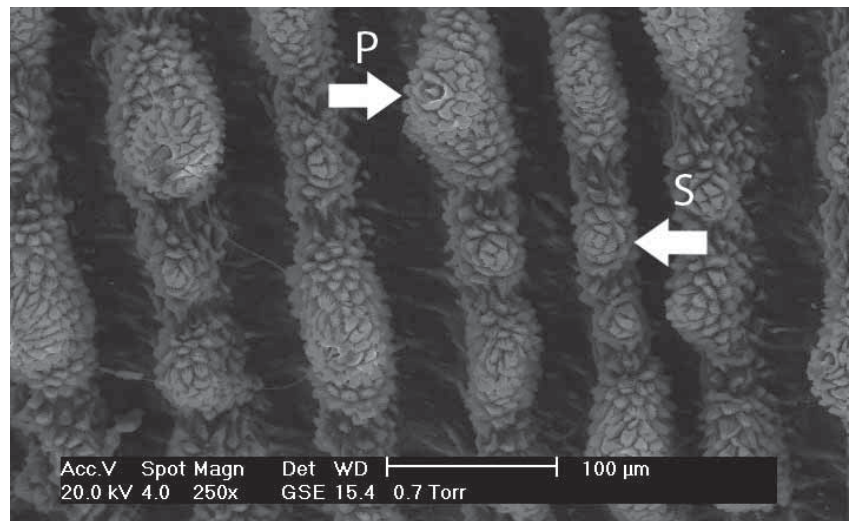


Figure 2. The larger principal dorsal papillae (P) and smaller secondary papillae (S) (LZ-URCA 701).

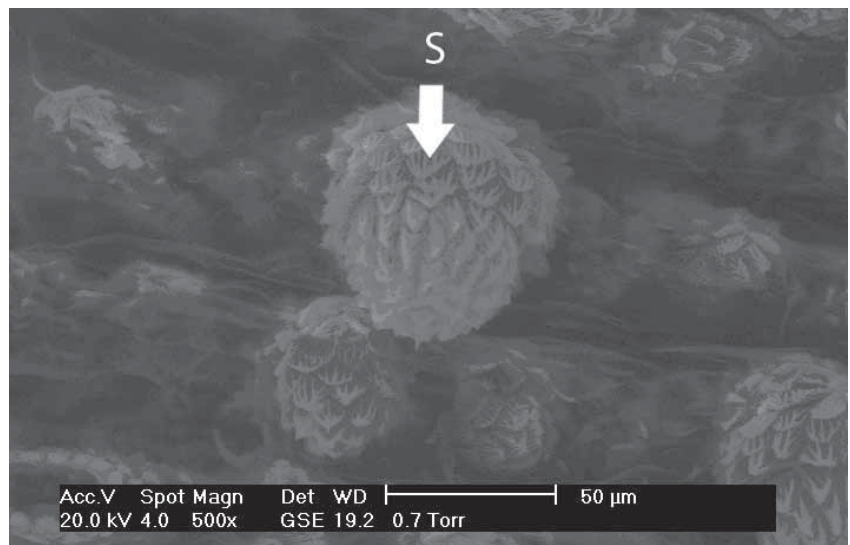
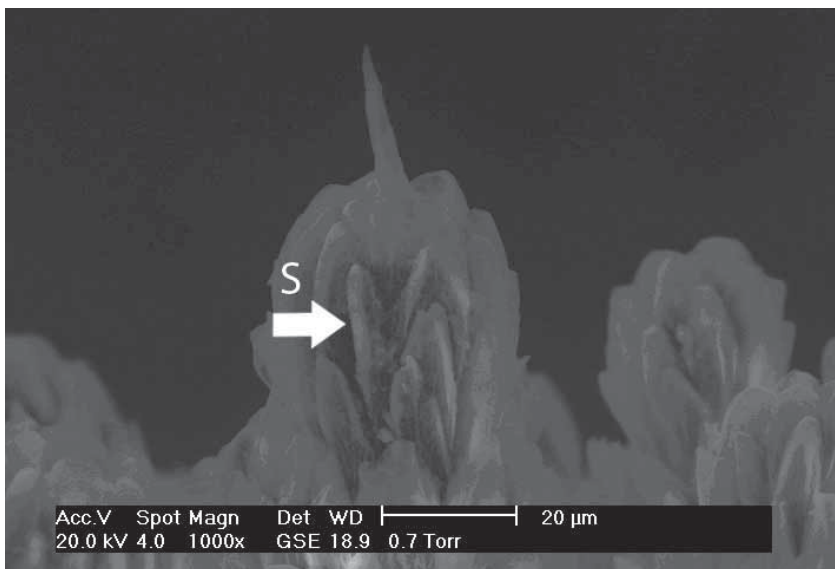
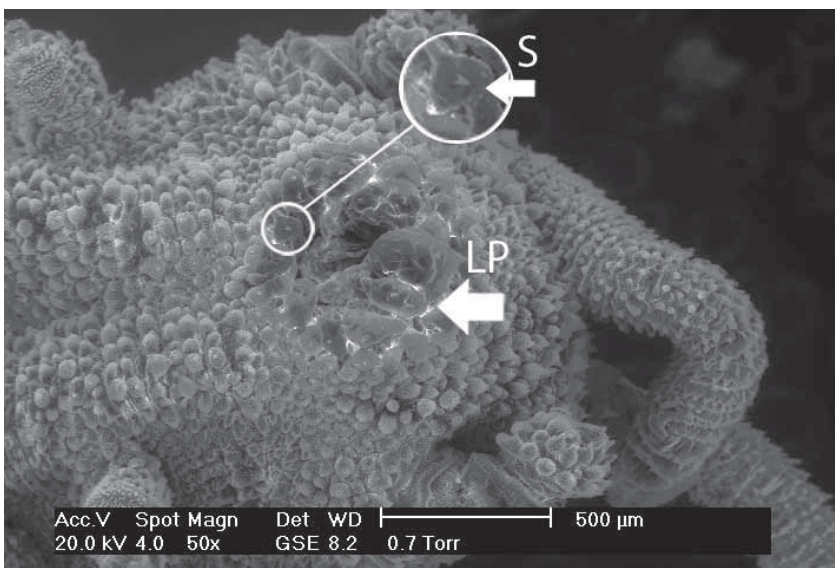


Figure 3. The principal median conical papillae, formed by a rounded basal section with microscales (S) and terminated by a short central bristle (LZ-URCA 701).





**Figure 4.** Lateral papillae composed of a cylindrical base with microscales (S) and a central median bristle (LZ-URCA 701).



**Figure 5.** The buccal orifice surrounded by five pairs of labial papillae (LP) and spines (S) (LZ-URCA 701).

with their bases fused and an apical section composed of long bristles; the other rings have papillae with separated bases, cylindrical apices, and short terminal bristles. The buccal orifice is surrounded by five pairs of labial papillae, with three to four spines on each, with the anterior spines being larger than the posterior ones (Figure 5). **Lobopods.** 33 pairs of legs, with four creeping pads on their feet; the last pair of legs is reduced to having only two creeping pads. Feet with

three papillae: two anterior and one posterior (Figure 6). Nephridial tubercles found on 4th and 5th pairs of legs divide the 3<sup>rd</sup> and 4<sup>th</sup> arches. The crural tubercles have a whitened coloration, and a central pore that communicates with the exterior; they are placed posterior to the coxal opening and located on other pairs of legs in addition to the pre-genital legs. **Female.** Length 32 mm and width 5.2 mm. Body dorsally convex and ventrally semi-convex, with a slight

depression along the median body line. The dimensions of this depression could not be accurately measured as the females were molting when captured. The location of the dorsal papillae was similar to those seen in the male, although there may be up to five secondary papillae between the two principal papillae. The principal lateral and medial papillae vary in form and size.

**Cephalic region.** Eyes identical to those of the males, also with diameters varying from 210 to 160 μm, dark, and situated at the lateral base of the antennae. These structures have 33 rings and being similar to those seen in the males. Buccal orifice is surrounded by five pairs of labial papillae, with three to four spines on each, the anterior spines being larger than the posterior, following the pattern seen in the males. The exterior and interior mandibular blades have an accessory serrated area formed by nine denticules.

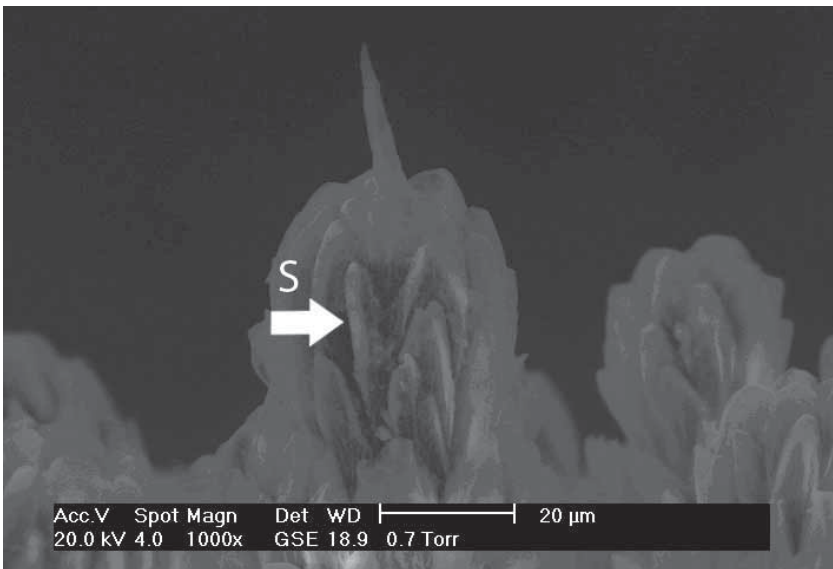
**Lobopods.** 34 pairs of legs are present, with the last pair reduced. Legs are morphologically similar to those of the males. The nephridial tubercles follow the same pattern as in the males. Coxal vesicle retracted.

**Remarks.** All of the animals, except for one male, were undergoing molting, and all were utilized in the description of the new species.

## Discussion

*Peripatus* was divided into four sections by Clark (1913): *Plicatoperipatus*, *Macroperipatus*, *Peripatus* and *Epiperipatus*, which all have a single character in common: three lateral papillae on their feet, two anterior and one posterior (Read, 1988), a character observed in *E. cratensis*.

The genus *Epiperipatus* was defined by Peck (1975) as having papillae on the dorsal surface that have the same shape, with accessory papillae between them, and crural tubercles in the male present on only the two pregenital pairs of legs (Peck, 1975).



**Figure 6.** Leg with creeping pads (CP) – two anterior and one posterior (LZ-URCA 701).

The inclusion of this new species into the genus *Epiperipatus* is based on the lower number of scales in the base of the primary papillae.

*Epiperipatus cratensis* belongs to the genus *Epiperipatus* (Clark, 1913) due to the lack of incomplete folds and primary papillae with three or four scales at their base. The determinant morphological characteristics are:

deep, well-defined furrows spaced distant from one another; principal papillae dominant and larger than the secondary (three small and one large central papilla between two principal papillae); nephridial tubercles located on the 4th and 5th pairs of legs between the 3rd and 4th arches; the number of legs varying from 33 to 34 pairs, and the mouth surrounded by

five pairs of labial lobes and one large anterior lobe. *Epiperipatus cratensis* is different from the other species of *Epiperipatus*, such as *E. tucupi* and *E. brasiliensis*, with both of these species having similar teguments. *E. brasiliensis* is larger, sometimes twice the size of *E. cratensis*, albeit with a smaller number of leg pairs; and *E. tucupi* differs from *E. cratensis* by having three ranks of scales at the base of the principal papillae.

On the other hand, *E. edwardsii* and *E. simoni* have similar teguments, both demonstrating large primary papillae occurring between two smaller ones, and its mouth is surrounded by seven pairs of labial lobes; while *E. cratensis* demonstrates a tegument with three small papillae and a large central papilla between two principal papillae, and its mouth is surrounded by five pairs of labial lobes (Table 1). *Epiperipatus cratensis* is the first species of Onychophora described for the “Brejos” (mountainous) Forests of northeastern Brazil. Climatic variations during the Pleistocene allowed the Atlantic Forest to advance into the Caatinga (dryland)

**Table 1.** Comparative characteristics of the Brazilian Neotropical *Epiperipatus*.

Characteristics	Species				
	<i>E. cratensis</i>	<i>E. brasiliensis</i>	<i>E. edwardsii</i>	<i>E. simony</i>	<i>E. tucupi</i>
Lobopods	33 pairs ♂ 34 pairs ♀	29 pairs ♂ 31-32 pairs ♀	26 pairs ♂ 29 pairs ♀	28- 32 pairs ♀	34 pairs ♀
Length	27 mm ♂ 32 mm ♀	38-80 mm ♀	25mm ♂ 30 mm ♀	68 mm ♀	60 mm ♀
Width	4.7 mm ♂ 5.2 mm ♀	-	4.5 mm ♂ 5.5 mm ♀	5.5 mm ♀	-
Antenna rings	31-36 ♂ 33 ♀	-	44	-	43-44 ♀
Transversal folds	12	-	-	-	-
Denticules on the mandibular blade	9	9-11	-	-	-
Eye diameter	210 μm x 160 μm	-	210 x 150 μm	-	200 x 160 μm
Diameter of principal papilla	120-190 μm	-	120-130 μm	-	140 μm
Arches on soles of feet	4	-	-	-	-
Coloration ( <i>in situ</i> )	Purple to white	-	Brown	-	-
Localization	Crato-CE	Santarém-PA	Santarém-PA	Marajó Island-PA	Santarém-PA
References	Present study	Bouvier (1905)	Bouvier (1905), Froehlich (1968)	Bouvier (1905)	Froehlich (1968)

domain, but after the interglacial periods, the forests returned to their original distribution, leaving islands of Atlantic Forest in localities with still favorable microclimates (Tabarelli and Santos, 2004). We can, therefore, assume that the populations of onychophorans were fragmented and isolated in these humid enclaves, as it is very unlikely that these small invertebrates were able to later disperse through the hot and dry Caatinga. As such, the “Brejos” Forests can be considered refuges for Atlantic Forest species within the dominium of the Caatinga (Andrade-Lima, 1982). In the light of the factors outlined above, we believe that other new Onychophora species will be found and described, as these “Brejos” Forests have been isolated for very long periods of time.

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