

# A new species of *Attaleachernes* Beier, 1937 (Pseudoscorpiones, Chernetidae) from Northeastern Brazil.

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## Resumo

Uma nova espécie de pseudoescorpião, *Attaleachernes* sp. nov.1, é descrita neste estudo, apresentando características morfológicas detalhadas, traços diagnósticos e ilustrações que a distinguem de seu congênere, *Attaleachernes thaleri* Mahnert, 2009. Além disso, fornecemos uma discussão comparativa sobre o gênero e incluímos uma descrição do habitat da espécie. Essa nova espécie representa apenas a segunda ocorrência registrada do gênero *Attaleachernes*. Também propomos recomendações para pesquisas futuras sobre *Attaleachernes* sp. nov.1, enfatizando a necessidade de uma exploração mais aprofundada de suas características e ecologia.

## Resumen

A new species of pseudoscorpion, *Attaleachernes* sp. nov.1, is described in this study, featuring detailed morphological characteristics, diagnostic traits, and illustrations that distinguish it from its congener, *Attaleachernes thaleri* Mahnert, 2009. Additionally, we provide a comparative discussion on the genus and include a description of the species' habitat. This new species represents only the second recorded occurrence of the genus *Attaleachernes*. We also propose recommendations for future research on *Attaleachernes* sp. nov.1, highlighting the need for further exploration of its characteristics and ecology.

## 1. Introduction

Pseudoscorpions are small predatory arachnids belonging to the class Arachnida and the order Pseudoscorpiones. They are widely distributed across terrestrial habitats on six continents, with the exception of Antarctica (Benavides, 2019). The group comprises 26 families (including one extinct) and 493 genera, 19 of which are extinct. In Brazil, 15 species have been recorded, with 10 documented in cave environments.

The family Chernetidae is the most diverse in terms of genera and the third richest in species, with over 730 species distributed across 120 genera, 23 of which occur in Brazil (WORLD PSEUDOSCORPIONES CATALOG, 2024). The genus *Attaleachernes* Mahnert, 2009 has been

recorded in only one Brazilian state and exhibits distinct characteristics, such as all trichobothria except et/it in basal half of fixed chelal finger and female spermathecae with a lemon-like shape.

This study describes a new species of *Attaleachernes* based on specimens collected in cave SL\_0190, located in Curionópolis, Pará. To date, only one species of the genus has been recorded: *Attaleachernes thaleri* Mahnert 2009, found in the Pantanal region of Mato Grosso, where it is associated with the canopy of the palm tree *Attalea phalerata*. However, knowledge about the behavior of *Attaleachernes* species remains limited, emphasizing the need for further research.

## 2. Methodology

### Study area

The specimens were collected from a ferruginous cave in the Serra Leste region, Pará, Brazil. This area is part of the Serra dos Carajás Speleological Unit, which encompasses a vast network of over 2,000 ferruginous caves and is known for its rich mineral deposits, including iron, nickel, copper, and gold (Piló et al., 2015).

The region experiences a tropical climate, with temperatures ranging from 23°C to 25°C and an average annual rainfall of approximately 2,400 mm. The dry season spans from June to September, with monthly precipitation varying between 10 and 90 mm, while the rainy season extends from October to April, with rainfall levels ranging from 160 to 340 mm per month (Sahoo et al., 2016).

### Field sampling

Fieldwork was carried out on November 2–15, 2016 Spelayon et al. The specimens were collected during fieldwork conducted as part of environmental licensing procedures by a consultancy company. They were subsequently deposited in the collection of the Center for Subterranean Biology Studies at the Federal University of Lavras, Minas Gerais, Brazil.

### Analysis and preparation

The specimens were examined using a Zeiss Axio Scope A1 optical microscope, with image analysis conducted via ZEN 2012 software. Illustrations of body structures and appendages were created using a camera lucida attached to an Olympus BX40 optical microscope equipped with phase contrast.

Photographs of anatomical structures and appendages were captured using a Zeiss Axio Zoom V16 microscope, with image acquisition facilitated by ZEN 2.1 software. The images were subsequently vectorized using Inkscape 1.1 software (Montesanto, 2015; available at inkscape.org). Additional examinations of the paratypes were performed using a Hitachi TM4000 scanning electron microscope (SEM).

The holotypes and paratypes were deposited in the Subterranean Invertebrate Collection of Lavras (ISLA).

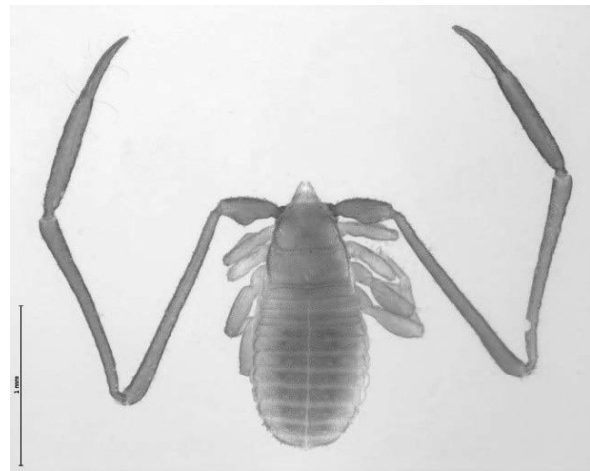


Figure 1: *Attaleachernes* sp. nov. 1, dorsal habitus. Scale bar: A (1.0 mm.).

### 3. Results

Family Chernetidae Menge, 1855

Genus *Attaleachernes* Mahner, 2009

*Attaleachernes* sp. nov. 1

#### Material Examined.

Holotype male (ISLA 39675), preserved in ethanol: Brazil, Curionópolis, Pará, Cave SL\_0190 (6° 0' 9.55" S, 49° 36' 58.33" W), November 2–15, 2016, collected by Spelayon et al. Paratype: 3 males, 2 tritonymphs, same data as the holotype. The holotype and paratypes are deposited in the Subterranean Invertebrate Collection of Lavras (ISLA), Federal University of Lavras.

#### Diagnosis.

*Attaleachernes* sp. nov. 1 differs from *Attaleachernes thaleri* by the following combination of characters: Morphological characteristics: Absence of a median mark on tergite I; absence of sclerotization and darkened zones on the femur, and the presence of five setae on the anterior margin of the carapace (instead of six in *A. thaleri*); all tergites are divided; tergites I–IV with 9–11 setae, and the subsequent ones with 13–16 setae on the posterior margin (*A. thaleri*: I–IV with 5–6 setae, subsequent ones with 7–8); tergite XI with 10–12 setae and the presence of two tactile setae (*A. thaleri*: 13–15 setae, no tactile setae); external serrula with 12–16 blades (*A. thaleri*: 18–22). Pedipalps: 10.4–11.7 times longer than wide and 1.1–1.2 times longer than the patella (*A. thaleri*: 8.5–10.1 times longer than wide and 1.03–1.09 times longer than the patella); pedipalpal patella 9.1–9.8 times longer than wide (*A. thaleri*: 7.0–8.6 times); trochanter with protuberance (*A. thaleri*: absent). Chelicerae without pedicel, 8.5–9.3 times longer than wide (*A. thaleri*: 6.8–7.5); central part of the cheliceral hand without dark or depigmented zones at the base (*A. thaleri*: present); fixed finger with 45–65 teeth (*A. thaleri*: 51–58). Leg I with tarsus 4.5–4.9 times longer than deep (*A. thaleri*: 5.1–6.2); leg IV with femur + patella 4.1–4.6 times longer than wide (*A. thaleri*: 4.7–5.5); tibia (male) 3.4–3.6 times longer than wide (*A. thaleri*: 5.5–5.8); tarsus with two long pseudotactile setae at the central tip, one larger (*A. thaleri*: a single short pseudotactile seta near the lateral tip, 0.10–0.11 mm long). On the fixed finger, all trichobothria, except et/it/est/ist, are located on the basal half of the finger (*A. thaleri*: only et/it/est and it are very close (*A. thaleri*: isb much closer to est than to it); isb and st are distant (*A. thaleri*: isb at the level of st); only et is near the tip of the finger, with it slightly further away (*A. thaleri*: et/it are close to the tip of the finger, with it slightly proximal to et).

#### Description.

Body pale orange brown, pedipalps darker; chelicerae translucent; pedipalps yellow-reddish and covered with scales. Body granulated and adorned with clavate, simple, and dentate vestitural setae.

**Carapace:** 1.0–1.15 times longer than wide; strongly granulated; presence of ocular spots; lateral sides of the median transverse furrow darker; short and clavate setae; two wide and deep furrows, finely granulated; subbasal furrow clearly closer to the posterior margin than to the median furrow; 5 setae on the anterior margin, 12–16 setae (some in a discal position) on the posterior margin.

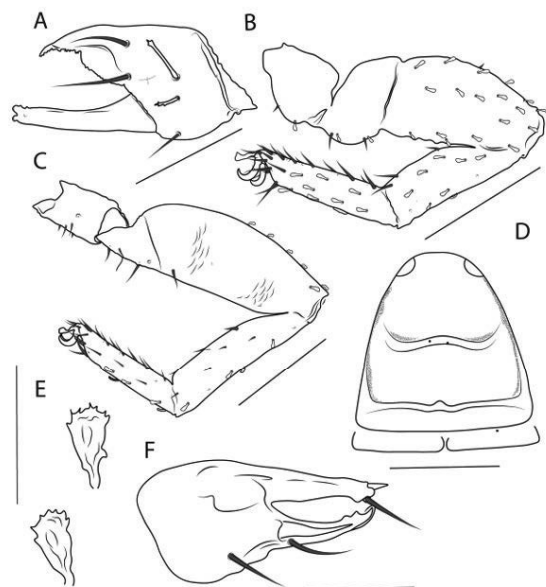


Figure 2: *Attaleachernes* sp. nov. 1. A) Male Left Chelicera (paratype); B) Leg I of male (paratype); C) Leg IV of male (paratype); D) Carapace of male (holotype); E) abdomen male setae det (paratype); F) Male Left Chelicera (holotype). Scale bars: A 0,1 mm (A, D e F), 0,2 mm (B e C), 0,04 mm (E).

**Coxae:** Palpal coxal lobe with 3 marginal setae (one microseta) and one discal seta; palpal coxa distinctly granulated on the lateral and anterior sides; coxa I with 10–13 setae, coxa II with 9–14 setae, III with 10–15 setae, IV with approximately 25–30 setae; intercoxal tubercle absent.

**Tergites:** All tergites are divided, starting from tergite II with a central reddish-brown mark. The setae are clavate.

Tergites chaetotaxy: 10: 10: 15: 17-21: 16-21: 20-23: 22-24: 20-24: 21-23: 19-23: 11-12.

**Chelicera:** Hand with 5 setae, two (bs' and bs'') apically dentate; fixed finger with 1 larger tooth and 3 small subapical teeth; movable finger with a bicuspid subapical lobe; smooth subgalea seta, reaching beyond the tip of the galea; robust and smooth galea; rallum with 3 blades (the anterior one with 3–5 teeth); external serrula with 12–16 blades.

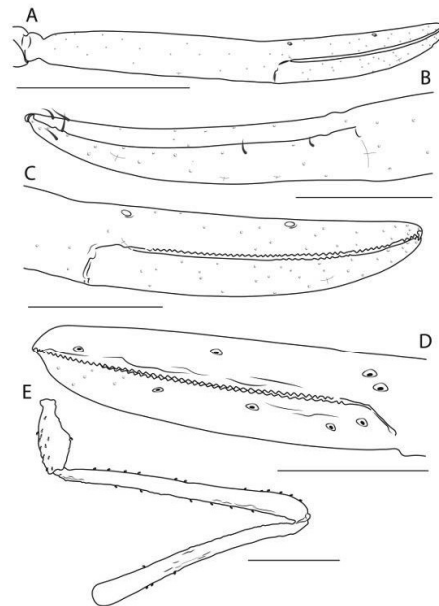
**Palps:** Strongly granulated, simple and clavate setae, strongly granulated; trochanter with a protuberance in the posterior central region, with simple and clavate setae on the anterior lateral side. It is 2.1–2.5 times longer than wide. Femur slightly clavate, 10.4–11.7 times longer than wide, and 1.1–1.2 times longer than the patella. Patella 9.1–9.8 times longer than wide. Chelae 8.5–9.3 times longer than wide. Chelal movable finger 8.1–9.8 times longer than wide. Chelal fixed finger with 45–65 small, sharp teeth.

**Leg I:** Trochanter: 1.5–1.8 times longer than wide; Femur + patella 2.6–3.1 times longer than wide; tibia 4.0–4.7 times longer than wide; tarsus 4.5–4.9 times longer than wide; a pair of long pseudotactile setae at the central tip of the tarsus; clavate setae present in the antiaxial region and smooth setae in the paraxial region; simple curved terminal seta; smooth claws longer than the undivided arolium.

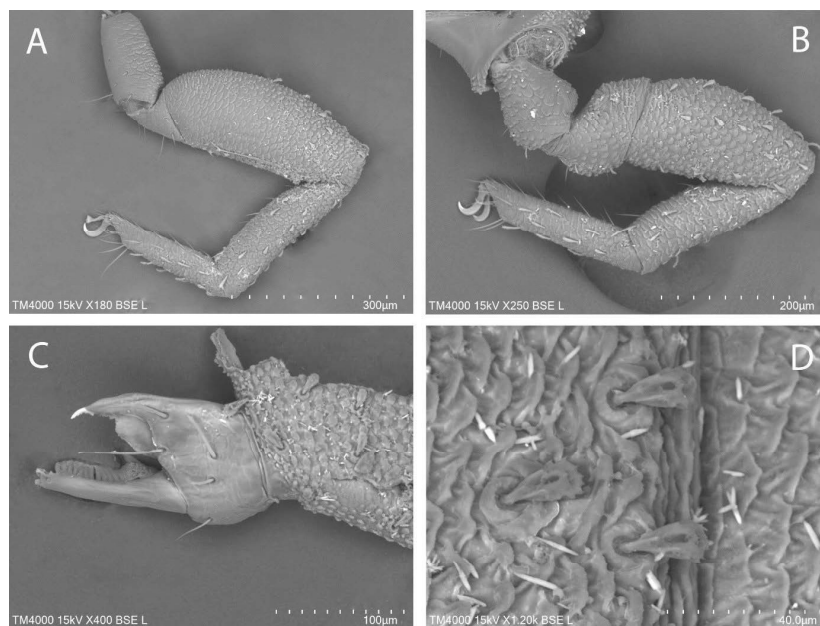
**Leg IV:** Trochanter: 1.1–1.5 times longer than wide; Femur + patella 2.8–3.0 times longer than wide; Tibia 3.4–3.6 times longer than wide; Tarsus 4.1–4.6 times longer than wide; pair of long pseudotactile setae at the central tip of the tarsus, one of them longer; clavate setae present in the antiaxial region and smooth setae in the paraxial region; one subterminal simple curved seta; claws smooth and longer than the undivided arolium.

Measurements (mm): (length/width or depth in mm; ratios in parentheses, calculated with three significant digits): Range for the holotype and male paratypes.

Body length 0.369–0.407/0.175–0.163 [2.1–2.0]. Carapace 0.600–0.621/0.591–0.541 (2.0–2.3). Palps: Trochanter 0.16–0.20/0.12–0.13 (2.1–2.5), femur 1.217–1.348/0.117–0.115 (10.4–11.7), patella 1.104–1.256/0.121–0.128 (9.1–9.9), chela 1.142–1.203/0.1–0.1 (8.5–9.3), movable finger length 0.488–0.518/0.060–0.053 (8.1–9.8). Leg I: Trochanter 0.1–0.2/0.1–0.1 (1.1–1.5), femur 0.34–0.35/0.07 (5.1–5.4), patella 0.18–0.19/0.05 (3.3–3.7), femur/patella 0.4/0.1 (2.8–3.0), tibia 0.2–0.3/0.1 (3.4–3.6), tarsus 0.2/0.1 (4.1–4.6). Leg IV: Trochanter 0.1–0.2/0.1 (1.5–1.8), femur + patella 0.4–0.5/0.2 (2.6–3.1), tibia 0.3–0.4/0.1 (4.0–4.7), basitarsus 0.18–0.19/0.06 (3.1–3.3), telotarsus 0.34/0.04 (9.1–9.6).



**Figure 3:** *Attaleachernes* sp. nov. 1. A) right chela paraxial distal male (paratype); B) chela male ventral view (paratype); C) right chela paraxial distal male (paratype); D) left chela antiaxial distal male (paratype); E) pedipalps of male (paratype). Scale bars: 0,2 (A, B, C e D) 0,5 (E).



**Figure 4:** *Attaleachernes* Sp. nov. 1. A Leg IV of male (paratype); B Leg I of male (Paratype); C Male Left Chelicera (paratype); D abdomen male setae detail (paratype).

## 4. Discussion

The discovery of *Attaleachernes* sp. nov.1 in this study challenges the previously held assumption that the genus is restricted to the Brazilian Pantanal. While studies such as Battirola et al. (2017) have recorded 1.197 individuals of 16 pseudoscorpion species associated with the soil, leaf litter, and canopy of *Attalea phalerata*, particularly emphasizing the family *Chernetidae*, the new species was identified in a cave in Curionópolis, Pará. This finding broadens our understanding of the genus' distribution and suggests that some species may inhabit distinct environments, including caves, rather than being strictly arboreal.

The presence of *Attaleachernes* sp. nov.1 in a subterranean habitat highlights the importance of exploring understudied ecosystems to better understand the diversity and biogeographical patterns of pseudoscorpions in Brazil. However, Brazilian cave fauna is increasingly threatened, particularly due to recent legislative changes that weaken cave protection laws. Ferreira et al. (2022) have warned about the risks these changes pose to subterranean habitats, which are already under pressure from mining and infrastructure development. A striking example is the Serra Leste 10 Mtpa Project in Curionópolis, Pará, which is expected to extract 107 million tons of iron ore, potentially causing significant damage to cave ecosystems and their specialized fauna.

Taxonomic knowledge of *Attaleachernes* remains incomplete, par-

ticularly regarding the morphological characters used to differentiate species. The newly described *Attaleachernes* sp. nov.1. presents distinct characteristics that set it apart from *A. thaleri*, including the number of lamellae on the external serrula (12–16 in sp. nov.1. vs. 18–22 in *A. thaleri*), the presence of two tactile setae on tergite XI (*Attaleachernes* sp. nov.1), which are absent in *A. thaleri*, and a distinct trichobothrial pattern on the fixed chelal finger. Additionally, *Attaleachernes* sp. nov.1. exhibits larger pedipalps (10.4–11.7 times longer than wide) compared to *A. thaleri* (8.5–10.1 times longer than wide) and possesses two long pseudotactile setae at the apical position of tarsus IV, whereas *A. thaleri* has only one short pseudotactile seta in the subapical position.

Subterranean ecosystems, such as caves, remain among the least explored environments on Earth, yet they harbor a high diversity of specialized organisms. These habitats represent a unique fraction of global biodiversity, both taxonomically and functionally. As emphasized by Mammola et al. (2019), the conservation of subterranean biodiversity is crucial to preserving these fragile ecosystems and their endemic species. The restricted distribution of *Attaleachernes* sp. nov. 1 underscores the urgent need for conservation measures to protect these habitats, which often serve as refuges for rare and vulnerable species.

## 5. Conclusion

The description of *Attaleachernes* sp. nov. 1 expands our understanding of pseudoscorpion biodiversity and represents only the second recorded occurrence of the genus *Attaleachernes* in both Brazil and globally. This new species is distinguished by its unique morphological traits, including notable differences in trichobothrial patterns, pedipalp proportions, and the number of tactile and pseudotactile setae compared to its congener, *A. thaleri*.

This discovery highlights the critical role of taxonomic research in

underexplored subterranean environments, such as caves, where biodiversity remains largely underestimated. It also reinforces the significance of Brazil as a hotspot of biological diversity, particularly for lesser-known arthropod groups like pseudoscorpions. Future studies should focus on exploring the ecological, behavioral, and evolutionary aspects of *Attaleachernes* sp. nov. 1. *Attaleachernes* sp. nov. 1, contributing to a deeper understanding of its role within subterranean ecosystems and informing conservation efforts for these fragile habitats.

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