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***Tmesiphantes hypogeus* sp. nov. (Araneae, Theraphosidae), the first troglobitic tarantula from Brazil**

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ABSTRACT

A new species of *Tmesiphantes* Simon, 1892, is described from sandstone/quartzitic caves of Chapada Diamantina, Bahia State, Brazil. This is the fifth species of the genus and the first record of a troglobitic mygalomorph in Brazil. A key is presented for all *Tmesiphantes* species.

Key words: cave, mygalomorph, new species, spider taxonomy, tarantula.

INTRODUCTION

Theraphosid is the largest mygalomorph family, containing 937 of the 2,683 described mygalomorph species (Platnick 2011). Despite its high diversity and wide distribution throughout most tropical and subtropical areas in the world, a few troglobitic species are known (cave restricted organisms with autapomorphic character-states related to this isolation, mainly regression of eyes and body pigmentation - sensu Holsinger and Culver 1988). All of these species are included in a single genus, *Hemirrhagus* Simon, 1903, found exclusively in Mexico. *Hemirrhagus* has 16 species, and all species with published collection records were found inside caves, among which six are proven troglobites (Gertsch 1973, 1982, Pérez-Miles and

Locht 2003, Redell 2005). Indeed, *Hemirrhagus* troglobitic species show high endemism, with each species restricted to a single cave.

Herein we describe a new species of theraphosid found in two Brazilian caves in the State of Bahia, representing the first theraphosid troglobites found in Brazil. The species is putatively included in the genus *Tmesiphantes*. This genus has 4 species: *T. nubilus* Simon, 1892, *T. amadoi* Yamamoto et al., 2007, *T. bethaniae* Yamamoto et al., 2007, and *T. caymii* Yamamoto et al., 2007, all found in the State of Bahia, Brazil.

MATERIALS AND METHODS

All measurements are presented in millimeters and were obtained with a Mitutoyo digital calliper with an error of 0.01 mm. Leg and palp measurements were taken from the dorsal aspect of the left side (unless appendages were lost or obviously regenerated).

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A Nikon SMZ1500 dissecting microscope was used for illustrations (with a camera lucida attachment). Urticating hairs were examined and photographed with a Leica DM LB2 compound microscope. Urticating hair terminology follows Cooke et al. (1972), and leg spines terminology follows Petrunkevitch (1925) with modifications proposed by Bertani (2001).

Specimens are deposited in the Museu Nacional do Rio de Janeiro (MNRJ).

Abbreviations: ALE: anterior lateral eyes; AME: anterior median eyes; MNHN: Muséum national d'Histoire naturelle, Paris, France; PLE: posterior lateral eyes; PLS: posterior lateral spinnerets; PME: posterior median eyes; PMS: posterior median spinnerets; STC: superior tarsal claws.

TAXONOMY

Tmesiphantes Simon, 1892

Tmesiphantes Simon, 1892:277, type species *Tmesiphantes nubilus* Simon, 1892:277 by monotypy, syntypes 2 males and 2 females deposited in MNHN, examined; 1903:920, f.1078; Gerschman-de-Pikelin and Schiapelli 1973:76, f. 39-44; Pérez-Miles et al. 1996:59, f. 48; Yamamoto et al. 2007:972, f.2-8.

Diagnosis: See Pérez-Miles et al. (1996) and Yamamoto et al. (2007).

Species included: *Tmesiphantes amadoi* Yamamoto et al., 2007, *Tmesiphantes bethaniae* Yamamoto et al., 2007, *Tmesiphantes caymmii* Yamamoto et al., 2007, *Tmesiphantes nubilus* Simon, 1892, and *Tmesiphantes hypogeus* sp. nov.

Identification key for *Tmesiphantes*.

Males

(Male of *T. hypogeus* sp. nov. is unknown)

1. Palpal bulb with thick embolus having a strong curvature at the tip (Yamamoto et al. 2007: figs 3-5)...*T. nubilus*.
-Palpal bulb with slender embolus ...2

2. Palpal bulb embolus enlarged at the tip with a small serrulated keel (Yamamoto et al. 2007: figs 9 and 11)...*T. amadoi*

-Palpal bulb embolus with a slender tip lacking a small serrulated keel...3

3. Palpal bulb embolus with a serrated inferior prolateral keel extending along the embolus (Yamamoto et al. 2007: fig. 15)...*T. caymmii*

-Palpal bulb lacking a serrated prolateral keel...*T. bethaniae*

Females

(Females of *T. amadoi* and *T. bethaniae* are unknown)

1. AME strongly reduced, shorter than PME; eye tubercle low, mostly transparent; urticating hair region reduced to two dorso-lateral patches (Figs 1, 2A, 2C)...*T. hypogeus* sp. nov.

-AME larger than PME, eye tubercle opaque; urticating hair patch covers most of abdomen dorsally...2

2. Spermatheca receptacula dilated apically (Yamamoto et al. 2007: fig. 8)...*T. nubilus*

-Spermathecae receptacula tapering distally (Yamamoto et al. 2007: fig. 19)...*T. amadoi*

Tmesiphantes hypogeus sp. nov.

Figures 1-5

Type material: Holotype: female: Brazil, Bahia, Andaraí, Igatu, Grana da Parede Vermelha, 12°52'42.8"S 41°18'59.5"W, 29 October 2010, M.E. Bichuette and J.E. Gallão (MNRJ 04357).

Paratype: female: Brazil, Bahia, Andaraí, Igatu, Grana das Cobras cave, 12°52'02.8"S 41°18'11.9"W, 30 July 2010, J.E. Gallão and M.E. Bichuette (MNRJ 04419).

Other material examined: Only the types.

Diagnosis: Females can be distinguished from all *Tmesiphantes* species by highly reduced AME that is shorter than PME, mostly transparent eye

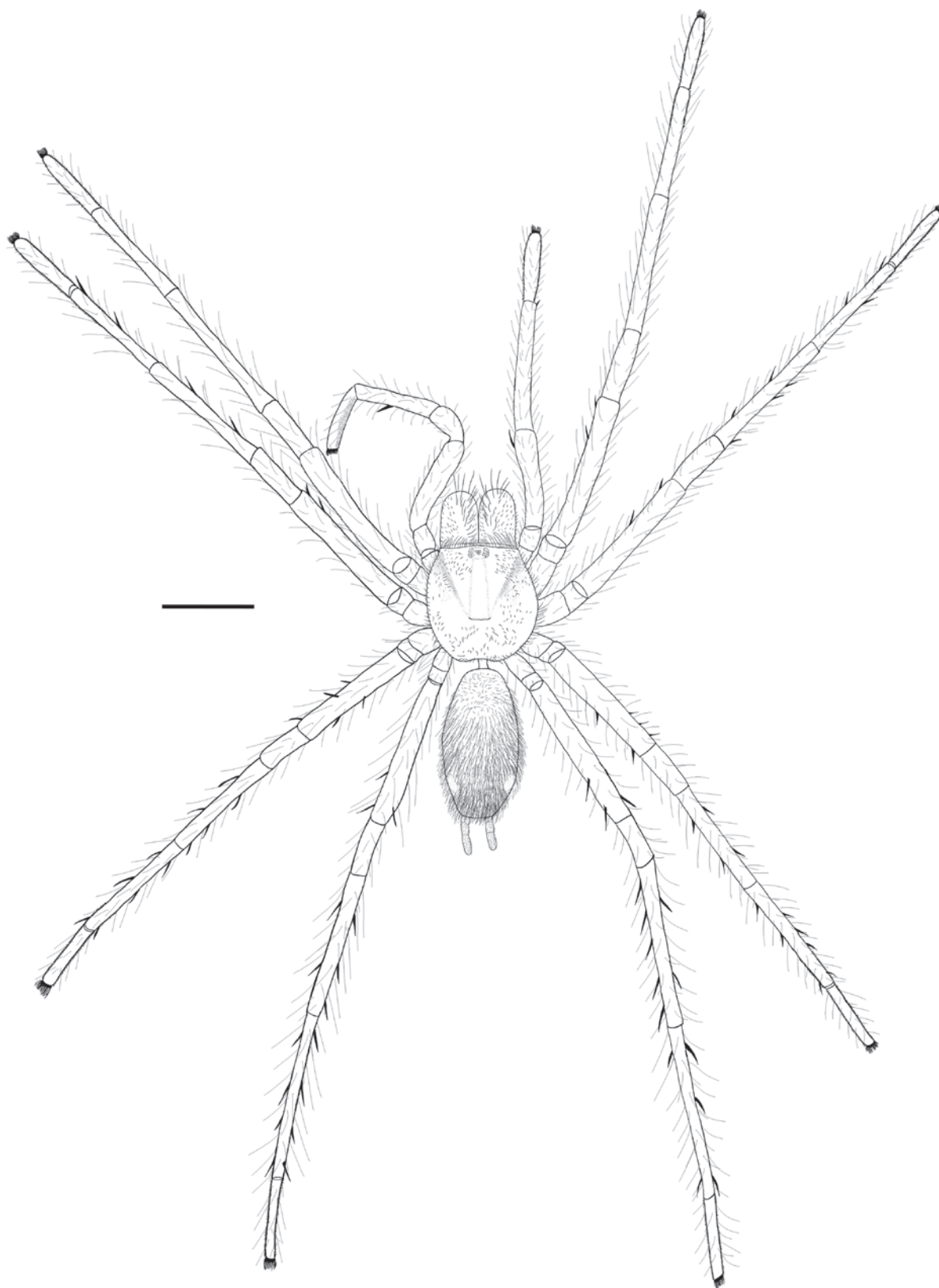


Fig. 1 - *Tmesiphantes hypogeus* sp. nov. Holotype female, habitus. Scale bar: 5 mm.

tubercle (Figs 2A, 2C), slender legs (Fig. 1) and reduction of the urticating hair area to two small patches on dorso-lateral abdomen (Figs 1, 2A).

Etymology: The specific name is from the Latin adjective (masculine) *hypogeus* (underground), referring to the isolated site condition.

Description: Female (holotype, Figs 1, 2A-D, 3, 4). Carapace 6.01 long, 5.61 wide, chelicerae 2.90. Legs (femur, patella, tibia, metatarsus, tarsus, total): I: 7.39, 2.92, 7.56, 5.55, 3.97, 27.39. II: 7.16, 3.10, 7.04, 5.74, 3.70, 26.74. III: 6.72, 2.62, 6.12, 6.29, 3.67, 25.42. IV: 7.99, 2.93, 8.50, 8.75, 4.17, 32.34. Palp: 5.10, 2.54, 4.32, –, 3.48, 15.44. Midwidths: femora I–IV=1.10, 0.97, 1.08, 1.04, palp=1.01; patellae I–IV=1.02, 0.97, 1.02, 1.04, palp=1.09; tibiae I–IV=0.74, 0.75, 0.76, 0.79, palp=0.81; metatarsi I–IV=0.61, 0.61, 0.58, 0.57; tarsi I–IV=0.62, 0.61, 0.59, 0.57, palp=0.71. Abdomen 7.24 long, 3.86 wide. Spinnerets: PMS, 0.69 long, 0.21 wide, 0.30 apart; PLS, 1.37 basal, 0.92 middle, 1.18 distal; midwidths 0.41, 0.41, 0.34, respectively.

Carapace: Length to width 1.07; cephalic area raised, thoracic striae narrow. Fovea: deep, straight, 1.33 wide. Carapace with short, thick, sparse setae; bordered with setae pointing out.

Eyes and eye tubercle: Tubercle 0.01 high, length 0.71, width 1.20. Clypeus 0.24. Anterior row procurved, posterior slightly recurved (Figs 2A, 2C). Sizes and inter-distances: AME 0.12, ALE 0.38, PME 0.19, PLE 0.26, AME–AME 0.14, AME–ALE 0.19, AME–PME 0.08, ALE–ALE 0.61, ALE–PME 0.16, PME–PME 0.37, PME–PLE 0.08, PLE–PLE 0.81, ALE–PLE 0.04, AME–PLE 0.32. Eye group width to length 2.36.

Maxillae: Length to width: 1.38. Cuspules: ca. 100 spread over ventral inner heel (Fig. 2B). Lyra absent. Labium: Length 0.92, width 1.46, with 18 cuspules. Labio-sternal groove deep, flat, without sigilla (Fig. 2B). Chelicerae: Rastellum absent,

basal segments with 9 and 10 teeth on promargin, on the left and right chelicera, respectively. Sternum: Length 2.57, width 2.87. Posterior angle rounded, not separating coxae IV. Sigilla: Three pairs, posterior elongated, others rounded, one diameter from margin (Fig. 2B).

Legs: Formulla: IV I II III. Clavate trichobothria: On central 2/4 of tarsi I–IV. Leg coxae: With sparse stiff short setae; stridulatory or modified setae lacking. Scopula sparse: Tarsi I–II with a double line of sparse setae; III–IV divided by three wide rows of setae. Metatarsi I–II 1/3 scopulated; III 1/5, IV ascopulate. Femur IV lacks retrolateral scopula. Spines: palp: femur p0-0-2ap, patella 0, tibia v2-4-3ap, p0-1-0; leg I: femur p0-0-1ap, patella 0, tibia v0-3-2ap, p0-1-0, metatarsus v2-2-2ap; leg II: femur p0-2-2(1ap), patella 0, tibia v1-3-2ap, p0-1-0; metatarsus v2-3-3ap, p0-1-1ap; leg III: femur p0-2-1, r0-1-1, patella 0, tibia v2-3-2ap, p1-1-0, r1-1-0, metatarsus v3-3-4(3ap), p1-1-1ap, r1-1-1ap; leg IV: femur p0-1-1, r0-1-1, patella 0, tibia v2-3-2ap, p1-1-0, r1-1-1, metatarsus v3-3-5(3ap), p1-1-1, r1-1-2. Claws: ITC absent from all legs; STC without teeth.

Urticating hairs: Two small oval areas on posterior dorso-lateral abdomen (Fig. 2A) having type III hairs 0.32 mm in length (Fig. 3).

Genitalia (Fig. 2D): Two short, almost triangular in shape, widely separated spermathecae.

Color (in alcohol): Carapace, chelicerae, legs, labium and sternum light yellowish brown. Abdomen light brown with longer greyish hairs.

Variation (paratype): Carapace 6.86 long, 6.15 wide, chelicerae 3.80. Legs (femur, patella, tibia, metatarsus, tarsus, total): I: 7.47, 3.56, 7.97, 5.79, 3.90, 28.69. II: 7.40, 3.14, 6.23, 5.97, 3.74, 26.48. III: 6.81, 2.82, 6.21, 6.66, 3.62, 26.12. Leg IV missing on both sides. Palp: 5.15, 2.82, 4.72, –, 3.60, 16.29. Midwidths: femora I–III=1.14, 1.04, 1.23, palp=1.06; patellae I–III=1.01, 1.09, 1.08,

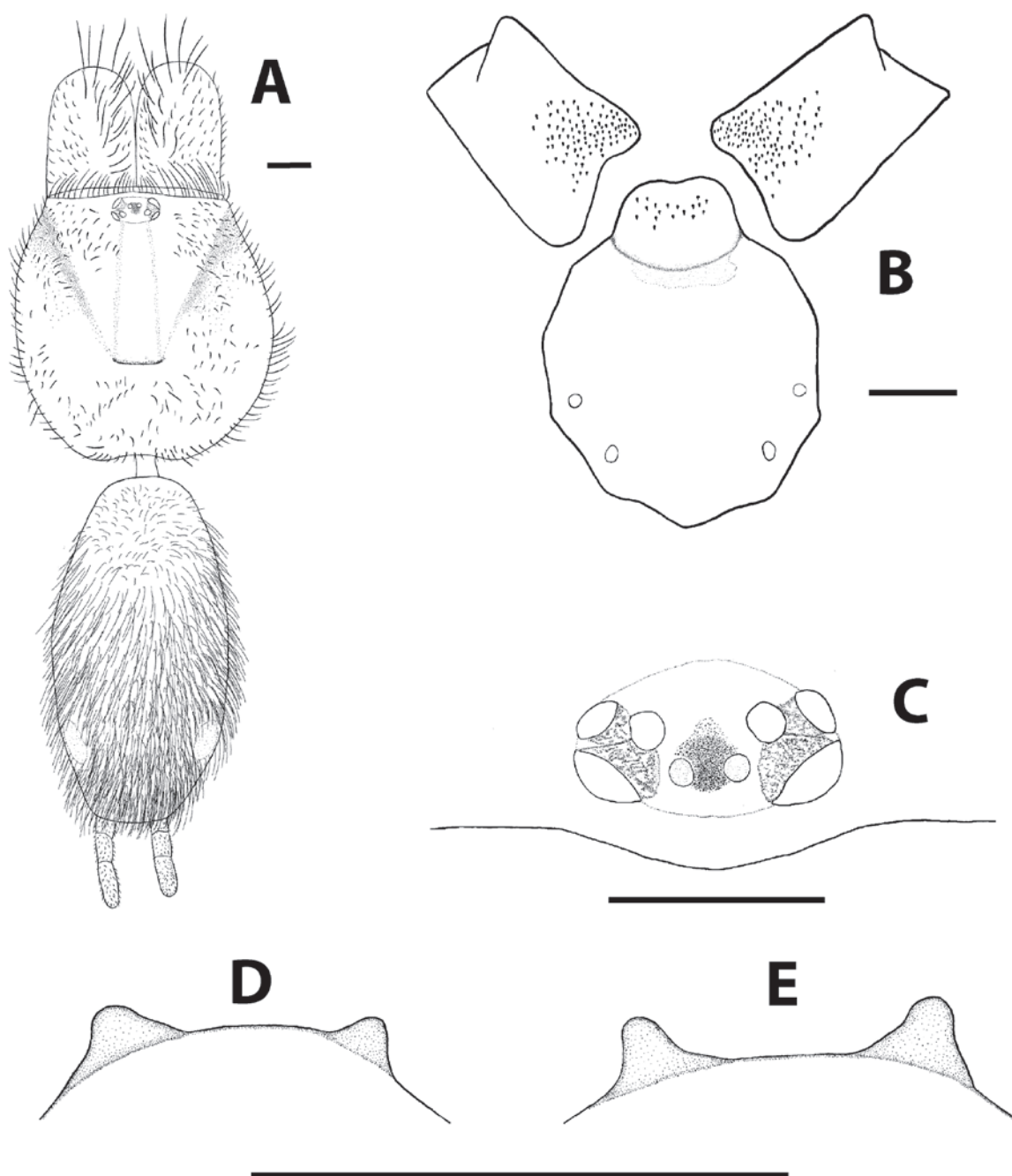


Fig 2 - *Tmesiphantes hypogeus* sp. nov. **A-D** Holotype female; **A**, Cephalothorax and abdome, dorsal; **B**, Sternum, labium and maxillae; **C**, Eye tubercle; **D-E**, Spermathecae, dorsal; **D**, Holotype; **E**, Paratype. Scale bars: 1 mm.

palp=1.10; tibiae I–III=0.82, 0.78, 0.81, palp=0.79; metatarsi I–III=0.61, 0.64, 0.75; tarsi I– III=0.63, 0.60, 0.45, palp=0.66. Abdomen 8.08 long, 4.02 wide. Spinnerets: PMS, 0.74 long, 0.29 wide, 0.33 apart; PLS missing on both sides.

Carapace: Length to width 1.11; Fovea: 1.28 wide.

Eyes and eye tubercle: Tubercle 0.01 high, length 0.76, width 1.08. Clypeus 0.18. Anterior row procurved, posterior slightly recurved. Sizes and inter-distances: AME 0.10, ALE 0.39, PME 0.14,

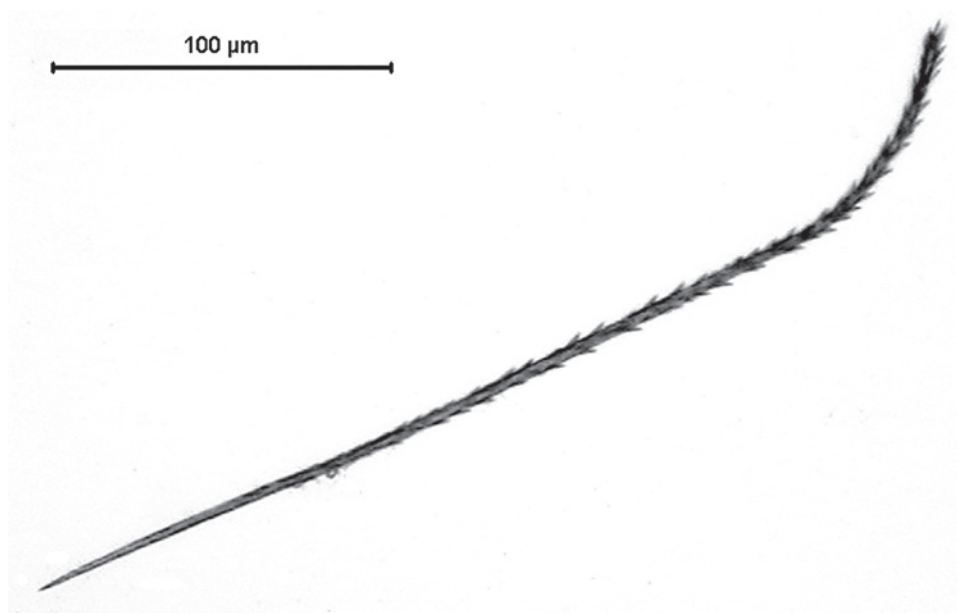


Fig. 3 - *Tmesiphantes hypogeus* sp. nov. Holotype female. Type III urticating hair.

PLE 0.24, AME–AME 0.13, AME–ALE 0.16, AME–PME 0.09, ALE–ALE 0.53, ALE–PME 0.14, PME–PME 0.38, PME–PLE 0.04, PLE–PLE 0.73, ALE–PLE 0.04, AME–PLE 0.31. Eye group width to length 1.99.

Maxillae: Length to width: 1.27. Cuspules: ca. 100 spread over ventral inner heel. Labium: length 1.07, width 1.44, with 9 cuspules. Labio-sternal groove with two large sigillae. Chelicerae: Basal segments with 8 and 9 teeth on promargin, on the left and right chelicera, respectively. Sternum: length 2.87, width 3.08. Scopula sparse: Tarsi I–II with a double line of setae. Spines: palp: femur p0-0-2, patella 0, tibia v2-4-3ap; leg I: femur p0-1-1, patella 0, tibia v1-3-1ap, metatarsus v1-3-2ap; leg II: femur p0-1-1, patella 0, tibia v1-3-2ap, p1-1-0; metatarsus v3-4-3ap, p0-1-1ap; leg III: femur p1-1-1, r0-1-1, patella 0, tibia v2-4-2ap, p1-1-1, r1-1-1, metatarsus v5-4-2ap, p2-1-1ap, r1-1-1ap. Claws: STC with a row of denticles.

Urticating hairs: absent, abdomen completely bald.

Genitalia (Fig. 2E) and color: Same as the holotype.

DISCUSSION

Tmesiphantes hypogeus sp. nov. has a reduced anterior median eye that is even smaller than its posterior median eye, a characteristic uncommon in theraphosids (Fig. 2C) that could be considered a troglomorphic character. The eye tubercle is low and mostly transparent, allowing one to see the internal structures of the anterior lateral eye, posterior median eye, and posterior lateral eye (Fig. 2C). Pigmentation circumscribes central eye tubercle area (Fig. 2C). Legs are long and slender (Fig. 1) and quite lacking in pigment (Fig. 4), another troglomorphic character possibly related to isolation in cave habitats. Urticating hairs (Fig. 3) are present only in two small postero-lateral dorsal patches (Figs 1, 2A). All of these characteristics are shared with species of *Hemirrhagus*, the only theraphosid genus containing troglobitic species, and are considered evidence for a troglobitic lifestyle (Gertsch 1973, 1982, Pérez-Miles and Locht 2003). On the other hand, *Tmesiphantes hypogeus* sp. nov. lacks two proposed synapomorphies of *Hemirrhagus*: ventral coxae with retrolateral



Fig. 4 - *Tmesiphantes hypogeus* sp. nov. Holotype female. Photo: M. E. Bichuette.

projection and type VI urticating hair on the abdomen dorsum (Pérez-Miles 1998, Pérez-Miles and Loch 2003). Therefore, we consider the shared characteristics to be morphological convergences due to their similar habitat use, and we include the new species putatively in the genus *Tmesiphantes* because of the almost circular sternum (Fig. 2B), low number of labial cuspules (Fig. 2B), presence of type III urticating hair (Fig. 3) and widely separated spermathecae that taper to their apex (Figs 2D,

2E). Furthermore, all four described *Tmesiphantes* species are found also in State of Bahia. A more precise classification of the species would be possible only if a male were collected; however, due to the rarity of the species this is not expected to occur soon. Due to the absence of *Tmesiphantes hypogeus* sp. nov. from epigeal environments in Chapada Diamantina as well as the presence of troglomorphic characteristics, we deduce that this species is categorically a troglomorphic species,

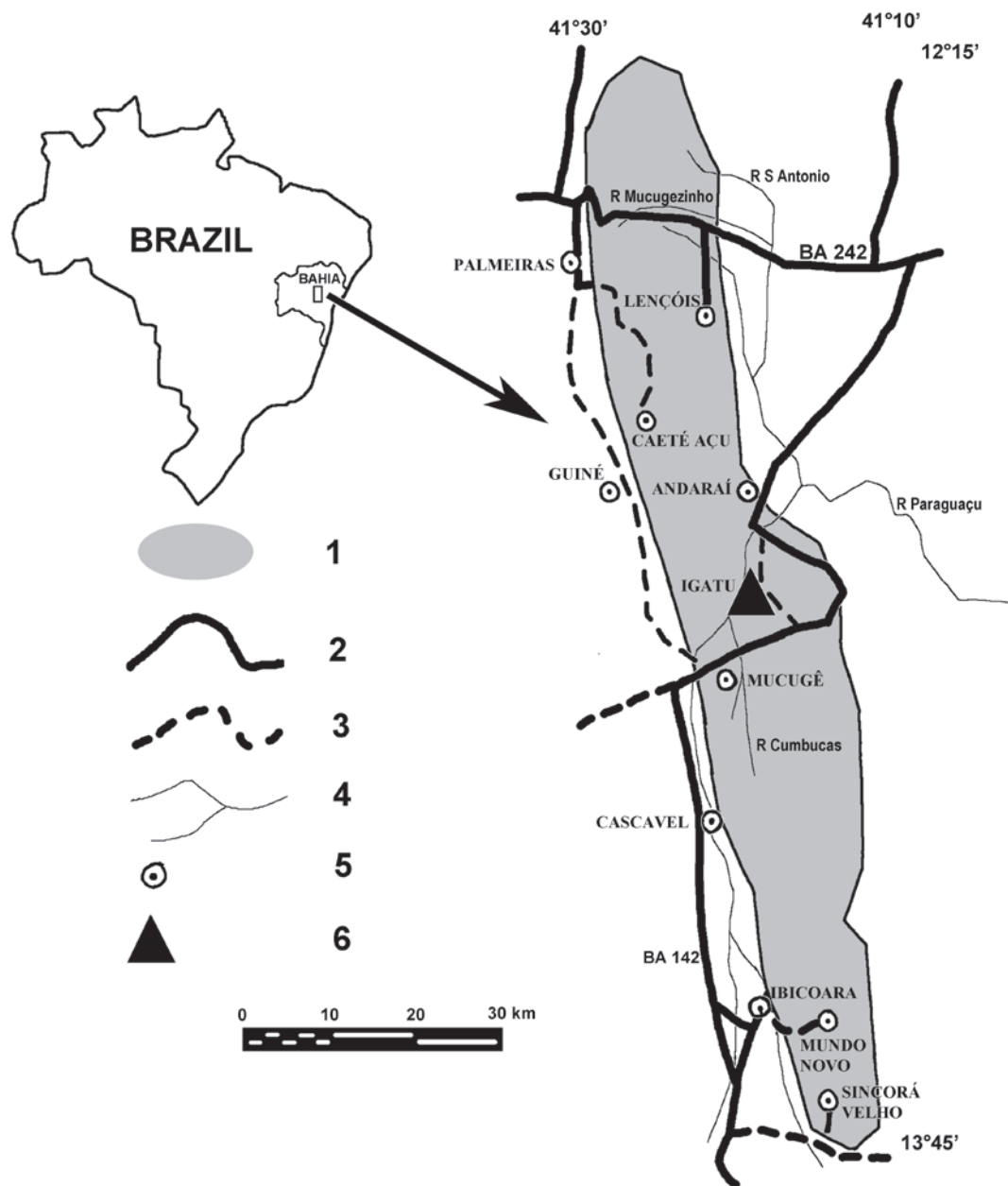


Fig. 5 - Type locality of *Tmesiphantes hypogeus* sp. nov. In detail – Chapada Diamantina National Park, Central Bahia, northeastern Brazil: 1, Boundaries of National Park; 2, Federal Roads; 3, Secondary Roads; 4, Rivers; 5, Cities; 6, Povoado de Igatu, collection area of the new mygalomorph.

indicating a process of differentiation occurring in isolation in the hypogean environment.

Distribution: Two sandstone/quartzitic caves in Povoado de Igatu, Andaraí county, Central Bahia, northeastern Brazil: Gruna das Cobras and Gruna da Parede Vermelha (Fig. 5).

Habitat description: The localities where *Tmesiphantes hypogeus* sp. nov. were found are sandstone/quartzitic caves 0.8 km distant from each other. The area is in the Espinhaço mountains (Fig. 5), and the region is composed of metasedimentary rocks deposited over a

billion years ago (Proterozoic era) formed mainly by sandstone, siltites and argilites. This spider shows a preference for rocky and humid substrates typical of parietal species. Both specimens were recorded exposed in the rocks, not showing cryptobiotic habits, as is typical of Mygalomorphae species, so there is strong evidence of regression in this behavior.

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RESUMO

Uma nova espécie de *Tmesiphantes* Simon, 1892, é descrita em cavernas areníticas/quartzíticas da Chapada Diamantina, estado da Bahia, Brasil. Essa é a quinta espécie do gênero e o primeiro registro de uma migalomorfa troglóbia do Brasil. É apresentada chave de identificação para todas as espécies de *Tmesiphantes*.

Palavras-chave: caverna, migalomorfa, espécie nova, taxonomia de aranhas, tarântula.

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