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Redescription of the species *Hooperella saccopteryx* (Brennan and Jones, 1960) (Trombidiformes: Trombiculidae) and first record to Brazil

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Original research

ABSTRACT

The Neotropical genus *Hooperella* Vercammen-Grandjean comprises four valid species, which are primarily found as parasites of bats. Currently, only *Hooperella vesperuginis* has been recorded in Brazil. In this study, we provide a comprehensive redescription of *H. saccopteryx*, incorporating data from the type series and newly identified specimens. These new specimens were only identified after a thorough examination of the types. We have included measurements of all seven leg segments, the opisthosoma ventral and sternal setae, which were not previously recorded. Notably, we observed differences in the number of specialized setae (σ) on the genu of leg I. Furthermore, this examination marks the first record of *H. saccopteryx* in Brazil.

Keywords chiggers; ectoparasites; bats; South America; taxonomy
Zoobank http://zoobank.org/47FCB01E-2E53-47F2-9AD4-280A5247738E

Introduction

The Neotropical genus *Hooperella* Vercammen-Grandjean 1967 has a parasitic preference for bats. Recently, Bassini-Silva *et al.* (2023) reviewed two species of this genus and concluded that there are four valid species: *Hooperella alvarezi* (Loomis, 1969), *Hooperella saccopteryx* (Brennan and Jones, 1960), *Hooperella vesperuginis* (Brennan and Jones, 1960) and *Hooperella*

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yucatanica (Loomis, 1969). *Hooperella alvarezi* and *H. yucatanica* are only recorded in Mexico, while the other two species are distributed throughout the Americas.

In Brazil, only the species *H. vesperuginis* has been recorded. Vercammen-Grandjean (1967) and Bassini-Silva *et al.* (2023) recorded this species in the states of Rio de Janeiro and Minas Gerais, parasitizing two different species of phyllostomid bats, the little big-eared bat, *Micronycteris megalotis* (Gray, 1842) and the Seba's short-tailed bat, *Carollia perspicillata* (L.). Despite the close proximity of Brazil to countries such as Bolivia, Colombia, Costa Rica, Mexico, Peru, Surinam, Trinidad and Tobago, and Venezuela, where *Hooperella saccopteryx* has been documented (Brennan and Jones 1960, 1961; Loomis 1969; Brennan 1970a, b; Brennan and Bronswijk 1975; Brennan and Reed 1975; Webb and Loomis 1977; Marinkelle and Grose 1981; Hoffmann 1990). This species has not yet been recorded in the national territory.

We present a comprehensive redescription of the species *H. saccopteryx* based on the type series and newly identified specimens from two different collections. This includes detailed images obtained through Scanning Electron Microscopy and schematic drawings. Besides that, the examined material represents the first records of this species in Brazil, specifically in the states of Pará, Rondônia and São Paulo.

Material and methods

The examined types of *H. saccopteryx* were deposited in the U.S. National Entomology Collection, Smithsonian Institution, National Museum of Natural History, Washington, DC, USA (USNM), currently located at the Systematic Entomology Laboratory (BARC-USDA-ARS), Beltsville, MD, USA. The slide-mounted material from Belém municipality, Pará State, Brazil, was also deposited in the USNM collection.

The examined material recorded in Rondônia and São Paulo States came from the tissue bank of the Acarological Collection of the Instituto Butantan (IBSP), São Paulo, Brazil, which are preserved in ethyl alcohol (100%). The specimens were slide-mounted in Hoyer's medium following the protocols described by Walter and Krantz (2009). For identification, we used the key for genera of Neotropical and Nearctic Trombiculidae (Brennan and Goff 1977) and later, we compared the results with the original descriptions of all species within the identified genus (*Hooperella*), and the type material. Part of this material from the IBSP Collection (n = 25) was prepared for Scanning Electron Microscopy (SEM), using the Digital Scanning Microscope FEI, Quanta 250, at the Laboratório de Biologia Celular, Instituto Butantan, São Paulo, Brazil.

The examination of morphological characters and measurements of the types and non-types were performed using a Leica DFC 500 digital camera coupled to a Leica DM4000B optical microscope with phase contrast. The microscope images were made with Leica Application Suite v. 2.5.0 software. Drawings and figures were prepared using Inkscape v.1.0.1 and Adobe Photoshop v. 13.0 software. The measurements are in micrometers and are available in the Supplementary Table 1.

In summary, the redescription of the species is based on the type material, new material from Pará and material stored in alcohol from São Paulo and Rondônia. The drawings were made from the holotype and paratypes. SEM imagery was obtained from material preserved in alcohol, originating from the states of São Paulo and Rondônia.

The terminology of the dorsal opisthosomal setae and setae on the prodorsal sclerite follows Grandjean (1939) with adaptations by Kethley (1990) and Grandjean (1935; 1947) for the specialized setae on the legs and palps.

Results

Family Trombiculidae Ewing, 1929

Hooperella saccopteryx (Brennan and Jones, 1960)

Trombicula saccopteryx Brennan and Jones 1960: 530; Brennan and Yunker 1966: 255; Marinkelle and Grose 1981: 18
Tecomatlana (*Hooperella*) *saccopterix* Vercammen-Grandjean 1967: 854 **misspelled**
Tecomatlana (*Hooperella*) *saccopteryx* Loomis 1969: 15; Brennan 1970: 35.
Hooperella saccopteryx Brennan 1970:811; Brennan and Reed 1975: 53; Brennan and Bronswijk 1975: 244; Webb and Loomis 1977: 82; Hoffmann 1990: 73; Zajkowska *et al.* 2018: 110.

(Figures 1-6, and Supplementary Tables 1 and 2)

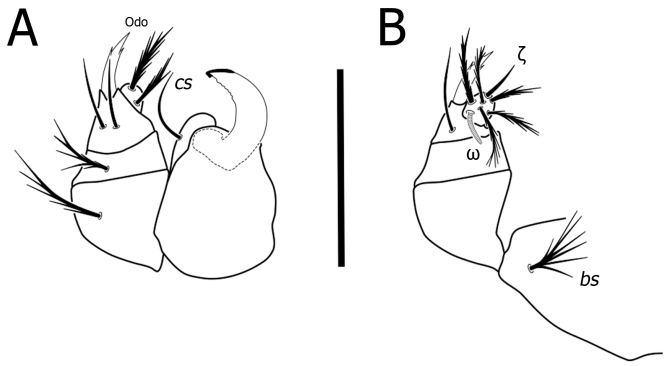

Figure 1 *Hooperella saccopteryx* (Brennan and Jones, 1960) (holotype); A – dorsal view of gnathosoma; B – ventral view of palp. Symbols: ω = solenidion on palptarsus; ζ = eupathidium on palptarsus; Odo = odontus; *cs* = adoral setae; *bs* = subcapitular setae. Scale: A and B 50 µm.

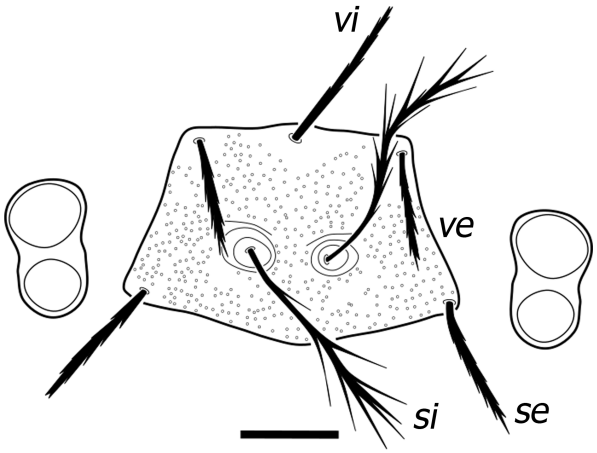

Figure 2 *Hooperella saccopteryx* (Brennan and Jones, 1960) (holotype); prodorsal sclerite. Symbols: *ve* = external vertical setae; *se* = external scapular setae; *vi* = internal vertical setae; *si* = internal scapular setae (trichobothria). Scale: 20 µm.

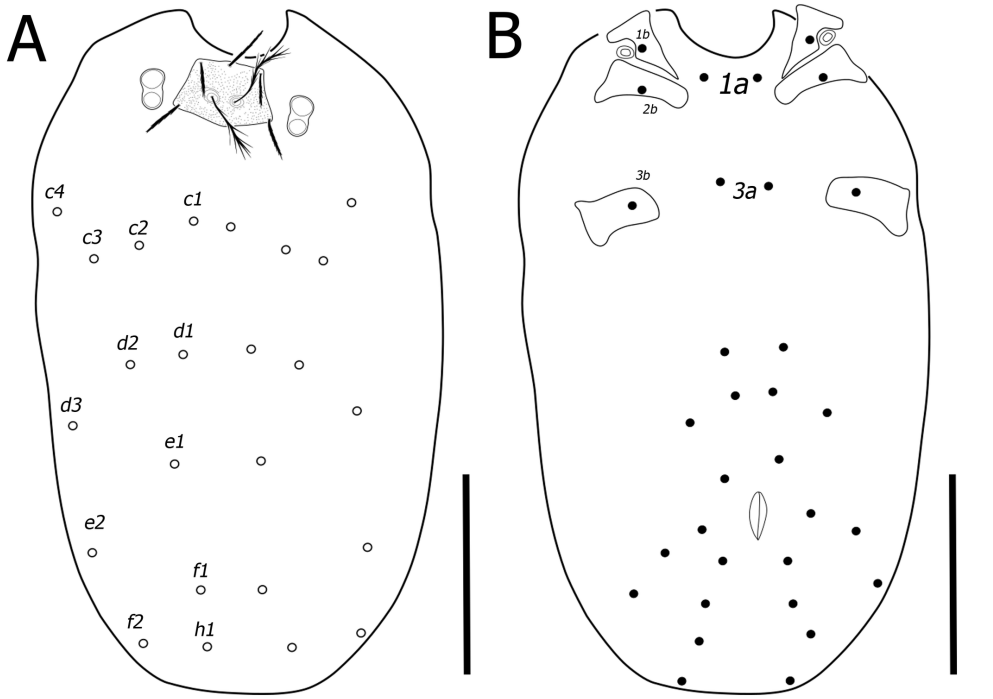

Figure 3 *Hooperella saccopteryx* (Brennan and Jones, 1960) (holotype); A – dorsal view of idiosoma; B – ventral view of idiosoma. Solid circles = ventral setae; open circles = dorsal setae; Symbols: *1a* = anterior sternal setae; *3a* = posterior sternal setae; c_1-c_4 = C row setae; d_1-d_3 = D row setae; e_1-e_2 = E row setae; f_1-f_2 = F row setae; h_1 = H row setae; *1b* = coxal field I seta; *2b* = coxal field II seta; *3b* = coxal field III seta. Scales: A and B 100 µm.

Diagnosis

Larva. Palpfemur and palpgenu each with a single branched seta; all three palptibial setae nude; adoral setae (*cs*) nude; cheliceral blade with small set of teeth just below the tricuspid cap; C, D and E rows with eight, six and four setae each; 3 to 7 eupathidia in Ge I, famulus (ε) Ta I and II distal and proximal to solenidion (ω), respectively.

Redescription

Larvae (holotype, 92 paratypes, and 60 non-types).

Gnathosoma — fPp = B/B/NNN/7Bωζ; odontus trifurcate; cheliceral blade with small set of teeth just below the tricuspid cap; gnathobase punctate, subcapitular (*bs*) setae branched and adoral (*cs*) setae nude (Figures 1A-B, and 5A).

Idiosoma — eyes 2/2, anterior lens larger, with ocular plate; prodorsal sclerite subtrapezoidal and entirely punctate, anterior margin slightly straight, lateral margins slightly sinuous, and posterior margins converging in the center to slightly 'u' (Figure 2 and 5B), with flagelliform trichobothria (*si*), with long and thin setules, and 5 branched normal setae [pair of *ve* (= AL) seta, a single *vi* (= AM) seta and pair of *se* (= PL) seta], *si* > se ≥ vi > *ve*; opisthosoma (Figures 3A-B) with 46 to 50 setae (46 in holotype); dorsal opisthosoma with 24 setae (Figure 5C), C row with 4 pairs of setae (c_4 = humeral setae), D row with 3 pairs of setae, E and F rows with 2 pairs of setae each, and H row with one pair of setae, and 22 to 26 ventral opisthosomal setae with 8 setae anterior to the anus and 14 to 18 setae posterior to the anus (14 in the holotype). Two pairs of sternal setae (*1a*, *3a*) between coxal fields I and III (Figure 5D).

Legs femur of legs I-III each divided into basifemur and telofemur, each leg terminates with paired claws, and a claw-like empodium without onychotriches, coxal fields punctate; *Leg*

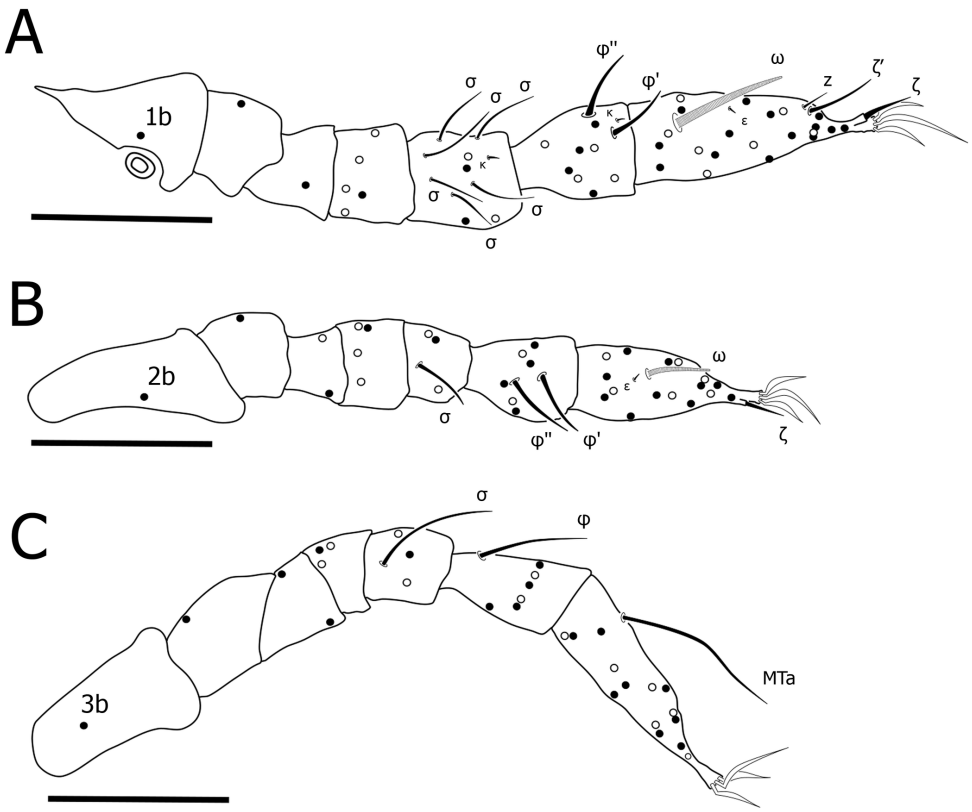

Figure 4 *Hooperella saccopteryx* (Brennan and Jones, 1960) (holotype); A – Leg I; B – Leg II; C – Leg III; Solid circles = ventral leg setae; open circles = dorsal leg setae. Symbols and abbreviations: ζ = subterminal eupathidium on Ta I and II; ω = solenidion on Ta I and II; σ = solenidia on Ge I-III; κ = microsetae on Ge I and Ti I; φ, φ′, and φ" = solenidia on Ti I-III; ζ′ = dorsal eupathidium on Ta I; z = companion seta on Ta I; ε = famulus on Ta I and II; *1b* = position of the coxal field I seta; *2b* = position of the coxal field II seta; *3b* = position of the coxal field III seta. Scales: A-C 50 μm.

I - coxal field seta *1b* branched (1B); trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 3 to 7 σ and microseta κ; tibia 8B, 2 φ and κ; tarsus 21B with ω, ε, dorsal eupathidium (ζ′) with companion seta (z) and subterminal eupathidium (ζ), base of famulus (ε) distal to ω, (Figure 4A and 6A). *Leg II* - coxal field seta *2b* (1B); trochanter 1B; basifemur 2B; telofemur 4B; genu 3B, σ; tibia 6B, 2 φ; tarsus 16B with ω, ε and subterminal eupathidium (ζ), base of ε proximal to ω (Figure 4B). *Leg III* - coxal field seta *3b* (1B); trochanter 1B; basifemur 2B; telofemur 3B; genu 3B, σ, tibia 6B, φ; tarsus 14B and one mastisetae (MTa) (Figure 4C and 6B-C).

Type material

Holotype — larva (USNMENT01759388); near to Guaracara River, San Fernando City, Trinidad and Tobago; 18 March 1958; ex *Saccopteryx bilineata* (Temminck) (Chiroptera: Emballonuridae); RML 34687.

Paratype — 5 larvae (USNMENT01759389-393); same data as holotype. The other 87 examined paratypes from Trinidad and Tobago are listed in Bassini-Silva *et al.* (2021), in the pages 94-95.

Additional material examined — **(USNM Collection)**. BRAZIL: 7 larvae; Belém Municipality, Pará State; 25 March 1968; ex *Saccopteryx leptura* (Schreber, 1774) (Chiroptera: Emballonuridae); T.H.G. Aitken coll.; (RML 49371). **(IBSP Collection)**. BRAZIL: 3 larvae (IBSP 18386); Monte Negro City, Rondônia State (63° 26′ 46" W, 10° 17′ 04" S); 12 May 2021;

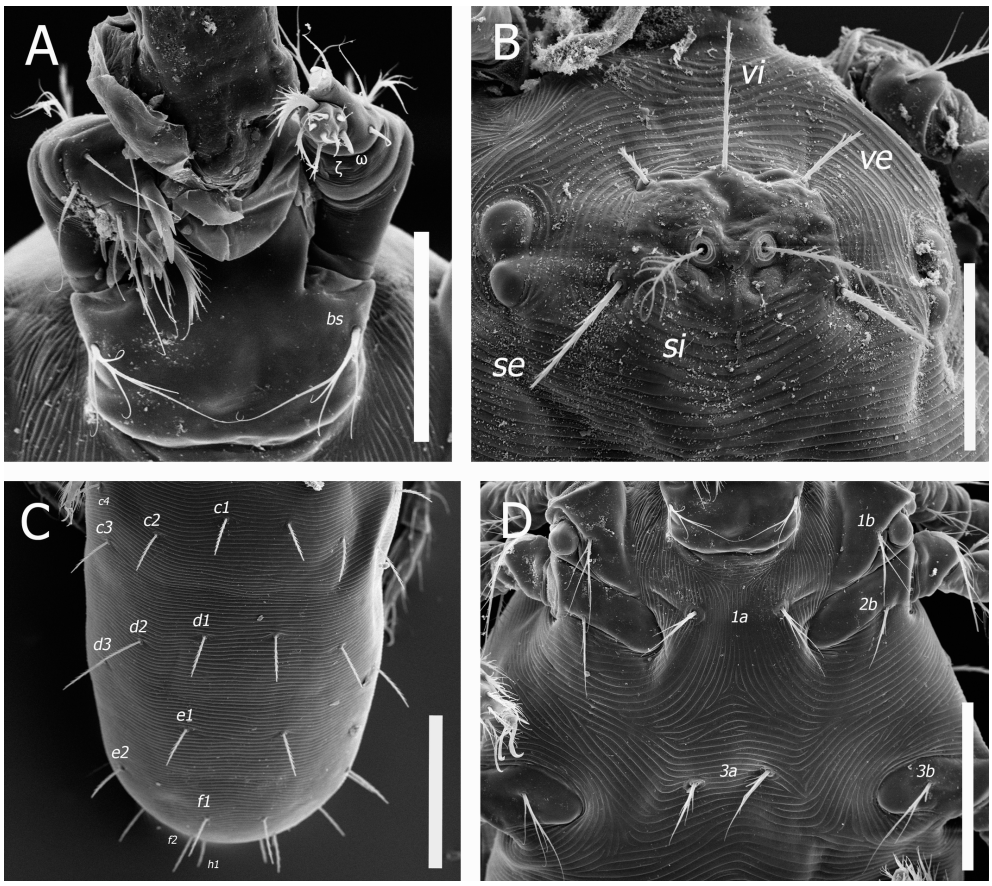

Figure 5 Scanning Electron Microscopy images of *Hooperella saccopteryx* (Brennan and Jones, 1960) (material). A – Ventral view of the gnathosoma; B – Prodorsal sclerite; C – Dorsal opisthosoma; D – Sternal region. Symbols and abbreviations: ω = solenidion on palptarsus; ζ = eupathidium on palptarsus; *bs* = subcapitular setae; *ve* = external vertical setae; *se* = external scapular setae; *vi* = internal vertical setae; *si* = internal scapular setae (trichobothria); c_1-c_4 = C row setae; d_1-d_3 = D row setae; e_1-e_2 = E row setae; f_1-f_2 = F row setae; h_1 = H row setae; *1a* = anterior sternal setae; *3a* = posterior sternal setae; *1b* = coxal field I seta; *2b* = coxal field II seta; *3b* = coxal field III seta. Scales: A 30 µm, B 40 µm, C 100 µm, and D 50 µm.

ex *S. bilineata*. 18 larvae (IBSP 18387); same locality (63° 26′ 38” W, 10°16′ 38” S) and host; 22 May 2021. 1 larva (IBSP 19274); same locality (63° 23′ 12” W, 10° 25′ 56” S) and host; 10 Dec. 2021. 17 larvae (IBSP 19289); same locality (63° 26′ 52” W, 10° 16′ 58”S) and host; 29 Nov. 2022; L.F. Dornelas Jr. coll. 6 larvae (IBSP 19337); Bebedouro Municipality, São Paulo State; 20 Oct. 2019; ex *S. leptura*. 8 larvae (IBSP 19338); same data.

Differentials diagnosis

The species *Hooperella saccopteryx* differs from other species of the genus in having a subtrapezoidal prodorsal sclerite, fewer opisthosomal setae (46 to 50 setae), and a variation of setae on the genu of leg I (3 to 7 σ). While the other species, *H. alvarezi*, *H. vesperuginis* and *H. yucatanica* have a rectangular prodorsal sclerite, more opisthosomal setae (108, 59 to 62, and 125, respectively) and only three σ on genu of leg I. Besides that, *H. saccopteryx* further differs from *H. yucatanica* in having 3-pronged odontus (vs. multi-pronged odontus) and nude adoral setae (vs. branched) and from *H. alvarezi* in having a different palpal formula (B/B/NNN vs. B/B/BBN).

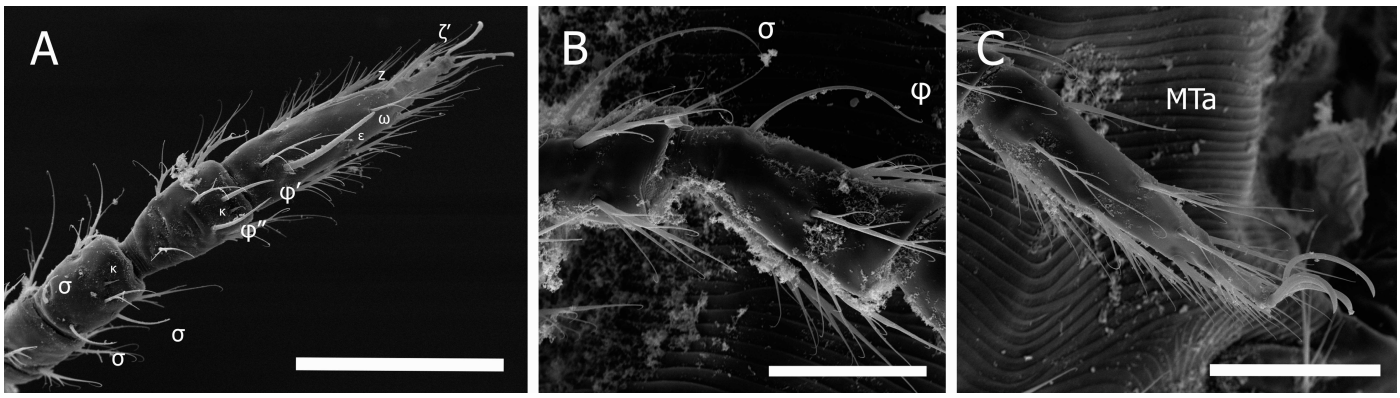

Figure 6 Scanning Electron Microscopy images of *Hooperella saccopteryx* (Brennan and Jones, 1960) (material). A – Genu, Tibia and Tarsus of the Leg I; B – Genu and Tibia of the Leg III; C –Tarsus of the Leg III. Scales: A 50 µm, B 20 µm, and C 30 µm.

Discussion

Upon examining the type series, we realized the necessity of redescribing the species by consolidating all the morphological data into this study. Additionally, it was only after reviewing the type material that we were able to accurately identify the specimens deposited in the acarological collections we visited (IBSP and USNM). Consequently, we have included the examined material in the updated description of this species.

Comparing the original description made by Brennan and Jones (1960) and the redescriptions made by Vercammen-Grandjean (1967) and Hoffmann (1990) with our current redescription of *H. saccopteryx*, we were able to add the measurements of all seven leg segments, as well as the ventral and sternal setae, which were previously not included. Additionally, we noticed differences, particularly in the number of specialized setae (σ) on the genu of leg I. Brennan and Jones (1960) and Vercammen-Grandjean (1967) commented about a variation in the quantities of these setae (5, and sometimes 6), while Hoffmann (1990) did not describe this variation, and stated that this species has only five specialized setae. However, we observed that there is a variation wider than stated by these authors, 3 to 7 specialized setae (σ) on genu of leg I; sometimes there is even a difference between the left and right leg of the same specimen. Another subtle difference observed referred to the number of setae in dorsal opisthosomal rows; Brennan and Jones (1960) did not observe two extra setae in the F row, contrary to the state by us and in the redescription made by Vercammen-Grandjean (1967). The **Supplementary Table 2** provides a quantification of the number the ventral setae located both posterior and anterior to the anus of each examined specimen. Besides that, this supplementary table shows the amount of σ on genu of leg I on both sides of symmetry axis in each specimen.

Regarding the measurements, as previously stated, many are new. While Brennan and Jones (1960) provided only the measurements of the holotype for the prodorsal sclerite and the specialized setae of legs I-III, Vercammen-Grandjean (1967) reported variations in the measurements of the prodorsal sclerite, opisthosomal setae, leg lengths, and the combined length of the three legs for four specimens. The previously presented measurements are consistent with those in this study, with no significant variation to note, as the small differences observed in some structures are probably due to the differing quality of the microscopes used. The **Supplementary Table 1** presents the measurements for specimen examined in this study, both for type and non-type specimens.

Based on our examination of the material from both collections, *H. saccopteryx* appears to have a strong preference for parasitizing bats of the genus *Saccopteryx*. However, this does not exclude the possibility of being found on other hosts, as indicated by various authors (Brennan and Jones 1960, 1961; Loomis 1969; Brennan 1970a, b; Brennan and Bronswijk 1975; Brennan

and Reed 1975; Webb and Loomis 1977; Marinkelle and Grose 1981; Hoffmann 1990), and compiled by Zajkowska *et al.* (2018) and Ševčík (2023). Until a thorough review of all materials is completed, it remains clear that this species has a broad distribution, being found from Mexico (Hoffmann 1990) to the southeastern region of Brazil (this study), and shows a preference for parasitizing phyllostomid bats.

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