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Taxonomic Review of the Wingmite Genus *Cameronieta* (Acari: Spinturnicidae) on Neotropical Bats, with a New Species from Northeastern Brazil

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ABSTRACT: The ectoparasitic mite genus *Cameronieta* (Acari: Mesostigmata: Spinturnicidae) is endemic to the New World and associated exclusively with bats of the family Mormoopidae. The genus consists of 7 species, 4 broadly distributed through the Caribbean and mainland of North and South America, and 3 species limited to the Greater Antilles archipelago. We present a brief review of the taxonomic history, redefine the genus, and consider some questions that remain concerning the biology and systematics of the group. A new species, *Cameronieta almaensis* n. sp., is described from the wings of *Pteronotus parnellii* collected from the Serra das Almas Reserve, in the northeastern state of Ceará, Brazil. This is the first record of *Cameronieta* from Brazil.

KEY WORDS: ectoparasite, Acari, Parasitiformes, Spinturnicidae, *Cameronieta*, Chiroptera, Mormoopidae, *Pteronotus*, Brazil, Ceará.

Mites of the family Spinturnicidae Oudemans 1901 are permanent, blood-feeding ectoparasites infecting bats (order Chiroptera). All of the active life-cycle stages (protonymphs, deutonymphs, adult males, and females) occur exclusively on the host's wing and tail membranes and display prominent morphological and biological adaptations for life in this highly specialized habitat (Rudnick, 1960). The idiosoma is compressed dorso-ventrally, and the legs are large and incrassate, with strong claws and pulvilli for clinging to the host (pulvilli are reduced on leg I of some Old World genera). All active stages of the parasite feed intermittently on host blood, and the chelicerae are elongate and armed with serrate-edged chelae. The life cycle is shortened by viviparity, with the larval stage bypassed within the egg of the gravid female, who later gives birth directly to a protonymph (Rudnick, 1960).

Machado-Allison (1965a, b) worked intensively with Neotropical Spinturnicidae and, while surveying the Venezuelan bat fauna, recognized that mites of the genus *Periglischrus* were consistently associated with bats of the family Phyllostomidae (Machado-Allison, 1965b). However, this author noted that mites on the wings of Parnell's moustache bat (*Pteronotus parnellii*) were morphologically distinct from previously known species from other phyllostomid bats. Females

of these latter mites differed in general body shape, the number and size of ventral plates, and their integumental sculpturing, and they displayed a complex fragmenting of the anal shield and migration of the anal opening to a subterminal position on the dorsal opisthosoma. Machado-Allison (1965b) formally described a new genus, *Cameronieta*, and the type species, *Cameronieta thomasi*, based upon these differences.

At about the same time, Furman (1966) studied a large collection of spinturnicids from bats from areas in Panamá and Trinidad similar to those Machado-Allison (1965a, b) studied in Venezuela, and clashes between the 2 researchers resulted in more questions than answers about mites of the genus *Cameronieta*. Furman's work (1966) on the spinturnicids (in Wenzel and Tipton, 1966) was evidently slow to come to press, and the addendum of Furman (1966) begins with the lamentation, "Since submission of the manuscript for this paper in 1962, a series of spinturnicids have been described by Machado-Allison." In short, Furman's work contained 3 carefully described and illustrated synonyms of species that had now been recently described from Venezuela by Machado-Allison (1965b), leading Furman to report these new synonymies in the addendum. Nevertheless, Furman was unequivocal in his conclusion that "*Cameronieta* is a synonym of *Periglischrus*, and *C. thomasi* becomes *Periglischrus thomasi* (Machado-Allison) (Ref)." Furman also reiterated in the addendum the

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point made in his formal description of *Periglischrus elongatus* infecting *Pteronotus parnellii fusca* from Trinidad—that it was not yet clear whether Machado-Allison's holotype of *C. thomasi* was an abnormal female heteromorph, a “genetic freak,” or if it was actually a representative of a distinct interbreeding population. Furman concluded his addendum with the irony that if it was correct that heteromorphic females in *Pe. elongatus* exist, then “this species will become a synonym” of the original heteromorph, *Pe. thomasi*.

Dusbábek (1967) confirmed the validity of the genus *Cameronieta* and recognized their strict association with bats of the subfamily Chilonycterinae (then classified within the Phyllostomidae). He also noted that Tibbetts (1957) had described the first species of the group, from *Mormoops megalophylla* (Peters, 1864) captured in southern Texas. Dusbábek (1967) formally transferred this mite, *Periglischrus strandtmanni* (Tibbetts, 1957), into the genus *Cameronieta* and described 3 new species from bats in Cuba. The same year, Machado-Allison (1967) advocated the removal of the chilonycterine bats from the family Phyllostomidae, based on their host's specific associations with this distinct group of mites. When Smith (1972), based on morphological studies, established the bat family Mormoopidae to include *Mormoops* and *Pteronotus*, he cited Machado-Allison (1967), stating that “apparently the spinturnicid mites found on mormoopid bats are, as a group, distinct from those found on phyllostomatids, implying distinctiveness in the bats as well.” Although no phylogenetic analysis has been reported, it is clear that the taxonomic affinities of spinturnicid mites are reflected in the phylogeny of their hosts (Rudnick, 1960; Machado-Allison, 1967). In short, mite genera appear to consistently track bat families. For example, in the New World, *Periglischrus Kolenati* 1857 is associated with the Phyllostomidae; *Mesoperiglischrus* Dusbábek, 1968 is associated with Natalidae; *Cameronieta* Machado-Allison, 1965 is associated with Mormoopidae; and *Spinturnix* Von Heyden, 1826 and *Paraspinturnix* Rudnick, 1960 are associated with Vespertilionidae.

Recently, Deunff et al. (2007) compared spinturnicid mites infecting *Pteronotus quadridens* (Gundlach, 1840) from Puerto Rico with the types of *Cameronieta torrei* Dusbábek infecting the same host species in Cuba and described a new subspecies, *Cameronieta torrei dusbabeki*. This important contribution focused on species of *Cameronieta*, their morphological characters, and developmental stages of the life cycle, and it set the foundations for understanding their divergence from species of *Periglischrus* Kolenati.

While surveying bats and ectoparasites in northeastern Brazil, we identified a morphologically distinct species of *Cameronieta* infecting the wings of *Pt. parnellii*. The purpose of this paper is to describe this species and to revise the definition of the genus through examination of comparative specimens from México and Venezuela presently housed in the parasite collections of the Harold W. Manter Laboratory of Parasitology at the University of Nebraska–Lincoln. We hope that this revision will encourage and facilitate the collection and identification of additional specimens of *Cameronieta* from mormoopid bats, as well as provide the initiative for much-needed observations and experiments with their natural history and ecology.

MATERIALS AND METHODS

For this study, we examined over 300 comparative specimens of *Cameronieta* (obtained from the Ceará region of Brazil) on slides prepared by the first author and specimens from the Harold W. Manter Laboratory of Parasitology obtained from the Michoacan region of México and from the Falcon region of Venezuela. Type specimens were cleared in lactophenol, slide-mounted individually in Hoyer's medium, and ringed with enamel. Measurements were taken using a computer-aided image system on a Zeiss AxioPhot microscope. Measurements are in micrometers (μm) unless otherwise stated and are given for the holotype, followed by the measurement range of paratypes in parentheses. Illustrations were traced from images taken with the Zeiss microscope and then redrawn and edited with Adobe Photoshop. Morphological nomenclature follows Krantz and Walter (2009). Types are deposited in the collections of the Fundação Oswaldo Cruz, Rio de Janeiro, Brazil; the Field Museum of Natural History, Chicago, Illinois, U.S.A.; the Harold W. Manter Laboratory of Parasitology, University of Nebraska–Lincoln, Nebraska, U.S.A.; the Instituto Butantan, Sao Paulo, Brazil; and the Instituto Nacional de Pesquisas Amazonia, Manaus, Brazil.

RESULTS

Including the new species described here, which is the first record of *Cameronieta* in Brazil, the genus is composed of 7 species: *Cameronieta strandtmanni* (Tibbetts, 1957); *C. thomasi* Machado-Allison, 1965b; *Cameronieta elongatus* (Furman, 1966); *Cameronieta machadoi* Dusbábek, 1967; *Cameronieta tibbettsi* Dusbábek, 1967; *C. torrei* Dusbábek, 1967 (and subspecies, *C. t. dusbabeki* Deunff, Whitaker, and Kurta, 2007); and *Cameronieta almaensis* n. sp. (Table 1).

Redescription of *Cameronieta* Machado-Allison, 1965

Type species: Cameronieta thomasi Machado-Allison, 1965, by original designation.

Table 1. Species of *Cameronieta* in Brazil.

Species	Host	Distribution	Reference
<i>Cameronieta almaensis</i> n. sp.	<i>Pteronotus parnellii</i>	Brazil	Present study
<i>Cameronieta elongatus</i> Furman, 1966	<i>Chilonycteris rubiginosa fusca</i> (sy. <i>Pt. parnellii rubiginosus</i>)	Panama	Furman, 1966
	<i>Pt. parnellii</i>	Venezuela	Herrin and Tipton, 1975
<i>Cameronieta machadoi</i> Dusbábek, 1967	<i>Chilonycteris macleayii macleayii</i> (sy. <i>Pt. macleayii macleayii</i>)	Cuba	Dusbábek, 1967
<i>Cameronieta strandtmanni</i> Tibbetts, 1957	<i>Mormoops megalophyla</i>	Texas	Tibbetts, 1957
	<i>M. megalophyla</i>	Venezuela	Herrin and Tipton, 1975
	<i>M. blainvillii</i>	Cuba	Dusbábek, 1967
	<i>M. blainvillii</i>	Puerto Rico	Kurta et al. 2007
<i>Cameronieta thomasi</i> Machado-Allison, 1965	<i>Chilonycteris rubiginosa fusca</i> (sy. <i>Pt. parnellii rubiginosus</i>)	Venezuela	Machado-Allison, 1965a
	<i>Pt. parnellii</i>	Venezuela	Herrin and Tipton, 1975
<i>Cameronieta tibbettsi</i> Dusbábek, 1967	<i>Chilonycteris parnellii boothi</i> (sy. <i>Pt. parnellii parnellii</i>)	Cuba	Dusbábek, 1967
<i>Cameronieta torrei</i> Dusbábek, 1967	<i>Chilonycteris fuliginosa torrei</i> (sy. <i>Pt. quadridens fuliginosus</i>)	Cuba	Dusbábek, 1967

Cameronieta is readily distinguished from all other mites of the family Spinturnicidae by a combination of exclusive characteristics: mouthparts protected within “camerostome,” anal shield in female divided into complex of dorsal and ventral components, and life stages clearly recognized by length and shape of peritreme. All active life stages, protonymphs, deutonymphs, males, and females are known only from the wings and tail membranes of mormoopid bats, where they feed on host blood. All individuals with 4 pairs of strong legs, each tipped with large, paired claws and lobed, diaphanous pulvillus; mouthparts with long and narrow cheliceral shafts, terminating in toothed fixed digit, and serrate-dentate moveable digit; without visible excrescences. Tritosternum absent. Dorsal shield divided and weakly sclerotized; podonotum and opisthonotum fused by suture, or separated. Unarmed integument of idiosoma with patterns of ventral aciculate and lateral and dorsal mammillate sculpturing. Peritremes long and completely dorsal in adults, extending from above the intercoxal space between coxae III and IV, anterior to level of coxa I; distinctively shortened in deutonymphs, with right-angle terminal bend; very short and straight in protonymphs. Adults and deutonymphs with 5 pairs of podosomal setae lateral to dorsal plate; sixth pair medial to stigma (blunt spiniforms in *C. thomasi*); protonymphs with only 4 lateral podosomal setae, with fifth pair near stigma. Genital setae present in all active stages; metasternal setae absent in protonymph. Gnathosome recessed ventrally under thick, membranous epistome and confined laterally by long, sclerotized medial border of first coxa and posteriorly by sternal shield (this recessed chamber is collectively referred to as the “camerostome” in this group).

Female: Cemerostome more strongly developed in females (especially *C. thomasi*). Sternal shield wider than long, contacting lateral margins of coxa I, with 3 pairs of setae, 2 pairs of lyrifissures. Metasternal setae set in integument lateral and posterior to shield; epigynial shield reduced with single pair of setae on posterior margin. Highly modified anal shield complex; with series of small ventral “plates” bearing adanal setae, with internal connections to single pair of sclerotized plates (“posterior gastric plates,” with medial border between Og4 and Og5); dorsal connections to displaced anal valves, with postanal seta and cribrum inverted on dorsal opisthosoma. Males with much longer legs than females, but in both sexes, leg I is longest, legs II and IV are of similar length, and leg III is shortest. Associated exclusively with bats of the family Mormoopidae.

Remarks

The family Mormoopidae, i.e., primary hosts for spinturnicids of the genus *Cameronieta*, is composed of 2 genera of cave-dwelling, insectivorous bats: *Mormoops* (2 species) and *Pteronotus* (7 species). They occur only in the Neotropics and southern fringes of the Nearctic region, ranging from southern Texas and Arizona through the Caribbean to Bolivia and central Brazil. Species of *Cameronieta* are assumed to maintain monoxenous associations with their host bats, but very little information is available on their exact host relationships.

Cameronieta strandtmanni (Tibbetts, 1957) is associated with bats of the genus *Mormoops*. Although Herrin and Tipton (1975) reported this

mite as a host-specific ectoparasite of *Mormoops megalophylla* (Peters, 1864), the species is presently thought to be oligoxenous: It is also recorded in Cuba infecting the only known host congener, *Mormoops blainvillii* Leach, 1821 (see Dusbábek, 1967, 1968), and in Puerto Rico (Kurta et al., 2007). These mites are very similar morphologically to those infecting species of *Pteronotus*, but *C. strandmanni* females are easily diagnosed by their lack of the distinctive “feather-like” (Dusbábek, 1967) or “prominent palmate” setae (Herrin and Tipton, 1975) that adorn the ventral leg segments of the *Cameronieta* species infecting *Pteronotus*. The comparative specimens we studied of *C. strandmanni* from *Mormoops megalophylla* in Michoacan, México (Gettinger collection, Harold W. Manter Laboratory of Parasitology), conform closely to the original description; this is a new record for the state of Michoacan, México.

The species boundaries and host associations of *Cameronieta* infecting bats of the genus *Pteronotus*, especially on the continent of South America, remain poorly resolved. There is significant confusion about the host associations of *Cameronieta* associated with the nominal bat species *Pt. parnellii*. *Cameronieta thomasi* has been reported from both *Pt. parnellii* and *Pteronotus davyi*, 2 bats that are morphologically distinct and difficult to misidentify. However, there has been confusion over the names in the past, which could have led to mistakes with the hosts. Also, there are now 3 morphologically distinct species of *Cameronieta* described from the nominal species *Pteronotus parnellii* Gray. Recent morphological and molecular research has demonstrated that *Pt. parnellii* is a composite of morphologically similar species (Gutiérrez and Molinari, 2008; Clare et al., 2013).

The most distinctive characters of the “*Pteronotus* group” of mites are the hyaline plumose-palmate setae that are present in the posterior position of coxa II and ventrally on the other leg segments. Although the translucent appearance of these setae can make them difficult to find in some specimen preparations, once the microscope is focused in a way to visualize them, these plumose leg setae, all lined in a single visual field, are impressive. One pattern is very common and occurs on the ventral legs of females of *C. almaensis*, *C. elongatus*, *C. machadoi*, and *C. tibbettsi*: The only coxa with a plumose-palmate seta is coxa II; all other leg segments have a single plumose-palmate seta, with the exception of trochanter IV, which has none, and femurs I and II, and tarsi II, III, and IV, which have 2 plumose-palmate setae. Although Dusbábek (1967) described

C. torrei with “feather-like setae developed as in preceding species,” (i.e., *C. machadoi*), his illustration shows trochanter II with 2 setae, instead of a single plumose-palmate seta. In the type species, *C. thomasi*, there is more doubling, and there are many more plumose-palmate setae per leg segment (e.g., femurs I and II appear to have 4 and 3, respectively).

The controversy over the status of heteromorphic females in *Cameronieta* between Machado-Allison and Furman has never been resolved (see Machado-Allison, 1965b; Furman, 1966; Machado-Allison and Antequera, 1971). The Smithsonian Venezuelan Project produced 3 more female specimens of *C. thomasi*, and Herrin and Tipton (1975) concluded that *C. thomasi* and *C. elongatus* (Furman, 1966) may occur on the same species of host. The polymorphic reproductive females that become attached or “incrusted” on lesions on the host wing (Machado-Allison and Antequera, 1971) remain controversial, complicating the taxonomy of the group.

***Cameronieta almaensis* n. sp. (Figs. 1–4)**

Diagnosis

Females of *C. almaensis* can be distinguished from other known species of the genus by the first pair of podosomal setae, which are very small (about 10 µm). *Cameronieta almaensis* is morphologically similar to *C. machadoi*, associated with Macleay’s mustached bat (*Pteronotus macleayii* (Gray, 1839)) in Cuba. These 2 mites differ in the form of the female dorsal shield: *C. machadoi* has a strongly incised posterior margin of the podonotum, and saddle-shaped pygidium, while in *C. almaensis*, the posterior margin of the podonotum is complete, and slightly concave, and the pygidium is subtriangular in shape. The dorsal opisthosomal setae of *C. almaensis* are small (less than 20 as found in *C. machadoi*). The sternal shield of *C. almaensis* has St2 set on posterolateral border, St3 directly medial to St2 in middle of shield, and the metasternal setae are posterior to the shield and slightly smaller than sternal setae, but not minute (as in *C. elongatus*).

Description

Female dorsum (Fig. 1): Dorsal shield oblong-oval, divided into podonotum with 7 pairs of circular pores, pygidium with 4. Peritremes completely dorsal, extending from stigmata at level between coxae III and IV, anteriorly to posterior margin of coxa I. Six pairs of medium to large podosomal setae (Ps1–Ps6)

Figures 1–2. *Cameronieta almaensis* n. sp., female. 1. Female dorsum. 2. Female venter.

follow lateral margins of dorsal shield just medial to peritremes, first pair minute to small (<12), set midway between anterior midline of dorsal shield and anterior tip of peritremes. Second to fifth pairs located laterally between dorsal shield and peritremes, sixth pair just medial to stigma. Distance between Ps1 and Ps2 greater than between Ps2 and Ps3, and all podosomal setae lightly barbed. Dorsal opisthosoma with 7 pairs of setae, also lightly barbed; first pair small, inserted medially just posterior to coxa IV; second, third, fourth, and fifth pairs medium-sized and set near lateral border of opisthosoma; last 2 pairs, sixth and seventh, minute to small, located close together. Anal opening dorsal, subterminal, anal valves subcircular, with inverted cribrum and minute postanal setae on the anterior rim of anus.

Female dorsal measurements: Holotype (range of paratypes)—Idiosomal length, 1076 (1076–1197); podonotal length, 228 (224–240); podonotal width, 184 (176–200); opisthonotal length, 58 (52–60);

opisthonotal width, 87 (84–91); peritreme, 234 (232–256); podosomal setae (Ps): Ps1, 11 (8–16); Ps2, 47 (41–49); Ps3, 45 (36–52); Ps4, 52 (48–55); Ps5, 51 (47–56); Ps6, 50 (43–50).

Female venter (Fig. 2): Sternal shield wider than long, with anterior margin slightly concave, anterolateral corners rounded and closely aligned to posterolateral margin of coxa I, bearing 3 pairs of sternal setae (St) small to medium in size; St1 near anterior margin, St2 on posterolateral corner, and St3 more medially placed near posterior margin of sternal shield. Two pairs of lyrifissures, first pair located just posterior and lateral to St1, but St1 not extending to this pore; second pair of lyrifissures set centrally, just anterior to St3. Integument lateral to sternal shield with aculeate sculpturing; medial gap without sculpturing posterior to shield. Metasternal setae inserted in aculeate integument posterior to sternal shield. Epigynal shield narrow, with pair of heavily pilose genital setae on posterior margin. Ten pairs of opisthogastric

Figures 3–4. *Cameronieta almaensis* n. sp., male. **3.** Male dorsum, with male chelicera. **4.** Male venter.

setae (Og) posterior to the genital shield, Og1 and Og2 closely associated, forming distinctive polygon; Og1 with simple alveolus, Og2–Og6 with horned alveoli; transverse lyrifissure just anterior to Og4; Og4 and Og5 associated with medial border of posterior gastric plates; Og7–10 lightly pilose; adanal setae long and pilose, set in complex of small ventral plates with connections through the anal atrium to dorsal anus. The postanal seta is minute, and because it is inverted to a dorsal position on the terminal opisthosoma, it appears anterior to the anus.

Female ventral measurements: Sternal shield length at level of St1, 83 (71–90); sternal shield width, 146 (140–168); St1, 20 (17–20); St2, 16 (14–18); St3, 18 (14–18); metasternal setae, 11 (9–12); genital setae, 62 (51–63); Og1, 10 (7–14); Og2, 11 (9–13); Og3, 7 (7–15); Og4, 13 (10–18); Og5 and Og6, 13 (12–16); Og7, 38 (30–42); Og8, 31 (30–37); Og9, 26 (22–30); Og10, 14 (13–18); adanal setae, 43 (41–49).

Female legs: Significant sexual dimorphism of legs. Female with much shorter legs than male; leg I longest, about 18% longer than subequal legs II and

IV and 39% longer than shorter leg III. Dorsal: All dorsal setae lightly barbed, with central posterior setae (pd2) of each femur long. Ventral (Fig. 4): Coxa I with short distal seta, proximal seta much longer and distinctly barbed; coxa II with medium, slightly barbed anterior seta and long, plumose-palmate posterior seta; coxa III with medium, slightly barbed anterior seta and very short posterior seta; coxa IV with single, small medial seta. All other leg segments, have single plumose-palmate seta, with exception of trochanter IV, which has none, and femurs I and II and tarsi II, III, and IV, which have 2 plumose-palmate setae (total, including coxa II, of 25 of these specialized setae). Leg chaetotaxy (from coxa to tibia): I = 2, 5, 11, 8, 8; II = 2, 5, 9, 8, 7; III = 2, 5, 6, 9, 7; IV = 1, 5, 7, 9, 8; ad1 and pd1 subtending ambulacrum well developed on tarsus I, but only ad1 occurs on tarsi II–IV and size is reduced on tarsus III and minute on tarsus IV.

Male dorsum (Fig. 3): Dorsal shield covers most of idiosoma, ornamented with 10 pairs of circular alveoli; podonotal and pygidial shields fused. Peritremes dorsal, originating at point above posterior margin of

coxa III and extending to point even with posterior margin of coxa I. Six pairs of lateral podosomal setae (Ps), all of medium size located between dorsal shield and peritremes; Ps1 and Ps2 located anterior and lateral to dorsal plate at level of anterior end of peritremes; Ps3 and Ps4 above coxa II; Ps5 above intercoxal region between coxae II and III; posterior sixth pair just medial to stigma. Integument lateral to dorsal shield with mammillate sculpturing. Male chelicera with elongate serrate-dentate moveable digit, and distinctly rigid, and hooked spermatodactyl.

Male dorsal measurements: Idiosomal length, 395 (395–440); podonotal length, 229 (224–245); podonotal width, 232 (201–245); pygidial shield length, 89 (73–89); pygidial shield width 102 (73–115); peritreme, 212 (211–220); Ps1, 26 (24–29); Ps2, 28 (27–33); Ps3, 31 (30–41); Ps4, 30 (29–38); Ps5, 29 (28–36); Ps6: 28 long.

Male venter (Fig. 4): Sternogenital shield with lineate sculpturing, bearing 5 pairs of strong setae; genital orifice presternal. Three pairs of lyrifissures aligned vertically, equally spaced, first, directly posterior to St1 (by length of seta); second, anterior and lateral to St3; third closely aligned with medial edge of St4 alveolus (metasternals). Integument of ventral opisthosoma (posterior to sternal shield), bearing 6 pairs of setae plus 1 adanal pair, first pair (Og1) near posterior margin of sternal shield; all opisthogastric setae medium in size (15–20); paranal setae more robust (24–26). Anus terminal, followed by minute postanal seta and cribrum.

Male ventral measurements: Sternogenital shield length, including presternum, 169 (161–204); St1, 30 (30–42); St2, 27 (27–39); St3, 25 (23–29); St4, 22 (22–30); St5, 20 (20–31).

Male legs: Significant sexual dimorphism of legs. Dorsal: Males with longer legs than females. With 1 very long mediodorsal seta on each femur: femur I, 124 (113–139); femur II, 100 (84–117); femur III, 96 (83–117); femur IV, 100 (94–101). Proximal anterodorsal seta of femur II small, 15 (15–19). Unlike females, males with long mediodorsal seta on tarsus I. Ventral (Fig. 4): Coxa I with proximal seta small, 21 (21–29); distal seta longer, 35 (35–42). Coxa II with 2 long setae, proximal, 35 (33–38); distal, 42 (40–47). Coxa III with proximal seta smaller, 27 (27–30), distal seta longer, 32 (30–39). Coxa IV with single medial seta 28 (26–30). Setation of both idiosoma and legs (ventral and dorsal) consistently

smooth, simple. Leg chaetotaxy (from coxa to tibia): I = 2, 5, 11, 10, 8; II = 2, 5, 9, 9, 7; III = 2, 5, 6, 9, 7; IV = 1, 5, 7, 9, 8; sexual dimorphism in setal counts of genu I (female with 8, male with 10 setae); genu II (female with 8, male 9 setae).

Protonymph: Based on single specimen in primary type series. Idiosomal length, 365. Dorsal shield lightly sclerotized; thin suture separates podonotal from pygidial shield. Peritreme short (96), with stigma over posterior coxa III, extending only length of coxa, not crossing intercoxal boundary between coxae III and II. Sternal shield oblong oval; margin difficult to see clearly, with 3 pairs of setae: St1 (26) on medial anterior margin, St2 (25) midlaterally, St3 (25) on posterior margin. No sternal lyrifissures. Five pairs of lateral podosomal setae, ranging from 17 to 25 long; 2 pairs above coxa I; 2 pairs above coxa II separated by 25; posterior pair near stigma 20 long. No metasternal setae. Genital setae on integument medial and posterior to sternal shield, followed by intercoxal area with 3 pairs of setae anterior to paranal setae flanking terminal anal plates, with minute postanal seta and cribrum. Three segmented chelicerae of similar form and size as adult (81 long).

Male deutonymph: Based on single specimen in primary type series. Idiosomal length, 425. Dorsal shield lightly sclerotized, delineated with full complement of 6 lateral podosomal setae; Ps1–Ps2 grouped over coxa I, Ps3–Ps4 grouped over coxa II, with Ps5 intercoxal between coxae II and III; Ps6 detached from anterior podosomal setae, inserted in intercoxal space between coxae III and IV. Dorsolateral Ps6 near stigma of peritreme, which extends anteriorly to intercoxal space of coxae II–III, where it turns at right angle and terminates just lateral to insertions of Ps4–Ps5, forming distinctive L-shape. Sternal shield with convex anterior margin, truncated posteriorly. St1 (30), St2 (26), St3 (24), metasternal setae (20), genital setae (14). Ps1 (19), Ps2 (25), Ps3 (30), Ps4 (25), Ps5 (26), Ps6 tending stigma (26); peritreme (130); chelicerae (84). Five opisthosomal setae posterior to genital setae and anterior to strong paranal setae tending anus, and minute postanal setae and cribrum.

Taxonomic summary

Type host: *Pteronotus parnellii* (Gray, 1843), *Mammalia*: *Chiroptera*: *Mormoopidae*, specimen ALP: 10.381, collected February 2013 by J. C. Almeida and M. Martins. Voucher specimen of the type host was deposited in the Collection Adriano Lucio

Peracchi (ALP), Universidade Federal Rural do Rio de Janeiro, Brazil, and is designated as the holosymbiotype.

Type locality: Municipality of Crateús, Reserva Particular do Patrimônio Natural Serra das Almas (RNSA) (40°50'–41°00'W; 05°05'–05°15'S), Ceará State, northeast Brazil.

Specimens deposited: The type series was deposited in the following collections: Coleção de Artrópodes Vetores Ápteros de Importância em Saúde das Comunidades (CAVAISC), Fundação Instituto Oswaldo Cruz, Rio de Janeiro, Brazil (holotype ACA-1774, male allotype ACA-1775; other paratypes, female ACA-1776, male ACA-1777, male deutonymph ACA-1778, protonymph ACA-1779); Harold W. Manter Laboratory of Parasitology, University of Nebraska–Lincoln, Nebraska, U.S.A. (2 female [HWML 75106], 2 male [HWML 75107] paratypes); Field Museum of Natural History, Chicago, Illinois (1 male, 2 female paratypes); Instituto Butantan, São Paulo, Brazil (1 male, 2 female paratypes); and Instituto Nacional Pesquisas Amazon, Manaus, Brazil (1 male, 2 female paratypes).

Other material examined (all from type host species and type locality): RSA-199, ex. *Pt. parnellii* (ALP: 10.387), 1111 females, 18 males, 5 male deutonymphs; CE-308, ex *Pt. parnellii*, 2 females, 1 male, and 3 protonymphs; RSA-175 (ALP: 10.183), 4 males and 3 male deutonymphs; CE-254, 3 females, 7 males, 1 male deutonymph, 3 protonymphs; CE-298, 4 females, 3 males, 1 male deutonymph.

Geographical distribution: This mite was collected exclusively from *Pt. parnellii* at the Reserva Natural Serra das Almas. This bat species is thought to have a disjunct distribution in the Neotropics (Patton and Gardner, 2007); this is the first spinturnicid mite described from the southern host distribution, on *Pteronotus parnellii rubiginosus* Wagner, 1843.

Etymology: The specific epithet is a noun taken in apposition and is in reference to the type locality in Ceará, the Reserva Natural Serra das Almas (“Mountain Ridge of Souls”).

Remarks

In this study, 87% of the type series and additional material were collected on the host bat’s plagiopatagium following the methodology of Almeida et al. (2015).

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