Two New Species of the Genus *Periglischrus* (Acari: Mesostigmata: Spinturnicidae) on Two Bat Species of the Genus *Tonatia* (Chiroptera: Phyllostomidae) from Southeastern Mexico, with Additional Data from Panama

JUAN B. MORALES-MALACARA¹ AND JAVIER JUSTE²

Laboratorio de Acarología, Departamento de Biología Comparada, Facultad de Ciencias, Universidad Nacional Autónoma de México, Coyoacán 04510, Distrito Federal, México

J. Med. Entomol. 39(2): 298–311 (2002)

ABSTRACT Two new species of spinturnicid mites of the genus *Periglischrus* are described and illustrated from phyllostomid bats from southeastern Mexico: The female, male, and protonymph of *Periglischrus steresotrichus*, new species, from *Tonatia evotis* Davis & Carter, and the female and male of *Periglischrus eurysternus*, new species, from *Tonatia saurophila* Koopman & Williams. A supplementary description of the male deutonymph of *P. eurysternus* from *T. saurophila* from Panama is given. The morphological features of the two new species of *Periglischrus* are used as a basis for discussing their phylogeny and its potential relationship to that of their hosts.

KEY WORDS Spinturnicidae, *Periglischrus steresotrichus*, *Periglischrus eurysternus*, *Tonatia*, bat ectoparasites

THE EXTERNAL MORPHOLOGY of the genus *Periglischrus* Kolenati, 1857 is conservative. For this reason, the traditional morphotaxonomical characters used at the species level are well defined. However, the overall similarity of some species makes it difficult to tell them apart (Morales-Malacara 2001). As a consequence, some species records have been incorrect, and new species have been erroneously described, as pointed out by Furman (1966) in his addendum, resulting in a small list of synonyms related with Machado-Allison's previous work (Machado-Allison 1964, 1965). Machado-Allison (1965) and Herrin and Tipton (1975) proposed some additional morphological features and biometric analyses as taxonomic criteria for species in the genus. However, many taxonomic questions remain about *Periglischrus* species. More recently, Morales-Malacara (2001) presented a significant new morphological analysis intended to strengthen taxonomic understanding of *Periglischrus* and to examine evolutionary trends within the genus. The morphological diversity now recognized in *Periglischrus* has provided additional diagnostic characters suitable for practical differentiation of the species. The resulting analysis has led to recognition of undescribed species additional to the 22 previously known species in *Periglischrus* (Morales-Malacara 2001, Morales-Malacara and López-Ortega

2001), all associated with phyllostomid bats in the Americas. Two of the new species, *Periglischrus* sp. B, and *Periglischrus* sp. A, belong to the *acutisternus*-clade (sensu Morales-Malacara 2001), and both are associated with the bat genus *Tonatia* Gray. In this paper we described these two new species. They are the first records of spinturnicid mites known to occur on *Tonatia evotis* Davis & Carter and *T. saurophila* Koopman & Williams, and they represent the 23th and 24th species named in the genus.

Materials and Methods

The *Periglischrus* specimens were collected by J. Galván, H. Arita, and R. Medellín in Chiapas and Quintana Roo, Mexico. Originally all mites were deposited in the collection of J.B.M-M. (MM). Additional specimens, collected in Panama by J. Juste, were obtained on loan from the mite collection of the Field Museum of Natural History (FMNH). Supplementary types and additional material of *Periglischrus tonatii* Herrin and Tipton, 1975, for a comparative analysis, were obtained on loan from the mite collections of the National Museum of Natural History, Smithsonian Institution (NMNH), and the Universidad Central de Venezuela (UCV).

Material Examined. *Periglischrus tonatii* Allotype ♂, ex *Tonatia carrikeri*, T. F. Amazonas, 163 km ESE Pto. Ayacucho, Venezuela, 24.VII.67 (SVP28813) (NMNH). *P. tonatii* Paratype DN ♀, ex *Tonatia brasiliensis*, T. F. Amazonas, 163 km ESE Pto. Ayacucho, Venezuela,

¹ E-mail: jbm@hp.fciencias.unam.mx.

² Estación Biológica de Doñana (CSIC), Avda. Ma Luisa s/n Sevilla 41080 Spain.

Figs. 1-2. *Periglischrus steresotrichus* n. sp., female. (1) Dorsum. (2) Dorsal plate.

24.VII.67 (SVP30068) (NMNH). *P. tonatii* 1 ♀, ex *Tonatia silvicola*, Capibara, Río Casiquiare, Edo. Amazonas (no date), R. Guerrero (N°19359-D) (UCV).

The bats collected in Mexico were deposited in the Colección Nacional de Mamíferos, Instituto de Biología, Universidad Nacional Autónoma de México (CNMA); and the bats collected in Panama were deposited in the mammal collections of the Museum of Texas Tech University (TTU), Lubbock, TX; and Estación Biológica de Doñana (EBD), Seville, Spain. For each host bat in the type series, the collector's field number is given. All mites were mounted in Hoyer's medium. Drawings were made with a phase contrast Zeiss microscope (Göttingen, Niedersachsen, Germany) with drawing tube. The nomenclature for idiosomal chaetotaxy follows Domrow (1972), and the foveae pattern nomenclature is from Morales-Malacara (2001). All measurements are in micrometers.

***Periglischrus steresotrichus* Morales-Malacara & Juste, new species (Figs. 1-12)**

Diagnosis. Female and male with four pairs of small proteronotal setae (Pn1-Pn4); setae Pn5 absent. Female sternal plate subpentagonal in shape, with a small subtriangular platelet just anterior to border of plate.

Female. Idiosoma broadly ovoid in prosomal portion, with enlarged opisthosoma. **Dorsum** (Fig. 1). Dorsal plate oblong-oval, longer than wide; anterior border rounded, with moderately defined anterolateral shoulders; posterior end narrower, broadly rounded; posterior one-fourth divided from anterior portion of plate by narrow transverse band of unsclerotized integument, with two distinct bridges connecting the two sections of plate; with 19 pairs of pores and micropores and five pairs of microsetae; with large or small and pale celled foveae arranged in groups of 1-5-2-2-2 (these last two foveal rows look like one row of four, because they are located almost at the same level)-2-2, and with a longitudinal partially darkened keel in the central area of plate (Fig. 2). Four pairs of small proteronotal setae (Pn1-Pn4); setae Pn5 absent; setae Pn1 located almost at level of anterior border of dorsal plate, setae Pn2-Pn4 located lateral to dorsal plate; distance between Pn1-Pn2 (41-47) < Pn2-Pn3 (59-67). Five pairs of hysteronotal setae: one pair of small poststigmatal setae (Pst) and four pairs of minute opisthosomal setae, plus one unpaired and minute seta on caudal dorsum over the anal orifice. Peritreme entirely dorsal and long, extending from level between coxa III and IV to level of coxa I. **Venter** (Fig. 3). Sternal plate subpentagonal in shape (Fig. 4), slightly

Figs. 3–4. *Periglischrus steresotrichus* n. sp., female. (3) Venter. (4) Sternal plate.

longer than wide, and darkly sclerotized over most of plate; anterolateral and posterolateral borders of plate straight; posterior margin slightly concave; anterior margin rounded, with a small subtriangular platelet just anterior to anterior border of plate. Three pairs of small sternal setae on the border of plate, with two pairs of pores. One pair of small metasternal setae situated between posterior border of sternal plate and anterior border of genital plate. Genital plate quite broad and elongate, anterior border wider and rather rounded; posterior margin with rounded tip; genital setae small, located on lateral borders and near rounded end of plate. Ventral opisthosoma with 11 pairs of minute to small setae; first pair of setae posterior to genital plate minute. Small pair of adanal setae located near caudal border of idiosoma and ventral to anal orifice. Ventral opisthosoma with two pairs of loboid sclerotized regions and one central elongated sclerotized area. *Legs*. Setation of legs as in Table 1. Ventral leg setae small to long, some serrated. Coxa I with two small and slender setae of equal size and a diagonal posterolateral ridge; coxa II with small and slender anterior seta, long posterior seta, and straight posterior ridge with a lateral angle; coxa III with very small and slender anterior seta, small and slightly ba-

sally robust posterior seta, and a curved posterolateral ridge; coxa IV with very small and slender seta and small slightly curved distal ridge. Posterolateral setae of trochanter II, femora I–II, genua I–II, tibiae I–II, one posterolateral seta of tarsus I, and three posterolateral setae of tarsus II medium to long, slender, curved and with tiny serrations (Figs. 5–6); one posteroventral seta of genua II–III, tibiae I–III, and tarsi I–III small, robust, truncated, fan-shape and with finely serrated tip. One anteroventral seta of trochanter III, femur III, genu III, tibiae III–IV, one anterolateral seta of genu III, tibiae III–IV and three anterolateral setae of tarsi III–IV long, quite robust, slightly curved and with tiny serrations (Figs. 7–8). Posterolateral setae of femur IV, genu IV, and tibia IV short to medium-sized, quite robust basally, with straight or sometimes curved filamentous end (Fig. 8). Dorsal leg setae short to long or very long; all distal dorsal setae of trochanters II–IV, femora I–IV, genua I–IV, one distal posterodorsal seta of tibia I, and one distal dorsal seta of tibiae II–IV long to very long, quite robust, and slender with tiny serrations; femur I with proximal anterodorsal seta short, and proximal posterodorsal long; femora II–III with both proximal dorsal setae minute; femur IV with both proximal dorsal setae very small. *Gnathosoma*. The

Figs. 5–8. *Periglischrus steresotrichus* n. sp., female, legs, ventral view (anterior upper). (5) I. (6) II. (7) III. (8) IV.

gnathosomal base is subrectangular in outline, with hypostomals 1 moderate in size, hypostomals 2 inapparent, and hypostomals 3 as microsetae; gnathosomal setal pair very small; palpi moderately slender with palpal setae small; trochanter–tarsus chaetotaxy formula 1-4-6-8-10 + thin and setiform undivided apotele. Mediodistal lobe of palpal tibia moderately produced and rounded.

Measurements. HOLOTYPE ♀ (followed in parentheses by range and mean of 2 PARATYPE ♀♀ and HOLOTYPE ♀): Idiosoma length 1,150 (1,125–1,153, 1,143), width at level of coxae II–III 563 (563–592, 578), width at midlevel of opisthosoma 1,129 (1,080–1,129, 1,100); dorsal plate length 372 (372–392, 381), width 274 (272–282, 276); sternal plate length 114 (114–135, 125), width, 115 (115–127, 122); genital plate length 98 (96–98, 97). Setal lengths: Pn1, 19 (19–22, 21); Pn2, 20 (20–23, 21); Pn3, 22 (21–24, 22); Pn4, 16 (16–20, 18); Pst, 19 (19–24, 21); St1, 17 (17–18, 17.3); St2, 22 (20–22, 21); St3, 19 (17–20, 18); genital setae 16 (16–18, 17); posterolateral seta of coxa II, 82 (77–88, 82).

Male. As in female except as noted. Smaller than female. Idiosoma ovoid, longer than wide. *Dorsum* (Fig. 9). Dorsal plate oblong-oval, with anterior border weakly protuded and rounded, and with somewhat angular anterolateral shoulders; some foveae smaller than in female and weakly discernible, and arranged in groups of 1-5-2-2-2-2-2-2; with longitudinal unsclerotized crack in the central area of plate moderately wide and ending at level of posterior portion of the fifth foveal row. Four pairs of small proteronotal setae as in female; setae Pn1 and Pn2 located

on integument contiguous to anterolateral border of dorsal plate; distance between Pn1–Pn2 (41–45) < Pn2–Pn3 (50–58). Two pairs of hysteronotal setae: poststigmatal setae small, and one pair of minute caudal setae, plus one minute unpaired seta on caudal dorsum. *Venter* (Fig. 10). Sternogenital plate flask-shaped, longer than wide, and darkly sclerotized over most of plate; anterior border essentially constituted by broad genital opening; anterolateral borders of plate angular and slightly concave; lateral borders nearly straight; posterolateral borders nearly straight but slightly convex, and posterior margin with a narrow and rounded tip; two pairs of pores; all setae on sternogenital plate long; sternogenital setae St1, St2, and St4 and genital setae on borders of plate, and St3 situated posterior to second pair of pores. Setae St1 long and extending distinctly beyond first pair of pores. Intercoxal IV area with eight pairs of setae: first pair very small (14–17) situated posterior to sternogenital plate; all other seven pairs of setae small in size (18–24), four pairs on intercoxal IV plate (including one pair of adanal setae) and three pairs situated on anterior and lateral integument, and close to the intercoxal plate. Anus terminal. *Legs.* Setation of legs as in Table 2. Ventral leg setae small to medium-sized, some with almost imperceptible serrations; coxa I with two medium-sized setae of equal size and diagonal slightly curved posterolateral ridge; coxa II with a medium-sized anterior seta, long posterior seta, and long nearly straight posterior ridge; coxa III with small anterior seta, medium-sized posterior setae, and curved ridge; coxa IV with small and thin seta and

Figs. 9–10. *Periglischrus steresotrichus* n. sp., male. (9) Dorsum. (10) Venter.

strong angulate ridge. Posterolateral setae of trochanter II, femora I–II, genua I–II and tibiae I–II small to medium in size, slender, and curved. One anterolateral seta of trochanter III, femora III–IV, genua III–IV, and tibiae III–IV medium-sized, slender, and slightly curved. One posteroventral seta of femora I–III, genua I–III moderately small, quite robust basally, and spine-like; one proximal posteroventral seta of tarsi I–III very small, quite robust, and spine-like with moderately bluntly pointed tip. Dorsal leg setae short to long or very long; all distal dorsal setae of trochanters II–IV medium-sized, robust, and slender with tiny serrations; all distal dorsal setae of femora I–IV, genua I–IV, and both proximal dorsal setae of tarsi III–IV long to very long, robust, and slender with tiny serrations; femur I with proximal anterodorsal seta small, and proximal posterodorsal medium in size; femur II with proximal anterodorsal seta minute, and proximal posterodorsal very small; femur III with both proximal dorsal setae minute; femur IV with proximal anterodorsal seta small, and posterodorsal seta minute. *Gnathosoma*. Trochanter-tarsus chaetotaxy formula as in female, except ventral seta on palpal trochanter very small, robust, truncated and with fan-shape. Palpal tibia without mediobasal lobe. Spermadactyl long and curved.

Measurements. ALLOTYPE ♂ (followed in parentheses by range and mean of 7 PARATYPE ♂♂ and ALLOTYPE ♂ [exceptions noted]): Idiosoma length 435 (408–435, 416); width 357 (329–359, 340); dorsal plate length 362 (357–363, 360); width 286 (259–286,

267); sternogenital plate length 218 (192–218, 202); width 157 (131–157, 145). Setal lengths: Pn1, 20 (20–21, 20.3 [$n = 7$]); Pn2, 22 (19–22, 21 [$n = 7$]); Pn3, 22 (21–26, 23.5); Pn4, 19 (18–24, 21); Pst, 20 (19–24, 22); St1, 51 (47–59, 52); St2, 49 (47–54, 51); St3, 40 (36–43, 40); St4, 40 (39–46, 42); gen, 33 (29–37, 33); posterolateral seta of coxa II, 51 (51–69, 63). Spermadactyl length 157 (153–170, 162 [$n = 7$]).

Female and Male Deutonymphs. Unknown.

Protonymph. As male except as noted. Smaller than male. *Dorsum* (Fig. 11). Dorsal plate with anterior median border protuding and rounded; with 15 or 16 pairs of pores and micropores and five pairs of microsetae; some foveae smaller than in male, weakly discernible, and arranged in groups of 1 (subdivided: 2)–3–2–2–2–2–2; with longitudinal unsclerotized crack in the middle of plate, wider and longer than in male and ending at level of central band of unsclerotized integument between two small bridges connecting the two sections of plate. Four pairs of proteronotal setae, and one pair of poststigmatal setae small to medium sized. Setae Pn1 and Pn2 located on integument very close to anterolateral border of dorsal plate; distance between Pn1–Pn2 (30–33) < Pn2–Pn3 (67–68). Peritreme short, lying over coxa III. *Venter* (Fig. 12). Sternal plate flask-shaped, longer than wide, and darkly sclerotized over most of plate; anterior border truncated and quite broad; anterolateral borders of plate concave; posterior margin with a moderately narrow and rounded tip; sternal setae St1–St3 long, on the border of plate, with two pairs of pores. Intercostal IV

Figs. 11–12. *Periglischrus steresotrichus* n. sp., protonymph. (11) Dorsum. (12) Venter.

area with five pairs of setae: first pair medium in size (18–19); all other four pairs of setae medium in size but a little longer (23–26) than first pair: three pairs of setae located on integument anterior to small intercoxal plate; fourth pair (adanal setae) situated on posterior edge of intercoxal plate. Anus terminal. *Legs*. Coxa I with a small posterolateral subtriangular and unsclerotized slit. Setation of legs as in Table 3. Ventral leg setae size and porportions as in male. *Gnathosoma*. Trochanter-tarsus chaetotaxy formula 1-4-5-8-10 + thin and setiform undivided apotele.

Measurements. PARATYPE PN (followed in parentheses by range and mean of 3 PARATYPE PNN and the previous PARATYPE PN [exceptions noted]): Idiosoma length 448 (412–466, 448); width 367 (327–405, 372); dorsal plate length 399 (372–415, 398); width 290 (257–297, 281 [$n = 3$]); sternal plate length 167 (149–174, 166); width 145 (124–153, 143). Setal lengths: Pn1, 29 (27–29, 28); Pn2, 29 (28–29, 29); Pn3, 37 (25–37, 32); Pn4, 24 (23–24, 24); Pst, 24 (23–27, 25); St1, 49 (43–51, 47); St2, 51 (45–51, 47); St3, 39 (35–41, 39); posterolateral seta of coxa II, 63 (61–68, 65).

Type Series. HOLOTYPE ♀, ALLOTYPE ♂, 1 PARATYPE ♂, and 3 PARATYPE PNN, ex *Tonatia*

evotis ♀, Estación Chajul, Reserva Montes Azules, Ococingo, Chiapas, México, 31-I-86, J. Galván (CNMA/778JG) (IBUNAM 23725). 5 PARATYPE ♂♂, 1 PARATYPE PN, ex *Tonatia evotis*, 4 km S, 1 km W Bacalar, Quintana Roo, México, 19.IV.83, H. Arita (CNMA/329HAW) (IBUNAM 20113). 1 PARATYPE ♂, ex *Tonatia evotis* ♂, same data, 19.IV.83, H. Arita (CNMA/339HAW) (IBUNAM 20114). 2 PARATYPE ♀♀, ex *Tonatia evotis* ♂, same data, 19.IV.83, R. Medellín (CNMA/1175RAML).

The holotype, allotype, 1 paratype ♂, and 1 paratype PN are deposited in the Colección Nacional de Acaros (CNAC) at the Instituto de Biología, Universidad Nacional Autónoma de México. The remaining paratypes are in the Morales-Malacara Collection (1 ♀, 2 ♂♂, 3 PNN); National Museum of Natural History, Smithsonian Institution, Washington, DC (1 ♀, 1 ♂); B.P. Bishop Museum, Honolulu, HI, (2 ♂♂); Natural History Museum, London (1 ♂); Field Museum of Natural History, Chicago IL (1 ♂).

Etymology. The species name is composed from the Greek *steresis* meaning “deprivation, loss” and *trichos* “hair,” referring to the absence of one pair of proteronotal setae on dorsum.

Table 1. Leg chaetotaxy of female of *P. steresotrichus*

	Coxa	Trochanter	Femur	Genu	Tibia	Tarsus
Leg I	2	1-0/3-1 (5)	2-4/3-2 (11)	1-4/2-1 (8)	1-4/3-1 (9)	4-19/6-4 (33)
II	2	1-1/3-1 (6)	2-4/3-1 (10)	1-3/2-1 (8)	1-3/3-1 (8)	3-5/5-3 (16)
III	2	1-1/3-0 (5)	1-3/2-0 (6)	1-4/3-1 (9)	1-3/3-0 (7)	3-5/5-3 (16)
IV	1	1-1/3-0 (5)	1-3/1-1 (6)	0-4/2-1 (7)	1-3/2-1 (7)	3-5/5-3 (16)

Table 2. Leg chaetotaxy of male of *P. steresotrichus*

	Coxa	Trochanter	Femur	Genu	Tibia	Tarsus
Leg I	2	0-0/4-1 (5)	2-4/4-1 (11)	1-4/3-1 (9)	1-5/3-1 (10)	4-20/7-4 (35)
II	2	1-1/3-1 (6)	2-4/3-1 (10)	1-4/3-1 (9)	1-3/3-1 (8)	3-5/5-3 (16)
III	2	1-1/3-0 (5)	1-3/2-0 (6)	1-4/4-1 (10)	1-3/3-1 (8)	3-5/5-3 (16)
IV	1	1-1/3-0 (5)	1-3/2-0 (6)	1-4/4-1 (10)	1-3/4-1 (9)	3-5/5-3 (16)

Remarks. There was only one spinturnicid record on *T. evotis*, misidentified as *Periglischrus tonatii*, from Quintana Roo, Mexico (Morales-Malacara 1996). However, after an exhaustive morphological analysis that included a comparative analysis of the type material of *P. tonatii*, and other additional material from *T. silvicola* from Venezuela, it was possible to rectify the former conclusion, and the mite was found to be an unknown species, referred as *Periglischrus* sp. B, by Morales-Malacara (2001), which is herein described as *Periglischrus steresotrichus*. It represents the first record of a spinturnicid mite on *Tonatia evotis*, the 23rd species named in the genus, and the 13th species of the genus recorded from Mexico.

The presence of *Periglischrus steresotrichus* on *Tonatia evotis* in two different localities and different collecting dates suggests that it is a monoxenous species. If so, its distribution may be correlated to that of *Tonatia evotis*, which occurs from central Honduras northward to the moist tropical regions of Chiapas, Tabasco, southern Veracruz, Campeche, and southern Quintana Roo (Sánchez-Herrera et al. 1986, Medellín and Arita 1989).

Periglischrus steresotrichus is phenetically closely related to *P. tonatii*, but is easily distinguished from it and other known species of the genus by the absence of the fifth proteronotal setae (Pn5) in adults and deutonymphs. Absence from the deutonymphs is known because we can see within two paratype protonymphs both female and male deutonymphs. Additionally, *P. steresotrichus* differs from *P. tonatii* in the shape of the small subtriangular platelet just anterior to the border of the female sternal plate.

Periglischrus eurysternus Morales-Malacara and Juste, new species (Figs. 13–24)

Diagnosis. Female sternal plate pear-shaped, with a broadly rounded anterior border. Genital plate broad and only slightly elongate; genital setae small and moderately robust. Two pairs of setae posterior to genital plate small, rather robust and very inflated.

Female. Idiosoma broadly ovoid in prosomal portion, with enlarged opisthosoma. *Dorsum.* (Fig. 13). Dorsal plate oblong-oval, longer than wide; anterior

border broadly rounded; posterior end narrower, broadly rounded; posterior one-fourth divided from anterior portion of plate by narrow transverse band of unsclerotized integument, with two distinct bridges connecting the two sections of plate; with 17 pairs of pores and micropores and five pairs of microsetae; with large or small and pale celled foveae arranged in groups of 1-5-2-4-2-2-2, and with a narrow longitudinal unsclerotized crack in the center of plate. Five pairs of minute to small (7–23) proteronotal setae; setae Pn1 and Pn2 located on integument contiguous to anterolateral border of dorsal plate; setae Pn3–Pn5 located lateral to dorsal plate; distance between Pn1–Pn2 (39–45) < Pn2–Pn3 (49–55). Five pairs of hysteronotal setae: one pair of very small poststigmatal setae (Pst) and four pairs of minute opisthosomal setae, plus one unpaired and minute seta on caudal dorsum over the anal orifice. Peritreme entirely dorsal and long, extending from level between coxa III and IV to level of coxa I. *Venter* (Fig. 14). Sternal plate pear-shaped, with a broadly rounded anterior border (Fig. 15), slightly longer than wide, and darkly sclerotized over most of the plate; anterolateral borders of plate straight; lateral borders slightly convex; posterior margin slightly concave; three pairs of small sternal setae on the border of plate, with two pairs of pores. One pair of small and somewhat robust metasternal setae laterally flanking posterior border of sternal plate. Genital plate broad and only slightly elongate; anterior border wider than posterior and rounded; posterior portion subtriangular with narrowly pointed tip; genital setae small and rather robust, located on lateral borders and near to subtriangular end of plate. Three pairs of setae posterior to genital plate minute to small: First pair of setae minute, second and third pairs small, rather robust and greatly inflated with finely acute tips. Ventral opisthosoma with nine pairs of minute to small setae. Adanal pair of small setae located near caudal border of idiosoma and ventral to anal orifice. Ventral opisthosoma with two pairs of sclerotized lobules and one central elongated sclerotized area. *Legs.* Setation of legs as in Table 4. Ventral leg setae small to long, some serrated; coxa I with small, slender proximal seta slightly longer than distal seta, and a diagonal and weakly curved posterolateral ridge. Coxa II with

Table 3. Leg chaetotaxy of protonymph of *P. steresotrichus*

	Coxa	Trochanter	Femur	Genu	Tibia	Tarsus
Leg I	2	0-0/3-1 (4)	2-4/3-1 (10)	1-4/2-1 (8)	1-4/2-1 (8)	3-16/6-3 (28)
II	2	1-0/2-1 (4)	1-4/2-1 (8)	1-4/2-1 (8)	1-3/2-1 (7)	3-5/4-3 (15)
III	2	1-1/2-0 (4)	1-3/1-0 (5)	1-4/2-1 (8)	1-3/2-0 (6)	3-5/4-3 (15)
IV	1	1-1/2-0 (4)	1-3/0-0 (4)	1-4/2-1 (8)	1-3/2-1 (7)	3-5/4-3 (15)

Figs. 13–14. *Periglischrus eurysternus* n. sp., female (13) Dorsum, (14) Venter.

small and moderately basally robust anterolateral seta, long posterolateral seta, and nearly straight and posterolaterally angulate ridge; coxa III with very small and slender anterior seta, small and slightly basally robust posterior seta, and nearly straight posterolateral ridge; coxa IV with small and slender seta and a curved distal ridge. Posterolateral setae of trochanter II, femur II, genua I–II, tibiae I–II, and one posterolateral setae of tarsus II medium to long, slender, curved and with tiny serrations; one posteroventral seta of genua II, tibia II, and tarsi I–II short, stout, knifelike and with bluntly pointed tip; one anteroventral seta of trochanters I–II, femora I–II, and genu II small, robust, spinelike and with bluntly pointed tip. One anterolateral and one anteroventral setae of tibia IV, long, quite robust, curved and with tiny serrations. Posterolateral setae of femur IV, genu IV, Tibia IV, and proximal posterolateral seta of tarsus IV medium to long, quite robust basally, with straight or sometimes curved filamentous end (Figs. 18–19). Dorsal leg setae short

to long or very long; all distal dorsal setae of trochanters II–IV, femora I–IV, genua I–IV, tibiae III–IV, two proximal dorsal setae of tarsus III, and two anterodorsal setae of tarsus IV long to very long, quite robust, and slender with tiny serrations; femur I with proximal anterodorsal seta minute and proximal posterodorsal seta long; femur II with proximal anterodorsal seta minute and proximal posterodorsal medium-sized; Femur III with both proximal dorsal setae minute; femur IV with both proximal dorsal setae very small. *Gnathosoma*. The gnathosomal base is subrectangular in outline, with hypostomals 1 moderate in size, hypostomals 2 inapparent, and hypostomals 3 as microsetae; gnathosomal setal pair very small; palpi quite slender with palpal setae small; trochanter–tarsus chaetotaxy formula 1-4-6-8–10 + thin and setiform undivided apotele. Mediodistal lobe of palpal tibia slightly produced and rounded.

Measurements. HOLOTYPE ♀ (followed in parentheses by range and mean of 3 PARATYPE ♀♀ and

Table 4. Leg chaetotaxy of female of *P. eurysternus*

	Coxa	Trochanter	Femur	Genu	Tibia	Tarsus
Leg I	2	1-0/3-1 (5)	2-4/4-1 (11)	1-4/2-1 (8)	1-4/3-1 (9)	4-19/6-4 (33)
II	2	1-1/3-1 (6)	2-4/3-1 (10)	1-4/2-1 (8)	1-3/3-1 (8)	3-5/5-3 (16)
III	2	0-1/4-0 (5)	0-3/2-1 (6)	1-4/3-1 (9)	1-3/3-0 (7)	3-5/5-3 (16)
IV	1	0-1/4-0 (5)	0-3/2-1 (6)	0-4/3-1 (8)	1-3/3-1 (8)	3-5/5-3 (16)

Figs. 15–19. *Periglischrus eurysternus* n. sp., female. (15) Sternal plate. (16) Leg I ventral view. (17) Leg II ventral view. (18) Leg III ventral view. (19) Leg IV ventral view.

HOLOTYPE ♀ [exceptions noted]: Idiosoma length 860 (731–860, 795 [$n = 2$]), width at level of coxae II–III 445 (351–445, 388 [$n = 3$]), width at midlevel of opisthosoma 690 (470–690, 580 [$n = 2$]); dorsal plate length 367 (357–370, 364), width 275 (268–284, 274); sternal plate length 124 (118–140, 128), width, 116 (100–129, 114); genital plate length 85 (77–85, 81). Setal lengths: Pn1, 8 (7–8, 8); Pn2, 16 (15–19, 16); Pn3, 20 (20–23, 22); Pn4, 12 (10–12, 11); Pn5, 8 (7–8, 8); Pst, 12 (10–12, 11); St1, 12 (12–14, 13); St2, 17 (16–18, 17); St3, 17 (17–18, 18); genital setae 14 (14–16, 15); posterolateral seta of coxa II, 73 (73–82, 78).

Male. As in female except as noted. Smaller than female. Idiosoma ovoid, longer than wide. *Dorsum* (Fig. 20). Dorsal plate oblong-oval, with anterior border nearly rounded, and with weakly rounded anterolateral shoulders; with 13 pairs of pores and micropores and five pairs of microsetae; some foveae smaller than in female; with longitudinal unsclerotized crack in the central area of plate as in female. Proteronotal setae small; setae Pn1 and Pn2 located on integument contiguous to anterolateral border of dorsal plate; distance between Pn1–Pn2 (37) < Pn2–Pn3 (58). Two pairs of hysteronotal setae; poststigmatal setae small, and one pair of minute caudal setae plus 1 minute unpaired

seta on caudal dorsum. *Venter* (Fig. 21). Sternogenital plate somewhat jar-shaped, longer than wide, and darkly sclerotized over most of the plate; anterior border essentially constituted by broad genital opening; anterolateral borders of plate short, and nearly rounded; lateral borders rounded; posterolateral borders curved and posterior margin nearly truncated; two pairs of pores; all setae on sternogenital plate moderately long; sternogenital setae St1, St2, and St4 and genital setae on borders of plate, and St3 situated posterior to second pair of pores. Setae St1 moderately long, extending only to first pair of pores (on additional specimen, setae St1 extending slightly beyond first pair of pores). Intercoxal IV area with eight pairs of setae: first pair very small (10), situated posterior to sternogenital plate; all seven other pairs of setae small in size (16–25), four pairs on intercoxal IV plate (including one pair of adanal setae) and three pairs situated on anterior and lateral integument, and close to the intercoxal plate. Anus terminal. *Legs.* Setation of legs as in Table 5. Ventral leg setae small to medium-sized, some serrated; coxa I with two medium-sized setae of equal size and curved posterolateral ridge associated with small subtriangular and unsclerotized lateral slit; coxa II with a medium-sized anterior seta,

Figs. 20–21. *Periglischrus eurysternus* n. sp., male. (20) Dorsum. (21) Venter.

long posterior seta, and long nearly straight posterior ridge; coxa III with rather small anterior seta, medium-sized posterior setae, and curved ridge; coxa IV with medium-sized seta, and moderately curved ridge. Posterolateral setae of trochanter II, femora I–II, genua I–II and tibiae I–II small to medium in size, slender, and somewhat curved. One anterolateral seta of femur III, genua III–IV, and tibiae III–IV medium to somewhat long in size, slender, and straight or slightly curved. One anteroventral seta of trochanters I–II, femora I–II, and genu II small, robust, spinelike and with bluntly pointed tip as in female. One posteroventral seta of Genu II, tibiae II, and one proximal posteroventral seta of tarsi I–II short, stout, knifelike and with bluntly pointed tip as in female; One anterolateral seta of trochanter IV, femur IV, one anteroventral seta of

genu IV, tibia IV, one posteroventral seta of femur III, genua III–IV, tibiae III–IV, one posterolateral seta of genu IV, tibia IV, and two proximal anterolateral and posterolateral setae of tarsi III–IV somewhat medium in size, quite robust, and spinelike. (Fig. 21). Dorsal leg setae short to long or very long; all distal dorsal setae of trochanters II–IV medium sized, robust, and slender with tiny serrations; all distal dorsal setae of femora I–IV, genua I–IV, and both proximal dorsal setae of tarsi III–IV long to very long, robust, and slender with tiny serrations; femur I with proximal anterodorsal seta rather small, and proximal posterodorsal moderately long; femur II with proximal anterodorsal seta minute, and proximal posterodorsal medium sized; femur III with proximal anterodorsal seta rather small, and proximal posterodorsal minute; femur IV with proximal

Table 5. Leg chaetotaxy of male of *P. eurysternus*

	Coxa	Trochanter	Femur	Genu	Tibia	Tarsus
Leg I	2	0-0/4-1 (5)	2-4/3-2 (11)	1-4/3-1 (9)	1-5/3-1 (10)	4-20/7-4 (35)
II	2	1-1/3-1 (6)	2-4/3-1 (10)	1-3/3-1 (9)	1-3/3-1 (8)	3-5/5-3 (16)
III	2	1-1/3-0 (5)	1-3/2-0 (6)	1-4/3-1 (9)	1-3/3-1 (8)	3-5/5-3 (16)
IV	1	1-1/3-0 (5)	1-3/2-0 (6)	1-4/3-1 (9)	1-3/3-1 (8)	3-5/5-3 (16)

Figs. 22–24. *Periglischrus eurysternus* n. sp., male deutonymph. (22) Dorsum. (23) Venter. (24) Leg I ventral view.

anterodorsal seta moderately long, and posterodorsal seta minute. *Gnathosoma*. Palpal tibia without medio-distal lobe. Spermadactyl very long and curved.

Measurements. ALLOTYPE ♂: Idiosoma length 451, width 351; dorsal plate length 378, width 259; sternogenital plate length 208, width 159. Setal lengths: Pn1, 17; Pn2, 23; Pn3, 26; Pn4, 17; Pn5, 20; Pst, 22; St1, 41; St2, 45; St3, 38; St4, 41; gen, 37; posterolateral seta of coxa II, 33. Spermadactyl length 214.

Female Deutonymph and Protonymph. Unknown.

Male deutonymph Description Based on Additional Material Examined from Panama. As in male except as noted. Smaller than male. *Dorsum* (Fig. 22) Dorsal plate with celled foveae almost imperceptible, and arranged in groups of 3-2-2-2-2; with longitudinal unsclerotized crack as in male. *Venter* (Fig. 23). Sternal plate flask-shaped, longer than wide, and darkly sclerotized over most of plate; anterior border somewhat narrow and truncated, and posterolateral borders narrowed to an acute angle at posterior end. Sternal setae St1-St3 moderately long, on borders of plate. Meta-sternal seta (St4) moderately long, laterally flanking

posterolateral borders of sternal plate. Genital setae moderately long, located immediately posterior to posterior end of sternal plate. Intercoxa IV area with eight pairs of very small to small setae: first pair as very small setae (10) situated posterior to genital setae; all other seven pairs of setae short to small (11–19), five pairs located on integument anterior to small intercoxal plate; sixth pair situated on lateral integument and close to intercoxal plate, and seventh pair (adanal setae) situated on posterior edge of intercoxal plate. *Legs*. Setation of legs as in male (Table 5). Ventral leg setae size and proportions as in male; except anteroventral seta of genu I small, robust, spinelike and with bluntly pointed tip; two posteroventral setae of femur I, one posteroventral seta of genu I, and tibia I rather small, spinelike and with acute tip (Fig. 24). *Gnathosoma*. Trochanter-tarsus chaetotaxy formula as in adults.

Measurements. 1 DN♂ (followed in parentheses by range and mean of 2 DNN♂ and the previous DN♂ [exceptions noted]): Idiosoma length 415 (412–423, 417) width 335 (335–337, 336); dorsal plate length 355

(355–363, 358); width 257 (245–257, 252); sternogenital plate length 159 (144–159, 151); width 123 (114–123, 118). Setal lengths: Pn1, 18 (18–19, 18.5 [$n = 2$]); Pn2, 23 (22–24, 23); Pn3, 20 (20–26, 23); Pn4, 19 (18–19, 19); Pn5, 17 (14–17, 15); Pst, 23 (19–24, 22); St1, 42 (39–43, 41); St2, 43 (41–43, 42); St3, 35 (35–39, 36); St4, 29 (29–32, 31); gen, 25 (25–29, 27); anterolateral seta of coxa II 31 (31–32, 31); posterolateral seta of coxa II, 39 (39–42, 41).

Type Series. HOLOTYPE ♀, ALLOTYPE ♂, and 3 PARATYPE ♀♀, ex *Tonatia saurophila* ♀, Arroyo José, Estación Chajul, Reserva Montes Azules, Ocoingo, Chiapas, México, 28.I.86, R.A. Medellín (CNMA/1628RAML).

Additional Material Examined. 1 DN♂, ex *Tonatia saurophila* ♀, Coiba island, Panama, 10.II.96, J. Juste (FMNH/NJJ7). 1 ♀, 2 DNN♂, ex *Tonatia saurophila* ♀, Coiba island, Panama, 14.II.96, J. Juste (FMNH/NJJ49). 3 ♀♀, 1 ♂, ex *Tonatia saurophila* ♂, Jicarón Island, Panama, 29.II.96, J. Juste (FMNH/NJJ218).

The holotype and allotype are deposited in the Colección Nacional de Acaros (CNAC) at the Instituto de Biología, Universidad Nacional Autónoma de México. The remaining paratypes are in the Morales-Malacara Collection (1 ♀); National Museum of Natural History, Smithsonian Institution, Washington, DC (1 ♀); Field Museum of Natural History, Chicago, IL (1 ♀).

Etymology. The species name is composed from the Greek *eury*s meaning “broad, wide,” and *sternon*, “breast, chest,” referring to the sternal plate of female with broad and rounded anterior border.

Remarks. Morales-Malacara (2001) mentioned a new spinturnicid mite, *Periglischrus* sp. A on *Tonatia bidens* from material obtained from Chiapas, Mexico (Medellín 1983, Medellín et al. 1997), but after the taxonomic revision of the *Tonatia bidens* complex made by Williams et al. (1995), we conclude that the host of this new *Periglischrus* sp. A really belongs to the *Tonatia saurophila* species.

The current description of *Periglischrus eurysternus* was based primarily on Mexican material, but additional material obtained from Panama on the same host (*T. saurophila*) was very useful for additional description of the male deutonymph and to ratify the strong morphological stability of this spinturnicid throughout its geographic distribution. The presence of *P. eurysternus* on *T. saurophila* in both Mexico and Panama suggests that it is a monoxenus species. Therefore, the distribution of *P. eurysternus* is expected to be correlated to that of *T. saurophila*, which occurs from southern Chiapas and Quintana Roo southward through Central America, and in South America, to Peru and eastward to Northeast Brazil (Williams et al. 1995).

Periglischrus eurysternus represents the first record of a spinturnicid mite on *Tonatia saurophila*, the 24th species named in the genus, the 14th species recorded from Mexico, and the 10th species recorded from Panama.

Periglischrus eurysternus is similar to *P. paratorrealbai*, particularly in the presence of the two pairs of

grossly inflated setae on the ventral idiosoma, the closely similar shape of the sternal plate of the females, the proportions in size of the proteronotal setae of females and males, and the very long and curved spermadactyl of males. But *P. eurysternus* is distinguished in the females by the more broadly rounded anterior border of sternal plate; setae Pn2 small but not minute; proximal seta larger than distal seta on coxa I; posterior seta on coxa III small, setiform, and slightly inflated; distance between setae Pn1–Pn2 < Pn2–Pn3; and in the males by the medium-sized coxa IV seta, and the anteroventral setae of femur I short, quite robust and spiniform but never inflated.

Discussion

The efforts of various authors to improve the morphological knowledge of spinturnicid mites (Rudnick 1960; Evans 1968; Deunff 1977, 1982; Estrada-Peña et al. 1989; Morales-Malacara 2001) have helped in examining evolutionary trends and have enhanced our understanding of host-parasite relationships (Morales-Malacara 2001).

According to Morales-Malacara and López-Ortega (2001), leg chaetotaxy shows intraspecific differences between adults in both new species (*P. steresotrichus* and *P. eurysternus*) and between deutonymphs of *P. eurysternus*, mainly in genu, tibia, and tarsus I. This feature confirms that it is a dimorphic character in the genus *Periglischrus*. Comparison of leg chaetotaxy between these two new species also shows hypotrichy in some leg segments, suggesting that different chaetotaxy patterns could be present in all the species groups of the genus *Periglischrus*, as has been shown in other spinturnicid genera (Estrada-Peña et al. 1989).

Morphological analysis of the genus *Periglischrus* by Morales-Malacara (2001) proposes a new grouping, with two separate evolutionary trends shown by phenetic clusters, or clades. Each clade is divided into four species groups based on their morphological similarities. In this arrangement, the two new species described herein as *Periglischrus steresotrichus*, from *Tonatia evotis*, and *P. eurysternus*, from *Tonatia saurophila*, belong to different species groups within the same *acutisternus* clade (sensu Morales-Malacara 2001). *P. steresotrichus* belongs to the *acutisternus* group, which includes four other species (*P. acutisternus*, *P. dusbabeki*, *P. paracutisternus*, and *P. tonatii*). All of them share a sclerotized projection or platelet at the anterior end of the sternal plate, the anterolateral corners of the sternogenital plate weakly marked, and long sternogenital setae. *P. eurysternus* belongs to the *torrealbai* group, that includes two other species (*P. torrealbai* and *P. paratorrealbai*). This group is characterized by a pear-shaped sternal plate with a somewhat narrow or broadly rounded anterior border; some ventral hysteronotal setae grossly enlarged, the proteronotal and poststigmatal setae very small in females and males, and the sternogenital plate with rounded lateral borders (Morales-Malacara 2001).

These two new and not closely related *Periglischrus* species are both found on the Neotropical phyllostomid bat genus *Tonatia* Gray. If the spinturnicid parasites are good indicators of relationships among hosts, it is to be expected that there will be evolutionary congruence in the host-parasites relationships. The bat genus *Tonatia*, defined by cranial and dental characters, seems a robust taxonomic entity and it is recognized in all recent taxonomic reviews of the family Phyllostomidae (Baker et al. 1989, Wetterer et al. 2000). The genus *Tonatia* was considered morphologically close to *Micronycteris* Gray (Goodwin 1942), but later phylogenetic approaches have associated it with the tribe Phyllostomini (Baker et al. 1989) and, finally, with the carnivorous tribe Vampyrini (Wetterer et al. 2000). At present, *Tonatia* has seven recognized species, traditionally arranged by size in three groups. Interestingly enough, the two new *Periglischrus* species, although belonging to the different phenetic branches *acutisternus* and *torrealbai*, are found on two species of the same large group of *Tonatia*. The morphological differences in these mites support that the size-based arrangement of *Tonatia* does not correspond to a natural group, as an allozyme-based study has suggested (Arnold et al. 1993). In fact, small and large bat species share external and cranial characters: e.g., *T. silvicola* (large) and *T. brasiliense* (small) show a similar marked postorbital constriction. Moreover, the presence of the same mite, *Periglischrus tonatii* (morphologically close to *P. steresotrichus*), on the large-sized *Tonatia silvicola* (Herrin and Tipton 1975) as well as on the middle-sized *T. carrikeri* (McCarthy et al. 1992) also supports this suggestion. However, the level of parasite/host evolutionary association between *Periglischrus* and *Tonatia* is still unclear: The parasites of some species of *Tonatia* are still unknown or undescribed. Also, while the taxonomic revision of the large (Davis and Carter 1978, Williams et al. 1995) and medium (Genoways and Williams 1980) species of *Tonatia* has been done, a revision of the small species of the group has not. The small species of *Tonatia* have been considered close to the still taxonomically confused genus *Micronycteris* (Goodwin 1942). The discovery of an additional undescribed *Periglischrus* sp. G on *T. brasiliense* (J.B.M.-M., unpublished data) supports this kin relationship between *Micronycteris* and *Tonatia*, because it belongs to the *gameri*-group, previously found on *Micronycteris*. The subgenera of *Micronycteris* have recently been elevated to a generic rank in the tribe Micronycterini within the subfamily Phyllostominae (Wetterer et al. 2000). Further phylogenetic analysis of the relationships within *Tonatia* and between it and *Micronycteris* may help to clarify this taxonomic question. At a higher taxonomic level, it is clear that the phenetic clade *acutisternus* of *Periglischrus* is mainly associated with the subfamily Phyllostominae (Morales-Malacara 2001). Interestingly enough, both mite groups *acutisternus* and *torrealbai* are found on bats of the tribes Vampyrini, Phyllostomini and Lonchorhinini within the subfamily Phyllostominae according to the last revision of the bat family Phyllostomidae (Wetterer et al. 2000). This

arrangement could indicate an occasional mite resource-tracking among the different groups of bats. However, the important ecological differences between these bats suggest a different scenario. In fact, the presence of the two mites groups in the three tribes of the Phyllostominae indicates more likely that the differentiation of the two groups of parasites took place, at least, at the same time that the differentiation of the Phyllostominae bats and that each bat tribe carried since then mites of the groups *acutisternus* and/or *torrealbai*.

Nevertheless, the understanding of this parasite/host co-evolution still requires a deeper understanding of the phylogenetic relationships within the considered mites and bats.

Acknowledgments

The senior author expresses his appreciation to Ronald Ochoa (National Museum of Natural History, Smithsonian Institution), who lent some type material; Ricardo Guerrero (Universidad Central de Venezuela), who lent other material; and The Field Museum of Natural History, which lent us all mite material from Panama. Field collection of the ectoparasitic mites from Mexico was performed by H. Arita, J. Galván, and R. Medellín. We also thank Laura del Castillo for her helpful assistance in mounting all the material on microscopic slides. For their comments on a draft of the manuscript, we express our appreciation to Livia León and Juan José Morrone (Departamento de Biología Evolutiva, Facultad de Ciencias, Universidad Nacional Autónoma de México) and Tila M. Pérez (Instituto de Biología, Universidad Nacional Autónoma de México). And my self, Juan B. Morales-Malacara, would like to express my deep thanks to the Instituto de Biología, Universidad Nacional Autónoma de México for its support in the achievement of this work during my sabbatical leave spent at it. And again, my appreciation to Tila M. Pérez for her valuable help during my permanence at the Instituto de Biología. The INRENARE of the Republic of Panama supported the studies in Coiba National Park. The Spanish Cooperation Agency (AECI) financed the research in Panama. Financial assistance in Mexico was provided by the Dirección General de Asuntos del Personal Académico, Universidad Nacional Autónoma de México, Grant No. IN214599.

References Cited

- Arnold, M. L., R. J. Baker, and R. L. Honeycutt. 1993. Genic differentiation and phylogenetic relationships within two new world bat genera. *Bioch. Syst. Ecol.* 11: 295–303.
- Baker, R. J., C. S. Hood, and R. L. Honeycutt. 1989. Phylogenetic relationships and classification of higher categories of the new world bat family Phyllostomidae. *Syst. Zool.* 38: 228–238.
- Davis, W. B., and D. C. Carter. 1978. A review of the round-eared bats of the *Tonatia silvicola* complex, with descriptions of three new taxa. *Occas. Pap. Mus. Tex. Tech Univ.* 53: 1–12.
- Deunff, J. 1977. Observations sur les Spinturnicidae de la région Paléartique occidentale (Acarina, Mesostigmata) spécificité, répartition et morphologie. *Acarologia* 18: 602–617.
- Deunff, J. 1982. Observations en microscopie électronique à Balayage sur la famille des Spinturnicidae (Acarina,

- Mesostigmata) I. Morphologie générale. *Acarologia* 23: 103–111.
- Domrow, R. 1972. Acari Spinturnicidae from Australia and New-Guinea. *Acarologia* 13: 552–584.
- Estrada-Peña, A., M. A. Peribáñez, and C. Sánchez. 1989. Observations on the leg chaetotaxy of the family Spinturnicidae (Acarina: Mesostigmata). *Acarologia* 30: 111–118.
- Evans, G. O. 1968. The external morphology of the post-embryonic developmental stages of *Spinturnix myoti* Kol. (Acari: Mesostigmata). *Acarologia* 10: 589–608.
- Furman, 1966. The spinturnicid mites of Panama, pp. 125–166. In R. L. Wenzel & V. J. Tipton [eds.]. *Ectoparasites of Panama*. Field Mus. Nat. Hist. U.S.A.
- Genoways, H. H., and S. L. Williams. 1980. Results of the Alcoa Foundation-Suriname expeditions. I. A new species of bat of the genus *Tonatia* (Mammalia: Phyllostomidae). *Ann. Carnegie Mus.* 49: 203–211.
- Goodwin, G. 1942. A summary of recognizable species of *Tonatia*, with description of two new species. *J. Mamm.* 23: 204–209.
- Herrin, C. S., and V. J. Tipton. 1975. Spinturnicid mites of Venezuela (Acarina: Spinturnicidae). *Brigham Young Univ. Sci. Bull. Biol. Ser.* 20: 1–72.
- Machado-Allison, C. E. 1964. Notas sobre Mesostigmata Neotropicales II. Cuatro nuevas especies de *Periglischrus* Kolenati, 1857. (Acarina, Spinturnicidae). *Rev. Soc. Mex. Hist. Nat.*, 25: 193–207.
- Machado-Allison, C. E. 1965. Las especies Venezolanas del género *Periglischrus* Kolenati, 1857 (Acarina, Mesostigmata, Spinturnicidae). *Acta Biol. Venez.* 4: 259–348.
- McCarthy, T. J., A. L. Gardner, and C. O. Handley Jr. 1992. *Tonatia carrikeri*. *Mamm. Spec.* 407: 1–4.
- Medellín, R. A. 1983. *Tonatia bidens* and *Mimon crenulatum* in Chiapas Mexico. *J. Mamm.* 64: 150.
- Medellín, R. A., and H. T. Arita. 1989. *Tonatia evotis* and *Tonatia silvicola*. *Mamm. Spec.* 334: 1–5.
- Medellín, R. A., H. T. Arita, and O. Sánchez. 1997. Identificación de los murciélagos de México clave de campo. Asociación Mexicana de Mastozoología, A.C., Mexico.
- Morales-Malacara, J. B. 1996. Mesostigmatid ectoparasites of bats in Mexico, pp. 105–108. In R. Mitchel, D. J. Horn, G. Needham, and W. C. Welbourn [eds.], *Acarology IX*. Proceedings. Ohio Biological Survey, Columbus, OH.
- Morales-Malacara, J. B. 2001. New morphological analysis of the bat wing mites of the genus *Periglischrus* (Mesostigmata: Spinturnicidae), pp. 185–195. In R. B. Halliday, D. E. Walter, H. C. Proctor, R. A. Norton and M. J. Colloff [eds.], *Proceedings of the 10th International Congress of Acarology*. CSIRO, Melbourne.
- Morales-Malacara, J. B., and G. López-Ortega. 2001. A new species of the genus *Periglischrus* (Acari: Mesostigmata: Spinturnicidae) on *Choeronycteris mexicana* (Chiroptera: Phyllostomidae) in Central Mexico. *J. Med. Entomol.* 38: 153–160.
- Rudnick, A. 1960. A revision of the mites of the family Spinturnicidae (Acarina). *Univ. Calif. Publ. Entomol.* 17: 157–284.
- Sánchez-Herrera, O., G. Téllez-Girón, R. A. Medellín, and G. Urbano-Vidales. 1986. New records of mammals from Quintana Roo, México. *Mammalia* 50: 275–278.
- Wetterer, A. L., Rockman, M. V., and N. B. Simmons. 2000. Phylogeny of Phyllostomid bats (Mammalia: Chiroptera): Data from diverse morphological systems, sex chromosomes and restriction sites. *Bull. Am. Mus. Nat. Hist.* 248: 1–200.
- Williams, S. L., M. R. Willig, and F. A. Reid. 1995. Review of the *Tonatia bidens* complex (Mammalia: Chiroptera), with descriptions of two new subspecies. *J. Mamm.* 76: 612–626.

Received for publication 21 May 2001; accepted 18 October 2001.