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Source: The Coleopterists Bulletin, 67(4):557-565.
Published By: The Coleopterists Society
DOI: http://dx.doi.org/10.1649/0010-065X-67.4.557
URL: http://www.bioone.org/doi/full/10.1649/0010-065X-67.4.557

The Coleopterists Bulletin, 67(4): 557–565. 2013.

A New Genus and Species of North American Exosternini Associated with Cavity-Nesting Owls and a Reassignment of *Phelister simoni* Lewis (Coleoptera: Histeridae: Histerinae)

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Abstract

We describe *Strigister* Caterino, Tishechkin, and Proudfoot **new genus** (Coleoptera: Histeridae: Histerinae: Exosternini) for *Strigister tecolotito* Caterino, Tishechkin, and Proudfoot **new species** and for *Strigister simoni* (Lewis, 1889) **new combination.** These species are excluded from *Phelister* Marseul based on several unique characters, especially transverse slits on the prosternal keel and a single v-shaped annulus on the antennal club, and the genus is suggested to be more closely related to *Baconia* Lewis. *Strigister tecolotito* has been found exclusively in association with nests of the ferruginous pygmy-owl (*Glaucidium brasilianum* (Gmelin)) and the Eastern screech-owl (*Megascops asio* (L.)) in extreme southern Texas, USA. *Strigister simoni* is known only from the type specimen, lacking ecological data, from Venezuela.

Key Words: taxonomy, inquiline, Neotropical region, Nearctic region, ferruginous pygmy-owl, Eastern screech-owl, cavity-nesting birds

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Phelister simoni was described by George Lewis in 1889 and was immediately recognized as unusual. He noted that "those who study the family will be able to form an idea of its peculiarities and to judge whether or not I have assigned it rightly to *Phelister"* (Lewis 1889). The time of his foreseen reckoning has come. The avenue by which it has come is through the fortuitous discovery of a close relative by the third author in the course of studies of the arthropod fauna of owl nest boxes in south Texas. The first two authors recognized the affinity of this new species with *P. simoni* immediately, but only in the course of ongoing studies of the entire Exosternini did their true uniqueness become clear.

The main feature that Lewis identified as peculiar in *P. simoni* was its prosternal keel, which he took the trouble to figure. The keel bears a median transverse incision dividing the flat posterior and ascending anterior halves. This incision appears to form a simple trichome, somewhat comparable to that found in the genus *Peploglyptus* LeConte (see Caterino 2005), initially suggesting myrmecophilous habits to the present authors. Lewis (1889) did not note the unique antennal club of the species, with a single, glabrous, v-shaped annulus, which also sets it strongly apart from other species of *Phelister* Marseul (and prohibits its keying out in Kovarik and Caterino 2001), which typically have two annuli marked by a simple setal row (Caterino and Tishechkin, unpublished data), but this further underscores its awkward placement in *Phelister.*

The new species described herein exhibits both of these unique features. It was collected in sufficient numbers to provide males and females for dissection and fresh specimens for DNA extraction. As phylogenetic relationships across the New World Exosternini have become clearer (Caterino and Tishechkin, unpublished data), the isolated position of this pair of species has become obvious. Analyses utilizing over 200 morphological characters, and sequences of 18S, 28S, and the mitochondrial COI gene, strongly support a position of these species close to the genus *Baconia* Lewis (the species of which are treated in Caterino and Tishechkin 2013b). In fact, several analyses have placed them within *Baconia*. However, because this is somewhat parameter-dependent, and because these species do not share any of the morphological characters that we consider to support *Baconia* monophyly, we consider their most likely placement to be as sister-group to *Baconia*, at least among taxa sampled to date (which does include nearly all worldwide genera of Exosternini). As such, a new genus to accommodate this highly distinctive lineage is necessary and appropriate.

Material and Methods

The morphological terminology used is that defined by Wenzel and Dybas (1941), supplemented by Helava *et al*. (1985) and Ôhara (1994). Most characters are illustrated and annotated in Caterino and Tishechkin (2013a, b). Following histerid conventions, total body length is measured from the anterior margin of the pronotum to the posterior margin of the elytra (to exclude preservation variability in head and pygidial extension), while width is taken at the widest point, generally near the elytral humeri. Conventional imaging was done using a Visionary Digital's 'Passport' portable imaging system, which incorporates a Canon 7D with MP-E 65mm 1–5X macro zoom lens. Images were stacked using Helicon Focus software. Scanning electron microscopy imaging was done on a Zeiss EVO 40 scope, and the specimen was sputter coated with gold. Additional photographs of these species are available through the Encyclopedia of Life (www.eol.org).

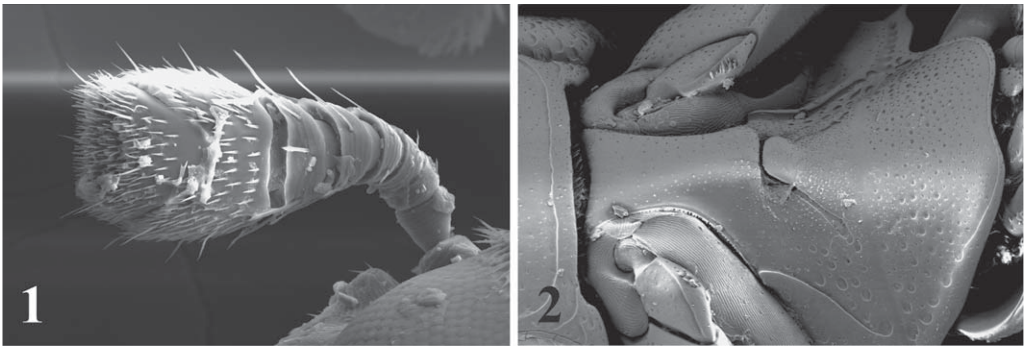
The following collections are referenced in the paper:

AMNH The American Museum of Natural History, New York, USA
BMNH The Natural History Museum, London, UK
FMNH The Field Museum, Chicago, USA
LSAM Louisiana State Arthropod Museum, Baton Rouge, USA
MSCC Michael S. Caterino Collection, Santa Barbara, USA
TAMU Texas A&M University, College Station, USA

Strigister Caterino, Tishechkin, and Proudfoot, new genus

Type species: *Strigister tecolotito* Caterino, Tishechkin, and Proudfoot, new species

Description. Size: Length 2.3–2.9 mm; width 2.0–2.7 mm. **Body**: Body piceous, elongate oval, sides rounded, moderately strongly convex dorsoventrally. **Head**: Frons flat to weakly convex, with frontal stria complete along inner edge of eye, recurved dorsad, acute at middle; supraorbital stria absent; epistoma weakly depressed, shallowly emarginate apically; labrum about 4X as wide as long, emarginate apically; mandibles strongly bent mediad, with very strongly pointed apices, right mandible with simple, acute tooth at base of incisor edge, left mandible with weakly bifid tooth at base; submentum produced into base of oral cavity; mentum about 3X wider than long, emarginate apically, with numerous long setae; maxillary cardo bare, stipes with several long setae near lateral margin, ultimate labial and maxillary palpomeres narrowed, subulate apically; antennal scape slightly longer than funicle, sides uneven, slightly widened apically, bluntly dentate apicomedially; funicle widening to cupuliform 8th antennomere; antennal club small, about length of apical 3 funicular antennomeres, increasingly setose toward apex, with single evident, weakly v-shaped annulus. **Pronotum**: Pronotal sides narrowed slightly from base to apex, disk without obvious gland openings, marginal stria complete along side, interrupted at anterior corner and behind head, submarginal stria complete along lateral and anterior margins; pronotal disk lacking prescutellar impression, variously sculptured. **Elytra**: Elytral disk with conspicuous ground punctation, secondary punctation denser apically; striae somewhat varied, but with most dorsal striae more or less complete. **Prosternum**: Prosternal keel truncate to weakly emarginate basally, with weak or no carinal striae basally, middle of keel interrupted by deep transverse incision, anterior to which the keel profile is depressed, with anterior carinal striae diverging from incision; prosternal lobe about two-thirds as long as keel, truncate to weakly emarginate apically, with very fine marginal stria. **Mesoventrite**: Mesoventral disk about 3X wider than long, anterior margin truncate to weakly produced, marginal stria complete, with varied anterolateral strioles. **Metaventrite**: Mesometaventral stria complete across front, continued by lateral metaventral stria toward metacoxa; postmesocoxal stria present, recurved anterad toward mesepimeron; metaventral disk weakly to moderately punctate. **Abdomen**: First abdominal ventrite with single complete lateral stria, disk moderately punctate, posterior margin moderately (females) to strongly (males)



Figs. 1–2. *Strigister tecolotito.* **1)** Antennal club; **2)** Prosternum, ventrolateral view.

emarginate; ventrites 2–5 weakly punctate at sides; propygidium and pygidium very large, similar in midline length, variably punctate, lacking obvious gland openings or striae. **Legs**: Profemur weakly notched at inner apex; protibia with outer edge weakly rounded, weakly 4–5 dentate, with 2 small, apical spurs; protarsus with simple ventral spines in both sexes; mesotibia weakly curved, with 5–6 prominent marginal spines and a few submarginal spines along anterior surface; metatibia longer, more or less straight, with 4–5 marginal and a few weakly submarginal spines. **Male genitalia**: Accessory sclerites absent, T8 with deep, narrow basal emargination, sides weakly rounded to apex, with narrow, shallow apical emargination, ventrolateral apodemes weakly produced, widely separated beneath; S8 divided along midline, hinged to T8 near base, apices with few divergent setae, emarginate on inner edges and curved inward, with apical and midline membraneous velum; T9 with rather thick basal apodemes, sclerotized along their lower edges, ventromedial apodemes well-developed, strongly recurved proximad, T9 apex rather narrowly truncate; T10 elongate cordate, weakly desclerotized along midline; S9 elongate, narrow along most of stem base bulbous, apex narrowly T-shaped, with very weak median emargination and strong lateral and apical flanges; tegmen very narrow, elongate, parallel-sided in basal two-thirds, narrowed to weakly bifid apex, lacking ventral tooth or process, but with moderately well-defined median ventral keel; median lobe short, simple, extruded through ventral foramen one-third proximad apical narrowing; basal piece nearly one-half tegmen length. **Female genitalia**: T8 forming a single plate, apically narrowly desclerotized, with deep, arcuate, basal emargination, ventrolateral edges desclerotized/incised about midway from base to apex; S8 divided along midline with basal baculi narrowly attached at basolateral corners, basally convergent and subparallel in proximal half; S9 small, triangular, articulated with strap-shaped extension from apex of S8; T10 broad, desclerotized along midline; valviferae paddle-shaped, paddles about one-third total length; coxites rather stout, apically weakly tridentate, with distinct, articulated apical stylus; bursa copulatrix mostly membraneous, not strongly expanded, with paired sclerites above attachment of spermatheca; spermatheca weakly sclerotized, approximately spherical, with elongate, weakly spiraled spermathecal gland attached near its base.

Diagnosis. This new genus can be easily recognized by several features unusual or unique among New World Exosternini. The single v-shaped annulus of the antennal club (Fig. 1) and the transversely incised prosternal keel (Fig. 2) are unique in Exosternini. The recurved and angulate frontal stria (Figs. 5–6), the truncate base of the prosternal keel (Figs. 7–8), the apically truncate prosternal lobe (Figs. 7–8), and the weakly bifidly toothed left mandible (Figs. 5–6) are found in few other New World Exosternini, and never in combination.

Etymology. The name of this genus refers to the habits of the new species, showing an apparently exclusive but somewhat general preference for the cavity nests of true owls (family Strigidae), in combination with the common histerid ending –ister. The name is masculine.

Key to the Species of *Strigister*

1. Fifth dorsal elytral stria complete (Fig. 4); inner subhumeral stria present apically; entire body surface distinctly alutaceous, with ground punctation relatively coarse and conspicuous (Figs. 4, 6); known from Venezuela .... ***Strigister simoni* (Lewis)**

1′. Fifth dorsal elytral stria strongly abbreviated from base (Fig. 3); inner subhumeral stria absent; body surface smooth to at most faintly alutaceous (more so ventrally), with ground punctation relatively fine and inconspicuous; known from Texas, USA .... *Strigister tecolotito* **Caterino, Tishechkin, and Proudfoot, new species**

Strigister tecolotito **Caterino, Tishechkin, and Proudfoot, new species**
(Figs. 1–3, 5, 7, 9–11)

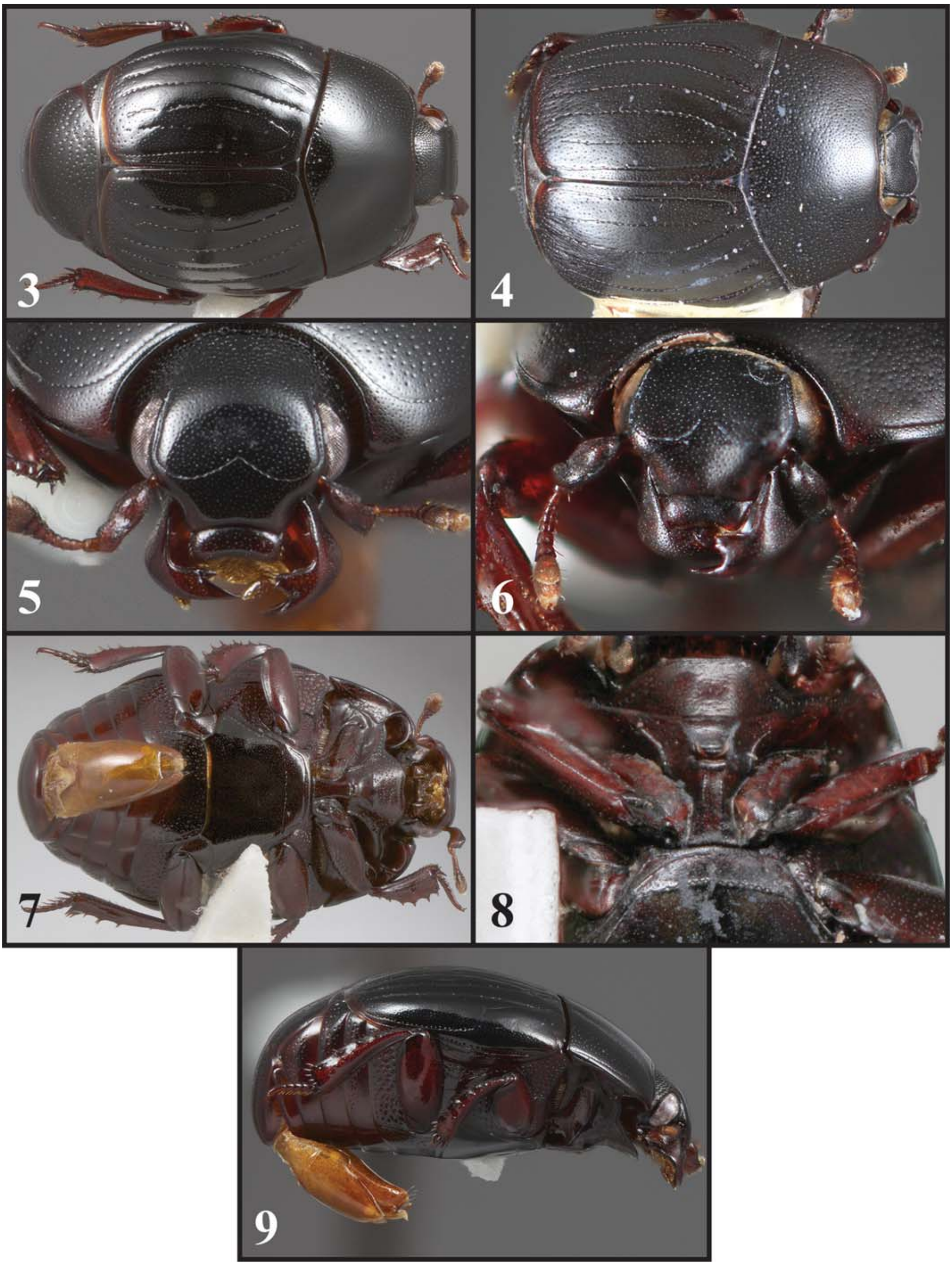
Type Material. Holotype male: "**USA:** TEXAS: Kenedy Co., Norias Division, King Ranch [26.8374°N, 97.7245°W] V-16-2002, G. A. Proudfoot" / "ex. nest box of eastern screech owl, *Megascops asio* (NBS 26.1 3HY – 16–18 days old)" / "TAMU-ENTO X0654492 [bar code label]" (TAMU). **Paratypes (93):** 11: same data as holotype; 21: same data as holotype, except V-15-2002 (NBS 41.1 3HY – 2 weeks old); 1: same data as holotype, except V-16-2002, 'roost?' (NBS 26.2); 5: same data as holotype, except IV-18.2002 (EASO 13-2 HY – 10 days old); 1: same data as holotype, except IV-18-2002 (nest box EASO 5.1); 8: same data as holotype, except VI-12-2002, nest box of ferruginous pygmy-owl, *Glaucidium brasilianum* (NBS 7.2 6HY – 21 days old); 2: same data as holotype, except VI-12-2002 (2HY, NBS 5.2); 17: same data as holotype, except VI-13-2002 (EASO (2001) NBS 24.1); 4: same data as holotype, except XI-8-2001, nest box of ferruginous pygmy-owl, *Glaucidium brasilianum* (nest box, FEPO 7); 2: same data as holotype, except XI-8-2001, nest box of ferruginous pygmy-owl, *Glaucidium brasilianum* (nest box, FEPO 16-2); 1: same data as holotype, except V-28-2010, nest box of *Glaucidium brasilianum* with nestlings, DNA Voucher MSC-2164; 1: same data as holotype, except VI-14-2002, nest box of ferruginous pygmy-owl, *Glaucidium brasilianum* (NBS 29.3 FEPO – 2HY); 2: TEXAS: Willacy Co., Hunke Ranch [26.5994°N, 97.9690°W], IV-18-2002, G. A. Proudfoot, nest box Eastern screech-owl *Megascops asio* (EASO 12-3, HY – 3 weeks old); 11: as preceding except V-13-2002 (NBS 1.3 3HY – 3 weeks old); (AMNH, BMNH, FMNH, LSAM, MSCC, TAMU).

Diagnostic Description. Length 2.3–2.9 mm; width 2.0–2.7 mm; as for generic description, plus the following specific characters: body overall rather finely punctate, ground punctation evident, secondary punctures more restricted in distribution, especially on apical edges of elytra, basal and lateral margins of pronotum, 1st abdominal ventrite, and pygidium and propygidium; body faintly alutaceous, mainly on venter if at all; pronotum with lateral submarginal stria departing distinctly from margin in anterior half; pronotal disk with secondary punctures more or less restricted to extreme basal margin and lateral thirds, slightly denser toward the margins; elytra with 2 complete epipleural striae, outer subhumeral stria present in apical two-thirds, inner subhumeral stria absent, oblique humeral stria distinctly impressed at base, striae 1–4 complete, 4th stria variably arched to sutural stria at base, usually narrowly separated from it, 5th stria variably present in apical half, sutural stria complete; propygidium and pygidium with coarse and more or less uniform secondary punctation intermingled with conspicuous ground punctation; prosternal keel truncate to weakly emarginate at base, carinal striae fragmented to absent basad transverse incision; mesoventrite with complete anterior marginal stria, short additional strioles present in anterolateral corners; mesometaventral stria finely crenulate, slightly anterad but close and parallel to mesometaventral suture; metaventrite with postmesocoxal stria arched anterad to mesepisternum, lateral metaventral stria extending toward middle of metacoxa, slightly abbreviated apically; metaventral disk with fine ground punctation on middle portion; 1st abdominal ventrite with small secondary punctures densest in basal half, sparser posteriorly; male (Fig. 10) as for generic description (male genitalia of congener *S. simoni* not known).

Remarks. The distinctions between this species and *S. simoni* are fairly clear, despite the fact that *S. simoni* remains known from only its type specimen. Intervening material may bridge some of this morphological gap, but the two are more than adequately distinguished by the differences in overall body sculpture and elytral striation.

Biology. This species has been found in association with two species of owls, both small, secondary, obligate cavity nesters, the Eastern screech-owl (*Megascops asio* (L.)) and the ferruginous pygmy-owl (*Glaucidium brasilianum* (Gmelin)). Presumably the beetles are predators on dipteran larvae and other associated arthropods in this arthropod-rich microhabitat. Larval specimens presumably belonging to this species have been collected in the same habitat. Their identity remains to be confirmed (which should be testable using adult/larval sequence comparison; Caterino and Tishechkin 2006), but if they prove to be those of *S. tecolotito*, they will be described in detail in a subsequent paper.

The known distribution includes nests of owls inhabiting live oak (*Quercus virginiana* Mill.; Fagaceae) forest and mesquite (*Prosopis glandulosa* Torr.; Fabaceae) bosque south of 27°N latitude in Texas. Significantly more Histeridae were recovered during nestling development in live oak habitat (21.5 per nest, $n = 11$) than in mesquite (3.8 per nest, $n = 5$). The climate of the study area is subtropical with 68 cm mean annual precipitation and 24 °C mean annual temperature.



Figs. 3–9. *Strigister* species. **3)** Dorsal habitus of *S. tecolotito*; **4)** Dorsal habitus of *S. simoni*; **5)** Frons of *S. tecolotito*; **6)** Frons of *S. simoni*; **7)** Ventral habitus of *S. tecolotito*; **8)** Pro- and mesosterna of *S. simoni*; **9)** Lateral habitus of *S. tecolotito*.

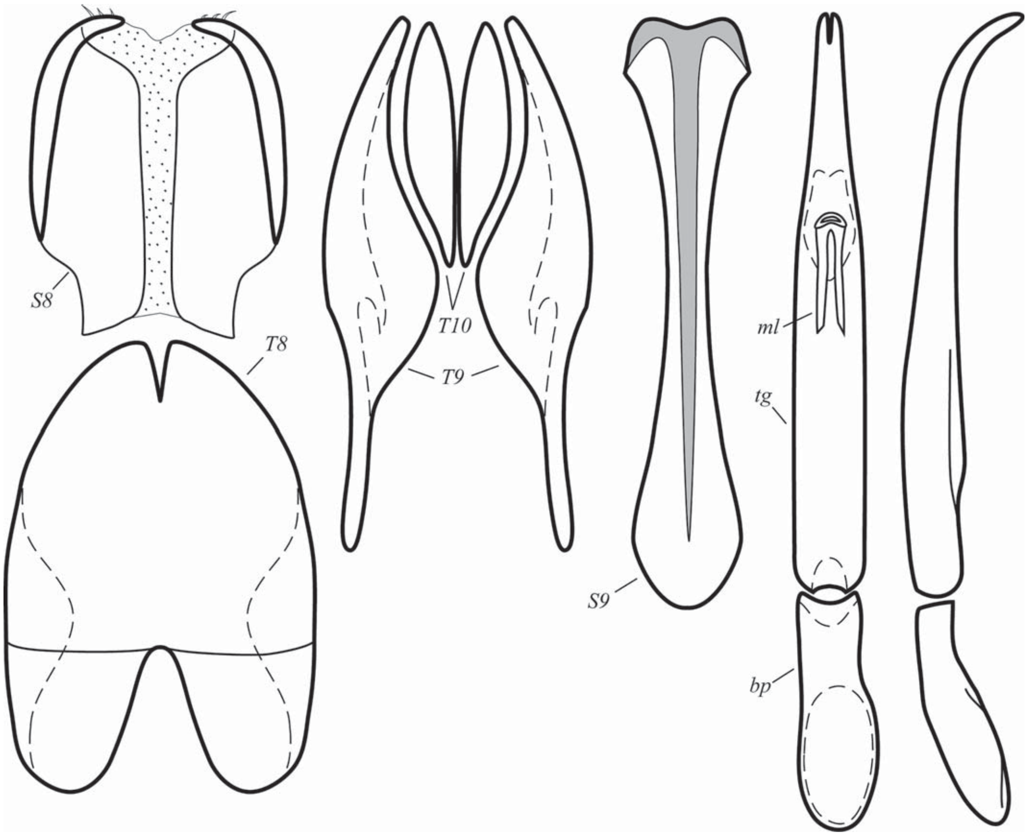


Fig. 10. Male genitalia of *Strigister tecolotito*. T8 = 8th tergite, S8 = 8th sternite, T9 = 9th tergite, S9 = 9th sternite, T10 = 10th tergite, tg = tegmen, bp = basal piece, ml = median lobe.

Etymology. This species name '*tecolotito*', meaning little owl, is a common Spanish name applied to the hosts of this species in Mexico. It is a noun in apposition.

Strigister simoni **(Lewis, 1889) new combination**
(Figs. 4, 6, 8, 10, 11)

Phelister simoni Lewis 1889: 46.

Type Locality. VENEZUELA: Carabobo: San Esteban [~10.42°N, 68.01°W]

Type Material. Holotype probably male: "San Esteban E.Simon III.88" / "Type" / "*Phelister simoni* Lewis Type" / "G.Lewis Coll. B.M.1926-369" (BMNH).

Diagnostic Description. As for generic description, plus the following specific characters: body overall conspicuously punctate and with nearly all surfaces finely alutaceous; middle of frons and epistoma slightly depressed at middle, frontal stria distinctly interrupted medially; lateral submarginal pronotal stria weakly departing from lateral margin anteriorly; pronotal disk more or less uniformly covered with conspicuous ground and coarse secondary punctures; elytra with 2 epipleural striae, outer subhumeral stria present in posterior three-fourths, inner subhumeral stria present in apical 2/3, striae 1–4 complete, 4th stria arched toward but disconnected from sutural, 5th stria slightly abbreviated basally; propygidium and basal half of pygidium with coarse secondary punctures interspersed with conspicuous ground punctation, apical half of pygidium lacking coarse, secondary punctation; prosternal keel with carinal striae distinct, parallel in basal half, basal margin weakly but distinctly emarginate; mesoventrite slightly produced at middle, marginal stria complete, diverging posterad at sides, with prominent strioles in anterolateral corners; mesometaventral stria distinctly crenulate, slightly arched forward; male not known.

Remarks. The coarse dorsal punctation, alutaceous microsculpture, and near complete

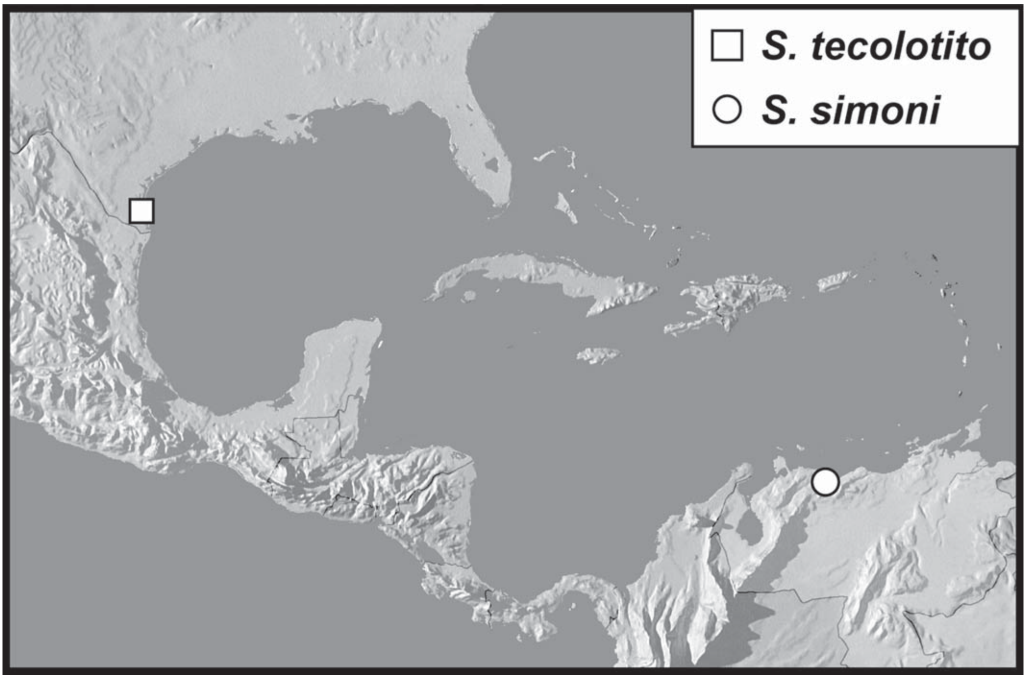


Fig. 11. Map showing collecting localities for the two species of *Strigister*.

fifth and inner subhumeral striae will easily distinguish this species from *S. tecolotito*. This species is known only from the type, the habits of which nothing was recorded by the original collector. The fact that nothing similar has been recollected in the vicinity, or anywhere between Venezuela and Texas, in the intervening 130 years suggests unusual habits. The nests of cavity-nesting birds may indeed hold the solution to this mystery.

Discussion

The association of *Strigister* with cavity-nesting birds is an intriguing one. Although such habits are not unique in Histeridae, they are uncommon. Kovarik and Caterino (2005) review most such cases, with most bird nest associates belonging to the Saprininae, especially the genera *Gnathoncus* Jacquelin du Val and *Euspilotus* Lewis, as well as the dendrophiline *Dendrophilus* Leach. A few associations specifically with owls have been previously reported, including *Geomysaprinus obscurus* (LeConte) from burrowing owl (*Athene cunicularia* (Molina; Lee and Ryckman 1954), *Abraeus granulum* (Erichson), *Dendrophilus punctatus* (Herbst), *Carcinops pumilio* (Erichson), *Gnathoncus nidicola* Stockmann, *Gnathoncus rotundatus* Kugelann, and *Margarinotus merdarius* (Hoffmann) with tawny owl (*Strix aluco* L.; Heselhaus 1915; Rüschkamp 1932; Spittle 1949), and *D. punctatus*, *Gnathoncus buyssoni* Auzat, and *M. merdarius* with barn owl (*Tyto alba* (Scopoli); Buck 1951**)**, as well as *D. punctatus* with Eastern screech-owl (Linsley 1944), reviewed in Hicks (1959). Most of these histerids have also been collected in nests of non-strigiform birds, and even in situations unrelated to nesting birds (Hicks 1959; Kovarik and Caterino 2005), and most associations with owls thus appear to be facultative.

In the case of *S. tecolotito*, the association appears to be obligate, although ephemeral, given the abundance of specimens collected in nesting boxes during nestling development and the near complete lack of specimens collected post-nesting. For example, the average number of Histeridae collected from material removed from nests of ferruginous pygmy-owl (n = 20) and Eastern screech-owl (n = 12) during nestling development was 8.6 and 7.0, with averages of 19 (n = 9) and 12 (n = 7) Histeridae per nest where present, respectively, whereas the average number of Histeridae collected from material removed from nests of ferruginous pygmy-owl (n = 12) and Eastern screech-owl (n = 8) approximately four months post-nesting was 0.50 and 0.13, with averages of 3 (n = 2) and 1 (n = 1). Nests that were sampled during nesting were not sampled post-nesting, and vice versa.

The seasonal variation in Histeridae numbers, and occurrence of most of the arthropods that cohabit nest sites of ferruginous pygmy-owls and Eastern screech-owls, may be explained by ecological succession and the dynamics of a simple food web. Specifically, the nest box, or natural cavity excavated by primary cavity nesters (usually woodpeckers, Picidae), is virtually a microecosystem in primary succession uninfluenced by preexisting communities. Temperatures inside nest boxes average 4°C cooler than ambient temperatures over 48 days of sampling during the nesting season. Once occupied by pioneer organisms, in this case owls, secondary succession commences and characteristics of community assemblage form. The first arthropods recorded are usually species of *Carnus* Nitzsch (Diptera: Carnidae) (Proudfoot *et al.*, unpublished data), haemtophagous parasites that feed on nestlings (Grimaldi 1997). *Carnus* species are known to complete their life cycle in the owl nest, adults take blood meals from nestlings, females lay their eggs in the nest, and the larvae develop feeding on organic nest material. In collecting specimens for this study, more than 2,000 adult *Carnus* specimens were collected from material removed from a single ferruginous pygmy-owl nest; the average number of adult *Carnus* collected from material removed from ferruginous pygmy-owl nests (n = 12) was 366. As the owl nestlings develop, prey remains and fecal matter accumulates at the bottom of the nest chamber, which significantly changes the substrate of the nest. Subsequently, the odor of prey remains and fecal matter attracts a multitude of arthropods that feed off the remains and/or the fecal matter. To date, 45 arthropod families are known to cohabit with ferruginous pygmy-owls and Eastern screech-owls during nesting (Proudfoot *et al.*, unpublished data). The addition of scavengers, detritivores, and decomposers that are attracted to prey remains and fecal matter eventually draws predators (Histeridae) and parasites (mainly Hymenoptera). Thus, arthropod richness and diversity increase with nestling development, the accumulation of prey remains and fecal matter, and the inevitable change in the nest's substrate. When the nestlings fledge, the resources that supported a diverse microecosystem are quickly depleted and the system begins to collapse, shifting to the most primal state for decomposers. At the onset of nesting, the cycle of seasonal succession begins again.

In the interest of pinpointing the niche of the rare and mysterious *S. simoni*, the following suggestions seem logical and instructive. Given the natural history data on *S. telocotito*, a close relationship between the two *Strigister* species, and the lack of ecological data on and rarity of *S. simoni*, it seems reasonable to suspect that it (and potentially other yet undiscovered relatives) might be residing in nests of tree hole-breeding birds elsewhere in the Neotropics. This region has numerous specialized, endemic tree hole-breeding birds that might host histerids, particularly in the orders Falconiformes, Strigiformes, Psittaciformes, and Piciformes (*i.e.*, falcons, owls, parrots, barbets, jacamars, and woodpeckers). Most, if not all, of these birds are known for never clearing their cavities of food remnants and feces during the nestling period, and these resources may become abundant. Additionally, there are numerous obligate tree hole-breeding Passeriformes and burrow-breeding Coraciiformes in the Neotropics, both of which groups are known for harboring relatively rich histerid faunas in their nests in other regions, including some highly specialized species in burrow nests in particular, *e.g.*, *Euspilotus perrisi* (Marseul) and *E. alcyonis* Bousquet and Laplante (Kovarik and Caterino 2005; Bousquet and Laplante 2006). The inquiline faunas of Neotropical bird nests are poorly explored, and scattered records and even dedicated studies list only few generalist beetle species, often tentatively identified (*e.g.*, Pung *et al.* 2000; Turrienzo and Di Iorio 2011 and references therein). We suggest that nests of obligate tree hole-breeding birds in the Neotropics, especially those of falcons, owls, coraciiform, and piciform birds, might harbor rich, undiscovered assemblages of specialized beetles, histerids in particular. We encourage naturalists with either entomological or ornithological interests to use any available opportunity to explore this poorly known niche in search of its dwellers. Our hope is that this paper will be a first step leading to more exciting discoveries and fruitful future cooperation between bird ecologists and insect systematists.

Acknowledgments

We thank King Ranch, Inc., El Tecolote Ranch, Inc., and Phil and Karen Hunke for permission to conduct the field collecting that led to this work; Ed Riley and Pete Teel (TAMU) for facilitating loans of specimens of the new species; and Roger Booth and Maxwell Barclay (BMNH) for assisting with studies of the type of *P. simoni*. This project was supported in part by National Science Foundation grant DEB 0949790 to MSC and AKT, and with funds provided by Phil and Karen Hunke, Jennifer Walter, and GAP.

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(Received 20 August 2013; accepted 16 October 2013. Publication date 20 December 2013.)