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Extinct or extant? A new species of *Termitodius* Wasmann, 1894, (Coleoptera: Scarabaeidae: Aphodiinae: Rhyparini) with a short review of the genus

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Extinct or extant? A new species of *Termitodius* Wasmann, 1894, (Coleoptera: Scarabaeidae: Aphodiinae: Rhyparini) with a short review of the genus

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Abstract. A new species of *Termitodius* Wasmann (Coleoptera: Scarabaeidae: Aphodiinae: Rhyparini) is described from Colombia, *Termitodius woodruffi* Skelley, Clavijo-Bustos, and Keller, **new species**. This species is both extant and abundantly preserved in copal. The genus *Termitodius* is reviewed with a key and brief accounts to all species.

Key words. Neotropical, fossil, copal, Colombia.

Resumen. Una nueva especie de *Termitodius* Wasmann (Coleoptera: Scarabaeidae: Aphodiinae: Rhyparini) es descrita de Colombia, *Termitodius woodruffi* Skelley, Clavijo-Bustos, y Keller, **nueva especie**. Esta especie es existente y abundantemente preservada en copal. El género *Termitodius* es revisado con una clave y reseñas breves para todas las especies.

Palabras clave. Neotropical, fósil, copal, Colombia.

ZooBank registration. urn:lsid:zoobank.org:pub:25B9843D-F0AA-4100-8E8E-DA0030EBE56D

Introduction

The pantropical tribe Rhyparini is represented in the Neotropical region by six genera and 25 species. Of these six genera, only one genus, *Rhyparus* Westwood, is distributed both in the eastern and western hemispheres, the remaining five are exclusively from America (Schoolmeesters 2021; Skelley 2021a, b). The genus *Termitodius* Wasmann was described in 1894 for a new species from Venezuela (Wasmann 1894). Since then, the only taxonomic treatments were the description of two new species 40 years ago (Reyes-Castillo and Martínez 1979) and its generic delimitation (Skelley 2007).

Though more than 30 fossil species of Aphodiinae are known from the Mesozoic and Tertiary period of the Cenozoic Era, none belong to the tribe Rhyparini nor to the Neotropical region (Krell 2007). Most of the described Neotropical Scarabaeoidea fossils are preserved in amber from the Dominican Republic (e.g., Ratcliffe

and Ocampo 2001; Ocampo 2002, 2006; Woodruff 2009; Poinar 2014). Members of the Rhyparini have been documented in Dominican amber (Wu 1996; Poinar and Poinar 1999; Krell 2007) that were recently described (Skelley 2021a, b). Other insects in the New World were described from more recent resin deposits like Colombian copal. However, the age of Colombian pieces lack consensus, with the current trend attributing it to the Cenozoic quaternary period (e.g., Hinojosa-Díaz and Engel 2007; Azar et al. 2009; Penney et al. 2013a; Poinar et al. 2017). Also, it is curious that many described species from copal inclusions are considered to be extant species, yet remain to be discovered as living specimens (Penney et al. 2013b).

The earliest published report that identifies the Colombian copal specimens as *Termitodius* is by Penney and Green (2011), who called it a "subfossil". However, Robert Woodruff began working on this new species in the early 2000s, but declining health and other events forced the project to be postponed. After deciding to describe this species to honor Woodruff, PES studied available modern specimens to document unreported specimens of all species in this rare genus. He borrowed a specimen identified by P. Reyes as "*T. coronatus*" from Colombia, that was later identified as a new species by O. L. Cartwright. Close examination found it to be most similar to the copal specimens in morphology and distribution, and not *T. coronatus*. This led to the following generic review and species description.

Materials and Methods

A paper to review *Termitodius* and describe the copal species was in preparation by R. E. Woodruff and PES in the mid-2000s. Then, Makham (2006) described *Aschnarhyparus* Makham, which led to a reduction and redirection of their original work that was partially published by Skelley (2007). The copal species description was set aside to reassess a review of *Termitodius*. With the recent location of an extant specimen and copal pieces in various collections, we are able to complete this review and honor Dr. Woodruff with the description of the species.

Holotypes of *T. araujoi* Reyes-Castillo and Martínez and *T. chaki* Reyes-Castillo and Martínez are stated to be deposited in the collection of P. Reyes (Reyes-Castillo and Martínez 1979). The Reyes collection is deposited in the IEXA. Museum closures denying staff access to collections over these years of the pandemic have greatly hindered taxonomic progress. Eder Mora-Aguilar (pers. comm., October 2021) stated the Reyes collection is at IEXA and that holotypes and some paratypes of this genus are present.

Terminology for dorsal carinae follows Krikken and Huijbregts (1987) and Howden (2003). Examined specimens are deposited in the following collections:

AAIC Albert Allen collection, Boise, ID, USA.
CEMT Entomology section of the Zoological Collection, Institute of Biosciences, Universidade Federal de Mato Grosso, Cuiabá, Mato Grosso, Brazil (F. Z. Vaz-de-Mello).
CMNC Canadian Museum of Nature, Ottawa, Ontario, Canada (F. Génier, A. Smith).
FSCA Florida State Collection of Arthropods, Gainesville, FL, USA.
IEXA Instituto de Ecología, A. C., Xalapa, Veracruz, México (L. Delgado).
IFIC Ian Foley collection, Bozeman, MT, USA.
IAvH-E Entomology Section of the Biological Collections, Instituto de Investigación de Recursos Biológicos Alexander von Humboldt, Villa de Leyva, Boyacá, Colombia (J. C. Neita Moreno).
OKIC Oliver Keller insect collection, Gainesville, FL, USA.
REWC Robert E. Woodruff collection, Gainesville, FL, USA.
RLBC Robert L. Beiriger collection, Loxahatchee, FL, USA.
UNSM University of Nebraska State Museum, Lincoln, NE, USA (M. J. Paulsen).
USNM United States National Museum, Smithsonian Institution, Washington DC, USA (F. Shockley).

Specimens were examined using a Leica MS5 stereomicroscope equipped with an ocular grid for measurements. Color pictures of individual specimens were taken with a Syncroscopy Auto-Montage system with a JVC 3-CCD, KY-F75U digital camera through a Leica Z16 APO lens. Images of entire pieces of copal were taken with a Nikon Coolpix AW130.

Scanning electron microscope (SEM) images were taken with a JEOL JSM-5510LV microscope. Extant specimens were imaged at low accelerating voltages and without being sputter coated. The specimen of *T. woodruffi*

from Colombian copal (Fig. 7–8) was prepared by dissolving a specimen out of the copal using an organic solvent, arranging parts individually for photography, and combining several images into a habitus using PaintShop Pro 7. Robert Woodruff dissolved the specimen out of the copal, but died before we could confirm which solvent was used. These pieces are deposited in the FSCA.

Verbatim label data is only given for the holotype designated here. Other data are paraphrased for clarity and brevity. Dissections were not made on the unique holotype, but a copal specimen was opened in the polishing process that allowed study of the male genitalia (Fig. 17). No diagnostic differences were noted in male genitalia of *T. araujoi*, *T. chaki*, or the new species. Genitalia are photographed only to show their similarity. They are not diagnosed for all species.

Discussions of geographical regions follow concepts of Morrone (2014). Maps were made using the shapefile of the proposal of biogeographical regionalization of Morrone (2014) provided by Löwenberg-Neto (2014) in ArcMap 10.4.

TERMITODIUS Wasmann, 1894

Termitodius Wasmann 1894: 220. **Type species.** *Termitodius coronatus* Wasmann 1894: 220, by monotypy. Schmidt 1922: 534 (descr).

Diagnosis. *Termitodius* is readily distinguished from all rhyparine genera by having the pronotal ridges swollen and bulbous at the anterior margin, long cylindrical metatibia, and mesotibia with inner subapical notch and tooth.

Description. [From Skelley 2007] Length approximately 3.4–4.0 mm. Body of typical rhyparine appearance with strong dorsal carinae and elytron with an apical bulb and trichomes. Head with clypeus abruptly inflexed medially, submarginal lines and bead present, angulate medial tooth evident in ventral view only when head extended. Pronotum dorsally robust, usually distinctly lobed, lateral margin flared anteriorly; dorsal carinae of variable development, each carina broadened with bulbous at anterior margin, carina simply broadened posteriorly, discolateral carina reduced on posterior ⅔. Metafemur long, slender, cylindrical, not notably widened apically. Meso- and metatibia elongate, circular in cross section, not flattened nor dilated toward apex. Mesotibia (*Termitodius*-type) apically truncate, complete terminal fringe of setae, apical spine small and perpendicular to tibial axis, second subapical spine on inner margin separated from apex by shallow notch, prominent in male, weakly developed in female. Elytron elongate, approximately 3 times longer than wide; not distinctly parallel-sided, evenly rounded to terminal bulb.

Comments. Various authors briefly comment on *Termitodius*. A discussion on how to distinguish *Termitodius* from *Rhyparus* is given in Cartwright and Woodruff (1969). However, the specimen illustrated as "*Termitodius* species (undescribed)" in Cartwright and Woodruff (1969, f. 3–4) is *Aschnarhyparus peregrinus* (Hinton 1934). A key to species is provided by Reyes-Castillo and Martínez (1979), who illustrate and describe adults of *T. araujoi* Reyes-Castillo and Martínez, 1979 and *T. chaki* Reyes-Castillo and Martínez, 1979, and also describe larva and pupa for the former species. Chalumeau (1981) discusses and illustrates the holotype of *T. coronatus*.

All known specimens of *Termitodius* were collected in association with termite nests. *Termitodius coronatus* was collected with *Eutermes meinerti* Wasmann (Isoptera, Termitidae) (Wasmann 1894; Krikken 1970). Immature stages of *Termitodius araujoi* were collected from the nest of "*Coptotermes crassus* Snyder" (Isoptera: Rhinotermitidae) (Reyes-Castillo and Martínez 1979). *Termitodius chaki* Reyes-Castillo and Martínez, 1979, was collected from the nest of "*Coptotermes* aff. *testaceus* (Linnaeus)", also one third instar larva was found, and two couples of specimens were observed during the copulation (Reyes-Castillo and Martínez 1979). Recent work on native New World *Coptotermes* shows them to be a single species, *C. testaceus* (Scheffrahn et al. 2015).

It is interesting that none of the known specimens were collected at light or in flight intercept traps. This could be a result of their true rarity, or likely that they do not fly often and possibly only during the day. Researchers need to focus efforts on host termite nests to study this genus.

Key to species of *Termitodius* Wasmann species

1. Caudal bulb of elytra with dorsal depression, appearing bilobed (Fig. 7, 9, 14); anterior lobe of paramedian pronotal costa evenly rounded on top in lateral view, lobe equally prominent anteriorly and posteriorly (Fig. 8, 10, 13); Colombia ..... ***T. woodruffi* Skelley, Clavijo-Bustos, and Keller, new species**

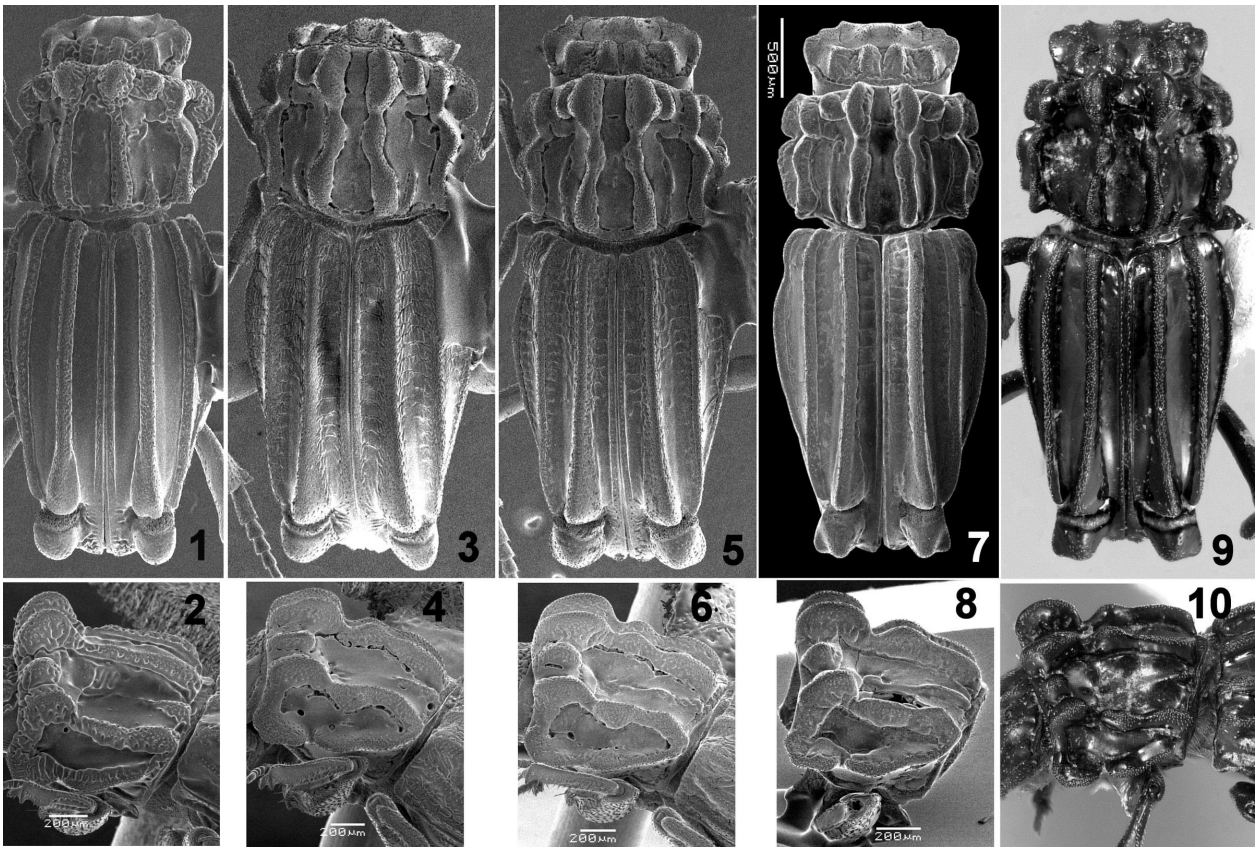
— Caudal bulb of elytra flattened to convex apically, not notably bilobed; anterior lobe of paramedian pronotal costa flattened on top in lateral view, lobe appearing more anteriorly sloped, more prominent posteriorly **2**

2(1). Elytral intervals between costae entirely smooth (Fig. 1), lacking puncture and sculpture; paramedian pronotal costa with anterior lobe circular in dorsal view (Fig. 2); Brazil, Venezuela ..... ***T. coronatus* Wasmann**

— Elytral intervals between costae can be apically smooth, with punctures and sculpture at least on basal half (Fig. 3, 5); paramedian pronotal costa with anterior lobe elongate in dorsal view (Fig. 4, 6); Mexico, Guatemala **3**

3(2). Elytral interval between juxtasutural and discomedian costa sculptured entire length (Fig. 3); basal portion of paramedian pronotal costa touching pronotal base (Fig. 4); Mexico ..... ***T. araujoi* Reyes-Castillo and Martínez**

— Elytral interval between juxtasutural and discomedian costa sculptured only at basal half (Fig. 5); basal portion of paramedian pronotal costa removed from base (Fig. 6); Mexico, Guatemala ..... ***T. chaki* Reyes-Castillo and Martínez**



Figures 1–10. *Termitodius* species dorsal habitus and lateral pronotum. **1–2)** *T. coronatus*, cotype. **3–4)** *T. araujoi*. **5–6)** *T. chaki*, paratype. **7–8)** *T. woodruffi*, copal paratype. **9–10)** *T. woodruffi*, holotype.

Termitodius araujoi Reyes-Castillo and Martínez

Figures 3–4, 18–19

Termitodius araujoi Reyes-Castillo and Martínez 1979: 120–125 (Mexico). Chalumeau 1981: 13; Dellacasa 1988: 28, 267, 426; Dellacasa 1989: 301; Howden 2003: 393; Skelley 2007: 8

Diagnosis. A species of *Termitodius* with the pronotal paramedian costa having the anterior lobe elongate in dorsal view and anteriorly sloping in lateral view (Fig. 3–4), posterior part of discolateral pronotal costa weak medially (absent in some), elytra intercostal areas basally with transverse wrinkles and glossy toward apex, the nearly globe-like caudal bulbs on the elytra, and in distribution (Mexico). Male genitalia (Fig. 18–19) similar to that of *T. woodruffi*.

Type. Holotype male and allotype female: "México: Palenque, Chiapas, 24-IV-1968, P.Reyes, col., *in* nido de *Coptotermes crassus* Snyder, selva alta perennifolia." Reyes-Castillo and Martínez (1979) state the holotype is deposited in the collection of P. Reyes, now deposited in IEXA (not examined). Allotype missing (pers. comm. Eder Mora).

Materials examined. MEXICO: Chiapas: Palenque, 24-IV-68, P. Reyes-leg, coll. Martinez, Selva Alta Perennifolia, en Termitodero de *Coptotermes crassus* (5 paratypes CMNC from Howden and Martínez collections); Palenque, 24-IV-1968, P. Reyes-C., selva tropical lluviosa, alt. 200 m., en termitero (3 FSCA); Palenque, 25-IV-1968, P. Reyes-C., tropical rain forest (5 FSCA, with a vial containing larvae, pupae, and host termite in alcohol). **Veracruz:** Lake Catemaco, Dos Amantes, 27-X-1967, 300m, P. Reyes-C., termite galleries (16 FSCA). The adults and larvae in alcohol at the FSCA were sent to R. E. Woodruff by P. O. Ritcher and are likely the specimens referenced by Reyes-Castillo and Martínez (1979).

Distribution. *Termitodius araujoi* is distributed in the province of Veracruz, in the Mesoamerican dominion of the Brazilian subregion (Fig. 33).

Termitodius chaki Reyes-Castillo and Martínez

Figures 5–6

Termitodius chaki Reyes-Castillo and Martínez 1979: 125–128 (Mexico). Chalumeau 1981: 13, 16; Dellacasa 1988: 34, 267, 426; Dellacasa 1989: 301; Galante et al. 2003: 309; Howden 2003: 393; Skelley 2007: 8.

Diagnosis. A species of *Termitodius* with the pronotal paramedian costa having the anterior lobe elongate in dorsal view and anteriorly sloping in lateral view (Fig. 5–6), posterior part of discolateral pronotal costa absent medially, elytra intercostal areas entirely with transverse wrinkles, the nearly globe-like caudal bulbs on the elytra, and in distribution (Mexico and Guatemala).

Type. Holotype male and allotype female: "México: Lacanjá-Chansayab, Selva Lacandona, Chiapas, 25-I-1977, P. Reyes, col., *in* nido de *Coptotermes* af. *testaceus* (Lin.), selva alta perennefolia, alt. 350m." Reyes-Castillo and Martínez (1979) state the holotype is deposited in the collection of P. Reyes, now deposited in IEXA (not examined).

Materials examined. MEXICO: **Chiapas:** Lacania-Chansayab, 28-I-1977, P. Reyes-C. Col. selva alta perennifolia, alt. 350 m, en Hormiguero de Coptotermes (6 paratypes CMNC from Howden and Martínez collections; 1 paratype CEMT; 1 paratype FSCA). **GUATEMALA: Suchitepéquez**: Patulul, Los Tarrales Private Reserve; 1000m; 14°31.942′, –91°08.799′; w/termites under bark; 8.VII.2009; M.J. Paulsen (1 UNSM).

Distribution. *Termitodius chaki* is distributed in the Mexican transition zone at the Chiapas Highlands province, and in the Veracruzan province of the Mesoamerican dominion of the Brazilian subregion (Fig. 33).

Comments. "*Termitodius chaki* R&M" illustrated in Galante et al. (2003) is not a *Termitodius*, it is a new species of *Nanotermitodius* Howden, 2003, that is currently being described. This Oaxacan record needs to be removed.

Termitodius coronatus Wasmann

Figures 1–2

Termitodius coronatus Wasmann 1894: 220 (Venezuela). Kolbe 1909: 62; Schmidt 1910a: 92; Schmidt 1910b: 133; Schmidt 1922: 534 (description); Hinton 1934: 340, 342; Blackwelder 1944: 216; Martínez 1950: 172; Krikken 1970: 470; Dajoz 1971: 139–140; Reyes-Castillo and Martínez 1979: 120; Chalumeau 1981: 13, 15–16, f.2 (holotype photograph); Krikken and Huijbregts 1987: 100; Dellacasa 1988: 37, 267, 426; Bordat 1996: 86; Howden 2003: 393; Skelley 2007: 7–8

Diagnosis. The only known species of *Termitodius* with the pronotal paramedian costa having the anterior lobe circular in dorsal view and almost the same size as anterior lobes on other pronotal costa. Other distinguishing characters include the posterior part of discolateral pronotal costa absent medially, glossy intercostal areas lacking punctures, the globe-like caudal bulbs on the elytra, and in distribution (Brazil and Venezuela).

Type. According to Chalumeau (1981, holotype fig. 2) the holotype label data: "Venezuela, Meinert; Las Trichéas Don Elias Hacienda 31.12.91; B. *Eutermes meinerti* m." Deposited in Muséum d'Historie Naturelle de Maastricht (not examined).

Materials examined. BRASIL: Acre: Rio Branco, Faz. Caluaba, II-1997, FZ. Vaz-de-Mello (CEMT). **VENEZUELA**: "/ Collection W.M. Mann /[cursive handwriting] Termitodius coronatus Wasm. Cotype, Las Trincheras, Venezuela 31/12 1891, by termites F. Meinert leg. /" (Fig. 1–2). Deposited in the USNM.

Distribution. The locality 'Las Trincheras' is more likely to correspond to the Bolívar state in Venezuela. Therefore, *T. coronatus* is distributed in the Brazilian subregion, precisely in the Pantepui and the Rondonia provinces of the Borean and South Brazilian dominions, respectively (Fig. 33).

Comments. Based on the new record from Brazil, *T. coronatus* is likely more common and widespread than previously understood. Focused collecting on host termites will likely yield many new records.

Termitodius woodruffi Skelley, Clavijo-Bustos, and Keller, new species

Figures 7–17, 220–22, 24–32

Diagnosis. A species of *Termitodius* with the pronotal paramedian costa having the anterior lobe elongate in dorsal view and evenly rounded in lateral view, posterior part of discolateral pronotal costa absent medially, elytra intercostal areas glossy and entirely lacking transverse wrinkles, caudal bulbs of elytra appearing bilobed in dorsal view, posterior lobe of pronotal lateral margin concave to sharp posterior angle, and in distribution (Colombia).

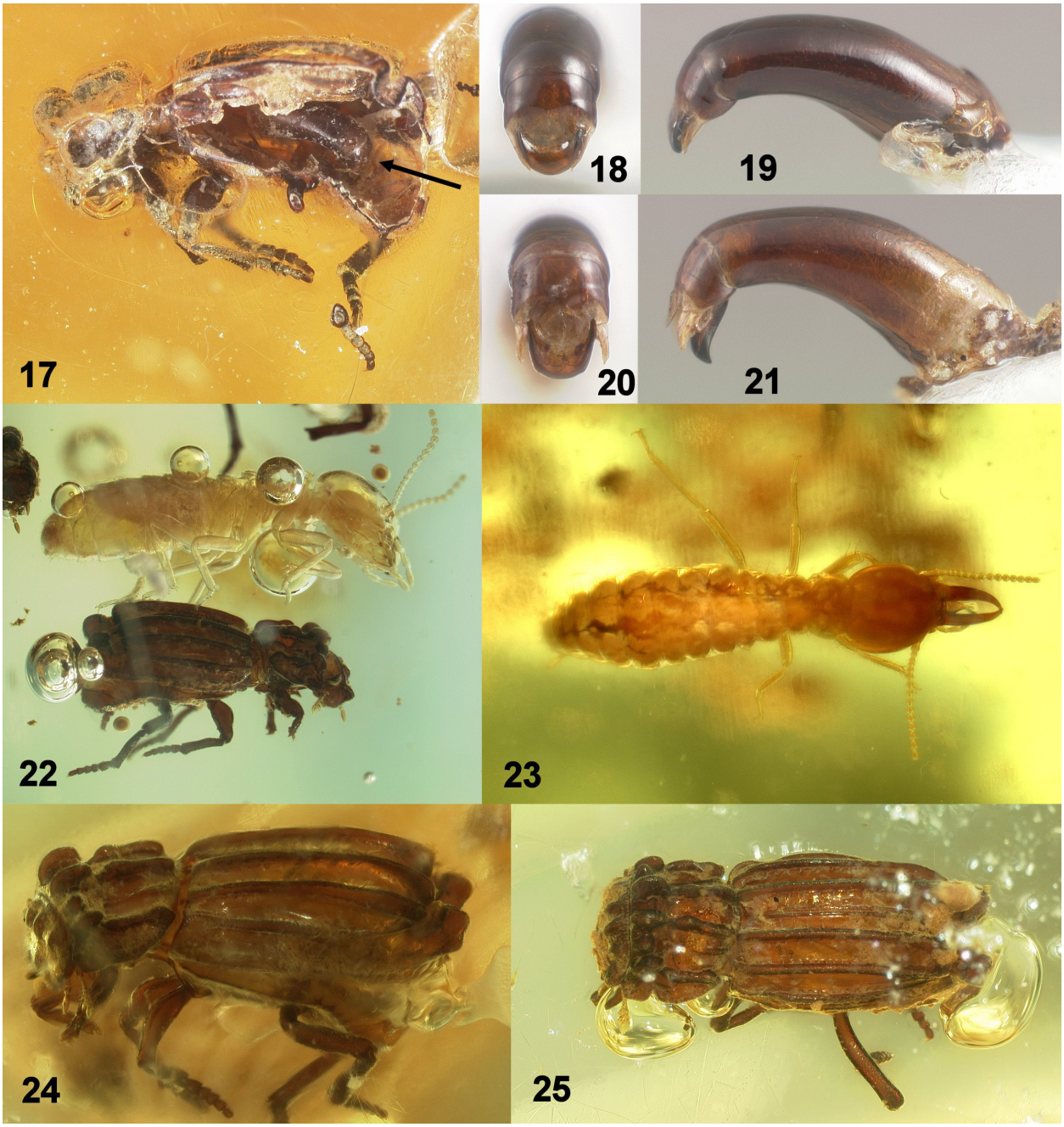
Description. Holotype male. **Body.** Length 3.44 mm, width 1.44 mm; color reddish brown; dorsum strongly costate often encrusted debris [removed for study], costae with fine punctures bearing fine setae; surface between costae glossy (Fig. 7–13). **Head.** Clypeus with anteriorly sinuate on each side, appearing multi-dentate; short sharp denticle on each side of anterior margin, lobes on gena angulate. Clypeus with central disc distinctly convex; with two weakly-raised parallel costae evident by punctation; peridiscal impression fine. Frons with four short but distinct longitudinal costae (two frontodiscal and two frontolateral), each with fine punctures; punctures of frons with setae similar to those on clypeus (Fig. 15). **Pronotum.** Surface glossy and apparently impunctate between costae; anterior portions of costae enlarged, appearing swollen and lobe-like. Paramedian costa complete, reduced behind anterior lobe, anterior lobe elongate, outwardly convex in dorsal view, evenly rounded on top in lateral view. Discolateral costa interrupted by pronotal depression, anterior lobe rounded, costa behind depression reduced to small tubercle at posterior margin base and near anterior fovea, absent medially. Submarginal costa complete, partially interrupted behind anterior lobe and at basal third. Lateral margin with laterally flattened anterior lobe on anterior third; posterior lobe prominent, concave laterally to sharp posterior angle. Scutellar shield not visible. **Elytron.** Surface glossy and apparently impunctate between costae. Juxtasutural costa complete, fine, not prominently raised. Discomedial costa complete, prominent, swelling posteriorly to a weakly triangularly shaped postdiscal bulb. Discolateral costa complete, prominent, equally developed entire length to caudal trichome. Posthumeral costa sinuate basally, showing humeral umbone anteriorly, posteriorly becoming smaller, reaching caudal trichome. Marginal costa smaller than others, complete from anterior margin to caudal bulb. Caudal bulb in caudal view nearly spherical (Fig. 14), with impunctate depression on dorsal surface, creating the internal and external protrusion visible in dorsal and lateral views, appearing bilobed. Metaventrite. Surface evenly, distinctly punctate. Median impression distinct on posterior half, anterolateral and postlateral juxtacoxal impressions weak. **Abdomen.** Ventrites finely punctate; groove along anteror margin of ventrites weakly fluted. Terminal ventrite with weak depressions along anterior margin. **Pygidium.** Surface with median longitudinal carina, longitudinal furrow on each side; punctation similar to punctation of abdominal ventrites. **Legs.** All femora and tibiae with surface evenly distinctly punctate. Profemur enlarged; mesofemur moderately swollen medially; metafemur narrow entire length, reaching elytral apex. Protibia with two small apical teeth, exterior margin weakly curved. Mesotibia with subapical concavity on inner margin (*Termitodius*-type in Skelley

Figures 11–16. *Termitodius woodruffi*, recent specimen, holotype. **11)** Dorsal habitus. **12)** Ventral habitus. **13)** Lateral habitus. **14)** Elytra apex, caudal view. **15)** Head, anterior view. **16)** Labels.

2007); subapical tooth sharp. Metatibia narrow entire length, almost cylindrical in cross section. Tarsi shorter than tibia, tarsomeres thickened, basal meso- and metatarsomere as long as next two tarsomeres; claws reduced. **Male genitalia.** Not studied on unique holotype; paratype with genitalia accessible (Fig. 20–21) have phallobase elongate, tubular; parameres short about a third length of phallobase; paramere apex ventrally curved in lateral view, broadly rounded in caudal view.

Variation. Variation is seen in the distinctness of the lobes on the elytral caudal bulb (Fig. 7, 9). In all, the surface is at least slightly concave, flattened, compared with the convex to distinctly rounded bulb of the other species. Other variations in surface structure (e.g. weak elytral interval sculpture Fig. 7 vs. no sculpture Fig. 9) could relate to resin preservation and subsequent viewing methods. Visibility of resin-preserved specimens is usually poor, hindering detailed studies of variation.

Materials examined. Male holotype (Fig. 9–15) label data (Fig. 16): "// Feby 1924 / WMMann // Santa Anna / Colombia // Collection / WMMann // Termitodius / cornonatus Wasm. / ReyesCastillo. det. 86 // Coptotermes / sp. D. R. Smith 67 // [yellow paper with red ink, OLCartwright's handwriting] N. Sp. N3[?] median / pronotal



Figures 17–25. Images of *Termitodius* and host. **17)** *T. woodruffi*, paratype, cut open in copal processing, note genitalia inside body (arrow). After photographing, genitalia removed for study. **18–19)** *T. araujoi* male genitalia, caudal and lateral view. **20–21)** *T. woodruffi* male genitalia of paratype in Fig. 17, caudal and lateral view. **22)** *T. woodruffi* with worker host termite. **23)** Soldier termite with *T. woodruffi*. **24–25)** *T. woodruffi*, individual paratypes.

carinae / [blue ink] #1 // [red paper] HOLOTYPE ♂/ *Termitodius* / *woodruffi* Skelley, / Clavijo, & Keller //", deposited in the USNM.

Paratypes (>200). Colombian specimens reported in the 17 copal pieces reported here are considered paratypes, and will have paratype labels associated with each piece of copal in their repositories. **COLOMBIA: Boyacá**

Department: One medium piece with ~10 paratypes (AAIC); One medium piece with 2 paratypes (AAIC); One small piece with 2 paratypes (AAIC). **Santander Department:** Four pieces with 1 paratype each (CEMT, Fig. 30); One piece with 3 paratypes (CEMT, Fig. 29); One small piece with 1 paratype (IFIC); One small piece with 2 paratypes (AAIC). **Questionable locality data:** One small piece with 5 paratypes labeled "copal from Kacheta, Colombia", with "Kacheta" crossed out and replaced with "Cachira ??" (CMNC, Fig. 27). **No locality data:** One medium-sized piece with about 15 paratypes including the male specimen (arrow) with genitalia visible and removed for study (RLBC donated to FSCA, Fig. 32); One large piece with ~100 paratypes (FSCA, Fig. 26); One medium piece with ~40 paratypes (IAvH-E, Fig. 31); One medium piece with 17 paratypes (RLBC); One small piece with 1 paratype (OKIC); One small piece with 3 paratypes and millipedes (REWC, Fig. 28, current repository unknown).

Distribution. 'Santa Anna' refers to a municipality in the department of Magdalena, Colombia. Records at a department level certainly correspond to localities in the Magdalena valley. In this way, the species is distributed in the Magdalena province, in the Pacific dominion of the Brazilian subregion (Fig. 33).

Etymology. Noun in the genitive case. Named for Robert E. "Bob" Woodruff, a coleopterist and dealer in amber fossils. Bob worked hard identifying insects in amber for other dealers with the underlying goal of getting the best insect fossils to the appropriate scientists for taxonomic research. He built an amber collection at the FSCA and was very fond of amber from the Dominican Republic. It is fitting we name a resin preserved species for him. *Termitodius* is one of the rarest genera in collections of extant species and belongs in Bob's favorite beetle family, the scarabs. A few years ago, Bob gave PES a few pieces as gifts to work jointly on this description. Bob died before the manuscript could be completed.

Comments. Detailed study of the recent specimen and those visible in copal yielded no characters sufficient to consider the two as distinct species. This would indicate the copal containing this species is from a younger deposit. Despite the lack of consensus about the age of Colombian copal, radiocarbon dating has been used, placing pieces from Santander in the order of 60 to around 10,000 years old (Clifford et al. 1997; Penney et al. 2013b; Modi et al. 2021).

Small copal pieces often lack host termites. Larger pieces have termite hosts and often other arthropod inclusions (e.g., millipedes, Fig. 28) that may also be termite nest guests. Some pieces have too many beetles to easily count (Fig. 26). With the knowledge that the copal is of a more recent origin, a soldier of the termite preserved with copal preserved *T. woodruffi* (Fig. 22–23) was shown to R. Scheffrahn (University of Florida, Ft. Lauderdale) who identified it as a *Coptotermes* Wasmann (Isoptera: Rhinotermitidae). He stated (Scheffrahn in lit. 2005; Scheffrahn et al. 2015) that there is only one New World endemic species presently in Colombia, *C. testaceus* (L.). These are known to live in the heartwood of living trees (Garcia Costa et al. 2020), which might explain why *T. woodruffi* has been preserved so abundantly in amber.

Compared to other aphodiines, *T. woodruffi* is the most common resin preserved aphodiine. The copal piece in Figure 26 likely has more specimens of *T. woodruffi*, than there are specimens of all species in collections. Bob Woodruff once owned a piece about the size of a grapefruit that had multiple hundreds of specimens. He sold that piece which he stated (pers. comm. PES) was on display in a museum. Specimens of this species are present in several collections and numerous private holdings not mentioned here. Photographs of *T. woodruffi* have appeared in various publications, like Penny and Green (2011), and on websites discussing copal or selling pieces.

Despite that most of the *Termitodius* species are known from a couple of localities and few specimens, the abundance of *T. woodruff* in copal is likely atypical. In contrast, only one living specimen of the species has been recorded and collected almost a century ago. These aspects may suggest a couple probable explanations that are not exclusive between each other. First, the rarity nowadays of the species is because of its association with termites in heartwood of living trees and ineffective collecting techniques, as true for other members of the genus and the tribe, or even for the subfamily (Smith and Skelley 2007).

Second, the rarity of *T. woodruffi* could also be explained by the probable reduction of its populations given the age of copal pieces and the climate and landscape changes that have taken place in Colombian tropical dry forests in recent years. Tropical dry forests are suffering from climate changes, especially more in the Americas than in other regions of the world (Miles et al. 2006). Also, the distribution of dry forests in Colombia have been

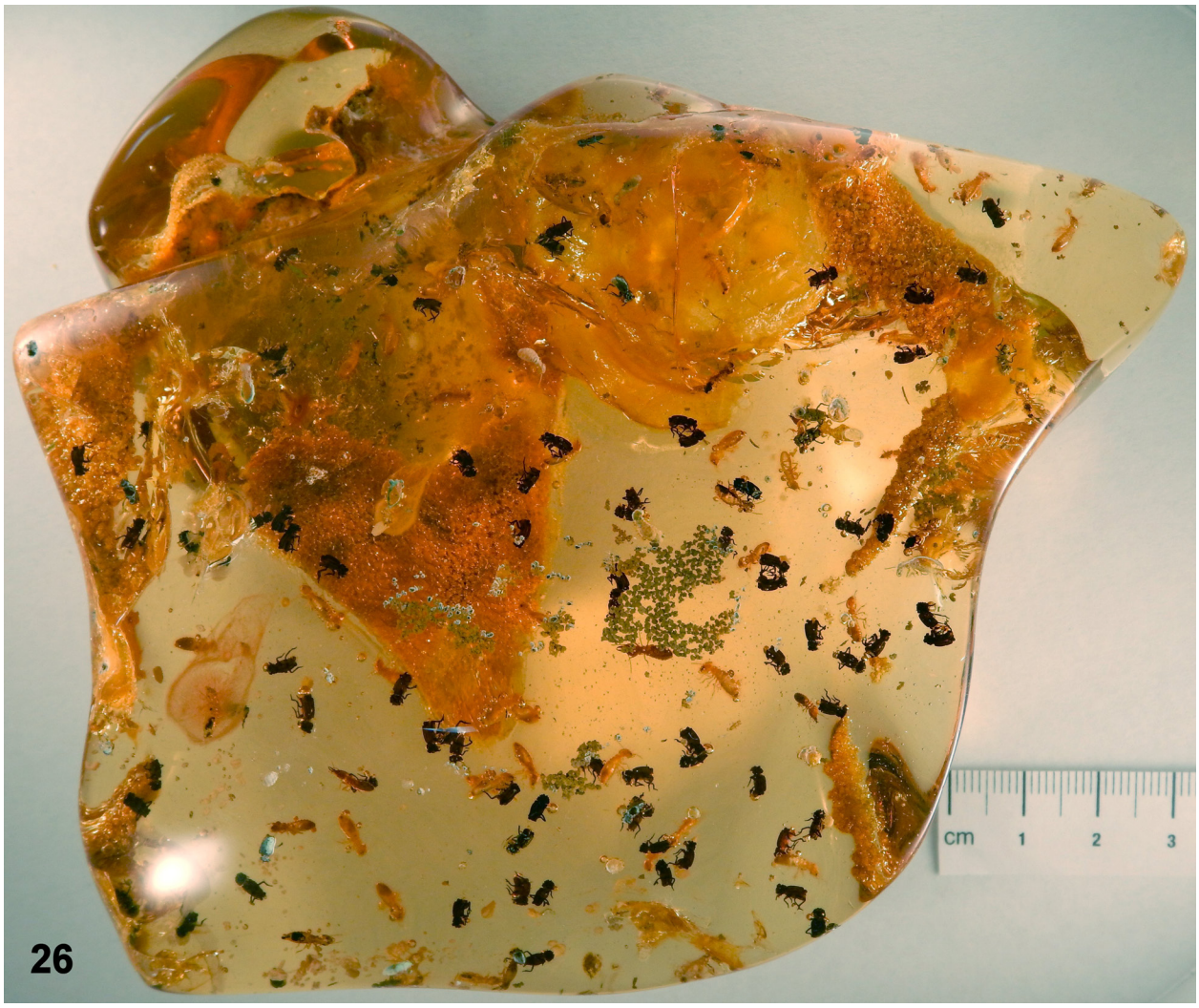


Figure 26. Large copal piece with about 100 *T. woodruffi* paratypes (FSCA).

affected by landscape changes caused primarily by urbanization, agriculture, and deforestation (Etter et al. 2006; Fernández-Méndez et al. 2014). As a result, the dry forests of Colombia in the Magdalena valley and Caribbean region where *T. woodruffi* has been recorded, have been declining in recent years and are vulnerable ecosystems that are endangered and in critical risk (Fernández-Méndez et al. 2014; Etter et al. 2015).

In conclusion, we feel the rarity of *Termitodius* in collections is only partially due to changes in the landscape which restrict populations to suitable habitats. But, the most important factor to their rarity is in the difficulty of sampling from live termite nests. As long as the host termites survive, populations of *T. woodruffi* will survive. If we had a better understanding how the copal was formed, we might gain some insight into these beetles. Obviously, we need to sample more appropriately for these taxa to find them.

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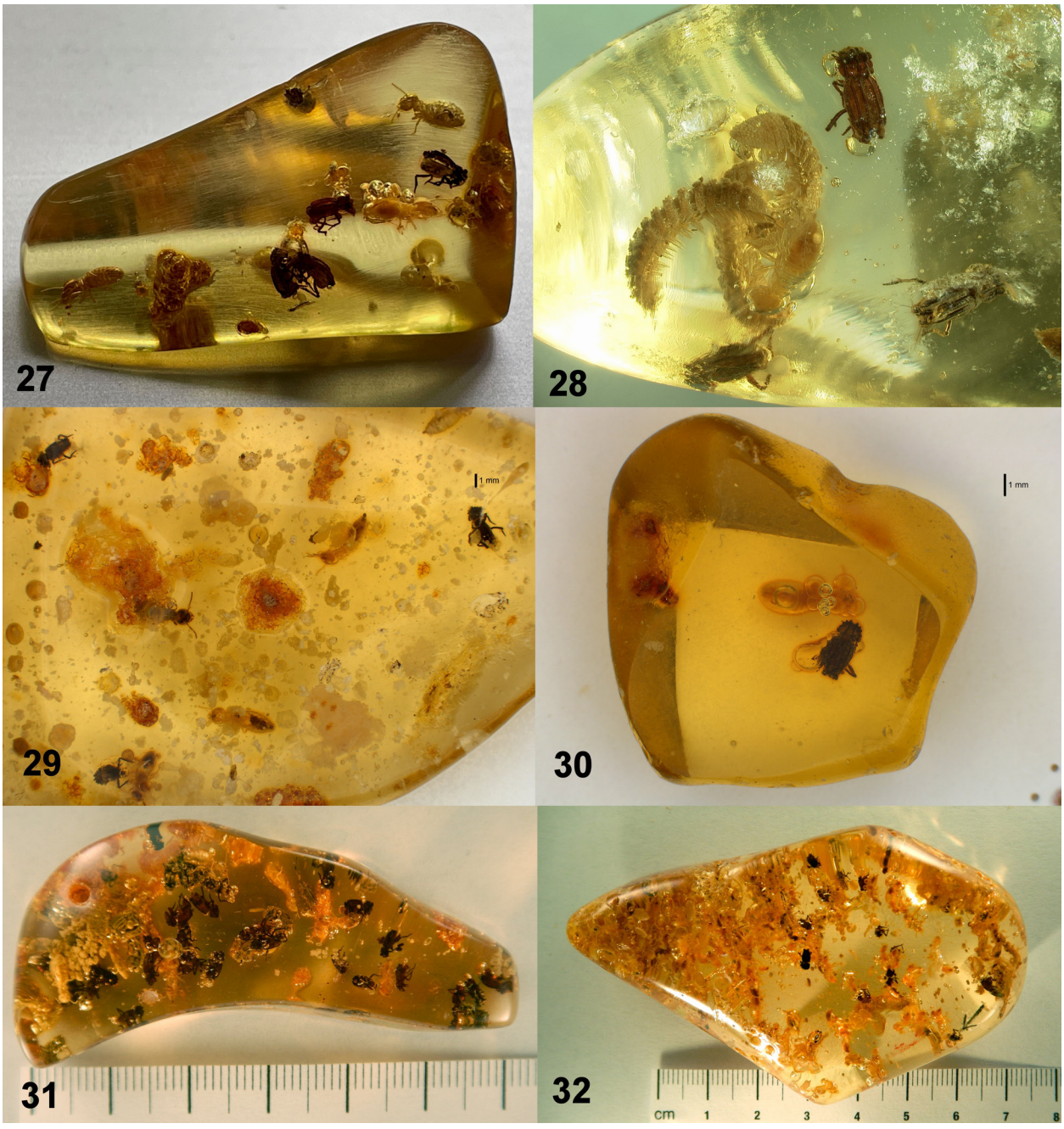

Figures 27–32. Some smaller copal pieces containing *T. woodruffi* paratypes, host termites and other inclusions. **27)** CMNC. **28)** REWC. **29–30)** CEMT. Scale line = 1 mm. **31)** IAvH-E. **32)** FSCA (ex. RLBC), arrow indicates male with genitalia extracted, see Fig. 17. Photos for Figures 29–30 by Vinícius Costa-Silva (CEMT).

Colombia, Sede Central – Tunja, Boyacá, Colombia). And lastly, we thank the Florida Department of Agriculture and Consumer Services, Division of Plant Industry (FDACS-DPI), for support of this work.

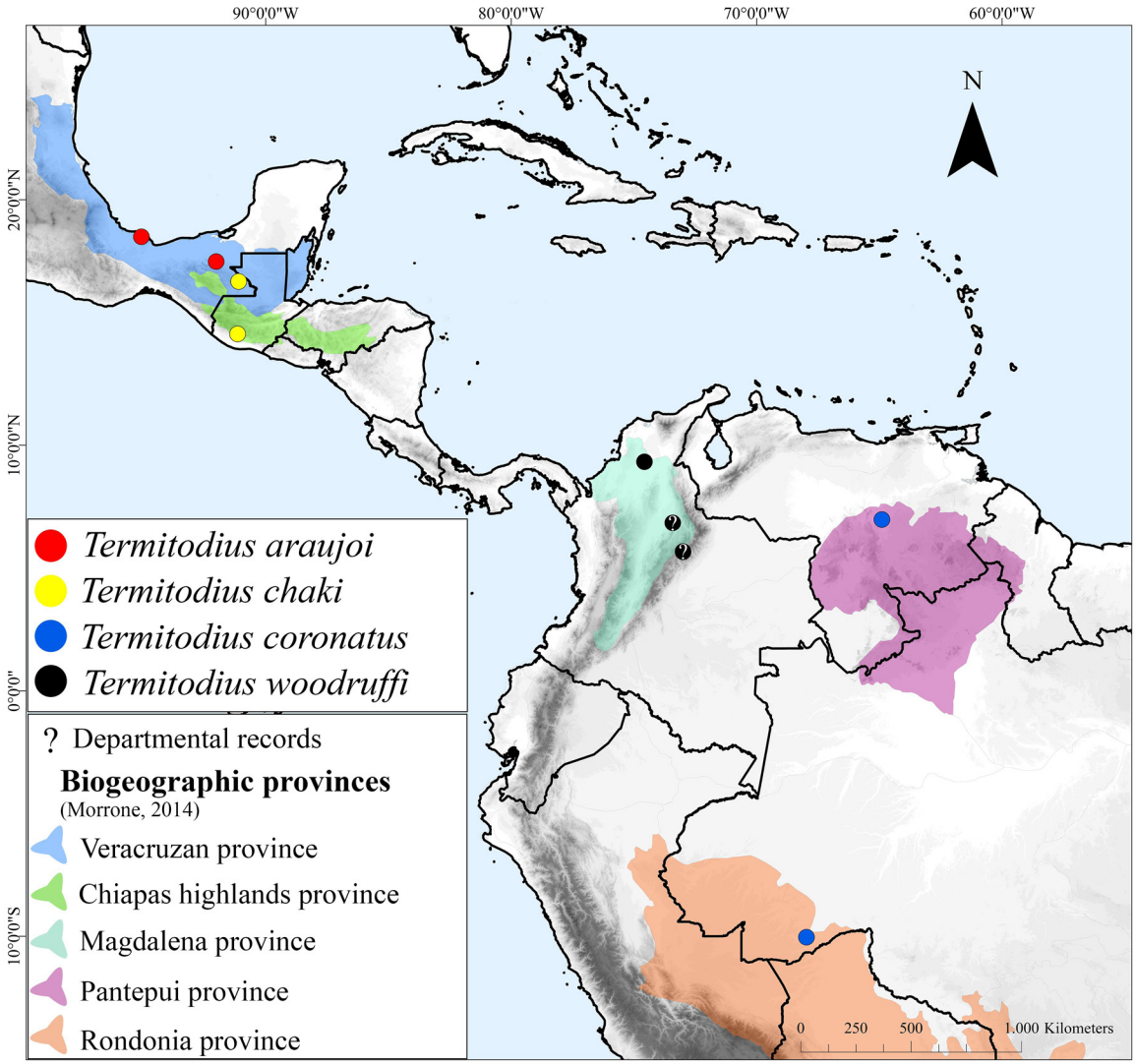

Figure 33. Distribution of *Termitodius* species.

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