

Review of *Scatimus* Erichson (Coleoptera: Scarabaeidae) in Colombia with the description of a new species

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Abstract

We present a review of *Scatimus* Erichson (Coleoptera: Scarabaeidae: Scarabaeinae: Ateuchini: Scatimina) in Colombia, with the description of *S. strenua* new species from the Central Andes (Antioquia Department). Records of *S. strandi* Balthasar from southwestern Colombia (Caquetá and Nariño Departments) are validated. The distributions of *S. ovatus* Harold from the Magdalena, Chocó-Darién, and Sierra Nevada de Santa Marta provinces and *S. fernandezi* Martínez in the eastern foothills of the Eastern Cordillera (Orinoco-Amazon) are confirmed. New departmental records and distribution maps for Colombia are presented; an updated key for the taxonomic identification of *Scatimus* is included. With a total of four species, Colombia has the second highest *Scatimus* species richness of any country.

Key words: Andes, Antioquia, southwestern Colombia, Magdalena Valley, *Scatimus strandi* species group

Introduction

Scatimus Erichson (Coleoptera: Scarabaeidae: Scarabaeinae: Ateuchini: Scatimina) is a Neotropical genus of small tunneler beetles inhabiting a wide variety of habitats including lowland rainforest, foothills, and cloud forests from Mexico to Brazil. Species like *S. pacificus* Génier & Kohlmann, *S. erinnyos* Kohlmann & Solís, and *S. onorei* Génier & Kohlmann have been found in coastal vegetation, and *S. fernandezi* Martínez and *S. onorei* in dry or montane forests. Most of the species are coprophagous and can be found feeding on cattle manure (*S. ovatus* Harold and *S. erinnyos*), however, some species, such as *S. fernandezi*, *S. erinnyos*, and *S. strandi* Balthasar, have been recorded feeding on carrion. *Scatimus* species are most often collected in pitfall traps baited with human feces, light traps, flight interception traps, and by canopy fogging (Kohlmann & Solís 1996; Génier & Kohlmann 2003; Chamorro *et al.* 2019). Habitat requirements, feeding habits, and collecting methods for *S. quadricuspis* Génier & Kohlmann and *S. cucullatus* Erichson, as well as life cycles and the immature stages of almost all species remain unknown, although the nest and larvae of *S. ovatus* were described (Edmonds & Halffter 1978; Halffter & Edmonds 1982). *Scatimus* has also been used in the elaboration of atlases for studying biodiversity and evaluating conservation priorities and the representativeness of protected areas (Kohlmann *et al.* 2007, 2010; Kohlmann 2011; Solís & Kohlmann 2012).

The genus was erected by Erichson (1847), with *Scatimus cucullatus* as the first species formally described in the genus, based primarily on the presence of a carina on the outer edge of the mesotibiae and metatibiae. After a few subsequent species descriptions by Harold (1862, 1869), Preudhomme de Borre (1886), Balthasar (1939), Martínez (1988), and Kohlmann & Solis (1996), a complete review of *Scatimus* was performed by Génier & Kohlmann (2003). Génier & Kohlmann (2003) concluded that there were 12 species within *Scatimus*.

Scatimus has been classified in the subtribe Scatimina, along with *Scatrichus* Génier & Kohlmann, *Onoreidium* Vaz-de-Mello, *Genieridium*, and *Trichillum* Harold (Vaz-de-Mello 2008). However, according to the molecular

analysis of Tarasov & Dimitrov (2016), the subtribe Scatimina is likely polyphyletic, and *Scatimus* is more related to *Ateuchus*, than to *Trichillum* and other genera in the subtribe.

Scatimus is a monophyletic genus composed of three major clades: *S. cucullatus* clade distributed in the southern Ecuadorian Andes, *S. ovatus* clade with species distributed in the Orinoco and northern Amazon basins and in Central America, and *S. strandi* clade with species concentrated in the Ecuadorian Andes and Tumbes region. The genus probably evolved in the Ecuadorian Andes, with later speciation events in Central America and the lowlands of South America. Ecuador harbors the highest number of species (seven), while in countries such as Belize, Mexico, and Brazil the genus is represented with a single species (Génier & Kohlmann 2003; Chamorro *et al.* 2019).

In their revision, Génier & Kohlmann (2003) listed only two species of the *S. ovatus* clade (*S. ovatus* and *S. fernandezi*) in Colombia, even though Escobar (2000) and Medina *et al.* (2001) had previously reported the presence of *S. strandi*, with no specific locality. However, Génier & Kohlmann (2003) mentioned the possible presence of the *S. strandi* clade species in the country based on the known distribution of this group and the lack of field inventories in remote forested areas. Recently Cárdenas-Bautista *et al.* (2020) confirmed the presence of *S. strandi* in Meta department, Colombia.

Due to the decades-long armed conflict in Colombia, many areas were difficult to access and study prior to a peace treaty signed in September of 2016. The Colombia Bio Project, a national initiative that sought to enhance biodiversity knowledge through a series of field expeditions, has focused recent fieldwork on these previously species-rich but inaccessible areas. In the present work we described a new species within the framework of the Colombia Bio project and provided new geographical records of the genus in the country based on entomological collections.

Materials and methods

The present study is based on the revision of specimens of *Scatimus* deposited in the Colección Entomológica del Instituto Alexander von Humboldt, Villa de Leyva, Boyacá, Colombia (IAvH-E) and Colección de Escarabajos Coprófagos de Colombia, Bogotá, Cundinamarca (CECC-CALT). Additional information on geographic distribution was obtained from the following collections (curators in parentheses):

MEFLG—Museo Francisco Luis Gallego, Universidad Nacional de Colombia, campus Medellín, Antioquia, Colombia (Sandra Uribe Soto).

MUSENUV—Museo de Entomología de la Universidad del Valle, Valle, Colombia (Carmen Elisa Posso Gómez).

UPTC—Museo de Historia Natural Luis Gonzalo Andrade, de la Universidad Pedagógica y Tecnológica de Colombia, Tunja, Colombia (Irina T. Morales Castaño).

The Génier & Kohlmann (2003) taxonomic keys and species descriptions were used for species determination. Descriptions are based on adult morphology and male genitalia characters following the terminology of Génier & Kohlmann (2003) and of Tarasov & Solodovnikov (2011) for endophallites (Génier 2019). The morphology was studied using a stereomicroscope Nikon SMZ 645 (6.5–40.0 \times) and an ocular micrometer. Internal sclerotized structures were dissected after relaxing the specimen in hot water (75 °C) for 10 minutes. The extraction of the genital organs was performed following the methodology of Medina *et al.* (2003): heavily sclerotized parts were soaked in a 15% solution of potassium hydroxide for three to five minutes and neutralized in a 15% solution of acetic acid. Genitalia were placed in a glycerin-filled vial beneath the specimens.

The images of the dorsal habit of the species and morphological characters were obtained with a Leica brand 10 megapixel MC 190 HD camera adapted to a Leica-S8 APO Trinocular stereoscopic microscope, stacking a series of photographs with the Helicon focus software (Soft Helicon 7.6.3). Geographical information for the new species and records were obtained either directly from fieldwork or from additional specimen labels from the entomological collections visited. Spatial data was processed with the ArcGIS 10.2 program to obtain distributions maps (Environmental Systems Research Institute 2011, E300 License 04/26/2013).

In order to test the phylogenetic placement of the new species, a cladistic analysis was performed based on the character matrix proposed by Génier & Kohlmann (2003). Taxon sampling comprised 18 species including all *Scatimus* species (13) and the sister genus *Scatrichus* (3). *Onoreidium ohausi* (Arrow) and *Trichillum externepunc-*

tatum Preudhomme de Borre were used to root the tree. *Onoreidium* and *Trichillum* were included as outgroups following Tarasov and Génier (2015), because the *Scatimus* genus is related with these in the clade: *Scatimus strandi* + (*Onoreidium howdeni* (Ferreira & Galileo) + (*Genieridium margaretaeae* (Génier & Vaz-de-Mello) + *Trichillum pauliani* (Balthasar)).

A total of 57 characters of the Génier & Kohlmann (2003) matrix were used to conduct the cladistic analysis (40 are binary and 17 multi-state), and it has been treated as unordered. Except for one character, which represents the three different distribution patterns found in the group (Génier & Kohlmann 2003), all characters correspond to the external morphology of adults: one for species distribution, one for body shape, nine of the head, eight of the prothorax, four of the elytra, six of the mesothorax, three of the metathorax, 14 of the legs, six of the abdomen, and five of the male genitalia. The new species character states in the matrix are as follows: 111001300011111010211 3101020110110112010111113110211001.

The data matrix was compiled using Mesquite 3.61 (Maddison & Maddison 2019) and analyzed under parsimony with TNT version 1.5 (Goloboff & Catalano 2016). The maximum-parsimony tree was identified using the heuristic algorithm "traditional search", with 1000 replications and 100 trees saved per replication and tree bisection reconnection swapping algorithm (TBR). To evaluate the support of tree branches, resampling tests based on bootstrap standard (sample with replacement, 1000 replicates) and Bremer support (TBR from existing trees, retain tree suboptimal by 100 steps) were performed. We calculated the retention index (RI) and consistency index (RC) as homoplasia measures with TNT using the script WSTATS.RUN and WinClada 1.00.08 was used to trace the characters on the trees (Nixon 2002).

For the description of *S. strenua* we use the phylogenetic species concept that defines a species as a group of organisms that share a common ancestor and can be distinguished from other organisms that do not share that ancestor (Wheeler & Platnick 2000).

***Scatimus strenua* Martínez-Revelo, Lopera-Toro, & Medina, new species**

(Figs. 1A–B, 2A–B, 3B, D–F, H, 4D, H, L, P, 5–6)

Type material. Holotype. "Colombia: Antioquia: El Carmen / de Viboral, Finca la Meseta, Bosque montano bajo, / 5° 52' / 45.05"N 75° 12'2.33"W, WGS84 / 1646 m, T.Exc.H. #T10_24, 4.xii. / 2016, A. Lopera, J. Cárdenas"—male (IAvH-E-196594). Printed on red label: "*Scatimus strenua* Martínez-Revelo, Lopera-Toro & Medina sp. nov."

Paratypes [7 males, 5 females]. Colombia: Antioquia: El Carmen de Viboral, Finca San José, Bosque montano bajo, Trampa de Excremento Humano, #T4_48, 5°53'16.68"N 75°11'37.11"W, 1198 m, WGS84, 2.xii.2016, A. Lopera, J. Cárdenas—2 females (IAvH-E-196589-90); #T6_24, 5°53'16.49"N 75°11'40.59"W, 1214 m, 1.xii.2016—1 female, (IAvH-E-196652); #T7_24, 5°53'14.54"N 75°11'41.36"W, 1237 m, 1.xii.2016—1 male, (IAvH-E-196588); #T7_48, 2.xii.2016—1 male (IAvH-E-196591); #T8_48, 5°53'13.01"N 75°11'41.63"W, 1250 m, 2.xii.2016—1 male (IAvH-E-196653); #T9_24, 5°53'13.08"N 75°11'39.77"W, 1125 m, 1.xii.2016—1 male (IAvH-E-196586); #T9_48, 2.xii.2016—2 males (IAvH-E-196592-93); Finca la Meseta, Bosque montano bajo, #T1_48, 5°52'58.07"N 75°11'55.32"W, WGS84, 1437 m, 5.xii.2016—1 male (IAvH-E-196595); #T2_48, 5°52'56.41"N 75°11'54.70"W, 1494 m, 5.xii.2016—1 female (IAvH-E-196596); Finca la Samaria, Bosque montano bajo, #T2_72, 5°53'20.0"N 75°11'13.2"W, 1166 m, 2.xii.2016—1 female (IAvH-E-196585). Printed on yellow labels: "*Scatimus strenua* Paratype Martínez-Revelo, Lopera-Toro & Medina sp. nov."

Non-type material examined. Colombia: Antioquia: Amalfi, Vereda Salazar (Bodega Vieja), 6°58'31.9"N 75°5'2.9"W, 1310 m, 3.v.2009, Grisales, S.—1 sex undetermined (MEFLG).

Diagnosis. *Scatimus strenua* is close to *S. strandi* but can be distinguished from this and other species of the *S. strandi* clade by the following characters: anterior margin of metafemur enlarged and very sharp in *S. strenua* (41¹), simply rounded in *S. cribosus* (41⁰). Median lobe of metaventrites anterior edge arcuate medially in *S. strenua* (25¹, Fig. 3E), distinctly angular medially in *S. pacificus*, *S. furcatus*, and *S. quadricuspis* (25⁰). Body elongate in dorsal view in *S. strenua* (1¹, Fig. 1A–B, E), body oval in *S. onorei* and *S. erinnyos* (1⁰, Fig. 1C–D). Surface of abdominal ventrites with weakly defined microsculpture on segment 3–4 laterally in *S. strenua* (47³, Fig. 3F), only on segment 3 in *S. onorei* (47⁴). Lateral surface of mesepimeron lacking transverse carina medially in *S. strenua* (27², Fig. 3D), present in *S. erinnyos* and *S. strandi* (27¹, Fig. 3C). Surface around dorsal portions of eye lacking microsculpture in *S. strenua* (9⁰), present in *S. erinnyos* (9¹) and surface of mesofemur and metafemur with minute punctures through-

out in *S. strenua* (38⁰, Fig. 3H), with several coarse and umbilicate punctures at apex anteriorly in *S. erinnyos* (38¹, Fig. 3G). Lateral marginal bead of pronotum distinctly reduced medially in *S. strenua* (16⁰, Fig. 3B) and sharply defined medially in *S. strandi* (16¹, Fig. 3A).

Description. Holotype male, (Fig. 1A). Pinned. **Measurements.** Body length 5.84 mm, elytral width 3.73 mm. Body elongate, lateral edges parallel on median third in dorsal view (1¹, Fig. 1A–B, E). **Color.** Black, with some brown reflections. **Head** (Figs. 2A–B). Dorsal surface of head glabrous, lacking setiferous punctures (5¹). Surface of clypeus and gena smooth, lacking wrinkles or transverse rugulae (3⁰), with scattered, fine punctures more pronounced towards the margins. Head with a single frontal carina between the eyes, arcuate medially, with lateral extremities anteriorly directed (6³). Anterior edge of clypeus with two moderately developed and reflexed teeth, clypeal median emargination angulate (4⁰), lateral margins arcuate between teeth and gena, disc of clypeus concave, vertical surface of clypeus V-shaped with a small central depression in the lower edge. Clypeogenal suture pronounced, surface of gena adjacent to the eye lacking coarse punctures (7⁰). Smooth eyes completely divided by canthus, dorsal portion of the eye approximately twice as long as wide (8⁰), surface around dorsal portions of eye lacking microsculpture (9⁰). Antennomeres 7–8 with pit on distal surface (10¹). **Pronotum** (Fig. 3B). Surface smooth. Anterior edge with membranous projection at head insertion (11¹). Lateral edge of pronotum simple, lacking setiferous punctures (12¹), with eight coarse setiferous punctures present in lateral fossae and three anteriorly to fossae (13¹), non-setiferous punctures each with a minute granule medially (14¹). Lateral declivity of pronotum lacking setiferous punctures (15¹), lateral marginal bead of pronotum distinctly reduced medially (16¹), posterior margin of pronotum lacking coarse punctures (17¹). **Elytra.** Elytral disc smooth and shiny, with scattered minute punctures (3.5 X). Anterolateral angle of elytron slightly produced (18⁰). Striae distinctly impressed with oval to rounded punctures separated by 3–4 times diameters on disc and lacking setiferous punctures on interstriae. Striae 1–3 with punctures larger, deeper and more pronounced and fused on apical declivity, striae 7 incomplete on posterior third, striae 8 deeply impressed with interstria lacking setiferous punctures (19²). Apical declivity of elytron lacking setiferous punctures on interstriae (20¹). Proepipleural sulcus shallower on anterior half with a distinct depression (fovea) adjacent to the anterior angle (21¹). **Thoracic ventrites** (Fig. 3D, F). Prosternum behind procoxa lacking setiferous punctures (22³), with few rounded punctures aligned with the posterior edge, margin of the punctures incomplete. Anterior region of propleuron strongly excavated and delimited posteriorly by a complete propleural carina, surface of excavated portion with rivose microsculpture and fine setae. Area posterior of propleuron with rounded punctures located on the posterior edge and reaching half the margin around procoxa. Mesoventrite with a moderately deep anteriomedian fossa and with setae anteriorly (23¹), lacking a median longitudinal carina (24⁰). Mesoepisternal suture well defined, thicker near the procoxa, and thinner towards the lateral edge. Disc of mesoventrite with dense ocellate punctures. Median lobe of metaventrite anterior edge arcuate medially (25¹), with straight lateral borders. Medial edge of mesocoxal cavity at least almost straight on a short distance (26⁰). Lateral surface of mesepimeron lacking transverse carina medially (27²), anteromedial surface punctate (28⁰). Posterior portion of metepisternon rounded (29¹), posteromedial area of metepisternon flat (30¹), lateral lobes of metaventrite lacking a posterior transverse row of punctures (31⁰). **Legs** (Fig. 3H). Protibiae tridentate on the outer margin, basal tooth smallest. External teeth of protibiae with additional small indentations at basal angles (35¹), dorsoapical transverse carina of protibiae emarginate (36¹). Ventral surface of protibiae with two rows of setae, the outer row with large curved apex setae, and the inner row with smaller straight setae. Ventral surface of profemora lacking setiferous punctures (32¹), with a row of long setae on the anterior margin and scattered coarse punctures in the posterior margin. Trochanto-femoral pit of prothoracic leg rounded (34⁰). Procoxa with anteromarginal sulcus (33¹). Mesotibiae with two transverse carinas on the external surface (42¹). Surface of mesofemur with minute punctures throughout (38⁰). Ventral surface of mesocoxa with coarse setiferous punctures, setae longer than punctures diameter (37²). Metatibiae with two transverse carinae on the external surface. Dorsal surface of metatibiae with a longitudinal medial row of straight setae and strong microsculpture on external half only (43¹), lacking dorsal accessory setiferous punctures (44¹). Ventral portion of metatibiae broadly arcuate in cross section near apex (45¹). Anterior edge of metafemur lacking marginal bead (40⁰), with anterior margin enlarged and very sharp (41¹). Dorsal surface of metafemur with minute punctures throughout. Longitudinal median sulcus of metacoxa sharply defined posteriorly (39¹). **Abdominal ventrites** (Fig. 3F). Median portion of abdominal ventrites unmodified, each suture clearly visible throughout (46¹). Surface of abdominal ventrites with weakly defined microsculpture laterally on ventrites 3 and 4 (47³), abdominal ventrites 7 and 8 feebly grooved along suture (49:1). Pre-pygidium is clearly visible, with a central, longitudinal, deep sulcus. **Pygidium.** Basal sulcus of pygidium narrowed and shallowly impressed medially (50⁰). Surface of pygidium

lacking setiferous punctures (51²). Transversal sulcus well defined with the superior border thickened towards the middle. **Aedeagus** (Fig. 4D, H). Parameres approximately conical (52¹). Ventral surface of paramere with strong microsculpture (53¹), parameres apex not projecting ventrally (54⁰). Dorsal portion of paramere sclerotized throughout (55⁰). Paramere hook feebly developed (56¹). **Endophallus** (Figs. 4L, P). Internal sac with four apical endophallites, the basal semicircular (Bsc), frontolateral peripheral (FLP) endophallites and lamella copulatrix (LC) are absent. The superior right peripheral endophallite (SRP) is semicircular, with a broader and rounded extremity, narrow and curved in its middle part, and ending in a handle-shaped projection with bilobed apex. The additional (AS) sclerite is short, with a forked apex. The subaxial (SA) and axial (A) endophallites are superposed. The SA endophallite is elongate, one extremity with a truncated apex and the other one with a forked apex. The A endophallite is elongate the same size as SA, one extremity with an acute apex and the other one rounded.

Female. (Fig. 1B). Body length 6.63 mm, elytral width 4.18 mm. Similar to the male except in: clypeus with four teeth (1¹), middle ones larger, pronotum with one to seven large rounded punctures anterior to and five to ten in the lateral fossae abdominal ventrite 7 parallel sided (48¹).

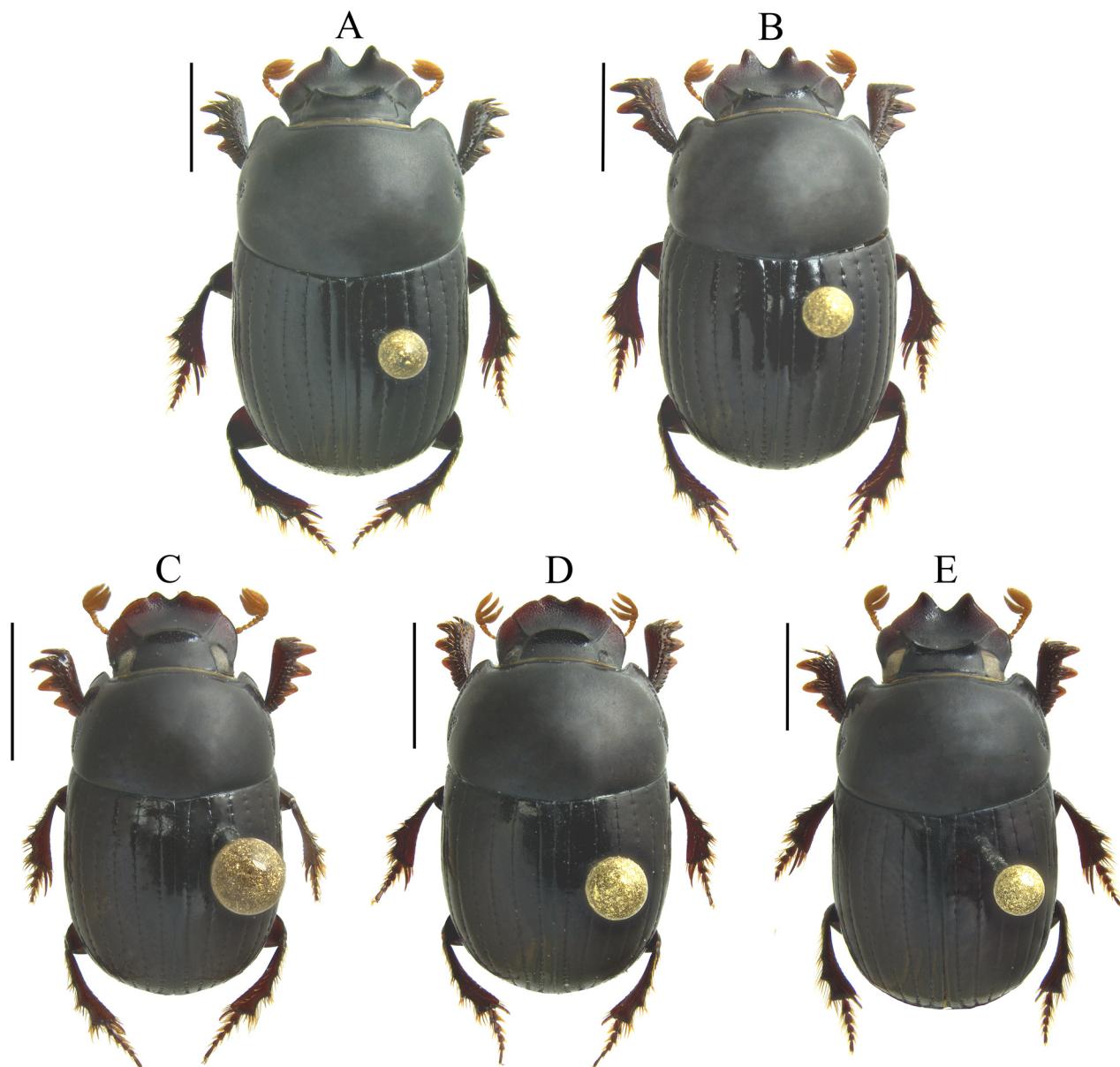


FIGURE 1. Species of *Scatimus* from Colombia. **A**, *Scatimus strenua* holotype male (Antioquia, 5°52'45.05"N 75°12'2.33"W); **B**, *Scatimus strenua*, paratype female (Antioquia, 5°53'16.68"N 75°11'37.11"W); **C**, *Scatimus fernandezi* male (Casanare, 5°16'20.9"N 72°24'2.6"W); **D**, *Scatimus ovatus* male (Tolima, 5°8'58.3"N 74°47'6.1"W); **E**, *Scatimus strandi* male (Nariño, 0°30'N 77°13'W). Scale bars: 2 mm.

Variation. Male: body length 5.61–6.27 mm, elytral width 3.77–4.35 mm. Pronotum with minimum two to maximum eight large rounded punctures anterior to and five to ten in the lateral fossae. Female: body length 5.11–6.63 mm; Elytral width 3.24–4.18 mm.

Etymology. The species epithet “*strenua*” refers to a Roman goddess of the new year, purification, and well-being, and should be treated as a noun in apposition. The name is dedicated to the courageous women from this area of Colombia, that have overcome the armed conflict that affected their region in the 1980s and 1990s.

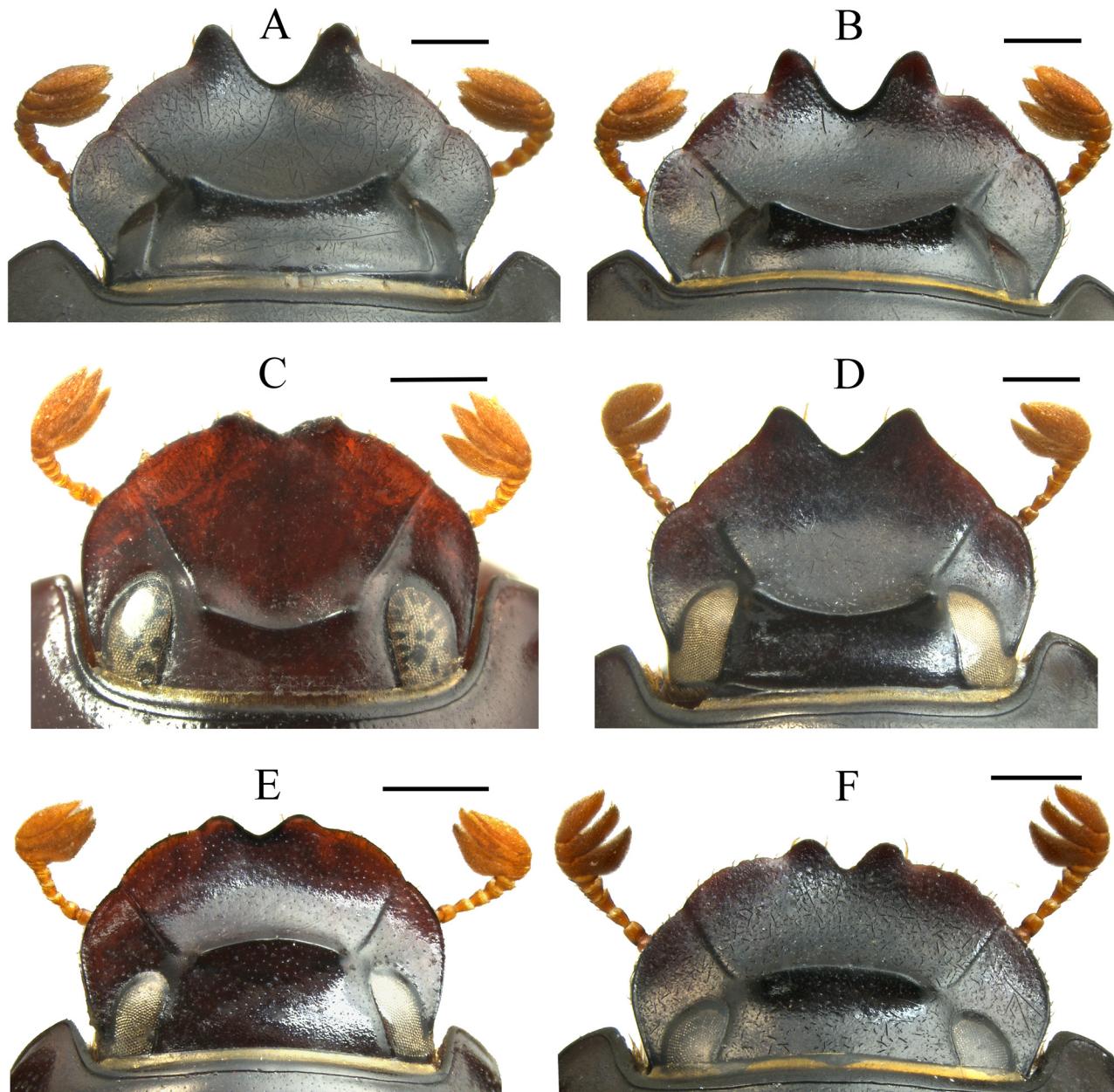


FIGURE 2. *Scatimus* heads in dorsal view. **A**, *Scatimus strenua* male (Antioquia, 5°52'45.05"N 75°12'2.33"W); **B**, *Scatimus strenua* female (Antioquia, 5°53'16.68"N 75°11'37.11"W); **C**, *Scatimus erinnyos* male (Costa Rica, Parque Nacional Guanacaste); **D**, *Scatimus strandi* male (Nariño, 0°30'N 77°13'W); **E**, *Scatimus fernandezi* (Casanare, 5°16'20.9"N 72°24'2.6"W); **F**, *Scatimus ovatus* (Tolima, 05°08'58.3"N 74°47'06.1"W). Scale bars = 0.5 mm.

Ecology and distribution. The landscape inhabited by *S. strenua* is part of the “Rio Melcocho” watershed. Vegetation cover is mostly forest classified by Espinel (2011) as Very Humid pre-Montane forest with influence of sub-Andean and Andean forests (van der Hammen & Rangel 1997). Scattered pastures and plantations are located on the few flat areas of these mountains. The tree canopy average height is 25 m with emergent trees of up to 35 m. Although the canopy is mostly continuous with abundant epiphytes, most timber producing trees have been already harvested, and the remaining forest can be considered as a mature secondary forest. The soils are well drained

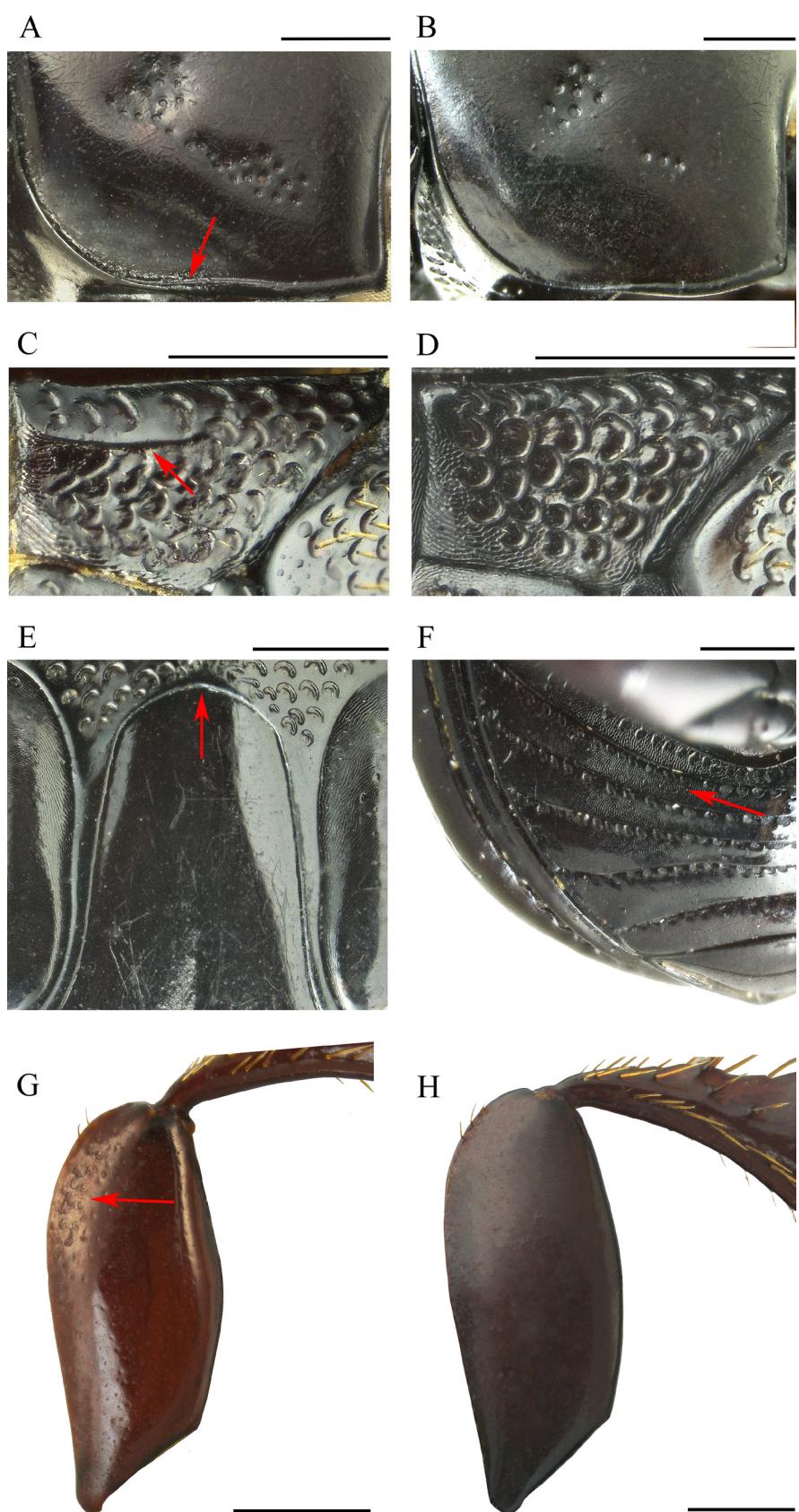


FIGURE 3. *Scatimus* pronotum, mesepimeron, metasternum, abdomen, and metafemur. **A**, *Scatimus strandi* pronotum (lateral view); **B**, *Scatimus strenua* pronotum (lateral view); **C**, *Scatimus strandi* mesepimeron (ventral view); **D**, *Scatimus strenua* mesepimeron (ventral view); **E**, *Scatimus strenua* metasternum (ventral view); **F**, *Scatimus strenua* abdomen; **G**, *Scatimus erinnyos* metafemur (ventral view); **H**, *Scatimus strenua* metafemur (ventral view). Scale bar = 0.5 mm.

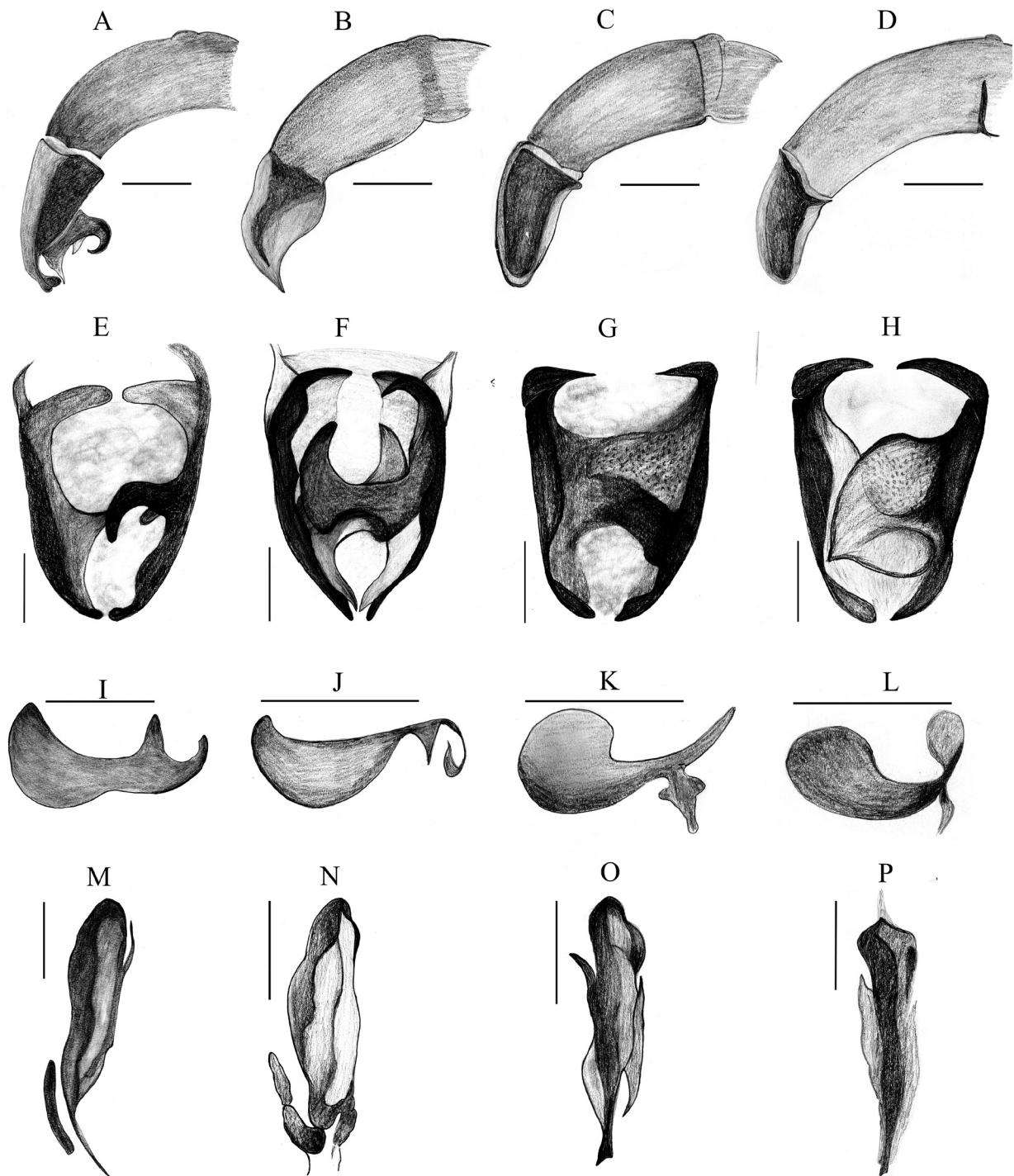


FIGURE 4. Male genitalia of *Scatimus* from Colombia. **A**, *Scatimus fernandezi* aedeagus (lateral view, scale bar = 0.5 mm); **B**, *Scatimus ovatus* aedeagus (lateral view, scale bar = 0.5 mm); **C**, *Scatimus strandi* aedeagus (lateral view, scale bar = 0.5 mm); **D**, *Scatimus strenua* aedeagus (lateral view, scale bar = 0.5 mm); **E**, *Scatimus fernandezi* parameres (ventral view, scale bar = 0.25 mm); **F**, *Scatimus ovatus* parameres (ventral view, scale bar = 0.25 mm); **G**, *Scatimus strandi* parameres (ventral view, scale bar = 0.25 mm); **H**, *Scatimus strenua* parameres (ventral view, scale bar = 0.25 mm); **I**, *Scatimus fernandezi* superior right peripheral sclerite (SRP, scale = 0.25 mm); **J**, *Scatimus ovatus* superior right peripheral sclerite (SRP, scale = 0.25 mm); **K**, *Scatimus strandi* superior right peripheral sclerite (SRP, scale = 0.25 mm); **L**, *Scatimus strenua* superior right peripheral sclerite (SRP, scale = 0.25 mm); **M**, *Scatimus fernandezi* additional (AS), subaxial (SA), and axial (A) sclerites superposed, scale bar = 0.25 mm; **N**, *Scatimus ovatus* additional (AS), subaxial (SA), and axial (A) sclerites superposed, scale bar = 0.25 mm; **O**, *Scatimus strandi* additional (AS), subaxial (SA), and axial (A) sclerites superposed, scale bar = 0.25 mm; **P**, *Scatimus strenua* additional (AS), subaxial (SA), and axial (A) sclerites superposed, scale bar = 0.25 mm.

and covered by a leaf litter layer 10–15 cm thick. Biogeographically, these forests belong to the Magdalena Valley mountain forests in the Tumbes-Chocó-Magdalena province, a key biological hotspot. The new species is part of a dung beetle (Scarabaeinae) ensemble of approximately 45 species including other endemic beetles such as *Dichotomius andresi* Sarmiento & Amat and *Cryptocanthon parvus* Howden, and moist forest beetles such as *Sylvicanthon aequinoctialis* (Harold), *Scybalocanthon moniliatus* (Bates), and *Sulcophanaeus noctis* (Bates), frequently collected in the Magdalena Valley.

On the phylogenetic placement of *Scatimus strenua* within the genus *Scatimus*. The cladistic analysis resulted in a single parsimonious cladogram with length: 122 steps, CI = 0.680, RI = 0.811. The topology of the strict consensus cladogram (Fig. 5) is similar to the one obtained by Génier and Kohlmann (2003). The three species groups were recovered, the *S. ovatus* clade was recovered as monophyletic with the following non-ambiguous synapomorphies: mesoventrites with a deep anteromedian fossa and with setae medially (23²), dorsal portion of paramere widely membranous at juncture medially (55¹), hook of paramere strongly developed (56²).

The *S. cucullatus* clade also was recovered as monophyletic, but with ambiguous synapomorphies: body in dorsal view elongate, lateral edges parallel on median third (1¹), head with a single straight frontal carina (6⁰), and anterolateral angle of elytron subquadrate (18¹).

Scatimus strenua clustered within the *S. strandi* clade, supported by a single non-ambiguous synapomorphy: head with a single frontal arcuate carina with lateral extremities anteriorly directed (6³), and forming a monophyletic unit with *S. onorei* + *S. erinnyos* + (*S. strandi* + *S. strenua*), supported by the following two ambiguous synapomorphies: non setiferous punctures of pronotal lateral declivity each with a minute granule medially (14¹), and postero-medial area of metepisternon flat or concave (30¹).

Updated species checklist. Two species of the *S. ovatus* clade, *S. ovatus* and *S. fernandezi* were already confirmed for Colombia by Medina *et al.* (2001). Escobar (2000) first reported *S. strandi* in Colombia but neither he nor Medina *et al.* (2001) included a locality, possibly causing Génier & Kohlmann (2003) to miss the presence of the species in Colombia. Recently, the presence of *S. strandi* was confirmed in the department of Meta (Cárdenas *et al.* 2020) and we here report three additional localities for the species in the departments of Caquetá and Nariño. *Scatimus fernandezi* previously was recorded in Casanare (Medina *et al.* 2001; Génier & Kohlmann 2003) and we here add new departmental records from Meta and Putumayo. *Scatimus ovatus* was reported in Medina *et al.* (2001) without a precise locality; Génier and Kohlmann (2003) registered it in Magdalena; Solís *et al.* (2011) mentioned “confer” *Scatimus ovatus* in Atlántico; González-Alvarado & Medina (2015) reported the species in Bolívar, Magdalena, Sucre, Tolima, and Santander; and Mendivil *et al.* 2020 from Caldas. Antioquia, Boyacá, and La Guajira are new departmental records (Table 1).

A fifth species could be added to the Colombian list when expeditions are performed on the border with Panama. *Scatimus erinnyos* is registered in Cerro Pirre and the Estación Ambiental Cana (7°45.32'N, 77°41.07'W), Panama, approximately 8 km from the department of Chocó in Colombia. It is possible that *S. erinnyos* is distributed throughout the continuous Chocó-Darién moist forest, that includes the departments of Antioquia, Cauca, Chocó, Nariño, and Valle del Cauca in Colombia.

Scatimus fernandezi Martínez, 1988

(Figs. 1C, 2E, 4A, E, I, M, 5–6)

Scatimus fernandezi Martínez, 1988: 85 (original description)

Material examined (3 undetermined). **COLOMBIA:** **Meta:** Acacias, Finca Santana, gallery forest, 550–600 m, 3°59'54"N 73°36'49"W, human dung trap, T4_72, 11.iv.2009, A. Lopera, (1 sex undetermined, CECC-CALT). **Putumayo:** Puerto Leguizamo, Bosque, 182 m, 0°07'15.2"S, 74°37'37.4"W, human dung trap, PLF22(24h), 5.ix.2019. D.E. Martínez & D. García (2 sex undetermined, IAvH-E-218066-67).

Scatimus ovatus Harold, 1862

(Figs. 1D, 2F, 4B, F, J, N, 5–6)

Scatimus ovatus Harold, 1862: 401; Bates 1887: 44 (distribution); Balthasar 1939: 90.

Scatimus patruelis Preudhomme de Borre, 1886: 108 (description); Bates 1887: 44 (distribution); Balthasar 1939: 90.
Scatimus quadridentatus Balthasar, 1939: 89.

Material examined (1 male, 5 sex undetermined). COLOMBIA: Antioquia: Apartadó, Vereda El Salto, forest, 7°56'05.3"N 076°34'16.3"W, WGS84, 196 m, human dung trap, Pol3BoT6EH, 21.ix.2017, D. Martínez (1 sex undetermined, IAvH-E-218073); Chigorodó, Vereda Remigio, forest, 7°38'30.7"N 76°34'20.3"W, 188 m, Pol2BoT5EH, 16.ix.2017, D.E. Martínez (3 sex undetermined, IAvH-E-218068–70). Boyacá: Puerto Boyacá, Reserva Natural El Paujil, forest, 206 m, 6°02'42.9"N 74°16'6.9"W, human dung trap, EPF9(48h), 2.ii.2019, M. Ramírez (1 male, IAvH-E-218071). La Guajira: Distracción, Finca el Corralito, 11°1'27.68"N 72°57'13.08"W, 896 m, A. Lopera & W. Chamorro, ix.2016, tropical dry forest, pitfall, human dung (1 sex undetermined, CECC-CALT).

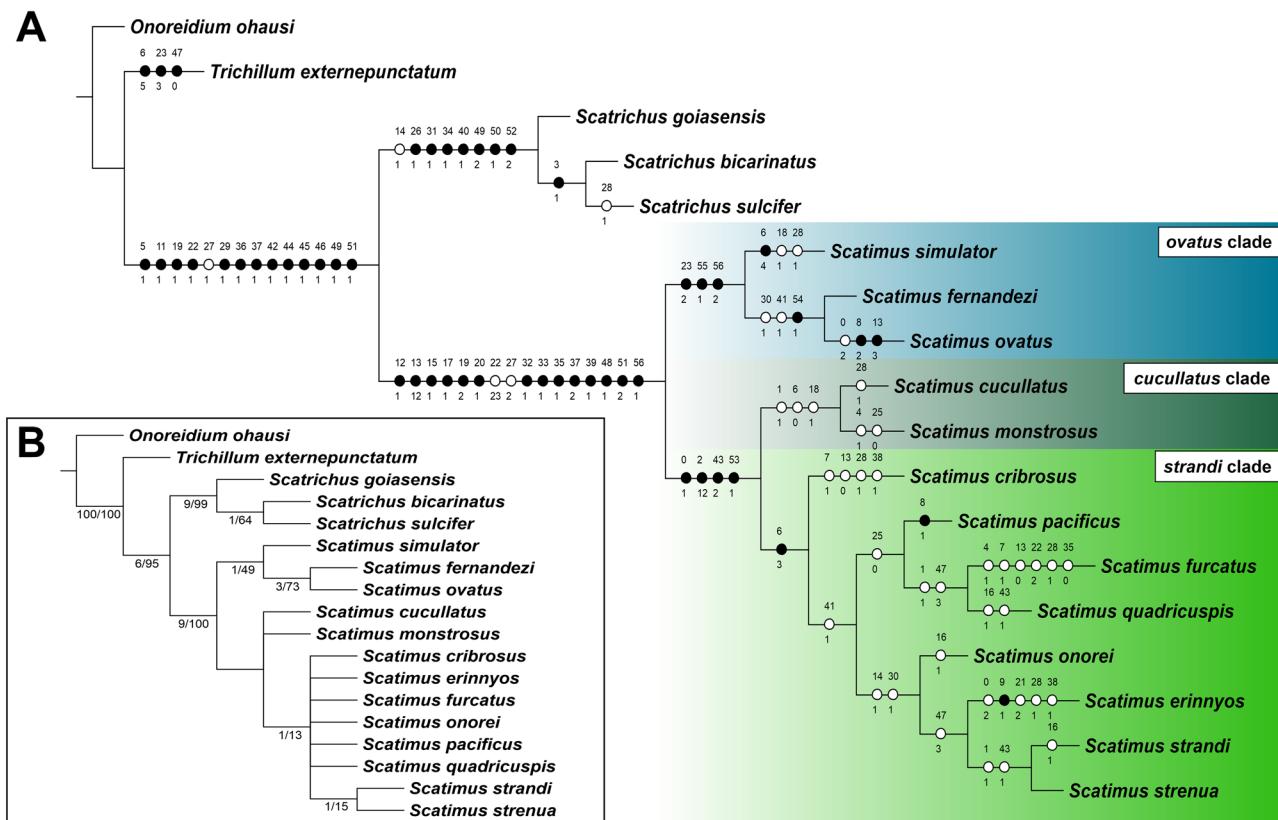


FIGURE 5. Results of the phylogenetic analyses. **A**, The single most parsimonious tree from TNT, with character evolution of *Scatimus*; all characters states are treated as unordered and equally weighted. Characters were mapped on branches using unambiguous character changes in Winclada (black circles, non homoplasious changes; white circles, homoplasious changes); numbers above the circles indicate characters, and number below circles indicate their states. **B**, Strict consensus of the five most parsimonious trees (length = 122 steps; consistency index = 0.680; retention index = 0.811) obtained with heuristic search. Clade support is indicated on branches (Bremer support values/bootstrap proportions).

Scatimus strandi Balthasar, 1939

(Figs. 1E, 2D, 3A, C, 4C, G, K, O, 5–6)

Scatimus strandi Balthasar, 1939:87 (original description)

Material examined (5 males, 4 females, 5 sex undetermined). COLOMBIA: Caquetá: San José del Fragua, Vereda La Esmeralda, Alto río Yuruyaco, 1°20'N 76°06'W, 1000 m, human dung trap, 3–5.ix.2000, E. González (1 male IAvH-E-72021, 1 sex undetermined UPTC COL:1296); San Vicente del Caguán, Parque Natural Nacional Los Picachos, Inspección de Policía Guayabal, Alto del Río Pato, Finca Andalucía, 2°47'51"N 74°51'18"W, 1250 m, human dung trap, xi–xii.1997, F. Escobar (4 males, IAvH-E-17308, IAvH-E-17309, IAvH-E-17312, IAvH-E-17315; 2 females IAvH-E-17310, IAvH-E-17316; 1 sex undetermined, UPTC COL:1295). Nariño: Ipiales, Territorio Kofán

Cuenca alta de los Ríos Rumiyaco-Ranchería, 0°30'N 77°13'W, 1250 m, human dung trap, x.1998, F. Escobar (2 females IAvH-E-17318, IAvH-E-218072; 3 sex undetermined, UPTC COL:1292, COL:1294, COL:1296).

TABLE 1. Checklist of the genus *Scatimus* from Colombia, departmental distribution based on examined specimens.

Species	Departmental distribution	Elevational range	Collections
<i>Scatimus fernandezi</i> Martínez, 1988	Casanare, Meta, Putumayo	142–600	CECC-CALT, IAvH-E
<i>Scatimus ovatus</i> Harold, 1862	Antioquia, Atlántico, Bolívar, Boyacá, Caldas, Córdoba, La Guajira, Magdalena, Santander, Sucre, Tolima	40–951	CECC-CALT, IAvH-E, MEFLG, MUSENUV
<i>Scatimus strandi</i> Balthasar, 1939	Caquetá, Nariño, Meta	1000–1500	IAvH-E, UPTC
<i>Scatimus strenua</i> new species	Antioquia	1125–1310	IAvH-E, MEFLG

Geographical distribution. The distribution of the genus in Colombia covers an elevational range between 40–1500 m in the Amazonia, Orinoquia, and Andes regions. No species from the Pacific region or insular areas are yet known. Two distribution patterns associated with the Andes Cordillera were identified: the first pattern corresponds to elevations below 1000 m for the *S. ovatus* clade and above 1000 m for the *S. strandi* clade (Table 1). Another pattern is the Cisandean distribution of *S. fernandezi* and *S. strandi*, and the Transandean of *S. ovatus* and *S. strenua* (Fig. 3).

The *S. ovatus* clade shows a wide distribution and the capacity to occupy humid, dry, and perturbed environments. According to the biogeographical regionalization of the Neotropics (Morrone 2014), *S. ovatus* inhabits the Chocó-Darién, Magdalena, and Guajira provinces, occupying both inner and edge habitats of moist forests and dry forests in the Guajira-Barranquilla xeric scrub ecoregion. *Scatimus fernandezi* is present in the Sabana and Napo provinces, frequent in habitats of gallery forest, rainforest, and occasionally in pastures of the Apure-Villavicencio dry forest ecoregion.

The *S. strandi* clade shows a more restricted distribution to well-preserved environments. *Scatimus strenua* is the only species with known distribution restricted in Colombia and presumably endemic to the Magdalena province. However, it's likely to be found in lowlands of the Magdalena river basin, similar to other members of the *S. strandi* clade such as *S. pacificus* and *S. onorei* who are found occasionally on the Pacific Coast in Ecuador and *S. erinnyos* along the coasts of Costa Rica and Panama. *Scatimus strandi* distribution extends from Ecuador to the Colombian Amazon and Orinoquia foothills, reaching as far north as Meta (Fig. 3), where it is associated with riparian forest and secondary forest (Cárdenas *et al.* 2020).

Conservation status of *Scatimus*. The degree of threat faced by Colombian species is not clear, there are no direct conservation efforts for any species, additionally none has been evaluated against the Red List criteria. However, as a consequence of the habitat requirements of the *S. strandi* clade (well-preserved montane forests) we expect a higher degree of threat for this group compared to the disturbance-tolerant *S. ovatus* clade.

The known populations present in protected areas are of *S. fernandezi* in the Reserva Privada de la Sociedad Civil Palmarito (Casanare), of *S. ovatus* in the Reserva El Palomar (Atlántico), Reserva Miraflores, Santuario de Flora y Fauna Los Colorados (Bolívar), Reserva Nacional El Paujil (Boyacá) and Parque Natural Nacional Sierra Nevada de Santa Marta (Magdalena) and of *S. strandi* in the Parque Natural Nacional Los Picachos (Caquetá).

Key to *Scatimus* species in Colombia based on Génier & Kohlmann (2003)

1. Carina of the head with lateral extremities posteriorly directed (6², Figs. 2E, F) (*Scatimus ovatus* clade) 2
- Carina of the head with lateral extremities anteriorly directed (6³, Figs. 2 A–D) (*Scatimus strandi* clade) 3
- 2(1). Dorsal portion of the eye approximately twice as long as wide (8⁰, Fig. 2E), coarse setiferous punctures of pronotum present in lateral fossae and anteriorly to fossae (13¹, Figs. 3A, B), apex of parameres swollen, more or less spherical (Figs. 4B, F) *Scatimus fernandezi*
- Dorsal portion of the eye variable in size (8², Fig. 2F), coarse setiferous punctures of pronotum absent or variably distributed (13³), apex of parameres flat and tapering into a point (Figs. 4A, E) *Scatimus ovatus*

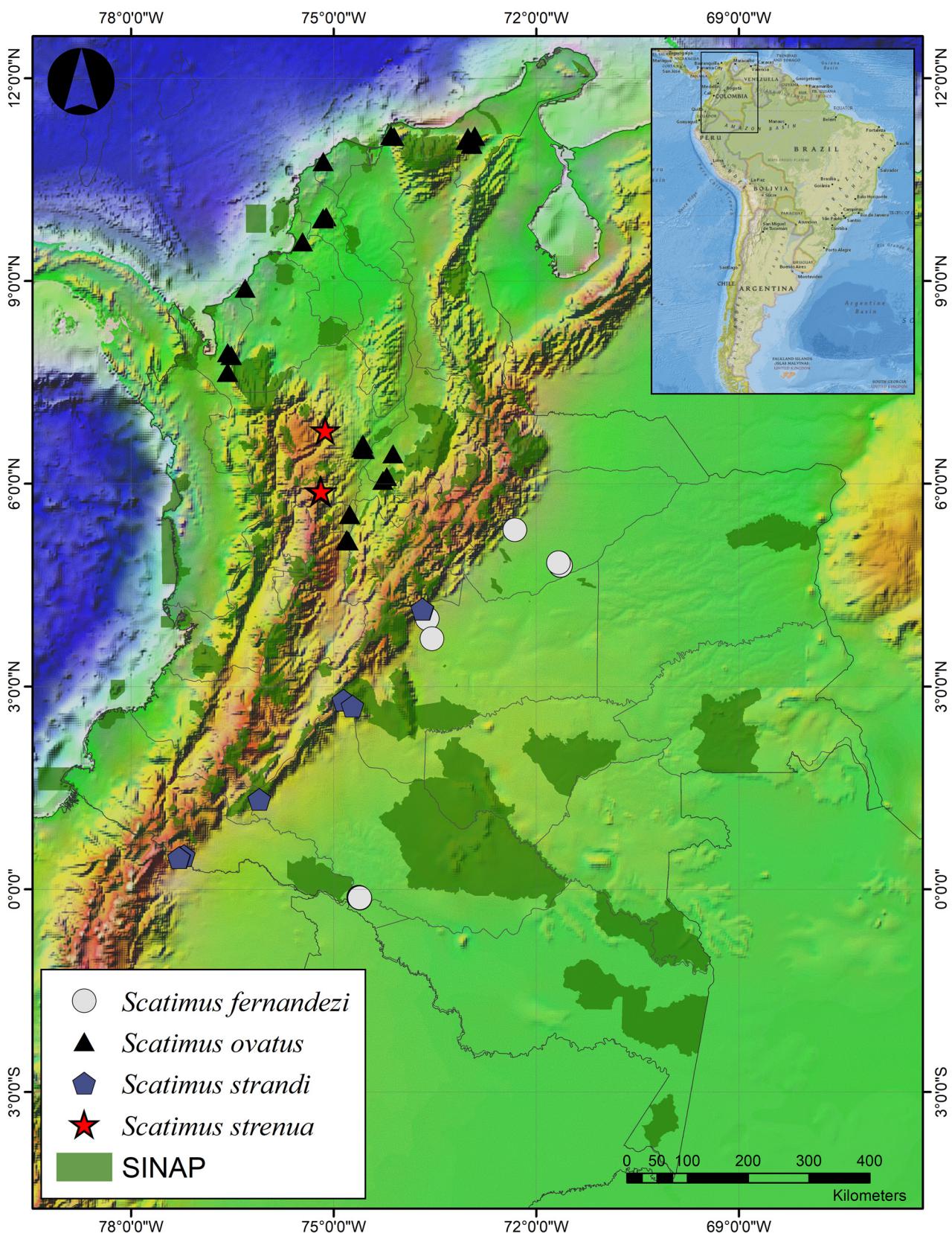


FIGURE 6. Geographical distribution of the *Scatimus* species from Colombia and their coincidence with protected areas (Sistema Nacional de Áreas Protegidas).

- 3(1). Body in dorsal view oval, lateral edges distinctly arcuate throughout (1⁰, Figs. 1C, D), dorsal surface of metatibiae smooth throughout (43²) 4
- Body in dorsal view elongate, lateral edges parallel on median third (1¹, Figs. 1A, B, E), dorsal surface of metatibiae with strong microsculpture on external half only (43¹) 5
- 4(3). Proepipleural sulcus of elytron lacking a distinct fovea near the anterior angle (22²), anteromedial surface of mesepimeron impunctate (28¹), surface of abdominal ventrite with ill-defined microsculpture on segment 3-4 laterally (47³, Fig. 3G), lower surface of mesofemur and metafemur with several coarse and umbilicate punctures at apex anteriorly *Scatimus erinnios*
- 5(3). Lateral surface of mesepimeron lacking transverse carina medially, males with distinct clypeal teeth forming a rounded clypeal border at their base (27², Figs. 2A, 3D), parameres with rounded and slightly angulate apex (Figs. 4D, H) *Scatimus strenua*
- Lateral surface of mesepimeron medially with a transverse carina, males with indistinct clypeal teeth forming a continuous clypeal border at their base (27¹, Figs. 2D, 3C), parameres with narrow and angulate apex (Figs. 4C, G) *Scatimus strandi*

Acknowledgments

A.L.T. wishes to thank the community of El Porvenir, especially Ledys Martínez, Andrea Orozco, and all the women who have endured the terrible effects of the war and still persevered towards the protection of these incredible forests. We thank Humberto Mendoza for the description of the “Melcocho” watershed vegetation, Mailyn González and the Colombia Bio Project for organization of the expedition to Antioquia, François Génier for confirming the observation of one of the morphological characters of *Scatimus*, Daniela Morales Becerra for her help with the Latin name of the species, Jhon Cesar Neita for advice on the phylogenetic analysis, and Jacob Socolar his for great help with language editing and proofreading. Cooperation Agreement 11-256, signed between the Norwegian University of Biological Sciences and the Instituto Alexander von Humboldt, corresponding to the project “Impacts of tropical agriculture on biodiversity through different spatial scales”, financed the expeditions where the new departmental records were found, and Diego Martínez’s stay in Villa de Leyva, Boyacá during the course of this investigation. We are grateful also to the anonymous reviewers for critically reading the manuscript and suggesting several improvements.

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