

Research article

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Taxonomic revision of the *Deltohyboma* Lane, 1946 *gilli* species group (Coleoptera: Scarabaeidae: Scarabaeinae: *Deltochilum*)Arturo GONZÁLEZ-ALVARADO ^{1,*} & Fernando Z. VAZ-DE-MELLO ²

¹Programa de Pós-graduação em Ecologia e Conservação da Biodiversidade, Universidade Federal de Mato Grosso, Cuiabá, Mato Grosso, Brazil. Current address: Colecciones Biológicas, Instituto de Investigación de Recursos Biológicos Alexander von Humboldt, Villa de Leyva, Boyacá, Colombia.

²Instituto de Biociências, Departamento de Biologia e Zoologia, Universidade Federal de Mato Grosso, Cuiabá, Mato Grosso, Brazil.

*Corresponding author: fagakorn@gmail.com²Email: vazdemello@gmail.com¹urn:lsid:zoobank.org:author:2D58A702-73A9-4C66-8CED-6B8B9A2AB10B²urn:lsid:zoobank.org:author:2FF2B7D6-1A6B-43C1-9966-A1A949FB2B05

Abstract. The dung beetles belonging to the genus *Deltochilum* Eschscholtz, 1822 are widely distributed in the Neotropical region. This genus is divided into eight subgenera, of these, the subgenus *Deltohyboma* Lane, 1946 is the most diverse, with an estimated 212 species. The most recent revision of *Deltohyboma* divided the subgenus into 19 species group. Here, taxonomy of the *gilli* species group is revised. Four new species (*D. jocelynae* sp. nov., *D. nonstriatum* sp. nov., *D. quasistriatum* sp. nov. and *D. tenuistriatum* sp. nov.) are described, making a total of five species within the species group. Keys for species identification and habitus as well as male genitalia morphology are illustrated.

Keywords. Dung beetles, Neotropics, new species, diversity.

González-Alvarado A. & Vaz-de-Mello F.Z. 2021. Taxonomic revision of the *Deltohyboma* Lane, 1946 *gilli* species group (Coleoptera: Scarabaeidae: Scarabaeinae: *Deltochilum*). *European Journal of Taxonomy* 775: 86–106. <https://doi.org/10.5852/ejt.2021.775.1551>

Introduction

The dung beetles (Scarabaeinae) of the genus *Deltochilum* Eschscholtz, 1822 are widely distributed in the Neotropical region, comprising 114 valid species (including four new species described here). *Deltochilum* is divided into eight subgenera (Génier 2012; González-Alvarado *et al.* 2019; González-Alvarado & Vaz-de-Mello 2014, 2021; Silva *et al.* 2015). Within those subgenera, two are monospecific *Euhyboma* Kolbe, 1893 and *Rubrohyboma* Paulian, 1938; one has two species *Parahyboma* Paulian, 1938; three have been taxonomically revised *Aganhyboma* Kolbe, 1893, *Deltochilum s. str.* and *Hybomidium* Shipp, 1897 (Génier 2012; González-Alvarado & Vaz-de-

Mello 2014; Silva *et al.* 2015). Recently, González-Alvarado & Vaz-de-Mello (2021) initiated the taxonomic revision of the most speciose subgenus, *Deltohyboma* Lane, 1946, with the proposal of 19 species groups within it.

The *gilli* species group is characterised by the following combination of character states: a) anterior margin of the clypeus, between clypeal teeth, concave and expanded posteriorly into triangular shape; b) posterior edge of metafemur with two margins; and c) ventral surface of the protibia with weak carina (González-Alvarado & Vaz-de-Mello 2021). This species group can be found, according to the biogeographical dominions and provinces defined by (Morrone 2014), in the Boreal Brazilian dominion, Guianan Lowlands and Pantepui provinces (González-Alvarado & Vaz-de-Mello 2021).

Of the almost 10 000 specimens of the subgenus *Deltohyboma* studied (González-Alvarado & Vaz-de-Mello 2021), belonging to 19 entomological collections, only eight (five species) were found, in two collections, belonging to the *gilli* species group. The species that gives its name to the species group, *D. gilli*, was described by González-Alvarado & Vaz-de-Mello (2021). In the current study, four further species are described.

Material and methods

This work is based on the study of eight specimens, six males and two females. Specimens examined are or will be deposited at the following collections (curator(s) in parentheses). The abbreviations of the collections follow GRSciColl (<https://gbif.org/grscicoll>), except for the Bruce D. Gill personal collection. The holotypes in his collection have now been deposited at the Canadian National Collection of Insects and Arachnids, Agriculture and Agri-Food Canada (Bruce Gill pers. comm).

BDGC = Bruce D. Gill personal collection, Ottawa, Canada (Bruce Gill)
CMNEN = Canadian Museum of Nature, Ottawa, Canada (François Génier)
CNCI = Canadian National Collection of Insects and Arachnids, Agriculture and Agri-Food Canada, Ottawa, Canada (Pat Bouchard and Serge Laplante).

The methodology as well as the terminology, pertaining to the external morphology and male genitalia follow those described in González-Alvarado & Vaz-de-Mello (2021). The material examined was prepared following the Material Citations Formatting Guide provided by this journal.

The distribution maps for the species were prepared with QGIS 3.12 software (under GNU General Public License). The maps were based on the data provided on the specimen labels and the free satellite images provided by Google Earth.

A complete description of the subgenus *Deltohyboma* and a short description of the *gilli* species group were provided in González-Alvarado & Vaz-de-Mello (2021); here, a more comprehensive description of the species group is presented, in which the characters shared by all species are described and are not repeated in the species descriptions. For species diagnoses, each species is compared to species belonging to the *gilli* species group only.

Results

Taxonomy

Class Insecta Linnaeus, 1758
Order Coleoptera Linnaeus, 1758
Suborder Polyphaga Emery, 1886
Superfamily Scarabaeoidea Latreille, 1802
Family Scarabaeidae Latreille, 1802
Subfamily Scarabaeinae Latreille, 1802
Tribe Deltophilini Lacordaire, 1856
Genus *Deltophilum* Eschscholtz, 1822
Subgenus *Deltohyboma* Lane, 1946

The *gilli* species group

Description

BODY (Fig. 1). Medium-sized species, length 8–8.4 mm, humeral width 5.1–5.2 mm.

HEAD (Fig. 2). Eyes large, inter-ocular distance seven to nine times width of one eye. Clypeal median emargination broadly u-shaped. Clypeal teeth separated approximately by 1.5 times the basal width of a tooth. Anterior margin of the clypeus, between clypeal teeth, concave and expanded posteriorly into triangular shape.

PRONOTUM (Fig. 3). Margin between anterior and medial angle subconcave. Medial angle of pronotum rounded to projected. Punctures almost with the same size, basal punctures only slightly larger than discal punctures. Pronotal disc with shiny points well-defined (Fig. 3F, arrows), separated between each other and separated or contiguous to punctures; or irregular (Fig. 3G, arrows), contiguous between to each other and to punctures.

ELYTRA (Fig. 4–5). Interstriae with shiny points mixed with the punctures. Interstriae VI and VII with basal carina almost identical in size. Carina of ninth interstria reaching middle of elytral length or slightly surpassing it. Striae I–VIII inconspicuous including apically, only in some parts striae slightly visible and very narrow or striae I–VII conspicuous and narrow, width of third stria $\frac{1}{30}$ th or $\frac{1}{40}$ th of the distance between stria II and III. If conspicuous, first stria widest and either striae III–VII subequal in width or striae III–VII ill-defined, successively narrower and more ill-defined, with VII almost inconspicuous, and stria VIII conspicuous apical and laterally or only laterally; in both discontinuous in some parts and reaching the apex of carina of the ninth interstria. Apex of elytra with tubercles on interstriae III–VII or III, V–VII (Fig. 5).

METAVENTRITE (Fig. 6). With weak posterior excavation, occupying approximately the metaventral basal fourth. Disc with conspicuous punctures at 8 × magnification. Disc punctures at least twice smaller than punctures on anterior-lateral area of metaventral process and dispersed, separated at least by three diameters of a puncture. Punctures on anterior-lateral area of metaventral process separated by less than one diameter. Anterior-medial area of metaventral process with few and smaller punctures than anterior-lateral ones.

LEGS. Ventral surface of protibia with a weak carina. Posterior edge of metafemur with two margins, one dorsal and other one ventral.

MALE. Protibial spur broad and foliaceous. Mesofemur modified, with slight sinuosity on apical third. Apex of mesotibia wider than female and on ventral-internal margin with a small or large spatulate expansion. Metatrochanter modified or not, if modified with an expansion on distal third. Metafemur with steep tapering on basal third, with expansion on posterior-ventral margin, before that steep tapering. Internal margin of metatibia with small or large tubercles. Ventricle I expanded posteriorly, expansion reaching from the middle of ventrite IV to almost the distal margin of ventrite V; width of expansion on ventrite

III variable, narrower to wider than distance between clypeal teeth. Genitalia (Figs 7–8). Paramera subtriangular, with dorsal and ventral edges straight in lateral view. Apex of paramera rounded in dorsal view. Paramera with short and thin apical-dorsal notch (Fig. 7, arrows). Medial area of endophallus with one endophallite (Fig. 8). Basal circular shape endophallite with ring very thin and handle strongly broadened medially.

FEMALE (Fig. 9). Protibial spur thinner than that of male and spiniform. Apex of mesotibia narrower than that of male. Metatrochanter not modified. Meso- and metafemur not modified. Internal margin of metatibia without tubercles. Metasternal disc with posterior excavation smaller than male. Ventrite V as wide as ventrite VI medially. Ventrite VI narrowed medially.

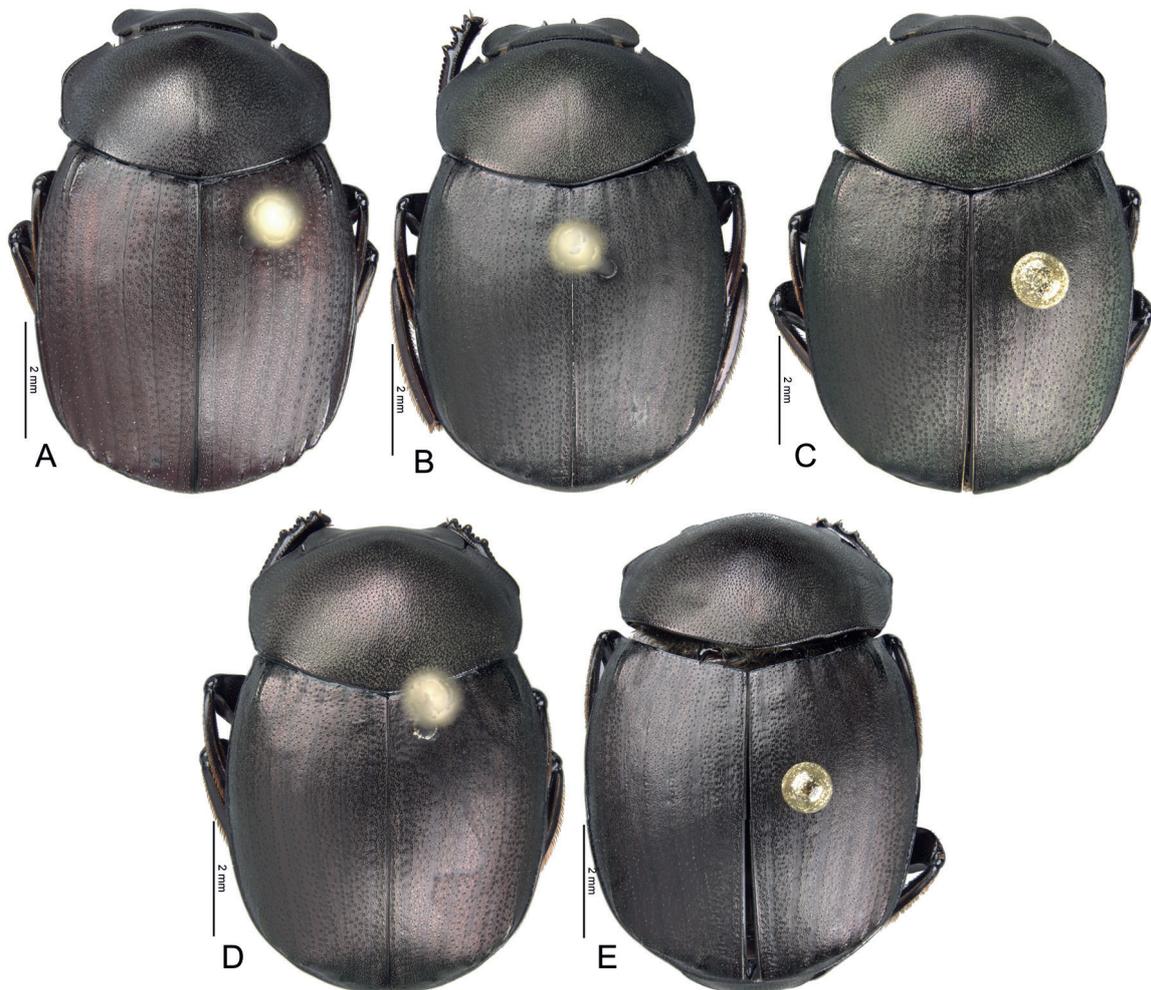


Fig. 1. Habitus of members of the *gilli* species group. **A.** Holotype of *Deltochilum gilli* González-Alvarado & Vaz-de-Mello, 2021, CNCI 379888. **B.** Holotype of *D. jocelynae* sp. nov., CNCI 379889. **C.** Holotype of *D. nonstriatum* sp. nov., CMNEN WSD00041746. **D.** Holotype of *D. quasistriatum* sp. nov., CMNEN WSD00041744. **E.** Holotype of *D. tenuistriatum* sp. nov., CMNEN WSD00041745.

Composition

Deltochilum gilli González-Alvarado & Vaz-de-Mello, 2021, *D. jocelynae* sp. nov., *D. nonstriatum* sp. nov., *D. quasistriatum* sp. nov. and *D. tenuistriatum* sp. nov.



Fig. 2. Head of members of the *gilli* species group. **A.** Holotype of *Deltochilum gilli* González-Alvarado & Vaz-de-Mello, 2021, CNCI 379888. **B.** Holotype of *D. jocelynae* sp. nov., CNCI 379889. **C.** Holotype of *D. nonstriatum* sp. nov., CMNEN WSD00041746. **D.** Holotype of *D. quasistriatum* sp. nov., CMNEN WSD00041744. **E.** Holotype of *D. tenuistriatum* sp. nov., CMNEN WSD00041745.

Remarks

This species group is only known from few (eight) specimens and their biology is poorly known. The specimens were collected above 680 m a.s.l. and the highest record is 1411 m a.s.l. (one specimen does

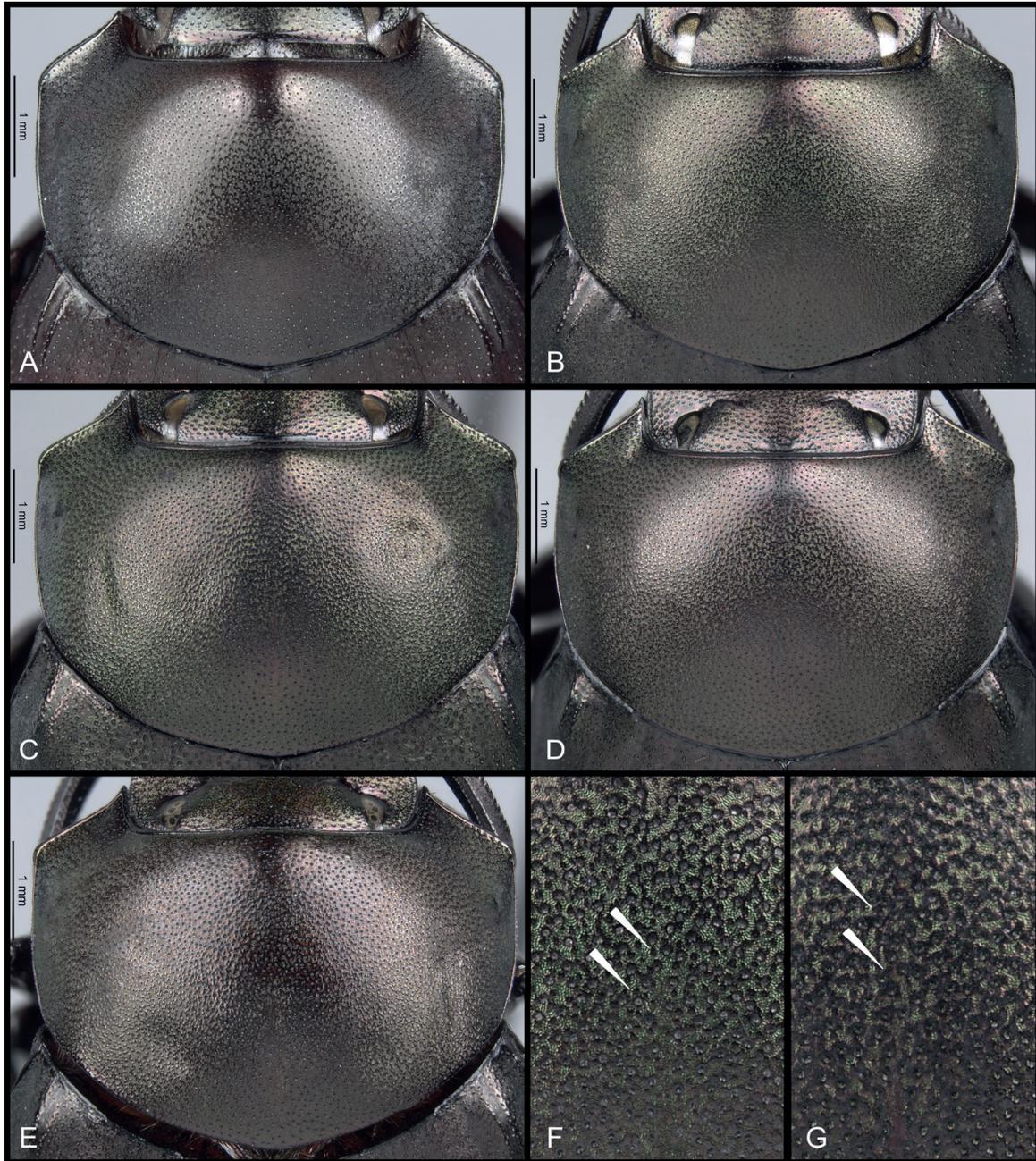


Fig. 3. Pronotum of members of the *gilli* species group. **A.** Holotype of *Deltochilum gilli* González-Alvarado & Vaz-de-Mello, 2021, CNCI 379888. **B.** Holotype of *D. jocelynae* sp. nov., CNCI 379889. **C.** Holotype of *D. nonstriatum* sp. nov., CMNEN WSD00041746. **D.** Holotype of *D. quasistriatum* sp. nov., CMNEN WSD00041744 **E.** Holotype of *D. tenuistriatum* sp. nov., CMNEN WSD00041745. **F.** Microsculpture of pronotal disc, Holotype of *D. jocelynae* sp. nov. **G.** Microsculpture pronotal disc, Holotype of *D. nonstriatum* sp. nov. White arrows show the shiny points.

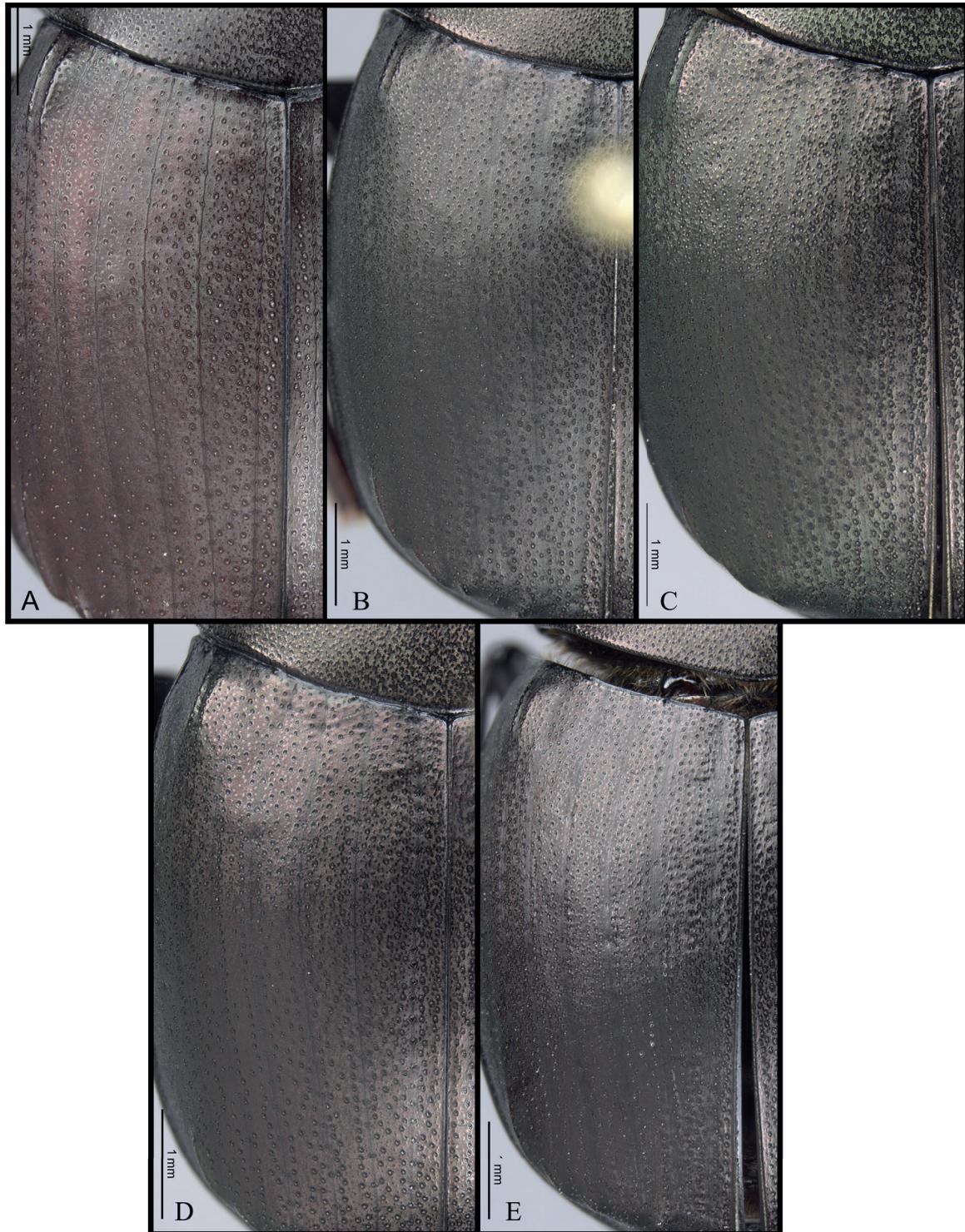


Fig. 4. Elytra of members of the *gilli* species group. **A.** Holotype of *Deltochilum gilli* González-Alvarado & Vaz-de-Mello, 2021, CNCI 379888. **B.** Holotype of *D. jocelynae* sp. nov., CNCI 379889. **C.** Holotype of *D. nonstriatum* sp. nov., CMNEN WSD00041746. **D.** Holotype of *D. quasistriatum* sp. nov., CMNEN WSD00041744. **E.** Holotype of *D. tenuistriatum* sp. nov., CMNEN WSD00041745.

not have altitude information). They were collected using pitfall traps baited with human dung (five specimens), carrion (one specimen) as well as via window trap (one specimen).

Deltochilum gilli González-Alvarado & Vaz-de-Mello, 2021

Figs 1A, 2A, 3A, 4A, 5A, 6A, 7A, 8A, 9A–B, 10

Deltochilum gilli González-Alvarado & Vaz-de-Mello, 2021: 50, figs 26c, 28.

Diagnosis

Elytra with apical tubercles on interstriae III–VII (Fig. 5A), first stria almost twice as wide as than second stria, striae III–VII subequal in width and conspicuous (Figs 1A, 4A) and sub-medial area of

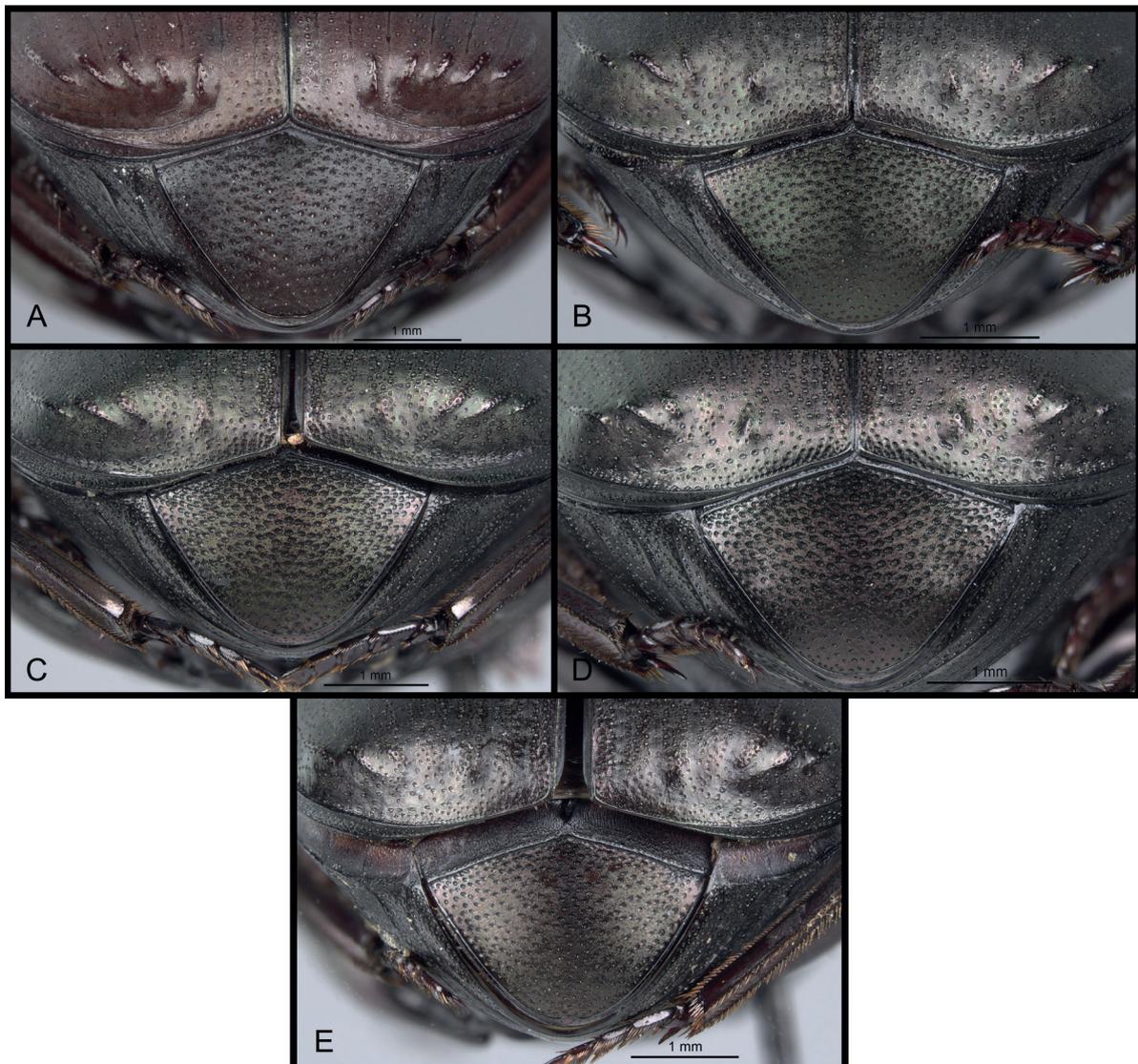


Fig. 5. Caudal view of members of the *gilli* species group. **A.** Holotype of *Deltochilum gilli* González-Alvarado & Vaz-de-Mello, 2021, CNCI 379888. **B.** Holotype of *D. jocelynae* sp. nov., CNCI 379889. **C.** Holotype of *D. nonstriatum* sp. nov., CMNEN WSD00041746. **D.** Holotype of *D. quasistriatum* sp. nov., CMNEN WSD00041744. **E.** Holotype of *D. tenuistriatum* sp. nov., CMNEN WSD00041745.

endophallus with elongate scales (Fig. 8A, arrow) distinguish this species (for a complete description see González-Alvarado & Vaz-de-Mello 2021).

Material examined

Holotype

GUYANA • 1 ♂; District 8, Mount Wokomung; 5°06'34.8" N, 59°49'15.3" W; alt. 1234 m; 27 Oct.–1 Nov. 2004; B. Hubley leg.; pitfall trap (human dung), primary forest; ROM 2004516; BDGC. [aedeagus and endophallus extracted]; CNC 379888.

Paratype

GUYANA • 1 ♀; same collection data as for preceding; BDGC.



Fig. 6. Ventral view of members of the *gilli* species group. **A.** Holotype of *Deltochilum gilli* González-Alvarado & Vaz-de-Mello, 2021, CNCI 379888. **B.** Holotype of *D. jocelynae* sp. nov., CNCI 379889. **C.** Holotype of *D. nonstriatum* sp. nov., CMNEN WSD00041746. **D.** Holotype of *D. quasistriatum* sp. nov., CMNEN WSD00041744. **E.** Holotype of *D. tenuistriatum* sp. nov., CMNEN WSD00041745.

Remarks

Within *D. (Deltohyboma)* only few species which possess the anterior margin of clypeus expanded posteriorly into a triangular shape have more than four elytral apical tubercles. Frequently, in species bearing over four apical tubercles, the anterior margin of the clypeus is not expanded into a triangular shape. *D. gilli* is one of those few exceptions.

Known distribution

Guyana. District 8, Mount Wokomung. (Fig. 10, blue circle).

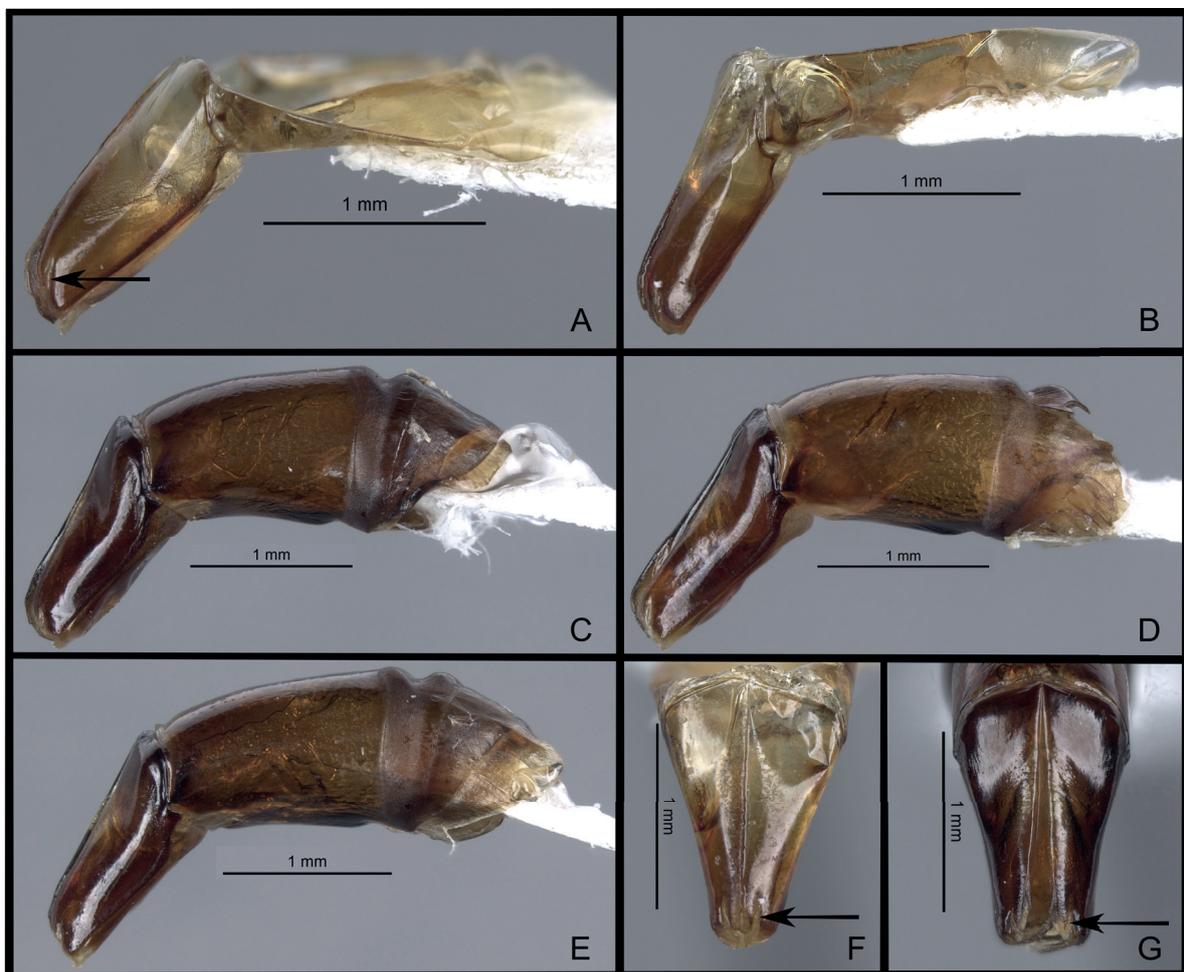


Fig. 7. Aedeagus of members of the *gilli* species group. **A–E.** Lateral view. **F–G.** Dorsal view of paramera. Arrows show the apical-dorsal notches of the paramera. **A.** Holotype of *Deltochilum gilli* González-Alvarado & Vaz-de-Mello, 2021, CNCI 379888. **B.** Holotype of *D. jocelynae* sp. nov., CNCI 379889. **C.** Holotype of *D. nonstriatum* sp. nov. CMNEN WSD00041746. **D.** Holotype of *D. quasistriatum* sp. nov., CMNEN WSD00041744. **E.** Holotype of *D. tenuistriatum* sp. nov., CMNEN WSD00041745. **F.** Holotype of *D. jocelynae* sp. nov. **G.** Holotype of *D. nonstriatum* sp. nov., CMNEN WSD00041746.

Deltochilum jocelynae sp. nov.

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Figs 1B, 2B, 3B, F, 4B, 5B, 6B, 7B, F, 8B, 9C–D, 10

Diagnosis

Close to *D. nonstriatum* sp. nov. by having striae I–VII inconspicuous (Figs 1B–C, 4B–C) including apically (Fig. 5B–C). However, it can be distinguished by presenting the smallest and most disperse interstitial punctures (Fig. 4B) as well as most disperse punctures on head frons (Fig. 2B) and on pronotal disc (Fig. 3B, F) and finally, by the well-defined shiny points on the pronotal disc (Fig. 3B, F).

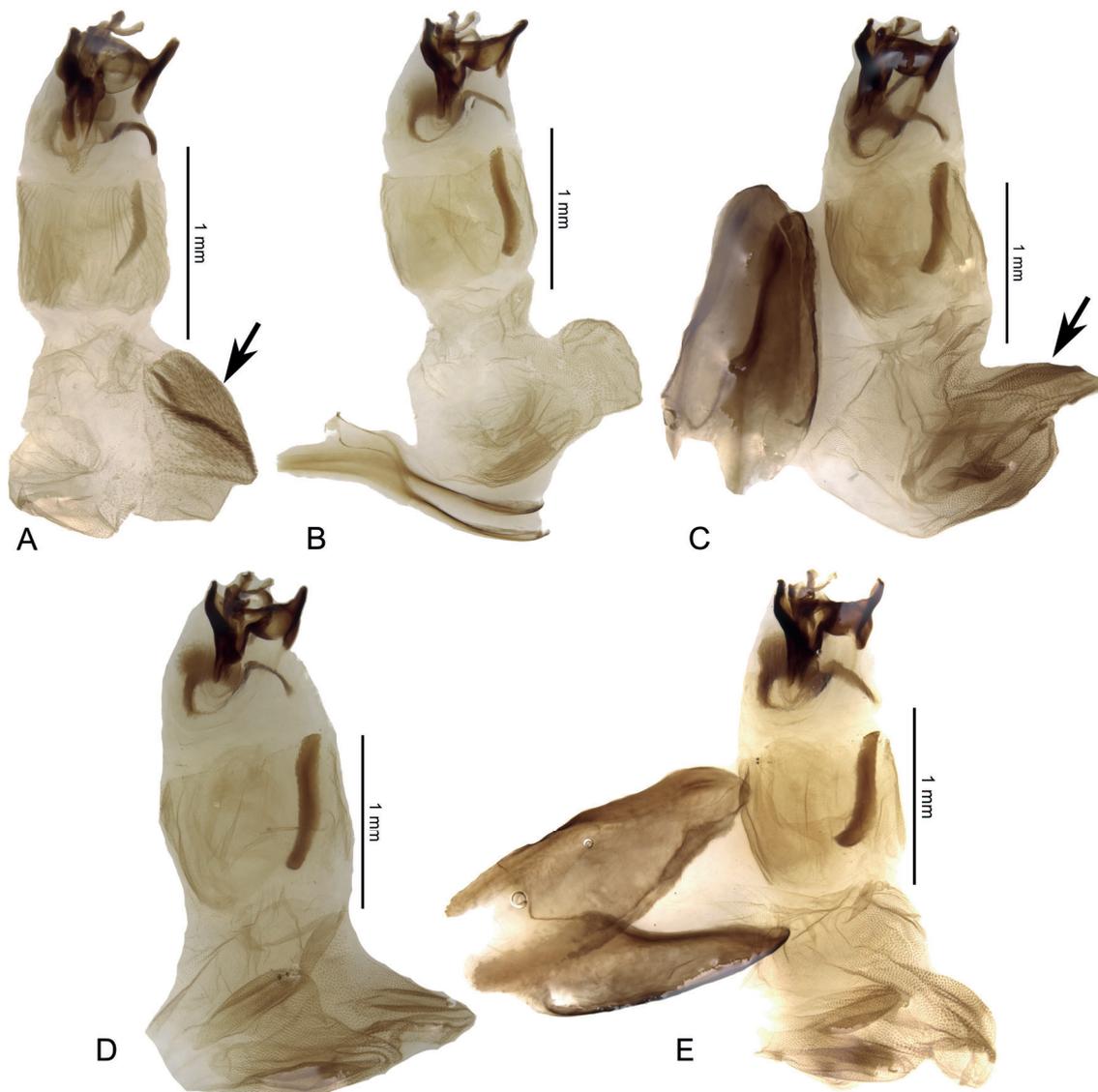


Fig. 8. Endophallus of members of the *gilli* species group. Arrows show the scales on the sub-medial area of the endophallus. **A.** Elongate scales. **C.** Regular scales. **A.** Holotype of *Deltochilum gilli* González-Alvarado & Vaz-de-Mello, 2021, CNCI 379888. **B.** Holotype of *D. jocelynae* sp. nov., CNCI 379889. **C.** Holotype of *D. nonstriatum* sp. nov., CMNEN WSD00041746. **D.** Holotype of *D. quasistriatum* sp. nov., CMNEN WSD00041744. **E.** Holotype *D. tenuistriatum* sp. nov., CMNEN WSD00041745.

Etymology

A patronym, noun in the genitive case, for Jocelyn Gill. See also the “Acknowledgments” section.

Type material

Holotype

GUYANA • 1 ♂; District 8, Mount Wokomung; 5°05'33.4" N, 59°50'34.4" W; alt. 1411 m; 4–8 Nov. 2004; B. Hubley leg.; pitfall trap (human dung), primary forest; ROM 2004526; BDGC; [aedeagus and endophallus extracted]; CNC 379889.

Paratypes

GUYANA • 1 ♂; same data as for holotype; BDGC • 1 ♀; same data as for holotype; 5°07'53.2" N, 59°48'31.4" W; alt. 698 m; 21–26 Oct. 2004; ROM 2004509; BDGC.

Description

MEASUREMENTS AND COLOR. Holotype male, length 8.1 mm, humeral width 5.1 mm. Dark green with some red reflections dorsally (Fig. 1B). Black ventrally, with shiny red reflections on anterior area of metaventral process, meso- and metafemora and ventrite VI (Fig. 6B).

HEAD (Fig. 2B). Dorsal inter-ocular distance approximately seven times width of one eye. Punctures on frons separated by less than one diameter of each puncture. Punctures on head disc separated by less than one diameter of each puncture.

PRONOTUM (Fig. 3B, F). Medial angle slightly projected. Punctures on the disc separated by less than one diameter. Shiny points on disc well-defined and contiguous to punctures.

ELYTRA (Figs 1B, 4B). Carina of the ninth interstria reaching middle of elytral length. Striae I–VIII inconspicuous including apically (Fig. 5B), only in some parts striae slightly visible and very narrow. Punctures of second interstria on disc separated by one or less than one diameter, on third a slightly disperse. Punctures of third interstria on disc occupying about $\frac{1}{4}$ th of the distance between striae II and III. Apical tubercles on interstriae III, V–VII (Fig. 5B).

ABDOMEN (Fig. 6B). Width of expansion of the ventrite I, on ventrite III, subequal to distance between clypeal teeth; expansion reaching distal margin of ventrite IV. Margins of expansion between ventrites II–IV forming an acute angle. Apex of expansion truncate. Basal area of expansion with punctures separated by less than one diameter.

LEGS. Apex of mesotibia on ventral-internal margin with a small spatulate expansion. Expansion of metafemur 1.8 × wider than the width of metafemur basal to expansion. Internal margin of metatibia with large tubercles, occupying almost all metatibial length.

PYGIDIUM (Fig. 5B). Most of the punctures separated by less than one diameter; punctures basally denser than punctures on disc. Discal punctures occupying approximately $\frac{1}{30}$ th the width on middle of pygidium.

GENITALIA (Figs 7B, 8B). Aedeagus as described in the *gilli* species group. Medial endophallite slightly sinuate. Sub-medial area of endophallus with scales.

Remarks

Only three specimens are known for this species, all teneral. The holotype does not appear to be teneral externally, however, the aedeagus is poorly sclerotised (Fig. 7B). The paratypes differ from the holotype by the sexual dimorphism and by having the elytra and the pygidium less sclerotised, with

those structures light brown (Fig. 9C–D). It appears that this species is sympatric with *D. gilli* since both species were collected a few kilometres apart (see Fig. 10, red square). *Deltochilum gilli* was collected almost 200 meters higher (altitude) than *D. jocelynae* sp. nov.. However, both species are easily separated via the elytra; *D. gilli* has conspicuous striae (Fig. 4A), whereas these are inconspicuous in *D. jocelynae* sp. nov. (Fig. 4B).

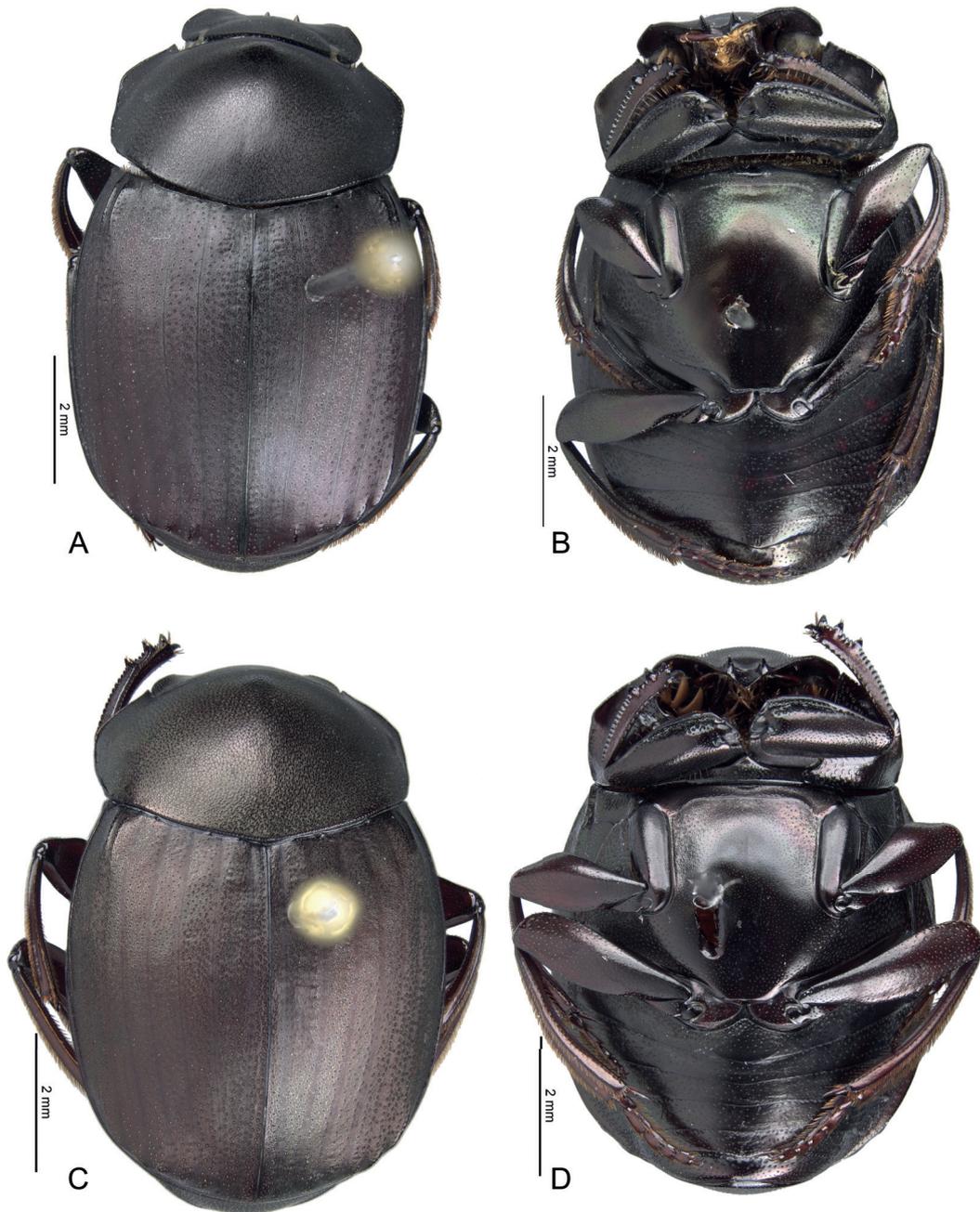


Fig. 9. Habitus A, C and ventral view B, D of the only two females known of the *gilli* species group. A–B. Paratype of *Deltochilum gilli* González-Alvarado & Vaz-de-Mello, 2021. C–D. Paratype *D. jocelynae* sp. nov.

Known distribution

GUYANA. District 8, Mount Wokomung (Fig. 10, yellow square).

Deltochilum nonstriatum sp. nov.

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Figs 1C, 2C, 3C, G, 4C, 5C, 6C, 7C, G, 8C, 10

Diagnosis

Close to *D. jocelynae* sp. nov. by having the striae I–VII inconspicuous (Figs 1B–C, 4B–C) including apically (Fig. 5B–C). However, it can be distinguished by presenting the largest and densest interstitial punctures (Fig. 4C), as well as densest punctures on the head frons (Fig. 2C) and on the pronotal disc (Fig. 3C, G); finally, by the irregular shiny points on the pronotal disc (Fig. 3C, G).

Etymology

From Latin *non-* 'not' + *stria* in reference to the inconspicuous elytral striae.

Type material

Holotype

VENEZUELA • 1 ♂; Bolívar, km 40 Sta. [Santa] Elena, Icabaru Road; 7°26'20" N, 61°33'30" W; alt. 1000 m; 4–6 Aug. 1986; B.D. Gill leg.; [aedeagus and endophallus extracted]; CMNEN WSD00041746.

Description

MEASUREMENTS AND COLOR. Holotype male, length 8.4 mm, humeral width 5.2 mm. Dark green with red reflections dorsally (Fig. 1C). Black ventrally, with shiny red reflections on anterior area of metaventral process, meso- and metafemora and ventrite VI (Fig. 6C).

HEAD (Fig. 2C). Dorsal inter-ocular distance approximately seven times width of one eye. Punctures on frons separated by less than one diameter of each puncture, almost contiguous. Punctures on head disc separated by less than one diameter of each puncture.

PRONOTUM (Fig. 3C, G). Medial angle projected. Punctures on the disc separated by less than one diameter, almost contiguous. Shiny points on disc irregular and contiguous to punctures.

ELYTRA (Figs 1C, 4C). Carina of the ninth interstria surpassing middle of elytral length. Striae I–VIII inconspicuous including apically (Fig. 5C), only in some parts striae slightly visible and very narrow. Punctures of second and third interstriae on disc separated by less than one diameter. Punctures of third interstria on disc occupying about $\frac{1}{10}$ th the distance between striae II and III. Apical tubercles on interstriae III, V–VII (Fig. 5C).

ABDOMEN (Fig. 6C). Width of expansion of ventrite I, on ventrite III, narrower than distance between clypeal teeth; expansion reaching distal margin of ventrite IV. Margins of expansion between ventrites II–IV forming an acute angle. Apex of expansion rounded. Basal area of expansion with punctures separated by less than one diameter, almost contiguous.

LEGS. Apex of mesotibia on ventral-internal margin with a small spatulate expansion. Expansion of metafemur twice wider than the width of metafemur basal to expansion. Internal margin of metatibia with large tubercles, occupying almost all metatibial length.

PYGIDIUM (Fig. 5C). Most of the punctures separated by less than one diameter; punctures basally denser than punctures on disc; basal punctures contiguous. Discal punctures occupying approximately $\frac{1}{28}$ th the width on middle of pygidium.

GENITALIA (Figs 7C, 8C). Aedeagus as described in the *gilli* species group. Medial endophallite almost straight. Sub-medial area of endophallus with scales (Fig. 8C, arrow).

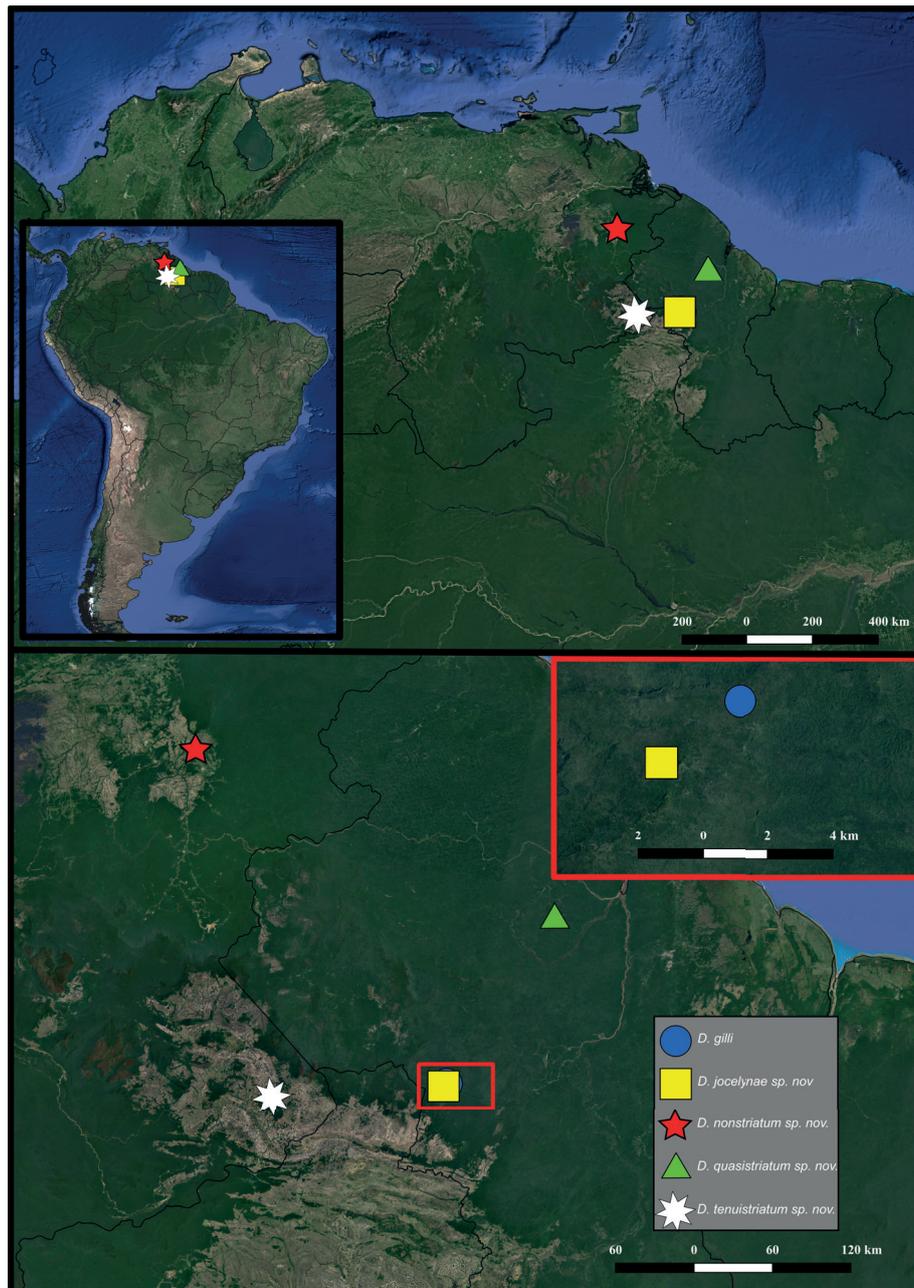


Fig. 10. Distribution map of the *gilli* species group. Blue circle = *Deltochilum gilli* González-Alvarado & Vaz-de-Mello, 2021; yellow square = *D. jocelynae* sp. nov.; red star = *D. nonstriatum* sp. nov.; green triangle = *D. quasistriatum* sp. nov.; white eight-point star = *D. tenuistriatum* sp. nov.

Remarks

This species is only known from the holotype. The holotype has an identification label from François Génier (CMNEN), in which he recognised this specimen as probably being a new species since 1998. The transcription of the label as follows: [handwritten] DELTOCHILUM / ? SP. NOV. / [printed] Dét. F. Génier, 199 [handwritten]8.

Known distribution

VENEZUELA. Bolívar: km 40 Santa Elena, Icabarú Road (Fig. 10, red star).

Deltochilum quasistriatum sp. nov.

urn: lsid:zoobank.org:act:E7290E3C-1482-481C-AAAC-E0C44D7432DE

Figs 1D, 2D, 3D, 4D, 5D, 6D, 7D, 8D, 10

Diagnosis

Close to *D. tenuistriatum* sp. nov. by having striae I–VII conspicuous (Figs 1D–E, 4D–E), but III–VII successively thinner and more ill-defined and the pronotal disc with irregular shiny points contiguous with punctures (Fig. 3D–E). However, it can be distinguished by having the first stria wider than second, largest interstitial punctures (Fig. 4D) and by the pygidial punctures which are largest and densest (Fig. 5D).

Etymology

From latin *quasi*- 'almost' + *stria* in reference to the ill-defined striae.

Type material

Holotype

GUYANA • 1 ♂; Mazaruni-Potaro District, Takutu Mountains; 6°15' N, 59°5' W; 18 Dec. 1983; P.D. Perkins and W.E. Steiner leg.; window trap, mountain rainforest, near logging area; EARTHWATCH Research Expedition; [aedeagus and endophallus extracted]; CMNEN WSD00041744.

Description

MEASUREMENTS AND COLOR. Holotype male, length 8.1 mm, humeral width 5.1 mm. Dark green with red reflections on pronotum, elytra dark brown with some red reflections (Fig. 1D). Dark brown ventrally, with few shiny red reflections on ventrite VI and meso- and meta-legs light brown (Fig. 6D).

HEAD (Fig. 2D). Dorsal inter-ocular distance approximately seven times width of one eye. Punctures on frons separated by less than one diameter of each puncture, almost contiguous. Punctures on head disc separated by one diameter of each puncture.

PRONOTUM (Fig. 3D). Medial angle projected. Punctures on the disc separated by less than one diameter, almost contiguous. Shiny points on disc irregular and contiguous to punctures.

ELYTRA (Figs 1D, 4D). Carina of ninth interstria reaching middle of elytral length. Punctures on first stria subequal in size to second stria, but denser. Striae I–VII conspicuous. First stria slightly wider than second stria. Striae III–VII narrow and ill-defined, successively narrower and more ill-defined, with VII almost inconspicuous. Width third stria approximately $\frac{1}{40}$ th of distance between striae II and III. Stria VIII conspicuous only laterally, discontinuous in some parts and reaching apex of carina of the ninth interstria. Punctures of second and third interstriae on disc separated by less than one diameter. Punctures of third interstria on disc occupying about $\frac{1}{10}$ th of the distance between striae II and III. Apical tubercles on interstriae III, V–VII (Fig. 5D).

ABDOMEN (Fig. 6D). Width of expansion of the ventrite I, on ventrite III, subequal to distance between clypeal teeth; expansion reaching middle of ventrite IV. Margins of expansion between ventrites II–IV forming an acute angle. Apex of expansion truncate. Basal area of expansion with punctures separated by less than one diameter, almost contiguous.

LEGS. Apex of mesotibia on ventral-internal margin with a small spatulate expansion. Expansion of metafemur 1.8 × wider than the width of metafemur basal to expansion. Internal margin of metatibia with large tubercles, occupying almost all metatibial length.

PYGIDIUM (Fig. 5D). Most of the punctures separated by less than one diameter; punctures basally denser than punctures on disc; basal punctures almost contiguous. Discal punctures occupying approximately 1/29th the width on middle of pygidium.

GENITALIA (Figs 7D, 8D). Aedeagus as described in the *gilli* species group. Medial endophallite sinuate. Sub-medial area of endophallus with scales.

Remarks

This species is only known from the holotype.

Known distribution

Guyana. Cuyuni-mazaruni, Takutu Mountains (Fig. 10, green triangle).

Deltochilum tenuistriatum sp. nov.

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Figs 1E, 2E, 3E, 4E, 5E, 6E, 7E, 8E, 10

Diagnosis

Close to *D. quasistriatum* sp. nov. by having the striae I–VII conspicuous (Figs 1D–E, 4D–E), but III–VII successively thinner and more ill-defined and by the pronotal disc with irregular shiny points contiguous to punctures (Fig. 3D–E). However, it can be distinguished by having the first stria subequal to second stria, smallest interstitial punctures (Fig. 4E) and by pygidial punctures which are smallest and most disperse (Fig. 5E).

Etymology

From Latin *tenuis* 'weak' + *stria* in reference to the ill-defined striae.

Type material

Holotype

VENEZUELA • 1 ♂; Bolívar, 10 km E of S. [San] F. [Francisco] Yuruani; 5°1'34" N, 61°2'34" W; alt. 1300 m; 8–10 Jul. 1987; S. and J. Peck leg.; carrion traps, Gran Sabana, forest; [aedeagus and endophallus extracted]; CMNEN WSD00041745.

Description

MEASUREMENTS AND COLOR. Holotype male, length 8 mm, humeral width 5.2 mm. Dark green with red reflections dorsally (Fig. 1E). Black ventrally, with shiny red reflections on metaventrite, metaventral process, meso- and metafemora and ventrite VI (Fig. 6E).

HEAD (Fig. 2E). Dorsal inter-ocular distance approximately eight times width of the eye. Punctures on frons separated by less than one diameter of each puncture. Punctures on head disc separated by less than one diameter of each puncture, almost contiguous.

PRONOTUM (Fig. 3E). Medial angle projected. Punctures on disc separated by less than one diameter, almost contiguous. Shiny points on disc irregular and contiguous to punctures.

ELYTRA (Figs 1E, 4E). Carina of ninth interstria reaching middle of elytral length. Punctures on first stria subequal in size to second stria, but denser. Striae I–VII conspicuous. Width of first stria subequal to second stria. Striae III–VII narrow and ill-defined, successively narrower and more ill-defined, with VII almost inconspicuous. Width third stria approximately $\frac{1}{40}$ th the distance between striae II and III. Stria VIII conspicuous only laterally, discontinuous in some parts and reaching apex of carina of the ninth interstria. Punctures of second interstria on disc separated by less than one diameter, on third by one diameter. Punctures of third interstria on disc occupying about $\frac{1}{14}$ th the distance between striae II and III. Apical tubercles on interstriae III, V–VII (Fig. 5E).

ABDOMEN (Fig. 6E). Width of expansion of ventrite I, on ventrite III, subequal to distance between clypeal teeth; expansion reaching distal margin of ventrite IV. Margins of expansion between ventrites II–III forming an acute angle. Expansion on ventrite IV narrower than on ventrite III, and margins almost parallel. Apex of expansion rounded. Basal area of expansion with punctures separated by less than one diameter, almost contiguous.

LEGS. Apex of mesotibia on ventral-internal margin with a small spatulate expansion. Expansion of metafemur $1.7 \times$ wider than the width of metafemur basal to expansion. Internal margin of metatibia with large tubercles, occupying almost all metatibial length.

PYGIDIUM (Fig. 5E). Most of the punctures separated by one diameter; punctures basally denser than punctures on disc. Discal punctures occupying approximately $\frac{1}{38}$ th the width on middle of pygidium.

GENITALIA (Figs 7E, 8E). Aedeagus as described in the *gilli* species group. Medial endophallite sinuate. Sub-medial area of endophallus with scales.

Remarks

This species is only known from the holotype.

Known distribution

Venezuela. Bolívar: 10 km E San Francisco Yuruani (Fig. 10, white eight-point star).

Identification key to species of the *gilli* species group

1. Striae I–VII inconspicuous, including apically, only in some parts striae slightly visible and very narrow (Fig. 4B–C)..... 2
– Striae I–VII conspicuous (Fig. 4A, D–E)..... 3
2. Head punctures on frons separated by less than one diameter of a puncture (Fig. 2B). Pronotal disc punctures separated by less than one diameter (Fig. 3B, F). Pronotal disc with well-defined shiny points (Fig. 3F, white arrows). Punctures of third interstria on disc occupying about $\frac{1}{14}$ th the distance between striae II and III (Fig. 4B). Width of expansion of first ventrite of male, on third ventrite, subequal to distance between clypeal teeth (Fig. 6B). Guyana, District 8: Mount Wokomung (Fig. 10, yellow square)..... *Deltochilum jocelynae* sp. nov.

- Head punctures on frons almost contiguous (Fig. 2C). Pronotal disc punctures separated by less than one diameter, almost contiguous (Fig. 3C, G). Pronotal disc with irregular shiny points (Fig. 3G, white arrows). Punctures of third interstria on disc occupying about $\frac{1}{10}$ th the distance between striae II and III (Fig. 4C). Width of expansion of first ventrite of male, on third ventrite, narrower than distance between clypeal teeth (Fig. 6C). Venezuela, Bolivar (Fig. 10, red star) *Deltochilum nonstriatum* sp. nov.
- 3. Elytral apical tubercles on interstriae III–VII (Fig. 5A). First stria almost twice wider than second stria (Fig. 4A). Striae III–VII subequal in width and conspicuous (Fig. 4A). Pronotal disc with shiny points well-defined and separated from punctures (Fig. 3A). Male metatrochanter with expansion on distal third. Width of expansion of first ventrite of male, on third ventrite, wider than distance between clypeal teeth (Fig. 6A). Sub-medial area of endophallus with elongate scales (Fig. 8A, arrow). Guyana, District 8: Mount Wokomung (Fig. 10, blue circle) *Deltochilum gilli* González-Alvarado & Vaz-de-Mello, 2021
- Elytral apical tubercles on interstriae III, V–VII (Fig. 5D–E). First stria subequal to slightly wider than second stria (Fig. 4D–E). Striae III–VII successively thinner and more ill-defined (Fig. 4D–E). Pronotal disc with shiny points irregular and contiguous to punctures (Fig. 3D–E). Male metatrochanter not modified. Width of expansion of first ventrite of male, on third ventrite, subequal to distance between clypeal teeth (Fig. 6D–E). Sub-medial area of endophallus with scales, but not elongate (Fig. 8D–E) Guyana, Mazaruni-Potaro District. Venezuela Bolívar (Fig. 10, white eight-point star and green triangle) 4
- 4. First stria wider than second stria (Fig. 4D). Punctures of third interstria on disc occupying about $\frac{1}{10}$ th the distance between striae II and III (Fig. 4D). Pygidium with discal punctures occupying approximately $\frac{1}{29}$ th the width on middle of pygidium and basal punctures almost contiguous (Fig. 5D). Guyana, Mazaruni-Potaro District: Takutu Mountains (Fig. 10, green triangle) *Deltochilum quasistriatum* sp. nov.
- First stria subequal in width to second stria (Fig. 4E). Punctures of third interstria on disc occupying about $\frac{1}{14}$ th the distance between II and III (Fig. 4E). Pygidium with discal punctures occupying approximately $\frac{1}{38}$ th the width on middle of pygidium basal punctures separated by less than one diameter but not almost contiguous (Fig. 5E). Venezuela, Bolívar: 10 km E of San Francisco (Fig. 10, white eight-point star) *Deltochilum tenuistriatum* sp. nov.

Discussion

The subgenus *Deltohyboma* was recently recognised as a very diverse taxon, with an estimated 212 species, 76% of that diversity remaining undescribed. Due to the number of species and the complexity of the group, the subgenus was divided into 19 species groups (González-Alvarado & Vaz-de-Mello 2021). These species groups were proposed to aid in the description of that diversity. Here, the taxonomic revision of one species group (*gilli*) is presented, with the description of four new species.

Based on information from labels, species belonging to the *gilli* species group, appear to be coprophagous, since five of the eight specimens known were collected with pitfall traps baited with human dung. However, those five specimens belong only to two species (*D. gilli* and *D. jocelynae* sp. nov.).

Usually, species of the subgenus *Deltohyboma* are collected in relatively high abundance of specimens in both pitfall traps baited with human dung or carrion. However, the *gilli* and the *barbipes* species groups appear to be an exception as these are represented by few specimens in collections. For both species groups it is unknown whether the species specialise in specific types of resources or if there is any other reason for the scarcity of those species. It is our hope that this revision will encourage the study of the biology and ecology of those scarce species here described.

The *gilli* species group can currently be found in sympatry with the *lindemanna* and *septemstriatum* species groups (González-Alvarado & Vaz-de-Mello 2021). The *gilli* and the *septemstriatum* species groups can be easily separated by following characters: inter-ocular distance less than nine times the width of one eye and striae inconspicuous or conspicuous but narrow (*gilli* species group), whereas the inter-ocular distance is more than nine times and the stria is conspicuous and broad in the *septemstriatum* species group (for characters to separate the *gilli* and *lindemanna* species groups see González-Alvarado & Vaz-de-Mello 2021).

Acknowledgments

We are very grateful to all the curators of the collections cited in the Material and methods section. AG is very grateful to Bruce and Jocelyn Gill for their hospitality in their home and collection. We give special thanks to Joana Pequito for revising the English and for her comments on the manuscript. We also appreciate the comments made by the anonymous reviewer who helped improve the manuscript. A. González-Alvarado was supported by a PhD fellowship from CNPq-TWAS (Conselho Nacional de Desenvolvimento Científico e Tecnológico-The World Academy of Sciences) [Process No.190752/2015-7] and the Canadian Museum of Nature Visiting Scientist Award. FZVM was supported by Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq 306745/2016-0, 302997/2013-0, 440604/2015-0, 431760/2018-7. This paper is part of A. González-Alvarado's PhD thesis.

References

- Génier F. 2012. A new species and notes on the subgenus *Deltochilum* (*Deltochilum*) Eschscholtz, 1822 (Coleoptera: Scarabaeidae: Scarabaeinae: Deltochilini). *Zootaxa* 3357: 25–36.
<https://doi.org/10.11646/zootaxa.3357.1.2>
- González-Alvarado A., Molano-Rendón F. & Vaz-de-Mello F.Z. 2019. A new genus of dung beetles (Coleoptera: Scarabaeidae: Scarabaeinae) endemic to the Brazilian Atlantic Forest. *Journal of Natural History* 53 (27–28): 1751–1765. <https://doi.org/10.1080/00222933.2019.1660429>
- González-Alvarado A. & Vaz-de-Mello F.Z. 2014. Taxonomic review of the subgenus *Hybomidium* Shipp 1897 (Coleoptera: Scarabaeidae: Scarabaeinae: *Deltochilum*). *Annales de la Société entomologique de France (NS)* 50 (3–4): 431–476.
- González-Alvarado A. & Vaz-de-Mello F.Z. 2021. Towards a comprehensive taxonomic revision of the Neotropical dung beetle subgenus *Deltochilum* (*Deltohyboma*) Lane, 1946 (Coleoptera: Scarabaeidae: Scarabaeinae): Division into species groups. *PLOS ONE* 16: e0244657.
<https://doi.org/10.1371/journal.pone.0244657>
- Morrone J.J. 2014. Biogeographical regionalisation of the Neotropical region. *Zootaxa* 3782 (1): 1–110.
<https://doi.org/10.11646/zootaxa.3782.1.1>
- Silva F.A.B., Louzada J. & Vaz-de-Mello F. 2015. A revision of the *Deltochilum* subgenus *Aganhyboma* Kolbe, 1893 (Coleoptera: Scarabaeidae: Scarabaeinae). *Zootaxa* 3925 (4): 451–504.
<https://doi.org/10.11646/zootaxa.3925.4.1>

Manuscript received: 19 January 2021

Manuscript accepted: 21 June 2021

Published on: 20 October 2021

Topic editor: Nesrine Akkari

Desk editor: Marianne Salaiün

Printed versions of all papers are also deposited in the libraries of the institutes that are members of the *EJT* consortium: Muséum national d'histoire naturelle, Paris, France; Meise Botanic Garden, Belgium; Royal Museum for Central Africa, Tervuren, Belgium; Royal Belgian Institute of Natural Sciences, Brussels, Belgium; Natural History Museum of Denmark, Copenhagen, Denmark; Naturalis Biodiversity Center, Leiden, the Netherlands; Museo Nacional de Ciencias Naturales-CSIC, Madrid, Spain; Real Jardín Botánico de Madrid CSIC, Spain; Zoological Research Museum Alexander Koenig, Bonn, Germany; National Museum, Prague, Czech Republic.